Masoneilan

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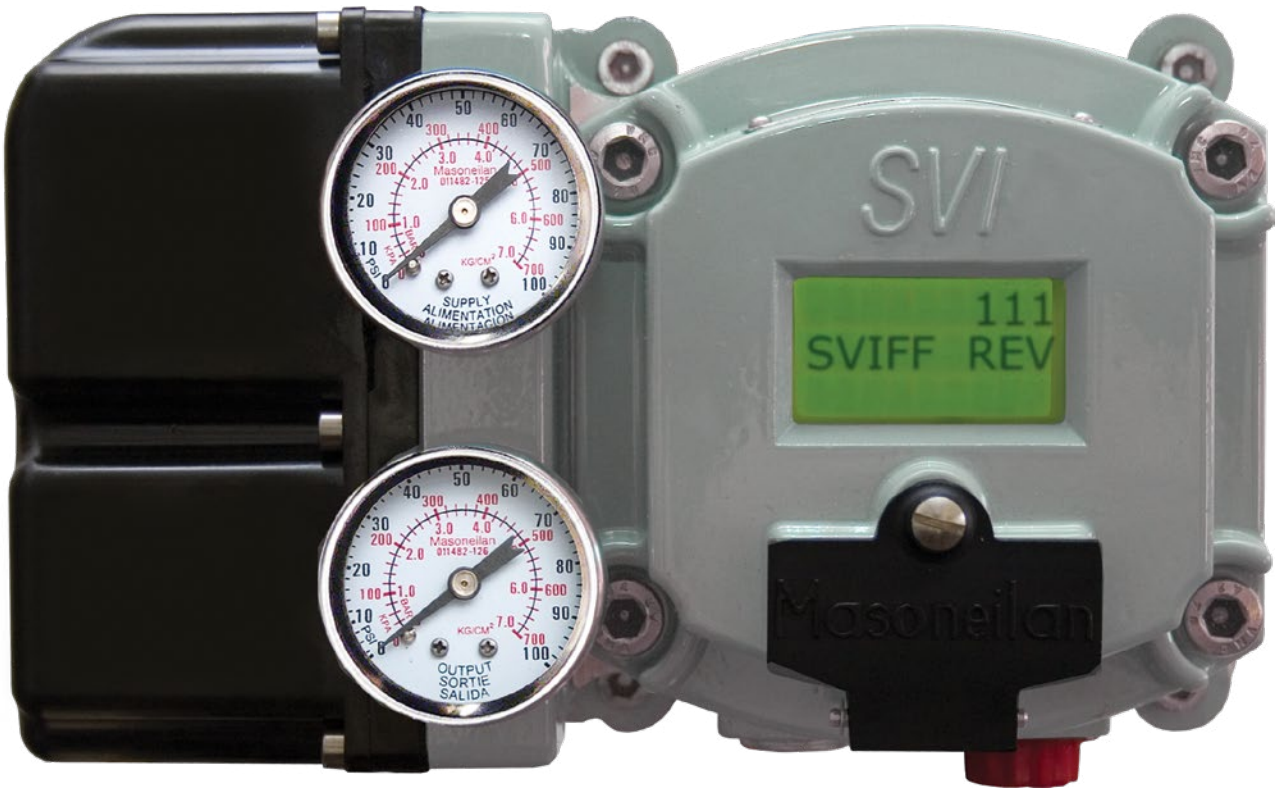
SVI™ FF Digital Positioner

Advanced Performance

Version 2

Installation and Operation Manual (Rev G)



About this Guide

This instruction manual applies to the following instruments and approved softwares:

SVI FF

- with firmware version 1.0.0.1 or higher
- with **ValVue™ software** version 3.0
- with handheld communicator with DD published for SVI FF

In no case does this manual guarantee the merchantability of the positioner or the software or its adaptability to a specific client needs.

Please report any errors or questions about the information in this manual to your local supplier or visit valves.bakerhughes.com.

DISCLAIMER

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Document Changes

Version/Date	Changes
A/03-2014	Original release
B/05-2014	Made changes to specification for Conformity, Linearity and Repeatability. Made changes to the Remote Positioner installation section,
C/05-2014	Made formatting changes.
D/06-2014	Omitted Link Master chapter. Made modifications to the Transducer Blocks Parameters table. Made modifications to the Foundation Fieldbus: Process Example appendix. Made modifications to the Fault State Processing appendix. Removed Remote Position Sensor section from install. Now a standalone manual.
E/08-2017	Added Appendix for Continuous Valve Diagnostics Concept. Made modifications to Transducer Block Parameters table. Added Diagnostics Comparison table to Introduction. Modified the Adv Setup pushbutton menu.
F/07-2019	Added Configuring the SVI FF and a Yokogawa Centum DCS. Added LO mode appendix. Updated Troubleshooting. Changed graphics for DCS switches installation Updated download site url.
G/11-2023	Updated to Baker Hughes format.

Contents

1. Safety Information

This section provides safety information including safety symbols that are used on the SVI FF and the safety symbol definition.

CAUTION

Read this entire section before installation and operation.

Safety Symbols

SVI FF instructions contain **WARNINGS**, **CAUTIONS** labels and **Notes**, where necessary, to alert you to safety related or other important information. Total compliance with all **WARNING**, and **CAUTION** notices is required for safe operation.

WARNING

Indicates a potentially hazardous situation, which if not avoided could result in serious injury.

CAUTION

Indicates a potentially hazardous situation, which if not avoided could result in property or data damage.

NOTE

Indicates important facts and conditions.

SVI FF Product Safety

The SVI FF digital valve positioner is intended for use with industrial compressed air or, natural gas systems only.

NOTE *Installations using natural gas are Zone 0 or Div 1 installations.*

Ensure that an adequate pressure relief provision is installed when the application of system supply pressure could cause peripheral equipment to malfunction. Installation must be in accordance with local and national compressed air and instrumentation codes.

General installation, maintenance or replacement

- Products must be installed in compliance with all local and national codes and standards by qualified personnel using safe site work practices. Personal Protective Equipment (PPE) must be used per safe site work practices.
- Ensure proper use of fall protection when working at heights, per safe site work practices. Use appropriate safety equipment and practices to prevent the dropping of tools or equipment during installation.
- Under normal operation, compressed supply gas is vented from the SVI FF to the surrounding area, and may require additional precautions or specialized installations.

Intrinsically Safe Installation

Products certified as explosion proof or flame proof equipment or for use in intrinsically safe installations *MUST BE*:

- Installed, put into service, used and maintained in compliance with national and local regulations and in accordance with the recommendations contained in the relevant standards concerning potentially explosive atmospheres.
- Used only in situations that comply with the certification conditions shown in this document and after verification of their compatibility with the zone of intended use and the permitted maximum ambient temperature.
- Installed, put into service and maintained by qualified and competent professionals who have undergone suitable training for instrumentation used in areas with potentially explosive atmospheres.

WARNING

Before using these products with fluids/compressed gases other than air or for non-industrial applications, consult the factory. This product is not intended for use in life support systems.

Under certain operating conditions, the use of damaged instruments could cause a degradation of the performance of the system, which can lead to personal injury or death. Under certain operating conditions the SVI FF High Flow unit can produce noise levels greater than 85 dBA. Perform proper site monitoring and testing to verify the need for engineering or administrative controls to eliminate or reduce hazardous noise levels.

Installation in poorly ventilated confined areas, with any potential of gases other than oxygen being present, can lead to a risk of personnel asphyxiation.

Use only genuine replacement parts which are provided by the manufacturer, to guarantee that the products comply with the essential safety requirements of the European Directives.

Changes to specifications, structure, and components used may not lead to the revision of this manual unless such changes affect the function and performance of the product.

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2. Introduction

The SVI FF (Smart Valve Interface) is the next generation of Masoneilan's intelligent digital valve positioners with the FOUNDATION Fieldbus interface. The SVI FF is a high performance, digital valve positioner that combines a local display with remote communication and diagnostic capabilities. The SVI FF offers a multitude of options that fulfill the broadest range of applications, using the FF protocol. The High Flow version is capable of 2.2 C_V air throughput.

An optional pushbutton and LCD display enables local operations of calibration and configuration functions. Remote operations can be performed with ValVue (Version 3) software, with any FDT-based frame application or any FF Registered host interface that has been pre-loaded with the Device Description files (DD) for SVI FF.

The SVI FF is provided with Masoneilan's ValVue software. The user-friendly interface facilitates the setup and diagnostics of a control valve.

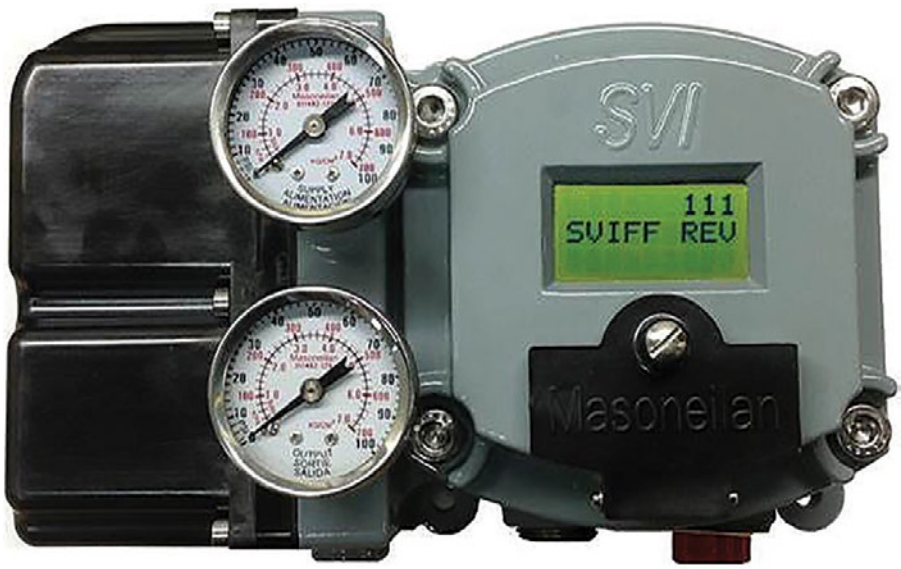

Figure 1 - SVI FF

ValVue Software

Not only does ValVue provide the ability to quickly and easily set up the SVI FF you can also monitor operation and diagnose problems with ValVue's advanced diagnostic capabilities.

ValVue Standard Edition

ValVue Standard Edition software is downloadable and is used with each SVI FF for positioner calibration and configuration. ValVue Standard Edition software is freeware. It provides functions to properly set up and start up an SVI FF digital valve positioner on any type of control valve, along with diagnostics, Sequence, Audit Trial, and Monitoring Device. After a 30 day trail period the Sequence, Audit Trial, and Monitoring Device functionality will become inoperable.

Contact

For the most recent software visit our SVI FF web site at:
https://valves.bakerhughes.com/resource-center

Operational Overview

The SVI FF is a smart electro-pneumatic positioner that:

1. Receives a digital setpoint from the controller and compares the setpoint input to the valve position reported by the position sensor.
2. Uses the position control algorithm to analyze the difference between the position setpoint and position feedback and sets a servo signal for the I/P converter.
3. Uses the output pressure of the I/P, which is amplified by a pneumatic relay that drives the actuator. Once the error between the setpoint and the valve position feedback is eliminated, no other correction is applied to the servo signal in order to maintain valve position.

The local explosion proof LCD/Buttons (if equipped) display provides information about the device. The LCD can display data from blocks on other devices, if the system is so configured. The switch board provides a user-configurable discrete output, which is optionally used to indicate different controller states.

SVI FF Features

The SVI FF Digital Valve Positioner is suitable for installation indoors or outdoors, and in a corrosive industrial or marine environment and is equipped with the following features:

- Extreme Accuracy, Reliability and Digital Precision
- Automated Valve Commissioning
- Precise, Quick, Responsive Control of Valve Position
- Valve Position Auto Tuning
- One Model for Rotary or Reciprocating Valves
- Local Operation/calibration/configuration with Optional Flameproof Push Buttons and LCD Digital Display
- Compatible with Air-to-Close or Air-to-Open Actuators
- Non-contact Magnet Coupled (Hall Effect) Position Sensing for Rotary and Reciprocating Control Valves
- Sealed Housing with No Moving Shafts, No Shaft Penetration, and Fully Potted Electronics
- Uniform Hazardous Area Approvals for ATEX, FMc, and FM with Other Approvals Available Upon Request
- Local, On-line Diagnostic Condition Monitor: Total Stem Travel, Number of Valve Cycles, Predictive Maintenance Data
- Advanced Valve Diagnostics with ValVue Software and the Pressure Sensor Option
- User-adjustable Response Times
- Split-range Capability
- Configurable High and Low Position Limits
- Characterize Stroke:
  - Linear
  - Equal Percentage 30:1
  - 2 up to 21 Point Custom Characterization
  - Equal Percentage 50:1
  - Quick Opening
  - Camflex Percentage
- Optimized Performance Regardless of Actuator Size
- Linearity Compensation for Actuator Linkages with ValVue Software
- User Configurable Tight Shutoff/Tight Open at Adjustable Input Threshold
- Remote Operation Calibration Configuration Diagnostics Using ValVue software or a handheld communicator
- Single or Double Acting (not available for the High Flow version)

Available Options

Some of the options available for the SVI FF include:

- Remote Position Sensor
- A Contact Output User Linked to Various Status and Alarm Flags
- Offshore Construction - Stainless Steel Housing and Components
- Pushbutton Display

Characterization

A characterization defines the relationship between the input signal and the output position of the valve. The SVI FF has a five built-in characterization curves. The additional *Custom* characterization requires manually entering values and is only for experts and under special circumstances.

The characterization may contain up to 21 configurable XY pairs and the position is linearly interpolated between the pairs. The first position is always 0, 0 and the last position is always 100,100. You can specify how many points to define between the start point (0, 0) and the endpoint (0, 100). The points are added as xy pairs.

The algorithm posts a failure if the curve slope violates the slope limitations: x/y ory/x < 20.

NOTE

When the characteristic is linear, the displays of position setpoint and target valve position all match. For all other (non-linear) characteristics the valve target position differs from the setpoint.

When you change characterization type, the Transducer block and AO block must be in OOS and the system is de-energized.

Control Sets

The position controller is a type of non-linear PID control algorithm with seven parameters listed below, as well as Auto Tune and Custom.

- Fastest (Smallest)
- Fast (Small)
- Medium
- Slow (Big)
- Slowest (Biggest)
- Auto Tune
- Custom

The preferred method is Auto Tune, which automatically tunes the valve. Custom requires manually entering values and is only for experts and under special circumstances. A Custom control set with out of range PID parameters is rejected by the system.

Configure the parameters using the parameter name or using FF parameter. Also see the “Control Sets Configuration” on page 48.

Continuous Diagnostics

Alerts

Most systems monitor block errors and these can be linked for alert reporting in the DCS. See Table 31 on page 149 for a full list of Transducer blocks parameters used for configuration. Also see “Continuous Valve Diagnostics Concept” on page 231 for an in depth discussions of this topic.

Alert configuration is available for the following areas:

- Deviation alerts: You can configure a Deviation Value, a Position Error (Alert Point), a Deadband around the Position Error and a Time before the alert is set. Active and historical alerts are indicated.
- HI, HI HI, LO and LO LO Alerts (): You can configure a desired Position, an Alert Point, and a Deadband around the Alert Point. Active and historical alerts are indicated.
- Near Closed Alert: You can configure a desired Position Closed value and an Alert Point in hours after which the alert is set. Active and historical alerts are indicated.
- Setpoint Timeout Alert: You can configure a desired Alert Point and Maximal Detect Time. Active and historical alerts are indicated.
- Pressure Alarms for HI, LO and LO LO: You can configure a desired Position, an Alert Point, and a Deadband around the Alert Point. Active and historical alerts are indicated.
- Temperature Alarms for HI and LO: You can configure a desired Position, an Alert Point, and a Deadband around the Alert Point. Active and historical alerts are indicated.
- IP Output Alarms for HI and LO: You can configure a desired Position, an Alert Point, and a Deadband around the Alert Point. Active and historical alerts are indicated.
- Travel Alerts: You can configure two sets of travel accumulation alarms based on an Alert Point and a Deadband. Active and historical alerts are indicated.
- Counter Alerts: You can configure two sets of cycle counter accumulation alarms based on an Alert Point and a Deadband. Active and historical alerts are indicated.
- Operating Time Alerts: You can configure an operating time alarms based on an Alert Time. Active and historical alerts are indicated.

Alarm/Alert Causes

Some causes of alarms/alerts include:

- Low Supply Pressure
- Obstacle
- Valve Sticking
- Position HI HI: Position Feedback Slip
- Position LO: Process out of range
- High friction
- Bad Tuning
- Position Alerts
- Position HI: Process out of range or Control Loop is not tuned
- Position LO LO: Position Feedback Slip

Trends

There are three trends available in the ValVue FF DTM or using a handheld device:

Travel Accumulation Trend Displays travel accumulation for the following areas:

- *Yearly Travel Accumulation Trend (%)*
- *Monthly Travel Accumulation Trend (%)*
- *Weekly Travel Accumulation Trend (%)*
- *Daily Travel Accumulation Trend (%)*

Cycle Counter Trend Displays cycle counter accumulation for the following areas:

- *Yearly Cycle Counter (Counts)*
- *Monthly Cycle Counter (Counts)*
- *Weekly Cycle Counter (Counts)*
- *Daily Cycle Counter (Counts)*

Position Error Trend Displays a trend of average error over time. for the following areas:

- *Yearly Average Error Over Time*
- *Monthly Average Error Over Time*
- *Weekly Average Error Over Time*
- *Daily Average Error Over Time*

Histograms

There are two histograms available in the ValVue FF DTM or using a handheld device:

Position Histogram Displays how many cycles are spent in each 10% position increment and to you can reset the total operating time for the histogram. *Position*

Error Histogram Displays the position error as function of position and you can reset the histogram.

Diagnostic Versions

There are two versions – Standard and Advanced. Table 1 illustrates the capabilities of each version.

Table 1 - Advanced versus Standard SVI FF Diagnostic Versions

Feature	Sub-feature	Advanced	Standard
Device States	Positioner State	**X**	**X**
	Positioner Alert Log	**X**	**X**
	Trend and Position Setup	**X**	**-**
	Device State	**X**	**X**
Configuration	Control Configuration	**X**	**X**
	Extended RB Configuration	**X**	-
	Extended TB Configuration	**X**	-
	Alerts	**X**	**X**
	LCD Display	**X**	**X**
Calibration	Find Stops	**X**	**X**
	Auto Tune	**X**	**X**
	Quick Wizard	**X**	**-**
	Full Wizard	**X**	**-**
Diagnostics	Step Test	**X**	**-**
	Ramp Test	**X**	**-**
	Signature Test	**X**	**-**
	Histograms	**X**	**-**
	Trends	**X**	**-**
Identification		**X**	**X**
Security		**X**	**-**
Print		**X**	**X**
Write Notes		**X**	**X**

Block Modes

Resource Block Modes

Resource block has two major modes:

- OOS – The block configuration parameters can be changed.

WARNING

ALL blocks are switched to OOS mode when the Resource block is switched to OOS mode.

When the TB is in OOS mode, the valve moves to its de-energized position.

- AUTO – This is normal operational mode.

BLOCK_ERROR_DESCR_1 provides additional details if the target mode is AUTO and the actual mode cannot be switched to AUTO (stays in OOS).

Transducer Block Modes

You can request the block to switch to one of the following block modes by writing MODE_BLK. TARGET parameter:

- OOS – The device de-energizes the valve. This mode also may be necessary for setting SETPOINT SOURCE, ACTUATOR_3.ACT_FAIL_ACTION and CHAR_SELECTION. TYPE, that can trigger a large movement of the valve if the valve is not de-energized.
- MAN – You are in control of the valve position. You can use this mode for most of the configuration, maintenance and diagnostic procedures. If the SETPOINT_SOURCE=AO-Final Value, you can move the valve by writing a value to FINAL_VALUE parameter.
- AUTO – The valve is under FF blocks control. Depending on the configuration of the SETPOINT_SOURCE, the SETPOINT is set from FINAL_VALUE, FINAL_VALUE_D or FINAL_VALUE_DINT.

Depending on the Transducer block configuration, valve position control and valve condition, the transducer block (MODE_BLK.ACTUAL) may be in one of the following states:

- OOS – This is an indication that the valve is in de-energized position. The valve cannot be moved until the block is in this mode. The TB goes to OOS mode if one of the following condition exists:
  - The Transducer block MODE_BLOCK.TARGET = OOS mode. You must change the Transducer block target mode to make the device operational.
  - The Resource block MODE_BLOCK.TARGET = OOS mode
  - The device has detected an abnormal condition, that does not allow it to operate. You must review the value of parameter 87.COMPLETE_STATUS for more

information about the reason for failure. You must correct the condition (e.g. connect the air supply if Air Supply Low error is reported or remove obstacle, stopping the valve if Actuator or Position Error is reported). When the condition is corrected, clear faults by writing the appropriate value to parameter 88. CLEAR_ STATUS. In some cases you may need to restart the device.

- A failure condition exists in the valve position control algorithm that won't allow the valve to operate. Verify that state by reading parameter 74.FAILED_STATE. For more information see the previous point.
- You have set the device to Fault State from the local LCD display. Review this by reading the value of parameter 86. APP_MODE. Correct the condition by switching the Application mode to Normal from the local display or by setting the parameter 86.APP_MODE to Normal.

WARNING

Changing the Application to Normal mode may switch the TB to MAN or AUTO mode and move the valve. It may be dangerous if someone is still working with the valve.

- LO – This is an indication that the valve is controlled from the local display. Verify this by reading parameter 86.APP_MODE – it has a value of Setup. Transfer the control back to the FF interface by switching the local LCD display to Normal mode. The mode can be switched remotely through FF, by writing to parameter 86.APP_MODE the value *Normal*.

WARNING

Changing the Application to Normal mode may switch the TB to MAN or AUTO mode and move the valve. It may be dangerous if someone is still working with the valve.

- MAN – You are in control of the valve positioner. You can execute configuration, maintenance and diagnostic procedures. If the SETPOINT_SOURCE=AO-Final Value, you can move the valve by writing a value to FINAL_VALUE parameter.
- AUTO – The valve position is being set from the function block, configured for that purpose. The following cases are possible:
  - SETPOINT_SOURCE=AO-Final Value, the Analog Output block is in control and SETPOINT is set from FINAL_VALUE
  - SETPOaINT_SOURCE= DO-Final Value D in Open/Close mode, one of the Discrete Output blocks is in control and SETPOINT is set from FINAL_VALUE_D.
  - SETPOINT_SOURCE= DO-Final Value D in 1% steps mode, one of the Discrete Output blocks is in control and SETPOINT is set from FINAL_VALUE_DINT.

Overview of Available Tools

There are several different tools for use in configuring and operating the SVI FF including:

- Local pushbuttons and display: Uses the optional pushbutton and LCD display to monitor, configure and operate the unit (see “Using the Pushbuttons and Digital Interfaces” on page 127).
- Handheld Communicator: Use any FF-capable handheld communicator, along with the Masoneilan FF DD to control operations.
- SVI FF DTM: Use the Masoneilan DTM to operate the unit inside a DTM program such as PACTWare or ValVue’s SVI FF DTM.
- Full ValVue software: Use the ValVue Suite software (see “ValVue Software” on page 14).

Principle of Operation

The SVI FF Electro- Pneumatic Digital Valve Positioner receives an electrical position setpoint signal as depicted in Figure 2. The output pressure is amplified by a pneumatic relay that drives the actuator. When the valve position agrees with the value called for by the position setpoint input signal, the system stabilizes with no further movement of the actuator.

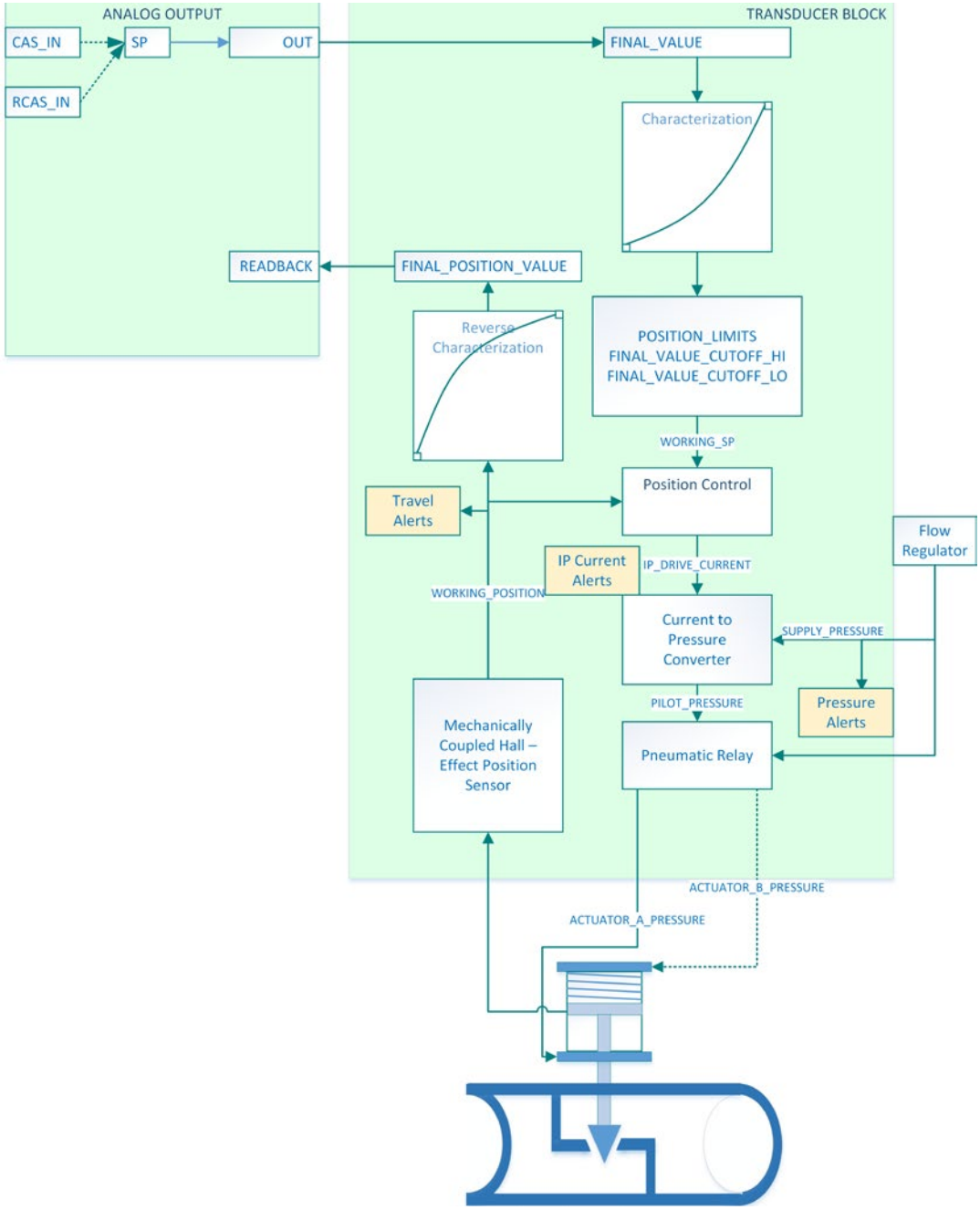

Figure 2 - Block Diagram with I/P Converter and Pressure Sensor

Physical and Operational Description

The SVI FF is housed in an industrial, tough, weatherproof, corrosion resistant aluminum housing that has been designed for operation in hazardous areas as listed in Appendix B. Electrical connections are made through two 1/2" NPT conduit entries. Pneumatic connections are made through two or three ¼" NPT ports.

Electronics Module

The Electronics module consists of an electronic circuit encapsulated in a housing. The electronics include a multiplexer, A/D, D/A, temperature sensor, Hall-Effect magnetic position sensor, pressure sensors, a micro controller, and a power management/distribution circuit. The programs controlling the SVI FF digital valve positioner are stored in a flash memory that allows for the downloading of upgraded firmware.

A separate non-volatile memory stores configuration information, and continuous diagnostic results. Expansion capabilities include connectors for the addition of the optional local display with pushbuttons. Using the internal programmed positioner algorithm, the CPU computes the required output based on information received from the measurement sensors. The base module has no user repairable components.

Magnetic Position Sensor

A non-contact sensor uses a magnetic field to transfer the position through the wall of the housing, without penetration, to sense the valve position. A Hall effect device, sealed within the electronics housing, senses the rotation of a magnetic assembly mounted on the end of a rotary valve shaft or on a driven linkage mounted on a reciprocating valve.

The output of the Hall sensor provides the position feedback signal to the position control algorithm. The magnetic assembly is environmentally sealed and is entirely external to the electronics housing (See Figure 26 on page 57). The Hall effect sensor has a maximum travel range of up to 140° rotation.

Position Display

The position sensor also provides, through the electronics module, a readout of valve position on the optional display and communication of valve position via FF protocol.

Pressure Sensor

The pressure sensor located in the Electronics Module measures the output of the single acting relay. The pressure measurement is displayed on the local display or read by an FF communication device.

Temperature Sensor

A temperature sensor is located in the electronics module and measures ambient temperature. This measurement is used to provide temperature compensation for the position and pressure sensors and other internal electronic components. The temperature is read via the FF communication link to provide a warning of excessive ambient temperature at the positioner.

Output Switch

The SVI FF supports a contact output, SW #1 (Discrete Output switch), that can be logically linked to status bits. The Discrete Output switch terminal is a solid state contact. The switch requires its own power source and must be connected to the appropriate connector on the Electronics Module Terminal Board. See “Output Switches” on page 67.

Pneumatic Module

The pneumatic module consists of an I/P and Relay assembly.

Current-to-Pressure Converter, I/P

The I/P converts a current signal to a pressure signal in the following manner. A fixed coil creates a magnetic field proportional to the applied current. The field magnetically pulls a flexure towards a nozzle to increase pressure on the flexure. The pressure on the flexure increases in response to an increase in the coil current. Encapsulation of the coil provides protection from the environment.

Single Acting Pneumatic Relay

The single acting pneumatic relay amplifies the pressure from the I/P and increases airflow as required for stable, responsive, actuator performance. The single acting relay operates on any supply pressure that is at least 5 psi (.345 bar, 34.5 kPa) above the required actuator pressure, up to 150 psi (10.3 bar, 1034 kPa).

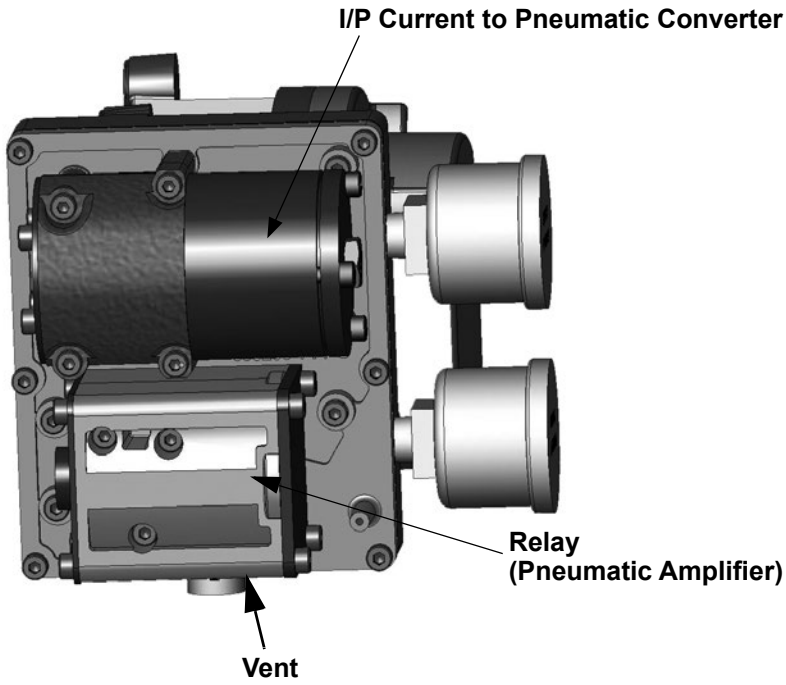

Figure 3 - SVI FF Pneumatic Module with Single Acting Relay

SVI FF High Flow

The single acting pneumatic relay amplifies the pressure from the I/P and increases airflow as required for stable, responsive, actuator performance. The single acting relay operates on any supply pressure that is at least 5 psi (.345 bar, 34.5 kPa) above the required actuator pressure, up to 150 psi (10.3 bar, 1034 kPa).

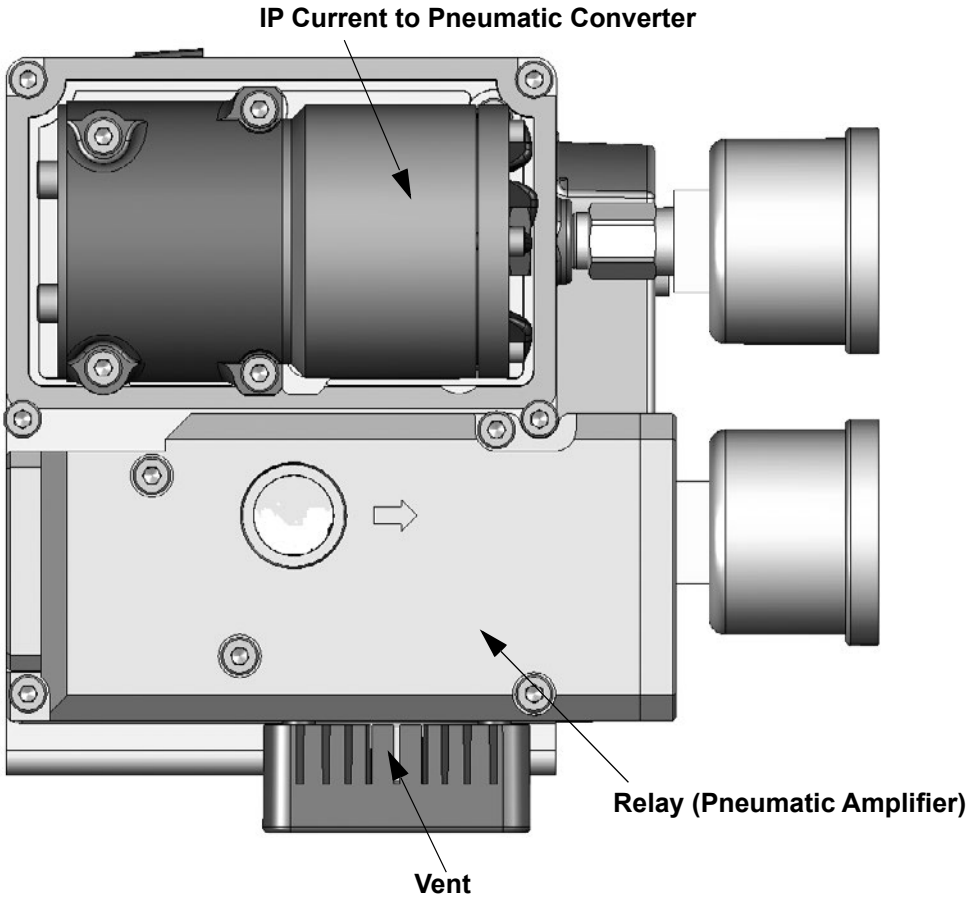

Figure 4 - SVI FF High Flow Pneumatic Module with Single Acting Relay

Double Acting Pneumatic Relay

The double acting pneumatic relay amplifies the pressure from the I/P and provides a pair of high flow output signals for operating a double acting cylinder actuator. The double acting relay operates on any supply pressure that is at least 5 psi (.345 bar, 34.5 kPa) above the required actuator pressure, up to 150 psi (10.3 bar, 1034 kPa). The two output pressures may be balanced by means of an adjustable seat assembly. The average of the two pressures is adjusted to equal 70% of the supply pressure. The double acting relay is rated for supply pressure to 150 psi (10.3 bar, 1034 kPa).

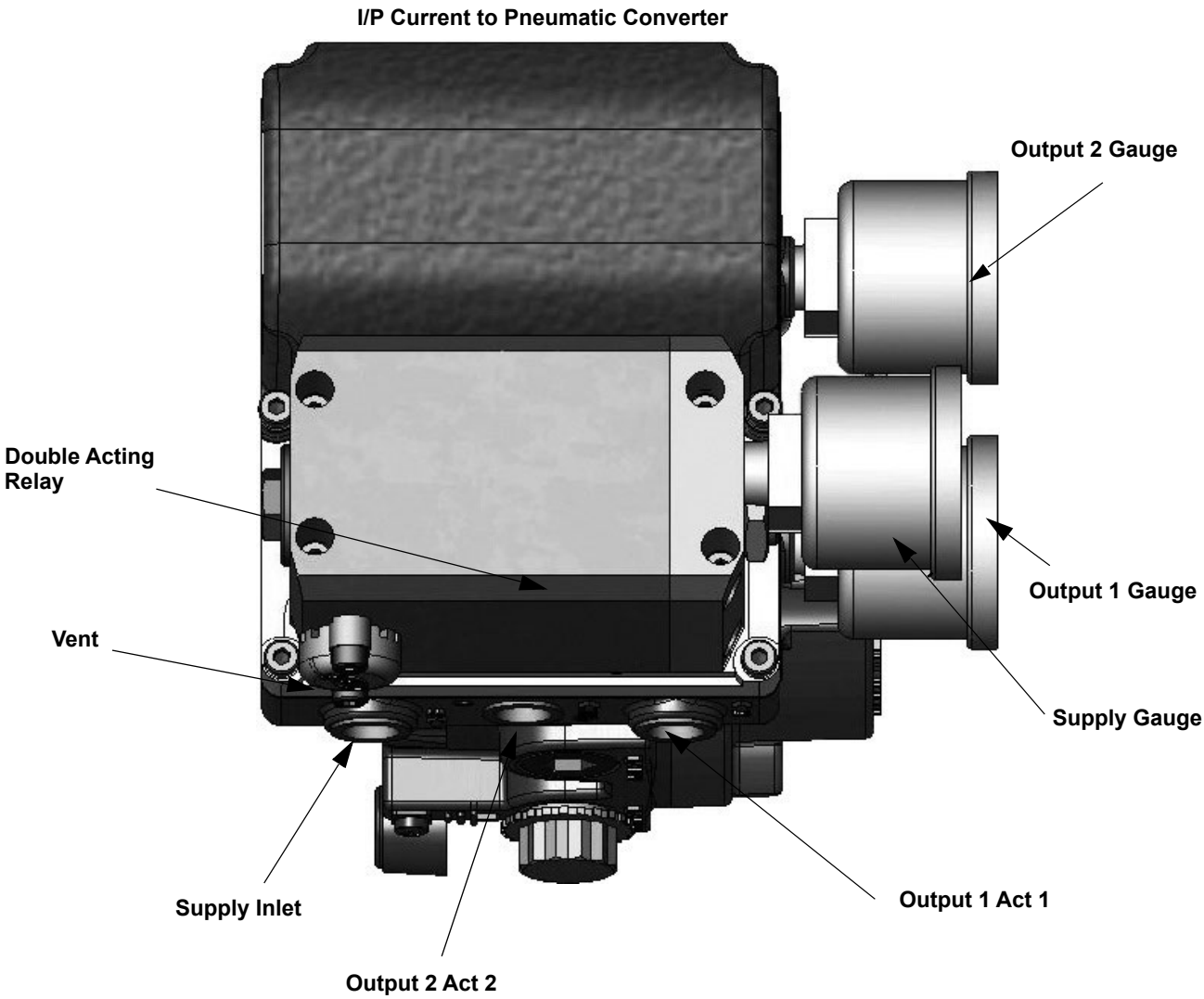

Figure 5 - Double Acting Pneumatic Relay

Double Acting Supply Pressure Balance

After installation on the actuator, set supply pressure in accordance with actuator specifications. Do not exceed the maximum pressure rating of the actuator. The double acting relay is adjusted at the factory and set to 70% of supply pressure. If adjustment is required consult the factory.

Optional Display and Pushbuttons

The optional display and buttons (Figure 6) are mounted on the SVI FF cover plate. The three pushbutton switches operating in conjunction with the display permit reading and modification of the instrument operating parameters without a PC or hand-held communicator. These switches perform generic functions - Increase, Decrease, and Accept by movement through a conventional menu structure, see “Using the Pushbuttons and Digital Interfaces” on page 127. The switches are operated in a hazardous environment without compromising the flameproof enclosure.

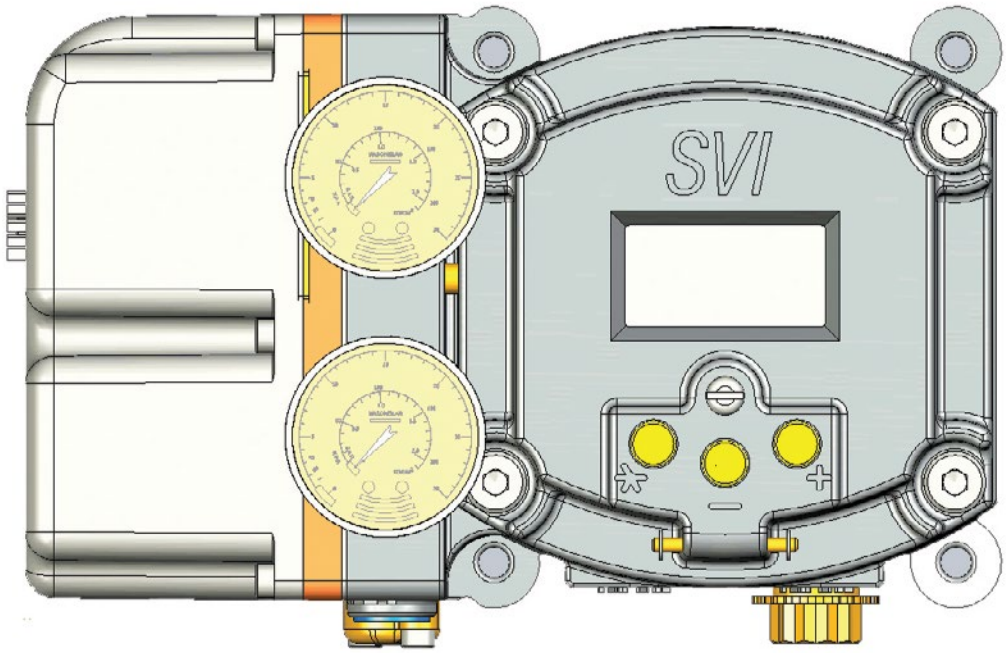

Figure 6 - Optional Display

Link Active Scheduler

To use the SVI FF in a link active scheduler configuration refer to the documentation for the specific DCS.

About This Manual

The SVI FF Instruction Manual is intended to help a field engineer install, setup, and calibrate an SVI FF in an efficient manner. This manual also provides in-depth information on SVI FF software, digital interfaces, operation, intrinsic safety configurations, and specifications. If you experience problems that are not documented in this guide contact the factory or your local representative. Sales offices are listed on the back cover of this manual.

Conventions Used in This Manual

Conventions used in this manual are as follows:

- Uppercase, *italicized* letters are used when referencing a term used in the SVI FF display window. For example, when indicating the term *mode*, as in setup mode, and referring to the display/software operation the convention is to spell mode is all uppercase letters: *MODE*.
- Italics is used for emphasis on important items.
- Fields where data is entered or user-entered data is *italicized*.
- Actions performed on buttons, checkboxes, etc. appear bolded.
  For example: Click **Done**.

3. Quick Start

Step 1: Install the Positioner on the Valve

See:

1. “Pre-Installation Issues” on page 44 before starting.
2. “Mounting the SVI FF on Rotary Valves” on page 50 or “Mounting the SVI FF on Reciprocating Valves” on page 55 or “Installing the SVI FF for Double- Acting Operation” on page 59. Additionally, if using a remote sensor, refer to *Masoneilan Valve Solutions Remote Sensor Quick Start (Ref. 31195)*.

Step 2: Connect Pressure Supply

Perform connections as in Figure 7 for the single acting. See Figure 10 on page 36 for High Flow connections and Figure 15 on page 41 for double acting air ports.

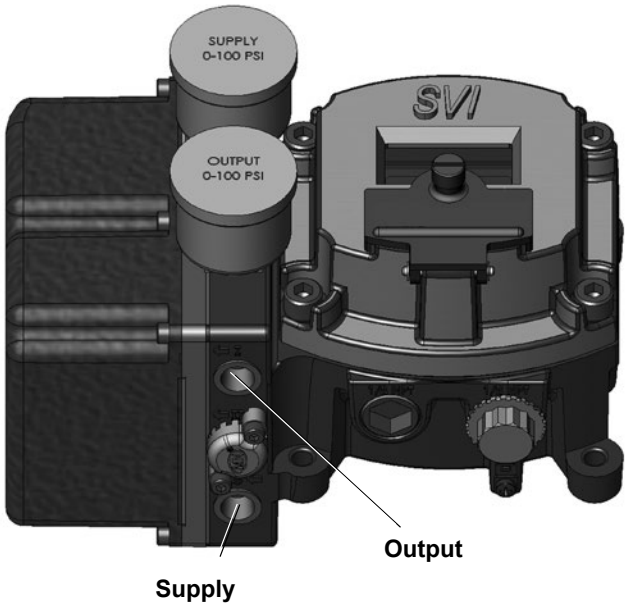

Figure 7 - SVI FF Air Ports on Single Acting Positioner

Step 3: Wire the SVI FF

Perform wiring as per Figure 8.

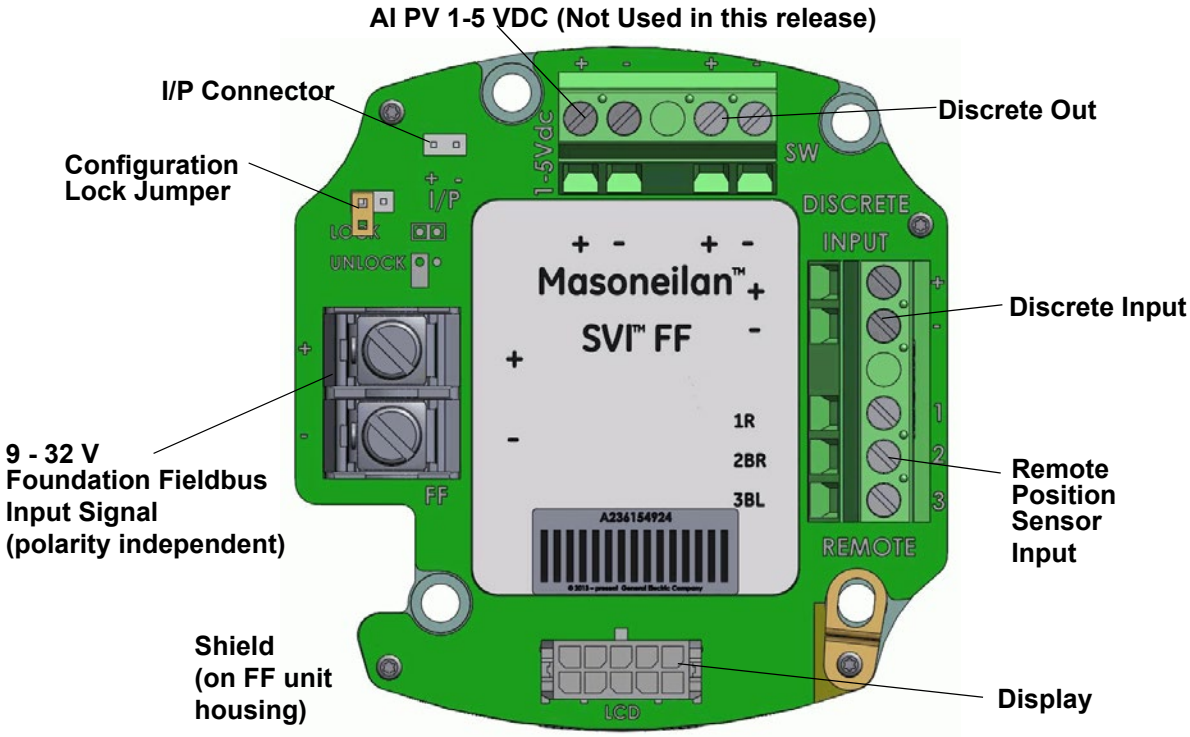

Figure 8 - Connections to Electronics Module (via Terminal Board)

NOTE

Refer to FOUNDATION Fieldbus instructions for shield connections on the FF H1 bus.

Step 4: Set Tag and Address

Using NI Configurator as an example:

1. Import DD/CFF files.

CAUTION

Do not navigate to the NI DD folder and copy the DD file onto itself.

2. Right-click on the device, select **Set Tag**, follow the prompts to enter a *Tag.*
3. Click **Set**.

CAUTION

Do not deactivate the Set to OOS mode checkbox. The block must be in OOS to change the Tag.

4. Right-click on the device, select **Set Address,** follow the prompts to enter an *Address.*

CAUTION

If the device is at the Visitor's or Temporary address range (248 (0xF8)- 251 (OxFB)), you must set the address outside of that range.

5. Click **Set**.

CAUTION

Do not deactivate the Set to OOS mode checkbox. The block must be in OOS to change the Address.

Step 5: Basic Configuration

This section serves as an example where the AO block and TB block are configured. However, there are a number of combinations that can be configured. This discussion is valid if the positioner is controlled by the AO block.

1. For the Transducer block set:
   - ACTUATOR_3.ACT_FAIL_ACTION_1 = either *1. Valve Closed* (most common) or *2. Valve Open*
   - **ACCESSORY.REMOTE_SENSOR = 0, if remote sensor is not in use (internal Hall sensor is used - most common)**
   - ACTIVATE_CONTROL_SET to one of:
     - *0***:** Activate Custom Control Set (required for Autotune as well - most common)
     - *1*: Activate Control Set 1 (Slowest)
     - *2*: Activate Control Set 2
     - 3: Activate Control Set 3
     - 4: Activate Control Set 4
     - 5: Activate Control Set 5 (Fastest)
     - *6:* Activate Control Set 6 (Double Acting - Slow)
     - *7*: Activate Control Set 7 (Double Acting- Fast)

- CHAR_SELECTION.TYPE to one of:
  - 0. Linear
  - 1. Equal Percentage (30:1)
  - 2. Equal Percentage (50:1)
  - 3. Quick Open (reversal from Equal Percentage (50:1))
  - 4. Custom
  - 5. Camflex Percentage

See “Transducer Block Parameters” on page 149. for further settings.

2. For the AO block set as below:
   - PV_SCALE.UNIT INDEX = %
   - XD_SCALE.UNIT INDEX = %
   - CHANNEL = *Position*
   - SHED_OPT = *NORMAL*
     SHED NORMAL RETURN

Step 6: Run Find Stops METHOD

WARNING *This procedure moves the valve.*

Use a configuration tool (DD, SVI FF local pushbuttons or software) to run METHOD.

Step 7: Run Auto Tune METHOD

WARNING *This procedure moves the valve.*

Use a configuration tool (DD, SVI FF local pushbuttons or software) to run METHOD.

When finished, ensure the Transducer block is returned to Auto.

CAUTION

If the Transducer block is switched to Auto, it then follows the setpoint received from the AO block (if scheduled).

if you fail to switch the Transducer block to Auto, then the valve will not be in control.

Downloads

To download the complete user manual, DD, SVI FF Advanced DTM and the ValVue Suite trial program, visit: *https://valves.bakerhughes.com/resource-center*.

4. Mechanical Installation

Overview

The SVI FF single acting (Figure 11 on page 37) and double acting (Figure 16 on page 42) are high performance, digital valve positioners that combine a local display with remote communication and diagnostic capabilities. The SVI FF is available with a variety of options to fulfill diverse applications.

NOTE

Prior to beginning the installation process review the "Safety Information" on page 9.

SVI FF Positioner Types

SVI FF positioner types include:

- "Single Acting Positioner Description" on page 35, including a high flow version
- "Double Acting Positioner Description" on page 41

Single Acting Positioner Description

The supply and output connections for the SVI FF (Figure 9), located on bottom of the pneumatic block, are tapped 1/4" NPT. Output is toward the front, supply is toward the back. Two pressure gauges, output on top, supply on bottom, are located on the front of the pneumatic block.

The supply and output connections for the SVI FF High Flow (Figure 10), located on bottom and leftside of the pneumatic block, are tapped 1/2" NPT.

Maximum allowable air supply pressure to the SVI FF varies according to actuator, valve size, and valve type. See Pressure Drop tables in valve specification sheets to determine the correct positioner supply pressure. Minimum supply pressure must be 5 psi to 10 psi (.345 bar - .69 bar) (34.485 - 68.97 kPa) above maximum spring range but cannot exceed the rated actuator pressure.

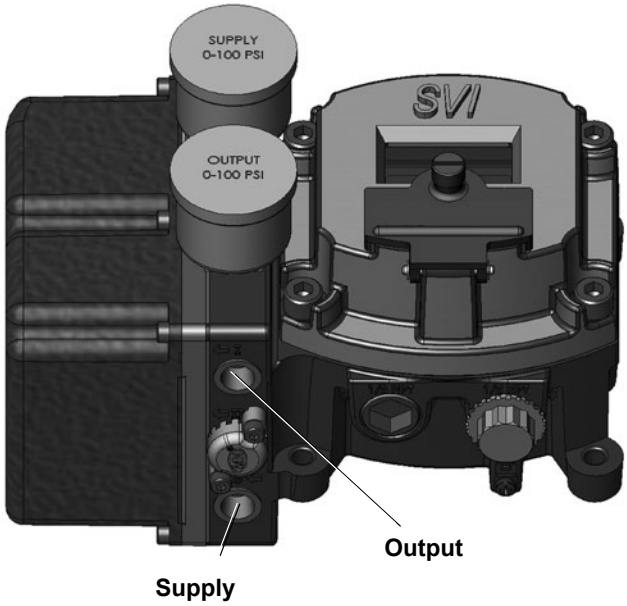

Figure 9 - SVI FF Air Ports on Single Acting Positioner

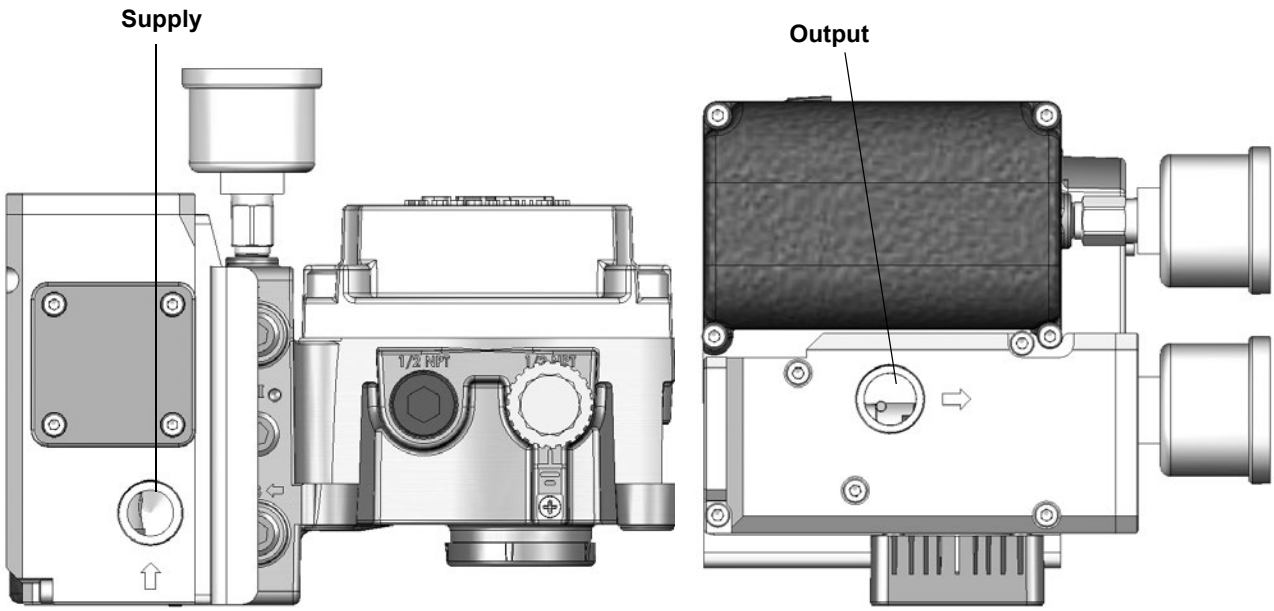

Figure 10 - SVI FF High Flow Air Ports on Single Acting Positioner

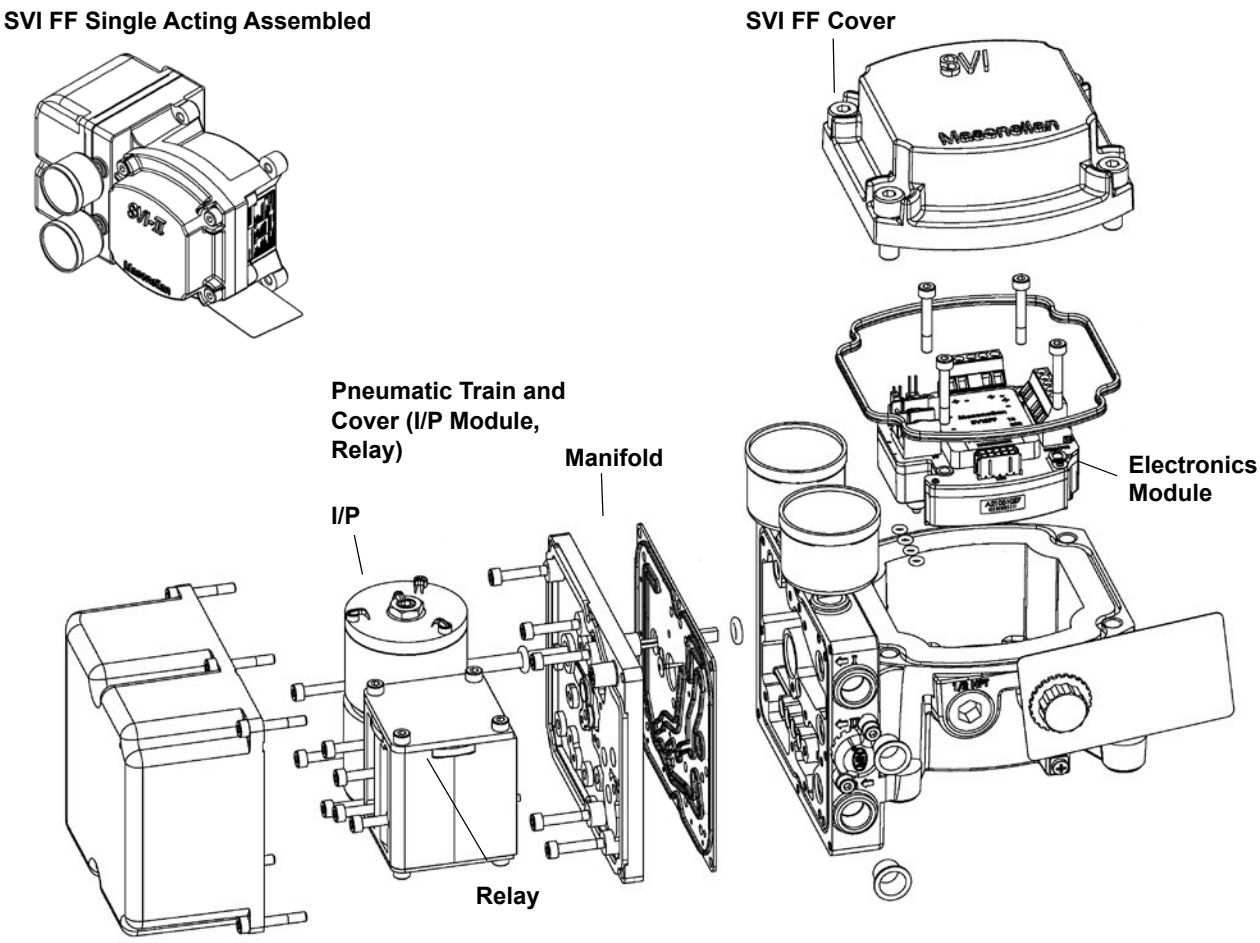

Figure 11 - SVI FF Single Acting Components

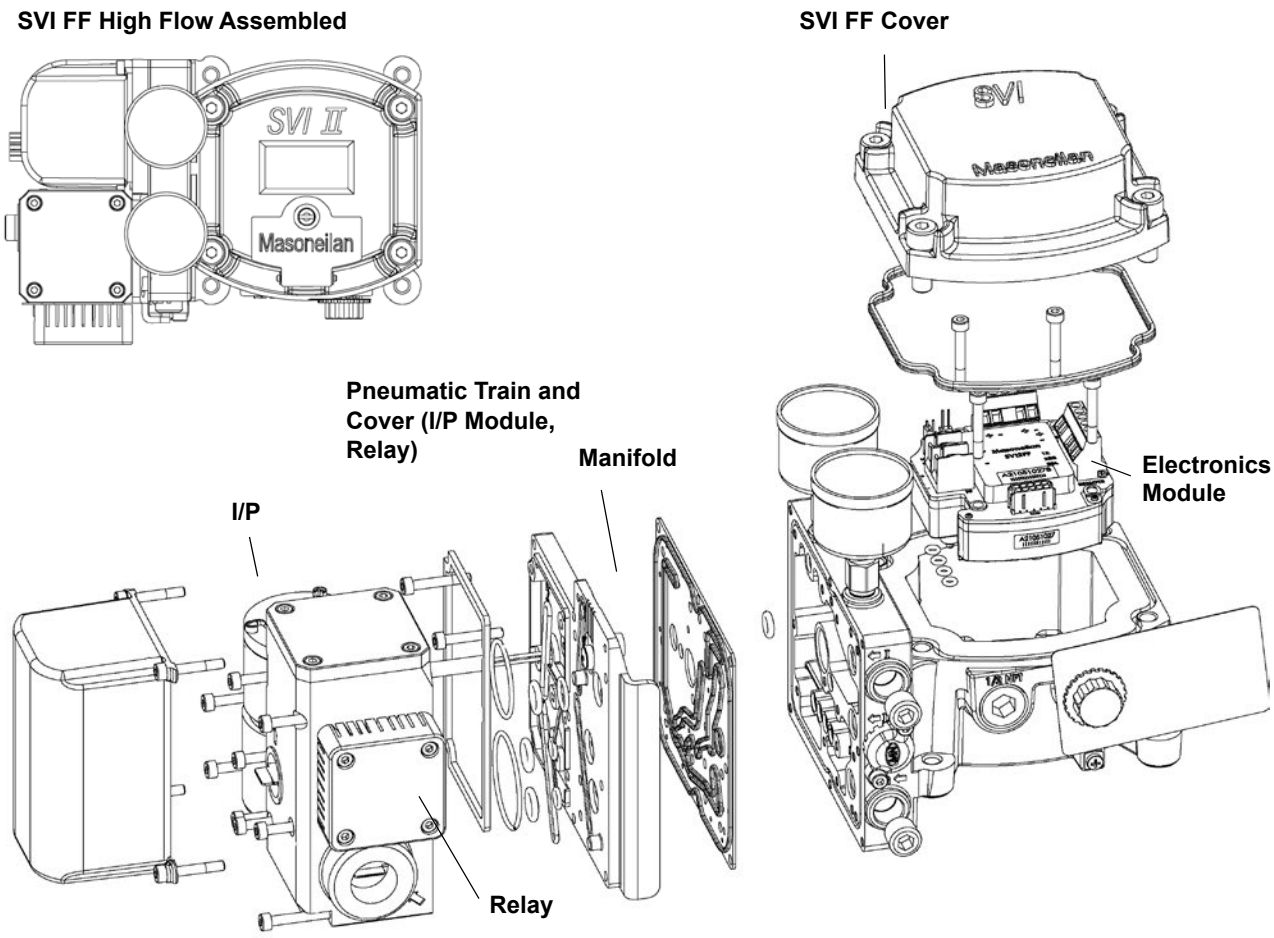

Figure 12 - SVI FF High Flow Components

SVI FF Single Acting and High Flow Dimensions

Figure 13 illustrates the SVI FF single-acting dimensions.

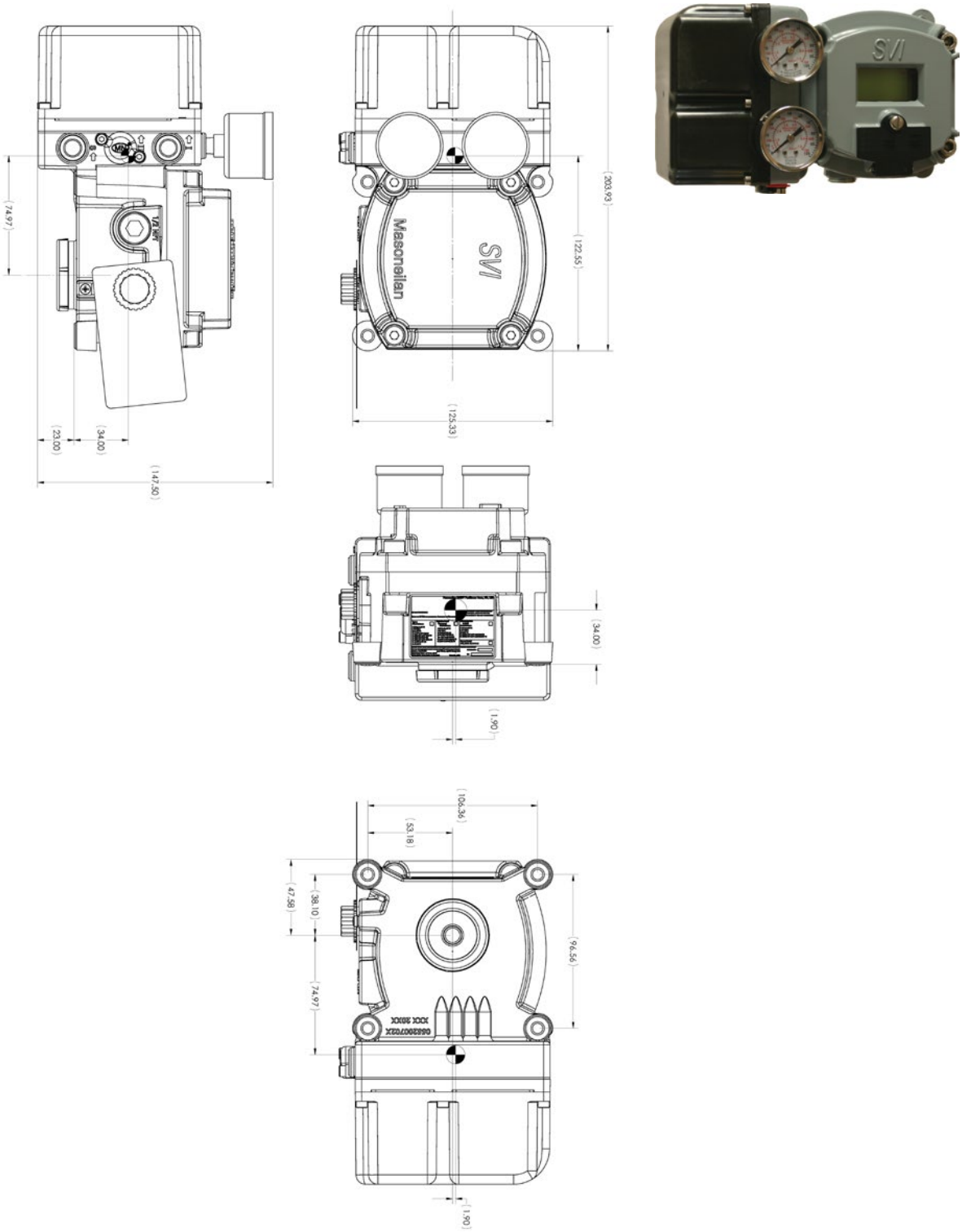

Figure 13 - SVI FF Single-Acting Dimensions

Figure 14 illustrates the SVI FF high flow dimensions.

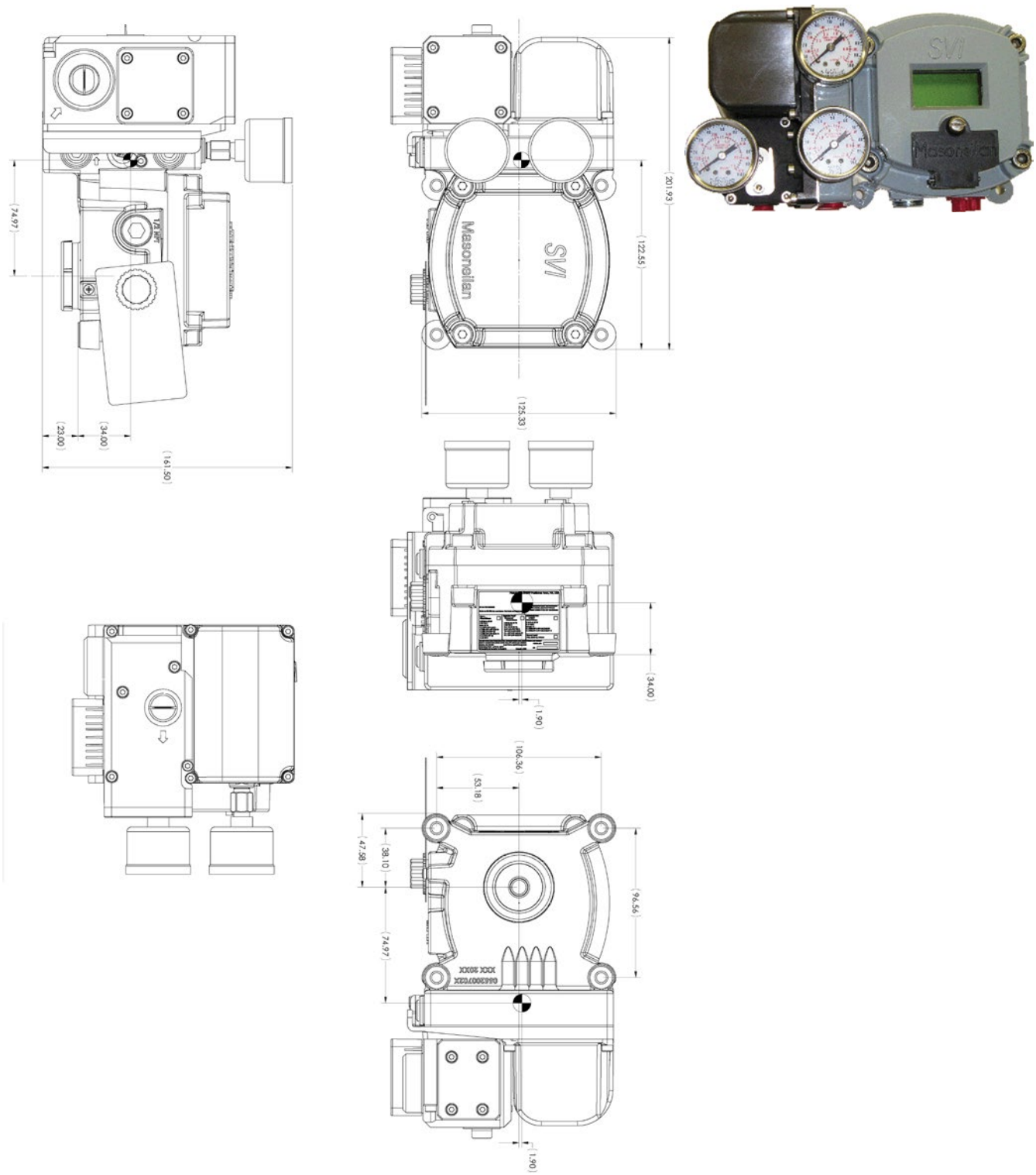

Figure 14 - SVI FF High Flow Dimensions

Double Acting Positioner Description

The Double Acting (DA) relay has a pair of opposed pneumatic outputs. When Output 1 delivers air to one side of the actuator, Output 2 vents air from the opposite side of the actuator piston. The volume of air trapped in each determines the position of the actuator.

The Action (ATO or ATC) is applied with respect to Output 1. When Output 1 is connected to deliver air to extend the actuator, the action is ATC, on a down-seating valve.

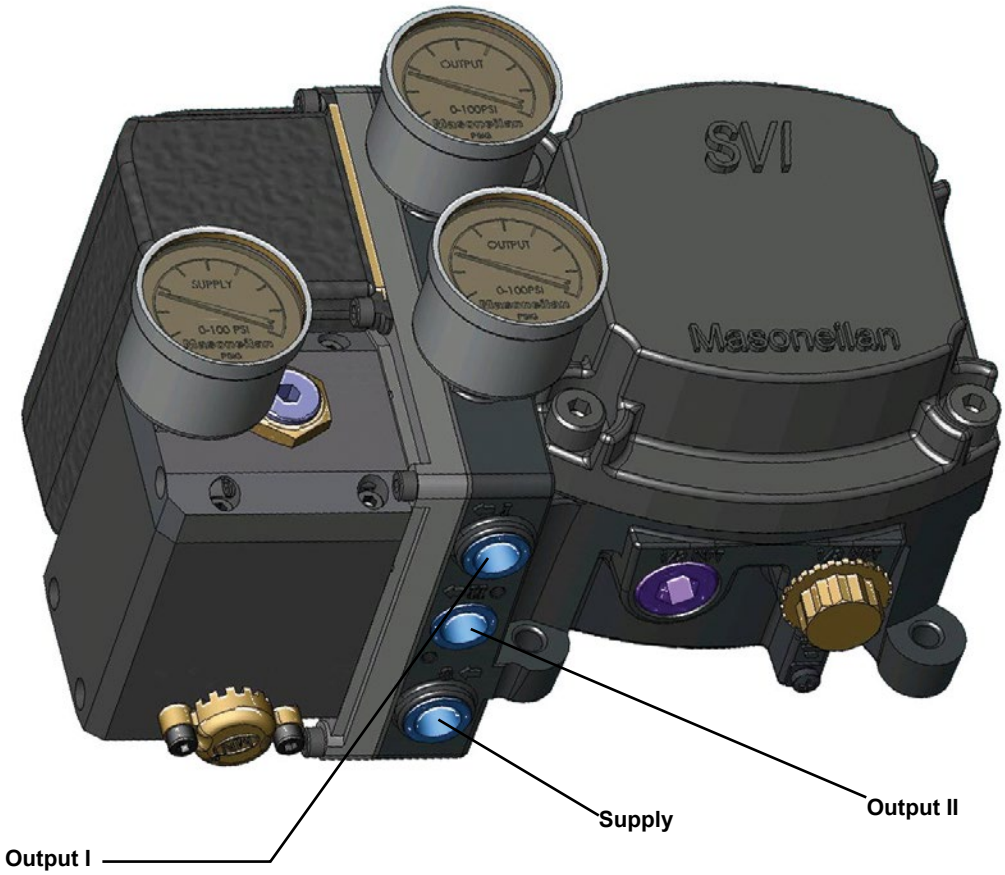

Figure 15 - Air Ports on Double Acting Positioner

Balance Pressure

The double-acting relay is designed to deliver pressure on both sides of a piston type actuator, so that the cylinder can provide the required thrust and stiffness. This stiffness is factory adjusted to 70% of the supply pressure. This means that, without any unbalance forces from the valve stem, both outputs deliver roughly 70% of air supply pressure.

Although it is not recommended, the stiffness can be adjusted by moving the Adjustable Seat assembly up or down.

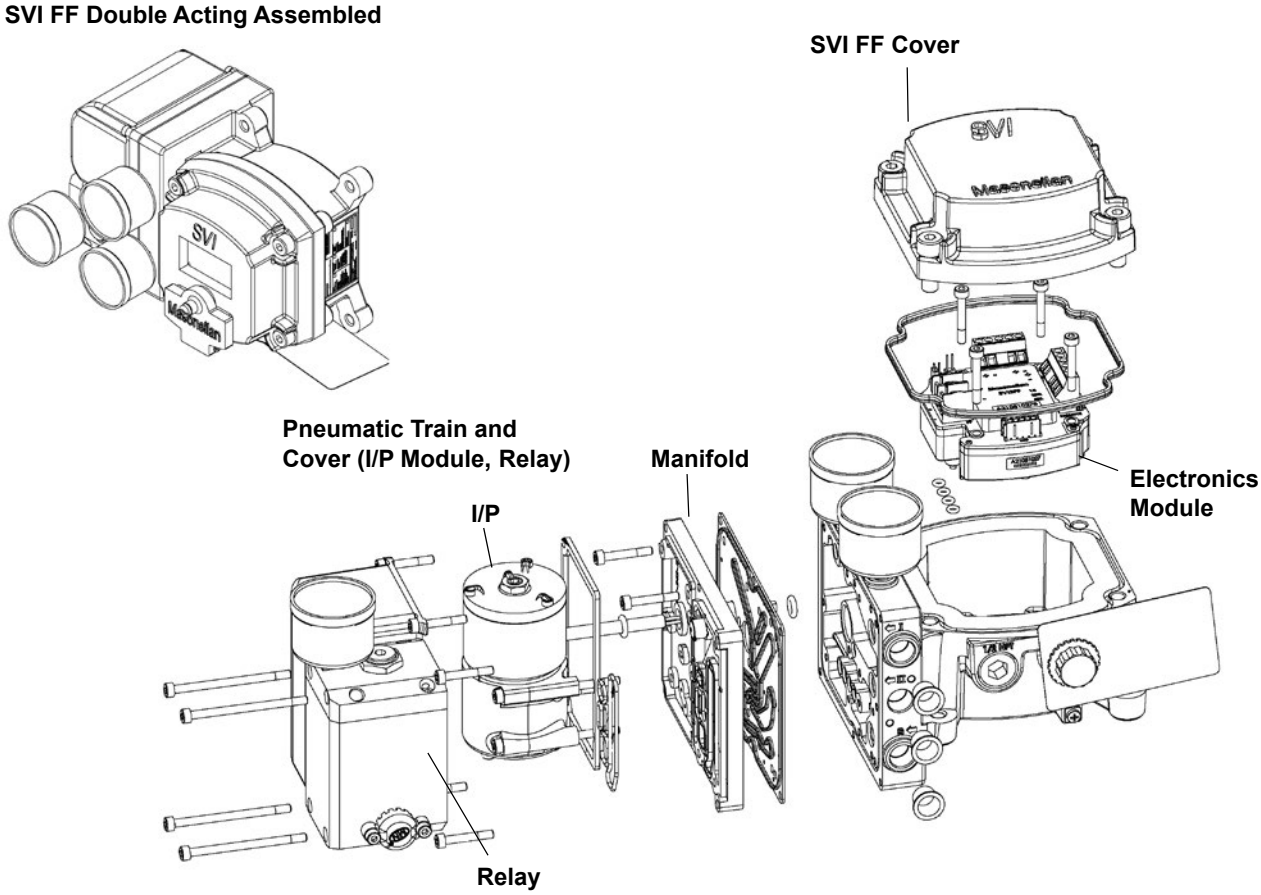

Figure 16 - SVI FF Double Acting Components

SVI FF Double Acting Dimensions

Figure 17 illustrates the SVI FF double-acting dimensions.

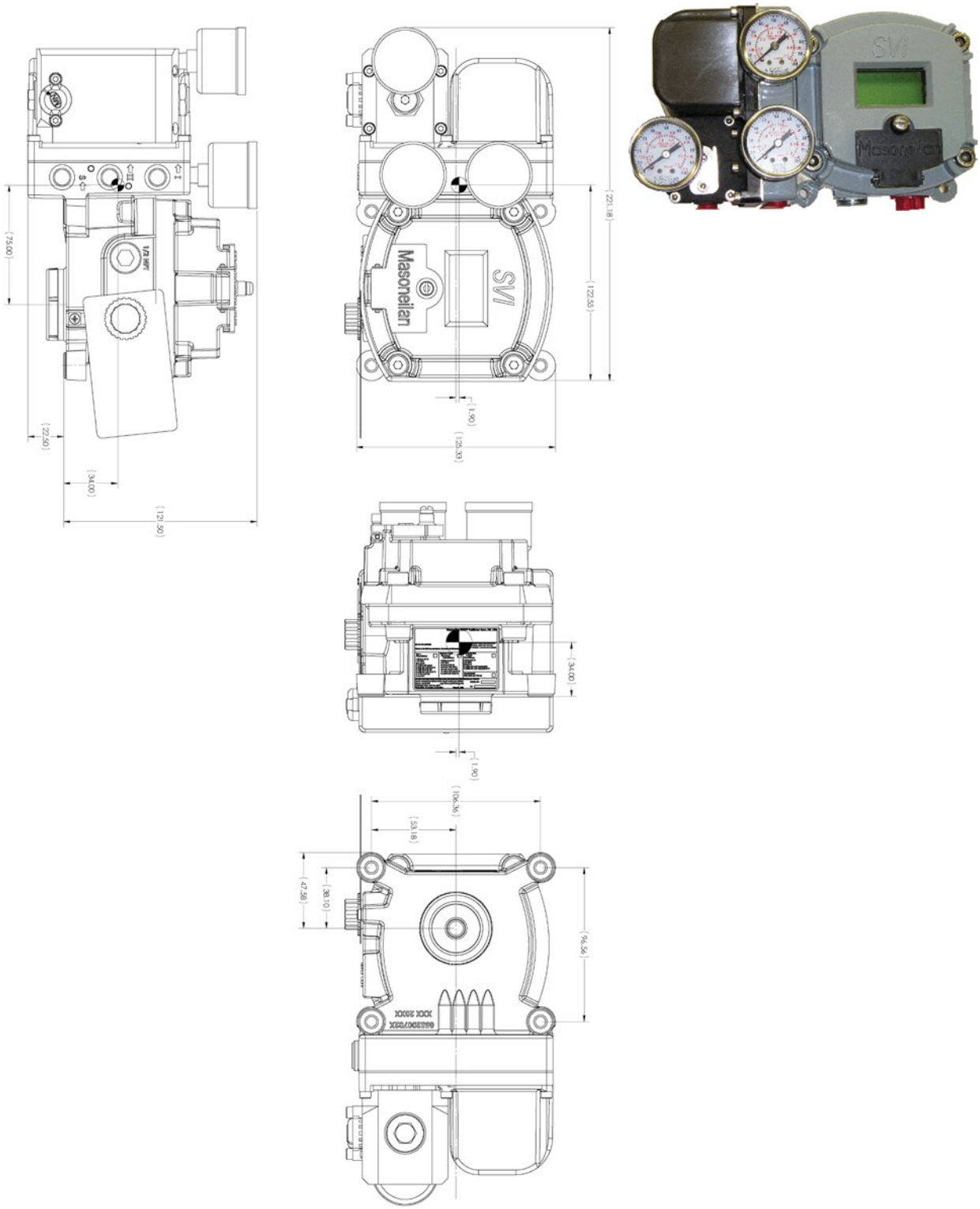

Figure 17 - SVI FF Double-Acting Dimensions

Installation

This section discusses:

Pre-Installation Issues

Storage

If the SVI FF is stored for a long duration, you must keep the housing sealed against weather, fluids, particles, and insects. To prevent damage to the SVI FF:

- Use the plugs provided with shipment to plug the ¼ NPT air connections, on the positioner and on the air filter regulator set.
- Do not allow standing water to accumulate.
- Observe storage temperature requirements.

Unpacking

Exercise care when unpacking the control valve and its mounted accessories. The ValVue software is downloadable from *https://valves.bakerhughes.com/resource-center.*

Figure 18 shows the unit tag that comes attached to the unit.

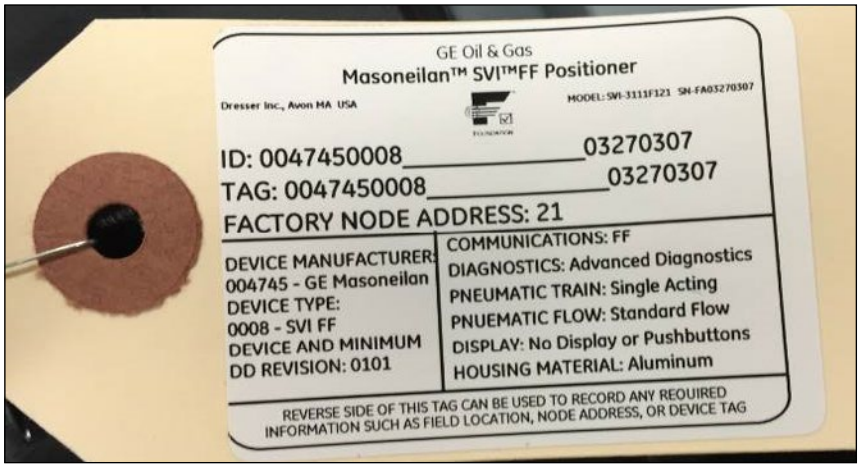

Figure 18 - Unit Tag

The tag lists the following items:

- *ID*: Unique factory-set identifier for the device.
- *Factory Node Address*: Lists the factory-set field bus node address.
- *Device Type:* A four digit code.
- *Communications:* Lists the protocol in use.
- *Pneumatic Train*: Single Acting or Double Acting.
- *Display*: Indicates whether the LED display and pushbuttons are installed.
- *Tag*: User-defined. This can be changed for the specific application.
- *Device Manufacturer*: The six digits comprise the first part of the *ID* and *Tag*. Used to identify the DD.
- *Device and Minimum DD Revision:* Represents the original firmware revision flashed during manufacture. This DD may have been upgraded since installation.
- *Diagnostics:* Lists the level of diagnostics with which the device was shipped. This may have been upgraded since installation.
- *Pneumatic Flow*: Standard Flow or High Flow.
- *Housing*: Aluminum only.

Installation Steps

If you experience problems that are not documented in this guide call the factory or your local representative. Sales offices are listed on the last page of this document.

WARNING

Failure to adhere to the requirements listed in this manual can cause loss of life and property.
Before installing, using, or carrying out any maintenance tasks associated with this instrument, READ THE INSTRUCTIONS CAREFULLY.

CAUTION

Refer to "Output Switch" on page 25 for guidelines on safely wiring switch load limits.

The steps necessary to complete the SVI FF installation and software setup are outlined in Table 2.

Table 2 - SVI FF Installation Steps

Step No.	Procedure	Reference
1	Attach mounting bracket to the actuator.	See page 50 for rotary valve and page 55 for reciprocating valve instructions.
2	Install the SVI FF magnetic assembly (rotary valves only).	See page 54 for instructions.
3	Assemble the SVI FF on the bracket that is mounted to the valve actuator.	See page 50 for rotary valve and page 55 for reciprocating valve instructions.
4	Install the Remote Position Sensor, if necessary.	See *GEA31195 Masoneilan Valve Solutions Remote Sensor Quick Start* for instructions. Also see SVI FF DTM help for software configuration.
5	Connect the pneumatic tubing to the SVI FF.	See page 62 for instructions.
6	Connect the air supply to the SVI FF.	See page 62 for instructions.
7	Connect the positioner to the FF Control Loop segment by installing the SVI FF wiring.	See page 66 for instructions.
8	Configure/Calibrate using LCD Pushbutton display	See page 128 for instructions.
	Configure/Calibrate using a Hand Held Communicator.	See page 131 for instructions.
	Configure/Calibrate using ValVue	See page 133 for instructions.

Installation Notes

- The installation must comply with local and national regulations concerning the compressed air supply and the SVI FF instrument.
- Installation and maintenance must be performed only by qualified personnel. Repairs to the SVI FF beyond the scope of this manual must be performed by the factory.
- Area Classification, Protection Type, Temperature Class, Gas Group, and Ingress protection must conform to the data indicated on the label.
- Wiring and conduit must conform to all local and national codes governing the installation. Wiring must be rated for at least 85ºC (185ºF) or 5ºC (41ºF) above maximum ambient, whichever is greater.
- Approved wire seals against ingress of water and dust are required and the 1/2" NPT fittings must be sealed with tape or pipe dope in order to meet the highest level of ingress protection.

To avoid injury or the process being affected when installing or replacing a positioner on a control valve, ensure that:

- If the valve is located in a hazardous area make sure the area has been certified as safe or that all electrical power to the area has been disconnected before removing any covers or disconnecting any leads.
- Shut off air supply to the actuator and to any valve mounted equipment.
- Ensure the valve is isolated from the process by either shutting off the process or using bypass valves for isolation. Tag shutoff or bypass valves to guard against a turn-on while work is in progress.
- Purge air from actuator and check that valve is in its unenergized position.

Control Sets Configuration

Table 3 and Table 4 give guidelines for configuring various actuator sizes with corresponding control sets. Table 5 lists the FF parameters.

Table 3 - Actuator Settings: Control Sets for Single Acting

Set #	Actuator Size	Examples
1	Small	4.5” Camflex (7-15 Spring Range)
2		#6, 87(ATC), 3-15 Spring Range #6, 88(ATO), 11-23 Spring Range #10, 87 (ATC), 3-15 Spring Range #10, 88(ATO), 11-23 Spring Range
3		#6, 87(ATC), 6-30 Spring Range #6, 88(ATO), 21-45 Spring Range #10, 87 (ATC), 6-30 Spring Range #10, 88(ATO), 21-45 Spring Range
4		#16, 87(ATC), 3-15 Spring Range #16, 88(ATO), 11-23 Spring Range #23, 87 (ATC), 3-15 Spring Range #23, 88(ATO), 11-23 Spring Range
5	Large	#16, 87(ATC), 6-30 Spring Range #16, 88(ATO), 21-45 Spring Range #23, 87 (ATC), 6-30 Spring Range #23, 88(ATO), 21-45 Spring Range

Table 4 - Actuator Settings: Control Sets for Double Acting

Set #	Actuator Size	Examples
6	Small	51, #12, Rated Travel ≤ 3.75” 51, #16, Rated Travel ≤ 2” 51, #20, Rated Travel ≤ 1.25”
7	Large	51, #12, Rated Travel = 4” 51, #16, Rated Travel ≥ 2.5” 51, #20, Rated Travel ≥ 1.5” Model 70 Camflex, Double Acting, #10

Table 5 - Control Set Settings

FF Parameter
ACTIVATE_CONTROL_SET 0: Activate Custom Control Set 1: Activate Control Set 1 (Slowest) 2: Activate Control Set 2 3: Activate Control Set 3 4: Activate Control Set 4 5: Activate Control Set 5 (Fastest) 6: Activate Control Set 6 (Double Acting - Slow) 7: Activate Control Set 7 (Double Acting- Fast) 10: Restore Control set (make Backup Control Set Active) 11: Make active control set as Custom control set
ACTIVE_CONTROL_SET

Mounting the SVI FF on Rotary Valves

This procedure is used to mount the SVI FF on rotary control valves that have less than 60° rotation, such as a Camflex or a Varimax. For valves that have rotation greater than 60° refer to “Rotary - 90°” on page 54.

Required Tools

The following tools are needed to complete the rotary valve installation:

- 316" Hex Key with tee handle
- 5/32" Hex Key
- 3 mm, 4 mm, 5 mm Hex Key
- 7/16" Wrench

To mount the SVI FF:

1. Attach the SVI FF rotary mounting bracket to the valve actuator using two (2) 5/16 - 18 UNC flat-head cap screws. Mount the SVI FF as shown in Figure 19, ATO or in Figure 20 on page 51, ATC. In the preferred mounting position, the long end of the mounting bracket is on your left when facing the actuator, for any position of the valve and actuator.

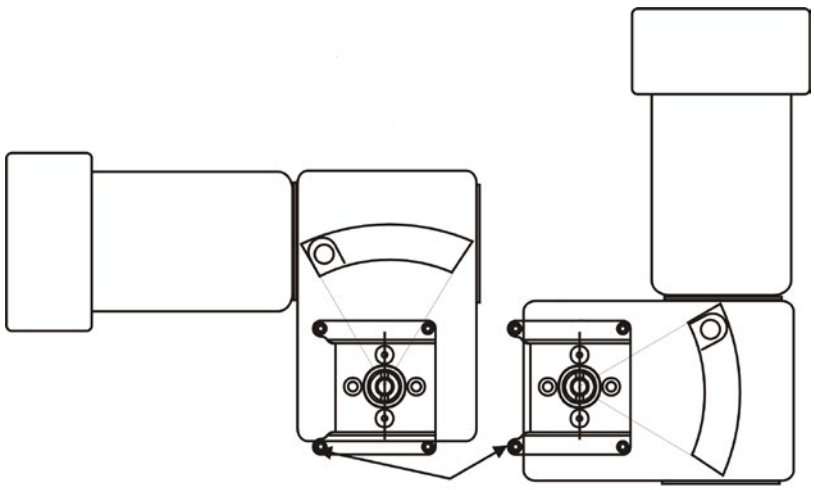

Figure 19 - Camflex Air-To-Open Mounting (Front View)

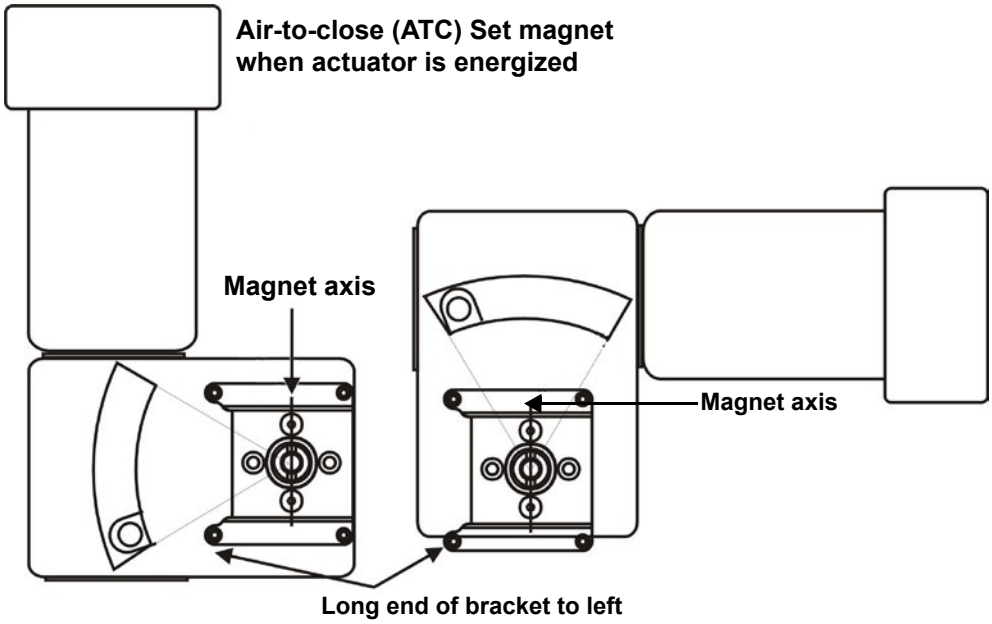

Figure 20 - Mounting Bracket on Air-to-Close Actuator

2. Bolt the extension shaft to the valve position take-off shaft using a 1/4 - 28 UNF socket flathead screw. Secure the machine screw holding the extension shaft with a torque of 144 in-lbs (16.269 N-m).

   Upon internal valve pressure the thrust shaft is pushed out to the mechanical stops, usually a thrust bearing. On valves where the valve position take-off is mounted directly on the end of the plug shaft, a Camflex for example, the shaft must be bearing on its stop to properly set up the SVI FF digital valve positioner. During hydrostatic testing the shaft is thrust to its stop and a normally tightened packing retains it in that position.

   On vacuum service, the valve shaft can be drawn into the body by the vacuum acting on the shaft, but the magnetic coupling must be assembled flush with the mounting bracket with the shaft pulled fully out to its thrust bearing.

3. Ensure that the end play from the vacuum position to the fully extended position is less than 0.06 in. (1.524 mm).
4. Slide the magnet holder into the extension shaft. The location of the magnets is in the ring of the magnet holder. The magnetic axis is the imaginary line through the center of both magnets.
5. Rotate the magnet holder so that the magnet axis is vertical when the valve is in the closed position. See Figure 19 on page 50 and Figure 20.
6. Align the end of the magnet holder flush with the end of the mounting bracket. Secure the magnet holder with two M6 set screws.
7. Slide the V-Seal over the magnet holder.
8. Secure the SVI FF onto the mounting bracket using four M6 x 20 mm Socket Head Cap screws.

9. Ensure no interference exists with the position sensor protrusion.
10. Ensure that the V-Seal makes contact with the skirt around the position sensor protrusion on the SVI FF housing.

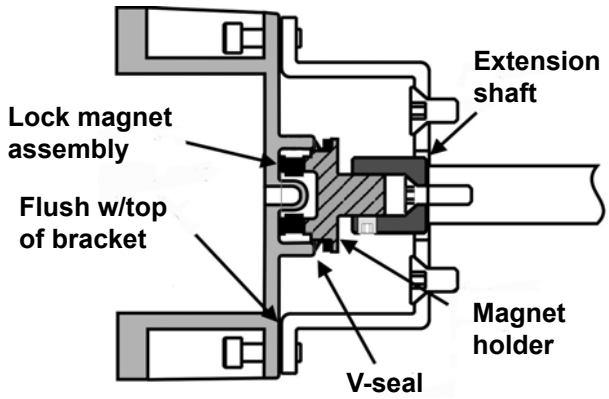

Figure 21 - Camflex with Mounting Bracket (Side View)

Table 6 shows the general guidelines for travel sensor alignment. Review the table prior to installing the SVI FF on a rotary valve actuator for proper alignment of the magnet. Proper alignment is required for proper Hall sensor operation.

Table 6 - Travel Sensor Alignment

Rotary Mounting System	Stroke Direction	Magnet Orientation	Valve Position	Sensor Counts (TB: RAW_POSITION)
Rotary	<60° Rotation Clockwise or counterclockwise rotation	 (0°)	Closed (0%)	0 ± 1000
	>60° Rotation Clockwise with increasing setpoint	 (-45°)	Full Open or Full Closed	-8000 ± 1500 or +8000 ± 1500
	>60° Rotation Counter clockwise rotation with increasing setpoint	 (+45°)	Full Open or Full Closed	-8000 ± 1500 or +8000 ± 1500
General Rule for other configurations	Any amount of rotation clockwise or counterclockwise	 (0°)	50% Travel (Mid-Stroke)	0 ± 1000

Rotary - 90°

For actuators with 60 to 120° rotation, follow the instructions in “Mounting the SVI FF on Rotary Valves” on page 50, except mount the magnet at plus or minus 45° while the actuator is de-energized as shown in Figure 22.

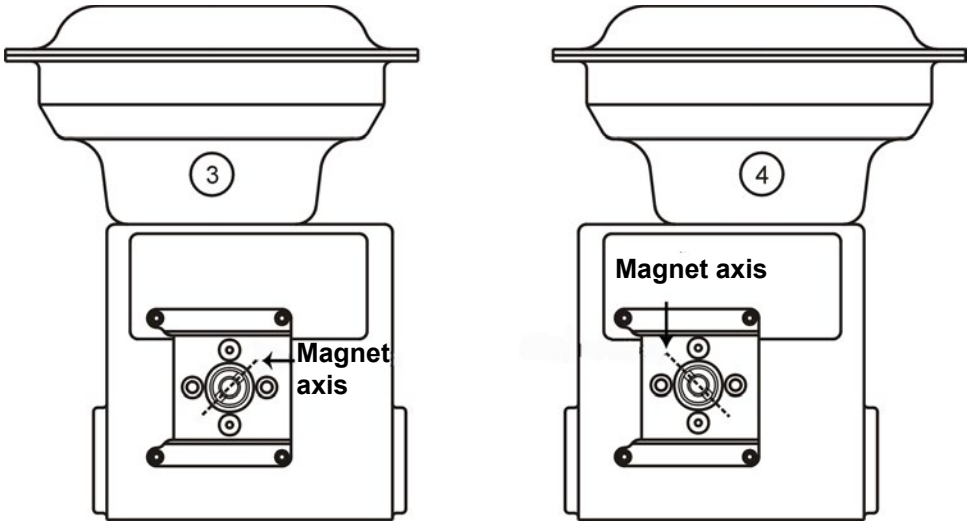

Figure 22 - Model 33 Actuator

Magnet Orientation on Rotary Valve Shafts

The same mounting hardware is used for Models 35, 30 actuators. For each actuator type the magnetic coupling must be properly oriented to the active sensing angle of the positioner’s Hall Effect sensor. The active range of the Hall Effect sensor is plus/minus 70° from the null magnet axis.

If the total valve travel is less than 60°, allowing a margin for tolerances, the best accuracy is achieved by mounting the magnet with the axis vertical in the valve-closed position. The axis of the magnets is the line through the centers of both magnets.

If travel of the valve exceeds 60°, the magnet must be assembled to the rotary valve shaft so that the magnet axis is vertical when the valve is at mid-scale.

Dismantling the SVI FF from Rotary Valves

WARNING

Before carrying out any work on the device, power off the instrument or make sure that the device’s location conditions for potentially explosive atmosphere permit the safe opening of the cover.

To remove the SVI FF digital valve positioner from a rotary valve perform the steps in “Mounting the SVI FF on Rotary Valves” on page 50 in reverse.

Mounting the SVI FF on Reciprocating Valves

This section describes the procedure for mounting the SVI FF on Reciprocating Valves (using Masoneilan's 87/88 Multi-Spring actuators as an example).

Tools required:

- 7/16" Combination Wrench (2 required)
- 3/8" Combination Wrench
- 1/2" Combination Wrench
- Phillips Head Screw Driver
- 5 mm Hex Key Wrench

Mounting the SVI FF on a Reciprocating Actuator

1. Ensure that the lever is pinned to the magnet assembly and held securely by an M5 flat head screw to ensure that the magnet axis is vertical when the lever is in the valve closed position. Tighten the lever screw securely.
2. Mount the SVI FF reciprocating mounting bracket to the actuator using two (2) 5/16 - 18 UNC cap screws. The mounting location of the bracket depends on the size and stroke of the actuator. Refer to Figure 26 and Table 7 on page 57.

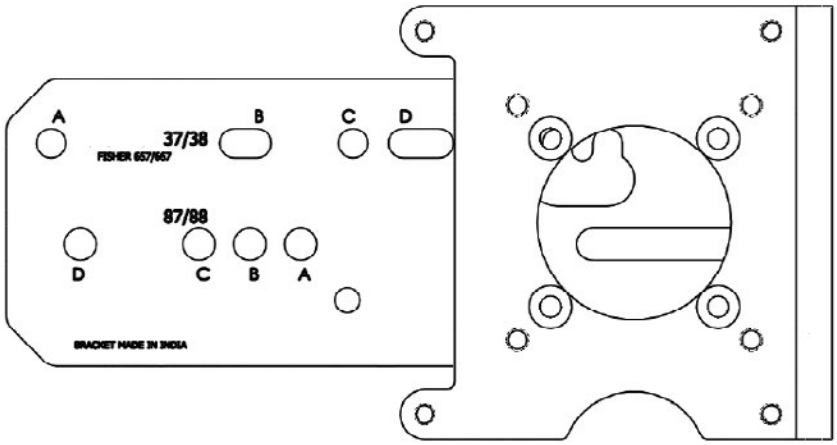

Figure 23 - Reciprocating Valve Mounting Bracket

3. Select mounting hole A, B, C or D for the stroke of the valve. For example, hole B is shown in Figure 24 on page 56 for a size 10 actuator with 1.0" stroke. Unless otherwise specified, the SVI FF mounting assumes that the actuator is in the normal upright position. The mounting hole in the slotted opening of the mounting bracket must be left when facing the actuator, with the actuator in the upright position.

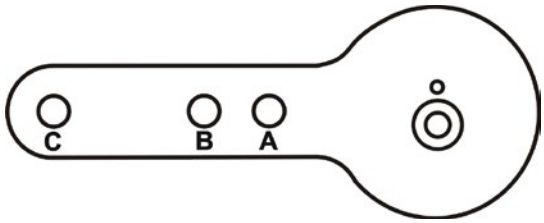

Figure 24 - Lever for Model 87/88 Multispring Actuator

4. Move the valve to its closed position. For air to extend, this requires using air pressure in the actuator to fully stroke the actuator. For air to retract, actuators vent the actuator of air pressure.
5. Thread the take-off rod to the actuator stem connector. Refer to Figure 25. Ensure that the travel pointer located on the coupling is correctly positioned.

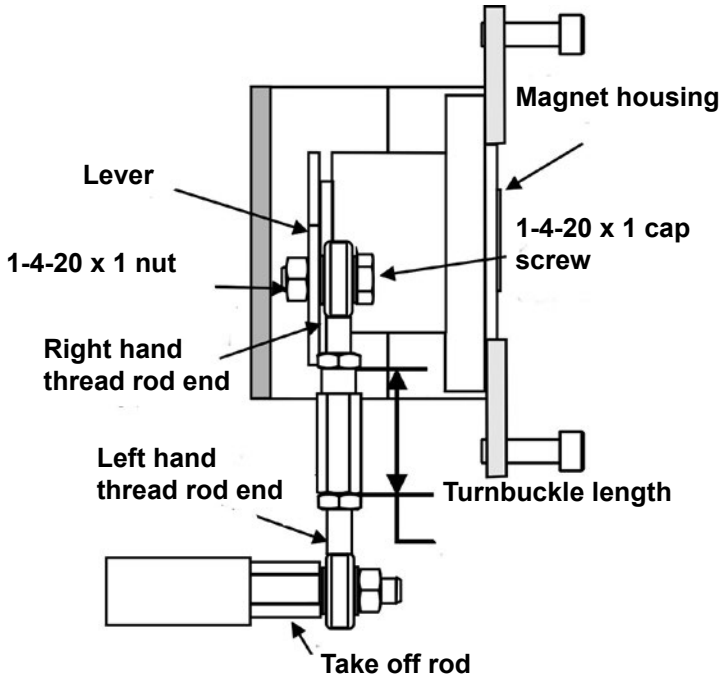

Figure 25 - Reciprocating Linkage

6. Attach the right hand threaded rod end to the SVI FF lever using a 1/4 - 20 x 1" cap screw and nut as shown. The lever hole position to be used depends upon the specific valve stroke. Refer to Figure 24 on page 56 and the Reciprocating Valve Linkage Selection, Table 7 on page 57.

7. Thread the right hand lock nut and turnbuckle onto the right hand rod end approximately two turns. Turnbuckle length is a function of actuator size. (Refer to Table7).
8. Secure the magnet housing assembly, including the lever and right hand rod end, to the bracket using four M5 X 10 mm flat head screws.
9. Attach the left hand threaded rod end to the take-off rod with 1⁄4 - 20 UNC nut and thread the left hand lock nut onto the rod end.
10. Thread the turnbuckle onto the left hand threaded rod end. Refer to Figure 25 on page 56.
11. Adjust the turnbuckle until the hole in the SVI FF lever is aligned with the indicating hole in the bracket. Tighten both turnbuckle lock nuts. See Figure 23 on page 55.
12. Mount the SVI FF to the bracket and secure with four M6 socket head cap screws.

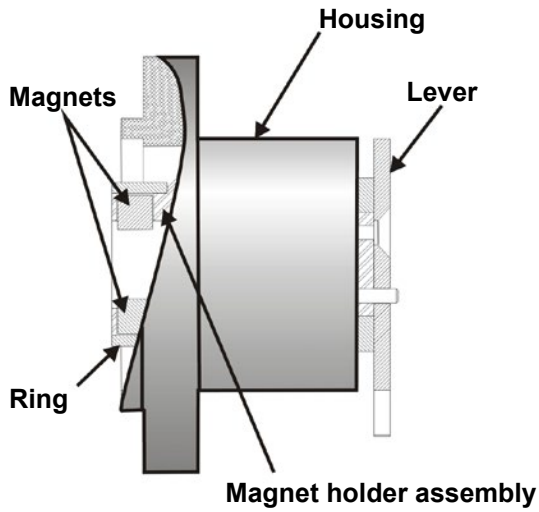

Figure 26 - Magnet Holder for Reciprocating Valves

Table 7 - Reciprocating Valve Mounting Hole and Turnbuckle Length

Actuator Size Masoneilan	Stroke	Mounting Hole	Lever Hole	Turnbuckle Length
6 and 10	0.5 - 0.8" (12.7 - 20.32 mm)	A	A	1.25" (31.75 mm)
10	0.5 - 0.8" (12.7 - 20.32 mm)	A	A	1.25" (31.75 mm)
10	>0.8 – 1.5" (20.32 - 38.1 mm)	B	B	1.25" (31.75 mm)
16	0.5 - 0.8" (12.7 - 20.32 mm)	B	A	2.90" (73.66 mm)

Table 7 - Reciprocating Valve Mounting Hole and Turnbuckle Length (Continued)

Actuator Size Masoneilan	Stroke	Mounting Hole	Lever Hole	Turnbuckle Length
16	>0.8 – 1.5" (20.32 - 38.1 mm)	C	B	2.90" (73.66 mm)
16	>1.5 – 2.5" (38.1 - 63.5 mm)	D	C	2.90" (73.66 mm)
23	0.5 - 0.8" (12.7 - 20.32 mm)	B	A	5.25" (133.35 mm)
23	>0.8 – 1.5" (20.32 - 38.1 mm)	C	B	5.25" (133.35 mm)
23	>1.5 – 2.5" (38.1 - 63.5 mm)	D	C	5.25" (133.35 mm)

Dismantling the SVI FF from Reciprocating Valves

WARNING

Before carrying out any work on the device, power off the instrument or make sure that the device's location conditions for potentially explosive atmosphere permit the safe opening of the cover.

To remove the SVI FF digital valve positioner from a reciprocating valve perform the steps in "Mounting the SVI FF on Reciprocating Valves" on page 55 in reverse.

Installing the SVI FF for Double- Acting Operation

This section explains how to mount the SVI FF for the 84/85/86 kit for double-acting valve positioner configurations.

To mount the kit:

1. Set valve to the closed position.
2. Install the mounting assembly to the yoke (Figure 27) using helical spring washer 5/16, flat washer 5/16 and hex screw 5/16-18x44.5 [1.75] LG.

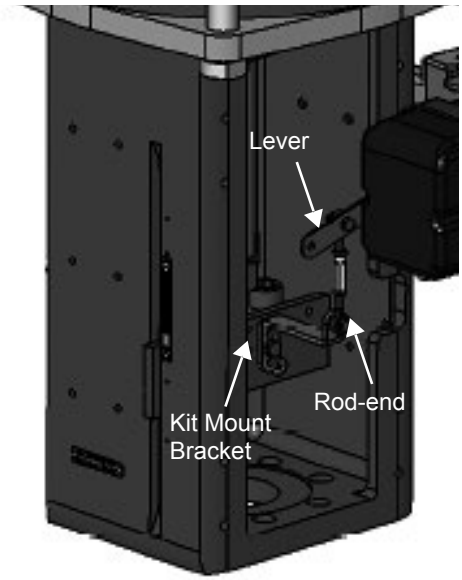

Figure 27 - 85/86 Valve

NOTE

Mount all components snug enough to stay in place but loose enough to tap with rubber hammer into final position.

3. Set rod-ends and brackets to stroke and size of actuator. The default setting is a 4.00" stroke. Other stroke settings are as in Figure 28.

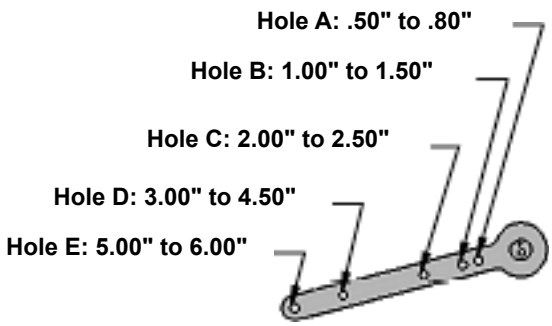

Figure 28 - Stroke Settings

4. Mount take-off bracket to stem block at angle which keeps turnbuckle assembly parallel to stem (Figure 29) using:
   a. For top: two plain 5/16 flat washers, helical spring washer 5/16, two hex nuts 5/16-18 regular.
   b. For bottom: hex nut regular 1/4-20 and hex screw 1/4-20 UNC x 22.2 [.88] LG.

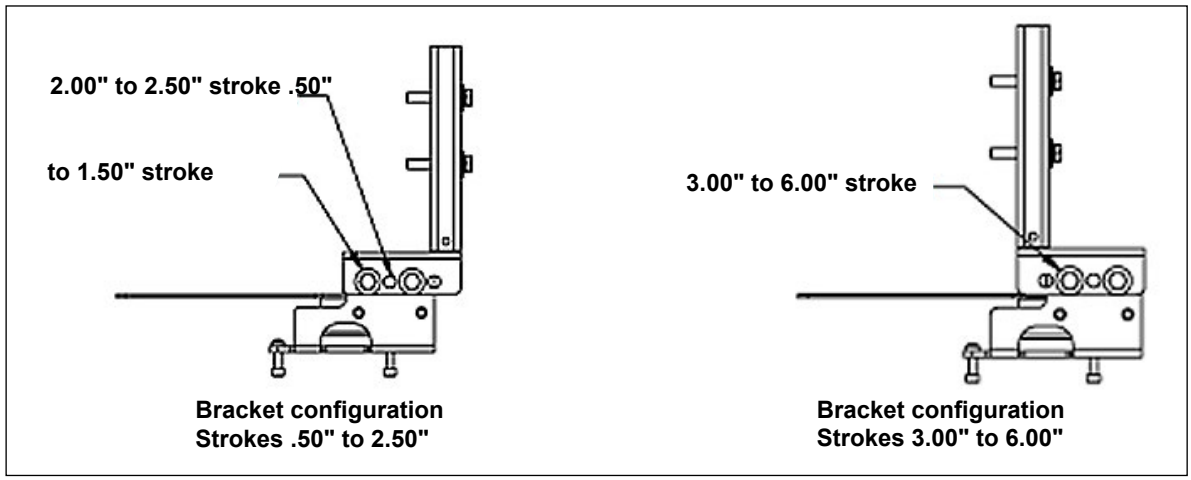

Figure 29 - Bracket Configuration Strokes .5 - 2.50" and 3-6"

5. Ensure the turnbuckle assembly is parallel to the stem and the magnets are in the valve closed position (Figure 30) and connect to take-off bracket.

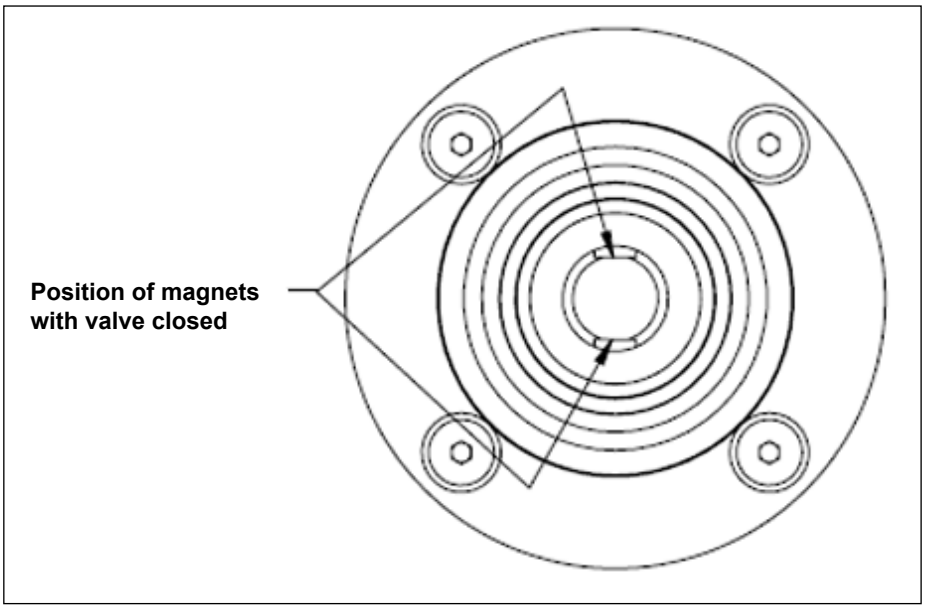

Figure 30 - Magnet Position with Valve Closed

6. Verify lever is in correct position with valve closed. Adjust rod-ends, if necessary.

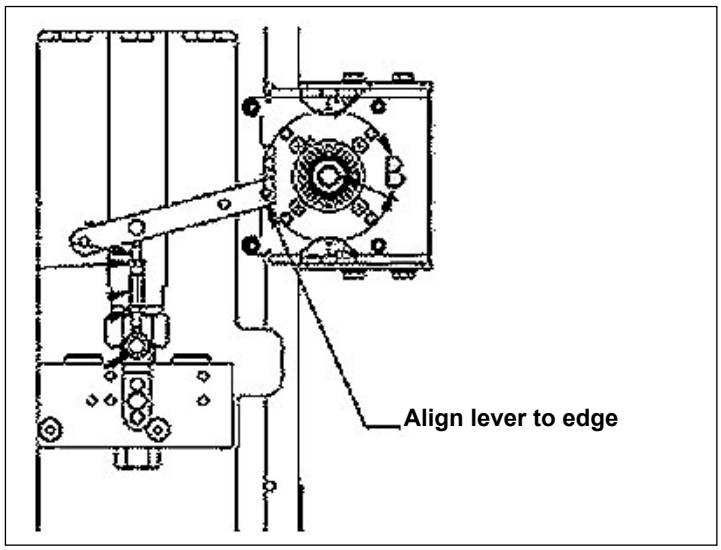

Figure 31 - Lever Alignment

7. Mount the SVI FF with M6-1 screws.
8. Cycle the valve open to close verifying proper components movement and that rod-ends move free and clear from other components.

Connecting the Tubing and Air Supply

The last step in hardware installation for the SVI FF is to connect the air supply to the positioner. This section describes the process for connecting the tubing and air supply to a single and double acting positioner.

WARNING

Isolate the valve from the process and disconnect air tubing from the positioner. Disconnect air fully to avoid injury or process damage.

The use of a Masoneilan filter regulator with a 5-micron filter is recommended for the air supply. Use 1/4" (6.35 mm) minimum tubing between filter regulator, the SVI FF and the actuator, with 3/8" (9.53 mm) used for larger actuators. Use a soft setting anaerobic hydraulic seal such as Loctite Hydraulic Seal 542 for sealing the pneumatic pipe threads. Follow manufacturer's instructions.

NOTE

Maximum allowable air supply pressure to the SVI FF varies according to actuator and valve size and type. See pressure drop tables in valve specification sheets to determine correct supply pressure. Minimum supply pressure must be 5 to 10 psi (.345 bar - .69 bar)
(34.485 - 68.97 kPa) above maximum spring pressure.

1. Install the tubing to the air supply port, ←***S*** (arrow only for High Flow).
2. For a
   - Single acting actuator - pipe the outbound air from the output pressure port (←***I***) to the actuator (arrow only for High Flow).
   - Double acting actuator - pipe output pressure port one (←***I***) for one side of the actuator and output pressure port two (←***II***) for the other side of the actuator (arrow only for High Flow).
3. Air supply:
   - Supply pressure for the single acting SVI FF:
     20 -150 psi max. (1.4 - 10.3 bar) (138 - 1034 kPa)
   - Supply pressure for the double acting and FF High Flow SVI FF:
     25 - 150 psi (1.73 - 10.3 bar) (172 - 1034 kPa)
   - Minimum tubing diameter 1⁄4" (6mm x 4mm)
   - Supply pressure must be 5 psi - 10 psi (.345 bar - .69 bar)
     (34.485 - 68.97 kPa) greater than the spring range of the actuator but may not exceed the rated actuator pressure. Refer to the valve or actuator instruction manual.

CAUTION

For High Flow installations above 125 psi (8.6 bar, 861 kPa), perform a manual find stops and use preset tuning, especially with large volume actuators. If possible, use a Quick Exhaust.

NOTE

The SVI FF Digital Valve Positioner is designed to operate with clean, dry, oil-free, instrument grade air to ANSI-ISA-57.3 1975 (R1981) or ISA-S7.3-1975 (R1981) or with a sweet natural gas supply (SVI FF models SVI FF-2 through SVI FF-3).

Table 8 - Air Supply Requirements

Dew Point	At least 18° F (-7°C) below minimum anticipated ambient temperature
Particulate Matter	Filtered to 5 microns
Oil Content	Less than 1 ppm w/w
Contaminants	Free of all corrosive contaminants

WARNING

Never exceed the actuator maximum rated supply pressure: 150 psi (10.3 bar, 1030 kPa). Damage to equipment or injury to personnel can result.

CAUTION

The SVI FF High Flow digital valve positioner cannot be placed in parallel with another volume booster. Contact the factory for further instructions regarding configuration with boosters as well as other non-standard configurations.

Do not use pipe thread sealant tape on pneumatic fittings. It may shred into small particles that can cause instrument malfunction. Remove any excess pipe thread sealant from the first and second threads to prevent uncured sealant from entering the air lines.

Actuator Piping

Connect Output 1, labeled *ACT 1* to the inlet port of the actuator in accordance with Figure 32. Output 2 labeled *ACT 2* connects to the opposing actuator port.

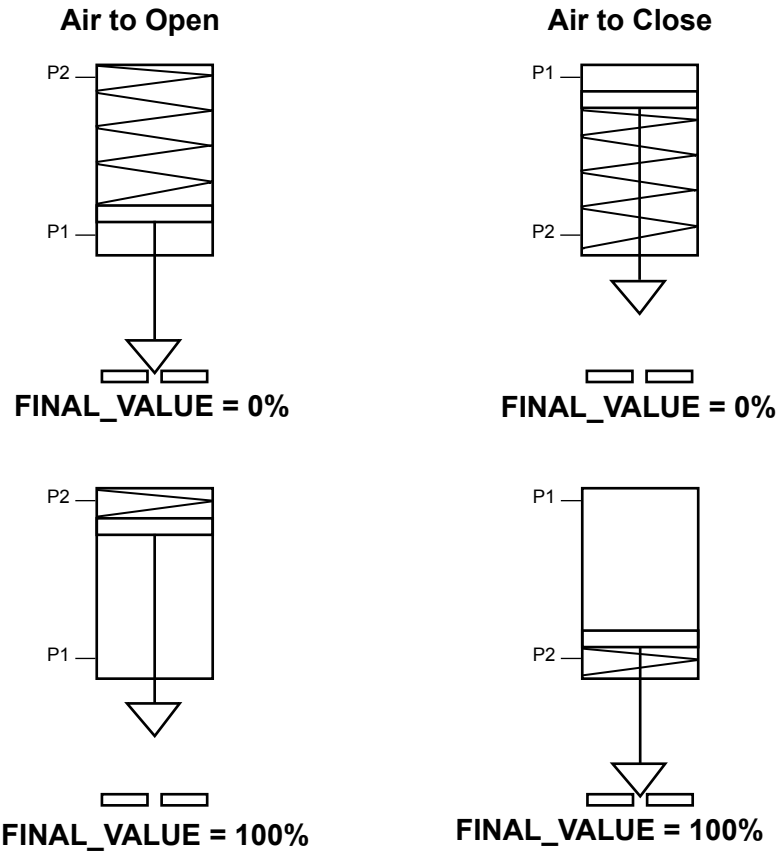

Figure 32 - Double Acting Positioner ATO/ATC Settings for Reciprocating Valves

Wiring the SVI FF

The procedure below outlines wiring the SVI FF.

WARNING

- *Comply with current national and local regulations for electrical installation work.*
- *Comply with national and local explosive atmosphere regulations.*
- *Before carrying out any work on the device, power off the instrument or make sure that the local conditions for potentially explosive atmosphere permit the safe opening of the cover.*

CAUTION

Refer to "Output Switch" on page 25 for guidelines on safely wiring switch load limits.

Connecting to the Control Loop

The SVI FF digital valve positioner *MUST BE* grounded according to local regulations. Physically connect the SVI FF to the control loop using a cable specified by the FF Foundation. A shielded cable is recommended.

To communicate using FF:

1. Connect one end of the cable to the control loop's 9 - 32 VDC output.
2. Remove the threaded wiring covers on the positioner.
3. Connect the other end of the cable to the SVI FF. There are two threaded openings on the positioner. Use the opening with the red plastic insert.

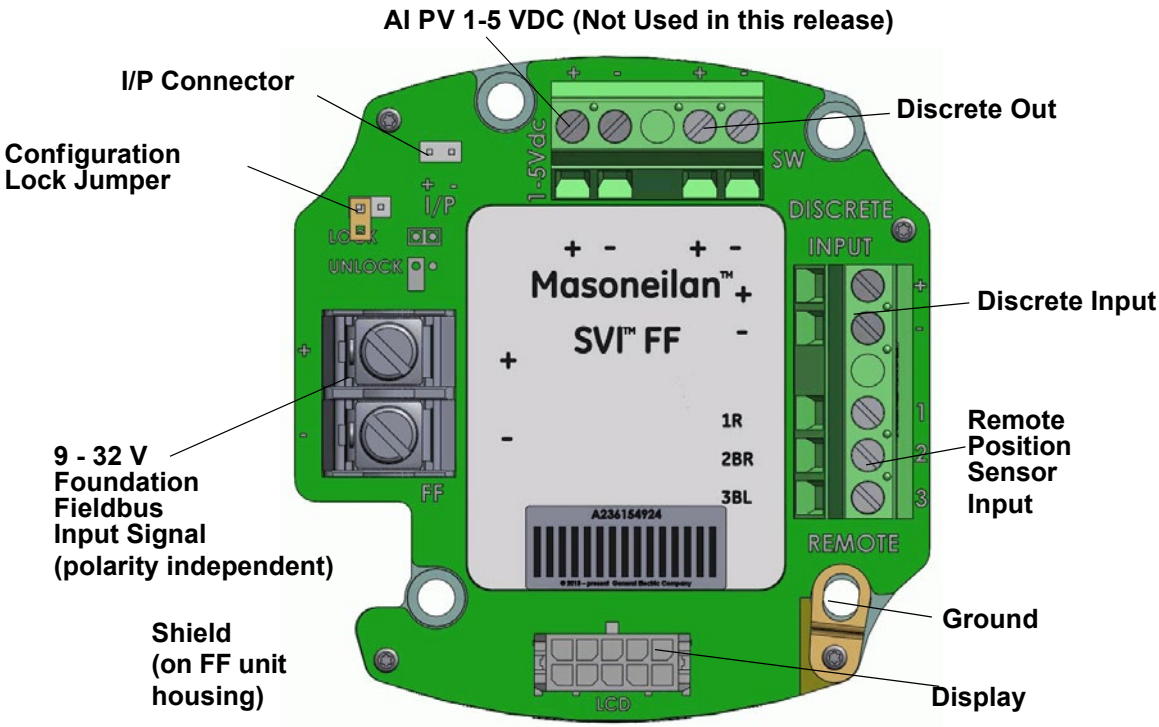

Figure 33 - Connections to Electronics Module (via Terminal Board)

Making Connections to the Terminal Board

Connect the wires from the option as follows (wire size 12 to 22 AWG on the 9 - 32 VDC FF input and 14 to 26 AWG on the PV, SW, DI, and Remote):

1. If the wires have not been stripped, strip approximately 1/4 in (6.35 mm) of the insulation at the end of wires.
2. Locate the correct terminal block on the terminal board (see Figure 33).
3. Loosen the screw until the opening is sufficient for wire insertion.
4 Insert the wire into the opening and retighten the screw.

Verify Wiring and Connections

Use the following procedure to ensure that the SVI FF is properly powered:

- Use an FOUNDATION™ Fieldbus approved device to ensure that the voltage is between 9 and 32 V. If voltage is less than 9 V, the voltage is out of range. If 9 V is not attainable, see “Troubleshooting” on page 117.

CAUTION

Improperly or inadequately grounded installations can cause noise or instability in the control loop. The internal electronic components are isolated from ground. Refer to FOUNDATION Fieldbus website for documentation and further instruction.

Output Switches

The SVI FF supports a contact output, SW #1 (Discrete Output switch), that can be logically linked to status bits.

The switch is polarity sensitive and must be connected only to a DC circuit. The switch (+) terminal must be electrically positive with respect to the (–) terminal. If the (+) terminal is electrically negative with respect to the (–) terminal, then the switch will conduct.

If the switch is connected directly across the power source the current will be limited only by the capacity of the power source and the switch can be damaged.

Without a load, when the switch is on (closed) the external voltage would be dropped across the switch. **This damages the switch** (Figure 34).

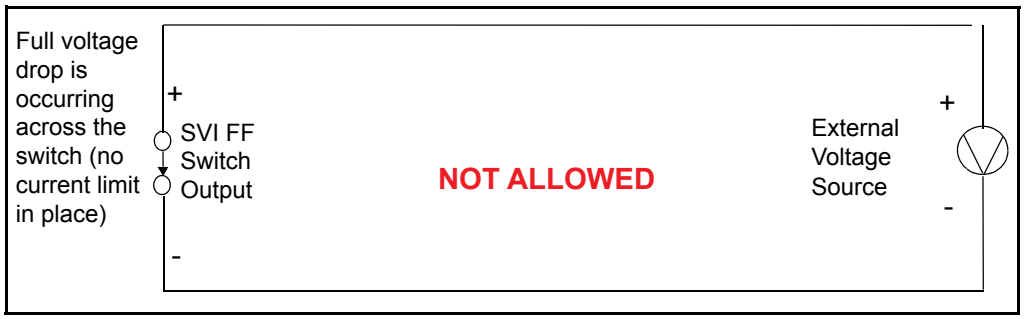

Figure 34 - Switch Installation Drawing without Load: Configuration Not Allowed

General Configuration Notes

This section discusses the necessary precautions when configuring a system.

	Switch OFF	Switch ON
V_{SWITCH}	30 VDC max.	≤ 1 V (Switch saturation voltage)
I_{SWITCH}	≤ 0.200 mA (Switch leakage current)	1 A max.

CAUTIONS

Incorrect polarity connection results in an effectively closed connection.

Consult with qualified personnel to ensure that electrical requirements for the switches are met.

The maximum voltage that can be applied to the digital switch outputs is 30 VDC. This is an open circuit parameter (the digital switch is in the open state). Under open circuit conditions, the switch current will be less than 0.200 mA.

The switch maximum current rating is 1 A. When the switch is ON, the typical switch voltage is ≤1V.

When the switch is on (closed) the external voltage must be dropped across the load (Figure 35).

CAUTION

The load must be designed such that the current in the circuit is ≤1 A at all times. Some 3rd party devices, such as incandescent lamps or solenoids, require surge and back EMF protection to prevent voltage spikes.

Inductive Load, Solenoid, Incandescent Lamp Configuration

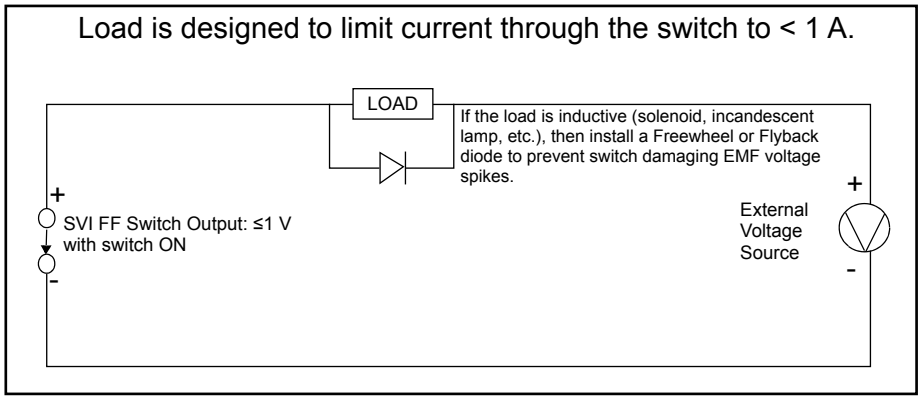

Figure 35 - Switch Installation Drawing: Correct Configuration with Load

Distributed Control Systems Configurations

This section gives guidance for configuration in a DCS application. Figure 36 gives two generalized drawings that cover DCS applications to ensure switch safety.

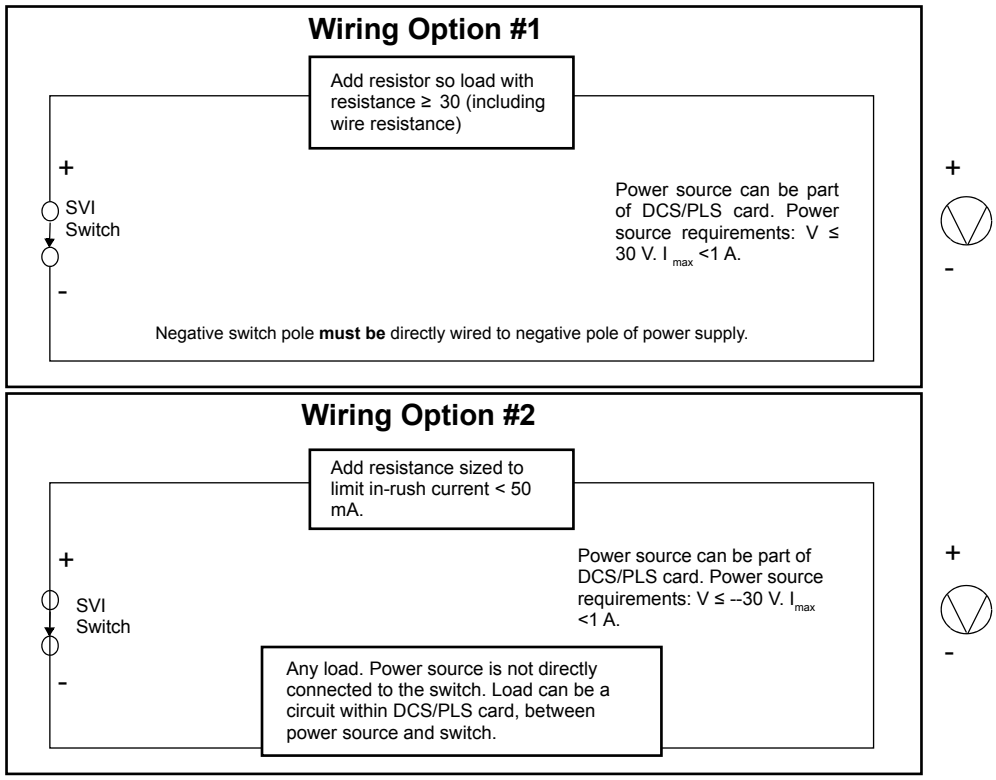

Figure 36 - DCS Switches Wiring Options

Configuration Considerations

- A typical value for 24 AWG cable about 0.025 Ohm/ft (see Wiring Option #1).
- If IS barrier is a combination of fuse, resistor and Zener diode then the connection is shown in Option #2. The barrier must have adequate resistance to limit inrush current, as the fuse cannot limit inrush current (see Wiring Option #2).

Switch Settings

The discrete output switch can be opened or closed in response to conditions that the SVI FF detects. This action is defined via DISCRETE_SWITCH_1_CONF (*Discrete Switch 1* on the SVI FF software) and are:

NOTE

The directional state of the switch is set using the *Software Switches* tab or using the DD's *DISCRETE_SWITCH_1_CONF. DIRECTION*.

0. *Disabled* - the switch is always inactive (default).
1. *DO Block* - the switch's state is linked to the state of a DO block. If the DO block feedback configuration changes, then the switch changes state. The DO switch auto-detects which DO block has the matching CHANNEL and translates 0 to inactive and non-0 to active. This is configured using the Software Switches tab on the DTM or using the DD.
2. *Fault State* - the switch is activated whenever a fault occurs and the switch remains activated until the SVI FF status is cleared.
3. *Not in Normal* - the switch is activated whenever the mode in not Normal.
4. *Maintenance Required* - the switch is activated whenever the device has an alert that requires maintenance.
5. *Warning Data* - the switch is activated whenever the TB block error Warning Data bit is set. This is manifested as a maintenance needed soon indication.
6. *Air Supply Alert* - the switch is activated whenever there is an air supply alert. This is configured using the Pressure Alarms tabs on the DTM or using the DD.
7. *Travel Deviation Alert* - the switch is activated whenever a travel deviation alert occurs. This is configured using the Travel Alarms tabs on the DTM or using the DD.
8. *Position HI Alert* - the switch is activated whenever a user-configured Position HI alert setting is exceeded. This is configured using the Position Alarms tabs on the DTM or using the DD.
9. *Position LO Alert* - the switch is activated whenever a user-configured Position LO alert setting is exceeded. This is configured using the Position Alarms tabs on the DTM or using the DD.
10. *Always Active* - the switch is always active and does not change state.

11. *Always Inactive* - the switch is always inactive.
12. *Reset Occurred* - the switch is active when a reset occurs and moves to configured default state.
13. *Tight Cutoff* - the switch is active when a tight cutoff is reached. At that time it closes if Normally Open and opens if Normally Closed. The switch resets once the threshold condition clears.

NOTE

DISCRETE_SWITCH_2_CONF (*Virtual Switch 2* on the SVI FF software), functions with the same settings. However, in this case, it drives a Virtual Discrete Switch (register) only. This register is usable to connect to the Discrete Input block.

NOTE

The contacts are OPEN when the SVI FF is unpowered and may be configured (via the DTM or DD) to be open or closed when the flag is asserted after boot.

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5. Check Out and Power Up

Overview

This section provides the checkout procedures required to determine if the SVI FF is in working order and to power up the unit.

NOTE

Perform all procedures in this section before putting the SVI FF into operation.

Check Out Procedures

SVI FF checkout consists of physical and operational checkout procedures.

Physical Inspection

The physical checkout procedures include:

- “Inspect Actuator, Linkages, or Rotary Adapter” on page 74
- “Verify Mounting and Linkage Adjustment” on page 74
- “Check the Magnet” on page 74
- “Check the Electronic Module Connections” on page 77
- Valve Mounting
- Air Supply

Inspect Actuator, Linkages, or Rotary Adapter

Verify that the mounting has not been damaged in shipment for a pre-mounted SVI FF, physically inspect the actuator, linkage. Record the following information for the configuration checkout:

1. Valve Air to Open (ATO) or Air to Close (ATC)
2. Actuator pressure rating
3. Actuator bench rangel valve; linear, equal percentage, or other.
4. Inherent trim characteristic of the control valve; linear, equal percentage, or other.

NOTE *Refer to the valve data sheet or model number of control valve.*

Verify Mounting and Linkage Adjustment

Inspect the mounting and make any needed adjustments before running the positioner and checking the digital configuration.

Check the Magnet

There are two methods of checking the SVI FF magnet:

- “Perform a Visual Inspection”
- “Use ValVue to Check Magnet Position” on page 76

Perform a Visual Inspection

You must remove the positioner from the bracket to visually inspect the magnet orientation. For rotary valves, such as a Camflex, or for actuators with rotation of less than 60°, the magnet assembly must be aligned as shown in Figure 37.

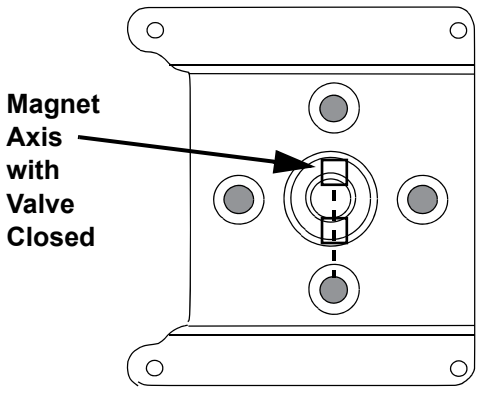

Figure 37 - Magnet Orientation for Rotary Valves with Valve Closed

For rotary valves, or for actuators with rotations greater than 60°, the magnet assembly must be aligned as shown in Figure 38.

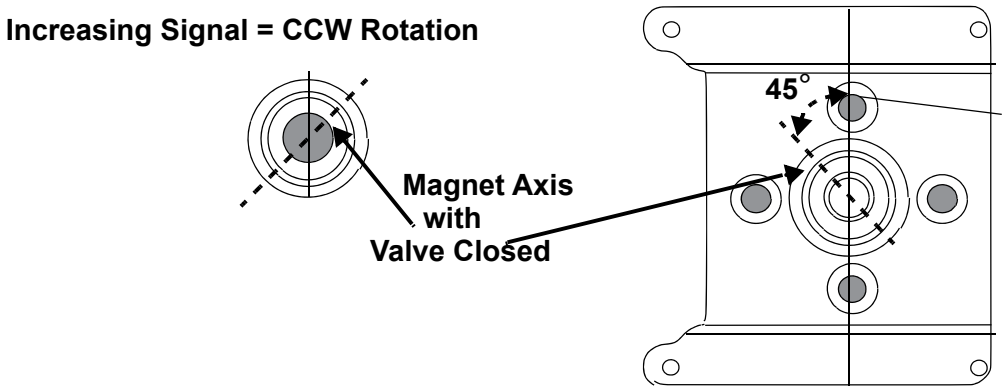

Figure 38 - Magnet Orientation for 90° Valve Rotation with De-energized Actuator

NOTE

For a reciprocating valve, it is not necessary to remove the positioner to visually inspect the magnet setting and linkage of a reciprocating valve.

For reciprocating valves the adjustable link turnbuckle must be parallel to the valve stem. To ensure linearity in positioning verify that the hole in the lever aligns with the indicating hole in the bracket when the valve is in the closed position. Check that the bracket is mounted on the correct holes. (See Figure 39 for details).

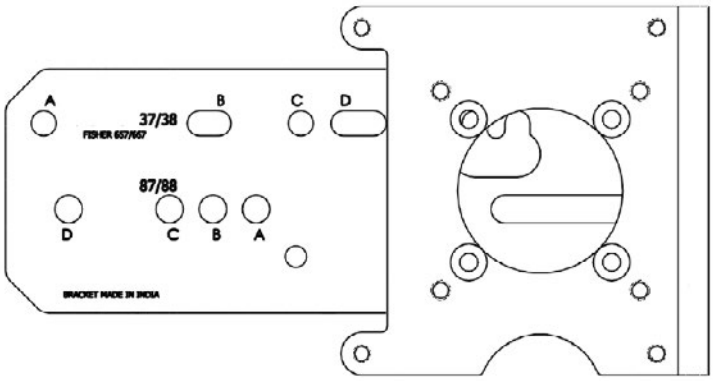

Figure 39 - Reciprocating Valve Mounting Bracket

Use ValVue to Check Magnet Position

Use this procedure to check the magnet using ValVue:

1. Connect to the positioner in accordance with the ValVue instructions.
   a. Run ValVue.
   b. Select the installed positioner from the list of *Connected Devices*.
   c. Select the: **Check** tab to view the current operating conditions of the selected positioner.
2. The *Raw Position Value* should be between – 1000 and +1000 when:
   - A reciprocating or less than 60° rotation rotary valve is closed.
   - A greater than 60° rotation rotary valve is at 45° of rotation (mid stroke for a 90° rotation rotary valve).

Check the Air Supply

1. Turn on the air supply.
2. Adjust the filter regulator.
3. Supply pressure must be a minimum of 5 (.35 bar, 34.5 kPa) to 10 psi (.69 bar, 68.97 kPa) greater than the spring range of the actuator but may not exceed the rated actuator pressure. Refer to the valve or actuator instruction manual.
4. Inspect the tubing connections between the filter-regulator and the positioner for leaks. 5.

Verify that the tubing is not bent or crushed.

6. Verify that all fittings are leak tight.

CAUTION

Do not use Teflon pipe seal tape as it can shred into particles harmful to the pneumatic components.

Check the Electronic Module Connections

WARNING

Do not remove the instrument cover or connect to an electrical circuit in a Hazardous Area unless power is disconnected.

The SVI FF terminal board has terminal blocks with screw connectors. Not all options are available for every model. Confirm the correctness of all applicable connections to the electronics module.

NOTE

When an SVI FF is turned on, apply the air supply before applying the electrical input signal.

Operational Checkout

The operational checkout of the SVI FF consists of:

1. “Connect to the H1 Network”
2. “Power Up the SVI FF” on page 78

Connect to the H1 Network

Connect to the Fieldbus power supply, then check and configure with the local display and pushbuttons, if so equipped. Refer to “Pushbuttons and Local Display” on page 128 for further details.

If the SVI FF is not equipped with local display use ValVue and a PC with an FF setup or a handheld communicator.

NOTE

When an SVI FF is turned on, apply the air supply before applying the electrical power.

Power Up the SVI FF

WARNING

This process can cause the valve to move. Before proceeding be sure the valve is isolated from the process. Keep hands clear from moving parts.

CAUTION

Always power the SVI FF from a fieldbus power supply that supplies 9 to 32 VDC.

NOTE

When an SVI FF is turned on, apply the air supply before applying the electrical input signal.

Before powering up the SVI FF:

1. Verify that the pneumatic connections and electronic cover screws are tightened. This is important to maintain the ingress protection level and the integrity of the flameproof enclosure.
2. If the installation is Intrinsically Safe, check that the proper barriers are installed and the field wiring meets local and national codes for an IS installation.
3. If the installation is non-incendive, then check that all the electrical connections are to approved devices and wiring meets local and national codes.
4. Verify that the markings on the label are consistent with the application.

NOTE

For Hazardous Location Installation information refer to "Specifications and References" on page95.

5. Proceed to perform a Calibration and Configuration.

NOTE

If the SVI FF is specified without local pushbuttons and display, local operation is not available. Configure and calibrate with ValVue or using the DD a handheld Communicator.

6. Failsafe/OOS Considerations

Failsafe Mode vs. OOS Mode

In the FF device certain hardware and firmware failures (Table 9) cause OOS mode. These failures are reported as a *Failsafe* condition on the Local User Interface. *Failsafe* can be caused by the position sensor condition when the magnets are out of range. See "Mounting the SVI FF on Rotary Valves" on page 50 or "Mounting the SVI FF on Reciprocating Valves" on page 55 to adjust the magnets. *Failsafe* can also be caused by SVI FF internal damage.

To change the mode from OOS to any of the working modes, you must correct the Failsafe condition cause. Possibly the device electronics may need replacement, which involves contacting Baker Hughes technical support.

Normally, the device Failsafe condition results in the OOS mode for the Transducer block. However, this behavior is configurable and may be changed using the parameter *FAILED_STATE*, sub-parameter *PROPAGATE_APFS_TO_RB*. By default this flag is set. If you set this flag, the following sequence occurs as a result of Failsafe:

1. The Transducer block transitions to the OOS, which transitions the Resource block to OOS.
2. The Resource block then sets OOS for the downstream blocks.

CAUTION

If the faults in Table 9 occur several times in a row, ensure that environmental noise is not the cause. If the environment is not noisy contact Masoneilan.

Table 9 - Failsafe Faults

Fault Name	Description
POSITION_SENSOR TEMPERATURE_	If upon request temperature compensated remote position sensor reading is outside of range in degrees or internal position sensor reading is outside of range in degrees for five reads in a row. Indicates a slipping or blocked sensor. If, upon request, temperature compensated temperature sensor reading is outside
SENSOR	of range in °C for five reads in a row. Indicates environment temperature is too hot/ cold.
I2CBUS	Internal serial bus fault. Indicates a hardware problem - may require replacing the positioner.
NVM_CHECKSUM0	If an FRAM record and its copy both have CRC errors (as detected by read on initialization,) OR if the temperature calibration table has not been written in its entirety (detected by a CRC of column CRCs) OR bad FRAM signature. Indicates a hardware problem- may require replacing the positioner.
REF_VOLTAGE	If temperature compensated reference voltage is out of range for five reads in a row,or if the raw reading is outside the range ±5% of nominal. Indicates a hardware problem- may require replacing the positioner.
PRESSURE4	If temperature compensated pressure sensor 4 (pilot) reading is outside of range. Indicates a hardware problem - may require replacing the positioner.
SELF_CHECK	A valid hidden record (in RAM) existing upon reset indicating that a fatal event (watchdog, illegal interrupt, stack overflow, data checksum) occurred twice in a row. Indicates a hardware problem - may require replacing the positioner.
FSTATE_REQ	Failed state requested by FF.

Exiting Failsafe Using AMS

To exit Failsafe:

1. Inspect the (current) faults/status flags (Figure 40).

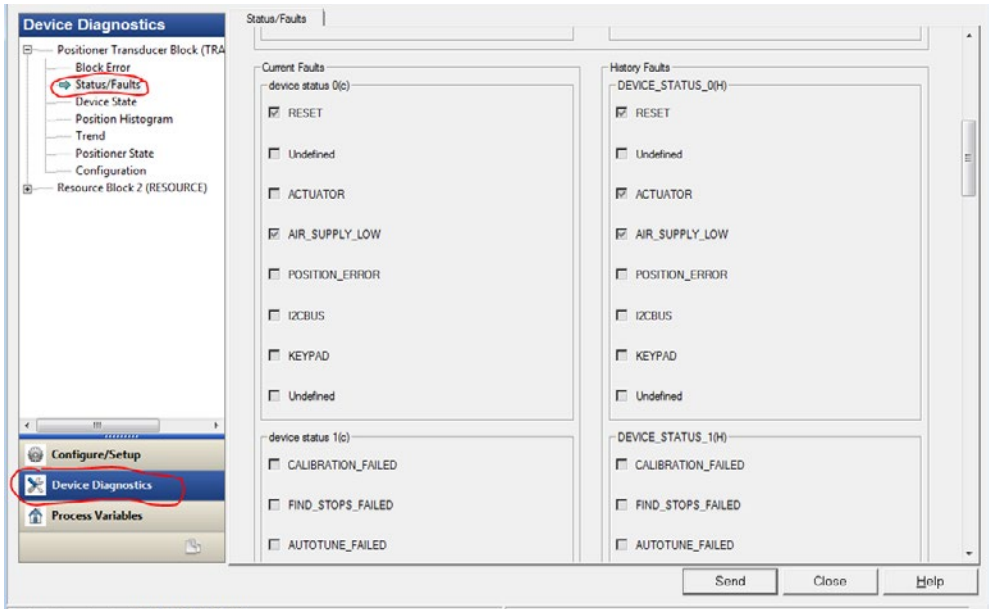

Figure 40 - AMS Status/Faults

2. If there are:
   - No failsafe faults, the method *change app mode* works, but in most cases it is unnecessary, and simply changing the Transducer block mode works fine.
   - Failsafe faults, they should be addressed (removed) first by:
     a. Correcting the underlying cause.
     b. Clearing the faults by:
        i.) Scrolling down and pressing the button at the bottom of Figure 40.
        ii.) Reviewing the screen for repeating faults.
        iii.) Switch mode to Manual or Auto as required.

Failsafe faults are listed in Table on page 80.

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7. Maintenance

SVI FF Maintenance and Repair

WARNING

Do not remove the instrument cover or connect to an electrical circuit in a Hazardous Area unless the power is disconnected.

Repair

See "Spare Parts" on page 91 for kits available for permitted field repairs.

NOTE

Only qualified service personnel are permitted to make repairs.

Only parts supplied by the factory are permitted. This includes not only the major assemblies but also mounting screws and O-rings. No substitutions with parts other than Masoneilan are permitted.

Tools Needed

- 5 mm hex key
- 3 mm hex key

Display Cover Removal and Installation

The display cover (shown in Figure 41) is provided as an option for the SVI FF. If you have an SVI FF with a solid cover and would like to replace the solid cover with a display cover follow the instructions below for removal and installation.

Removing the SVI FF Display Cover

To remove the SVI FF display cover:

1. Using a 5 mm Hex key unscrew the four screws around the perimeter of the SVI FF cover.
2. Lift the cover off the positioner.

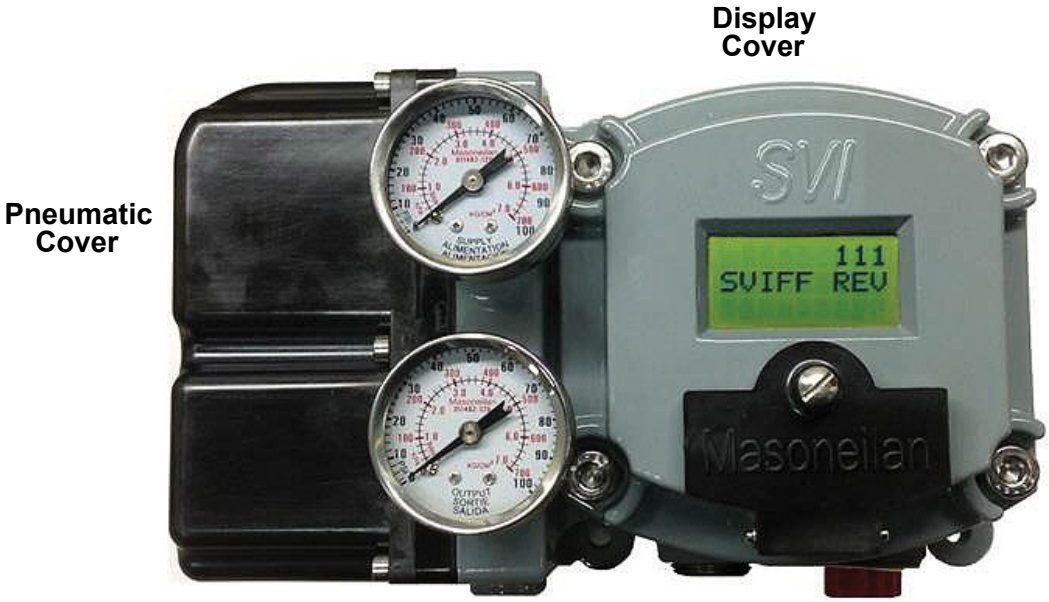


Figure 41 - SVI FF Display and Pneumatic Covers

Installing the SVI FF Display Cover

NOTE

After replacing the SVI FF Display Cover you must power up the unit (see "Power Up the SVI FF" on page 78 of this guide).

The replacement display cover is shipped with a lanyard to prevent the cable (that connects from the display to the Terminal Board) from breaking. The lanyard must be inserted under the screw in the lower left corner, that attaches the terminal board to the SVI FF housing.

To install the cover:

1 Install the lanyard and tighten the screw to 5 in-lbs (.565 N-m).

2 Using the 3 mm hex key, remove the screw from the lower left corner, connecting the terminal board to the SVI FF housing.

3 Connect the cable from the display into the LCD connector on the terminal board.

4. Ensure that the gasket is in its groove in the housing.

5 Place the cover over the screw mounts.

6. Tighten the four screws with the 5 mm hex key.
7. After installing the new display power up the unit (refer to “Power Up the SVI FF” on page 78).

CAUTION

The cover of the SVI FF is a critical component for safety in Hazardous Areas. To ensure safe operation the flat surfaces of the cover and the housing must be clean and absolutely free of particles or dents. There must be no gap between the housing and cover; torque spec is 50 in-lbs (5.65 N-m).

Make sure that:

- The gasket is seated in the groove in the housing flange.
- No wires or retaining cable can be trapped under the cover flange.
- The flange area is not corroded and the surface is not scarred.
- The four cover bolts are securely tightened to 50 in-lbs (5.65 N-m).

I/P Module Removal and Installation

Prior to removing the pneumatic components it is necessary to remove the electronics module cover (see “Removing the SVI FF Display Cover” on page 84) and the pneumatic cover first.

Do not remove the I/P module in a hazardous area unless the power is disconnected.

Application of more than 1.6 mA to the I/P motor can permanently damage it.

The I/P is rigidly assembled to a wire way sleeve that is a critical component for explosion proof service. Use care to slide the sleeve from the pneumatic module without applying a strain to it.

Pneumatic Cover Removal: FF and High Flow

To remove the FF pneumatic cover:

1 Using a 3 mm hex key, remove the six screws from around the perimeter of the cover

2. Lift the cover off and put aside for re-installation.

To remove the FF High Flow pneumatic cover:

1 Using a 3 mm hex key, remove the four screws from around the perimeter of the cover (Figure 42 or Figure 43).

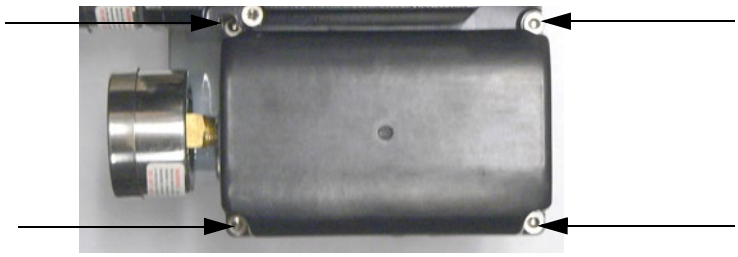


Figure 42 - Pneumatic Cover Screws: High Flow

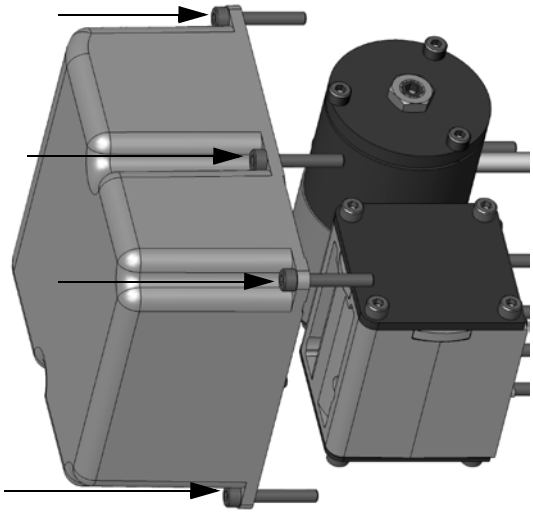


Figure 43 - Pneumatic Cover Screws: FF (Four Shown)

2. Lift the cover off and put aside for installation.

Pneumatic Cover Removal

To remove the pneumatic cover:

1 Using a 3 mm hex key, remove the six screws from around the perimeter of the cover

2. Lift the cover off and put aside for re-installation.

I/P Module Removal

To remove I/P module:

1. Disconnect the I/P wire from the terminal board.
2. Using a 3 mm hex key, remove the four screws from around the perimeter of the I/P module.

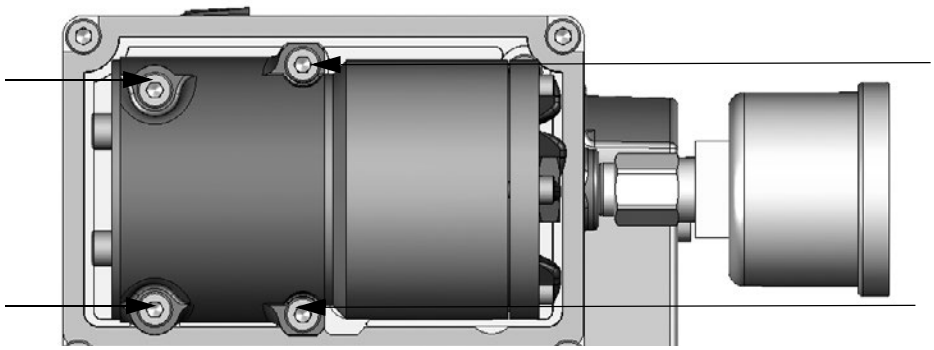


Figure 44 - SVI FF High Flow Pneumatic Module with Single Acting Relay

3. Lift the module off the positioner.

I/P Module Installation

To install I/P module:

1. Place the module in the designated area on the positioner.
2. Using a 3 mm hex key, install the four screws around the perimeter of the I/P module.
3. Replace the I/P wire connector on the terminal board.
4. Replace the Display Cover (see “Installing the SVI FF Display Cover” on page 84).

Ensure that:

- The wire is not damaged when feeding it through the housing.
- A single O-ring is in place on the wire-sleeve and is not damaged.
- The four retaining screws are tight and torque to 15 in-lb (1.7 N-m).
- Inserting the wire sleeve through the housing does not require force.

Pneumatic Cover Installation

To install the pneumatic cover:

1. Place the cover over the pneumatic module.
2. Using a 3 mm hex key, install the six screws around the perimeter of the cover and torque to 8 in-lb (.9 N-m).

Relay Removal and Installation

To remove the pneumatic relay:

1. Using a 3 mm hex key, remove the three screws from around the perimeter of the relay.
2. Lift the relay off the positioner.

Relay Installation

To install pneumatic relay:

1. Place the relay in the designated area on the positioner.
2. Using a 3 mm hex key, install the three screws around the perimeter of the relay.

Make sure that:

1. The five O-rings are seated in the base of the relay and are not damaged.
2. The three mounting screws are tight and torque to 15 in-lb (1.7 N-m).

CAUTION

When you have completed maintenance on the pneumatic relay it is necessary to reinstall the pneumatic cover. Refer to on *"Pneumatic Cover Installation" on page 87.*

Adjusting I/P Zero

The I/P Zero is calibrated at the factory prior to shipment. If there is a problem with I/P zero please contact your representative.

Connecting Components to the Electronics Module

If it is necessary to remove and install any SVI FF component you may need to reconnect the component to the SVI FF Electronics Module via the SVI FF Terminal Board. Refer to "Wiring the SVI FF" on page 65 of this manual for instructions.

Repair by Replacement

Using ValVue and repair-by-replacement is the fastest method to service an SVI FF. See the ValVue instruction manual for details regarding uploading and downloading configuration files. Upload all configuration information from the installed positioner to ValVue, then install the replacement positioner and download the configuration file into the replacement unit. Run STOPS, and Auto Tune, and the repair is complete. The positioner that was removed can be refurbished and reused.

NOTE *Substitution of components can void safety approvals.*

Internal Diagnostics

The SVI FF performs internal self-diagnostics and hardware checks. When ValVue or handheld or the local display indicates that there are error messages write them down for troubleshooting.

FAILSAFE Mode

See "Failsafe/OOS Considerations" on page 79. for further discussions.

Several of the internal diagnostics tests puts the SVI FF into FAILSAFE mode if the errors continue for a preset time. When the SVI FF goes into FAILSAFE, the valve is driven to its Failsafe position. It remains in that position until a technician clears the cause of the error and resets the instrument. Reset is performed in two ways:

- Connect a FF H1 segment and ValVue, and then change the Transducer block mode (if faults are already cleared).

or

- Turn the power off and on.

To prevent the valve from moving after reset, put the controller in manual, and set the valve position setpoint to the failsafe position 0% if ATO, 100% if ATC.

Viewing Firmware Versions

Firmware versions can be viewed using the:

- SVI FF DTM on the *Positioner* tab. The firmware revision is *Software Revision* (Figure 45). Where the first digit, here *1*, represents the *DD Revision.*

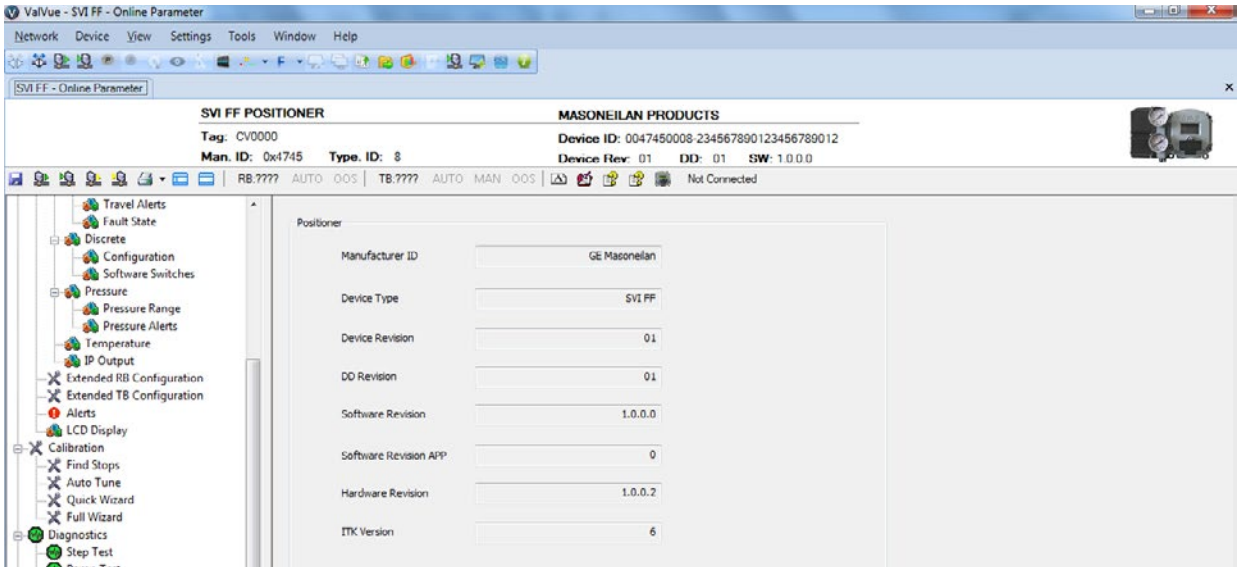


Figure 45 - Positioner Tab

- By creating/printing the SVI FF Configuration Report by:
  1. Selecting **View** > **Network View** > **Topology Pane**.
  2. Selecting the positioner, right-clicking and selecting **Additional Functions** > **Report**.
- Handheld by selecting **Online** > **SVI FF Device** > **Resource Block** > **Device > Identification.**

Spare Parts

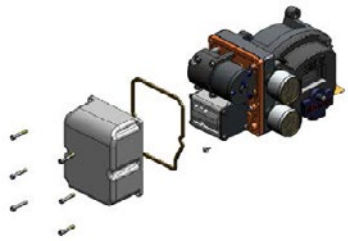
Electronics:

- □ SVI FF-2 (720024064-999-0000)
- □ SVI FF-3 (720024066-999-0000)
- □ SVI FF-2 Double Acting (720024067-999-0000)
- □ SVI FF-3 Double Acting (720024068-999-0000)

Item	Description	Quantity
1	ELECTRONIC ASSEMBLY SVI II AP	1
2	SILICONE GASKET, COVER ELECTRONICS	1
3	SCR HEX SHCS M4 X 0.7 X 27 MICROSPHERES 593 PATCH	6
4	O-RING, REF NO. 2-006	6
5	INSTRUCTIONS	1

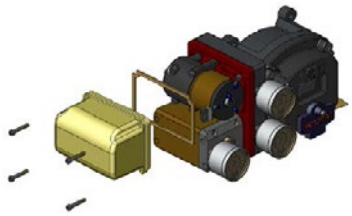
SA Reinforced Pneumatic Cover Kit (720028475-999-0000)

Item	Description	Quantity
1	SCR HEX SHCS M4 X 0.7 X 25 MICROSPHERES 593 PATCH	6
2	GASKET MANIFOLD S/A	1
3	REINFORCED PNEUMATICS COVER SA	1



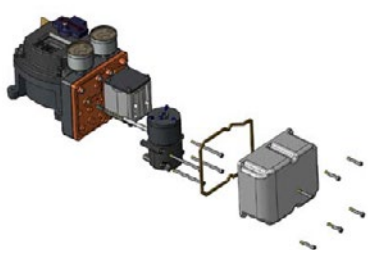
DA Reinforced Pneumatic Cover Kit (720028476-999-0000)

Item	Description	Quantity
1	SCR HEX SHCS M4 X 0.7 X 25 MICROSPHERES 593 PATCH	4
2	GASKET I/P COVER D/A SVI2AP	1
3	REINFORCED COVER PNEUMATICS DA	1



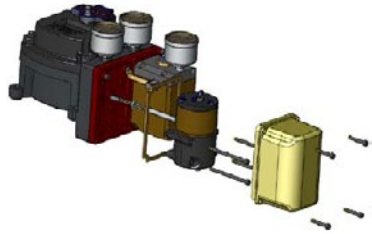
SA IP Assembly Reinforced Cover (720028473-999-0000)

Item	Description	Quantity
1	I/P, ASSY	1
2	O-RING, I/P STEM	2
3	SCR HEX SHCS M4 X 0.7 X 60 MICROSPHERES 593 PATCH	4
4	REINFORCED PNEUMATICS COVER	1
5	PNEUMATICS COVER GASKET	1
6	SCR HEX SHCS M4 X 0.7 X 25 MICROSPHERES 593 PATCH	6
7	INSTRUCTIONS	1



DA IP Assembly Reinforced Cover (720028474-999-0000)

Item	Description	Quantity
1	IP ASSEMBLY, SVI II ESD	1
2	O-RING, I/P STEM	2
3	SCR HEX SHCS M4 X 0.7 X 60 MICROSPHERES 593 PATCH	4
4	REINFORCED PNEUMATICS COVER	1
5	PNEUMATICS COVER GASKET	1
6	SCR HEX SHCS M4 X 0.7 X 25 MICROSPHERES 593 PATCH	4
7	INSTRUCTIONS	1



Standard Push Button Display Silicone Gasket (720028469-999-0000)

Item	Description	Quantity
1	ASSY, COVER WINDOW	1
2	Silicone Gasket, Cover, Electronics	1
3	Instructions	1

Offshore Push Button Display Silicone Gasket (720028471-999-0000)

Item	Description	Quantity
1	ASSY COVER WINDOW, MARINE	1
2	Silicone Gasket, Cover, Electronics	1
3	Instructions	1

SA Standard and Offshore Relay Reinforce Cover (720028472-999-0000)

Item	Description	Quantity
1	RELAY, SA	1
2	SCR HEX SHCS M4 X 0.7 X 60 MICROSPHERES 593 PATCH	3
3	REINFORCED PNEUMATICS COVER	1
4	PNEUMATICS COVER GASKET	1
5	SCR HEX SHCS M4 X 0.7 X 25 MICROSPHERES 593 PATCH	6
6	INSTRUCTIONS	1

DA Standard Relay (720003881-999-0000)

Item	Description	Quantity
1	RELAY, DA Offshore 12:1	1
2	SCR HEX SHCS M4 X 0.7 X 60 MICROSPHERES 593 PATCH	4
3	O-RING, CONTOURED, DA 12:1 RELAY	1
4	Instructions	1

DA Offshore Relay (720003882-999-0000)

Item	Description	Quantity
1	RELAY, DA Offshore 12:1	1
2	SCR HEX SHCS M4 X 0.7 X 60 MICROSPHERES 593 PATCH	4
3	O-RING, CONTOURED, DA 12:1 RELAY	1
4	Instructions	1

Pushbutton Door, Kit (720002448-999-0000)

Item	Description	Quantity
1	SCREW CAPTIVE PANEL	1
2	PIVOT PIN PUSH BUTTON COVER SVI II	1
3	CIRCLIP SHAFT PUSH B	3
4	COVER PUSHBUTTON SVI2AP	1
5	GASKET COVER PUSHBUTTON SVI2	1

HC SA Standard Relay (720014541-999-0000)

Item	Description	Quantity
1	Relay SA HC	1
2	M4 X 0.7 X 60 SHCS	5
3	O-RING ID 9.19 [0.362] WIDTH 2.62 [0.103] REF NO 2-110	3
4	O-RING ID 29.87 [1.176] WIDTH 1.78 [0.0703] REF NO 2-025	1
5	O-RING ID 9.137.82 [1.498] WIDTH 1.78 [0.0703] REF NO 2-1029	1
6	INSTRUCTIONS	1

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Appendix A. Specifications and References

Physical and Operational Specifications

This section provides the physical and operational specifications for the SVI FF.

Table 10 - Environmental Specifications

Operating Temperature Limits	-40° F to 185° F (-40°C to 85°C)
Storage Temperature Limits	-58° F to 185° F (-50°C to 85°C)
Temperature Effect	< 0.005% /° F typical; -40°F to 180°F (< 0.01% /°C typical; -40°C to 82°C)
Supply Pressure Effect	0.05% per psi unit (.73% per bar unit)
Ambient Humidity	10 to 95% non-condensing
Humidity Effect	Less than 0.2% after 2 days at 104° F (40°C), 95% Relative Humidity.
Electromagnetic Compatibility Electrostatic	IEC\EN61326-1 Ed 2 compliant ☐ Immunity Table 62 Industrial and Electromagnetic Environment ☐ Emission Limits CISPR 11 Group 1 Class A
Vibration Influence Measured at SVI FF Housing	4 mm at 5 - 15 Hz - Negligible 2 G at 15 - 150 Hz Less than 2 % of span 1 G at 150 - 2000 Hz - Less than 2% of span

Table 11 - Operational Specifications*

Accuracy	± 0.5% (typical ±0. 10% or less) Full Span
Hysteresis and Deadband	± 0.3% Full Span
Repeatability	± 0.3% Full Span
Conformity/Linearity	± 0.5% Full Span
Start-Up Drift	Less than 0.02% in first hour
Long Term Drift	Less than 0.003% per month
Position Travel Limits	Rotary: 18 - 140° Reciprocating: 0.25” - 4“(6 mm - 100 mm); Extended mounting: > 4" (100 mm Note: Above 4” (100 mm) consult factory for mounting instructions.
Flow Characteristics Applied in addition to the control valve’s inherent characteristic.	Linear Equal Percentage (of 50:1 or 30:1) Camflex Quick Opening (inverse of 50:1 equal percentage) User Configurable Tight Shut Off (0 -20% of input)
Position Auto Tune SVI FF performs automatic determination of the optimal valve position control parameters. In addition to P, I, D, the position algorithm uses damping, symmetry for exhaust and fill time constants, dead zone and magnitude characterization parameters. Auto Tune is optimized for 5% step changes with negligible overshoot. After the Auto Tune process is completed, you can further adjust the positioner tuning parameters to more conservative or to more responsive values.	Proportional gain: 0 to 5, displayed as 0 to 5000 Integral time: 0 to 100 seconds - displayed as 0 to 1000 (1/10s) Derivative time: 0 to 200 milliseconds Dead Zone: 0 to ±5% (0 to 10% deadband) Padj: ± 3000 (depends on P) Beta (non-linear gain factor): -9 to +9 Stroking Time: 0 to 250 seconds Position compensation coefficient: 1 to 20 Boost: 0 to 20

* Specifications are subject to change without notice

Table 12 - Input Signal, Power, and Display Specifications

Input voltage	9 - 32 V polarity independent
Normal/Maximum current	17.4/ 18.3 mA
Wire Size	☐ FF input: 12 to 22 AWG ☐ All others: 14 to 26 AWG
Digital Communication Protocol	FOUNDATION Fieldbus registered device
Physical Layer Type (s)	☐ 121 - Low-power signaling, bus powered, Entity Model I.S. ☐ 511 - Low-power signaling, bus powered, FISCO I.S.
Local Display (optional)	LCD, explosion proof
Push Buttons	External, Three Explosion Proof / Flameproof push buttons

Table 13 - Construction Material Specifications

Housing and Cover	Aluminum ASTM B85 SG100A standard Stainless Steel optional
Weight	Standard Flow Model: ☐ Aluminum - 7.4 lbs./ 3.3 kg ☐ Stainless Steel - 16 lbs/ 7.3 kg High Flow Model: ☐ With Display: 9.4 lbs./ 4.2 kg ☐ Without Display: 8.9 lbs./ 4.0 kg
Relay and Manifold	Standard Flow Model: ☐ Single Acting - PPS, 300 Series Stainless Steel, nitrile diaphragms ☐ Double Acting - 300 Series Stainless Steel, Ryton Aluminum 6061 T6, Ryton High Flow Model: ☐ 300 Series Stainless Steel, Ryton Aluminum 6061 T6, Ryton
I/P Motor	430 stainless steel, PPS, 300 series stainless steel
Mounting Bracket	300 series stainless steel
Magnet Holder	Corrosion Protected Anodized Aluminum 6061 T6
Pole Ring	416 stainless steel
Levers	300 Series stainless steel

Table 14 - System Connectivity

DD Registered with FOUNDATION Fieldbus Foundation	Yes, available through foundation website
Diagnostics	Options include: Valve signature, ramp, friction, stroking speed, step response, cumulative travel, cumulative cycles, and time of operation in near-closed position. Some diagnostics require pressure sensor and ValVue software.

Table 15 - Pneumatics Single Acting Standard Flow

Air Supply	Dry, oil-free, 5 micron filtered and regulated air and sweet natural gas (See ISA S7.3)
Action	Direct Acting
Supply Pressure	20 -150 psi max. (1.4 - 10.3 bar) Regulate 5 - 10 psi (.345 bar - .69 bar) above actuator spring range. Do not exceed actuator rating.
Air Delivery - Single Acting Relay	10.0 scf/min (280 L/min) at 30 psi (2.1 bar) supply 16.6 scf/min (470 L/min) at 60 psi (4.2 bar) supply 23.3 scf/min (660 L/min) at 90 psi (6.3 bar) supply
Air Capacity (flow coefficient)	Loading Cv = 0.57 Venting Cv = 0.53
Air Consumption	0.20 scf/min (5.7 L/min) at 30 psi (2.1 bar) supply 0.28 scf/min (8 L/min) at 60 psi (4.2 bar) supply 0.42 scf/min (12 L/min) at 90 psi (6.3 bar) supply
Air Supply Failure	Single Acting Relay On supply failure the actuator output drops. Some overshoot may occur when air pressure returns after a period without air supply pressure. Always set control set point to 0%, and put the process control system in manual, for smooth recovery from air supply failure.
Loss of Input Signal	Output drops to low pressure.
Output Pressure	0 - 150 psi (10.3 bar) max

Table 16 - High Flow Pneumatics Single Acting High Flow

Air Supply	Dry, oil-free, 5 micron filtered, filtered and regulated air and sweet natural gas (See ISA S7.3)
Action	Direct Acting
Supply Pressure	20 -150 psi max. (1.4 - 10.3 bar) Regulate 5 - 10 psi (.345 bar - .69 bar) above actuator spring range. Donot exceed actuator rating.
Air Delivery - Single Acting Relay	39.0 scf/min (1104 L/min) at 30 psi (2.1 bar) supply 70.6 scf/min (2000 L/min) at 60 psi (4.2 bar) supply 102.0 scf/min (2888 L/min) at 90 psi (6.3 bar) supply 134.0 scf/min (3794 L/min) at 120 psi (8.4 bar) supply
Air Capacity (flow coefficient)	Loading Cv = 2.2 Venting Cv = 2.2
Air Consumption	0.20 scf/min (5.8 L/min) at 30 psi (2.1 bar) supply 0.45 scf/min (12.6 L/min) at 60 psi (4.2 bar) supply 0.65 scf/min (18.3 L/min) at 90 psi (6.3 bar) supply 0.84 scf/min (23.9 L/min) at 120 psi (8.4 bar) supply
Air Supply Failure	Single Acting Relay On supply failure the actuator output drops. Some overshoot may occur when air pressure returns after a period without air supply pressure. Always set control set point to 0%, and put the process control system in manual, for smooth recovery from air supply failure.
Loss of Input Signal	Output drops to low pressure.
Output Pressure	0-150 psi (10.3 bar) max.

Table 17 - Pneumatics Double Acting Standard Flow

Air Supply	Dry, oil-free, 5 micron filtered, filtered and regulated air and sweet natural gas (see ISA S7.3)
Action	Output 1 increases with increasing Output 2 decreases with increasing
Supply Pressure for Double Acting	25 - 150 psi max. (1.73 to 10.3 bar) Do not exceed actuator rating.
Air Delivery for Double Acting	7.2 scf/min (204 L/min) at 30 psi (2.1 bar) supply 12.8 scf/min (362 L/min) at 60 psi (4.2 bar) supply 18.3 scf/min (518 L/min) at 90 psi (6.3 bar) supply 23.8 scf/min (674 L/min) at 120 psi (8.4 bar) supply
Air Consumption for Double Acting	0.42 scf/min (12 L/min) at 30 psi (2.1 bar) supply 0.57 scf/min (16 L/min) at 60 psi (4.2 bar) supply 0.85 scf/min (24 L/min) at 90 psi (6.3 bar) supply 1.06 scf/min (30 L/min) at 120 psi (8.4 bar) supply
Air Supply Failure	Positioner cannot control the failure position of an actuator without a spring. The actuator can, under different conditions, fail in place, fail open, or fail close. In cases where the valve must fail to a required position additional control equipment is required. Some overshoot can occur when air pressure returns after a period without air supply pressure. Always set control set point to 0%, and put the process control system in manual, for smooth recovery from air supply failure.
Loss of Input Signal	Output 1 drops to low pressure. Output 2 rises to supply pressure.

Table 18 - FOUNDATION Fieldbus Block Times

Analog Output (AO)	12 ms	Arithmetic (AR)	20 ms
(2) Enhanced Process Control (PID)	12 ms	Input Selector (SEL)	15 ms
(2) Discrete Output (DO)	12 ms	Multiple Analog Input (AI)	15 ms
Output Splitter (OS)	20 ms	Control Selector (CS)	20 ms
(3) Analog Input (AI)	12 ms	(2) Discrete Input (DI)	12 ms

Table 19 - ITK

ITK certification	6.1.1 or later

Table 20 - Certifications

FM, FMc, ATEX, IEC	
JIS, CU-TB, INMETRO, NEPSI, IA Contact your local sales office for certification specific information.	
Explosion proof, Intrinsically safe, Flame proof	
Enclosure protection	NEMA 4x/IP66
CE Mark	

Table 21 - Supported/Permitted/Recommended Modes for Blocks

BLOCK	SUPPORTED MODES	PERMITTED MODES	Normal
Resource	O/S, Auto	O/S, Auto	Auto
Analog Input	O/S, Man, Auto	O/S, Man, Auto	Auto
Discrete Input	O/S, Man, Auto	O/S, Man, Auto	Auto
Control Selector	O/S, IMan, Man, Auto	O/S, Man, Auto	Auto
PID Control	O/S, IMan, LO, Man, Auto, Cas, RCas, ROut	O/S, Man, Auto, Cas, RCas, ROut	Cas, Auto
Analog Output	O/S, LO, IMan, Man, Auto, Cas, RCas	O/S, Man, Auto, Cas, RCas	Cas, Auto
Discrete Output	O/S, LO, Iman, Man, Auto, Cas, RCas	O/S, Man, Auto, Cas, RCas	Cas, Auto
Transducer	O/S, Auto, Man, LO O/S, IMan, Auto, Cas	O/S, Auto, Man	Auto
Output Splitter	O/S, IMan, Auto, Cas	O/S, Auto, Cas	Cas, Auto
Multiple Analog Input	O/S, Man, Auto	O/S, Man, Auto	Auto
Input Selector	O/S, Man, Auto	O/S, Man, Auto	Auto
Arithmetic	O/S, Man, Auto	O/S, Man, Auto	Auto
IMan and *LO* may not be Target modes.			

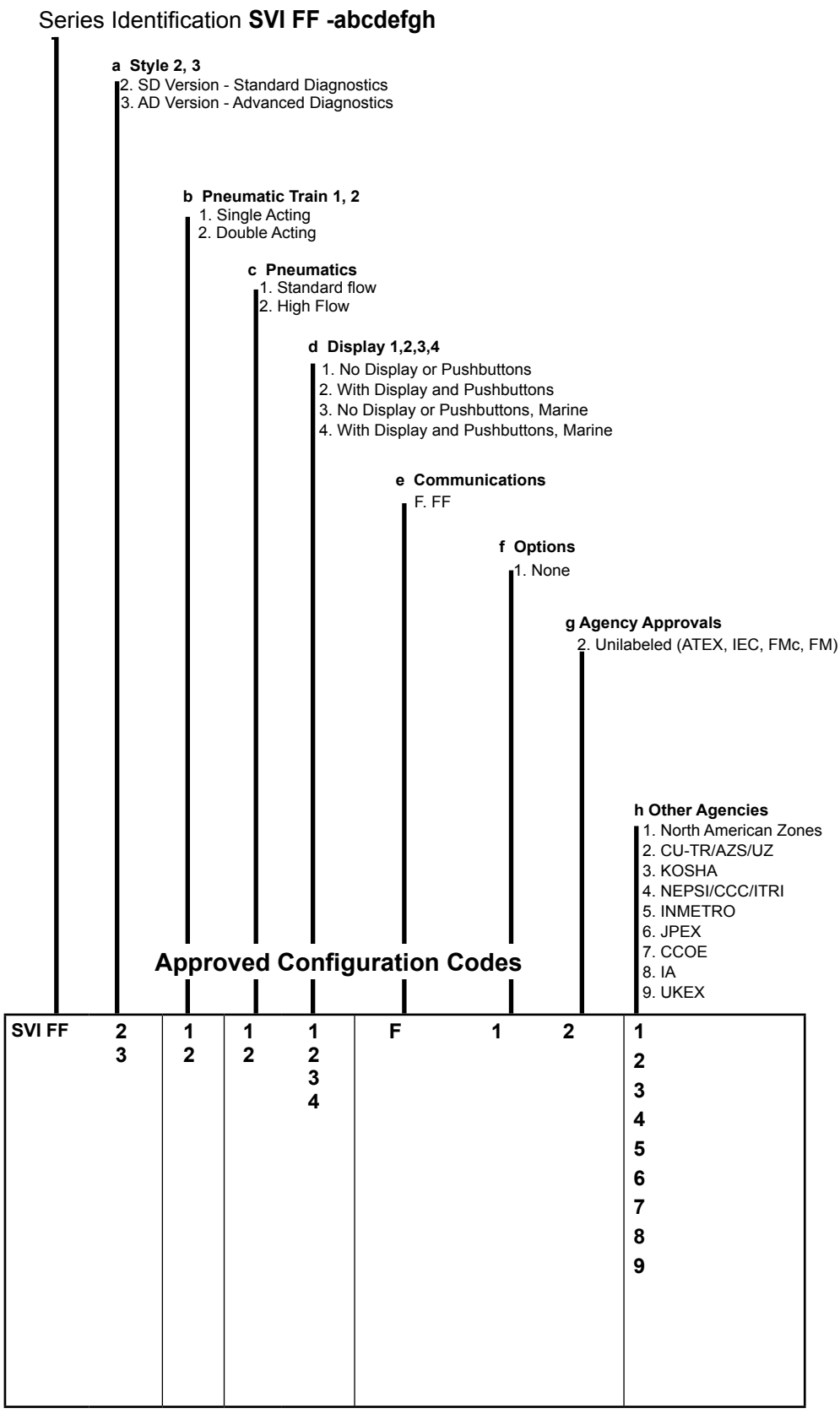

Figure 46 - SVI FF Model Numbering

Appendix B. About Fieldbus

Outline

Fieldbus is a bi-directional digital communication protocol for field devices, which offers an advancement in technologies for process control systems and is widely employed by numerous field devices.

SVI FF employs the specification standardized by The Fieldbus Foundation, and provides interoperability between Masoneilan devices and those produced by other manufacturers.

Fieldbus comes with software consisting of AO function block, two DI function blocks and optional PID function block and a selection of other blocks as necessary, providing the means to implement a flexible instrumentation system.

For more general information on other features, engineering, design, construction work, startup and maintenance of Fieldbus, refer to *Fieldbus Technical Information* (TI 38K3A01-01E).

Internal Structure of SVI FF

The SVI FF contains two virtual field devices (VFD) with the following functions.

System/ Network Management VFD	• Sets node addresses and Physical Device tags (PD Tag) necessary for communication. • Controls the scheduling and execution of function blocks. • Manages block parameters, block-to-block signal propagation and communication resources (Virtual Communication Relationship: VCR).

Function Block VFD	• Resource block - Manages the information common to each FB VFD in SVI FF.
	• Transducer block - Operates as the intermediary between Hardware I/O (actuator, sensor) and AO/DI function blocks; passes the control signal from AO function block to I/P module to control the valve position.
	• AO block - Accepts a:
	  • Control signal from an upstream block and pass the signal to Transducer block.
	  • Valve position signal from Transducer block and feedbacks it to an upstream block.

- DI block - Receives the discrete signal from Transducer block and outputs them.
- PID block - Offers PID control function. This is configured by choosing the algorithm:
  - Ideal algorithm
  - Parallel algorithm
  - Series algorithm
  - I-PD algorithm
  - IP-D algorithm
- DO block - Takes a binary setpoint and writes it to a specified I/O channel to produce an output signal. The Discrete Output function block supports mode control, output tracking, and simulation.
- AR (Arithmetic) block - Contains math functions that are selected by name.
- IS block - Provides selection of up to four inputs and generates an output based on the configured action. This block normally receives its inputs from AI blocks. The block performs maximum, minimum, middle, average and first good signal selection.
- OS (Output Splitter) block - Splits a single control signal into two parts for coordinating the actions of two or more valves, such as for split-range control or sequencing control of a large and a small valve.
- AI block - The analog input (AI) block is designed to let users use *standard* models of the generalized signal conditioning function. The AI block receives and processes data measured by the transducer block as follows:
  - Scaling
  - Square-root calculation (for an orifice plate)
  - Low-pass filter
  - Alarm generation

Logical Structure of Each Block

Setting of various parameters, node addresses, and PD Tags shown in Figure 47 is required before starting operation.

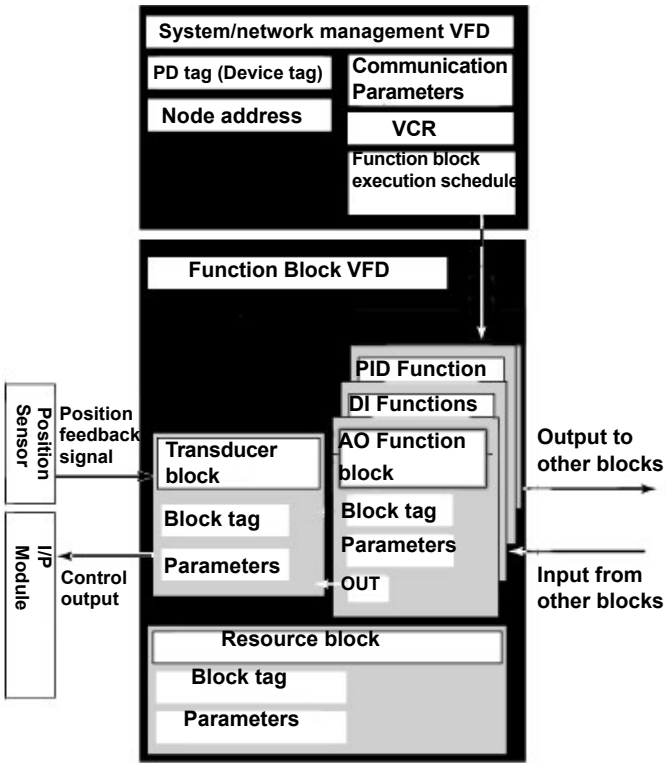

Figure 47 - Logical Structure of Each Block

System Configuration

The following instruments are required for use with Fieldbus devices:

Power supply	Fieldbus requires a dedicated power supply. It is recommended that current capacity be well over the total value of the maximum current consumed by all devices (including the host). Conventional DC current cannot be used as is.
Terminators	Fieldbus requires two terminators. Refer to the supplier for details of terminators that are attached to the host.
Field device	Connect the field devices necessary for instrumentation. SVI FF has passed the interoperability test conducted by The Fieldbus Foundation. In order to properly start Fieldbus, use the devices to satisfy the requirements of the above test.
Host	Used for accessing field devices. A dedicated host (such as DCS) is used for an instrumentation line while dedicated communication tools are used for experimental purposes.
Cable	Used for connecting devices. Refer to *Fieldbus Technical Information* (TI 38K3A01-01E) for details of instrumentation cabling. Provide a cable sufficiently long to connect all devices. For field branch cabling, use terminal boards or a connection box, as required. Termination processing depends on the type of device being deployed. For SVI FF, use an M4 screw terminal claw. Some hosts require a connector.

Refer to Masoneilan when making arrangements to purchase the recommended equipment.

The number of devices that can be connected to a single bus and the cable length vary depending on system design.

When constructing systems, both the basic and overall design must be carefully considered to allow device performance to be fully exploited.

Connection of Devices

Connect the devices as shown in Figure 48. Connect the terminators at both ends of the trunk, with a minimum length of the spur laid for connection.

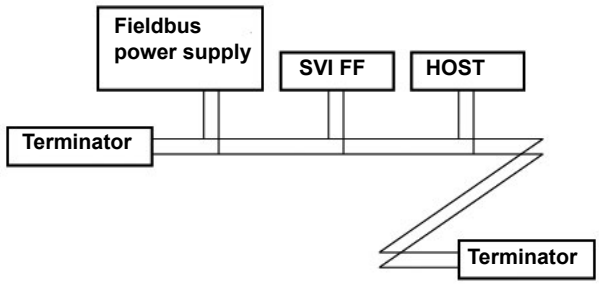

Figure 48 - Cabling

Before using a Fieldbus configuration tool other than the existing host, confirm it does not affect the loop functionality in which all devices are already installed. Disconnect the relevant control loop from the bus if necessary.

Integration of DD

If the host supports DD (Device Description), install the DD of the SVI FF. Check if the host has the following directory under its default DD directory: 004745/0008. If this directory is not found, the SVI FF DD has not been included:

1. Create the above directory.
2. Copy the DD file into the directory. The name and attribute of all parameters of the SVI FF appear.

There are two sets of DD files, depending on the DD version:

- Version 5 (recommended): The files names are: (0m0n.ff5,0m0n.sy5) (m, n is a numeral).
- Version 4: The files names are: (0m0n.ff0,0m0n.sym) (m, n is a numeral).

Download both versions and place them in the directory. Depending on the DCS in use, you may need to use one or the other. The host normally detects the correct file for use. Emerson may use different files. Contact Emerson for details.

Off-line configuration is done using the capability file (CFF). If you do not have the DD or capability file for the SVI FF, download it from https://valves.bakerhughes.com/resource-center or from the Foundation Fieldbus Foundation website.

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Appendix C. Foundation Fieldbus: Process Example

Overview

This section introduces a process example and several concepts used throughout various discussions. It briefly introduces Foundation Fieldbus blocks and some of the essential block concepts. The process example is a heat exchanger (Figure 49) with two control valves and three measurement devices. The controls are configured in a cascade arrangement to illustrate concepts of transfer between modes and states of the various levels of control.

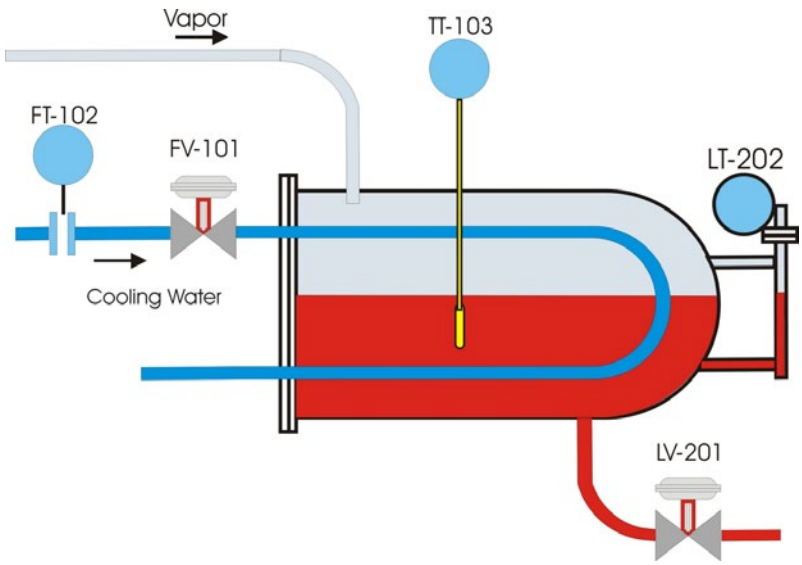


Figure 49 - Heat Exchanger

Reference Model Process

The Heat Exchanger model, shown in Figure 49, is not a practical example but it does incorporate elements that illustrate important SVI FF features. Each module has a device tag used for SVI FF identification. The process consists of a vessel with a product vapor inflow that is condensed and flows out as a liquid outflow. The tank level is controlled by an outflow control valve, LV 201. The tank contents are chilled by coolant water. The temperature is controlled by a temperature controller cascaded to a flow controller. The coolant flow is controlled by control valve FV 101.

P & I D

Figure 50 shows, in schematic form, the physical devices and indicates the measurement and control functions that reside in each device. The flow of control information between devices is indicated by dashed lines.

- The coolant flow control valve, FV 101, has a PID control function block, one DI block and an Analog Output block (AO), all located within the valve positioner. The DI block can set either a high limit, a low limit or both the high and low limits.
- The coolant flow transmitter, FT 102, has only a transmitter function. It has Analog Input function block (AI) implemented in its firmware.
- The temperature transmitter TT 103 contains one Analog Input block and a PID block.
- The PID blocks in TT 103 and FV 101 devices are scheduled to work in cascade as shown in Figure 51. The AO block in the FV 101 receives the output from the FV 101 PID block and via the transducer block transmits it to the control hardware of the valve.
- The condensed fluid flow control valve, FV 201, has a DI block and an Analog Output block, all located within the valve positioner. Liquid level is controlled by a remote controller LC201 to demonstrate Remote Cascade operation.
- The level transmitter LT 202 includes an Analog Input block. The flow controller in LV 201 receives the process measurement from level transmitter LT 202. The PID control regulates the valve LV201.
- The DI block ZSL 101, depending on the wiring, serves as low and/or high stem position limit switches in the control valve positioner FV 101.
  The DI block ZSL 201, depending on the wiring, serves as low and/or high stem position limit switches in the control valve positioner FV 201.

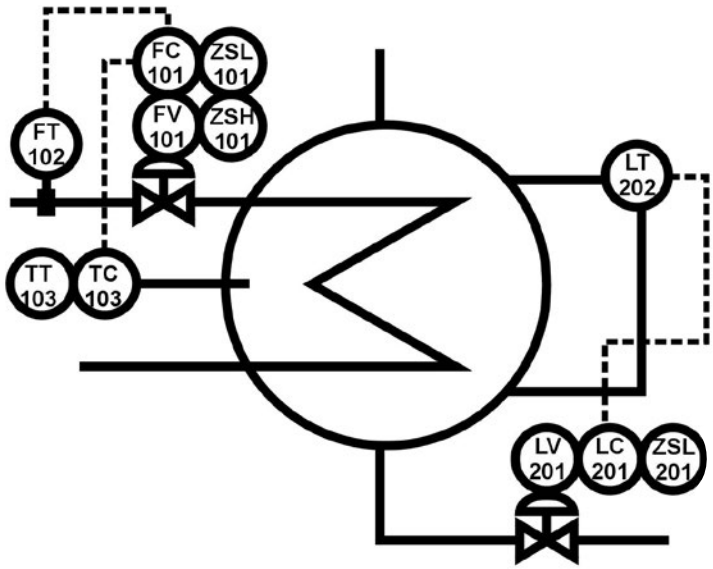


Figure 50 - Piping and Instrumentation Diagram

Function Block Links

Each of the control functions is represented in the control configuration as Foundation Fieldbus function blocks. They are grouped according to the physical device containing them and they are shown with the links between the blocks, soft wiring, for data flow.

All the blocks in the temperature cascade are shown in Figure 51. Similarly The level loop function blocks are shown in Figure 52.

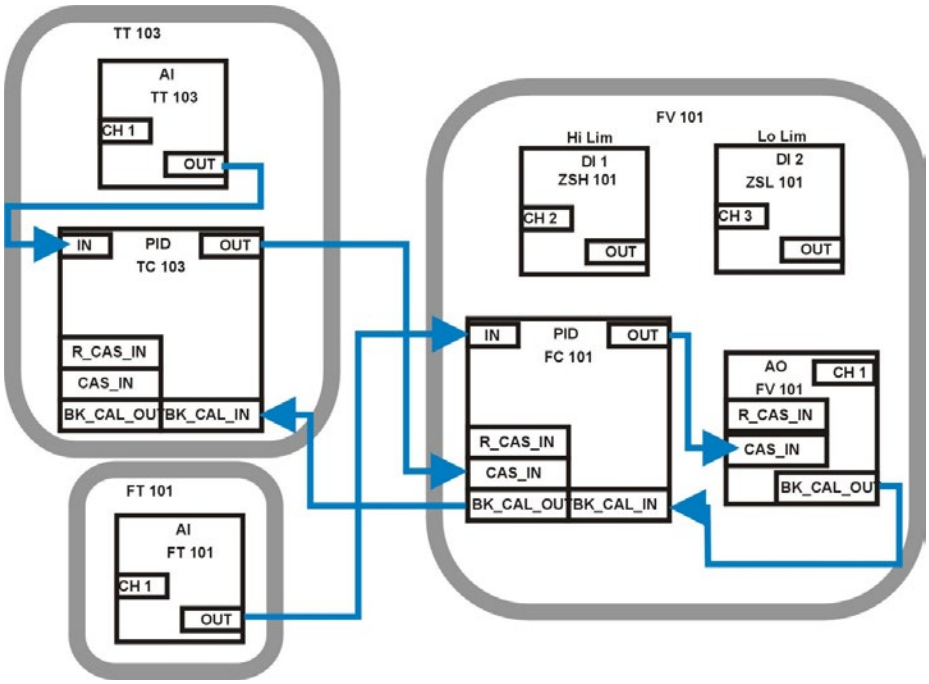


Figure 51 - Temperature Cascade Block Diagram

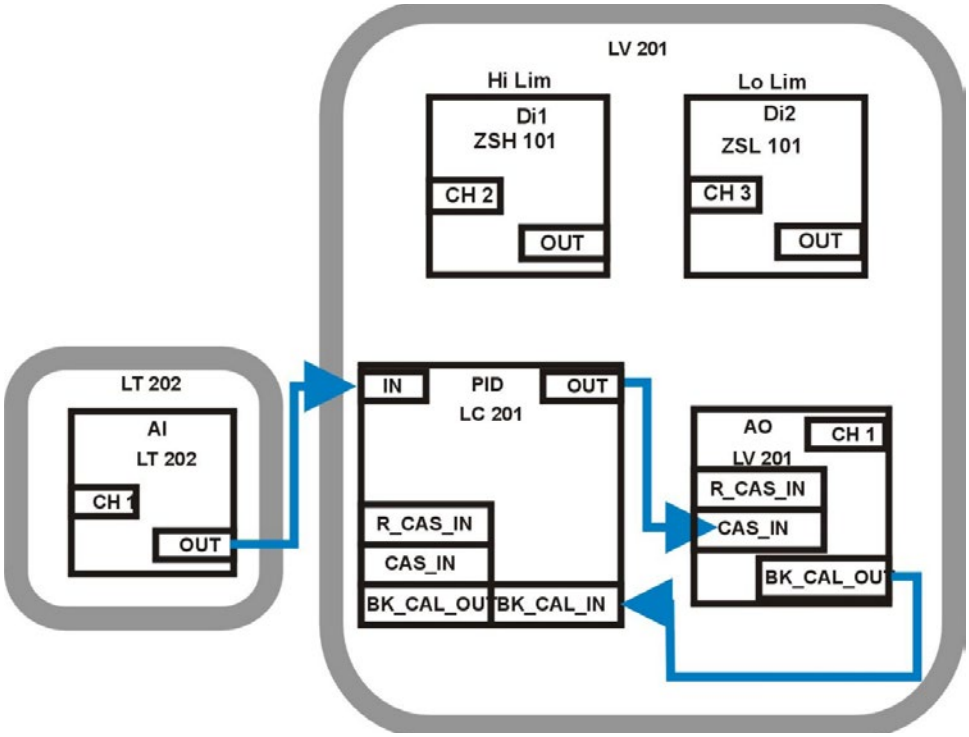


Figure 52 - Level Loop Block Diagram

To complete the model SVI FF (Figure 53) is temporarily connected to the heat exchanger's Foundation Fieldbus wiring at an intermediate point.

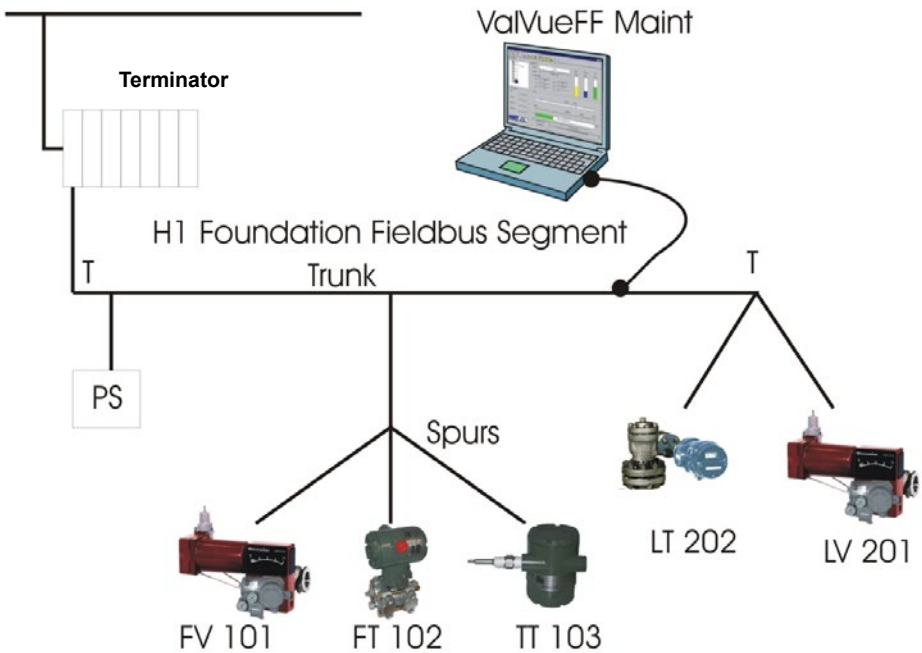


Figure 53 - ValVue Connected as a Visitor Device

The Heat Exchanger Reference Model segment consists of a Heat Exchanger Host in a control center with a Foundation Fieldbus trunk connected to two junction boxes. One junction box has spurs to the flow and temperature control devices and the other connects to the devices controlling tank level. A power supply with isolation electronics and two terminators completes the configuration. Configure the ValVue maintenance computer interface cards (NIFBUS) so as to not interfere with the Heat Exchanger Host.

CAUTION

Never connect a PC to an operating segment unless it is configured as a Basic Device. See Figure 50 on page 110 to view the configuration options.

Do not cause a short circuit in a working segment while connecting or disconnecting any device.

Device Operational States and Block Modes

SVI FF manages the operational states of the positioner and its embedded PID controller by controlling the target modes for each of the function blocks. The actual mode of each block can be different from the target mode. The actual mode is controlled by the block itself in accordance with mode rules based on the quality of the data and modes of the linked blocks. A brief summary of modes follows, a thorough discussion of modes is beyond the scope of this instruction manual. You can refer to the Fieldbus Foundation specification that specifies the formal rules for mode changing.

Three operational states are set by SVI FF. Out Of Service (OOS) forces all of the blocks to Out Of Service mode. The outputs remain at the values prior to the state change, but their status indicates that the block is OOS. All output calculation is suspended. Back calculation values are passed to other linked blocks to enable initialization. The PID block remains in OOS after configuration changes unless it is put into one of its allowed modes from the PID dialog box.

Block Modes

All blocks (function/transducer/resource) have operating modes. There are eight modes defined in the Foundation Fieldbus specification. Not all modes are supported by every block. For example, the Discrete Input block (DI) supports Auto, Man and OOS. The action of the modes are described in the following paragraphs. Transfers between modes are managed by the function blocks in response to manual commands that in turn responded to changes in the modes of linked blocks and responded to changes in the quality of the parameters that are transmitted. Control and status options can be set to manage mode changing behavior.

BLOCK_ERR_DESC_1 often can provide information as to why the block is not switched to the TARGET mode.

Remote-Output (Rout)	The block output is set by a control application running on an interface device through the remote-output-in parameter. The algorithm is bypassed and the remote block controls its output directly. The algorithm must initialize so that no bump is experienced when the mode switches to Auto. A remote-output-out parameter is maintained by the block to support initialization of the control application when the block mode is not remote- output. The setpoint can be maintained or initialized to the process variable value.
Remote-Cascade (RCas)	The block setpoint is set by a control application running on an interface device through the remote-cascade in parameter. Based on this setpoint the normal block algorithm determines the primary output value. A remote-cascade out parameter is maintained by the block to support initialization of the control application when the block mode is not remote-cascade.
Cascade (Cas)	A setpoint value, scheduled and published by another function block through the Cascade input parameter, is used by the normal block algorithm in determining the primary output value. This connection between function blocks is defined by a link object.
Automatic (Auto)	A local setpoint value is used by the normal block algorithm in determining the primary output value. The local setpoint value can be written to by an operator through an interface device.
Manual (Man)	The block output is not being calculated, although it can be limited. It is directly set by the operator through an FF H1 interface device. The algorithm must initialize so that no bump is experienced when the mode switches. The setpoint can be maintained or initialized to the process variable parameter value or to the setpoint value associated with the previous retained target mode.
Local Override (LO)	Applies to control and output blocks that support a track input parameter. In the local override mode the block output is being set to track the value of the track input parameter. The algorithm must initialize so that no bump is experienced when the mode switches from LO back to the target mode. The setpoint can be maintained or initialized to the process variable parameter value. The SVI FF Transducer block is in this mode when the device is in setup mode from the local display. The block is switched to TARGET mode when the local display is switched to Normal.

CAUTION

Ensure before switching back that a safe operating environment exists.

Initialization Manual (IMan)	The block output is set in response to the back-calculation input parameter status. When the status indicates there is no path to the final output element, the control blocks must initialize to provide for bumpless transfer when the condition clears. A back-calculation out parameter is supported by all output and control class function blocks. The setpoint can be maintained or initialized to the process variable parameter value.
Out of Service (OOS)	The block is not being evaluated. The output and setpoint are maintained at last value. When the Transducer block is in OOS mode the output to the valve is de-energized.

Multiple Modes and States

The Analog Output block (AO) must go to CAS mode to connect to a PID function block in cascade. To prevent the setpoint signal out of the Analog Output block (AO) from setting the valve position into the transducer block, the Analog Output block (AO) must go into OOS mode. Table 22 shows several examples of mode operation.

When a block is in OOS mode its output status is bad. Any connected blocks know and automatically change their modes. For example, when a PID block sees bad status in BKCAL IN it goes to IMAN mode for initialization to the downstream block while awaiting the status to return to good cascade.

Examples of Operational States

Examples of operational states that are combinations of block modes are shown in this section. A new device or a newly configured device can start up in the out of service (OOS) state (Table 22).

Table 22 - Mode Operation

Operation	(AI)	PID	AO	TB
Configure the transducer block (Auto tuning, travel calibration, etc.)				MAN
Configure transducer block (Changing position control parameters, etc.)				OOS
Manual valve positioning from ValVue or other human interface.				MAN
Manual valve positioning from a PID controller human interface.		Manual	CAS	Auto
PID single loop control	Auto	Auto	CAS	Auto
PID cascade loop control (setpoint is published by another block)	Auto	CAS	CAS	Auto

Transferring Modes

Once the PID and an Output block are scheduled, the PID can command the setpoint. Which further is translated as a Final_Value to the Transducer block. All blocks must be in service mode.

RCas Mode

When the positioner is receiving it's position setpoint from a remote computer system, such as a DCS, then the normal state for the positioner is RCas. In this example, the level control valve,

LV201, is receiving it's signal from a DCS. The Analog Output block (AO) is shown in RCas mode. RCas mode cannot be manually switched to, it is automatically switched to after being configured. For example:

Configure the set point of the positioner in DCS to receive remote data, when the positioner turns to Normal mode, the mode of AO block shows RCas in the *Block Actual Mode* field.

PID in RCas Mode

If an internal PID is used in a cascade where the PID receives a setpoint from a remote computer system, then the normal state has the PID in RCas mode and the Analog Output block (AO) is in Cas mode.

The Foundation Fieldbus Application Process specifies the mode handling for inter-operable function blocks. It also specifies which mode a block must be in when each parameter is written. SVI FF provides an intelligent, optimized, process for managing configuration and calibration changes. It does not place blocks into Out Of Service mode unless the parameter requires OOS. It analyzes the requested changes and then sets the correct mode for each affected function block.

The Foundation Fieldbus specifies a mechanism for transferring between function block modes. The user declares a target for the block mode but the actual mode is set by the block in accordance with rules. The rules allow modes based on the state of input data. Function blocks comply with the Fieldbus Foundation rules. SVI FF sets target modes for individual function blocks as required by configuration, calibration, diagnostics and other services. It sets target modes for a group of function blocks to achieve three operational states of the positioner: Out of Service, Manual, and Normal.

CAUTION

The PID block remains in Out of Service mode or IMAN when configuration changes are made. After returning to Normal operating state, change the PID bloc k mode. If the AO block is left in Auto mode the valve cannot be moved. Refer to you DCS manual.

Appendix D. Troubleshooting

What to Do First

When a problem occurs, check the following first.

Mounting of SVI FF positioner:

- Is the linkage to the valve actuator correctly set up?
  - Is the feedback lever correctly attached, if applicable?
  - Is the span of rotation angle of the position sensor against the valve stroke less than the minimum requirement?
- Have find stops and auto tuning been performed after installation?

Air Piping:

- Are the air pipes correctly connected? Is there no leak of air?
- Is the air supply pressure high enough to drive the valve?
- Is the A/M selector on the positioner set to A (automatic)?

Wiring:

- Is the SVI FF positioner correctly connected to the fieldbus?
- Has the power to the fieldbus been turned on? Is the terminal-to-terminal voltage equal to or greater than 9 V?
- Is the terminator correctly installed?
- Is a host system connected to the fieldbus (prior to scheduling only)?

Troubleshooting Communications

Table 23 - Troubleshooting Communications

Problem	Presumed Cause	Remedy	See Section
Communication with the SVI FF cannot be performed.	Wiring is incorrect.	Correct wiring.	☐ "Wiring the SVI FF" on page 65 ☐ "System Configuration" on page 106
	The power is off or the power supply voltage is less than 9 V.	Supply proper voltage.	☐ "Wiring the SVI FF" on page 655 ☐ "Physical and Operational Specifications" on page 95
	The address detection range is not correctly set.	Correct address detection range.	"Step 4: Set Tag and Address" on page 32
Communication with the SVI FF is frequently cut off.	The fieldbus is experiencing a large amount of noise. Missing terminators on the bus, incorrect terminator placement or extra terminators. Refer to FOUNDATION Fieldbus specifications for a full discussion of terminator requirements.	Using an oscilloscope, check the waveform on the fieldbus.	—
The SVI FF can be detected, but neither function blocks nor transducer block can be seen.	The node address of the SVI FF is left in the default (0xF8-0xFB).	Change the device to an operable address. See the descriptions for address settings.	"Step 4: Set Tag and Address" on page 32

Troubleshooting Function Block Parameters

Table 24 - Troubleshooting Function Block Parameters

Problem	Presumed Cause	Remedy	See Section
A value cannot be written to a parameter in the SVI FF.	You have attempted to write a value outside the valid range.	Check the setting range of parameters.	"Transducer Block Parameters" on page 149
	The present mode does not allow write access.	Change the target mode. See the parameter lists.	"Transducer Block Parameters" on page 149
	The jumper is in write protected configuration.	Rewire - remove jumper.	"Local Display and Pushbuttons" on page 127
The actual mode of a function block differs from the target mode.	Resource block in O/S.	Change the target mode of the resource block to Auto.	☐ "Transducer Block Parameters" on page 149 ☐ "Block Modes" on page 113
	Schedules that define when function blocks execute are not set correctly.	Set the schedules using a configuration tool.	"Step 5: Basic Configuration" on page 33
	The transducer block is not in Auto mode.	Change the target mode of the transducer block to Auto.	☐ "Transducer Block Parameters" on page 149 ☐ "Block Modes" on page 113
	Block is not scheduled.	Include block in schedule and download the schedule.	See the DCS manufacturer's manual

Table 24 - Troubleshooting Function Block Parameters (Continued)

Problem	Presumed Cause	Remedy	See Section
A block's dynamic parameters do not update.	☐ The block in question is in OOS mode.	☐ Change the target mode as necessary.	☐ "Transducer Block Parameters" on page 149 ☐ "Block Modes" on page 113
	Source block (e.g. Transducer block) is not in Auto/Man mode.	Set Transducer block to Auto.	
	Block is not scheduled.	Include block in schedule and download the schedule.	See the DCS manufacturer's manual
	☐ Resource block is O/S.	☐ Change the target mode of the resource block to Auto.	☐ "Transducer Block Parameters" on page 149 ☐ "Block Modes" on page 113
Input parameters do not update.	Device is only a standard model diagnostics device.	Purchase advanced edition.	"Available Options" on page 16

Troubleshooting Valve Control

Table 25 - Troubleshooting Valve Control

Problem	Presumed Cause	Remedy	See Section
A change in setpoint causes no action of the valve.	Air piping is incorrect.	Correct piping.	"Connecting the Tubing and Air Supply" on page 62
	The valve control is in FAILSAFE state.	Fix any physical issues, if applicable, clear faults, set valve control to Normal and set block back to AUTO.	"Transducer Block Modes" on page 20. See "Exiting Failsafe Using AMS" on page 81.
	Air supply is not being fed.	Supply proper air pressure.	"Connecting the Tubing and Air Supply" on page 62
	The valve has failed.	Apply a pneumatic pressure directly to the valve actuator and check whether there is valve action.	N/A

Table 25 - Troubleshooting Valve Control (Continued)

Problem	Presumed Cause	Remedy	See Section
The valve's full stroke is insufficient for the setpoint input (An accumulated value of 100% travel = 1 stroke. The travel does not need to occur in one movement.):	The air supply pressure is not high enough to drive the valve actuator.	Check the air supply pressure rating for the valve actuator and supply air at the correct pressure, and redo Find Stops and the redo Auto Tuning.	☐ "Connecting the Tubing and Air Supply" on page 62 ☐ "Quick Start" on page 31
	The range of the setpoint is limited by software.	Change the position limits.	"Transducer Block Parameters" on page 149
The steady state deviation between the setpoint and readback position exceeds specifications.	The tight-shut or full-open action is active.	Check the values of FINAL_VALUE_CUTOFF_HI and FINAL_VALUE_CUTOFF_LO.	"Transducer Block Parameters" on page 149
	The tuning has not been performed correctly.	Redo tuning to perform 0 & 100% point adjustment.	"Quick Start" on page 31
	Tuning is incorrect.	Run tuning.	
The valve oscillates cyclically (limit cycle).	The friction of packing is large.	1. Repair packing. 2. Redo auto tuning.	1. Contact manufacturer. 2. "Quick Start" on page 31
	There's an air leak from the output pressure pipe, or the feedback lever is not correctly attached.	Check the piping and attachment of the lever, and redo Auto Tuning.	☐ "Installation" on page 44 ☐ "Quick Start" on page 31
	Process condition is unstable.	Review the process setpoint/ tuning.	"Quick Start" on page 31
	Lever/linkage connection problem.	Verify linkage operation.	"Installation" on page 44

Table 25 - Troubleshooting Valve Control (Continued)

Problem	Presumed Cause	Remedy	See Section
Valve response is too slow.	The control gain is insufficient.	Redo tuning.	☐ “Quick Start” on page 31 ☐ “Transducer Block Parameters” on page 149
	If only the responses that require air exhaust are slow, it means that the regulator’s maximum cap Control block limits configuration set improperly. acity is not large enough.	Replace the regulator.	—
	The I/P module’s nozzle has become blocked from the air supply.	Check whether the Deviation Alert Deviation Value is out of specification. If it does occur, contact the nearest service station or representative office.	“Transducer Block Parameters” on page 149
	The control relay has become blocked from dirt contained in the air supply or the like.	Check whether or not an error has occurred in XD_ERROR in steady states.	“Transducer Block Parameters” on page 149
	There’s air leak from the pipe of output pressure, or feedback lever is not correctly attached.	Check the piping and attachment of the lever (and if changed), and write 1 to AUTOTUNE to redo tuning.	☐ “Installation” on page 44 ☐ “Quick Start” on page 31
	Enabled Rate Limits settings.	Review Rate Limits and adjust Position_Limits. Limits_ Right.Enable_Right. This must be done by a qualified valve technician.	N/A
	Control block limits configuration set improperly.	Review and fix limits. This must be done by a qualified control engineer.	N/A

Troubleshooting Auto Tuning

Table 2 - Troubleshooting Auto Tuning

Problem	Presumed Cause	Remedy	See Section
Auto tuning requests are rejected.	The transducer block is not in manual mode.	Change the target mode of the Transducer block to Man.	“Transducer Block Parameters” on page 149
	If POSITION_LIMITS in enabled autotune is rejected.	Disable the limits and position limits parameter (Position. Limits_Limits_ Protected) for duration of Autotune.	“Step 7: Run Auto Tune METHOD” on page 34
	Another process is started and running.	Wait until the process finishes or cancel.	
When auto tuning has finished,the result appears with a value index: ☐ 31: Failed actuation ☐ 32: Control limits protected ☐ 33: Failed open loop tuning ☐ 45: P gain below limit ☐ 46: P gain adjustment above limit ☐ 55: Bias out of range ☐ 66: Fill time exceeded ☐ 77: Exhaust time exceeded ☐ 88: Parameter out of range.	Supply pressure reading is incorrect. Supply pressure is not sufficient for spring range.	Adjust supply pressure.	☐ “Quick Start” on page 31 ☐ “Step 7: Run Auto Tune METHOD” on page 34
		If there is nothing wrong with the air supply pressure and piping, contact the nearest service station or representative office.	—
	The search for optimal tuning parameters was unsuccessful.	1. Redo autotune and change aggressiveness. 2. Select one of the fine tuning parameters and redo tuning. 3. Manually tune.	☐ “Quick Start” on page 31 ☐ “Auto Tuning” on page 48
	The span of rotation angle is incorrect or the 50% position deviation from the horizontal level is too large.	Correct the installation and try auto tuning again.	☐ “Installation”on page 44 ☐ “Operational Checkout” on page 77
	The valve hysteresis is large.	Carry out manual tuning.	—

Table 26 - Troubleshooting Auto Tuning (Continued)

Problem	Presumed Cause	Remedy	See Section
Autotune doesn’t complete	Feedback slipping, loose. Rotary installation: magnet assembly rotates using hands. Reciprocating bracket: the turn-buckle, rod-end, and take off arm aren't secured.	Secure all set screws and locking nuts. Check reciprocating assembling for binding during operation. In general, Autotune may fail if the valve is too slow - in this case manually tune.	“Installation” on page 44
	Magnet far away from housing. Rotary installation: the face of the magnet holder isn't flush with the face of the mounting bracket. Cannot be recessed by more than 1/8"	Loosen up the set screws holding the magnet assembly in the magnet holder and pull the magnet so it is flush with the mounting bracket. In general, Autotune may fail if the valve is too slow - in this case manually tune.	
	High friction, sticking, slipping. The friction measured is more than 30% of the spring force or the valve is visibly jumping around the setpoint.	Run Autotune with Aggressiveness settings of 2 or 4, or, proceed to manually tune the SVI FF ensuring the Integral Gain (I) is set to a minimum of 100. In general, Autotune may fail if the valve is too slow - in this case manually tune.	

Troubleshooting Tuning

Table 27 lists items for tuning in addition to the Auto Tuning items in Table 26.

Table 27 - Troubleshooting Tuning

Problem	Presumed Cause	Remedy	See Section
Position oscillation	Positioner gain (P) set high High Position overshoots by more than 20% of the step and oscillates more than twice. Position may be oscillating if the friction is high and the integral part is fast.	Decrease the Gain (P) & (Padj) by 50 unit increments until oscillation ceases.	“Transducer Block Parameters” on page 149
Position gain (P) low - slow.	Verify that the gain is at least 100 and the oscillation is a smooth sine wave going up and down.	1. Run Auto Tune. 2. If 1 does not work: ☐ Increase gain. ☐ Increase the integral gain. ☐ Use one of the pre-defined presets.	
Bias Out of Range alarm active	Setpoint at 0% or 100% while the position if off by more than 5%	1. Verify mounting and linkage are correct. 2. Run Auto Tune. 3. Run Manual Tune.	N/A
	Problem with I/P or relay	1. Disconnect the I/P and verify that there's no output. 2. Set the calibrator to apply 1.5 mA maximum to the I/P and verify that there's full output. More than 1.5 mA damages the I/P. If both steps don’t work, replace the I/P module. Contact Baker Hughes or channel partner.	N/A

Table 27 - Troubleshooting Tuning (Continued)

Problem	Presumed Cause	Remedy	See Section
Actuator error alarm active	Handwheel or other travel restriction in place. The handwheel on the actuator is not in neutral or is partially engaged	1. Verify mounting and linkage are correct. 2. Run Auto Tune. 3. Run Manual Tune. 4. Verify supply pressure.	N/A
	Extreme valve sticking	☐ Using ValVue Trend, see if the valve has friction greater than 50% of the spring range or ☐ Observe the valve and see if the movement jumps significantly with a smooth input signal. ☐ Repair the valve when possible.	N/A
	Insufficient air supply	Using ValVue or another HART® interface, verify that the air supply setting. It must be set to 5 psi (.35 bar, 34.5 kPa) greater than the spring final. For double-acting actuator, the air supply must be that required to generate the force to move the valve. Increase the air supply per the actuator requirements	N/A

Troubleshooting Position, Pressure, and Temperature Sensors

See Table 30 on page 142.

Appendix E. Using the Pushbuttons and Digital Interfaces

Overview

This section describes three ways to communicate, configure, and calibrate the SVI FF. The Smart Valve Interface is truly a smart device capable of:

- Streamlining the valve positioning function
- Improving precision of process control
- Providing diagnostic information
- Communicating critical information locally and remotely

The four available communication tools listed below offer increasing levels of functionality:

- Local Display and Push Buttons
- ValVue
- FF Handheld Communicator
- Any FF capable host loaded with the DD for the SVI FF

Local Display and Pushbuttons

The most basic and easiest digital interface is the local pushbutton and display option mounted on the SVI FF. It is available at any time and provides immediate local access to most configuration, calibration, and fault messages. It is approved for use in Explosion Proof and Intrinsically Safe installations in Hazardous Areas.

Additionally, in Normal mode the local display scrolls sequentially displaying setpoint, pressure and position information. The display sequences from one variable to the next every 1.5 seconds. Depending on specific SVI FF configuration details, the LCD also regularly displays some parameter's values. You can configure the device to show the PID process variables, AO block setpoint or other control parameter. Refer to the SVI FF DTM online help for procedures to configure parameters.

NOTE

The display is limited to values between 0 and 100. Therefore, the display may show a value for the actual setpoint that is not valid if the setpoint is above 100 or below 0.

Handheld Communicator

The handheld communicator is a universally available tool that provides all the accessibility of the local button and display. This tool has the functionality to upload and download configurations, enter alphanumeric messages and set the custom characteristic numerical parameters. The GE DPI620 is approved for Intrinsically Safe use in Hazardous Areas in accordance with SVI FF approvals.

CAUTION

Once finished with any DD-based configuration you must return to Normal mode, Use the APP_MODE command to do this from the DD. See N "Changing Out of LO Mode" on page 251.

ValVue

ValVue combines the power of the PC with the features of the SVI FF for ease of use and automation of positioner operation and full access to all data. ValVue Standard Version is provided with all SVI FF positioners and is recommended for set up, service and maintenance where a PC or laptop is permitted.

Pushbuttons and Local Display

This section covers the optional local interface consisting of the LCD alphanumeric display and pushbuttons. Operation of the SVI FF Digital Valve Positioner as a local device is controlled through the optional device-mounted pushbuttons and digital display, shown in Figure 54 on page 129. Using the display you can read the input signal, valve position, and actuator pressure. The display sequences from one variable to the next every 1.5 seconds.

Using the pushbuttons you can exit from operating mode at any time and step through a menu structure to perform a wide range of operations including BAS SETUP, ADVANCED SETUP, METHOD and MAN POS to configure and calibrate the valve. ValVue is used to perform all diagnostics functions. The pushbuttons do not support diagnostics functions.

The SVI FF has four operational modes: AUTO (normal operating mode) and Manual (manual operating mode and for parameter changes), OOS (block execution stops) and LO modes. The SVI FF also has a mode for handling of faults and power-up: Failsafe.

NOTE

The display is limited to values between 0 and 100. Therefore, the display may show a value for the actual setpoint that is not valid if the setpoint is above 100 or below 0.

Pushbuttons

The local pushbuttons are located behind a hinged cover, directly below the display window. To open the cover loosen the screw and swing the cover down. Always re-fasten the cover after use to protect the pushbuttons from environmental contamination.

The three pushbuttons perform the following functions:

- *Left Button* - Marked with *****, permits you to *select* or *accept* the value or parameter option currently displayed.
- *Middle Button* - Marked **–**, permits you to move back through the menu structure to the previous item in the menu or decrement the value currently shown in the digital display. When used to decrease a displayed value, holding the button down causes the value to decrease at a faster rate.
- *Right Button* - Marked **+**, permits you to move forward through the menu structure to the next item in the menu, or to increment the value currently shown in the digital display. When used to increase a displayed value, holding this button down causes the value to increase at a faster rate.

NOTE

An exclamation point (!) in the SVI FF display window indicates that there is instrument status available.

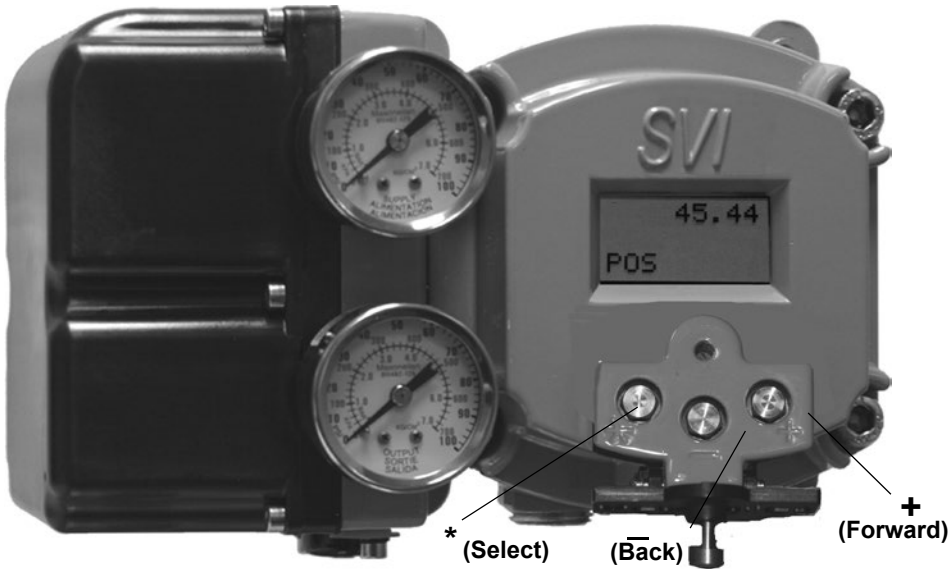


Figure 54 - SVI FF Display

NOTE

If the pushbuttons are pushed after being locked by ValVue software, the message LOCKED appears. Refer to the ValVue online help for instructions to unlock the pushbuttons.

Pushbutton Locks and Configuration-Lock Jumper

Before performing any of these functions with the local display you must first ensure that the pushbuttons are placed in the unlocked mode using ValVue. The positioner ships in the unlocked mode.

The SVI FF offers several levels of plant security. It may be desirable, after initial setup, to lock the pushbuttons so that the SVI FF parameters cannot be inadvertently changed by the buttons. Several levels of software modifiable pushbutton locks are provided.

Table 28 - Pushbutton Lock Security Level

Level	Access
Allow Local Buttons	Buttons on the SVI FF are fully enabled.
Lock Out Local Calibration and Configuration	Use the buttons to perform operations in normal operating mode and manual mode. Do not go to configure or calibrate mode.
Lock Out Local Manual	Examine variables in normal operating mode but do not put the valve in manual operating mode. Access to calibrate or configure modes is not available.
Lock Out All Buttons	The buttons are disabled.

Hardware Configuration Lock

Additional security is achieved using the hardware configuration-lock jumper shown in Figure 33 on page 66. When set to secure position, shorting the two-pin header, configuration and calibration are not permitted by the local interface or by remote communications. Pushbuttons, ValVue and a handheld are locked out, except to examine configuration, calibration, and position. This is similar to Security Level 1 shown in Table 28.

Hand Held Communicator

For communication to an FF device, there is a Device Description Language. A Device Description, DD, is published by registration with the Foundation Fieldbus Foundation. When the DD is installed in a host communication device then the host can readily access all the information in the smart field device. The SVI FF DD can be obtained from the website or by contacting your local representative.

WARNING

Do not connect a PC or FF to an intrinsically safe circuit except on the safe area side of the barrier. Do not operate a PC in a hazardous area without compliance to local and plant regulations.

CAUTION

Do not connect an FF setup modem and PC to a control circuit unless the controller is FF compatible or has a filter. Loss of control or a process upset may occur if the controller output circuit is not compatible with the signal.

CAUTION

Once finished with any DD-based configuration you must return to Normal mode, Use the APP_MODE command to do this from the DD. See N *"Changing Out of LO Mode" on page 251.*

Check-out with a Handheld Communicator

This section covers a subset of the functions available with a handheld. If the SVI FF is not equipped with optional pushbuttons and local display the checkout and configuration is performed using the standard FF communications interface. In addition to the functions performed with the local pushbuttons additional functions are performed with the handheld. For example, the instrument tag descriptor is written and stored in non-volatile memory and used for point to point wiring checkout.

Connect the handheld communicator to the SVI FF as shown in Figure 55. Refer to the product manual for the communicator.

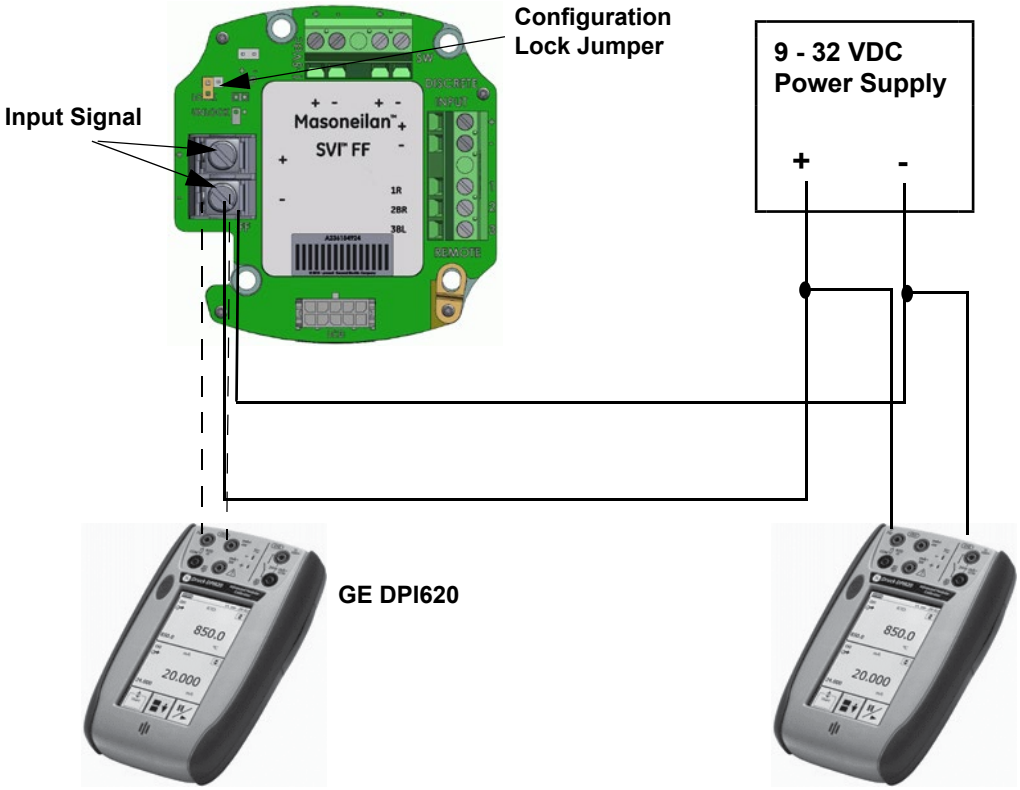


Figure 55 - SVI FF Communicator Connections

Be sure that the configuration lock jumper is in the unlock position. When the jumper is in the lock position (shorting the two-pin header) the handheld is not permitted to make any changes. However, parameters are readable. If fault messages appear, they must be handled before proceeding with communications. Before communications proceeds all error messages must be cleared. For example, the following message is displayed if the instrument has been serviced and the air is not connected.

"Process applied to the non-primary variable is outside the operating limits of the field device"

ValVue

The third digital interface available for the SVI FF is Masoneilan's ValVue software. ValVue provides a user friendly interface that facilitates set up and operation of the positioner. ValVue is used to configure, calibrate and perform valve diagnostics.

Installation of ValVue Software, and Registration

For assistance contact the nearest sales office, your local representative or email svisupport@bakerhughes.com.

Installation of Cover

The cover of the SVI FF is a critical component for safety in Hazardous Areas. To ensure safe operation the flat surfaces of the cover and the housing must be clean and absolutely free of particles or dents. The O-ring must be securely located in its groove. Install the cover and tighten all four screws. There must be no gap between the housing and cover.

Display Menus

When you leave the NORMAL mode to go to SETUP mode the valve is placed in the last position it was in when leaving NORMAL. When in SETUP mode the device does not respond to the system processed setpoint. However, the SVI FF unit can still respond to commands, including commands to position the valve. When you switch to the VIEW DATA or VIEW ERR menus from the NORMAL operate mode menu the valve is still in NORMAL mode and still responds to the system processed setpoint.

NORMAL Operating Mode Menus

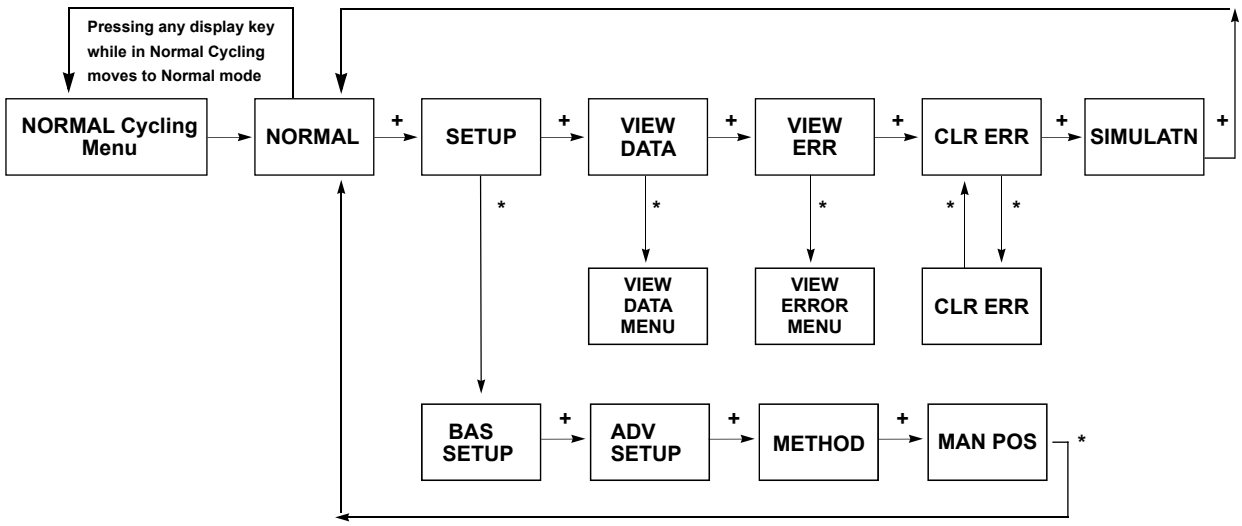


Figure 56 - NORMAL Operation Menu Structure

BAS SETUP Menu

If a change is made in the Air-to-Open / Air-to-Close configuration option or if you move the SVI FF to a different valve or make any change to the valve position linkage, you must run the Find Stops again.

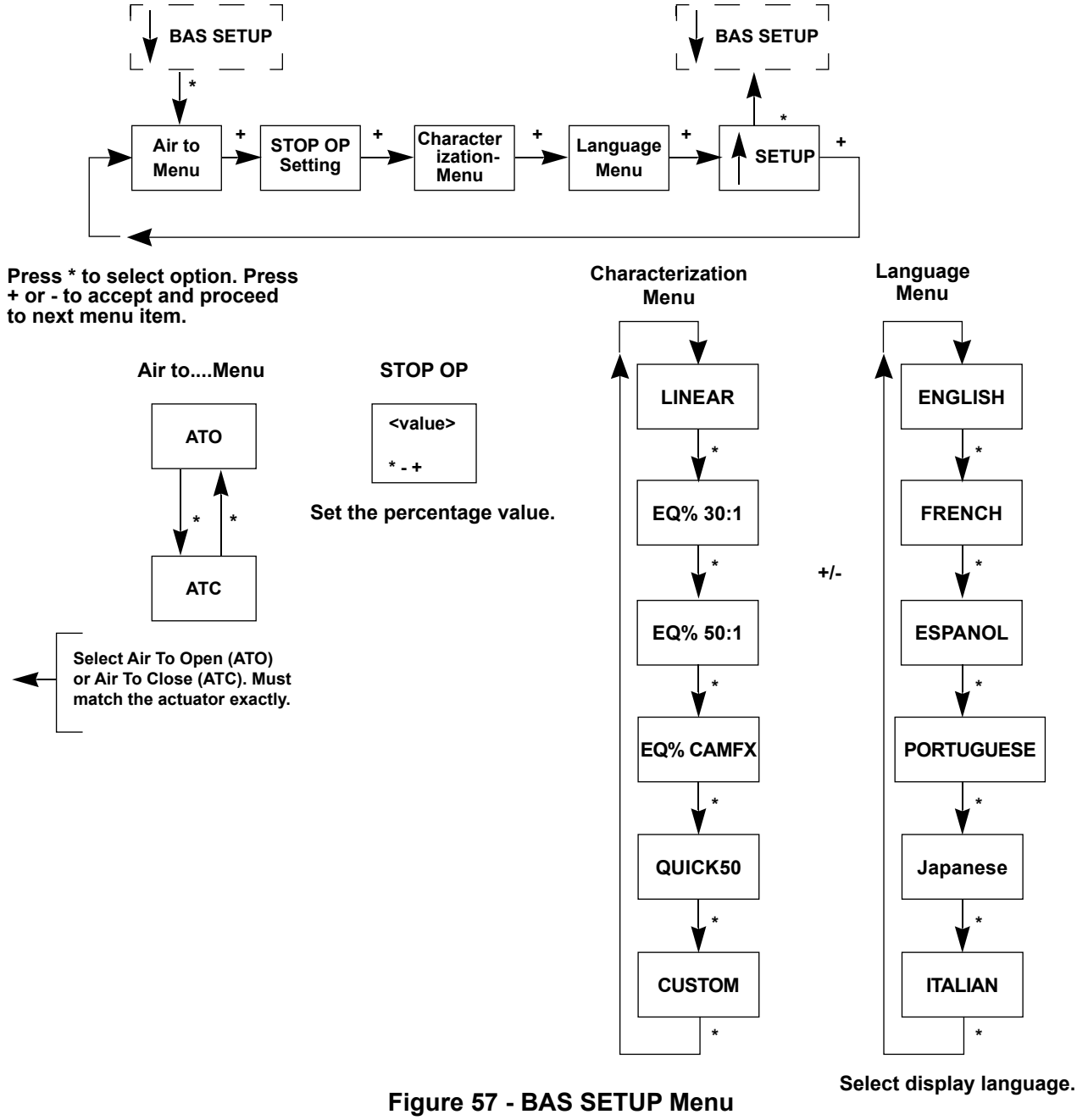


Figure 57 - BAS SETUP Menu

ATO / ATC

WARNING

This procedure can cause the valve to move. Before proceeding be sure the valve is isolated from the process. Keep hands clear from moving parts.

The positioner must be configured as Air-to-Open, ATO, or as Air-to-Close, ATC. If the positioner has a double acting relay, the action is defined for the output labeled ACT1, or Output 1.

To determine if a direct acting positioner is considered ATO or ATC perform the following test:

1. Apply the actuators rated pressure to the positioner supply.

CAUTION

Do not exceed actuator pressure rating on the control valve specification sheet. Damage to the valve stem, shaft, or trim can occur.

2. Disconnect the electrical input signal from the positioner or set it to less than 9 V.
3. Observe the position of the control valve. If it is closed the actuator is ATO. If the valve is open it is ATC.

Valve Characteristics

The positioner must be configured to supply the correct relationship between input signal and valve position. This is called the *position characteristic*. Table 29 lists characteristics for configuring the positioner.

Use of a linear characteristic is recommended unless the process dynamics or control valve application calls for an alternate characteristic. SVI FF offers a custom characteristic for specialty applications. Prior to selection of custom, the parameters for the custom characteristic must be entered using ValVue.

NOTE

The characteristic configured in the positioner is applied in addition to the plug characteristic built into the valve trim. Do not configure a percentage characteristic if the valve has a percentage plug.

Table 29 - Guidelines for Characteristic Choice

Valve Type and Built In Characteristic	Desired Installed Valve Position Characteristic	Standard Positioner Characteristic Selection
Camflex	Linear	LINEAR
Camflex	Equal Percentage	EQUAL50 EQ% CAMFX (when replacing a 4700E)
Varimax	Linear	LINEAR
Varimax	Equal Percentage	EQUAL50
21000 series Model # 21X1X or 41000 series Model # 41X1X with LINEAR TRIM	Linear	LINEAR
21000 series Model # 21X1X or 41000 series Model # 41X1X with LINEAR TRIM	Equal Percentage	EQUAL50
21000 series Model # 21X2X or 41000 series Model # 41X2X with EQUAL PERCENTAGE TRIM	Linear	Not Recommended
21000 series Model # 21X2X or 41000 series Model # 41X2X with EQUAL PERCENTAGE TRIM	Equal Percentage	LINEAR
Ball Valve with typical MODIFIED PERCENTAGE TRIM	Linear	Not Recommended
Ball Valve with typical MODIFIED PERCENTAGE TRIM	Equal Percentage	LINEAR
Butterfly valve with typical MODIFIED PERCENTAGE TRIM	Linear	Not Recommended
Butterfly valve with typical MODIFIED PERCENTAGE TRIM	Equal Percentage	LINEAR
Reciprocating valve with LINEAR TRIM	Linear	LINEAR
Reciprocating valve with LINEAR TRIM	Equal Percentage	EQUAL50
Rotary or Reciprocating valve with EQUAL PERCENTAGE TRIM	Linear	Not recommended
Rotary or Reciprocating valve with EQUAL PERCENTAGE TRIM	Equal Percentage	LINEAR

ADV SETUP Menu

Use this menu to set the pressure units, tight shutoff options and the PID setting.

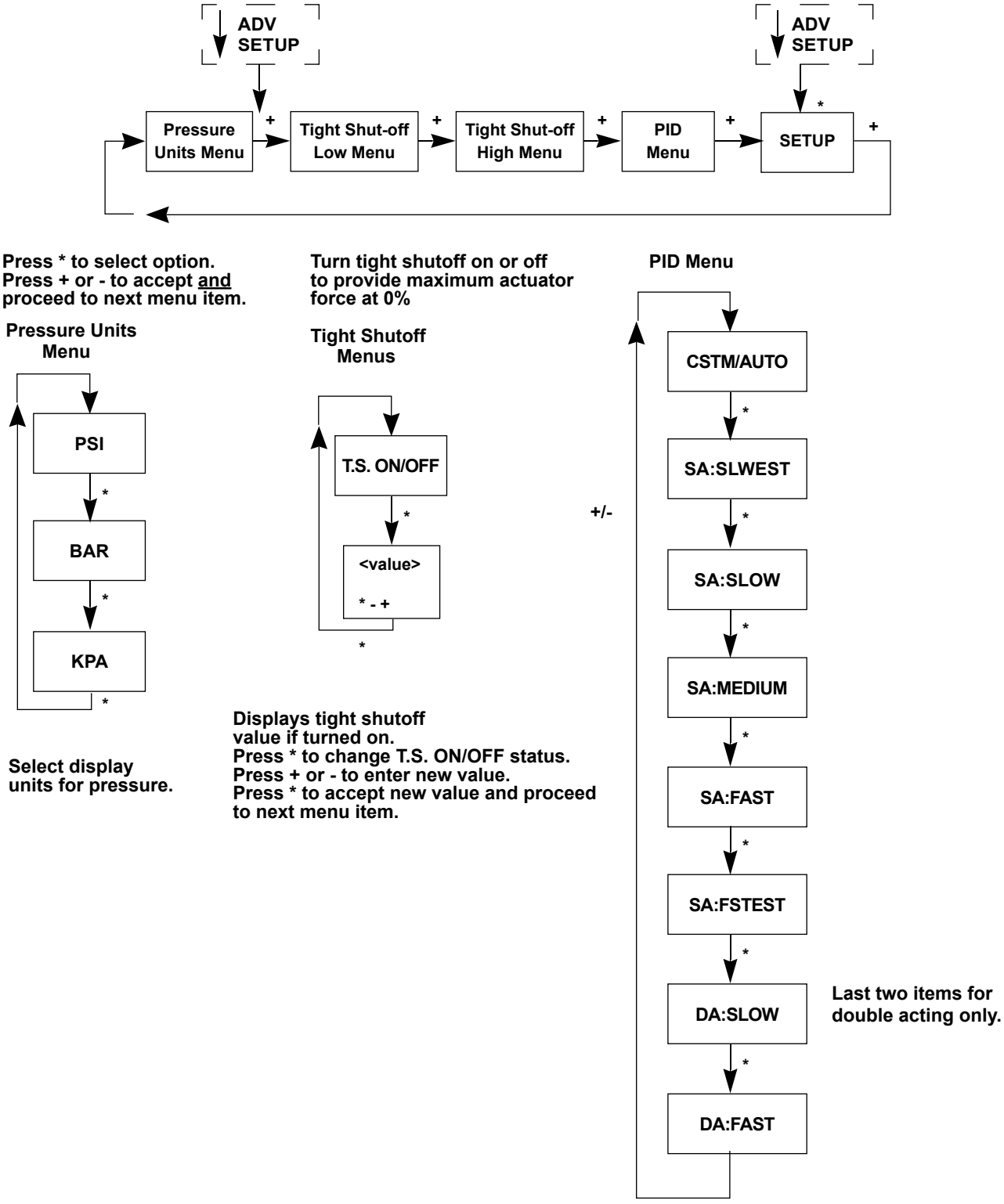


Figure 58 - ADV SETUP Menu

Pressure Units

Select the display units for the optional actuator pressure sensor. The available choices are psi, bar or kPa. The choice applies to both the local LCD display and to the displays with ValVue or the a handheld communicator.

Tight Shutoff

Tight Shutoff LO is an optional performance feature that prevents leakage at the closed position. Without this feature, at the closed position with an input signal of 0%, the valve may be forced tight against the seat with maximum available actuator force or it may be only touching the seat with minimum force. In either case, it is under control.

To prevent leakage that can occur in the second case, configure TS LO ON and set a value of position setpoint below which the actuator applies maximum seating force. As the position signal drops toward the TS value, SVI FF moves the valve to the TS position value. When the position reaches the TS value SVI FF applies maximum actuator force.

Tight Shutoff HI is an optional performance feature that prevents leakage at the open position. Without this feature, at the open position with an input signal of 100%, the valve may be forced tightly open with maximum available actuator force or it may be only touching the with minimum force. In either case, it is under control.

To prevent leakage that can occur in the second case, configure TS HI ON and set a value of position setpoint below which the actuator applies maximum seating force. As the position signal approaches the TS value, SVI FF moves the valve to the TS position value. When the position reaches the TS value SVI FF applies maximum actuator force.

For both TS LO and HI, the TS function has 0.5% deadband to prevent chatter. If TS is set ON at 2%, for example, then the valve begins to open when the setpoint reaches 2.5%.

NOTE

In all cases, tight shutoff is engaged when:

1. *the setpoint is below (or above for tight open) the configured threshold, and*
2. *the valve position is within 5% of that threshold.*

These features are implemented by FINAL_VALUE_CUTOFF_LO or FINAL_VALUE_ CUTOFF_HI.

NOTE

See Appendix H "Notes on Characterization" on page 199 for a discussion of the impact of Characterization on Tight Shutoff settings.

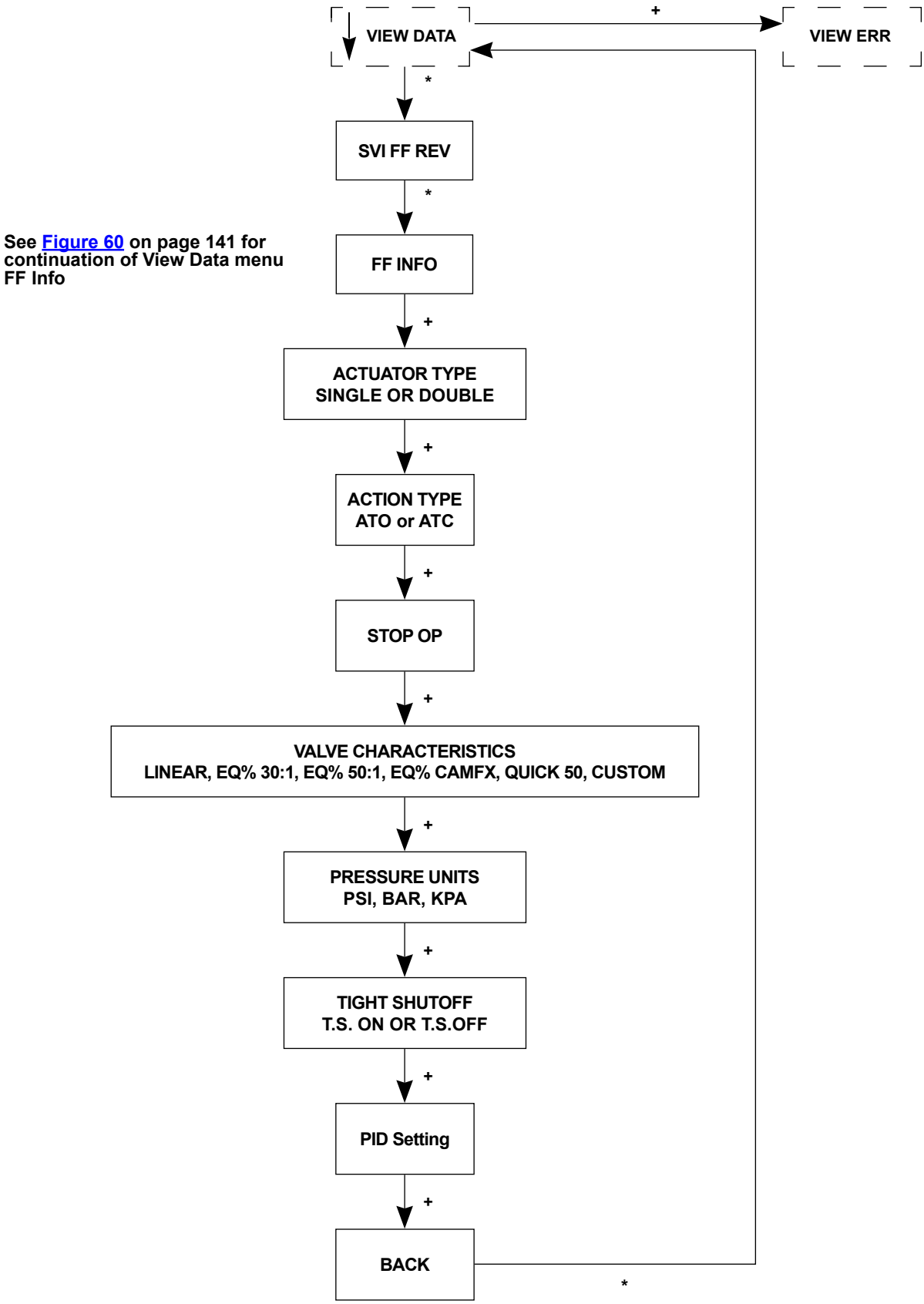
VIEW DATA Menu

Use the VIEW DATA menu to read the current configuration, calibration, and status information. This information cannot be changed from the VIEW DATA menu. Figure 59 on page 140 and Figure 60 on page 141 show the available data.

Viewing Configuration and Calibration Parameters

To view configuration and calibration parameters use the following procedure:

1. Press **+** to move through the options until you reach the VIEW DATA menu.
2. Press ***** to go to *VIEW DATA* menu. Press **+** to select the *VIEW DATA* mode.
3. To exit from the *VIEW DATA* menu, press ***** at any menu line. You return to the last menu displayed.



See Figure 60 on page 141 for continuation of View Data menu FF Info

Figure 59 - VIEW DATA Menu Part 1

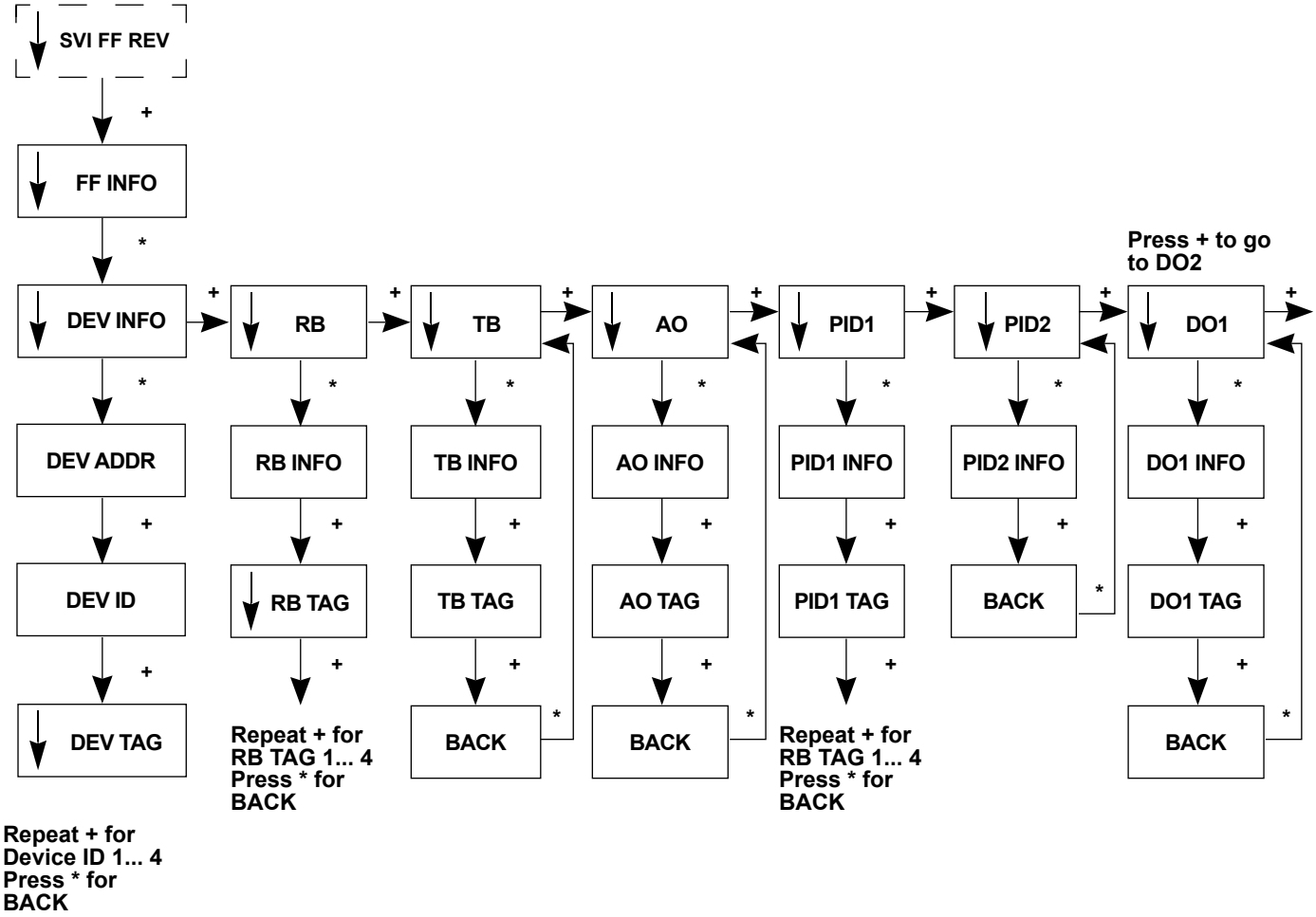


Figure 60 - VIEW DATA Menu Part 2

VIEW ERROR Menu

Use the VIEW ERROR menu to view actuator and pressure errors.

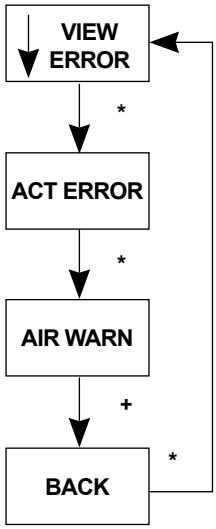


Figure 61 - VIEW ERROR Menu

Table 30 lists the fault codes and messages that appear on the display and explains the message meaning and possible causes.

Error messages depend on the device status and can vary for different devices.

Categories include:

- Failsafe: the valve is non-operational.
- Warning: the alert is annunciated; the valve may become non-operational.
- Logonly: informational; to support further analysis of valve condition.

Table 30 - Error Messages

Display Message	Description	Category	Cause	Byte_ Bit
RESET	Reset occurred due to command or power up. Always present after power up.	Logonly	Normal operation on power up always sets RESET. Use CLEAR ERR to remove warning.	0_0
ACTUATOR	Positioner unable to position a valve normally	Warning	Low pressure or obstacle	0_2

Table 30 - Error Messages (Continued)

Display Message	Description	Category	Cause	Byte_ Bit
AIRSUPPLY LOW	Supply pressure option is configured and supply pressure is < 10 psi (.69 bar, 69 kPa). Otherwise I/ P pressure is below 0.8 psi (.05 bar, 5.5 kPa)	Warning	Mechanical or pneumatic problem. Insufficient supply pressure.	0_3
POS ERROR	The position error exceeds the limit for more than configured time (when position is not near end points).	Warning after T1	Pneumatic/ mechanical, configuration, loose magnet, bad tuning	0_4
I2CBUS	Internal serial bus fault	Failsafe	N/A	0_5
KEYBOARD	LCD/Button Failure	Logonly	Damaged buttons or electronics or condensation	0_6
CALIB ERR	Calibrate failed	Logonly	If calibration of AO or pressure fails. Invalid values for current calibration and input range. Valve may be uncalibrated.	1_0
STOP ERR	Calibration error. Find STOPS was unsuccessful.	Logonly	Configuration, calibration	1_1
TUNE ERR	Auto tune failed	Logonly	Mechanical or pneumatic problem causes tuning failure. Bad tuning parameters initial values.	1_2
EXT DIAG	An extended diagnostic procedure failed to complete	Logonly	Pneumatic / mechanical, configuration	1_4
RTOS_ SCHEDULING	If any RTOS task overruns itself.	Logonly	If there are multiple failures; replace positioner.	1_5
BIAS ERR	Position algorithm error in output bias. If BIAS is outside alarm limits [10,000, 30,000]	Warning	Pneumatic/ mechanical	2_0

Table 30 - Error Messages (Continued)

Display Message	Description	Category	Cause	Byte_ Bit
I/P LIMIT	I/P current too high or too low. If temperature compensated I/P current is out of range [-100, 30000] counts.	Logonly	Electronic hardware	2_1
TEMP ERR	Temperature compensated temperature sensor reading is outside of range in ° C.	Logonly	Environment	2_2
NVM ERR_R	An FRAM record and its copy both have CRC errors (as detected by read on initialization) or if temperature calibration table has not been written in its entirety (detected by CRC of column CRCs)	Failsafe	Electronic hardware	3_0
RAM ERR	RAM data item had a bad checksum	Warning	Electronic hardware	3_1
FLASH ERR	Flash memory failed checksum test	Failsafe	Electronic hardware	3_2
STACK ERR	A valid hidden record (in RAM) existing upon reset indicating that a stack overflow had occurred	Warning	Electronic hardware	3_3
FACTORYWRITE	Raw write to FRAM.	Failsafe	Electronic hardware	3_4
FCTRYMODE	Factory mode activated.	Logonly	N/A	3_7
NVM ERR-T	An FRAM record and its copy both have CRC errors	Warning	Electronic hardware	3_5
REF VOLT	Temperature compensated reference voltage is out of range for five reads in a row or the raw reading it out of range.	Failsafe	Electronic hardware	4_0
POS SENSR	Temperature compensated remote position sensor reading is outside of range in degrees or internal position sensor reading is outside of range in degrees for five reads in a row.	Failsafe	Electronic hardware	4_1
TEMPERATURE_ SENSOR	If, upon request, temperature compensated temperature sensor reading is outside the range [–60.0, 100.0] C.	Failsafe	Environmental issue or electronic hardware.	4_3
PRES1 ER	Temperature compensated pressure sensor 1 reading is outside the range	Warning	Electronic hardware	4_5
PRES2 ER	Temperature compensated pressure sensor 2 reading is outside the range	Warning	Electronic hardware	4_6

Table 30 - Error Messages (Continued)

Display Message	Description	Category	Cause	Byte_ Bit
PRES3 ER	Temperature compensated pressure sensor 3 (supply) reading is outside of range.	Warning	Electronic hardware	4_7
PRES4 ER	Temperature compensated pressure sensor 4 (pilot) reading is outside of range.	Failsafe	Electronic hardware	5_0
PRES5 ER	Temperature compensated pressure sensor 5 reading is outside the range	Warning	Electronic hardware	5_1
WATCHDOG_ TIMEOUT	Watchdog event from which the positioner recovered automatically.	Warning	Electronic hardware	5_2
NVM ERR-W	Writer to FRAM fails or data repairing in FRAM fails	Logonly	Electronic hardware	5_3
IRQ FAULT	Valid hidden record (in RAM) existing upon reset that indicates that an illegal interrupt occurred	Logonly	Electronic hardware	5_4
TMOUT_FLASH_ TEST	If a round of flash test is not completed in 2 hrs.	Warning	Electronic hardware	5_5
MCU ERR 1	Micro-Controller Self Check failed	Failsafe	Electronic hardware	5_6
SW ERR	Software self check error	Warning	CPU/firmware	5_7
UI_OFF	Display is turned off because it is not responsive at low (main board) temperature, -10 deg.C.	Lgonly	Ambient temperature.	7_4
IPC_LOST	Electronics failure**.**	Failsafe	Electronic hardware	7_6
SETPOINT_ TIMEOUT	Timeout of GOOD setpoint delivery from FF.	Warning	Electronic hardware	7_7
FSTATE_REQ	Failed State requested by FF.	Failsafe	Electronic hardware	8_0
NEWDIAGSIGN_ BASELINE	New baseline signature successfully saved (should be cleared by host on read).	Lgonly	N/A	8_1
NEWDIAGSIGN_ USER	New user signature successfully saved (should be cleared by host on read).	Lgonly	N/A	8_2
IPC_DISCONNECT	Electronics failure**.**	Lgonly	Electronic hardware	8_3
POS_CUTOFF_HI	Indicator of position cut-off high (at open stop).	Lgonly	N/A	8_4
NEWDIAGSIGN_ CURRENT	New current signature successfully saved (should be cleared by host on read).	Lgonly	N/A	8_5
NV_BK_RESTORE	Process of saving or restoring NVMEM factory defaults failed.	Lgonly	Electronic hardware	8_6

Display and Clear Error Messages

Use this procedure, VIEW ERR, to view fault codes and messages listed in Table 30 of this manual.

1. Press **+** in *NORMAL* mode to move through the options until you reach the *VIEW ERR* menu item.
2. Press ***** to go to *VIEW ERR* menu.
3. Press ***** to display the list of status values.
4. Press **+** to move forward trough the list in sequence.
5. Press **–** to move back through the list.
6. Press ***** at any status message to return to the *VIEW ERR* option.
7. Press **+** to move to *Clear ERR*.
8. Press ***** to clear all messages.

MAN POS Menu

Use the MAN POS menu to manually set the valve position.

NOTE *The positioner cannot be in OOS mode.*

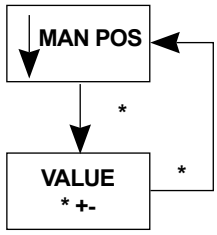


Figure 62 - MAN POS Menu

METHOD Menu

Use the METHOD menu manually set the stops.

NOTE *The positioner cannot be in OOS mode.*

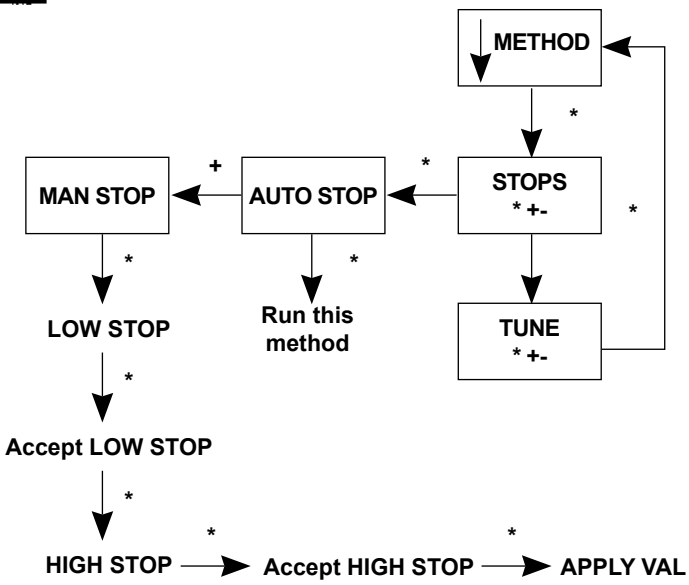


Figure 63 - METHOD Menu

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Appendix F. Transducer Block Parameters

Table 31 lists the Transducer block parameters.

CAUTION

Once finished with any DD-based configuration you must return to Normal mode, Use the APP_MODE command to do this from the DD. See "Changing Out of LO Mode" on page 251.

NOTE

In the Transducer block each alert has an Active and Historical bit. Active bit presents the current state of the condition. Historical bit indicates whether the condition occurred in the past. Both are user clearable.

Table 31 - Transducer Block Parameters

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
BLOCK_INFO (0)				
Block Tag (1)				Block tag is detected by the application is use
DD_MEMBER (2)		0		DD member ID defined by DD tokenizer, when the DD is created (constant).
DD ITEM (3)		20018		DD member ID defined by DD tokenizer, when the DD is created (constant).
DD REVIS (4)		0x0001		DD revision.
Profile (5)		8060		Hard-coded to Custom Transducer block (constant).
Profile Revision (6)		01		
Execution Time (7)		0		0 indicates that this block does not need to be scheduled (constant).
EXECUTION_PERIOD (8)		0		0 indicates that this block does not need to be scheduled.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
Number of Parameters (9)		120		Number of parameters in the block.
NEXT_FB_TO_EXECUTE (10)		0		Next block for execution. Not used in this application.
VIEWS_INDEX (11)		20010		Starting index of the views.
NUMBER_VIEW_3 (12)		6		1 - Indicates how many View3s are used. See “Views” on page 225.
NUMBER_VIEW_4 (13)		5		1 - Indicates how many View4s are used. “Views” on page 225.
ST_REV (15)	1-0xFFFF	0		The revision level of the static data associated with the function block.
TAG_DESC (2)				The user description of the intended application of the block.
STRATEGY (3)		0		The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
ALERT_KEY (4)	[1, 255]	0		The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
MODE_BLK (5)				
TARGET (1)	See Description	Auto		Limited to set only one of the PERMITTED modes. See “Block Modes” on page 20.
ACTUAL (2)				Reflects the actual block mode for the device. See “Block Modes” on page 20.
PERMITTED (3)		Auto, MAN, OOS		The following is the list of permitted bit values: ☐ 0x80 - Out of Service mode ☐ 0x10 - Manual ☐ 0x04 - Auto mode All other bits are filtered and ignored.
NORMAL (4)		Auto		
BLOCK_ERR (6)				This alert is generated by any change to the static data. Update event is generated each time a static parameter attribute value is changed.
UPDATE_EVT (7)				Update event is generated each time a static parameter attribute value is changed.
UNACKNOWLEDGED (1)				Standard FF alarm behavior. ☐ 0 = Undefined. ☐ 1 = Acknowledged. ☐ 2 = Unacknowledged.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
UPDATE_STATE (2)				Standard FF alarm behavior ☐ 0 = Undefined. ☐ 1 = Update reported. ☐ 2 = Update not reported.
TIME_STAMP (3)				Standard FF alarm behavior. The time when the parameter was updated.
STATIC_REVISION (4)				Standard FF alarm behavior.
RELATIVE_INDEX (5)				Standard FF alarm behavior. The relative OD index of the static parameter whose change caused this alert.
UPDATE_EVT (8)				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 sub code field. The first alert to become active sets 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 sub code has changed.
UNACKNOWLEDGED (1)	0-2	0		Unacknowledged has the following enumerations: ☐ 0 = Undefined. ☐ 1 = Acknowledged. ☐ 2 = Unacknowledged.
ALARM_STATE (2)	0 to 4	0		Alarm State has the following enumerations: ☐ 0 = Undefined. ☐ 1 = Clear - reported. ☐ 2 = Clear - not reported. ☐ 3 = Active - reported. ☐ 4 = Active - not reported.
TIME_STAMP (3)	0	0		Alarm time.
SUB_CODE (4)	0	0		For Block Alarms, when multi-bit alarms are selected using the resource block FEATURES_SEL parameter, the sub code contains the two byte bitstring value of Block Error when taken as an Unsigned16, such that the most significant bit (MSB) of the Block Error bitstring is mapped to the most significant bit (MSB) of the Unsigned16 that represents the subcode attribute of the Alarm parameter. For all other alarms, the subcode contains an enumeration specifying the cause of the alert to be reported. It is used primarily for diagnostic alarms, notified with block alarm. Standard sub codes are defined by the Fieldbus Foundation, although manufacturers may define additional ones.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
VALUE (5)	0	0		The value of the associated parameter at the time the alert was detected, except that for multi-bit alarms, the value is 0 (zero).
TRANSDUCER_DIRECTORY (9)				
NUMBER_OF_XDS (1)	3	3		Number of transducers in the device.
POSITIONER_INDEX (2)	10	10		Index of the positioner transducer.
PRESSURES_INDEX (3)	48	48		Index of the supply pressure transducer.
TEMPERATURE_INDEX (4)	59	59		Index of temperature transducer.
POSITION_TRANSDUCER_ TYPE (10)	106	106		Indicates that it is the advanced positioner valve.
XD_ERROR_POS (11)	0	0		The following errors can be reported in the XD_ ERROR parameter: ☐ 0 No Error. ☐ 16 Unspecified error (to be mapped to Other in Block Error. ☐ 17 General error. ☐ 18 Calibration error. ☐ 19 Configuration error. ☐ 20 Electronics Failure. ☐ 21 Mechanical Failure. ☐ 22 I/O Failure. ☐ 23 Data Integrity Error. ☐ 24 Software Error. ☐ 25 Algorithm Error.
FINAL_VALUE (12)				The requested valve position and setpoint status written by an Analog Output block. The output is used as the setpoint when controlled in Man mode.
STATUS (1)				The status written by the Analog Output FB.
VALUE (2)				The requested valve position, written by the AO FB.
FINAL_VALUE_RANGE (13)			Man	The range of the FINAL_VALUE (setpoint) and the FINAL_VALUE_RANGE (actual position). This parameter is not changeable.
EU_100 (1)	100	100		Max Position value at 100%. Fixed to 100.
EU_0 (2)	0	0		Min Position value at 100%. Fixed to 0.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
UNITS_INDEX (3)	%(1342)	%(1342)		Engineering Units at 100. Fixed to %(1342).
DECIMAL (4)	2	2		
POSITION_LIMITS (14)			Man	Position Limits defined as percentage of valve travel.
LIMITS_PROTECTED (1)	T/F	F		Position Limits change is restricted. If True, ENABLE_HI and ENABLE_LO cannot be changed. This should be set to False before running diagnostic procedures.
ENABLE_HI (2)	T/F	F		Position Limit HI enabled.
ENABLE_LO (3)	T/F	F		Position Limit LO enabled.
LIMIT_HI (4)	-25 to +125	125		Position Limit HI Point. The working setpoint is limited be this value.
LIMIT_LO (5)	-25 to +125	-25		Position Limit LO Point.
ENABLE_RATE_HI (6)	T/F	F		Enables working setpoint Position Rate Limit when the valve setpoint increased.
ENABLE_RATE_LO (7)	T/F	F		Enables working setpoint Position Rate Limit when the valve setpoint decreased.
LIMIT_RATE (8)	0.5 to 100.1	100.1		Position Rate Limit.
FINAL_ VALUE_ CUTOFF_HI (15)				If the working position is higher than this value, the valve is forced to its maximum high value (fully opened).
ENABLE (1)	T/F	F	Man	True if CUTOFF_HI algorithm to be enabled.
CUTOFF_POINT_HI (2)	≥ 80%	98	Man	Cut-Off point HI. Valve is fully open to after this point. From 80% to 200%.
FINAL_ VALUE_ CUTOFF_LO (16)				If the working position is less than this value, the valve is forced to its maximum low value (fully closed).
ENABLE (1)	T/F	F	Man	True if CUTOFF_LO algorithm to be enabled.
CUTOFF_POINT_LO (2)	≤ 20%	2	Man	Cut-Off point LO. Valve is fully closed to after this point. Below 20% to at least -50%.
FINAL_ POSITION_ VALUE (17)				The actual valve position and status.
STATUS (1)				
VALUE (2)				Actual position value.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
ACTIVATE_CONTROL_ SET (18)	0, 1, 2, 3, 4, 5, 6, 7, 10, 11, 255	0	Auto	Allows copying of the Working Control Set or the Backup Control Set to the Active control set. The following commands are available: ☐ 0: Activate Custom Control Set. ☐ 1: Activate Control Set 1(Slowest). ☐ 2: Activate Control Set 2. ☐ 3: Activate Control Set 3. ☐ 4: Activate Control Set 4. ☐ 5: Activate Control Set 5(Fastest). ☐ 6: Activate Control Set 6 (Double Acting - Slow). ☐ 7: Activate Control Set 7 (Double Acting- Fast). ☐ 10: Restore Control set (make Backup Control Set Active). ☐ 11: Make active control set as Custom control set. ☐ 255: Do Nothing. See Table 3 on page 48 and Table 4 on page 48 for tables recommending control sets by valve.
ACTIVE_ CONTROL_SET (19)				This read-only parameter contains the control parameters currently used by the positioner.
Selector (1)			NA	Identifies the active control set.
P (2)			NA	
I (3)			NA	
D (4)			NA	
Padj (5)			NA	
Beta (6)			NA	
PosComp (7)			NA	
DeadZone (8)			NA	
NonLin (9)			NA	
CUSTOM_ CONTROL_SET (20)				User editable values. These values do not change the active control set until ACTIVATE_CONTROL_ SET is not set to 0.
P (1)	max. 5000		Auto	
I (2)	max. 1000		Auto	
D (3)	max. 200		Auto	

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
Padj (4)	[-3000,3000]		Auto	
Beta (5)	[-9, 9]		Auto	
PosComp (6)	[2, 20]		Auto	
DeadZone (7)	max. 821		Auto	
NonLin (8)	[0,20]		Auto	
BACKUP_CONTROL_ SET (21)				Values before the last control set was activated.
Selector (1)			NA	
P (2)			NA	
I (3)			NA	
D (4)			NA	
Padj (5)			NA	
Beta (6)			NA	
PosComp (7)			NA	
DeadZone (8)			NA	
NonLin (9)			NA	
TRAVEL CALIBRATION (22)				The location of last positioner calibration. This describes the physical location at which the calibration was performed. (ex. NIST, Acme Labs).
CAL_LOCATION (1)	See Description		Auto	The location of last positioner calibration. This describes the physical location at which the calibration was performed.
CAL_DATE (2)	See Description		Auto	The date of the last positioner calibration.
CAL_WHO (3)	See Description		Auto	The name of the person responsible for the last positioner calibration.
STOP_HI_POS (4)	0-FFFFFF FF	0	Auto	Calibration Point HI: Is set when the calibration procedure is invoked. Provides the temperature compensated position, as reported by the sensor. Value is not valid if TRAVEL_CALIBRATION. LAST_RESULT is not successful.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
STOP_LO_POS (5) z	0-FFFFFF FF	0	Auto	Calibration Point LO: Is set when the calibration procedure is invoked. Provides the temperature compensated position, as reported by the sensor. Value is not valid if TRAVEL_CALIBRATION. LAST_RESULT is not successful.
CAL_TYPE (6)	See Description		Auto	Last Calibration Type: ☐ 0. Not Calibrated. ☐ 1. Closed Endpoint (Manual). ☐ 2. Open Endpoint (Manual). ☐ 3. Both Endpoints (Manual). ☐ 4. Both Endpoints (Automatic). ☐ 5. User Set (cloned). Is set when the calibration procedure is invoked.
LAST_RESULT (7)	See Description		Auto	Last Calibration Type: ☐ 0. No or Failed Calibration. ☐ 1. Successful Calibration. Is set using the Find Stops procedure when the calibration procedure is invoked.
TRAVEL (23)				
RANGE (1)	0.1-10000	100	Man	A numeric value, describing the Range of travel. Is used when alerts are calculated.
UNITS_INDEX (2)		%		Enumeration of the travel Units. The following units are supported: ☐ Inch ☐ cm ☐ mm ☐ deg ☐ Rad ☐ % The units have no effect on the application - it is used to present the units for the working SP.
WORKING_SP (24)				The final command value to the positioning algorithm after characterization.
STATUS (1)				FF status.
VALUE (2)				The setpoint value is in percent from the travel, after characterization. The value does not change if the Travel Settings are changed. The value is used when the conversion to travel units is done.
WORKING_POS (25)				The actual measured feedback position before de-characterization.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
STATUS (1)				
VALUE (2)				The value is in percent from the travel. The value does not change if the Travel Settings are changed. The value is used when the conversion to travel units is done.
DEVIATION_ALERT (26)				
DEVIATION_VALUE (1)				Dynamically calculated difference between working setpoint and working position. The written value is overwritten by the algorithm.
ALERT_POINT (2)	0.1-250	20		If the DEVIATION VALUE is above ALERT_POINT for deviation TIME, it sets the ALERT to true. Position error in travel units.
DEADBAND (3)	0.01 - 10	1		The change in position error before the alert is cleared.
TIME (4)	From 0 - 3600	20		The user defined allowable duration in seconds of deviation before alert. When presented to the user, the value should be in seconds and limited between 1s to 60 minutes (3600s).
ALERT (5)	0	0		TRUE if DEVIATION VALUE is bigger than DEVIATION_ALERT_POINT for DEVIATION_TIME. FALSE if DEVIATION_VALUE is smaller than (DEVIATION_ALERT+DEVIATION_DEADBAND).
HISTORIC ALERT (6)	0	0		TRUE if ALERT is true. Not Changed if ALERT is false.
ENABLE (7)	0	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting.
POSITION_HIHI_ALERT (27)				
POSITION (1)				Current valve position in travel units.
ALERT_POINT (2)		110		POSITION Value, above which the ALERT is set to True. Should be set above POSITION_HI_ALERT. ALERT_POINT.
DEADBAND (3)		1		POSITION change, required to clear the ALERT, once it was set to True.
ALERT (4)		0		True if the position has reached above ALERT_ POINT and have not come below (ALERT_POINT-DEADBAND).
HISTORIC ALERT (5)		0		True if ALERT is true. Not Changed if ALERT is false.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
ENABLE (6)	TRUE	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting.
POSITION_HI_ALERT (28)				
POSITION (1)				Current valve position in travel units. Presented here for convenience.
ALERT_POINT (2)		105		POSITION Value, above which the ALERT is set to True. Should be set above POSITION_LO_ALERT. ALERT_POINT.
DEADBAND (3)		1		POSITION change, required to clear the ALERT, once it was set to True.
ALERT (4)		0		True if the position has reached above ALERT_ POINT and have not come below (ALERT_POINT-DEADBAND).
HISTORIC ALERT (5)		0		True if ALERT is true. Not Changed if ALERT is false.
ENABLE (6)	TRUE	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting.
POSITION_LO_ALERT (29)				
POSITION (1)				Current valve position in travel units. Presented here for convenience.
ALERT_POINT (2)	-51 to 199	-5		POSITION Value, below which the ALERT is set to True. Should be set below POSITION_HI_ALERT. ALERT_POINT.
DEADBAND (3)	0.1-10	1		POSITION change, required to clear the ALERT, once it was set to True.
ALERT (4)	0	0		True if the position has reached below ALERT_ POINT and have not come above (ALERT_ POINT+DEADBAND).
HISTORIC ALERT (5)	0	0		True if ALERT is true. Not Changed if ALERT is false.
ENABLE (6)	0	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting.
POSITION_ LOLO_ALERT (30)				
POSITION (1)				Current valve position in travel units. Presented here for convenience.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
ALERT_POINT (2)	-51 to 199	-10		POSITION Value, below which the ALERT is set to True. Should be set below POSITION_LO_ALERT.ALERT_ POINT.
DEADBAND (3)	0.1-10	1		POSITION change, required to clear the ALERT, once it was set to True.
ALERT (4)	0	0		True if the position has reached below ALERT_POINT and have not come above (ALERT POINT+DEADBAND).
HISTORIC ALERT (5)	0	0		True if ALERT is true. Not Changed if ALERT is false.
ENABLE (6)	0	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting.
TRAVEL_ ACCUMULATION_ A_ALERT (31)				Not writable for Standard Diagnostics version.
TRAVEL_ ACCUMULATION (1)		0		Totalized change in travel, since the TRAVEL_ ACCUMULATION was cleared. The value increments when the magnitude of the change exceeds the DEADBAND. Not writable for Standard Diagnostics version.
ALERT_POINT (2)	0-0xFFFF FFFF	1Milion		Travel accumulation value, above which the ALERT is set to True. Not writable for Standard Diagnostics version.
DEADBAND_AB (3)	0.1-10	1		POSITION change, required to exceed, before the TRAVEL ACCUMULATION is increased. Not writable for Standard Diagnostics version.
ALERT (4)	0	0		True if the TRAVEL_ACCUMULATION is above ALERT_POINT. Not writable for Standard Diagnostics version.
HISTORIC ALERT (5)	0	0		True if ALERT is true. Not changed if ALERT is false. Not writable for Standard Diagnostics version.
ENABLE (6)	0	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting. Not writable for Standard Diagnostics version.
TRAVEL_ ACCUMULATION_ B_ALERT (32)				Not writable for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
TRAVEL_ ACCUMULATION (1)		0		Totalized change in travel, since the TRAVEL_ ACCUMULATION was cleared. The value increments when the magnitude of the change exceeds the DEADBAND. Not writable for Standard Diagnostics version.
ALERT_POINT (2)	0-0xFFFF FFFF	Milion		Travel accumulation value, above which the ALERT is set to True. Not writable for Standard Diagnostics version.
DEADBAND_ AB (3)	0.1-10	1		POSITION change, required to exceed, before the TRAVEL ACCUMULATION is increased. Not writable for Standard Diagnostics version.
ALERT (4)	0	0		True if the TRAVEL_ACCUMULATION is above ALERT_POINT. Not writable for Standard Diagnostics version.
HISTORIC ALERT (5)	0	0		True if ALERT is true. Not Changed if ALERT is false. Not writable for Standard Diagnostics version.
ENABLE (6)	0	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting. Not writable for Standard Diagnostics version.
TRAVEL_ ACCUMULATION_ TREND (33)				The total change in travel trend. The value increments when the magnitude of the change exceeds the TRAVEL_ ACCUMULATION_ALERT.DEADBAND. No value for Standard Diagnostics version.
CURRENTLY COLLECTED (1)		0		Travel accumulation for the current 24 hours period. No value for Standard Diagnostics version.
TODAY(FULL DAY) (2)		0		Travel accumulation for the last full 24 hours period. No value for Standard Diagnostics version.
LAST_DAY (3)		0		Travel accumulation for the previous full 24 hours period. No value for Standard Diagnostics version.
PREVIOUS_DAY (4)		0		Travel accumulation for the previous full 24 hours period. No value for Standard Diagnostics version.
THREE_DAYS_AGO (5)		0		Travel accumulation for the last three days current week. No value for Standard Diagnostics version.
CURRENT_WEEK (6)		0		Travel accumulation for the current week. No value for Standard Diagnostics version.
LAST_WEEK (7)		0		Travel accumulation for the last full week. No value for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
PREVIOUS_WEEK (8)		0		Travel accumulation for the previous week (2 weeks ago). No value for Standard Diagnostics version.
THREE_WEEKS_AGO (9)		0		Travel accumulation for the past 3 weeks. No value for Standard Diagnostics version.
CURRENT_MONTH (10)		0		Travel accumulation for the current month period. No value for Standard Diagnostics version.
LAST_MONTH (11)		0		Travel accumulation for the last full month period. No value for Standard Diagnostics version
PREVIOUS_MONTH (12)		0		Travel accumulation for the previous full month period. No value for Standard Diagnostics version.
THREE_MONTHS_AGO (13)		0		Travel accumulation for the past 3 months. No value for Standard Diagnostics version.
CURRENT_12_ MONTHS (14)		0		Travel accumulation for the current 12 month period. No value for Standard Diagnostics version.
LAST_12_MONTHS (15)		0		Travel accumulation for the last full 12 months. No value for Standard Diagnostics version.
PREVIOUS_ 12_MONTHS (16)		0		Travel accumulation for the previous full 12 months. No value for Standard Diagnostics version.
THREE_YEARS_AGO (17)		0		Travel accumulation for the 3 years ago. No value for Standard Diagnostics version.
CYCLE_COUNTER_ A_ALERT (34)				Not writable for Standard Diagnostics version.
CYCLE_COUNTER (1)		0		Number of times the travel changes the direction Not writable for Standard Diagnostics version.
ALERT_POINT (2)		10000		CYCLE_COUNTER Value, above which the ALERT_ POINT sets ALERT to True. Not writable for Standard Diagnostics version.
DEADBAND_AB (3)	0.05-10	1		POSITION change, required to exceed, before the CYCLE_COUNTER is increased. Not writable for Standard Diagnostics version.
ALERT (4)	0	0		True if CYCLE_COUNTER is above ALERT_POINT. Not writable for Standard Diagnostics version.
HISTORIC ALERT (5)	0	0		True if ALERT is true. Not Changed if ALERT is false. Not writable for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
ENABLE (6)	0	0		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting. Not writable for Standard Diagnostics version.
CYCLE_COUNTER_ B_ALERT (35)				Not writable for Standard Diagnostics version.
CYCLE_COUNTER (1)		0		Number of times the travel changes the direction. Not writable for Standard Diagnostics version.
ALERT_POINT (2)		1000		CYCLE_COUNTER Value, above which the ALERT_ POINT sets the ALERT to True. Not writable for Standard Diagnostics version.
DEADBAND_AB (3)	0.05-10	1		POSITION change, required to exceed, before the CYCLE_COUNTER is increased. Not writable for Standard Diagnostics version.
ALERT (4)	0	0		True if CYCLE_COUNTER is above ALERT_POINT. Not writable for Standard Diagnostics version.
HISTORIC ALERT (5)	0	0		True if ALERT is true. Not Changed if ALERT is false. Not writable for Standard Diagnostics version.
ENABLE (6)	0	0		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting. Not writable for Standard Diagnostics version.
CYCLE_COUNTER_ TREND (36)				The number of times the travel changes direction. The value increments when the magnitude of the change exceeds the CYCLE_COUNTER_ALERT.DEADBAND. No value for Standard Diagnostics version.
CURRENTLY COLLECTED (1)		0		Cycles for the current 24 hours period. No value for Standard Diagnostics version.
TODAY(FULL DAY) (2)		0		Cycles for the last full 24 hours period. No value for Standard Diagnostics version.
LAST_DAY (3)		0		Cycles for the previous full 24 hours period. No value for Standard Diagnostics version.
PREVIOUS_DAY (4)		0		Cycles for the previous full 24 hours period. No value for Standard Diagnostics version.
THREE_DAYS_AGO (5)		0		Cycles for the past three days. No value for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
CURRENT_WEEK (6)		0		Cycles for the current week. No value for Standard Diagnostics version.
LAST_WEEK (7)		0		Cycles for the last full week. No value for Standard Diagnostics version.
PREVIOUS_WEEK (8)		0		Cycles for the previous week (2 weeks ago). No value for Standard Diagnostics version.
THREE_WEEKS_AGO (9)		0		Cycles for 3 weeks past. No value for Standard Diagnostics version.
CURRENT_MONTH (10)		0		Cycles for the current month period. No value for Standard Diagnostics version.
LAST_MONTH (11)		0		Cycles for the last full month period. No value for Standard Diagnostics version.
PREVIOUS_MONTH (12)		0		Cycles for the previous full month period. No value for Standard Diagnostics version.
THREE_MONTHS_AGO (13)		0		Cycles 3 months past. No value for Standard Diagnostics version.
CURRENT_12_MONTHS (14)		0		Cycles for the current 12 month period. No value for Standard Diagnostics version.
LAST_12_MONTHS (15)		0		Cycles for the last full 12 months. No value for Standard Diagnostics version.
PREVIOUS_ 12_MONTHS (16)		0		Cycles for the previous full 12 months. No value for Standard Diagnostics version.
THREE_YEARS_AGO (17)		0		Cycles for 3 years past. No value for Standard Diagnostics version.
POSITION_ERROR_ TREND (37)				Trend of the position error. No value for Standard Diagnostics version.
CURRENTLY COLLECTED (1)		0		Position Error for the current time less than 24 hours period. No value for Standard Diagnostics version.
TODAY (FULL DAY) (2)		0		Position Error for the last full 24 hours period. No value for Standard Diagnostics version.
LAST_DAY (3)		0		Position Error for the previous full 24 hours period. No value for Standard Diagnostics version.
PREVIOUS_DAY (4)		0		Position Error for the previous full 24 hours period. No value for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
THREE_DAYS_AGO (5)		0		Position Error for the previous full 24 hours period. No value for Standard Diagnostics version.
CURRENT_WEEK (6)		0		Position Error for the current week. No value for Standard Diagnostics version.
LAST_WEEK (7)		0		Position Error for the last full week. No value for Standard Diagnostics version.
PREVIOUS_WEEK (8)		0		Position Error for the previous week (2 weeks ago). No value for Standard Diagnostics version.
THREE_WEEKS_AGO (9)		0		Position Error 3 weeks ago. No value for Standard Diagnostics version.
CURRENT_MONTH (10)		0		Position Error for the current month period. No value for Standard Diagnostics version.
LAST_MONTH (11)		0		Position Error for the last full month period. No value for Standard Diagnostics version.
PREVIOUS_MONTH (12)		0		Position Error for the previous full month period. No value for Standard Diagnostics version.
THREE_MONTHS_AGO (13)		0		Position Error 3 months ago. No value for Standard Diagnostics version.
CURRENT_12_ MONTHS (14)		0		Position Error for the current 12 month period. No value for Standard Diagnostics version.
LAST_12_MONTHS (15)		0		Position Error for the last full 12 months. No value for Standard Diagnostics version.
PREVIOUS _12_MONTHS (16)		0		Position Error for the previous full 12 months. No value for Standard Diagnostics version.
THREE_YEARS_AGO (17)		0		Position Error 3 years ago. No value for Standard Diagnostics version.
POSITION_ HISTOGRAM (38)				An array of counters that count how many macro cycles the valve was in different position segments. The counters should increase only if the device is under control - the transducer block is in AUTO mode and the quality of the set point is GOOD. No value for Standard Diagnostics version.
TOTAL_TIME (1)		0		Total Working time in seconds or time since the reset to the values in the histogram. No value for Standard Diagnostics version.
5%-CLOSED (2)		0		Macrocyles in the range from closed to 5%. No value for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
10% (3)		0		Macrocyles below 10%. No value for Standard Diagnostics version.
20% (4)		0		Macrocyles between 10% and 20%. No value for Standard Diagnostics version.
30% (5)		0		Macrocyles between 20% and 30%. No value for Standard Diagnostics version.
40% (6)		0		Macrocyles between 30% and 40%. No value for Standard Diagnostics version.
50% (7)		0		Macrocyles between 40% and 50%. No value for Standard Diagnostics version.
60% (8)		0		Macrocyles between 50% and 60%. No value for Standard Diagnostics version.
70% (9)		0		Macrocyles between 60% and 70%. No value for Standard Diagnostics version.
80% (10)		0		Macrocyles between 70% and 80%. No value for Standard Diagnostics version.
90% (11)		0		Macrocyles between 80% and 90%. No value for Standard Diagnostics version.
95% (12)		0		Macrocyles between 90% and 95%. No value for Standard Diagnostics version.
95%-OPEN (13)		0		Number of macrocycles spent in the 95% to Open range. No value for Standard Diagnostics version.
NEAR_CLOSED_ ALERT (39)				The near closed alert is reported only if the valve had been working with a valid set point and in auto mode. The Near Closed alert does NOT count if the device is in Tight Closed Condition. Not writable for Standard Diagnostics version.
POINT_CLOSED (1)	- 49 to 100	5		Point, below which the valve is considered Near Closed. Not writable for Standard Diagnostics version.
NEAR_CLOSED (2)		0		Time in hours the valve spends in near closed position (POINT_CLOSED-CLOSED) under control (in Manual, Auto or LO modes). Not writable for Standard Diagnostics version.
ALERT_POINT (3)	2000	2000		Value in hours, above which the ALERT is set to True. Not writable for Standard Diagnostics version.
ALERT (4)	0	0		True if NEAR_CLOSED is above ALERT_POINT. Not writable for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
HISTORIC ALERT (5)	0	0		True if ALERT is true. Not changed if ALERT is false. Not writable for Standard Diagnostics version.
ENABLE (6)	0	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting. Not writable for Standard Diagnostics version.
POSITION_ERROR_ HISTOGRAM (40)				An array of counters that defines average position error in each region. The values are calculated only if the device is under control - and the quality of the set point is GOOD. No value for Standard Diagnostics version.
5%-CLOSED (1)		0		Average position error in the range between closed and 5%. No value for Standard Diagnostics version.
10% (2)		0		Average position error in the range below 10%. No value for Standard Diagnostics version.
20% (3)		0		Average position error in the range between 10% and 20%. No value for Standard Diagnostics version.
30% (2)		0		Average position error in the range between 20% and 30%. No value for Standard Diagnostics version.
40% (3)		0		Average position error in the range between 30% and 40%. No value for Standard Diagnostics version.
50% (4)		0		Average position error in the range between 40% and 50%. No value for Standard Diagnostics version.
60% (5)		0		Average position error in the range between 50% and 60%. No value for Standard Diagnostics version.
70% (6)		0		Average position error in the range between 60% and 70%. No value for Standard Diagnostics version.
80% (7)		0		Average position error in the range between 70% and 80%. No value for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
90% (8)		0		Average position error in the range between 80% and 90%. No value for Standard Diagnostics version.
95% (9)		0		Average position error in the range between 90% and 95%. No value for Standard Diagnostics version.
95%-OPEN (11)		0		Average position error in the range between 95% and open. No value for Standard Diagnostics version.
SETPOINT_ TIMEOUT_ALERT (41)				The setpoint update alert is reported only if the valve setpoint has not been updated by the AO or DO block for more than ALERT_POINT time.
TIME_SINCE_UPDATE (1)	>0	0		Time since the last update from the AO or DO block.
ALERT_POINT (2)	>0.5	20		Value, above which the ALERT is set to True. Note, that this time must be at least two times bigger than the macro cycle.
MAX_TIME (3)	≥ 0	0		Maximal Time detected before the setpoint is updated.
ALERT (4)	0	0		True if TIME_SINCE_UPDATE is above ALERT_POINT.
HISTORIC ALERT (5)	0	0		True if ALERT is true. Not changed if ALERT is false.
ENABLE (6)	0	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting.
XD_FSTATE (42)				Fault state action configuration.
CONFIGURATION (1)	1,2	1	All	Defines the source for configuration: ☐ 1: One time Copy FSTATE_TIME, FSTATE_VALUE and FSTATE_OPT from Analog output block. This is temporary configuration, and the value goes back to 2 (Independent). ☐ 2: Independent Configuration.
XD_FSTATE_OPT (2)	0 to 3	0	All	Defines an action to be taken on a transducer when position is not updated. ☐ 0: Hold Last Value ☐ 1: Fail Closed ☐ 2: Fail Open ☐ 3: Fault state LO value
FSTATE_VALUE (3)	-50 to 160	0	All	The preset analog working setpoint value to use when fault occurs. This value is used only if the I/O option Fault State to value is selected.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
FSTATE_TIME (4)	1.0 to 100000	5	All	Time to keep the current position before the FSTATE_ VALUE is used as a set point.
CHAR_SELECTION (43)				
TYPE	See Description	0	OOS	Characteristic conversion type: ☐ 0. Linear. ☐ 1. Equal Percentage (30:1). ☐ 2. Equal Percentage (50:1). ☐ 3. Quick Open (reversal from Equal Percentage (50:1)). ☐ 4. Custom. ☐ 5. Camflex Percentage. ☐ 255. Activate Custom (Defined in CUSTOM_CHAR. CUSTOM_CHAR_POINTS).
NUMBER_OF_POINTS	0-19	actual	na	Number of valid CURRENT_CHAR_POINTS (depends on the curve selected).
CURRENT_CHAR_ POINTS (44) **CUSTOM_CHAR (45)**	each	see Descr.		Actual characterization curve setpoint to position, valid up to CHAR_SELECTION.NUMBER_OF_POINTS. Note that 16384 is equivalent to 100% and 0 is equivalent to 0%, and endpoints (0,0) and (16384,16384) are implied and are not shown in the curve. The DD and configuration tools must do the conversion.
CUSTOM_CHAR (45)				
ACTION (1)	See Description	225	Auto Man OOS	Action on Characterization points: ☐ 0. Initialize with Linear. ☐ 1. Initialize with Equal Percentage (30:1). ☐ 2. Initialize with Equal Percentage (50:1). ☐ 3. Initialize with Quick Open (reversal from Equal Percentage (50:1)). ☐ 4. Initialize with Custom. ☐ 5. Initialize with Camflex Percentage. ☐ 7. Initialize with Current. ☐ 255. No Action.
NUMBER_OF_POINTS (2)	0-19	19	Auto Man OOS	Selected number of valid CUSTOM_CHAR_POINTS.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
CUSTOM_ CHAR_ POINTS (46)	each		Man OOS	Custom characterization points. The array contains x-y pairs in an increasing order. The slope of the curve should be limited between 2.5 and 87.5 degrees. (slope between 0.05 and 20) for up to selected CUSTOM_CHAR.NUMBER_OF_ POINTS. If this condition is not true, the curve can be saved but cannot be activated (by writing CHAR_ SELECTION.TYPE=4)The initial value is expected to be (if Camflex is selected): Setpoint (16 bit) Position (16 bit) 2458 983 4915 1966 7117 2949 8724 3932 9981 4915 11012 5898 11869 6881 12593 7864 13206 8847 13718 9830 14156 10813 14944 12780 15335 13763 15729 14746 16122 15729 16384 is equivalent to 100% and 0 is equivalent to 0%, and endpoints (0, 0) and (16384,16384) are implied and must not be entered in the curve. The DD and configuration tools must do the conversion. passed back to connected function block.
READBACK_SELECT (47)		0		☐ 0: Final Position Value. It is strongly recommended to keep 0 as the Final Position value. ☐ 1: Working Position Value. This parameter only has impact on AO block.
TRANSDUCER_TYPE (48)	100	100		Standard Pressure.
XD_ERROR_ PRESSURE (49)	0	0		Pressure transducer error.
SUPPLY_PRESSURE (50)				The actual valve supply pressure and status. No value for Standard Diagnostics version.
STATUS (1)				No value for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
VALUE (2)				No value for Standard Diagnostics version.
PRESSURE_RANGE (51)			MAN/ OOS	The range of the supply pressure. This parameter has to be synchronized with the scale parameter of the Analog Output block.
EU_100 (1)	0-1034.2	1034.2		Upper Range for the supply pressure. The value should be recalculated if the Unit Index is changed. This value is not user changeable.
EU_0 (2)	0-1034.2	0		Lower Range for the supply pressure. This value is not user changeable.
UNITS_INDEX (3)	See Description	kPa (1133)		Engineering Units The following values should be available: ☐ 1133: kPa. ☐ 1141: psi. ☐ 1137: bar.
DECIMAL (4)	3	3		
SUPPLY_PRESSURE_ HI_ALERT (52)				Not writable for Standard Diagnostics version.
PRESSURE (1)				Current SUPPLY_PRESSURE value. Not writable for Standard Diagnostics version.
ALERT_POINT (2)	0-1034.2	1034.2		SUPPLY_PRESSURE Value, above which the ALERT is set to True. Should be in the units of pressure. Not writable for Standard Diagnostics version.
DEADBAND (3)	0 - 20	0.5		SUPPLY_PRESSURE change, required to clear the ALERT, once it was set to True. Not writable for Standard Diagnostics version.
ALERT (4)		FALSE		True if the SUPPLY_PRESSURE has reached above ALERT_POINT and have not come below (ALERT_ POINT-DEADBAND). Not writable for Standard Diagnostics version.
HISTORIC ALERT (5)	True - False	FALSE		True if ALERT is true. Not changed if ALERT is false. Not writable for Standard Diagnostics version.
ENABLE (6)	True - False	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting. Not writable for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
SUPPLY_ PRESSURE_ LO_ALERT (53)				Not writable for Standard Diagnostics version.
PRESSURE (1)				Current SUPPLY_PRESSURE value. Not writable for Standard Diagnostics version.
ALERT_POINT (2)	0-1034.2	20		SUPPLY_PRESSURE Value, below which the ALERT is set to True. Not writable for Standard Diagnostics version.
DEADBAND (3)	0 - 20	0.5		SUPPLY_PRESSURE change, required to clear the ALERT, once it was set to True. Not writable for Standard Diagnostics version.
ALERT (4)	FALSE	FALSE		True if the SUPPLY_PRESSURE has reached below ALERT_POINT and have not come above (ALERT_POINT+DEADBAND). Not writable for Standard Diagnostics version.
HISTORIC ALERT (5)	True - False	FALSE		True if ALERT is true. Not changed if ALERT is false. Not writable for Standard Diagnostics version.
ENABLE (6)	True - False	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting. Not writable for Standard Diagnostics version.
SUPPLY_ PRESSURE_ LOLO_ALERT (54)				Not writable for Standard Diagnostics version.
PRESSURE (1)				Current SUPPLY_PRESSURE value. Not writable for Standard Diagnostics version.
ALERT_POINT (2)	0-1034.2	20		SUPPLY_PRESSURE Value, below which the ALERT is set to True. Not writable for Standard Diagnostics version.
DEADBAND (3)	0 - 20	0.5		SUPPLY_PRESSURE change, required to clear the ALERT, once it was set to True. Not writable for Standard Diagnostics version.
ALERT (4)	FALSE	FALSE		True if the SUPPLY_PRESSURE has reached below ALERT_POINT and have not come above (ALERT_POINT+DEADBAND). Not writable for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
HISTORIC ALERT (5)	True - False	FALSE		True if ALERT is true. Not Changed if ALERT is false. Not writable for Standard Diagnostics version.
ENABLE (6)	True - False	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting. Not writable for Standard Diagnostics version.
ACTUATOR_A_ PRESSURE (55)				The actual control pressure and status. No value for Standard Diagnostics version.
STATUS (1)				No value for Standard Diagnostics version.
VALUE (2)				No value for Standard Diagnostics version.
ACTUATOR_B_ PRESSURE (56)				The actual control pressure and status. Valid for double acting valves. No value for Standard Diagnostics version.
STATUS (1)				No value for Standard Diagnostics version.
VALUE (2)				No value for Standard Diagnostics version.
ATMOSPHERIC_ PRESSURE (57)				The actual Atmospheric pressure and status. No value for Standard Diagnostics version.
STATUS (1)				No value for Standard Diagnostics version.
VALUE (2)				No value for Standard Diagnostics version.
PILOT_PRESSURE (58)				The actual pilot pressure and status. No value for Standard Diagnostics version.
STATUS (1)				No value for Standard Diagnostics version.
VALUE (2)				No value for Standard Diagnostics version.
TEMP_ TRANSDUCER_ TYPE (59)	101	101		Standard Temperature.
XD_ERROR_ TEMPERATURE (60)	0	0		Temperature Transducer Error 22 I/O Failure
TEMPERATURE (61)				The actual temperature measured by actuator electronics. No value for Standard Diagnostics version.
STATUS (1)				No value for Standard Diagnostics version.
VALUE (2)				No value for Standard Diagnostics version.
TEMPERATURE_HI_ ALERT (62)				High temperature alert. Not writable for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
TEMPERATURE (1)				Current TEMPERATURE value. Not writable for Standard Diagnostics version.
ALERT_POINT (2)	-45 to 85	85		TEMPERATURE Value, above which the ALERT is set to True. Not writable for Standard Diagnostics version.
DEADBAND (3)	0 - 2	2		TEMPERATURE change, required to clear the ALERT, once it was set to True. Not writable for Standard Diagnostics version.
ALERT (4)		FALSE		True if the TEMPERATURE has reached above ALERT_POINT and have not come below (ALERT_POINT-DEADBAND). Not writable for Standard Diagnostics version.
HISTORIC ALERT (5)	True - False	FALSE		True if ALERT is true. Not changed if ALERT is false. Not writable for Standard Diagnostics version.
ENABLE (6)	True - False	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting. Not writable for Standard Diagnostics version.
TEMPERATURE_LO_ ALERT (63)				Low temperature alert. Not writable for Standard Diagnostics version.
TEMPERATURE (1)				Current TEMPERATURE value. Not writable for Standard Diagnostics version.
ALERT_POINT (2)	-45 to 85	-40		TEMPERATURE Value, below which the ALERT is set to True. Not writable for Standard Diagnostics version.
DEADBAND (3)	0 - 2	2		TEMPERATURE change, required to clear the ALERT, once it was set to True. Not writable for Standard Diagnostics version.
ALERT (4)	FALSE	FALSE		True if the TEMPERATURE has reached below ALERT_POINT and have not come above (ALERT_POINT+DEADBAND). Not writable for Standard Diagnostics version.
HISTORIC ALERT (5)	True - False	FALSE		True if ALERT is true. Not changed if ALERT is false. Not writable for Standard Diagnostics version.
ENABLE (6)	True - False	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting. Not writable for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
IP_DRIVE_CURRENT (64)				The actual drive current to control the IP converter. Presented in percentage. No value for Standard Diagnostics version.
STATUS (1)				No value for Standard Diagnostics version.
VALUE (2)				Float value in % of IP Current MAX. No value for Standard Diagnostics version.
IP_DRIVE_ CURRENT_ HI_ALERT (65)				Alarm reported, when the Drive Current through the I/P converter is too High. Not writable for Standard Diagnostics version.
CURRENT (1)				Current IP DRIVE CURRENT value. Not writable for Standard Diagnostics version.
ALERT_POINT (2)	-20 to 120	100		When the CURRENT Value is above ALERT POINT, the ALERT is set to True. Not writable for Standard Diagnostics version.
DEADBAND (3)	from 0 to 20	5		Not writable for Standard Diagnostics version.
TIME (4)	1 to 60	60		The user defined allowable duration in seconds of CURRENT below ALERT_POINT before alert is set to True. Not writable for Standard Diagnostics version.
ALERT (5)	FALSE	FALSE		True if the CURRENT has reached below ALERT_ POINT and have not come above ALERT_POINT. Not writable for Standard Diagnostics version.
HISTORIC ALERT (6)	True - False	FALSE		True if ALERT is true. Not changed if ALERT is false. Not writable for Standard Diagnostics version.
ENABLE (7)	True - False	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting. Not writable for Standard Diagnostics version.
IP_DRIVE_ CURRENT_ LO_ALERT (66)				Alarm reported, when the Drive Current through the I/P converter is too Low. Not writable for Standard Diagnostics version.
CURRENT (1)				Current IP DRIVE CURRENT value. Not writable for Standard Diagnostics version.
ALERT_POINT (2)	-20 to 120	0		When the CURRENT Value is below ALERT POINT, the ALERT is set to True. Not writable for Standard Diagnostics version.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
DEADBAND (3)	from 0 to 20	5		Not writable for Standard Diagnostics version.
TIME (4)	1 to 60	60		The user defined allowable duration in seconds of CURRENT below ALERT_POINT before alert is set to True. Not writable for Standard Diagnostics version.
ALERT (5)	FALSE	FALSE		True if the CURRENT has reached below ALERT_ POINT and have not come above ALERT_POINT. Not writable for Standard Diagnostics version.
HISTORIC ALERT (6)	True - False	FALSE		True if ALERT is true. Not changed if ALERT is false. Not writable for Standard Diagnostics version.
ENABLE (7)	True - False	TRUE		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting. Not writable for Standard Diagnostics version.
FIND_STOPS (67)		0	Man	Should be used by method or DTM only. Find Stops - Writing to the FIND_STOPS parameter triggers execution of the following commands in the valve: ☐ 1, Find stops Start - starts an automatic full find stops process. ☐ 2, Find stops Cancel - cancels a find stops process (full or partial). ☐ 3, Find stops Set Closed - moves the valve to full closed position. ☐ 4, Find stops Set Open - moves the valve to full open position. ☐ 5, Find stops Accept - accepts the valve position as one of the stops - not finalized until commit. ☐ 6, Find stops Commit - saves the stop positions changed and recalculates scaling factors. ☐ 11, Find stops Running (un-selectable) - read only. ☐ 0, Find stops Not running (un-selectable - read only. Note, that FIND_STOPS can be started only when the TB is in MAN mode. The expectation is that the method or the DTM will not allow you to change the mode before the operation is completed.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
OFFLINE_DIAGNOSTIC (68)	See Description	0	Man	Should be used by method or DTM only. Offline valve diagnostic procedure command and status. Writing to this parameter triggers the procedure to execute the following procedures: ☐ 1. Execute Valve Signature: Not available for standard diagnostics. ☐ 2. Execute Ramp Test: Not available for standard diagnostics. ☐ 3. Save current signature as Baseline: Not available for standard diagnostics. ☐ 4. Save current signature as Custom: Not available for standard diagnostics. ☐ 5. Save current signature as Current: Not available for standard diagnostics. ☐ 6. Prepare Baseline for Upload: Not available for standard diagnostics. ☐ 7. Prepare Custom for Upload: Not available for standard diagnostics. ☐ 8. Prepare Current for Upload: Not available for standard diagnostics. ☐ 9. Execute Step Test: Not available for standard diagnostics. ☐ 10. Save current signature as Factory: Not available for standard diagnostics. ☐ 99. Cancel Diagnostic. This parameter may be written only when the parameter DIAGNOSTIC_CONFIGURATION contains correct values of sub-parameters. It means that DIAGNOSTIC_CONFIGURATION must be written prior to OFFLINE_DIAGNOSTIC.Reading this parameter provides the status of the last Offline Procedure: ☐ 0.Not Running. ☐ 100. Running.
DIAGNOSTIC_ CONFIGURATION (69)				Should be used by method or DTM only.
START_POSITION (1)		40	Any	Applicable to: All Start position for the test. May be above or below End position. Range is -5 to full open +5.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
END_POSITION (2)		60	Any	Applicable to: All Start position for the test. May be above or below End position. Range is -5 to full open +5. Applicable to open loop signature: Start and End Positions must be more than 20% different.
SET_POINT_RATE (3)		5	Any	Applicable to: Ramp test and Signatures. 0.5-100.1 %/s.
SAMPLING_TIME (4)		10	Any	Applicable to: Step test. 2 to 60 s.
DIRECTION (5)		0	Any	Applicable to Diagnostic signature, Ramp test: ☐ 0. Both ways (from Start position to End position and back). ☐ 1. One way (from Start position to End position).
OPTION (6)		0	Any	☐ 0. Open loop. ☐ 1. Closed loop.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
DIAGNOSTIC_DATA (70)	See Description	0	Any	Should be used by DTM only. An array that contains the data collected during the diagnostic procedure execution. [0] - Contains the offset in bytes of the data to read from the beginning of the diagnostic data buffer, This is the only writable value in the array and may be used to initiate the read procedure, by writing 0. The value is auto incremented after each read of the array with sub-index 0. [1] - Skip count - writing 0 to this reads all of the data, writ-ing 1 reads every other point, writing 2 reads every 3rd point, etc. [2] - Number of valid data pairs read. A user program can read all of the data by making successive reads until this value is less than 12. [3] - [26] - Diagnostic data chunk. It contains data pairs (position/pressure pairs or position/setpoint pairs) as follows e.g.: [3]-1st position integer [4] - 1st Pressure integer. [5]-2nd position integer [6] - 2nd Pressure integer. Note that the first record of the buffer has some information about the results to the procedure, including: - Procedure being executed. - Configuration used for the procedure. - Number of data points. - Starting and ending position. - Other parameters specific to the test. See the UC25 document for details of the headers for various tests.
AUTOTUNE (71)			Man	Should be used by method or DTM only. Writing sets three parameters: Supply Pressure, Aggressiveness and Tune Flags and send their values the processor for updating.The fourth parameter Completion may take only one of three values on writing: DO nothing (0), START Autotune(1), CANCEL Autotune (99). All other values on write are Reading returns values of the first three parameters rejected, and a wrong parameter error is reported.obtained from the processor. The fourth parameter - Completion, on the read specifies the autotune process completion code.
Supply Press				Supply Pressure.
Aggressiveness	-9 to 9			Aggressiveness of the Auto Tune procedure: ☐ -9: Relaxed. ☐ 0 Normal (Default). ☐ +9: Aggressive.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
Tune Flags	1			Not currently used
Completion	0			Writing ☐ 1: Starts the autotune process. ☐ 99: Cancels the autotune process. ☐ 0: Do not run -- an attempt to write parameter Autotune with this value of this sub-parameter returns immediately Reading. ☐ 100: Running. ☐ 0: Not Run or Success or Completion code: ☐ 31: Failed actuation. ☐ 32: Control limits protected. ☐ 33: Failed open loop tuning. ☐ 45: P gain below limit. ☐ 46: P gain adjustment above limit. ☐ 55: Bias out of range. ☐ 66: Fill time exceeded. ☐ 77: Exhaust time exceeded. ☐ 88: Parameter out of range.
CHECK_PROCESS (72)				The current process running.
PROCESS_ID (1)				Enumerated Process ID of the currently running process. Zero when no process is running. ☐ 0 - No Process. ☐ 1 - Find Stops process. ☐ 4 - Autotune process. ☐ 7 - Diagnostic - signature. ☐ 8 - Step Test. ☐ 15 - Ramp Test Diagnostics. ☐ 24 - Log file to dig buffer. ☐ 25 - Diagnostic buffer to log file. ☐ 26 - Standard NVMEM objects to log file. ☐ 27 - Log file to Standard NVMEM objects. ☐ 28 - Cancel a process.
PERCENT_COMPLETE (2)				Currently not implemented. Always zero.
UI_CUSTOM_ CONFIGURATION (73)				Configuration of the custom 1 and Custom 2 display values.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
CUSTOM_1_ CONFIGURATION (1)	from 1-9	1	Any	Custom_1_Configuration allows the user to select the value displayed on the local LCD display. The value is converted to the processor as an Integer and is used to generate a display string as follows: ☐ 1. WORK_SP (Default for the Custom 1). ☐ 2. WORK_POS ☐ 3. PID1.SP ☐ 4. PID1.PV ☐ 5. PID1.OUT ☐ 6. PID2.SP ☐ 7. PID2.PV ☐ 8. PID2.OUT ☐ 9. AI1.OUT ☐ 10. AI2.OUT ☐ 11. AI3.OUT ☐ 12. AO.SP ☐ 13. DO1.SP ☐ 14. DO2.SP ☐ 15. IS.IN1 ☐ 16. IS.IN2 ☐ 17. IS.IN3 ☐ 18. IS.IN4
CUSTOM_2_ CONFIGURATION (2)	from 1-9	2	Any	Custom_2_Configuration allows the user to select the value displayed on the local LCD display for the second custom selection. The value is converted to the processor as an Integer and is used to generate a display string as follows: ☐ 1. WORK_SP ☐ 2. WORK_POS. (Default for the Custom 2). ☐ 3. PID1.SP ☐ 4. PID1.PV ☐ 5. PID1.OUT ☐ 6. PID2.SP ☐ 7. PID2.PV ☐ 8. PID2.OUT ☐ 9. AI1.OUT ☐ 10. AI2.OUT ☐ 11. AI3.OUT ☐ 12. AO.SP ☐ 13. DO1.SP ☐ 14. DO2.SP ☐ 15. IS.IN1 ☐ 16. IS.IN2 ☐ 17. IS.IN3 ☐ 18. IS.IN4

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
FAILED_STATE (74)				Failed State status.
FF (1)	NA	NA		FF related failed State ☐ 1 - FAILED_STATE is reported by the Resource Block. ☐ 0 - No FAILED STATE condition exists.
APP (2)				Valve Control related Failed State: ☐ 0 - No active Valve Control Failed State condition exists. ☐ 1 - Failed State Condition is detected in the Valve Control.
PROPAGATE_ APFS_ TO_RB (3)	0, 1	1		Propagate Fail State to Resource Block: ☐ 0 – Do not propagate. ☐ 1 – Propagate Failsafe state of TB to RB.
FINAL_VALUE_D (75)			MAN OOS	Set Point received from DO block as boolean. This point is referred as Channel 2.
STATUS (1)		BAD		Status of the set point value.
VALUE (2)	0, 1			Value: ☐ 0 - Complete close. ☐ #0 - Complete Open.
FINAL_POSITION_ VALUE_D (76)				Actual discrete valve position, provided to DO block as boolean. This point is referred as Channel 2.
STATUS (1)				Status of the position value.
VALUE (2)	0, 1, 2, 4,...100			Value: ☐ 0 - Complete close. ☐ #0 - Partially or fully open.
FINAL_VALUE_DINT (77)			MAN OOS	Set Point Received from DO block as integer. This point is referred as Channel 3.
STATUS (1)		BAD		Status of the set point value.
VALUE (2)	0, 1, 2, 4,...100			Value: ☐ 0 - Complete close. ☐ 0 -100 - Discrete value of the setpoint in increments of %. All other values are rejected with a status - Out of Range.
FINAL_POSITION_ VALUE_DINT (78)				Actual discrete valve position, provided to DO block as Integer. This point is referred as Channel 3.
STATUS (1)		BAD		Status of the position value.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
VALUE (2)	0, 1, 2,4,...100			Value: ☐ 0 - Complete close. ☐ 1-100 - Discrete value of the setpoint in increments of %. All other values are rejected with a status - Out of Range.
DISCRETE_OUTPUT_1 (79)				Discrete Switch Output 1 value and status.
STATUS (1)				Status.
VALUE (2)	0,1			Value: ☐ 0 - Close. ☐ 1 - Open.
DISCRETE_OUTPUT_2 (80)				Discrete Switch Output 2 value and status. Virtual switch.
STATUS (1)				Status
VALUE (2)	0,1			Value: ☐ 0 - Close. ☐ 1 - Open.
DISCRETE_INPUT (81)				Discrete Input - The state of the external DI switch to FF.
STATUS (1)				Status.
VALUE (2)	0,1	x		Value: ☐ 0 - Close. ☐ 1 - Open.
DISCRETE_ SWITCH_1_CONF (82)			MAN OOS	Discrete switch configuration for switch 1.
DIRECTION (1)			MAN OOS	Value: ☐ 1 - Normal Open (default). ☐ 0 - Normal Closed.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
FUNCTION (2)	0-13	0	MAN OOS	Custom_1_Configuration allows you to select the virtual switch activation condition. ☐ 0. Disabled (always inactive; default). ☐ 1. Activates the switch being controlled by the DO block. ☐ 2. Activated when position control in fault state. ☐ 3. Activated when position control is not in normal mode. ☐ 4. Activates so the TB reports if maintenance is required now ☐ 5. Activates so the TB reports if maintenance is required soon. ☐ 6. Activated when the air supply is too low. ☐ 7. Activated when a Travel Deviation Alert occurs. ☐ 8. Activated when a Position HI Alert occurs. ☐ 9. Activated when a Position LO Alert occurs. ☐ 10. Always active. ☐ 11. Always Inactive (same as disabled). ☐ 12. Activated when a Reset occurred. ☐ 13. Activated when a Tight Cutoff state occurs.
DISCRETE_ SWITCH_2_CONF (83)			MAN OOS	Discrete switch configuration for switch 2. Virtual switch.
DIRECTION (1)			MAN OOS	Value: ☐ 1 - Normal Open (default). ☐ 0 - Normal Closed.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
FUNCTION (2)	0-13	0	MAN/ OOS	Custom_2_Configuration allows you to select the virtual switch activation condition. ☐ 0. Disabled (always inactive; default). ☐ 1. Activates the switch being controlled by the DO block. ☐ 2. Activated when position control in fault state. ☐ 3. Activated when position control is not in normal mode. ☐ 4. Activates so the TB reports if maintenance is required now. ☐ 5. Activates so the TB reports if maintenance is required soon. ☐ 6. Activated when the air supply is too low. ☐ 7. Activated when a Travel Deviation Alert occurs. ☐ 8. Activated when a Position HI Alert occurs. ☐ 9. Activated when a Position LO Alert occurs. ☐ 10. Always Active. ☐ 11. Always Inactive (same as disabled). ☐ 12. Activated when a Reset occurred. ☐ 13. Activated when a Tight Cutoff state occurs.
UI_ACCESS_ CONTROL (84)			MAN/ OOS	Controls the access and functions available to the LCD user interface display.
LOCK_LEVEL (1)		0	MAN/ OOS	
PASSWORD_ ENABLED (2)	T/F	F	MAN/ OOS	
PASSWORD (3)			MAN/ OOS	
UI_LANGUAGE (85)	0 to 6	0 - English	Man/ OOS	☐ 0: English ☐ 1: French ☐ 2: Spanish ☐ 3: Portuguese ☐ 4: Japanese ☐ 5: Italian ☐ 6: German
APP_MODE (86)	Normal, Manual, LO, FailSafe	Normal		Processor mode.
COMPLETE_STATUS (87)	NA	NA		Full status presentation - Data is mapped to the Status presented in the processor.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
CLEAR_STATUS (88)	NA	NA		Clear status and faults: ☐ 0 - No Action. ☐ 1 - Clear Current Status. ☐ 2 - Clear Current and Historic Status.
OPEN_STOP_ ADJUSTMENT (89)	60.00 to 100.00		MAN/ OOS	Keep set at 100%.
SETPOINT_SOURCE (90)	1 to 3	1	OOS	Describes the source of the set point: ☐ 1 - Control is coming from AO-FINAL_VALUE. ☐ 2 - Control is coming from DO-FINAL_VALUE_D in Open/Close mode. ☐ 3 - Control is coming from DO-FINAL_VALUE_ DINT in 1% steps mode.
SETPOINT (91)				Setpoint being transferred to the setpoint position.
STATUS (1)		GOOD		Status.
VALUE (2)	-50, 199			Value: Floating value representing the actual position.
ACTUAL_POSITION (92)				Actual Position.
STATUS				Status.
VALUE	-50, 199			Value: Floating value presenting the actual position.
RAW_POSITION (93)		0		Temperature compensated Raw Position Sensor value; in counts. The value should be between =/- 15000 for the valve to operate normally.
ALERT_ACTION (94)				
MAPPED_TO_RB (1)	See Description		Any	Indicates if alarms are reported by the RB: ☐ 1: Map to RB (default). ☐ 2: Report in TB.
Deviation Alert (2)	0 - 3	2	Any	The user can select one of the following: ☐ 0: Not Reported. ☐ 1: Warning Data. ☐ 2: Maintenance Required. ☐ 3: Device Failure.
Position HIHI Alert (3)	0 - 3	2	Any	Defines the action for a HIHI alert.
Position HI Alert (4)	0 - 3	1	Any	Defines the action for a HI alert.
Position LO Alert (5)	0 - 3	1	Any	Defines the action for a LO alert.
Position LOLO Alert (6)	0 - 3	2	Any	Defines the action for a LOLO alert.
Set Point Timeout Alert (7)	0 - 3	2	Any	Defines the action for a Set Point Timeout alert.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
Near Close Alert (8)	0 - 3	1	Any	Defines the action for a Near Close alert.
Travel Accumulation A Alert (9)	0 - 3	1	Any	Defines the action for a Travel Accumulation alert.
Travel Accumulation B Alert (10)	0 - 3	1	Any	Defines the action for a Travel Accumulation alert.
Cycle Counter A Alert (11)	0 - 3	2	Any	Defines the action for a Cycle Counter alert.
Cycle Counter B Alert (12)	0 - 3	2	Any	Defines the action for a Cycle Counter alert.
Working Time Alert (13)	0 - 3	1	Any	Defines the action for a Working Time alert.
Supply Pressure HI Alert (14)	0 - 3	2	Any	Defines the action for a Supply Pressure HI alert.
Supply Pressure LO Alert (15)	0 - 3	1	Any	Defines the action for a Supply Pressure LO alert.
Supply Pressure LOLO Alert (16)	0 - 3	2	Any	Defines the action for a Supply Pressure LOLO alert.
Temperature HI Alert (17)	0 - 3	1	Any	Defines the action for a Temperature HI alert.
Temperature LO Alert (18)	0 - 3	1	Any	Defines the action for a Temperature LO alert.
IP Drive Current Alert HI (19)	0 - 3	2	Any	Defines the action for a IP Drive Current HI alert.
IP Drive Current Alert LO (20)	0 - 3	2	Any	Defines the action for a IP Drive Current LO alert.
Sensor Failure Alert (21)	0 - 3	3	Any	Defines the action for a Sensor Failure alert.
Processor Alert (22)	0 - 3	3	Any	Defines the action for a Processor alert.
Valve Control Alert (23)	0 - 3	3	Any	Defines the action for a Valve Control alert.
Commissioning Alert (24)	0 - 3	1	Any	Defines the action for a Commissioning alert.
Air Supply Alert (25)	0 - 3	1	Any	Defines the action for a Air Supply alert.
Supporting Hardware Alert (26)	0 - 3	1	Any	Defines the action for a Supporting Hardware alert.
ALERT_STATE (95)				

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
Deviation Alert (1)	T/F	F	Any	Provides the current state of the Alert condition: ☐ TRUE: Alert condition is active. ☐ FALSE: Alert condition does not exist.
Position HIHI Alert (2)	T/F	F	Any	Provides the current state of the Position HIHI alert condition.
Position HI Alert (3)	T/F	F	Any	Provides the current state of the Position HI alert condition.
Position LO Alert (4)	T/F	F	Any	Provides the current state of the Position LO alert condition.
Position LOLO Alert (5)	T/F	F	Any	Provides the current state of the Position LOLO alert condition.
Set Point Timeout Alert (6)	T/F	F	Any	Provides the current state of the Set Point Timeout alert condition.
Near Close Alert (7)	T/F	F	Any	Provides the current state of the Near Close alert condition.
Travel Accumulation A Alert (8)	T/F	F	Any	Provides the current state of the Travel Accumulation A alert condition.
Travel Accumulation B Alert (9)	T/F	F	Any	Provides the current state of the Travel Accumulation B alert condition.
Cycle Counter A Alert (10)	T/F	F	Any	Provides the current state of the Cycle Counter A alert condition.
Cycle Counter B Alert (11)	T/F	F	Any	Provides the current state of the Cycle Counter B alert condition.
Working Time Alert (12)	T/F	F	Any	Provides the current state of the Working Time alert condition.
Supply Pressure HI Alert (13)	T/F	F	Any	Provides the current state of the Supply Pressure HI alert condition.
Supply Pressure LO Alert (14)	T/F	F	Any	Provides the current state of the Supply Pressure LO alert condition.
Supply Pressure LOLO Alert (15)	T/F	F	Any	Provides the current state of the Supply Pressure LOLO alert condition.
Temperature HI Alert (16)	T/F	F	Any	Provides the current state of the Temperature HI alert condition.
Temperature LO Alert (17)	T/F	F	Any	Provides the current state of the Temperature LO alert condition.
IP Drive Current Alert HI (18)	T/F	F	Any	Provides the current state of the IP Drive Current HI alert condition.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
IP Drive Current Alert LO (19)	T/F	F	Any	Provides the current state of the IP Drive Current LO alert condition.
Sensor Failure Alert (20)	T/F	F	Any	Provides the current state of the Sensor Failure alert condition.
Processor Alert (21)	T/F	F	Any	Provides the current state of the Processor alert condition.
Valve Control Alert (22)	T/F	F	Any	Provides the current state of the Valve Control alert condition.
Commissioning Alert (23)	T/F	F	Any	Provides the current state of the Commissioning alert condition.
Air Supply Alert (24)	T/F	F	Any	Provides the curre nt state of the Air Supply alert condition.
Supporting Hardware Alert (25)	T/F	F	Any	Provides the current state of the Supporting Hardware alert condition.
ALERT_COUNTERS (96)				Alert Counters Alerts - Contains a counter for each of the alerts reported. Counters are incremented any time an alarm condition is reported.
Deviation Alert (1)	0 - 0xFFFF	0	Any	How many times the Deviation alert is detected.
Position HIHI Alert (2)	0 - 0xFFFF	0	Any	How many times the Position HIHI alert is detected.
Position HI Alert (3)	0 - 0xFFFF	0	Any	How many times the Position HI alert is detected.
Position Lo Alert (4)	0 - 0xFFFF	0	Any	How many times the Position LO alert is detected.
Position LOLO Alert (5)	0 - 0xFFFF	0	Any	How many times the Position LOLO alert is detected.
Set Point Timeout Alert (6)	0 - 0xFFFF	0	Any	How many times the Set Point Timeout alert is detected.
Near Close Alert (7)	0 - 0xFFFF	0	Any	How many times the Near Close alert is detected.
Travel Accumulation A Alert (8)	0 - 0xFFFF	0	Any	How many times the Travel Accumulation A alert is detected.
Travel Accumulation B Alert (9)	0 - 0xFFFF	0	Any	How many times the Travel Accumulation B alert is detected.
Cycle Counter A Alert (10)	0 - 0xFFFF	0	Any	How many times the Cycle Counter A alert is detected.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
Cycle Counter B Alert (11)	0 - 0xFFFF	0	Any	How many times the Cycle Counter B alert is detected.
Working Time Alert (12)	0 - 0xFFFF	0	Any	How many times the Working Time alert is detected.
Supply Pressure HI Alert (13)	0 - 0xFFFF	0	Any	How many times the Supply Pressure HI alert is detected.
Supply Pressure Lo Alert (14)	0 - 0xFFFF	0	Any	How many times the Supply Pressure LO alert is detected.
Supply Pressure LOLO Alert (15)	0 - 0xFFFF	0	Any	How many times the Supply Pressure LOLO alert is detected.
Temperature HI Alert (16)	0 - 0xFFFF	0	Any	How many times the Temperature HI alert is detected.
Temperature LO Alert (17)	0 - 0xFFFF	0	Any	How many times the Temperature LO alert is detected.
IP Drive Current Alert HI (18)	0 - 0xFFFF	0	Any	How many times the IP Drive Current HI alert is detected.
IP Drive Current Alert LO (19)	0 - 0xFFFF	0	Any	How many times the IP Drive Current LO alert is detected.
Sensor Failure Alert (20)	0 - 0xFFFF	0	Any	How many times the Sensor Failure alert is detected.
Processor Alert (21)	0 - 0xFFFF	0	Any	How many times the Processor alert is detected.
Valve Control Alert (22)	0 - 0xFFFF	0	Any	How many times the Valve Control alert is detected.
Commissioning Alert (23)	0 - 0xFFFF	0	Any	How many times the Commissioning alert is detected.
Air Supply Alert (24)	0 - 0xFFFF	0	Any	How many times the Air Supply alert is detected.
Supporting Hardware Alert (25)	0 - 0xFFFF	0	Any	How many times the Supporting Hardware alert is detected.
ALERT_LOG (97)				Used by the DTM only. Access alert logs from the device.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
COMMAND (1)				Command (Write) / Status (Read). The Value written to this field forces the Alert Log API to execute the following functions; note, that for WRITE operations this field is interpreted as a Command. 0x00 – Copy the Alert Log into the READ Buffer and Reset the read index on READ access. When the Read Alert Log parameter is then executed the Alert Log Entry if populated with the first Alert Log array entry. The subsequent READ operations populate the Alert Log Entry with the next entry, and so forth. The Command / Status field returns the number of entries in the Alert Log. 0xFA – Writing this value clears the AlertLog Table completely, including the NVRAMstorage.On READ operation returns the number of Alert Log Entries, if the data read is valid; or returns 0 if the data entry is NOT valid. Note: During READ operation the Command / Status field is Status. It contains the number of the Alert entries in the Alert Log. 0 - indicates No Entries. MAX number of Alert entries in the Alert Log is 32.
ALERT_TIME (2)				The Time stamp for the entry. When the data is cleared and there are no entries, this field is set as 0x00 00 00 00 00 00 0000. The same field is used when the alerts are reported to time stamp the alerts.
ALERT_DATA (3)				The Alert Bitmap. Contains the current state of all alerts. To see the alert, the Data value has to be compared with the previous data value. Is updated when the alert is detected (a bit is set) and when the alert is cleared (a bit is cleared).
WORKING TIMES (98)				
SINCE_RESET (1)				Hours since last reset.
TOTAL_TIME (2)				Lifetime hours.
FACTORY_USE_1 (99)				
ALERT_TOTAL_TIME (1)				Total number of hours since manufacturing or since reset.
ALERT_POINT (2)	<0xFFFFFFFF	8760		TOTAL_TIME value, above which the ALERT is set to True.
ALERT (3)	FALSE	FALSE		TRUE if TOTAL TIME is higher than Alert Point.
HISTORIC ALERT (4)	True - False	FALSE		True if ALERT is true. Not changed if ALERT is false.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
ENABLE (5)	True - False	1		True - Enables the ALERT to be reported according to the configuration. False - Disables ALERT reporting.
FACTORY_USE_1 (100)				A parameter used for factory configuration of the instrument.
FACTORY_USE_2 (101)				A parameter used for factory configuration of the instrument.
ACTUATOR_1 (102)			Auto, Man, OOS	Information about the actuator.
ACT_MAN_ID (1)				The actuator manufacturer identification.
ACT_MODEL_NUM (2)				The actuator model number.
ACT_SN (3)				The actuator serial number.
ACTUATOR_2 (103)			Auto, Man, OOS	Information about the actuator.
ACT_TYPE (1)				Actuator Type: Default value is spring-diaphragm.
ACT_SIZE				6
ACT_ROTARY_ MOMENT_ARM				n/a
ACT_EFFECTIVE_ AREA				60
ACTUATOR_3 (104)			Auto, Man, OOS	Information about the actuator.
Shutoff_DP (1)	NA			100
Hand_Wheel (2)	NA			-
STYLE 93)	See Descrip-tion	1		The actuator Style ☐ 0: Double Acting. ☐ 1: Single Acting.
ACT_FAIL_ACTION (4)	See Descrip-tion Limit is important.	1	OOS	Condition of the actuator, when the power is lost: ☐ 1. Valve Closed - Self-closing (air to open). ☐ 2. Valve Open - Self-opening (air to close).

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Auto, Mode	Description
RELAY_TYPE (5)	See Description Range is not important	1	Auto, Man, OOS	Relay Type: ☐ 1.= Standard Relay: Double or Single Acting. ☐ 2=High Capacity: Single Acting.
SUPPLY_PRS_MAX (6)	NA			Maximum supply pressure for the actuator.
PRS_CONTROL_HI (7)	NA	103.4		Maximum supply pressure for the actuator in control - it should be the same as Bench Range.
PRS_CONTROL_LO (8)	NA	20.6		Minimum Supply Pressure for the actuator in control - it should be the same as Bench Range.
ACTUATOR_INFO (105)			Auto, Man, OOS	
DESCRIPTOR (1)				
MESSAGE (2)				
DATE (3)				
SPEC_SHEET (4)				
VALVE_ IDENTIFICATION (1006)			Auto, Man, OOS	Information about the valve identification.
VALVE_MAN_ID				The valve manufacturer identification.
VALVE_MODEL_NUM				The valve model number.
VALVE_SN				The valve serial number.
VALVE_SERVICE (107)				Valve service information.
SERVICE		Water		
PID_No				
VALVE_BODY_1 (108)			Auto, Man, OOS	Valve service information.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
VALVE_TYPE		1		The type of the valve. Globe, Reciprocating. Valve Type – Description: ☐ 0 Undefined. ☐ 1 Linear. ☐ 2 Rotary. ☐ 255 Other. FISHER: Supports only: ☐ 1 Sliding-stem. ☐ 2 Rotary.
BODY SIZE				Body Size
PACKING				String containing the packing - Braided PTFE/Carbon or aramid core.
PLUG_TYPE				Linear contoured.
SEAT_RING_TYPE				String containing the ring type - Quick Change.
VALVE_BODY_2 (109)			Auto, Man, OOS	Valve service information.
CHARACTERISTIC				
LEAKAGE_CLASS				
VALVE_BODY_3 (110)			Auto, Man, OOS	Valve service information.
FLOW_ACTION				
RATED_ADJ_CV				
VALVE_INFO (111)			Auto, Man, OOS	
SAME_AS_ACTUATOR (1)	T/F	T		True if the valve and actuator information is the same.
DESCRIPTOR (1)				
MESSAGE (2)				
DATE (3)				
SPEC_SHEET (4)				
BOOSTER (112)			Auto, Man, OOS	

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
Manufacturer				
Model				
Qty				
ACCESSORY (113)			Auto, Man, OOS	
SOLENOID				
REMOTE_SENSOR	0-1 read 2-3 write			Indicates/Enables the remote sensor connection. The following enumeration is available: ☐ 0: Remote sensor is disabled/Not Active (read only - write does nothing). ☐ 1: Remote sensor is enabled (read only - write does nothing). ☐ 2: Enable Local HAL Sensor (write only - write does nothing if it is already 0). ☐ 3: Enable Remote Sensor (write only - write does nothing if it is already 1). MUST restart device for the change to take effect.
POSITION_EXTREMES (114)			Auto, Man, OOS	Minimum and Maximum position values observed since start or the last update from the user.
FINAL_VALUE_MAX (1)	-50 to 199	-50		FINAL VALUE: Maximum value detected since last update from the user.
FINAL_VALUE_MIN (2)	-50 to 199	199		FINAL VALUE: Minimum value detected since last update from the user.
FINAL_POS_VALUE_ MAX (3)	-50 to 199	-50		FINAL POSITION VALUE: Maximum value detected since last update from the user.
FINAL_POS_VALUE_ MIN (4)	-50 to 199	199		FINAL POSITION VALUE: Minimum value detected since last update from the user.
WORKING_SP_MAX (5)	-50 to 199	-50		WORKING_SP: Minimum value detected since last update from the user.
WORKING_SP_MIN (6)	-50 to 199	199		WORKING_SP: Minimum value detected since last update from the user.
WORKING_POS_MAX (7)	-50 to 199	-50		WORKING_POS: Maximum value detected since last update from the user.
WORKING_POS_MIN (8)	-50 to 199	199		WORKING_POS: Minimum value detected since last update from the user.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
PRESSURE_ EXTREMES (115)			Auto, Man, OOS	Minimum and Maximum Pressure values observed since the last update from the user. Note: The extremes are evaluated every 0.5 seconds. Faster changes in the pressure may not be registered.
SUPPLY_PRESSURE_ MAX (1)	-25 to 1050	-25		SUPPLY_PRESSURE: Maximum value detected since last update from the user.
SUPPLY_PRESSURE_ MIN (2)	-25 to 1050	1050		SUPPLY_PRESSURE: Minimum value detected since last update from the user.
ACTUATOR_A_MAX (3)	-25 to 1050	-25		ACTUATOR_A: Maximum value detected since last update from the user.
ACTUATOR_A_MIN (4)	-25 to 1050	1050		ACTUATOR_A: Minimum value detected since last update from the user.
ACTUATOR_B_MAX (5)	-25 to 1050	-25		ACTUATOR_B: Maximum value detected since last update from the user.
ACTUATOR_B_MIN (86	-25 to 1050	1050		ACTUATOR_B: Minimum value detected since last update from the user.
PILOT_MAX (7)	-25 to 1050	-25		PILOT_PRESSURE: Maximum value detected since last update from the user.
PILOT_MIN (8)	-25 to 1050	1050		PILOT_PRESSURE: Minimum value detected since last update from the user.
TEMPERATURE_ EXTREMES (116)			Auto, Man, OOS	Minimum and Maximum Temperature values observed since the last update from the user. Note: The extremes are evaluated every 0.5 seconds. Faster changes in the temperature may not be registered.
TEMPERATURE_MAX (1)	-40 to 85	-40		TEMPERATURE: Maximum value detected since last update from the user.
TEMPERATURE_MIN (2)	-40 to 85	85		TEMPERATURE: Minimum value detected since last update from the user.
IP_CURRENT_ EXTREMES (117)			Auto, Man, OOS	Minimum and Maximum IP_Current values observed since the last update from the user. Note: The extremes are evaluated every 0.5 seconds. Faster changes in the IP current may not be registered.
IP_CURRENT_MAX (1)	-25 to 150	-25		IP_DRIVE_CURRENT: Maximum value detected since last update from the user.
IP_CURRENT_MIN (2)	-25 to 150	150		IP_DRIVE_CURRENT: Minimum value detected since last update from the user.

Table 31 - Transducer Block Parameters (Continued)

Parameter (in bold) Sub-parameter (Index)	Range	Initial Value	Mode	Description
ADVANCED (118)			Any	Advanced/Standard implementation for the device
BLOCK_ERR_DESC_1 (119)				Bit map; bit N = 0 - No error, bit N = 1 - Specific error occurred. Bit 0: No Error. Reserved. Must be always 0. Bit 1: Mode Switch Error. 1 = The PTB Actual mode cannot be set to any non-AUTO mode. Bit 2: The response to the FF request times out. Bit 3: SP Source conflict. 1 = A DO block attempts to become a SP source on the channel already taken by the other DO block. Bit 4: FIND_STOPS Failed. 1 = Find Stops request made by writing FIND_STOPS parameter failed.

Appendix G. Static Parameters During Restore to Defaults

Table 32 lists the parameters that don’t change when restore with defaults is invoked in the Resource block.

Table 32 - Static Parameters

Index	Parameter Name	Index	Parameter Name
14	POSITION_LIMITS	51	PRESSURE_RANGE
15	FINAL_VALUE_CUTOFF_HI	82	DISCRETE_SWITCH_1_CONF
16	FINAL_VALUE_CUTOFF_LO	83	DISCRETE_SWITCH_2_CONF
19	ACTIVE_CONTROL_SET	84	UI_ACCESS_CONTROL
22	TRAVEL CALIBRATION	85	UI_LANGUAGE
33	TRAVEL_ACCUMULATION_TREND	89	OPEN_STOP_ADJUSTMENT
36	CYCLE_COUNTER_TREND	94	ALERT_ACTION
37	POSITION_ERROR_TREND	96	ALERT_COUNTERS
38	POSITION_HISTOGRAM	97	ALERT_LOG
40	POSITION_ERROR_HISTOGRAM	99	WORKING_TIME_ALERT
43	CHAR_SELECTION	104	ACTUATOR_3
44	CURRENT_CHAR_POINTS	113	ACCESSORY

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Appendix H. Notes on Characterization

Valve Over/Under Reaction Near Endpoints

This section is intended to explain why at times the valve can appear to be either over-reacting or under-reacting to the user-based configuration.

A principle point to understand is the difference between the *travel* domain and the *user* domain:

- The *travel* domain is what is actually happening to the valve - the amount of movement during operation. This reflects the state of the *working setpoint*.
- The *user* domain is reflected in the output seen on the LCD, through a DTM or other interface. This reflects the value of the *FINAL_VALUE* parameter.

How do these two relate to each other:

FINAL_VALUE --> Characterization process --> Working Setpoint

Whichever user-selected characterization process occurs (based on valve type), dictates the behavior that are seen during valve operation. Figure 64 shows the characterizations curves.

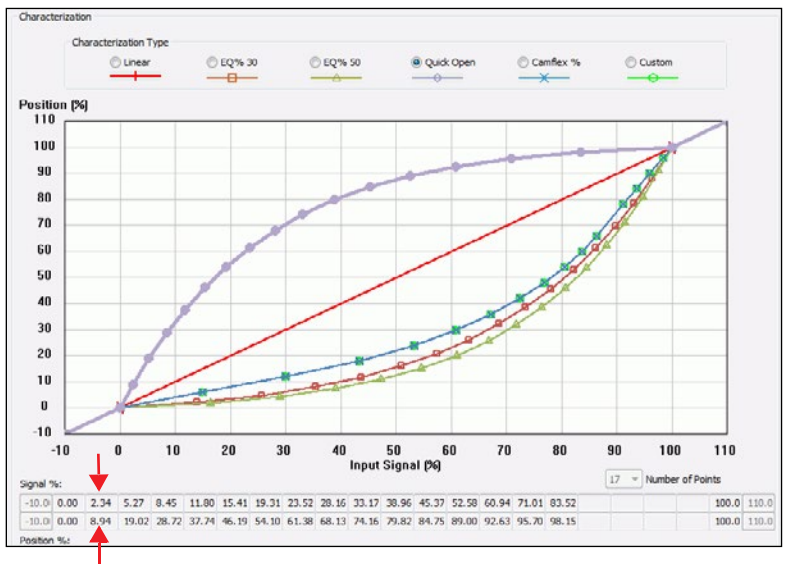

Figure 64 - Characterization Curves

An example to highlight the difference between the *travel* and *user* domains, is the effect of *FINAL_VALUE_CUTOFF_HI*, a user-configurable parameter, on the *Quick Open* and *EQ% 50* curves. The *Quick Open* curve has a much more dramatic increase/decrease near the curve extremes than the *EQ% 50.* For the *Quick Open* curve, if you a enter a *FINAL_VALUE_CUTOFF_HI* value, it causes a large deviation between the working setpoint (travel domain and the *FINAL_VALUE* (user domain) (*see the red arrows in Figure 64*). Entering the same *FINAL_VALUE_CUTOFF_HI* value for the *EQ% 50* causes a much smaller deviation.

If you were to do the same for both curves using the *FINAL_VALUE_CUTOFF_LO* value the effects would swap.

Configuration of Position Limits, Position Rate Limits and FINAL_VALUE_CUTOFF and Characterization

Figure 65 graphically explains how setpoint and position interact.

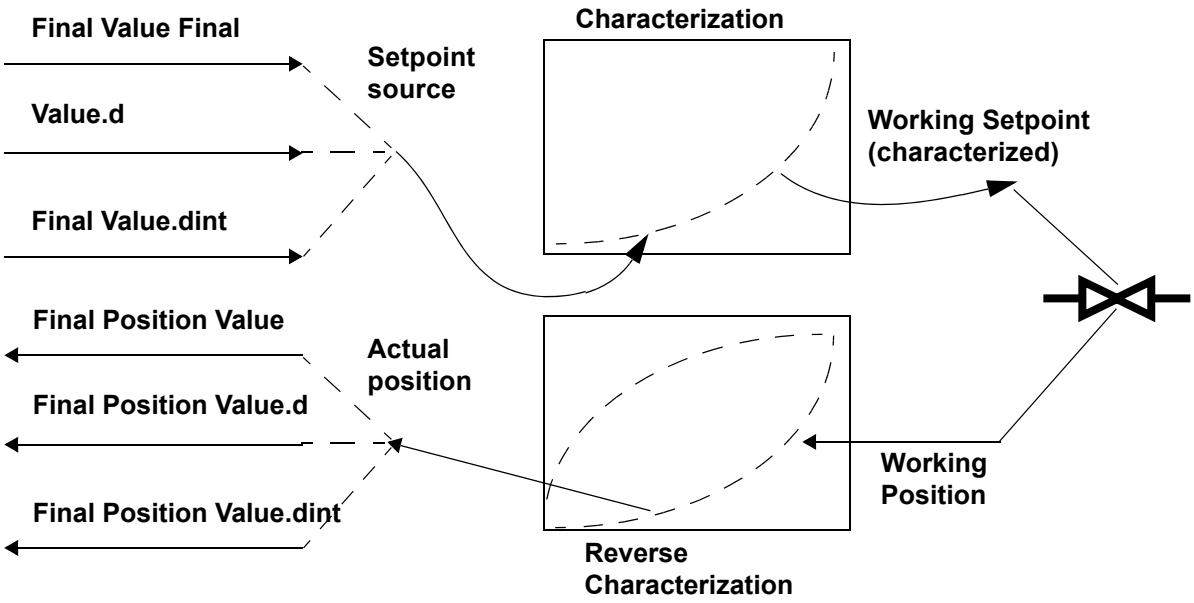

Figure 65 - ValVue SVIFF Setpoint to Position Schema

Figure 66 shows the interplay between a configured position limit, in this case 10% and its effect for two characterization types:

- For Linear (red curve), the 10% limit causes an effective setpoint limit of 10%.
- For EQ% 50 (green curve with triangles), the 10% limit causes an effective limit of 45%.

This type of behavior must be kept in mind when choosing a characterization and associated limits.

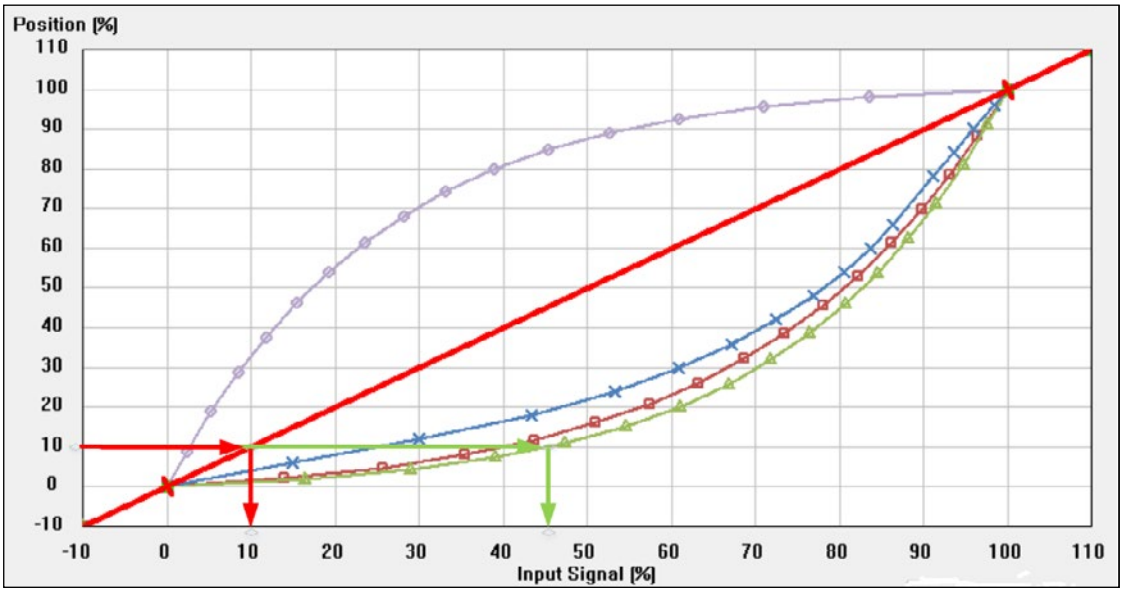

Figure 66 - Position Limits versus Setpoint Limit Table

33 lists the position and travel settings as reference.

Table 33 - Position and Travel Settings

FF Parameter	SVI FF DTM Field	Description
LIMITS_PROTECTED set to FALSE	*Position Limits Protected* checkbox.	Enables editing of the limits.
ENABLE_HI	*Position Limits HI Enabled* checkbox.	Enables the LIMIT_HI parameter.
ENABLE_LO	*Position Limits LO Enabled* checkbox.	Enables the LIMIT_LO parameter.
FINAL_VALUE_CUTOFF_HI	*Position Limits HI* field.	Use this field to enter the value.
FINAL_VALUE_CUTOFF_LO	*Position Limits LO* field.	Use this field to enter the value.
FINAL_VALUE_CUTOFF_HI. ENABLE	*Cut-Offs Full Open Enabled* checkbox.	Enables the FINAL_VALUE_CUTOFF_ HI.CUTOFF_POINT_HI field.
FINAL_VALUE_CUTOFF_HI. CUTOFF_POINT_HI	*Cut-Offs Full Open Above* field.	If the FINAL_VALUE is more positive than this value, the valve is forced to its maximum high value (fully opened).

Table 33 - Position and Travel Settings (Continued)

FF Parameter	SVI FF DTM Field	Description
FINAL_VALUE_CUTOFF_LO. ENABLE	*Cut-Offs Tight Shutoff Enable* checkbox.	Enables the FINAL_VALUE_CUTOFF_LO. CUTOFF_POINT_LO field.
FINAL_VALUE_CUTOFF_LO. CUTOFF_POINT_LO	*Cut-Offs Tight Shutoff Enable* field.	If the FINAL_VALUE is more negative than this value, the valve is forced to its maximum low value (fully closed).

Relationship Between Alerts, Alert Response Type and Block Error

When an FF block has an error, the system must be configured to report that error. This configuration task consists of two components:

1. Configuring HI and/or LO Alerts and ensuring they are enabled.
2. Linking each alert to a desired response level. These include:
   - *Device Failure*
   - *Maintenance Required*
   - *Warning Data*
   - *Not Reported*

Appendix I. Fault State Processing

This section explains how the fault state is processed in the SVI FF.

NOTE

The discussion that follows uses the AO block as an example. However this can occur through the DO block as well.

The fault state can be initiated from multiple sources:

- “Initiate Fault State from the Host”
- “Fault State Conditions Detected by AO Block” on page 204
- “Fault State Conditions Detected by Transducer Block” on page 204
- “Fault State Condition is Detected and Processed by the Position Control Hardware and Software” on page 205

Initiate Fault State from the Host

The host may drive the entire device to fault state by setting the SET_FSTATE parameter to SET. The Fault State related I/O option (IO_OPTS) determines the reaction of the Analog Output or Discrete Output function block - whether the action is simply to hold, or to move to FSTATE_VAL.

If Analog Output block is in AUTO, CAS or RCAS mode and if I/O Option IO_OPTS bit 6 (Fault State to value) is:

- Set, the OUT parameter of the block is set to the value defined in FSTATE_VAL. FF specification recommends that FSTATE_VAL value is close to the de-energized position.
- *NOT* set, the OUT parameter of the block remains unchanged - the valve keeps the position set before the fault state is initiated.

The Transducer block then follows the setpoint received from the output block.

When the CLEAR_FSTATE parameter is set to CLEAR, the block normal processing is restored.

Fault State Conditions Detected by AO Block

The AO block monitors multiple conditions and goes to Fault State if:

- The CAS_IN input is not updated for a user-configurable number of block executions in a row and the block is in CAS (cascade) mode.
- The status of the received data in CAS_IN is Initiate Fault State and the block is in CAS mode.
- The RCAS_IN input is not updated and the block is in RCAS (remote cascade) mode.
- The status of the received data in RCAS_IN is Initiate Fault State and the block is in RCAS mode.

The Fault State related I/O option (IO_OPTS) determines the reaction of the Analog Output function block - whether the action is simply to hold, or to move to FSTATE_VAL. If I/O Option IO_OPTS bit 6 (Fault State to value) is:

- *NOT* set, the OUT parameter of the block remains unchanged - the valve keeps the position set before the fault state is detected.
- Set, the OUT parameter of the block remains unchanged for the duration defined in FSTATE_TIME parameter. If the conditions causing the Fault State persist, the OUT parameter is then set to the value defined in FSTATE_VAL. FF specification recommends that FSTATE_VAL value is close to the de-energized position.

The Transducer block follows the setpoint received from the output block. When I/O Option IO_OPTS bit 6 is:

- NOT set - the setpoint follows the same point.
- Set - the setpoint tracks the FSTATE_VAL position.

Once the condition causing Fault State is removed, the normal processing is restored and the block follows the setpoint provided in the input.

Fault State Conditions Detected by Transducer Block

In AUTO mode, the transducer block monitors the setpoint received from the AO.OUT parameter via the TB.FINAL_VALUE.

If the value received has bad status (bad value received from communications, AO block in OOS mode, etc.) or if the value is not updated (AO is not scheduled or a changed configuration is incorrect), the behavior in the TB is defined by the XD_FSTATE.XD_FSTATE_OPT and XD_FSTATE.FSTATE_TIME parameters. For the first several seconds (defined by XD_FSTATE. FSTATE_TIME), the valve follows the last good setpoint. After that, XD_FSTATE.XD_FSTATE_ OPT defines the behavior as follows:

- XD_FSTATE.XD_FSTATE_OPT = 0: the valve continues staying in position.
- XD_FSTATE.XD_FSTATE_OPT = 1: the valve goes to fully closed position (expected to be near 0%, subject to stops tolerances).

- XD_FSTATE.XD_FSTATE_OPT = 2: the valve goes to fully open position (expected to be near 100%, subject to stops tolerances).
- XD_FSTATE.XD_FSTATE_OPT = 3: the valve goes to the position, specified in XD_ FSTATE. FSTATE_VALUE. FF specification recommends that XD_FSTATE.FSTATE_ VALUE value is close to the de-energized position.

Once the condition causing the Fault State is removed, normal processing is restored and the block follows the setpoint provided in the TB.FINAL_VALUE.

CAUTION

Going to fully energized position (open for ATO, closed for ATC) is subject to supply pressure availability and commensurate with the spring range.

For double-acting positioners without a spring, going to fully energized position (open for ATO, closed for ATC) is subject to supply pressure availability.

Fault State Condition is Detected and Processed by the Position Control Hardware and Software

If the failure is detected by the position control software or in the hardware and the valve can not be controlled, the positioner's output is de-energized, which lets the spring to push the valve.

CAUTION

Going to fully energized position (open for ATO, closed for ATC) is subject to supply pressure availability and commensurate with the spring range.

For double-acting positioners without a spring, going to fully energized position (open for ATO, closed for ATC) is subject to supply pressure availability.

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Appendix J. Configuring the SVI FF and a Yokogawa Centum DCS

Purpose and Scope

This application note provide the steps for SVI FF integration in Yokogawa® DCS and to guide you in how to avoid some of the interoperability issues detected with older versions of the Yokogawa DCS. Most of the screen shots are made on Yokogawa Centum CS3000 version R3.07.00 (Figure 67), but the steps are similar in other versions of the software.

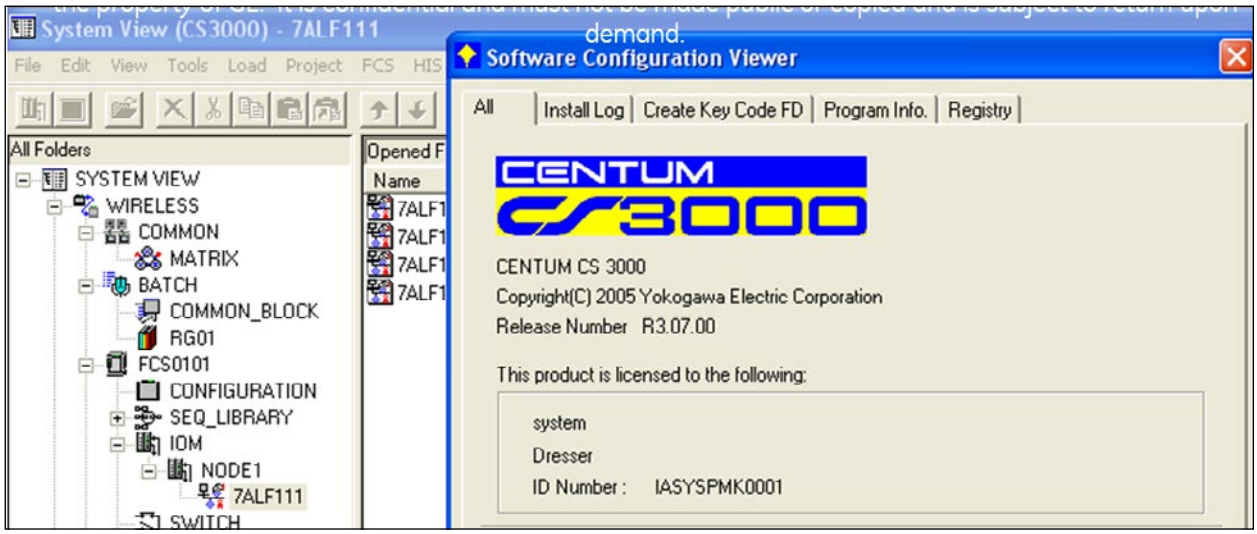

Figure 67 - Yokogawa Centum DCS Version

Status of SVI FF interoperability with Yokogawa DCS

As part of the integration process, the SVI FF was provided to the Yokogawa Interoperability Team and has successfully passed all tests. Additionally, the SVI FF has also been provided to several key customer test locations using Yokogawa Centum DCS with successful integration.

NOTE

Post Rev 2 this procedure must be used ensure that earlier DDs are upgraded to achieve proper functionality.

Special Notes When Working with Yokogawa DCS

It has been noticed that when a device is connected to the DCS, the system is trying to reuse the information collected from the previous connection. In some cases this may create interoperability problems. This is probably done to speed up the process of device configuration, but may create issues if the new device is modified. The following user actions are suspected and may cause problem:

- Importing of a new DD
- Connecting an upgraded device with newer version and modified DD

When this happen, the information presented in the device panel does not reflect the configuration in the actual physical device.

The problem was resolved by deleting the previous version of the device, downloading the control application without the device and then creating/download the newly created instance of the device and its blocks.

Procedure

1. Preparation for Device Connection

Before the SVI FF is connected to the Yokogawa DCS, you must collect some information and configure the Yokogawa DCS for the SVI FF device connection. This section documents the steps required.

A. Finding the DD Directory

Depending on the version of the Yokogawa system, the Device Description (DD) files for SVI FF may not be integrated and installed with the Centum Software installation. Then, the DDs must be manually integrated in the corresponding directories. Only perform this process when a new version of the device is being integrated and a new set of DDs are being installed. When the DD is integrated, it supports all devices of that version. The DD files are located at: *https://valves.bakerhughes.com/resource-center*. To access the files:

1. Enter *SVI FF* in the *Search* field and the screen below appears (Figure 68).

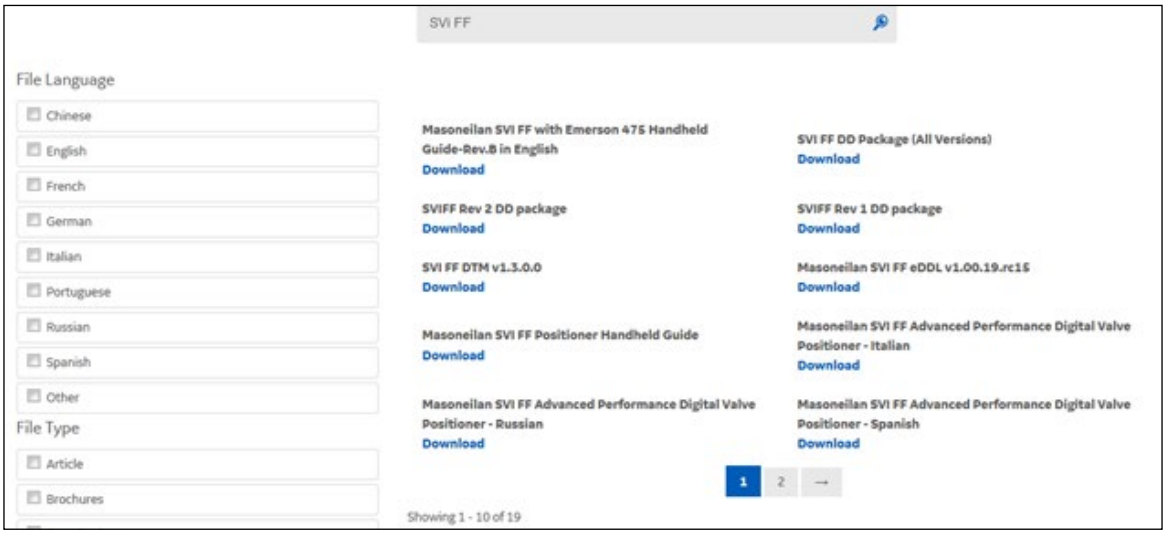

Figure 68 - Search Results

2. Click **Download** under *SVIFF Rev 2 DD Package* and a dialog appears asking whether to *Save File* or *Open*.
3. Select **Save File** and click **OK** and the files are saves to the *Windows Download* directory for use in the next section.

To locate the DD directory:

1. Navigate in the System View application to the FF interface module. Figure 69 provides an example.

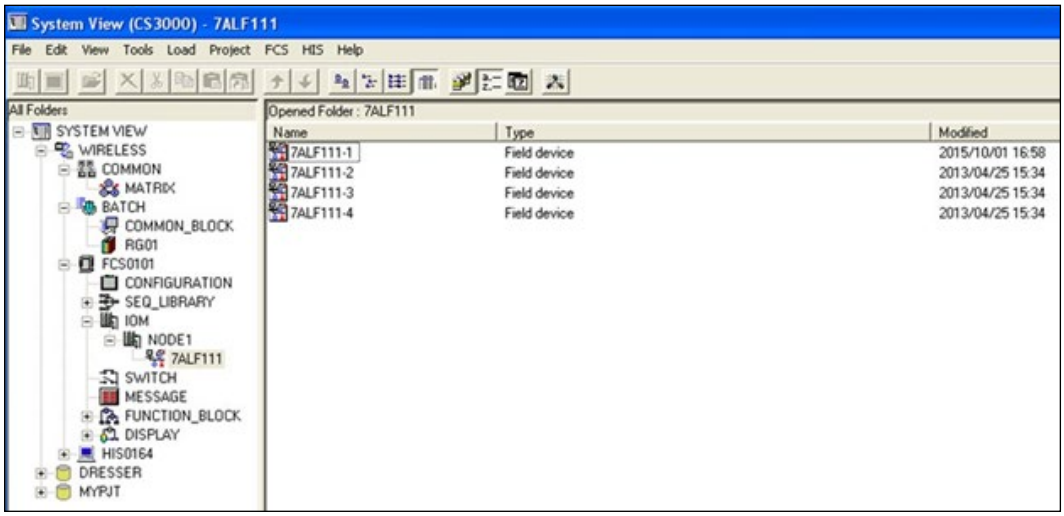

Figure 69 - Example of Fieldbus Interface Module in System View

2. Open the *Fieldbus Builder* and select **Environment Settings**.

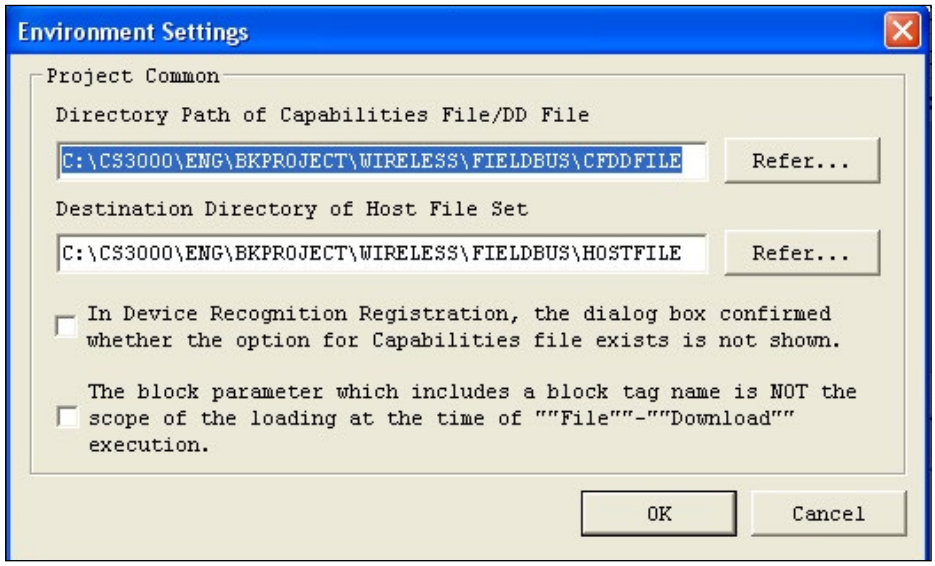

Figure 70 - Figure 4: DD/CFF Files Directory Path

The *Directory Path* presented points to the location, where the DD/CFF files are stored.

3. Copy the path and paste it in *Windows Explorer*. The *004745* folder contains the DD/CFF files for all Baker Hughes devices (Figure 71).

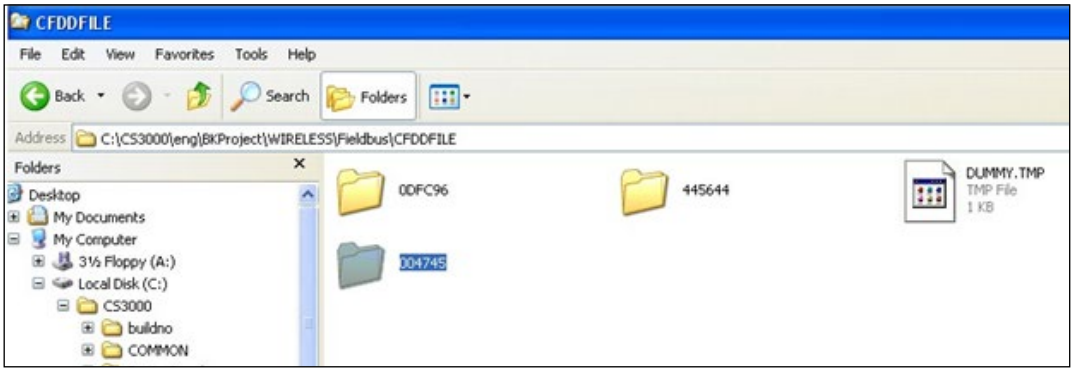

Figure 71 - Example of the Baker Hughes DD/CFF Files Location

The files for SVI FF are located in a directory 0008 under the 004745.
The full path for this example looks like this:
C:\CS3000\eng\BKProject\WIRELESS\Fieldbus\CFDDFILE\004745\0008

4. Copy the DD/CFF files in to the directory.

CAUTION

The System View and Fieldbus Builder software may need to be re-started because the DDs are often loaded and cached when the DD tools are started.

B. Setting System Management and Network Management Parameters

Configure the FF communication parameters to provide reliable communication between the host and devices connected to the segment. Set the communication parameters once and you do not need to change them when additional devices (positioners) are connected to the segment.

Figure 72 provides the values that are used during the device registration and interoperability testing (see FF specification document *FF-940 FS 1.5 - Communication Profile* chapter *5.4 Default link settings for communication parameters on H1_31_25kbps Physical Layer networks)*.

5.4 Default link settings for communication parameters on H1_31_25kbps Physical Layer networks

The following default values are recommended as the initial link settings where interoperability is uncertain. Tighter (i.e., shorter duration) settings will result in better (i.e., higher throughput) network performance, but may cause interoperability problems for some equipment.

The default values for the SM SET_ADDR timers T1, T2 and T3 are:

Timer	Default Value	Corresponding Time Period
T1	480000	15 s
T2	2880000	90 s
T3	1440000	45 s

Table 12 — SMK Timer Default Values

The default value for the DLL Time Sync Class is: 1 ms.

The default value for the DLL Slot time is: 8. Support for smaller values is recommended.

The default value for the DLL Max response delay is: 10. Support for smaller values is recommended.

The default value for the DLL Inter Pdu Gap is: 16. Support for smaller values is recommended.

The default value for the PhL Preamble Extension is: 0. Networks including digital repeaters may require larger values.

The default value for the PhL Post-Transmission Gap Extension is: 0.

The recommended maximum value for the DLL Max Scheduling Overhead is: 4. Support for smaller values is recommended.

The SMIB object OPERATIONAL_POWERUP should have a default value of TRUE.

Figure 72 - Default Link Settings for Communication Parameters on H1_31_25kbps Physical Layer Networks

C. Setting Environment Settings

Configure the *Network Management* parameters manually (the optimal configuration may result in values different from recommendations):

- Open the *Environment* settings and verify that *Make NM Parameter the optimum value* checkbox is not selected (Figure 73).

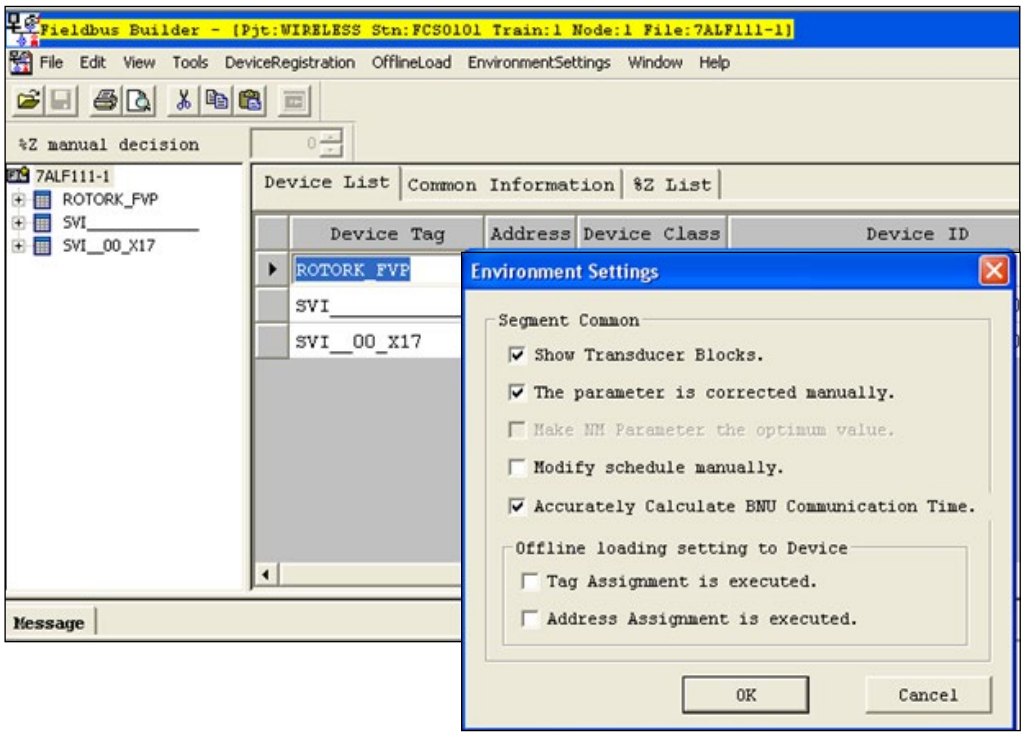

Figure 73 - Environment Settings

D. Adjust the Communication Parameter . . .

WARNING

Changing Network Management Communication parameters stops execution of ALL control devices on this segment until the new parameters are downloaded and the segment schedule is re-initialized.

Review the use of all instruments on the segment and take necessary steps to ensure safety of all control loops and safety applications related to the segment.

1. Open the *Fieldbus Builder* and select from the main menu **Tools->Adjust Communication Parameter. . .**
2. Open the *Parameter Edit* window and select the **Segment->Common-NM** from the device list.

   The window on the right side presents the Network management parameters and their values.

3. Edit the values to match the default/recommended settings by the FOUNDATION fieldbus in document *FF-940 FS 1.5 - Communication Profile* chapter *5.4 Default link settings for communication parameters on H1_31_25kbps Physical Layer networks*.

4. Click **OK** to accept the settings and close the window (Figure 74).

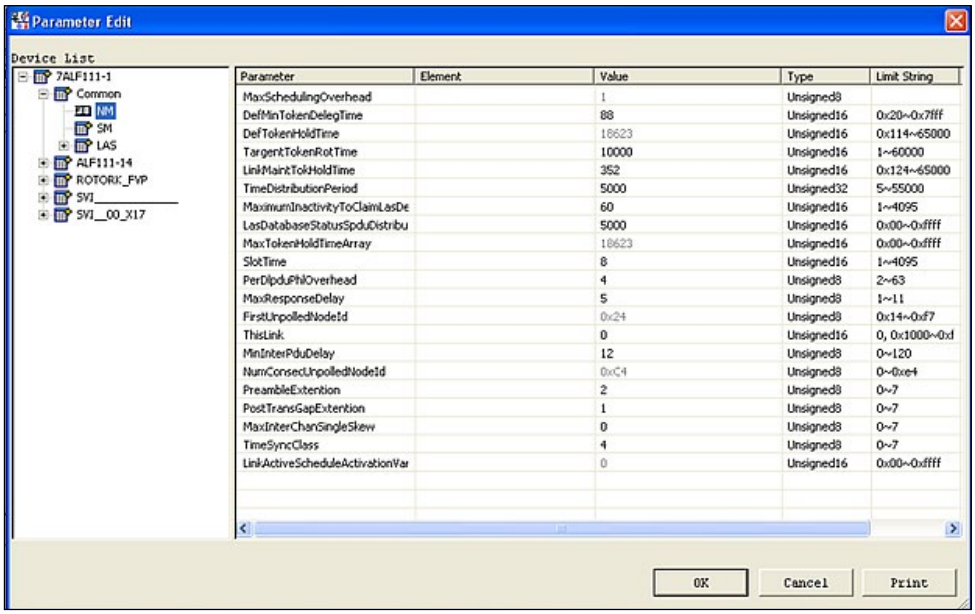

Figure 74 - Network Management Parameter List

5. Ensure that the modified values are downloaded to the controller by selecting **Files -> Download**.

E. Setting the Positioner's Address

To speed up the process of device discovery, reduce the working address range. If it is an existing application with multiple devices connected, you can find the devices and their addresses when you click on the segment and select *Device List* tab (Figure 75).

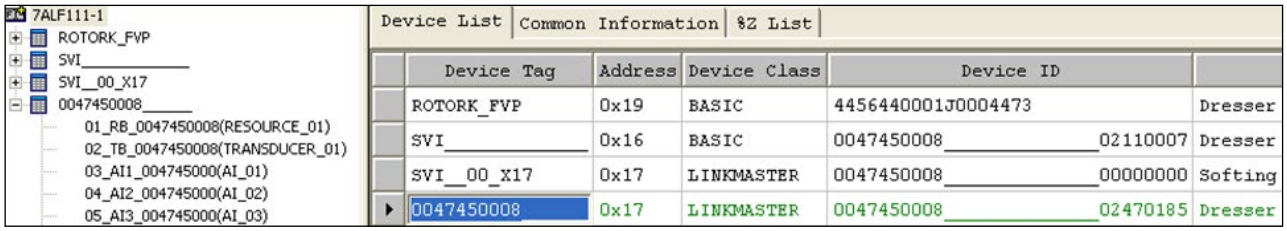

Figure 75 - Device List

Quite often the Field Instruments connected to the Yokogawa DCS are restricted to be between 20 (0x14) and 32 (0x20). This range is adjustable and may be further restricted or extended.

It is a good practice to review the list of devices already configured or connected to the segment in the device list and select one of the un-used device addresses for the new device. Use ValVue3 or a similar tool to set the device address with the selected value before the device is connected to the bus.

2. Connecting the SVI FF

The device can be connected to an active FF segment at any time. If a duplicate device address is detected, the device is moved to a temporary address and may require additional address assignment.

Starting Device Recognition Registration

1. From the Fieldbus Builder, right-click on the segment and select **Device Recognition Registration** from the menu (Figure 76).

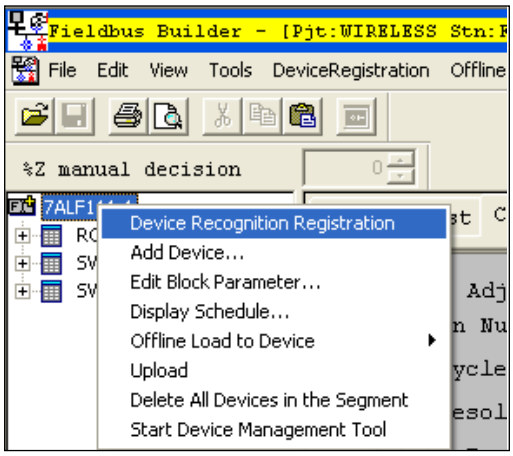

Figure 76 - Device Recognition Registration

This starts a procedure to discover all devices connected to the Foundation Fieldbus Segment (Figure 77).

The *Fieldbus Builder* software and the Fieldbus interface module interrogates the connected devices and collects information required to identify the devices. The results are presented in the message window in the *Fieldbus Builder*.

The information includes *Device Tag*, *Device ID*, *Device Address*, *Basic* or *Linkmaster class*, etc. If the device is recognized for the first time, additional information is collected about the device blocks, device parameters, device capabilities and default device parameters settings. If the CFF file is not found for that device, the *Fieldbus Builder* also creates a (temporary) CFF File.

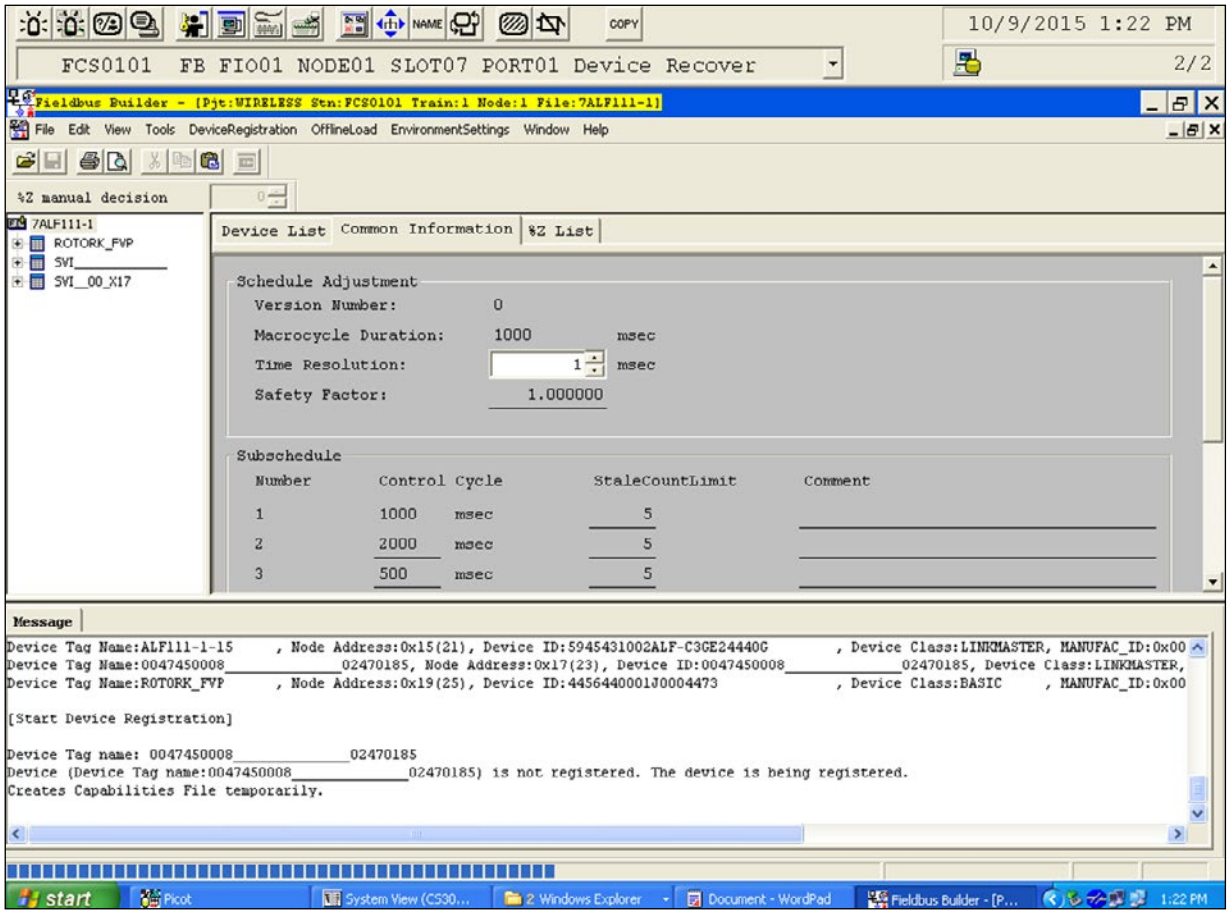

Figure 77 - Device Recognition Progress

NOTE

This information is cached in the Fieldbus Builder and changes in the device and its DD/CFF file are not recreated unless the device is deleted and downloaded again.

The block tags in Yokogawa are limited to 16 characters, and remaining block tag characters are ignored. The following message appears (Figure 78).

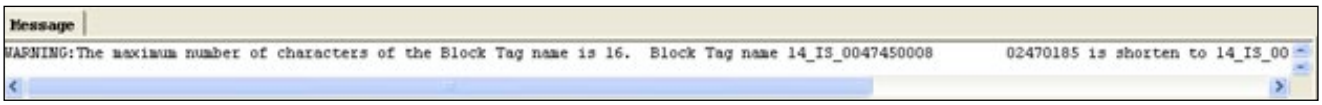

Figure 78 - Notification Message for Block Tag Change

CAUTION

This may create a problem if more than one SVI FF is connected to the same segment as the first 16 characters for the Resource block are the same in both devices, the first 16 characters in the Transducer block are the same in both devices, etc. If more than one SVI FF device is connected to the same segment, the block tags must be set differently in the Fieldbus Builder.

3. Edit Block Parameters

Control engineers need to configure the blocks for the application requirements.

A. Configure the Parameter Edit Window

1 In *Fieldbus Builder* select **Tools->Edit block parameters** menu to open the *Parameter Edit* window (Figure 79).

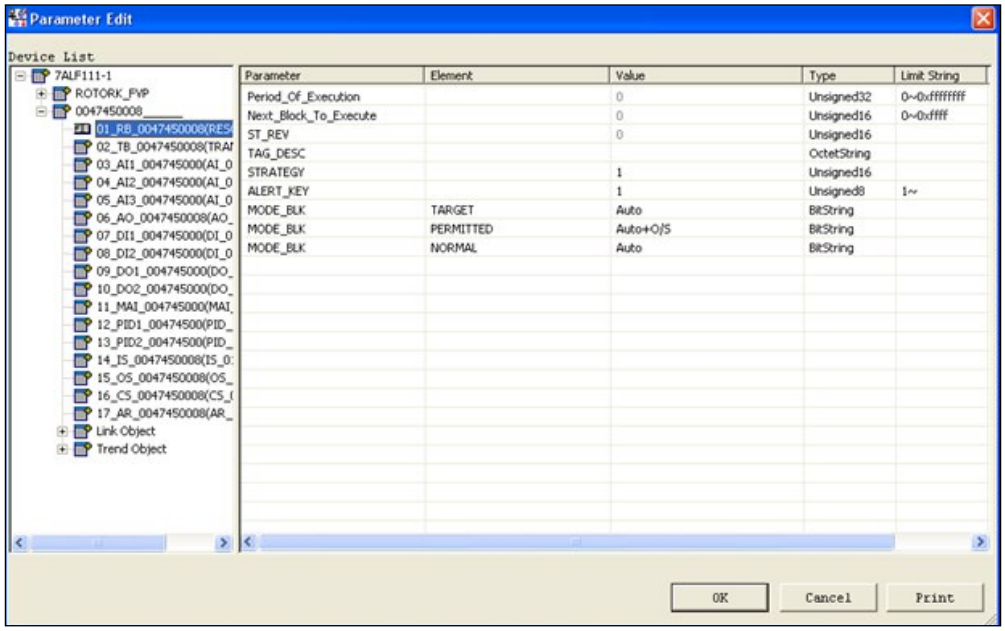

Figure 79 - Parameter Edit Window

2. Select the block in the *Device List* menu and the current configuration appears on the right side window. Parameters and their values are presented by the parameter index in the block, but the actual block index is not shown on the window.

B. Change the Parameter Value

1. Click on the selected parameter value to allow modification of the parameter value (Figure 80).

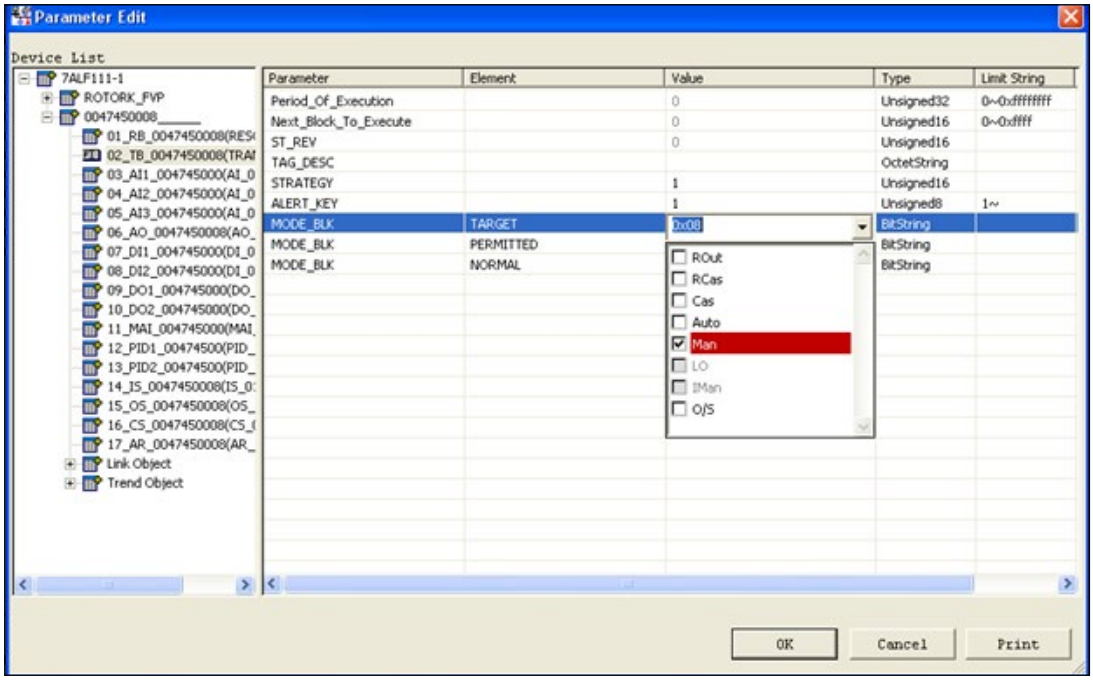

Figure 80 - Parameter Value Modification

2. Click **OK** to modify the settings in the *Fieldbus Builder*, but do not download them to the device.

C. Download Settings to the Device

1. Click **File->Download** menu in the *Fieldbus Builder* to download the modified parameters to the device (Figure 81).

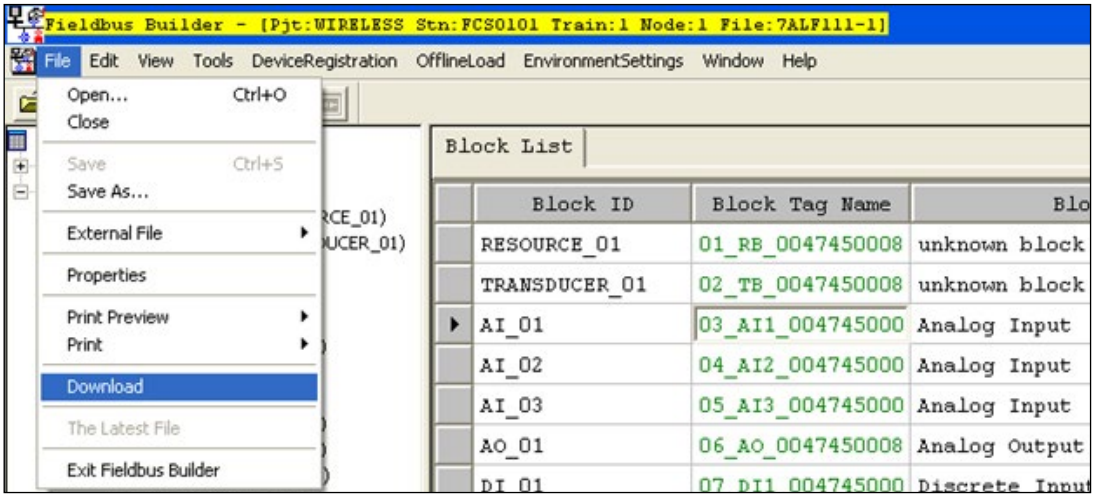

Figure 81 - Download Function

2. Select the SVI FF device in the download confirmation window for the download to proceed (Figure 82).

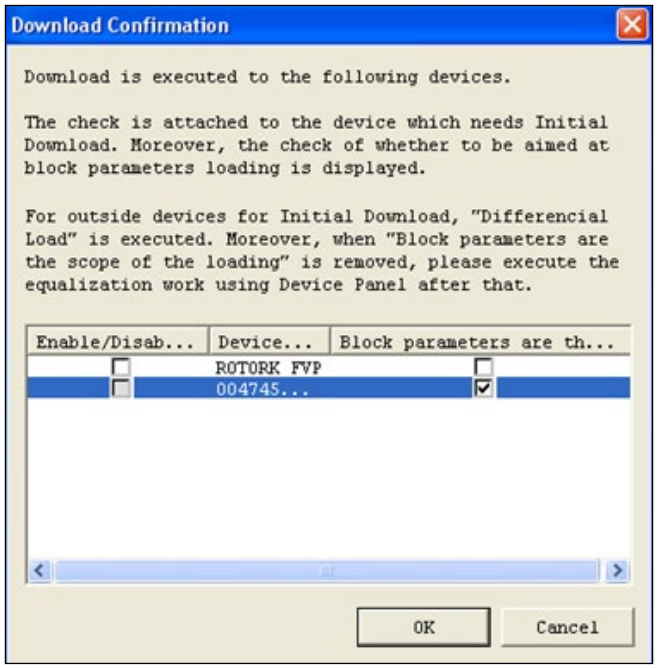

Figure 82 - Device Download Confirmation

When the download process is completed, the result appears in the message window in *Fieldbus Builder* (Figure 83).

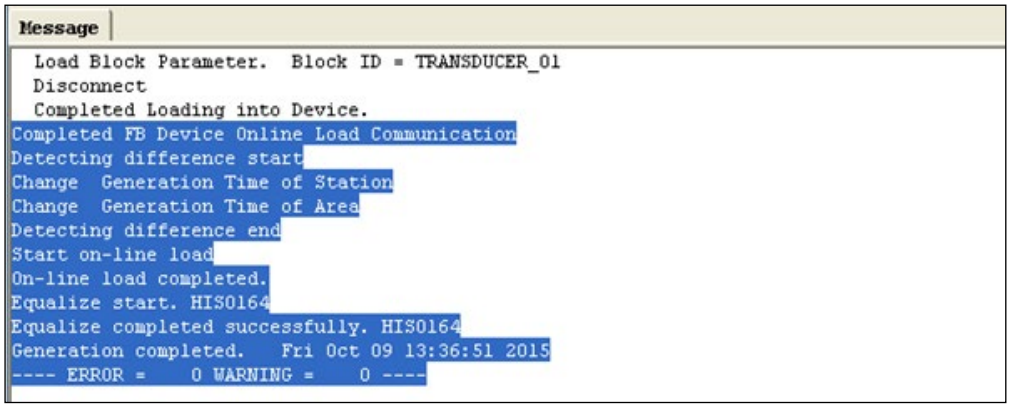

Figure 83 - Successful Download Result

If an error is detected during the download process, it is also appears in the message window. The report includes the individual parameters that are rejected by the device and the total number of errors detected during the download process (Figure 84).

```
WARNING: Negative Confirmation. [ClassCode:0x800][AdditionalDetail:0x1]
ERROR:Negative Confirmation Returned from Device. TRANSDUCER_01 MODE_BLK
  Load Block Parameter.  Block ID = AI_01
  Load Block Parameter.  Block ID = AI_02
  Load Block Parameter.  Block ID = AI_03
. . . . . .
  Load Block Parameter.  Block ID = AR_01
  Load Link Object.
  Clear Trend Object.
  Load Trend Object.
  Change Resource Block Mode to AUTO.
  Disconnect
  Completed Loading into Device.
Completed FB Device Online Load Communication
Detecting difference start
Change      FIO CardDef         Train=1          Node=1          Slot=7
Change      FIO CardDef         Train=1          Node=1          Slot=8
Change      FIO IOM Config      Train=1          Node=1          Slot=7          Port=0,1
Change      FIO IOM Config      Train=1          Node=1          Slot=8          Port=0,1
Change      Generation Time of Station
Change      Generation Time of Area
Detecting difference end
Start on-line load
On-line load completed.
Equalize start. HIS0164
Equalize completed successfully. HIS0164
Generation completed.   Fri Oct 09 13:32:33 2015
---- ERROR =    1 WARNING =    1 ----
```

Figure 84 - Error Reporting During Download

4. Set Device Information

In some cases the device technicians are not allow to access function block parameters. They may have access only to *Device Information* display.

A. Invoke the Device Information Window

1. Open the *Device Information* window by selecting **Tools->Display Device Information** from the *Fieldbus Builder* main menu (Figure 85).

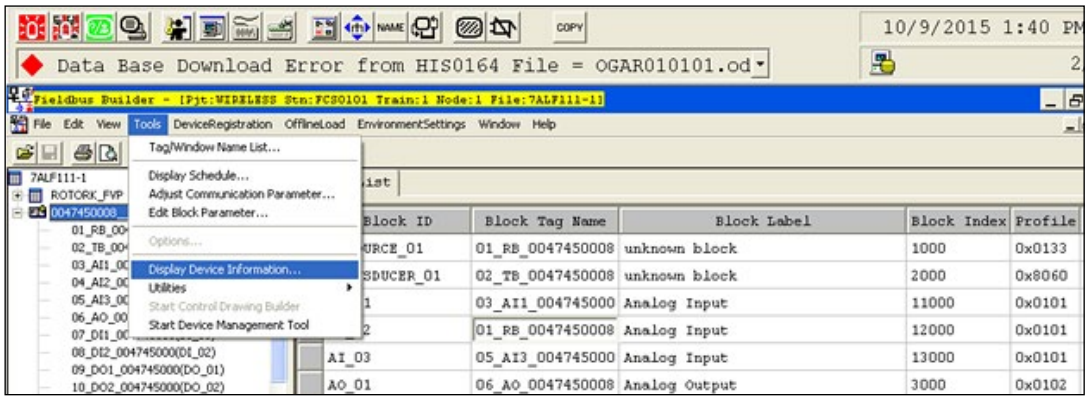

Figure 85 - Invoke Display Device Information Window

The device panel is open presenting the list of the devices connected to the segment (Figure 86).

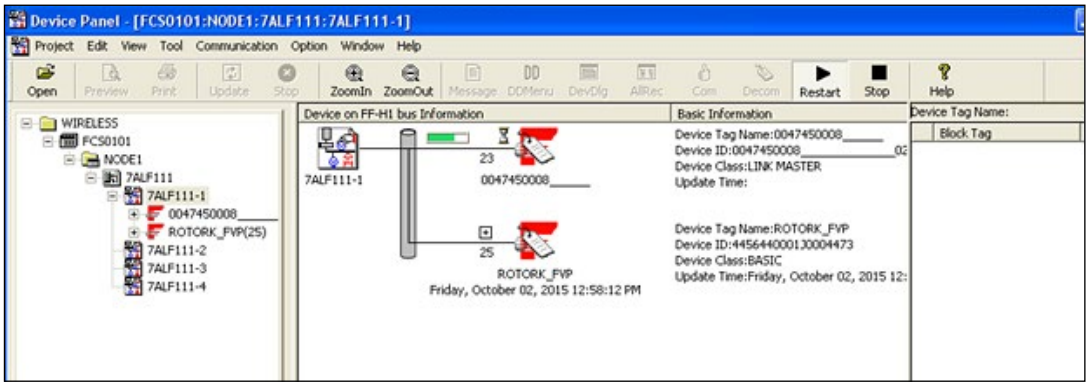

Figure 86 - Device Panel Window

If this is the first connection to the device, the *Device Panel* window starts the upload process from the device (presented with the green progress bar in the window).

2. Click on the plus sign above the device address that appears in the list of device blocks and their mode (Figure 87).

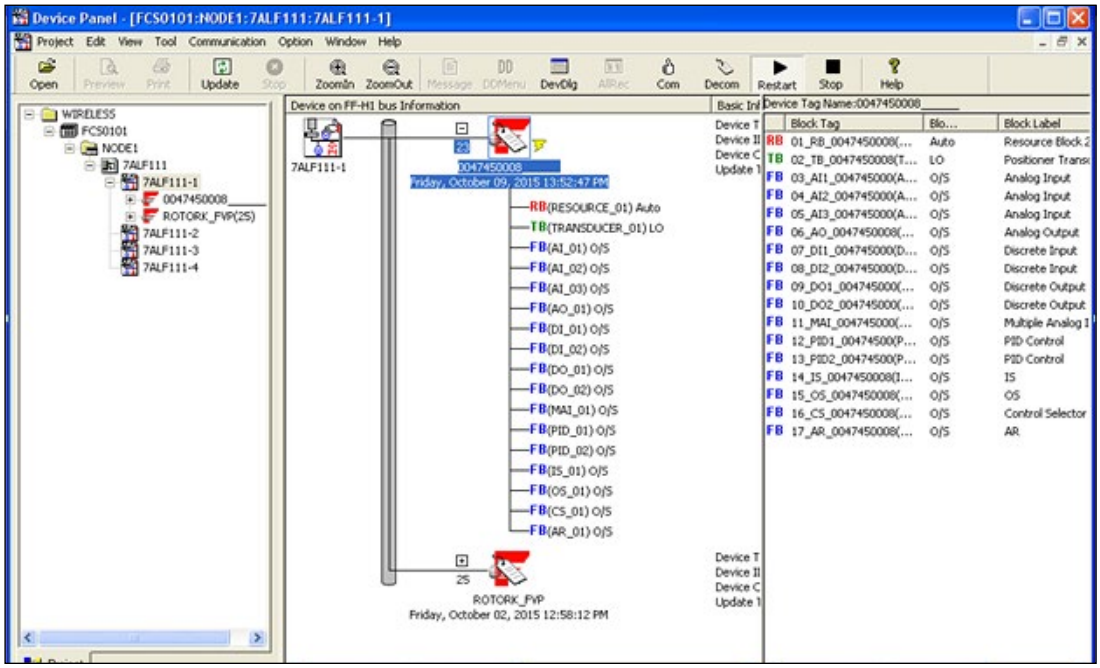

Figure 87 - Device Addresses

All parameters are updated from the device.

3. Open the *Device Information* display by double-clicking on the device in the *Device Panel* window (Figure88).

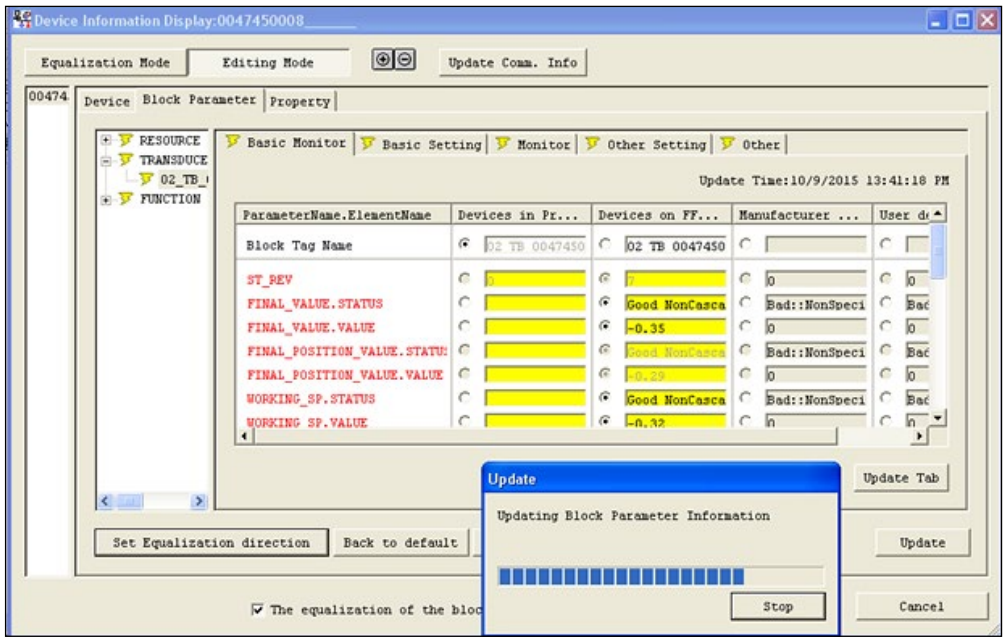

Figure 88 - Device Information Display Window

4. Click on the **Update Tab** button to upload of the data from the device to the window. Modification of a parameter triggers an automatic download of the modified value to the device (Figure 89).

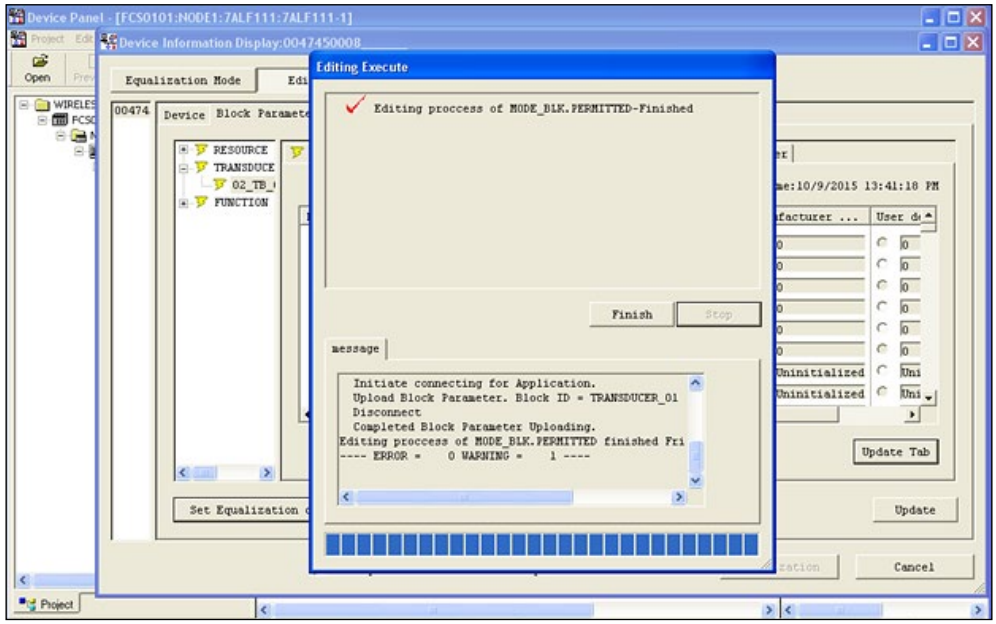

Figure 89 - Device Information Display Window: Editing Execute

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Appendix K. Views

Views

Table 34 lists the views, view parameters and gives a general description of its purpose.

Table 34 - VIEWS

View	Values
View1: Dynamic analog values related to the valve position control	☐ 1 ST_REV ☐ 12 FINAL_VALUE ☐ 17 FINAL_POSITION_VALUE ☐ 23 WORKING_SP ☐ 24 WORKING_POS ☐ 49 SUPPLY_PRESSURE ☐ 54 ACTUATOR_A_PRESSURE ☐ 55 ACTUATOR_B_PRESSURE ☐ 56 ATMOSPHERIC_PRESSURE ☐ 57 PILOT_PRESSURE ☐ 60 TEMPERATURE ☐ 63 IP_DRIVE_CURRENT ☐ 90 SETPOINT ☐ 91 ACTUAL_POSITION
View2: Basic Configuration View	☐ 1 ST_REV ☐ 2 TAG_DESC ☐ 3 STRATEGY ☐ 4 ALERT_KEY ☐ 71 UI_CUSTOM_CONFIGURATION ☐ 83 UI_ACCESS_CONTROL ☐ 84 UI_LANGUAGE ☐ 93 ALERT_ACTION

Table 34 - VIEWS (Continued)

View	Values
View3: Dynamic analog values related to the valve position control	☐ 1 ST_REV ☐ 12 FINAL_VALUE ☐ 17 FINAL_POSITION_VALUE ☐ 23 WORKING_SP ☐ 24 WORKING_POS ☐ 49 SUPPLY_PRESSURE ☐ 54 ACTUATOR_A_PRESSURE ☐ 55 ACTUATOR_B_PRESSURE ☐ 56 ATMOSPHERIC_PRESSURE ☐ 57 PILOT_PRESSURE ☐ 60 TEMPERATURE ☐ 63 IP_DRIVE_CURRENT ☐ 90 SETPOINT ☐ 91 ACTUAL_POSITION
VIEW3.1: Values related to the Discrete Inputs and Outputs in the device	☐ 1 ST_REV ☐ 72 FAILED_STATE ☐ 73 FINAL_VALUE_D ☐ 74 FINAL_POSITION_VALUE_D ☐ 75 FINAL_VALUE_DINT ☐ 76 FINAL_POSITION_VALUE_DINT ☐ 77 DISCRETE_OUTPUT_1_STATE ☐ 78 DISCRETE_OUTPUT_2_STATE ☐ 79 DISCRETE_INPUT
View3.2: Values related to the errors detected in the device	☐ 1 ST_REV ☐ 5 MODE_BLK MODE_BLK ☐ 6 BLOCK_ERR ☐ 11 XD_ERROR_POS ☐ 48 XD_ERROR_PRESSURE ☐ 61 XD_ERROR_TEMPERATURE ☐ 86 APP_MODE ☐ 87 COMPLETE_STATUS ☐ 94 ALERT_STATE ☐ 95 ALERT_COUNTERS
View3.3: Provides histogram data	☐ 37 POSITION_HISTOGRAM ☐ 39 POSITION_ERROR_HISTOGRAM
View3:4: Extremes reached in the device since power up	☐ 111 POSITION_EXTREMES ☐ 112 PRESSURE_EXTREMES ☐ 113 TEMPERATURE_EXTREMES ☐ 114 IP_CURRENT_EXTREMES

Table 34 - VIEWS (Continued)

View	Values
View3.5: Block Alarm status	☐ 1 ST_REV ☐ 7 UPDATE_EVT ☐ 8 BLOCK_ALM ☐ 96 WORKING_TIMES
View4: Valve configuration	☐ 1 ST_REV ☐ 13 FINAL_VALUE_RANGE ☐ 14 POSITION_LIMITS ☐ 15 FINAL_VALUE_CUTOFF_HI ☐ 16 FINAL_VALUE_CUTOFF_LO ☐ 20 CUSTOM_CONTROL_SET ☐ 23 TRAVEL ☐ 41 XD_FSTATE ☐ 46 READBACK_SELECT ☐ 88 OPEN_STOP_ADJUSTMENT ☐ 89 SETPOINT_SOURCE
View4.1: Pressure range configuration	☐ 1 ST_REV ☐ 50 PRESSURE_RANGE
View4.2: Position and travel alert status and configuration	☐ 1 ST_REV ☐ 25 DEVIATION_ALERT ☐ 26 POSITION_HIHI_ALERT ☐ 27 POSITION_HI_ALERT ☐ 28 POSITION_LO_ALERT ☐ 29 POSITION_LOLO_ALERT ☐ 30 TRAVEL_ACCUMULATION_A_ALERT ☐ 31 TRAVEL_ACCUMULATION_B_ALERT
View4.3: Position and travel alert continued	☐ 1 ST_REV ☐ 33 CYCLE_COUNTER_A_ALERT ☐ 34 CYCLE_COUNTER_B_ALERT ☐ 38 NEAR_CLOSED_ALERT ☐ 40 SETPOINT_TIMEOUT_ALERT ☐ 97 WORKING_TIME_ALERT
View4.4: Pressure temperature and current alerts	☐ 1 ST_REV ☐ 51 SUPPLY_PRESSURE_HI_ALERT ☐ 52 SUPPLY_PRESSURE_LO_ALERT ☐ 53 SUPPLY_PRESSURE_LOLO_ALERT ☐ 61 TEMPERATURE_HI_ALERT ☐ 62 TEMPERATURE_LO_ALERT ☐ 64 IP_DRIVE_CURRENT_HI_ALERT ☐ 65 IP_DRIVE_CURRENT_LO_ALERT

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Appendix L. References

The following is a list of useful references to additional documentation:

- FOUNDATION Fieldbus Application Guide 31,25 kbit/s Intrinsically Safe Systems AG-163 Revision 2.0.
- FOUNDATION Fieldbus Application Guide 31.25 kbit/s Wiring and Installation AG-140 Revision 1.0.
- FOUNDATION Specification Function Block Application Process DOCUMENT: FF-890 REVISION: FS 1.8.

NOTE *Contact FieldComm Group™ for additional information.*

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Appendix M. Continuous Valve Diagnostics Concept

Since its introduction about 20 years ago, FOUNDATION fieldbus has been well accepted by customers for the opportunity it provides for device diagnostics. The device health and status are even more important for the final control elements used in a controlled process – positioners, and analog and discrete output devices.

This document describes the diagnostic features integrated in the SVI FF advanced diagnostic positioner and provides some guidelines how they can be used in applications.

Introduction

Evaluation of the valve/positioner state requires:

1. Appropriate conditions to collect informative data
2. Data collection
3. Data processing

Different measures to estimate the valve health may require different conditions, rate of data collection and often put special requirements on the amount of data collected and speed of data processing. In order to provide the best information, the SVI FF provides three different diagnostic approaches:

- “Off Line Diagnostics” on page 232: Gives a short description of this topic.
- “Off Line Diagnostics” on page 232: Gives a short description of this topic.
- Continuous diagnostics: Gives a detailed descriptions on how continuous diagnostics can be used for estimation of the device status.

Off Line Diagnostics

Off Line diagnostics are used when the application process is not running. Off-line diagnostics procedure execution requires significant changes of valve setpoint, which disturbs the application process.

When off Line diagnostic procedures are executed, the data is collected in the SVI FF positioner at a very high rate (e.g. between 10 and 60 times per second) and then it is uploaded and presented by the SVI FF DTM.

Step Test

The step test evaluates how the positioner is responding on a request to change in the set point significantly for a short time. It gives a good measure of the actuator/valve speed.

Ramp Test

The ramp test measures the relationship between the set point and actual actuator/valve position, when the setpoint is changed at a limited rate.

Signature

The Valve Signature provides a relationship between the actuator pressure and the actuator/valve actual position.

On Line Diagnostics

On Line diagnostic procedures collect data while the valve is running and do not disturb the application process. Special tools are used to collect the data from the valve, evaluate performance and present the information.

DTM

The SVI FF DTM can provide a basic level of online diagnostic by presenting the data from the positioner in numeric or graphical form. You can also export the data for further analysis with external tools.

Valve Aware

Valve Aware provides advanced diagnostic procedures. It collects data from the positioner on a regular basis and stores it for further evaluation without any human interaction. The processing and storage power provided by the contemporary computers detects:

- Change in valve/positioner friction
- Stick slip in the valve
- Changes in dynamic behavior, etc.

Continuous Diagnostics

Continuous diagnostics are executed in the device and continuously evaluate the status of the positioner, the actuator and the valve.

The diagnostics described in this section are implemented in the firmware or in the positioner hardware. Resource and Transducer blocks are used to implement and report the results of the calculations. The problem detection algorithms are running continuously and provide immediate notification for detected events.

The SVI FF positioner can detect two basic groups of events:

- Problems in the positioners performance
- Problems in the actuator/valve control

Positioner Diagnostics

Positioner diagnostics are used to evaluate the state of the positioner itself. The positioner is designed so that it continues to communicate on the fieldbus if the detected problem so allows. A limited number of severe failures detected in the hardware and the positioner may not be able to report when a failure is detected. In this case, the positioner continues to control the valve if possible. If control of the valve is not possible, the positioner de-energizes its output, driving the valve to de-energized position, as defined by the actuator.

As an example: A program memory failure may not allow for the correct execution of software logic and the valve is de-energized. A local LCD failure is reported and control is not allowed.

Processor Failure

Failures in the processor program execution are reported in this group of alerts. Examples of this kind of failure include:

- Program execution failure detected by a watch dog
- Program memory failure
- NV memory failure, etc.

Sensor Failure

This failure is reported when the diagnostic procedures detects problem in the supporting sensors, embedded in the positioner. These are:

- Supply pressure sensor
- Temperature sensor, etc.

Valve Control

Problems detected with valve control are reported in this group. If the actual position cannot be driven to follow the setpoint, a valve control failure is reported. There may be multiple reasons for this failure:

- Problem with the supply pressure
- Obstacle in the valve movement, etc.

Commissioning

This problem is reported if the positioner has not been calibrated. The Find Stops procedure must be executed to clear the problem. If the positioner is shipped installed on the valve, it is factory calibrated and this problem won't occur.

Air Supply

This problem is reported if the supply pressure is out of the spec (most likely too low).

Supporting Hardware

This problem is reported if a failure in one of the supporting accessories is detected:

- Local LCD display
- Remote Position Sensor, etc.

Valve/Actuator Diagnostics

The SVI FF positioner collects information from multiple sensors. This information is used to evaluate the quality of valve and actuator control and the working conditions.

Valves and applications may have significant differences in the expected behavior – e.g. small valves usually are fast and are able to reduce the error between the setpoint and actual position within seconds. Valve wear may be significantly impacted by the content and temperature of the fluid being processed or by the material used to make the valve.

To adjust to the variety of applications, SVI FF positioners provide a set of parameters, which can be modified to adjust to the specifics of the process being controlled. Adjustable alert points and dead bands (where applicable) are provided for the monitored parameters and can be modified from default settings to reflect the specifics of the application.

An alert is set when the monitored value crosses the point defined by the Alert Point and stays active until the alert is cleared or the monitored value is restored to within the expected limits. Dead band can be used to avoid multiple notifications for the same event.

NOTE

In the Transducer block each alert has an Active and Historical bit. Active bit presents the current state of the condition. Historical bit indicates whether the condition occurred in the past. Both are user clearable.

For each alert the SVI FF provides an Alert Counter – a counter indicating how many times the alert happened in the past.

Deviation

Deviation alert is set if the error between the set point and actual position is bigger that the alert limit for the time defined in the alert configuration.

Deviation error can be caused by high valve friction, improper valve tuning, an obstacle in the valve movement, valve stops (e.g. valve seat is reached), supply pressure, etc.

Position

A position alert is set if the actual valve position is out of the expected alert limit. The alert is cleared when the position is within the limits again (including Dead Band).

The position alert is used to detect if the valve is in a Tight Open or Tight Close condition, to detect position sensor slippage or valve plug wear.

If the alert is set to detect a Tight Open or Tight Close condition, the alert count is used to understand how many times the Tight Open or Tight Close was activated.

SVI FF allows configuration of the following position alerts:

- HI HI
- HI
- LO
- LO LO

Some examples of what can cause this are:

- Calibration issues
- Linkage drift
- Drift issues related to valve wear
- Incorrect valve size

Travel Accumulation Alert

Accumulated travel is a good indication for valve wear. SVI FF provides two alerts, which are used to report two different conditions:

- Travel Accumulation A
- Travel Accumulation B

Combined with the travel accumulation trend, this alert is used to schedule valve maintenance procedures.

Cycle Counter

Cycle Counter is another good indication for valve usage and the SVI FF provides two alerts, which are used to report two different conditions:

- Cycle Counter A
- Cycle Counter B

Combined with the Cycle Counter Trend, this alert is used to schedule valve maintenance procedures.

Some examples of what can cause valve cycling are:

- High friction
- Process (setpoint) cycling
- Improper positioner tuning
- Valve controlled near Tight Open/Tight Close limit

Set Point Timeout

When the Transducer block is in Auto mode, a new setpoint is expected from the FOUNDATION fieldbus protocol on a regular basis. This alert is used to detect FF communication problems.

Supply Pressure

Having a steady source of air is essential for the valve/positioner performance. The actual value of the supply pressure is monitored and an alert is set if it is out of the limits. The following limits provide different alerts:

- HI Alert triggered by HI Alert Limit
- LO Alert triggered by LO Alert Limit
- LO LO Alert triggered by LO LO Alert Limit

Temperature

Temperature alerts monitor the positioner temperature and can generate a separate alert if the temperature crosses the High or the Low limit.

IP Current

IP current is used by the pressure control loop to regulate the actuator pressure. Two alerts are user configurable for the application:

- HI IP Current
- LO IP Current

When the valve is in steady state the IP current is in the middle of the expected working range, balancing the supply and exhaust of pressure to the actuator. Having very high or very low values of IP current for long time may be indication of a problem in the pressure control loop – e.g. relay degradation.

Working Time

Working Time is another good indication for valve usage. The SVI FF provides an alert, which is used to report when the valve has been working longer than the value indicated in the Working Time Alert Limit.

Combined with the Travel Accumulation and Near Closed Cycle Accumulation, this alert is used to schedule valve maintenance procedures.

Time Near Closed

Time Near Close is a good indication of possible valve wear, if the alert is too frequent. The Near Close alert is reported only if the valve had been working with a valid set point and in Auto mode. The Near Close alert does NOT count if the device is in Tight Closed Condition.

Not writable for the Standard Diagnostics version.

Supporting Information for Diagnostic Configuration

The SVI FF provides a set of unique parameters, which can assist in diagnostic configuration.

Alert Counters

Alert Counters were briefly discussed in the previous section. A total of 25 counters are provided (one for each alert) to register each alert’s occurrences.

The Alert Counters are writable – You can clear all or each counter individually. Clearing the alert counters may be useful if the alert configuration is changed and to detect whether a particular problem is a recurring issue.

Mins and Maxs

A set of parameters are provided in the Transducer block to register the maximum and minimum value of most dynamic parameters. The extreme values are cleared if the valve is rebooted. Table 35 though Table 38 provides the values being monitored in various areas.

NOTE

The items in these tables can be used as constructive guidelines for alert configuration.

Table 35 - Valve Position Values Monitored

	114-POSITION_EXTREMES	DESCRIPTION
1	FINAL_VALUE_MAX	Max value of Position Setpoint
2	FINAL_VALUE_MIN	Min value of Position Setpoint
3	FINAL_POS_VALUE_MAX*	Max value of Actual Position: Represents a possible calibration issue if the position is above 100% when the valve is fully open.
4	FINAL_POS_VALUE_MIN*	Min value of Actual Position: Represents a possible calibration issue if the position is below 0% when the valve is fully closed.
5	WORKING_SP_MAX	Max value of Characterized Position Setpoint
6	WORKING_SP_MIN	Min value of Characterized Position Setpoint
7	WORKING_POS_MAX	Max value of Characterized Actual Position
8	WORKING_POS_MIN	Min value of Characterized Actual Position

* These two values are useful in determining calibration error: Whether or not the valve is operating at near 105% or near -5%.

Table 36 - Pressure Related Values Monitored

	PRESSURE_EXTREMES	DESCRIPTION
1	SUPPLY_PRESSURE_MAX**	Max value of the Supply Pressure
2	SUPPLY_PRESSURE_MIN**	Min value of the Supply Pressure
3	ACTUATOR_A_MAX	Max value of the Actuator A Pressure
4	ACTUATOR_A_MIN	Min value of the Actuator A Pressure
5	ACTUATOR_B_MAX	Max value of the Actuator B Pressure
6	ACTUATOR_B_MIN	Min value of the Actuator B Pressure
7	PILOT_MAX	Max value of the Pilot Pressure
8	PILOT_MIN	Min value of the Pilot Pressure

** These two values are useful in troubleshooting whether low supply pressure exists. If on valve operation, the supply pressure drops below the 5% range (around spring range), it can indicate that the supply source is insufficient.

Table 37 - Temperature Related Values Monitored

	TEMPERATURE_EXTREMES	DESCRIPTION
1	TEMPERATURE_MAX***	Max value of the temperature in the positioner
2	TEMPERATURE_MIN***	Min value of the temperature in the positioner

*** These two values being out of working range can indicate temperature-based environmental issues.

Table 38 - IP Current Related Values Monitored

	IP_CURRENT_EXTREMES	DESCRIPTION
1	IP_CURRENT_MAX	Max value of the IP current
2	IP_CURRENT_MIN	Min value of the IP current

Alert Log

The SVI FF keeps a log of the detected diagnostic events embedded in the firmware. The last 32 events are logged in the event log, which can be used to understand the sequence of diagnostic events. For example:

1. Event --> Low supply pressure
2. Event --> Position deviation
3. Event --> Position LO
4. Event --> Position LO LO

A timestamp is provided for each event. The time for the event depends on the time distributed on the fieldbus.

When the SVI FF DTM is used to read the events, the DTM extends the number of listed events as it does not overwrite the oldest existing events when it reaches the 33 event (Figure 90).

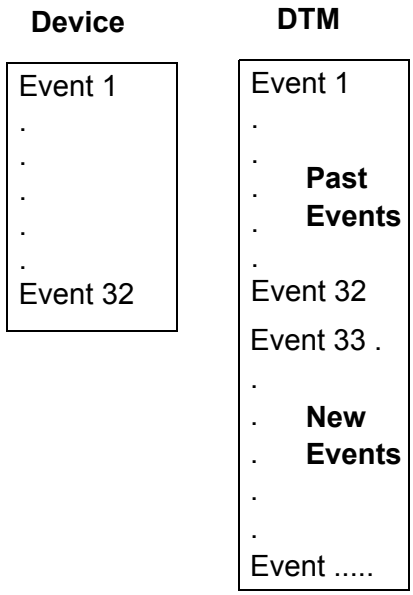

Figure 90 - Device vs. DTM Event Log

Application Specific Categorization

The SVI FF provides another level of configuration, which allows mapping of diagnostic events to one of the following categories of actions:

- Device Failure – You need to take immediate action – the device is failing or may be failing at any moment.
- Device Needs Maintenance Now – You need to schedule maintenance procedure now.
- Device Needs Maintenance Soon – You should schedule maintenance procedure.
- No Action – You have decided that no action should be taken if this alert condition is detected.

Figure 91 illustrates the default configuration for the ALERT_ACTION parameter.

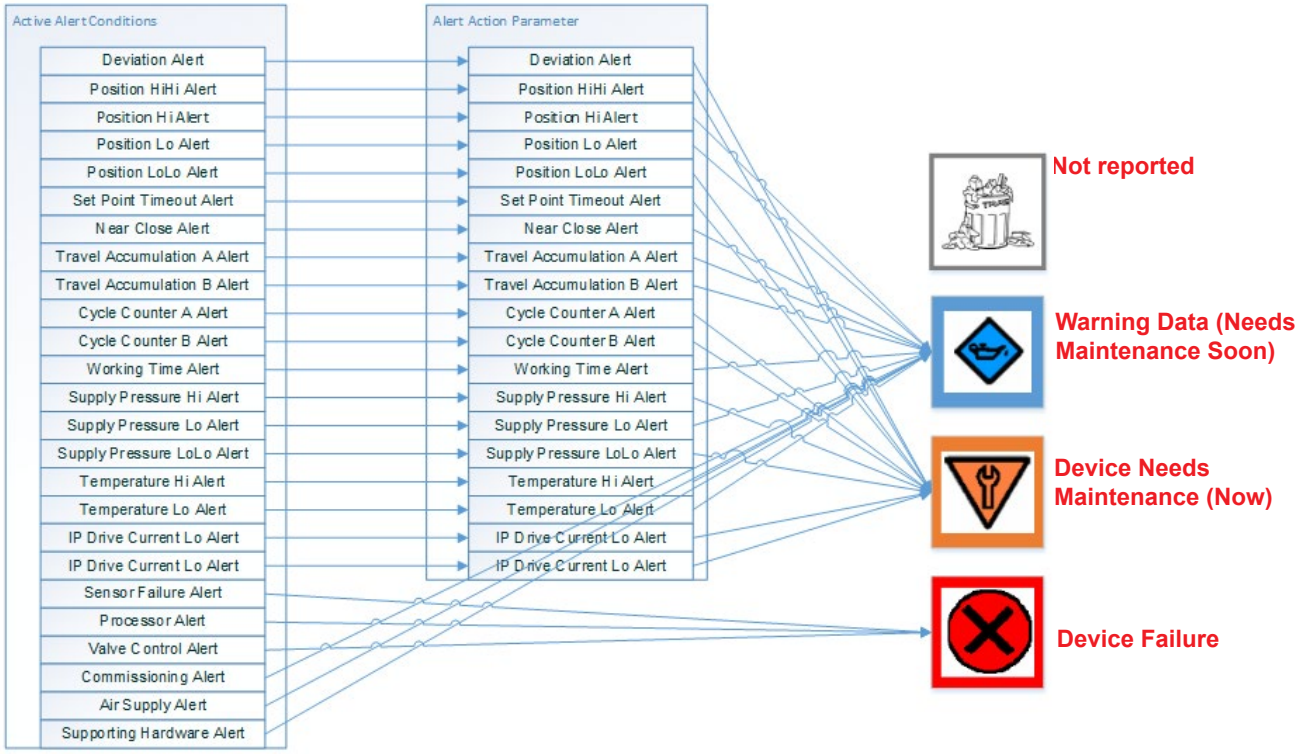

Figure 91 - Configuration for ALERT_ACTION Parameter

You can modify the alert actions related to valve and actuator diagnostic events. As indicated in Figure 91, the positioner specific alert actions are not configurable – they are hard wired to the corresponding notification.

The transducer BLOCK_ERR parameter is used to show the mapping results. For the hosts that do not support Transducer blocks, a special configuration is provided, so that the report is duplicated in resource BLOCK_ERR parameter. This is done though the Alert Action parameter configured to map to the Resource block.

Reporting Diagnostic Condition to the Host

All parameters related to the diagnostic alerts are described in the DDs and can be read by the host at any moment. The SVI FF DTM also provides a detailed graphical presentation about the current and historic diagnostic conditions detected by the device.

Monitoring a significant number of parameters and conditions can create a significant traffic on the bus and may not be convenient. To avoid this, the SVI provides several levels of simplification, which allows reporting the device status to the operator in the plant, but also provides additional details to the device specialists.

Diagnostic Events Reported by Block Error

Setting the parameters in the Block Error parameter provides a good level of abstraction. The detected failure is mapped to one of the bits in BLOCK ERR as follows:

- Device Needs Maintenance Now
- Device Needs Maintenance Soon
- NV Memory Failure, etc.

All hosts monitor the errors reported by the BLOCK_ERR parameter and the information is immediately indicated to the operator with the level of urgency required.

For the hosts that do not support Transducer blocks, the diagnostic indication is duplicated in the resource BLOCK_ERR parameter.

Some DCSs monitor the status of the BLOCK_ERR parameter and automatically generate notification alarms to the operator. Similar device status alarms are also generated if the communication to the device is disturbed or if the DCS detects other device failures.

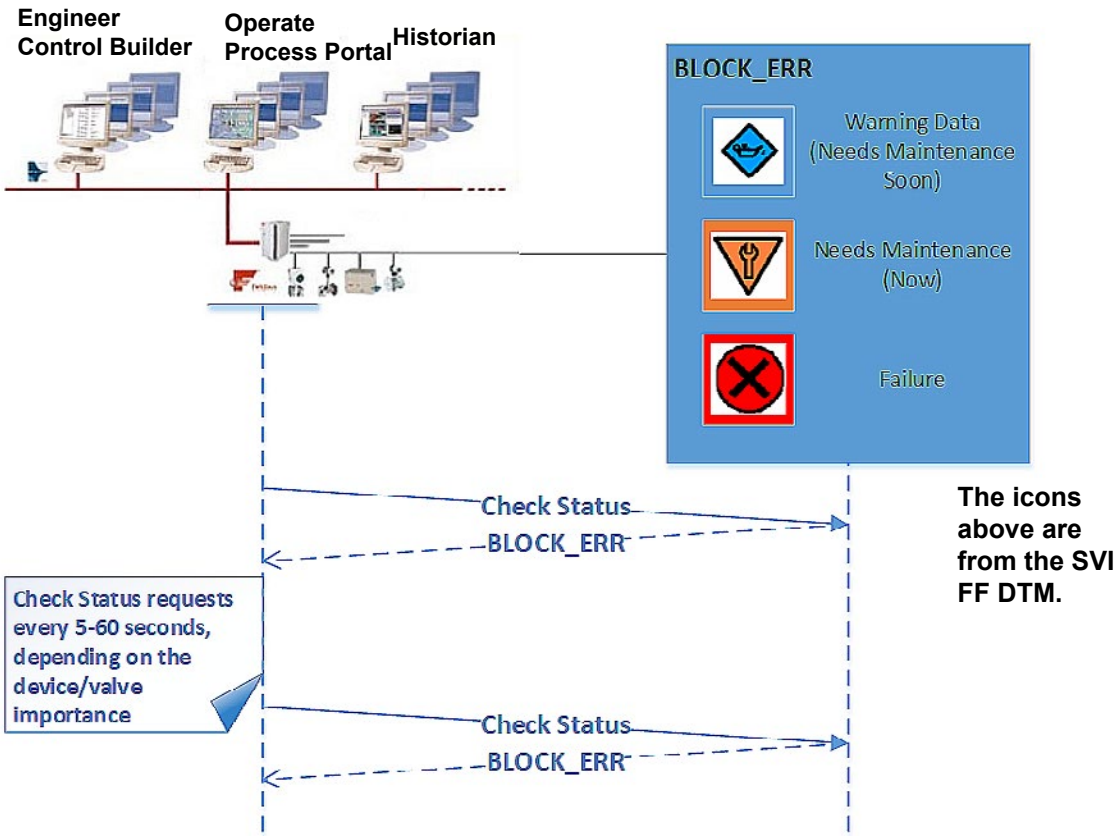

Figure 92 - Diagnostic Events Block Errors

This approach provides a simple and reliable way to monitor the device status. The Block Error parameter is part of the Resource or Transducer block dynamic views and most hosts read the dynamic parameters on a regular basis.

The BLOCK_ERR parameter reports also FF standard errors, including:

- Block Configuration
- Simulate Active
- Memory Failure
- Static Data Lost, etc.

The disadvantage of this approach is that it creates additional traffic on the bus – the host is polling the device on a regular basis.

Diagnostic Events Reported by Alarms

In hosts that support Foundation Fieldbus alarms, the standard block alarm (provided through BLOCK_ALM parameter) is reported when a failure is detected in the device. The block alarm is used for all configuration, hardware, connection failure or system problems in the block and in this case also reports the diagnostic events detected by the positioner. The first alert to become active sets 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 sub code has changed.

Figure 93 illustrates how BLOCK_ALM is generated when a problem is detected in the SVI FF positioner.

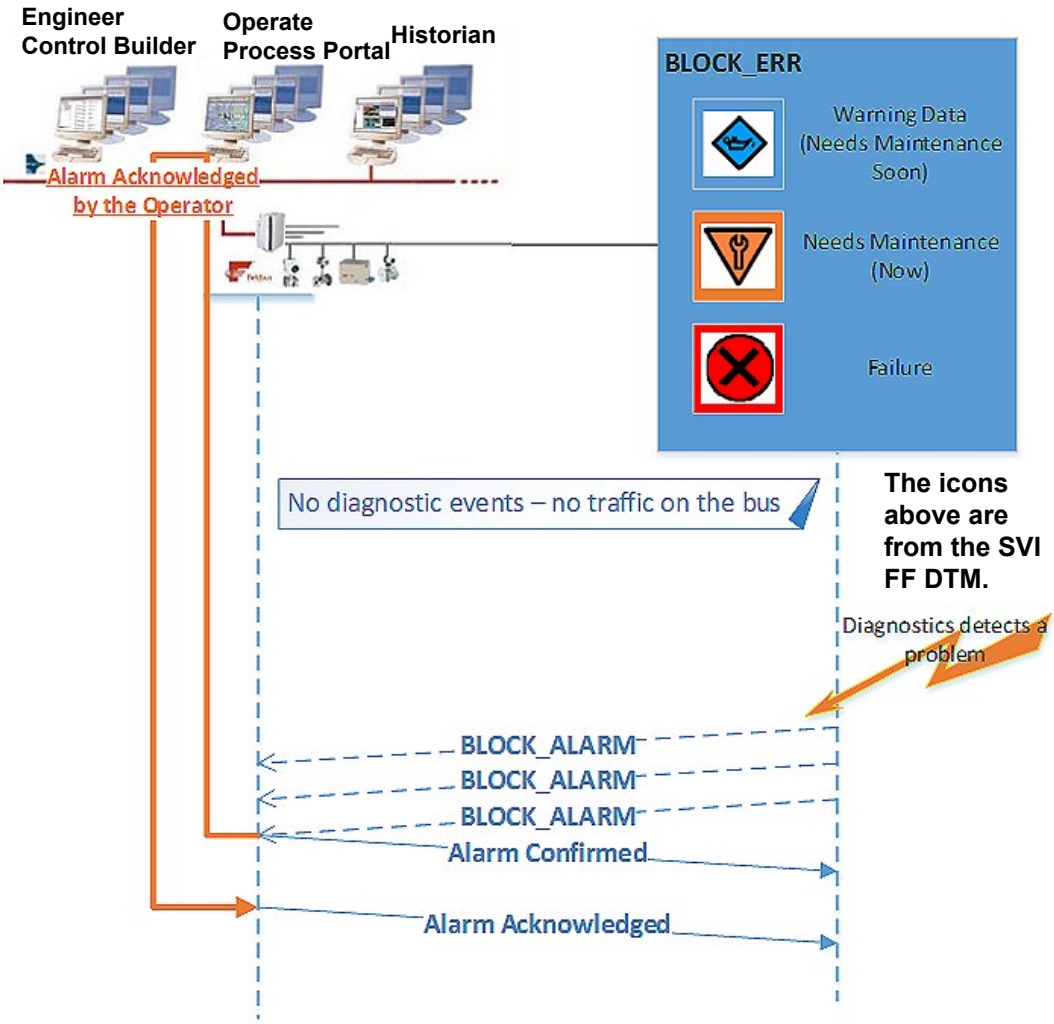

Figure 93 - Diagnostic Events Reported by Alarms

If the failures, detected in the positioner, are mapped to the Resource block, the standard for resource block alarm summary (ALARM_SUM) parameter can be used to enable or disable the alarm notifications.

The SVI FF supports multi-bit alarm notification, which allows for reporting multiple simultaneous alarms, such as Block Alarm/Block Error. Each alarm of a multi-bit alarm is referred to as a *bit-alarm*. Support for multi-bit alarms is specified using the Resource block FEATURES and FEATURES_SEL parameters. When not selected, the behavior of a multi-bit alarm parameter is the same as that specified for the simple alarm parameter behavior of the Block Alarm parameter.

The device status reported through block alarms provides significantly less traffic on the bus – the alarm is reported only when the diagnostic condition is detected.

The BLOCK_ALARM is generated when other standard FF errors are detected, including:

- Block Configuration
- Simulate Active
- Memory Failure
- Static Data Lost, etc.

In practice you must pay special attention to the way alarms are processed by the application. Often, a single device failure triggers a set of application and device alarms (sometimes referred as alarm explosion) and it may be difficult to find the source of the event. Client/Server services are often used to provide additional information.

Diagnostic Events Reported According to *FF-912 Field Diagnostic Profile* Specification

FF-912 – Field Diagnostic Profile specification was created recently to enhance and standardize the device status reporting to the host. It creates a single group of parameters to aggregate all device status and diagnostics so that a Host system can integrate this information into its infrastructure.

Figure 94 from the FF Specification illustrates the basic Field Diagnostic.

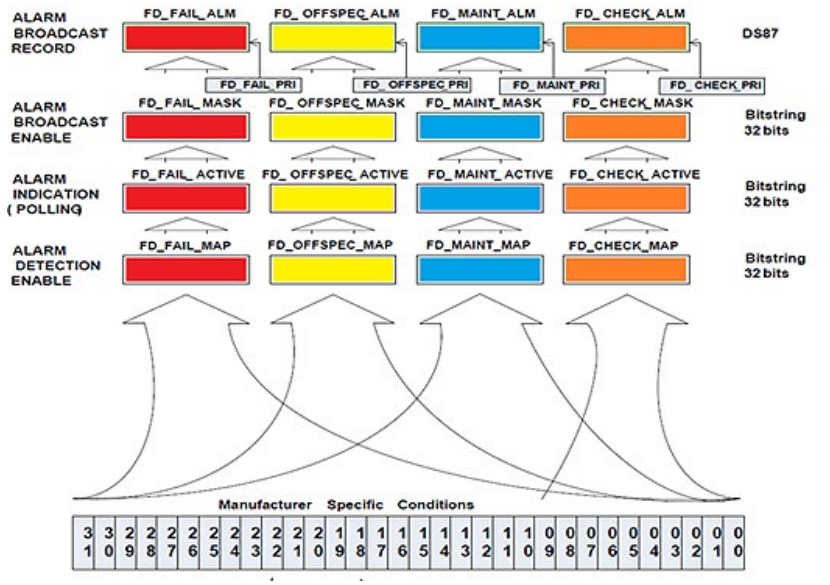

Figure 94 - Basic Field Diagnostic

The SVI FF monitors the specific conditions, as described in “Continuous Diagnostics” on page 233. These conditions are classified by the corresponding MAPs in four different categories and indicated in four different parameters:

- Fail – FD_FAIL_ACTIVE
- Off Spec - FD_OFFSPEC_ACTIVE
- Maintenance Required – FD_MAINT_ACTIVE
- Check Required – FD_CHECK_ACTIVE.

You can then filter the detected condition (FD_XXX_MASK) and the SVI FF populates the corresponding alarm.

The standard Field Diagnostics Profile allows diagnostic conditions to be polled or to be reported as multi-bit alarms if the host system supports that specification.

Figure 95 illustrates how Field Diagnostic Profile parameters can be used in host that polls for diagnostic conditions.

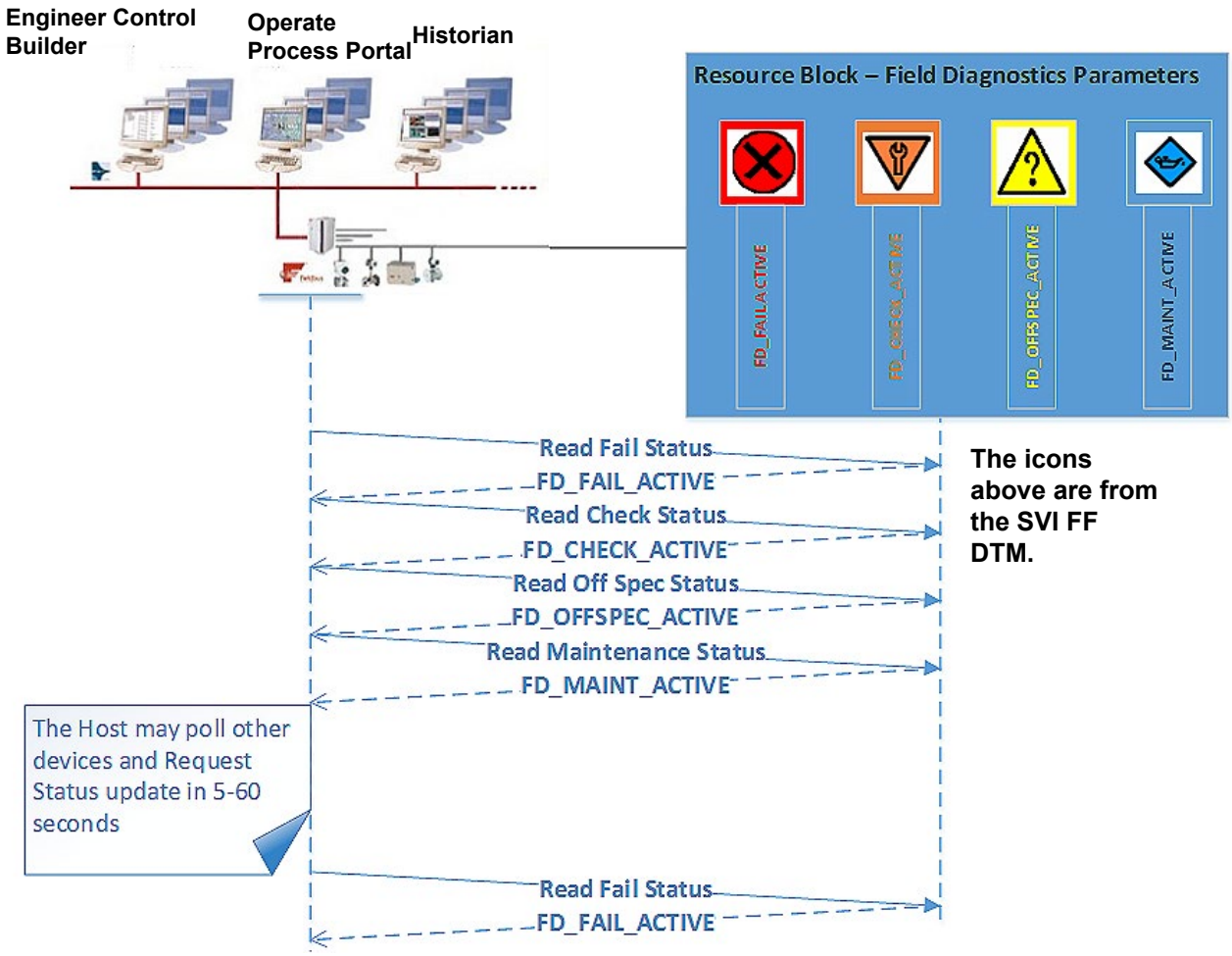

Figure 95 - Host Field Diagnostic Profile Parameters

If the host supports alarms, it can create a publisher subscriber connection to receive alarm notifications when an interesting diagnostic condition is detected. Figure 96 illustrates how SVI FF reports the detected conditions.

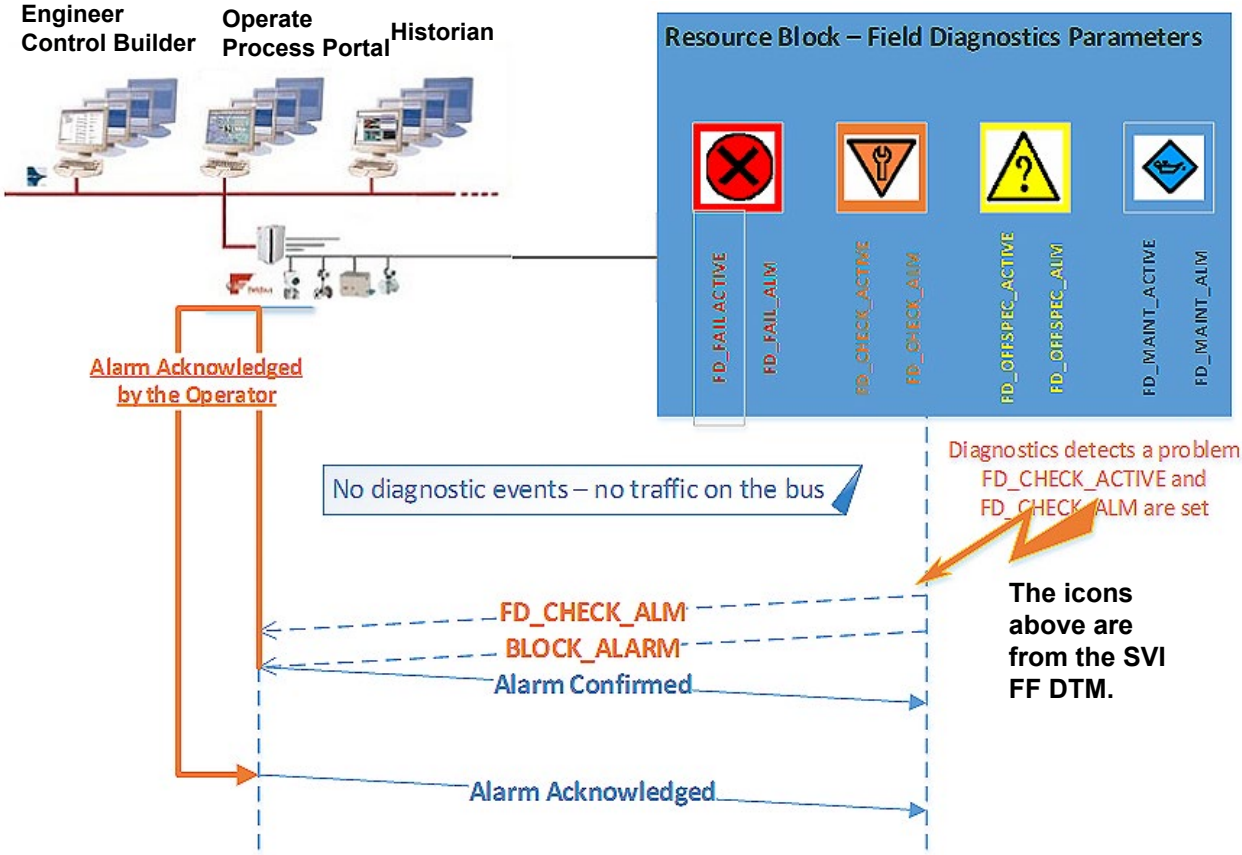

Figure 96 - SVI FF Response to Detected Conditions

Multiple conditions may be reported when device status is reported by Field Diagnostics parameters at the same time.

Discrete Switch Configuration

The SVI FF has a discrete switch (contact) DS1, which can be used to drive external equipment (up to 24 V/1 A). Discrete Switch 1 can be activated if one of the following diagnostic conditions is detected:

- A failure in position control algorithm and the actuator is in Fault (de-energized) State
- The position control algorithm is not In Normal state
- Device Need Maintenance Soon
- Device Needs Maintenance Now
- Air Supply Alert – HI, LO or LOLO alert condition is active
- Travel Deviation Alert
- Position HI Alert
- Position LO Alert
- Position control algorithm has been re-initialized
- Tight cutoff is active

This switch can be used (with minimal external equipment – e.g. one solenoid and no additional logic) to keep the valve in place when the supply pressure drop or when the valve position is above the High Limit and Hi Position Alert is reported.

Processing to DI Block

If you want to detect a discrete condition, but do not want to drive the external contact, a Virtual Switch, VS2, is available in the SVI FF device. VS2 can be configured in a similar way as Discrete Switch 1, the difference being that no physical contact changes - just an internal boolean.

Discrete Switch DS1 or Virtual Switch VS2 can be provided on the fieldbus and additional actions can be taken by the DCS application. For more information see the table *Channels for Discrete Input Blocks* in the *SVI FF Function Blocks Instruction Manual* (GEA31248).

Conclusion

The SVI FF provides a comprehensive mechanism for positioner self-diagnostics and an extensive number of user-configurable procedures for valve and actuator diagnostics.

The detected conditions can be reported to the host in multiple ways, providing flexibility and easy integration of the SVI FF positioner in any host application.

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Appendix N. Changing Out of LO Mode

LO (local override) indicates that someone is working on the device from the local display. Sometimes users forget to switch back the TB to Normal mode and the following results occur:

- ALL commands are ignored from the Fieldbus:
  - DTM
  - DCS
  - Asset Manager
  - DD
  - Handheld
- The only command accepted is Set to Normal.

WARNING

Take care at all times that the positioner is not in or left in LO mode inadvertently, as control commands from other sources can be ignored!

To resolve this problem, you need to have the positioner so that the LCD displays *Normal* so the TB is out of *LO* mode. There are several different methods available to move the positioner out of LO. All of these separate methods work:

- "Local Display"
- "Handheld" on page 253
- "DD Host" on page 258
- "Device DTM" on page 252
- "DD Method" on page 256

WARNING

Switching the display to Normal mode allows the positioner to follow the Setpoint from the TB, which may move the valve.

Local Display

This procedure assumes that you are starting with a display displaying LO mode.

- Press **+** until *Normal* appears (usually *Normal*), then click *****.
  You can verify that the action is complete by observing that the LCD automatically cycles through the pressures and setpoints.

Device DTM

To switch the device display to *Normal* mode from the device DTM:

1. Open the device DTM and ensure that it is in *Connected* state (Figure 97).
2. Set the TB to Manual mode to avoid valve movement, (1. in Figure 97).
3. Select **Positioner State** from the DTM Menu (2. in Figure 97).

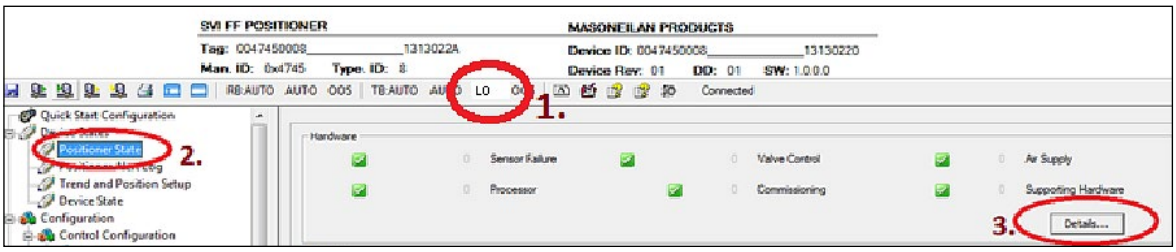

Figure 97 - SVI FF DTM

4. From the *Hardware Group* select **Details . . .** (3. in Figure 97)
   In *Position Control State* group box (at the bottom of the screen) you can see that the device is being setup from the local display (4. in Figure 98).

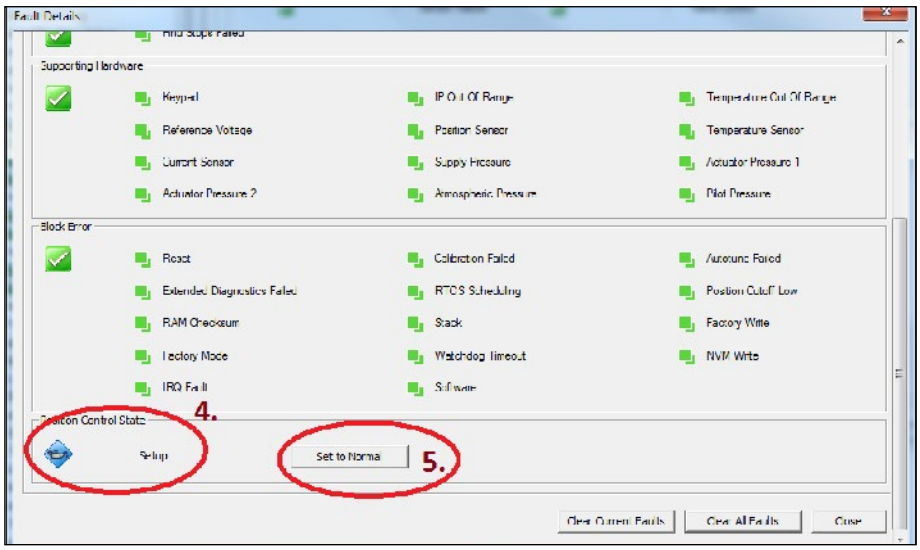

Figure 98 - Position Control State

5. Press **Set to Normal** (5. in Figure 98) to switch the display back to *Normal* mode and the positioner follows the setpoint received from Transducer block. You can verify succes by noting that the TB state is not LO, as in Figure 97.

Handheld

For example, the Emerson 475 as a basis for the procedure. Navigation may differ slightly on other devices.

1. From the FF main screen select **Online**. Press the right button  or double-tap the item.
2. Select the device (Figure 99).

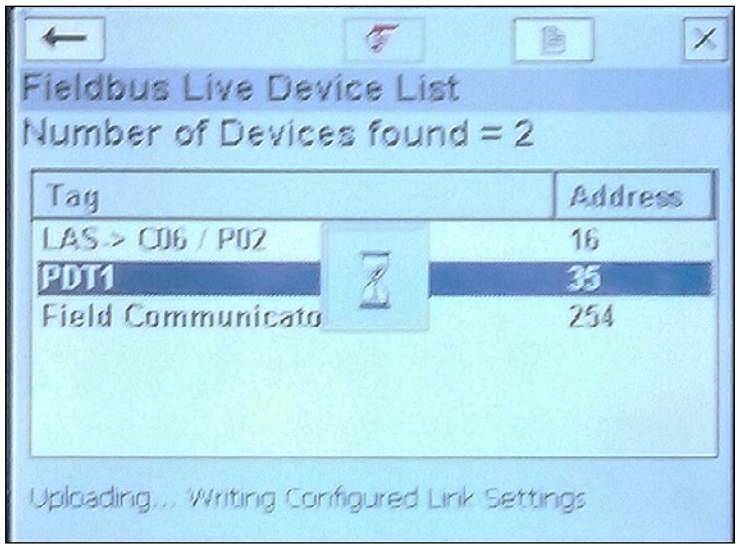

Figure 99 - Device

3. Press the right button  or double-tap the item. The *Block Tag* screen appears (Figure 100).

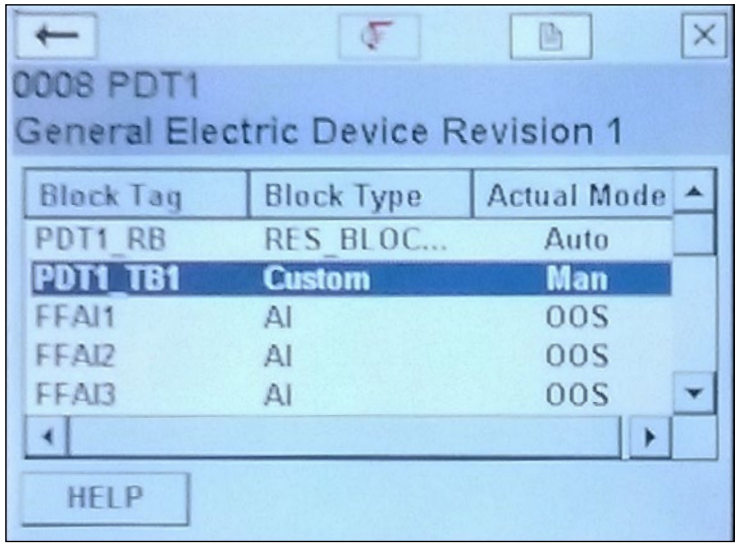

Figure 100 - Block Screen

4. Select **Custom** and press the right button  or double-tap the item.

   The next menu screen appears (Figure 101).

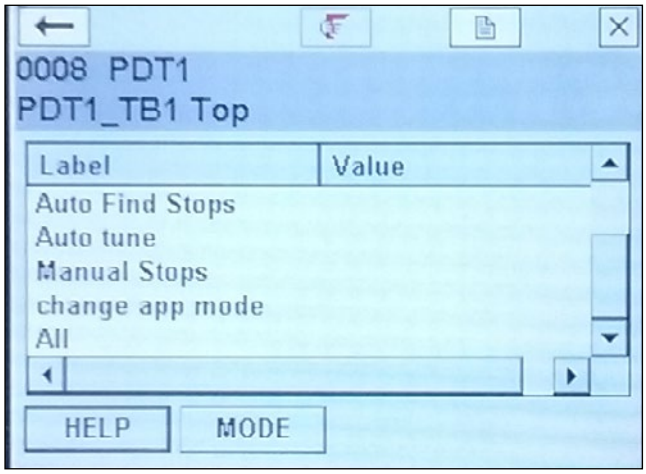

Figure 101 - change app mode

5. Select **change app mode** and the *Block Mode Target* screen appears (Figure 102).

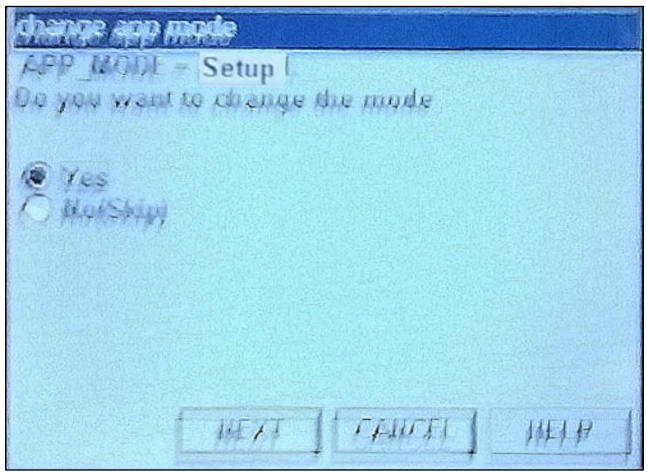

Figure 102 - App Mode Before Changing

6. Select **Next** and the *Change to* screen appears (Figure 103).

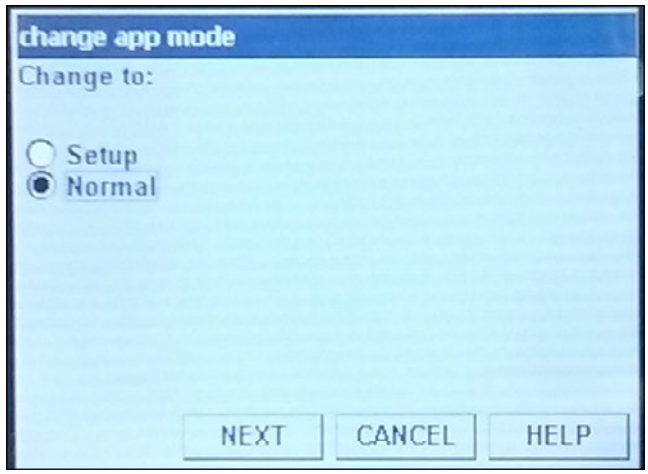

Figure 103 - App Mode Selection

7. Click **Normal**, click **Next** and Figure 104 appears.

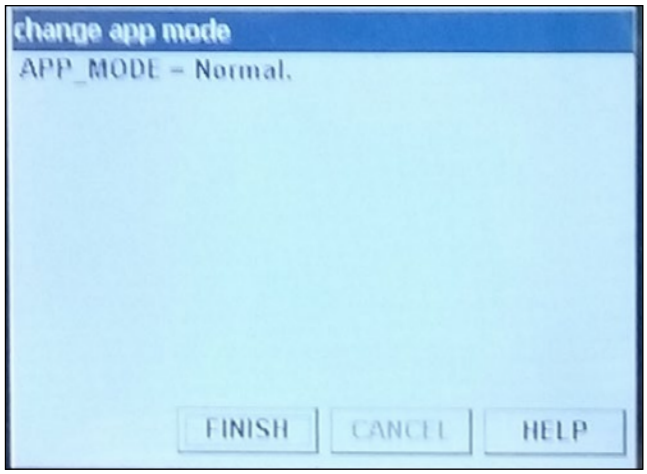

Figure 104 - App Mode Changed

8. Click **Finish**.

DD Method

This section shows an example using the Invensys EVO. The screens may change a bit between programs, however, the text that appears will not. The objective of this procedure is to set the unit to *Normal* mode so that the TB block is changed from *LO* mode to *Normal*.

1. Open the DD host program and navigate to and select the positioner, right-click and select **Methods > change app mode**.

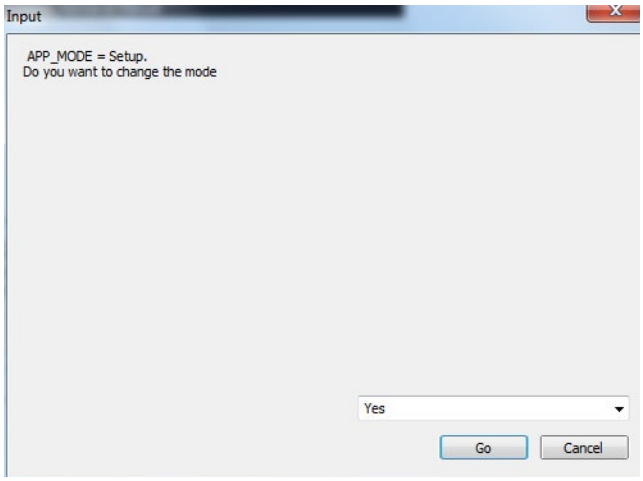

Figure 105 - Initial Mode

It is important to note that the mode indicates *Setup* on the DD screen. This is what appears even when the positioner in *LO* mode.

2. Ensure *Yes* ()is shown in Figure 105, then click **Go** and Figure 106 appears.

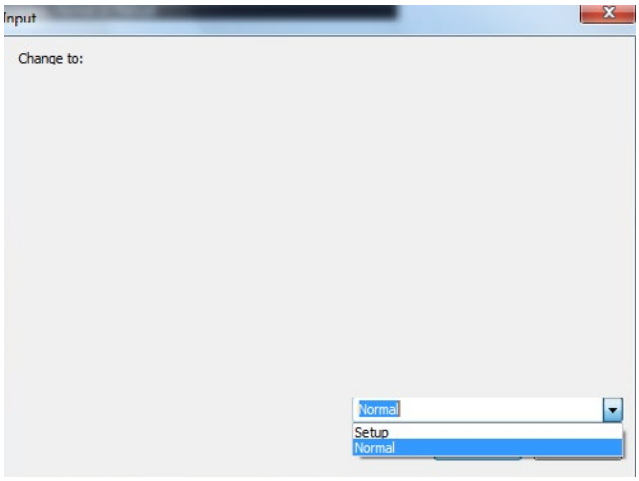

Figure 106 - Mode Selection

3. Select **Normal** in the pulldown, click **GO** and Figure 107 appears.

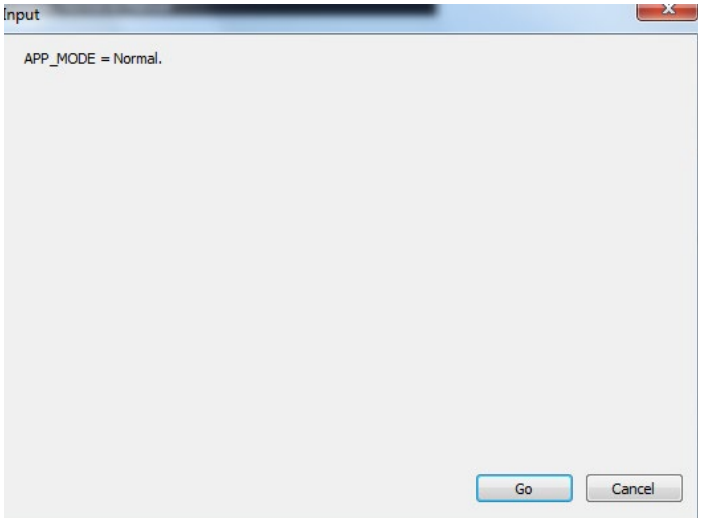

Figure 107 - Mode Changed

4. Click **GO** and Figure108

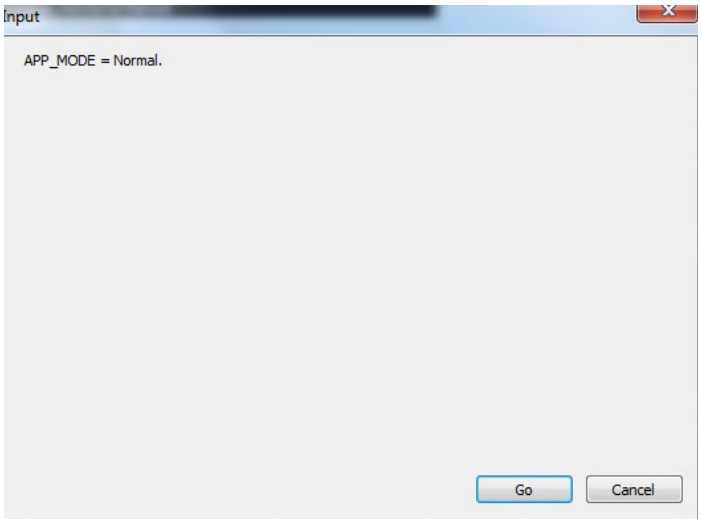

Figure 108 - Mode Confirmed

DD Host

The display mode also can be changed remotely from a DD based host. To switch the display back to normal:

1. Open the device editor in connected mode and navigate to the Transducer block.
2. Verify that the block is in LO mode.
3. Set Target mode to *Manual* to avoid valve movement when the mode is switched.
4. Observe the state of the display/position control by reading *86.APP_MODE* parameter – it should have a value of *Setup* (Figure 109).

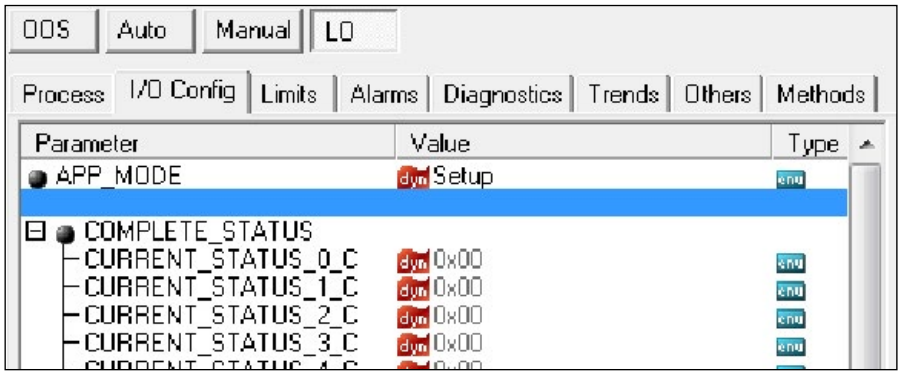

Figure 109 - 86.APP_MODE Parameter

5. From the drop-down menu select **Normal** (Figure 110).

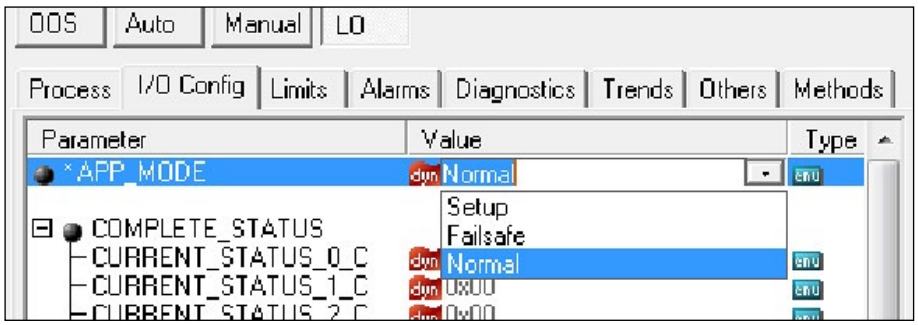

Figure 110 - Select Normal Mode

6. Write the changed value of *APP_MODE* parameter to the device. You can verify success by noting that the mode in is now not *LO*.

Appendix O. Air to Open/Air to Close Configuration

NOTE

Masoneilan strongly recommends that the Transducer block be configured at all times to reflect the actuator state (ATO or ATC). The AO block can be used to reflect the system's control configuration. Ensure that AO block control configuration changes are done by a qualified engineer.

The SVI FF can be used on normal and reverse action actuators. There are two methods you can use to switch the actuator action:

- "Standard DD-based Configuration Tool: Transducer Block - Fail Action Parameter" on page 260
- "SVI FF DTM" on page 261

NOTE

For all methods, the position limits, rate limits, cut off points, alerts and characterization also change accordingly. For example, if the position limit is set to 90%, if you change the setpoint (FINAL_VALUE parameter) the valve will be unable to fully close or open.

Configuring the Transducer block swaps the valve closed and open fail positions. Table 39 lists the *Final_Position_Value* for each configuration and Figure 111 illustrates its workings.

Table 39 - Valve Position Parameter vs. Action

Valve Actual Position	Normal Action	Reverse Action
FINAL_POSITION_VALUE.VALUE = 0	Valve Closed (de-energized)	Valve Closed (energized)
FINAL_POSITION_VALUE.VALUE = 100	Valve Open (energized)	Valve Open (de-energized)

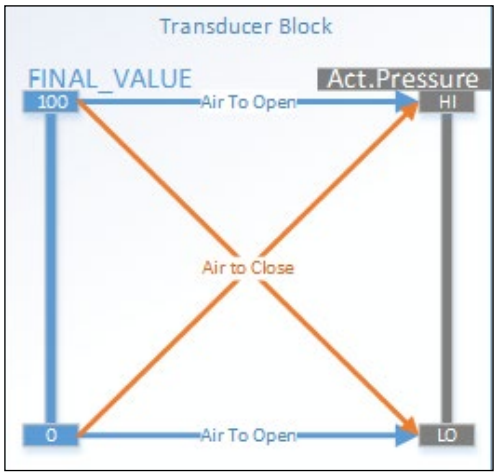

Figure 111 - Transducer Block Open/Close Action vs Final_Value

Standard DD-based Configuration Tool: Transducer Block - Fail Action Parameter

Using this method swaps the closed and open fail positions for the valve. Table39 lists the *Final_Position_Value* for each configuration and Figure 112 illustrates its workings.

You can use a tool such as a DCS configuration station or a handheld to configure the valve in *Normal Action* or *Reverse Action* by setting the transducer block parameter *ACTUATOR_3. ACT_FAIL_ACTION* (Figure112).

Figure 112 - Transducer Block - Fail Action Parameter

SVI FF DTM

An SVI FF DTM user can change the selection in the *Quick Start Configuration* screen. Using this method swaps the closed and open fail positions for the valve. The DTM changes the Transducer block and Table 39 on page 259 lists the *Final_Position_Value* for each configuration.

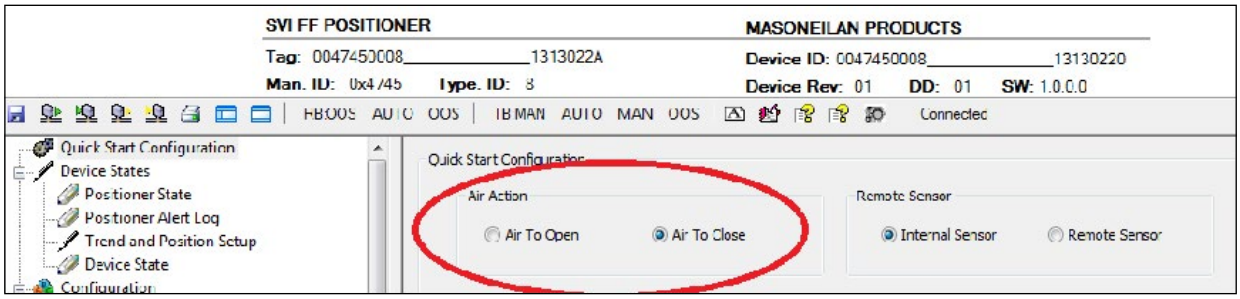

Figure 113 - Select Air Action

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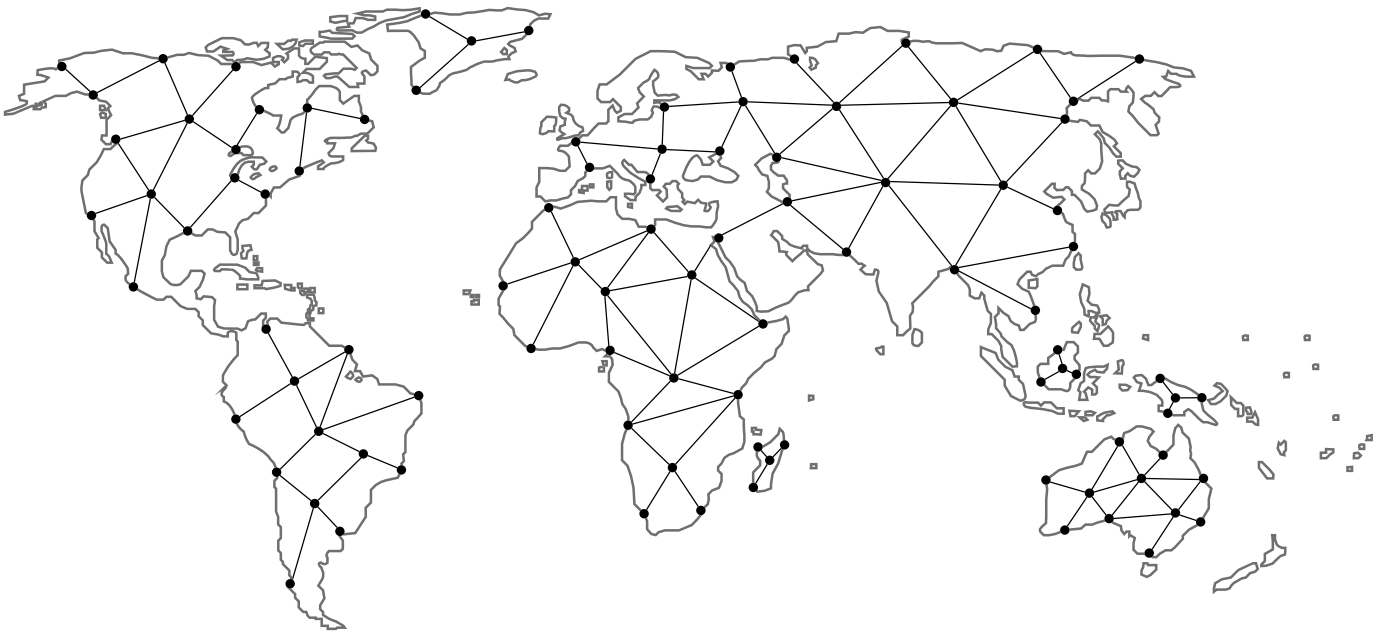

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