FIELDVUE® DVC5000f Series Digital Valve Controllers for FOUNDATION™ fieldbus

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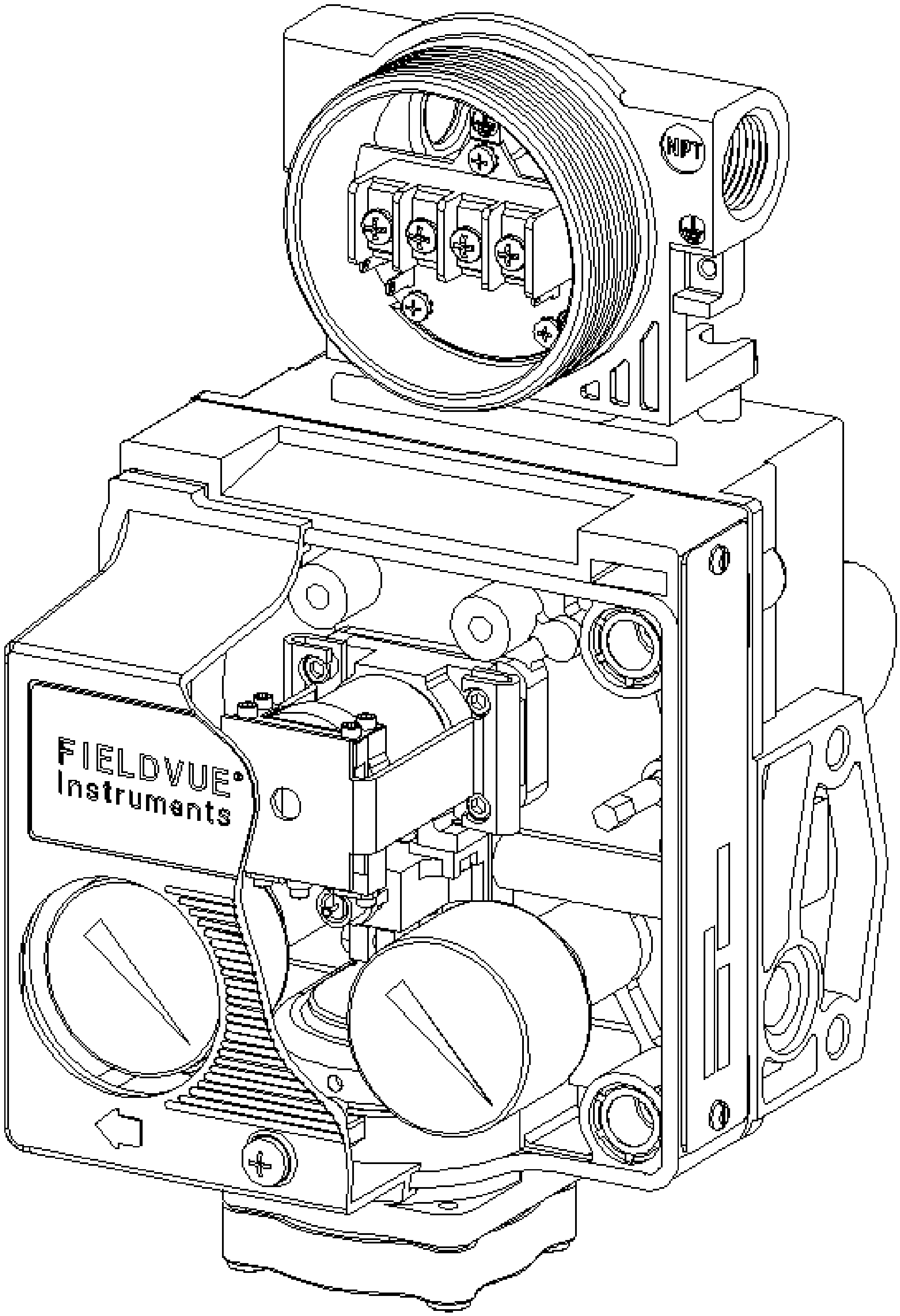

Cutaway View of FIELDVUE® Type DVC5010f Digital Valve Controller Showing Master Module Assembly

Section 1 Introduction

1

Scope of Manual

This instruction manual includes specifications, installation, operating, and maintenance information for the DVC5000f Series digital valve controllers. The manual describes the functionality of FIELDVUE® fieldbus instruments with device revision 7.

This manual describes device setup using the FOUNDATION fieldbus specified DD (device description) parameter access and methods. The display and implementation of these parameters depends upon the host software available. Refer to the applicable host software documentation for information on executing methods and accessing parameters. For information on using the VL2000 Series ValveLink™ software with the instrument, refer to the *FIELDVUE VL2000 Series ValveLink® Software User Guide - Form 5446.*

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

Instrument Description

DVC5000f Series digital valve controllers for FOUNDATION™ fieldbus (figures 1-1 and 1-2) are interoperable, process controlling, communicating, microprocessor-based, digital-to-pneumatic instruments. In addition to the primary function of converting a digital input signal to a pneumatic output, the DVC5000f Series digital valve controller, using FOUNDATION fieldbus communications protocol, gives easy access to information critical to process operation as well as process control. You can gain information from the principal component of the process, the control valve itself, by using a personal computer or operator's console within the control room.

Using a compatible fieldbus configuration device, you can obtain information about the health of the instrument, the actuator, and the valve. You can also obtain asset information about the actuator or valve manufacturer, model, and serial number. You can set input and output configuration parameters and calibrate the instrument.

Using the FOUNDATION fieldbus protocol, information from the instrument can be integrated into control systems.

The DVC5000f Series digital valve controller is designed to directly replace standard single-acting valve mounted positioners.

Figure 1-1. Sliding-Stem Control Valve with Type DVC5010f Digital Valve Controller

Figure 1-2. Rotary Control Valve with Type DVC5020f Digital Valve Controller

Device Description and Methods

FOUNDATION fieldbus technology uses Device Descriptions (DD) and function blocks to achieve interoperability between instruments and control systems or hosts from various manufacturers. The DD provides information to describe the data interface to the device.

For fieldbus devices, in addition to providing parameter definitions and other information required by the control system to communicate with the fieldbus device, the DD may also include methods. Methods can be used for a variety of functions including automatic calibration, setting protection, setting up the instrument, etc. These methods are a predetermined sequence of steps for information required to setup, calibrate, and perform other functions on the instrument. How the method prompts and how messages appear is determined by the host system. For information on using methods on the host system, see the appropriate host system documentation.

The following methods are provided with the DVC5000f Series Device Description: Setup Wizard, Stabilize/Optimize, Restart, Protect Transducer Data, Input Characterization, Auto Travel Calibration, Manual Calibration, Cal Tvl Sensor, Pressure Sensor Cal, Store/Restore Data, and Stroke Valve. Following is a brief description of each of these methods.

The Setup Wizard and Stabilize/Optimize methods are only available via the transducer block and are described in detail in section 3.

- **Setup Wizard**—The Setup Wizard performs the initial setup and calibration of the instrument. Note: this method includes the ability to invoke the Auto Travel Calibration method discussed below. The Setup Wizard can also invoke the Stabilize/Optimize method.

- **Stabilize/Optimize**—The Stabilize/Optimize method is used to adjust the instrument tuning sets to improve performance of the final control system. It provides an interface to the instrument that integrates several parameters used during the stabilization process.

The Restart method is only available via the resource block and is described in detail in section 4.

- **Restart**—The Restart method is required for restarting the instrument without removing power. It also allows the user to set data within the instrument to its default state. In addition to restarting the instrument, this method also performs instrument integrity tests to verify that it is ok to Restart the instrument.

The Protect Transducer Data and Input Characterization methods are available only via the transducer block and are described in detail in section 4.

- **Protect Transducer Data** —The Protect Transducer Data method is required for changing transducer block data protection.

- **Input Characterization**—The Input Characterization method provides a mechanism for setting the instrument input characterization, including the custom array. This method provides the user a simple mechanism for setting the parameter and the array, including data integrity checks, data presentation, and command/response processing.

The Auto Travel Calibration, Manual Calibration, Calibrate Travel Sensor, Calibrate Pressure Sensor, and Store/Restore Data methods are all available via the transducer block and are described in detail in section 5.

- **Auto Travel Calibration**—The Auto Travel Calibration method is required to automatically calibrate the instrument travel. It is provided as an independent method and is also a part of the Setup Wizard. The Auto Travel Calibration method, as it is included in the Setup Wizard, is also described in detail in Section 3.

- **Manual Calibration**—The Manual Calibration method is required to manually calibrate the instrument travel.

- **Cal Tvl Sensor**—The Cal Tvl Sensor method is available to calibrate the travel sensor when the instrument is mounted on a competitive actuator or when the travel sensor is replaced.

- **Pressure Sensor Cal**—The Pressure Sensor Cal method is required to calibrate the internal pressure sensor information for display to the user.

- **Store/Restore Data**—The Store/Restore Data method is used to restore data in either the factory data or Field Setup section of Non-Volatile Memory (NVM). Store/Restore Data can also be used to store the current data into the Field Setup section of NVM.

- **Stroke Valve**—The Stroke Valve method can be used to remotely stroke the valve via the host system. This method is available via the transducer block and is described in detail in section 8.

To use the DDs they must be installed on the host system. For information on installing the DDs, see Appendix F.

1

Displaying the Device Description Version and Compatibility

You can use the DD Version method to display the version and compatibility information for the device descriptions installed on the system. The DD Version method is included with the device description (DD) software. For information on using methods, see the host system documentation. This method is available via the resource block (method name About_DD) and the transducer block (method name About_DD_TB).

Start DD Version. After initializing the method displays the following message:

```
DVC5000f Device Description Version

Device Description for DVC5000f Series
Version number: <value>
Dated: <value>
Compatibility: <value>
File Name: <value>

Copyright 1998, 1999, 2000 Fisher
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Please press the enter key to exit this
method.
```

where <value> is the current version, date, and compatibility, and the file name where the DDs are located. This manual applies to the following devices and device descriptions:

- DVC5000f Series AO/PID digital valve controller
  - Device Type: 5400
  - Device Revision: 7
  - Device Description: 1
- DVC5000f Series DO/DI digital valve controller
  - Device Type: 5900
  - Device Revision: 7
  - Device Description: 1

What This Manual Contains

This manual contains the following sections. Each section has its own table of contents. See the appropriate table of contents for the section for a complete listing of the subsections.

Section 1—Introduction: provides the scope of the manual; describes the instrument, DDs (device descriptions), and methods; lists device specifications and sources of other related information.

Section 2—Installation: explains how to mount the instrument on the actuator and how to make pneumatic and electrical connections.

Section 3—Initial Setup and Calibration: explains how to get your FIELDVUE instrument operational and how to automatically calibrate travel using the Setup Wizard. Also explains how to stabilize or optimize performance.

Section 4—Detailed Setup: explains how to modify resource and transducer block parameters to fit the instrument to your application.

Section 5—Calibration: explains how to calibrate your FIELDVUE instrument.

Section 6—Viewing Device Information: describes which resource and transducer block parameters to view to see information about the instrument.

Section 7—Principle of Operation: explains how the FIELDVUE DVC5000f Series instruments work.

Section 8—Maintenance: provides information for troubleshooting and maintaining your FIELDVUE instrument.

Section 9—Parts: lists parts kits and replaceable parts for your FIELDVUE instrument.

Section 10—Loop Schematics: contains loop schematics for installing your FIELDVUE instrument in intrinsically safe installations.

Appendix A—Function Block Overview: describes function blocks that are common to all FOUNDATION fieldbus devices. It also describes specific attributes of each function block and provides examples of how function blocks work together to complete measurement and control tasks.

Appendix B—Analog (AO) Function Block: describes the operation and parameters of the analog output function block

Appendix C—PID Function Block: describes the operation and parameters of the proportional-plus-integral-plus-derivative function block.

Appendix D—Discrete Input (DI) Function Block: describes the operation and parameters of the discrete input function block.

Appendix E—Discrete Output (DO) Function Block: describes the operation and parameters of the discrete output function block.

Appendix F—DD Installation: explains how to install the device description (DD) software for the FIELDVUE DVC5000f Series digital valve controllers on your host system.

Appendix G—Operation with Fisher-Rosemount DeltaV™: provides specific instructions for performing basic configuration operations on the DVC5000f Series digital valve controller using the Fisher-Rosemount DeltaV host system.

Appendix H—Block Parameter Index: lists, by parameter name, the block parameters discussed in this manual. This list also includes a page number where more information about the parameter may be found.

Glossary—Contains definitions, acronyms, and abbreviations of terms.

Related Information

Fieldbus Installation and Wiring Guidelines

This manual describes how to connect the fieldbus to the digital valve controller. For a technical description, planning, and installation information for a FOUNDATION fieldbus, refer to the *FOUNDATION Fieldbus Technical Overview* available from the fieldbus FOUNDATION and the *Fieldbus Supplement to Installing Your DeltaV Scalable Process System* available from your Fisher Controls sales office or sales representative.

Other Related Information

Other documents containing information related to the DVC5000f Series digital valve controllers include:

- *FIELDVUE® DVC5000f Series Fieldbus Digital Valve Controllers (Bulletin 62.1:DVC5000f)*
- *Mounting FIELDVUE® Instruments on Piston Actuators (PS Sheet 62.1:FIELDVUE(B))*
- *FIELDVUE® VL2000 Series ValveLink Software User Guide*
- Fieldbus Technical Overview, Form 8748

Specifications

Specifications for the DVC5000f Series digital valve controllers are shown in table 1-1.

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Table 1-1. Specifications

Electrical Input

Voltage Level: 9 to 32 volts
Maximum Current: 26 mA
Reverse Polarity Protection: Unit is not polarity sensitive
Termination: Bus must be properly terminated per ISA SP50 guidelines

Function Block Suites

Either Fieldbus Logic or Standard Control as follows:
■ Fieldbus Logic (discrete connectivity)
Includes DO and four DI function blocks
■ Standard Control (basic control)
Includes AO and PID function blocks

Digital Communication Protocol

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

Output Signal[1]

Pneumatic pressure as required by the actuator, up to 95% of supply pressure
Minimum Span: 0.4 bar (6 psi)
Maximum Span: 6.2 bar (90 psi)
Action: Direct only

Supply Pressure[1]

Minimum and Recommended: 0.3 bar (5 psi) higher than maximum actuator requirements
Maximum: 6.9 bar (100 psig)

Steady-State Air Consumption[1,2]

At 1.4 bar (20 psig) supply pressure: Less than 0.3 normal m^3/hr (10 scfh)
At 2.4 bar (35 psig) supply pressure: Less than 0.4 normal m^3/hr (15 scfh)
At 4.1 bar (60 psig) supply pressure: Less than 0.6 normal m^3/hr (22 scfh)
At 6.9 bar (100 psig) supply pressure: Less than 0.9 normal m^3/hr (34 scfh)

Maximum Output Capacity[1,2]

At 1.4 bar (20 psig) supply pressure: 7.6 normal m^3/hr (285 scfh)
At 4.1 bar (60 psig) supply pressure: 15.3 normal m^3/hr (570 scfh)

Independent Linearity[1]

±0.5% of output span

Operating Ambient Temperature Limits

–40°C to 80°C (–40°F to 175°F)

Stem Travel (DVC5010f)

0 to 102 mm (4-inches) maximum
0 to 19 mm (0.75-inches) minimum

Shaft Rotation (DVC5020f)

0 to 90 degrees maximum

Electromagnetic Interference (EMI)

Output signal changes less than +/– 0.1% when tested per IEC 801–1 and 801–3, 27 to 1000 MHz with field strength of 30 V/m (volts per meter)

Electrical Classification

Hazardous Area: Refer to Hazardous Area Classification Bulletins 9.2:001 series and 9.2:002.
Housing Classification: NEMA 4X, CSA Type 4X, IEC 60529 IP65

Connections

Supply Pressure: 1/4-inch or R 1/4 NPT female and integral pad for mounting 67CFR regulator
Output Pressure: 1/4-inch or R 1/4 NPT female
Vent (pipe-away): 1/4-inch or R 1/4 NPT female
Electrical: 1/2-inch NPT female, M20 female, or G 1/2 parallel (bottom entrance)

Mounting

Designed for direct actuator mounting. For weatherproof housing capability, the instrument must be mounted upright (terminal box on top) to allow the vent to drain.

Weight

Less than 2.7 Kg (6 lbs)

Options

■ Supply and output pressure gauges ■ Integrally mounted filter regulator

1. Defined in ISA Standard S51.1.
2. Normal m^3/hr—Normal cubic meters per hour at 0°C and 1.01325 bar, absolute; Scfh—Standard cubic feet per hour at 60°F and 14.7 psia.

Section 2 Installation

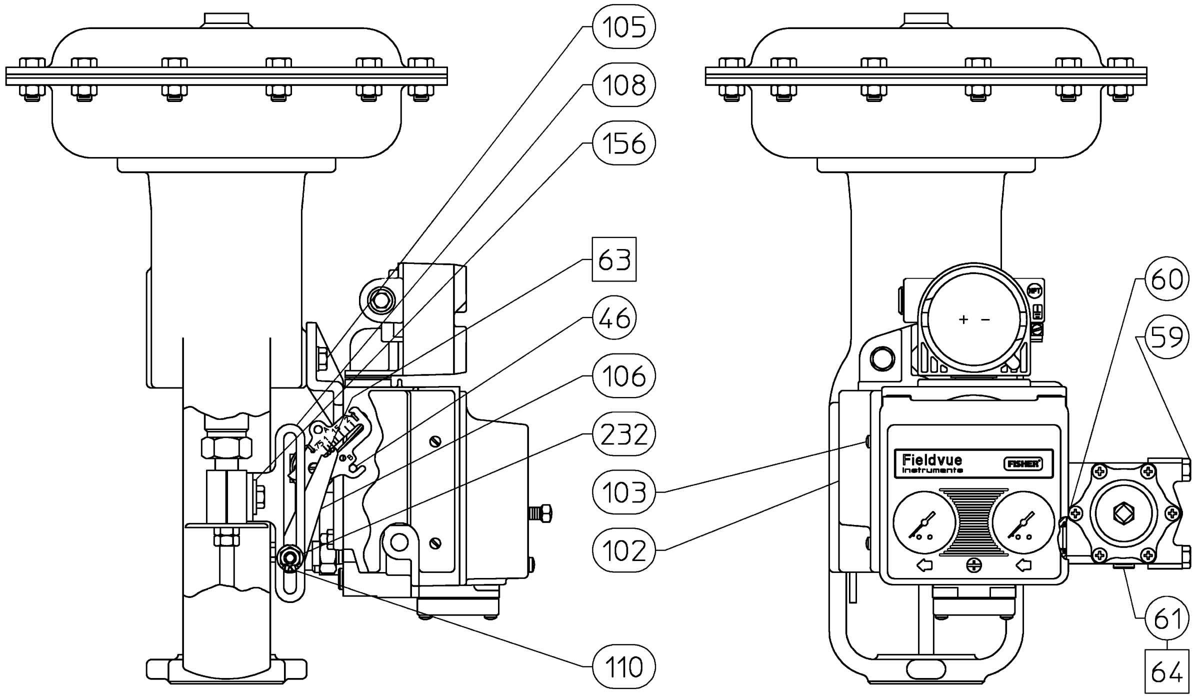

Figure 2-1. Type DVC5010f Digital Valve Controller with Integrally Mounted Filter Regulator Yoke-Mounted on Type 657/667 Size 30-60 Actuator

Mounting

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before mounting the DVC5000f Series digital valve controller:

- **Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**
- **Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**

Mounting Type DVC5010f on Fisher Sliding-Stem Actuators

657 and 667 Actuators

Unless otherwise noted, refer to figures 2-1 and 2-2 for key number locations.

WARNING

To avoid personal injury due to the sudden uncontrolled movement of parts, do not loosen the stem connector cap screws on a Type 667 actuator when the stem connector has spring force applied to it. Apply enough pressure to lift the plug off the seat before loosening the stem connector cap screws.

1. Isolate the control valve from the process line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut off all pressure lines to the actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

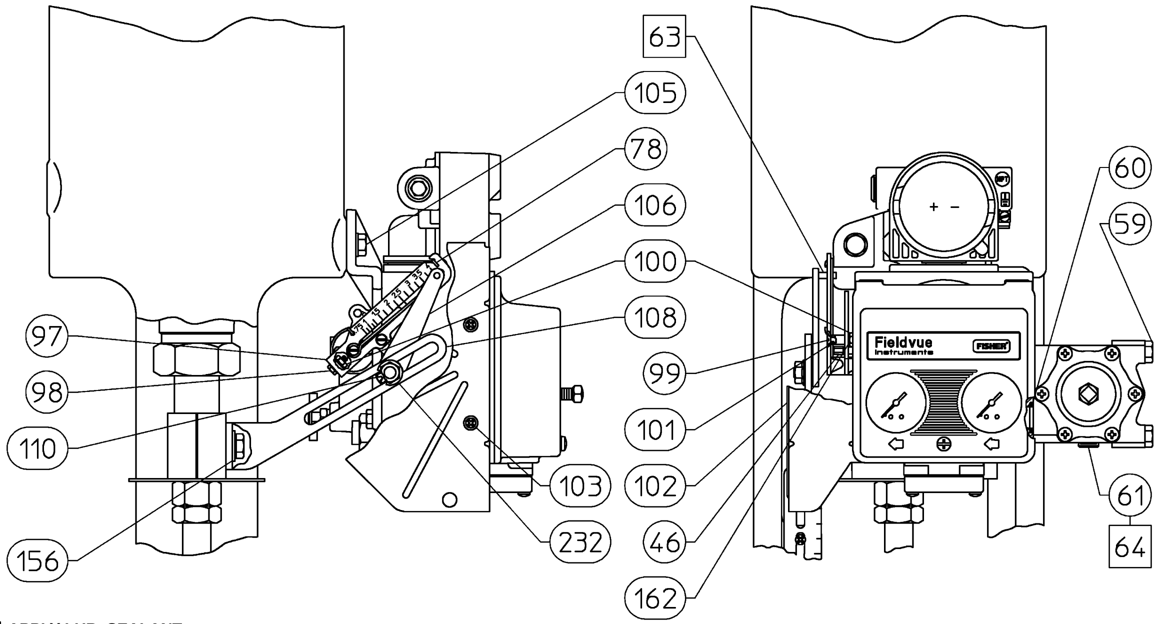

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Figure 2-2. Type DVC5010f Digital Valve Controller with Integrally Mounted Filter Regulator Yoke-Mounted on Type 657/667 Size 70-100 Actuator

2. Attach the connector arm (key 108) to the valve stem connector.

3. Attach the mounting bracket (key 107) to the digital valve controller housing with screws (key 104).

4. If valve travel exceeds 2 inches, a feedback arm extension (key 97) is required. Remove the bias spring (key 78) for up to 2-inch travel from the feedback arm (key 79, figure 9-1). Attach the bias spring (key 78) for up to 4-inch travel to the feedback arm extension. Attach the feedback arm extension to the feedback arm with screw (key 98), screw (key 99), spacer (key 101), lock washers (key 162), and hex nuts (key 100). Remove the pipe plug (key 61) from the output connection on the back of the housing, apply sealant (key 64), and reinstall in the output connection on the side of the housing.

5. Loosely install a hex flange screw (key 105) in the right hole of the lower actuator mounting boss.

6. Position the digital valve controller so the hole in the mounting pad of the mounting bracket goes onto the mounting screw (key 105). Slide the digital valve controller to the left to expose the left hole. Install the left screw (key 105). Tighten both screws (key 105).

Note

The alignment pin (key 46) is stored inside the digital valve controller housing in a threaded hole near the top of the module base.

7. Set the position of the feedback arm (key 79, figure 9-1) on the digital valve controller as follows:

- **For 657 actuators**, insert the alignment pin (key 46) through the slot on the feedback arm marked ‘‘**B**’’.

- **For 667 actuators**, insert the alignment pin (key 46) through the hole in the feedback arm marked “**A**”

8. Apply lubricant (key 63) to the pin of the adjustment arm (key 106). Place the pin into the slot of the feedback arm (key 79) so that the bias spring loads the pin against the side of the arm with the valve travel markings.

9. Install the external lock washer (key 110) on the adjustment arm. Position the adjustment arm in the slot of the connector arm (key 108) and loosely install the washer (key 126) and screw (key 109).

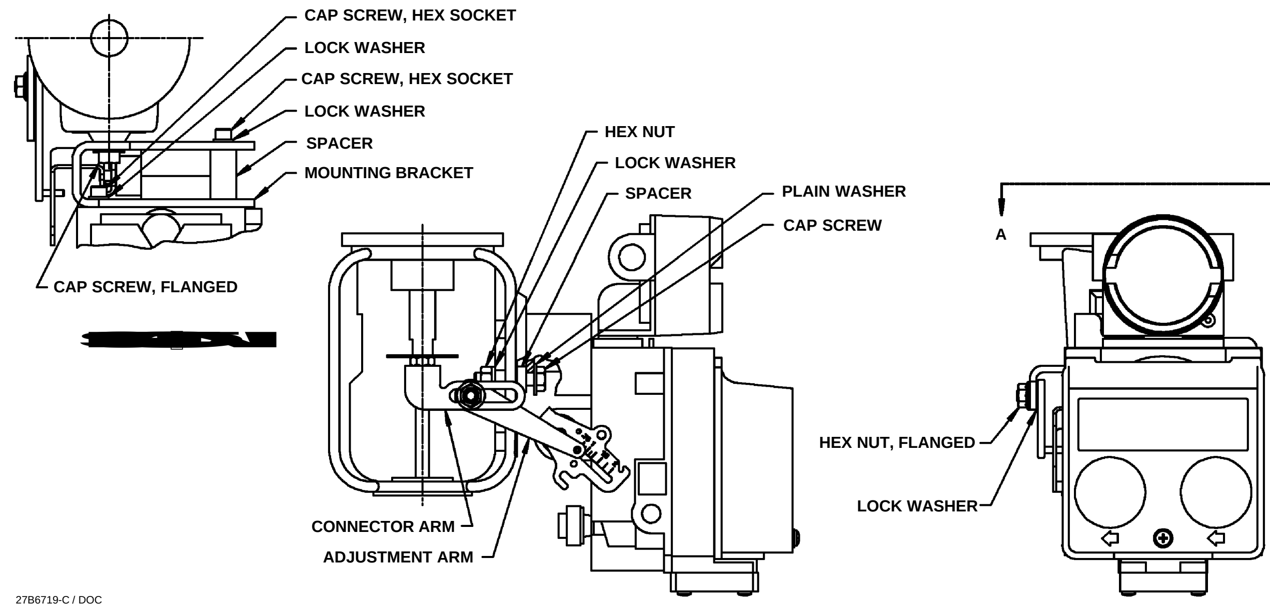

Figure 2-3. Type DVC5010f Digital Valve Controller Mounted on a Baumann Size 32, 54, or 70 Actuator

10. Slide the adjustment arm pin in the slot of the connector arm until the pin is in line with the desired valve travel marking. Tighten the screw (key 109).

11. Remove the alignment pin (key 46) and store it in the module base next to the I/P assembly.

12. Attach the shield (key 102) with two screws (key 103). On Type 657 or 667 size 70-100 actuators, start the screws before installing the shield.

Mounting Type DVC5010f on Other Sliding-Stem Actuators

Baumann Size 32, 54, and 70 Actuators

Refer to figure 2-3 for parts locations.

1. Isolate the control valve from the process line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.

2. If necessary, remount the actuator on the valve so that the pipeline will be perpendicular to the yoke legs to provide clearance for the digital valve controller.

3. Loosen the lower locknut on the valve stem. Slip the connector arm between the locknuts. Tighten the lower locknut against the connector arm.

4. Attach the mounting bracket to the digital valve controller with three cap screws.

5. Position the digital valve controller so the top hole in the mounting bracket mounting pad aligns with the threaded hole in the yoke mounting boss. Start the flanged cap screw with washer in the yoke boss. Do not tighten.

6. Position the digital valve controller so the bottom hole in the mounting bracket mounting pad aligns with the through hole in the yoke leg.

7. Position the spacer between the mounting bracket and yoke leg, then insert the cap screw through the mounting bracket, spacer and yoke leg.

8. Secure the assembly with the washer and hex nut. Align the digital valve controller with the actuator yoke and tighten the hex nut. Tighten the cap screw in the mounting bracket top hole.

Note

The alignment pin (key 46) is stored inside the digital valve controller housing in a threaded hole near the top of the module base.

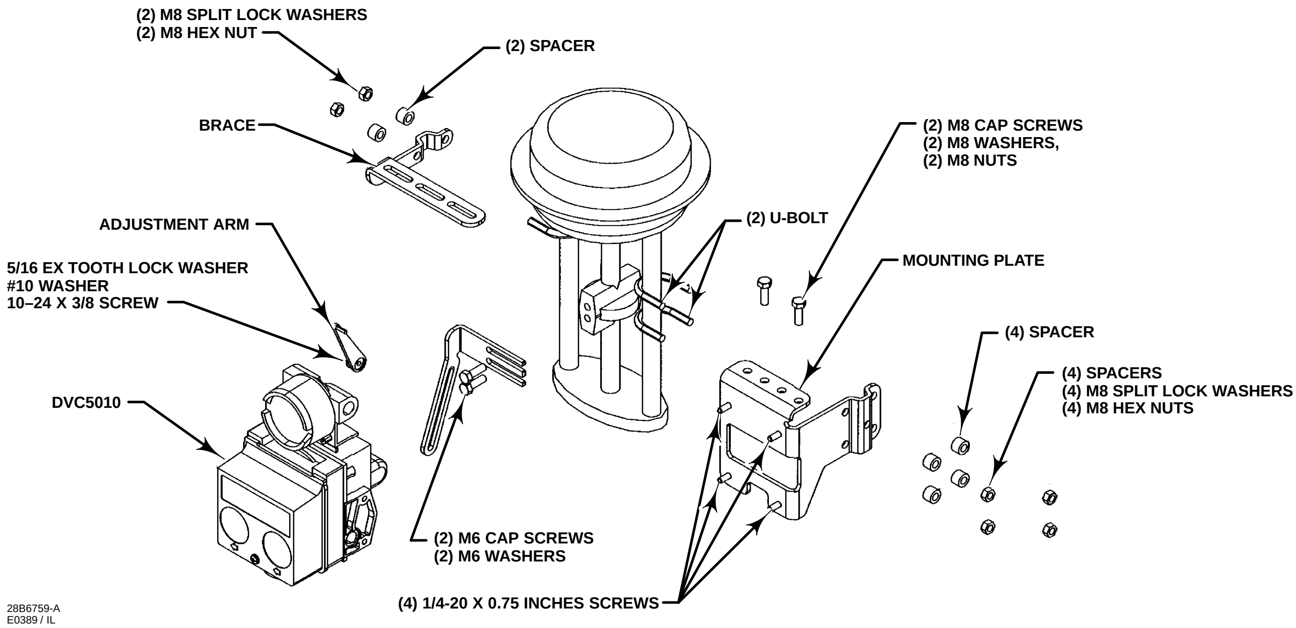

Figure 2-4. Type DVC5010f Digital Valve Controller Yoke-Mounted on Gulde Pneumatic Actuator Type 3024S

9. Set the position of the feedback arm (key 79, figure 9-1) on the digital valve controller as follows:

- **For fail-closed actuators**, insert the alignment pin (key 46) through the slot on the feedback arm marked ‘‘**A**’’.

- **For fail-open actuators**, insert the alignment pin (key 46) through the hole in the feedback arm marked “**B**”

10. Apply lubricant to the adjustment arm pin. Place the pin into the slot of the feedback arm (key 79) so that the bias spring loads the pin against the side of the arm with the valve travel markings.

11. As shown in figure 2-3, loosely fasten the adjustment arm to the connector arm with a machine screw, washer and lock washer.

12. Slide the adjustment arm pin in the slot of the connector arm until the pin is in line with the desired valve travel marking. Tighten the machine screw.

13. Remove the alignment pin (key 46) and store it in the module base next to the I/P assembly.

Gulde Actuators

Refer to figure 2-4 for parts locations.

1. Isolate the control valve from the process line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.

2. Attach the connector arm to the valve stem connector.

3. Attach the mounting bracket to the instrument housing.

4. Loosely attach the mounting bracket to the actuator leg with U-bolts, washers, and hex nuts. Position the digital valve controller vertically so that the terminal box clears the diaphragm casing of the actuator. Tighten the hex nuts, securing the mounting bracket to the actuator leg.

Note

The alignment pin (key 46) is stored inside the digital valve controller housing in a threaded hole near the top of the module base.

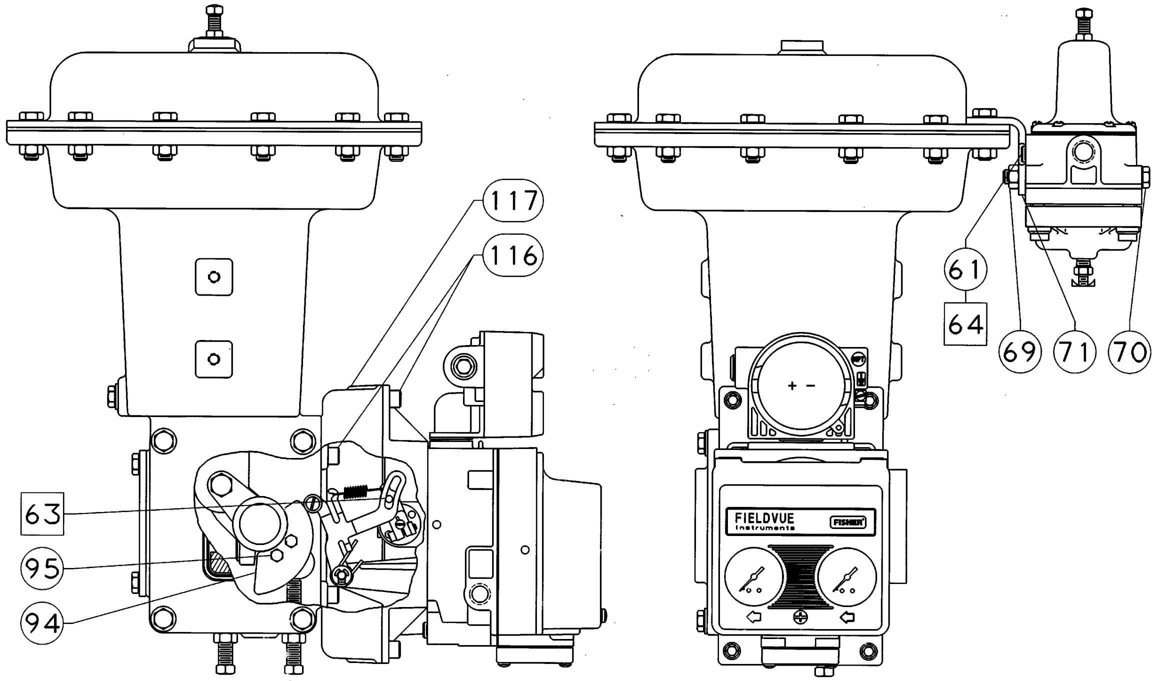

Figure 2-5. Type DVC5020f Digital Valve Controller Mounted on Type 1052 Size 33 Actuator with Casing-Mounted Filter Regulator

5. Set the position of the feedback arm (key 79, figure 9-1) on the digital valve controller as follows:

- **For P_O (air opens) actuators**, insert the alignment pin (key 46) through the hole in the feedback arm marked "**A**"

- **For P_S (air closes) actuators**, insert the alignment pin (key 46) through the slot on the feedback arm marked "**B**".

6. Apply lubricant to the pin of the adjustment arm. Place the pin into the slot of the feedback arm (key 79, figure 9-1) so that the bias spring loads the pin against the side of the arm with the valve travel markings.

7. Install the external lock washer on the adjustment arm. Position the adjustment arm in the slot of the connector arm and loosely install the washer and screw.

8. Loosely attach the brace to the mounting bracket with screws, washers, and hex nuts. Attach the brace to the actuator leg with U-bolts, washers, and hex nuts. Tighten the screws and hex nuts.

9. Slide the adjustment arm pin in the slot of the connector arm until the pin is in line with the desired valve travel marking. Tighten the screw on the adjustment arm.

10. Remove the alignment pin (key 46) and store in the module base next to the I/P assembly.

11. Attach the shield with two screws.

Mounting Type DVC5020f on Fisher Rotary Actuators

1051 and 1052 Actuators

Unless otherwise noted, refer to figure 2-5 or 2-6 for key number locations.

1. Isolate the control valve from the process line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.

Note

Go to step 12 if the actuator already has the cam (key 94) installed.

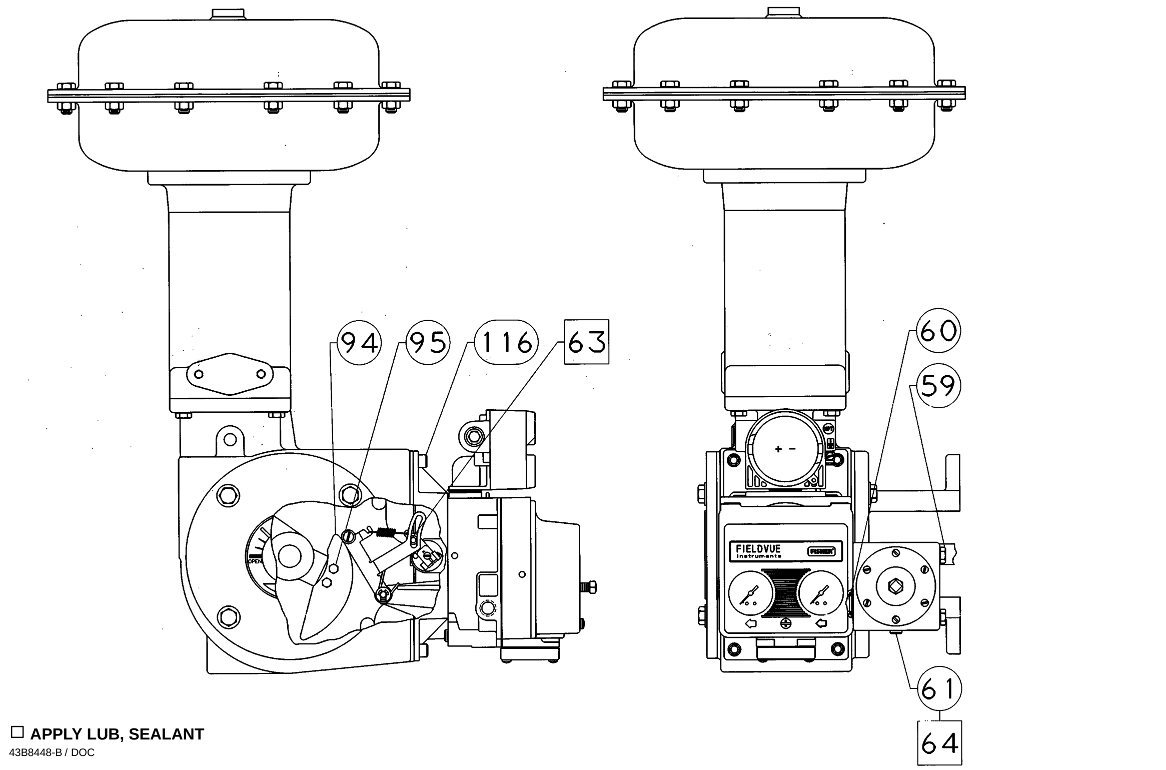

Figure 2-6. Type DVC5020f Digital Valve Controller with Integrally Mounted Filter Regulator Mounted on Type 1051 Size 40 Actuator

2. Mark the positions of the travel indicator and actuator cover. Then, remove the actuator travel indicator machine screws, travel indicator, and actuator cover cap screws.

3. Remove the cover plate from the actuator housing.

Note

For information on the various actuator mounting styles and positions, refer to the appropriate actuator instruction manual.

4. For actuator mounting styles A and D, proceed to the note before step 8. For actuator mounting styles B and C, continue with step 5.

5. Disconnect the actuator turnbuckle from the lever arm.

Note

Do not change the position of the rod end bearing on the end of the turnbuckle.

6. Loosen the lever clamping bolt in the lever.

7. Mark the lever/valve shaft orientation, and remove the lever.

Note

Linear Cam—Cam A has the letter D (direct acting) on one side and the letter R (reverse acting) on the other side. Always install cam A with the letter D on the same side as the cam mounting screw heads (key 95).

8. Install the cam (key 94) on the actuator lever with the cam mounting screws (key 95).

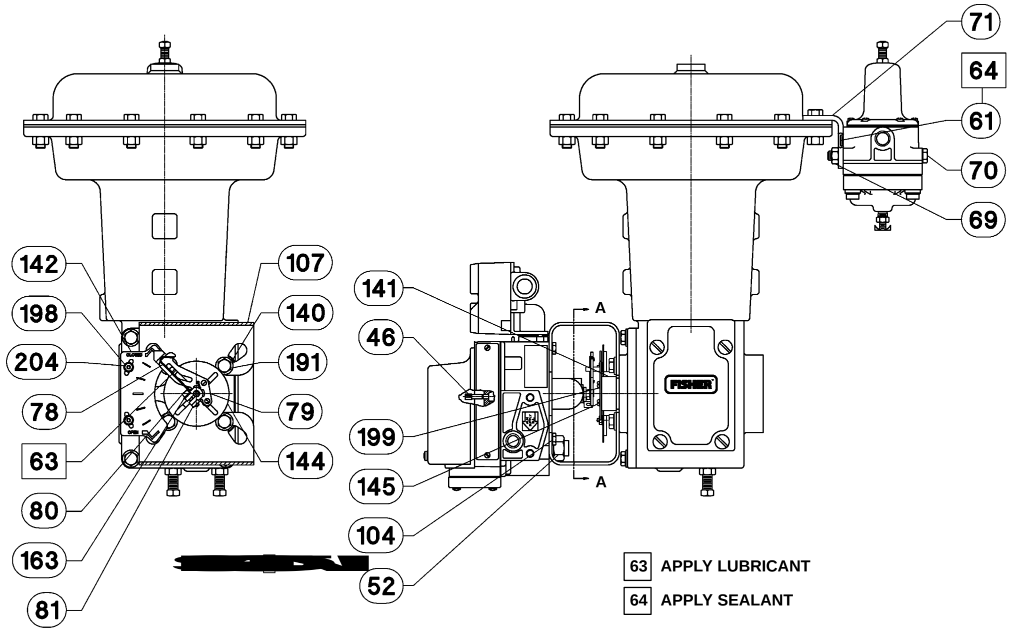

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Figure 2-7. Type DVC5030f Digital Valve Controller Mounted on Type 1052 Size 33 Actuator with Casing-Mounted Filter Regulator

9. For actuator styles A and D, proceed to step 12. For actuator styles B and C, continue with step 10.

10. Slide the lever/cam assembly (cam side first) onto the valve shaft. Orient the lever with the shaft as noted in step 7, and tighten the lever clamping bolt.

Note

Refer to the appropriate actuator instruction manual to determine the distance required between the housing face and the lever face and to determine the proper tightening torque for the lever clamping bolt.

11. Connect the turnbuckle and the lever arm.

12. **For Type 1051 size 33 and 1052 size 20 and 33 actuators,** attach an adaptor (key 117) to the actuator with four screws (key 116). Then assemble the digital valve controller assembly to the adaptor. The roller on the digital valve controller feedback arm will contact the actuator cam as it is being attached. Install and tighten four screws (key 116).

For other size 1051 and 1052 actuators, assemble the digital valve controller assembly to the front access opening of the actuator. The roller on the digital valve controller feedback arm will contact the actuator cam as it is being attached. Install and tighten four screws (key 116).

13. Replace the actuator cover and the travel indicator in the positions that were marked in step 2.

Note

Actuator cover alignment on the Type 1052 actuator can be aided by moving the actuator slightly away from its up travel stop using a regulated air source. If hole alignment cannot be obtained in this manner, temporarily loosen the cap screws that secure the housing to the mounting yoke, and shift the housing slightly. Do not completely stroke the actuator while the cover is removed.

Mounting Type DVC5030f on Fisher Rotary Actuators

1051 Size 33 *and* 1052 Size 20 and 33 *Actuators*

Unless otherwise noted, refer to figure 2-7 for key number locations.

1. Isolate the control valve from the process line pressure, release pressure from both sides of the

valve body, and drain the process media from both sides of the valve. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.

In step 2, refer to the actuator instruction manual for key number locations.

2. Remove the self-tapping screws (key 38) and the travel indicator (key 37). Also remove the self-tapping screws (key 36) and the travel indicator scale (key 35).

Before attaching the mounting bracket and travel indicator assembly, determine the desired position of the travel indicator scale (key 142) relative to the actuator hub (above, below, left, or right). Figure 2-7 shows the travel indicator scale to the left of the actuator hub. The travel indicator scale is not installed at this time. The travel indicator scale is installed in step 11.

3. Position the mounting bracket (key 107) so that the travel indicator scale (key 142) will be in the desired position. The travel indicator scale is not installed at this time; it is installed in step 11.

4. Attach the mounting bracket (key 107) to the actuator using four hex head cap screws (key 191) and washers (key 140).

5. Place the spacer (key 141) on the actuator hub.

6. Attach the travel indicator assembly (key 144) to the spacer as follows:

a. If the valve is open without pressure to the actuator [push-down-to-close (PDTC) actuator mounting], position the assembly so that the pointer on the travel indicator assembly will be over the open mark on the travel scale. Attach the travel indicator assembly (key 144) and spacer (key 141) to the actuator hub using two machine screws (key 145). For size 33 actuators only, also include two washers (key 199), as shown in figure 2-7.

b. If the valve is closed without pressure to the actuator [push-down-to-open (PDTO) actuator mounting], position the assembly so that the pointer on the travel indicator assembly will be over the closed mark on the travel scale. Attach the travel indicator assembly (key 144) and spacer (key 141) to the actuator hub using two machine screws (key 145). For size 33 actuators only, also include two washers (key 199), as shown in figure 2-7.

7. Position the feedback arm (key 79, figure 9-3) so that, when the digital valve controller is mounted on the actuator, the pin on the travel indicator assembly (key 144) will slide into the slot on the feedback arm.

8. Apply lubricant (key 63) to the travel indicator assembly pin (key 144).

9. Position the digital valve controller on the mounting bracket (key 107). Be sure the pin on the travel indicator assembly (key 144) is in the feedback arm slot such that the bias spring (key 78) loads the pin against the side of the slot marked with an X.

10. Attach the digital valve controller to the mounting bracket (key 107) using four hex head cap screws (key 104).

11. Attach the travel indicator scale (key 142) to the mounting bracket (key 107) with two washers (key 198) and hex nuts (key 197). Position the scale so that the OPEN or CLOSED mark is beneath the travel indicator pointer (key 144) and tighten the hex nuts.

1051 Size 30 to 60 *and* 1052 Size 40 to 70 *Actuators*

Unless otherwise noted, refer to figure 2-7 for key number locations.

1. Isolate the control valve from the process line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.

In steps 2 and 3, refer to the actuator instruction manual for key number locations.

2. Remove the self-tapping screws (key 38) and the travel indicator (key 37). Also remove self-tapping screws (key 36) and the travel indicator scale (key 35).

3. Remove the four hex head cap screws (key 34) and washers (key 63) that secure the actuator cover (key 33). Do not remove the cover. Set aside the screws and washers for later use.

Before attaching the travel indicator assembly, determine the desired position of the travel indicator scale (key 142) relative to the actuator hub (above, below, left, or right). Figure 2-7 shows the travel indicator scale to the left of the actuator hub. The travel indicator scale is not installed at this time. The travel indicator scale is installed in step 11.

4. Attach the travel indicator assembly (key 144) to the spacer as follows:

a. If the valve is open without pressure to the actuator [push-down-to-close (PDTC) actuator mounting], position the assembly so that the pointer on the travel indicator assembly will be over the open mark on the travel scale. Attach the travel indicator assembly (key 144) to the actuator hub using two machine screws (key 145).

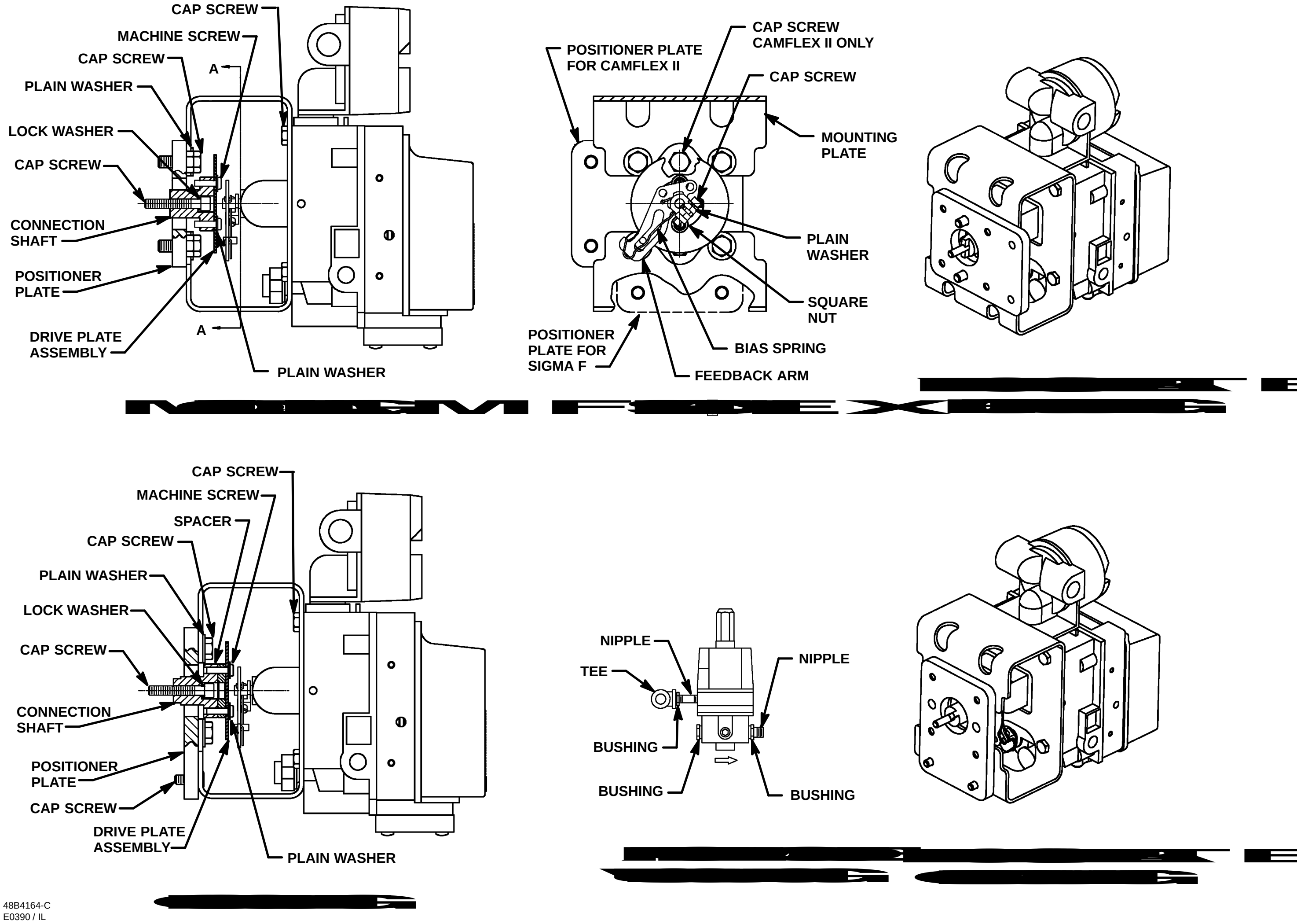

Figure 2-8. Mounting a Type DVC5030f Digital Valve Controller on a Masoneilan Camflex II and Sigma F Actuator

b. If the valve is closed without pressure to the actuator [push-down-to-open (PDTO) actuator mounting], position the assembly so that the pointer on the travel indicator assembly will be over the closed mark on the travel scale. Attach the travel indicator assembly (key 144) to the actuator hub using two machine screws (key 145).

5. Attach the digital valve controller to the mounting bracket assembly (key 107) using four hex head cap screws (key 104).

6. Position the feedback arm (key 79, figure 9-3) so that, when the digital valve controller is mounted on the actuator, the pin on the travel indicator assembly (key 144) will slide into the slot on the feedback arm.

7. Apply lubricant (key 63) to the travel indicator assembly pin (key 144).

8. Position the mounting bracket (key 107), with controller, so that the travel indicator scale (key 142) will be in the desired position. The travel indicator scale is not installed at this time; it is installed in step 11.

9. Be sure the pin on the travel indicator assembly (key 144) is in the feedback arm slot such that the bias spring (key 78) loads the pin against the side of the slot marked with an X.

10. Attach the mounting bracket to the actuator using the four hex head screws (key 34) and washers (key 63) removed in step 3.

11. Attach the travel indicator scale (key 142) to the mounting bracket (key 107) with two washers (key 198) and hex nuts (key 197). Position the scale so that the OPEN or CLOSED mark is beneath the travel indicator pointer (key 144) and tighten the hex nuts.

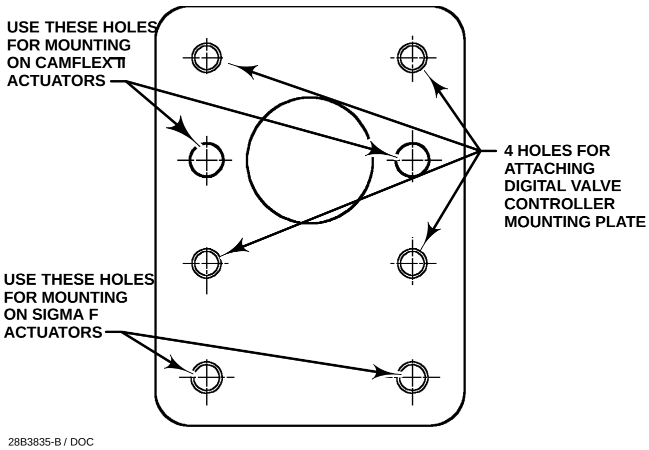

Figure 2-9. Positioner Plate for Mounting Type DVC5030f Digital Valve Controller on Masoneilan Camflex II or Sigma F Actuators

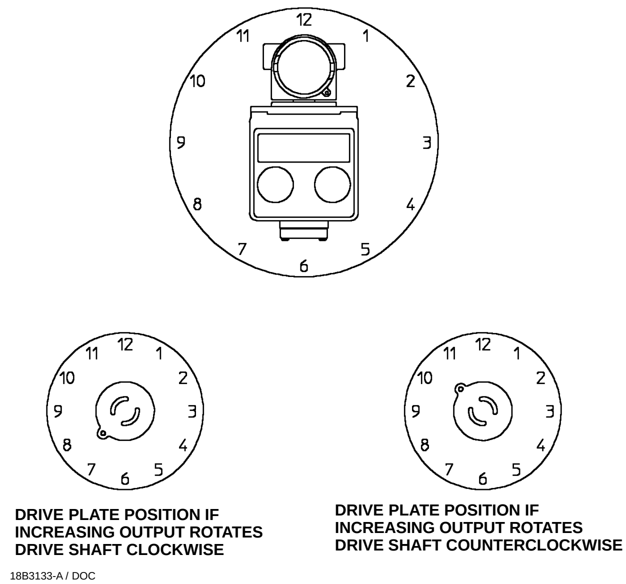

Figure 2-10. Drive Plate Assembly Installation

Mounting Type DVC5030f on Other than Fisher Actuators

Mounting on Masoneilan Sigma F and Camflex II Actuators

Refer to figure 2-8 and the parts list for parts identification, unless otherwise noted.

1. Isolate the control valve from the process line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.

2. Using a 3/16-inch hex wrench, remove the existing hub from the actuator shaft.

3. Attach the coupler to the actuator shaft using the 1/4-28 set screw.

4. Refer to figure 2-9. Attach the positioner plate to the actuator as follows:

- **For Camflex II actuators**, attach the positioner plate with two 5/16-18 x 3/4 inch hex head cap screws.

- **For Sigma F actuators**, attach the positioner plate with two 1/4-20 x 5/8 inch hex head cap screws.

5. Using a 3/16-inch hex wrench, remove the existing hub from the actuator shaft.

6. Attach the shaft connector to the actuator shaft using a 1/4-inch lock washer and 1/4-28 x 1-1/2 inch socket head cap screw.

Refer to figure 2-10. The digital valve controller can mount to the actuator in any one of four possible mounting quadrants. Determine the desired mounting position then proceed with the next step. Considering the top of the digital valve controller as the 12 o'clock position, in the next step attach the drive plate assembly so that the pin is positioned as follows:

- **If increasing digital valve controller output rotates the drive plate assembly clockwise**, position the pin at approximately the 7:30 position.

- **If increasing digital valve controller output rotates the drive plate assembly counterclockwise**, position the pin at approximately the 10:30 position.

7. Attach the drive plate assembly to the shaft connector as follows:

- **For Camflex II actuators**, attach the drive plate assembly to the shaft connector with two no. 8 plain washers and 8-32 x 5/8 inch machine screws.

- **For Sigma F actuators**, position the spacer between the shaft connector and drive plate assembly. Attach the drive plate assembly and spacer to the shaft connector with two no. 8 plain washers and 8-32 x 5/8 inch machine screws.

8. Attach the mounting plate to the digital valve controller with four 1/4-20 x 1/2 inch cap screws.

9. Position the digital valve controller, with mounting plate, over the drive plate assembly. Be sure the pin on the drive plate assembly engages the slot in the feedback arm and that the bias spring loads the pin as

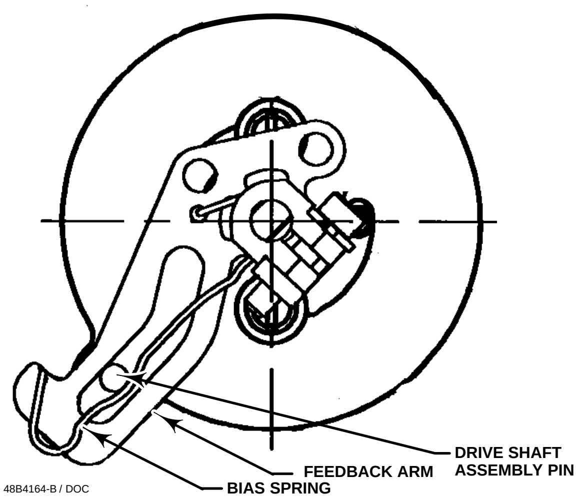

Figure 2-11. Positioning Drive Shaft Assembly Pin in the Feedback Arm

shown in figure 2-11. Using four 5/16 plain washers and 5/16-18 x 1/2 inch hex head cap screws, attach the mounting plate to the positioner plate.

10. Make pneumatic connections to the actuator as follows:

- **For single-acting actuators**, make connections as described in Pneumatic Connections in this section.

- **For double-acting actuators**, DVC5000f Series digital valve controllers are direct-acting instruments. With a direct-acting instrument, as the input signal increases, the output signal increases. Determine whether the actuator piston rod should extend or retract upon increasing input signal then proceed as follows:

a. Determine the actuator action and mount the Fairchild reversing relay as follows:

- If the actuator piston rod should extend from the cylinder upon increasing input signal, nipple mount the Fairchild relay to the lower cylinder connection.

- If the actuator piston rod should retract into the cylinder upon increasing input signal, nipple mount the Fairchild relay to the upper cylinder connection.

b. Using 3/8-inch (10 mm) outside diameter tubing, connect the 1/4-inch NPT or R 1/4 digital valve controller output connection to the pipe tee on the Fairchild relay.

c. Using 3/8-inch (10 mm) outside diameter tubing, connect the remaining cylinder connection to the pipe tee on the Fairchild relay.

d. On the Type 67CFR regulator, remove the 1/4-inch NPT pipe plug and, using 3/8-inch (10 mm) outside diameter tubing, connect the regulator output to the 1/4-inch NPT bushing on the Fairchild relay.

e. Make supply and electrical connections as described in Pneumatic Connections and Electrical Connections in this section.

f. Refer to *PS Sheet 62.1:FIELDVUE(B) Mounting FIELDVUE Instruments on Piston Actuators* for Model 25463 spring adjustment information. Adjust the spring as necessary.

Mounting on Neles-Jamesbury QP-3, QP-4 and QP-5 Actuators

Refer to figure 2-12 and the parts list for parts identification, unless otherwise noted.

1. Isolate the control valve from the process line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.

2. Attach the mounting bracket (key 3) to the actuator using four hex head screws (key 6).

3. Attach the coupler (key 4) to the actuator shaft using two 1/4-28 x 3/4 set screws (key 10).

4. Attach the travel indicator (key 1) to the coupler as follows:

a. If the valve is open without pressure to the actuator [push-down-to-close (PDTC) actuator mounting], position the travel indicator so that the pointer will be over the open mark on the travel indicator scale (key 2). Attach the travel indicator (key 1) to the coupler (key 4) using two washers (key 11) and machine screws (key 7).

b. If the valve is closed without pressure to the actuator [push-down-to-open (PDTO) actuator mounting], position the travel indicator so that the pointer on the will be over the closed mark on the travel indicator scale. Attach the travel indicator (key 1) to the coupler (key 4) using two washers (key 11) and machine screws (key 7).

5. Apply lubricant (key 63) to the travel indicator pin (key 1).

6. Position the feedback arm (key 79, figure 9-3) so that, when the digital valve controller is mounted on the actuator, the pin on the travel indicator (key 1) will slide into the slot on the feedback arm.

2

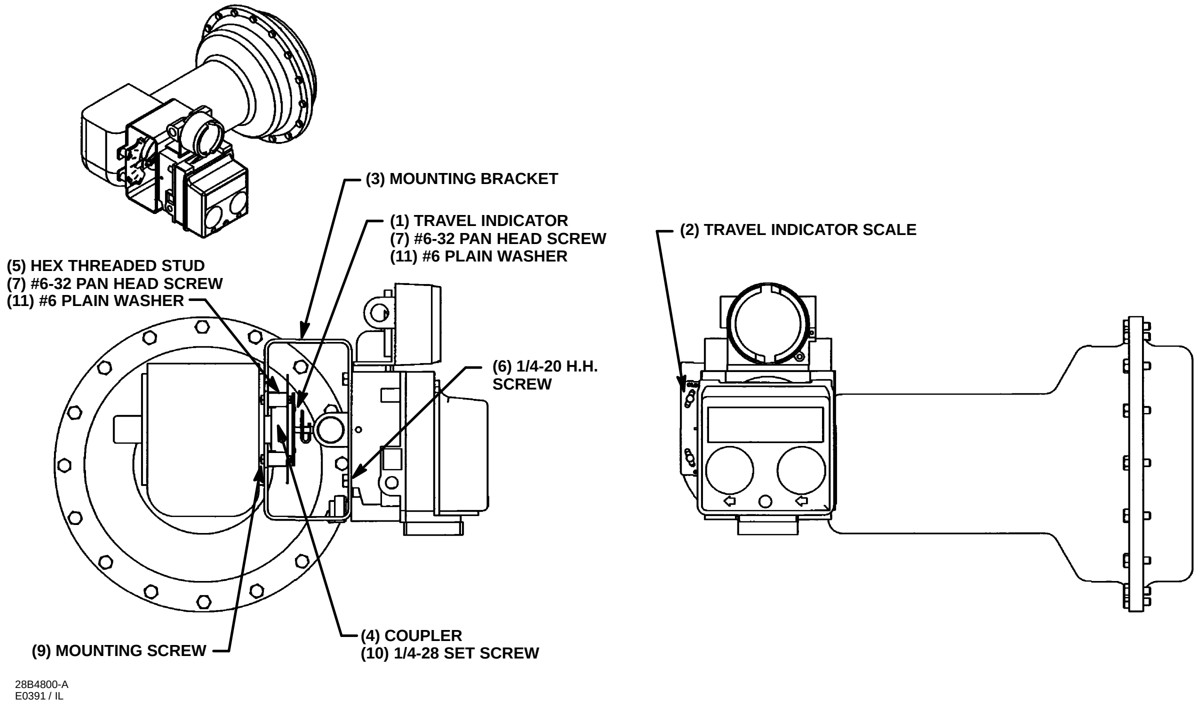

Figure 2-12. Mounting a Type DVC5030f Digital Valve Controller on a Neles-Jamesbury QP-3, QP-4, and qp-5 Actuators

7. Position the digital valve controller on the mounting bracket (key 3). Be sure the pin on the travel indicator (key 1) is in the feedback arm slot such that the bias spring (key 78) loads the pin against the side of the slot marked with an X. Attach the digital valve controller to the mounting bracket (key 3) using four hex head screws (key 6).

8. Attach the travel indicator scale (key 2) to the mounting bracket (key 3) with two washers (key 11) and threaded hex studs (key 5), and machine screws (key 7). Position the scale so that the OPEN or CLOSED mark is beneath the travel indicator pointer (key 1) and tighten the machine screws.

Mounting Type DVC5040f on System 9000 Actuators

Refer to figures 2-13 and 9-4 for key numbers.

1. Isolate the control valve from the process line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

WARNING

To avoid personal injury due to the sudden uncontrolled movement of parts, do not loosen the stem connector cap screws when the stem connector has spring force applied to it. Apply enough pressure to lift the plug off the seat before loosening the stem connector cap screws.

2. Install the O-ring (key 167) as shown in figure 2-14 to the mounting flange of the digital valve controller.

3. Line up the O-ring from the previous step with its associated actuator port on the power module assembly and attach the digital valve controller to the System 9000 actuator power module assembly with two cap screws (key 116). See figure 2-14.

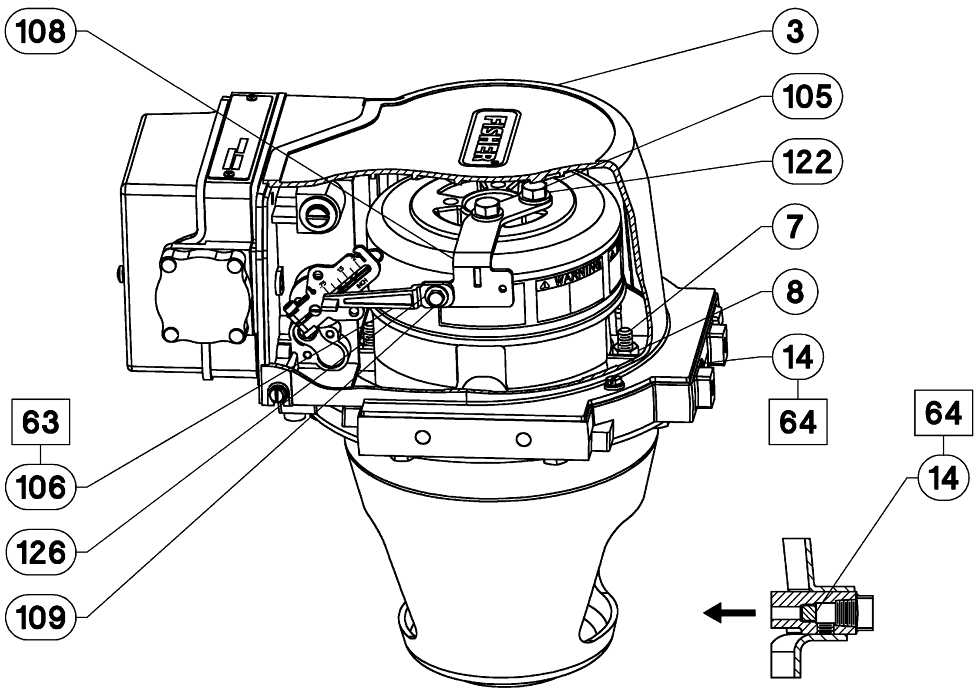

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Figure 2-13. System 9000 Actuator Assembly with Type DVC5040f Digital Valve Controller

Note

The alignment pin (key 46) is stored inside the digital valve controller housing in a threaded hole near the top of the module base.

4. Set the position of the feedback arm (key 79, figure 9-1) on the digital valve controller as follows:

- **For fail-closed actuators**, insert the alignment pin (key 46) through the hole on the feedback arm marked ‘‘**A**’’.

- **For fail-open actuators**, insert the alignment pin (key 46) through the hole in the feedback arm marked “**B**”

5. Apply lubricant (key 63) to the pin portion of the adjustment arm (key 106). Place the pin into the slot of the feedback arm (key 79) so that the bias spring loads the pin against the side of the arm with the valve travel markings.

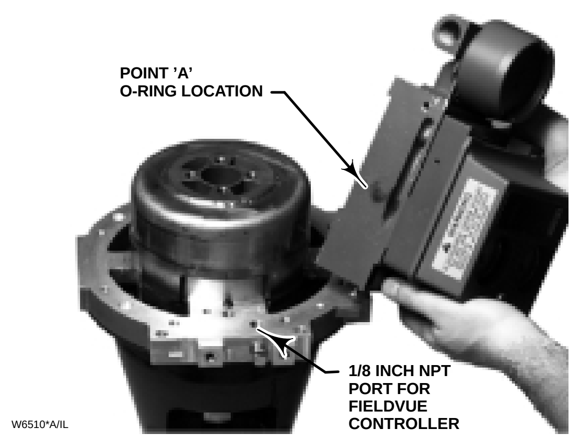

Figure 2-14. Digital Valve Controller Point of Connection (size 20 shown)

6. Loosely install the washer (key 126) and machine screw (key 109) to attach the adjustment arm (key 106) to the actuator feedback bracket (key 108).

7. Slide the adjustment arm pin in the slot of the feedback arm until the pin is in line with the desired valve travel marking (see figure 2-15). Tighten the machine screw (key 109).

Travel Markings Inches (mm)	0.75 (19)	|	(32)	1.5	|	2
Actuator Travel, Inches	0.75(1)	1.0	1.25	1.50	1.75	2.0

1. For travels less than 0.75 inches, use the 0.75 (19) travel mark.

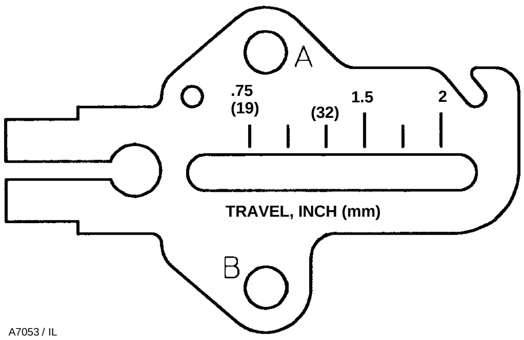

Figure 2-15. Alignment of Travel Markings

8. Remove the alignment pin (key 46) and store it in the threaded hole near the top of the digital valve controller module base. Install the digital valve controller cover.

9. Install the System 9000 actuator cover assembly.

Mounting the Type 67CFR Filter Regulator

A Type 67CFR filter regulator, when used with the DVC5000f Series digital valve controllers, can be mounted three ways.

Integral-Mounted Regulator

Refer to figures 2-1, 2-2 and 2-6. Lubricate an O-ring (key 60) and insert it in the recess around the SUPPLY connection on the digital valve controller. Attach the Type 67CFR filter regulator to the side of the digital valve controller. This is the standard method of mounting the filter regulator.

Yoke-Mounted Regulator

Mount the filter regulator with 2 screws (key 59) to the pre-drilled and tapped holes in the actuator yoke. Thread a 1/4-inch socket-head pipe plug (key 61) into the unused outlet on the filter regulator. The O-ring (key 60) is not required.

Casing-Mounted Regulator

Refer to figures 2-5 and 2-7. Use the separate Type 67CFR filter regulator casing mounting bracket provided with the filter regulator. Attach the mounting bracket to the Type 67CFR and then attach this assembly to the actuator casing. Thread a 1/4-inch socket-head pipe plug (key 61) into the unused outlet on the filter regulator. The O-ring (key 60) is not required.

Pneumatic Connections

All pressure connections on the digital valve controller are 1/4-inch NPT or R 1/4 female connections. Use 3/8-inch (10 mm) tubing for all pneumatic connections. If remote venting is required, refer to the vent subsection.

Supply Connections

WARNING

Personal injury or property damage may occur from an uncontrolled process if the supply medium is not clean, dry, oil-free, or noncorrosive gas. Industry instrument air quality standards describe acceptable dirt, oil, and moisture content. Due to the variability in nature of the problems these influences can have on pneumatic equipment, Fisher Controls has no technical basis to recommend the level of filtration equipment required to prevent performance degradation of pneumatic equipment. A filter or filter regulator capable of removing particles 40 microns in diameter should suffice for most applications. Use of suitable filtration equipment and the establishment of a maintenance cycle to monitor its operation is recommended.

Supply pressure must be clean, dry air or noncorrosive gas that meets the requirements of ISA Standard S7.3-1975 (R1981). A Fisher Controls Type 67CFR filter regulator, or equivalent, may be used to filter and regulate supply air. A filter regulator can be integrally mounted onto the side of the digital valve controller, casing mounted separate from the digital valve controller, or mounted on the actuator mounting boss. Supply and output pressure gauges may be supplied on the digital valve controller. The output pressure gauge can be used as an aid for calibration.

Connect the nearest suitable supply source to the1/4-inch NPT IN connection on the filter regulator (if furnished) or to the 1/4-inch NPT SUPPLY connection on the digital valve controller housing (if Type 67CFR filter regulator is not attached).

Output Connections

A factory mounted digital valve controller has its output piped to the supply connection on the actuator. If mounting the digital valve controller in the field use 3/8-inch (10 mm) outside diameter tubing to connect the 1/4-inch NPT or R 1/4 digital valve controller output connection to the pneumatic actuator input connection.

Vent

WARNING

If a flammable, toxic, or reactive gas is to be used as the supply pressure medium, personal injury and property damage could result from fire or explosion of accumulated gas or from contact with toxic or reactive gas. The digital valve controller/actuator assembly does not form a gas-tight seal, and when the assembly is in an enclosed area, a remote vent line, adequate ventilation, and necessary safety measures should be used. A remote vent pipe alone cannot be relied upon to remove all hazardous gas. Vent line piping should comply with local and regional codes and should be as short as possible with adequate inside diameter and few bends to remove exhaust gases to a ventilated area.

The relay output constantly bleeds supply air into the area under the cover. The vent opening at the back of the housing should be left open to prevent pressure buildup under the cover. If a remote vent is required, the vent line must be as short as possible with a minimum number of bends and elbows.

To connect a remote vent to Type DVC5010f, DVC5030f, and DVC5040f digital valve controllers—sliding-stem Remove the plastic vent (key 52, figure 9-1). The vent connection is 1/4-inch NPT or R 1/4 female. Typically, 3/8-inch (10 mm) tubing is used to provide a remote vent.

To connect a remote vent to Type DVC5020f digital valve controllers—rotary Replace the standard mounting bracket (key 74, figure 9-2) with the vent-away mounting bracket (key 74). Install a pipe plug (key 127, figure 9-2) in the vent-away mounting bracket (key 74). Mount the digital valve controller on the actuator as described in the "Installation" section of this manual.

Electrical Connections

FOUNDATION Fieldbus Connections

The digital valve controller is normally powered over the bus from a fieldbus 9 to 32 volt power supply. Refer to the site planning guide for proper wire types, termination, length, etc. for a fieldbus loop.

Wire the digital valve controller as follows: (refer to figures 9-1 through 9-4 for identification of parts). Wiring should meet plant wiring standards.

1. Remove the terminal box cap (key 4) from the terminal box (key 3).

2. Bring the field wiring into the terminal box. When applicable, install conduit using local and national electrical codes which apply to the application.

3. The instrument is not polarity sensitive. Connect one wire from the control system output card to one of the LOOP screw terminals on the pwb/terminal strip assembly in the terminal box shown in figure 2-16. Connect the other wire from the control system output card to the other LOOP screw terminal in the terminal box.

WARNING

Personal injury or property damage can result from the discharge of static electricity. Connect a 14 AWG (2.08 mm^2) ground strap between the digital valve controller and earth ground when flammable or hazardous gases are present. Refer to national and local codes and standards for grounding requirements.

To avoid static discharge from the plastic cover, do not rub or clean the cover with solvents. Clean with a mild detergent and water only.

4. As shown in figure 2-16, two safety ground terminals are available for connecting a safety ground,

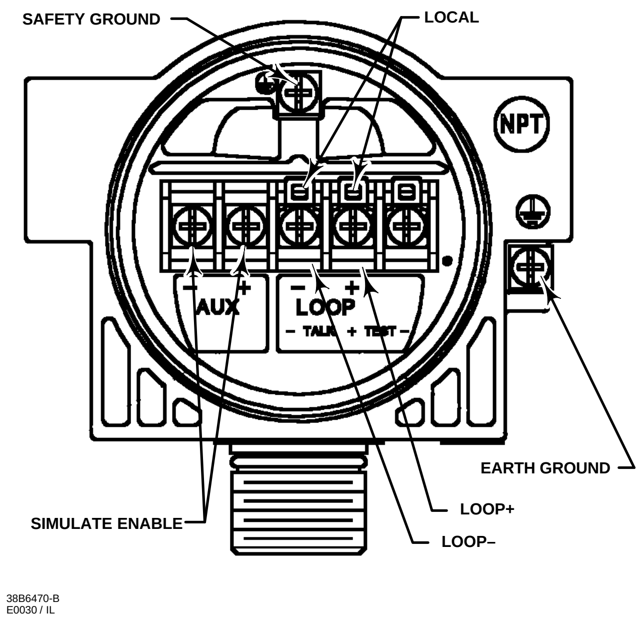

Figure 2-16. DVC5000f Series Digital Valve Controller Terminal Box

earth ground, or drain wire. The safety ground terminals are electrically identical. Make connections to these terminals following national and local codes and plant standards.

5. Replace and hand tighten the cover on the terminal box.

Test Connections

WARNING

Personal injury or property damage caused by fire or explosion may occur if the following procedure is attempted in an area which contains a potentially explosive atmosphere or has been classified as hazardous. Confirm that area classification and atmosphere conditions permit the safe removal of the terminal box cap before proceeding.

The test connections inside the terminal box permit checking the instrument current by measuring the voltage across a 1 ohm resistor.

1. Remove the terminal box cap.

2. Adjust the test meter to measure a range of 0.001 to 0.1 volts.

3. Connect the positive lead of the test meter to the TEST + connection and the negative lead to the TEST – connection inside the terminal box.

4. Measure instrument current as:

Voltage (on test meter) × 1000 = Instrument Milliamps

example:

Test Meter Voltage = 0.025

Test Meter Voltage X 1000 = Instrument Milliamps

0.025 X 1000 = 25.0 milliamperes

If the current is not approximately 25 milliamperes, check the field wiring and terminal box to printed wiring board connection inside the instrument. See the “Maintenance” section, Section 8, for information on disassembling the instrument.

5. Remove the test leads and replace the terminal box cover.

Communication Connections

WARNING

Personal injury or property damage caused by fire or explosion may occur if this connection is attempted in an area which contains a potentially explosive atmosphere or has been classified as hazardous. Confirm that area classification and atmosphere conditions permit the safe removal of the terminal box cap before proceeding.

A FOUNDATION fieldbus communicating device, such as a personal computer running ValveLink VL2000 Series software, interfaces with the DVC5000f Series digital valve controller from any wiring termination point in the segment. If you choose to connect the fieldbus communicating device directly to the instrument, attach the device to the BUS terminals or to the LOCAL connections inside the terminal box to provide local communications with the instrument.

Simulate Enable Jumper

Install a jumper across the SIMULATE ENABLE terminals to enable the instrument to accept a simulate command. (These terminals are marked AUX on the terminal board, see figure 2-16.) With the jumper in place and the simulate parameter in the AO block set to enabled, the transducer block ignores the output of the AO block. The simulate value and status become the readback value and status to the AO block and the transducer block is ignored. For more information on running simulations, see the FOUNDATION fieldbus specifications and the host system documentation.

Commissioning Tag

Your DVC5000f Series digital valve controller is supplied with a removable commissioning tag that contains both the device ID and a space to record the device tag. The device ID is a unique code that identifies a particular device in the absence of a device tag. The device tag is used as an operational identification for the device and is usually defined by the piping and instrumentation diagram (P&ID).

When commissioning more than one device on a fieldbus segment, identifying which device is at a particular location can be tedious without tags. The removable tag provided with the digital valve controller can be used to link the device ID and the physical installation location. The installer should note the physical location in both places on the removable commissioning tag and tear off the bottom portion. This should be done for each device on the segment. The bottom portion of the tags can be used for commissioning the segment in the control system.

Section 3 Initial Setup and Calibration

General Information

Fieldbus is an all digital, serial, two-way communication protocol that interconnects devices such as valve controllers, transmitters, discrete devices, and controllers. It is a local-area network (LAN) for instruments that enables basic control and I/O to be moved to the field devices. The DVC5000f Series digital valve controllers use the FOUNDATION fieldbus technology developed and supported by Fisher-Rosemount and the other members of the independent Fieldbus Foundation.

Addressing

To be able to setup and calibrate a device and have it communicate with other devices on the fieldbus, a device must be assigned a permanent address. Unless requested otherwise, when the digital valve controller ships from the factory it is assigned an uninitialized address.

If there are two or more devices with the same address, the first device to start up will use the assigned address, for example 20. Each of the other devices will be given one of the four available temporary addresses. If a temporary address is not available, the device will be unavailable until a temporary address becomes available.

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

Block Mode

Setting up and calibrating a digital valve controller requires modifying parameters in the transducer block. All blocks have a mode parameter, which determines the source of the set point, the destination of the output, and how the block executes. The ability to modify a block parameter is determined by the mode. For more information about block modes, see section 4.

Initial Setup

CAUTION

Changes to the instrument setup may cause the valve to move.

The Setup Wizard modifies transducer block parameters to setup the instrument. The Setup Wizard (method name Setup_Wizard) is included with the device description (DD) software.

Note

The AO block mode must be Out of Service for the Setup Wizard to operate properly.

CAUTION

The AO block mode can be set to Out of Service by setting the Resource block mode to Out of Service. However, setting the Resource block to Out of Service also sets all function blocks within the device to Out of Service, including the PID block. If the PID block is used to control another loop, be sure some other means are provided to control the loop before taking the block Out of Service.

Before starting the Setup Wizard, the AO block should be Out of Service. If the AO block is not out of service, the AO block may interfere with calibration and stabilize/optimize. This interference could cause erratic or incorrect results. If the AO block is not Out of Service, the Setup Wizard provides you an opportunity to abort and set the AO block out of service.

Note

The instrument output will not track the input while the AO block is Out of Service.

1. Start the Setup Wizard. For information on starting the Setup Wizard from a DeltaV host system, see Appendix G. For information on running methods from other host systems, see the system documentation.

2. The Setup Wizard first checks to see if the transducer block is Out-of-Service. If not, the Setup Wizard warns you that the transducer block will be placed out of service and of the possible results of doing so. Select Yes to continue or select No to abort the Setup Wizard.

Table 3-1. Actuator Information for Initial Setup

Actuator Manufacturer	Actuator Model	Actuator Size	Value for Actuator Size Parameter	Starting Tuning set	Instrument Model	Travel Sensor Motion
Fisher Controls	513 or 513R	20 and 32	Small	E	DVC5010f	513—Clockwise 513R—Counterclockwise
	585C or 585CR	25 50	Small Medium	F J		585C—Clockwise 585CR—Counterclockwise
	657 or 667	30 34, 40 45, 50	Medium Medium Large	H K L		657—Clockwise 667—Counterclockwise
	1250 or 1250R	225 450 675	Medium Medium Large	H J L		1250—Clockwise 1250R—Counterclockwise
	System 9000	12, 20 25, 50 80	Small Small Medium	D G K	DVC5040f	fail-closed—Counterclockwise fail-open—Clockwise
	1051 or 1052	20, 30, 33 40	Medium Medium	H K	DVC5020f	1051—Clockwise 1052—Clockwise
	1051 or 1052	20, 30, 33 40	Medium Medium	H K	DVC5030f	See table 3-2
	1066SR	20 27, 75	Small Large	G L		
Baumann	All	32 54 70	Small Medium Medium	Expert(1) H I	DVC5010f	Air to Extend—Clockwise Air to Retract—Counterclockwise
Gulde	3024	GA1.21 GA1.31 GA1.41	Small Medium medium	Expert(2) H K		Air opens—Counterclockwise Air closes—Clockwise
	3025	P460, P462, P900	Large	M		
Masoneilan	Camflex II	4.5 6 or 7	Small Medium	D H	DVC5030f	See description for Travel Sensor Motion parameter.
	Sigma F, Minitorque, and Ball II	A B C	Small Medium Medium	D H K		
Neles-Jamesbury	Quadra-Power II	QP2,QP3 QP4 QP5	Medium Medium Medium	H J K		

1. For Baumann size 32 actuator: High Performance Gain=1.9, High Performance Travel Rate=11, High Performance Pressure Rate=70, Standard Gain=0.6, Standard Travel Rate=13
2. For Gulde Type 3024 size 1.2.1: High Performance Gain=3.0, High Performance Travel Rate=13, High Performance Pressure Rate=70, Standard Gain=1.0, Standard Travel Rate=13

Table 3-2. DVC5030 Travel Sensor Motion Selections

Type 1051, 1052, and 1066SR Actuators	
Mounting Style(1)	**Travel Sensor Motion**
A	Clockwise
B	Counterclockwise
C	Counterclockwise
D	Clockwise

1. Refer to actuator instruction manual for description of mounting styles.

3. The Setup Wizard next initializes the instrument. Once initialization is complete, you are prompted for setup information. Table 3-1 provides the actuator information required to setup and calibrate the instrument.

- **Actuator Size** (small, medium, or large)—Refer to table 3-1.

- **On Loss of Instrument Power or Air, Valve** (opens or closes)—This identifies whether the valve is fully open or fully closed when instrument air or power is removed. If you are unsure how to set this parameter, disconnect the power to the instrument and note the actuator response. If the actuator closes the valve, select closes. If the actuator opens the valve, select opens.

- **Feedback Connection** (Rotary - All types, Sliding Stem - Standard Feedback, Sliding Stem - Roller Feedback)—For rotary valves, select Rotary - All types. For sliding-stem valves, if the feedback linkage consists of a connector arm, adjustment arm and feedback arm (similar to that shown in figure 3-1), select Sliding Stem - Standard Feedback. If the feedback linkage consists of a roller that follows a cam (similar to that shown in figure 3-2), select Sliding Stem - Roller Feedback.

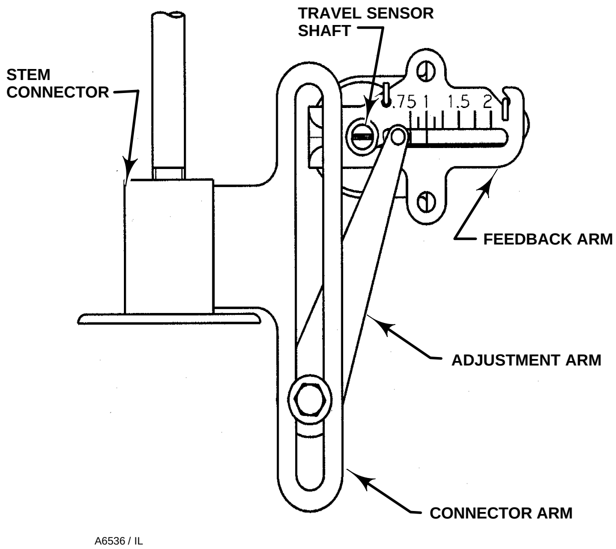

Figure 3-1. Sliding Stem - Standard Feedback Connection

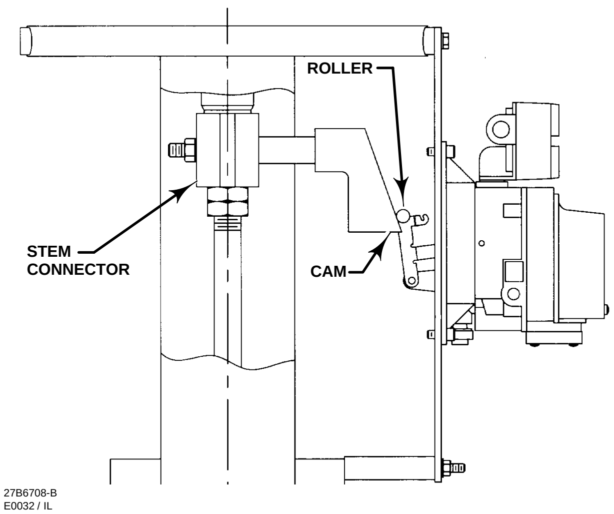

Figure 3-2. Sliding Stem - Roller Feedback Connection

WARNING

If you answer YES to the prompt for permission to move the valve, the instrument will move the valve through a significant portion of its travel range. To avoid personal injury and property damage caused by the release of pressure or process fluid provide some temporary means of control for the process.

- **Travel Sensor Motion** (increasing air pressure causes the travel sensor shaft to rotate clockwise or counterclockwise)—The Setup Wizard asks if it can move the valve to determine travel sensor motion. If you answer Yes, the instrument will stroke the valve the full travel span to determine travel sensor motion. If you answer No, then you must specify the rotation for increasing air pressure: clockwise or counterclockwise. Determine rotation by viewing the end of the travel sensor shaft, as shown in figure 3-1, or refer to table 3-1. If increasing air pressure to the actuator causes the shaft to turn clockwise, select clockwise. If it causes the shaft to turn counterclockwise, select counterclockwise.

CAUTION

Changes to the tuning can result in valve/actuator instability.

- **Tuning Set**—There are eleven tuning sets to choose from. Each tuning set provides preselected values for the digital valve controller gain and rate settings. Typically, tuning set C provides the slowest response and M provides the fastest response. For information on selecting a tuning set, refer to table 3-1 or select Help on the Setup Wizard display. To enter the values for the high performance and standard tuning parameters, select Expert.

4. The Setup Wizard next asks if you want to use defaults for Travel Cutoff high, Travel Cutoff Low, and Input Characterization. If you select Yes, these parameters are changed to the default values. If you select No, they are left at their previous values. For parameter details, see the “Detailed Setup” section.

WARNING

During calibration the valve will move full stroke. To avoid personal injury and property damage caused by the release of pressure or process fluid, provide some temporary means of control for the process.

5. At this point, instrument setup is complete. You are asked if you would like to calibrate the valve. Select Yes and follow the prompts to automatically calibrate the valve travel. The calibration procedure uses the valve and actuator stops as the 0% and 100% calibration points. For additional information, refer to Auto Calibrate Travel in this section.

If you select No, the Setup Wizard asks if you would like to run the Stabilize/Optimize method. If the valve cycles or overshoots, or is unresponsive, select Yes to run the Stabilize/Optimize method and improve operation. For additional information, refer to

Stabilizing or Optimizing Valve Response in this section.

If you select No, the Setup Wizard exits. Before exiting, the Setup Wizard asks if you want to return the transducer block mode to Auto, if the transducer block was in the Out-of-Service mode before the method started. Select Yes to change the transducer block mode to Auto. Select No to leave the transducer block in its current mode. Remember to restore the Analog Output (AO) block mode if you changed it to Out of Service before starting the Setup Wizard.

Auto Calibrate Travel

If you choose to calibrate the valve, the Setup Wizard starts the Auto Travel Calibrate method. Perform the following steps to automatically calibrate valve travel.

1. If the Feedback Connection is Sliding Stem - Standard Feedback, you must set the crossover. Continue to step 2. For all other Feedback Connection selections, there is no user interaction during auto travel calibration. Go to step 5.

2. If the crossover must be set, there are three means of crossover adjustment: Manual (Initial Setup), Use Default (50%), or Use Last Value. Manual is the recommended choice. It permits you to manually set the crossover. If you select manual, continue to step 3.

If you select Use Last Value, no further user interaction is required during the calibration process. Go to step 5. The crossover setting currently stored in the instrument from the last travel calibration is used, followed by a series of actions that will automatically calibrate the instrument. Use this selection if you cannot use manual, such as when you cannot see the valve.

If you select Use Default, this also does not require any further user interaction during the calibration process. Go to step 7. A value for the crossover is written to the instrument, followed by a series of actions that will automatically calibrate the instrument. Use this selection only as a last resort. Default assumes a midrange position on the travel sensor as the crossover point. However, this may not be an appropriate value to use for crossover because of variations in mounting and travel sensor calibration.

3. If you selected Manual for the crossover adjustment, the Setup Wizard prompts you to set the crossover. This prompt includes the current travel value and asks you to select the direction and amount the valve should move in order to set the crossover.

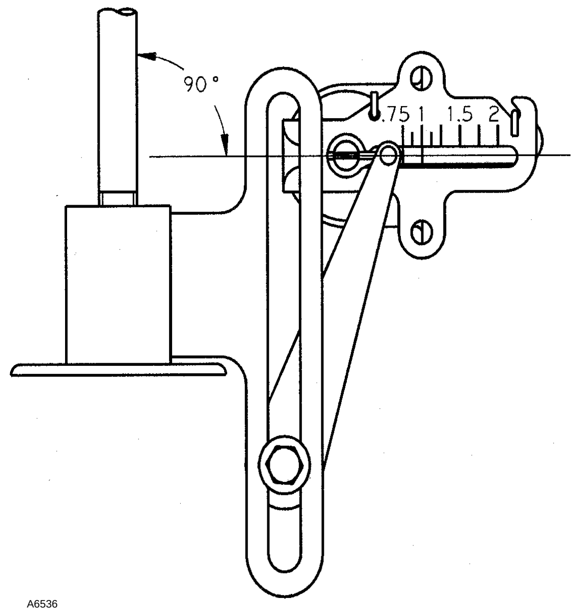

Figure 3-3. Crossover Point

4. Select the direction and size of change required to set the feedback arm so it is 90° to the actuator stem, as shown in figure 3-3. Once the feedback arm is in the right position, select Mark Current Position.

5. From here on the calibration process is automatic. No further interaction is required.

6. When calibration is complete, you are next asked to enter information about the calibration, including who performed the calibration, where was it performed, and the date on which it was performed.

7. After calibration is complete, the Setup Wizard asks if you want to run the Stabilize/Optimize method.

If the valve cycles or overshoots, or is unresponsive, select Yes to run the Stabilize/Optimize method and improve operation. For additional information, refer to Stabilizing or Optimizing Valve Response in this section. Begin with step 2.

If you select No, the Setup Wizard exits. Before exiting, the Setup Wizard asks if you want to return the transducer block mode to Auto, if the transducer block was in the Out-of-Service mode before the method started. Select Yes to change the transducer block mode to Auto. Select No to leave the transducer block in its current mode. Remember to restore the Analog Output (AO) block mode if you changed it to Out of Service before starting the Setup Wizard.

Stabilizing or Optimizing Valve Response

If after completing initial setup and auto calibration the valve cycles or overshoots, or is unresponsive, you can improve operation running the Stabilize/Optimize method. The Stabilize/Optimize (method name Stabilize_Optimize) is included with the device description (DD) software. For information on using methods on the host system, see the host system documentation.

Before starting Stabilize/Optimize, the AO block should be Out of Service. If the AO block is not out of service, you will not be able to check response because the method will not be able to adjust the transducer block set point. If the AO block is not Out of Service, Stabilize/Optimize provides you an opportunity to abort and set the AO block out of service.

Note

The instrument output will not track the input while the AO block is Out of Service.

1. Start the Stabilize/Optimize method. For information on starting the Stabilize/Optimize method from a DeltaV host system, see Appendix G. For information on running methods from other host systems, see the system documentation.

2. Move the valve open or closed either 10% or 20% to check response. If valve operation is unsatisfactory, select Change Response then perform one or the other of the following:

To Stabilize Valve Operation:

- Select Standard Decrease to select the next lower tuning set (e.g., F to E). If the current tuning set is C, Stabilize/Optimize asks if the tuning set should be changed to Expert to allow you to adjust the gain below the tuning set value.

- Select Small Decrease to decrease the High Performance Gain by 10% from the current value. Stabilize/Optimize recalculates the other tuning parameters based on this gain value.

To Improve Valve Response:

- Select Standard Increase to select the next higher tuning set (e.g., F to G). If the current tuning set is M, Stabilize/Optimize asks if the tuning set should be changed to Expert to allow you to adjust the gain above the tuning set value.

- Select Small Increase to increase the High Performance Gain by 10% from the current value. Stabilize/Optimize recalculates the other tuning parameters based on this gain value.

3. When you have finished changing the response, select Done with Change Response to once again move the valve and check response.

4. When valve operation is satisfactory, select Exit Stabilize/Optimize to exit the method. Before exiting, the method asks if you want to return the transducer block mode to Auto, if the transducer block was in the Out-of-Service mode before the method started. Select Yes to change the transducer block mode to Auto. Select No to leave the transducer block in its current mode. Remember to restore the Analog Output (AO) block mode if you changed it to Out of Service before starting the Stabilize/Optimize method or if you entered this method from the Setup Wizard.

Section 4 Detailed Setup

This section describes the resource and transducer block parameters that must be modified to setup the instrument. Table 4-1 lists the parameters in this section in alphabetical order by label. It provides the block mode and protection necessary to modify the parameter and a page reference where more detail on the parameter can be found. Each parameter is identified by its label as well as its parameter name. The mode listed is the actual mode the block must be in to be able to modify the parameter.

Access to each parameter depends upon the host system software. For information on using the host system to modify block parameters, see the appropriate system documentation.

Block Modes

Setting up and calibrating a digital valve controller requires modifying parameters in the resource and transducer blocks. All blocks have a mode parameter, which determines the source of the set point, the destination of the output, and how the block executes. The ability to modify a block parameter is determined by the mode. The mode required to change the parameter is listed in the description for each parameter.

The block mode is determined by the Block Mode parameter (parameter name MODE_BLK). It is a structured parameter composed of the subindexes actual, target, permitted, and normal. The following defines each of the subindexes.

- **Permitted mode**—(subindex 3) The permitted mode defines the modes allowed for the block. This is set by the user or host system but is restricted by the instrument to modes supported by the instrument for the particular block. Any change request to the Target or Normal subindex is checked against the permitted subindex to ensure the requested mode is permitted.

When setting the Permitted mode, there is no check against any of the other subindexes (Normal or Target modes). Therefore, the instrument may be in a Normal or Target mode that is not permitted because the permitted subindex was modified after the Normal or Target mode was set. This will have no effect on the instrument until the user attempts to modify the Target or Normal mode. At this time these subindexes are tested against the Permitted modes, thus the user cannot change the Normal or Target modes to what was formerly permitted.

- **Normal mode**—(subindex 4) The normal mode is the mode the block should be in during normal operating conditions. The normal mode is set by the user or host system and can only be set to a permitted mode (see permitted mode). The user or host system can compare the actual mode to the normal mode and, based on the results, determine if the block is operating normally.

- **Target mode**—(subindex 1) The Target mode is the mode requested by the user or host system. Only one mode is allowed to be set and it must be a permitted mode as defined by the permitted subindex of the mode parameter.

- **Actual mode**—(subindex 2) This is the current mode of the block. The actual mode may differ from the target modes due to operating conditions of the block.

Changing the block mode requires accessing the Block Mode parameter. For information on using the host system to change the block mode via this parameter, see the appropriate host system documentation.

Restarting the Instrument

WARNING

Restarting the instrument may cause loss of process control.

You can restart the instrument to reset parameters, links, etc. within the instrument. However, due to the effect that a restart can have on the instrument, and therefore the control loop, restarting the instrument should be used cautiously and only as a last measure.

There are three different restarts: Restart Resource, Restart Processor, and Restart with Defaults. Following is a brief description of the effects for each of these restarts.

- **Restart Resource**—Performing a Restart Resource sets the instrument dynamic parameters to their default values. Selecting this action to restart the instrument is not recommended. Use either Restart Processor or Restart with Defaults.

- **Restart Processor**—Performing a Restart Processor has the same effect as removing power from the instrument and re-applying power.

- **Restart with Defaults**—Performing a Restart with Defaults should be done with care. This restart resets the static parameters for all of the blocks in the

Table 4-1. Listing of Block Parameters in this Section by Label and Parameter Name

Parameter Label	Parameter Name	Index Number(1)	Block Mode Required to Modify Parameter	Data Protection that Affects Parameter(2)	Page Reference
Resource Block Parameters					
Alert Key	ALERT_KEY	04	All		4-5
Block Tag	TAG_DESC	02	All		4-4
Strategy	STRATEGY	03	All		4-5
Transducer Block Parameters					
Act. Fail Action	ACT_FAIL_ACTION	21	Out of Service	Mechanical	4-7
Actuator Mfg	ACT_MAN_ID	22	All	Configuration	4-7
Actuator Model	ACT_MODEL_NUM	23	All	Configuration	4-7
Actuator S/N	ACT_SN	24	All	Configuration	4-7
Actuator Size	ACT_CODE	38	Out of Service	Mechanical	4-7
Alert Disabled	SERVO_ALARM_SUMMARY.DISABLED	78.4	All		4-12
Alert Key	ALERT_KEY	04	All		4-12
Alert Priority	SERVO_ALARM_PRIORITY	76	All		4-12
Block Tag	TAG_DESC	02	All		4-6
Calibration Date	XD_CAL_DATE	30	All	Calibration	4-7
Calibration Loc.	XD_CAL_LOC	29	All	Calibration	4-7
Calibration Person	XD_CAL_WHO	31	All	Calibration	4-7
Custom Char.	USER_CHAR	54	Out of Service	Configuration	4-10
Cycle Count	CYCLE_COUNT	96	All	Mechanical	4-15
Cycle Count DB	SERVO_ALARM_CYCLE_COUNT.THRESHOLD	80.2	All		4-15
Cycle Count Alrt Pt	SERVO_ALARM_CYCLE_COUNT.LIMIT	80.1	All		4-15
Factory Inst S/N	FACTORY_SN	34	– – –	Read only	4-6
Feedback Connection	FEEDBACK_LINEARIZATION	35.2	Out of Service	Mechanical	4-8
Field Inst S/N	FIELD_SN	33	All	Configuration	4-6
High Perf Gain	SERVO_GAIN	18	All	Tuning	4-9
High Perf Press Rate	ALGO_GAIN	50	All	Tuning	4-9
High Perf Tvl Rate	SERVO_RATE	20	All	Tuning	4-9
Input Char.	FLOW_CHARACT	53	Out of Service	Configuration	4-10
Message	MESSAGE1	98	All		4-7
Output Blk Timeout	SERVO_ALARM_OUTBLK_TIMEOUT	93	All		4-15
Press Units	PRESSURE_UNITS.RB_UNITS	56	All	Configuration	4-7
Standard Gain	SERVO_STD_GAIN	61.1	All	Tuning	4-9
Standard Tvl Rate	SERVO_STD_RATE	61.2	All	Tuning	4-9
Strategy	STRATEGY	03	All		4-6
Temp Hi Alrt Pt	SERVO_ALARM_TEMP_HI	87	All		4-15
Temp Lo Alrt Pt	SERVO_ALARM_TEMP_LO	88	All		4-15
Travel Cutoff High	FINAL_VALUE_CUTOFF_HI	15	All	Configuration	4-12
Travel Cutoff Low	FINAL_VALUE_CUTOFF_LO	16	All	Configuration	4-12
Tvl Accumulator	TRAVEL_ACCUM	95	All	Mechanical	4-14
Tvl Accum Alrt Pt	SERVO_ALARM_TRAVEL_ACCUM.LIMIT	81.1	All		4-14
Tvl Accum DB	SERVO_ALARM_TRAVEL_ACCUM.THRESHOLD	81.2	All		4-14
Tvl Dev. Alrt DB	SERVO_ALARM_TRAVEL_DEV.THRESHOLD	86.3	All		4-14
Tvl Dev. Alrt Pt	SERVO_ALARM_TRAVEL_DEV.LIMIT	86.1	All		4-14
Tvl Dev. Alrt Time	SERVO_ALARM_TRAVEL_DEV.TIME_LIMIT	86.2	All		4-14
Tvl Hi Alrt DB	SERVO_ALARM_TRAVEL_HI.THRESHOLD	82.2	All		4-13
Tvl Hi Alrt Pt	SERVO_ALARM_TRAVEL_HI.LIMIT	82.1	All		4-13
Tvl Hi Hi Alrt DB	SERVO_ALARM_TRAVEL_HI_HI.THRESHOLD	83.2	All		4-13
Tvl Hi Hi Alrt Pt	SERVO_ALARM_TRAVEL_HI_HI.LIMIT	83.1	All		4-13
Tvl Lo Alrt DB	SERVO_ALARM_TRAVEL_LO.THRESHOLD	84.2	All		4-13
Tvl Lo Alrt Pt	SERVO_ALARM_TRAVEL_LO.LIMIT	84.1	All		4-13
Tvl Lo Lo Alrt DB	SERVO_ALARM_TRAVEL_LO_LO.THRESHOLD	85.2	All		4-14
Tvl Lo Lo Alrt Pt	SERVO_ALARM_TRAVEL_LO_LO.LIMIT	85.1	All		4-14
Tvl Sensor Motion	FEEDBACK_ROTATION	35.1	Out of Service	Mechanical	4-8
Valve Mfg	VALVE_MAN_ID	25	All	Configuration	4-8
Valve Model	VALVE_MODEL_NUM	26	All	Configuration	4-8
Valve S/N	VALVE_SN	27	All	Configuration	4-8
Valve Style	VALVE_TYPE	28	All	Configuration	4-8

1. Digit after the decimal indicates subindex number. For example, 81.1 indicates parameter number 81 subindex 1.
2. Parameters without any data protection listed are not affected by any type of protection mechanism.

instrument to their initialized state. After a Restart with Defaults, you should run the Setup Wizard and download the instrument configuration from the control system to properly setup the instrument. You also may need to re-establish communication links and trends. Parameters that are set to their default state and their default values are listed in table 4-2.

The Restart method (method name Restart_Device) is included with the device description (DD) software. This method should be used to restart the instrument. For information on using methods on the host system, see the host system documentation.

1. Start the method. Restart informs you about what can happen when an instrument restart is performed. Select Yes to continue or, if you do not want to restart the instrument, select No to abort the method without restarting.

2. Select the desired restart action or select Exit to exit the Restart method. Select Help to get information on the restart actions.

- If you select Restart Resource, Restart informs you the resource has been restarted. You must acknowledge the message to continue.

- If you selected Restart with Defaults or Restart Processor, Restart informs you of the consequences of this action and asks if you want to continue. Select Yes to perform the restart action or select No to select another action or exit. Restart informs you when the restart is completed. You must acknowledge the message to continue.

Resource Block Setup

The resource block describes the characteristics of the fieldbus device such as device name and type, manufacturer, serial number, amount of free memory, and free time. There is only one resource block in a DVC5000f Series digital valve controller.

Label: Block Tag
Parameter Name: TAG_DESC
Index Number: 2
Mode:All
Range: Up to 32 characters
Description: A unique description for the resource block. The block tag must be unique for each block within a system.

Table 4-2. Parameters Modified by Restart with Default

Index Number	Parameter Name	Initial Value
	Resource Block Parameters	
1	ST_REV	0
2	TAG_DESC	spaces
3	STRATEGY	0
4	ALERT_KEY	0
5	MODE_BLK	
	PERMITTED	Auto or Out of Service
	NORMAL	Auto
9	DD_RESOURCE	spaces
10	MANUFAC_ID	0x5100
11	DEV_TYPE	0x5400
12	DEV_REV	0x07
13	DD_REV	0x01
15	HARD_TYPES	0x0002
17	FEATURES	Reports supported Failsafe supported Soft write lock supported Output Readback supported
18	FEATURE_SEL	same as FEATURES except no reports supported
19	CYCLE_TYPE	Scheduled
20	CYCLE_SEL	Scheduled
21	MIN_CYCLE_T	3200
22	MEMORY_SIZE	0
23	NV_CYCLE_T	5760,000
24	SHED_RCAS	0
27	SHED_ROUT	0
31	MAX_NOTIFY	15
32	LIM_NOTIFY	MAX_NOTIFY
33	CONFIRM_TIME	640000
34	WRITE_LOCK	Unlocked
37	ALARM_SUM	
	DISABLED	0
38	ACK_OPTION	0
39	WRITE_PRI	0
	AO Block Parameters	
1	ST_REV	0
2	TAG_DESC	spaces
3	STRATEGY	0
4	ALERT_KEY	0
5	MODE_BLK	
	PERMITTED	Auto or Out of Service
	NORMAL	Auto
8	SP	
9	OUT	
11	PV_SCALE	
	EU 100%	100
	EU 0%	0
	Engineering Units	%
	Decimal Places	2
12	XD_SCALE	
	EU 100%	100 only
	EU 0%	0 only
	Engineering Untis	% only
	Decimal Places	2
14	IO_OPTS	0
15	STATUS_OPTS	0
18	SP_RATE_DN	+INF
19	SP_RATE_UP	+INF
20	SP_HI_LIM	100
21	SP_LO_LIM	0
22	CHANNEL	0

–Continued–

Table 4-2. Parameters Modified by Restart with Default (cont.)

Index Number	Parameter Name	Initial Value
23	FSTATE_TIME	0
24	FSTATE_VAL	0
27	SHED_OPT	0
PID Block Parameters		
1	ST_REV	0
2	TAG_DESC	spaces
3	STRATEGY	0
4	ALERT_KEY	0
5	MODE_BLK	
	PERMITTED	Auto or Out of Service
	NORMAL	Auto
10	PV_SCALE	
	EU 100%	100
	EU 0%	0
	Engineering Units	%
	Decimal Places	2
11	OUT_SCALE	
	EU 100%	100
	EU 0%	0
	Engineering Units	%
	Decimal Places	2
13	CONTROL_OPTS	0
14	STATUS_OPTS	0
16	PV_FTIME	0
17	BYPASS	0
19	SP_RATE_DN	+INF
20	SP_RATE_UP	+INF
21	SP_HI_LIM	100
22	SP_LO_LIM	0
23	GAIN	1
24	RESET	1000
25	BAL_TIME	0
26	RATE	0
28	OUT_HI_LIM	100
29	OUT_LO_LIM	0
30	BKCAL_HYS	0.5%
34	SHED_OPT	0
37	TRK_SCALE	
	EU 100%	100
	EU 0%	0
	Engineering Units	%
	Decimal places	2
41	FF_SCALE	
	EU 100%	100
	EU 0%	0
	Engineering Units	%
	Decimal Places	2
42	FF_GAIN	0
45	ALARM_SUM	
	DISABLED	0
46	ACK_OPTION	0
47	ALARM_HYS	0.5%
48	HI_HI_PRI	0
49	HI_HI_LIM	+INF
50	HI_PRI	0
51	HI_LIM	+INF
52	LO_PRI	0
53	LO_LIM	–INF
54	LO_LO_PRI	0
55	LO_LO_LIM	–INF

–Continued–

Table 4-2. Parameters Modified by Restart with Default (cont.)

Index Number	Parameter Name	Initial Value
56	DV_HI_PRI	0
57	DV_HI_LIM	+INF
58	DV_LO_PRI	0
59	DV_LO_LIM	–iNF
Transducer Block Parameters		
1	ST_REV	0
2	TAG_DESC	spaces
3	STRATEGY	0
4	ALERT_KEY	0
5	MODE_BLK	
	PERMITTED	Auto or Out of Service
	NORMAL	Auto

Label: Strategy
Parameter Name: STRATEGY
Index Number: 3
Mode: All
Range: 0 to 65535
Description: This parameter permits you to strategically group blocks so the operator can identify where the block is located. The blocks may be grouped by plant area, plant equipment, etc. This data is not checked or processed by the block.

Label: Alert Key
Parameter Name: ALERT_KEY
Index Number: 4
Mode: All
Range: 1 to 255
Description: An identification number that permits grouping alerts. This number may be used to indicate to the operator the source of the alert such as the instrument, plant unit, etc.

Transducer Block Setup

The transducer block decouples function blocks from the local output functions required to command output hardware. The transducer block typically contains setup and calibration information. Within the transducer block you can match the instrument to the valve and actuator, adjust tuning, characterize the instrument input, set travel control parameters, and set alerts.

Data Protection

Protection is provided for certain transducer block parameters to prevent inadvertently overwriting key data by the host system or user. The Data Protection method (method name Protect_Data) provides a procedure for changing the transducer block data protection. It is included with the device description

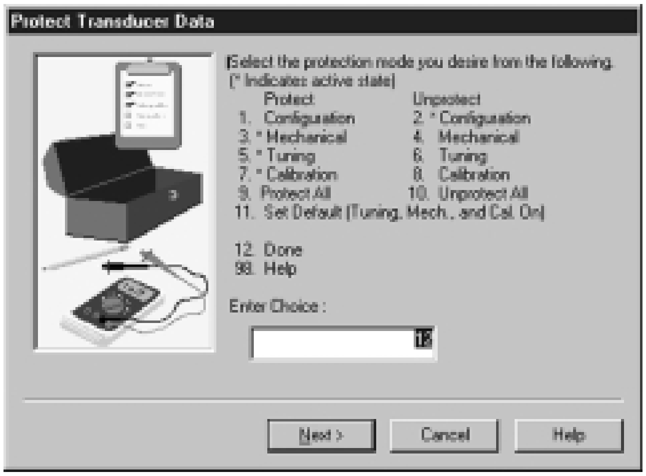

Figure 4-1. Data Protection Method Display on a DeltaV Host System

(DD) software. For information on using methods on the host system, see the host system documentation. Data Protection sets the protection for particular categories of data within the transducer block. Categories of protection are: Calibration, Configuration, Mechanical, and Tuning.

1. Start the Data Protection method. For information on starting the Data Protection from a DeltaV host system, see Appendix G. For information on running methods from other host systems, see the system documentation.

2. The method first initializes the instrument then displays the current protection and prompts for the desired protection as shown in figure 4-1.

The * preceding each selection indicates that this item is currently active, therefore, only one column (either Protect or Unprotect) will contain an * for any given row. Thus, an * preceding the Configuration selection in the Unprotect column means data in the Configuration category is not protected.

You can select to change the protection on any one data category, or you can select to Protect All or Unprotect All. Selecting Set Default protects data in the Tuning, Mechanical, and Tuning categories, but leaves the Configuration data unprotected.

Note

The Setup Wizard method automatically changes the protection to Set Default as part of its normal setup routine.

Select Help to see a list of the parameters included in each of the data categories.

3. Once you select the desired protection, Data Protection executes the desired selection, and updates the display.

4. When you have completed setting the desired protection, select Done.

This completes the Data Protection method.

Device Parameters

Label: Block Tag
Parameter Name: TAG_DESC
Index Number: 2
Mode: All
Range: Up to 32 characters
Description: A unique description for the transducer block. The tag description must be unique for each block within a system.

Label: Strategy
Parameter Name: STRATEGY
Index Number: 3
Mode: All
Range: 0 to 65535
Description: This parameter permits you to strategically group blocks so the operator can identify where the block is located. The blocks may be grouped by plant area, plant equipment, etc. This data is not checked or processed by the block.

Label: Factory Inst S/N
Parameter Name: FACTORY_SN
Index Number: 34
Description: The Serial number of the Instrument as assigned at the factory. This is a read only parameter and can only be changed by the factory.

Label: Field Inst S/N
Parameter Name: FIELD_SN
Index Number: 33
Mode: All
Range: Up to 32 characters
Description: A serial number for the instrument assigned by the user.

DVC5000f Series digital valve controllers have three serial numbers: One stamped on the instrument nameplate and two assigned to the printed wiring board. When the instrument ships from the factory, all three serial numbers are the same. The Factory Instrument Serial Number is assigned to the printed wiring board by the factory and cannot be changed. The Field Instrument Serial Number is also assigned to the printed wiring board by the factory but CAN be changed by the user.

If you replace the printed wiring board in an instrument or move it to a different instrument, change the Field Instrument Serial Number to match the serial number on the valve and actuator where you are installing the printed wiring board. Factory Instrument and Field Instrument Serial Numbers that do not match identify a printed wiring board that is not the original board that shipped with the instrument from the factory.

Label: Calibration Person
Parameter Name: XD_CAL_WHO
Index Number: 31
Mode: All
Range: Up to 32 characters
Description: The name of the person responsible for the last instrument calibration.

Label: Calibration Loc.
Parameter Name: XD_CAL_LOC
Index Number: 29
Mode: All
Range: Up to 32 characters
Description: The physical location where the last positioner calibration was performed. (e.g., NIST, AcmeLabs).

Label: Calibration Date
Parameter Name: XD_CAL_DATE
Index Number: 30
Mode: All
Range: See host system documentation
Description: The date of the instrument calibration. Date may range from milliseconds to 99 years. See host system documentation for method of specifying date.

Label: Message
Parameter Name: MESSAGE1
Index Number: 98
Mode: All
Range: Up to 80 characters
Description: User Message.

Valve and Actuator Information

Label: Actuator Mfg
Parameter Name: ACT_MAN_ID
Index Number: 22
Mode: All
Range: 4 characters
Description: The actuator manufacturer's identification number as defined by the Fieldbus Foundation. For Fisher Controls, the manufacturer ID is 20736 (005100 hex).

Label: Actuator Model
Parameter Name: ACT_MODEL_NUM
Index Number: 23
Mode: All
Range: Up to 32 characters
Description: The actuator type number.

Label: Actuator S/N
Parameter Name: ACT_SN
Index Number: 24
Mode: All
Range: Up to 32 characters
Description: The actuator serial number.

Label: Actuator Size
Parameter Name: ACT_CODE
Index Number: 38
Mode: Out of Service
Range: Small (1), Medium (2), or Large (3)
Description: Code used to describe the size of the actuator (small, medium, or large).

Label: Act. Fail Action
Parameter Name: ACT_FAIL_ACTION
Index Number: 21
Mode: Out of Service
Range: Self-closing (1), Self-opening (2), Hold last (3), Max value (4), or Min value (5)
Description: Specifies the action the actuator takes in the case of loss of air pressure.

Label: Press Units
Parameter Name: PRESSURE_UNITS.RB_UNITS
Index Number: 56 subindex 2
Mode: All
Range: kPa (1133), bar (1137), or psig (1143)
Description: Defines the output pressure units in either psig, bar, or kPa.

Label: Valve Mfg
Parameter Name: VALVE_MAN_ID
Index Number: 25
Mode: All
Range: 4 characters
Description: The valve manufacturer's identification number as defined by the Fieldbus Foundation. For Fisher Controls, the manufacturer ID is 20736 (005100 hex).

Label: Valve Model
Parameter Name: VALVE_MODEL_NUM
Index Number: 26
Mode: All
Range: 32 characters
Description: Specifies the valve design letter or type number

Label: Valve S/N
Parameter Name: VALVE_SN
Index Number: 27
Mode: All
Range: Up to 32 characters
Description: The valve serial number.

Label: Valve Style
Parameter Name: VALVE_TYPE
Index Number: 28
Mode: All
Range: Sliding stem (1) or Rotary (2)
Description: Specifies the type of valve: sliding stem or rotary

Label: Tvl Sensor Motion
Parameter Name: FEEDBACK_ROTATION
Index Number: 35 subindex 1
Mode: Out of Service
Range: Clockwise (1) or Counterclockwise (2)
Description: Establishes the proper feedback orientation for the travel sensor. Determine the desired travel sensor motion by viewing the rotation of the end of the travel sensor shaft. If increasing air pressure to the actuator causes the shaft to turn counterclockwise, enter 1 (counterclockwise). If it causes the shaft to turn clockwise, enter 2 (clockwise). Tables 4-3 through 4-5 show the required travel sensor motion selections for Fisher Controls and Baumann actuators.

Table 4-3. DVC5010f and DVC5020f Travel Sensor Motion Selections

Actuator	Travel Sensor Motion
Sliding-Stem Actuators	
513	Clockwise
513R	Counterclockwise
585C	Clockwise
585CR	Counterclockwise
657	Clockwise
667	Counterclockwise
1250	Clockwise
1250R	Counterclockwise
Rotary Actuators	
1051	Clockwise
1052	Clockwise
Baumann Actuators	
Air to Extend	Clockwise
Air to Retract	Counterclockwise

Table 4-4. DVC5030f Travel Sensor Motion Selections

Type 1051, 1052, and 1066SR Actuators	
Mounting Style	**Travel sensor Motion**
A	Clockwise
B	Counterclockwise
C	Counterclockwise
D	Clockwise

Table 4-5. DVC5040f Travel sensor Motion Selections

Actuator	Travel Sensor Motion
System 9000 fail-closed	Counterclockwise
System 9000 fail-open	Clockwise

Table 4-6. Feedback Connection Selections for Various Actuator Types

Actuator Type	Feedback Connection
513 and 513R 657 and 667 1250 and 1250R System 9000 Baumann and Gulde	Sliding Stem
471 585 and 585R 1051 and 1052 1066SR and all Type DVC5030f applications	Rotary

Label: Feedback Connection
Parameter Name: FEEDBACK_LINEARIZATION
Index Number: 35 subindex 2
Mode: Out of Service
Range: Sliding Stem (1) or Rotary (2)
Description: Specifies how the travel sensor is linked to the valve stem or valve shaft. Refer to table 4-6 to determine the required feedback connection.

Setting Response

Tuning

CAUTION

Changes to the tuning can result in valve/actuator instability.

The following parameters adjust the instrument tuning. Tuning consists of adjusting the high performance values and the standard values. Normally the instrument uses the high performance values. However, should the pressure sensor fail, the unit can continue to operate using the standard gain and rate values if the standard gain is not equal to 0.

You can use the Setup Wizard or the Stabilize/ Optimize Tuning method to adjust tuning using tuning sets. See Section 3 “Initial Setup” for more information on the Setup Wizard and the Stabilize/Optimize Tuning method. Table 4-7 lists the tuning values for the various tuning sets.

Label: High Perf Gain
Parameter Name: SERVO_GAIN
Index Number: 18
Mode: All
Range: 0 or 0.1 to 20
Description: This parameter value is the high performance gain. This is the normal gain value used by the instrument.

Label: High Perf Tvl Rate
Parameter Name: SERVO_RATE
Index Number: 20
Mode: All
Range: 0 or 5 to 25
Description: This parameter value is the high performance travel rate. This is the normal travel rate feedback used by the instrument.

Label: High Perf Press Rate
Parameter Name: ALGO_GAIN
Index Number: 50
Mode: All
Range: 15 to 150
Description: This parameter value is the high performance pressure rate. This is the normal pressure rate feedback used by the instrument.

Table 4-7. Gain and Rate Values for Preselected Tuning Sets(1)

TUNING SET	HIGH PERFORMANCE			STANDARD	
	Gain	Travel Rate	Pressure Rate	Gain	Travel Rate
C	0.5	10.0	120	0.40	13.0
D	1.0	10.0	60	0.50	
E	1.2	10.0	49	0.60	
F	1.6	10.0	37	0.75	
G	2.1	10.5	46	1.00	
H	2.5	11.6	69	1.30	13.0
I	3.0	12.7	82	2.00	
J	4.0	14.5	62	3.00	
K	5.0	16.2	50	3.99	
L	8.0	18.0	31	5.25	
M	10.0	18.0	25	6.99	

1. For User Adjusted, the High Performance Gain and Standard Gain may be adjusted independently. For Expert, all tuning parameters may be adjusted independently. See parameter descriptions for range of adjustment.

Label: Standard Gain
Parameter Name: SERVO_STD_GAIN
Index Number: 61 subindex 1
Mode: All
Range: 0.1 to 10
Description: This parameter value is the standard gain. This is the gain of the instrument if the pressure sensor fails.

Label: Standard Tvl Rate
Parameter Name: SERVO_STD_RATE
Index Number: 61 subindex 2
Mode: All
Range: 5 to 20
Description: This parameter value is the standard travel rate. This is the travel rate feedback used by the instrument if the pressure sensor fails.

Input Characterization

With input characterization you can modify the overall characteristic of the valve and instrument combination. Selecting an equal percentage, quick opening, square root, or custom input characteristic modifies the overall valve and instrument characteristic. If you select the linear input characteristic, the overall valve and instrument characteristic is the characteristic of the valve, which is determined by the valve trim (i.e., the plug or cage). Figure 4-3 shows the four fixed characteristics available: linear, equal percentage, quick opening, or square root. Table 4-8 lists the values for these characteristics.

The Input Characterization method is available to help you set the instrument input characterization, including defining the custom characterization array. The Input Characterization method (method name Input_Characterization) is included with the device description (DD) software. For information on using methods on the host system, see the host system documentation.

1. Start the Input Characterization. The method warns you the valve will move and that there may be a loss of process control. Select Yes to continue or select No to abort Input Characterization.

2. Once the instrument is initialized, Input Characterization prompts you to select the characterization type. You can select one of the predefined characterization types (linear, equal percentage, quick opening, or square root) or you can define a custom characterization.

Select Custom Characterization Type to set a baseline for the array or to edit the array. Custom characterization permits you to specify 49 points on a custom characteristic curve. Each point defines a travel target in percent of travel for a corresponding input, also in percent of travel. Input values range from –25% to 125% in 3.125% increments. You can begin your custom characteristic by selecting one of the predefined characterization types as a baseline for the array. Then select Edit the Array to edit each of the 49 points.

If you select Edit Custom Characterization Array, Input Characterization checks the current characteristic type. If the current characteristic is not custom, Input Characterization asks if you want to change the input characterization to custom. Select Yes, to change the Characterization Type to Custom and select a baseline array or edit the array. Select No, to leave the Characterization Type unchanged.

3. If you selected Custom Characterization Type, Input Characterization prompts you to select an action. An action in this case is to either select a starting baseline for the array, edit the array, or save the array to the instrument.

If you select Save Array, Input Characterization saves the array to the instrument and returns to step 2.

Except for Set Baseline to a Constant Value, if you select Set Baseline..., Input Characterization initializes the array to the specified baseline.

If you select Set Baseline to a Constant Value, Input Characterization asks you for the value to be used. The value entered must be between –25% and +125%.

4. If you selected Edit the Array in step 3, Input Characterization prompts you for the values to be used for each of the 49 points. You need not specify a value for each point. However, the value of each succeeding point must be greater than the value of the preceeding point (i.e. no loops in the curve or backward bending curve, see figure 4-2)

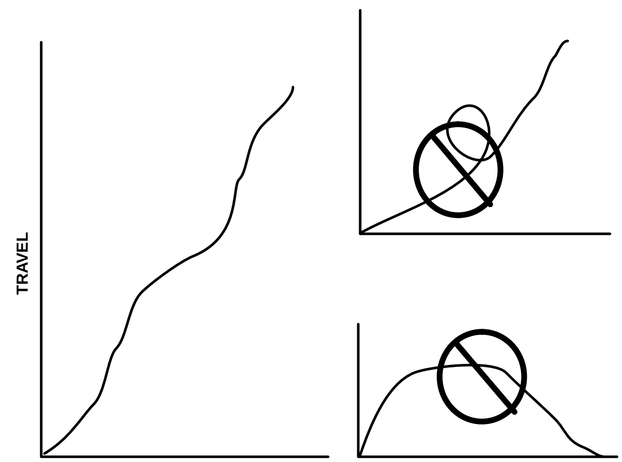

Figure 4-2. Permissible Custom Characterization Curves

5. When you are done editing the array, enter a value of 99 for the index number.

6. Input Characterization then asks if you want to save the array. Select Yes to save the array to the instrument, or select No to continue editing the array.

Parameters Modified by the Input Characterization Method

The following parameters are modified by the Input Characterization method:

Label: Input Char.
Parameter Name: FLOW_CHARACT
Index Number: 53
Mode: Out of Service
Range: Linear (0), Equal % (1), Quick opening (2), Square root (3), or Custom (4)
Description: Defines the relationship between the ranged travel and ranged input. You can select from the fixed input characteristics shown in Figure 4-3 or you can define a custom characteristic. Figure 4-3 plots the characterized output values for each index number for the fixed input characteristics. Table 4-8 lists the values used to define the fixed input characteristics.

Label: Custom Char.
Parameter Name: USER_CHAR
Index Number: 54 index 1 through 49
Mode: Out of Service
Range: –25.00 to 125.00% The value entered for an index number cannot be less than the value entered for a lower index number. (The curve cannot loop upon itself.)
Description: User defined flow characterization array for valve profile.

Table 4-8. Input Characteristic Curve Values

Input		Characterized Output (%)				Input		Characterized Output (%)			
Index Number	Percent	Linear	Equal Percentage	Quick Opening	Square Root	Index Number	Percent	Linear	Equal Percentage	Quick Opening	Square Root
1	–25.00	–25.00	–12.5	–3.18	–25.00	26	53.13	53.13	14.27	84.35	72.89
2	–21.88	–21.88	–10.94	–2.78	–25.00	27	56.25	56.25	16.39	85.75	75.00
3	–18.75	–18.75	–9.38	–2.38	–25.00	28	59.38	59.38	18.78	87.08	77.06
4	–15.63	–15.63	–7.81	–1.99	–25.00	29	62.50	62.50	21.49	88.34	79.06
5	–12.50	–12.50	–6.25	–1.59	–25.00	30	65.63	65.63	24.55	89.55	81.01
6	–9.38	–9.38	–4.69	–1.19	–25.00	31	68.75	68.75	28.01	90.70	82.92
7	–6.25	–6.25	–3.13	–0.79	–25.00	32	71.88	71.88	31.92	91.80	84.78
8	–3.13	–3.13	–1.56	–0.40	–25.00	33	75.00	75.00	36.33	92.85	86.60
9	0.00	0.00	0.00	0.00	0.00	34	78.13	78.13	41.32	93.86	88.39
10	3.13	3.13	0.27	23.93	17.68	35	81.25	81.25	46.96	94.83	90.14
11	6.25	6.25	0.57	36.04	25.00	36	84.38	84.38	53.33	95.77	91.86
12	9.38	9.38	0.90	44.21	30.62	37	87.50	87.50	60.53	96.67	93.54
13	12.50	12.50	1.29	50.38	35.36	38	90.63	90.63	68.67	97.55	95.20
14	15.63	15.63	1.72	55.35	39.53	39	93.75	93.75	77.87	98.39	96.82
15	18.75	18.75	2.21	59.50	43.30	40	96.88	96.88	88.26	99.21	98.43
16	21.88	21.88	2.76	63.07	46.77	41	100.00	100.00	100.00	100.00	100.00
17	25.00	25.00	3.39	66.20	50.00	42	103.13	103.13	103.13	103.13	125.00
18	28.13	28.13	4.09	68.98	53.03	43	106.25	106.25	106.25	106.25	125.00
19	31.25	31.25	4.89	71.49	55.90	44	109.38	109.38	109.38	109.38	125.00
20	34.38	34.38	5.79	73.78	58.63	45	112.50	112.50	112.50	112.50	125.00
21	37.50	37.50	6.81	75.87	61.24	46	115.63	115.63	115.63	115.63	125.00
22	40.63	40.63	7.96	77.81	63.74	47	118.75	118.75	118.75	118.75	125.00
23	43.75	43.75	9.26	79.61	66.14	48	121.88	121.88	121.88	121.88	125.00
24	46.88	46.88	10.73	81.29	68.47	49	125.00	125.00	125.00	125.00	125.00
25	50.00	50.00	12.39	82.86	70.71						

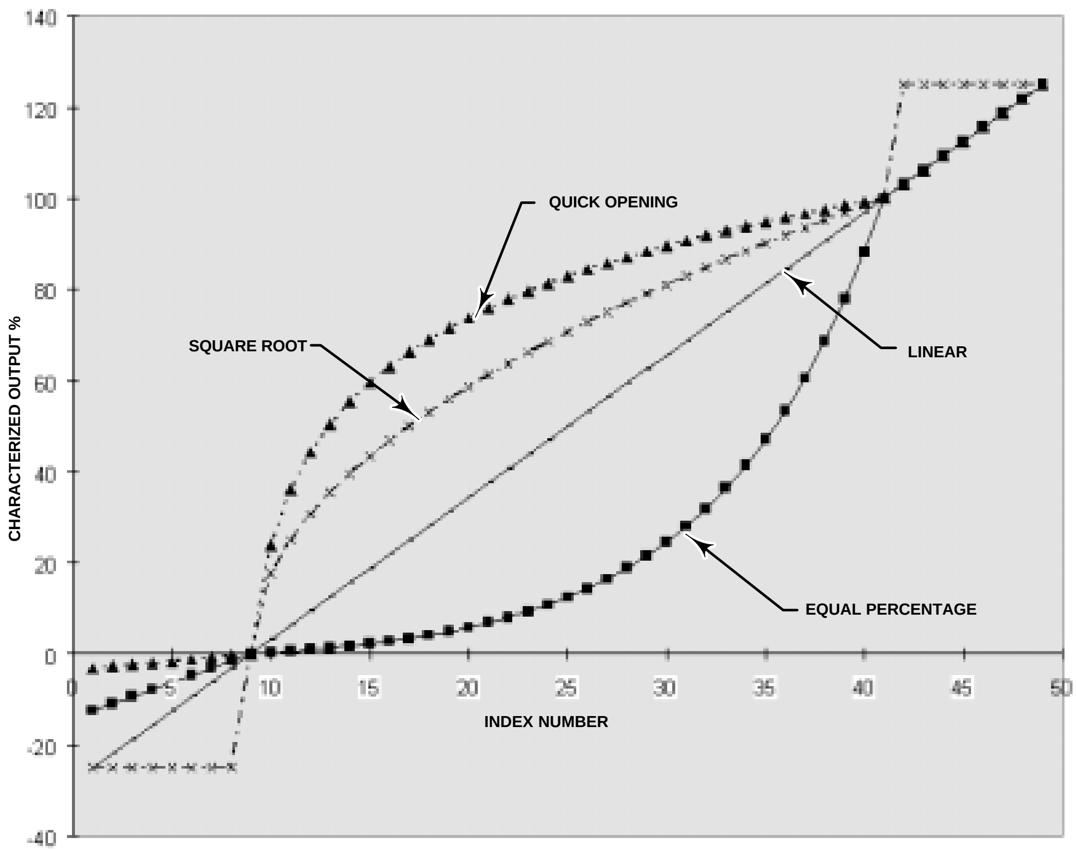

Figure 4-3. Input vs Output Values for Various Input Characteristics

To define a custom input characteristic, select 4 (custom) for the input characterization parameter. Then access the custom characterization parameter via the Input Characterization method to customize the input characteristic curve. Note: The value for each index number must be equal to or greater than the value for the previous index number.

Travel Control

Label: Travel Cutoff High
Parameter Name: FINAL_VALUE_CUTOFF_HI
Index Number: 15
Mode: All
Range: –24.375 to 125
Description: Defines the high cutoff point for the travel in percent (%) of ranged travel. Above this cutoff, the travel target is set to 123.0% of the ranged travel. Travel Cutoff High is effectively deactivated by setting it to 125.0%.

Label: Travel Cutoff Low
Parameter Name: FINAL_VALUE_CUTOFF_LO
Index Number: 16
Mode: All
Range: –25 to 124.375
Description: Defines the low cutoff point for the travel in percent (%) of ranged travel. Travel Cutoff Low can be used to ensure proper seat load is applied to the valve. When below this cutoff, the travel target is set to –23.0% of the ranged travel. A Travel Cutoff Low of 0.5% is recommended to help ensure maximum shutoff seat loading. Travel Cutoff Low is effectively deactivated by setting it to –25%.

Setting Alerts

The following alerts are available from the instrument. Each alert is represented by one of 15 bits within the specified parameter. The hexadecimal value listed is a common way of identifying which bit is true.

Alert	Hexadecimal Value
Drive Failure	0001
Cycle Count	0002
Travel Accumulator	0004
Travel High	0008
Travel High-High	0010
Travel Low	0020
Travel Low-Low	0040
Travel Deviation	0080
Temperature High	0100
Temperature Low	0200
I/P Feedback	0400
Pressure High	0800
Pressure Low	1000
Pressure Deviation	2000
Servo Timeout	4000
NVM Writes	8000

Table 4-9. Bit Represented by Hexadecimal Value

Thousands				Hundreds				Tens				Ones			
8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Refer to table 4-9 to determine which bit is true for a given hexadecimal value. For example, a hexadecimal value of 400 indicates bit 10 is true.

The following parameters determine the alert handling:

- **Alert Disabled**—determines which alerts are reported
- **Alert Status**—indicates which alerts are currently active
- **Alert Unreported**—indicates which alerts are unreported,
- **Alert Unacknowledged**—indicates which alerts have not been acknowledged by the receiving device.

See Section 6 for a description of the Alert Status, Alert Unreported, and Alert Unacknowledged parameters.

Label: Alert Disabled
Parameter Name: SERVO_ALARM_SUMMARY. DISABLED
Index Number: 78 subindex 4
Mode: All
Range: 0 to 65535 (hex values 0000 to FFFF)
Description: Identifies which alerts are disabled for reporting by the instrument. Enter the sum of all the values for alerts that are to be disabled. Entering a value of zero for this parameter, enables all alerts. See also Feature Select in Section 6.

Label: Alert Key
Parameter Name: ALERT_KEY
Index Number: 4
Mode: All
Range: 0 to 255
Description: An identification number that permits grouping alerts. This number may be used to indicate to the operator the source of the alert such as the instrument, plant unit, etc.

Label: Alert Priority
Parameter Name: SERVO_ALARM_PRIORITY
Index Number: 76
Mode: All
Range: 0 to 15
Description: Permits assigning a priority to transducer block alarms.

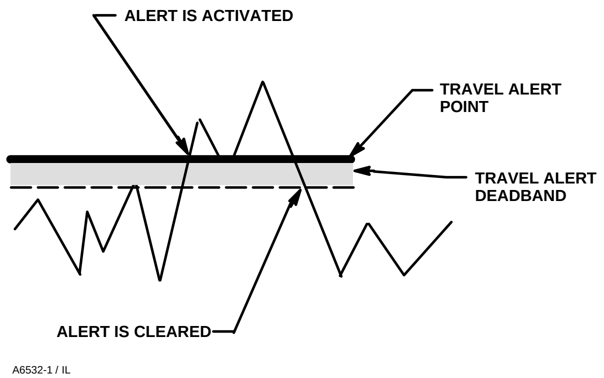

Figure 4-4. Travel Alert Deadband Example (Travel High Alert Shown)

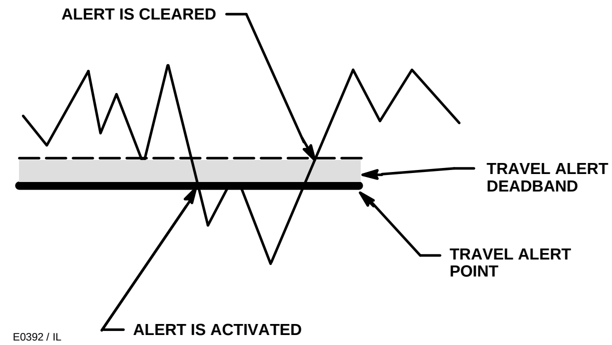

Figure 4-5. Travel Alert Deadband Example (Travel Low Alert Shown)

Setting Travel Alerts

Label: Tvl Hi Alrt Pt
Parameter Name: SERVO_ALARM_TRAVEL_HI.LIMIT
Index Number: 82 subindex 1
Mode: All
Range: 0 to 125%
Description: This parameter determines the travel high alert point. The travel high alert point is the value of the travel, in percent (%) of ranged travel, which, when exceeded, activates the Travel Hi Alert.

Label: Tvl Hi Alrt DB
Parameter Name: SERVO_ALARM_TRAVEL_HI.THRESHOLD
Index Number: 82 subindex 2
Mode: All
Range: 0 to 100%
Description: This parameter determines the travel high alert deadband. The travel high alert deadband is the travel, in percent (%) of range travel, required to clear a Travel High Alert, once it has been activated. See figure 4-4.

Label: Tvl Hi Hi Alrt Pt
Parameter Name: SERVO_ALARM_TRAVEL_HI_HI.LIMIT
Index Number: 83 subindex 1
Mode: All
Range: 0 to 125%
Description: This parameter determines the travel high-high alert point. The travel high-high alert point is the value of the travel, in percent (%) of ranged travel, which, when exceeded, activates the Travel Hi-Hi Alert.

Label: Tvl Hi Hi Alrt DB
Parameter Name: SERVO_ALARM_TRAVEL_HI_HI.THRESHOLD
Index Number: 83 subindex 2
Mode: All
Range: 0 to 100%
Description: This parameter determines the travel high-high alert deadband. The travel high-high alert deadband is the travel, in percent (%) of range travel, required to clear a Travel Hi-Hi Alert, once it has been activated. See figure 4-4.

Label: Tvl Lo Alrt Pt
Parameter Name: SERVO_ALARM_TRAVEL_LO.LIMIT
Index Number: 84 subindex 1
Mode: All
Range:–25 to 100%
Description: This parameter determines the travel low alert point. The travel low alert point is the value of the travel, in percent (%) of ranged travel, which, when exceeded, activates the Travel Lo Alert.

Label: Tvl Lo Alrt DB
Parameter Name: SERVO_ALARM_TRAVEL_LO.THRESHOLD
Index Number: 84 subindex 2
Mode: All
Range: 0 to 100%
Description: This parameter determines the travel low alert deadband. The travel low alert deadband is the travel, in percent (%) of ranged travel, required to clear a Travel Lo Alert, once it has been activated. See figure 4-5.

Label: Tvl Lo Lo Alrt Pt
Parameter Name: SERVO_ALARM_TRAVEL_LO_LO.LIMIT
Index Number: 85 subindex 1
Mode: All
Range: –25 to 100%
Description: This parameter determines the travel low-low alert point. The travel low-low alert point is the value of the travel, in percent (%) of ranged travel, which, when exceeded, activates the Travel Lo-Lo Alert.

Label: Tvl Lo Lo Alrt DB
Parameter Name: SERVO_ALARM_TRAVEL_LO_LO.THRESHOLD
Index Number: 85 subindex 2
Mode: All
Range: 0 to 100%
Description: This parameter determines the travel low-low alert deadband. The travel low-low alert deadband is the travel, in percent (%) of ranged travel, required to clear a Travel Lo-Lo Alert, once it has been activated. See figure 4-5.

Label: Tvl Dev. Alrt Pt
Parameter Name: SERVO_ALARM_TRAVEL_DEV.LIMIT
Index Number: 86 subindex 1
Mode:All
Range: 0 to 125%
Description: This parameter determines the travel deviation alert point. The travel deviation alert point is the alert point for the difference, expressed in percent (%), between the targeted travel and the ranged travel. When the difference exceeds the alert point for more than the Travel Deviation Time, the Travel Deviation Alert is activated.

Label: Tvl Dev. Alrt Time
Parameter Name: SERVO_ALARM_TRAVEL_DEV.TIME_LIMIT
Index Number: 86 subindex 2
Mode: All
Range: 0 to 120 seconds
Description: This parameter determines travel deviation time. The travel deviation time is the time, in seconds, that the travel must exceed the travel deviation alert point before the Travel Deviation Alert is activated.

Label: Tvl Dev. Alrt DB
Parameter Name: SERVO_ALARM_TRAVEL_DEV.THRESHOLD
Index Number: 86 subindex 3
Mode: All
Range: 0 to 100%
Description: This parameter determines the travel deviation alert deadband. The travel deviation must fall below the travel deviation alert point minus the deadband value for a Travel Deviation Alert to clear once it has been activated.

Label: Tvl Accumulator
Parameter Name: TRAVEL_ACCUM
Index Number: 95
Mode: All
Description: Travel Accumulator records the total change in travel, in percent (%) of ranged travel, since the accumulator was last cleared. The value of the travel accumulator increments when the magnitude of the change exceeds the travel accumulator deadband. See figure 4-6. You can reset the Travel Accumulator by configuring it to zero.

Label: Tvl Accum DB
Parameter Name: SERVO_ALARM_TRAVEL_ACCUM.THRESHOLD
Index Number: 81 subindex 2
Mode: All
Range: 0 to 100%
Description: This parameter determines the travel accumulator deadband. The travel accumulator deadband is the area around the travel reference point, in percent (%) of ranged travel, that was established at the last increment of the accumulator. This area must be exceeded before a change in travel can be accumulated. See figure 4-6.

Label: Tvl Accum Alrt Pt
Parameter Name: SERVO_ALARM_TRAVEL_ACCUM.LIMIT
Index Number: 81 subindex 1
Mode: All
Range: 0 to
Description: This parameter determines the travel accumulator alert point. The travel accumulator alert point is the value of the travel accumulator, in percent (%) of ranged travel, which, when exceeded, activates the Travel Accumulator Alert.

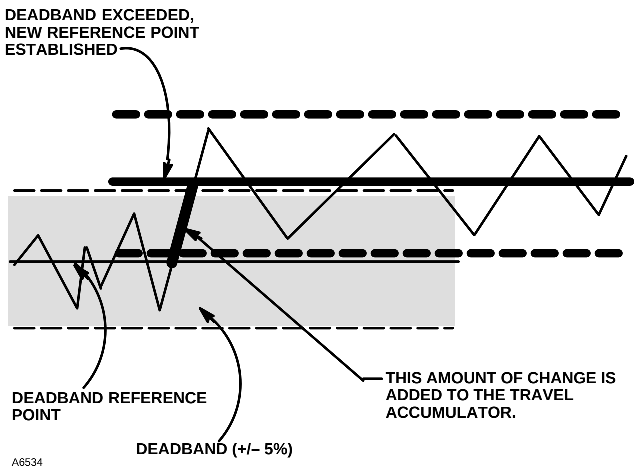

Figure 4-6. Travel Accumulator Deadband (set at 10%)

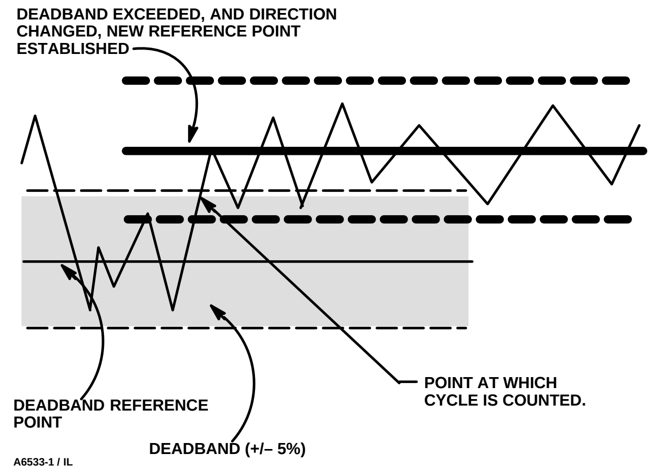

Figure 4-7. Cycle Counter Deadband (set at 10%)

Temperature Alerts

Label: Temp Hi Alrt Pt
Parameter Name: SERVO_ALARM_TEMP_HI
Index Number: 87
Mode: All
Range: 0 to 125°C
Description: This parameter determines the temperature high alert point, in degrees Celsius, for the temperature high alert.

Label: Temp Lo Alrt Pt
Parameter Name: SERVO_ALARM_TEMP_LO
Index Number: 88
Mode:All
Range: –60 to 100°C
Description: This parameter determines the temperature low alert point, in degrees Celsius, for the temperature low alert.

Cycle Counter Alert

Label: Cycle Count
Parameter Name: CYCLE_COUNT
Index Number: 96
Mode: All
Description: Cycle Counter records the number of times the travel changes direction. The change in direction must occur after the deadband has been exceeded before it is counted as a cycle. Once a new cycle has occurred, a new deadband around the last travel is set. See figure 4-7. You can reset the cycle counter by configuring it as zero.

Label: Cycle Count DB
Parameter Name: SERVO_ALARM_CYCLE_COUNT.THRESHOLD
Index Number: 80 subindex 2
Mode: All
Range: 0 to 100%
Description: This parameter determines the cycle counter alert deadband. The cycle counter alert deadband is the area around the travel reference point, in percent (%) of ranged travel, that was established at the last increment of the cycle counter. This area must be exceeded before a change in travel direction can be counted as a cycle. See figure 4-7.

Label: Cycle Count Alrt Pt
Parameter Name: SERVO_ALARM_CYCLE_COUNT.LIMIT
Index Number: 80 subindex 1
Mode: All
Range: 0 to
Description: This parameter determines the cycle counter alert point. The cycle counter alert point is the value of the cycle counter, in cycles, which, when exceeded, activates the Cycle Counter Alert.

Output Block Time-Out

Label: Output Blk Timeout
Parameter Name: SERVO_ALARM_OUTBLK_TIMEOUT
Index Number: 93
Mode: All
Range: A value greater than 0 up to 800 seconds
Description: This parameter determines how long the transducer block waits for a set point change from the AO block before it activates the alarm. This time is the time, in seconds, between AO block executions.

Section 5 Calibration

Calibrating Travel

WARNING

During calibration, the valve may move. To avoid personal injury and property damage caused by the release of pressure or process fluid, provide some temporary means of control for the process.

5

Note

The AO block mode must be Out of Service to be able to Calibrate Travel.

CAUTION

The AO block mode can be set to Out of Service by setting the Resource block mode to Out of Service. However, setting the Resource block to Out of Service also sets all function blocks within the device to Out of Service, including the PID block. If the PID block is used to control another loop, be sure some other means are provided to control the loop before taking the block Out of Service.

Automatic Travel Calibration

When a DVC5000f Series digital valve controller is ordered as part of a control valve assembly, the factory mounts the digital valve controller on the actuator, connects the feedback linkage, connects the necessary tubing, then sets up and calibrates the digital valve controller as specified on the order.

You can calibrate the instrument travel automatically using the Auto Travel Calibration method. The Auto Travel Calibration method (method name Auto_Calibrate) is included with the device description (DD) software. For information on using methods on the host system and the Auto Travel Calibration method to automatically calibrate instrument travel, see the host system documentation.

Before starting Auto Travel Calibration, the AO block should be Out of Service. If the AO block is not out of service, you will not be able to calibrate the instrument because Auto Travel Calibration will not be able to change the transducer block set point. If the AO block is not Out of Service, the method provides you an opportunity to abort and set the AO block out of service.

1. Start Auto Travel Calibration. For information on starting calibration methods from a DeltaV host system, see Appendix G. For information on running methods from other host systems, see the system documentation.

2. Auto Travel Calibration warns you the valve will move and that there may be a loss of process control. Select Yes to continue or select No to abort Auto Travel Calibration.

3. Auto Travel Calibration next initializes the instrument. After initialization, if the Feedback Connection is Sliding Stem - Standard Feedback, Auto Travel Calibration prompts you to set the crossover. For all other Feedback Connections, Auto Travel Calibration skips to step 7. For details of the Feedback Connection parameter see the “Detailed Setup” section

4. If the crossover must be set, there are three means of crossover adjustment: Manual (Initial Setup), Use Default (50%), or Use Last Value. Manual is the recommended choice. It permits you to manually set the crossover. If you select manual, continue to step 5.

If you select Use Last Value, no further user interaction is required during the calibration process. Go to step 7. The crossover setting currently stored in the instrument from the last travel calibration is used, followed by a series of actions that will automatically calibrate the instrument. Use this selection if you cannot use manual, such as when you cannot see the valve.

If you select Use Default, this also does not require any further user interaction during the calibration process. Go to step 7. A value for the crossover is written to the instrument, followed by a series of actions that will automatically calibrate the instrument. Use this selection only as a last resort. Default assumes a midrange position on the travel sensor as the crossover point. However, this may not be an appropriate value to use for crossover because of variations in mounting and travel sensor calibration.

5. If you selected Manual for the crossover adjustment, Auto Travel Calibration prompts you to set the crossover. This prompt includes the current travel value and asks you to select the direction and amount the valve should move in order to set the crossover.

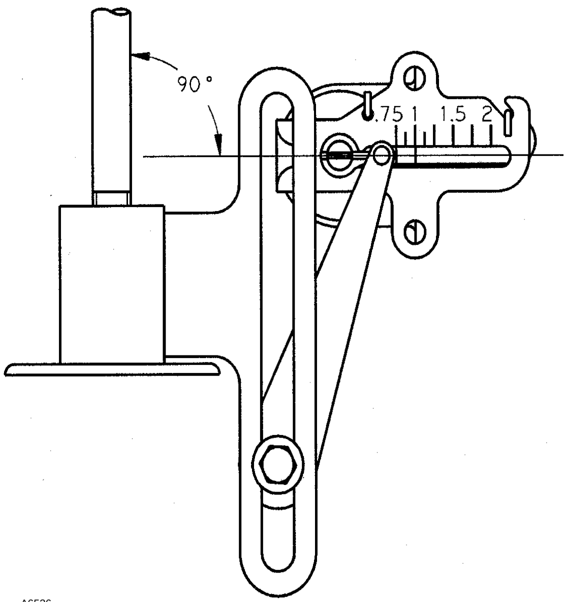

Figure 5-1. Crossover Point

6. Select the direction and size of change required to set the feedback arm so it is 90° to the actuator stem, as shown in figure 5-1. Once the feedback arm is in the right position, select Mark Current Position.

7. From here on the calibration process is automatic. No further interaction is required.

8. When calibration is complete, you are next asked to enter information about the calibration, including who performed the calibration, where it was performed, and the date on which it was performed.

9. Before exiting, Auto Travel Calibration asks if you want to return the transducer block mode to Auto, if the transducer block was in the Out-of-Service mode before the method started. Select Yes to change the transducer block mode to Auto. Select No to leave the transducer block in its current mode.

Remember to restore the Analog Output (AO) block mode if you changed it to Out of Service before starting Auto Travel Calibration. This is the end of the Auto Travel Calibration method.

Manual Travel Calibration

You can calibrate the instrument travel manually using the Manual Calibration method. The Manual Calibration method (method name Man_Calibrate) is included with the device description (DD) software. For information on using methods on the host system and the Manual Calibration method to manually calibrate instrument travel, see the host system documentation.

Before starting Manual Calibration, the AO block should be Out of Service. If the AO block is not out of service, you will not be able to calibrate the instrument because Manual Calibration will not be able to change the transducer block set point. If the AO block is not Out of Service, the method provides you an opportunity to abort and set the AO block out of service.

1. Start Manual Calibration. For information on starting calibration methods from a DeltaV host system, see Appendix G. For information on running methods from other host systems, see the system documentation.

2. Manual Calibration warns you the valve will move and that there may be a loss of process control. Select Yes to continue or select No to abort Manual Calibration.

3. Manual Calibration next initializes the instrument. After initialization, if the Feedback Connection is Sliding Stem - Standard Feedback, Manual Calibration prompts you to set the crossover. For all other Feedback Connections Manual Calibration skips to step 5. For details of the Feedback Connection parameter see the “Detailed Setup” section

4. If the crossover must be set, there are three means of crossover adjustment: Manual (Initial Setup), Use Default (50%), or Use Last Value. Manual is the recommended choice. It permits you to manually set the crossover.

If you select Use Last Value the crossover setting currently stored in the instrument from the last travel calibration is used, followed by a series of actions that will automatically calibrate the instrument. Use this selection if you cannot use manual, such as when you cannot see the valve.

If you select Use Default a value for the crossover is written to the instrument, followed by a series of actions that will automatically calibrate the instrument. Use this selection only as a last resort. Default assumes a midrange position on the travel sensor as the crossover point. However, this may not be an appropriate value to use for crossover because of variations in mounting and travel sensor calibration.

5. Manual Calibration first commands the instrument to mark end points of travel. You must acknowledge each message to continue. If the Feedback Connection is not Sliding Stem - Standard Feedback, go to step 8. If the Feedback Connection is Sliding Stem - Standard Feedback, and if you selected Manual for the crossover, continue to step 6. If you selected Use Last Value or Use Default, go to step 8.

6. If you selected Manual for the crossover adjustment, Manual Calibration prompts you to set the crossover. This prompt includes the current travel value and asks you to select the direction and amount the valve should move in order to set the crossover.

7. Select the direction and size of change required to set the feedback arm so it is 90° to the actuator stem, as shown in figure 5-1. Once the feedback arm is in the right position, select Mark Current Position.

8. Select the direction and size of change required to set the travel at the closed end point. When the valve is at is full closed position, select Mark Current Position.

9. Select the direction and size of change required to set the travel at the open end point. When the valve is at is full open position, select Mark Current Position.

10. From here on the calibration process is automatic. No further interaction is required.

11. When calibration is complete, you are next asked to enter information about the calibration, including who performed the calibration, where it was performed, and the date on which it was performed.

12. Before exiting, Manual Calibration asks if you want to return the transducer block mode to Auto, if the transducer block was in the Out-of-Service mode before the method started. Select Yes to change the transducer block mode to Auto. Select No to leave the transducer block in its current mode.

Remember to restore the Analog Output (AO) block mode if you changed it to Out of Service before starting Manual Calibration. This is the end of the Manual Calibration method.

Calibrating the Pressure Sensor

Note

The pressure sensor is normally adjusted at the factory and should not require adjustment.

You can calibrate the instrument pressure sensor automatically using the Pressure Sensor Cal method. The Pressure Sensor Cal method (method name Calibrate_Pressure_Sensor) is included with the device description (DD) software. For information on using methods on the host system and the Pressure Sensor Cal method to automatically calibrate instrument travel, see the host system documentation.

An external gauge to measure the digital valve controller output is required to calibrate the pressure sensor. This gauge is referred to as the reference gauge in the following procedure. The instrument output gauge may be used as the reference gauge.

Note

The AO block mode must be Out of Service to be able to run the Pressure Sensor Cal method.

CAUTION

The AO block mode can be set to Out of Service by setting the Resource block mode to Out of Service. However, setting the Resource block to Out of Service also sets all function blocks within the device to Out of Service, including the PID block. If the PID block is used to control another loop, be sure some other means are provided to control the loop before taking the block Out of Service.

Before starting Pressure Sensor Cal, the AO block should be Out of Service. If the AO block is not out of service, you will not be able to calibrate the instrument because Pressure Sensor Cal will not be able to change the transducer block set point. If the AO block is not Out of Service, the method provides you an opportunity to abort and set the AO block out of service.

1. Start Pressure Sensor Cal. For information on starting calibration methods from a DeltaV host system, see Appendix G. For information on running methods from other host systems, see the system documentation.

2. Pressure Sensor Cal warns you the valve will move and that there may be a loss of process control. Select Yes to continue or select No to abort Pressure Sensor Cal.

3. Enter the units to use for calibrating the pressure sensor.

4. Pressure Sensor Cal begins by setting the valve travel to –25% travel. After the pressure has stabilized, enter the pressure reading from the reference pressure gauge.

5. Pressure Sensor Cal next sets the valve travel to 125% travel. After the pressure has stabilized, enter the pressure reading from the reference pressure gauge.

6. Pressure Sensor Cal displays the calibrated actuator pressure. If this value is not correct, select No, and Pressure Sensor Cal returns to step 4 so that you can recalibrate pressure. If the value displayed is correct, select Yes to continue to the next step.

7. Before exiting, Pressure Sensor Cal asks if you want to return the transducer block mode to Auto, if the transducer block was in the Out-of-Service mode before the method started. Select Yes to change the transducer block mode to Auto. Select No to leave the transducer block in its current mode.

Remember to restore the Analog Output (AO) block mode if you changed it to Out of Service before starting Pressure Sensor Cal. This is the end of the Pressure Sensor Cal method.

Storing and Restoring Data

The Store/Restore Data method (method name Restore_Data) permits you to restore instrument data from factory setup and calibration data or from the Field Setup section of the instrument Non-Volatile Memory (NVM). You can also use Store/Restore Data to store setup and calibration data in the Field Setup section of NVM. The Store/Restore Data method is typically used to store current instrument data so that in case of a problem during setup or calibration you can return the instrument to its previous configuration. The method is included with the device description (DD) software. For information on using methods on the host system, see the host system documentation.

1. Start the Store/Restore Data method. For information on starting calibration methods from a DeltaV host system, see Appendix G. For information on running methods from other host systems, see the system documentation.

2. Restore Data warns you that the valve will move and that there may be a loss of process control. Select Yes to continue, or select No to abort Restore Data.

3. There are three means of storing or restoring data:

Table 5-1. Factory and Field Setup Parameters

Parameter Label	Index Number[1]
Act. Fail Action	21
Actuator Size	38
Actuator Stops	36
Calibration Date	30
Calibration Loc.	29
Calibration Person	31
Crossover	43
FB Temp Coef	41
Feedback Connection	35.2
Feedback High	39
Feedback Low	40
Feedback Span	42
High Perf Gain	18
High Perf Press Bias	51
High Perf Press Rate	50
High Perf Reset	19
High Perf Tvl Rate	20
Inst. Deadband	47
Inst. Output Bias	44
IVP Gain	48
IVP Offset	49
Press Cal. Units	56.1
Pressure Gain	55.1
Pressure Offset	55.2
Press Units	56.1
Standard Gain	61.1
Standard Tvl Rate	61.2
Travel Cutoff High	15
Travel Cutoff Low	16
Tvl Sensor Motion	35.1

1. Digit after the decimal indicates subindex number. For example, 55.1 indicates parameter number 55 subindex 1.

- **Restore Factory Configuration Data**—Restore Data replaces the current values for the parameters listed in table 5-1 with the values stored in the factory data section of the instrument NVM. This restores the values for these parameters back to the values used to setup the instrument at the factory. Be sure to perform initial setup and calibration after restoring factory data.

- **Restore Field Configuration**—Restore Data replaces the current values for the parameters listed in table 5-1 with the values that were last stored in the Field Setup section of the instruments's NVM.

- **Store Field Configuration**—Restore Data stores the current values for the parameters listed in table 5-1 in the Field Setup section of the instrument's NVM.

Note

If you select Restore Factory Configuration or Restore Field Configuration, Restore Data sets the input characterization to linear.

Select the desired means of storing or restoring data, or select Exit Store/Restore Data to exit the method without storing or restoring configuration data.

4. Before exiting, Store/Restore Data asks if you want to return the transducer block mode to Auto, if the transducer block was in the Out-of-Service mode before the method started. Select Yes to change the transducer block mode to Auto. Select No to leave the transducer block in its current mode.

This is the end of the Store/Restore Data method.

Section 6 Viewing Device Information

6

6

Table 6-1. Listing of Block Parameters in this Section by Label and Parameter Name

Parameter Label	Parameter Name	Index Number(1)	Block Mode Required to Modify Parameter	Data Protection that Affects Parameter(2)	Page Reference
Resource Block Parameters					
Alert Key	ALERT_KEY	04			6-3
Clear FState	CLR_FSTATE	30			6-4
Confirm Time	CONFIRM_TIME	33			6-5
Block Execution	CYCLE_SEL	20			6-5
DD Revision	DD_REV	13	Read Only	Read Only	6-3
Device Revision	DEV_REV	12	Read Only	Read Only	6-3
Device State	RS_STATE	07	Read Only	Read Only	6-4
Device Type	DEV_TYPE	11	Read Only	Read Only	6-3
Fault State	FAULT_STATE	28	Read Only	Read Only	6-4
Feature Select	FEATURE_SEL	18			6-5
Free Space	FREE_SPACE	24	Read Only	Read Only	6-3
Free Time	FREE_TIME	25	Read Only	Read Only	6-3
Hardware Types	HARD_TYPES	15	Read Only	Read Only	6-3
Manufacturer ID	MANUFAC_ID	10	Read Only	Read Only	6-3
Max Alerts Poss	MAX_NOTIFY	31	Read Only	Read Only	6-5
Memory Size	MEMORY_SIZE	22	Read Only	Read Only	6-3
Min Cycle Time	MIN_CYCLE_T	21	Read Only	Read Only	6-3
Min NVM Cycle Time	NV_CYCLE_T	23	Read Only	Read Only	6-3
Max Alerts Allow	LIM_NOTIFY	32			6-5
RCas Timeout	SHED_RCAS	26			6-4
Restart	RESTART	16			6-4
ROut Timeout	SHED_ROUT	27			6-4
Set FState	SET_FSTATE	29			6-4
Strategy	STRATEGY	03			6-4
Tag Description	TAG_DESC	02			6-3
Write Lock	WRITE_LOCK	34			6-4
Write Priority	WRITE_PRI	39			6-5
Transducer Block Parameters					
Actuator Pressure	PRESSURE	57	Read Only	Read Only	6-6
Alert Status	SERVO_ALARM_SUMMARY.CURRENT	78.1	Read Only		6-7
Alert Unacknowledged	SERVO_ALARM_SUMMARY.UNACKNOWLEDGED	78.2	Read Only		6-7
Alert Unreported	SERVO_ALARM_SUMMARY.UNREPORTED	78.3	Read Only		6-7
Block Error	BLOCK_ERR	06	Read Only	Read Only	6-8
Cycle Count	CYCLE_COUNT	96	All	Mechanical	6-6
Diag & Cal Rev..	DIAG_CAL_REV	102	Read Only	Read Only	6-6
Diagnostics Options	RESERVED_DPR	106			6-7
Drive Signal	S_VAR_2	64	Read Only	Read Only	6-6
Function Block Options	RESERVED_FBP	107			6-7
Hardware Rev.	ELECT_REV_NO	101	Read Only	Read Only	6-6
Inst. Model No.	INST_MODEL_CODE	37	All	Mechanical	6-6
Instrument Temp.	ELECT_TEMP	70	Read Only	Read Only	6-6
NVM Write Count	NVM_WRITES	100	Read Only	Read Only	6-6
Other Status	SELFTEST_STATUS	97	Read Only	Read Only	6-8
Transducer Error	XD_ERROR	11	Read Only	Read Only	6-8
Travel	FINAL_POSITION_VALUE.VALUE	17.1	Read Only	Read Only	6-6
Travel Status	FINAL_POSITION_VALUE.STATUS	17.2	Read Only	Read Only	6-6
Tvl Accumulator	TRAVEL_ACCUM	95	All	Mechanical	6-6

1. Digit after the decimal indicates subindex number. For example, 78.1 indicates parameter number 78 subindex 1.
2. Parameters without any data protection listed are not affected by any type of protection mechanism.

This section describes the resource and transducer block parameters that provide instrument information. Most of the parameters listed in this section are read only. Parameters that are used to set up the instrument are described in Section 3 “Initial Setup” or Section 4 “Detailed Setup.” Some of the setup parameters may be listed in this section because they provide instrument information; however, no detail is given here for modifying them.

Table 6-1 lists the parameters in this section in alphabetical order by label with a page reference where more detail on the parameter can be found. Each parameter is identified by its label as well as its parameter name and index number.

Access to each parameter depends upon the host system software. For information on using the host system to view block parameters, see the appropriate system documentation.

Resource Block Parameters

Identification

Label: Manufacturer ID
Parameter Name: MANUFAC_ID
Index Number: 10
Description: The manufacturer of the device where this block is located, used by the interface device to locate the DD file for this device. The ID number assigned by FOUNDATION fieldbus to Fisher Controls is 20736 (005100 hex).

Label: Device Type
Parameter Name: DEV_TYPE
Index Number: 11
Description: Identifies the type of device where this block is located, used by the interface device to locate the DD file for this device.

Label: Device Revision
Parameter Name: DEV_REV
Index Number: 12
Description: Manufacturer revision number associated with this device, used by the interface device to locate the DD file for this device.

Label: DD Revision
Parameter Name: DD_REV
Index Number: 13
Description: Revision of the device description (DD) associated with this device, used by the interface device to locate the DD file for this device.

Label: Tag Description
Parameter Name: TAG_DESC
Index Number: 2
Description: A unique description for the resource block. The tag description must be unique for each block within a system.

Label: Alert Key
Parameter Name: ALERT_KEY
Index Number: 4
Description: An identification number that permits grouping alerts. This number may be used to indicate to the operator the source of the alert such as the instrument, plant unit, etc.

Hardware

Label: Memory Size
Parameter Name: MEMORY_SIZE
Index Number: 22
Description: Indicates memory, in kilobytes, available for additional function blocks. Because no additional function blocks may be added to DVC5000f Series instruments, this parameter value is 0.

Label: Free Space
Parameter Name: FREE_SPACE
Index Number: 24
Description: Indicates the percentage of memory (see parameter 22, Memory Size) available for additional function blocks. Because no additional function blocks may be added to DVC5000f Series instruments, this parameter value is 0.

Label: Free Time
Parameter Name: FREE_TIME
Index Number: 25
Description: Percent of the block processing time that is free to process additional blocks. Because no additional function blocks may be added to DVC5000f Series instruments, this parameter value is 0.

Label: Min Cycle Time
Parameter Name: MIN_CYCLE_T
Index Number: 21
Description: The shortest time in which the device can execute its function block schedule (macrocycle).

Label: Min NVM Cycle Time
Parameter Name: NV_CYCLE_T
Index Number: 23
Description: Minimum time interval required to write parameters to non-volatile memory. Zero indicates data cannot be written to non-volatile memory.

Label: Hardware Types
Parameter Name: HARD_TYPES
Index Number: 15
Description: Indicates the types of hardware available as channel numbers on this device.
0=Scalar Input
1=Scalar Output
2=Discrete Input
3=Discrete Output

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Label: Restart
Parameter Name: RESTART
Index Number: 16
Description: There are four possible initialization values that can be entered into the Restart parameter. See Restarting the Instrument on page 4-2.

DVC5000f Series instruments only support scalar outputs.

Mode

Label: Strategy
Parameter Name: STRATEGY
Index Number: 3
Description: This parameter permits strategic grouping of blocks so the operator can identify where the block is located. The blocks may be grouped by plant area, plant equipment, etc. This data is not checked or processed by the block.

Label: Fault State
Parameter Name: FAULT_STATE
Index Number: 28
Description: Indicates a condition set by loss of communication to an output block, fault promoted to an output block, or a physical contact. When the Fault state is ACTIVE, the output function blocks perform their FSTATE actions.

Label: Set FState
Parameter Name: SET_FSTATE
Index Number: 29
Mode:
Range: 1 (OFF) or 2 (SET)
Description: Allows manually placing the instrument in the fault state by selecting SET. See also Features Select.

Label: Clear FState
Parameter Name: CLR_FSTATE
Index Number: 30
Mode:
Range:1 (OFF) or 2 (CLEAR)
Description: Selecting CLEAR clears the device fault state, if no faults are currently active. See also Features Select.

Label: RCas Timeout
Parameter Name: SHED_RCAS
Index Number: 26
Mode:
Range:
Description: Time duration, in 1/32 milliseconds, at which to give up on computer writes to function block

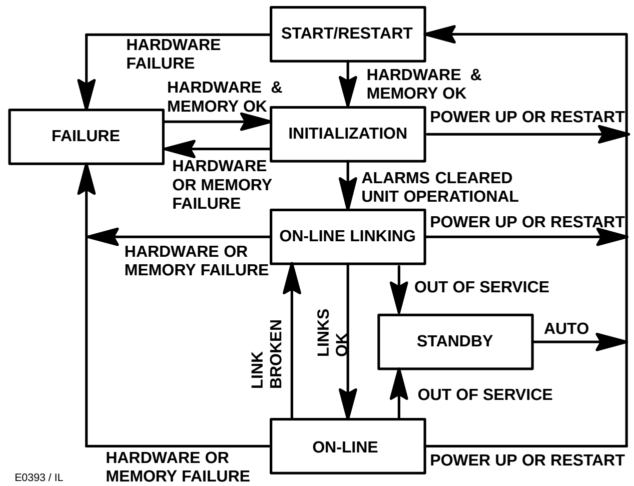


Figure 6-1. Instrument State Diagram

RCas locations. Shed from RCas shall never happen when Shed RCas is 0.

Label: ROut Timeout
Parameter Name: SHED_ROUT
Index Number: 27
Mode:
Range:
Description: Time duration, in 1/32 milliseconds, at which to give up on computer writes to function block ROut locations. Shed from ROut shall never happen when Shed ROut is 0.

Label: Write Lock
Parameter Name: WRITE_LOCK
Index Number: 34
Mode:
Range: 1 (NOT LOCKED) or 2 (LOCKED)
Description: If LOCKED, no writes from anywhere are allowed, except to unlock Write Lock. When locked, block inputs will continue to be updated.

Label: Device State
Parameter Name: RS_STATE
Index Number: 7
Description: Indicates the state of the function blocks. As shown in figure 6-1, five states are possible:

- **Start Restart**—The instrument is in this state when power is applied. In this state the memory and other hardware necessary for reliable operation is tested. If all hardware tests pass, the instrument state moves to Initialization. If a hardware failure is detected, the instrument state changes to Failure.

- **Initialization**—The instrument can enter this state from the Start/Restart or Failure states. In the Initialization state, all unreported function block alarms are automatically confirmed and acknowledged. Once the instrument is considered operational, block execution is scheduled and the instrument state moves to On-line Linking.

- **Online Linking**—In this state, all defined links are evaluated. Once defined links are established, the instrument state changes to Online.

- **Online**—The instrument will be in this state if it is operational and all defined links are established. If one or more defined links are detected as not established, the state changes to Online linking.

- **Standby**—The instrument enters this state if the resource block mode is Out of Service. In this state all function block modes are forced to Out of Service. The transducer block mode is not affected. When the resource block mode is changed to Auto, the instrument state changes to Start Restart.

- **Failure**—This state may be entered from any other state except Standby. The instrument moves to this state whenever a hardware or memory failure is detected which would prevent reliable operation. When the failure clears, the instrument state moves to Initialization.

Options

Label: Block Execution
Parameter Name: CYCLE_SEL
Index Number: 20
Description: Indicates if function block execution can be scheduled. If bit 0 is active, the function blocks execute per the function block schedule. Default is schedule selected.

Label: Feature Select
Parameter Name: FEATURE_SEL
Index Number: 18
Mode:
Range: 1 (reports supported), 2 (fault state supported), 3 (soft write lock supported), and 5 (output readback supported)
Description: Permits selecting the desired feature from those that are available. Available features for DVC5000f Series instruments include:

- **Reports**—Selecting reports enables alarm and event reporting. Reporting of specific alarms may be disabled, see Alarms in Section 4.

- **Fault State**—Selecting fault state enables the ability to manually set and clear the fault state. See Set FState and Clear FState.

- **Soft Write Lock**—When selected, permits using the Write Lock parameter to prevent any external change to static or nonvolatile parameter values. Block connections and calculation results will proceed normally, but the configuration is locked. See also the Write Lock parameter description.

- **Output Readback**—When selected, permits the transducer block output to be fedback to the READBACK parameter in the AO block.

Default is all features selected.

Alarms

Label: Write Priority
Parameter Name: WRITE_PRI
Index Number: 39
Mode:
Range: 0 to 15
Description: Priority of the alarm generated by setting Write Lock to NOT LOCKED.

Label: Confirm Time
Parameter Name: CONFIRM_TIME
Index Number: 33
Mode:
Range:
Description: The time, in milliseconds, the instrument waits for confirmation of receipt of a report before trying again. The instrument does not retry if Confirm Time is 0.

Label: Max Alerts Allow
Parameter Name: LIM_NOTIFY
Index Number: 32
Mode:
Range: 0 to Max Notify
Description: The maximum number of unconfirmed alert notify reports allowed. See Max Alerts Poss. If Max Alerts Allow is set to 0, no alerts are reported.

Label: Max Alerts Poss
Parameter Name: MAX_NOTIFY
Index Number: 31
Description: The maximum number of unconfirmed alert reports that the instrument can send without getting a confirmation. This limit is determined by the amount of memory available for alert reports. Use Max Alerts Allow to set a number lower than Max Alerts Poss to control alert flooding.

Transducer Block Parameters

Instrument Parameters

Label: Actuator Pressure
Parameter Name: PRESSURE
Index Number: 57
Description: Indicates the value of the instrument output pressure in psi, bar, or kPa.

Label: Drive Signal
Parameter Name: S_VAR_2
Index Number: 64
Description: Indicates the drive signal, as a percentage of the maximum drive available, going to the I/P converter from the printed wiring board.

Note

In most applications, the drive signal ranges between 50% and 75% of the maximum drive signal.

Label: Cycle Count
Parameter Name: CYCLE_COUNT
Index Number: 96
Description: Indicates the number of times the travel changes direction. Only changes in direction of the travel after the travel has exceeded the deadband are counted as a cycle. Once a new cycle has occurred, a new deadband around the last travel is set. See Cycle Counter Deadband in Section 4.

Label: Tvl Accumulator
Parameter Name: TRAVEL_ACCUM
Index Number: 95
Description: This parameter indicates the total change in travel, in percent of ranged travel. The accumulator only increments when travel exceeds the deadband. Then the greatest amount of change in one direction from the original reference point (after the deadband has been exceeded) will be added to the Travel Accumulator. See Travel Accumulator Deadband in Section 4.

Label: Instrument Temp.
Parameter Name: ELECT_TEMP
Index Number: 70
Description: This parameter indicates the internal temperature of the instrument in degrees Celsius.

Label: NVM Write Count
Parameter Name: NVM_WRITES
Index Number: 100
Description: Indicates the number of writes to non-volatile memory.

Label: Travel
Parameter Name: FINAL_POSITION_VALUE.VALUE
Index Number: 17 subindex 1
Description: This parameter shows the value of the DVC5000f Series digital valve controller travel in percent (%) of ranged travel. Travel always represents how far the valve is open.

Label: Travel Status
Parameter Name: FINAL_POSITION_VALUE.
STATUS
Index Number: 17 subindex 2
Description: Indicates a fault that makes the travel measurement bad or prevents the actuator from responding. This information is passed along with each transmission of the travel in the form of a status attribute.

Device Information

Label: Inst. Model No.
Parameter Name: INST_MODEL_CODE
Index Number: 37
Range: 1 through 4
Description: This parameter indicates the Instrument type number:
1=DVC5010f
2=DVC5020f
3=DVC5030f
4=DVC5040f

Label: Hardware Rev.
Parameter Name: ELECT_REV_NO
Index Number: 101
Description: This parameter indicates the revision number of the electronics in the instrument.

Label: Diag & Cal Rev..
Parameter Name: DIAG_CAL_REV
Index Number: 102
Description: This parameter indicates the number of the Fisher Controls diagnostic and calibration revision in the instrument.

Options

Label: Diagnostics Options
Parameter Name: RESERVED_DPR
Index Number: 106
Description: This parameter indicates which of the following diagnostic capabilities is included in the instrument:

Standard Diagnostics
Public Diagnostics
Advanced Diagnostics

Label: Function Block Options
Parameter Name: RESERVED_FBP
Index Number: 107
Description: This parameter indicates which of the following function blocks or special functions is available with the instrument:

Enhanced Servo
PID

Instrument Status

The following alerts are available from the instrument. Each alert is represented by one of 15 bits within the specified parameter. The hexadecimal value listed is a common way of identifying which bit is true.

Alert	Hexadecimal Value
Drive Failure	0001
Cycle Count	0002
Travel Accumulation	0004
Travel High	0008
Travel High-High	0010
Travel Low	0020
Travel Low-Low	0040
Travel Deviation	0080
Temperature High	0100
Temperature Low	0200
I/P Feedback	0400
Pressure High	0800
Pressure Low	1000
Pressure Derivative	2000
AO Timeout Alarm	4000
NVM Write	8000

Table 6-2. Bit Represented by Hexadecimal Value

Thousands				Hundreds				Tens				Ones			
8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Refer to table 6-2 to determine which bit is true for a given hexadecimal value. For example, a hexadecimal value of 400 indicates bit 10 is true.

The following parameters determine the alert handling:

- **Alert Status**—indicates which alerts are currently active
- **Alert Unreported**—indicates which alerts are unreported,
- **Alert Unacknowledged**—indicates which alerts have not been acknowledged by the receiving device.

The value that appears with each parameter is the sum of the values of all the alerts being handled by that parameter. For example, a hexadecimal value of 0084 for the Alert Status indicates the Travel Accumulator (0004) and Travel Deviation (0080) alerts are active. A hexadecimal value of 0012 for the Alarm Unacknowledged parameter indicates that the Cycle Count (0002) and Travel High-High (0010) alerts have not been acknowledged by the receiving device. For information on enabling alerts, setting trip points, and deadbands, see section 4.

Label: Alert Status
Parameter Name: SERVO_ALARM_SUMMARY.CURRENT
Index Number: 78 subindex 1
Description: Indicates which enabled alerts are active. The value is the sum of the hexadecimal values of all active alerts.

Label: Alert Unacknowledged
Parameter Name: SERVO_ALARM_SUMMARY.UNACKNOWLEDGED
Index Number: 78 subindex 2
Description: Indicates which reported alerts are unacknowledged by the receiving device. The value is the sum of the hexadecimal values for all unacknowledged alerts.

Label: Alert Unreported
Parameter Name: SERVO_ALARM_SUMMARY.UNREPORTED
Index Number: 78 subindex 3
Description: Indicates which active and enabled alerts are unreported. The value is the sum of the hexadecimal values of all unreported alerts.

Label: Block Error
Parameter Name: BLOCK_ERR
Index Number: 6
Range: 0 through 15
Description: This parameter indicates the error status of the hardware or software components associated with a block. Table 6-3 lists conditions reported in the Block Error parameter. Conditions in *italics* are not applicable for the transducer block and are provided only for your reference.

Label: Transducer Error
Parameter Name: XD_ERROR
Index Number: 11
Range: 0 and 16 through 25
Description: One of the transducer error codes defined in the FF Transducer Specifications in section 4.7 Block Alarm Subcodes.
0=No error
17=General error, pressure sensor failure(3)
19=Configuration error
20=Electronics failure, I/O processor failure
22=I/O failure, position sensor
24=Software error

DVC5000f Series instruments support alarm subcodes 17 (General error), 20 (Electronics failure), 22 (I/O failure), and 24 (Software error).

Label: Other Status
Parameter Name: SELFTEST_STATUS
Index Number: 97
Description: The following bits indicate the status of the instrument self test:
128=Tvl Snsr Hi Error
256=Tvl Snsr Lo Error
512=Voltage Ref Fail
1024=IOP Other Error
2048=IOP Configuration Error
4096=IOP Timeout
8192=Press Snsr Fail
16384=Tvl Snsr Failure
32768=Simulate Jumper

Table 6-3. Block Error Conditions

Condition Number	Condition Name and Description
0	**Other** -Error condition is not 0 in the transducer error parameter.
1	*Block Configuration Error (N/A)*
2	**Link Configuration Error** - No active link for alarm reporting
3	*Simulate Active (N/A)*
4	**Local Override** -Transducer block has started offline diagnostics, target and actual modes are Auto.
5	**Instrument Fault State** - Transducer block actual mode is Out of Service, position sensor reading is not between Feedback Low and Feedback High values (Transducer error parameter I/O failure condition 22), I/O processor error (Transducer error parameter Electronics failure condition 20), Pressure Sensor failure(1) (Transducer error parameter General error condition 17), Drive failure, Output Block Timeout, or NVM failure on read.
6	**Maintenance Needed Soon** - NVM failure on write, or Pressure Sensor failure
7	*Input failure/process variable has Bad status (N/A)*
8	*Output failure (N/A)*
9	**Memory failure** - NVM failure on read or write
10	*Lost Static Data (N/A)*
11	*Lost NV Data (N/A)*
12	*Readback Check Failed*
13	**Maintenance Needed Now** - Position sensor reading is not between Feedback Low and Feedback High values, I/O processor error, or NVM failure on read
14	*Power Up (N/A)*
15	**Out of Service** - Transducer block actual mode is Out of Service, position sensor reading is not between Feedback Low and Feedback High values (Transducer error parameter I/O failure condition 22), I/O processor error (Transducer error parameter Electronics failure condition 20), Pressure Sensor failure(2) (Transducer error parameter General error condition 17), Drive failure, Output Block Timeout, or NVM failure on read.

1. Error condition occurs do to pressure sensor failure only if Standard Gain tuning parameter is equal to 0.
2. Error condition occurs do to pressure sensor failure only if Standard Gain tuning parameter is not equal to 0.

3. This error condition occurs only if the Standard Gain tuning parameter is equal to 0.

Section 7 Principle of Operation

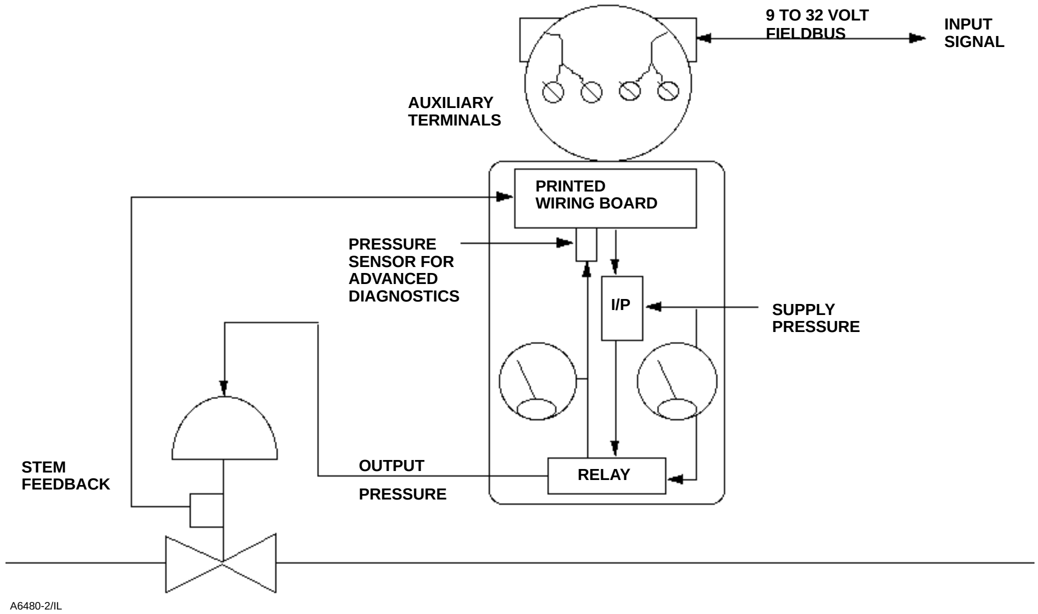


Figure 7-1. DVC5000f Series Digital Valve Controller Principle of Operation

FOUNDATION Fieldbus Communication

The DVC5000f Series digital valve controllers use the FOUNDATION fieldbus to communicate with other fieldbus instruments and the control system. Fieldbus is an all digital, serial, two-way communication system which interconnects “field” equipment such as transmitters, valve controllers, and process controllers. Fieldbus is a local-area network (LAN) for instruments used in both process and manufacturing automation with built-in capability to distribute the control application across the network.

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

- a standardized physical interface to the wire
- bus powered devices on a single wire pair
- intrinsic safety options.

In addition, the FOUNDATION fieldbus enables:

- Increased capabilities due to full digital communications
- reduced wiring and wire terminations due to multiple devices on one pair of wires
- increased selection of suppliers due to interoperability
- reduced loading on control room equipment due to possible distribution of some control and input/output functions to field devices
- speed options for process control and manufacturing applications.

For more information on the operation of the FOUNDATION fieldbus, refer to the FOUNDATION fieldbus specifications.

Digital Valve Controller Operation

DVC5000f Series digital valve controllers have a single master module that may be easily replaced in the field without disconnecting field wiring or tubing. The master module contains the following submodules: current-to-pneumatic (I/P) converter, printed wiring board assembly, and pneumatic relay. The master module can be rebuilt by replacing the submodules. See figures 7-1 and 7-2.

DVC5000f Series digital valve controllers are bus-powered instruments that provide a control valve position in response to a digital input from the control room. The following describes a direct acting Type DVC5010f digital valve controller mounted on a Type 657 actuator.

The input is routed into the terminal box through a single pair of wires and then to the printed wiring board assembly submodule where it is read by the microprocessor, processed by a digital algorithm, and converted into an analog I/P drive signal.

As the input increases, the drive signal to the I/P converter increases. This increases the pressure to

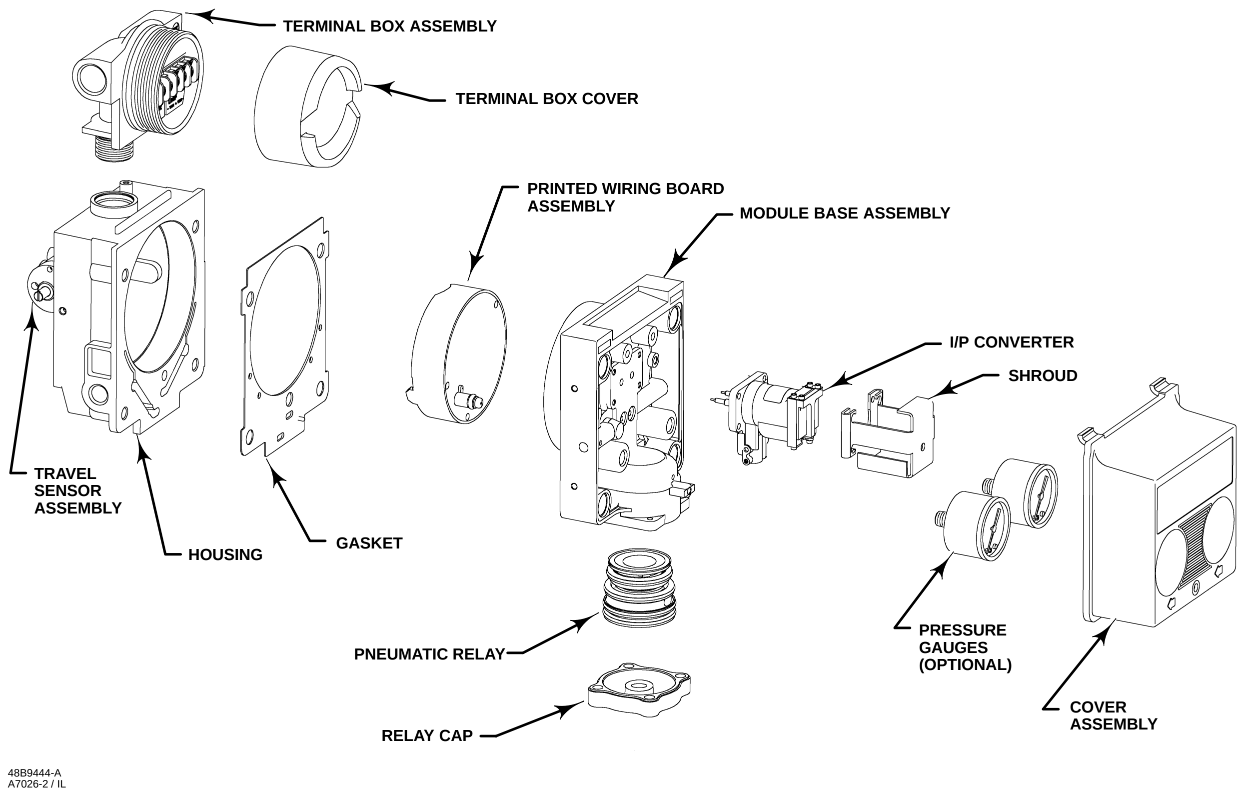


Figure 7-2 . DVC5000f Series Digital Valve Controller Assembly

the pneumatic relay submodule. As the pressure increases, the pneumatic relay opens the supply port and closes the exhaust port, increasing the output pressure to the actuator. The increased output pressure causes the actuator stem to move downward. Stem position is sensed through the feedback linkage by the travel sensor which is electrically connected to the printed wiring board assembly submodule. The stem continues to move downward until the correct stem position is attained. At this point the printed wiring board assembly decreases the I/P drive signal reducing nozzle and relay pressure until the system is in equilibrium.

As the input decreases, the drive signal to the I/P converter submodule decreases, decreasing the pressure. The pneumatic relay closes the supply port and opens the exhaust port, releasing the actuator casing pressure to atmosphere. The stem moves upward until the correct position is attained. At this point the printed wiring board assembly increases the I/P drive signal until the system returns to equilibrium.

Section 8 Maintenance

Note

If the feedback arm (key 79) or feedback arm assembly (key 84) is removed from the DVC5000f Series digital valve controller, the travel sensor (key 77) must be recalibrated.

Because of the diagnostic capability of the DVC5000f Series digital valve controllers, predictive maintenance is available through the use of AMS ValveLink Software. Using the digital valve controller, valve and instrument maintenance can be enhanced, thus avoiding unnecessary maintenance. For information on using the ValveLink software, see the *AMS VL2000 Series ValveLink Software User Guide*.

Stroking the Digital Valve Controller Output

Using the Stroke Valve Method

You can remotely stroke the digital valve controller output from a host system using the Stroke Valve method. The Stroke Valve method (method name Stroke_Valve) is included with the device description (DD) software. For information on using methods on the host system and the Stroke Valve method to remotely stroke the instrument output, see the host system documentation.

Note

The AO block mode must be Out of Service to be able to run Stroke Valve.

Before starting Stroke Valve, the AO block should be Out of Service. If the AO block is not out of service, you will not be able stroke the valve because Stroke Valve will not be able to change the transducer block set point. If the AO block is not Out of Service, the method provides you an opportunity to abort and set the AO block out of service.

1. Start Stroke Valve.

2. Stroke valve next displays the current set point and travel and prompts for the desired set point change.

- **Move Open or Move Closed**—adjusts the current set point by the amount indicated (+/– 10%) up to the maximum or minimum allowed.

- **Go to...**—sets the current set point to the value indicated (5%, 50%, or 95% of travel).

- **Change Set Point**—changes set point to specified value.

- **Refresh Display**—refreshes the current values for the set point and travel as the valve moves. Because the valve moves slower than the method executes, use refresh display to update the actual valve travel.

- **Exit Stroke Valve**—Select this if you are done. This is the end of the Stroke Valve method.

Instrument Troubleshooting

If communication or output difficulties are experienced with the instrument, refer to the troubleshooting chart provided in table 8-1. The following transducer block parameters are also available to aid troubleshooting the instrument.

Maintenance: Travel and Pressure

Label: A/D Readback
Parameter Name: AD_FEEDBACK
Index Number: 62
Description: Indicates the analog-to-digital converter output for the feedback input.

Label: Crossover
Parameter Name: CROSSOVER
Index Number: 43
Description: Indicates the bias point for the feedback mechanism in sliding-stem applications.

Label: Feedback High
Parameter Name: FEEDBACK_HI
Index Number: 39
Description: Indicates the feedback value when the feedback arm is at its +60° position. Must be greater than the feedback low indication.

8

Table 8-1. Instrument Troubleshooting

Symptom	Possible Cause	Action
1. Instrument will not communicate.	1a. Insufficient terminal voltage.	1a. Measure the terminal voltage. Terminal voltage should be between 9 and 32 Vdc.
	1b. Cable capacitance too high.	1b. Wrong cable type or segment length too long. See Site Planning Guide.
	1c. Improper field wiring.	1c. Check integrity of wiring connections. Make sure cable shield is grounded only at the control system.
	1d. Disconnected loop wiring cable at PWB.	1d. Verify connectors are plugged in correctly.
	1e. PWB failure.	1e. Measure voltage at test terminals. The voltage should be 0.025 volts ±0.003 volts. If not, check terminal voltage. Replace the PWB if necessary.
	1f. Defective cable from terminal box.	1f. Check cable continuity. If necessary, replace the terminal box assembly.
	1g. Defective terminal box assembly printed wiring board.	1g. Check for damaged printed wiring board lands and terminals. If necessary, replace the terminal box assembly.
2. Instrument will not calibrate, has sluggish performance or oscillates.	2a. Travel sensor “frozen”, will not turn.	2a. Rotate feedback arm to ensure it moves freely. If not, replace the pot/bushing assy.
	2b. Broken travel sensor wire(s).	2b. Inspect wires for broken solder joint at pot or broken wire. Replace pot/bushing assy.
	2c. Travel sensor mis-adjusted.	2c. Perform Travel Sensor Adjustment procedure.
	2d. Open travel sensor.	2d. Check for continuity in electrical travel range. If necessary, replace pot/bushing assy.
	2e. Cables not plugged into PWB correctly.	2e. Inspect connections and correct.
	2f. Feedback arm loose on pot.	2f. Perform Travel Sensor Adjustment procedure.
	2g. Feedback arm bent/damaged or bias spring missing/damaged.	2g. Replace feedback arm and bias spring.
	2h. Configuration errors.	2h. Verify configuration
	2j. I/P assy primary restriction plugged.	2j. Apply supply pressure and depress cleanout wire.
	2k. Air blockage in I/P assy nozzle block, not cleared by depressing cleanout wire.	2k. Replace I/P assy.
	2l. O-ring(s) between I/P assy missing or hard and flattened losing seal.	2l. Replace O-ring(s).
	2m. I/P assy damaged/corroded/clogged.	2m. Check for bent flapper, loose cleanout valve, open coil (continuity), contamination, staining, or dirty air supply. Coil resistance should be between 1680 - 1860 ohms. Tighten cleanout valve, replace I/P assy if damaged, corroded, clogged, or open coil.
	2n. I/P assy out of spec.	2n. I/P assy nozzle may have been adjusted. Verify drive signal (55% to 75%) Replace I/P assy if drive signal is continuously high or low.
	2p. Defective gasket.	2p. Check gasket for closed holes, excessive deformation due to overtightening or “oozing”. If necessary, replace gasket.
	2q. Defective relay.	2q. Depress I/P assy armature, look for increase in output pressure. Remove relay, inspect for missing Belleville washer, missing valve spring, missing valve plug. Inspect “lip” under top O-ring for breakage due to relay removal. Inspect O-rings and replace if hard or damaged. Replace parts or relay if I/P assy good and air passages not blocked.
2. Instrument will not calibrate, has sluggish performance or oscillates.	2r. Defective 67CFR regulator, supply pressure gauge jumps around.	2r. Replace 67CFR regulator.

Table 8-2. Calibration Status Bit Enumeration

Bit Number	Calibration Step	Description
0	Calibration Error	An error was found during calibration
1	Full Close Marked	Valve fully closed position has been marked
2	Full Open Marked	Valve fully open position has been marked
3	Crossover Marked	Crossover point has been marked
4	IVP in Progress	Calibration of the IVP is in progress
5	Autocal In Progress	Auto calibration is in progress
6	Man Cal Done	Manual calibration is complete
7	Auto Cal Done	Auto calibration is complete

Label: Feedback Low
Parameter Name: FEEDBACK_LO
Index Number: 40
Description: Indicates the feedback value when the feedback arm is at its –60° position. Must be less than the feedback high indication.

Label: Pressure Gain
Parameter Name: PRESSURE_SCALE.GAIN
Index Number: 55 subindex 1
Description: Indicates the pressure sensor gain.

Label: Pressure Offset
Parameter Name: PRESSURE_SCALE.OFFSET
Index Number: 55 subindex 2
Description: Indicates the pressure sensor offset (bias).

Label: Press Cal. Units
Parameter Name: PRESSURE_UNITS.CAL_UNITS
Index Number: 56 subindex 1
Range: 1133 (kPa), 1137 (bar), or 1143 (psig)
Description: Indicates calibration and readback units for actuator pressure (psig, bar, or kPa).

Label: Calibrate Status
Parameter Name: CALIBRATE_STATUS
Index Number: 73
Description: Indicates the status of the instrument as it progresses through the calibration procedures by activating a series of bits. The bit numbers and descriptions are listed in table 8-2.

Maintenance: I/P and Other

Label: IP Feedback
Parameter Name: IP_FB
Index Number: 68
Description: Indicates the feedback from the current-to-pressure (I/P) converter.

Label: Voltage Ref
Parameter Name: VOLTAGE_REF
Index Number: 69
Description: Indicates the analog reference signal voltage in analog-to-digital converter counts. Use the following equation to convert the counts to voltage:

$$\text{Volts} = \frac{\text{Counts}}{50.61}$$

Label: I/O Proc Status
Parameter Name: P_STATUS
Index Number: 66
Description: Indicates the status of the internal I/O processor.

Label: I/O Proc Count
Parameter Name: P_COUNT
Index Number: 67
Description: Indicates the I/O processor count status.

Label: Alert Priority
Parameter Name: SERVO_ALARM_PRIORITY
Index Number: 76
Description: Indicates the priority for transducer block alarms. For more information on alerts, see “Setting Alerts” in Section 4.

Label: Firmware Date
Parameter Name: FIRMWARE_DATE
Index Number: 103
Description: Indicates date of firmware installed in the instrument.

Label: Drive Signal Alert
Parameter Name: SERVO_ALARM_DRIVE_SIGNAL
Index Number: 79
Description: Indicates if drive signal alert reporting is disabled and if the alert is active. For more information on alerts, see “Setting Alerts” in Section 4.

Label: Drive Sgl Alrt Pt
Parameter Name: SERVO_ALARM_DRIVE_SIGNAL.
LIMIT
Index Number: 79 subindex 1
Mode: All
Range: –25 to 125%
Description: The value, in percent, which when exceeded by the difference between Drive Signal (I/P

current) and its readback value causes the Drive Signal Alert to become active, if the Drive Signal Alert Time has elapsed.

Label: Drive Sgl Alrt Time
Parameter Name: SERVO_ALARM_DRIVE_SIGNAL.
TIME_LIMIT
Index Number: 79 subindex 2
Mode: All
Range: 0 to 120 seconds
Description: The difference between Drive Signal (I/P current) and its readback value must exceed the Drive Signal Alert Point for this time period, in seconds, before the Drive Signal Alert becomes active.

Label: I/P Feedback Alert
Parameter Name: SERVO_ALARM_IP_FB
Index Number: 89
Description: Indicates if I/P feedback alert reporting is disabled and if the alert is active. For more information on alerts, see “Setting Alerts” in Section 4.

Label: I/P FB Alrt Pt
Parameter Name: SERVO_ALARM_IP_FB.LIMIT
Index Number: 89 subindex 1
Mode: All
Range: 0 to 254
Description: The value which when exceeded by the I/P feedback current causes the I/P Feedback Alert to become active, if the I/P Feedback Alert Time has elapsed.

Label: I/P FB Alrt Time
Parameter Name: SERVO_ALARM_IP_FB.
TIME_LIMIT
Index Number: 89 subindex 2
Mode: All
Range: 0 to 120 seconds
Description: The I/P feedback current must exceed the I/P Feedback Alert Point for this time period, in seconds, before the I/P Feedback Alert becomes active.

Checking Voltage Available

WARNING

Personal injury or property damage caused by fire or explosion may occur if this test is attempted in an area which contains a potentially explosive atmosphere or has been classified as hazardous.

To check the Voltage Available at the instrument, perform the following:

1. Measure the voltage at the instrument BUS terminals. The voltage measured should be between 9 and 32 volts.

2. Measure the voltage at the instrument TEST terminals. This voltage should be 0.025 ±0.002 volts.

Master Module Maintenance

The digital valve controller contains a master module consisting of the I/P converter, pwb assembly, and pneumatic relay. The master module may be easily replaced in the field without disconnecting field wiring or tubing.

Removing the Master Module

To remove the master module, perform the following steps. Refer to figures 9-1 through 9-4 for key number locations.

WARNING

To avoid personal injury or equipment damage, turn off the supply pressure to the digital valve controller before attempting to remove the module base assembly from the housing.

1. For sliding-stem applications only, a protective shield (key 102) for the feedback linkage is attached to the side of the module base assembly. Remove this shield and keep for reuse on the replacement module. The replacement module will not have this protective shield.

2. Unscrew the captive screw in the cover (key 43) and remove the cover from the module base (key 2).

3. Using a 1/4-inch hex wrench, loosen the four-socket head screws (key 38). These screws are captive in the module base by retaining rings (key 154).

Note

The master module is linked to the housing by two cable assemblies. Disconnect these cable assemblies after you pull the master module out of the housing.

4. Pull the master module straight out of the housing (key 1). Once clear of the housing, swing the master module to the side of the housing to gain access to the cable assemblies.

5. The digital valve controller has two cable assemblies which connect the master module, via the pwb assembly, to the travel sensor and the terminal box. Disconnect these cable assemblies from the pwb assembly on the back of the master module.

CAUTION

To avoid affecting performance of the instrument, take care not to damage the master module gasket or guide surface. Do not bump or damage the bare connector pins on the pwb assembly.

Replacing the Master Module

To replace the master module, perform the following steps. Refer to figures 9-1 through 9-4.

CAUTION

To avoid affecting performance of the instrument, inspect the guide surface on the module and the corresponding seating area in the housing before installing the module base assembly. These surfaces must be free of dust, dirt, scratches, and contamination.

Ensure the gasket is in good condition. Do not reuse a damaged or worn gasket.

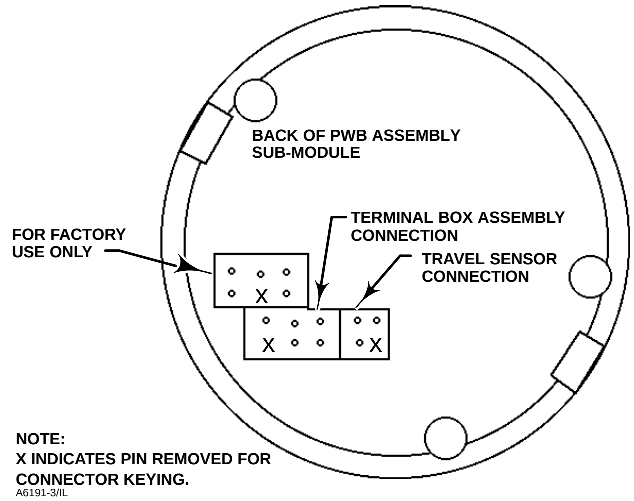


Figure 8-1. DVC5000f Series Digital Valve Controller Connector Locations

1. Ensure the gasket is aligned properly on the master module.

2. Connect the terminal box connector to the pwb assembly (key 50), shown in figure 8-1. Orientation of the connector is required.

3. Connect the travel sensor connector to the pwb assembly (key 50), shown in figure 8-1. Orientation of the connector is required.

4. Insert the module base (key 2) into the housing (key 1).

5. Install four screws (key 38) in the master module into the housing. If not already installed, press four retaining rings (key 154) into the module base. Evenly tighten the screws in a crisscross pattern to a final torque of 138 lbf•in (16 N•m).

6. Insert the cover hinge tabs into the module base. Swing the cover down into position and tighten the screw (key 41).

7. If not already installed, screw the vent (key 52) into the vent connection on the back of the housing.

8. If not already installed, apply sealant (key 64) to the pipe plug (key 61) and install it in the output connection on the back of the housing.

9. For sliding-stem applications only, install the protective shield (key 102) onto the side of the replacement module base assembly.

Submodule Maintenance

The digital valve controller's master module contains the following submodules: I/P converter, pwb assembly, and pneumatic relay. If problems occur, these submodules may be removed from the master module and replaced with new submodules. After replacing a submodule, the master module may be put back into service.

Note

If the pwb assembly or I/P converter submodule is replaced, calibrate and configure the DVC5000f Series digital valve controller to maintain accuracy specifications. If any other submodule was replaced, recalibration or adjustment of the digital valve controller, master module, or submodules is not necessary.

Note

Exercise care when you perform maintenance on the master module. Reinstall the cover to protect the I/P converter and gauges when servicing other submodules.

I/P Converter

Refer to figures 9-1 through 9-4 for key number locations. The I/P converter (key 41) is located on the front of the master module.

Replacing the I/P Filter

A screen in the supply port beneath the I/P converter serves as a secondary filter for the supply medium. To replace this filter, perform the following procedure:

1. Remove the I/P converter and shroud as described in the Removing the I/P Converter procedure.

2. Remove the screen from the supply port.

3. Install a new screen in the supply port as shown in figure 8-2.

4. Inspect the O-ring in the I/P output port. if necessary, replace it.

5. Reinstall the I/P converter and shroud as described in the Replacing the I/P Converter procedure.

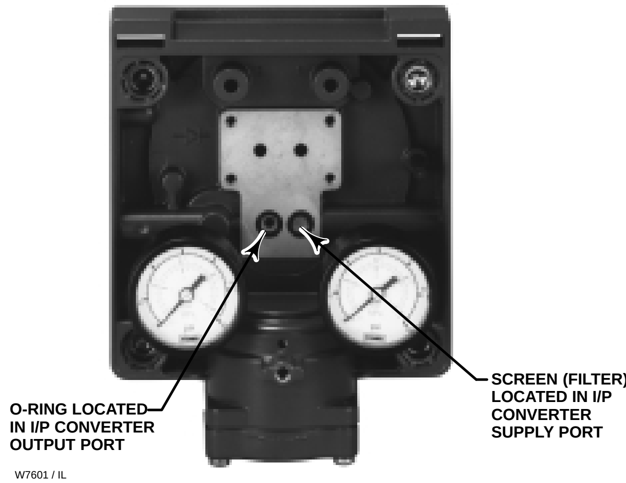


Figure 8-2. I/P Filter Location

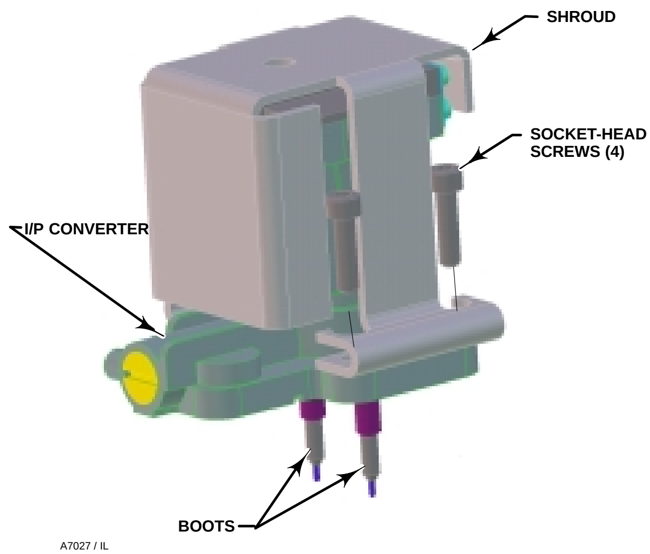


Figure 8-3. I/P Converter

Removing the I/P Converter

1. Remove the front cover, if not already removed.

2. Refer to figure 8-3. Remove the four socket-head screws that attach the shroud and I/P converter to the module base.

3. Remove the shroud; then pull the I/P converter straight out of the module base. Be careful not to damage the two electrical leads that come out of the base of the I/P converter.

4. Ensure that the O-ring and screen stay in the module base and do not come out with the I/P converter.

Replacing the I/P Converter

1. Refer to figure 8-2. Inspect the condition of the O-ring and screen in the module base. Replace them, if necessary. Apply sealant to the O-rings.

2. Ensure the two boots shown in figure 8-3 are properly installed on the electrical leads.

3. Install the I/P converter straight into the module base, taking care that the two electrical leads feed into the guides in the module base. These guides route the leads to the printed wiring board assembly submodule.

4. Install the shroud over the I/P converter.

5. Install the four socket-head screws and evenly tighten them in a crisscross pattern to a final torque of 20.7 lbf•in (2 N•m).

PWB (Printed Wiring Board) Assembly

Refer to figures 9-1 through 9-4 for key number locations. The pwb assembly (key 50) is located on the back of the module base assembly.

Removing the Printed Wiring Board Assembly

1. Remove the master module according to instructions in this manual.

2. Remove three screws (key 33).

3. Lift the pwb assembly straight out of the module base.

4. Ensure that the O-ring (key 40) is attached to the pressure sensor or sensor plug after the pwb assembly has been removed from the module base. If the O-ring remained in the module base, remove it and place it back on the pressure sensor or sensor plug.

Replacing the PWB Assembly

1. Apply sealant (key 65) to the O-ring (key 40) and install it on the pressure sensor or sensor plug located on the pwb assembly (key 50).

Note

If the pwb assembly submodule is replaced, calibrate and configure the DVC5000f Series digital valve controller to maintain accuracy specifications.

2. Properly orient the pwb assembly as you install it into the module base. The two electrical leads from the I/P converter must guide into their receptacles in the pwb assembly and the pressure sensor or sensor plug on the pwb assembly must fit into its receptacle in the module base.

3. Push the pwb assembly into its cavity in the module base.

4. Install and tighten three screws (key 33) to a torque of 10.1 lbf•in (1 N•m).

Pneumatic Relay

Refer to figures 9-1 through 9-4 for key number locations. The pneumatic relay (key 24) is located on the side of the master module.

Removing the Pneumatic Relay

1. Loosen the four screws (key 25) that attach the relay cap (key 26) to the module base. The screws are captive in the relay cap by O-rings (key 152).

2. Remove the relay cap. If there is resistance, use a flat-bladed screwdriver in the notch around the perimeter of the cap to pry it off.

Note

The Belleville spring (key 31) is captivated in the relay cap by a spring washer (key 32). A coil spring is retained on the valve plug by an interference fit on the inside diameter of the spring. The valve plug is captive internally in the relay by an O-ring on the valve plug. These parts may drop out as you remove the cap.

3. Use a flat-bladed screwdriver in the notch of the relay to pry the relay out of the module base.

CAUTION

Do not use excessive force with the screwdriver when prying out the relay. The lip of the notch may break, which would not allow the O-ring to seal properly.

Replacing the Pneumatic Relay

1. Ensure the compartment in the module base that holds the relay is clean.

2. Visually inspect the 0.016-inch hole in the module base (the fixed bleed on the relay output) to ensure it is clean and free of obstructions. If cleaning is necessary, do not enlarge the hole.

3. Apply sealant (key 65) to three O-rings (key 24L) and one additional O-ring (key 24M) on the relay.

4. Insert the relay submodule into the module base. You will feel a slight resistance as the O-rings engage. No orientation of the relay is necessary.

5. Push on the relay until the O-rings are seated in their respective bores and the input diaphragm makes contact with the bottom of the bore. Take care not to damage the supply port during assembly.

6. If not already installed, attach the coil spring and O-ring onto the valve plug, and insert the valve plug through the supply port of the relay.

7. Insert the four screws (key 25) through the cap. Install the O-rings (key 152) on the screws until the O-rings are inside the counterbored holes and not protruding past the surface of the cap.

8. Place the Belleville spring (key 31) in the relay cap, with its inside diameter contacting the relay cap. Place the spring washer (key 32), with its three fingers pointing up, against the Belleville spring.

9. Install the relay cap on the module base. As the relay cap is installed, the spring washer fingers will grab the relay cap and retain the Belleville spring. Tighten the screws, in an crisscross pattern, to a final torque of 20.7 lbf•in (2 N•m).

Gauges, Pipe Plugs, or Tire Valves

Depending on the options ordered, the DVC5000f Series digital valve controller will be equipped with either two gauges (key 47), two pipe plugs (key 66), or two tire valves (key 67). These are located on the top of the master module next to the I/P converter.

Perform the following procedure to replace the gauges, tire valves, or pipe plugs. Refer to figures 9-1 through 9-5 for key number locations.

1. Remove the front cover (key 43).

2. Remove the gauge, pipe plug, or tire valve as follows:

For gauges (key 47), use a wrench on the flats of the shaft underneath each gauge to remove the gauges from the module base.

For pipe plugs (key 66) and tire valves (key 67), use a wrench to remove these from the module base.

3. Apply sealant (key 64) to the threads of the replacement gauges, pipe plugs, or tire valves.

4. Using a wrench, screw the gauges, pipe plugs, or tire valves into the module base.

Terminal Box

Refer to figures 9-1 through 9-4 for key number locations.

The terminal box is located on the housing and contains the terminal strip assembly for field wiring connections.

Removing the Terminal Box

1. Loosen the set screw (key 58) in the cap (key 4) so that the cap can be unscrewed from the terminal box.

2. After removing the cap (key 4), note the location of field wiring connections and disconnect the field wiring from the terminal box.

3. Remove the master module, disconnecting the cable assembly from the terminal box assembly. This cable assembly attaches to the pwb assembly on the back of the master module.

4. On Type DVC5010f and DVC5020f digital valve controllers, remove the mounting bracket to permit rotatating the terminal box.

5. Remove the screw (key 72). Remove the terminal box as follows:

- For Type DVC5010f, DVC5020f, and DVC5030f, digital valve controllers, unscrew the terminal box assembly from the housing.

- For Type DVC5040f digital valve controllers, pull the terminal box straight out from the housing.

6. Remove two wire retainers (key 44), internal and external to the terminal box.

Replacing the Terminal Box

Note

Inspect all O-rings for wear and replace as necessary.

1. Install two wire retainers (key 44), internal and external to the terminal box.

2. Apply sealant (key 65) to the O-ring (key 36) and install the O-ring over the 2-5/16 inch thread on the terminal box. Use of a tool is recommended to prevent cutting the O-ring while installing it over the threads.

3. Apply lubricant (key 63) to the 2-5/8 inch threads on the terminal box to prevent seizing or galling when the cap is installed.

4. Screw the cap (key 4) onto the terminal box.

5. Install a set screw (key 58) into the cap (key 4). Loosen the cap (not more than 1 turn) to align the set screw over a slot in the terminal box. Tighten the set screw (key 58).

Type DVC5010f, DVC5020f, and DVC5030f, digital valve controllers

6. Apply sealant (key 65) to the O-ring (key 35) and install the O-ring over the 15/16 inch thread on the terminal box. Use of a tool is recommended to prevent cutting the O-ring while installing it over the threads.

7. Apply sealant (key 64) to the 15/16 inch thread on the terminal box to prevent seizing or galling when the terminal box assembly is installed onto the housing.

8. Screw the terminal box assembly onto the housing until it bottoms out. Back off the terminal box assembly a maximum of 1-1/4 turns for proper orientation of the terminal box to the housing. Install the screw (key 72) to prevent the terminal box assembly from rotating.

9. Apply sealant (key 64) to the conduit entrance plug (key 62) and install it into the desired side of the terminal box.

Type DVC5040f digital valve controllers

6. Apply sealant (key 65) to the O-ring (key 35) and install the O-ring over the guide surface on the terminal box. Take care not to dameage the guide surface.

7. Push the terminal box assembly into the housing until it bottoms out. Install the screw (key 72).

8. Apply sealant (key 64) to the conduit entrance plug (key 62) and install it into the desired side of the terminal box.

Travel Sensor

Replacing the travel sensor requires removing the digital valve controller from the actuator.

Note

If the pwb assembly submodule is replaced, calibrate and configure the DVC5000f Series digital valve controller to maintain accuracy specifications.

Disassembly

Type DVC5010f and DVC5040f Digital Valve Controller

Refer to figure 9-1 or 9-4 for key number locations.

1. Remove piping and fittings from the instrument.

2. Disconnect the adjustment arm from the connector arm and the feedback arm.

3. Remove the digital valve controller from the actuator.

4. Loosen the screw (key 80) that secures the feedback arm (key 79) to the travel sensor shaft.

5. Remove the feedback arm (key 79) from the travel sensor shaft.

6. Separate the master module from the housing by performing the Removing the Master Module procedure.

The travel sensor assembly (key 77) consists of a bushing and potentiometer joined with thread lock, therefore the two components must be removed as one unit.

7. Loosen the set screw (key 58) that locks the travel sensor assembly against the housing.

8. Unscrew the travel sensor assembly (key 77) from the housing.

Type DVC5020f Digital Valve Controller

Refer to figure 9-2 for key number locations.

1. Remove piping and fittings from the instrument.

2. Remove the digital valve controller from the actuator.

3. Disconnect the bias spring (key 82) from the feedback arm assembly (key 84) and the arm assembly (key 91). Remove the mounting bracket (key 74) from the back of the digital controller.

4. Loosen the screw (key 80) that secures the arm assembly to the travel sensor shaft.

5. Remove the arm assembly (key 91) from the travel sensor assembly (key 77) shaft.

8

6. Separate the master module from the housing by performing the Removing the Master Module procedure.

The travel sensor assembly (key 77) consists of a bushing and potentiometer joined with thread lock, therefore the two components must be removed as one unit.

7. Loosen the set screw (key 58) that locks the travel sensor assembly against the housing.

8. Unscrew the travel sensor assembly (key 77) from the housing.

Type DVC5030f Digital Valve Controller

Refer to figure 9-3 for key number locations.

1. Remove piping and fittings from the instrument.

2. Depending upon the actuator mounting, perform one or the other of the following:

- **For units mounted on Fisher actuators** Remove the digital valve controller from the actuator. Loosen the screw (key 80) that secures the feedback arm (key 79) to the travel sensor shaft. Remove the feedback arm from the travel sensor shaft.

- **For units mounted on other than Fisher actuators** Loosen the screw that secures the coupler to the travel sensor shaft. Remove the digital valve controller from the actuator.

3. Separate the master module from the housing by performing the Removing the Master Module procedure.

4. From within the housing, unscrew the travel sensor assembly (key 77) from the housing.

Assembly

Note

When installing the travel sensor assembly, take care to not wind up the wires inside the housing. This can damage the soldered connections.

Type DVC5010f and DVC5040f Digital Valve Controllers

Refer to figure 9-1 or 9-4 for key number locations.

1. Apply lubricant (key 63) to the travel sensor assembly (key 77) threads.

2. Insert the travel sensor assembly into the housing. Reach inside the housing and grasp the wires attached to the connector.

3. Screw the travel sensor assembly into the housing, simultaneously guiding the wires to prevent them from winding up inside the housing. This will reduce potential damage to the soldered connections.

4. Tighten the travel sensor assembly against the housing and tighten the set screw (key 58) to lock the assembly in place.

5. Loosely assemble the bias spring (key 82), screw (key 80), and nut (key 81) to the feedback arm (key 79), if not already installed.

6. Attach the feedback arm (key 79) to the travel sensor shaft.

The travel sensor may be adjusted using either a multimeter to measure the potentiometer resistance, or, if the instrument can be connected to a host system, use the Calibrate Travel Sensor method as described in this section. To use the multimeter, perform steps 7 through 13. To use the Calibrate Travel Sensor method, skip to step 14.

Travel Sensor Adjustment with a Multimeter

7. Align the feedback arm (key 79) to the housing (key 1) by inserting the alignment pin (key 46) through the hole marked “A” on the feedback arm. Fully engage the alignment pin into the tapped hole in the side of the housing.

8. Connect a multimeter set to a resistance range of 3000 ohms to pins 2 and 3 of the travel sensor connector. Refer to figure 8-4 for pin location.

9. Adjust the travel sensor shaft to obtain a measured resistance of 1950 to 2050 ohms.

Note

In the next step, be sure the feedback arm surface with the travel markings remains flush with the end of the travel sensor shaft.

10. While observing the resistance, tighten the screw (key 80) to secure the feedback arm to the travel sensor shaft. Be sure the resistance reading remains within the range listed in step 9. Paint the screw to discourage tampering with the connection.

11. Disconnect the multimeter from the travel sensor connector.

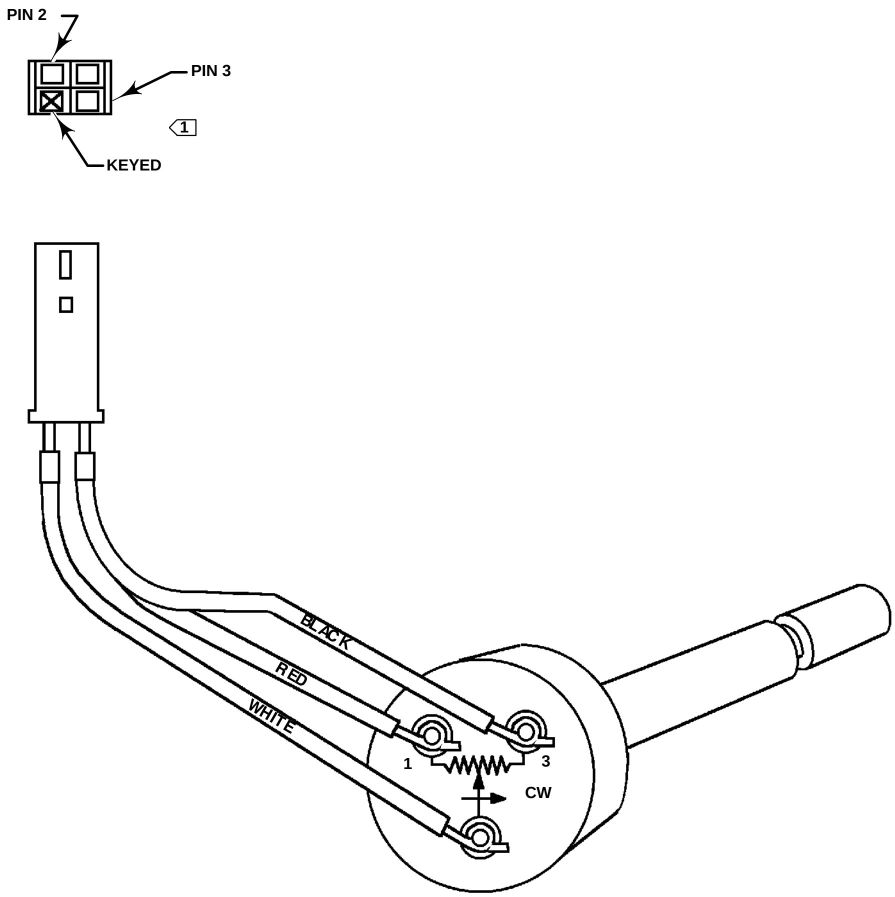


Figure 8-4. Potentiometer Resistance Measurement

12. Reassemble the master module to the housing by performing the Replacing the Master Module procedure.

13. Travel sensor replacement is complete. Install the digital valve controller on the actuator as described in the “Installation” section, Section 2.

Travel Sensor Adjustment Using the Calibrate Travel Sensor Method

The next two steps do not apply if you used a multimeter to adjust the travel sensor. Perform these steps only if you selected to adjust the travel sensor using the Calibrate Travel Sensor method.

14. Reassemble the master module to the housing by performing the Replacing the Master Module procedure.

15. Perform the appropriate Calibrating the Travel Sensor procedure.

Type DVC5020f Digital Valve Controller

Refer to figure 9-2 for key number locations.

1. Apply lubricant (key 63) to the bushing threads.

2. Insert the travel sensor assembly (key 77) into the housing. Reach inside the housing and grasp the wires attached to the connector.

3. Start threading the travel sensor assembly into the housing, simultaneously guiding the wires to prevent them from winding up inside the housing. This will reduce potential damage to the soldered connections.

4. Tighten the travel sensor assembly against the housing and tighten the set screw (key 58) to lock the assembly in place.

5. Loosely assemble the screw (key 80) and nut (key 81) to the arm assembly (key 91), if not already installed.

6. Attach the arm assembly (key 91) to the travel sensor assembly (key 77) shaft.

The travel sensor may be adjusted using either a multimeter to measure the potentiometer resistance, or, if the instrument can be connected to a host system, use the Calibrate Travel Sensor method as described in this section. To use the multimeter, perform steps 7 through 17. To use the Calibrate Travel Sensor method, skip to step 18.

Travel Sensor Adjustment with a Multimeter

7. Connect a multimeter set to a resistance range of 7000 ohms to pins 2 and 3 of the travel sensor connector. Refer to figure 8-4 for pin location.

8. Hold the arm assembly (key 91) in a fixed position so that the arm is parallel to the housing back plane and pointing toward the terminal box.

9. Adjust the travel sensor shaft to obtain a measured resistance of 6250 to 6350 ohms.

Note

In the next step, be sure the arm assembly outer surface remains flush with the end of the travel sensor shaft.

10. While observing the resistance, tighten the screw (key 80) to secure the feedback arm to the travel sensor shaft. Be sure the resistance reading remains within the range listed in step 9. Paint the screw to discourage tampering with the connection.

11. Disconnect the multimeter from the travel sensor connector.

12. Apply lubricant (key 63 or equivalent) to the pin portion of the arm assembly (key 91).

13. Push the feedback arm into the housing, engaging the pin of the arm assembly into the slot in the feedback arm.

14. Install the washer (key 86) and E-ring (key 85) next to the inboard flange bearing (key 83).

15. Install the bias spring (key 93).

16. Reassemble the master module to the housing by performing the Replacing the Master Module procedure

17. Travel sensor replacement is complete. Install the digital valve controller on the actuator as described in the “Installation” section, Section 2.

Travel Sensor Adjustment Using the Calibrate Travel Sensor Method

The next two steps do not apply if you used a multimeter to adjust the travel sensor. Perform these steps only if you selected to adjust the travel sensor using the Calibrate Travel Sensor method.

18. Reassemble the master module to the housing by performing the Replacing the Master Module procedure.

19. Perform the appropriate Calibrating the Travel Sensor procedure.

Type DVC5030f Digital Valve Controller

Refer to figure 9-3 for key number locations.

1. Apply lubricant (key 63) to the bushing O-ring and threads.

2. Screw the bushing into the housing until it is tight.

3. For units that mount on other than Fisher actuators, go to step 12.

4. For units that mount on Fisher actuators, attach the feedback arm (key 79) to the travel sensor shaft.

The travel sensor may be adjusted using either a multimeter to measure the potentiometer resistance, or, if the instrument can be connected to a host system, use the Calibrate Travel Sensor method as described in this section. To use the multimeter, perform steps 5 through 11. To use the Calibrate Travel Sensor method, skip to step 12.

Travel Sensor Adjustment with a Multimeter

5. Align the feedback arm (key 79) to the housing (key 1) by inserting the alignment pin (key 46) through the hole marked “A” on the feedback arm. Fully engage the alignment pin into the tapped hole in the side of the housing.

6. Connect a multimeter set to a resistance range of 3000 ohms to pins 2 and 3 of the travel sensor connector. Refer to figure 8-4 for pin location.

7. Adjust the travel sensor shaft to obtain a measured resistance of 1950 to 2050 ohms.

Note

In the next step, be sure the feedback arm outer surface remains flush with the end of the travel sensor shaft.

8. While observing the resistance, tighten the screw (key 80) to secure the feedback arm to the travel sensor shaft. Be sure the resistance reading remains within the range listed in step 7. Paint the screw to discourage tampering with the connection.

9. Disconnect the multimeter from the travel sensor connector.

10. Reassemble the master module to the housing by performing the Replacing the Master Module procedure.

11. Travel sensor replacement is complete. Install the digital valve controller on the actuator as described in the “Installation” section, Section 2.

Travel Sensor Adjustment with the Calibrate Travel Sensor Method

The next two steps do not apply if you used a multimeter to adjust the travel sensor. Perform these steps only if you selected to adjust the travel sensor using the Calibrate Travel Sensor method.

12. Reassemble the master module to the housing by performing the Replacing the Master Module procedure.

13. Perform the appropriate Calibrating the Travel Sensor procedure.

Calibrating the Travel Sensor

Note

The travel sensor is normally adjusted at the factory and should not require adjustment.

If the travel sensor has been replaced adjust the travel sensor by performing the following procedure. You can use the Cal Tvl Sensor method to adjust the travel sensor. The Cal Tvl Sensor method (method name Calibrate_Travel_Sensor) is included with the device description (DD) software. For information on using methods on the host system and the Cal Tvl Sensor method to calibrate the travel sensor, see the host system documentation.

Note

The AO block mode must be Out of Service for Cal Tvl Sensor to operate properly.

DVC5010f, DVC5030f, and DVC5040f Digital Valve Controllers

CAUTION

The AO block mode can be set to Out of Service by setting the Resource block mode to Out of Service. However, setting the Resource block to Out of Service also sets all function blocks within the device to Out of Service, including the PID block. If the PID block is used to control another loop, be sure some other means are provided to control the loop before taking the block Out of Service.

Before starting Cal Tvl Sensor, the AO block should be Out of Service. If the AO block is not out of service, you will not be able to calibrate the instrument because Cal Tvl Sensor will not be able to change the transducer block set point. If the AO block is not Out of Service, the method provides you an opportunity to abort and set the AO block out of service.

1. Start Cal Tvl Sensor. For information on starting calibration methods from a DeltaV host system, see Appendix G. For information on running methods from other host systems, see the system documentation.

2. Cal Tvl Sensor warns you the valve will move and that there may be a loss of process control. Select Yes to continue or select No to abort Cal Tvl Sensor.

3. Cal Tvl Sensor displays the current instrument type and asks if it is correct. If the instrument type is correct select Yes. If not, select No to specify a different instrument model.

4. Remove instrument and actuator pressure.

5. For a Type DVC5010f or DVC5040f, loosen or remove the adjustment arm.

For a Type DVC5030f, indicate if increasing actuator pressure rotates the end of the travel sensor shaft clockwise or counterclockwise by responding to the Cal Tvl Sensor prompt.

Note

The alignment pin (key 46) is stored inside the digital valve controller housing.

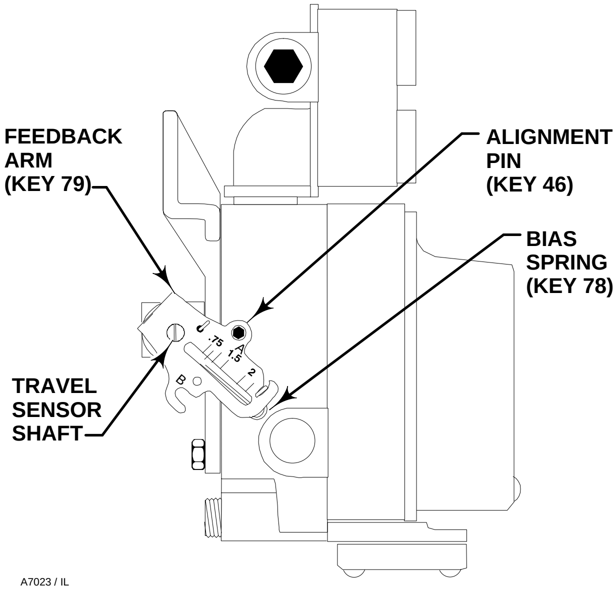


Figure 8-5. Type DVC5010f Digital Valve Controller Showing Feedback Arm in Position for Travel Sensor Adjustment

6. Align the feedback arm (key 79) with the housing, as shown in figure 8-5, by inserting the alignment pin (key 46) through the hole marked "A" on the feedback arm. Fully engage the alignment pin into the tapped hole in the housing.

7. Loosen the screw that secures the feedback arm to the travel sensor shaft. To prevent binding, position the feedback arm so that the surface with the travel markings is flush with the end of the travel sensor shaft.

8. Rotate the end of the travel sensor shaft until the travel sensor count is 15000 ±2000. Cal Tvl Sensor displays the travel sensor count as you adjust the travel sensor shaft.

9. If you haven't finished adjusting the travel sensor, select Yes when Cal Tvl Sensor asks you if it should continue displaying the travel sensor counts. Select No to continue to the next step.

10. While observing the travel sensor counts, tighten the screw that secures the feedback arm to the travel sensor shaft. Be sure the travel sensor counts remain within the range displayed on the Cal Tvl Sensor screen.

11. Cal Tvl Sensor redisplays the travel sensor count to verify the travel sensor shaft did not move while tightening the screw.

12. If the travel sensor count is not within the displayed range, Cal Tvl Sensor permits you to correct the adjustment or exit.

13. Before exiting, Cal Tvl Sensor instructs you to remove the alignment pin, reinstall the instrument if removed, connect the air supply, and recalibrate the travel.

14. Also before exiting, Cal Tvl Sensor asks if you want to return the transducer block mode to Auto, if the transducer block was in the Out-of-Service mode before the method started. Select Yes to change the transducer block mode to Auto. Select No to leave the transducer block in its current mode.

Remember to restore the Analog Output (AO) block mode if you changed it to Out of Service before starting Cal Tvl Sensor. This is the end of the Cal Tvl Sensor method.

DVC5020f Digital Valve Controllers (Calibrating the Travel Sensor)

Before starting Cal Tvl Sensor, the AO block should be Out of Service. If the AO block is not out of service, you will not be able to calibrate the instrument because Auto Travel Calibrate will not be able to change the transducer block set point. If the AO block is not Out of Service, the method provides you an opportunity to abort and set the AO block out of service.

1. Start Cal Tvl Sensor. For information on starting calibration methods from a DeltaV host system, see Appendix G. For information on running methods from other host systems, see the system documentation.

2. Cal Tvl Sensor warns you the valve will move and that there may be a loss of process control. Select Yes to continue or select No to abort Cal Tvl Sensor.

3. Cal Tvl Sensor checks the values for feedback high and low, calculates the difference, and displays these values if they are out of specification. You can either abort the method to correct the error or continue.

4. Cal Tvl Sensor displays the current instrument type and asks if it is correct. If the instrument type is correct select Yes. If not, select No to specify a different instrument model.

5. Remove instrument and actuator pressure.

6. See figure 8-6 for parts identification. Remove the instrument from the actuator. Disconnect the bias spring (key 82) from the feedback arm assembly (key 84) and the arm assembly (key 91). Remove the mounting bracket (key 74) from the back of the instrument.

7. Loosen the screw that secures the arm assembly to the travel sensor shaft. To prevent binding, position the arm assembly so that the outer surface is flush with the end of the travel sensor shaft.

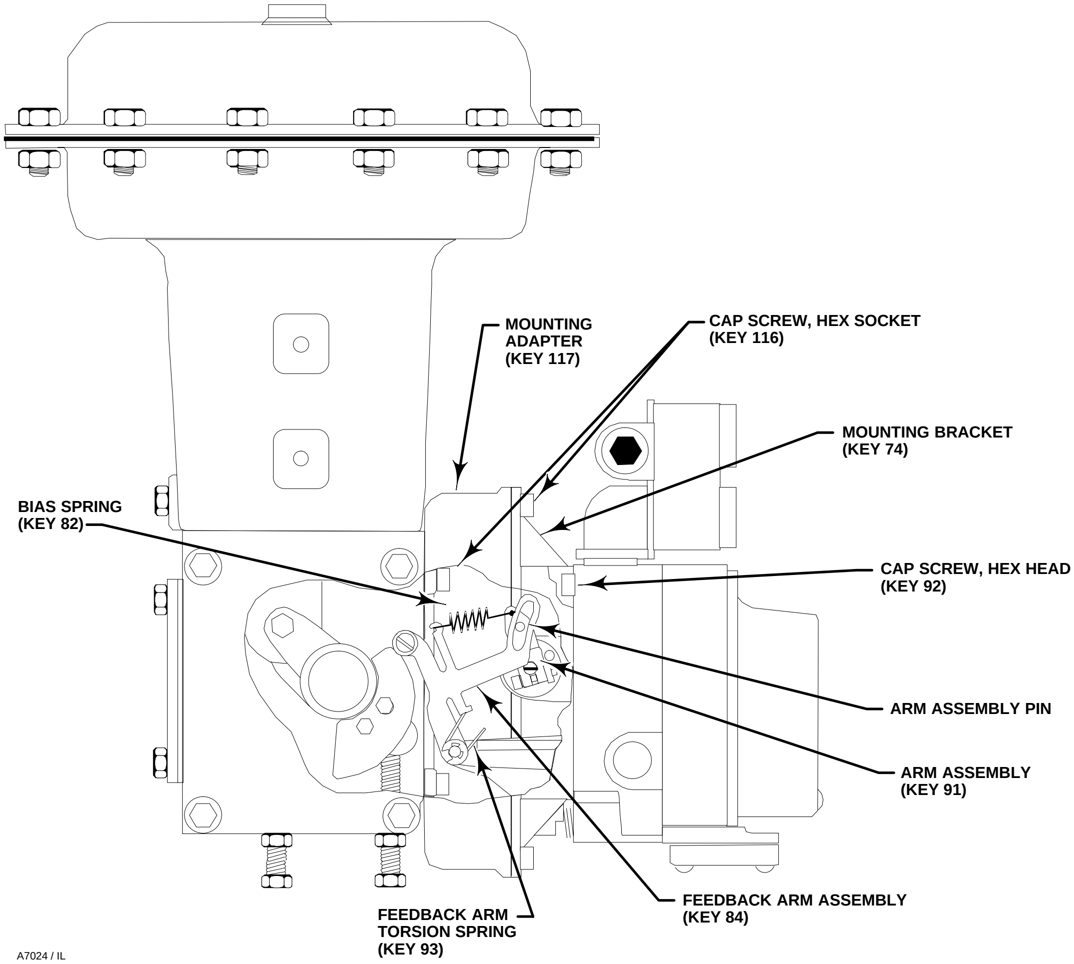


Figure 8-6. Type DVC5020f Digital Valve Controller Mounted on Type 1052, Size 33 Actuator

8. Hold the arm assembly (key 91) so that the arm assembly points toward the terminal box and the arm is parallel to the back of the housing, as shown in figure 8-7.

9. Rotate the end of the travel sensor shaft until the travel sensor count is 30000 ±2500. Cal Tvl Sensor displays the travel sensor count as you adjust the travel sensor shaft.

10. If you haven’t finished adjusting the travel sensor, select Yes when Cal Tvl Sensor asks you if it should continue displaying the travel sensor counts. Select No to continue to the next step.

11. While observing the travel sensor counts, tighten the screw that secures the feedback arm to the travel sensor shaft. Be sure the travel sensor counts remain within the range displayed on the Cal Tvl Sensor screen.

12. Cal Tvl Sensor redisplays the travel sensor count to verify the travel sensor shaft did not move while tightening the screw.

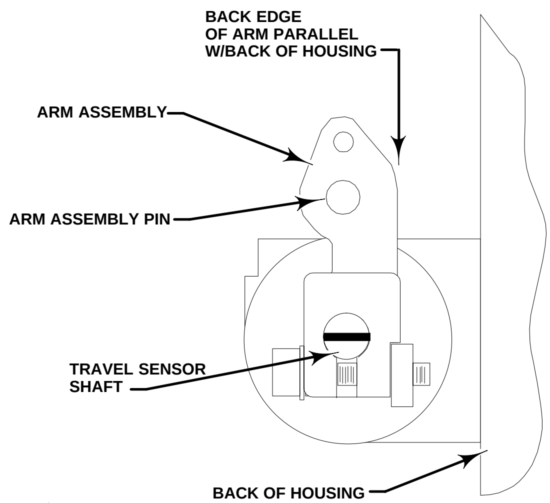


Figure 8-7. Type DVC5020f Travel Sensor Arm/Housing Back Plane Alignment

13. If the travel sensor count is not within the displayed range, Cal Tvl Sensor permits you to correct the adjustment or exit.

14. Before exiting, Cal Tvl Sensor instructs you to reinstall the instrument, connect the air supply, and recalibrate the travel.

15. Also before exiting, Cal Tvl Sensor asks if you want to return the transducer block mode to Auto, if the transducer block was in the Out-of-Service mode before the method started. Select Yes to change the transducer block mode to Auto. Select No to leave the transducer block in its current mode.

Remember to restore the Analog Output (AO) block mode if you changed it to Out of Service before starting Cal Tvl Sensor. This is the end of the Cal Tvl Sensor method.

Section 9 Parts

Parts Ordering

Whenever corresponding with your Fisher Controls sales office or representative about this equipment, always mention the controller serial number. When ordering replacement parts, refer to the 11-character part number of each required part as found in the following parts list. Parts which do not show part numbers are not orderable.

Parts Kits

Conversion kit 6 listed below provides the parts required to convert a DVC5010f to a DVC5020f. Conversion kit 7 provides the parts required to convert a DVC5020f to a DVC5010f.

Key	Description	Part Number
1*	Elastomer Spare Parts Kit	14B5072X012
2*	Relay Spare Parts Kit	14B5072X022
3*	Small Hardware Spare Parts Kit	14B5072X032
6	Conversion Kit (DVC5010f to DVC5020f)	
	Also see note below	14B5072X102
7	Conversion Kit (DVC5020f to DVC5010f)	14B5072X112
9	Alignment Pin Kit (kit contains 15 alignment pins)	14B5072X092

Note

Conversion kit key 6 contains a vent-away mounting bracket. Install a 1/4-inch NPT socket head pipe plug in the tapped hole in the side of the mounting bracket if Type DVC5020f digital valve controller is not for vent-away construction.

Parts List

Parts which do not show part numbers are not orderable.

Note

Parts with footnote numbers shown are available in parts kits. Also see footnote information at the bottom of the page.

Key	Description	Part Number

Common Parts

Key	Description	Part Number
1	Housing, aluminum	
23	Cap Screw, hex socket, SST[3] (4 req'd)	1H3697X0032
33	Mach Screw, pan hd, SST[3] (3 req'd)	14B1930X012
34*	O-ring, nitrile[1] (2 req'd)	10A3802X012
36*	O-ring nitrile[1]	1H8762X0012
38	Cap Screw, hex socket, SST[3] (4 req'd)	1P714638992
39*	O-ring, nitrile[1] (2 req'd)	1D687506992
40*	O-ring, nitrile[1]	14B1935X012
41	I/P Assembly (See I/P Assembly listing below)	
42*	Gasket, nitrile[1]	34B0601X022
43	Cover Assembly, plastic	
	For DVC5010f, DVC5020f, & DVC5030f	34B0612X012
	For DVC5040f	37B2518X012
48	Nameplate	
49	Drive Screw[3] (4 req'd)	
52	Vent, plastic[3]	
	Used w/DVC5010f and DVC5030f only	11B8279X012
58	Set Screw, hex socket, SST[3]	14B1559X012
61	Pipe Plug, hex socket, SST	
	For DVC5010f, DVC5020f (std mntg), & DVC5030f	1C3335X0032
	For DVC5020f vent-away mounting (2 req'd)	1C3335X0032
62	Pipe Plug, hex hd, SST	1H5137X0012
63	Lubriplate Mag-1 Lubricant (not furnished with the instrument)	
64	Zink-Plate No. 770 Anti-Seize Compound (not furnished with the instrument)	
65	Dow Corning 111 Lubricant (not furnished with the instrument)	
74	Mounting Bracket[6]	
	DVC5020f only	
	Std	44B1219X022
	Vent-away	24B1376X012
75*	O-Ring, nitrile[1,6]	
	DVC5020f Vent-away only	11A8741X052
128	Pipe Plug	
	DVC5020f Vent-away only	
	Pl stl	1E823128982
	SST	1E823135042
211	Lubricant, Nyogel 760G (not furnished with the instrument)	

I/P Assembly

Key	Description	Part Number
	I/P Converter w/shroud & boots	38B6041X022
41	I/P Converter	
169	Shroud	34B7568X012
210*	Boot, nitrile (2 req'd)	12B4131X012
231	Seal, Screen	18B6035X012

Module Base

Key	Description	Part Number
	Master Module Assembly	14B5071X022
	The following parts are included in the master module assembly.	
2	Module Base Assembly	34B3169X012
23	Cap Screw, (4 req'd)	
24	Relay Module[2] (See Relay listing below)	
33	Machine Screw, (3 req'd)	
38	Cap Screw, hex socket[3] (4 req'd)	

* Recommended spare
1. Available in the Elastomer Spare Parts Kit
2. Available in the Relay Spare Parts Kit
3. Available in the Small Hardware Spare Parts Kit
6. Available in the DVC5010f to DVC5020f Conversion Kit

Key	Description	Part Number
39	O-ring, (2 req'd)	
41	I/P Assembly w/shroud & boots	
154	Retaining Ring (4 req'd)	

Terminal Box

Key	Description	Part Number
4	Terminal Box Cap	34B0567X012
44	Wire Retainer, pl stl[3] (2 req'd)	14B3147X022
58	Set Screw, hex socket, SST[3]	14B1559X012
72	Cap Screw, hex socket, SST[3]	
	For DVC5010f, DVC5020f, DVC5030f	1H3697X0032
	For DVC5040f,	
	Inch	1L545438992
	Metric	17B5168X012
164	Terminal Box Assembly	
	For DVC5010f, DVC5020f, & DVC5030f	38B6470X012
	For DVC5040f	38B6471X012

Relay

Key	Description	Part Number
24	Relay Module[2]	
24L	O-Ring[1, 2] (3 req'd)	
24M	O–Ring[1, 2]	
25	Mach Screw, pan hd[2] (4 req'd)	
26	Cap	34B0583X022
31	Belleville Spring[2]	
32	Washer[2]	
152	O-ring, (4 req'd)	

PWB Assembly

Key	Description	Part Number
50*	PWB Assembly	
	Standard Control	
	Standard Diagnostics	18B6028X062
	Advanced Diagnostics	18B6028X052
	Fieldbus Logic	
	Standard Diagnostics	18B6028X102
	Advanced Diagnostics	18B6028X092

Pressure Gauges, Pipe Plugs, or Tire Valve Assemblies

Key	Description	Part Number
47*	Pressure Gauge (2 req'd)	
	PSI/MPA/BAR Gauge Scale	
	Plastic case, brass connection	
	To 25 PSI, 170 kPa, 1.7 bar	11B4040X012
	To 50 PSI, 345 kPa, 3.4 bar	11B4040X022
	To 100 PSI, 690 kPa, 6.9 bar	11B4040X032
	SST case, SST connection	
	To 25 PSI, 170 kPa, 1.7 bar	11B4039X012
	To 50 PSI, 345 kPa, 3.4 bar	11B4039X022
	To 100 PSI, 690 kPa, 6.9 bar	11B4039X032
	PSI/KG/CM^2 Gauge Scale	
	Plastic case, brass connection	
	To 25 PSI, 1.8 kg/cm^2	11B4040X042
	To 50 PSI, 3.5 kg/cm^2	11B4040X052
	To 100 PSI, 7.0 kg/cm^2	11B4040X062
66	Pipe Plug, hex hd (2 req'd)	
	Plated steel	1D829328982
	SST	1D8293X0012
67	Tire Valve Assembly, pl stl (2 req'd)	1N908899012

Feedback Parts

Key	Description	Part Number
46	Alignment Pin[9]	
	For DVC5010f, DVC5030f & DVC5040f only	14B0656X022
223	Potentiometer and Bushing Assy	
	For DVC5010f & DVC5020f	14B5070X062
	For DVC5030f	17B4030X022
	For DVC5040f	17B4031X022
78	Bias Spring, SST[3]	
	For DVC5010f, DVC5030f, & DVC5040f	24B0654X032
79	Feedback Arm, SST	
	DVC5010f	
	For 513, 513R, 529, 585C, 585CR, 656, 657/30-100, 667/30-100, 1250, 1250R, Baumann, and Gulde	37B5270X042
	DVC5040f	
	For 9000/all sizes	34B1929X022
	DVC5030f	
	For all sizes 1032, 1051, 1052, and 1066SR	34B2179X022
80	Cap Screw, hex socket, SST[3]	14B6978X012
81	Square Nut, SST[3]	16A6711X032
82	Bias Spring, SST[3] DVC5020f only	24B1532X012
83	Flange Bearing, Rulon[6] DVC5020f only (2 req'd)	13A1592X012
84	Feedback Arm Assy, SST[6]	
	DVC5020f only	
	For 471, 585, 585R, 1051/30-60 1052/40-70 and 1061/30–100	14B1557X032
	For 1051/33 and 1052/20, 33	14B1377X032
85	E-ring, pl stl[3] DVC5020f only (2 req'd)	1E455338992
86	Plain Washer, pl stl[6] DVC5020f only (2 req'd)	1A4988X0012
87	Follower Post, SST[6] DVC5020f only	13A1656X012
88	Roller, SST/PTFE[6] DVC5020f only	13A1657X012
89	Spring Lock Washer, pl stl[6] DVC5020f only	1K623638992
90	Hex Nut, pl stl[6] DVC5020f only	1A8396X0012
91	Arm Assy, SST[6] DVC5020f only	14B0659X022
92	Cap Screw, hex socket[6] DVC5020f only (4 req'd)	1L7325X0012
93	Torsion Spring, Feedback Arm[6] DVC5020f only	14B1426X012
104	Cap Screw, hex hd (4 req'd)	
	For DVC5010f only	1A3917X0072
	Not for mounting on 1250 and 1250R actuators	
107	Mounting Bracket	
	For DVC5010f only	44B0655X022
	Not for mounting on 1250 and 1250R actuators	
121	Thread Lock, Loctite 242 (not furnished with instrument)	
160	Sealant, Torque Seal (not furnished with instrument)	
163	Plain Washer, SST	14B6976X012

Mounting Parts

Type DVC5010f Digital Valve Controller

For Types 657 & 667, size 30-60 actuators

Key	Description	Part Number
102	Shield, polyester	34B1428X012
103	Mach Screw, pan hd, pl stl[3] (2 req'd)	11A6514X022
105	Screw, hex flg, pl stl	
	W/o side-mtd h'wheel (2 req'd)	14B1379X032
	W/side-mtd h'wheel (none req'd)	– – –

* Recommended spare
1. Available in the Elastomer Spare Parts Kit
2. Available in the Relay Spare Parts Kit
3. Available in the Small Hardware Spare Parts Kit
6. Available in the DVC5010f to DVC5020f Conversion Kit
9. Available in the Alignment Pin Kit

9

Key	Description	Part Number
106	Adjustment Arm, aluminum/SST	28B6046X012
108	Connector Arm, stl	
	W/o side-mtd h'wheel	24B0652X012
	W/side-mtd h'wheel	32B3526X012
110	Lock Washer, ext, pl stl	14B0698X022
120	Cap Screw, hex hd, (2 req'd)	
	W/o side-mtd h'wheel	
	For sizes 30, 34, 40 (2 req'd)	1A352524052
	For sizes 45–60 (none req'd)	– – –
	W/side-mtd h'wheel (none req'd)	– – –
148	Spacer, pl stl	
	W/o side-mtd h'wheel (none req'd)	– – –
	W/side-mtd h'wheel (2 req'd)	
	For size 34, 40	1J830724092
	For size 45–60	1F906724092
149	Washer,	
	W/o side-mtd h'wheel (none req'd)	– – –
	W/side-mtd h'wheel (2 req'd)	1B865928982
155	Cap screw, hex hd, SST	
	W/o side-mtd h'wheel (none req'd)	– – –
	W/side-mtd h'wheel (2 req'd)	
	For size 34, 40	1A352524052
	For size 45–60	1B787724052
156	Washer, SST	
	W/o side-mtd h'wheel (2 req'd)	
	For size 30, 34, 40	1D716228982
	For size 45–60	1H723125072
	W/side-mtd h'wheel (none req'd)	– – –
232	Hex Nut, flanged, SST	18B2293X212
	For Types 657 & 667, size 70-100 actuators	
78	Bias Spring	22B9009X022
97	Feedback Arm Ext, SST	42B9010X022
98	Mach Screw, hex hd, SST	12B2922X012
99	Mach Screw, flat hd, SST	14B6701X012
100	Hex Nut, SST (2 req'd)	1A3303X0012
101	Spacer, SST	14B1554X012
102	Shield, SST	44B1429X012
103	Mach Screw, pan hd, SST(3) (2 req'd)	1N10183X022
105	Screw, hex flg, SST (2 req'd)	14B1379X022
106	Adjustment Arm, aluminum/SST	28B6046X012
108	Connector Arm, stl	
	W/o side-mtd h'wheel	22B9008X012
	W/side-mtd h'wheel	23B9247X012
110	Lock Washer, ext, pl stl	14B0698X022
156	Washer, SST (2 req'd)	
	For 657 & 667 size 70, 667 size 76	14B5349X022
	For 657 & 667 size 80–100	1K899525072
162	Lock Washer, split, SST (2 req'd)	61000580X12
	For Gulde Model GA and P actuators	
102	Shield, polyester	34B1428X012
103	Mach Screw, pan hd, pl stl (2 req'd)	11A6514X012
106	Adjustment Arm, aluminum/SST	28B6046X012
107	Mounting Bracket, pl stl	44B0224X012
108	Connector Arm, pl stl	24B0652X012
110	Lock Washer, ext, pl stl	14B0698X012
111	Brace	44B0225X012
112	Cap Screw, hex hd, pl stl (2 req'd)	19A4833X012
113	Cap Screw, hex hd, pl stl (2 req'd)	10B6605X012
114	U-Bolt, pl stl (4 req'd)	14B0226X012
115	Hex Nut, pl stl (10 req'd)	19A4788X012
123	Plain Washer, pl stl (2 req'd)	10B6633X012
124	Plain Washer, pl stl (2 req'd)	10B6609X012
125	Cap Screw, hex hd, pl stl	19A4775X012
127	Lock Washer, pl stl (8 req'd)	11Y8560R082

Key	Description	Part Number
	Type DVC5020f Digital Valve Controller	
	For Type 585 and 585R Actuators	
84	Feedback Arm Ass'y, SST	17B3156X012
94	Cam, SST	27B3157X012
98	Machine Screw, hex hd, SST (2 req'd)	13A1618X022
100	Hex Nut, SST (2 req'd)	1A6622X0012
116	Cap Screw, hex socket, pl stl (8 req'd)	1P7146X0022
117	Mounting Adaptor	44B1220X012
162	Lock Washer, SST (2 re'd)	1A3291X0012
170	Reversing Relay	15A8804X342
171	Pipe Bushing, hex (2 req'd)	
	Plated steel	1B6149X0012
	SST	1B6149X0032
172	Pipe Tee	
	Plated steel	1C597547362
	SST	1P506938982
173	Cap Screw, hex hd, pl stl (2 req'd)	1C631224052
174	Pipe Nipple	
	Plated steel	1C678926232
	SST	1P5068X0012
175	Pipe Nipple	
	Plated steel	1A385026012
	SST	1A3580X0012
176	Pipe Bushing, hex	
	Plated steel	1E253726232
	SST	1E2537K0012
203	Follower Arm Extension, SST	17B3158X012
	For Type 1051, size 30-60 and Type 1052, size 40-70 actuators	
116	Cap Screw, hex socket, SST (4 req'd)	1P7146X0022
	For Type 1051, size 33 and Type 1052 size 20 & 33 actuators	
116	Cap Screw, hex socket, pl stl (8 req'd)	1P7146X0022
117	Mounting Adaptor	44B1220X012
	Type DVC5030f Digital Valve Controller	
	For Types 1051, size 30-60 and Type 1052, size 40-70 actuators	
104	Cap Screw, hex head, SST (4 req'd)	1B2905X0012
107	Mounting Bracket Ass'y, stl/SST	34B9501X012
140	Washer, pl stl (4 req'd)	
	For 1051 size 30–40 & 1052 size 40	1H723125072
	For 1051 size 60 & 1052 size 60–70	1A518925072
142	Travel Indicator Scale, SST	24B2183X012
144	Travel Indicator Ass'y, SST	24B2178X012
145	Machine Screw, pan hd, SST (2 req'd)	59061180X12
198	Plain Washer, SST (2 req'd)	61000350X12
204	Hex Nut, SST (2 req'd)	1A3303X0012
	For Type 1051 and 1052, size 33 actuators	
104	Cap Screw, hex hd, SST (4 req'd)	1B2905X0012
107	Mounting Bracket Ass'y	34B9503X022
140	Washer, pl stl (4 req'd)	1B865928982
141	Spacer, pl stl	17B1702X012
142	Travel Indicator Scale, SST	24B2183X012
144	Travel Indicator Ass'y, SST	24B2178X012
145	Machine Screw, pan hd, SST (2 req'd)	13B9244X012
191	Cap Screw, hex hd, pl stl (4 req"d)	1A381624052
198	Plain Washer, SST (2 req'd)	61000350X12
199	Washer, pl stl (2 req'd)	1K261028992
204	Hex Nut, SST (2 req'd)	1A3303X0012
	For Type 1052, size 20 actuators	
104	Cap Screw, hex hd, SST (4 req'd)	1B2905X0012
107	Mounting Bracket Ass'y stl/SST	34B9502X012
141	Spacer, pl stl	17B1701X012
142	Travel Indicator Scale, SST	24B2183X012

3. Available in the Small Hardware Spare Parts Kit.

Key	Description	Part Number
144	Travel Indicator Ass'y, SST	24B2178X012
145	Machine Screw, pan hd, SST (2 req'd)	59061300X12
191	Cap Screw, hex hd, pl stl (4 req"d)	1A353124052
198	Plain Washer, SST (2 req'd)	61000350X12
204	Hex Nut, SST (2 req'd)	1A3303X0012
	For Type 1066SR actuators	
104	Cap Screw, hex hd, SST (4 req'd)	1B2905X0012
107	Mounting Bracket Ass'y	34B9503X012
140	Washer, pl stl (4 req'd)	
	For size 20	1B865928982
	For size 27	1H723125072
	For size 75	1A518925072
141	Spacer, pl stl	
	For sizes 20 & 27	17B1703X012
	For size 75	17B1710X012
142	Travel Indicator Scale, SST	24B2183X012
144	Travel Indicator Ass'y, SST	24B2178X012
145	Machine Screw, pan hd, SST (2 req'd)	
	For sizes 20 & 27	14B2026X012
	For size 75	14B2027X012
198	Plain Washer, SST (2 req'd)	61000350X12
199	Washer, pl stl	
	For sizes 20 & 27 (2 req'd)	1K261028992
	For size 75 (none req'd)	– – –
204	Hex Nut, SST (2 req'd)	1A3303X0012

Type DVC5030f Digital Valve Controller on Other Actuators

	To replace Masoneilan positioners	
	Mounting Plate	48B5236X012
	Positioner Plate	28B3835X012
	Drive Plate Ass'y	28B4644X012
	Connector Shaft	28B3834X012
	Pipe Bushing, hex	
	For double-acting actuators only	
	1/4 x 1/8 NPT	1E2537K0012
	3/8 x 1/4 NPT (2 req'd)	1B6149X0032
	Pipe Nipple, NPT	
	For double-acting actuators only	
	1/8-27 x 1-1/2"	1A3850X0012
	1/4-18 x 7/8"	1P506838982
	Pipe Tee, 1/4 NPT	
	For double-acting actuators only	1P506938982
	Spacer	
	For Sigma F actuators only	28B5971X012
	Cap Screw, hex hd,	
	For Camflex II actuators, 5/16-18 x 3/4" (2 req'd)	1A3816K0012
	For Sigma F actuators, 1/4-20 x 5/8" (2 req'd)	1A4078X0052
	Cap Screw, hex hd, 1/4-20 x 1/2" (4 req'd)	1B2905X0012
	Cap Screw, hex hd, 5/16-18 x 1/2" (4 req'd)	1C2752X0042
	Machine Screw, pan hd 8-32 x 5/8" (2 req'd)	18B2293X352
	Cap Screw, hex socket, 1/4-28 x 1-1/2"	18B2293X362
	Lock Washer, 1/4"	18B4163X012
	Plain Washer, 5/16" (4 req'd)	18B2293X032
	Plain Washer, No. 8 (2 req'd)	1E8730X0012
	Cap Screw, hex socket, 8-32 x 3/4"	14B6978X012
	Plain Washer,	18B2293X552
	Square Nut, 8-32	16A6711X032
	Alignment Pin	14B0656X022
	Bias Spring	24B0654X032
	Feedback Arm	34B2179X012
	To replace Neles-Jamesbury positioners	
1	Travel Indicator	24B2178X012
2	Travel Indicator Scale	24B2183X012
3	Mounting Bracket	
	For QP3	F28B4801-02
	For QP4 & QP3	F28B4800-02
4	Coupler	
	For QP3	F28B4801-01
	For QP4 & QP3	F28B4800-01
5	Threaded Hex Stud	F28B4801-03
6	Hex Head Screw, 1/4-20 x 1/2 (4 req'd)	1B2293X272
7	Pan Head Machine Screw, 6-32 x 5/16 (4 req'd)	18B2293X272
9	Mounting Screws, hex head	
	For QP3, 3/8-16 x1/2 (4 req'd)	FH37516150HH
	For QP4 & QP5, 1/2-13 x1/2 (4 req'd)	FH37516150HH
10	Set Screw, 1/4-20 x 3/4 (2 req'd)	FH25028075SS
11	Plain Washer, #6 (4 req'd)	18B2293X292
14	Split Lockwasher, (4 req'd)	
	For QP3, QP4 & QP5, 1/4	FH25000000SL
	For QP3 3/8	FH37500000SL
	For QP4 & QP5 1/2	FH50000000SL

Cam

	For DVC5020f only	
	For Type 1051, size 30-60 and 1052, size 40-70 actuators	
94	Cam, SST	33A1613X022
95	Mach Screw, hex hd, SST (2 req'd)	13A1618X012
	For Type 1052, size 20 actuators	
94	Cam, SST	36A4653X022
95	Mach Screw, hex hd, SST (2 req'd)	13A1617X012
	For Type 1051 and 1052, size 33 actuators	
94	Cam, SST	30B1529X022
95	Mach Screw, hex hd, SST (2 req'd)	13A1617X012

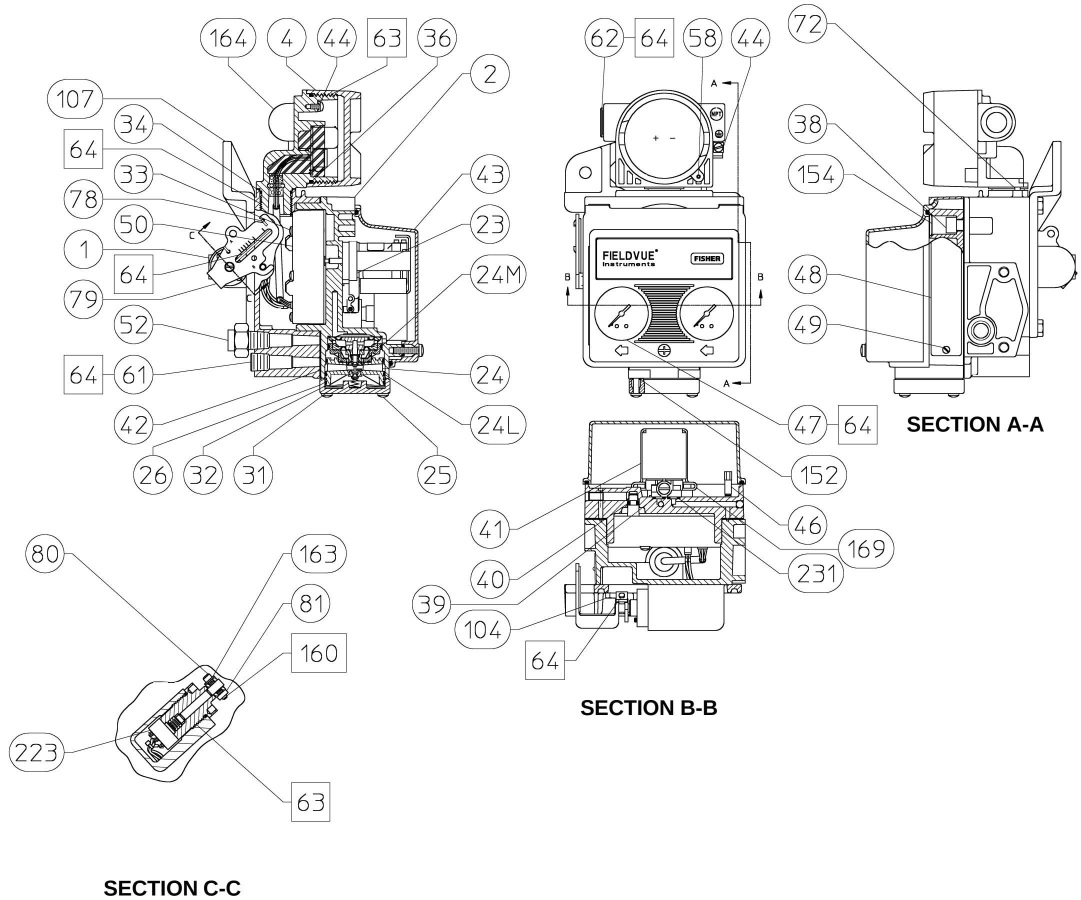
Filter Regulator Mounting Parts

For use only when filter regulator is specified.

	For Integral Mounting	
59	Cap Screw, hex hd, SST (2 req'd)	1C398824052
60*	O-Ring, nitrile	1E591406992
61	Pipe Plug, hex socket, SST	1C333528992
	For Casing Mounting	
61	Pipe Plug, hex socket, SST	1C333528992
69	Hex Nut, pl stl (2 req'd)	1A352724122
70	Cap Screw, hex hd, pl stl (2 req'd)	1C197024052
71	Mounting Bracket, pl stl	1F401225072
	For Yoke Mounting	
59	Cap Screw, hex hd, SST (2 req'd)	1C398824052
61	Pipe Plug, hex socket, SST	1C333528992
	For Wall Mounting	
161	Pipe Nipple, galv stl	1C678926232
	For Universal Mounting	
59	Cap Screw, hex hd, SST (2 req'd)	1C3988X0022
60*	O-Ring, nitrile	1E591406992
61	Pipe Plug, hex socket, SST	1C3335X0012
69	Hex Nut, pl stl (2 req'd)	1A352724122
70	Cap Screw, hex hd, pl stl (2 req'd)	1C197024052
71	Mounting Bracket	1F401225072
161	Pipe Nipple, galv stl	1C678926232

9

* Recommended spare

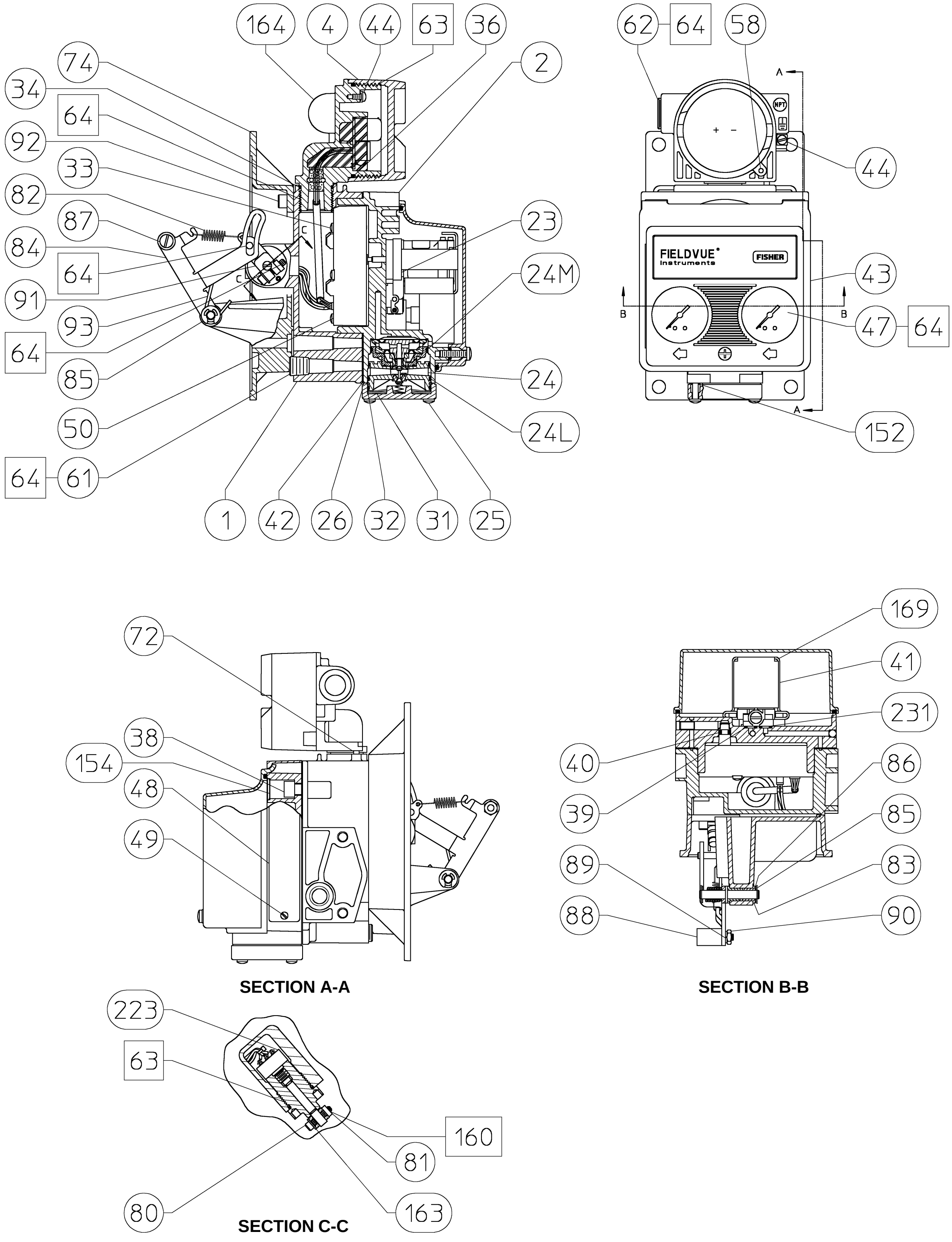


☐ APPLY LUB, SEALANT

48B9410 A DOC
SHT 1 OF 2
SHT 2 OF 2

Figure 9-1. Type DVC5010f Digital Valve Controller Assembly

9



☐ **APPLY LUB, SEALANT**
48B9420-A / DOC
SHT 1 OF 3
SHT 2 OF 3

Figure 9-2. Type DVC5020f Digital Valve Controller Assembly

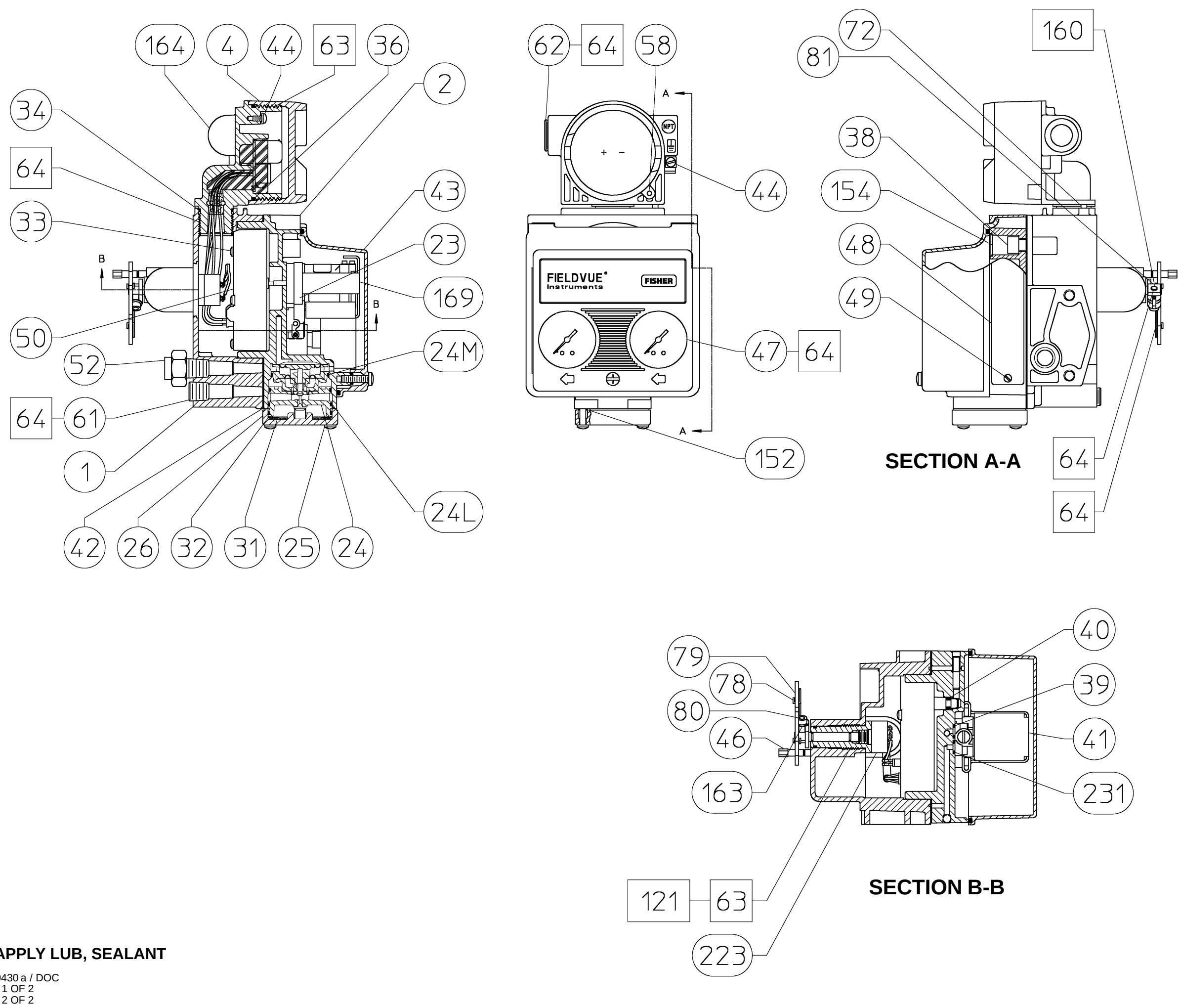


Figure 9-3. Type DVC5030f Digital Valve Controller Assembly

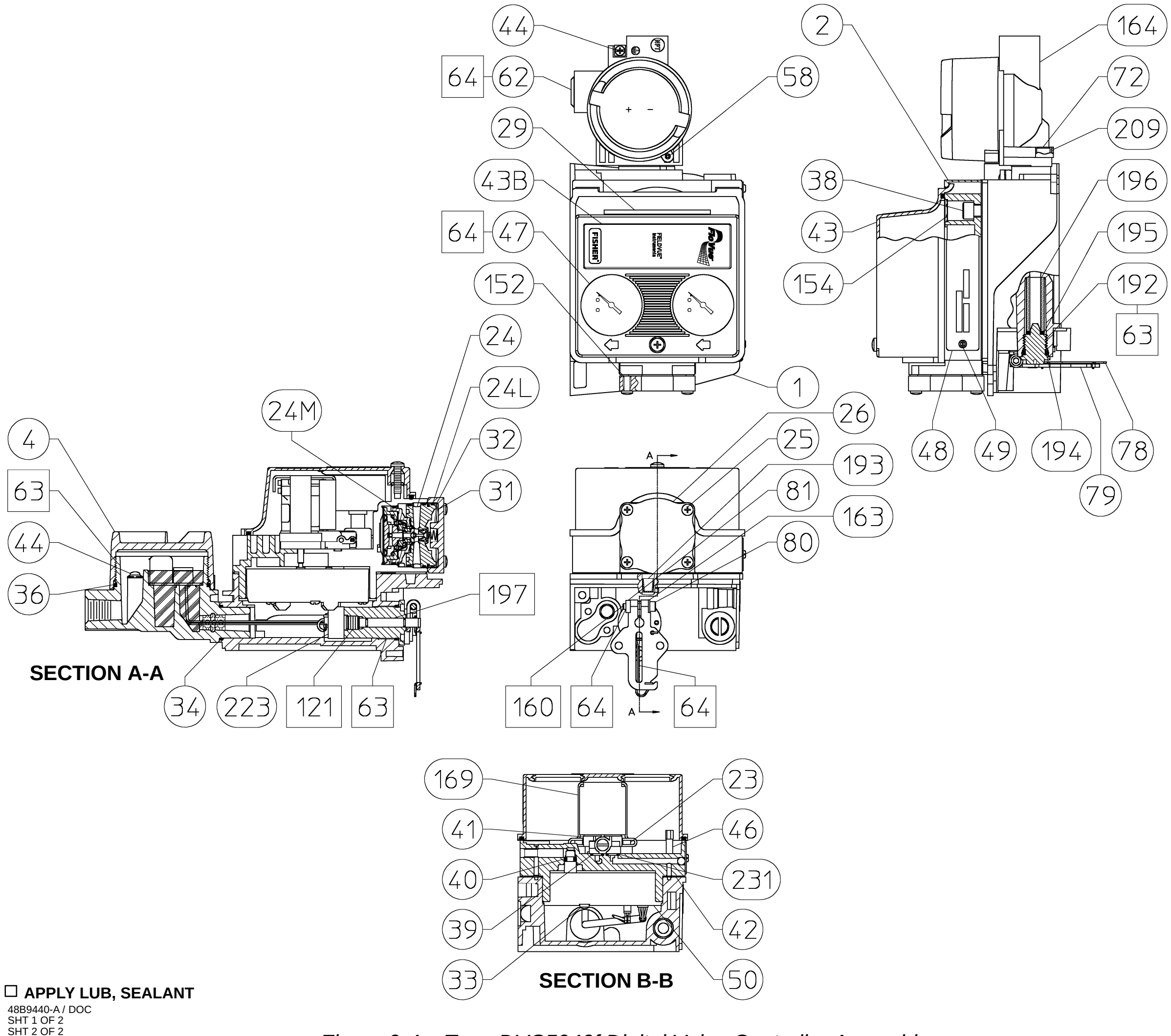


Figure 9-4. Type DVC5040f Digital Valve Controller Assembly

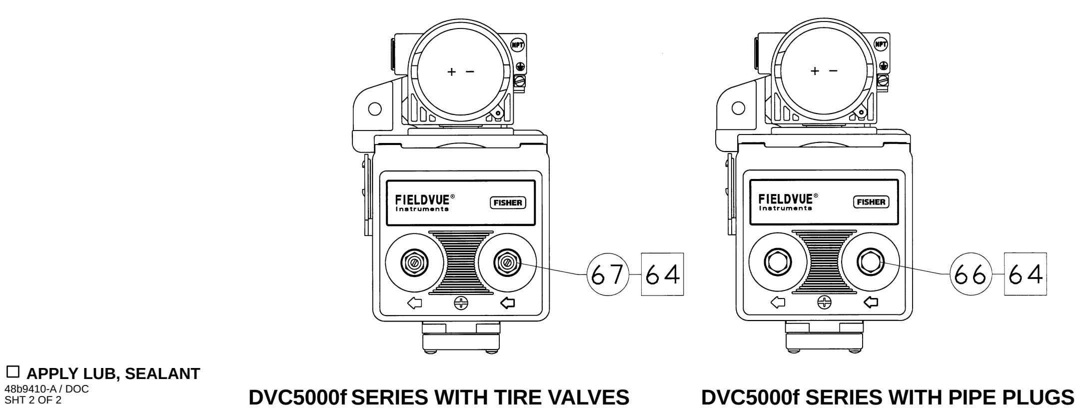
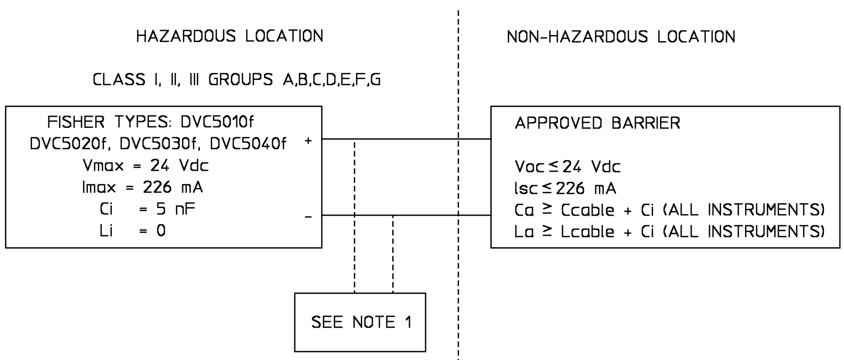


Figure 9-5. Typical DVC5000f Series Digital Valve Controller with Tire Valves and Pipe Plugs

Section 10 Loop Schematics

This section includes loop schematics required for wiring of intrinsically safe installations. If you have any questions, contact your Fisher Controls sales representative or sales office.

CSA Schematics



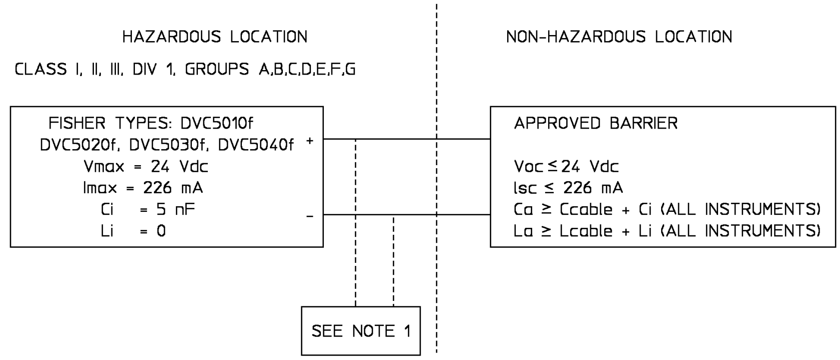
NOTES:

1. THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS, NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (Vmax) AND THE CURRENT (Imax) OF THE INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (Voc) AND CURRENT (Isc) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAXIMUM UNPROTECTED CAPACITANCE (Ci) AND INDUCTANCE (Li) OF EACH INTRINSICALLY SAFE APPARATUS, AND THE INTERCONNECTING WIRING , MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (Ca) AND INDUCTANCE (La) DEFINED BY THE ASSOCIATED APPARATUS. IF THESE CRITERIA ARE MET, THEN THE COMBINATION MAY BE CONNECTED.
2. LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.
3. SEE THE CANADIAN ELECTRICAL CODE (CEC) PART I AND ANSI/ISA RP12.6 FOR GUIDANCE ON INSTALLATION.

NO CHANGE IN PART OR VENDOR OF PART ALLOWED WITHOUT PRIOR APPROVAL OF: CSA

28B1708-B

FM Schematics



NOTES:

1. THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS, NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (Vmax) AND CURRENT (Imax) OF THE INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (Voc or Vt) AND CURRENT (Isc or It) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAXIMUM UNPROTECTED CAPACITANCE (Ci) AND INDUCTANCE (Li) OF EACH INTRINSICALLY SAFE APPARATUS, AND THE INTERCONNECTING WIRING, MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (Ca) AND INDUCTANCE (La) DEFINED BY THE ASSOCIATED APPARATUS. IF THESE CRITERIA ARE MET, THEN THE COMBINATION MAY BE CONNECTED.
2. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), NFPA 70, ARTICLE 504 AND ANSI/ISA RP12.6.
3. CLASS 1, DIV 2 APPLICATIONS MUST BE INSTALLED AS SPECIFIED IN NEC ARTICLE 501-4(B) WHEN BARRIERS ARE NOT USED.
4. LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.
5. MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 Vrms.
6. RESISTANCE BETWEEN BARRIER GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM.

NO CHANGE IN PART OR VENDOR OF PART ALLOWED WITHOUT PRIOR APPROVAL OF: FM

28B1707-B

Appendix A FOUNDATION Fieldbus Technology and Fieldbus Function Blocks

Overview

This appendix introduces fieldbus systems that are common to all fieldbus devices.

Introduction

A fieldbus system is a distributed system composed of field devices and control and monitoring equipment integrated into the physical environment of a plant or factory. Fieldbus devices work together to provide I/O and control for automated processes and operations. The Fieldbus Foundation provides a framework for describing these systems as a collection of physical devices interconnected by a fieldbus network. One of the ways that the physical devices are used is to perform their portion of the total system operation by implementing one or more function blocks.

Function Blocks

Function blocks within the fieldbus device perform the various functions required for process control. Because each system is different, the mix and configuration of functions are different. Therefore, the Fieldbus Foundation has designed a range of function blocks, each addressing a different need.

Function blocks perform process control functions, such as analog input (AI) and analog output (AO) functions as well as proportional-integral- derivative (PID) functions. The standard function blocks provide a common structure for defining function block inputs, outputs, control parameters, events, alarms, and modes, and combining them into a process that can be implemented within a single device or over the fieldbus network. This simplifies the identification of characteristics that are common to function blocks.

The Fieldbus Foundation has established the function blocks by defining a small set of parameters used in all function blocks called universal parameters. The FOUNDATION has also defined a standard set of function block classes, such as input, output, control, and calculation blocks. Each of these classes also has a small set of parameters established for it. They have also published definitions for transducer blocks commonly used with standard function blocks. Examples include temperature, pressure, level, and flow transducer blocks.

The FOUNDATION specifications and definitions allow vendors to add their own parameters by importing and subclassing specified classes. This approach permits extending function block definitions as new requirements are discovered and as technology advances.

Figure A-1 illustrates the internal structure of a function block. When execution begins, input parameter values from other blocks are snapped-in by the block. The input snap process ensures that these values do not change during the block execution. New values received for these parameters do not affect the snapped values and will not be used by the function block during the current execution.

Once the inputs are snapped, the algorithm operates on them, generating outputs as it progresses. Algorithm executions are controlled through the setting of contained parameters. Contained parameters are internal to function blocks and do not appear as normal input and output parameters. However, they may be accessed and modified remotely, as specified by the function block.

Input events may affect the operation of the algorithm. An execution control function regulates the receipt of input events and the generation of output events during execution of the algorithm. Upon completion of the algorithm, the data internal to the block is saved for use in the next execution, and the output data is snapped, releasing it for use by other function blocks.

A block is a tagged logical processing unit. The tag is the name of the block. System management services locate a block by its tag. Thus the service personnel need only know the tag of the block to access or change the appropriate block parameters.

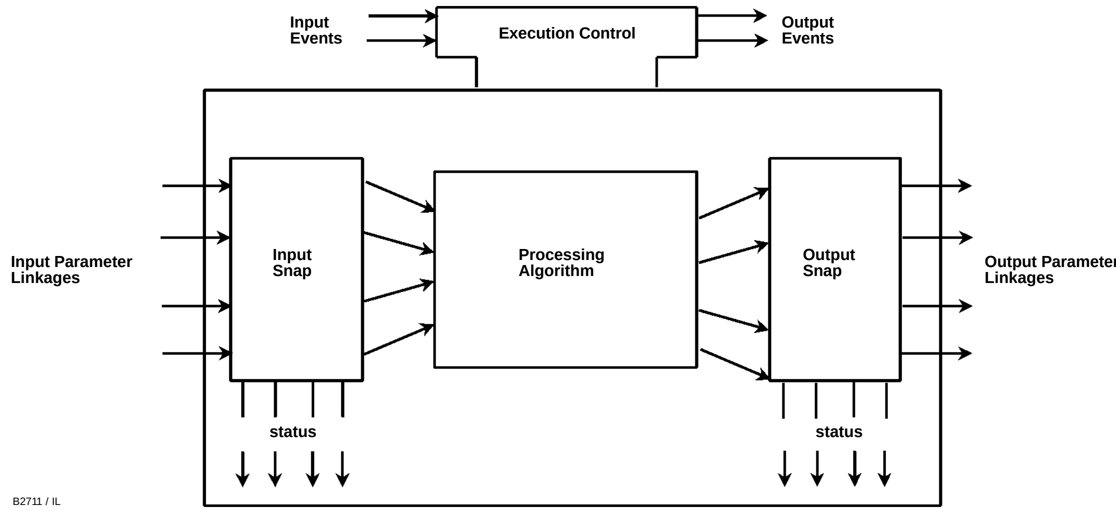


Figure A-1. Function Block Internal Structure

Function blocks are also capable of performing short-term data collection and storage for reviewing their behavior.

Device Descriptions

Device Descriptions are specified definitions that are associated with the function blocks. Device descriptions provide for the definition and description of the function blocks and their parameters.

To promote consistency of definition and understanding, descriptive information, such as data type and length, is maintained in the device description. Device Descriptions are written using an open language called the Device Description Language (DDL). Parameter transfers between function blocks can be easily verified because all parameters are described using the same language. Once written, the device description can be stored on an external medium, such as a CD-ROM or diskette. Users can then read the device description from the external medium. The use of an open language in the device description permits interoperability of function blocks within devices from various vendors. Additionally, human interface devices, such as operator consoles and computers, do not have to be programmed specifically for each type of device on the bus. Instead their displays and interactions with devices are driven from the device descriptions.

Device descriptions may also include a set of processing routines called methods. Methods provide a procedure for accessing and manipulating parameters within a device, such as for setup and calibration.

BLOCK OPERATION

In addition to function blocks, fieldbus devices contain two other block types to support the function blocks. These are the resource block and the transducer block. The resource block contains the hardware specific characteristics associated with a device. Transducer blocks couple the function blocks to local input/output functions.

Instrument-Specific Function Blocks

Resource Blocks

The resource block contains the hardware specific characteristics associated with a device; it has no input or output parameters. The algorithm within a resource block monitors and controls the general operation of the physical device hardware. The execution of this algorithm is dependent on the characteristics of the physical device, as defined by the manufacturer. As a result of this activity, the algorithm may cause the generation of events. There is only one resource block defined for a device. For example, when the mode of the resource block is Out of Service, it impacts all function blocks.

Transducer Blocks

Transducer blocks connect function blocks to local input/output functions. They read sensor hardware and write to effector (actuator) hardware. This permits the transducer block to execute as frequently as necessary to obtain good data from sensors and ensure proper writes to the actuator without burdening the function blocks that use the data. The transducer block also isolates the function block from the specific characteristics of the physical I/O.

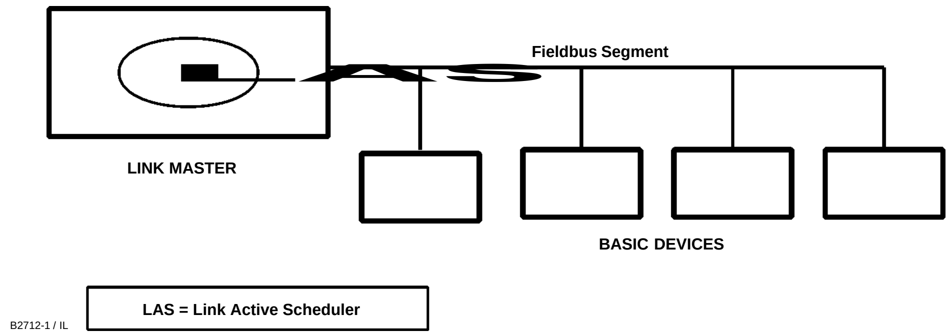


Figure A-2. Simple Single-Link Fieldbus Network

Alerts

When an alert occurs, execution control sends an event notification and waits a specified period of time for an acknowledgment to be received. This occurs even if the condition that caused the alert no longer exists. If the acknowledgment is not received within the pre-specified time-out period, the event notification is retransmitted. This assures that alert messages are not lost.

Two types of alerts are defined for the block, events and alarms. Events are used to report a status change when a block leaves a particular state, such as when a parameter crosses a threshold. Alarms not only report a status change when a block leaves a particular state, but also report when it returns back to that state.

NETWORK COMMUNICATION

Figure A-2 illustrates a simple fieldbus network consisting of a single segment (link).

Link Active Scheduler (LAS)

All links have one and only one Link Active Scheduler (LAS). The LAS operates as the bus arbiter for the link. The LAS does the following:

- recognizes and adds new devices to the link.
- removes non-responsive devices from the link.
- distributes Data Link (DL) and Link Scheduling (LS) time on the link. Data Link Time is a network-wide time periodically distributed by the LAS to synchronize all device clocks on the bus. Link Scheduling time is a link-specific time represented as an offset from Data Link Time. It is used to indicate when the LAS on each link begins and repeats its schedule. It is used by system management to synchronize function block execution with the data transfers scheduled by the LAS.
- polls devices for process loop data at scheduled transmission times.
- distributes a priority-driven token to devices between scheduled transmissions.

The digital valve controller does not include an LAS. However, not having an LAS does not affect device operation.

Only one device can communicate at a time. Permission to communicate on the bus is controlled by a centralized token passed between devices by the LAS. Only the device with the token can communicate. The LAS maintains a list of all devices that need access to the bus. This list is called the “Live List.“

Two types of tokens are used by the LAS. A time-critical token, compel data (CD), is sent by the LAS according to a schedule. A non-time critical token, pass token (PT), is sent by the LAS to each device in numerical order according to address.

Device Addressing

Fieldbus uses addresses between 0 and 255. Addresses 0 through 15 are reserved for group addressing and for use by the data link layer. If there are two or more devices with the same address, the first device to start will use its programmed address. Each of the other devices will be given one of four temporary addresses between 248 and 251. If a temporary address is not available, the device will be unavailable until a temporary address becomes available.

Scheduled Transfers

Information is transferred between devices over the fieldbus using three different types of reporting.

- **Publisher/Subscriber:** This type of reporting is used to transfer critical process loop data, such as the

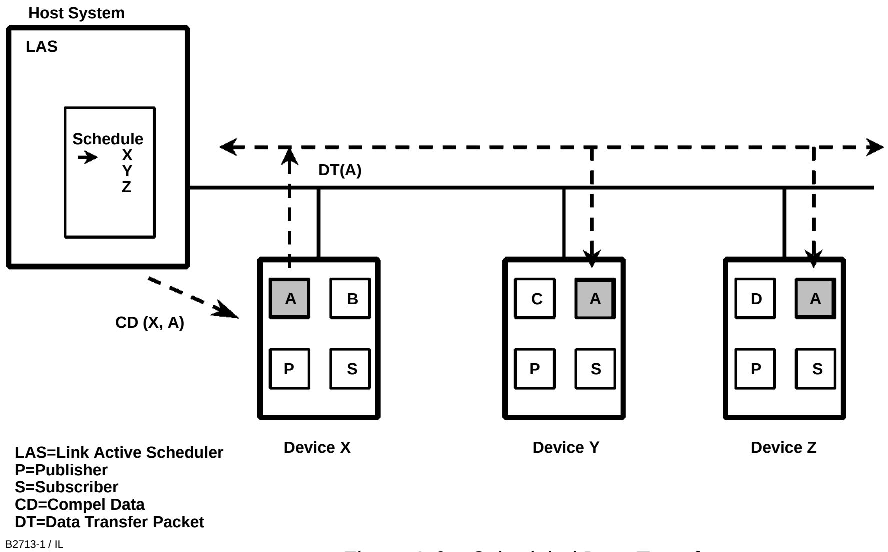


Figure A-3. Scheduled Data Transfer

process variable. The data producers (publishers) post the data in a buffer that is transmitted to the subscriber (S), when the publisher receives the Compel Data (CD) message from the LAS. The buffer contains only one copy of the data. New data completely overwrites previous data. Updates to published data are transferred simultaneously to all subscribers in a single broadcast. Transfers of this type can be scheduled on a precisely periodic basis.

- **Report Distribution:** This type of reporting is used to broadcast and multicast event and trend reports. The destination address may be predefined so that all reports are sent to the same address, or it may be provided separately with each report. Transfers of this type are queued. They are delivered to the receivers in the order transmitted, although there may be gaps due to corrupted transfers. These transfers are unscheduled and occur in between scheduled transfers at a given priority.

- **Client/Server:** This type of reporting is used for request/ response exchanges between pairs of devices. Like Report Distribution reporting, the transfers are queued, unscheduled, and prioritized. Queued means the messages are sent and received in the order submitted for transmission, according to their priority, without overwriting previous messages. However, unlike Report Distribution, these transfers are flow controlled and employ a retransmission procedure to recover from corrupted transfers.

Figure A-3 diagrams the method of scheduled data transfer. Scheduled data transfers are typically used for the regular cyclic transfer of process loop data between devices on the fieldbus. Scheduled transfers use publisher/subscriber type of reporting for data transfer. The Link Active Scheduler maintains a list of transmit times for all publishers in all devices that need to be cyclically transmitted. When it is time for a device to publish data, the LAS issues a Compel Data (CD) message to the device. Upon receipt of the CD, the device broadcasts or “publishes“ the data to all devices on the fieldbus. Any device that is configured to receive the data is called a “subscriber.”

Unscheduled Transfers

Figure A-4 diagrams an unscheduled transfer. Unscheduled transfers are used for things like user-initiated changes, including set point changes, mode changes, tuning changes, and upload/download. Unscheduled transfers use either report distribution or client/server type of reporting for transferring data.

All of the devices on the fieldbus are given a chance to send unscheduled messages between transmissions of scheduled data. The LAS grants permission to a device to use the fieldbus by issuing a pass token (PT) message to the device. When the device receives the PT, it is allowed to send messages until it has finished or until the “maximum token hold time“ has expired, whichever is the shorter time. The message may be sent to a single destination or to multiple destinations.

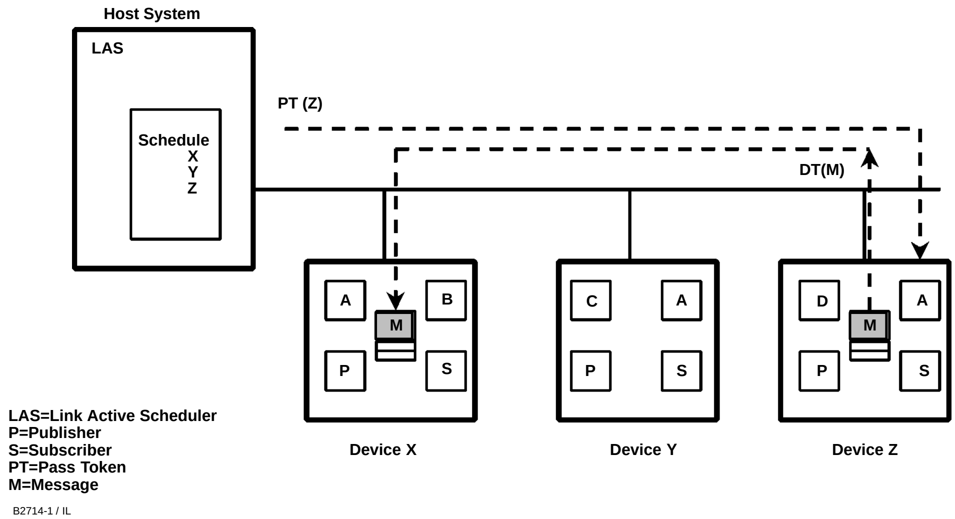


Figure A-4. Unscheduled Data Transfer

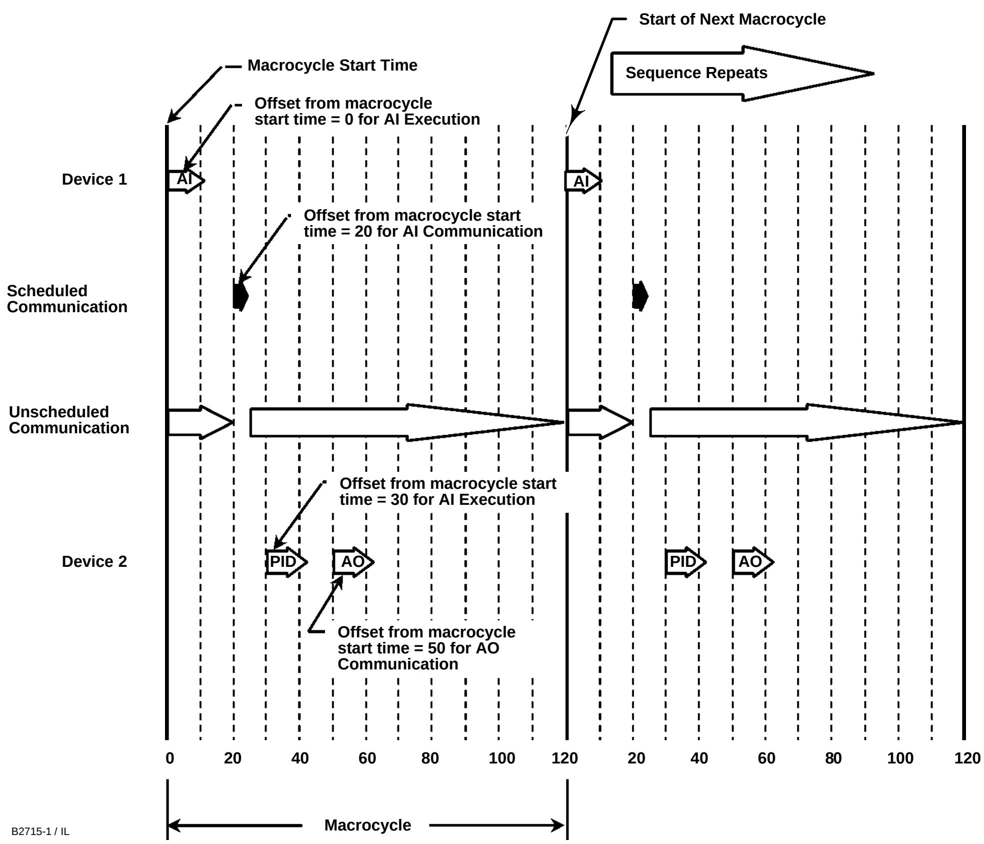


Figure A-5. Example Link Schedule Showing Scheduled and Unscheduled Communication

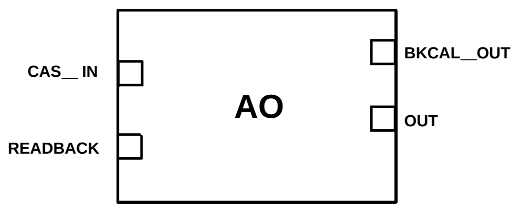
A

Function Block Scheduling

Figure A-5 shows an example of a link schedule. A single iteration of the link-wide schedule is called the macrocycle. When the system is configured and the function blocks are linked, a master link-wide schedule is created for the LAS. Each device maintains its portion of the link-wide schedule, known as the Function Block Schedule. The Function Block Schedule indicates when the function blocks for the device are to be executed. The scheduled execution time for each function block is represented as an offset from the beginning of the macrocycle start time.

To support synchronization of schedules, periodically Link Scheduling (LS) time is distributed. The beginning of the macrocycle represents a common starting time for all Function Block schedules on a link and for the LAS link-wide schedule. This permits function block executions and their corresponding data transfers to be synchronized in time.

Appendix B Analog Output (AO) Function Block



CAS_IN = The remote setpoint value from another function block.
BKCAL_OUT = The value and status required by the BKCAL_IN input of another block to prevent reset windup and to provide bumpless transfer to closed loop control.
OUT = The block output and status.
READBACK = Actual valve position.

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Figure B-1. Analog Output (AO) Function Block

The Analog Output (AO) function block assigns an output value to a field device through a specified I/O channel. The block supports mode control, signal status calculation, and simulation. Figure B-2 illustrates the internal components of the AO function block, and table B-1 lists the definitions of the block parameters. The digital valve controller measures and uses actual valve position for READBACK.

Setting the Output

To set the output for the AO block, you must first set the mode to define the manner in which the block determines its setpoint. In Manual mode the value of the output attribute (OUT) must be set manually by the user, and is independent of the setpoint. In Automatic mode, OUT is set automatically based on the value specified by the set point (SP) in engineering units and the I/O options attribute (IO_OPTS). In addition, you can limit the SP value and the rate at which a change in the SP is passed to OUT.

In Cascade mode, the cascade input connection (CAS_IN) is used to update the SP. The back calculation output (BKCAL_OUT) is wired to the back calculation input (BKCAL_IN) of the upstream block that provides CAS_IN. This provides bumpless transfer on mode changes and windup protection in the upstream block. The OUT attribute or an analog readback value, such as valve position, is shown by the process value (PV) attribute in engineering units.

To support testing, you can enable simulation, which allows you to manually set the channel feedback. There is no alarm detection in the AO function block.

To select the manner of processing the SP and the channel output value configure the setpoint limiting options, the tracking options, and the conversion and status calculations.

Set Point Selection and Limiting

To select the source of the SP value use the MODE attribute. In Automatic (Auto) mode, the local, manually-entered SP is used. In Cascade (Cas) mode, the SP comes from another block through the CAS_IN input connector. In RemoteCascade (RCas) mode, the SP comes from a host computer that writes to RCAS_IN. The range and units of the SP are defined by the PV_SCALE attribute.

In Manual (Man) mode the SP automatically tracks the PV value when you select the SP-PV Track in Man I/O option. The SP value is set equal to the PV value when the block is in manual mode, and is enabled (True) as a default. You can disable this option in Man or O/S mode only.

The SP value is limited to the range defined by the setpoint high limit attribute (SP_HI_LIM) and the setpoint low limit attribute (SP_LO_LIM).

In Auto mode, the rate at which a change in the SP is passed to OUT is limited by the values of the setpoint upward rate limit attribute (SP_RATE_UP) and the setpoint downward rate limit attribute (SP_RATE_DN). A limit of zero disabless rate limiting, even in Auto mode.

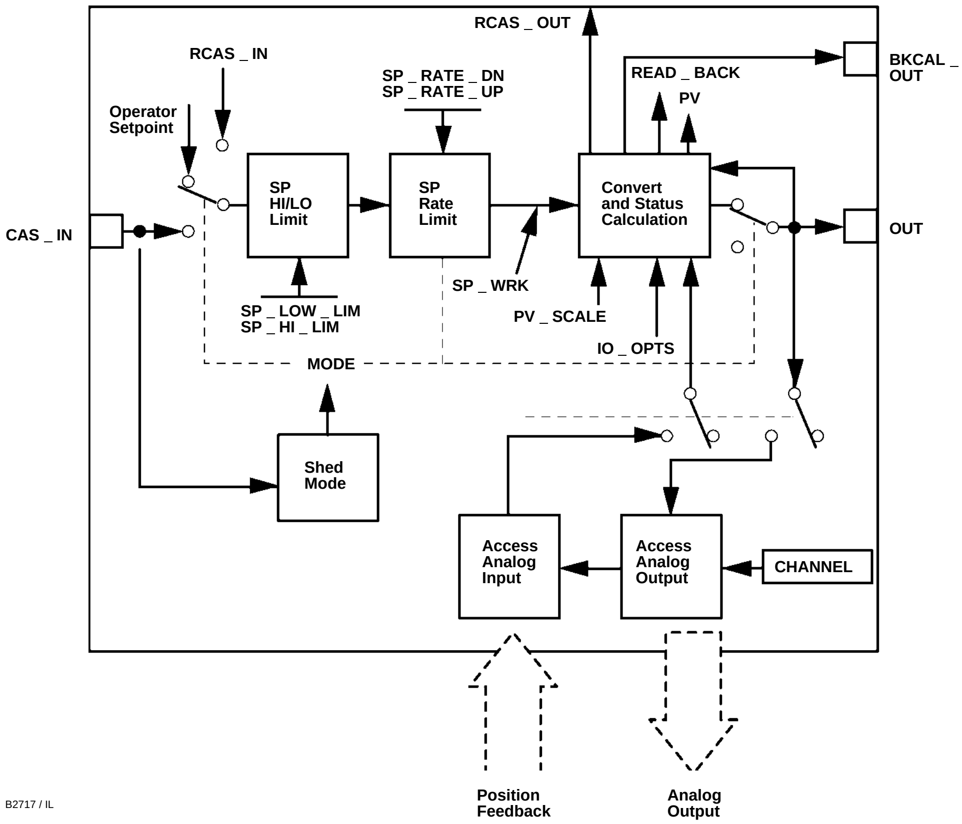


Figure B-2. Analog Output Function Block Schematic

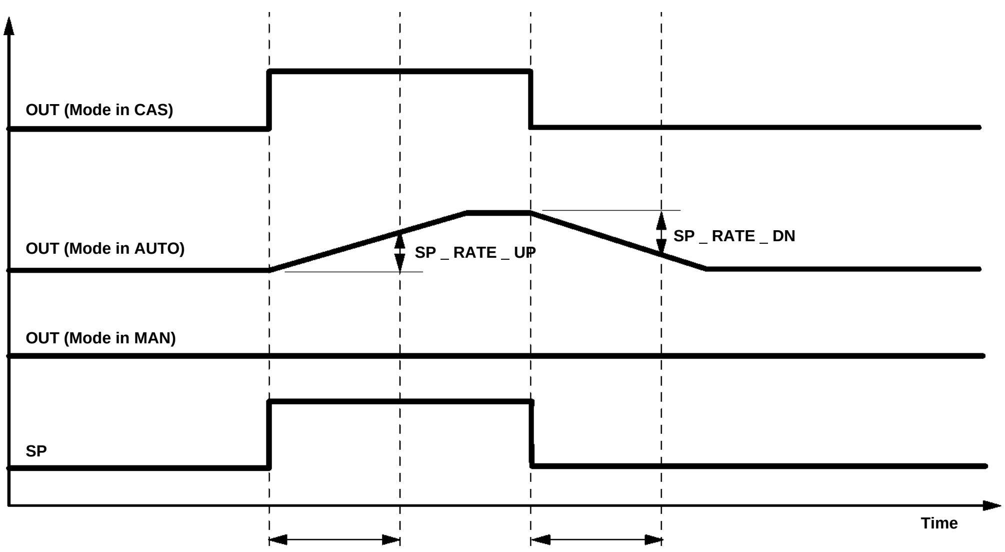


Figure B-3. Analog Output Function Block Timing Diagram

Table B-1. Analog Output Function Block Parameter Definitions

Parameter Name	Index Number	Units	Description
ALERT_KEY	04	None	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
BKCAL_OUT	25	EU of PV_SCALE	The value and status required by the BKCAL_IN input of another block to prevent reset windup and to provide bumpless transfer to closed loop control.
BLOCK_ALM	30	None	The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the active status in the status parameter. As soon as the Unreported status is cleared by the alert report ing task, and other block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	06	None	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown. see table E-4.
CAS_IN	17	EU of PV_SCALE	The remote setpoint value from another function block.
CHANNEL	22	None	Defines the output that drives the field device. Parameter not used by DVC5000f Series digital valve controller.
FSTATE_TIME	23	Seconds	Time from failure detection to reaction if failure still exists.
FSTATE_VAL	24	EU of PV_SCALE	Preset value to use if I/O_OPTS Fault State to Value or Use Fault State Value on Restart is set.
GRANT_DENY	13	None	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.
IO_OPTS	14	None	Allows you to select the type of tracking and the output value when a fault condition occurs. Increase-to-Open and Increase-to-Close are not available.
MODE_BLK	05	None	The actual, target, permitted, and normal modes of the block. Target: The mode to ”go to” Actual: The mode the ”block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
OUT	09	EU of XD_SCALE	The primary value and status calculated by the block in Auto mode. OUT may be set manually in Man mode.
PV	07	EU of PV_SCALE	The process variable used in block execution. This value is converted from READBACK to show the actuator position in the same units as the setpoint value.
PV_SCALE	11	None	The high and low scale values, the engineering units code, and the number of digits to the right of the decimal point associated with the PV.
RCAS_IN	26	EU of PV_SCALE	Target SP and status by supervisory host
RCAS_OUT	28	EU of PV_SCALE	Block set point and status after
READBACK	16	EU of XD_SCALE	The measured or implied actuator position associated with the OUT value, only if Feature Select is Output Readback supported. If not, READBACK is the simulated input if SIMULATE is enabled or the transducer block feedback if SIMULATE is disabled.
SHED_OPT	27	None	Defines the action to be taken when the set point or ourput are not updated in a remote mode.
SIMULATE	10	EU of XD_SCALE	Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulate is disabled, the simulate value and status track the actual value and status.
SP	08	EU of PV_SCALE	The analog set point of this block
SP_HI_LIM	20	EU of PV_SCALE	The highest set point value allowed. SP_HI_LIM must be greater than SP_LO_LIM.
SP_LO_LIM	21	EU of PV_SCALE	The lowest set point value allowed. SP_LO_LIM must be less than SP_HI_LIM.
SP_RATE_DN	18	EU of PV_SCALE per second	Ramp rate for downward set point changes. When the ramp rate is set to zero, the set point is used immediately.
SP_RATE_UP	19	EU of PV_SCALE per second	Ramp rate for upward set point changes. When the ramp rate is set to zero, the setpoint is used immediately.
STATUS_OPTS	15	None	Options the user may select for the block processing of status.
STRATEGY	03	None	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
ST_REV	01	None	The revision level of the static data associated with the function block. The revision value will be incremented each time a static pa rameter value in the block is changed.
TAG_DESC	02	None	The user description of the intended application of the block.

–Continued–

Table B–1. Analog Output Function Block Parameter Definitions (continued)

Parameter Name	Index Number	Units	Description
UPDATE_EVT	29	None	This alert is generated by any changes to static data.
XD_SCALE	12	None	The high and low scale values and engineering units code are read only. This parameter determines the number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel.

In Auto mode, the converted SP value is stored in the OUT attribute. In Man mode, the OUT attribute is set manually, and is used to set the analog output defined by the CHANNEL parameter.

You can access the actuator position associated with the output channel through the READBACK parameter (in OUT units) and in the PV attribute (in engineering units). The digital valve controller supports position feedback and therefore provides the actual valve position in PV and READBACK directly. If the actuator does not support position feedback, the PV and READBACK values are based on the OUT attribute.

Simulation

When simulation is enabled, the last value of OUT is maintained and reflected in the field value of the SIMULATE attribute. In this case, the PV and READBACK values and statuses are based on the SIMULATE value and the status that you enter.

B

Action On Fault Detection

To define the state to which you wish the valve to enter when the block is in CAS mode, and the CAS_IN input detects a bad status, configure the following parameters:

IO_OPTS: Determines the action OUT will take upon a fault state. If the IO_OPTS “Fault State to Value” is not selected, then OUT holds its last position when Fault State is set. If “Fault State to Value” is selected, OUT goes to the FSTATE_VAL value when Fault State is set.

FSTATE_TIME: The length of time, in seconds, that the AO block will wait to set Fault State. When Fault State is set, the OUT value goes to either the FSTATE_VAL value or holds its last position, depending on I/O_OPTS. When the block has a target mode of CAS, a fault condition will be detected if the CAS_IN has a BAD status or an Initiate Fault State substatus is received from the upstream block.

FSTATE_VAL: Determines the OUT value if IO_OPTS “Fault State to Value” is selected. The OUT value transitions to FSTATE_VAL after FSTATE_TIME elapses and the fault condition has not cleared.

I/O Options

The I/O options parameter (IO_OPTS) allows you to select how the I/O signals are processed. You can set I/O options in Manual or Out of Service mode only. The following I/O options are available in the AO block:

Use PV for BKCAL_OUT—Changes the BKCAL_OUT value to the PV value. When the Use PV for BKCAL_OUT option is not enabled (False), the BKCAL_OUT value is the working setpoint value.

Target to Man if Fault State Activated—Set the target mode to Man, thus losing the original target, if Fault State is activated. This latches an output block into the manual mode.

Use Fault State value on Restart—Use the value of FSTATE_VAL for SP when power is restored of if the device is restarted, otherwise use the last value saved in non-volatile memory. This does not act like Fault State, it only uses the value of FSTATE_VAL.

Fault State to Value—The output action to take when a fault occurs (if not selected, use hold last value; if selected, use FSTATE_VAL).

Increase to Close—Indicates whether or not the output value is inverted before it is communicated to the I/O channel. Note: in the digital valve controller the transducer block automatically accounts for Increase to Close/Increase to Open valve action during calibration, therefore this parameter may only be set to disabled.

SP–PV Track in LO or IMan—Permits the SP to track the PV when the actual mode of the block is LO or IMan. SP–PV Track in Man takes precedence over SP–PV Track in LO or IMan. SP–PV Track in Man must be enabled in order for SP–PV Track in LO or IMan to track when target mode is MAN.

SP–PV Track in Man—Permits the SP to track the PV when the block target mode is Man.

SP Track retained Target—Causes the set point to track the RCAS or CAS parameter based on the retained target mode when the actual mode is MAN or LO.

Block Errors

Table B-2 lists conditions reported in the BLOCK_ERR parameter. Conditions in *italics* are not applicable for the AO block and are provided only for your reference.

Table B-2. BLOCK_ERR Conditions

Condition Number	Condition Name and Description
0	*Other (N/A)*
1	**Block Configuration Error** - SHED_OPT set to 0
2	*Link Configuration Error (N/A)*
3	**Simulate active** - Simulation is enabled and the block is using a simulated value in its execution.
4	**Local Override** - Device in fault state. Actual mode LO.
5	**Device Fault State Set** - AO block in fault state after FSTATE_TIME because of Bad status or IFS substatus on CAS_IN or Resource block commanded fault state.
6	*Device Needs Maintenance Soon (N/A)*
7	**Input failure/process variable has Bad status** - PV has bad status and Feature Select in the Resource block has the Out Readback bit set.
8	**Output failure** - PV has bad status.
9	*Memory Failure (N/A)*
10	*Lost Static Data (N/A)*
11	*Lost NV Data (N/A)*
12	*Readback Check Failed (N/A)*
13	*Device Needs Maintenance Now (N/A)*
14	**Power Up** - This condition exists after power up until actual mode is not Out of Service.
15	**Out of Service** - The block is in Out of Service (O/S) mode.

Modes

The Analog Output function block supports the following modes:

- **Manual (Man)**—You can manually set the output to the I/O channel through the OUT attribute. This mode is used primarily for maintenance and troubleshooting.

- **Automatic (Auto)**—The block output (OUT) reflects the target operating point specified by the setpoint (SP) attribute.

- **Cascade (Cas)**—The SP attribute is set by another function block through a connection to CAS_IN. The SP value is used to set the OUT attribute automatically. This is the most frequently used mode in the digital valve controller.

- **RemoteCascade (RCas)**—The SP is set by a host computer by writing to the RCAS_IN parameter. The SP value is used to set the OUT attribute automatically.

- **Out of Service (O/S)**—The block is not processed. The output channel is maintained at the last value and the status of OUT is set to Bad: Out of Service. The BLOCK_ERR attribute shows Out of Service.

- **Initialization Manual (Iman)**—The path to the output hardware is broken and the AO block output will remain at the last position. This means the transducer block mode is Out of Service.

- **Local Override (LO)**—The output of the block is not responding to OUT because the fault state action is active.

The target mode of the block may be restricted to one or more of the following modes: Man, Auto, Cas, RCas, or O/S.

Shed Options

Shed from or climb to a remote mode is determined by the parameter SHED_OPT. A block climbs and sheds through the same path. For example, if SHED_OPT specifies that a block should shed to Auto, then, if the block target mode is set to RCas, the block goes through Auto on the way to RCas. You can configure the shed option as follows:

Shed With Return Options

Remote cascade connection failure shifts actual mode but keeps trying to restore remote cascade (in other words, the remote cascade target mode stays in effect).

Normal—On failure of a remote cascade connection, the block attempts to attain the highest permitted non–remote mode until remote cascade is restored. On change to remote cascade target mode from any other mode, the block attempts to attain the highest permitted non–remote mode until a remote cascade connection is established.

Retained Target—On failure of a remote cascade connection, the block attempts to attain the mode retained in the target mode. On change to the remote cascade target mode from any other mode, the block attempts to attain the mode retained by target mode until a remote cascade connection is established.

Auto—On failure of a remote cascade connection, the block attempts to attain Auto, if permitted, until remote cascade is restored. On change to remote target mode from any other mode, the block attempts to attain Auto, if permitted, until a remote cascade connection is established.

Man—On failure of a remote cascade connection, the block sheds to Man until a remote cascade connection is restored. On change to remote target mode, from any other mode, the block goes to Man until a cascade connection is established.

Shed With No Return Options

For any shed with no return option, the target mode changes as determined by the option. Therefore, there is no attempt to restore the connection following failure. The behavior on change to the remote cascade target mode is identical to that for Shed With Return Options.

Normal—On failure of a remote cascade connection, the block sets the target mode to the highest permitted non-remote mode. On change to a remote cascade target mode from any other mode, the block attempts to attain the highest permitted non-remote mode until a remote cascade connection is established.

Retained Target—On failure of a remote cascade connection, the block sets the target mode to mode retained in target mode. On change to the remote cascade target mode from any other mode, the block attempts to attain the mode retained by target mode until a remote cascade connection is established. The DeltaV system does not support the retained target shed. Selecting the retained target results in shed to Auto. This applies to any block, regardless of whether it is in a field device or a DeltaV controller. The writing device sets or clears the retained target bits in the target mode. Therefore, any workstation or other device (DeltaV controller applications, for example) that does not support retained target operation ignores the retained target bits. In a DeltaV system, regardless of where the block is located, the retained target bits are turned off, and the block sheds to Auto.

Auto—On failure of a remote cascade connection, the block sets the target mode to Auto, if permitted. On change to the remote target mode from any other mode, the block attempts to attain Auto, if permitted, until a remote cascade connection is established.

Man—On failure of remote cascade connection, the block sets the target mode to Man, if permitted. On change to the remote target mode from any other mode, the block goes to Man until a cascade connection is established.

The user may configure SHED_OPT so that it calls for a target mode that is not permitted. When doing this, the mode logic uses the following rules as applied by the remote logic:

- Shed logic never results in a non-permitted target mode.

- Shed logic never attempts to attain an actual mode of Auto or Cas if that mode is not permitted.

Status Handling

Output or readback fault detection is reflected in the status of PV, OUT, and BKCAL_OUT. A limited SP condition is reflected in the BKCAL_OUT status. When simulation is enabled through the SIMULATE attribute, you can set the value and status for PV and READBACK.

When the block is in Cas mode and the CAS_IN input goes bad, the block sheds mode to the next permitted mode.

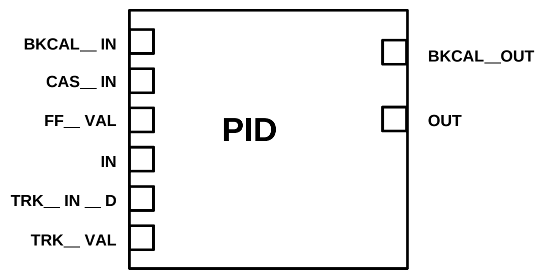
Application Information

The configuration of an AO function block and its associated output channels depends on the specific application. A typical configuration for the Analog Output involves the following attributes:

PV_SCALE	Set the range and engineering units to values that correspond to the operation range. For the digital valve controller, PV_SCALE is typically set between 0 and 100%.
BKCAL_OUT	If you are using the CAS_IN connector wired from another block, wire the BKCAL_OUT attribute to the other block's BKCAL_IN attribute.
IO_OPTS	Set the type of tracking and action upon fault state. Note: the digital valve controller does not use the Increase to Close IO option. The valve action is determined by the transducer block during calibration.
SHED_OPT	Set the action to be taken when the set point or output are not updated in a remote mode.

B

Appendix C PID Function Block



BKCAL_IN	=	The analog input value and status from another block's BKCAL _OUT output that is used for backward output tracking for bumpless transfer and to pass limit status.
CAS_IN	=	The remote setpoint value from another function block.
FF_VAL	=	The feedforward control input value and status.
IN	=	The connection for the process variablefrom another function block.
TRK_IN_D	=	Initiates the external tracking function.
TRK_VAL	=	The value after scaling applied to OUT in Local Override mode.
BKCAL_OUT	=	The value and status required by the BKCAL_IN input of another function block to prevent reset windup and to provide bumpless transfer to closed loop control.
OUT	=	The block output and status.

B2720 / IL

Figure C-1. Proportional+Integral+Derivative (PID) Function Block

The PID function block combines all of the necessary logic to perform proportional/integral/derivative (PID) control. The block supports mode control, signal scaling and limiting, feedforward control, override tracking, alarm limit detection, and signal status propagation.

The block supports two forms of the PID equation: Standard and Series. You can choose the appropriate equation using the FORM parameter. The Standard ISA PID equation is the default selection.

$$Standard = GAIN \times e \times \left(1 + \frac{1}{\tau_r s + 1} + \frac{\tau_d s}{\alpha \times \tau_d s + 1}\right) + F$$

$$Series = GAIN \times e \times \left(1 + \frac{1}{\tau_r s}\right) \times \left(\frac{\tau_d s + 1}{\alpha \times \tau_d s + 1}\right) + F$$

where

GAIN: proportional gain value

τ_r: integral action time constant (RESET parameter) in seconds

s: laplace operator

τ_d: derivative action time constant (RATE parameter)

α: fixed smoothing factor of 0.1 applied to RATE

F: feedforward control contribution from the feedforward input (FF_VAL)

To further customize the block for use in your application, you can configure filtering, feedforward inputs, tracking inputs, setpoint and output limiting, PID equation structures, and block output action. Table C-1 lists the PID block parameters and their descriptions, units of measure, and index numbers, and figure C-2 illustrates the internal components of the PID function block.

Set Point Selection and Limiting

The set point of the PID block is determined by the mode. Figure C-3 illustrates the method for set point selection. You can configure the SP_HI_LIM and SP_LO_LIM parameters to limit the set point. In Cascade or Remote Cascade mode, the set point is adjusted by another function block or by a host computer, and the output is computed based on the set point.

In Automatic mode, the set point is entered manually by the operator, and the output is computed based on the set point. In Auto mode, you can also adjust the set point limit and the set point rate of change using the SP_RATE_UP and SP_RATE_DN parameters.

In Manual mode the output is entered manually by the operator, and is independent of the set point. In Remote Output mode, the output is entered by a host computer, and is independent of the set point.

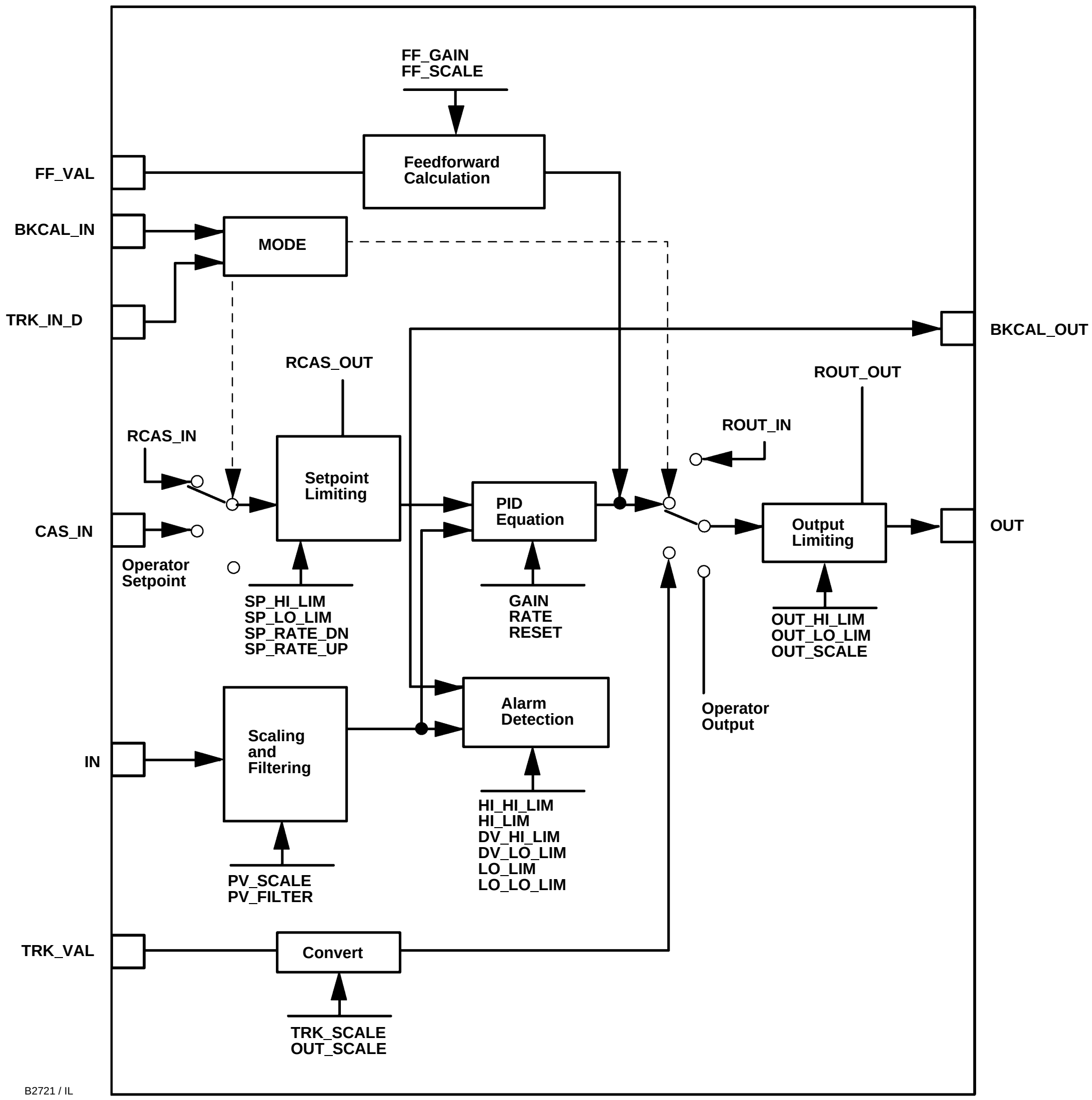


Figure C-2. PID Function Block Schematic

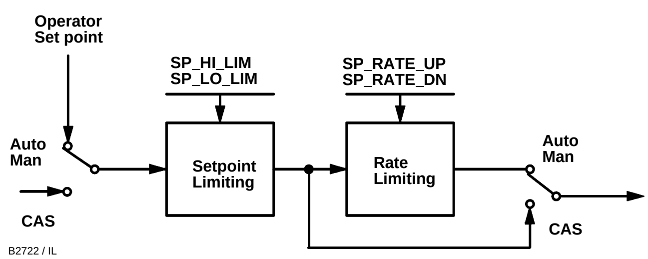


Figure C-3. PID Function Block Set Point Selection

Filtering

The filtering feature changes the response time of the device to smooth variations in output readings caused by rapid changes in input. You can adjust the filter time constant (in seconds) using the PV_FTIME or SP_FTIME parameters. Set the filter time constant to zero to disable the filter feature.

Feedforward Calculation

The feedforward value (FF_VAL) is scaled (FF_SCALE) to a common range for compatibility with the output scale (OUT_SCALE). A gain value (FF_GAIN) is applied to achieve the total feedforward contribution.

Table C-1. PID Function Block System Parameters

Parameter Name	Index Number	Units	Description
ACK_OPTION	46	None	Used to set auto acknowledgment of alarms.
ALARM_HYS	47	Percent	The amount the alarm value must return to within the alarm limit before the associated active alarm condition clears.
ALARM_SUM	45	None	The summary alarm is used for all process alarms in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert report ing task, another block alert may be reported without clearing the Active status, if the subcode has changed.
ALERT_KEY	04	None	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
BAL_TIME	25	Seconds	The specified time for the internal working value of bias to return to the operator set bias. Also used to specify the time constant at which the integral term will move to obtain balance when the output is limited and the mode is AUTO, CAS, or RCAS.
BETA	73	Percent	Used to set disturbance rejection vs. tracking response action for 2 degrees of freedom PID.
BIAS	66	EU of OUT_SCALE	The bias value used to calculate output for a PD structure.
BKCAL_HYS	30	Percent	The amount the output value must change away from the its output limit before limit status is turned off.
BKCAL_IN	27	EU of OUT_SCALE	The analog input value and status from another block's BKCAL_OUT output that is used for backward output tracking for bumpless transfer and to pass limit status.
BKCAL_OUT	31	EU of PV_SCALE	The value and status required by the BKCAL_IN input of another block to prevent reset windup and to provide bumpless transfer of closed loop control.
BLOCK_ALM	44	None	The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the active status in the status parameter. As soon as the Unreported status is cleared by the alert report ing task, and other block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	06	None	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string so that multiple errors may be shown.
BYPASS	17	None	Used to override the calculation of the block. When enabled, the SP is sent directly to the output.
CAS_IN	18	EU of PV_SCALE	The remote setpoint value from another block.
CONTROL_OPTS	13	None	Allows you to specify control strategy options. The supported control options for the PID block are Bypass Enable, SP–PV Track in Man, SP-PV Track in Rout, SP–PV Track in LO or IMAN, SP Tracks RCAS or CAS in LO, IMAN, Man, or Rout, Direct Acting, Track enable, Track in Manual, Use PV for BKCAL OUT, Act on IR, Obey SP limits if CAS or RCAS, and No Out limits in Man.
DV_HI_ALM	64	None	The DV HI alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
DV_HI_LIM	57	EU of PV_SCALE	The setting for the alarm limit used to detect the deviation high alarm condition.
DV_HI_PRI	56	None	The priority of the deviation high alarm.
DV_LO_ALM	65	None	The DV LO alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
DV_LO_LIM	59	EU of PV_SCALE	The setting for the alarm limit use to detect the deviation low alarm condition.
DV_LO_PRI	58	None	The priority of the deviation low alarm.
ERROR	67	EU of PV_SCALE	The error (SP–PV) used to determine the control action.
FF_GAIN	42	None	The feedforward gain value. FF_VAL is multiplied by FF_GAIN before it is added to the calculated control output. A value of 0 disables feedforward.
FF_SCALE	41	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the feedforward value (FF_VAL).
FF_VAL	40	EU of FF_SCALE	The feedforward control input value and status.
FORM	70	None	Selects equation form (series or standard)
GAIN	23	None	The proportional gain value. This value cannot = 0.
GAMMA	72	Percent	Used to set disturbance rejection vs. tracking response action for a 2.0 degree of freedom PID.
GRANT_DENY	12	None	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by the device.

–Continued–

C

Table C-1. PID Function Block System Parameters (Continued)

Parameter Name	Index Number	Units	Description
HI_ALM	61	None	The HI alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
HI_HI_ALM	60	None	The HI HI alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
HI_HI_LIM	49	EU of PV_SCALE	The setting for the alarm limit used to detect the HI HI alarm condition.
HI_HI_PRI	48	None	The priority of the HI HI Alarm.
HI_LIM	51	EU of PV_SCALE	The setting for the alarm limit used to detect the HI alarm condition.
HI_PRI	50	None	The priority of the HI alarm.
IDEADBAND	74	EU of PV_SCALE	Integral action stops when ERROR is within IDEADBAND, proportional and derivative action continue.
IN	15	EU of PV_SCALE	The connection for the PV input from another block.
LO_ALM	62	None	The LO alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
LO_LIM	53	EU of PV_SCALE	The setting for the alarm limit used to detect the LO alarm condition.
LO_LO_ALM	63	None	The LO LO alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
LO_LO_LIM	55	EU of PV_SCALE	The setting for the alarm limit used to detect the LO LO alarm condition.
LO_LO_PRI	54	None	The priority of the LO LO alarm.
LO_PRI	52	None	The priority of the LO alarm.
MODE_BLK	05	None	The actual, target, permitted, and normal modes of the block. Target: The mode to ”go to” Actual: The mode the ”block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
OUT	09	EU of OUT SCALE	The block input value and status.
OUT_HI_LIM	28	EU of OUT SCALE	The maximum output value allowed. OUT_HI_LIM must be greater than OUT_LO_LIM.
OUT_LO_LIM	29	EU of OUT_SCALE	The minimum output value allowed. OUT_LO_LIM must be less than OUT_HI_LIM.
OUT_SCALE	11	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with OUT.
PV	07	EU of PV_SCALE	The process variable used in block execution.
PV_FTIME	16	Seconds	The time constant of the first–order PV filter. It is the time required for a 63 percent change in the IN value.
PV_SCALE	10	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with PV.
RATE	26	Seconds	The derivative action time constant.
RCAS_IN	32	EU of PV_SCALE	Target setpoint and status that is provided by a supervisory host. Used when mode is RCAS.
RCAS_OUT	35	EU of PV_SCALE	Block setpoint and status after ramping, filtering, and limiting that is provided to a super visory host for back calculation to allow action to be taken under limiting conditions or mode change. Used when mode is RCAS.
RESET	24	Seconds per repeat	The integral action time constant.
ROUT_IN	33	EU of OUT_SCALE	Target output and status that is provided by a supervisory host. Used when mode is ROUT.
ROUT_OUT	36	EU of OUT_SCALE	Block output that is provided to a supervisory host for a back calculation to allow action to be taken under limiting conditions or mode change. Used when mode is RCAS
SHED_OPT	34	None	Defines action to be taken on remote control device timeout.
SP	08	EU of PV_SCALE	The target block setpoint value. It is the result of setpoint limiting and setpoint rate of change limiting.
SP_FTIME	69	Seconds	The time constant of the first–order SP filter. It is the time required for a 63 percent change in the IN value.
SP_HI_LIM	21	EU of PV_SCALE	The highest SP value allowed. SP_HI_LIM must be greater than SP_LO_LIM.
SP_LO_LIM	22	EU of PV_SCALE	The lowest SP value allowed. SP_LO_LIM must be less than SP_HI_LIM.
SP_RATE_DN	19	EU of PV_SCALE per second	Ramp rate for downward SP changes. When the ramp rate is set to zero, the SP is used immediately.
SP_RATE_UP	20	EU of PV_SCALE per second	Ramp rate for upward SP changes. When the ramp rate is set to zero, the SP is used immediately.
SP_WRK	68	EU of PV_SCALE	The working set point of the block after limiting and filtering is applied.

–Continued–

Table C-1. PID Function Block System Parameters (Continued)

Parameter Name	Index Number	Units	Description
STATUS_OPTS	14	None	Allows you to select options for status handling and processing. The supported status option for the PID block are IFS if BAD IN, IFS if BAD CAS_IN, Use Uncertain as Good, and Target to Manual if BAD IN.
STRATEGY	03	None	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
ST_REV	01	None	The revision level of the static data associated with the function block. The revision value will be incremented each time a static pa rameter value in the block is changed.
STRUCTURE	71	None	Defines PID equation structure to apply controller action.
TAG_DESC	02	None	The user description of the intended application of the block.
TRK_IN_D	38	None	Discrete input that initiates external tracking.
TRK_SCALE	37	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the external tracking value (TRK_VAL).
TRK_VAL	39	EU of TRK SCALE	The value (after scaling from TRK_SCALE to OUT_SCALE) applied to OUT in LO mode.
UPDATE_EVT	43	None	This alert is generated by any changes to the static data.

Tracking

Output tracking is enabled through the control options. You can set control options in Manual or Out of Service mode only.

The Track Enable control option must be set to True for the track function to operate. When the Track in Manual control option is set to True, the operator cannot override the tracking function in Manual mode. When Track in Manual is False, the operator can override the tracking function when the block is in Manual mode. Activating the track function causes the block's actual mode to revert to Local Override.

The TRK_VAL parameter specifies the value to be converted and tracked into the output when the track function is operating. The TRK_SCALE parameter specifies the range of TRK_VAL.

When the TRK_IN_D parameter is True and the Track Enable control option is True, the TRK_VAL input is converted to the appropriate value and output in units of OUT_SCALE.

Output Selection and Limiting

Output selection is determined by the mode and the set point. In Automatic, Cascade, or Remote Cascade mode, the output is computed by the PID control equation. In Manual and Remote Output mode, the output may be entered manually (see also Set Point Selection and Limiting). You can limit the output by configuring the OUT_HI_LIM and OUT_LO_LIM parameters.

Set Point Tracking

You can configure the method for tracking the set point by configuring the following control options (CONTROL_OPTS):

- **SP–PV Track in Man**—Permits the SP to track the PV when the actual mode of the block is Man.

- **SP–PV Track in LO or IMan**—Permits the SP to track the PV when the actual mode of the block is Local Override (LO) or Initialization Manual (IMan).

- **SP–PV Track in ROUT**—Permits the SP to track the PV when the actual mode of the block is RemoteOut (ROUT).

When one of these options is set, the SP value is set to the PV value while in the specified mode.

You can select the value that a master controller uses for tracking by configuring the Use PV for BKCAL_OUT control option. The BKCAL_OUT value tracks the PV value. BKCAL_IN on a master controller connected to BKCAL_OUT on the PID block in an open cascade strategy forces its OUT to match BKCAL_IN, thus tracking the PV from the slave PID block into its cascade input connection (CAS_IN). If the Use PV for BKCAL_OUT option is not selected, the working set point (SP_WRK) is used for BKCAL_OUT.

You can set control options in Manual or Out of Service mode only. When the mode is set to Auto, the SP will remain at the last value (it will no longer follow the PV.

PID Equation Structures

Configure the STRUCTURE parameter to select the PID equation structure. You can select one of the following choices:

- Proportional, integral, and derivative on error (PID)
- Proportional and integral on error, derivative on PV (PI_D)
- Integral on error, proportional and derivative on PV (I_PD)
- Proportional on error, derivative on error (PD)
- Integral on error, derivative on error (ID)
- Integral on error, derivative on PV (I_D)
- Two degrees of Freedon (2DOF)

Reverse and Direct Action

To configure the block output action, set the Direct Acting control option. This option defines the relationship between a change in PV and the corresponding change in output. With Direct Acting enabled (True), an increase in PV results in an increase in the output.

You can set control options in Manual or Out of Service mode only.

Block Errors

Table C-2 lists conditions reported in the BLOCK_ERR parameter. Conditions in *italics* are not applicable for the PID block and are provided only for your reference.

Table C-2. BLOCK_ERR Conditions

Condition Number	Condition Name and Description
0	*Other (N/A)*
1	**Block Configuration Error**—SHED_OPT or BYPASS set to 0
2	*Link Configuration Error (N/A)*
3	*Simulate Active (N/A)*
4	**Local Override**—The actual mode is LO and Track Enable is set.
5	*Device Fault State Set (N/A)*
6	*Device Needs Maintenance Soon (N/A)*
7	**Input failure/process variable has Bad status**—The parameter linked to IN is indicating a Bad status.
8	*Output Failure (N/A)*
9	*Memory Failure (N/A)*
10	*Lost Static Data (N/A)*
11	*Lost NV Data (N/A)*
12	*Readback Check Failed (N/A)*
13	*Device Needs Maintenance Now (N/A)*
14	*Power Up (N/A)*
15	**Out of Service** - The actual mode is Out of Service (O/S).

Modes

The PID function block supports the following modes:

- **Manual (Man)**—The block output (OUT) may be set manually.
- **Automatic (Auto)**—The SP may be set manually and the block algorithm calculates OUT.
- **Cascade (Cas)**—The SP is calculated in another block and is provided to the PID block through the CAS_IN connection.
- **RemoteCascade (RCas)**—The SP is provided by a host computer that writes to the RCAS_IN parameter.
- **RemoteOutput (Rout)**—The OUT is provided by a host computer that writes to the ROUT_IN parameter
- **Local Override (LO)**—The track function is active. OUT is set by TRK_VAL. The BLOCK_ERR parameter shows Local override.
- **Initialization Manual (IMan)**—The output path is not complete (for example, the cascade–to–slave path might not be open). In IMan mode, OUT tracks BKCAL_IN.
- **Out of Service (O/S)**—The block is not processed. The OUT status is set to Bad: Out of Service. The BLOCK_ERR parameter shows Out of service.

You can configure the Man, Auto, Cas, and O/S modes as permitted modes for operator entry.

Shed Options

Shed from or climb to a remote mode is determined by the parameter SHED_OPT. A block climbs and sheds through the same path. For example, if SHED_OPTS specifies that a block should shed to Auto, then, if the block target mode is set to RCas, the block goes through Auto on the way to RCas. You can configure the shed option as follows:

Shed With Return Options

Remote cascade connection failure shifts actual mode but keeps trying to restore remote cascade (in other words, the remote cascade target mode stays in effect).

Normal—On failure of a remote cascade connection, the block attempts to attain the highest permitted non–remote mode until remote cascade is restored. On change to remote cascade target mode from any other mode, the block attempts to attain the highest permitted non–remote mode until a remote cascade connection is established.

Retained Target—On failure of a remote cascade connection, the block attempts to attain the mode retained in the target mode. On change to the remote cascade target mode from any other mode, the block attempts to attain the mode retained by target mode until a remote cascade connection is established.

Auto—On failure of a remote cascade connection, the block attempts to attain Auto, if permitted, until remote cascade is restored. On change to remote target mode from any other mode, the block attempts to attain Auto, if permitted, until a remote cascade connection is established.

Man—On failure of a remote cascade connection, the block sheds to Man until a remote cascade connection is restored. On change to remote target mode, from any other mode, the block goes to Man until a cascade connection is established.

Shed With No Return Options

For any shed with no return option, the target mode changes as determined by the option. Therefore, there is no attempt to restore the connection following failure. The behavior on change to the remote cascade target mode is identical to that for Shed With Return Options.

Normal—On failure of a remote cascade connection, the block sets the target mode to the highest permitted non-remote mode. On change to a remote cascade target mode from any other mode, the block attempts to attain the highest permitted non-remote mode until a remote cascade connection is established.

Retained Target—On failure of a remote cascade connection, the block sets the target mode to mode retained in target mode. On change to the remote cascade target mode from any other mode, the block attempts to attain the mode retained by target mode until a remote cascade connection is established. The DeltaV system does not support the retained target shed. Selecting the retained target results in shed to Auto. This applies to any block, regardless of whether it is in a field device or a DeltaV controller. The writing device sets or clears the retained target bits in the target mode. Therefore, any workstation or other device (DeltaV controller applications, for example) that does not support retained target operation ignores the retained target bits. In a DeltaV system, regardless of where the block is located, the retained target bits are turned off, and the block sheds to Auto.

Auto—On failure of a remote cascade connection, the block sets the target mode to Auto, if permitted. On change to the remote target mode from any other mode, the block attempts to attain Auto, if permitted, until a remote cascade connection is established.

Man—On failure of remote cascade connection, the block sets the target mode to Man, if permitted. On change to the remote target mode from any other mode, the block goes to Man until a cascade connection is established.

The user may configure SHED_OPTS so that it calls for a target mode that is not permitted. When doing this, the mode logic uses the following rules as applied by the remote logic:

- Shed logic never results in a non-permitted target mode.
- Shed logic never attempts to attain an actual mode of Auto or Cas if that mode is not permitted.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set. The types of block error for the PID block are defined above.

Process alarm detection is based on the PV value. You can configure the alarm limits of the following standard alarms:

- High (HI_LIM)
- High high (HI_HI_LIM)
- Low (LO_LIM)
- Low low (LO_LO_LIM)

Additional process alarm detection is based on the difference between SP and PV values and can be configured via the following parameters:

- Deviation high (DV_HI_LIM)
- Deviation low (DV_LO_LIM)

Table C-3. PID Function Block Alarm Priorities

Priority Number	Priority Dexcription
0	The alarm is disabled
1	An alarm condition with a priority of 1 can be recognized by the system. The device monitors the alarm but does not report it until requested by the host system.
2	An alarm condition with a priority of 2 is reported to the operator, but generally does not require operator attention (such as diagnostics and system alerts).
3–7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8–15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

In order to avoid alarm chattering when the variable is oscillating around the alarm limit, an alarm hysteresis in percent of the PV span can be set using the ALARM_HYS parameter. The priority of each alarm is set in the following parameters:

- HI_PRI
- HI_HI_PRI
- LO_PRI
- LO_LO_PRI
- DV_HI_PRI
- DV_LO_PRI

Alarms are grouped into five levels of priority, as shown in table C-3.

Status Handling

If the input status on the PID block is Bad, the mode of the block reverts to Manual. In addition, you can select the Target to Manual if Bad IN status option to direct the target mode to revert to manual. You can set the status option in Manual or Out of Service mode only.

Application Information

The PID function block is a powerful, flexible control algorithm that is designed to work in a variety of control strategies. The PID block is configured differently for different applications. The following examples describe the use of the PID block for closed–loop control (basic PID loop), feedforward control, cascade control with master and slave, and complex cascade control with override.

Closed Loop Control

To implement basic closed loop control, compute the error difference between the process variable (PV) and set point (SP) values and calculate a control output signal using a PID (Proportional Integral Derivative) function block.

The proportional control function responds immediately and directly to a change in the PV or SP. The proportional term GAIN applies a change in the loop output based on the current magnitude of the error multiplied by a gain value.

The integral control function reduces the process error by moving the output in the appropriate direction. The integral term RESET applies a correction based on the magnitude and duration of the error. To reduce reset action, configure the RESET parameter to be a large value.

The derivative term RATE applies a correction based on the anticipated change in error. Derivative control is typically used in temperature control where large measurement lags exist.

Application Example: Basic PID Block for Steam Heater Control

Situation

A PID block is used with an AI block and an AO block to control the steam flow used to heat a process fluid in a heat exchanger. Figure C-4 illustrates the process instrumentation diagram.

Solution

Figure C-5 illustrates the correct function block configuration. The PID loop uses TT101 as an input and provides a signal to the analog output TCV101. The BKCAL_OUT of the AO block and the BKCAL_IN of the PID block communicate the status and quality of information being passed between the blocks. The status indication shows that communications is functioning and the I/O is working properly.

Application Example: Feedforward Control

Situation

In the previous example, control problems can arise because of a time delay caused by thermal inertia between the two flow streams (TT100 and TT101). Variations in the inlet temperature (TT100) take an excessive amount of time to be sensed in the outlet (TT101). This delay causes the product to be out of the desired temperature range.

Solution

Figure C-7 illustrates the process instrumentation diagram of the steam heater control example with feedforward control added. Feedforward control is added to improve the response time of the basic PID control. Figure C-6 illustrates the correct function block configuration. The temperature of the inlet process

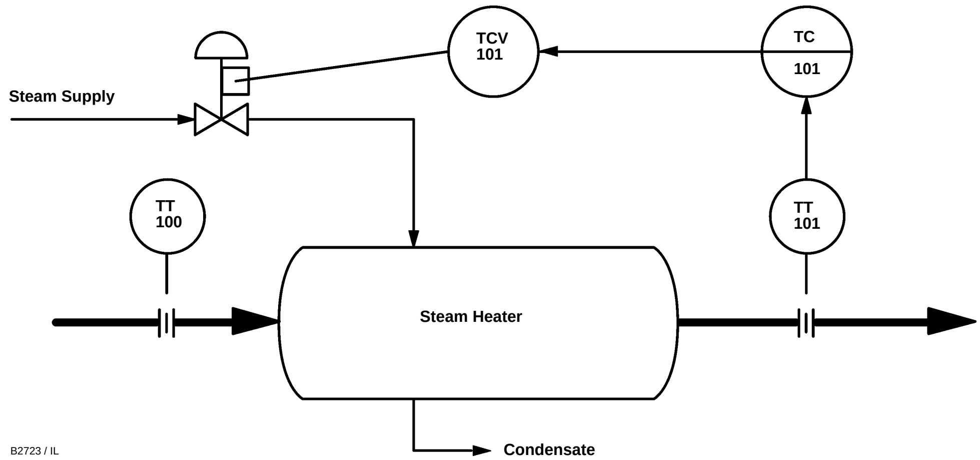


Figure C-4. Steam Heater Control Application Example

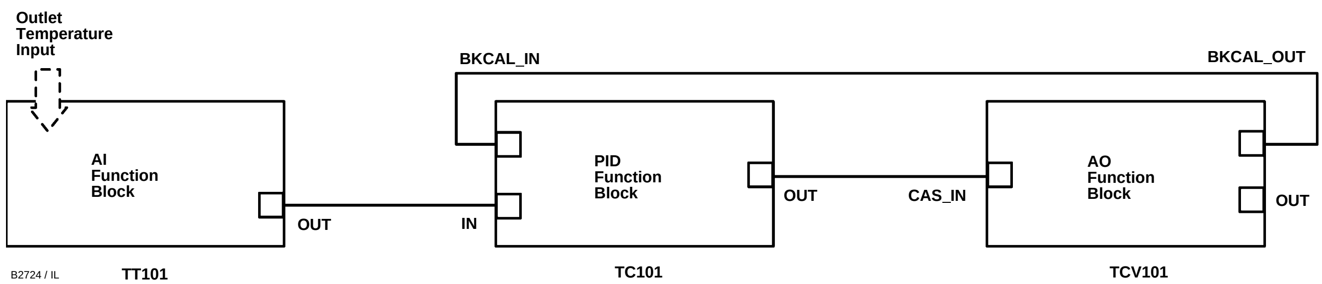


Figure C-5. Function Block Configuration Diagram for Steam Heater Control Example

fluid (TT100) is input to an AI function block and is connected to the FF_VAL connector on the PID block. Feedforward control is then enabled (FF_ENABLE), the feedforward value is scaled (FF_SCALE), and a gain (FF_GAIN) is determined.

Application Example: Cascade Control with Master and Slave Loops

Situation

A slave loop is added to a basic PID control configuration to measure and control steam flow to the steam heater. Figure C-8 illustrates the process instrumentation diagram. Variations in the steam pressure cause the temperature in the heat exchanger to change. The temperature variation will later be sensed by TT101. The temperature controller will modify the valve position to compensate for the steam pressure change. The process is slow and causes variations in the product temperature.

Solution

If the flow is controlled, steam pressure variations will be compensated before they significantly affect the heat exchanger temperature. The output from the master temperature loop is used as the set point for the slave steam flow loop. Figure C-9 illustrates the correct function block configuration. The BKCAL_IN and BKCAL_OUT connections on the PID blocks are used to prevent controller windup on the master loop when the slave loop is in Manual or Automatic mode, or it has reached an output constraint.

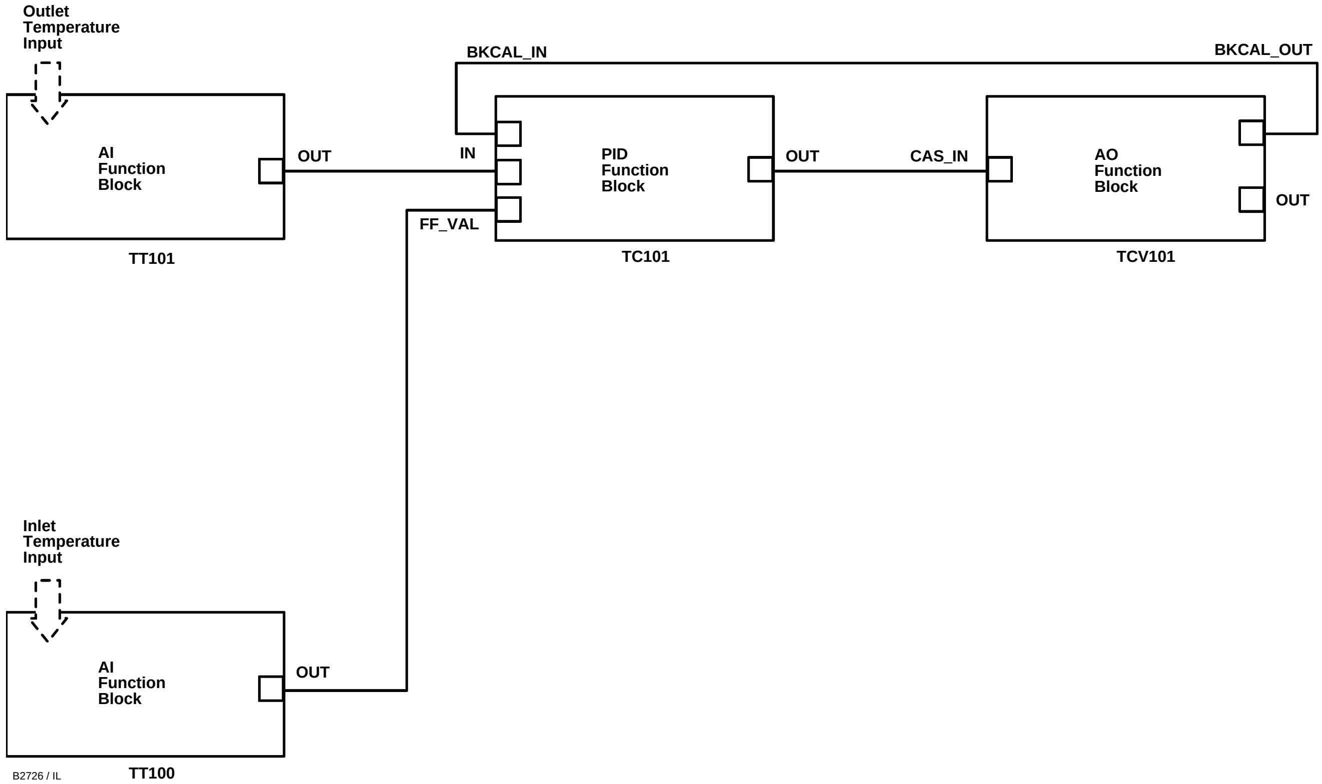


Figure C-6. Function Block Configuration Diagram for Steam Heater Control Example with Feedforward Control

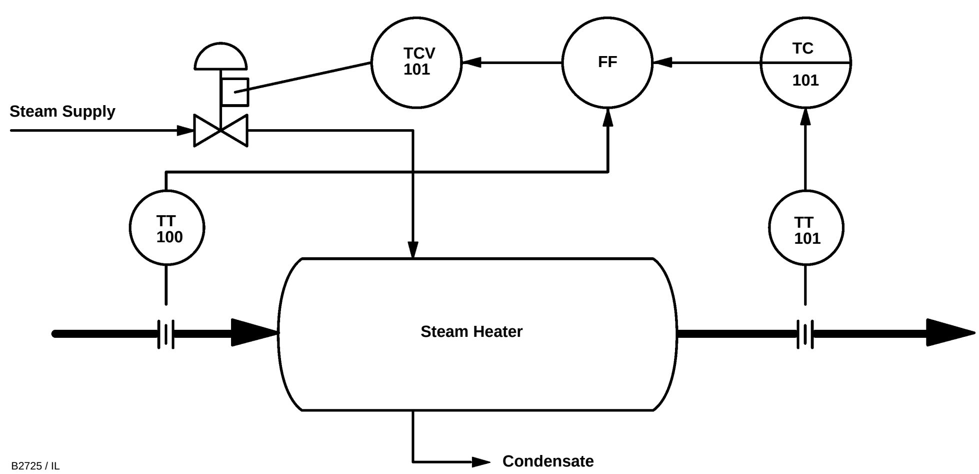


Figure C-7. Steam Heater Control Example with Feedforward

C

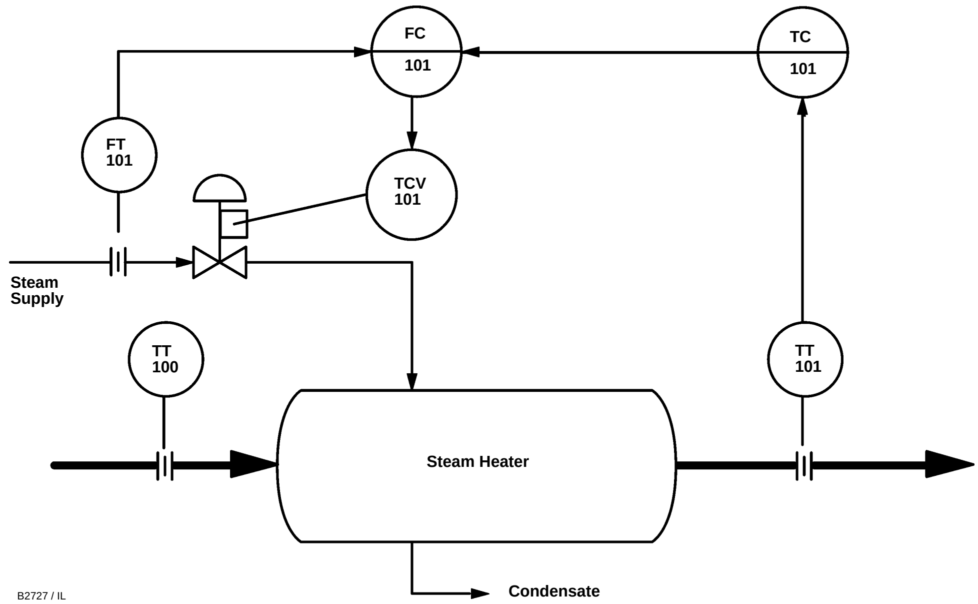


Figure C-8. Steam Heater Control Example with Feedforward and Cascade Control

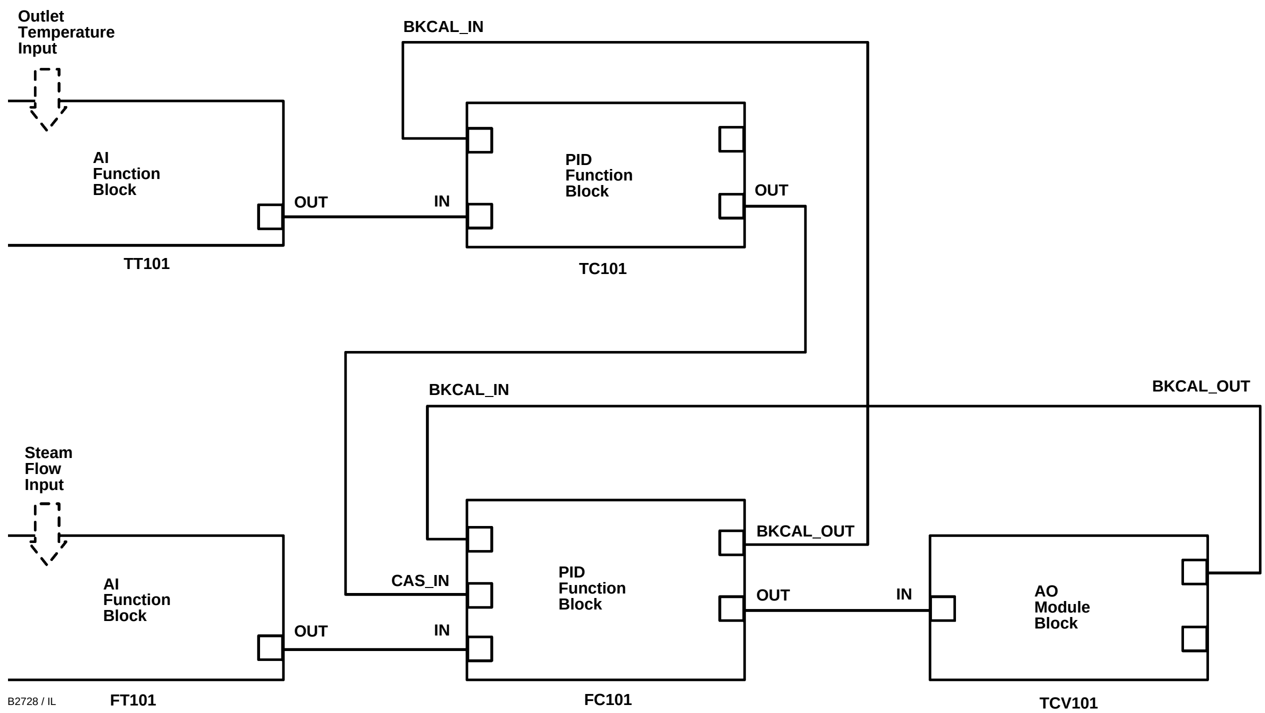


Figure C-9. Function Block Configuration Diagram for Steam Heater Control Example with Feedforward and Cascade Control

C

Appendix D Discrete Input (DI) Function Block

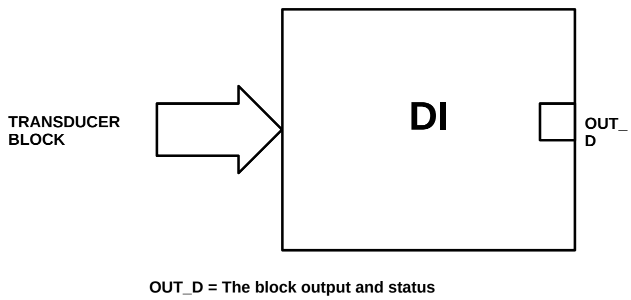


Figure D-1. Discrete Input (DI) Function Block

Table D-1. Discrete Input Function Block Channel Definitions

Channel	FIELD_VAL_D Set When
1	Valve position is greater than 97%
2	Valve position is less than 3%
3	Valve position is below Travel Lo Lo Alrt Pt
4	Valve position is below Travel Lo Alrt Pt
5	Valve position is above Travel Hi Alrt Pt
6	Valve position is above Travel Hi Hi Alrt Pt
7	Valve position is within proximity set by Travel Lo Lo Alrt Pt
8	Valve position is within proximity set by Travel Lo Alrt Pt
9	Valve position is within proximity set by Travel Hi Alrt Pt
10	Valve position is within proximity set by Travel Hi Hi Alrt Pt

The Discrete Input (DI) function block processes a single discrete input from a field device and makes it available to other function blocks. You can configure inversion and alarm detection on the input value. In the DVC5000f Series digital valve controller, the discrete input function block can provide limit switch functionality and valve position proximity detection. The Discrete Input function block supports mode control, signal status propagation, and simulation.

Normally, the block is used in Automatic mode so that the process variable (PV_D) is copied to the output (OUT_D). You can change the mode to Manual to disconnect the field signal and substitute a manually-entered value for the output. In this case, PV_D continues to show the value that will become the OUT_D when the mode is changed to Automatic.

To support testing, you can enable simulation, which allows the measurement value to be supplied manually through the SIMULATE_D parameter. Figure D-2 illustrates the internal components of the DI function block, and table D-3 lists the definitions of the block parameters.

I/O Selection

To select the I/O associated with the discrete measurement, configure the value of the CHANNEL parameter. In the digital valve controller, the three classes of channels are

- Fixed limit switch
- Variable limit switch based on transducer block travel alarm settings
- Proximity position detection based on transducer block travel alarm settings.

The CHANNEL parameter for each of the four DI blocks available in the digital valve controller may be set independently to achieve the desired position detection. The DI block CHANNEL definitions are listed in table D-1. Refer to the following descriptions for details of the operation of these channels.

Fixed Limit Switch

Channels 1 and 2 provide fixed open and closed limit switch functionality for the DI block. These channels will detect if the valve position is more than 97% for open detection or less than 3% for closed detection. These channels provide a fixed 1% deadzone to clear the detected position.

Variable Limit Switch

Channels 3 through 6 provide variable limit switch functionality for the DI block. Trip points for this limit switch functionality are based on the Travel Alert settings in the transducer Block. The DI function block provides the same type of position detection as the travel alerts in the transducer block. Table D-2 lists the

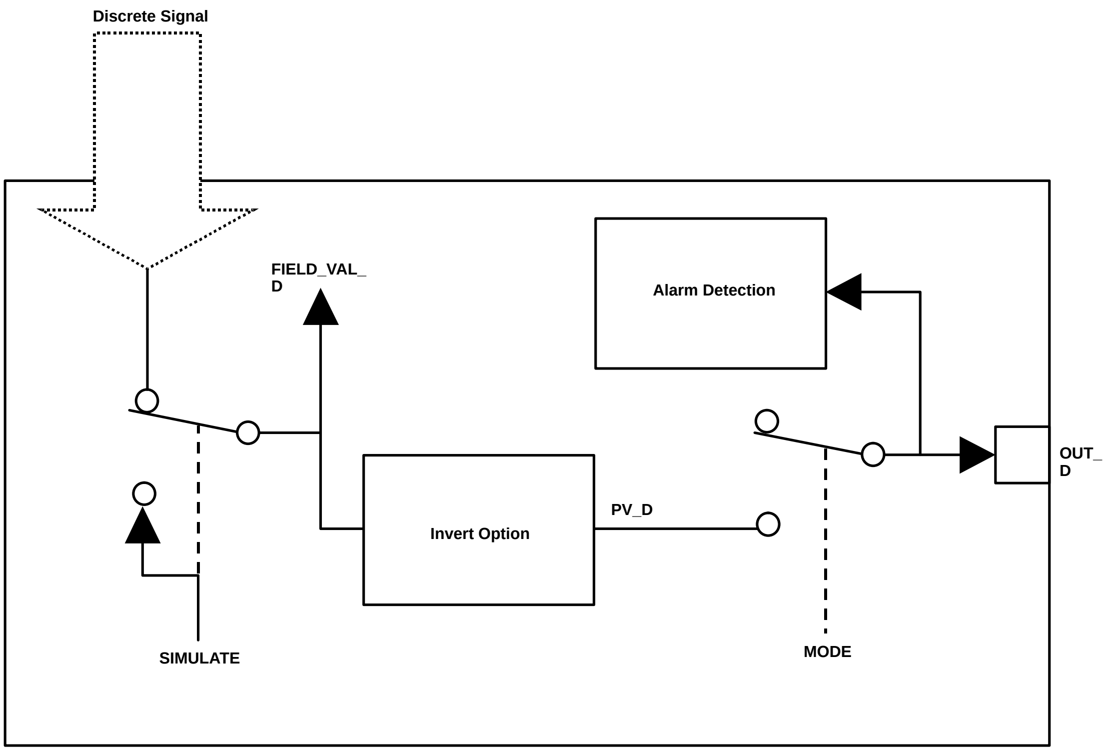


Figure D-2. Discrete Input Function Block Schematic

transducer block parameters used with DI block channels 3 though 6. Section 4 describes the transducer block travel alerts.

Table D-2. Transducer Block Parameters Used with Discrete Input Function Block Channels 3 through 6 (Variable Limit Switch)

Transducer Block Parameter	Parameter Function
Tvl Lo Lo Alrt Pt	Lo Lo Limit Switch trip point
Tvl Lo Lo Alrt DB	Lo Lo Limit Switch deadband
Tvl Lo Alrt Pt	Lo Limit Switch trip point
Tvl Lo Alrt DB	Lo Limit Switch deadband
Tvl Hi Alrt Pt	Hi Limit Switch trip point
Tvl Hi Alrt DB	Hi Limit Switch deadband
Tvl Hi Hi Alrt Pt	Hi Hi Limit Switch trip point
Tvl Hi Hi Alrt DB	Hi Hi Limit Switch deadband

D

Valve Position Proximity Detection

Channels 7 through 10 provide valve position proximity detection for the DI block. The transducer block Travel Alrt Pt and Travel Alrt DB parameters are also used with the valve position proximity, but they provide a different function. The Travel Alrt Pt for the selected channel determines the center point for the position to be detected. The Travel Alrt DB for the selected channel sets the upper and lower trigger points, or the width of the proximity detection band. A 1% deadzone exists above and below this band that the travel must exceed to clear the detected position. Figure D-3 illustrates the operation of the proximity detection function. Travel Alrt Pt refers to Tvl Lo Alrt PT, Tvl Hi Alrt Pt, Tvl Lo Lo Alrt Pt, and Tvl Hi Hi Alrt Pt in table D-4. Travel Alrt DB refers to Tvl Lo Alrt DB, Tvl Hi Alrt DB, Tvl Lo Lo Alrt DB, and Tvl Hi Hi Alrt DB in table D-4.

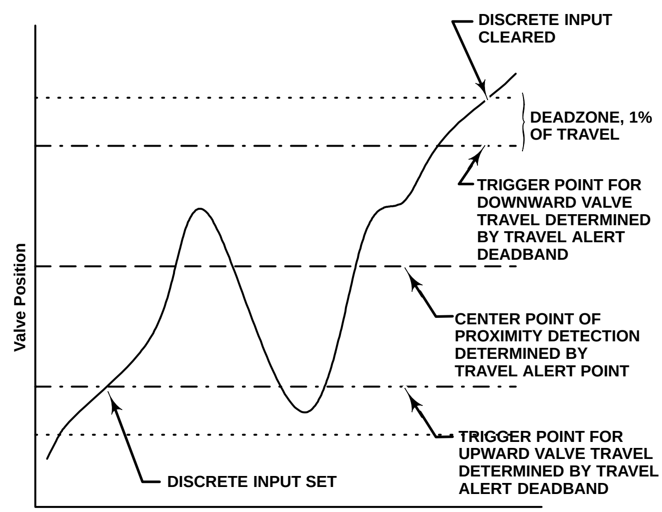


Figure D-3. Discrete Input Proximity Detection Function

Table D-3. Discrete Input Function Block Parameter Definitions

Parameter Name	Index Number	Units	Description
ACK_OPTION	21	None	Used to set auto acknowledgement of alarms
ALARM_SUM	20	None	The current alsert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
ALERT_KEY	04	None	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
BLOCK_ALM	19	None	The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the active status in the status parameter. As soon as the unreported status is cleared by the alert reporting task, and other block alert may be reported without clearing the active status, if the subcode has changed.
BLOCK_ERR	06	None	This parameter reflects the error status associated with the hardware or software components associated with a block. Multiple errors may be shown, see table D-5.
CHANNEL	15	None	Defines the functionality of the discrete input. See I/O Selection for details.
DISC_ALM	24	EU of PV_SCALE	The status and time stamp associated with the discrete alarm.
DISC_LIM	23	EU of PV_SCALE	State of discrete input which will gererate and alarm.
DISC_PRI	22	None	Priority of the discrete alarm.
FIELD_VAL_D	17	On/Off	Raw value of the field device discrete input, with a status reflecting the transducer condition.
GRANT_DENY	12	None	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.
IO_OPTS	13	None	Allows you to select how the I/O signals are processed. The supported I/O option for the DI function block is invert.
MODE_BLK	05	None	The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
OUT_D	08	EU of OUT	The primary discrete value calculated as a result of executing the function.
OUT_STATE	11	EU of OUT	Index to the text describing the states of a discrete output.
PV_D	07	EU of PV_SCALE	The process variable used in block execution. This value is converted from Readback to show the actuator position in the same units as the set point value.
PV_FTIME	16	Seconds	Time that FIELD_VAL_D must be in a new state, before the change is reflected to PV_D and OUT_D.
SIMULATE_D	09	None	Allows the transducer discrete input or output to the block to be manually supplied when simulate is enabled. When simulation is disabled, the simulate value and status track the actual value and status.
ST_REV	01	None	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
STATUS_OPTS	14	None	Options the user may select for the block processing of status.
STRATEGY	03	None	The strategy field can be used to identify grouping of blocks. This data is not chedked or processed by the block.
TAG_DESC	02	None	The user description of the intended application of the block.
UPDATE_EVT	18	None	This alert is generated by any change to the static data.
XD_STATE	10	EU of XD_SCALE	Index to the text describing the states of a discrete for the value obtained from the transducer.

Table D-4. Transducer Block Parameters Used with Discrete Input Function Block Channels 7 through 10

Transducer Block Parameter	Parameter Function
Tvl Lo Lo Alrt Pt	Lo Lo Proximity Detection Center Point
Tvl Lo Lo Alrt DB	Lo Lo Proximity Detection Width
Tvl Lo Alrt Pt	Lo Proximity Detection Center Point
Tvl Lo Alrt DB	Lo Proximity Detection Width
Tvl Hi Alrt Pt	Hi Proximity Detection Center Point
Tvl Hi Alrt DB	Hi Proximity Detection Width
Tvl Hi Hi Alrt Pt	Hi Hi Proximity Detection Center Point
Tvl Hi Hi Alrt DB	Hi Hi Proximity Detection Width

Table D-4 lists the transducer block parameters used for proximity detection with DI block channels 7 though 10.

Block Initialization

The Fieldbus Foundation specification requires that certain parameters in the function blocks have initial values of uninitialized. In addition to setting the Resource block mode to AUTO, the control system or the user must change those parameters from their uninitialized value to a valid value in order for the function block to move from the Out of Service mode. For the DI function block, the CHANNEL parameter must be initialized.

Simulation

To support testing of the control strategy, you can Enable the SIMULATE_D parameter. Normally the measurement value and status used for FIELD_VAL_D in the DI block reflect actual process values as provided by the transducer block. When the SIMULATE_D parameter is Enabled, value and status used for FIELD_VAL_D is supplied by the user manually. To enable simulation in the DI function block, the simulate jumper must be installed. For information on the installation of this jumper, see the "Installation" section.

CAUTION

The block does not respond to actual process values when SIMULATE_D is Enabled.

The SIMULATE_D parameter has three components:

- Simulate Enable_Disable determines whether the function block will use the actual process value and status, or Simulate Value and Simulate Status.

- Transducer Value and Status reflect the process values provided by the transducer block.

- Simulate Value and Status may be entered by the user when Simulate Enable_Disable is set to Enabled.

To use simulate, first install the simulate jumper in the terminal box, then set Simulate Enable_Disable to Enabled, then enter the desired values for Simulate Value and Status.

When SIMULATE_D is Enabled, the Simulate Active bit of the BLOCK_ERR parameter is set (refer to the Block Errors description). When the simulate jumper is installed, the Simulate Jumper bit of the transducer block parameter SELFTEST_STATUS is set.

Field Value Processing

The Invert bit of the IO_OPTS parameter may be used to logically invert the value of FIELD_VAL_D before it is stored as PV_D. PV_FTIME may be used to set the length of time that FIELD_VAL_D must be in a new state before that new state is reflected in PV_D. The PV_D value goes to the mode switch where it becomes OUT_D when the actual mode is AUTO. OUT_D is also tested for an alarm state.

Note

Invert is the only I/O option that the DI block supports. You can set the I/O option only when the block mode is Out of Service.

Alarm Detection

To select the state that initiates an input alarm, and to set discrete alarm substatus in the output, configure the DISC_LIM parameter. You can enter any value between 0 and 255. A value of 255 disables the alarm. When OUT_D matches the DISC_LM state, the discrete value of an alarm is set.

Block Errors

Table D-5 lists conditions reported in the BLOCK_ERR parameter. Conditions in *italics* are not applicable for the DI block and are provided only for your reference.

Table D-5. BLOCK_ERR Conditions

Condition Number	Condition Name and Description
0	*Other (N/A)*
1	**Block Configuration Error**—CHANNEL set to 0 (uninitialized)
2	*Link Configuration Error (N/A)*
3	**Simulate Active**—Simulate is Enabled. Output does not reflect process conditions
4	*Local Override (N/A)*
5	*Device Fault State Set (N/A)*
6	*Device Needs Maintenance Soon (N/A)*
7	**Input failure/process variable has Bad status**—The hardware is bad or the transducer block mode is Out of Service
8	*Output Failure (N/A)*
9	*Memory Failure (N/A)*
10	*Lost Static Data (N/A)*
11	*Lost NV Data (N/A)*
12	*Readback Check Failed (N/A)*
13	*Device Needs Maintenance Now (N/A)*
14	**Power Up**—Set after power-up until actual mode is not Out of Service
15	**Out of Service**—The actual mode is Out of Service (O/S). The block is not being processed.

Modes

The Discrete Input function block supports the following modes:

- **Manual (Man)**—The block output (OUT_D) is disconnected from the field and set manually.
- **Automatic (Auto)**—The block algorithm determines output.
- **Out of Service (O/S)**—The block is not processed. The OUT_D status is set to Bad: Out of Service. The BLOCK_ERR parameter shows Out of Service.

Status Handling

Under normal conditions, a Good: Non-Cascade status is passed through to OUT_D. The block also supports the Status Action On Failure and BLOCK_ ERR indications.

When SIMULATE_D is enabled, FIELD_VAL_D, PV_D, and OUT_D change to the simulated status.

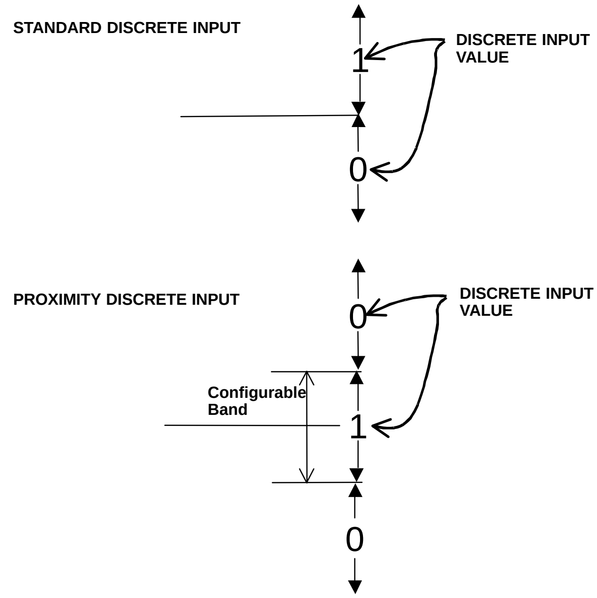


Figure D-4. Proximity Discrete Input Compared to a Standard Discrete Input

When the block is set to Manual mode, OUT_D is set to Good: Non–cascade, Constant status.

Action on Failure

In case of hardware failure, FIELD_VAL_D, PV_D, and OUT_D change to a Bad status and the BLOCK_ ERR parameter shows Process Variable has Bad Status. If the transducer block mode is Out of Service, the status of FIELD_VAL_D, PV_D, and OUT_D is set to Bad:Out of Service.

Application Information

Figure D-4 compares the operation of a standard discrete input to a proximity discrete input. With the standard discrete input, the discrete input changes state when the valve position passes a configurable trip point. This can be used to indicate if the valve position is above or below the trip point.

With the proximity discrete input a configurable band can be established about a central point. Whenever the valve position enters this configurable band, the discrete input changes state. A proximity discrete input is useful for applications which require knowing the location of the valve when the valve is not near 0% or 100%. The ESD or batch applications described in the DO application section are both great examples of that situation.

D

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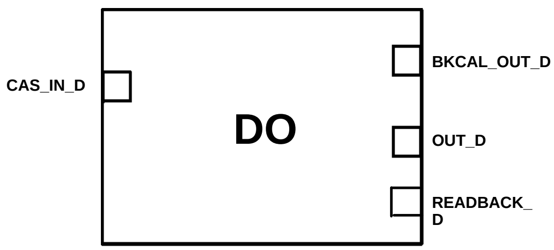
Appendix E Discrete Output (DO) Function Block



CAS_IN_D = The remote set point value from another function block.
BKCAL_OUT_D = The value and status required by the BKCAL_IN_D input of another block for output tracking.
OUT_D = The block output and status.
READBACK_D = Actual valve position

Figure E-1. Discrete Output (DO) Function Block

The Discrete Output (DO) function block processes a discrete set point and outputs it to the specified I/O channel to produce an output signal. The DVC5000f Series digital valve controller discrete output block provides both normal open/closed control and the ability to position the valve in 5% increments for coarse throttling applications. The digital valve controller measures and uses actual valve position for READBACK_D.

The DO block supports mode control and simulation. In operation, the DO function block determines its set point and sets the output. The transducer block provides a readback signal of actual position from the instrument. Figure E–1 illustrates the primary inputs and outputs of the DO function block. Table E-2 lists definitions for the function block parameters.

I/O Selection

To select the I/O associated with the discrete output, configure the value of the CHANNEL parameter. Table E-1 lists the valid Channel selections for the DO block.

Table E-1. Channel Selections for the Discrete Output Function Block

Value	Description	Function
0	Uninitialized	Disables the DO block.
1	Valve Control	Enables the DO block to set valve position

Block Initialization

The Fieldbus Foundation specification requires that certain parameters have initial values of uninitialized in function blocks. In addition to setting the Resource block mode to AUTO, the control system or the user must change those parameters from their uninitialized value to a valid value in order for the function block to move from the Out of Service mode. For the DO function block, the parameters that must be initialized are:

SHED_OPT (see page E4 for valid values)

CHANNEL

Setting the Output

To set the output for the DO block, you must first set the mode to define the manner in which the block determines its set point and output. In Cascade mode, the set point equals the input value at the CAS_IN_D parameter. In Automatic or Manual mode, the set point must be entered manually by the user. For Automatic, the value must be written to the SP_D parameter and for Manual, the value must be written to OUT_D. In Remote Cascade mode, the set point is determined by a host computer that is writing to the RCAS_IN_D parameter. Table E-3 lists discrete states used by the digital valve controller for the set point.

The SP_PV Track in Man option permits the set point to track the process variable when the block is in Manual mode. With this option enabled, the set point (SP_D) becomes a copy of the process variable (PV_D), and a manually-entered SP_D value is overwritten on the block's next execution cycle. This option can prevent a state change when transitioning from Manual to Automatic mode. You can disable this option in Manual or Out of Service mode only.

The Invert option inverts the set point at SP_D before it is stored in OUT_D. With this option enabled,

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Table E-2. Discrete Output Function Block Parameter Definitions

Parameter Name	Index Number	Units	Description
ALERT_KEY	04	None	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
BKCAL_OUT_D	21	None	The value and status required by the BKCAL_IN_D input of another block for output tracking
BLOCK_ALM	26	None	The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the active status in the status parameter. As soon as the Unreported status is cleared by the alert reporting task, and other block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	06	None	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown. See table
CAS_IN_D	17	None	The remote set point value from another block.
CHANNEL	18	None	Defines the output that drives the field device. For the digital valve controller, select channel to set valve position.
FSTATE_TIME	19	Seconds	Time from detection of a fault in the remote set point to the Fault State output action.
FSTATE_VAL_D	20	EU of PV_STATE	Preset discrete SP_D value to use if I/O_OPTS Fault State to Value is set.
GRANT_DENY	13	None	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.
IO_OPTS	14	None	Allows you to select the type of tracking and the output value when a fault condition occurs. Supported I/O options for the DO function block are SP Tracks PV in Man, SP Tracks PV in LO, SP Tracks Retained Target in Man or LO, Fault State to Value, Use Fault state on Restart, Target to Man if Fault State Activated, and Use PV for BKCAL_OUT.
MODE_BLK	05	None	The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
OUT_D	09	EU of OUT	The primary discrete value calculated as a result of executing the function
PV_D	07	None	The discrete process variable calculated from READBACK_D.
PV_STATE	11	EU of OUT	Index to the text describing the states of a discrete output.
RCAS_IN_D	22	EU of PV_STATE	Target set point and status provided by a supervisory host to a discrete control or output block.
RCAS_OUT_D	24	EU of PV_STATE	Block set point and status provided to a supervisoy host for back calculation and to allow action to be taken under limiting conditions or mode change.
READBACK_D	16	None	The discrete feedback from the output in 5% increments.
SHED_OPT	23	None	Defines action to be taken on remote control device timeout.
SIMULATE_D	10	None	Allows the transducer discrete input or output to the block to be manually supplied when simulate is enabled. When simulation is disabled, the simulate value and status track the actual value and status.
SP_D	08	None	The discrete target block output value (set point).
ST_REV	01	None	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
STATUS_OPTS	15	None	Options the user may select for the block processing of status.
STRATEGY	03	None	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
TAG_DESC	02	None	The user description of the intended application of the block.
UPDATE_EVT	25	None	This alert is generated by any change to the static data.
XD_STATE	12	EU of XD_SCALE	Index to the text describing the states of a discrete for the value obtained from the transducer.

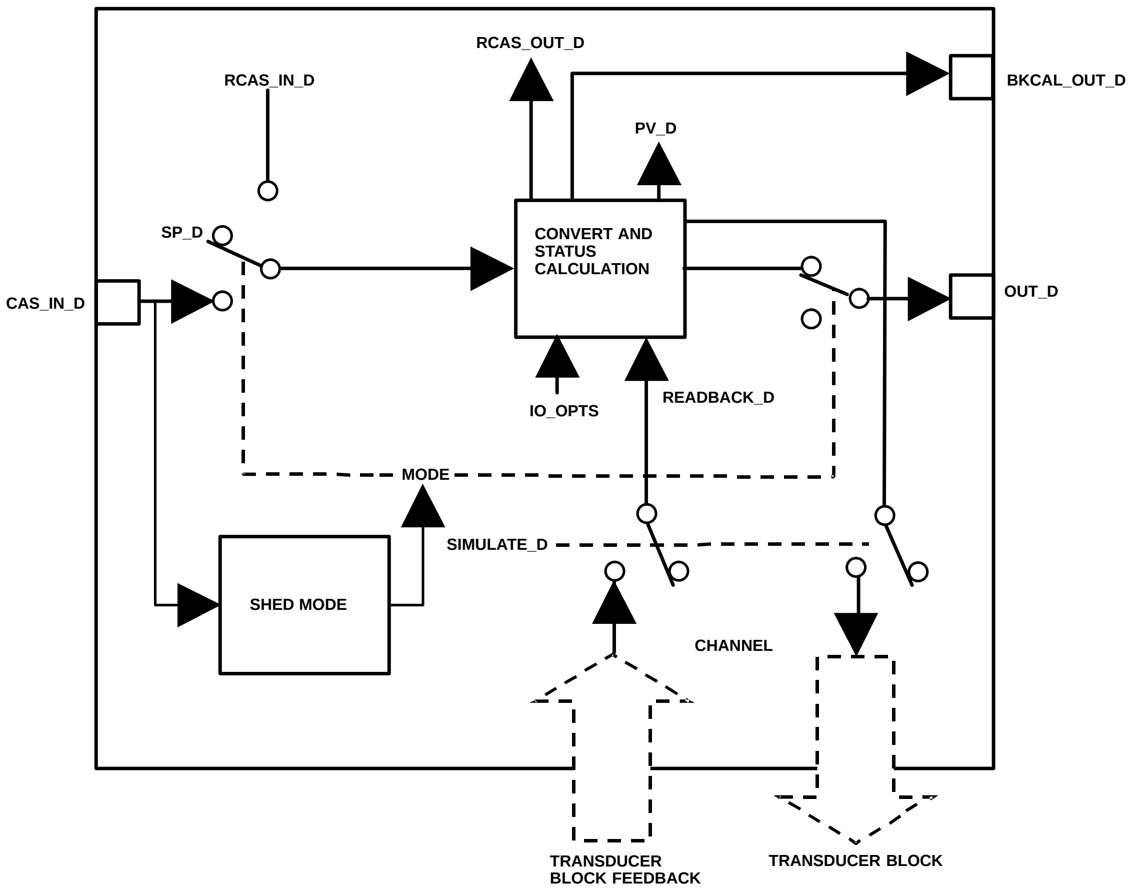

Figure E-2. Discrete Output Function Block Schematic

Table E-3. Valve Set Point for Discrete State

Discrete State	Valve Set Point with IO_OPTS Invert = 0	Valve Set Point with IO_OPTS Invert = 1
0	Closed	Open
1	Open	Closed
5	5%	Closed
10	10%	Closed
15	15%	Closed
20	20%	Closed
25	25%	Closed
30	30%	Closed
35	35%	Closed
40	40%	Closed
45	45%	Closed
50	50%	Closed
55	55%	Closed
60	60%	Closed
65	65%	Closed
70	70%	Closed
75	75%	Closed
80	80%	Closed
85	85%	Closed
90	90%	Closed
95	95%	Closed
100	Open	Closed

OUT_D becomes an inverted copy of SP_D where non-zero values of SP_D are considered a logic 1. With this option disabled, OUT_D is a direct copy of SP_D. The readback value is processed through the Invert option to become PV_D. The Use PV for BKCAL_OUT option specifies that BKCAL _OUT equal the value of the process variable (PV_D) instead of the set point (SP_D). If you do not enable this option, BKCAL_OUT will equal SP_D.

E

Simulation

To support testing of the control strategy, you can Enable the SIMULATE_D parameter. Normally, the valve position value and status used for READBACK_D in the DO block reflect actual process values to the nearest 5%, as provided by the transducer block. When the SIMULATE_D parameter is enabled, value and status used for READBACK_D is supplied by the user manually. To enable simulation in the DO function block, the simulate jumper must be installed. For information on the installation of this jumper, see the “Installation” section.

CAUTION

The valve holds its last position and does not respond to user entered changes when SIMULATE_D is Enabled.

Note

When simulate is active, the output block no longer writes values to the transducer block. If the Output Blk Timeout period is exceeded, the transducer block will set the valve to the No-Air position.

The SIMULATE_D parameter has three components:

- Simulate Enable_Disable determines whether the function block will use the actual valve position value and status, or Simulate Value and Simulate Status.

- Transducer Value and Status reflect the process values provided by the transducer block.

- Simulate Value and Status may be entered by the user when Simulate Enable_Disable is set to Enabled.

To use simulate, first install the simulate jumper in the terminal box, then set Simulate Enable_Disable to Enabled, then enter the desired values for Simulate Value and Status.

When SIMULATE_D is Enabled, the Simulate Active bit of the BLOCK_ERR parameter is set (refer to the Block Errors description). When the simulate jumper is installed, the Simulate Jumper bit of the transducer block parameter SELFTEST_STATUS is set.

Action on Fault Detection

Fault State is caused by one of three sources: A status pertaining to CAS, A status pertaining to RCAS, or SET_FAULTSTATE in the resource block. To implement Fault State, configure the following parameters:

IO_OPTS: Determines the action OUT_D will take upon a fault state. If the IO_OPTS "Fault State to Value" is not selected, then OUT_D holds its last position when Fault State is set. If "Fault State to Value" is selected, OUT_D goes to the FSTATE_VAL_D value when Fault State is set.

FSTATE_TIME: The length of time, in seconds, that the DO block will wait to set Fault State. When Fault State is set, the OUT_D value goes to either the FSTATE_VAL_D value or holds its last position, depending on I/O_OPTS. When the block has a target mode of CAS, a fault condition will be detected if the CAS_IN_D has a BAD status or an Initiate Fault State substatus is received from the upstream block.

FSTATE_VAL_D: Determines the OUT_D value if IO_OPTS "Fault State to Value" is selected. The OUT_D value transitions to FSTATE_VAL_D after FSTATE_TIME elapses and the fault condition has not cleared.

Block Errors

Table E-4 lists conditions reported in the BLOCK_ERR parameter. Conditions in *italics* are not applicable for the AO block and are provided only for your reference.

Modes

The DO block supports the following modes:

- **Manual (Man)**—The block output OUT_D value may be entered manually.

- **Automatic (Auto)**—The block algorithm uses the local set point SP_D value to determine OUT_D.

- **Cascade (Cas)**—The block uses a set point supplied by another function block.

- **RemoteCascade (RCas)**—The block uses a set point supplied by a host computer.

- **Out of Service (O/S)**—The block is not processed and the output is not transferred to I/O. The BLOCK_ERR attribute shows Out of service.

Shed Options

Shed from or climb to a remote mode is determined by the parameter SHED_OPT. A block climbs and sheds through the same path. For example, if SHED_OPT specifies that a block should shed to Auto, then, if the block target mode is set to RCas, the block goes through Auto on the way to RCas. You can configure the shed option as follows:

Shed With Return Options

Remote cascade connection failure shifts actual mode but keeps trying to restore remote cascade (in other words, the remote cascade target mode stays in effect).

Table E-4. BLOCK_ERR Conditions

Condition Number	Condition Name and Description
0	*Other (N/A)*
1	**Block Configuration Error** - SHED_OPT or CHANNEL set to 0 (uninitialized)
2	*Link Configuration Error (N/A)*
3	**Simulate active** - Simulation is enabled and the block is using a simulated value in its execution.
4	**Local Override** - Device in fault state. Actual mode LO.
5	**Device Fault State Set** - DO block in fault state after FSTATE_TIME because of Bad status or IFS substatus on CAS_IN_D or Resource block commanded fault state.
6	*Device Needs Maintenance Soon*
7	**Input failure/process variable has Bad status** - PV has bad status and Feature Select in the Resource block has the Out Readback bit set or the transducer block mode is Out of Service.
8	**Output failure** - PV has bad status or the transducer block mode is Out of Service.
9	*Memory Failure (N/A)*
10	*Lost Static Data (N/A)*
11	*Lost NV Data (N/A)*
12	*Readback Check Failed (N/A)*
13	*Device Needs Maintenance Now (N/A)*
14	**Power Up** - This condition exists after power up until actual mode is not Out of Service.
15	**Out of Service** - The block is in Out of Service (O/S) mode.

Normal—On failure of a remote cascade connection, the block attempts to attain the highest permitted non-remote mode until remote cascade is restored. On change to remote cascade target mode from any other mode, the block attempts to attain the highest permitted non-remote mode until a remote cascade connection is established.

Retained Target—On failure of a remote cascade connection, the block attempts to attain the mode retained in the target mode. On change to the remote cascade target mode from any other mode, the block attempts to attain the mode retained by target mode until a remote cascade connection is established.

Auto—On failure of a remote cascade connection, the block attempts to attain Auto, if permitted, until remote cascade is restored. On change to remote target mode from any other mode, the block attempts to attain Auto, if permitted, until a remote cascade connection is established.

Man—On failure of a remote cascade connection, the block sheds to Man until a remote cascade connection is restored. On change to remote target mode, from any other mode, the block goes to Man until a cascade connection is established.

Shed With No Return Options

For any shed with no return option, the target mode changes as determined by the option. Therefore, there is no attempt to restore the connection following failure. The behavior on change to the remote cascade target mode is identical to that for Shed With Return Options.

Normal—On failure of a remote cascade connection, the block sets the target mode to the highest permitted non-remote mode. On change to a remote cascade target mode from any other mode, the block attempts to attain the highest permitted non-remote mode until a remote cascade connection is established.

Retained Target—On failure of a remote cascade connection, the block sets the target mode to mode retained in target mode. On change to the remote cascade target mode from any other mode, the block attempts to attain the mode retained by target mode until a remote cascade connection is established. The DeltaV system does not support the retained target shed. Selecting the retained target results in shed to Auto. This applies to any block, regardless of whether it is in a field device or a DeltaV controller. The writing device sets or clears the retained target bits in the target mode. Therefore, any workstation or other device (DeltaV controller applications, for example) that does not support retained target operation ignores the retained target bits. In a DeltaV system, regardless of where the block is located, the retained target bits are turned off, and the block sheds to Auto.

Auto—On failure of a remote cascade connection, the block sets the target mode to Auto, if permitted. On change to the remote target mode from any other mode, the block attempts to attain Auto, if permitted, until a remote cascade connection is established.

Man—On failure of remote cascade connection, the block sets the target mode to Man, if permitted. On change to the remote target mode from any other mode, the block goes to Man until a cascade connection is established.

The user may configure SHED_OPT so that it calls for a target mode that is not permitted. When doing this, the mode logic uses the following rules as applied by the remote logic:

- Shed logic never results in a non-permitted target mode.
- Shed logic never attempts to attain an actual mode of Auto or Cas if that mode is not permitted.

Status Handling

Under normal operating conditions, the statuses of OUT_D and BKCAL_OUT_D are Good:Cascade. If the output hardware fails, the status of BKCAL_OUT_D is set to Bad:Device Fail, and the BLOCK_ERR shows Output Failure. If the hardware used for output feedback fails, the status of READBACK_D and PV_D is set to Bad:DeviceFail, and the BLOCK_ERR shows Process Variable has Bad Status. If the transducer block mode is Out of Service, the status of READBACK_D and PV_D is set to Bad:Out of Service.

Application Information

In addition to the expected 100% and 0% position (On-Off switching) of the valve, the digital valve controller has the added capability to move the valve to any 5% position, for example 5%, 10%, 15%, …, 85%, 90%, etc. The advantage of this approach is that the valve works well in standard On-Off applications as well as two valued applications, for example, ESD and Batch.

The most common problem with ESD valves is that when there is an emergency and the valve needs to close, it doesn't. It's stuck. With 5% positioning the valve can be diagnosed to determine when it is starting to stick. By moving the valve to 95% or 90% the process is not at risk of shut down, but you know the valve will move when the process needs it to.

In a batch environment, vessels are filled with on-off valves for speed, but there can be a problem at shutoff. The amount of material may not be "close enough" for the recipe and additional material may have to be added. This addition can be tricky and/or time consuming for the operator. The capability of being able to "crack" the valve to 5 to 10% and "dribble" in the correct amount either manually or automatically through recipe control can provide significant reduction in variability, and reduction in "FDA"-like reporting and certification. In addition, it can elminate the need for a second smaller "on-off" valve or the operator climbing up and dumping in a pail of material to add "just the right amount."

Appendix F Device Description (DD) Installation

Overview

Several support files are required for the DVC5000f Series digital valve controller. They are:

- **Device Description (DD) files**—These files define the data interface to the digital valve controller (file extensions .sym and .ffo).

- **Capabilities File**—These files allow a host to configure the control system off-line (e.g., without having a device physically attached to the host) (file extension .cff).

- **DeltaV Registry File**—This file is used by DeltaV to define the device interface (file extension .reg)

- **DeltaV fhx File**—This file is used by DeltaV to define the device and the data interface to the device (file extension .fhx).

- **DeltaV Windows Resource File**—These files define the user interface for the device for DeltaV and include the definitions for the transducer block interface and the resource block interface (file extension .dll).

The directory structure defined by the Fieldbus Foundation for device descriptions is as follows:

....\xxxxxx\yyyy\rrddcc.eee

where:

....\ is the path to the DD structure as implemented by the host system. This is typically defined as the base path to the DD since access to the specific device DD is predefined from the base folder. The Fieldbus Foundation defines a folder named “release” that is included with the CD-ROM, however, you do not need to retain this folder name.

xxxxxx is the 6-digit hexadecimal equivalent of the manufacturer’s identification number as defined by the Fieldbus Foundation. Fisher Controls’ ID number is 5100 (or in the folder format 005100). This number is also stored in the instrument Resource Block in the parameter Mfg ID (parameter name MANUFAC_ID).

yyyy is the 4-digit hexadecimal equivalent of the device type, as defined by the manufacturer. The device types for the DVC5000f Series digital valve controller include 5200, 5400, or 5900 for example. This number is stored in the instrument Resource Block in the parameter Device Type (parameter name DEV_TYPE).

rr is the 2-digit hexadecimal equivalent of the device revision, as defined by the manufacturer. It is stored in the instrument Resource Block in the parameter Device Revision (parameter name DEV_REV).

dd is the 2-digit hexadecimal equivalent of the device description (DD) revision that applies to the device, as defined by the manufacturer. It must be equal to or greater than the value stored in the instrument Resource Block in the parameter DD Revision (parameter name DD_REV). The latest version of the DD, for a particular device revision, is the file with the largest value for this number. When part of the name of a capabilities file, this value is always the same as the device DD revision stored in the instrument Resource Block in the parameter DD Revision (parameter name DD_REV).

cc is a 2-digit hexadecimal equivalent for the capabilities files (.cff) revision, as defined by the manufacturer. The latest revision of the capabilities files, for a particular device revision, is the file with the largest value for this number.

eee is the file extension. At this time, five extensions exist for files, they are:

- .ffo—This extension denotes a complete, tokenized, device description for the instrument.

- .cff—This extension denotes a capabilities file for the instrument as defined by the FOUNDATION Fieldbus Common File Format specification.

- .sym—This extension denotes a device description (DD) symbol file.

- .fhx—This extension denotes a DeltaV device definition file.

- .dll—This extension denotes a windows resource file.

- .reg—This extension denotes a DeltaV registry file.

Installation

To install the DD on your host system, refer to your host system documentation. In general the following may apply:

- Device descriptions furnished by Fisher Controls contain only those files applicable to Fisher Controls. All the files are located in the manufacturer ID Folder (005100 for xxxxxx in directory structure above). A readme file is included at the top level. Read this file for any additional information regarding DD installation.

- Device descriptions furnished by the Fieldbus Foundation (on CD-ROM or diskette) contain the files for each registered manufacturer and their associated device(s). It is placed on the media starting with the release folder, which then contains a folder (xxxxxx) for each manufacturer as defined above. For Fisher Controls this folder is 005100. A readme file may be included at the top level. Read this file for any additional information regarding the DD

- The most recent device description for Fisher Controls devices can be dowloaded from the internet at www.FIELDVUE.com. If you are downloading from the internet, the file on the website will be compressed (zipped) and must be decompressed (unzipped) before proceeding. Refer to the website download and installation procedures for setting up the DD on your system. Note the folder where the decompressed files are placed. This information will be required later in the installation procedure.

Installing on DeltaV Workstations

Installation on DeltaV Pro Plus Workstation

Set Up the Manufacture ID and Device Type Folders

1. Make sure that all copies of the DeltaV Explorer are closed.

2. Using Windows NT Explorer (NOT the DeltaV Explorer), locate the following folder on the DeltaV system:

   C:\DeltaV\DVData\amsdevices

3. Locate the folder where you have placed the new Fisher Controls support files (DD, fhx, dll, etc).

   - On the CD-ROM, this folder is called \amsdevices

   - For files downloaded from the internet, this folder is in the directory you specified when you decompressed (unzipped) the download file.

4. In the new support files folder, select the \amsdevices folder, then select the 005100 folder.

5. Copy this folder (and all its subfolders) to the \amsdevices folder on the DeltaV system. The system informs you if the folders already exist and asks if they should be replaced. Answer Yes to All, if asked, so the new folders are properly updated.

Run the *.REG File

6. Perform one of the following procedures for each digital valve controller device type you are installing. If you have additional digital valve controller device types, perform the appropriate procedure for that device type.

   - **For the DVC5000f AO/PID Digital Valve Controller**

   a. The device type parameter for this unit is 5400. This device includes the AO and PID function blocks. From the Windows NT Explorer, select the amsdevices\005100\5400 folder.

   b. Double click on the DVC5400FR7.REG file to register the new device in Windows NT and DeltaV.

   c. Delete any previous version of the .ffo and .sym files. previous versions will have a DD version number smaller than the DD version number loaded. The DD version number is the last two digits of the file name (i.e., 0702.ffo. The DD version number is 02).

d. When the pop-up window appears stating that the device has been successfully added to the registry, click ok.

- **For the DVC5000f DO/DI Digital Valve Controller**

a. The device type parameter for this unit is 5900. This device includes the DO and DI function blocks. From the Windows NT Explorer, select the amsdevices\005100\5900 folder.

b. Double click on the DVC5900FR7.REG file to register the new device in Windows NT and DeltaV.

c. Delete any previous version of the .ffo and .sym files. previous versions will have a DD version number smaller than the DD version number loaded. The DD version number is the last two digits of the file name (i.e., 0702.ffo. The DD version number is 02).

d. When the pop-up window appears stating that the device has been successfully added to the registry, click ok.

Use DeltaV Explore to Import the *.FHX File

7. Start the DeltaV Explorer (NOT the Windows NT Explorer)

8. From the DeltaV Explorer **File** menu, select **Import > Standard DeltaV Format...** Browse to the required .fhx file in the folder(s) created above. The .fhx file is located in the same folder as the .REG file.

9. Import the .fhx file for each digital valve controller installed in step 6. Select YES if asked the following question; “Do you wish to update the existing object in the database.”

Note

If errors or warnings appear upon conclusion of the import then there are possible conflicts within the .fhx file. Be sure to record the warning/error messages from the message window in DeltaV Explorer so that it can be communicated to the DeltaV Technical Support Group.

10. Close the Import screen by clicking Close.

Verify Device Support

11. From DeltaV Explorer, select **Library > Fieldbus Devices > Fisher Controls** and verify the device or devices are now supported. Double click on the device name to display the device revision number.

Exit And Restart DeltaV Explorer

12. Exit the DeltaV Explorer application. Wait approximately 15 seconds for the AMS server to shut down then start DeltaV Explorer again. The fieldbus device support files are now ready to use.

13. DD installation is complete. To update existing devices, go to the Updating Existing Devices procedure in this appendix. To Install new devices, refer to Appendix G.

Installation on DeltaV Application Workstation

Pro Plus Status

1. Prior to installing the Fieldbus Device on the Application Workstation, verify the ProPlus station has been updated with the new devices. If it has not, then install the devices on the ProPlus station, as described in the Installation on DeltaV Pro Plus Workstation procedure.

Installation

2. Repeat steps 1 through 12 of the Installation on DeltaV Pro Plus Workstation procedure for each Application Station on which you wish to run the AMS application.

3. DD installation is complete. To update existing devices, go to the Updating Existing Devices procedure in this appendix. To Install new devices, refer to Appendix G.

Installing on a Fieldbus Host System Other than DeltaV

Note

This procedure is for installing Fieldbus device files (i.e. DD) on a host system that only requires the support files as defined by the Fieldbus Foundation

The following is a generic procedure for installing the device descriptions on a host system. Refer to your host system documentation for specific information.

1. Locate or create the folder on the host system to contain all the DD and capabilities files. If you are

creating a folder, you can name this new folder whatever you would like and it can have any path you define. For this installation procedure, this folder will be referred to as the base folder.

2. On the CD-ROM or in the website download files, locate the folder with the new support files. This folder is called \RELEASE.

3. Open this folder and select the folder named 005100.

4. Copy the 005100 folder from the CD-ROM or website download location to the base folder. If this is an update (the folders already exist), the system informs you that the folders already exist and asks if they should be replaced. Answer Yes or OK so the folders are properly updated.

5. The new support files are now installed. You may have to restart applications and drivers in order for the new files to become active.

6. DD installation is complete. Consult the system documentation for commissioning new devices or updating existing devices.

Updating Existing Devices

WARNING

The following steps require taking the digital valve controller out of service. To avoid personal injury and property damage caused by the release of pressure or process fluid, observe the following before starting this procedure:

- **Provide some temporary means of control for the process before taking the digital valve controller out of service.**

Be sure you have an updated printed wiring board (pwb) assembly available before starting this procedure. Perform the following procedure to upgrade devices that have been a part of the system and require upgrading due to installation of the device description upgrade.

Note

Export the control modules in the following step (step 2) to make a backup copy. In case of a mistake while performing the procedure, the function block information can be retrieved from the backup copy. If the procedure is completed successfully, the backup copy may be deleted.

1. From the DeltaV Explorer screen, select the device to be upgraded.

2. From Control Studio, record the function block assignments for all function blocks assigned to the device(s) to be upgraded. Also, export the control modules so that you have a backup copy. Once the assignments are recorded, proceed.

3. Right click on the device name or icon. From the context menu select **Decommission**.

4. Select **Make spare** to make the device a spare device.

5. At this point, the DVC5000f Series digital valve controller electronics should be upgraded. Remove the existing pwb assembly and replace with the new pwb assembly as described in the printed wiring board removal and replacement procedures in the “Maintenance” section, Section 8, of this manual.

6. Once the electronics are upgraded, upgrade the DeltaV placeholder as follows:

   a. Select the placeholder (the device icon) in the DeltaV explorer screen.

   b. Right click the placeholder. From the context menu select **Properties**.

   c. Select Manufacturer. From the **Device Type** drop-down list select the device type:

- 0300—The device type for digital valve controllers with revision 6 firmware. These devices included both AO and PID function blocks. Note: This is most likely the firmware revision of the device you are upgrading from. You will be upgrading to one of the following.

- 5400—The device type for digital valve controllers with revision 7 firmware that include the AO and PID function blocks.

- 5900—The device type for digital valve controllers with revision 7 firmware that include the DO and DI function blocks.

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d. From the **Device Revision** drop-down list select the device revision. (Depending upon your selection of device type, the system will automatically select the device revision.)

e. Click OK to make the change

7. Verify correct operation by commissioning and downloading the new device as described in Appendix G. If the device cannot be commissioned, then the device type and/or revision within the digital valve controller may not match the device type and/or revision within the placeholder.

Note

When changing the Device Type, the function block assignments in the DeltaV system will be unassigned and will have to be re-assigned.

The green valve icon should appear for the device in the port view on the DeltaV Explorer screen.

If a red triangle appears for the device icon, close and reopen the DeltaV Explorer application. If this action does not correct the situation (the red triangle is still displayed), then there is a problem with one of the installation files. DO NOT PROCEED TO STEP 8!

Check the library under fieldbus\Fisher to be sure that revision 7 appears. If revision 7 does not appear, then you have not completed the registry update. Go back and repeat step 6 of the DD installation procedure. If revision 7 does appear, close and reopen DeltaV Explorer. If the problem still exists, shut down DeltaV completely and restart. If the problem continues after you have done all of the above, consult your Fisher Controls representative or sales office. You may still be able to commission and download the device and any associated function blocks, but this is not recommended.

8. Once the devices are commisioned, reassign the function blocks using the assignments recorded in step 2.

9. The device is now successfully commissioned and downloaded; perform the initial setup, calibration, and configuration download procedures.

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Appendix G Operation with Fisher-Rosemount® DeltaV™

Introduction

Note

This appendix does not necessarily provide the latest information on using the DeltaV system. For the latest information on using the DeltaV system, refer to the on-line help or documentation supplied with the system.

This appendix provides specific instructions for performing basic setup operations on the DVC5000f Series digital valve controller using the Fisher-Rosemount DeltaV host system. It is not a comprehensive resource, rather a starting point. For more information, refer to the following sources:

- **Section 3: Initial Setup and Calibration** for detailed information regarding initial setup, travel calibration and stabilizing and optimizing valve performance.

- **Section 4: Detailed Setup** for detailed information on setting up cutoffs, limits, alerts, input characterization and additional information for modifying resource block and transducer block parameters to fit the instrument to your application.

- **Section 5: Calibration** for complete calibration information.

- **Section 6: Viewing Device Information** for complete information on which resource block and transducer block parameters to view to see infomation about the instrument.

- **Appendix A: FOUNDATION fieldbus Function Block Overview** for general information about FOUNDATION fieldbus function blocks.

- **Appendix B: Analog Output (AO) Function Block** for complete information about the analog output function block and its parameters.

- **Appendix C: PID Function Block** for complete information about the Proportional-plus-Integral-plus-Derivative function block and its parameters.

- **Appendix D: Discrete Input (DI) Function Block** for complete information about the discrete input function block and its parameters.

- **Appendx E: Discrete Output (DO) Function Block** for complete information about the discrete output function block and its parameters.

- **DeltaV On-line Help or Documentation** for complete and current information about navigating in the DeltaV system.

Software Functionality

DVC5000f Series digital valve controllers are designed to permit remote setup, calibration, and testing using the Fisher-Rosemount DeltaV system.

To use the methods, accessed as described in this appendix, requires that the device description (DD) for the DVC5000f Series digital valve controller be installed on the host system. For information on installing the device description, refer to Appendix F “DD Installation” and the host system documentation.

Initial Setup and Travel Calibration

Use the Setup Wizard method to perform initial setup and automatically calibrate travel for the DVC5000f Series digital valve controller. The Setup Wizard is available through the transducer block.

Accessing the Setup Wizard

Refer to figure G-1 and the following steps to access and start the Setup Wizard:

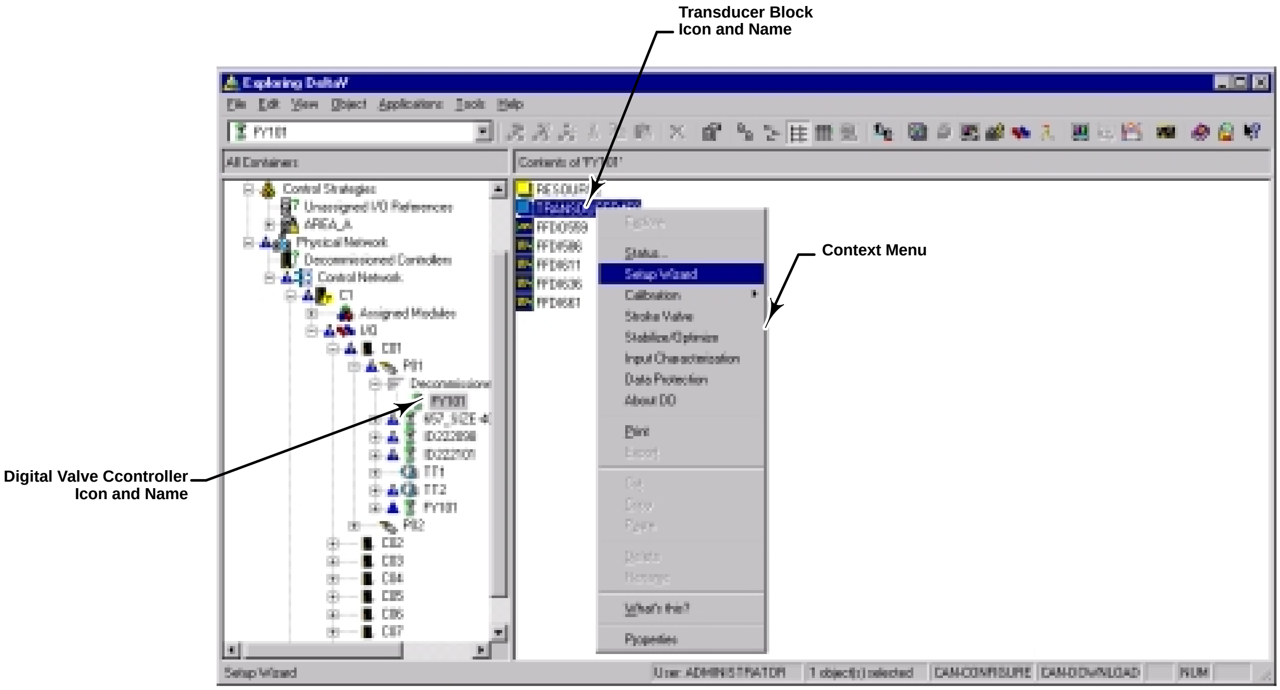

Figure G-1. Navigating to the Setup Wizard

1. Start DeltaV Explorer by selecting **DeltaV > Engineering > DeltaV Explorer** from the Start menu.

2. Locate the digital valve controller icon in the **All Containers** pane and left-click once on the digital valve controller icon or name.

3. Locate the transducer block icon in the **Contents of...** pane and right-click once on the block icon or name.

4. Select **Setup Wizard** from the context menu.

5. Follow the on-screen instructions through the initial setup and calibration steps. (Refer to section 3 of this manual.)

Stabilizing and Optimizing Valve Response

You can invoke the Stabilize/Optimize method from the Setup Wizard, or refer to figure G-2 and the following steps to access and start the Stabilize/Optimize method:

1. Start DeltaV Explorer by selecting **DeltaV > Engineering > DeltaV Explorer** from the Start menu.

2. Locate the digital valve controller icon in the **All Containers** pane and left-click once on the digital valve controller icon or name.

3. Locate the transducer block icon in the **Contents of...** pane and right-click once on the block icon or name.

4. Select **Stabilize/Optimize** from the context menu.

5. Follow the on-screen instructions to adjust valve response. (Refer to section 3 of this manual.)

Calibration and Detailed Setup

In addition to initial setup, the insturment can be more closely matched to the application by modifying other transducer block parameters. Access to these parameters is described in Set Digital Valve Controller Configuration Parameters in this appendix. You can also calibrate the instrument using the methods described in the “Calibration” section. Access to these methods is described in Calibrating the Digital Valve Controller in this appendix.

If you know the instrument has been setup correctly (for example, the instrument was mounted on the valve/actuator assembly at the factory), you can proceed to Configuring the Loop. Otherwise calibrate the instrument as described in Calibrating the Digital Valve Controller in this appendix and in the “Calibration” section and perform the detailed setup as described in Set Digital Valve Controller Configuration Parameters in this appendix and in the “Detailed Setup” section. Then proceed to Configuring the Loop.

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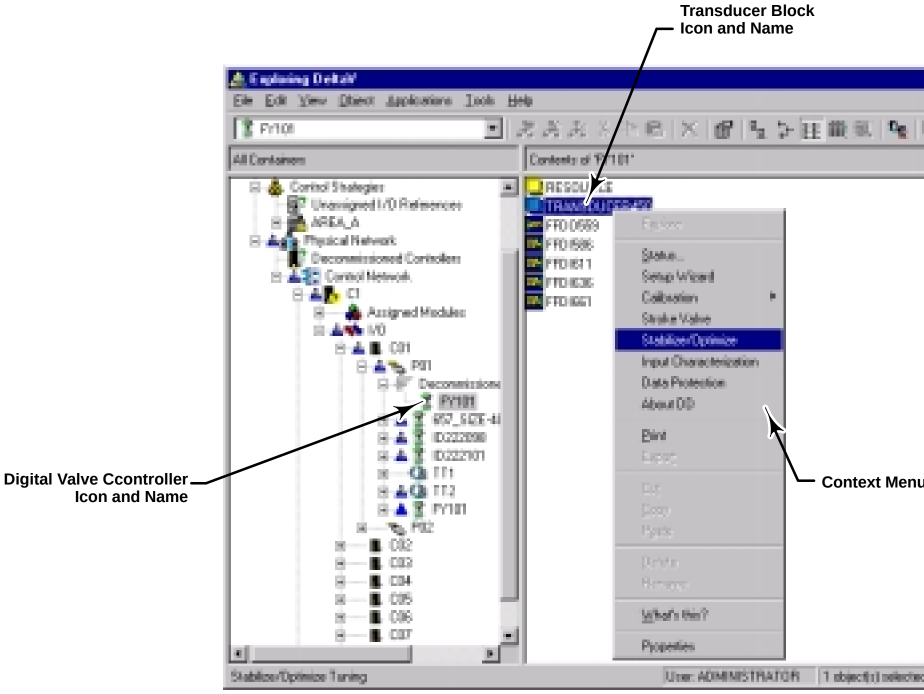

Figure G-2. Navigating to the Stabilize/Optimize Method

Configuring the Loop

To completely configure the digital valve controller for use in a fieldbus loop, you must perform the following procedures:

1. **Create a device place holder**—A place holder is an electronic representation of the digital valve controller that exists in the DeltaV database with no associated physical device.

2. **Define a control strategy**—The control strategy is the relationship between all of the function blocks on the fieldbus segment.

3. **Commission the device**—Commissioning the device involves downloading applicable parameters from the device place holder to the physical device.

4. **Set the digital valve controller block parameters**—Setting the digital valve controller block parameters sets up the digital valve controller for use in your specific application.

5. **Download the control strategy to the device**—Downloading the control strategy to the device transfers the control strategy from the DeltaV system to the digital valve controller.

Note

The following procedures assume that the DeltaV system and the digital valve controller are installed and powered.

Create a Device Place Holder

1. Start DeltaV Explorer by selecting **DeltaV > Engineering > DeltaV Explorer** from the start menu.

2. Navigate through the file structure to the listing of fieldbus ports (see figure G-3).

3. Right click on the port to which you wish to connect the new fieldbus device and select **New Fieldbus Device** from the menu that appears. The **Fieldbus Device Properties** dialog box, shown in figure G-4, appears.

4. Enter all the appropriate device information in the dialog box.

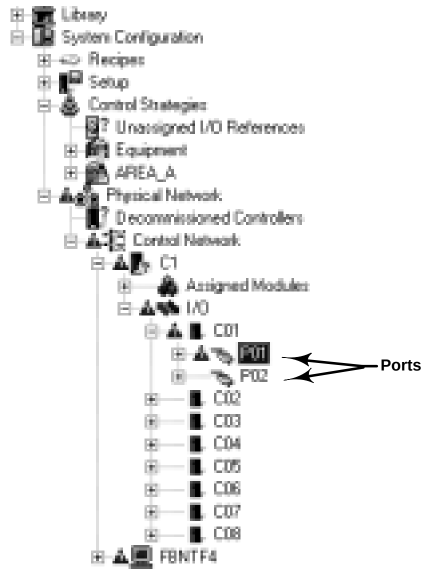

Figure G-3. Location of Fieldbus Ports

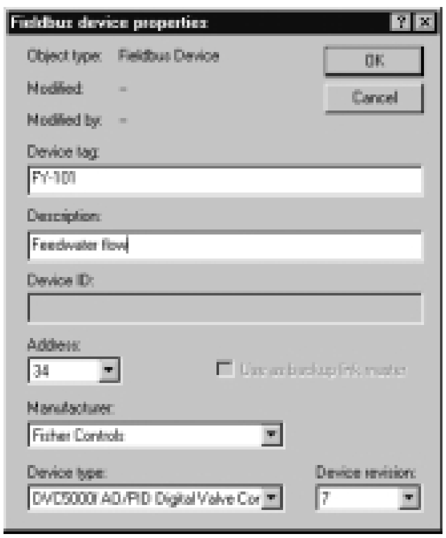

Figure G-4. Fieldbus Device Properties Dialog Box

Note

The DeltaV system automatically completes the address field. You can customize these fields, but it usually is not necessary. Select the device type and device revision based upon the digital valve controllers to be used.

5. Select OK to add the device to the segment. The device appears on the segment as a non-commissioned fieldbus device.

Define the Control Strategy

1. Start DeltaV Control Studio by selecting **DeltaV > Engineering > Control Studio** from the Start menu.

2. Refer to figure G-5. From the menu along the right side of the window, select the function blocks you wish to add. For the purpose of this example, we will add an AI, a PID, and an AO block.

3. Connect the blocks as you want them to execute. For the purpose of this example, we connected the blocks as shown in figure G-6.

Note

If you are not able to draw connections between the blocks, select the Connect button and try again.

4. To rename the block with an appropriate tag, right click on each block and select **Rename** from the menu that appears.

5. To assign the I/O to a fieldbus device, right click on each block and select **Assign I/O > to Fieldbus...** and enter the device block in the dialog box that appears (see figure G-7). Select Browse to select the device block to which you wish to assign each control block. You will have to navigate through the correct controller, I/O card, and port to reach the device and its blocks.

6. Save the control strategy.

7. To assign the strategy to the correct node in the controller, select the Assign to Node button.

Commission the Device

To commission the digital valve controller, you simply need to drag the appropriate device from the **Decommissioned Fieldbus Device** folder to the appropriate device place holder.

1. Start DeltaV Explorer by selecting **DeltaV > Engineering > DeltaV Explorer** from the Start menu.

2. Select the device you wish to commission from the **Decommissioned Fieldbus Devices** folder. The device will be listed with its unique device identifier (Dev ID).

3. Drag the decommissioned device to the device place holder that you created earlier (see figure G-8). The **Device Commissioning Wizard**—**Start** window shown in figure G-9 appears.

4. Select Next. The **Device Commissioning Wizard**—**Reconcile Block** window for the resource block, shown in figure G-10, appears.

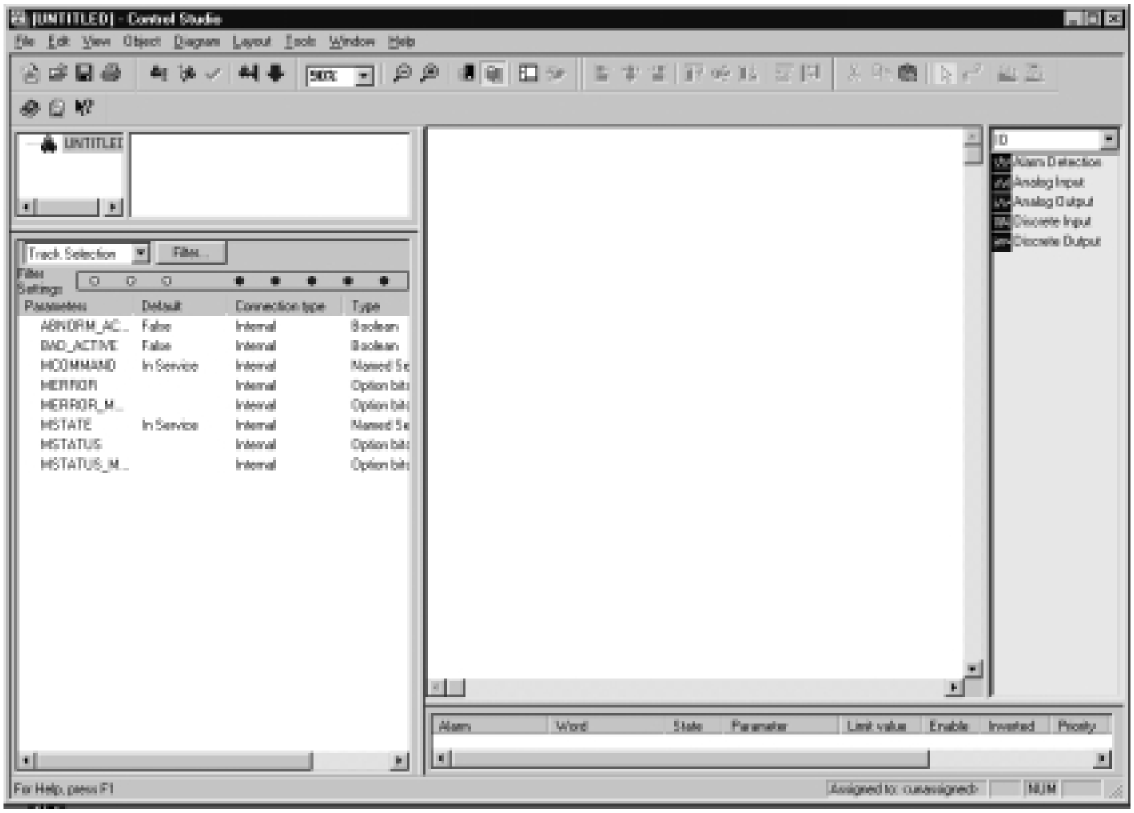

Figure G-5. Main Control Studio Screen

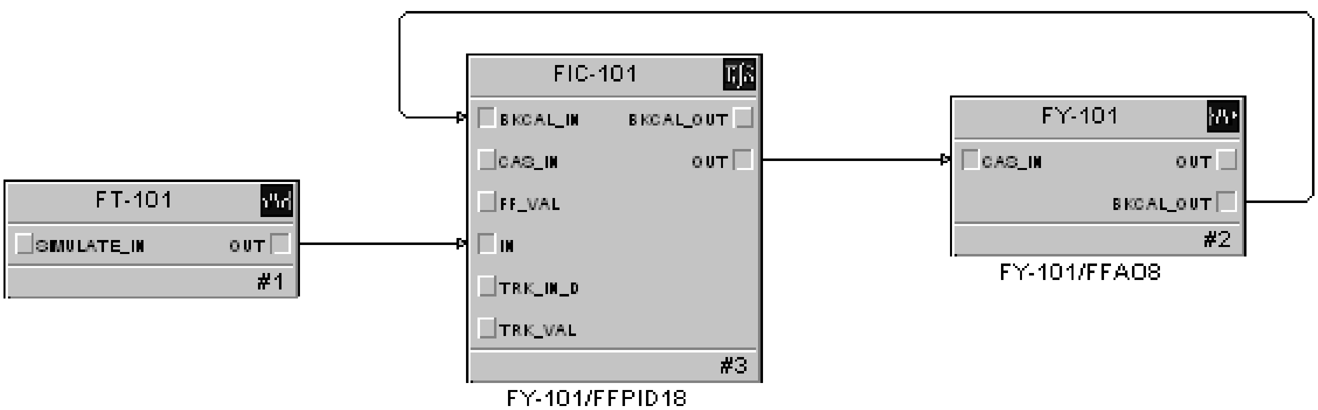

Figure G-6. A Basic Control Strategy

Figure G-7. Assign to Fieldbus Dialog Box

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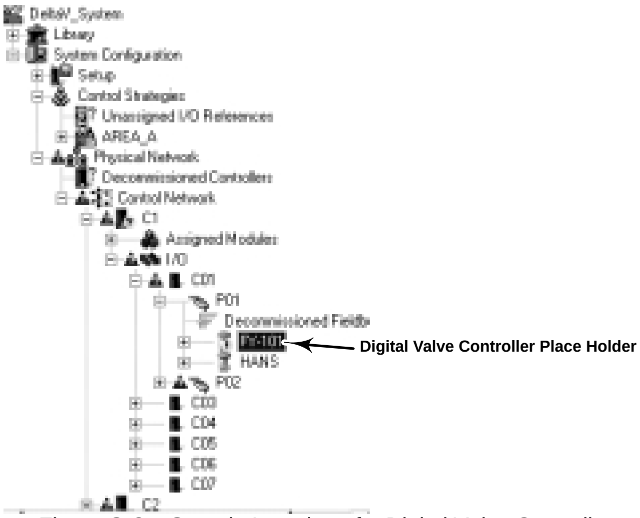

Figure G-8. Sample Location of a Digital Valve Controller place holder in DeltaV Explorer

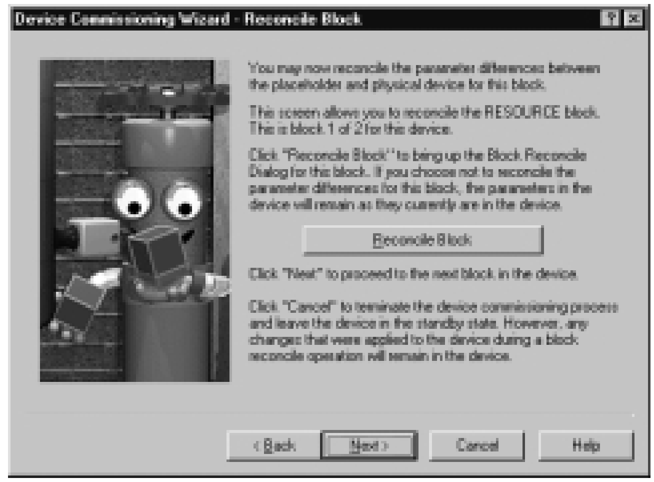

Figure G-10. Device Commissioning Wizard—Reconcile Block Window for the Resource Block

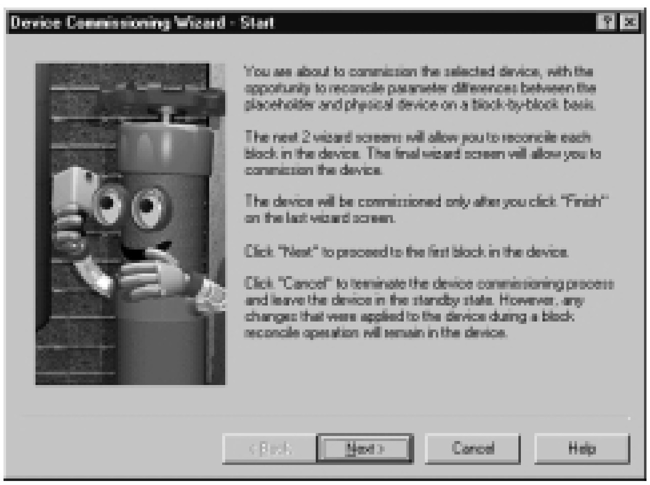

Figure G-9. Device Commissioning Wizard Start Window

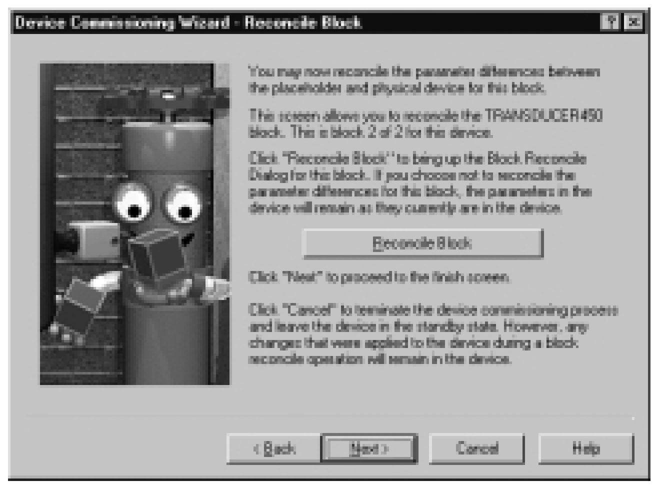

Figure G-11. Device Commissioning Wizard—Reconcile Block Window for the Transducer Block

Note

If you wish to reconcile differences between the Resource block in the digital valve controller and the Resource block in the device place holder that you created, select Reconcile Block. If you wish to override the settings in the device place holder with the settings in the device, go to step 5.

5. Select Next. The **Device Commissioning Wizard**—**Reconcile Block** window for the transducer block, shown in figure G-11, appears.

Note

If you wish to reconcile differences between the Transducer block in the digital valve controller and the Transducer block in the device place holder that you created, select Reconcile Block. If you wish to override the settings in the device place holder with the settings in the device, go to step 6.

6. Select Next. The Device Commissioning Wizard—Finish window shown in figure G-12 appears.

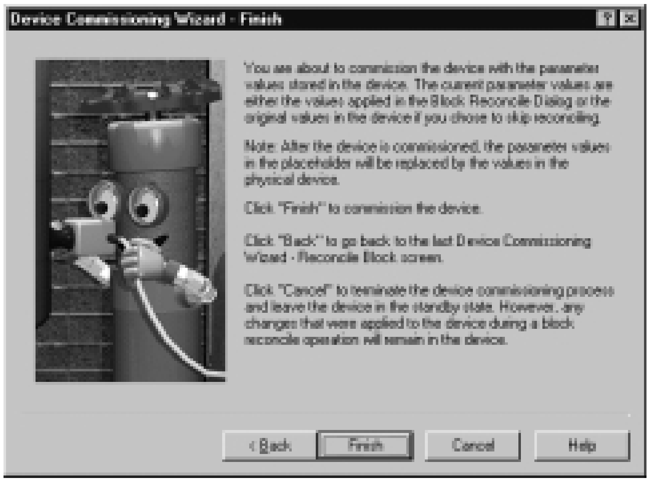

Figure G-12. Device Commissioning Wizard—Finish Window

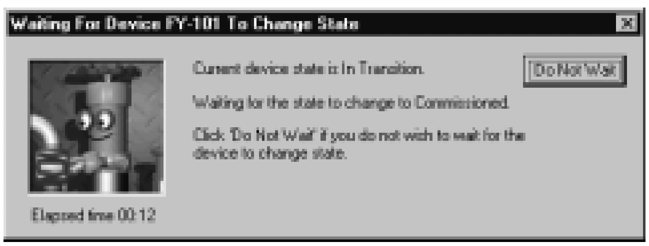

Figure G-13. Device Commissioning Wizard—Waiting Window

7. Select Finish. The window shown in figure G-13 appears informing you that DeltaV is waiting for the device to change from a decommissioned (FY-101)to a commissioned (FY-101)state. This process may take several minutes. Once the DeltaV finishes commissioning the device, the icon in DeltaV Explorer changes from non-commissioned to commissioned.

Set Digital Valve Controller Configuration Parameters

Changing the Transducer Block Protection

Modifying some of the transducer block parameters requires changing the block protection. For information on the block protection required to change a parmeter, see table 4-1 in the “Detailed Setup” section or table 6-1 in the “Viewing Device Information” section. The Data Protection method is available to change the transducer block parameter protection. For a detailed description of this method, see Data Protection in the “Detailed Setup” section. Refer to figure G-16 and the

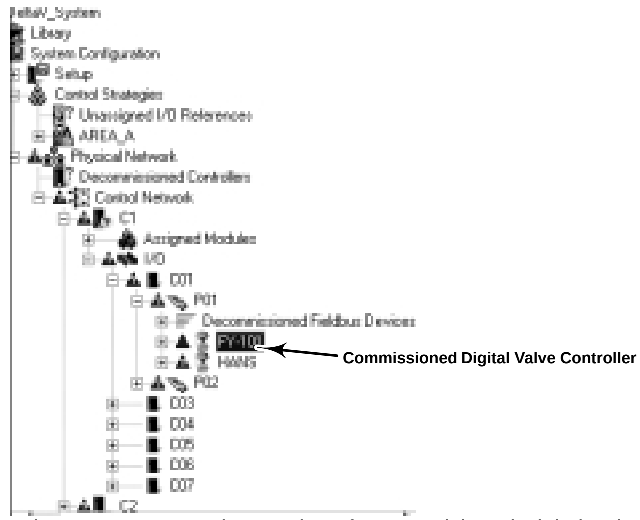

Figure G-14. Sample Location of a Commisioned Digital Valve Controller in DeltaV Explorer

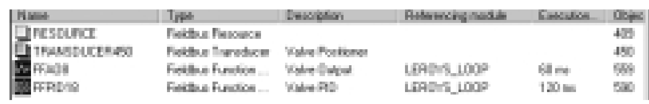

Figure G-15. List of Function Blocks for a Digital Valve Controller in DeltaV Explorer

following steps to access and start the Data Protection method.

1. Start DeltaV Explorer by selecting **DeltaV > Engineering > DeltaV Explorer** from the Start menu.

2. Navigate through the file structure to find the digital valve controller you wish to configure (see figure G-14).

3. Double click the digital valve controller. The function blocks within the digital valve controller appear in the right pane of the DeltaV Explorer window (see figure G-15). Right-click once on the block icon or name.

4. Select **Data Protection** from the context menu.

5. Follow the on-screen instructions to change transducer block parameter protection.

Changing the Transducer Block Mode

Modifying some of the transducer block parameters requires changing the block mode to Out of Service (O/S). For information on which parmeters require the block mode to be Out of Service, see table 4-1 in the “Detailed Setup” section or the individual parameter descriptions in sections 4, 5, 6, and 8. Perform the following procedure to change the block mode.

1. Start DeltaV Explorer by selecting **DeltaV > Engineering > DeltaV Explorer** from the Start menu.

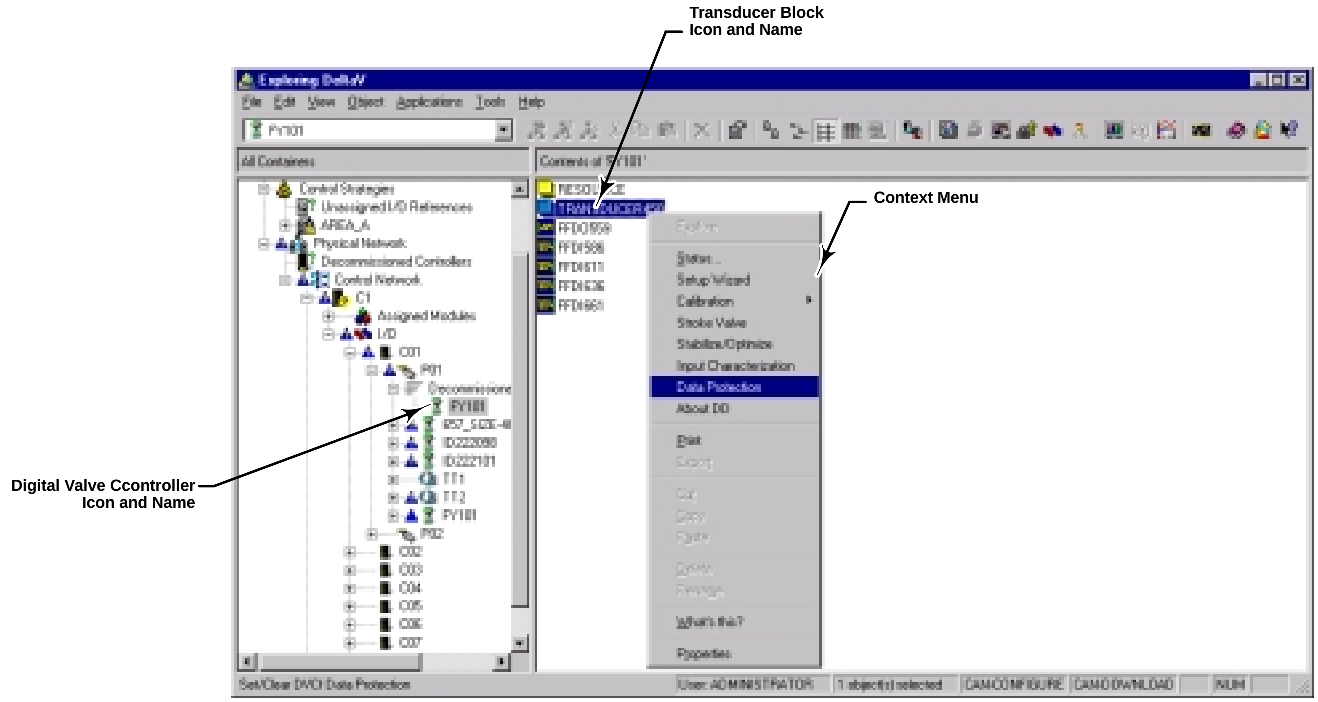

Figure G-16. Navigating to the Data Protection Method

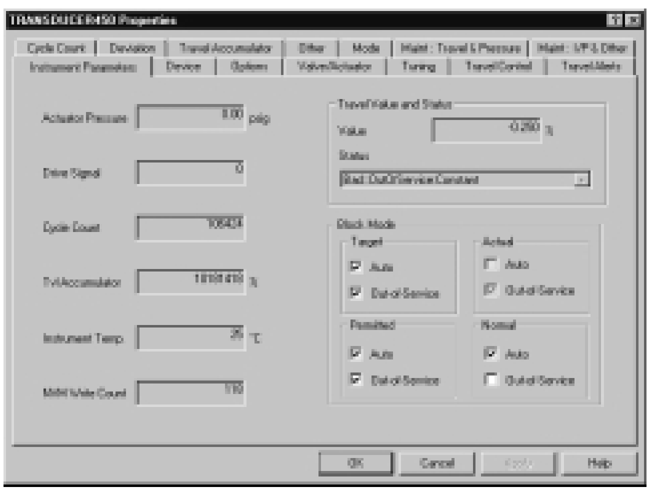

Figure G-17. Transducer Block Properties Window

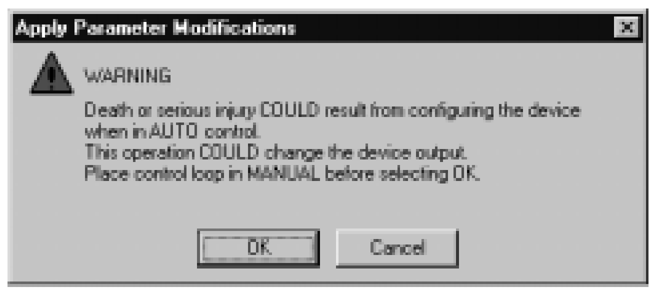

Figure G-18. Transducer Block Modify Parameters Warning

2. Double click on the TRANSDUCER block icon. The transducer block properties window shown in figure G-17 appears.

3. Select the **Mode** tab.

4. Select Out of Service (O/S) and deselect Auto in the Target Mode region of the window. The mode you change in the properties window remains highlighted as in figure G-17 so you can easily track changes.

5. Click the Apply button.

Note

As shown in figure G-18, DeltaV warns you that whenever you make changes to transducer block parameters the changes you make may upset the process and create a dangerous situatuation. Before you click OK, verify that the control loop is in manual control.

Once the requested change is made, DeltaV warns you, as shown in figure G-19, that the control system does not match the device configuration and that the changes you made may change the device output. To avoid bumping the process, check the device output

Figure G-19. Transducer Block Modify Parameters Warning

before placing the control loop in Auto. Click OK to return to the properties page.

Modifying Transducer Block Parameters

1. If you just changed the transducer block mode, the properties window should be displayed. Skip to step 5. If the properties window is not being displayed, go to step 2.

2. Locate the icon for the digital valve controller you wish to configure in the DeltaV Explorer **All Containers** pane. Left-click once on the digital valve controller icon or name.

3. Locate the transducer block icon in the **Contents of...** pane and right-click once on the block icon or name.

4. Double click on the TRANSDUCER block icon. The transducer block properties window shown in figure G-17 appears.

5. Select the parameter you wish to configure and enter the appropriate changes. The parameters you change in the properties window remain highlighted so you can easily track changes.

6. After making all the desired changes, click the OK button.

Note

As shown in figure G-18, DeltaV warns you that whenever you make changes to transducer block parameters the changes you make may upset the process and create a dangerous situatuation. Before you click OK, verify that the control loop is in manual control.

Once the requested changes are made, DeltaV warns you, as shown in figure G-19, that the control system does not match the device configuration and that the changes you made may change the device output. To avoid bumping the process, check the device output before placing the control loop in Auto. Click OK to close the properties page.

Download the Control Strategy to the Device

1. Select **DeltaV > Engineering > Control Studio** from the Start menu. The main control studio window shown in figure G-5 appears.

2. Open the control strategy that you defined earlier.

3. Click the Download button ( ) and follow the on-line instructions to download the control strategy to the digital valve controller,

Calibrating the Digital Valve Controller

The following methods are included with the device description for calibrating the Instrument:

- **Auto Travel Calibration**—Use this method to automatically calibrate the instrument travel. It is provided as an independent method and is also a part of the Setup Wizard.

- **Manual Calibration**—Use this method to manually calibrate the instrument travel.

- **Cal Tvl Sensor**—Use this method to calibrate the travel sensor when the instrument is mounted on a competitive actuator or when the travel sensor is replaced.

- **Pressure Sensor Cal**—Use this method to calibrate the internal pressure sensor information for display to the user.

- **Store/Restore Data**—Use this method to restore factory configuration data or to store and restore field configuration data.

A detailed description of these methods is found in Section 5, “Calibration.” Refer to figure G-20 and the steps below to access the calibration methods.

1. Select **DeltaV > Engineering > DeltaV Explorer** from the Start menu.

2. Locate the digital valve controller icon in the **All Containers** window and left-click once on the digital valve controller icon or name.

3. Locate the transducer block icon in the **Contents of...** window and right-click once on the block icon or name.

4. Select **Calibrate** from the context menu.

5. Select the desired calibration method from the drop-down menu.

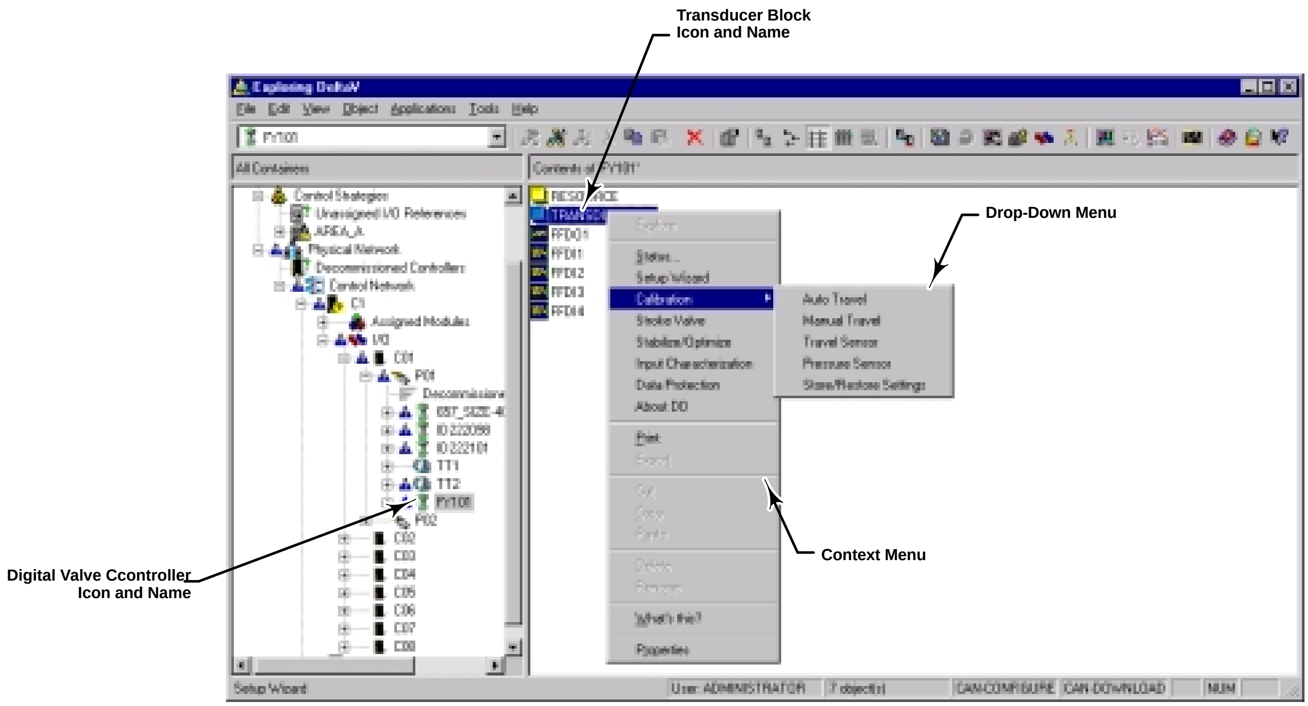

Figure G-20. Navigating to the Calibration Methods

6. Follow the on-screen instructions to perform the desired calibration.

Appendix H Block Parameter Index

The following is an alphabetical list of the parameter names for the block parameters as listed in the device description (DD). Each parameter name is followed by a page number reference where a detailed description of the parameter can be found.

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Glossary

Algorithm
A set of logical steps to solve a problem or accomplish a task. A computer program contains one or more algorithms.

Alphanumeric
Consisting of letters and numbers.

ANSI (acronym)
The acronym ANSI stands for the American National Standards Institute

ANSI Class
Valve pressure/temperature rating.

Bench Set
Pressure, supplied to an actuator, required to drive the actuator through rated valve travel. Expressed in pounds per square inch.

Byte
A unit of binary digits (bits). Usually a byte consists of eight bits.

Configuration
Stored instructions and operating parameters for a FIELDVUE Instrument.

Control Loop
An arrangement of physical and electronic components for process control. The electronic components of the loop continuously measure one or more aspects of the process, then alter those aspects as necessary to achieve a desired process condition. A simple control loop measures only one variable. More sophisticated control loops measure many variables and maintain specified relationships among those variables.

Controller
A device that operates automatically to regulate a controlled variable.

Crossover Point
The mid-point of the stroking range of a sliding-stem actuator. A visual indication of the crossover point is found when the slot in the instrument feedback arm forms a 90-degree angle with the valve stem.

Deadband
Region around a reference point that must be exceeded before a new event occurs.

Deviation
Usually, the difference between set point and process variable. More generally, any departure from a desired or expected value or pattern.

Device ID
Unique identifier embedded in the instrument at the factory.

Drive Signal
The signal to the I/P converter from the printed wiring board. It is the percentage of the total microprocessor effort needed to drive the valve fully open. In most applications, drive signal ranges from 55% to 75%.

Feedback Arm
The mechanical connection between the valve stem linkage and the FIELDVUE Instrument travel sensor.

Feedback Signal
Indicates to the instrument the actual position of the valve. The travel sensor provides the feedback signal to the instrument printed wiring board assembly. A mechanical linkage connects the travel sensor to the valve stem or shaft.

Firmware
The combination of a hardware device and computer instructions and data that reside as read-only software on that device.

Note

1. This term (firmware) is sometimes used to refer only to the hardware device or only to the computer instructions or data, but these meanings are deprecated.

2. The confusion surrounding this term has led some to suggest that it be avoided altogether. The term is included here because of its use in older documentation and culture.

Gain
The ratio of output change to input change.

Hardware Revision
Revision number of the Fisher Controls instrument hardware. The physical components of the instrument are defined as the hardware.

HART (acronym)
The acronym HART stands for Highway Addressable Remote Transducer.

Instrument Level
Determines the functions available for the instrument.

Leak Class
Defines the allowable leakage by a valve when it is closed. Leak class numbers are listed in two standards: ANSI/FCI 70-2-1991 and IEC 534-4 (1986).

Linearity, dynamic
Linearity (independent) is the maximum deviation from a straight line best fit to the opening and closing curves and a line representing the average value of those curves.

Memory
A type of semiconductor used for storing programs or data. FIELDVUE instruments use three types of memory: Random Access Memory (RAM), Read Only Memory (ROM), and Non-Volatile Memory (NVM).

Non-Volatile Memory (NVM)
A type of semiconductor memory that retains its contents even though power is disconnected. NVM contents can be changed during configuration unlike ROM which can be changed only at time of instrument manufacture. NVM stores configuration restart data.

Octet
See byte

Parallel
Simultaneous: said of data transmission on two or more channels at the same time.

Pressure Sensor
A FIELDVUE instrument internal device that senses the output pressure from the pneumatic relay.

Random Access Memory (RAM)
A type of semiconductor memory that is normally used by the microprocessor during normal operation that permits rapid retrieval and storage of programs and data. See also Read Only Memory (ROM) and Non-Volatile Memory (NVM).

Rate
Amount of change in output proportional to the rate of change in input.

Read-Only Memory (ROM)
A memory in which information is stored at the time of instrument manufacture. You can examine but not change ROM contents.

Seat Load
Force exerted on the valve seat, typically expressed in pounds force per lineal inch of port circumference. Seat load is determined by shutoff requirements.

Software
Computer programs, procedures, and possibly associated documentation and data pertaining to the operation of a computer system.

Temperature Sensor
A device within the FIELDVUE instrument that measures the instrument's internal temperature.

Travel
Movement of the valve stem or shaft which changes the amount the valve is open or closed.

Travel Sensor
A device within the FIELDVUE instrument that senses valve stem or shaft movement. The travel sensor is mechanically connected to the valve stem or shaft.

Tuning
The adjustment of control terms or parameter values to produce a desired control effect.

Tuning Set
Preset values that identify gain and rate settings for a FIELDVUE instrument. The tuning set and supply pressure together determine an instrument's response to input signal changes.

Watch Dog Timer
A timer that the microprocessor must pulse periodically. If the microprocessor is unable to pulse the timer, the instrument shuts down.

Notes

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This product may be covered by one or more of the following patents (5,451,923; 5,434,774; 5,439,021; 5,265,637) or under pending patent applications.

For information, contact Fisher :
Marshalltown, Iowa 50158 USA
Cernay 68700 France
Sao Paulo 05424 Brazil
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