

# Fisher® FIELDVUE™ DVC6000 SIS Digital Valve Controllers for Safety Instrumented System (SIS) Solutions Instruction Manual (Supported)

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# Fisher® FIELDVUE™ DVC6000 SIS

## Digital Valve Controllers for Safety Instrumented System (SIS) Solutions

*This manual applies to:*

|                   |       |              |
|-------------------|-------|--------------|
| Device Type       | 03    | 03           |
| Device Revision   | 1     | 2            |
| Hardware Revision | 1     | 1            |
| Firmware Revision | 3 – 6 | 7, 9, 10, 11 |
| DD Revision       | 8     | 8            |

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## Fast Key Sequence

| Function/Variable                      | Fast-Key Sequence | Coordinates <sup>(1)</sup> | Function/Variable                         | Fast-Key Sequence | Coordinates <sup>(1)</sup> |
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1. Coordinates are to help locate the menu item on the menu tree on the following pages.

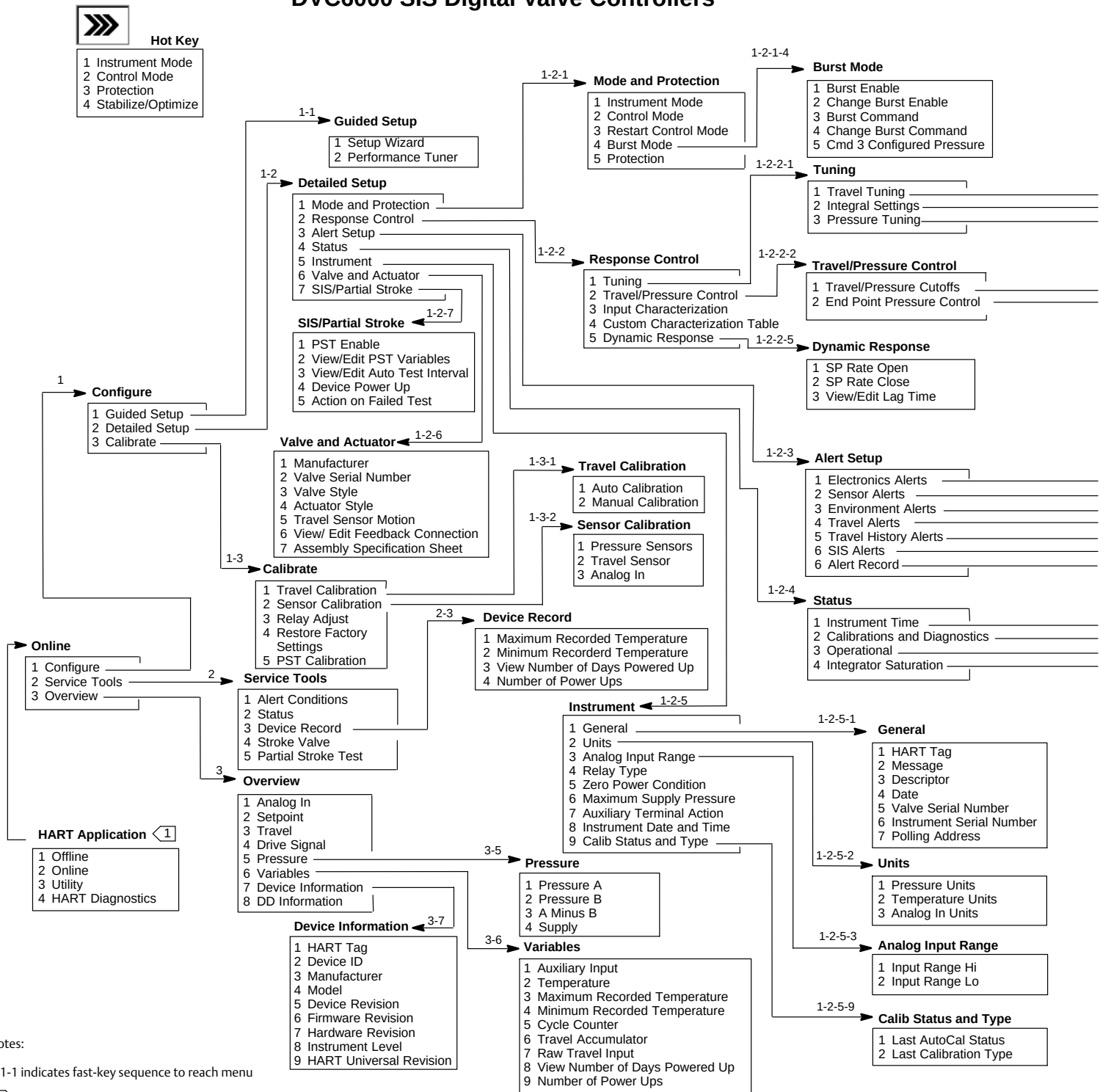
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## Fast Key Sequence

| Function/Variable                         | Fast-Key Sequence | Coordinates <sup>(1)</sup> | Function/Variable                       | Fast-Key Sequence | Coordinates <sup>(1)</sup> |
|-------------------------------------------|-------------------|----------------------------|-----------------------------------------|-------------------|----------------------------|
| Partial Stroke Test                       | 2-5               | 2-F                        | Travel                                  | 3-3               | 2-G                        |
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| Supply Pressure Lo Alert Point            | 1-2-3-3-2-3       | 12-E                       | View/Edit Partial Stroke Test Variables | 1-2-7-2           | 2-C                        |
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1. Coordinates are to help locate the menu item on the menu tree on the following pages.

## Field Communicator Menu Tree for DVC6000 SIS Digital Valve Controllers



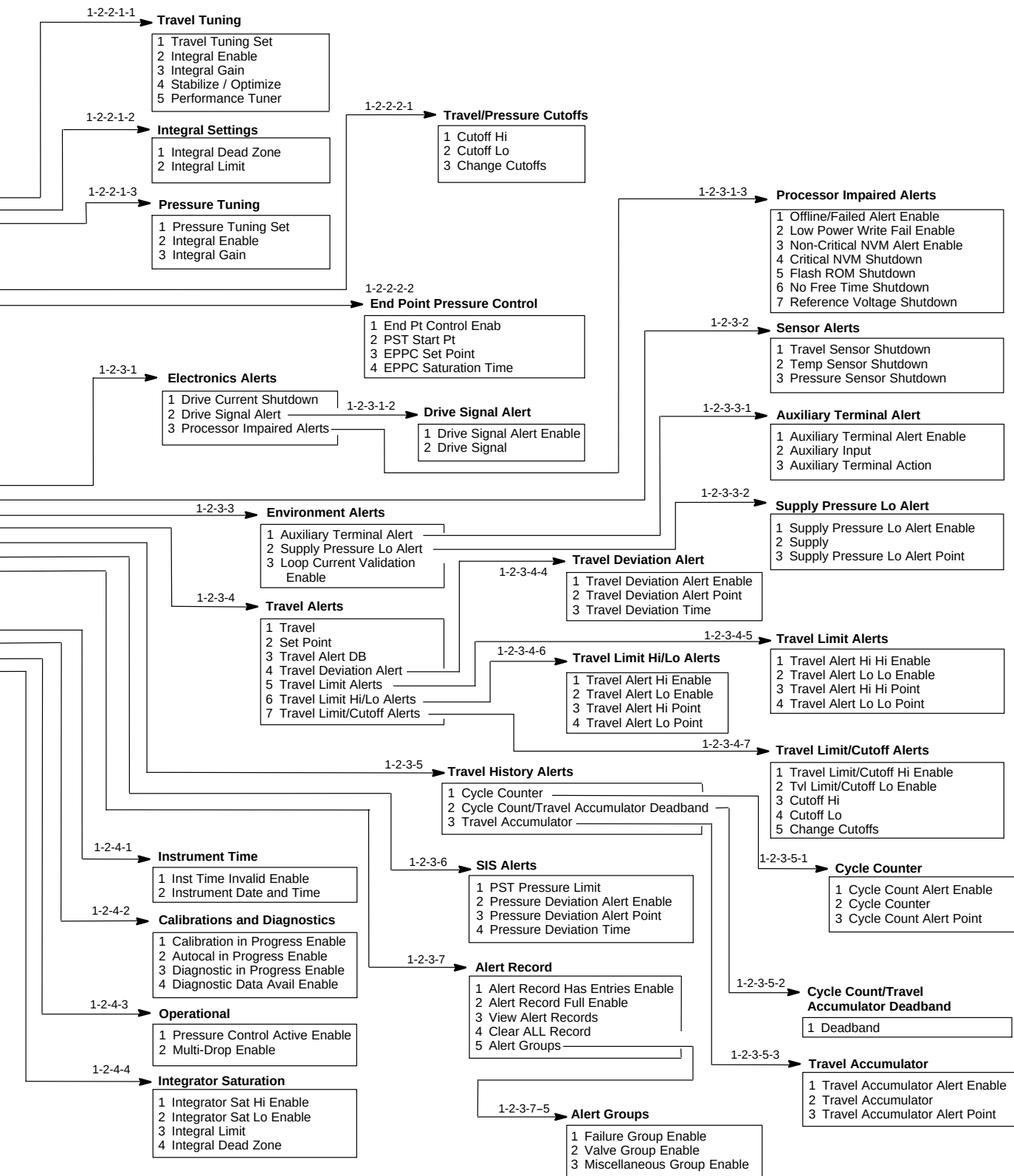
Notes:

1-1-1 indicates fast-key sequence to reach menu

**1** This menu is available by pressing the left arrow key from the previous menu.

## 2 Method to change PST Enable (1-2-7-1)

# DVC6000 SIS





THE FIELDVUE DVC6000 SIS DIGITAL VALVE CONTROLLER IS A CORE COMPONENT OF THE PLANTWEB™ DIGITAL PLANT ARCHITECTURE. THE DIGITAL VALVE CONTROLLER POWERS PLANTWEB BY CAPTURING AND DELIVERING VALVE DIAGNOSTIC DATA. COUPLED WITH VALVELINK™ SOFTWARE, THE DVC6000 SIS PROVIDES USERS WITH AN ACCURATE PICTURE OF VALVE PERFORMANCE, INCLUDING ACTUAL STEM POSITION, INSTRUMENT INPUT SIGNAL AND PNEUMATIC PRESSURE TO THE ACTUATOR. USING THIS INFORMATION, THE DIGITAL VALVE CONTROLLER DIAGNOSES NOT ONLY ITSELF, BUT ALSO THE VALVE AND ACTUATOR TO WHICH IT IS MOUNTED.

FIELDVUE DVC6000 SIS Digital Valve Controller

## Section 1 Introduction and Specifications

**1**

|                                              |     |
|----------------------------------------------|-----|
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Table 1-1. FIELDVUE DVC6000 SIS Capabilities

|                                                       |
|-------------------------------------------------------|
| Auto Calibration                                      |
| Custom Characterization                               |
| Alerts                                                |
| Step Response, Drive Signal Test & Dynamic Error Band |
| Advanced Diagnostics (Valve Signature)                |
| Performance Tuner                                     |
| Performance Diagnostics <sup>(1)</sup>                |
| Solenoid Valve Health Monitoring <sup>(1)</sup>       |
| Partial Stroke Testing                                |
| 1. Available in Firmware Revision 7 and higher.       |

## Scope of Manual

This instruction manual includes specifications and installation, operation, and maintenance information for FIELDVUE DVC6000 SIS digital valve controllers for Safety Instrumented System (SIS) Solutions, device revision 1, firmware revision 3–6 or device revision 2, firmware 7, 9, 10, and 11.

This instruction manual describes using the 475 Field Communicator with device description revision 8, used with DVC6000 SIS device revision 2, firmware revision 7, 9, 10, or 11 to setup and calibrate the instrument. You can also use Fisher ValveLink™ software version 7.3 or higher to setup, calibrate, and diagnose the valve and instrument. For information on using ValveLink software with the instrument, refer to the ValveLink software help or documentation.

Do not install, operate, or maintain a DVC6000 SIS digital valve controller without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding

## Conventions Used in this Manual

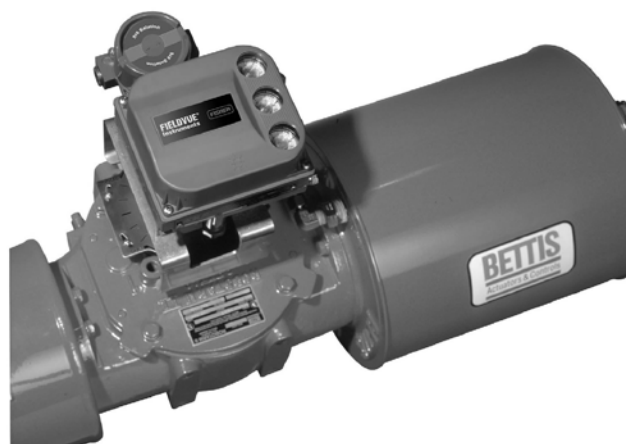


Procedures that require the use of a Field Communicator have the Field Communicator symbol in the heading.



Procedures that are accessible with the Hot Key on the Field Communicator will also have the Hot Key symbol in the heading.

Some of the procedures also contain the sequence of numeric keys required to display the desired Field Communicator menu. For example, to access *Device Setup*, from the Online menu, press 2 (selects



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Figure 1-1. FIELDVUE DVC6030 SIS Digital Valve Controller Mounted on a Quarter-Turn Actuator

*Configure*) followed by a 1 (selects *Guided Setup*) followed by a second 1 (selects *Setup Wizard*). The key sequence in the procedure heading is shown as (2-1-1). The path required to accomplish various tasks, the sequence of steps through the Field Communicator menus, is also presented in textual format. An overview of the Field Communicator menu structures are shown at the beginning of this manual.

## Description

DVC6000 SIS digital valve controllers (figure 1-1) are communicating, microprocessor-based current-to-pneumatic instruments. The DVC6000 SIS digital valve controller for Safety Instrumented System (SIS) Solutions monitors the health of final control elements and solenoid valves; the primary function of the DVC6000 SIS is to actuate its pneumatic outputs in response to a demand signal from a logic solver, which should move the valve to the configured safe state.

Using HART® communications protocol the digital valve controller allows easy access to information critical to process operation. You can gain information from the principal component of the process, the control valve itself, using the Field Communicator at the valve or at a field junction box, or by using a personal computer or operator's console within the control room.

DVC6000 SIS instruments permits partial stroking of the valve to minimize the chance of valve failure upon a safety demand and, consequently, the possibility of catastrophic situations. A partial stroke test verifies valve movement with a small ramp to the input. This ramp is small enough not to disrupt production, but is large enough to confirm that the valve is working. DVC6000 SIS instruments also provide state-of-the-art

testing methods, which reduce testing and maintenance time, improve system performance, and provide diagnostic capabilities.

Using a personal computer and ValveLink software, AMS Suite: Intelligent Device Manager, or a Field Communicator, you can perform several operations with the DVC6000 SIS digital valve controller. You can obtain general information concerning software revision level, messages, tag, descriptor, and date. Diagnostic information is available to aid you when troubleshooting. Input and output configuration parameters can be set, and the digital valve controller can be calibrated. Refer to table 1-1 for details on the capabilities of the DVC6000 SIS.

Using the HART protocol, information from the field can be integrated into control systems or be received on a single loop basis.

## Specifications



### WARNING

**Refer to table 1-2 for application specifications. Incorrect configuration of a positioning instrument could result in the malfunction of the product, property damage or personal injury.**

**1**

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Specifications for DVC6000 SIS digital valve controllers are shown in table 1-2. Specifications for the Field Communicator can be found in the product manual for the Field Communicator.

Table 1-2. Specifications

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| <div data-bbox="82 390 115 428" data-label="Text">1</div> <p><b>Available Configurations</b></p> <p><b>Valve-Mounted Instruments</b><br/> <i>DVC6010 SIS:</i> Sliding-stem applications<br/> <i>DVC6020 SIS:</i> Rotary and long-stroke sliding-stem applications [over 102 mm (4 inch) travel]<br/> <i>DVC6030 SIS:</i> Quarter-turn rotary applications</p> <p>All units can be used in either 4-wire or 2-wire system installations.</p> <p>DVC6000 SIS digital valve controllers must have the Safety Instrumented System Application (SIS) option</p> <p><b>Remote-Mounted Instrument<sup>(1)</sup></b><br/> <i>DVC6005 SIS:</i> Base unit for 2 inch pipestand or wall mounting<br/> <i>DVC6015:</i> Feedback unit for sliding-stem applications<br/> <i>DVC6025:</i> Feedback unit for rotary or long-stroke sliding-stem applications<br/> <i>DVC6035:</i> Feedback unit for quarter-turn rotary applications</p> <p>DVC6000 SIS digital valve controllers can be mounted on Fisher and other manufacturers rotary and sliding-stem actuators</p> <p><b>Input Signal</b></p> <p><b>Point-to-Point:</b><br/> <i>Analog Input Signal:</i> 4-20 mA DC, nominal<br/> Minimum voltage available at instrument terminals must be 10.5 VDC for analog control, 11 VDC for HART communication<br/> <i>Minimum Control Current:</i> 4.0 mA<br/> <i>Minimum Current w/o Microprocessor Restart:</i> 3.5 mA<br/> <i>Maximum Voltage:</i> 30 VDC<br/> <i>Overcurrent Protection:</i> Input circuitry limits current to prevent internal damage<br/> <i>Reverse Polarity Protection:</i> No damage occurs from reversal of loop current</p> <p><b>Multi-drop:</b><br/> <i>Instrument Power:</i> 11-30 VDC at approximately 8 mA<br/> <i>Reverse Polarity Protection:</i> No damage occurs from reversal of loop current</p> <p><b>Output Signal</b></p> <p>Pneumatic signal as required by the actuator, up to full supply pressure.<br/> <b>Minimum Span:</b> 0.4 bar (6 psig)</p> | <p><b>Maximum Span:</b> 9.5 bar (140 psig)<br/> <b>Action:</b> Double, Single direct, and Single reverse</p> <p><b>Supply Pressure<sup>(2)</sup></b></p> <p><b>Recommended:</b> 1.7 bar (25 psi) or 0.3 bar (5 psi) plus the maximum actuator requirements, whichever is higher<br/> <b>Maximum:</b> 10 bar (145 psig) or maximum pressure rating of the actuator, whichever is lower</p> <p><b>Supply Medium</b></p> <p><b>Air:</b> Supply pressure must be clean, dry air that meets the requirements of ISA Standard 7.0.01.</p> <p><b>Natural Gas:</b> Natural gas must be clean, dry, oil-free, and noncorrosive. H<sub>2</sub>S content should not exceed 20 ppm.</p> <p>A maximum 40 micrometer particle size in the air system is acceptable. Further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimized</p> <p><b>Steady-State Air Consumption<sup>(3,4)</sup></b></p> <p><b>Low Bleed Relay</b><br/> <i>At 1.4 bar (20 psig) supply pressure:</i> Average value 0.056 normal m<sup>3</sup>/hr (2.1 scfh)<br/> <i>At 5.5 bar (80 psig) supply pressure:</i> Average value 0.184 normal m<sup>3</sup>/hr (6.9 scfh)</p> <p>The low bleed relay is the standard relay for DVC6000 SIS digital valve controllers, used for On/Off applications. Performance may be affected in throttling applications.</p> <p><b>Standard Relay:</b><br/> <i>At 1.4 bar (20 psig) supply pressure:</i><br/> Less than 0.38 normal m<sup>3</sup>/hr (14 scfh)<br/> <i>At 5.5 bar (80 psig) supply pressure:</i><br/> Less than 1.3 normal m<sup>3</sup>/hr (49 scfh)</p> <p><b>Maximum Output Capacity<sup>(3,4)</sup></b></p> <p><b>At 1.4 bar (20 psig) supply pressure:</b><br/> 10.0 normal m<sup>3</sup>/hr (375 scfh)<br/> <b>At 5.5 bar (80 psig) supply pressure:</b><br/> 29.5 normal m<sup>3</sup>/hr (1100 scfh)</p> <p><b>Independent Linearity<sup>(5)</sup></b><br/> ±0.50% of output span</p> |
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# Introduction and Specifications

Table 1-2. Specifications (continued)

## Electromagnetic Interference (EMI)

Meets EN 61326-1 (First Edition)  
Immunity—Industrial locations per Table 2 of the EN 61326-1 standard. Performance is shown in table 1-3 below.  
Emissions—Class A  
ISM equipment rating: Group 1, Class A

**Lightning and Surge Protection**—The degree of immunity to lightning is specified as Surge immunity in table 1-3. For additional surge protection commercially available transient protection devices can be used.

## Vibration Testing Method

Tested per ISA-S75.13 Section 5.3.5. A resonant frequency search is performed on all three axes. The instrument is subjected to the ISA specified 1/2 hour endurance test at each major resonance, plus an additional two million cycles.

## Input Impedance (Point-to-Point only)

The input impedance of the DVC6000 SIS active electronic circuit is not purely resistive. For comparison to resistive load specifications, an equivalent impedance of 550 ohms may be used. This value corresponds to 11 V @ 20 mA.

## Operating Ambient Temperature Limits<sup>(2,6)</sup>

–40 to 85°C (–40 to 185°F) for most approved valve-mounted instruments  
–60 to 125°C (–76 to 257°F) for remote-mounted feedback unit  
–52 to 85°C (–62 to 185°F) for valve-mounted instruments utilizing the Extreme Temperature option (fluorosilicone elastomers)

## Humidity Limits

0 to 100% condensing relative humidity with minimal zero or span shifts

## Electrical Classification

### Hazardous Area

**CSA**—Intrinsically Safe, Explosion-proof, Division 2, Dust Ignition-proof  
**FM**—Intrinsically Safe, Explosion-proof, Non-incendive, Dust Ignition-proof  
**ATEX**—Intrinsically Safe, Flameproof, Type n  
**IECEx**—Intrinsically Safe, Flameproof, Type n

## Electrical Housing

**CSA**—Type 4, IP66  
**FM**—Type 4, IP66  
**ATEX**—IP66  
**IECEx**—IP66

Refer to tables 1-4, 1-5, 1-6 and 1-7, Hazardous Area Classifications and Special Instructions for “Safe Use” and Installation in Hazardous Locations in Section 2, and Appendix B for specific approval information.

Pollution Degree 2, Overvoltage Category III per ANSI/ISA-82.02.01 (IEC 61010-1 Mod).

**Auxiliary Terminal Contact:** Nominal Electrical Rating 5 V, <1 mA; It is recommended that the switch be sealed or have gold plated contacts to avoid corrosion.

For proper operation of the auxiliary input terminal capacitance should not exceed 18000pF.

## Other Classifications/Certifications

**Gas Certified, Single Seal Device**— CSA, FM, ATEX, and IECEx

**FSETAN**—Federal Service of Technological, Ecological and Nuclear Inspectorate (Russia)

**GOST-R**—Russian GOST-R

**INMETRO**— National Institute of Metrology, Quality, and Technology (Brazil)

**KGS**—Korea Gas Safety Corporation (South Korea)

**KISCO**—Korea Industrial Safety Corporation (South Korea)

**NEPSI**— National Supervision and Inspection Centre for Explosion Protection and Safety of Instrumentation (China)

**PESO CCOE**— Petroleum and Explosives Safety Organisation – Chief Controller of Explosives (India)

**TIIS**— Technology Institution of Industrial Safety (Japan)

Contact your Emerson Process Management sales office for classification/certification specific information

## IEC 61010 Compliance Requirements (Valve-Mounted Instruments only)

**Power Source:** The loop current must be derived from a Separated Extra-Low Voltage (SELV) power source.

**Environmental Conditions:** Installation Category I

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Table 1-2. Specifications (continued)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| <div data-bbox="82 388 115 430">1</div> <p><b>Connections</b></p> <p><b>Supply Pressure:</b> 1/4 NPT internal and integral pad for mounting 67CFR regulator</p> <p><b>Output Pressure:</b> 1/4 NPT internal</p> <p><b>Tubing:</b> 3/8-inch, recommended</p> <p><b>Vent:</b> 3/8 NPT internal</p> <p><b>Electrical:</b> 1/2 NPT internal conduit connection, M20 adapter optional</p> <p><b>Stem/Shaft Travel</b></p> <p>Linear Actuators with rated travel between 6.35 mm (0.25 inch) and 606 mm (23.375 inches)</p> <p>Rotary Actuators with rated travel between 50 degrees and 180 degrees.</p> <p><b>Mounting</b></p> <p>Designed for direct actuator mounting or remote pipestand or wall mounting. Mounting the instrument vertically, with the vent at the bottom of the assembly, or horizontally, with the vent pointing down, is recommended to allow drainage of moisture that may be introduced via the instrument air supply.</p> <p><b>Weight</b></p> <p><b>Valve-Mounted Instruments</b></p> <p>Aluminum: 3.5 kg (7.7 lbs)</p> <p>Stainless Steel: 7.7 kg (17 lbs)</p> <p><b>Remote-Mounted Instruments</b></p> <p>DVC6005 SIS Base Unit: 4.1 kg (9 lbs)</p> <p>DVC6015 Feedback Unit: 1.3 kg (2.9 lbs)</p> <p>DVC6025 Feedback Unit: 1.4 kg (3.1 lbs)</p> <p>DVC6035 Feedback Unit: 0.9 kg (2.0 lbs)</p> | <p><b>Construction Materials</b></p> <p><b>Housing, module base and terminal box:</b><br/>A03600 low copper aluminum alloy (standard)<br/>CF8M (cast 316 stainless steel) (optional for valve-mounted instruments only)</p> <p><b>Cover:</b> Thermoplastic polyester</p> <p><b>Elastomers</b><br/><i>Standard:</i> Nitrile<br/><i>Optional:</i> Fluorosilicone</p> <p><b>Options</b></p> <ul style="list-style-type: none"> <li>■ Supply and output pressure gauges or ■ Tire valves, ■ Integral mounted filter regulator, ■ Stainless steel housing, module base, and terminal box, ■ Extreme Temperature, ■ Beacon Indicator, ■ LCP100 local control panel ■ Natural Gas Certified, Single Seal Device, ■ Feedback Assembly PTFE Sleeve Protective Kit for aluminum units in saltwater or particulate environments</li> </ul> <p><b>Declaration of SEP</b></p> <p>Fisher Controls International LLC declares this product to be in compliance with Article 3 paragraph 3 of the Pressure Equipment Directive (PED) 97 / 23 / EC. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.</p> <p>However, the product <i>may</i> bear the CE marking to indicate compliance with <i>other</i> applicable European Community Directives.</p> |
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NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 – Process Instrument Terminology.

1. 3-conductor shielded cable, 22 AWG minimum wire size, is required for connection between base unit and feedback unit. Pneumatic tubing between base unit output connection and actuator has been tested to 91 meters (300 feet). At 15 meters (50 feet) there was no performance degradation. At 91 meters there was minimal pneumatic lag.

2. The pressure/temperature limits in this document and any applicable code or standard should not be exceeded.

3. Values at 1.4 bar (20 psig) based on a single-acting direct relay; values at 5.5 bar (80 psig) based on double-acting relay.

4. Normal m<sup>3</sup>/hour – 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

5. Typical value. Not applicable for travels less than 19 mm (0.75 inch) or for shaft rotation less than 60 degrees. Also, not applicable to DVC6020 SIS digital valve controllers in long-stroke applications.

6. Temperature limits vary based on hazardous area approval

# Introduction and Specifications

## Related Documents

Other documents containing information related to DVC6000 SIS digital valve controllers for safety instrumented systems include:

- Bulletin 62.1:DVC6000 SIS—FIELDVUE DVC6000 SIS Digital Valve Controllers for Safety Instrumented System (SIS) Solutions (D102784X012)

- Bulletin 62.1:DVC6000(S1)— FIELDVUE DVC6000 Digital Valve Controller Dimensions (D103308X012)

- FIELDVUE DVC6000 SIS Digital Valve Controllers for Safety Instrumented System (SIS) Solutions Quick Start Guide (D103307X012)

- Safety Manual for FIELDVUE DVC6000 Digital Valve Controllers for Safety Instrumented System (SIS) Solutions – 0–20 mA or 0–24 VDC (D103035X012)

- Safety Manual for FIELDVUE DVC6000 SIS Digital Valve Controllers for Safety Instrumented System (SIS) Solutions – 4–20 mA (D103294X012)

- Partial Stroke Test using 475/375 Field Communicator—Supplement to Fisher FIELDVUE DVC6000 SIS Digital Valve Controllers for Safety Instrumented System (SIS) Solutions Instruction Manual (D103320X012)

- Partial Stroke Test using ValveLink Software—Supplement to Fisher FIELDVUE DVC6000 SIS Digital Valve Controllers for Safety Instrumented System (SIS) Solutions Instruction Manual (D103274X012)

- Pre-Commissioning Installation / Setup Guidelines Using ValveLink Software —Supplement to Fisher FIELDVUE DVC6000 SIS Digital Valve Controllers for Safety Instrumented System (SIS) Solutions Instruction Manual (D103285X012)

- Fisher LCP100 Local Control Panel Instruction Manual (D103272X012)

- FIELDVUE LC340 Line Conditioner Instruction Manual (D102797X012)

- FIELDVUE HF340 HART Filter Instruction Manual (D102796X012)

- ValveLink Software Help or Documentation

All documents are available from your Emerson Process Management sales office. Also visit our website at [www.FIELDVUE.com](http://www.FIELDVUE.com).

## Educational Services

For information on available courses for the DVC6000 SIS digital valve controller, as well as a variety of other products, contact:

Emerson Process Management  
Educational Services, Registration  
P.O. Box 190; 301 S. 1st Ave.  
Marshalltown, IA 50158-2823  
Phone: 800-338-8158 or  
Phone: 641-754-3771  
FAX: 641-754-3431  
e-mail: [education@emerson.com](mailto:education@emerson.com)

Table 1-3. Electromagnetic Immunity Performance

| Port               | Phenomenon                           | Basic Standard | Test Level                                                                                                                                  | Performance Criteria <sup>(1)</sup> |                 |
|--------------------|--------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------------|
|                    |                                      |                |                                                                                                                                             | Point-to-Point Mode                 | Multi-drop Mode |
| Enclosure          | Electrostatic discharge (ESD)        | IEC 61000-4-2  | 4 kV contact<br>8 kV air                                                                                                                    | A <sup>(2)</sup>                    | A               |
|                    | Radiated EM field                    | IEC 61000-4-3  | 80 to 1000 MHz @ 10V/m with 1 kHz AM at 80%<br>1400 to 2000 MHz @ 3V/m with 1 kHz AM at 80%<br>2000 to 2700 MHz @ 1V/m with 1 kHz AM at 80% | A                                   | A               |
|                    | Rated power frequency magnetic field | IEC 61000-4-8  | 30 A/m at 50/60 Hz                                                                                                                          | A                                   | A               |
| I/O signal/control | Burst                                | IEC 61000-4-4  | 1 kV                                                                                                                                        | A <sup>(2)</sup>                    | A               |
|                    | Surge                                | IEC 61000-4-5  | 1 kV (line to ground only, each)                                                                                                            | B                                   | B               |
|                    | Conducted RF                         | IEC 61000-4-6  | 150 kHz to 80 MHz at 3 Vrms                                                                                                                 | A                                   | A               |

Performance Criteria: +/- 1% effect.  
 1. A = No degradation during testing. B = Temporary degradation during testing, but is self-recovering.  
 2. Excluding auxiliary switch function, which meets Performance Criteria B.

Table 1-4. Hazardous Area Classifications—CSA (Canada)

| Certification Body | Type                               | Certification Obtained                                                                                                           | Entity Rating                                                             |                                                                        | Temperature Code                                       | Enclosure Rating                    |
|--------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------------------------|-------------------------------------|
| CSA                | DVC60x0<br>DVC60x0S<br>(x = 1,2,3) | Ex ia Intrinsically Safe<br>Class I,II,III Division 1 GP A,B,C,D,E,<br>F,G per drawing GE42818<br>Natural Gas Approved           | Vmax = 30 VDC<br>Imax = 226 mA<br>Ci = 5 nF<br>Li = 0.55 mH<br>Pi = 1.4 W |                                                                        | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | Type 4X, IP66<br>Single Seal Device |
|                    |                                    | Explosion-proof<br>Class I Division 1 GP B,C,D<br>Natural Gas Approved                                                           | ---                                                                       |                                                                        | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | Type 4X, IP66<br>Single Seal Device |
|                    |                                    | Class I Division 2 GP A,B,C,D<br>Class II Division 1 GP E,F,G<br>Class II Division 2 GP F,G<br>Class III<br>Natural Gas Approved | ---                                                                       |                                                                        | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | Type 4X, IP66<br>Single Seal Device |
|                    | DVC6005                            | Ex ia Intrinsically Safe<br>Class I,II,III Division 1 GP A,B,C,D,<br>E,F,G per drawing GE42818<br>Natural Gas Approved           | Vmax = 30 VDC<br>Imax = 226 mA<br>Ci = 5 nF<br>Li = 0.55 mH<br>Pi = 1.4 W | Voc = 30 VDC<br>Isc = 12 mA<br>Ca = 66 nF<br>La = 246 mH<br>Po = 86 mW | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | Type 4X, IP66<br>Single Seal Device |
|                    |                                    | Explosion-proof<br>Class I Division 1 GP B,C,D<br>Natural Gas Approved                                                           | ---                                                                       |                                                                        | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | Type 4X, IP66<br>Single Seal Device |
|                    |                                    | Class I Division 2 GP A,B,C,D<br>Class II Division 1 GP E,F,G<br>Class II Division 2 GP F,G<br>Class III<br>Natural Gas Approved | ---                                                                       |                                                                        | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | Type 4X, IP66<br>Single Seal Device |
|                    | DVC60x5<br>(x = 1,2,3)             | Ex ia Intrinsically Safe<br>Class I,II,III Division 1 GP A,B,C,D,<br>E,F,G per drawing GE42818                                   | Vmax = 30 VDC<br>Imax = 100 mA<br>Ci = 0 uF<br>Li = 0 mH<br>Pmax = 160 mW |                                                                        | T4(Tamb ≤ 125°C)<br>T5(Tamb ≤ 95°C)<br>T6(Tamb ≤ 80°C) | Type 4X, IP66                       |
|                    |                                    | Explosion-proof<br>Class I Division 1 GP B,C,D                                                                                   | ---                                                                       |                                                                        | T4(Tamb ≤ 125°C)<br>T5(Tamb ≤ 95°C)<br>T6(Tamb ≤ 80°C) | Type 4X, IP66                       |
|                    |                                    | Class I Division 2 GP A,B,C,D<br>Class II Division 1 GP E,F,G<br>Class II Division 2 GP F,G<br>Class III                         | ---                                                                       |                                                                        | T4(Tamb ≤ 125°C)<br>T5(Tamb ≤ 95°C)<br>T6(Tamb ≤ 80°C) | Type 4X, IP66                       |

# Introduction and Specifications

Table 1-5. Hazardous Area Classifications—FM (United States)

| Certification Body | Type                               | Certification Obtained                                                                                                                                                                                                                                  | Entity Rating                                                             |                                                                            | Temperature Code                                       | Enclosure Rating                    |
|--------------------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------|--------------------------------------------------------|-------------------------------------|
| FM                 | DVC60x0<br>DVC60x0S<br>(x = 1,2,3) | IS Intrinsically Safe<br>Class I,II,III Division 1 GP A,B,C,D,<br>E,F,G per drawing GE42819<br>Natural Gas Approved                                                                                                                                     | Vmax = 30 VDC<br>Imax = 226 mA<br>Ci = 5 nF<br>Li = 0.55 mH<br>Pi = 1.4 W |                                                                            | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | Type 4X, IP66<br>Single Seal Device |
|                    |                                    | XP Explosion-proof<br>Class I Division 1 GP B,C,D<br>NI Non-incendive<br>Class I Division 2 GP A,B,C,D<br>DIP Dust Ignition-proof<br>Class II, III Division 1 GP E,F,G<br>S Suitable for Use<br>Class II, III Division 2 GP F,G<br>Natural Gas Approved | ---                                                                       |                                                                            | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | Type 4X, IP66<br>Single Seal Device |
|                    | DVC6005                            | IS Intrinsically Safe<br>Class I,II,III Division 1 GP A,B,C,D,E,<br>F,G per drawing GE42819<br>Natural Gas Approved                                                                                                                                     | Vmax = 30 VDC<br>Imax = 226 mA<br>Ci = 5 nF<br>Li = 0.55 mH<br>Pi = 1.4 W | Voc = 9.6 VDC<br>Isc = 3.5 mA<br>Ca = 3.6 uF<br>La = 100 mH<br>Po = 8.4 mW | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | Type 4X, IP66<br>Single Seal Device |
|                    |                                    | XP Explosion-proof<br>Class I Division 1 GP B,C,D<br>NI Non-incendive<br>Class I Division 2 GP A,B,C,D<br>DIP Dust Ignition-proof<br>Class II, III Division 1 GP E,F,G<br>S Suitable for Use<br>Class II, III Division 2 GP F,G<br>Natural Gas Approved | ---                                                                       |                                                                            | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | Type 4X, IP66<br>Single Seal Device |
|                    | DVC60x5<br>(x = 1,2,3)             | IS Intrinsically Safe<br>Class I,II,III Division 1 GP A,B,C,D,<br>E,F,G per drawing GE42819                                                                                                                                                             | Vmax = 30 VDC<br>Imax = 100 mA<br>Ci = 0 uF<br>Li = 0 mH<br>Pi = 160 mW   |                                                                            | T4(Tamb ≤ 125°C)<br>T5(Tamb ≤ 95°C)<br>T6(Tamb ≤ 80°C) | Type 4X, IP66                       |
|                    |                                    | XP Explosion-proof<br>Class I Division 1 GP A,B,C,D<br>NI Non-incendive<br>Class I Division 2 GP A,B,C,D<br>DIP Dust Ignition-proof<br>Class II, III Division 1 GP E,F,G<br>S Suitable for Use<br>Class II, III Division 2 GP F,G                       | ---                                                                       |                                                                            | T4(Tamb ≤ 125°C)<br>T5(Tamb ≤ 95°C)<br>T6(Tamb ≤ 80°C) | Type 4X, IP66                       |

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Table 1-6. Hazardous Area Classifications—ATEX

| Certificate | Type                               | Certification Obtained                                                                                                                                                                                         | Entity Rating                                                         |                                                                          | Temperature Code                                       | Enclosure Rating           |
|-------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------|----------------------------|
| ATEX        | DVC60x0<br>DVC60x0S<br>(x = 1,2,3) | II 1 G D<br>Intrinsically Safe<br>Gas<br>Ex ia IIC T5/T6 Ga<br>Dust<br>Ex ia IIIC T85°C (Ta ≤ +73°C), T92°C<br>(Ta ≤ +80°C) Da<br>Per drawing GE60771<br>Natural Gas Approved                                  | Ui = 30 VDC<br>Ii = 226 mA<br>Ci = 5 nF<br>Li = 0.55 mH<br>Pi = 1.4 W |                                                                          | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | IP66<br>Single Seal Device |
|             |                                    | II 2 G<br>Flameproof<br>Gas<br>Ex d IIC T5/T6 Gb<br>Natural Gas Approved                                                                                                                                       | ---                                                                   |                                                                          | T5(Tamb ≤ 85°C)<br>T6(Tamb ≤ 80°C)                     | IP66<br>Single Seal Device |
|             |                                    | II 3 G<br>Type n<br>Gas<br>Ex nC IIC T5/T6 Gc<br>Natural Gas Approved                                                                                                                                          | ---                                                                   |                                                                          | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | IP66<br>Single Seal Device |
|             | DVC6005                            | II 1 G D<br>Intrinsically Safe<br>Gas<br>Ex ia IIC T5/T6 Ga<br>Dust<br>Ex ia IIIC T85°C (Ta ≤ +76°C), T89°C<br>Ta ≤ +80°C) Da<br>Per drawing GE60771<br>Natural Gas Approved                                   | Ui = 30 VDC<br>Ii = 226 mA<br>Ci = 5 nF<br>Li = 0.55 mH<br>Pi = 1.4 W | Uo = 9.6 VDC<br>Io = 3.5 mA<br>Co = 3.6 uF<br>Lo = 100 mH<br>Po = 8.4 mW | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | IP66<br>Single Seal Device |
|             |                                    | II 2 G<br>Flameproof<br>Gas<br>Ex d IIC T5/T6 Gb<br>Natural Gas Approved                                                                                                                                       | ---                                                                   |                                                                          | T5(Tamb ≤ 85°C)<br>T6(Tamb ≤ 80°C)                     | IP66<br>Single Seal Device |
|             |                                    | II 3 G<br>Type n<br>Gas<br>Ex nC IIC T5/T6 Gc<br>Natural Gas Approved                                                                                                                                          | ---                                                                   |                                                                          | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | IP66<br>Single Seal Device |
|             | DVC60x5<br>(x = 1,2,3)             | II 1 G D<br>Intrinsically Safe<br>Gas<br>Ex ia IIC T4/T5/T6 Ga<br>Dust<br>Ex ia IIIC T85°C (Tamb ≤ +64°C) T100°C<br>(Tamb ≤ +79°C), T135°C (Tamb ≤ +114°C)<br>T146°C (Tamb ≤ +125°C) Da<br>Per drawing GE60771 | Ui = 30 VDC<br>Ii = 100 mA<br>Ci = 0 uF<br>Li = 0 mH<br>Pi = 160 mW   |                                                                          | T4(Tamb ≤ 125°C)<br>T5(Tamb ≤ 95°C)<br>T6(Tamb ≤ 80°C) | IP66                       |
|             |                                    | II 2 G<br>Flameproof<br>Gas<br>Ex d IIC T4/T5/T6 Gb                                                                                                                                                            | ---                                                                   |                                                                          | T4(Tamb ≤ 125°C)<br>T5(Tamb ≤ 95°C)<br>T6(Tamb ≤ 80°C) | IP66                       |
|             |                                    | II 3 G<br>Type n<br>Gas<br>Ex nA IIC T4/T5/T6 Gc                                                                                                                                                               | ---                                                                   |                                                                          | T4(Tamb ≤ 125°C)<br>T5(Tamb ≤ 95°C)<br>T6(Tamb ≤ 80°C) | IP66                       |

# Introduction and Specifications

Table 1-7. Hazardous Area Classifications—IECEX

| Certificate | Type                               | Certification Obtained                                                                   | Entity Rating                                                         |                                                                          | Temperature Code                                       | Enclosure Rating           |
|-------------|------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------|----------------------------|
| IECEX       | DVC60x0<br>DVC60x0S<br>(x = 1,2,3) | Intrinsically Safe<br>Gas<br>Ex ia IIC T5/T6 per drawing GE42990<br>Natural Gas Approved | Ui = 30 VDC<br>Ii = 226 mA<br>Ci = 5 nF<br>Li = 0.55 mH<br>Pi = 1.4 W |                                                                          | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | IP66<br>Single Seal Device |
|             |                                    | Flameproof<br>Gas<br>Ex d IIC T5/T6<br>Natural Gas Approved                              | ---                                                                   |                                                                          | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | IP66<br>Single Seal Device |
|             |                                    | Type n<br>Gas<br>Ex nC IIC T5/T6<br>Natural Gas Approved                                 | ---                                                                   |                                                                          | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | IP66<br>Single Seal Device |
|             | DVC6005                            | Intrinsically Safe<br>Gas<br>Ex ia IIC T5/T6 per drawing GE42990<br>Natural Gas Approved | Ui = 30 VDC<br>Ii = 226 mA<br>Ci = 5 nF<br>Li = 0.55 mH<br>Pi = 1.4 W | Uo = 9.6 VDC<br>Io = 3.5 mA<br>Ca = 3.6 uF<br>La = 100 mH<br>Po = 8.4 mW | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | IP66<br>Single Seal Device |
|             |                                    | Flameproof<br>Gas<br>Ex d IIC T5/T6<br>Natural Gas Approved                              | ---                                                                   |                                                                          | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | IP66<br>Single Seal Device |
|             |                                    | Type n<br>Gas<br>Ex nC IIC T5/T6<br>Natural Gas Approved                                 | ---                                                                   |                                                                          | T5(Tamb ≤ 80°C)<br>T6(Tamb ≤ 75°C)                     | IP66<br>Single Seal Device |
|             | DVC60x5<br>(x = 1,2,3)             | Intrinsically Safe<br>Gas<br>Ex ia IIC T4/T5/T6 per drawing GE42990                      | Ui = 30 VDC<br>Ii = 100 mA<br>Ci = 0 uF<br>Li = 0 mH<br>Pi = 160 mW   |                                                                          | T4(Tamb ≤ 125°C)<br>T5(Tamb ≤ 95°C)<br>T6(Tamb ≤ 80°C) | IP66                       |
|             |                                    | Flameproof<br>Gas<br>Ex d IIC T4/T5/T6                                                   | ---                                                                   |                                                                          | T4(Tamb ≤ 125°C)<br>T5(Tamb ≤ 95°C)<br>T6(Tamb ≤ 80°C) | IP66                       |
|             |                                    | Type n<br>Gas<br>Ex nA IIC T4/T5/T6                                                      | ---                                                                   |                                                                          | T4(Tamb ≤ 125°C)<br>T5(Tamb ≤ 95°C)<br>T6(Tamb ≤ 80°C) | IP66                       |

1



## Section 2 Installation

### Hazardous Area Classifications and Special Instructions for “Safe Use” and Installations in Hazardous Areas

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## Installation

The DVC6000 SIS can be used with either air or natural gas as the supply medium. If using natural gas as the pneumatic supply medium, natural gas will be used in the pneumatic output connections of the DVC6000 SIS to any connected equipment. In normal operation the unit will vent the supply medium into the surrounding atmosphere unless it is remotely vented.

When using natural gas as the supply medium, in a non-hazardous location in a confined area, remote venting of the unit is required. Failure to do so could result in personal injury, property damage, and area re-classification. For hazardous locations remote venting of the unit may be required, depending upon the area classification, and as specified by the requirements of local, regional, and national codes, rules and regulations. Failure to do so when necessary could result in personal injury, property damage, and area re-classification.

### WARNING

**Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before proceeding with any Installation procedures:**

- Always wear protective clothing, gloves, and eyewear.
- Personal injury or property damage may result from fire or explosion if natural gas is used as the supply medium and appropriate preventive measures are not taken. Preventive measures may include, but are not limited to, one or more of the following: Remote venting of the unit, re-evaluating the hazardous area classification, ensuring adequate ventilation, and the removal of any ignition sources. For information on remote venting of this controller, refer to page 2-22.
- If installing this into an existing application, also refer to the WARNING at the beginning of the Maintenance section of this instruction manual.

- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

### WARNING

**To avoid static discharge from the cover when flammable gases or dust are present, do not rub or clean the cover with solvents. To do so could result in a spark that may cause the flammable gases or dust to explode, resulting in personal injury or property damage. Clean with a mild detergent and water only.**

2

### WARNING

**This unit vents the supply medium into the surrounding atmosphere. When installing this unit in a non-hazardous (non-classified) location in a confined area, with natural gas as the supply medium, you must remotely vent this unit to a safe location. Failure to do so could result in personal injury or property damage from fire or explosion, and area re-classification.**

**When installing this unit in a hazardous (classified) location remote venting of the unit may be required, depending upon the area classification, and as specified by the requirements of local, regional, and national codes, rules and regulations. Failure to do so when necessary could result in personal injury or property damage from fire or explosion, and area re-classification.**

**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 reduce case pressure buildup.**

In addition to remote venting of the unit, ensure that all caps and covers are correctly installed. Failure to do so could result in personal injury or property damage from fire or explosion, and area re-classification.

## 2

### Hazardous Area Classifications and Special Instructions for “Safe Use” and Installations in Hazardous Locations

Certain nameplates may carry more than one approval, and each approval may have unique installation/wiring requirements and/or conditions of “safe use”. These special instructions for “safe use” are in addition to, and may override, the standard installation procedures. Special instructions are listed by approval.



#### Note

This information supplements the nameplate markings affixed to the product.

Always refer to the nameplate itself to identify the appropriate certification. Contact your Emerson Process Management sales office for approval/certification information not listed here.

Approval information is for both aluminum and stainless steel constructions.



#### WARNING

Failure to follow these conditions of safe use could result in personal injury or property damage from fire or explosion, or area re-classification.

#### CSA

##### Intrinsic Safety, Explosion proof, Division 2, Dust-Ignition proof

No special conditions for safe use.

Refer to table 1-4 for approval information, figure B-1, B-3 and B-4 for CSA loop schematics, and figure B-2 and B-5 for typical CSA nameplates.

#### FM

##### Special Conditions of Safe Use

##### Intrinsic Safety, Explosion proof, Non-incendive, Dust-Ignition proof

1. When product is used with natural gas as the pneumatic medium, the maximum working pressure of the natural gas supply shall be limited to 145 psi.
2. When product is used with natural gas as the pneumatic medium the product shall not be permitted in a Class I, Division 2, Group A, B, C, D location without the proper venting installation as per the manufacturer's instruction manual.
3. The apparatus enclosure contains aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.
4. Parts of the enclosure are constructed from plastic. To prevent risk of electrostatic sparking, the plastic surface should only be cleaned with a damp cloth.

Refer to table 1-5 for approval information, figure B-6, B-7 and B-8 for FM loop schematics, and figure B-2 and B-9 for typical FM nameplates.

#### ATEX

##### Special Conditions for Safe Use

##### Intrinsically Safe

1. This apparatus can only be connected to an intrinsically safe certified equipment and this combination must be compatible as regards the intrinsically safe rules.
2. The electrical parameters of this equipment must not exceed any following values:  
 $U_0 \leq 30 \text{ V}$ ;  $I_0 \leq 226 \text{ mA}$ ;  $P_0 \leq 1.4 \text{ W}$
3. Operating ambient temperature:  $-52^\circ\text{C}$  or  $-40^\circ\text{C}$  to  $+80^\circ\text{C}$
4. For the model with aluminum body: the apparatus must not be submitted to frictions or mechanical impacts.
5. Covered by standards EN 60079-0 (2009), EN 60079-11 (2012), EN 60079-26 (2007).
6. Install per drawing GE60771.

Refer to table 1-6 for additional approval information, figures B-10, B-12, and B-13 for ATEX loop schematics and figure B-11 for typical ATEX Intrinsic Safety nameplates.

## **Flameproof**

Operating ambient temperature:  $-52^{\circ}\text{C}$  or  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

Refer to table 1-6 for additional approval information, and figure B-14 for typical ATEX Flameproof nameplates.

## **Type n**

Operating ambient temperature:  $-52^{\circ}\text{C}$  or  $-40^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$

Refer to table 1-6 for additional approval information, and figure B-15 for typical ATEX Type n nameplates.

## **IECEX**

### **Conditions of Certification**

#### **Intrinsically Safe, Type n, Flameproof**

*Ex ia / Ex nC / Ex d*

1. **Warning:** Electrostatic charge hazard. Do not rub or clean with solvents. To do so could result in an explosion.

*Ex nC / Ex nA / Ex d*

2. Do not open while energized.

Refer to table 1-7 for additional approval information, and figures B-16, B-17, and B-18 for IECEx loop schematics, and figures B-19 and B-20 for typical IECEx nameplates.

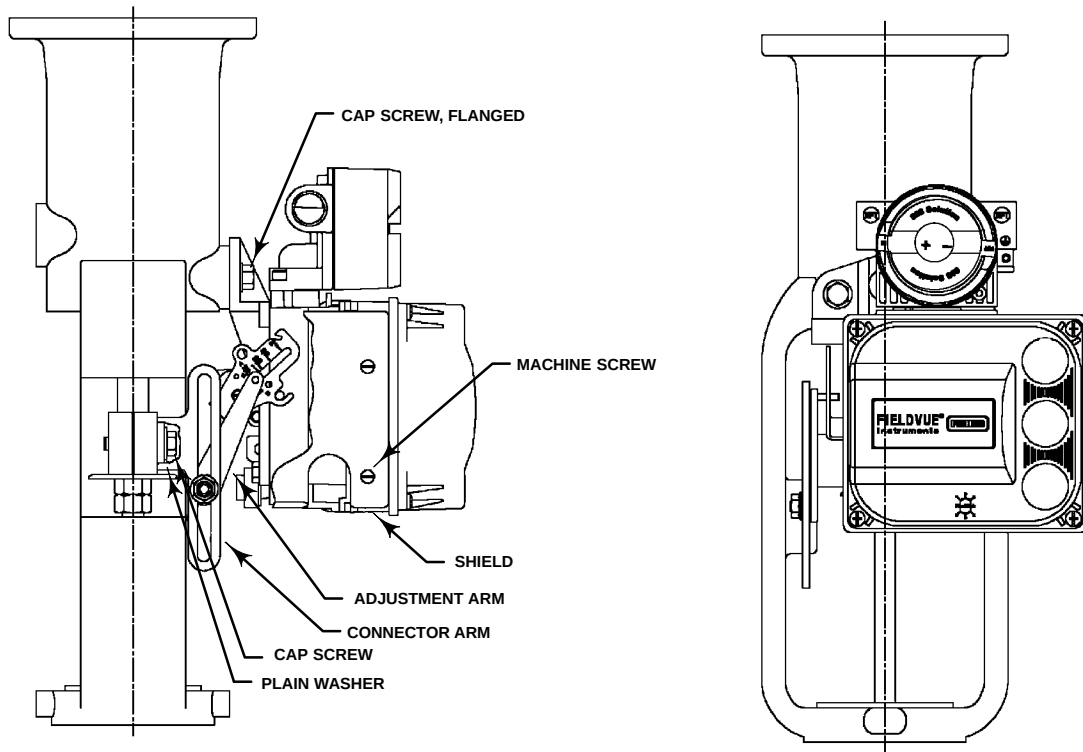


Figure 2-1. FIELDVUE DVC6010 SIS Digital Valve Controller Mounted on Sliding-Stem Actuators with up to 2 Inches Travel

## Mounting Guidelines

### DVC6010 SIS on Sliding-Stem Actuators Up to 102 mm (4 Inches) of Travel

If ordered as part of a control valve assembly, the factory mounts the digital valve controller on the actuator, makes pneumatic connections to the actuator, sets up, and calibrates the instrument. If you purchased the digital valve controller separately, you will need a mounting kit to mount the digital valve controller on the actuator. See the instructions that come with the mounting kit for detailed information on mounting the digital valve controller to a specific actuator model.

The DVC6010 SIS digital valve controller mounts on sliding-stem actuators with up to 102 mm (4 inch) travel. Figure 2-1 shows a typical mounting on an actuator with up to 51 mm (2 inch) travel. Figure 2-2 shows a typical mounting on actuators with 51 to 102 mm (2 to 4 inch) travel. For actuators with greater than 102 mm (4-inch) travel, see the guidelines for mounting a DVC6020 SIS digital valve controller.



## Note

**Do not use the stainless steel DVC6010S SIS in high vibration service where the mounting bracket uses standoffs (spacers) to mount to the actuator.**

Refer to the following guidelines when mounting on sliding-stem actuators with up to 4 inches of travel. Where a key number is referenced, refer to figure 8-1.

1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. 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.
2. Attach the connector arm to the valve stem connector.
3. Attach the mounting bracket to the digital valve controller housing.

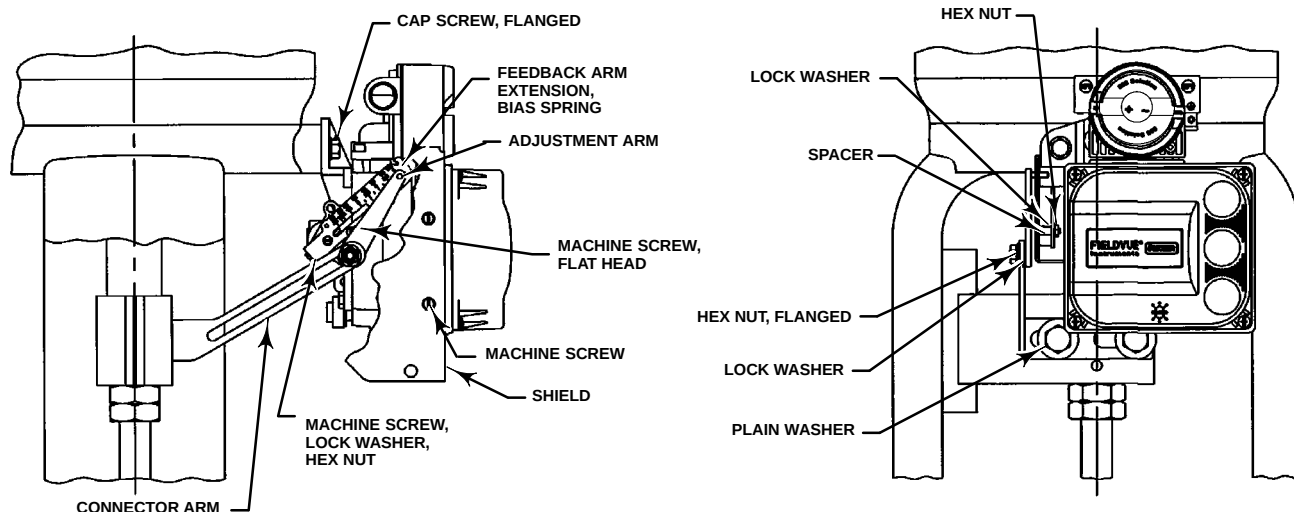


Figure 2-2. FIELDVUE DVC6010 SIS Digital Valve Controller Mounted on Sliding-Stem Actuators with 2 to 4 Inches Travel

4. If valve travel exceeds 2 inches, a feedback arm extension is attached to the existing 2-inch feedback arm. Remove the existing bias spring (key 78) from the 2-inch feedback arm (key 79). Attach the feedback arm extension to the feedback arm (key 79) as shown in figure 2-2.

5. Mount the digital valve controller on the actuator as described in the mounting kit instructions.

6. Set the position of the feedback arm (key 79) on the digital valve controller to the no air position by inserting the alignment pin (key 46) through the hole on the feedback arm as follows:

- **For air-to-open actuators** (i.e., the actuator stem retracts into the actuator casing or cylinder as air pressure to the casing or lower cylinder increases), insert the alignment pin into the hole marked "A". For this style actuator, the feedback arm rotates counterclockwise, from A to B, as air pressure to the casing or lower cylinder increases.

- **For air-to-close actuators** (i.e., the actuator stem extends from the actuator casing or cylinder as air pressure to the casing or upper cylinder increases), insert the alignment pin into the hole marked "B". For this style actuator, the feedback arm rotates clockwise, from B to A, as air pressure to the casing or upper cylinder increases.



## Note

**When performing the following steps, ensure there is enough clearance between the adjustment arm and the feedback arm to prevent interference with the bias spring.**

7. Apply anti-seize (key 64) to the pin of the adjustment arm. As shown in figure 2-3, place the pin into the slot of the feedback arm or feedback arm extension so that the bias spring loads the pin against the side of the arm with the valve travel markings.
8. Install the external lock washer on the adjustment arm. Position the adjustment arm in the slot of the connector arm and loosely install the flanged hex nut.
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 flanged hex nut.
10. Remove the alignment pin (key 46) and store it in the module base next to the I/P assembly.
11. After calibrating the instrument, attach the shield with two machine screws.

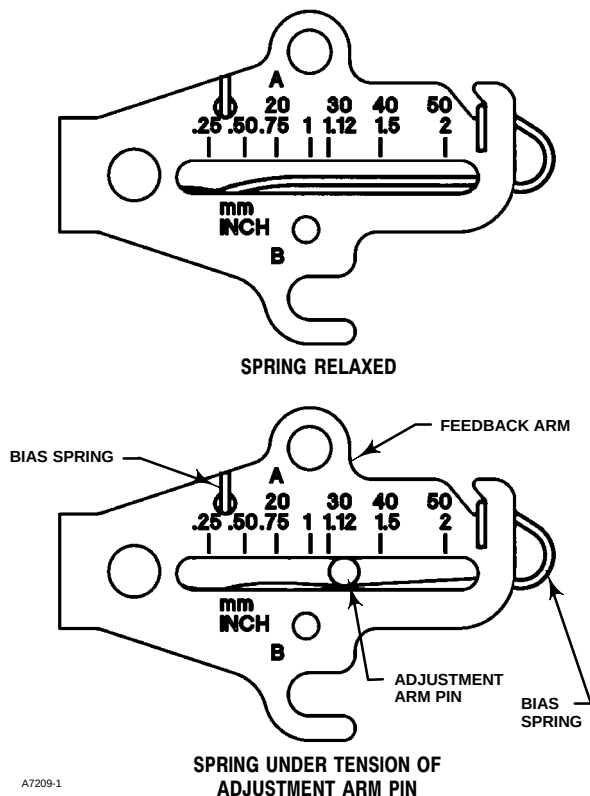


Figure 2-3. Locating Adjustment Arm Pin in Feedback Arm

## DVC6020 SIS on Long-Stroke (4 to 24 Inch Travel) Sliding-Stem Actuators and Rotary Actuators

If ordered as part of a control valve assembly, the factory mounts the digital valve controller on the actuator, makes pneumatic connections to the actuator, sets up, and calibrates the instrument. If you purchased the digital valve controller separately, you will need a mounting kit to mount the digital valve controller on the actuator. See the instructions that come with the mounting kit for detailed information on mounting the digital valve controller to a specific actuator model.



### Note

All cams supplied with FIELDVUE mounting kits are characterized to provide a linear response.



### Note

Do not use the stainless steel DVC6020S SIS in high vibration service where the mounting bracket uses standoffs (spacers) to mount to the actuator.

DVC6020 SIS digital valve controllers use a cam (designed for linear response) and roller as the feedback mechanism. Figure 2-4 shows an example of mounting on sliding-stem actuators with travels from 4 inches to 24 inches. Some long-stroke applications will require an actuator with a tapped lower yoke boss. Figures 2-5 and 2-6 show the DVC6020 SIS mounted on rotary actuators.

As shown in figure 2-5, two feedback arms are available for the digital valve controller. Most long-stroke sliding-stem and rotary actuator installations use the long feedback arm [62 mm (2.45 inches) from roller to pivot point]. Installations on Fisher 1051 size 33 and 1052 size 20 and 33 actuators use the short feedback arm [54 mm (2.13 inches) from roller to pivot point]. Make sure the correct feedback arm is installed on the digital valve controller before beginning the mounting procedure.

Refer to figures 2-4, 2-5, and 2-6 for parts locations. Also, where a key number is referenced, refer to figure 8-2. Refer to the following guidelines when mounting on sliding-stem actuators with 4 to 24 inches of travel or on rotary actuators:

1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. 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 a cam is not already installed on the actuator, install the cam as described in the instructions included with the mounting kit. For sliding-stem actuators, the cam is installed on the stem connector.
3. If a mounting plate is required, fasten the mounting plate to the actuator.

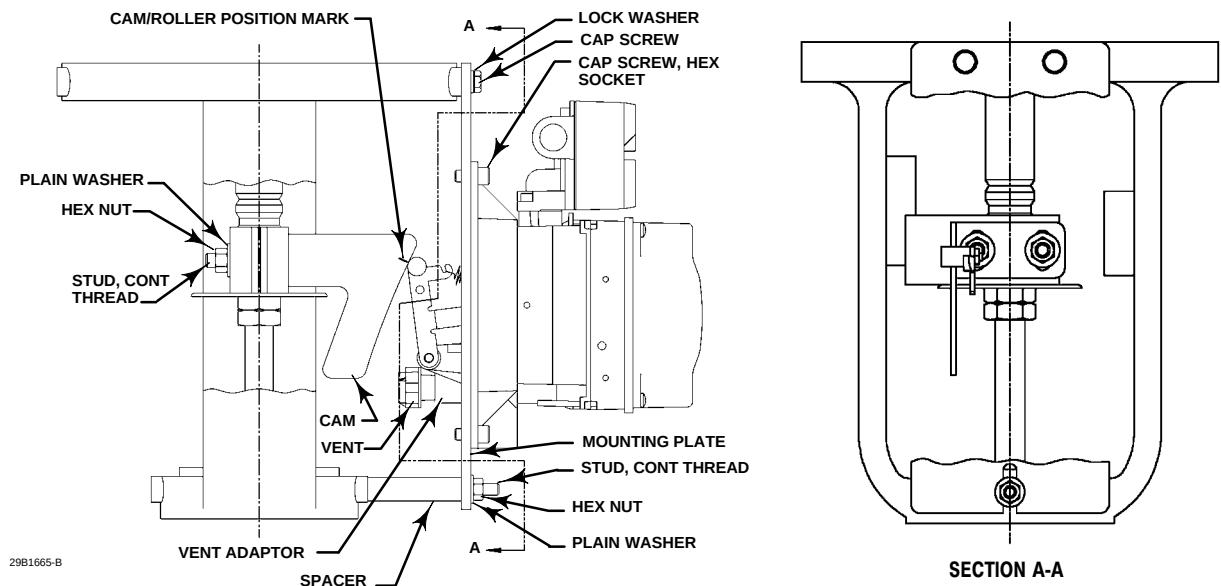


Figure 2-4. FIELDVUE DVC6020 SIS Digital Valve Controller Mounted on Long-Stroke Sliding-Stem Actuator.

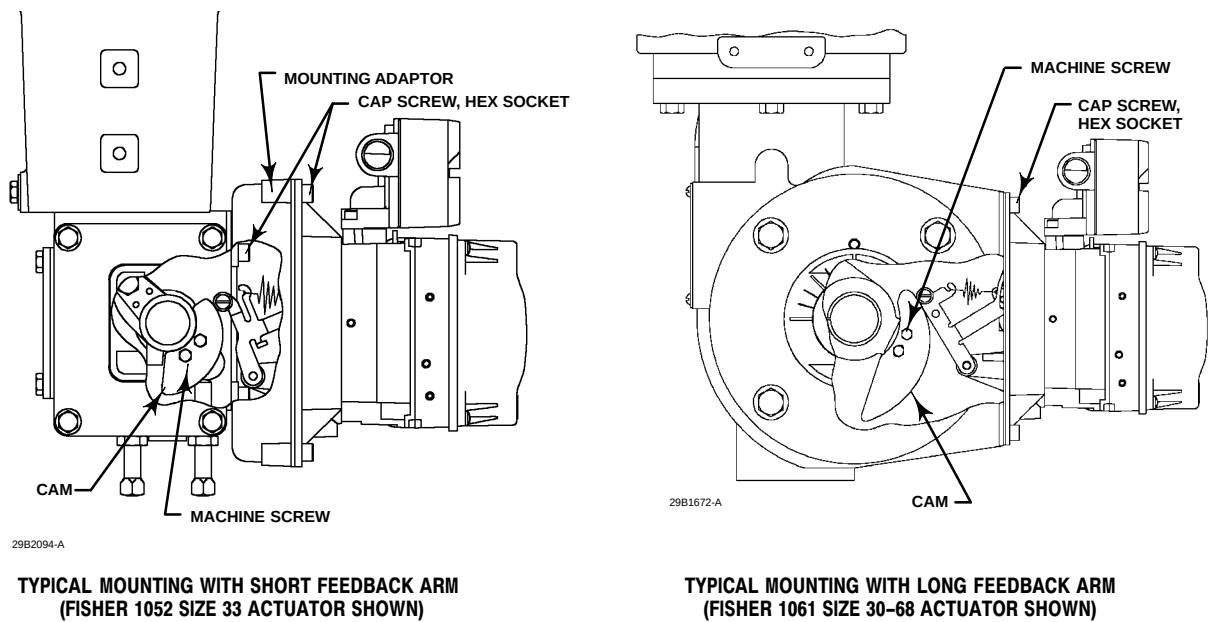


Figure 2-5. FIELDVUE DVC6020 SIS Digital Valve Controller Mounted on Rotary Actuator

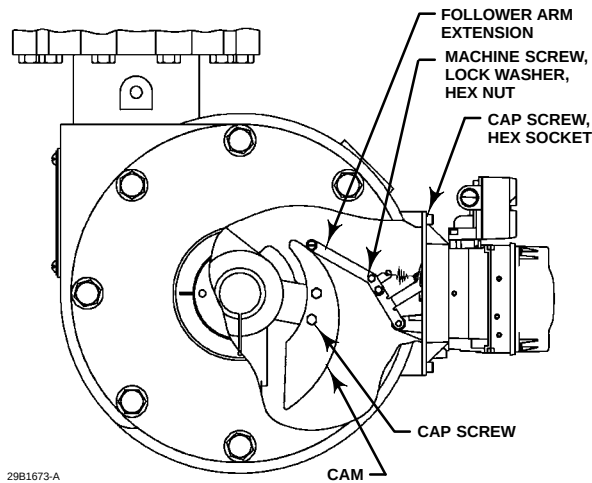


Figure 2-6. FIELDVUE DVC6020 SIS Digital Valve Controller with Long Feedback Arm and Follower Arm Extension Mounted on a Rotary Actuator

4. For applications that require remote venting, a pipe-away bracket kit is available. Follow the instructions included with the kit to replace the existing mounting bracket on the digital valve controller with the pipe-away bracket and to transfer the feedback parts from the existing mounting bracket to the pipe-away bracket.

5. Larger size actuators may require a follower arm extension, as shown in figure 2-6. If required, the follower arm extension is included in the mounting kit. Follow the instructions included with the mounting kit to install the follower arm extension.

6. Apply anti-seize (key 64) to the pin of the adjustment arm as shown in figure 2-7.

7. Mount the DVC6020 SIS on the actuator as follows:

- If required, a mounting adaptor is included in the mounting kit. Attach the adaptor to the actuator as shown in figure 2-5. Then attach 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.

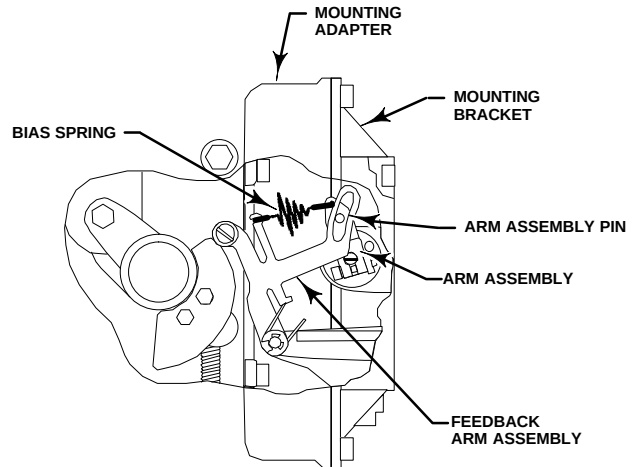


Figure 2-7. Locating Adjustment Arm Pin in Feedback Arm of a FIELDVUE DVC6020 SIS Digital Valve Controller

- If no mounting adaptor is required, attach the digital valve controller assembly to the actuator or mounting plate. The roller on the digital valve controller feedback arm will contact the actuator cam as it is being attached.

8. For long-stroke sliding-stem actuators, after the mounting is complete, check to be sure the roller aligns with the position mark on the cam (see figure 2-4). If necessary, reposition the cam to attain alignment.

## DVC6030 SIS on Quarter-Turn Actuators

If ordered as part of a control valve assembly, the factory mounts the digital valve controller on the actuator, makes pneumatic connections to the actuator, sets up, and calibrates the instrument. If you purchased the digital valve controller separately, you will need a mounting kit to mount the digital valve controller on the actuator. See the instructions that come with the mounting kit for detailed information on mounting the digital valve controller to a specific actuator model.

Figure 2-8 shows the DVC6030 SIS digital valve controller mounted on a quarter-turn actuator. Refer to figure 2-8 for parts locations. Refer to the following guidelines when mounting on quarter-turn actuators:



## Note

**Due to NAMUR mounting limitations, do not use the stainless steel DVC6030S SIS in high vibration service.**

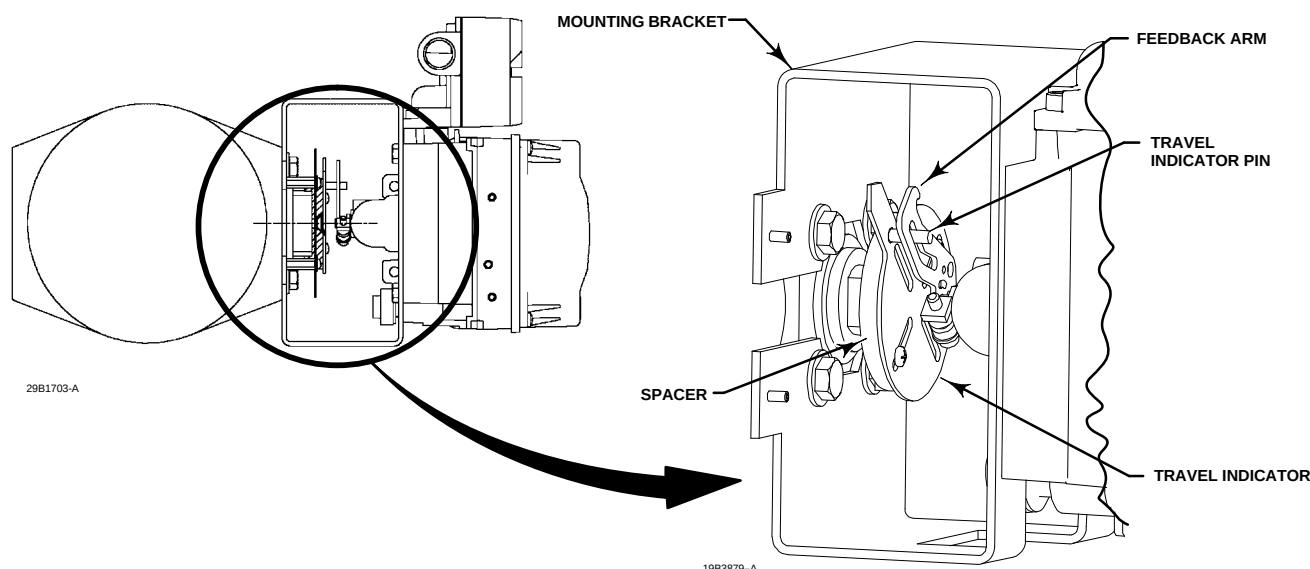


Figure 2-8. Mounting a FIELDVUE DVC6030 SIS Digital Valve Controller on a Rotary Actuator (1032 Size 425A Shown)

1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. 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, remove the existing hub from the actuator shaft.

3. If a positioner plate is required, attach the positioner plate to the actuator as described in the mounting kit instructions.

4. If required, attach the spacer to the actuator shaft.

Refer to figures 2-9 and 2-10. The travel indicator assembly can have a starting position of 7:30 or 10:30. Determine the desired starting 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 travel indicator, so that the pin is positioned as follows:

- If increasing pressure from the digital valve controller output A rotates the potentiometer shaft **clockwise (as viewed from the back of the instrument)**, mount the travel indicator assembly such that the arrow is in the 10:30 position, as shown in figure 2-9.

- If increasing pressure from the digital valve controller output A rotates the potentiometer shaft

**counterclockwise (as viewed from the back of the instrument)**, mount the travel indicator assembly such that the arrow is in the 7:30 position, as shown in figure 2-10.



## Note

ValveLink software and the Field Communicator use the convention of clockwise (figure 2-9) and counterclockwise (figure 2-10) when viewing the potentiometer shaft from the back of the FIELDVUE instrument.

5. Attach the travel indicator, to the shaft connector or spacer as described in the mounting kit instructions.

6. Attach the mounting bracket to the digital valve controller.

7. Position the digital valve controller so that the pin on the travel indicator engages the slot in the feedback arm and the bias spring loads the pin as shown in figure 2-11. Attach the digital valve controller to the actuator or positioner plate.

8. If a travel indicator scale is included in the mounting kit, attach the scale as described in the mounting kit instructions.

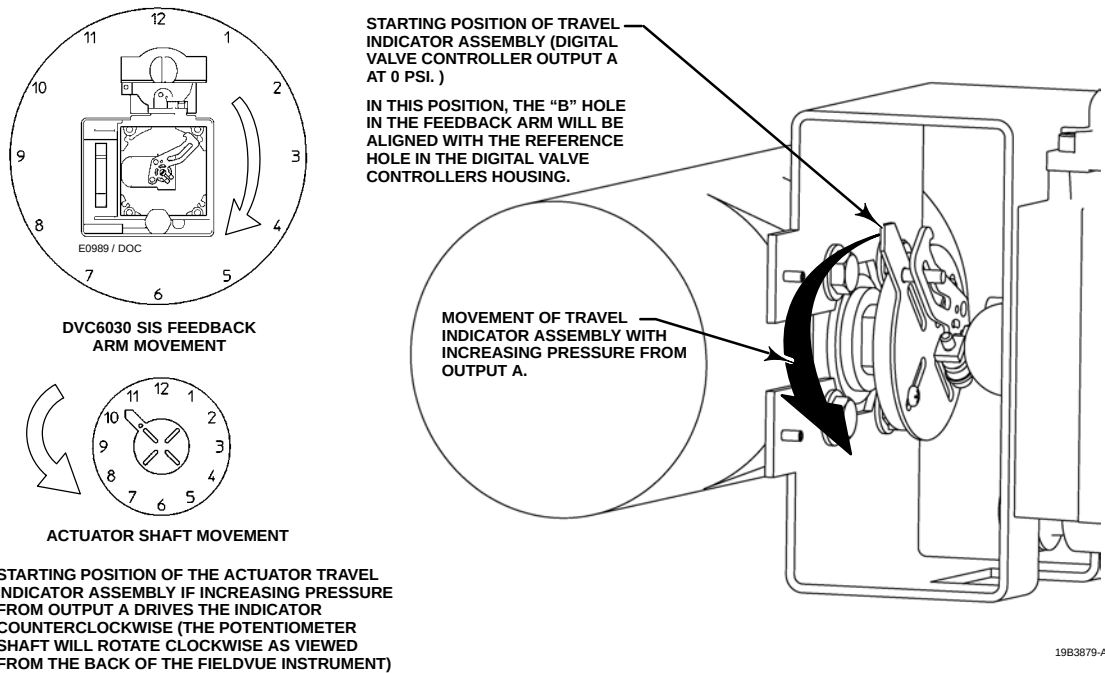


Figure 2-9. Explanation of Travel Indicator Starting Position and Movement, if **Clockwise** Orientation is Selected for "Travel Sensor Motion" in ValveLink Software or the Field Communicator

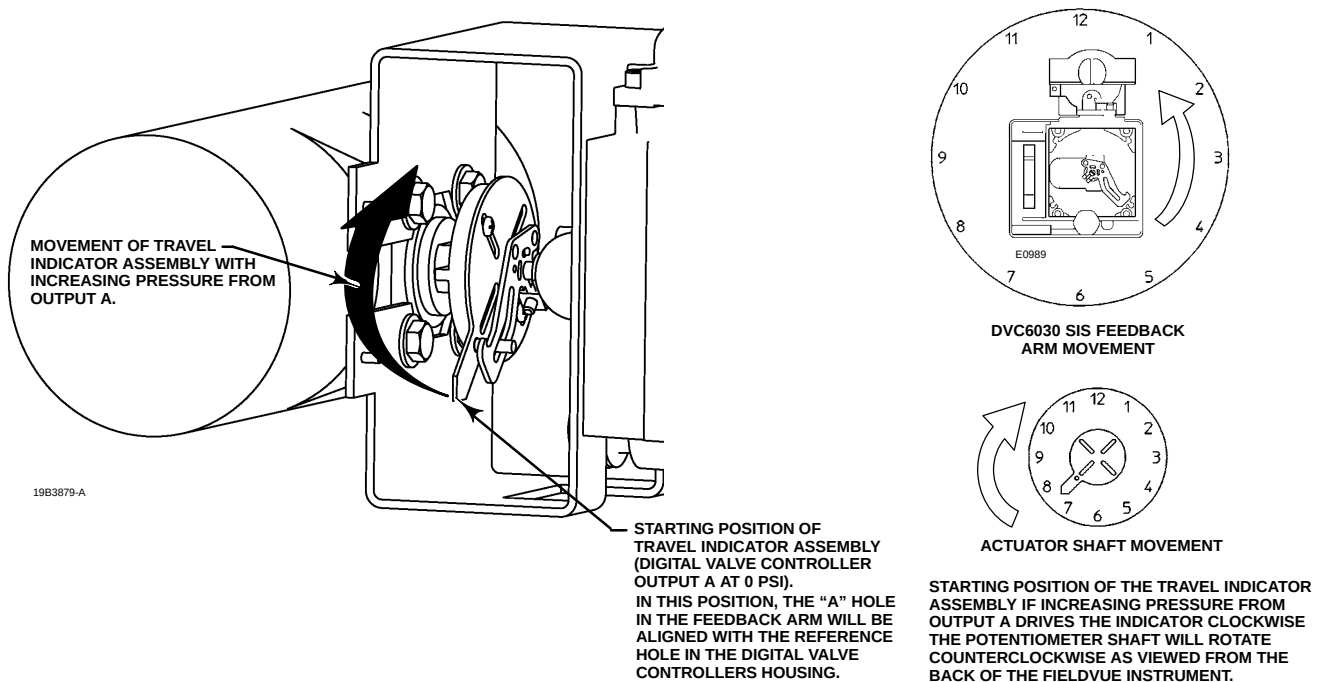


Figure 2-10. Explanation of Travel Indicator Starting Position and Movement if **Counterclockwise** Orientation is Selected for "Travel Sensor Motion" in ValveLink Software or the Field Communicator

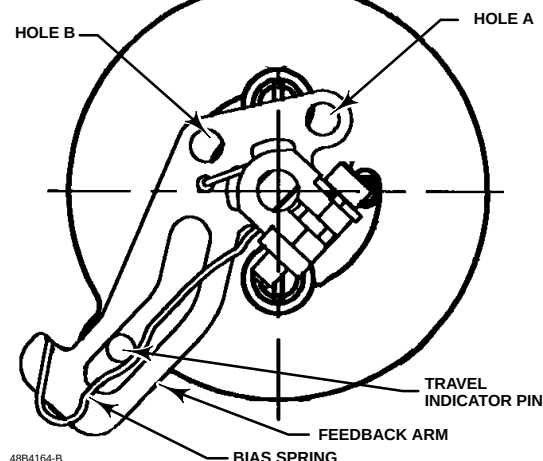


Figure 2-11. Positioning Travel Indicator Pin in the Feedback Arm (Viewed as if Looking from the FIELDVUE DVC6030 SIS toward the Actuator)

## DVC6005 SIS Base Unit

For remote-mounted digital valve controllers, the DVC6005 SIS base unit ships separately from the control valve and does not include tubing, fittings or wiring. See the instructions that come with the mounting kit for detailed information on mounting the base unit to a specific actuator model.

For remote-mounted instruments, mount the DVC6005 SIS base unit on a 50.8 mm (2 inch) pipestand or wall. The included bracket is used for either mounting method.

## Wall Mounting

Refer to figures 2-12 and 2-13. Drill two holes in the wall using the dimensions shown in figure 2-12. Attach the mounting bracket to the base unit using four spacers and 25.4 mm (1-inch) 1/4-20 hex head screws. Attach the base unit to the wall using suitable screws or bolts.

## Pipestand Mounting

Refer to figure 2-13. Position a standoff on the back of the base unit. Using two 101.6 mm (4-inch) 1/4-20 hex head screws loosely attach the base unit to the pipestand with the mounting bracket. Position the second standoff, then using the remaining 101.6 mm (4-inch) hex head screws, securely fasten the base unit to the pipe stand.

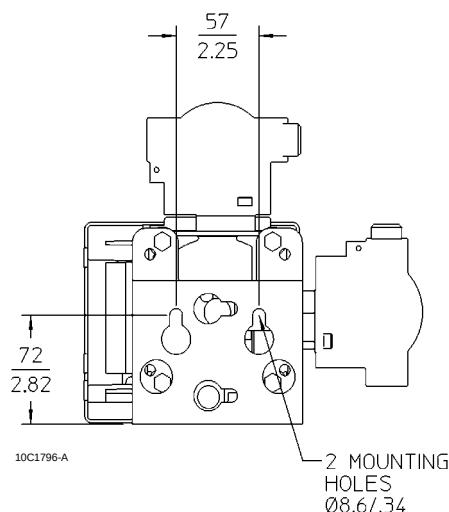


Figure 2-12. FIELDVUE DVC6005 SIS Base Unit with Mounting Bracket (Rear View)

## DVC6015 on Sliding-Stem Actuators Up to 102 mm (4 Inches) of Travel

If ordered as part of a control valve assembly, the factory mounts the remote feedback unit on the actuator, makes pneumatic connections to the actuator, sets up, and calibrates the instrument. If you purchased the remote feedback unit separately, you will need a mounting kit to mount the remote feedback unit on the actuator. See the instructions that come with the mounting kit for detailed information on mounting the remote feedback unit to a specific actuator model.

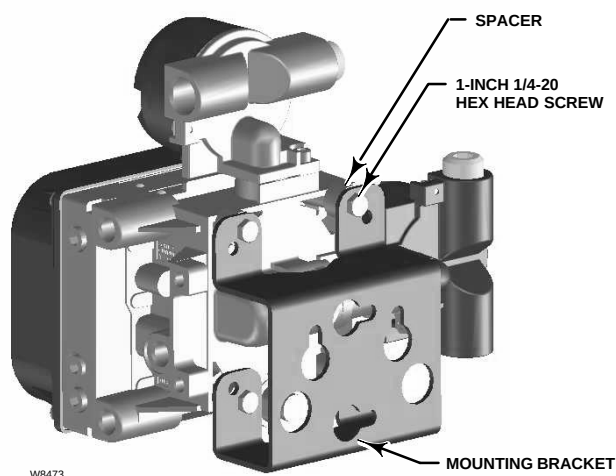


## Note

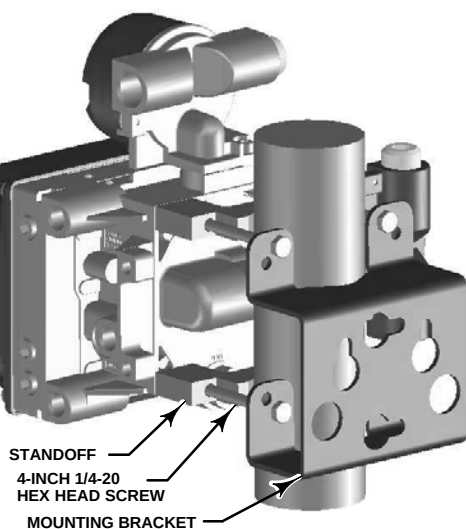
Refer to the DVC6005 SIS Base Unit mounting instructions for off-actuator mounting instructions.

The DVC6015 remote feedback unit mounts on sliding-stem actuators with up to 102 mm (4-inch) travel. Figure 2-1 shows a typical mounting on an actuator with up to 51 mm (2 inch) travel. Figure 2-2 shows a typical mounting on actuators with 51 to 102 mm (2 to 4 inch) travel. For actuators with greater than 102 mm (4 inch) travel, see the guidelines for mounting a DVC6025 remote feedback unit.

2



WALL MOUNTING



PIPESTAND MOUNTING

Figure 2-13. FIELDVUE DVC6005 SIS Base Unit Mounting



## Note

While the housing differs on the DVC6015 and the DVC6010 SIS, feedback parts are the same.

Refer to the following guidelines when mounting on sliding-stem actuators with up to 4 inches of travel. Where a key number is referenced, figure 8-6.

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

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

3. Attach the mounting bracket to the remote feedback unit housing.

4. If valve travel exceeds 2 inches, a feedback arm extension is attached to the existing 2-inch feedback arm. Remove the existing bias spring (key 78) from the 2-inch feedback arm (key 79). Attach the feedback arm extension to the feedback arm (key 79) as shown in figure 2-2.

5. Mount the remote feedback unit on the actuator as described in the mounting kit instructions.

6. Set the position of the feedback arm (key 79) on the remote feedback unit to the no air position by inserting the alignment pin (key 46) through the hole on the feedback arm as follows:

- **For air-to-open actuators** (i.e., the actuator stem retracts into the actuator casing or cylinder as air pressure to the casing or lower cylinder increases), insert the alignment pin into the hole marked "A". For this style actuator, the feedback arm rotates counterclockwise, from A to B, as air pressure to the casing or lower cylinder increases.

- **For air-to-close actuators** (i.e., the actuator stem extends from the actuator casing or cylinder as air pressure to the casing or upper cylinder increases), insert the alignment pin into the hole marked "B". For this style actuator, the feedback arm rotates clockwise, from B to A, as air pressure to the casing or upper cylinder increases.



## Note

When performing the following steps, ensure there is enough clearance between the adjustment arm and the feedback arm to prevent interference with the bias spring.

7. Apply anti-seize (key 64) to the pin of the adjustment arm. As shown in figure 2-3, place the pin into the slot of the feedback arm or feedback arm extension so that the bias spring loads the pin against the side of the arm with the valve travel markings.

8. Install the external lock washer on the adjustment arm. Position the adjustment arm in the slot of the connector arm and loosely install the flanged hex nut.

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 flanged hex nut.
10. Remove the alignment pin (key 46) and store it in the module base next to the I/P assembly.
11. After calibrating the instrument, attach the shield with two machine screws.

## DVC6025 on Long-Stroke (4 to 24 Inch Travel) Sliding-Stem Actuators and Rotary Actuators

If ordered as part of a control valve assembly, the factory mounts the remote feedback unit on the actuator, makes pneumatic connections to the actuator, sets up, and calibrates the instrument. If you purchased the remote feedback unit separately, you will need a mounting kit to mount the remote feedback unit on the actuator. See the instructions that come with the mounting kit for detailed information on mounting the remote feedback unit to a specific actuator model.



### Note

Refer to the DVC6005 SIS Base Unit mounting instructions on page 2-13 for off-actuator mounting instructions.

DVC6025 remote feedback units use a cam and roller as the feedback mechanism. Figure 2-4 shows an example of mounting on sliding-stem actuators with travels from 4 inches to 24 inches. Some long-stroke applications will require an actuator with a tapped lower yoke boss. Figures 2-5 and 2-6 show examples of mounting on rotary actuators.



### Note

While the housing differs on the DVC6025 and the DVC6020 SIS, feedback parts are the same.

As shown in figure 2-5, two feedback arms are available for the remote feedback unit. Most long-stroke sliding-stem and rotary actuator installations use the long feedback arm [62 mm (2.45 inches) from roller to pivot point]. Installations on 1051 size 33 and 1052 size 20 and 33 actuators use the

short feedback arm [54 mm (2.13 inches) from roller to pivot point]. Make sure the correct feedback arm is installed on the remote feedback unit before beginning the mounting procedure.

Refer to figures 2-4, 2-5, and 2-6 for parts locations. Refer to the following guidelines when mounting on sliding-stem actuators with 4 to 24 inches of travel or on rotary actuators:

1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. 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 a cam is not already installed on the actuator, install the cam as described in the instructions included with the mounting kit. For sliding-stem actuators, the cam is installed on the stem connector.
3. If a mounting plate is required, fasten the mounting plate to the actuator.
4. For applications that require remote venting, a pipe-away bracket kit is available. Follow the instructions included with the kit to replace the existing mounting bracket on the remote feedback unit with the pipe-away bracket and to transfer the feedback parts from the existing mounting bracket to the pipe-away bracket.
5. Larger size actuators may require a follower arm extension, as shown in figure 2-6. If required, the follower arm extension is included in the mounting kit. Follow the instructions included with the mounting kit to install the follower arm extension.
6. Apply anti-seize (key 64) to the pin of the adjustment arm as shown in figure 2-7.
7. Mount the DVC6025 on the actuator as follows:
  - If required, a mounting adaptor is included in the mounting kit. Attach the adaptor to the actuator as shown in figure 2-5. Then attach the remote feedback unit assembly to the adaptor. The roller on the remote feedback unit feedback arm will contact the actuator cam as it is being attached.
  - If no mounting adaptor is required, attach the remote feedback unit assembly to the actuator or mounting plate. The roller on the remote feedback unit feedback arm will contact the actuator cam as it is being attached.
8. For long-stroke sliding-stem actuators, after the mounting is complete, check to be sure the roller aligns with the position mark on the cam (see figure 2-4). If necessary, reposition the cam to attain alignment.

## DVC6035 on Quarter-Turn Actuators

If ordered as part of a control valve assembly, the factory mounts the remote feedback unit on the actuator, makes pneumatic connections to the actuator, sets up, and calibrates the instrument. If you purchased the remote feedback unit separately, you will need a mounting kit to mount the remote feedback unit on the actuator. See the instructions that come with the mounting kit for detailed information on mounting the remote feedback unit to a specific actuator model.

2



### Note

Refer to the DVC6005 SIS Base Unit mounting instructions on page 2-13 for off-actuator mounting instructions.

Figure 2-8 shows an example of mounting on a quarter-turn actuator. Refer to figure 2-8 for parts locations. Refer to the following guidelines when mounting on quarter-turn actuators:



### Note

While the housing differs on the DVC6035 and the DVC6030 SIS, feedback parts are the same.

1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. 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, remove the existing hub from the actuator shaft.
3. If a positioner plate is required, attach the positioner plate to the actuator as described in the mounting kit instructions.

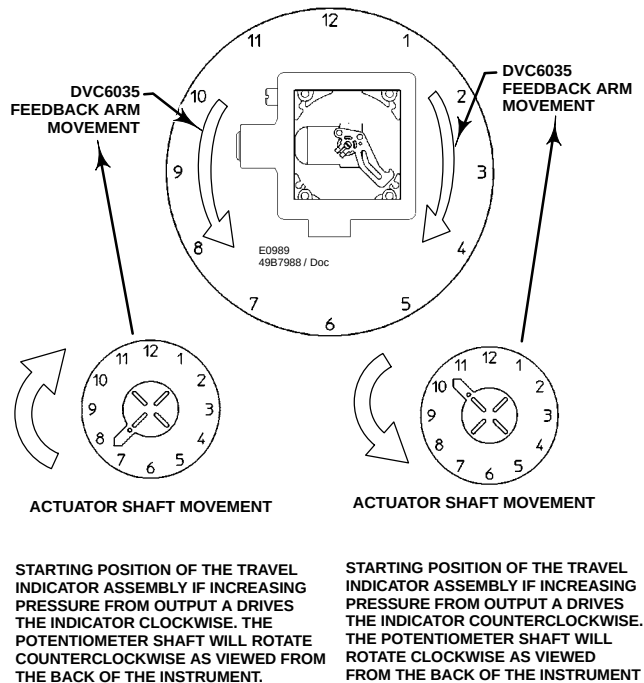


Figure 2-14. FIELDVUE DVC6035 Travel Indicator Installation

4. If required, attach the spacer to the actuator shaft.

Refer to figure 2-14. The travel indicator assembly can have a starting position of 7:30 or 10:30. Determine the desired starting position then proceed with the next step. Considering the top of the remote travel sensor as the 12 o'clock position, in the next step attach the travel indicator, so that the pin is positioned as follows:

- If increasing pressure from the base unit output A rotates the remote feedback units potentiometer shaft counterclockwise (as viewed from the back of the instrument), mount the travel indicator assembly such that the arrow is in the 7:30 position, as shown in figures 2-10 and 2-14.
- If increasing pressure from the base unit output A rotates the remote feedback units potentiometer shaft clockwise (as viewed from the back of the instrument), mount the travel indicator assembly such that the arrow is in the 10:30 position, as shown in figures 2-9 and 2-14.

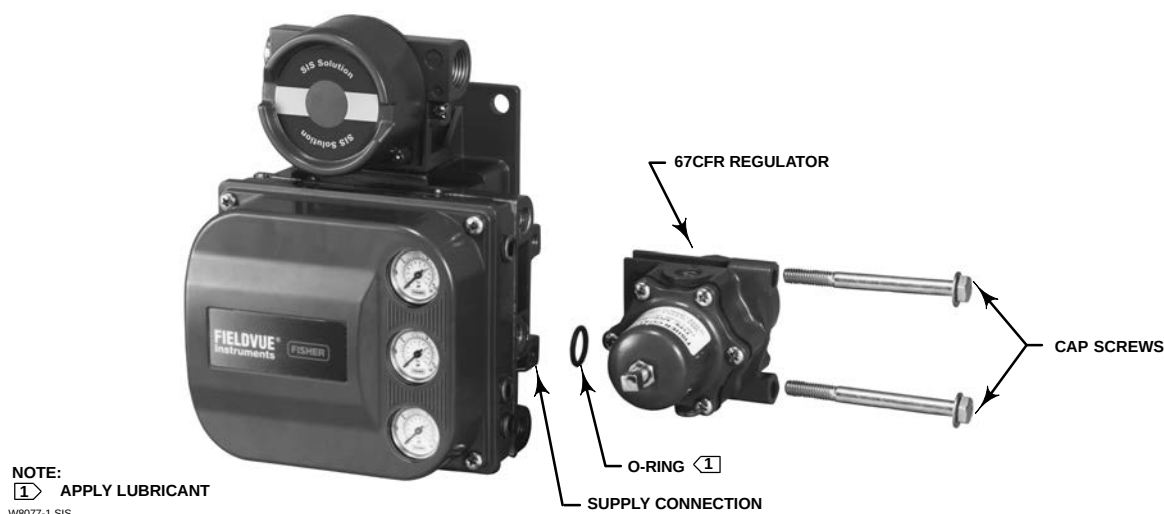


Figure 2-15. Mounting the Fisher 67CFR Regulator on a FIELDVUE DVC6000 SIS Digital Valve Controller



## Note

ValveLink software and the Field Communicator use the convention of clockwise (figure 2-9) and counterclockwise (figure 2-10) when viewing the potentiometer shaft from the back of the FIELDVUE instrument.

5. Attach the travel indicator, to the shaft connector or spacer as described in the mounting kit instructions.
6. Attach the mounting bracket to the remote feedback unit.
7. Position the remote feedback unit so that the pin on the travel indicator engages the slot in the feedback arm and the bias spring loads the pin as shown in figure 2-11. Attach the remote feedback unit to the actuator or positioner plate.
8. If a travel indicator scale is included in the mounting kit, attach the scale as described in the mounting kit instructions.

## 67CFR Filter Regulator

A 67CFR filter regulator, when used with the DVC6000 SIS digital valve controllers, can be mounted three ways.

### Integral-Mounted Regulator

Refer to figure 2-15. Lubricate an O-ring and insert it in the recess around the SUPPLY connection on the digital valve controller. Attach the 67CFR filter regulator to the side of the digital valve controller. Thread a 1/4-inch socket-head pipe plug into the unused outlet on the filter regulator. This is the standard method of mounting the filter regulator.

### Yoke-Mounted Regulator

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

### Casing-Mounted Regulator

Use the separate 67CFR filter regulator casing mounting bracket provided with the filter regulator. Attach the mounting bracket to the 67CFR and then attach this assembly to the actuator casing. Thread a 1/4-inch socket-head pipe plug into the unused outlet on the filter regulator. The O-ring is not required.

# DVC6000 SIS

## Pressure Connections

### WARNING

Refer to the Installation WARNING at the beginning of this section.

2

Pressure connections are shown in figure 2-16. All pressure connections on the digital valve controller are 1/4 NPT internal connections. Use at least 10 mm (3/8-inch) tubing for all pneumatic connections. If remote venting is required, refer to the vent subsection.

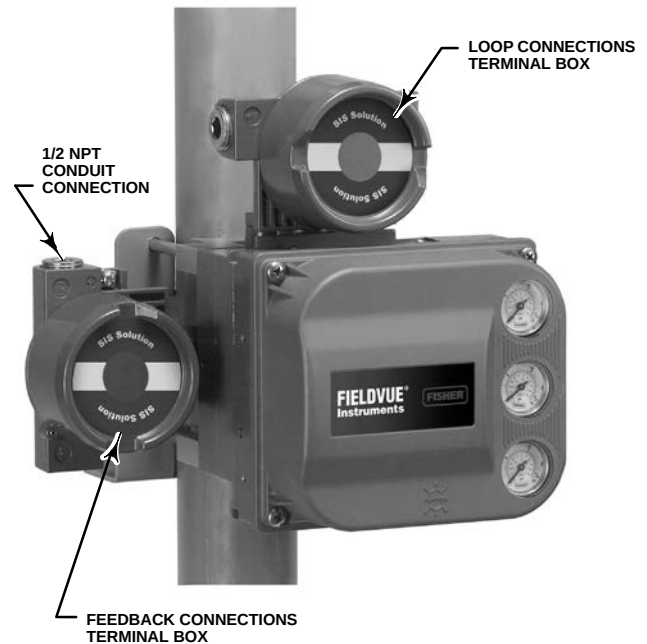
## Supply Connections

### WARNING

To avoid personal injury and property damage resulting from bursting of parts, do not exceed maximum supply pressure.

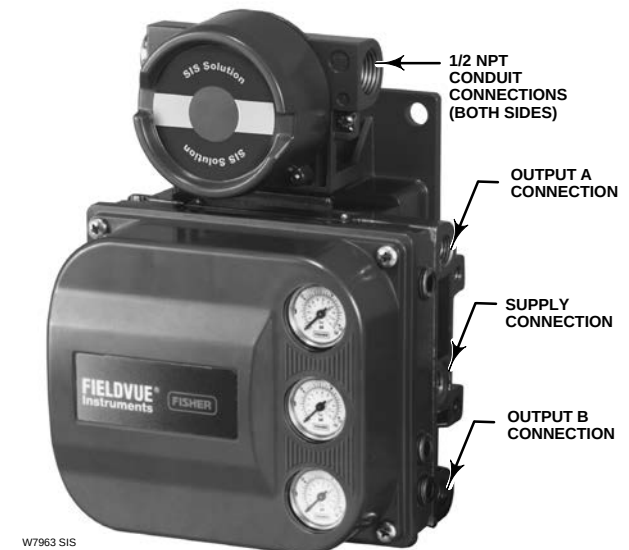
Personal injury or property damage may result from fire or explosion if natural gas is used as the supply medium and appropriate preventive measures are not taken. Preventive measures may include, but are not limited to, one or more of the following: Remote venting of the unit, re-evaluating the hazardous area classification, ensuring adequate ventilation, and the removal of any ignition sources. For information on remote venting of this controller, refer to page 2-22.

Severe personal injury or property damage may occur from an uncontrolled process if the instrument supply medium is not clean, dry, oil-free, and noncorrosive. While use and regular maintenance of a filter that removes particles larger than 40 micrometers in diameter will suffice in most applications, check with an Emerson Process Management field office and industry instrument air quality standards for use with corrosive air or if you are unsure about the amount of air filtration or filter maintenance.



W8371-1 SIS

DVC6005 SIS BASE UNIT



W7963 SIS

NOTE:  
PNEUMATIC CONNECTIONS APPLICABLE TO BOTH VALVE-MOUNTED INSTRUMENTS AND DVC6005 SIS BASE UNIT.

Figure 2-16. FIELDVUE DVC6000 SIS Digital Valve Controller Connections



## WARNING

When using natural gas as the supply medium, or for explosion proof applications, the following warnings also apply:

- Remove electrical power before removing the housing cap. Personal injury or property damage from fire or explosion may result if power is not disconnected before removing the cap.
- Remove electrical power before disconnecting any of the pneumatic connections.
- When disconnecting any of the pneumatic connections or any pressure retaining part, natural gas will seep from the unit and any connected equipment into the surrounding atmosphere. Personal injury or property damage may result from fire or explosion if natural gas is used as the supply medium and appropriate preventive measures are not taken. Preventive measures may include, but are not limited to, one or more of the following: Remote venting of the unit, re-evaluating the hazardous area classification, ensuring adequate ventilation, and the removal of any ignition sources. For information on remote venting of this controller, refer to page 2-22.
- Ensure that all caps and covers are correctly installed before putting this unit back into service. Failure to do so could result in personal injury or property damage from fire or explosion.

The DVC6000 SIS can be used with air or natural gas as the supply medium. If using natural gas as the pneumatic supply medium, natural gas will be used in the pneumatic output connections of the DVC6000 SIS to any connected equipment. In normal operation the unit will vent the supply medium into the surrounding atmosphere unless it is remotely vented.

Gas Certified, Single Seal instruments can be identified by the natural gas approval label shown in figure 2-17. The Natural Gas Certified, Single Seal device option simplifies conduit sealing requirements. Read and follow all local, regional, and federal wiring requirements for natural gas installations. Contact your

Emerson Process Management sales office for information on obtaining a Natural Gas Certified, Single Seal DVC6000 SIS digital valve controller.

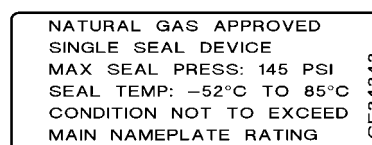
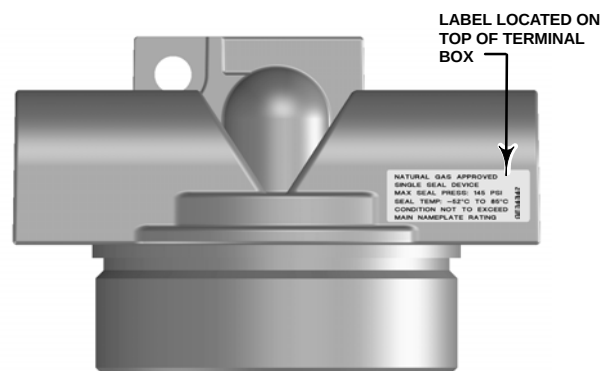


Figure 2-17. Gas Certified Label

Supply pressure must be clean, dry air that meets the requirements of ISA Standard 7.0.01.

Alternatively, natural gas must be clean, dry, oil-free, and noncorrosive. H<sub>2</sub>S content should not exceed 20 ppm.

Filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimized.

For additional information on air quality refer to the appropriate safety manual:

- Safety Manual for FIELDVUE DVC6000 SIS Digital Valve Controllers for Safety Instrumented System (SIS) Solutions 0–20 mA or 0–24 VDC (D103035X012) **or**

- Safety Manual for FIELDVUE DVC6000 SIS Digital Valve Controllers for Safety Instrumented System (SIS) Solutions 4–20 mA (D103294X012)

A 67CFR filter regulator with standard 5 micrometer filter, 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 gauges can be used as an aid for calibration.

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

## 2

### Output Connections

A factory mounted digital valve controller has its output piped to the pneumatic input connection on the actuator. If mounting the digital valve controller in the field, connect the 1/4 NPT digital valve controller output connections to the pneumatic actuator input connections.

### Single-Acting Actuators

When using a single-acting direct digital valve controller (relay A or C) on a single-acting actuator always connect OUTPUT A to the actuator pneumatic input. Only when using relay C in the special application (i.e. solenoid health monitoring) do you need to connect OUTPUT B to the monitoring line.

When using a single-acting reverse digital valve controller (relay B) on a single-acting actuator always connect OUTPUT B to the actuator pneumatic input. Only when using relay type B in the special application (i.e. solenoid health monitoring) do you need to connect OUTPUT A to the monitoring line.

### Double-Acting Actuators

DVC6000 SIS digital valve controllers on double-acting actuators always use relay A. When the relay adjustment disc is properly set, OUTPUT A will vent to the atmosphere and OUTPUT B will fill to supply pressure when power is removed from the positioner.

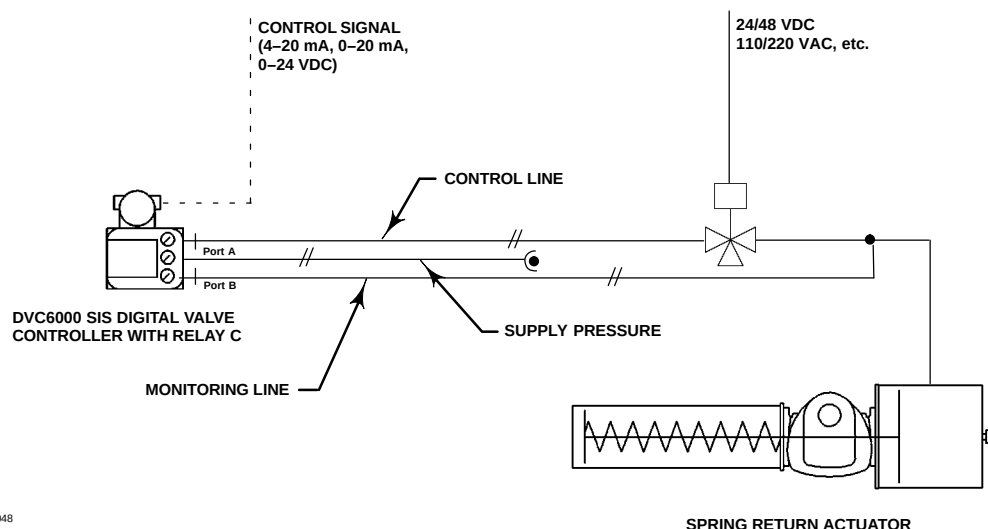


W9131-1 SIS

*Figure 2-18. FIELDVUE DVC6010 SIS Mounted on a Fisher 585C Piston Actuator*

For example, to have the actuator stem extend from the cylinder with increasing input current on a vertically mounted sliding-stem valve with a piston actuator, connect OUTPUT A to the upper actuator cylinder connection and connect OUTPUT B to the lower cylinder connection. Figure 2-18 shows a digital valve controller connected to a double-acting piston actuator that will extend the stem with increasing input current.

To have the actuator stem retract into the cylinder with increasing input current, connect OUTPUT A to the lower cylinder connection and OUTPUT B to the upper cylinder connection.



E1048

Figure 2-19. Pneumatic Hookup for Solenoid Testing

## Special Construction to Support Logic Solver Initiated Solenoid Valve Health Monitoring

In single-acting actuator applications with a solenoid valve installed, the DVC6000 SIS can be configured to monitor the health of the solenoid valve test, which is initiated by the Logic Solver. This is accomplished by connecting the unused output port B from the DVC6000 SIS to the pneumatic monitoring line between the solenoid valve and the actuator, as shown in figure 2-19. When single-acting, direct relay C is installed, the “unused” output port is port B. When single-acting, reverse relay B is used, the unused port is port A.



## Note

This application is called “special application” in the Setup Wizard relay selection.

This configuration is not possible with a double-acting actuator or when using relay A in single-acting mode.

## Vent

### WARNING

Personal injury or property damage can occur from cover failure due to overpressure. Ensure that the housing vent opening is open and free of debris to prevent pressure buildup under the cover.

### WARNING

This unit vents the supply medium into the surrounding atmosphere. When installing this unit in a non-hazardous (non-classified) location in a confined area, with natural gas as the supply medium, you must remotely vent this unit to a safe location. Failure to do so could result in personal injury or property damage from fire or explosion, and area re-classification.

When installing this unit in a hazardous (classified) location remote venting of the unit may be required, depending upon the area classification, and as specified by the requirements of local, regional, and national codes, rules and regulations. Failure to do so when necessary could result in personal injury or property damage from fire or explosion, and area re-classification.

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 reduce case pressure buildup.

In addition to remote venting of the unit, ensure that all caps and covers are correctly installed. Failure to do so could result in personal injury or property damage from fire or explosion, and area re-classification.

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 DVC6010 SIS and DVC6030 SIS digital valve controllers and DVC6005 SIS base unit**— remove the plastic vent (key 52, figure 8-1). The vent connection is 3/8 NPT internal. At a minimum, 12.7 mm (1/2-inch) tubing should be used when installing a remote vent to prevent excessive pressure from building up under the cover.

**To connect a remote vent to DVC6020 SIS digital valve controllers**— Replace the standard mounting bracket (key 74, figure 8-2) with the vent-away bracket (key 74). Install a pipe plug 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. The vent connection is 3/8 NPT internal. At a minimum, 12.7 mm (1/2-inch) tubing should be used when installing a remote vent to prevent excessive pressure from building up under the cover.

## Electrical Connections

### WARNING

To avoid personal injury resulting from electrical shock, do not exceed the maximum input voltage specified in table 1-2 of this instruction manual, or on the product nameplate. If the input voltage specified differs, do not exceed the lowest specified maximum input voltage.

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

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

**Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion.**

The valve may move in an unexpected direction when power is applied to the DVC6000 SIS digital valve controller. To avoid personal injury and property damage caused by moving parts, keep hands, tools, and other objects away from the valve/actuator assembly when applying power to the instrument.



## WARNING

To avoid personal injury or property damage caused by fire or explosion, remove power to the instrument before removing the terminal box cover in an area which contains a potentially explosive atmosphere or has been classified as hazardous.

### 4-20 mA Loop Connections

The digital valve controller is normally powered by a control system output card. The use of shielded cable will ensure proper operation in electrically noisy environments.



## WARNING

To avoid personal injury or property damage from the sudden release of process pressure, be sure the valve is not controlling the process. The valve may move when the source is applied.

Wire the digital valve controller as follows: (unless indicated otherwise, refer to figures 8-1 through 8-3 for identification of parts).

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. Refer to figure 2-20. Connect the control system output card positive wire "current output" to the LOOP + screw terminal in the terminal box. Connect the control system output card negative (or return) wire to the LOOP – screw terminal.



## WARNING

2

Personal injury or property damage, caused by fire or explosion, can result from the discharge of static electricity. Connect a 14 AWG (2.08 mm<sup>2</sup>) 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 when flammable gases or dust are present, do not rub or clean the cover with solvents. To do so could result in a spark that may cause the flammable gases or dust to explode, resulting in personal injury or property damage. Clean with a mild detergent and water only.

4. As shown in figure 2-20, two ground terminals are available for connecting a safety ground, earth ground, or drain wire. These ground terminals are electrically identical. Make connections to these terminals following national and local codes and plant standards.

5. Replace and hand tighten the terminal box cap. When the loop is ready for startup, apply power to the control system output card.



## Note

When the DVC6000 SIS is operating under normal conditions at 4 mA (trip condition is 20 mA) be sure to apply no less than 4 mA.

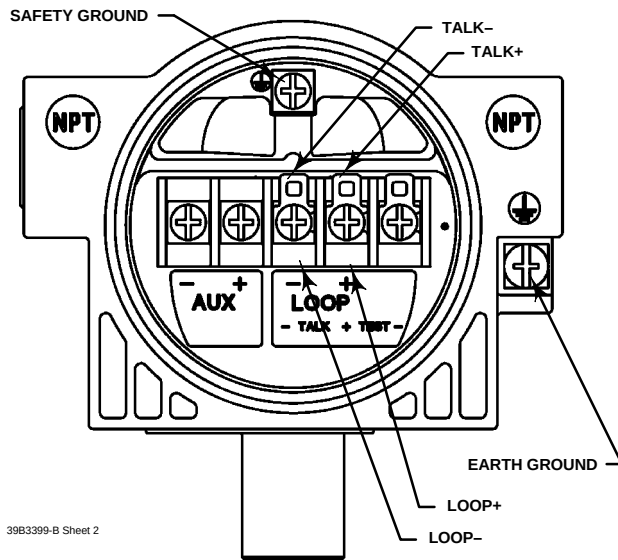


Figure 2-20. FIELDVUE DVC6000 SIS Digital Valve Controller Terminal Box

## Remote Travel Sensor Connections

The DVC6005 SIS base unit is designed to receive travel information via a remote sensor. The remote sensor can be any of the following:

- Emerson Process Management supplied DVC6015, DVC6025 or DVC6035 feedback unit,

- An under-traveled 10 kOhm potentiometer used in conjunction with onboard 30 kOhm resistor, or
- A potentiometer used in conjunction with two fixed resistors (potentiometer travel is the same as actuator travel).



## WARNING

Personal injury or property damage, caused by wiring failure, can result if the feedback wiring connecting the base unit with the remote feedback unit shares a conduit with any other power or signal wiring.

Do not place feedback wiring in the same conduit as other power or signal wiring.



## Note

3-conductor shielded cable, 22 AWG minimum wire size, is required for connection between base unit and feedback unit. Pneumatic tubing between base unit output connection and actuator has been tested to 15 meters (50 feet) maximum without performance degradation.

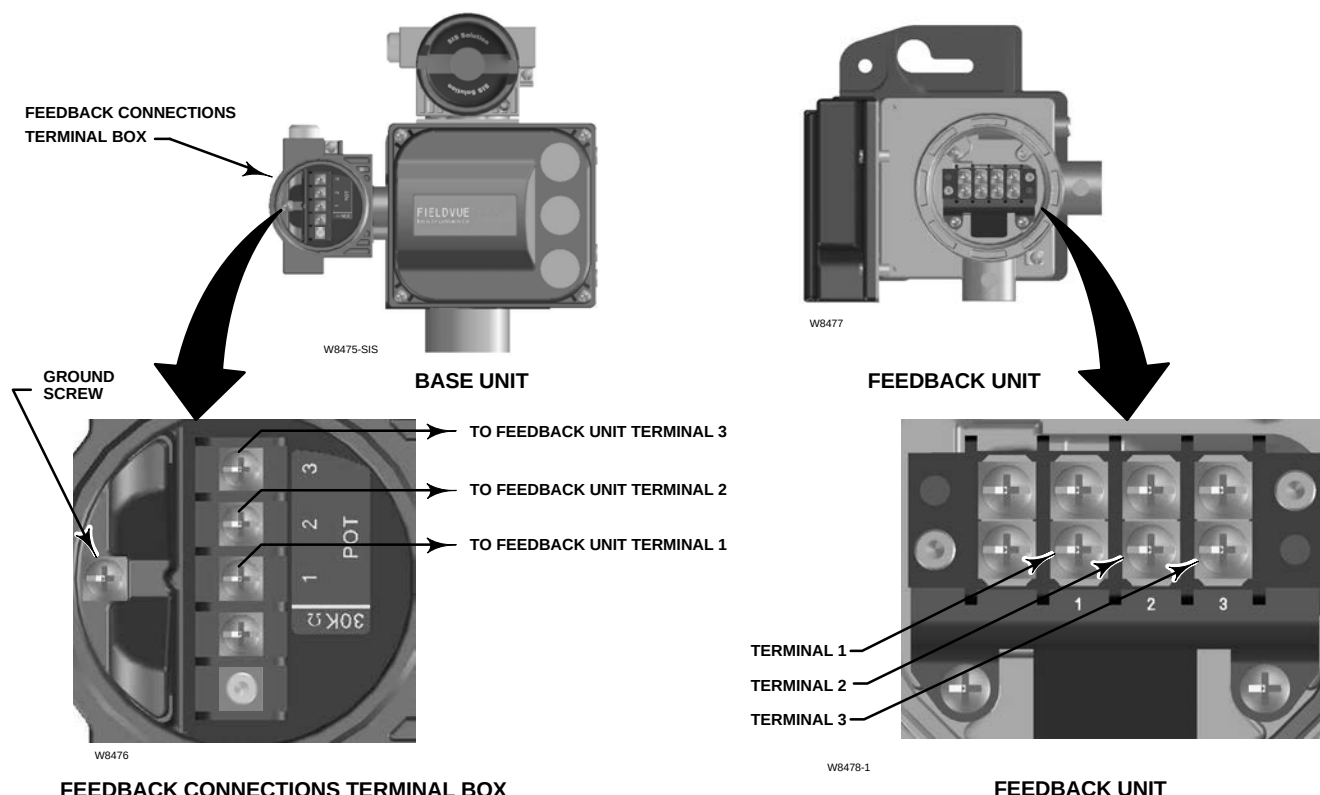


Figure 2-21. Terminal Details for Connecting Base Unit and Feedback Units of Remote-Mounted Digital Valve Controllers

## Using the DVC6015, DVC6025 & DVC6035 Feedback Unit as a Remote Travel Sensor

1. On the feedback unit, remove the housing cap.
2. On the base unit, remove the feedback connections terminal box cap (see figure 2-16).
3. If necessary, install conduit between the feedback unit and the base unit following applicable local and national electrical codes. Route the 3-conductor shielded cable between the two units (refer to figure 2-21).
4. Connect one wire of the 3-conductor shielded cable between terminal 1 on the feedback unit and terminal 1 on the base unit.
5. Connect the second wire of the 3-conductor shielded cable between terminal 2 on the feedback unit and terminal 2 on the base unit.

6. Connect the third wire of the 3-conductor shielded cable between terminal 3 on the feedback unit and terminal 3 on the base unit.
7. Connect the cable shield or drain wire to the ground screw in the feedback connections terminal box of the base unit.



## Note

**Do not connect the shield or drain wire to any terminal on the feedback unit, to the earth ground, or any other alternative ground.**

8. Replace and hand tighten all covers.

## Using an External 10 kOhm External Potentiometer as a Remote Travel Sensor



### Note

Potentiometer travel must be between 1.3 and 1.6 times greater than the actuator travel. For example: if an actuator has a travel of 9 inches, then a linear potentiometer must be selected with a rated travel between 11.7 and 14.4 inches. The resistive element must be tapered from 0 kOhm to 10 kOhm over rated travel of the potentiometer. The actuator will only use 63 to 76 % of the potentiometer rated travel.



### Note

The digital valve controller must be configured using the SStem/Roller selection on the menu of the appropriate setup device.

The base unit (DVC6005 SIS) was designed to work with a 40 kOhm potentiometer for travel feedback. However, there are linear potentiometers that are readily available with a rated resistance of 10 kOhm. Therefore, the feedback terminal box of the DVC6005 SIS contains an additional 30 kOhm fixed resistor that may be added to the circuit. This brings the total resistance up to the required 40 kOhm.

1. Mount the external 10 kOhm potentiometer to the actuator such that the mid-travel position of the potentiometer (5 kOhm) corresponds to the mid-travel position of the actuator. This will leave an equal amount of unused resistive element on both ends of the travel, which is required by the digital valve controller to function properly.
2. On the base unit, remove the feedback connections terminal box cap (see figure 2-16).
3. If necessary, install conduit between the potentiometer and the base unit following applicable local and national electrical codes. Route the 3-conductor shielded cable between the two units (refer to figure 2-22).

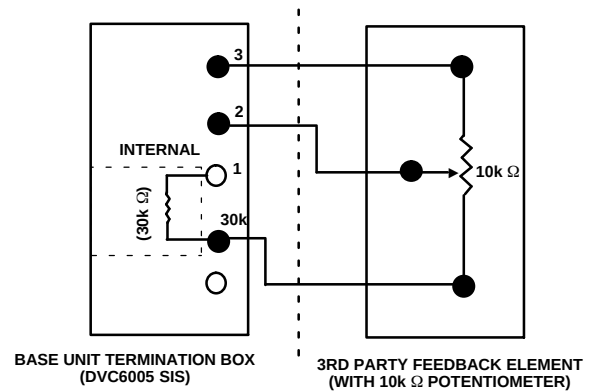


Figure 2-22. Terminal Details for Connecting a FIELDVUE DVC6005 SIS Base Unit and a 10k Ohm External Potentiometer

4. Connect one wire of the 3-conductor shielded cable between the Terminal labeled "30k $\Omega$ " on the base unit and one end lead of the potentiometer.
5. Connect the second wire of the 3-conductor shielded cable between the middle lead (wiper) of the 10 kOhm potentiometer to Terminal 2 on the base unit.
6. Connect the third wire of the 3-conductor shielded cable between Terminal 3 on the base unit and the other end-lead of the 10 kOhm potentiometer.
7. Connect the cable shield or drain wire to the ground screw in the feedback connections terminal box of the base unit. Do not connect the shield or drain wire to the external potentiometer.
8. Replace and tighten the base unit cover.

## Using a Potentiometer with Two Fixed Resistors as a Remote Travel Sensor

Perform the following procedure if a potentiometer is used with the same, or slightly longer travel than the actuator's travel.



### Note

The potentiometer must be capable of resistance close to 0 Ohms.

### CAUTION

To prevent damage to the potentiometer, ensure that it is free to travel the entire length of the actuator's travel.



## Note

The digital valve controller must be configured using the SStem/Roller selection on the menu of the appropriate setup device.

This procedure uses three resistors connected in series, two fixed resistors and one potentiometer. Three conditions must be met for the resistor combination to correctly operate the digital valve controller:

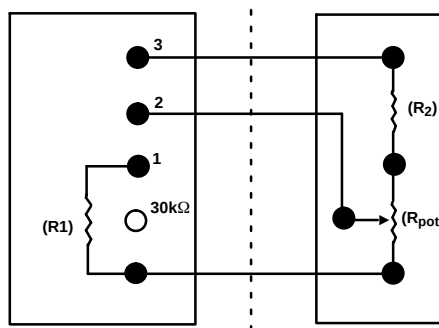
- The maximum resistance of the potentiometer ( $R_{pot(max)}$ ) must be between 3.9 kOhm and 10 kOhm.
- The resistance of  $R_1$  is 4.25 times greater than  $R_{pot(max)}$ .
- The resistance of  $R_2$  is 4 times less than  $R_{pot(max)}$ .



## WARNING

To avoid personal injury or property damage from an uncontrolled process ensure that the R1 resistor is properly insulated before installing it in the terminal box.

1. On the base unit, remove the feedback connections terminal box cap (see figure 2-16).
2. If necessary, install conduit between the two-resistor series and the base unit following applicable local and national electrical codes. Route the 3-conductor shielded cable between the two units (refer to figure 2-23).
3. Install the fixed resistor ( $R_1$ ) across the unlabeled bottom Terminal and Terminal #1. The bottom terminal does not have a screw. The screw on the 30 kOhm terminal can be used.  $R_1$  must be properly insulated when installed in the terminal box to prevent personal injury or property damage.



BASE UNIT TERMINATION BOX  
(DVC6005 SIS)

THREE-RESISTOR SERIES

Figure 2-23. Terminal Details for Connecting a FIELDVUE DVC6005 SIS Base Unit and a Three-Resistor Series

4. Connect one wire of the 3-conductor shielded cable between the unlabeled bottom Terminal on the base unit and an end-lead of the external potentiometer ( $R_{pot}$ ).
5. Connect the second wire of the 3-conductor shielded cable between the middle lead (wiper) of the external potentiometer ( $R_{pot}$ ) and Terminal 2 on the base unit.
6. Connect the third wire of the 3-conductor shielded cable between a lead on fixed resistor ( $R_2$ ) and terminal #3 of the base unit.
7. Connect the available end-lead on the potentiometer ( $R_{pot}$ ) with the available lead on fixed resistor ( $R_2$ ).
8. Connect the cable shield or drain wire to the ground screw in the feedback connections terminal box of the base unit. Do not connect the shield or drain wire to the two-resistor series.
9. Replace and tighten the base unit cover.

**Example: Using a linear potentiometer rated at 400 Ohms/inch on an actuator with 16" of travel.**

- $R_{pot(max)}$  is  $400 \text{ Ohms/in} \times 16" = 6.4 \text{ kOhm}$
- $R_1 = 6.4 \text{ kOhm} \times 4.25 = 27.2 \text{ kOhm}$
- $R_2 = 6.4 \text{ kOhm} / 4 = 1.6 \text{ kOhm}$

## Test Connections



### WARNING

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

2

Test connections inside the terminal box can be used to measure loop current 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 Loop current as:

Voltage (on test meter)  $\times$  1000 = milliamps

example:

Test meter Voltage  $\times$  1000 = Loop Milliamps

0.004  $\times$  1000 = 4.0 milliamperes

0.020  $\times$  1000 = 20.0 milliamperes

5. Remove 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 a potentially explosive atmosphere or in an area that has been classified as hazardous. Confirm that area classification and atmosphere conditions permit the safe removal of the terminal box cap before proceeding.**

A HART communicating device, such as a Field Communicator or a personal computer running

ValveLink software communicating through a HART modem, interfaces with the DVC6000 SIS digital valve controller from any wiring termination point in the 4–20 mA loop. If you choose to connect the HART communicating device directly to the instrument, attach the device to the LOOP + and LOOP – terminals or to the TALK + and TALK – connections inside the terminal box to provide local communications with the instrument.

## Wiring Practices

### Logic Solver or Control System Requirements

There are several parameters that should be checked to ensure the Logic Solver or control system are compatible with the DVC6000 SIS digital valve controller.

### *Voltage Available (In a Milliamp Current Loop, Point-to-Point Mode Only)*

The voltage available at the DVC6000 SIS digital valve controller must be at least 11 VDC. The voltage available at the instrument is not the actual voltage measured at the instrument when the instrument is connected. The voltage measured at the instrument is limited by the instrument and is typically less than the voltage available.

As shown in figure 2-24, the voltage available at the instrument depends upon:

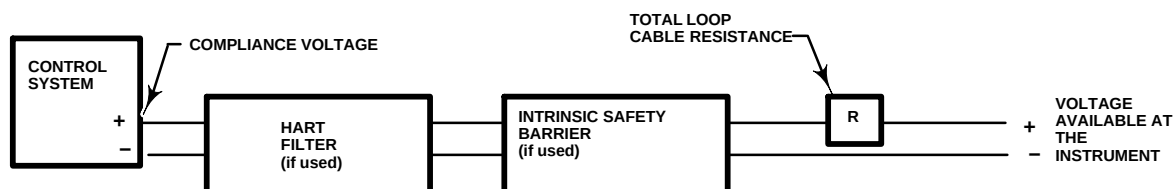
- the control system compliance voltage
- if a filter or intrinsic safety barrier is used, and
- the wire type and length.

The control system compliance voltage is the maximum voltage at the control system output terminals at which the control system can produce maximum loop current.

The voltage available at the instrument may be calculated from the following equation:

Voltage Available = [Control System Compliance Voltage (at maximum current)] – [filter voltage drop (if a HART filter is used)] – [total cable resistance  $\times$  maximum current] – [barrier resistance  $\times$  maximum current].

The calculated voltage available should be greater than or equal to 11 VDC.



## Calculate Voltage Available at the Instrument as follows:

Control system compliance voltage

- Filter voltage drop (if used) 1
- Intrinsic safety barrier resistance (if used) x maximum loop current
- Total loop cable resistance x maximum loop current
- = Voltage available at the instrument 2

## Example Calculation

- 18.5 volts (at 21.05 mA)
- 2.3 volts (for HF300 filter)
- 2.55 volts (121 ohms x 0.02105 amps)
- 1.01 volts (48 ohms x 0.02105 amps for 1000 feet of Belden 9501 cable)
- = 15.19 volts available—if safety barrier (2.55 volts) is not used

## NOTES:

- 1 Obtain filter voltage drop. The measured drop will be different than this value. The measured filter voltage drop depends upon control system output voltage, the intrinsic safety barrier (if used), and the instrument. See note 3.
- 2 The voltage available at the instrument is not the voltage measured at the instrument terminals. Once the instrument is connected, the instrument limits the measured voltage to approximately 9.0 to 10.5 volts.

Figure 2-24. Determining Voltage Available at the Instrument (Point-to-Point Mode Only)

Table 2-1 lists the resistance of some typical cables.

The following example shows how to calculate the voltage available for a Honeywell™ TDC2000 control system with a HF340 HART filter, and 1000 feet of Belden™ 9501 cable:

Voltage available = [18.5 volts (at 21.05 mA)] - [2.3 volts] - [48 ohms × 0.02105 amps]

Voltage available = [18.5] - [2.3] - [1.01]

Voltage available = 15.19 volts

## Compliance Voltage

If the compliance voltage of the control system is not known, perform the following compliance voltage test.

1. Disconnect the field wiring from the control system and connect equipment as shown in figure 2-25 to the control system terminals.
2. Set the control system to provide maximum output current.
3. Increase the resistance of the 1 KΩ potentiometer, shown in figure 2-25, until the current observed on the milliammeter begins to drop quickly.

4. Record the voltage shown on the voltmeter. This is the control system compliance voltage.

For specific parameter information relating to your control system, contact your Emerson Process Management sales office.

## Maximum Cable Capacitance

The maximum cable length for HART communication is limited by the characteristic capacitance of the cable. Maximum length due to capacitance can be calculated using the following formulas:

$$\text{Length(ft)} = [160,000 - C_{\text{master}}(\text{pF})] \div [C_{\text{cable}}(\text{pF/ft})]$$

$$\text{Length(m)} = [160,000 - C_{\text{master}}(\text{pF})] \div [C_{\text{cable}}(\text{pF/m})]$$

where:

160,000 = a constant derived for FIELDVUE instruments to insure that the HART network RC time constant will be no greater than 65 μs (per the HART specification).

$C_{\text{master}}$  = the capacitance of the control system or HART filter

$C_{\text{cable}}$  = the capacitance of the cable used (see table 2-1)

Table 2-1. Cable Characteristics

| Cable Type           | Capacitance <sup>(1)</sup><br>pF/ft | Capacitance <sup>(1)</sup><br>pF/m | Resistance <sup>(2)</sup><br>Ohms/ft | Resistance <sup>(2)</sup><br>Ohms/m |
|----------------------|-------------------------------------|------------------------------------|--------------------------------------|-------------------------------------|
| BS5308/1, 0.5 sq mm  | 61.0                                | 200                                | 0.022                                | 0.074                               |
| BS5308/1, 1.0 sq mm  | 61.0                                | 200                                | 0.012                                | 0.037                               |
| BS5308/1, 1.5 sq mm  | 61.0                                | 200                                | 0.008                                | 0.025                               |
| BS5308/2, 0.5 sq mm  | 121.9                               | 400                                | 0.022                                | 0.074                               |
| BS5308/2, 0.75 sq mm | 121.9                               | 400                                | 0.016                                | 0.053                               |
| BS5308/2, 1.5 sq mm  | 121.9                               | 400                                | 0.008                                | 0.025                               |
| BELDEN 8303, 22 awg  | 63.0                                | 206.7                              | 0.030                                | 0.098                               |
| BELDEN 8441, 22 awg  | 83.2                                | 273                                | 0.030                                | 0.098                               |
| BELDEN 8767, 22 awg  | 76.8                                | 252                                | 0.030                                | 0.098                               |
| BELDEN 8777, 22 awg  | 54.9                                | 180                                | 0.030                                | 0.098                               |
| BELDEN 9501, 24 awg  | 50.0                                | 164                                | 0.048                                | 0.157                               |
| BELDEN 9680, 24 awg  | 27.5                                | 90.2                               | 0.048                                | 0.157                               |
| BELDEN 9729, 24 awg  | 22.1                                | 72.5                               | 0.048                                | 0.157                               |
| BELDEN 9773, 18 awg  | 54.9                                | 180                                | 0.012                                | 0.042                               |
| BELDEN 9829, 24 awg  | 27.1                                | 88.9                               | 0.048                                | 0.157                               |
| BELDEN 9873, 20 awg  | 54.9                                | 180                                | 0.020                                | 0.069                               |

1. The capacitance values represent capacitance from one conductor to all other conductors and shield. This is the appropriate value to use in the cable length calculations.  
2. The resistance values include both wires of the twisted pair.

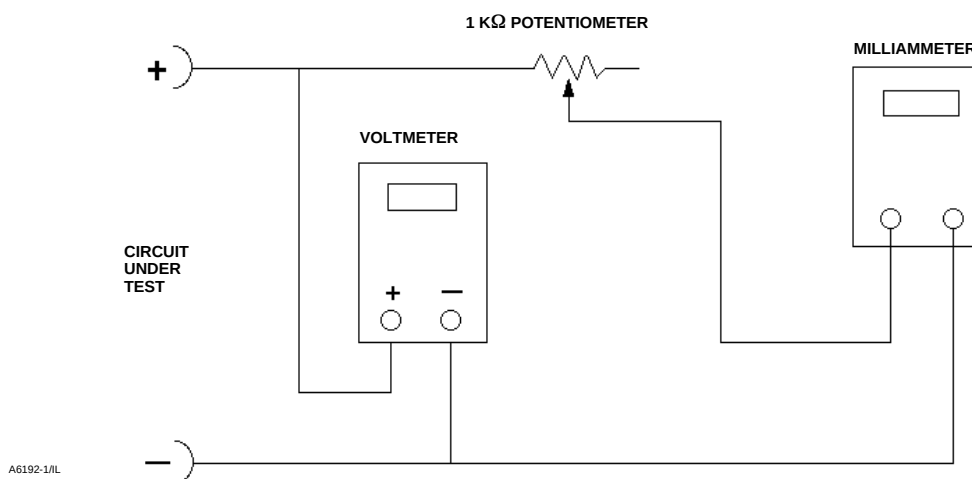


Figure 2-25. Voltage Test Schematic

The following example shows how to calculate the cable length for a Foxboro™ I/A control system (1988) with a  $C_{\text{master}}$  of 50,000 pF and a Belden 9501 cable with characteristic capacitance of 50pF/ft.

$$\text{Length(ft)} = [160,000 - 50,000\text{pF}] \div [50\text{pF/ft}]$$

$$\text{Length} = 2200 \text{ ft.}$$

The HART communication cable length is limited by the cable characteristic capacitance. To increase cable length, select a wire with lower capacitance per foot. Contact your Emerson Process Management sales office for specific information relating to your control system.

## Installation in a Safety Instrumented System

A DVC6000 SIS instrument may be used in a Safety Instrumented System (SIS) to control operation of a safety block valve or vent valve. The actuator may be either single-acting or double-acting with spring return. DVC6000 SIS instruments will have the label shown in figure 2-26 on the terminal box cover.

The digital valve controller may be installed with a solenoid valve in either a 4-wire system, (figure 2-28), in a 2-wire system (figure 2-29), or a 2-wire system without a solenoid valve (figure 2-30). The digital valve controller ships from the factory with the DIP switch on the printed wiring board set to the correct position per the ordered option.

When operating with a 4-20 mA current signal, the digital valve controller must be setup for point-to-point operation. When operating with a voltage signal, the digital valve controller must be setup for multi-drop operation. The operational mode is determined by a DIP switch on the printed wiring board. As shown in figure 2-27, the nameplate indicates the operational mode set on the printed wiring board at the factory. For information on verifying or changing the switch position, refer to Replacing the PWB Assembly and Setting the DIP Switch and table 7-2 in the Maintenance section.

## Installation in a 4-Wire System

Figure 2-28 is an example of the digital valve controller installed in a 4-wire system. In this installation, two separate signals are used: a 4-20 mA DC signal (from the Logic Solver or DCS) for the digital valve controller and a 24 VDC signal (from the Logic Solver) for the solenoid valve.



### Note

When a solenoid valve operated by an independent power supply is used pneumatically in series with a DVC6000 SIS, the power source could be 24/48 VDC, 110/220 VAC, etc. Power supply is dependent on customer specifications.

The digital valve controller control mode is set to “analog”. When a shutdown condition exists, the logic solver (or DCS) activates the solenoid valve and also cuts the current to the digital valve controller to 0 or 4 mA, thus causing the valve to move to its zero travel

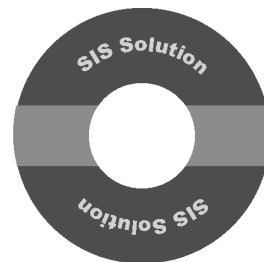


Figure 2-26. Terminal Box Cover Label on FIELDVUE DVC6000 SIS Digital Valve Controllers

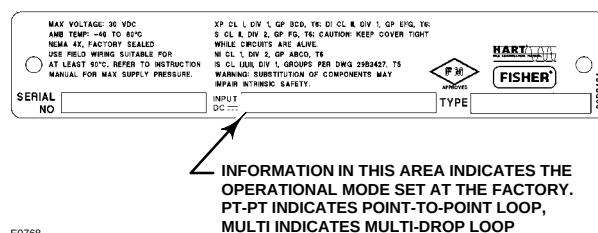


Figure 2-27. Typical Digital Valve Controller Nameplate

position. In this installation, the switch on the digital valve controller printed wiring board must be set for point-to-point operation. To set the digital valve controller control mode in an SIS 4-wire system, from the *Online* menu select *Configure*, *Guided Setup*, and *Setup Wizard*.

The Setup Wizard will automatically setup the instrument for a 4-wire installation based upon the printed wiring board DIP switch setting.



### Note

Using the digital valve controller in a 4-wire system with an ASCO™ low-power solenoid valve EF8316G303, EF8316G304, EFX8553G305 103594 or EFX8551G305 103594 (or an equivalent low-power solenoid valve) requires a separate external air supply for pilot. Ensure that the solenoid valve’s “selection gasket” is in the “External Position”.

The use of external piloting when using an EF8316G303 or EF8316G304 requires the pilot pressure to be at least 15 psig higher than the main line pressure.

(continued on next page)

## SINGLE-ACTING SPRING AND DIAPHRAGM ACTUATOR OR PISTON ACTUATOR WITH SPRING RETURN

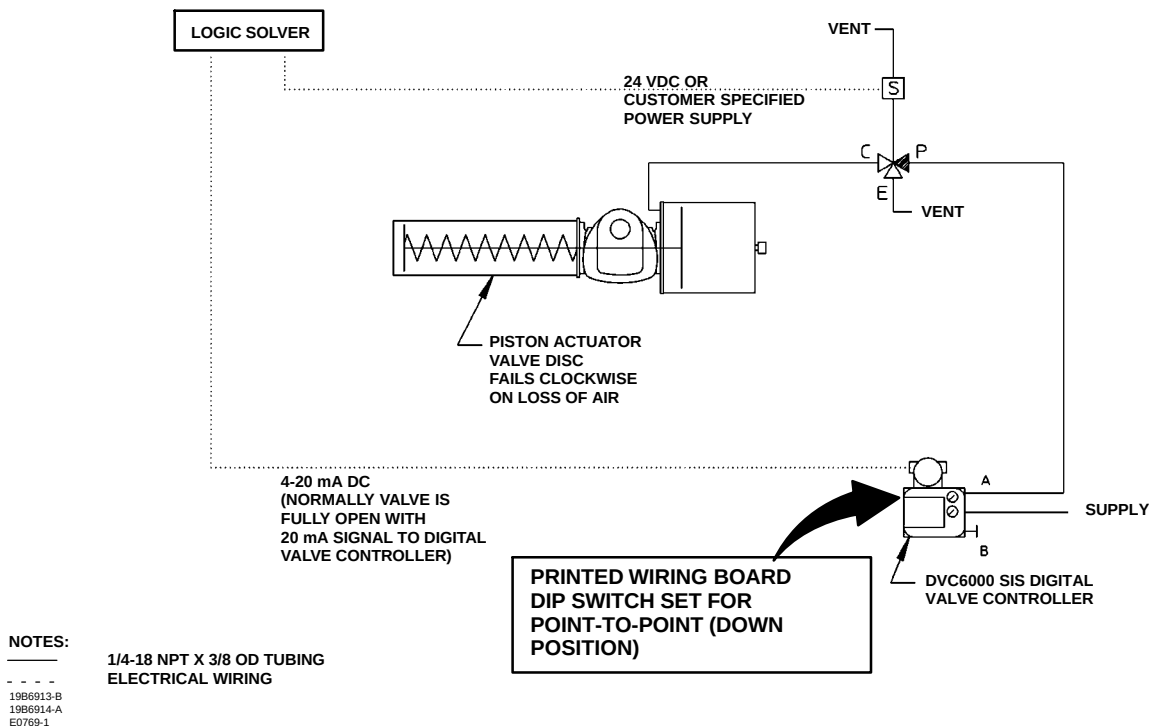


Figure 2-28. Example of FIELDVUE DVC6000 SIS Digital Valve Controller Installed in a 4-Wire SIS System

**ASCO EFX8553G305 103594 or EFX8551G305 103594 low-powered solenoid valves with aluminum bodies can be used where the application requires zero differential pressure and when the solenoid valve exhaust port is connected to another solenoid valve used as a selector or diverter.**

**For more information, refer to the ASCO catalog or contact your Emerson Process Management sales office.**

model such as the ASCO EF8316G303, EF8316G304, EFX8553G305 103594, or EFX8551G305 103594). The digital valve controller's control mode is set to "digital". When a shutdown condition exists, the logic solver cuts power to both the digital valve controller and the solenoid valve (if connected), causing the valve to move to it's zero travel position. A Fisher LC340 line conditioner is required to allow HART communications over the segment. Alternatively, an impedance boosting multiplexer (available from MTL, Pepperl+Fuchs/Elcon and others) may be used, eliminating the need for a line conditioner when installed as per figure 2-30.

## Installation in a 2-Wire System

Figures 2-29 and 2-30 are examples of the digital valve controller installed in a 2-wire system. In these installations the logic solver provides a single 24 VDC signal that powers both the digital valve controller and the optional solenoid valve (a low power consumption



## Note

**Use of a solenoid valve is optional, and dependent on stroking speed and other operating conditions.**

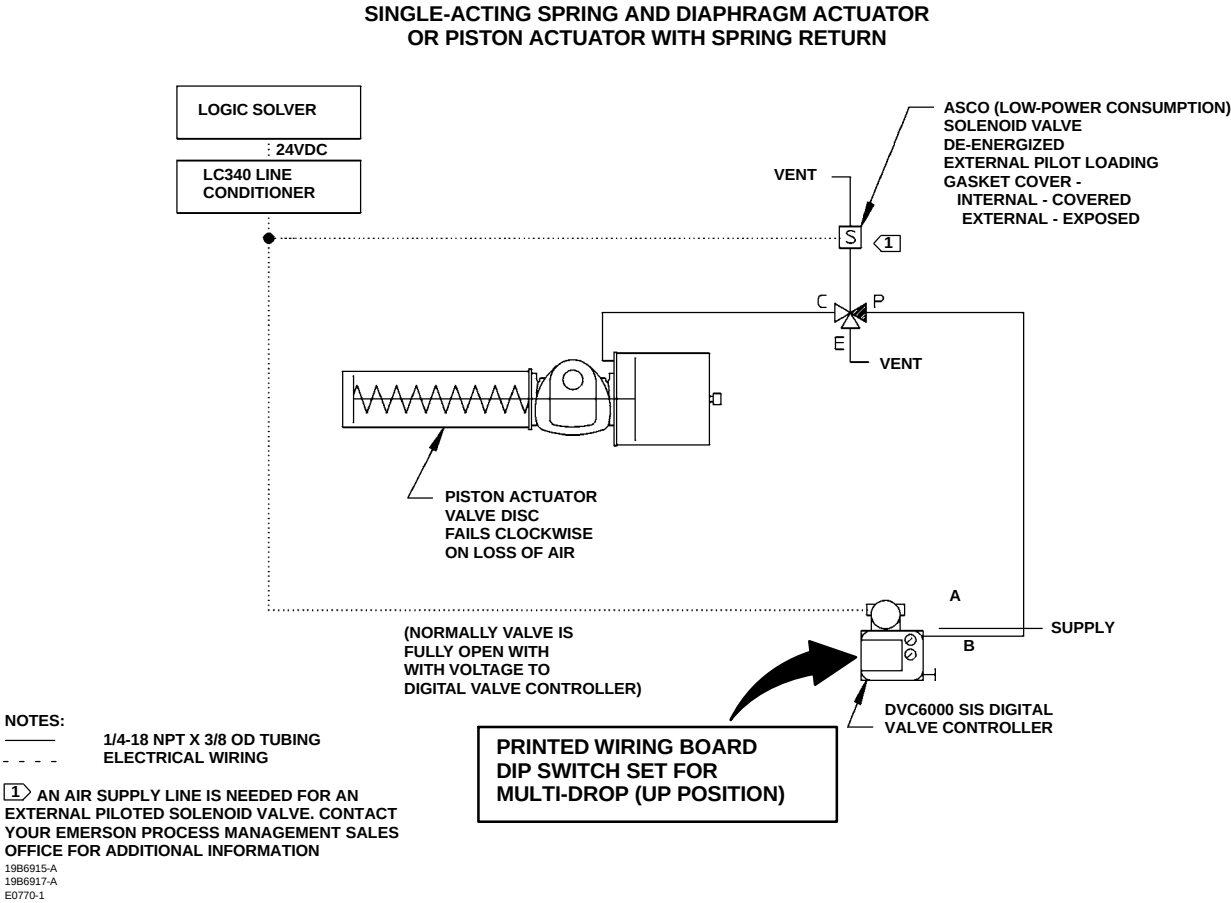


Figure 2-29. Example of FIELDVUE DVC6000 SIS Digital Valve Controller Installed in a 2-Wire SIS System

Table 2-2. Maximum Loop Wire Resistance per Logic Solver Output Voltage<sup>(1)</sup>

| Logic Solver Output Voltage (VDC) | Maximum Loop Wire Resistance (Ohms) | Maximum Wire Length (feet) <sup>(2)</sup> |        |        |        |
|-----------------------------------|-------------------------------------|-------------------------------------------|--------|--------|--------|
|                                   |                                     | 22 AWG                                    | 20 AWG | 18 AWG | 16 AWG |
| 24.00                             | 32.0                                | 952                                       | 1429   | 2381   | 3175   |
| 23.75                             | 27.0                                | 804                                       | 1205   | 2009   | 2679   |
| 23.50                             | 22.0                                | 655                                       | 982    | 1637   | 2183   |
| 23.25                             | 17.0                                | 506                                       | 759    | 1265   | 1687   |
| 23.00                             | 12.0                                | 357                                       | 536    | 893    | 1190   |
| 22.75                             | 7.0                                 | 208                                       | 313    | 521    | 694    |
| 22.50                             | 2.0                                 | 60                                        | 89     | 149    | 198    |

1. Maximums in this table assume a line conditioner and a solenoid that requires a minimum of 20.4 V and 42 mA to engage.  
2. Wire length includes both wires in a twisted pair.

The line conditioner introduces an approximate 2.0 volt drop in the SIS system wiring with a 50 mA load. If used with a solenoid valve (such as the ASCO EF8316G303, EF8316G304, EFX8553G305 103594, or EFX8551G305 103594) the guaranteed

engagement voltage at maximum temperature must be ensured.

ASCO EF8316 or EF8553 solenoid valves (if connected) require up to 42 mA to pull in. The digital valve controller set for multi-drop operation draws approximately 8 mA. Based on these conditions, table 2-2 lists the maximum loop wire resistance permitted for various logic solver output voltages. The table also lists maximum length of wire of various gauges that may be used.

The line conditioner is intended for installation in a control or marshalling cabinet near the logic solver field wiring terminals. In some installations, such as shown in figure 2-30, where no solenoid is used, an impedance boosting multiplexer may be used in place of a line conditioner. The LC340 line conditioner will be needed when a low-power solenoid is connected to the same 2-wire loop as the digital valve controller as shown in figure 2-29.

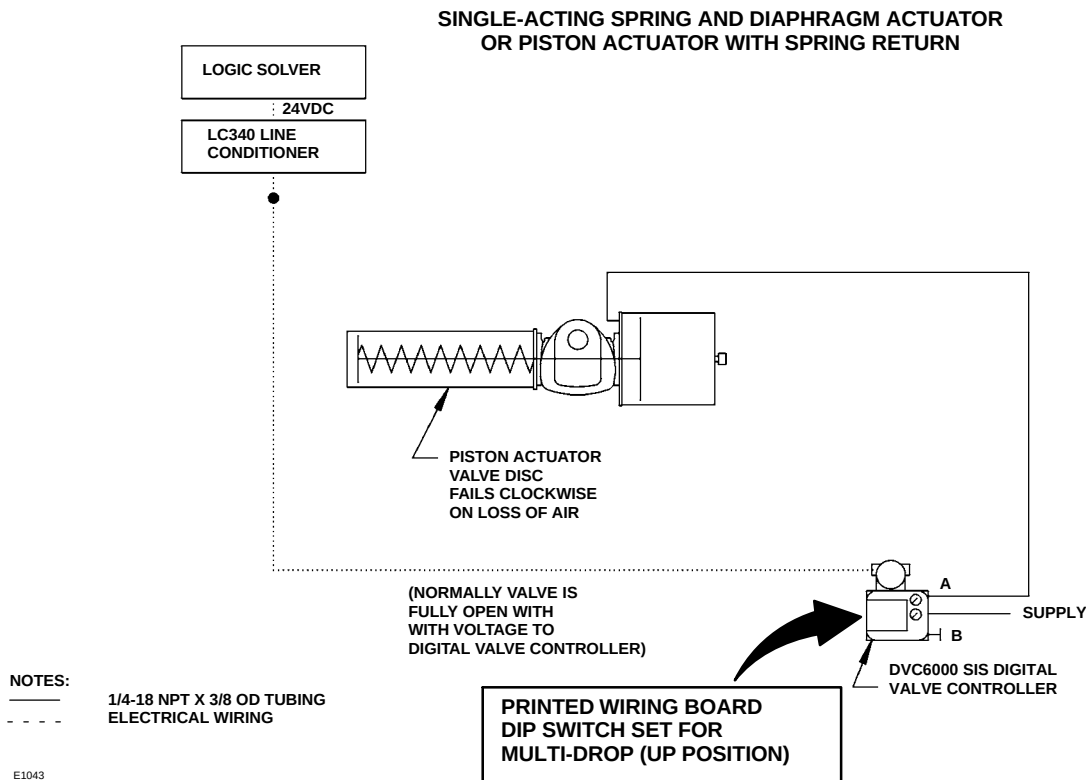


Figure 2-30. Example of FIELDVUE DVC6000 SIS Digital Valve Controller Installed in a 2-Wire SIS System (without a Solenoid Valve)

Make connections to the line conditioner as follows:

### CAUTION

**Do not overtighten the wiring connection terminals or subject them to heavy lateral (pushing) loads. This could damage the line conditioner.**

1. Be sure the digital valve controller DIP switch is set for multi-drop operation.
2. Connect the digital valve controller LOOP + terminal to the line conditioner FLD + terminal.
3. Connect the digital valve controller LOOP – terminal to the line conditioner FLD – terminal.
4. Connect the solenoid valve field terminals to the line conditioner FLD + and – terminals.
5. Connect the logic solver output to the line conditioner SYS + and – terminals.



### Note

Using the digital valve controller in a 2-wire system (multi-drop operation) with an ASCO low-power solenoid valve EF8316G303, EF8316G304, EFX8553G305 103594 or EFX8551G305 103594 (or an equivalent low-power solenoid valve) requires a line conditioner. Using a low-power piloted solenoid valve requires a separate air supply.

When using an EF8316G303 or EF8316G304 ensure that the solenoid valve's "selection gasket" is in the "External Position". The use of external piloting requires the pilot pressure to be at least 15 psig higher than the main line pressure.

(continued on next page)

EFX8553G305 103594 or EFX8551G305 103594 low-powered solenoid valves with aluminum bodies can be used where the application requires zero differential pressure and when the solenoid valve exhaust port is connected to another solenoid valve used as a selector or diverter.

For more information, refer to the ASCO catalog or contact your Emerson Process Management sales office

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See the separate FIELDVUE LC340 Line Conditioner Instruction Manual (D102797X012) for detailed installation information.

To set the digital valve controller Control Mode for operation in an SIS 2-wire system select *Configure*, *Guided Setup*, and *Setup Wizard* from the *Online* menu.

The Setup Wizard will automatically setup the instrument for a 2-wire installation based upon the printed wiring board DIP switch setting.

---



## Note

To ensure correct installation, follow the **Basic Setup** procedures as described in Section 3.

---

## LCP100 Local Control Panel

### Installation

The Fisher LCP100 Local Control Panel has four (4) mounting holes for on-site mounting of the device. The LCP100 must be installed so that the wiring connections are on the bottom to prevent accumulation of moisture inside the box.

## Electrical Connections



### WARNING

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous location, ingress protection, and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

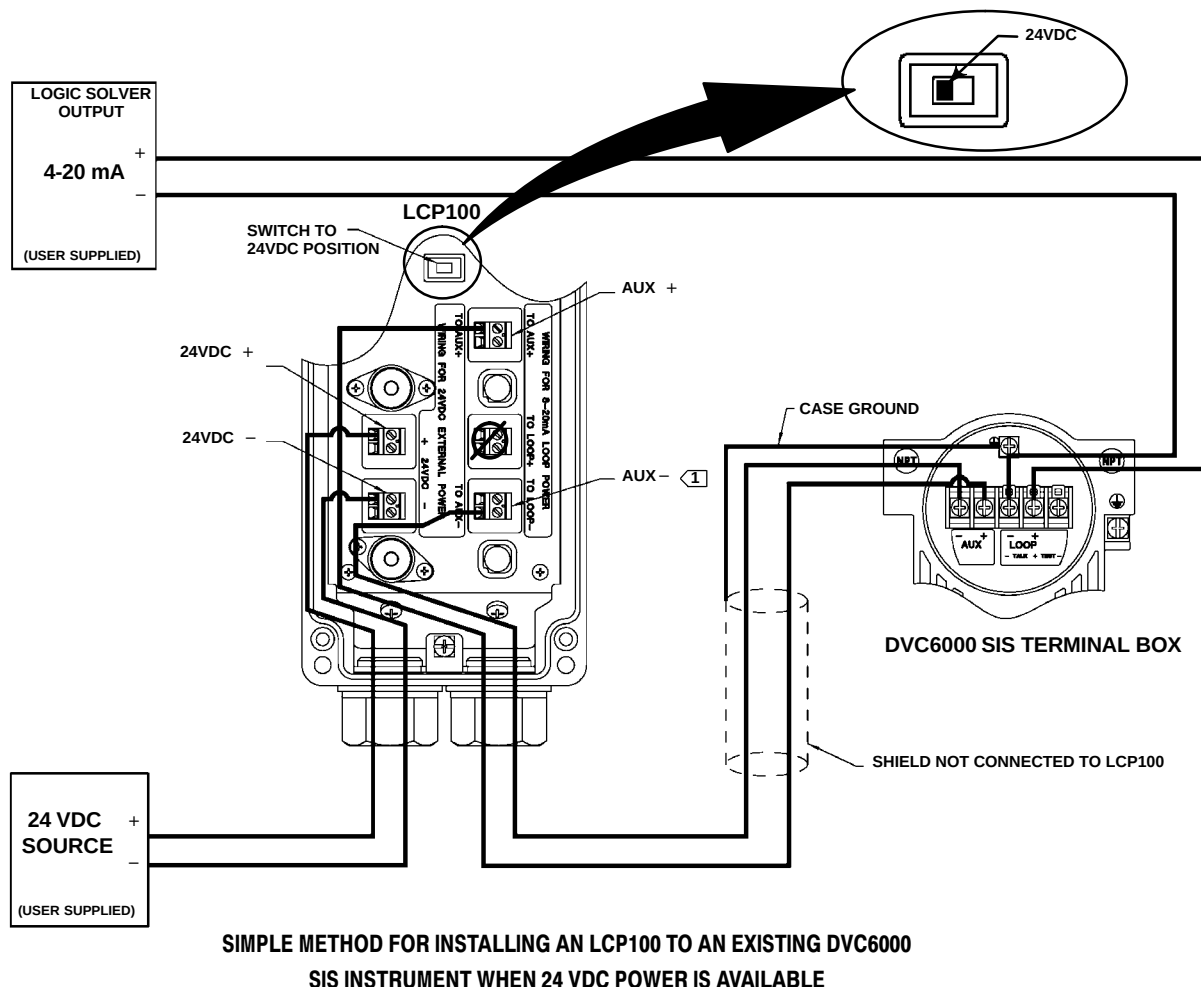
Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion

2

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Electrical connections are shown in figures 2-31, 2-32, and 2-33. There are two different methods to power the LCP100. Method one requires an external 24 VDC source to power the LCP100. Method two uses loop power wiring in series.

In method one, shown in figure 2-31, signal wiring is brought to the enclosure through a 3/4 NPT or M20 housing conduit connection (connection type is identified on nameplate).



**NOTE:** DO NOT CONNECT THE LOOP + TERMINAL IN THE LCP100 TO THE LOOP + TERMINAL IN THE DVC6000 SIS. THIS WILL CAUSE THE LCP100 TO UNNECESSARILY CONSUME 4 mA AT THE EXPENSE OF THE DVC6000 SIS.

1 THIS CONNECTION IS ALSO LABELED LOOP -.

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E1082-2

Figure 2-31. Wiring for 24 VDC External Power Configuration

Method two can be accomplished in two ways; with the wiring going first to the LCP100, then to the DVC6000 SIS, as shown in figure 2-32, or with the wiring going first to the DVC6000 SIS, then to the LCP100, as shown in figure 2-33. However, because the LCP100 does consume energy to drive the push buttons and lights, the minimum current signal from the logic solver must be 8 mA. If the logic solver cannot provide an output range of 8-20 mA, then method one must be used.

When connections are complete move the DIP switch to the appropriate power setting. If external 24 VDC is used to power the LCP100, make sure the switch is on

the side that says "24VDC". If loop power is used, slide the switch to the side that says "LOOP".



## Note

**Factory default for the DIP switch power selector is 24VDC.**

When installing the cover tighten the screws evenly in a criss-cross pattern to help ensure the cover is properly installed.

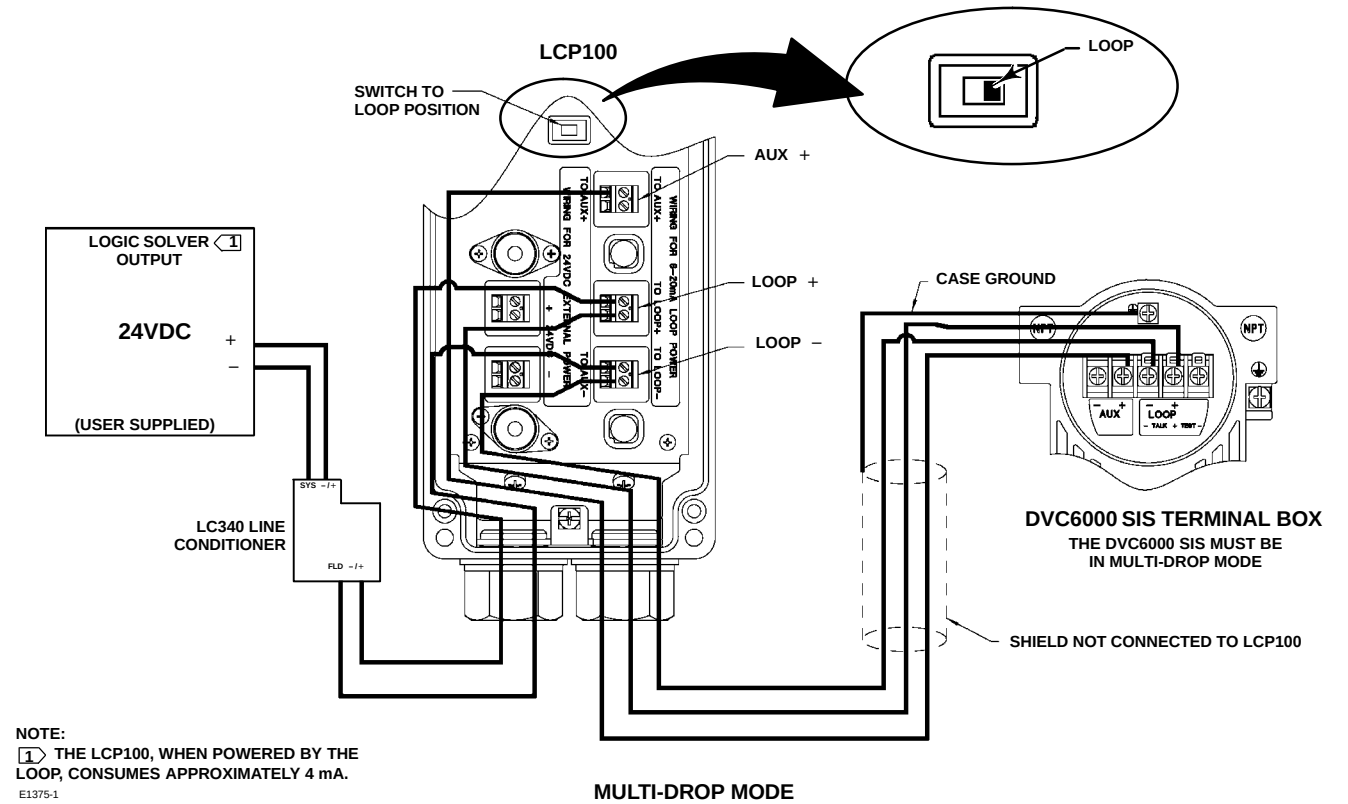
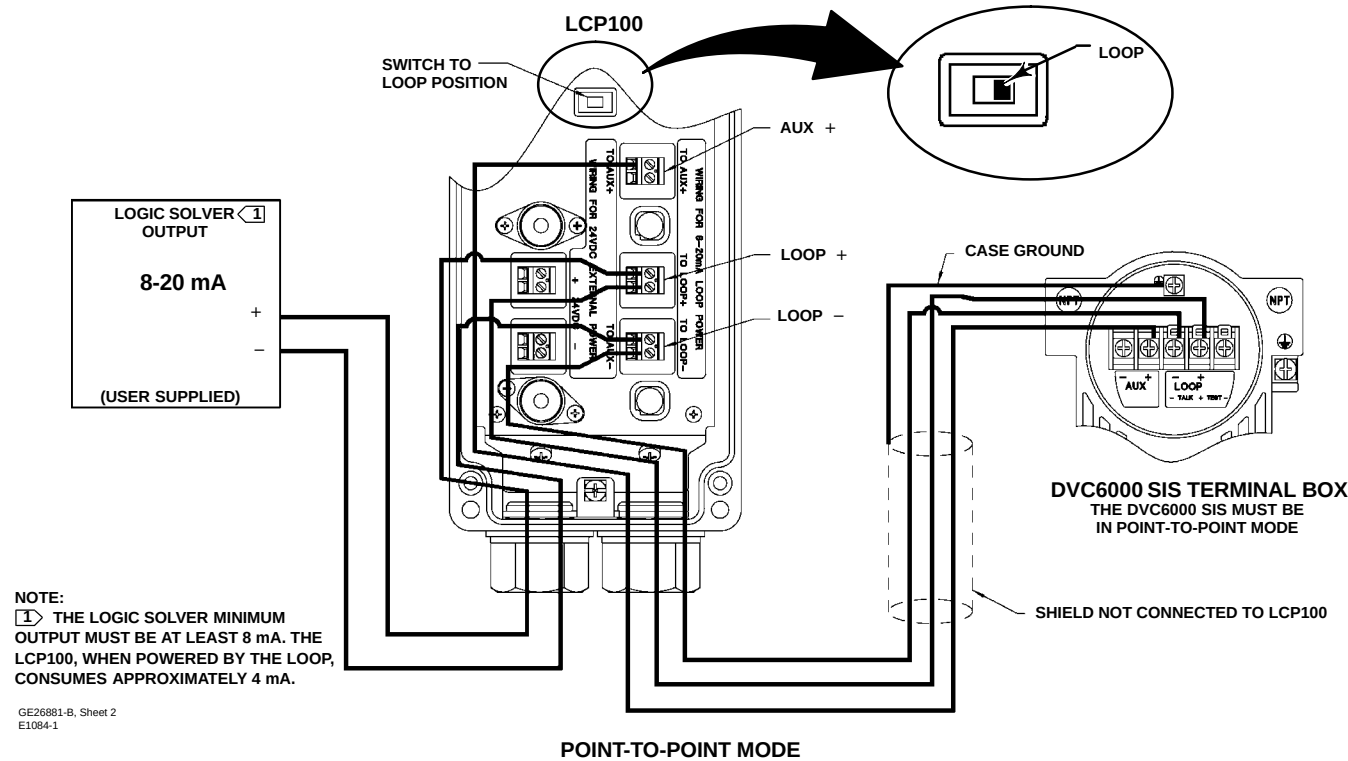
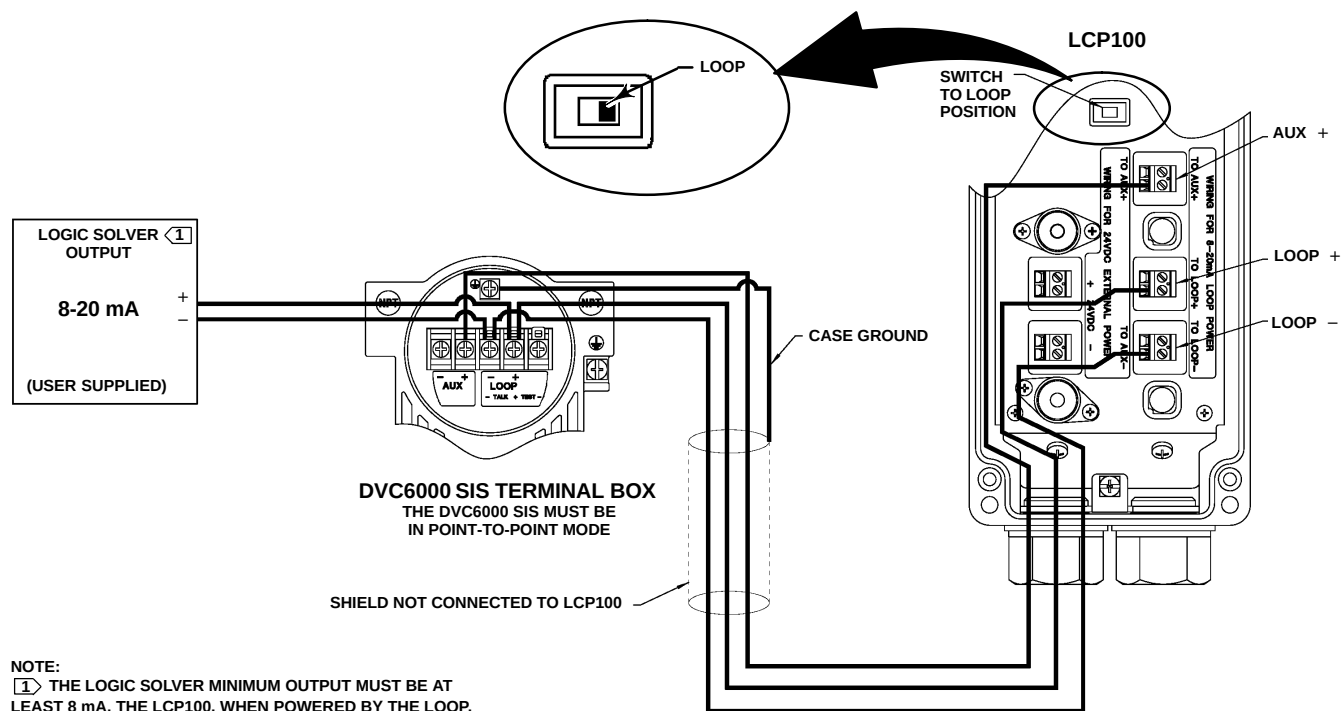


Figure 2-32. Wiring for Loop-Powered Configuration; Logic Solver Wired to the Fisher LCP100 then the FIELDVUE DVC6000 SIS

# DVC6000 SIS

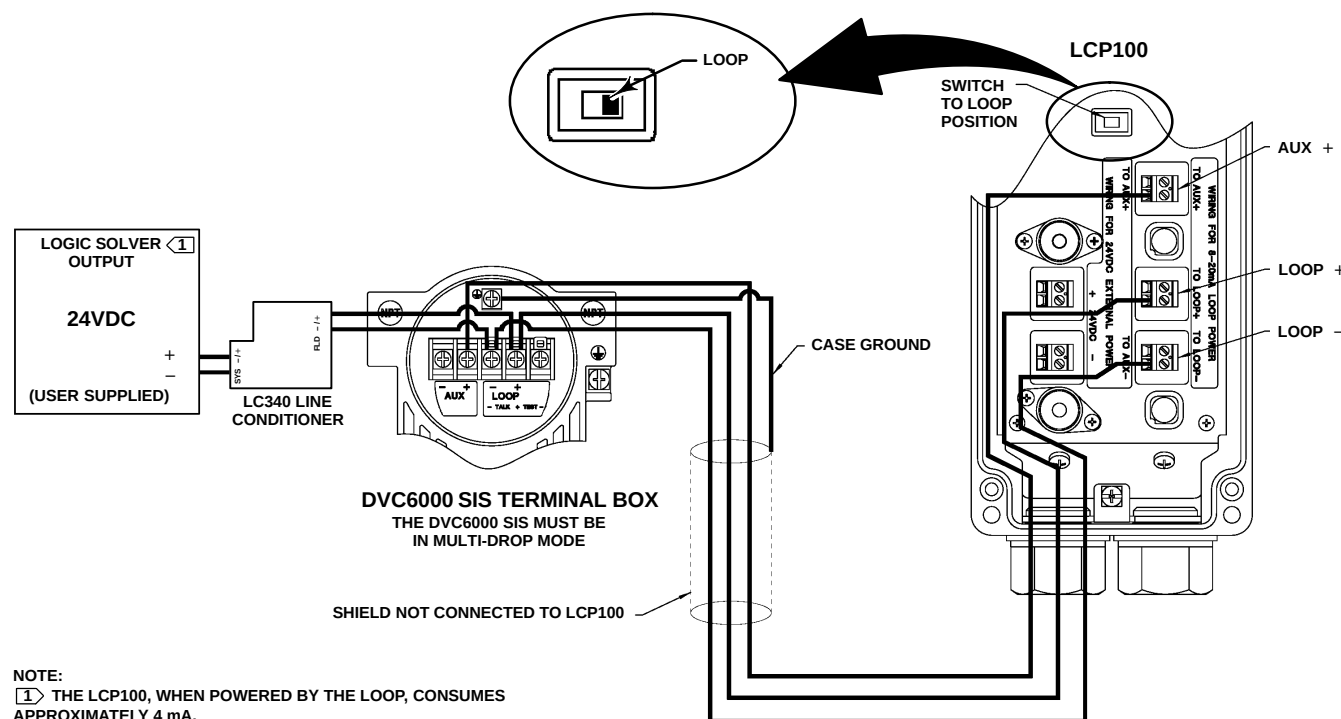
2



**NOTE:**  
1 THE LOGIC SOLVER MINIMUM OUTPUT MUST BE AT LEAST 8 mA. THE LCP100, WHEN POWERED BY THE LOOP, CONSUMES APPROXIMATELY 4 mA.

GE26881-B, Sheet 1  
E1083-1

## POINT-TO-POINT MODE



**NOTE:**  
1 THE LCP100, WHEN POWERED BY THE LOOP, CONSUMES APPROXIMATELY 4 mA.

E1384

## MULTI-DROP MODE

Figure 2-33. Wiring for Loop-Powered Configuration; Logic Solver Wired to the FIELDVUE DVC6000 SIS then the Fisher LCP100

# Section 3 Basic Setup

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## Configuration Protection

To setup and calibrate the instrument, the protection must be set to *None* with the Field Communicator. If the protection is not *None*, changing the protection requires placing a jumper across the Auxiliary terminals in the terminal box.

3



### Note

When a Fisher LCP100 control panel is used, changing protection does not require placing the jumper across the Auxiliary terminals in the terminal box.

To remove protection:

1. Connect a 4-20 mA source to the instrument.
2. Connect the Field Communicator to the instrument and turn it on.
3. Press the Hot key on the Field Communicator and select *Protection*.
4. From the *Protection* menu, select *None*. When prompted by the Field Communicator, temporarily attach the jumper to the AUX + and AUX – terminals in the instrument terminal box.

## Instrument Mode

To setup and calibrate the instrument, the instrument mode must be *Out Of Service*.

To view/change the instrument mode, press the Hot Key and select *Instrument Mode*. If the mode is not *Out Of Service*, select *Out Of Service* from the *Instrument Mode* menu and press ENTER.

Instrument Mode allows you to either take the instrument Out of Service or place it In Service. Taking the instrument Out of Service allows you to perform instrument calibration and also allows you to change setup variables that affect control. See Setting Protection to ensure protection is set correctly prior to operation.

## Guided Setup



### WARNING

Changes to the instrument setup may cause changes in the output pressure or valve travel. Depending on the application, these changes may upset process control, which could result in personal injury or property damage.



### WARNING

To avoid personal injury or equipment damage caused by the release of process pressure, always use the Setup Wizard to perform setup and calibration before placing the DVC6000 SIS in operation for the first time. The Setup Wizard sets up the required parameters for SIS solutions.



### Note

To setup and calibrate the instrument, the protection must be *None* and the Instrument Mode must be *Out Of Service*. See Configuration Protection and Instrument Mode at the beginning of this section for information on removing instrument protection and changing the instrument mode.



## Note

**In the event of a power failure the DVC6000 SIS automatically restores the device to In Service upon restoration of power. This is to provide greater availability of the safety function.**

**If power is inadvertently interrupted while performing set up or maintenance, you may need to return the DVC6000 SIS to out of service if the interrupted task requires that mode of operation.**

When the DVC6000 SIS digital valve controller is ordered as part of a control valve assembly, the factory mounts the digital valve controller and sets up the instrument as specified on the order. When mounting to a valve in the field, the instrument needs to be set up to match the instrument to the valve and actuator.

Before beginning Guided Setup, be sure the instrument is correctly mounted as described in the Installation section.

## Setup Wizard (1-1-1)



## Note

**The Setup Wizard must be run for first time installations before placing the DVC6000 SIS in service.**

Use the Setup Wizard to setup the digital valve controller for operation in an SIS solution. The Setup Wizard automatically sets up the instrument using specified actuator information. To access the Setup Wizard from the *Online Menu* select *Configure*, *Guided Setup*, and *Setup Wizard*.

1. When prompted by the Setup Wizard, enter the pressure units (psi, bar, kPa, or kg/cm<sup>2</sup>).
2. Enter the maximum instrument supply pressure.

After entering the maximum instrument supply pressure, the Setup Wizard prompts you for actuator information.

3. Enter the partial stroke test start point.
4. Indicate if the DVC6000 SIS is connected to an LCP100.
5. Enter the manufacturer of the actuator on which the instrument is mounted. If the actuator manufacturer is not listed, select Other.
6. Enter the actuator model or type. If the actuator model is not listed, select Other.
7. Enter the actuator size.
8. Enter the Relay Type.
9. Select whether the valve is open or closed under the zero power condition, if prompted.

3



## Note

**When completing steps 3 through 9, refer to table 3-1 for possible configurations for a digital valve controller operated by a 4-20 mA input current (point-to-point mode), and table 3-2 for possible configurations for a digital valve controller operated by a 0-24 VDC power supply (multi-drop mode).**



## WARNING

**If you answer YES to the prompt for permission to move the valve when the Field Communicator is determining the travel sensor motion, the instrument will move the valve through its full 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.**

10. Indicate if a volume booster or quick release is present.

Table 3-1. Possible Configurations for a FIELDVUE DVC6000 SIS Digital Valve Controller operated by 4-20 mA

| Setup Wizard Configuration |                            |                      | Operating Conditions    |                     | Status Monitoring |        |
|----------------------------|----------------------------|----------------------|-------------------------|---------------------|-------------------|--------|
| Relay Type                 | Partial Stroke Start Point | Zero Power Condition | Input Current           | Actual Valve Travel | Travel Set Point  | Travel |
| A or C                     | Open                       | Close                | Common Application      |                     |                   |        |
|                            |                            |                      | 20 mA                   | Open                | 100%              | 100%   |
|                            | Close                      | Open                 | Less Common Application |                     |                   |        |
|                            |                            |                      | 4 mA                    | Open                | 100%              | 100%   |
|                            |                            | Close                | Less Common Application |                     |                   |        |
|                            |                            |                      | 4 mA                    | Close               | 0%                | 0%     |
| B                          | Open                       | Close                | Common Application      |                     |                   |        |
|                            |                            |                      | 20 mA                   | Open                | 100%              | 100%   |
|                            | Close                      | Open                 | Less Common Application |                     |                   |        |
|                            |                            |                      | 4 mA                    | Open                | 100%              | 100%   |
|                            |                            | Close                | Common Application      |                     |                   |        |
|                            |                            |                      | 4 mA                    | Close               | 0%                | 0%     |
|                            | Open                       | Close                | Less Common Application |                     |                   |        |
|                            |                            |                      | 20 mA                   | Open                | 100%              | 100%   |
|                            | Close                      | Open                 | Common Application      |                     |                   |        |
|                            |                            |                      | 4 mA                    | Open                | 100%              | 100%   |
|                            |                            | Close                | Less Common Application |                     |                   |        |
|                            |                            |                      | 4 mA                    | Close               | 0%                | 0%     |

Table 3-2. Possible Configurations for a FIELDVUE DVC6000 SIS Digital Valve Controller operated by 0-24 VDC

| Setup Wizard Configuration |                            |                      | Operating Conditions    |                     | Status Monitoring |        |
|----------------------------|----------------------------|----------------------|-------------------------|---------------------|-------------------|--------|
| Relay Type                 | Partial Stroke Start Point | Zero Power Condition | Power Supply            | Actual Valve Travel | Travel Set Point  | Travel |
| A or C                     | Open                       | Close                | Common Application      |                     |                   |        |
|                            |                            |                      | 24 VDC                  | Open                | 100%              | 100%   |
|                            | Close                      | Open <sup>(1)</sup>  | Less Common Application |                     |                   |        |
|                            |                            |                      | 24 VDC                  | Open                | 100%              | 100%   |
|                            |                            | Close <sup>(1)</sup> | Less Common Application |                     |                   |        |
|                            |                            |                      | 24 VDC                  | Close               | 0%                | 0%     |
| B                          | Open                       | Close                | Common Application      |                     |                   |        |
|                            |                            |                      | 24 VDC                  | Open                | 100%              | 100%   |
|                            | Close                      | Open <sup>(1)</sup>  | Less Common Application |                     |                   |        |
|                            |                            |                      | 24 VDC                  | Open                | 100%              | 100%   |
|                            |                            | Close <sup>(1)</sup> | Less Common Application |                     |                   |        |
|                            |                            |                      | 24 VDC                  | Close               | 0%                | 0%     |

1. In these configurations, the DVC6000 SIS is used as a diagnostic device, the safety function is provided by other devices in the pneumatic loop, e.g. a solenoid valve.



## Note

The use of a Quick Exhaust Valve (QEV) is not recommended for safety instrumented system applications. The use of a QEV in an SIS application may cause the valve to cycle.

11. Specify if factory defaults should be used for setup. If you select YES for factory default, the Field Communicator sets the setup parameters to the values listed in table 3-3. If you select NO for the factory defaults, the setup parameters listed in the table remain at their previous settings.

Typically the Setup Wizard determines the required setup information based upon the actuator manufacturer and model specified. However, if you enter other for the actuator manufacturer or the

actuator model, then you will be prompted for setup parameters such as:

Actuator Style (select spring & diaphragm, piston single-acting with spring, piston double-acting with spring)

Valve Style (select the valve style, rotary or sliding stem)

On Loss of Instrument Signal, (valve opens or closes). See Zero Power Condition in the Detailed Setup section.

Feedback Connection (select Rot-All, SS-roller, or SStem-Standard). See Feedback Connection in the Detailed Setup section.

Partial Stroke Start Point (select the start point for the Partial Stroke Test; either Valve Open or Valve Close).

LCP100 Local Control Panel (indicate if the instrument is connected to an LCP100 local control panel).

Travel Sensor Motion (increasing air pressure causes the travel sensor shaft to rotate clockwise or counterclockwise), the Setup Wizard will ask if it can move the valve to determine travel sensor motion.

If you answer yes, the instrument may stroke the valve the full travel span to determine travel sensor rotation. If you answer No, then you will have to specify the rotation for increasing air pressure (determine the rotation by viewing the end of the travel sensor shaft). See Travel Sensor Motion in the Detailed Setup section.

Tuning Set (see Tuning Set in the Detailed Setup section).

After choosing the appropriate tuning set, a message appears on the display, asking if you would like to download factory defaults for Setup. Yes is recommended for Initial Setup. Refer to table 3-3 for factory download defaults.

Follow the prompts on the Field Communicator display. 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 the Calibration section.

Once Auto Calibration is complete, you will be asked to enter the desired stroke test speed (default is 0.25%/sec). An additional automatic PST calibration is run to determine the default value or the partial stroke pressure limit for single acting actuators (this will be differential pressure for double acting) and pressure set point for End Point Pressure Control.

When calibration is complete, you are asked if you wish to adjust the relay (double-acting only). Select yes to adjust the relay. For additional information, refer to Relay Adjustment in the Calibration section.

Table 3-3. Factory Download Default Settings

| Setup Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Default Setting                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| Analog Input Units <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | mA                                                |
| Analog In Range High <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 20.0 mA                                           |
| Analog In Range Low <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 4.0 mA                                            |
| Control Mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Analog <sup>(1)</sup><br>Digital <sup>(2)</sup>   |
| Restart Control Mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Analog <sup>(1)</sup><br>Digital <sup>(2)</sup>   |
| Lag Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0 secs                                            |
| Input Characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Linear                                            |
| Travel Limit High                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 125%                                              |
| Travel Limit Low                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -25%                                              |
| Travel Cutoff High                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 50%                                               |
| Travel Cutoff Low                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 50%                                               |
| Travel Deviation Alert Point                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 5.0%                                              |
| Travel Deviation Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 10.0 seconds                                      |
| Set Point Rate Open <sup>(3)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0%/sec                                            |
| Set Point Rate Close <sup>(4)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0%/sec                                            |
| Polling Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0                                                 |
| Pressure Deviation Alert Point                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 5.0 psi <sup>(5)</sup>                            |
| Pressure Deviation Alert Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 30.0 seconds                                      |
| Command #3 (Trending) Pressure<br>For double-acting actuators<br>For single-acting actuators                                                                                                                                                                                                                                                                                                                                                                                                                           | differential output pressure<br>actuator pressure |
| Valve Set Point <sup>(2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 100% if ZPC = Open<br>0% if ZPC = Closed          |
| Restart Travel Set Point <sup>(2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 100% if ZPC = Open<br>0% if ZPC = Closed          |
| Self-Test Shutdown <sup>(2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | All Failures Disabled                             |
| <sup>1</sup> . Analog mode only – DIP switch set to Pt-Pt.<br><sup>2</sup> . Digital mode only. – DIP switch set to Multi.<br><sup>3</sup> . In firmware 3 thru 6 this parameter is labeled Minimum Opening Time.<br>In firmware 10 and below this parameter should be set to zero.<br><sup>4</sup> . In firmware 3 thru 6 this parameter is labeled Minimum Closing Time.<br>In firmware 10 and below this parameter should be set to zero.<br><sup>5</sup> . Adjust to bar, kPa, or kg/cm <sup>2</sup> if necessary. |                                                   |



## Note

**Relay Adjustment is only available for the double-acting relay (Relay A).**

After instrument setup is completed, and you have placed the instrument in service, if End Point Pressure Control not enabled, you will be prompted to enable it. Select yes. Refer to Partial Stroke Variables in the Detailed Setup section for more information.

If after completing auto setup and auto calibration the valve seems slightly unstable or unresponsive, you can improve operation by selecting *Performance Tuner* from the *Guided Setup* menu. For additional information on using the Performance Tuner to optimize digital valve controller tuning, refer to the Performance Tuner information below.

## Performance Tuner (1-1-2)



### WARNING

During performance tuning the valve may move, causing process fluid or pressure to be released. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

The Performance Tuner is used to optimize digital valve controller tuning. It can be used with digital valve controllers mounted on most sliding-stem and rotary actuators, including Fisher and other manufacturers' products. Moreover, because the Performance Tuner can detect internal instabilities before they become apparent in the travel response, it can generally optimize tuning more effectively than manual tuning. Typically, the Performance Tuner takes 3 to 5 minutes to tune an instrument, although tuning instruments mounted on larger actuators may take longer.

Access the Performance Tuner by selecting *Performance Tuner* from the *Guided Setup* menu. Follow the prompts on the Field Communicator display to optimize digital valve controller tuning.

## Section 4 Detailed Setup



**Menu and Quick Key Sequence Tables** ..... Front Cover

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## Detailed Setup



The *Detailed Setup* selection from the *Configure* menu allows you to configure the digital valve controller to your application. Table 4-1 lists the default settings for a standard factory configuration. You can adjust actuator response, set the various modes, alerts, ranges, travel cutoffs and limits. You can also restart the instrument and set the protection.

4



### Note

In the event of a power failure the DVC6000 SIS automatically restores the device to In Service upon restoration of power. This is to provide greater availability of the safety function.

If power is inadvertently interrupted while performing set up or maintenance, you may need to return the DVC6000 SIS to out of service if the interrupted task requires that mode of operation.

## Mode and Protection (1-2-1)

### Mode

- Instrument Mode 

You can change the instrument mode by selecting *Mode and Protection, Instrument Mode* from the *Detailed Setup* menu, or press the Hot Key and select *Instrument Mode*.

Instrument Mode allows you to either take the instrument Out Of Service or place it In Service. Taking the instrument Out Of Service allows you to perform instrument calibration and also allows you to change setup variables that affect control, provided the calibration/configuration protection is properly set. See Setting Protection.

Table 4-1. Factory Default Detailed Setup Parameters

| Setup Parameter             |                                                          | Default Setting <sup>(1)</sup>                       |
|-----------------------------|----------------------------------------------------------|------------------------------------------------------|
| Instrument Configuration    | Control Mode                                             | Analog / Digital <sup>(2)</sup>                      |
|                             | Restart Control Mode <sup>(3)</sup>                      | DIGITAL<br>ANALOG                                    |
|                             | Multi-drop<br>Point-to-Point                             |                                                      |
|                             | Zero Power Condition                                     | Valve Closed <sup>(2)</sup>                          |
|                             | Analog In Range Low                                      | 4 mA                                                 |
|                             | Analog In Range High                                     | 20 mA                                                |
|                             | Analog Input Units                                       | mA                                                   |
|                             | Feedback Connection                                      | Rotary – All <sup>(2)</sup>                          |
|                             | Travel Sensor Motion                                     | Clockwise <sup>(2)</sup>                             |
|                             | Auxiliary Terminal Action                                | Push Button Partial<br>Stroke Test                   |
|                             | Maximum Supply Pressure                                  | 50 <sup>(2)</sup>                                    |
|                             | Pressure Units                                           | PSI                                                  |
|                             | Temperature Units                                        | F                                                    |
|                             | Polling Address                                          | 0                                                    |
|                             | Burst Mode Enable                                        | No                                                   |
| Dynamic Response and Tuning | Burst Command                                            | 3                                                    |
|                             | Cmd 3 Configured Pressure<br>For double-acting actuators | differential output<br>pressure<br>actuator pressure |
|                             | For single-acting actuators                              |                                                      |
|                             | Tuning Set                                               | F <sup>(2)</sup>                                     |
|                             | Input Characteristic                                     | Linear                                               |
|                             | Travel Limit High                                        | 125%                                                 |
|                             | Travel Limit Low                                         | –25%                                                 |
|                             | Travel/Pressure Cutoff High                              | 50%                                                  |
|                             | Travel/Pressure Cutoff Low                               | 50%                                                  |
|                             | Set Point Rate Open <sup>(4)</sup>                       | 0%/sec                                               |
| Travel History Alerts       | Set Point Rate Close <sup>(5)</sup>                      | 0%/sec                                               |
|                             | Set Point Filter Lag Time                                | 0 sec                                                |
|                             | Partial Stroke Start Point                               | Valve Open <sup>(2)</sup>                            |
|                             | Cycle Count Alert Enable                                 | No                                                   |
|                             | Cycle Count Alert Deadband                               | 1%                                                   |
|                             | Cycle Count Alert Point                                  | 1000000                                              |
| Deviation & Other Alerts    | Travel Accumulator Alert Enable                          | No                                                   |
|                             | Travel Accumulator Deadband                              | 1%                                                   |
|                             | Travel Accumulator Alert Point                           | 1000000%                                             |
|                             | Travel Deviation Alert Enable                            | Yes                                                  |
|                             | Travel Deviation Alert Point                             | 5%                                                   |
|                             | Travel Deviation Time                                    | 10 sec                                               |
|                             | Pressure Deviation Alert Enable                          | Yes                                                  |
|                             | Pressure Deviation Alert Point                           | 5 psi                                                |
| Travel Alerts               | Pressure Deviation Alert Time                            | 30 sec                                               |
|                             | Drive Signal Alert Enable                                | Yes                                                  |
|                             | Supply Pressure Alert Enable                             | Yes                                                  |
|                             | Supply Pressure Alert Point                              | 19 psi                                               |
|                             | Travel Alert Lo Enable                                   | No                                                   |
|                             | Lo Point                                                 | –25%                                                 |
|                             | Travel Alert Hi Enable                                   | No                                                   |
|                             | Hi Point                                                 | 125%                                                 |
|                             | Travel Alert Lo Lo Enable                                | No                                                   |
|                             | Lo Lo Point                                              | –25% <sup>(6)</sup>                                  |
|                             | Travel Alert Hi Hi Enable                                | No                                                   |
|                             | Hi Hi Point                                              | 125% <sup>(7)</sup>                                  |
|                             | Deadband                                                 | 5%                                                   |
|                             |                                                          |                                                      |

–continued on next page–

Table 4-1. Factory Default Detailed Setup Parameters (continued)

| Setup Parameter      |                                    | Default Setting <sup>(1)</sup> |
|----------------------|------------------------------------|--------------------------------|
| Electronic Alerts    | Shutdown Activated                 | Yes                            |
|                      | Low Power Write Fail Enable        | No                             |
|                      | Non-Critical NVM Alert Enable      | No                             |
| Informational Status | Instrument Time Invalid Enable     | Yes                            |
|                      | Calibration in Progress Enable     | No                             |
|                      | Autocalibration in Progress Enable | No                             |
|                      | Diagnostics in Progress Enable     | No                             |
|                      | Diagnostics Data Available Enable  | Yes                            |
|                      | Integrator Saturated Hi Enable     | Yes                            |
|                      | Integrator Saturated Lo Enable     | Yes                            |
|                      | Pressure Control Active Enable     | Yes                            |
|                      | Multi-Drop Alert Enable            | No                             |
| Alert Record         | Valve Alerts Enable                | Yes                            |
|                      | Failure Alerts Enable              | Yes                            |
|                      | Miscellaneous Alerts Enable        | No                             |
|                      | Alert Record Not Empty Enable      | Yes                            |
|                      | Alert Record Full Enable           | Yes                            |

1. The settings listed are for standard factory configuration. DVC6000 SIS instruments can also be ordered with custom configuration settings. For the default custom settings, refer to the order requisition.  
2. If the instrument is shipped mounted on an actuator, these values depend upon the actuator on which the instrument is mounted.  
3. Based on DIP switch setting.  
4. In firmware 3 thru 6 this parameter is labeled Minimum Opening Time. In firmware 10 and below this parameter should be set to zero.  
5. In firmware 3 thru 6 this parameter is labeled Minimum Closing Time. In firmware 10 and below this parameter should be set to zero.  
6. Lo Lo point is 1% when used with LCP100.  
7. Hi Hi point is 99% when used with LCP100.



## Note

Some changes that require the instrument to be taken Out Of Service will not take effect until the instrument is placed back In Service or the instrument is restarted.

### • Control Mode

You can change the control mode by selecting *Control Mode* from the *Mode and Protection* menu, or press the Hot Key and select *Control Mode*.

Control Mode lets you define where the instrument reads its set point. Follow the prompts on the Field Communicator display to choose one of the following control modes: Analog or Digital.

Choose Analog control mode if the instrument is to receive its set point over the 4-20 mA loop. Normally the instrument control mode is Analog.

Choose Digital control mode if the instrument is to receive its set point digitally by a 0-24 VDC control signal, via the HART communications link.

A third mode, Test, is also displayed. Normally the instrument should not be in the Test mode. The Field Communicator automatically switches to this mode whenever it needs to stroke the valve during calibration or stroke valve, for example. However, if you abort from a procedure where the instrument is in the Test mode, it may remain in this mode. To take the instrument out of the Test mode, select *Control Mode* then select either Analog or Digital.

### • Restart Control Mode

Restart Control Mode lets you choose which operating mode you want the instrument to be in after a restart. Access Restart Control mode by selecting *Restart Control Mode* from the *Mode and Protection* menu. Follow the prompts on the Field Communicator display to define the restart control mode as Resume Last, Analog, or Digital.

### • Burst Mode

Enabling burst mode provides continuous communication from the digital valve controller. Burst mode applies only to the transmission of burst mode data (analog input, travel target, pressure, and travel) and does not affect the way other data is accessed.

Access to information in the instrument is normally obtained through the poll/response of HART communication. The Field Communicator or the control system may request any of the information that is normally available, even while the instrument is in burst mode. Between each burst mode transmission sent by the instrument, a short pause allows the Field Communicator or control system to initiate a request. The instrument receives the request, processes the response message, and then continues “bursting” the burst mode data.



## Note

Do not use burst mode while using the HART Loop Interface Monitor (HIM) from Moore Industries with DVC6000 SIS digital valve controllers.

To enable burst mode, select *Burst Mode*, and *Burst Enable* from the *Mode and Protection* menu.

• *Burst Enable*—Yes or no. Burst mode must be enabled before you can change the burst mode command.

- **Change Burst Enable**—Turns Burst Mode on and off. Actual valves are Burst Enable = Disabled(Polled), Enabled.

- **Burst Command**—There are four burst mode commands. Command 3 is recommended for use with the Rosemount 333 HART Tri-Loop HART-to-analog signal converter. The other three are not used at this time.

- **Change Burst Command**—Allows you to pick the command to be sent from the instrument when Burst Mode is on. Select HART Univ Cmd 1, HART Univ Cmd 2, HART Univ Cmd 3, or DVC6000 Cmd 148.

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- **Cmd 3 Configured Pressure**—Command 3 provides the following variables:

**Primary variable**—analog input in % or ma,

**Secondary variable**—travel target in % of ranged travel,

**Tertiary variable**—supply or output pressure in psig, bar, kPa, or kg/cm<sup>2</sup>. Select *Cmd 3 Configured Pressure* from the *Burst* menu to select if the output A, output B, differential (A–B), or supply pressure is sent.

**Quaternary variable**—travel in % of ranged travel.

## Protection

### • Protection »»

When the digital valve controller is in SIS mode, and protection is on, the instrument cannot be taken Out of Service. Protection must be turned off to change the instrument mode.

To change an instrument's protection, press the Hot key on the Field Communicator and select *Protection* or select *Configure, Detailed Setup, Mode and Protection*, and *Protection*.

Two levels of protection are available:

- **None**—Neither setup nor calibration is protected. Allows changing calibration and setup parameters.

- **Config & Calib**—Both setup and calibration are protected. Prohibits changing calibration and protected setup parameters.

Table 4-3 lists configurable parameters in the instrument and the requirements for modifying these parameters, in terms of instrument mode and protection.

Table 4-2. Gain Values for Preselected Travel Tuning Sets

| Tuning Set | Proportional Gain | Velocity Gain | Minor Loop Feedback Gain |
|------------|-------------------|---------------|--------------------------|
| C          | 4.4               | 3.0           | 35                       |
| D          | 4.8               | 3.0           | 35                       |
| E          | 5.5               | 3.0           | 35                       |
| F          | 6.2               | 3.1           | 35                       |
| G          | 7.2               | 3.6           | 34                       |
| H          | 8.4               | 4.2           | 31                       |
| I          | 9.7               | 4.8           | 27                       |
| J          | 11.3              | 5.6           | 23                       |
| K          | 13.1              | 6.0           | 18                       |
| L          | 15.5              | 6.0           | 12                       |
| M          | 18.0              | 6.0           | 12                       |
| X (Expert) | User Adjusted     | User Adjusted | User Adjusted            |

## Response Control (1-2-2)

Select *Configure, Detailed Setup*, and *Response Control*. Follow the prompts on the Field Communicator display to configure the following response control parameters: *Tuning, Travel/Pressure Control, Input Characterization, Custom Characterization Table*, and *Dynamic Response*.

### Tuning

#### Travel Tuning (1-2-2-1-1)



## WARNING

Changes to the tuning set may cause the valve/actuator assembly to stroke. To avoid personal injury and property damage caused by moving parts, keep hands, tools, and other objects away from the valve/actuator assembly.

**Travel Tuning Set**— There are eleven tuning sets to choose from. Each tuning set provides a preselected value for the digital valve controller gain settings. Tuning set C provides the slowest response and M provides the fastest response. Table 4-2 lists the proportional gain, velocity gain and minor loop feedback gain values for preselected tuning sets.

In addition, you can select User Adjusted or Expert, which allows you to modify tuning of the digital valve controller. With User Adjusted, you specify the proportional gain; an algorithm in the Field Communicator calculates the velocity gain and minor loop feedback gain. With Expert you can specify the proportional gain, velocity gain, and minor loop feedback gain.

Table 4-3. Conditions for Modifying FIELDVUE DVC6000 SIS Digital Valve Controller Parameters

| Parameters           |                                       | In Service |             | Out of Service |             |
|----------------------|---------------------------------------|------------|-------------|----------------|-------------|
|                      |                                       | Protected  | Unprotected | Protected      | Unprotected |
| Mode and Protection  | Instrument Mode                       | ---        | ✓           | ---            | ✓           |
|                      | Control Mode <sup>(1)</sup>           | ---        | ---         | ---            | ---         |
|                      | Restart Cont. Mode <sup>(1)</sup>     | ---        | ---         | ---            | ---         |
|                      | Burst Mode Enable                     | ✓          | ✓           | ✓              | ✓           |
|                      | Burst Command                         | ✓          | ✓           | ✓              | ✓           |
|                      | Cmd #3 (Trending) Pressure Protection | ✓          | ✓           | ✓              | ✓           |
| Response and Control | Travel Tuning Set                     | ---        | ✓           | ---            | ✓           |
|                      | Travel Proportional Gain              | ---        | ✓           | ---            | ✓           |
|                      | Travel Velocity Gain                  | ---        | ✓           | ---            | ✓           |
|                      | Travel MLFB Gain                      | ---        | ✓           | ---            | ✓           |
|                      | Travel Integral Enable                | ---        | ✓           | ---            | ✓           |
|                      | Travel Integral Gain                  | ---        | ✓           | ---            | ✓           |
|                      | Stabilize / Optimize                  | ---        | ---         | ---            | ✓           |
|                      | Performance Tuner                     | ---        | ---         | ---            | ✓           |
|                      | Integral Dead Zone                    | ---        | ✓           | ---            | ✓           |
|                      | Integral Limit                        | ---        | ✓           | ---            | ✓           |
|                      | Pressure Tuning Set                   | ---        | ✓           | ---            | ✓           |
|                      | Pressure Proportional Gain            | ---        | ✓           | ---            | ✓           |
|                      | Pressure MLFB                         | ---        | ✓           | ---            | ✓           |
|                      | Pressure Integral Enable              | ---        | ✓           | ---            | ✓           |
|                      | Pressure Integral Gain                | ---        | ✓           | ---            | ✓           |
|                      | Cutoff Hi                             | ---        | ---         | ---            | ✓           |
|                      | Cutoff Lo                             | ---        | ---         | ---            | ✓           |
|                      | End Point Pressure Control Enable     | ---        | ---         | ---            | ✓           |
|                      | Partial Stroke Start Point            | ---        | ---         | ---            | ✓           |
|                      | Pressure Set Point                    | ---        | ✓           | ---            | ✓           |
|                      | Pressure Saturation Time              | ---        | ✓           | ---            | ✓           |
| Alerts               | Input Characterization                | ---        | ---         | ---            | ✓           |
|                      | Custom Characterization Table         | ---        | ---         | ---            | ✓           |
|                      | Set Point Rate Open <sup>(2)</sup>    | ---        | ---         | ---            | ✓           |
|                      | Set Point Rate Close <sup>(3)</sup>   | ---        | ---         | ---            | ✓           |
|                      | Lag Time                              | ---        | ---         | ---            | ✓           |
|                      | Drive Current Shutdown                | ---        | ---         | ---            | ✓           |
|                      | Drive Signal Alert                    | ✓          | ✓           | ✓              | ✓           |
|                      | Drive Signal <sup>(1)</sup>           | ---        | ---         | ---            | ---         |
|                      | Offline/Failed Alert Enable           | ✓          | ✓           | ✓              | ✓           |
|                      | Low Power Write Fail Enable           | ✓          | ✓           | ✓              | ✓           |
|                      | Non-Critical NVM Alert Enable         | ✓          | ✓           | ✓              | ✓           |
|                      | Critical NVM Shutdown                 | ---        | ---         | ---            | ✓           |
|                      | Flash ROM Shutdown                    | ---        | ---         | ---            | ✓           |
|                      | No Free Time Shutdown                 | ---        | ---         | ---            | ✓           |
|                      | Reference Voltage Shutdown            | ---        | ---         | ---            | ✓           |
|                      | Temp Sensor Shutdown                  | ---        | ---         | ---            | ✓           |
|                      | Travel Sensor Shutdown                | ---        | ---         | ---            | ✓           |
|                      | Pressure Sensor Shutdown              | ---        | ---         | ---            | ✓           |
|                      | Auxiliary Terminal Alert Enable       | ✓          | ✓           | ✓              | ✓           |
|                      | Auxiliary Input <sup>(1)</sup>        | ---        | ---         | ---            | ---         |
|                      | Auxiliary Terminal Action             | ---        | ✓           | ---            | ✓           |
|                      | Supply Pressure Lo Alert Enable       | ✓          | ✓           | ✓              | ✓           |
|                      | Supply Pressure <sup>(1)</sup>        | ---        | ---         | ---            | ---         |
|                      | Supply Press Lo Alert Point           | ✓          | ✓           | ✓              | ✓           |
|                      | Travel <sup>(1)</sup>                 | ---        | ---         | ---            | ---         |
|                      | Travel Set Point <sup>(1)</sup>       | ---        | ---         | ---            | ---         |
|                      | Travel Alert Deadband                 | ✓          | ✓           | ✓              | ✓           |

✓—indicates parameter may be modified for instrument mode and protection shown.  
 1. Information only.  
 2. In firmware 3 thru 6 this parameter is labeled Minimum Opening Time.  
 3. In firmware 3 thru 6 this parameter is labeled Minimum Closing Time.

—Continued—

Table 4-3. Conditions for Modifying FIELDVUE DVC6000 SIS Digital Valve Controller Parameters (Continued)

| Parameters |                                       | In Service |             | Out of Service |             |
|------------|---------------------------------------|------------|-------------|----------------|-------------|
|            |                                       | Protected  | Unprotected | Protected      | Unprotected |
| Alerts     | Travel Deviation Alert Enable         | ✓          | ✓           | ✓              | ✓           |
|            | Travel Deviation Alert Point          | ✓          | ✓           | ✓              | ✓           |
|            | Travel Deviation Time                 | ✓          | ✓           | ✓              | ✓           |
|            | Travel Alert Hi Hi Enable             | ✓          | ✓           | ✓              | ✓           |
|            | Travel Alert Lo Lo Enable             | ✓          | ✓           | ✓              | ✓           |
|            | Travel Alert Hi Hi Point              | ✓          | ✓           | ✓              | ✓           |
|            | Travel Alert Lo Lo Point              | ✓          | ✓           | ✓              | ✓           |
|            | Travel Alert Hi Enable                | ✓          | ✓           | ✓              | ✓           |
|            | Travel Alert Lo Enable                | ✓          | ✓           | ✓              | ✓           |
|            | Travel Alert Hi Point                 | ✓          | ✓           | ✓              | ✓           |
|            | Travel Alert Lo Point                 | ✓          | ✓           | ✓              | ✓           |
|            | Travel Limit / Cutoff Hi Alert Enable | ✓          | ✓           | ✓              | ✓           |
|            | Travel Limit / Cutoff Lo Alert Enable | ✓          | ✓           | ✓              | ✓           |
|            | Travel / Pressure Cutoff Hi           | ---        | ---         | ---            | ✓           |
|            | Travel / Pressure Cutoff Lo           | ---        | ---         | ---            | ✓           |
|            | Cycle Count Alert Enable              | ✓          | ✓           | ✓              | ✓           |
|            | Cycle Counter                         | ✓          | ✓           | ✓              | ✓           |
|            | Cycle Count Alert Point               | ✓          | ✓           | ✓              | ✓           |
|            | Cycle Count / Tvl Accum Deadband      | ✓          | ✓           | ✓              | ✓           |
|            | Travel Accumulator Alert Enable       | ✓          | ✓           | ✓              | ✓           |
| Status     | Travel Accumulator                    | ✓          | ✓           | ✓              | ✓           |
|            | Travel Accumulator Alert Point        | ✓          | ✓           | ✓              | ✓           |
|            | Partial Stroke Pressure Limit         | ✓          | ✓           | ✓              | ✓           |
|            | Pressure Deviation Alert Enable       | ✓          | ✓           | ✓              | ✓           |
|            | Pressure Deviation Alert Point        | ✓          | ✓           | ✓              | ✓           |
|            | Pressure Deviation Time               | ✓          | ✓           | ✓              | ✓           |
|            | Alert Record Has Entries Enable       | ✓          | ✓           | ✓              | ✓           |
|            | Alert Record Full Enable              | ✓          | ✓           | ✓              | ✓           |
|            | View Alert Records <sup>(1)</sup>     | ---        | ---         | ---            | ---         |
|            | Clear ALL Records                     | ✓          | ✓           | ✓              | ✓           |
|            | Failure Group Enable                  | ✓          | ✓           | ✓              | ✓           |
|            | Valve Group Enable                    | ✓          | ✓           | ✓              | ✓           |
| Instrument | Miscellaneous Group Enable            | ✓          | ✓           | ✓              | ✓           |
|            | Instrument Time Invalid Enable        | ✓          | ✓           | ✓              | ✓           |
|            | Instrument Time and Date              | ✓          | ✓           | ✓              | ✓           |
|            | Calibration in Progress Enable        | ✓          | ✓           | ✓              | ✓           |
|            | Autocalibration in Progress Enable    | ✓          | ✓           | ✓              | ✓           |
|            | Diagnostics in Progress Enable        | ✓          | ✓           | ✓              | ✓           |
|            | Diagnostic Data Available Enable      | ✓          | ✓           | ✓              | ✓           |
|            | Pressure Control Active Enable        | ✓          | ✓           | ✓              | ✓           |
|            | Multi-Drop Enable                     | ✓          | ✓           | ✓              | ✓           |
|            | Integrator Saturated Hi Enable        | ✓          | ✓           | ✓              | ✓           |
|            | Integrator Saturated Lo Enable        | ✓          | ✓           | ✓              | ✓           |
|            | Integral Limit                        | ---        | ✓           | ---            | ✓           |
|            | Integral Dead Zone                    | ---        | ✓           | ---            | ✓           |
|            | HART Tag                              | ✓          | ✓           | ✓              | ✓           |
|            | Message                               | ✓          | ✓           | ✓              | ✓           |
|            | Descriptor                            | ✓          | ✓           | ✓              | ✓           |
|            | Date                                  | ✓          | ✓           | ✓              | ✓           |
|            | Valve Serial Number                   | ---        | ✓           | ---            | ✓           |
|            | Instrument Serial Number              | ---        | ✓           | ---            | ✓           |
|            | Polling Address                       | ---        | ---         | ---            | ✓           |
|            | Pressure Units                        | ---        | ---         | ---            | ✓           |
|            | Temperature Units                     | ✓          | ✓           | ✓              | ✓           |
|            | Analog Input Units                    | ---        | ---         | ---            | ✓           |
|            | Analog Input Range High               | ---        | ---         | ---            | ✓           |
|            | Analog Input Range Low                | ---        | ---         | ---            | ✓           |

✓—indicates parameter may be modified for instrument mode and protection shown.  
1. Information only.

—Continued—

Table 4-3. Conditions for Modifying FIELDVUE DVC6000 SIS Digital Valve Controller Parameters (Continued)

| Parameters           |                                        | In Service |             | Out of Service |             |
|----------------------|----------------------------------------|------------|-------------|----------------|-------------|
|                      |                                        | Protected  | Unprotected | Protected      | Unprotected |
| Valve & Actuator     | Relay Type                             | ---        | ---         | ---            | ✓           |
|                      | Zero Power Condition                   | ---        | ---         | ---            | ✓           |
|                      | Maximum Supply Pressure                | ---        | ---         | ---            | ✓           |
|                      | Auxiliary Terminal Action              | ---        | ---         | ---            | ✓           |
|                      | Instrument Date and Time               | ✓          | ✓           | ✓              | ✓           |
|                      | Last Calibration Status <sup>(1)</sup> | ---        | ---         | ---            | ---         |
|                      | Calibration Location <sup>(1)</sup>    | ---        | ---         | ---            | ---         |
|                      | Manufacturer <sup>(1)</sup>            | ---        | ---         | ---            | ---         |
|                      | Valve Serial Number                    | ---        | ✓           | ---            | ✓           |
|                      | Valve Style                            | ---        | ---         | ---            | ✓           |
| SIS / Partial Stroke | Actuator Style                         | ---        | ---         | ---            | ✓           |
|                      | View/Edit Feedback Connection          | ---        | ---         | ---            | ✓           |
|                      | Travel Sensor Motion                   | ---        | ---         | ---            | ✓           |
|                      | Partial Stroke Test Enable             | ---        | ---         | ---            | ✓           |
|                      | Partial Stroke Press Limit             | ---        | ---         | ---            | ✓           |
|                      | Maximum Travel Movement                | ---        | ---         | ---            | ✓           |
|                      | Test Speed                             | ---        | ---         | ---            | ✓           |
|                      | Test Pause Time                        | ---        | ---         | ---            | ✓           |
|                      | View/Edit Auto Test Interval           | ---        | ✓           | ---            | ✓           |
|                      | Device Power Up                        | ---        | ---         | ---            | ✓           |

✓—indicates parameter may be modified for instrument mode and protection shown.  
1. Information only.

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## Note

When selecting a tuning set for a DVC6015, DVC6025 or DVC6035 remote mount unit, it may be necessary to reduce the tuning set, due to the effects of the long tubing between the digital valve controller and the actuator.

- **Integral Enable**—Yes or No. Enable the integral setting to improve static performance by correcting for error that exists between the travel target and actual travel. Travel Integral Control is disabled by default.

- **Integral Gain**—Travel Integral Gain is the ratio of the change in output to the change in input, based on the control action in which the output is proportional to the time integral of the input.



## Note

Use Expert tuning only if standard tuning has not achieved the desired results.

**Stabilize/Optimize or Performance Tuner may be used to achieve the desired results more rapidly than Expert tuning.**

- **Stabilize/Optimize**—Stabilize/Optimize permits you to adjust valve response by changing the digital valve controller tuning.

If the valve is unstable, select *Decrease Response* to stabilize valve operation. This selects the next lower tuning set (e.g., F to E). If the valve response is sluggish, select *Increase Response* to make the valve more responsive. This selects the next higher tuning set (e.g., F to G).

Table 4-4 provides tuning set selection guidelines for Fisher actuators. These tuning sets are only recommended starting points. After you finish setting up and calibrating the instrument, you may have to select either a higher or lower tuning set to get the desired response. You can use the Performance Tuner to optimize tuning.

If after selecting *Decrease Response* or *Increase Response* the valve travel overshoot is excessive, select *Decrease Damping* to select a damping value that allows more overshoot. Select *Increase Damping* to select a damping value that will decrease the overshoot. When finished, select *done*.

Table 4-4. Actuator Information for Basic Setup

| Actuator Manufacturer | Actuator Model | Actuator Size                                      | Actuator Style                                                              | Starting Tuning Set   | Feedback Connection                                                        | Travel Sensor Motion                                                         |                  |
|-----------------------|----------------|----------------------------------------------------|-----------------------------------------------------------------------------|-----------------------|----------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------|
|                       |                |                                                    |                                                                             |                       |                                                                            | Relay A or C                                                                 | Relay B          |
| Fisher                | 585C & 585CR   | 25<br>50<br>60<br>68, 80<br>100, 130               | Piston Dbl w/ or w/o Spring. See actuator instruction manual and nameplate. | E<br>I<br>J<br>L<br>M | SStem-Standard for travels up to 4 inches. SStem-Roller for longer travels | Depends upon pneumatic connections. See description for Travel Sensor Motion |                  |
|                       | 657            | 30<br>34, 40<br>45, 50<br>46, 60, 70, 76, & 80-100 | Spring & Diaphragm                                                          | H<br>K<br>L<br>M      | SStem-Standard                                                             | Clockwise                                                                    | Counterclockwise |
|                       | 667            | 30<br>34, 40<br>45, 50<br>46, 60, 70, 76, & 80-100 | Spring & Diaphragm                                                          | H<br>K<br>L<br>M      | SStem-Standard                                                             | Counterclockwise                                                             | Clockwise        |
|                       | 1051 & 1052    | 20, 30<br>33<br>40<br>60, 70                       | Spring & Diaphragm                                                          | H<br>I<br>K<br>M      | Rotary                                                                     | Clockwise                                                                    | Counterclockwise |
|                       | 1061           | 30<br>40<br>60<br>68, 80, 100, 130                 | Piston Dbl w/o Spring                                                       | J<br>K<br>L<br>M      | Rotary                                                                     | Depends upon pneumatic connections. See description for Travel Sensor Motion |                  |
|                       | 1066SR         | 20<br>27, 75                                       | Piston Sgl w/Spring                                                         | G<br>L                | Rotary                                                                     | Depends upon mounting style, see actuator instruction manual and table 4-5   |                  |
|                       | 2052           | 1<br>2<br>3                                        | Spring & Diaphragm                                                          | H<br>J<br>M           | Rotary                                                                     | Clockwise                                                                    | Counterclockwise |

Table 4-5. Travel Sensor Motion Selections for the FIELDVUE DVC6030 SIS on 1066SR Actuators

| Mounting Style | Travel Sensor Motion |                  |
|----------------|----------------------|------------------|
|                | Relay A or C         | Relay B          |
| A              | Clockwise            | Counterclockwise |
| B              | Counterclockwise     | Clockwise        |
| C              | Counterclockwise     | Clockwise        |
| D              | Clockwise            | Counterclockwise |

• **Performance Tuner**—The Performance Tuner is used to optimize digital valve controller tuning. It can be used with digital valve controllers mounted on most sliding-stem and rotary actuators, including Fisher and other manufacturers' products. Moreover, because the Performance Tuner can detect internal instabilities before they become apparent in the travel response, it can generally optimize tuning more effectively than manual tuning. Typically, the Performance Tuner

takes 3 to 5 minutes to tune an instrument, although tuning instruments mounted on larger actuators may take longer.

## Integral Settings (1-2-2-1-2)

• **Integral Dead Zone**—A window around the Primary Setpoint in which integral action is disabled. This feature is used to eliminate friction induced limit cycles around the Primary Setpoint when the integrator is active. The Dead Zone is configurable from 0% to 2%, corresponding to a symmetric window from 0% to +/-2% around the Primary Setpoint. Default value is 0.25%.

• **Integral Limit**—The Integral Limit provides an upper limit to the integrator output. The high limit is configurable from 0 to 100% of the I/P drive signal.

## Pressure Tuning (1-2-2-1-3)



### WARNING

Changes to the tuning set may cause the valve/actuator assembly to stroke. To avoid personal injury and property damage caused by moving parts, keep hands, tools, and other objects away from the valve/actuator assembly.

- **Pressure Tuning Set**—There are twelve Pressure Tuning Sets to choose from. Each tuning set provides a preselected value for the digital valve controller gain settings. Tuning set C provides the slowest response and M provides the fastest response.

Tuning set B is appropriate for controlling a pneumatic positioner. Table 4-6 lists the proportional gain, pressure integrator gain and minor loop feedback gain values for preselected tuning sets.

In addition, you can specify Expert tuning and individually set the pressure proportional gain, pressure integrator gain, and pressure minor loop feedback gain. Individually setting or changing any tuning parameter will automatically change the tuning set to X (expert).

Table 4-6. Gain Values for Preselected Pressure Tuning Sets

| Tuning set | Pressure Proportional Gain | Pressure Integrator Gain | Pressure Minor Loop Feedback Gain |
|------------|----------------------------|--------------------------|-----------------------------------|
| B          | 0.5                        | 0.3                      | 35                                |
| C          | 2.2                        | 0.1                      | 35                                |
| D          | 2.4                        | 0.1                      | 35                                |
| E          | 2.8                        | 0.1                      | 35                                |
| F          | 3.1                        | 0.1                      | 35                                |
| G          | 3.6                        | 0.1                      | 34                                |
| H          | 4.2                        | 0.1                      | 31                                |
| I          | 4.8                        | 0.1                      | 27                                |
| J          | 5.6                        | 0.1                      | 23                                |
| K          | 6.6                        | 0.1                      | 18                                |
| L          | 7.8                        | 0.1                      | 12                                |
| M          | 9.0                        | 0.1                      | 12                                |
| X (Expert) | User Adjusted              | User Adjusted            | User Adjusted                     |

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### Note

Use Expert tuning only if standard tuning has not achieved the desired results.

Stabilize/Optimize and performance tuner may be used to achieve the desired results more rapidly than Expert tuning.



### Note

When selecting a tuning set for a DVC6015, DVC6025 or DVC6035 remote mount unit, it may be necessary to reduce the tuning set, due to the effects of the long tubing between the digital valve controller and the actuator.

- **Integral Enable**—Yes or No. Enable the pressure integral setting to improve static performance by correcting for error that exists between the pressure target and actual pressure. Pressure Integral Control is disabled by default.

- **Integral Gain**—Pressure Integral Gain (also called reset) is the gain factor applied to the time integral of the error signal between desired and actual pressure. Changing this parameter will also change the tuning set to Expert.

## Travel/Pressure Control

### Tvl/Press Cutoffs (1-2-2-2-1)

- *Cutoff Hi*—Defines the high cutoff point for the travel in percent (%) of ranged input current.
- *Cutoff Lo*—Defines the low cutoff point for the travel set point.
- *Change Cutoffs*—Allows you to set Cutoff Hi and Cutoff Lo. When a cutoff is set the corresponding travel or pressure limit is disabled.

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Travel cutoffs are adjustable when the DVC6000 SIS is operating with a 4-20 mA current input. The Setup Wizard automatically sets travel cutoffs at 50%, making the DVC6000 SIS work like an on-off device. At current levels from 4.0 to 11.99 mA, the DVC6000 SIS will provide minimum output pressure, and at 12 to 20 mA, the DVC6000 SIS will provide full output pressure.

You can customize valve response to the control signal by changing the travel cutoffs. For example, it is possible to have the valve throttle between 10 and 90% travel, but work as an on-off valve between 0% to 10% and 90% to 100% travel. The user now has a standard throttling control valve between 10% and 90% travel. Outside of this range, the valve will move to its travel extreme (0% or 100%).



## Note

If you run the Setup Wizard after adjusting the Travel Cutoffs, they will revert back to the default values. You will need to reset the Travel Cutoffs to the desired settings.



## Note

The partial stroke test cannot be conducted by the Field Communicator or ValveLink software while the digital valve controller is in its normal travel control mode (with adjustable cutoffs set to a different value than the default).



## WARNING

Using the auxiliary terminal (push button) for partial stroke testing while the DVC6000 SIS digital valve controller is in point-to-point mode may cause changes in output pressure and travel, resulting in process instability. Depending on the application, these changes may upset the process, which may result in personal injury or property damage.

If the auxiliary terminal button is pressed for more than 3 seconds, but less than 5 seconds, the digital valve controller will drive the valve from its existing travel position to 100% travel condition for a fail close valve (or 0% travel for a fail open valve) and perform the partial stroke test. Once the partial stroke test is completed, the digital valve controller will bring the valve back to its original travel, corresponding to the control set point.



## Note

In a typical 0-24 VDC de-energize-to-trip operating system, a digital valve controller with the single-acting direct relay will provide full output pressure to port A when 24 VDC is applied, and minimum (near 0) output pressure to port A when 0 VDC is applied. With the single-acting direct relay, there would be no output pressure from port B.

Other configurations of the relay are available (see table 3-2). An example of this flexibility is the use of a single-acting reverse relay that will supply full pressure output at 0 VDC input. This configuration can be useful to provide the benefits of Partial Valve Stroke Diagnostics but minimize the spurious trip rate (the power to the digital valve controller can be lost without tripping the valve), but would only be recommended when a solenoid is provided to take the valve to the safe position

Table 4-7. Guidelines for Manually Setting Pressure Set Point

| Actuator Type | Relay Type | Zero Power Condition | Partial Stroke Start Point | Pressure Set Point |
|---------------|------------|----------------------|----------------------------|--------------------|
| Single-Acting | A or C     | Closed               | Open                       | Psupply – 2 psig   |
|               |            |                      | Closed                     | 2 psig             |
|               |            | Open                 | Open                       | 2 psig             |
|               |            |                      | Closed                     | Psupply – 2 psig   |
|               | B          | Closed               | Open                       | 2 psig             |
|               |            |                      | Closed                     | Psupply – 2 psig   |
|               |            | Open                 | Open                       | Psupply – 2 psig   |
|               |            |                      | Closed                     | 2 psig             |
| Double-Acting | A          | Closed               | Open                       | Psupply – 5 psig   |
|               |            |                      | Closed                     | 5 psig – Psupply   |
|               |            | Open                 | Open                       | 5 psig – Psupply   |
|               |            |                      | Closed                     | Psupply – 5 psig   |

**End Point Pressure Control (1-2-2-2-2)**

● **End Pt Control Enab**— Yes or No. End Point Pressure Control allows the digital valve controller to pull back from saturation of the pneumatic output after reaching the travel extreme. Rather than having the instrument provide full supply pressure (saturation) continuously at the travel extreme, the digital valve controller switches to an End Point Pressure Control where the output pressure (pressure controller set point) to the actuator is controlled at a certain value. This value is configured through Pressure Set Point. Because the digital valve controller is constantly in control and not allowed to reach a dormant or saturated state, it is constantly testing its own pneumatic system. If there is an output pressure deviation, for example, the instrument will issue an alert. To assure there is an alert when an output pressure deviation occurs, set up the alert as described under Pressure Deviation Alert.

● **PST Start Pt**—Defines the travel stop the valve needs to be at before a partial stroke test can be initiated. Also defines the travel stop for end point pressure control. Setting this value to Not Configured will disable partial stroke tests and end point pressure control.

● **EPPC Set Point**— As part of End Point Pressure Control, Pressure Set Point is the target pressure the positioner controls to when the valve is at the travel stop defined by PST Start Point. Default values for Pressure Set Point are summarized in table 4-7. When controlling pressure in the open position, Pressure Set Point must be set at a value that ensures the valve will remain open. When controlling pressure in the closed position, Pressure Set Point must be set at a value that ensures the valve will remain closed and has

enough force to maintain its rated shutoff classification. For double-acting spring return actuators, this is the differential pressure required to either maintain the fully open or fully closed position, depending on the valve and actuator configuration. For a double-acting actuator without springs with a fail-close valve, this is 95% of the supply pressure. If the valve is fail-open, the upper operating pressure for all actuator is set to the supply pressure.

**Note**

**End Point Pressure Control will be set automatically during the Setup Wizard or during the Auto Calibration Travel procedure.**

Refer to table 4-7 for guidelines for manually setting Pressure Set Point.

● **EPPC Saturation Time**—The amount of time the digital valve controller stays in hard cutoff before switching to pressure control. Default is 45 seconds.

**Input Characterization (1-2-2-3)**

Input Characterization defines the relationship between the travel target and ranged set point. Ranged set point is the input to the characterization function. If the zero power condition equals closed, then a set point of 0% corresponds to a ranged input of 0%. If the zero power condition equals open, a set point of 0% corresponds to a ranged input of 100%. Travel target is the output from the characterization function.

To select an input characterization, select *Input Characterization* from the *Response Control* menu. You can select from the three fixed input characteristics shown in figure 4-1 or you can select a custom characteristic. Figure 4-1 shows the relationship between the travel target and ranged set point for the fixed input characteristics, assuming the Zero Power Condition is configured as closed.

You can specify 21 points on a custom characteristic curve. Each point defines a travel target, in % of ranged travel, for a corresponding set point, in % of ranged set point. Set point values range from -6.25% to 106.25%. Before modification, the custom characteristic is linear.

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## Custom Characterization Table (1-2-2-4)

To define a custom input characteristic select *Custom Characterization Table* from the *Response Control* menu. Select the point you wish to define (1 to 21), then enter the desired set point value. Press Enter then enter the desired travel target for the corresponding set point. When finished, select point 0 to return to the *Response Control* menu.

With input characterization you can modify the overall characteristic of the valve and instrument combination. Selecting an equal percentage, quick opening, or custom (other than the default of linear) input characteristic modifies the overall valve and instrument characteristic. However, 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).

## Dynamic Response (1-2-2-5)

- **SP Rate Open** (Minimum Opening Time in firmware 3–6)—Maximum rate (% of valve travel per second) at which the digital valve controller will move to the open position regardless of the rate of input current change. A value of 0 will deactivate this feature and allow the valve to stroke open as fast as possible. In firmware 10 and below this parameter should be set to 0.

- **SP Rate Close** (Minimum Closing Time in firmware 3–6)—Maximum rate (% of valve travel per second) at which the digital valve controller will move to the close position regardless of the rate of input current change. A value of 0 will deactivate this feature and allow the valve to stroke close as fast as possible. In firmware 10 and below this parameter should be set to 0.

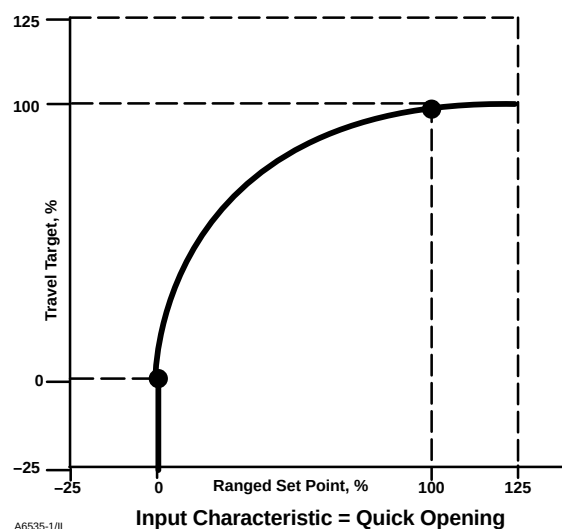
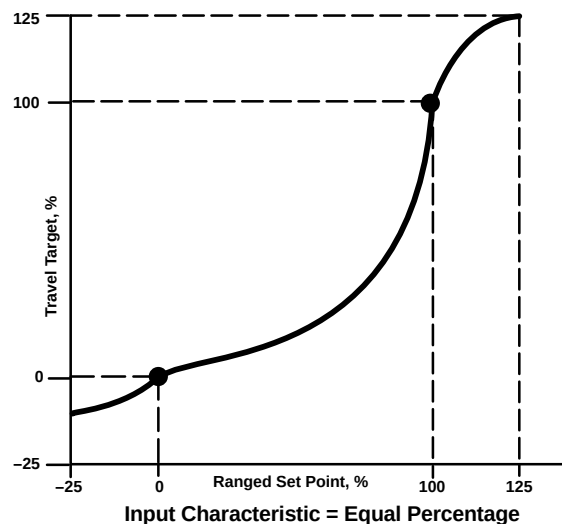
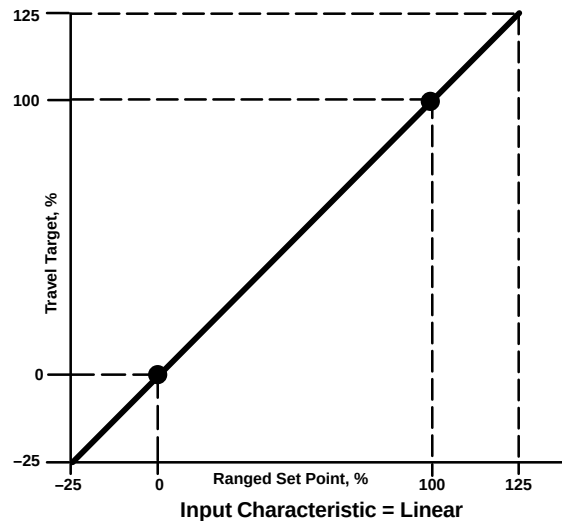


Figure 4-1. Travel Target Versus Ranged Set Point, for Various Input Characteristics (Zero Power Condition = Closed)



## Note

**Lag Time** is available in firmware 7, 9, 10, and 11.

- **Lag Time**—Slows the response of the digital valve controller. A value ranging from 0.2 to 10.0 can be used for noisy or fast processes to improve closed loop process control. Entering a value of 0.0 will deactivate the lag filter. In firmware 7, 9, and 10 this parameter should be set to 0.

## Alert Setup (1-2-3)

The following menus are available for configuring alerts and shutdowns. Items on the menus may be changed with the instrument In Service. Protection does not need to be removed (no need to set to *None*). Alerts are not processed when a diagnostic is in progress. Select *Configure*, *Detailed Setup*, and *Alert Setup*. Follow the prompts on the Field Communicator display to configure the following Alerts: *Electronic Alerts*, *Sensor Alerts*, *Environment Alerts*, *Travel Alerts*, *Travel History Alerts*, *SIS Alerts*, and *Alert Record*.



## Note

The Alerts section covers alerts and shutdowns. An alert, if enabled, can provide information on operation and performance issues. A shutdown, if enabled, and upon the occurrence of the associated failure alert, will cause the instrument air output to go to the Zero Power Condition as per figure 4-6. It will remain latched in that condition until power to the instrument is cycled and the failure alert has cleared. While in shutdown condition the instrument will remain powered up and able to communicate via HART.

### Electronics Alerts (1-2-3-1)

- **Drive Current Shutdown**—Describes the status of I/P current; should the current fail, the digital valve controller will drive the output to its safe

condition. Drive Current Shutdown is part of “Self Test shutdown”. Default is not enabled.

### Drive Signal Alert (1-2-3-1-2)

Drive Signal Alert checks the drive signal and calibrated travel. If one of the following conditions exists for more than 20 seconds, the Drive Signal Alert is set.

For the case where Zero Power Condition is defined as closed:

Drive Signal < 10% and Calibrated Travel > 3%

Drive Signal > 90% and Calibrated Travel < 97%

For the case where Zero Power Condition is defined as open:

Drive Signal < 10% and Calibrated Travel < 97%

Drive Signal > 90% and Calibrated Travel > 3%

- **Drive Signal Alert Enable**—Yes or No. Drive Signal Alert Enable activates checking of the relationship between the Drive Signal and the calibrated travel.

- **Drive Signal**—Shows the value of the instrument drive signal in % (percent) of maximum drive.

### Processor Impaired Alerts (1-2-3-1-3)

- **Offline/Failed Alert Enable**—If enabled, set when the device is in a failed state and not controlling the input.

- **Low Power Write Alert Enable**—When enabled, an alert is generated if a write to the instrument is attempted and fails when the loop current is less than 3.5 mA.

- **Non-Critical NVM Alert Enable**—When enabled, an alert is generated whenever there is a failure associated with non-critical NVM (non-volatile memory). Default is not enabled.

- **Critical NVM Shutdown**—When enabled, the instrument shuts down whenever there is a failure associated with critical NVM (non-volatile memory). Default is not enabled.

- **Flash ROM Shutdown**—When enabled, the instrument shuts down whenever there is a failure associated with flash ROM (read only memory). Default is not enabled.

- **No Free Time Shutdown**—When enabled, the instrument shuts down whenever there is a failure associated with No Free Time. Default is not enabled.

- **Reference Voltage Shutdown**—When enabled, the instrument shuts down whenever there is a failure associated with the internal voltage reference. Default is not enabled.

## Sensor Alerts (1-2-3-2)

- **Travel Sensor Shutdown**—When enabled, the instrument shuts down whenever there is a failure associated with the travel sensor. Default is not enabled.

- **Temp Sensor Shutdown**—When enabled, the instrument shuts down whenever there is a failure associated with the temperature sensor. Default is not enabled.

- **Pressure Sensor Shutdown**—When enabled, the instrument shuts down whenever there is a failure associated with the pressure sensor. Default is not enabled.

## Environment Alerts (1-2-3-3)

### Auxiliary Terminal Alert (1-2-3-3-1)

- **Auxiliary Terminal Alert Enable**—Yes or No. When enabled, the auxiliary terminal acts as an alert activation.

- **Auxiliary Input**—The auxiliary input of the digital valve controller can be configured to be used in different ways. The default configuration allows a pre-configured partial stroke test to be initiated by shorting the aux terminals together, such as with the use of an appropriately connected local pushbutton switch. It can also be configured to enable an alert that will be generated when a switch connected to the Aux terminals is either “open” or “closed”. The third configuration option is for the Aux terminals to be used with the LCP100. In this configuration, the partial stroke test is initiated using the LCP100, and the Aux Input alert is not available.

- **Auxiliary Terminal Action**— Can be Disabled, Alert on Open or Close Contact, SIS Local Control Panel or Push Button Partial Stroke Test. If the LCP100 is not selected, the default is Partial Stroke Test. If the LCP100 is selected during Setup Wizard or enabled in Detailed Setup as Auxiliary Terminal Action – SIS Local Control Panel, the following parameters will be automatically set under Travel Alerts:

- Hi Hi / Lo Lo Enable – YES
- Lo Lo Point (%) – 1
- Hi Hi Point (%) – 99
- DVC Power Up – Manual Reset

## Supply Pressure Lo Alert (1-2-3-3-2)

- **Supply Pressure Lo Alert Enable**—When enabled, the instrument sends an alert when the supply pressure falls below the supply pressure alert point.

- **Supply**—Displays the instrument supply pressure in psi, bar, kPa, or kg/cm<sup>2</sup>.

- **Supply Pressure Lo Alert Point**— When the supply pressure falls below the supply pressure alert point, the supply pressure alert is active. To disable the supply pressure alert, set Supply Press Alert Point to zero.

- **Loop Current Validation Enable**—When enabled, the instrument shuts down whenever there is a failure associated with the measured loop current being out-of-range.

## Travel Alerts (1-2-3-4)

- **Travel**—Travel displays the actual position of the valve in percent (%) of calibrated travel.

- **Set Point**—Travel Set Point is the input to the characterization function.

- **Travel Alert DB**—Travel Alert Deadband is the travel, in percent (%) of ranged travel, required to clear a travel alert, once it has been set. The deadband applies to both Travel Alert Hi/Lo and Travel Alert Hi Hi/Lo Lo. See figure 4-2.

### Travel Deviation Alert (1-2-3-4-4)

If the difference between the travel target and the actual target exceeds the Travel Deviation Alert Point for more than the Travel Deviation Time, the Travel Deviation Alert is set. It remains set until the difference between the travel target and the actual travel is less than the Travel Deviation Alert Point minus the Travel Alert Deadband.

- **Travel Deviation Alert Enable**—Select Yes or No. When enabled, checks the difference between the travel target and the actual travel.

- **Travel Deviation Alert Point**—The alert point for the difference, expressed in percent (%), between the travel target and the actual travel. When the difference exceeds the alert point for more than the Travel Deviation Time, the Travel Deviation Alert is set. Default value is 5%.

- **Travel Deviation Time**—The time, in seconds, that the travel deviation must exceed the Travel Deviation Alert Point before the alert is set. Default value is 10 seconds.

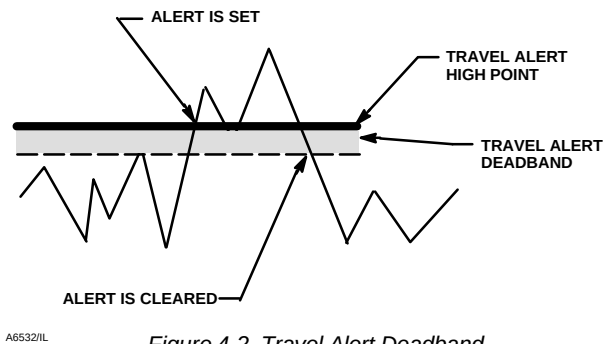


Figure 4-2. Travel Alert Deadband

## Travel Limit Alerts (1-2-3-4-5)

Travel Alert Hi Hi is set if the ranged travel rises above the alert high point. Once the alert is set, the ranged travel must fall below the alert high high point by the Travel Alert Deadband before the alert is cleared. See figure 4-2.

Travel Alert Lo Lo is set if the ranged travel falls below the alert low low point. Once the alert is set, the ranged travel must rise above the alert low low point by the Travel Alert Deadband before the alert is cleared.

- **Travel Alert Hi Hi Enable**—Yes or No. Activates checking of the ranged travel against the Travel Alert High-High points.
- **Travel Alert Lo Lo Enable**—Yes or No. Activates checking of the ranged travel against the Travel Alert Low-Low points.
- **Travel Alert Hi Hi Point**—The value of the travel, in percent (%) of ranged travel, which, when exceeded, sets the Travel Alert Hi Hi alert. When used with the LCP100 local control panel this value is defaulted to 99% (< 99% travel, flashing light, > 99% travel, solid lights).
- **Travel Alert Lo Lo Point**—The value of the travel, in percent (%) of ranged travel, which, when exceeded, sets the Travel Alert Lo Lo alert. When used with the LCP100 local control panel the value is set to 1%.

## Travel Limit Hi/Lo Alerts (1-2-3-4-6)

Travel Alert Hi is set if the ranged travel rises above the alert high point. Once the alert is set, the ranged travel must fall below the alert high point by the Travel Alert Deadband before the alert is cleared. See figure 4-2.

Travel Alert Lo is set if the ranged travel falls below the alert low point. Once the alert is set, the ranged

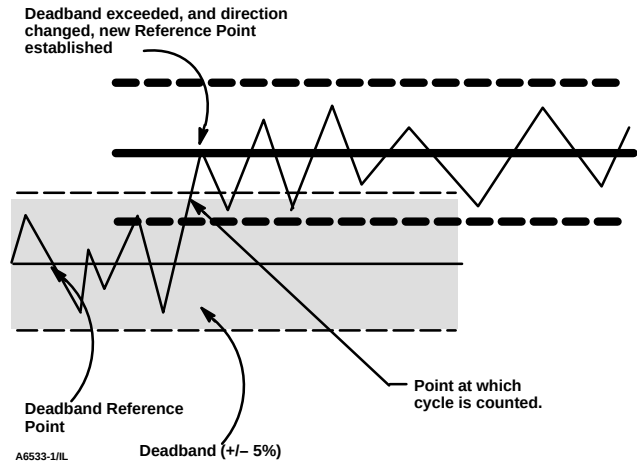


Figure 4-3. Cycle Counter Deadband (set at 10%)

travel must rise above the alert low point by the Travel Alert Deadband before the alert is cleared.

- **Travel Alert Hi Enable**—Yes or No. Activates checking of the ranged travel against the Travel Alert High Point.
- **Travel Alert Lo Enable**—Yes or No. Activates checking of the ranged travel against the Travel Alert Lo Point.
- **Travel Alert Hi Point**—The value of the travel, in percent (%) of ranged travel, which, when exceeded, sets the Travel Alert High alert.
- **Travel Alert Lo Point**—The value of the travel, in percent (%) of ranged travel, which, when exceeded, sets the Travel Alert Low alert.

## Travel Limit/Cutoff Alerts (1-2-3-4-7)

- **Travel Limit/Cutoff Hi Enable**—Yes or No. Activates the Travel Limit/Cutoff Hi alert.
- **Travel Limit/Cutoff Lo Enable**—Yes or No. Activates the Travel Limit/Cutoff Lo alert.
- **Cutoff Hi**—Defines the high cutoff point for the travel in percent (%) of pre-characterized set point.
- **Cutoff Lo**—Defines the low cutoff point for the travel in percent (%) of pre-characterized set point.
- **Change Cutoffs**—Allows you to set Cutoff Hi and Cutoff Lo. When a cutoff is set the corresponding travel or pressure limit is disabled.

## Travel History Alerts

### Cycle Counter (1-2-3-5-1)

- **Cycle Count Alert Enable**—Yes or No. Activates checking of the difference between the Cycle Counter

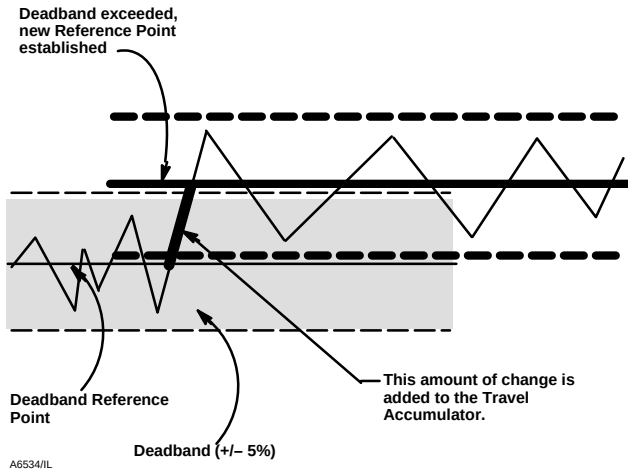


Figure 4-4. Travel Accumulator Deadband (set at 10%)

and the Cycle Counter Alert point. The Cycle Counter Alert is set when the value exceeds the Cycle Counter Alert point. It is cleared after you reset the Cycle Counter to a value less than the alert point.

- **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 can be counted as a cycle. See figure 4-3. You can reset the Cycle Counter by configuring it as zero.

- **Cycle Count Alert Point**—The value of the Cycle Counter, in cycles, which, when exceeded, sets the Cycle Counter Alert.

## Cycle Count/Travel Accumulator Deadband (1-2-3-5-2)

- **Deadband**

Cycle Counter 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 4-3.

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 4-4.

## Travel Accumulator (1-2-3-5-3)

- **Travel Accumulator Alert Enable**—Yes or No. Activates checking of the difference between the Travel Accumulator value and the Travel Accumulator Alert Point. The Travel Accumulation Alert is set when the Travel Accumulator value exceeds the Travel

Accumulator Alert Point. It is cleared after you reset the Travel Accumulation to a value less than the alert point.

- **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 4-4. You can reset the Travel Accumulator by configuring it to zero.

- **Travel Accumulator Alert Point**—The value of the Travel Accumulator, in percent (%) of ranged travel, which, when exceeded, sets the Travel Accumulator Alert.

## SIS Alerts (1-2-3-6)

- **PST Pressure Limit**—Partial Stroke Pressure Limit defines the output pressure that will cause the partial stroke test to stop. For actuators that vent from the test starting point, the pressure limit will be a minimum value. For actuators that fill from the test starting point, the pressure will be a maximum value.

- **Pressure Deviation Alert Enable**—Yes or No. This alert notifies a monitoring system when a deviation in the actuator pressure has occurred. This is used when the instrument is controlling via pressure (Pressure Control Mode is enabled) to the actuator (rather than valve position) to prevent saturation of the pneumatic output. When enabled, this alert checks the difference between the target pressure and the actual pressure. If the difference exceeds the Pressure Deviation Alert Point for more than the pressure deviation time, the Pressure Deviation Alert is set. It remains set until the difference between the target pressure and the actual pressure is less than the Pressure Deviation Alert Point. The pressure deviation alert point and deviation alert time are configurable and can be disabled altogether.

- **Pressure Deviation Alert Point**—The alert point for the difference between the pressure target and the actual pressure. When the difference exceeds the alert point for more than the Pressure Deviation Time, the Pressure Deviation Alert is set. After completion of the Setup Wizard or Auto Travel calibration a default value of 2 psi is set. This will generate an alert when the actuator pressure is not within  $\pm 2$  psi of the target pressure.

- **Pressure Deviation Time**—The time, in seconds, that the pressure deviation must exceed the Pressure Deviation Alert Point before the alert is set. The Pressure Deviation Time is set to 30 seconds by default.

## Alert Record (1-2-3-7)

To be recorded, an alert must both be enabled for reporting, and the group in which it resides must be enabled for recording. Table 4-8 lists the alerts included in each of the groups. When any alert from an enabled group becomes active, active alerts in all enabled groups are stored.

- **Alert Record Has Entries Enable**—Yes or No. When enabled indicates when an alert has been recorded.

- **Alert Record Full Enable**—Yes or No. When enabled indicates when the Alert Event Record is full.

- **View Alert Records**—Displays all recorded alerts and the date and time the alerts were recorded.

- **Clear ALL Records**—Clears the alert record. To clear the alert record, all alerts in enabled groups must be inactive.

### Alert Groups (1-2-3-7-5)

- **Failure Group Enable**—Permits enabling the Failure Alert group. Table 4-8 lists the alerts included in each of the groups.

- **Valve Group Enable**—Permits enabling the Valve Alert group. Table 4-8 lists the alerts included in each of the groups.

- **Miscellaneous Group Enable**—Permits enabling the Miscellaneous Alert group. Table 4-8 lists the alerts included in each of the groups.

## Status (1-2-4)

Select *Configure*, *Detailed Setup*, and *Status*. Follow the prompts on the Field Communicator display to configure the following parameters: *Instrument Time*, *Calibration and Diagnostics*, *Operational*, and *Integrator*.

### Instrument Time (1-2-4-1)

- **Inst Time Invalid Enable**—Yes or No. When enabled indicates when the Instrument Time Invalid alert is active.

- **Instrument Date and Time**—Permits setting the instrument clock. When alerts are stored in the alert record, the date and time (obtained from the instrument clock) that they were stored is also stored in the record. The instrument clock uses a 24-hour format.

Table 4-8. Alerts Included in Alert Groups for Alert Record

| Alert Group          | Alerts Include in Group                                                                                                                                                      |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Valve Alerts         | Travel Lo Alert<br>Travel Hi Alert<br>Travel Lo Lo Alert<br>Travel Hi Hi Alert<br>Travel Deviation Alert<br>Drive Signal Alert                                               |
| Failure Alerts       | Flash ROM Fail<br>No Free Time<br>Reference Voltage Fail<br>Drive Current Fail<br>Critical NVM Fail<br>Temperature Sensor Fail<br>Pressure Sensor Fail<br>Travel Sensor Fail |
| Miscellaneous Alerts | Auxiliary input                                                                                                                                                              |

4

## Calibrations & Diagnostics (1-2-4-2)

- **Calibration in Progress Enable**—Yes or No. When enabled indicates that calibration is in progress.

- **AutoCal in Progress Enable**—Yes or No. When enabled indicates that auto calibration is in progress.

- **Diagnostic in Progress Enable**—Yes or No. When enabled indicates that a diagnostic test is in progress.

- **Diagnostic Data Avail Enable**—Yes or No. When enabled indicates when there is diagnostic data available.

### Operational (1-2-4-3)

- **Pressure Control Active Enable**—Yes or No. When enabled indicates when Pressure Control is active.

- **Multi-Drop Enable**—Yes or No. When enabled indicates the digital valve controller is operating in a multi-drop loop.

### Integrator Saturation (1-2-4-4)

- **Integrator Sat Hi Enable**—Yes or No. When enabled indicates when the Integrator Saturated High alert is active.

- **Integrator Sat Lo Enab**—Yes or No. When enabled indicates when the Integrator Saturated Lo alert is active.

- **Integral Limit**—The Integral Limit provides an upper limit to the integrator output. The high limit is configurable from 0 to 100% of the I/P drive signal.

- **Integ Dead Zone**—A window around the Primary Setpoint in which integral action is disabled. This feature is used to eliminate friction induced limit cycles around the Primary Setpoint when the integrator is

active. The Dead Zone is configurable from 0% to 2%, corresponding to a symmetric window from 0% to  $\pm 2\%$  around the Primary Setpoint. Default value is 0.25%.

## Instrument (1-2-5)

Select *Configure*, *Detailed Setup*, and *Instrument*. Follow the prompts on the Field Communicator display to configure the following Instrument parameters: *General*, *Units*, *Analog Input Range*, *Relay Type*, *Zero Power Condition*, *Maximum Supply Pressure*, *Auxiliary Terminal Action*, *Instrument Date and Time*, and *Calib Status and Type*.

### 4

#### General (1-2-5-1)

- **HART Tag**—Enter an up to 8 character HART tag for the instrument. The HART tag is the easiest way to distinguish between instruments in a multi-instrument environment. Use the HART tag to label instruments electronically according to the requirements of your application. The tag you assign is automatically displayed when the Field Communicator establishes contact with the digital valve controller at power-up.

- **Message**—Enter any message with up to 32 characters. Message provides the most specific user-defined means for identifying individual instruments in multi-instrument environments.

- **Descriptor**—Enter a descriptor for the application with up to 16 characters. The descriptor provides a longer user-defined electronic label to assist with more specific instrument identification than is available with the HART tag.

- **Date**—Enter a date with the format MM/DD/YY. Date is a user-defined variable that provides a place to save the date of the last revision of configuration or calibration information.

- **Valve Serial Number**—Enter the serial number for the valve in the application with up to 12 characters.

- **Instrument Serial Number**—Enter the serial number on the instrument nameplate, up to 12 characters.

- **Polling Address**—If the digital valve controller is used in point-to-point operation, the Polling Address is 0. When several devices are connected in the same loop, such as for split ranging, each device must be assigned a unique polling address. The Polling Address is set to a value between 0 and 15. To change the polling address the instrument must be Out Of Service.

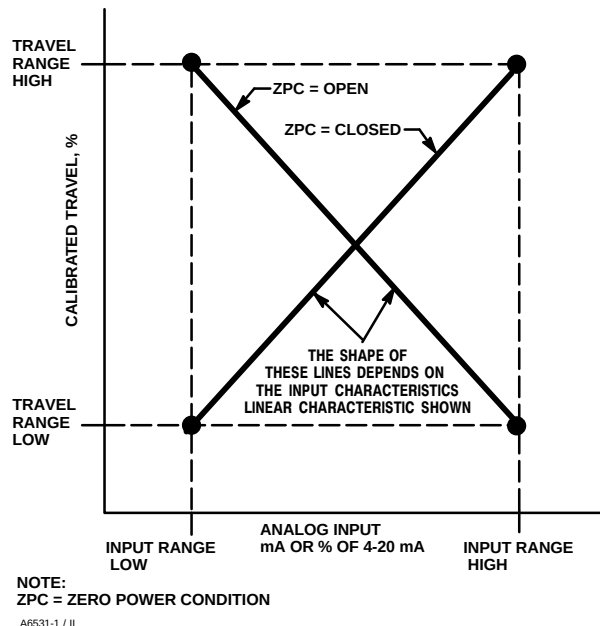


Figure 4-5. Calibrated Travel to Analog Input Relationship

For the Field Communicator to be able to communicate with a device whose polling address is not 0, it must be configured to automatically search for all or specific connected devices.

#### Units (1-2-5-2)

- **Pressure Units**—Defines the output and supply pressure units in either psi, bar, kPa, or kg/cm<sup>2</sup>.

- **Temperature Units**—Degrees Fahrenheit or Celsius. The temperature measured is from a sensor mounted on the digital valve controller's printed wiring board.

- **Analog In Units**—Permits defining the Analog Input Units in mA or percent of 4-20 mA range. Only for instruments in a 4-20 or 0-20 mA installation (point-to-point operation).

#### Analog Input Range (1-2-5-3)

- **Input Range Hi**—Permits setting the Input Range High value. Input Range High should correspond to Travel Range High, if the Zero Power Condition is configured as closed. If the Zero Power Condition is configured as open, Input Range High corresponds to Travel Range Low. See figure 4-5.

- **Input Range Lo**—Permits setting the Input Range Low value. Input Range Low should correspond to Travel Range Low, if the Zero Power Condition is configured as closed. If the Zero Power Condition is configured as open, Input Range Low corresponds to Travel Range High. See figure 4-5.



| RELAY TYPE                      | LOSS OF POWER                                                                   | LOSS OF PNEUMATIC SUPPLY                  |
|---------------------------------|---------------------------------------------------------------------------------|-------------------------------------------|
| Single-Acting Direct (Relay C)  | Instrument goes to zero air output at port A.                                   | Failure direction per actuator fail mode. |
| Double-Acting (Relay A)         | Instrument goes to full supply air output at port B. A goes to zero air output. | Failure direction cannot be determined.   |
| Single-Acting Reverse (Relay B) | Instrument goes to full supply air output at port B.                            | Failure direction per actuator fail mode. |

Figure 4-6. Zero Power Condition

- **Relay Type** —There are three basic categories of relays that result in various combinations from which to select.

*Relay Type:* The relay type is printed on the label affixed to the relay body.

A = double-acting or single-acting

B = single-acting, reverse

C = single-acting, direct

*Special App:* This is used only in single-acting applications where the “unused” output port is configured to read the pressure downstream of a solenoid valve. See page 2-21 for additional information.

*Lo Bleed:* The label affixed to the relay body indicates it is a low bleed version (default for SIS tier).

- **Zero Power Condition** (Zero Control Signal in firmware 3–6)—The position of the valve (open or closed) when the electrical power to the instrument is removed. Zero Power Condition (ZPC) is determined by relay and actuator action, as shown in figure 4-6.

- **Maximum Supply Pressure**—Enter the maximum supply pressure in psi, bar, kPa, or kg/cm<sup>2</sup>, depending on what was selected for pressure units.

- **Auxiliary Terminal Action**—Selections are Disabled, Alert on Open or Close Contact, SIS Local Control Panel or Push Button Partial Stroke Test. If the LCP100 is not selected, the default is Partial Stroke Test. If the LCP100 is selected during Setup Wizard or enabled in Detailed Setup as Auxiliary Terminal Action – SIS Local Control Panel, the following parameters will be automatically set under Travel Alerts:

Hi Hi / Lo Lo Enable – YES

Lo Lo Point (%) – 1

Hi Hi Point (%) – 99

DVC Power Up – Manual Reset

- **Instrument Date and Time**—A user-defined variable that provides a place to save the date of the last revision of configuration or calibration information.

## Calibration Status and Type (1-2-5-9)

- *Last AutoCal Status*—Indicates the status of the last instrument calibration.

- *Last Calibration Type*—Indicates the type of the last instrument calibration.

## Valve & Actuator (1-2-6)

Select *Configure*, *Detailed Setup*, and *Valve & Actuator*. Follow the prompts on the Field Communicator display to configure the following instrument parameters: *Manufacturer*, *Valve Serial Number*, *Valve Style*, *Actuator Style*, *Travel Sensor Motion*, *View/Edit Feedback Connection*, and *Assembly Specification Sheet*.

- **Manufacturer**—Enter the manufacturer of the actuator on which the instrument is mounted. If the actuator manufacturer is not listed, select Other.

- **Valve Serial Number**—Enter the serial number for the valve in the application with up to 12 characters.

- **Valve Style**—Enter the valve style, rotary or sliding-stem.

- **Actuator Style**—Enter the actuator style, spring and diaphragm, piston double-acting without spring, piston single-acting with spring, or piston double-acting with spring.

- **Travel Sensor Motion**—Select Clockwise, or Counterclockwise. Travel Sensor Motion establishes the proper travel sensor rotation. Determine the

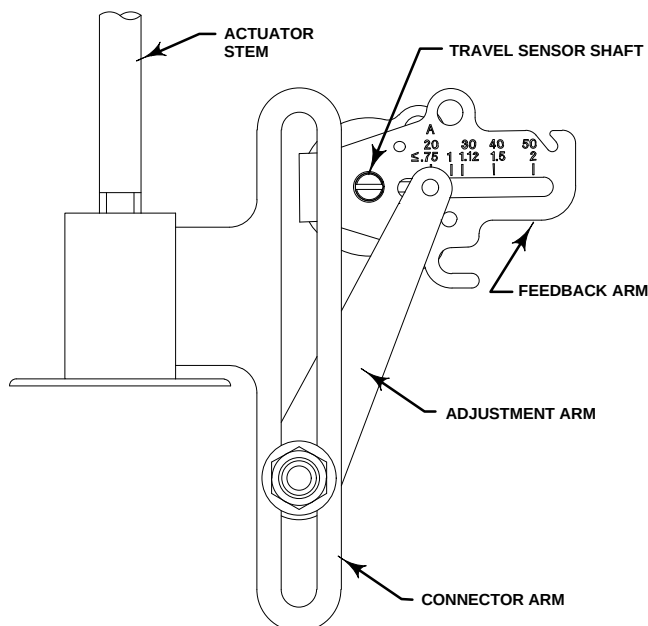


Figure 4-7. Feedback Connection for Typical Sliding-Stem Actuator (Up to 4 inch Travel)

rotation by viewing the end of the travel sensor shaft from the perspective of the actuator.

**For instruments with Relay A and C:** If increasing air pressure at output A causes the shaft to turn clockwise, enter Clockwise. If it causes the shaft to turn counterclockwise, enter Counterclockwise.

**For instruments with Relay B:** If increasing air pressure at output B causes the shaft to turn counterclockwise, enter Clockwise. If it causes the shaft to turn clockwise, enter Counterclockwise.

- **View/Edit Feedback Connection**—Select Rotary All, SStem - Roller or SStem - Standard. For rotary valves, enter Rotary - All, SStem - Roller.

For sliding-stem valves, if the feedback linkage consists of a connector arm, adjustment arm, and feedback arm (similar to figure 4-7), enter SStem - Standard. If the feedback linkage consists of a roller that follows a cam (similar to figure 4-8), enter Rotary All, SStem - Roller.

- **Assembly Specification Sheet**—Allows you to view and edit the Specification Sheet used by ValveLink software.

## SIS/Partial Stroke (1-2-7)

- **PST Enable**—Yes or No. Enables or disables the Partial Stroke Test.

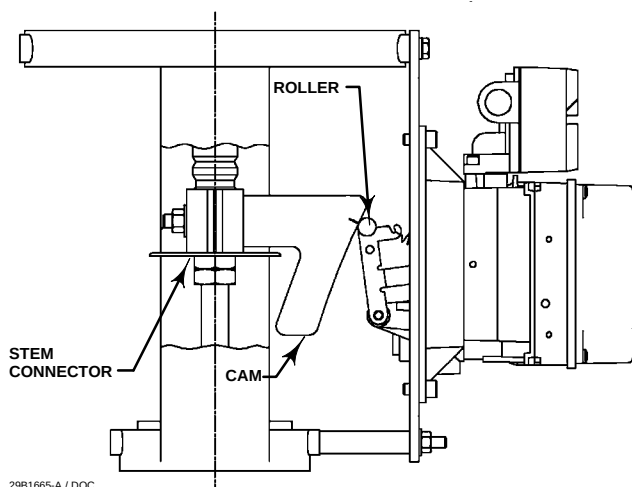


Figure 4-8. Feedback Connection for Typical Long-Stroke Sliding-Stem Actuator (4 to 24 Inches Travel)

- **PST Enable**—Checks the instrument for proper configuration for the Partial Stroke Test to run. If the configuration is not correct, you are given the opportunity to correct it. Once the configuration is correct the Partial Stroke test is enabled.

- **View/Edit PST Variables**—Follow the prompts on the Field Communicator display to enter or view information for following PST Variables: *Max Travel Movement*, *Stroke Speed*, *Pause Time*, *PST Press Limit*, *PST Mode Enable*, *Pressure Set Point*, and *End Pt Control Enable*. For more information on the partial stroke test see Partial Stroke Test in Section 6.

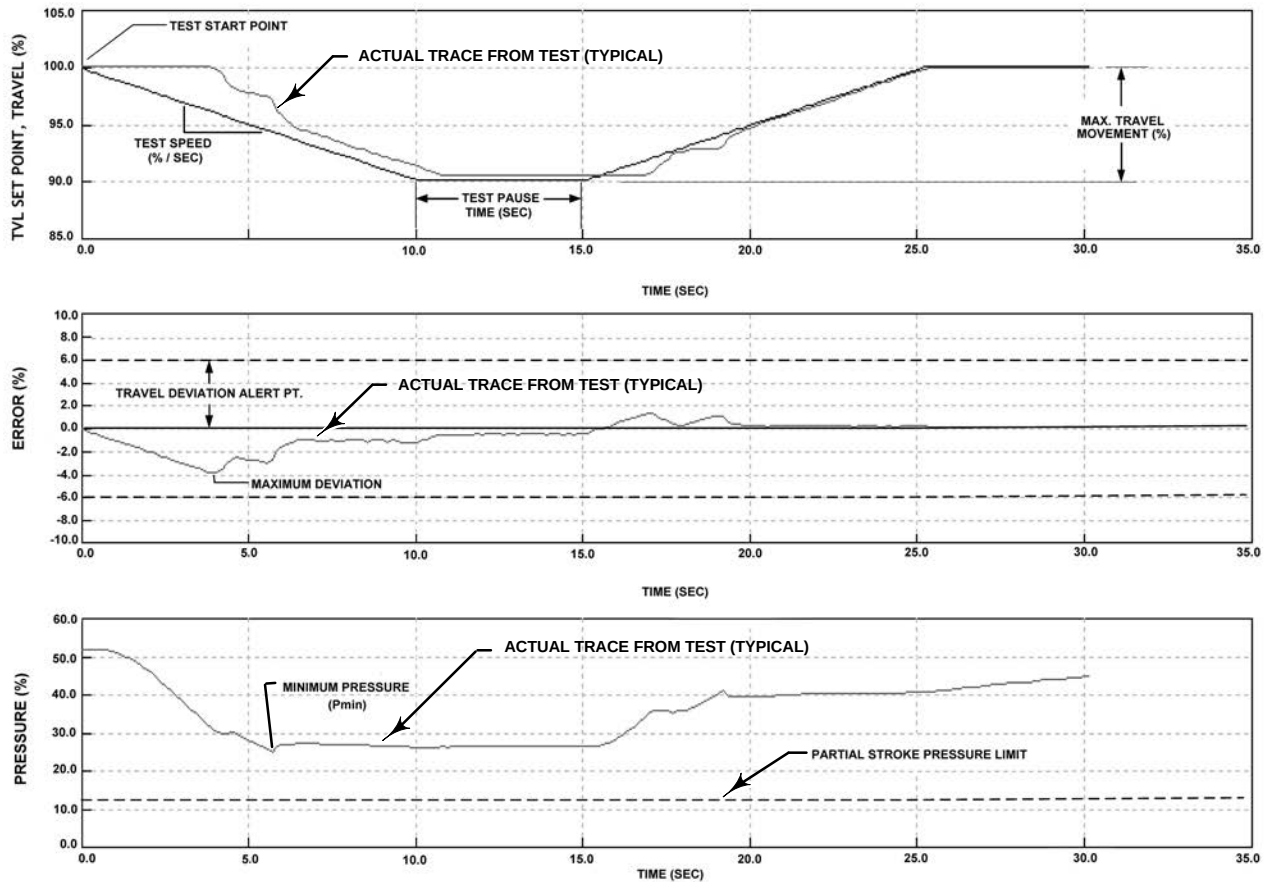
**Max Travel Movement**—Defines the maximum displacement of partial stroke test signal from the travel stop. Default value is 10%. It may be set to a value between 1 and 30% in 0.1% increments.



## Note

**The Max Travel Movement is the percentage of total span that the valve moves away from its operating state towards its fail state during a Partial Stroke Test.**

**Stroke Speed**—The stroke speed can be set for 1%/second, 0.5%/second, 0.25%/second, 0.12%/second, or 0.06%/second. The default value for Partial Stroke Speed is 0.25%/second. For large size actuators set the stroke speed to 0.06%/second.



4

Figure 4-9. Time Series Plots of Travel Set Point, Travel, Error, and Actuator Pressure for a Typical Emergency Shutdown Valve

**Pause Time**—Setup Wizard sets the Partial Stroke Pause Time to 5 seconds. This is the pause time between the up and down strokes of the test. It can be set for 5, 10, 15, 20 or 30 seconds.

**PST Press Limit** (single-acting actuators)—During Setup Wizard or Auto Travel Calibration, the Partial Stroke Pressure Limit will be set to a positive value for single-acting actuators. For those actuators that vent from the test starting point, the pressure limit will be a minimum value. For those actuators that fill from the test starting point, the pressure limit will be a maximum value. The pressure signal used for this threshold depends on relay type and is summarized below.

## Relay Type

A or C  
B  
B Special App.  
C Special App.

## Pressure Signal

Port A – Port B  
Port B – Port A  
Port B  
Port A

**PST Press Limit** (double-acting actuators)— During Setup Wizard or Auto Travel Calibration, the PST Press Limit will be set to a negative value for actuators where the Partial Stroke Start Point is opposite of the Zero Power Condition (e.g., Partial Stroke Start Point = Open and Zero Power Condition = Closed) and to a positive value for actuators where the Partial Stroke Start Point is the same as the Zero Power Condition.

## Manual SIS / Partial Stroke Parameter Configuration



### Note

In order to manually set the partial stroke pressure limit with the correct value, you must be able to run a valve signature test using ValveLink software (see figure 4-9). It is then possible to set the partial stroke pressure limit with the Field Communicator, using the information generated by the valve signature test.

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Thresholds for detecting a stuck valve are automatically configured when Setup Wizard or Partial Stroke Calibration routines are run. However thresholds can also be configured manually. To manually configure thresholds, disable the travel deviation alert by setting Travel Dev Alert Pt to 125% (1-2-3-4-4-2). Also disable end point pressure control (1-2-2-2-2-1) and disable the partial stroke pressure limit (1-2-7-2) by setting the values shown in table 4-9.

Run the partial stroke test using the Field Communicator. Once the test is completed, download the partial stroke test results using ValveLink software.

On the partial stroke graph page, select the Tvl(%) / Time radio button to plot travel set point and travel time series traces. The Travel Deviation Alert Point should be set at least 1.5 times the maximum deviation obtained from the time series plot. Maximum Travel Movement should be set at least 5% above the Travel Deviation Alert Point.

Table 4-9. Values for Disabling Partial Stroke Pressure Limit

| Actuator Type | Relay Type | Zero Power Condition | Partial Stroke Start Point | Partial Stroke Pressure Limit (Disabled) |
|---------------|------------|----------------------|----------------------------|------------------------------------------|
| Single-Acting | A or C     | Closed               | Open                       | 0.0                                      |
|               |            |                      | Closed                     | Psupply                                  |
|               |            | Open                 | Open                       | Psupply                                  |
|               |            |                      | Closed                     | 0.0                                      |
|               | B          | Closed               | Open                       | Psupply                                  |
|               |            |                      | Closed                     | 0.0                                      |
|               |            | Open                 | Open                       | 0.0                                      |
|               |            |                      | Closed                     | Psupply                                  |
| Double-Acting | A          | Closed               | Open                       | -Psupply                                 |
|               |            |                      | Closed                     | Psupply                                  |
|               |            | Open                 | Open                       | Psupply                                  |
|               |            |                      | Closed                     | -Psupply                                 |

On the partial stroke graph page, select the Press/Time radio button to plot the pressure trace. If the actuator pressure starts high and moves low, find the minimum actuator pressure. If the actuator pressure starts low and moves high, find the maximum actuator pressure. Use table 4-10 to estimate the partial stroke pressure limit.

In the example shown in the middle graph of figure 4-9, the maximum travel deviation between travel set point and travel is approximately 4%. Travel Deviation Alert Point should be set to  $1.5 \times 4\% = 6\%$ . Max Travel Movement should be set at  $6\% + 5\% = 11\%$ .

In the bottom graph of figure 4-9, with a single-acting piston actuator, fail closed, Relay A, and supply pressure at 52 psig (read from instrument gauge), Partial Stroke Pressure Limit is the minimum actuator pressure attained during the test, i.e., 24 psig. Set the Partial Stroke Pressure Limit to  $0.5 \times P_{min} = 12$  psig.

The default value is 0.

For double-acting valves, the differential pressure is used.

#### • View/Edit Auto Test Interval

An interval of time (in days) between partial stroke tests that are automatically run by the digital valve controller, subject to the device being powered up. A value of 0 disables this feature.

#### • Device Power Up

Defines the power up behavior of the DVC6000 SIS. Auto Reset allows the valve to track the command signal when power is applied to the device. Manual Reset will lock the device in its safety position until the digital valve controller is reset.

If Manual Reset is selected, its state can be determined from the status monitor by monitoring the Locked In Safety Position alert.

When Auxiliary Terminal Action is set to SIS Local Control Panel (LP100), Device Power Up is set to Manual Reset and cannot be changed to Auto Reset.

The reset signal depends on how the aux terminals are configured. If configured for SIS Local Control Panel, the digital valve controller can be reset by pressing the button next to the green light on the LCP100. If configured as Push Button Partial Stroke, the digital valve controller can be reset by shorting the aux terminals for more than 3 seconds but less than 10 seconds. The device cannot be reset from the aux terminals if they are configured otherwise.

#### • Action on Failed Test

Displays the action taken by the instrument if a communication timeout occurs. Values are Ramp Back or Step Back.

Table 4-10. Estimates for Partial Stroke Pressure Limits

| Actuator Style       | Relay Type | Zero Power Condition | PST Starting Point | Partial Stroke Pressure Limit                                     |
|----------------------|------------|----------------------|--------------------|-------------------------------------------------------------------|
| Spring and Diaphragm | A or C     | Closed               | Open               | $P_{min} - 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$ |
|                      |            |                      | Closed             | $P_{max} + 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$ |
|                      |            | Open                 | Open               | $P_{max} + 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$ |
|                      |            |                      | Closed             | $P_{min} - 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$ |
|                      | B          | Closed               | Open               | $P_{max} + 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$ |
|                      |            |                      | Closed             | $P_{min} - 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$ |
|                      |            | Open                 | Open               | $P_{min} - 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$ |
|                      |            |                      | Closed             | $P_{max} + 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$ |
| Single-Acting Piston | A or C     | Closed               | Open               | $0.5 * P_{min}$                                                   |
|                      |            |                      | Closed             | $P_{max} + 0.5 * (P_{supply} - P_{max})$                          |
|                      |            | Open                 | Open               | $P_{max} + 0.5 * (P_{supply} - P_{max})$                          |
|                      |            |                      | Closed             | $0.5 * P_{min}$                                                   |
|                      | B          | Closed               | Open               | $P_{max} + 0.5 * (P_{supply} - P_{max})$                          |
|                      |            |                      | Closed             | $0.5 * P_{min}$                                                   |
|                      |            | Open                 | Open               | $0.5 * P_{min}$                                                   |
|                      |            |                      | Closed             | $P_{max} + 0.5 * (P_{supply} - P_{max})$                          |
| Double-Acting Piston | A          | Closed               | Open               | $P_{min} - 0.5 * (P_{supply} + P_{min})$                          |
|                      |            |                      | Closed             | $P_{max} + 0.5 * (P_{supply} - P_{max})$                          |
|                      |            | Open                 | Open               | $P_{max} + 0.5 * (P_{supply} - P_{max})$                          |
|                      |            |                      | Closed             | $P_{min} - 0.5 * (P_{supply} + P_{min})$                          |

## Valve Stuck Alert

### CAUTION

If a valve stuck alert is active, there may be potential energy stored in the valve and actuator assembly. Sudden release of this energy may cause the valve to suddenly open or close, resulting in equipment damage.

While performing the partial stroke test, even if the valve sticks, the digital valve controller will not fully exhaust or fill the actuator pressure in its attempt to complete the partial stroke. Rather, the instrument will

abort the test and issue an alert. It is recommended that the Travel Deviation alert be enabled and configured.

The Valve Stuck alert will be generated either by the Travel Deviation alert (the difference between expected and actual travel exceeds the level defined in the deviation alert), or if the actuator pressure reaches the Partial Stroke pressure limit. If the Travel Deviation alert is not configured, then the Partial Stroke pressure limit will abort the test and cause the Valve Stuck alert.

If the valve is stuck and only the Travel Deviation alert is enabled (without specifying partial stroke pressure limit) the Valve Stuck alert will still be generated and the test will be aborted.



## Section 5 Calibration



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## Calibration Overview

When a DVC6000 SIS digital valve controller is ordered as part of a control valve assembly, the factory mounts the digital valve controller on the actuator and connects the necessary tubing, then sets up and calibrates the controller.

For digital valve controllers that are ordered separately, recalibration of the analog input or pressure sensors generally is unnecessary. However, after mounting on an actuator, perform the initial setup (either auto or manual), then calibrate travel by selecting *Calibrate*, *Travel Calibration*, and *Auto Calibration* from the *Configure* menu. For more detailed calibration information, refer to the following calibration procedures, available from the *Calibrate* menu:

### 5

#### Travel Calibration

- **Auto Calibration** —This procedure automatically calibrates the travel. The calibration procedure uses the valve and actuator stops as the 0% and 100% calibration points.

- **Manual Calibration** —This procedure permits manual calibration of the travel. This calibration procedure allows you to determine the 0% and 100% calibration points and obtain the optimum linearity on a sliding-stem valve.

#### Sensor Calibration

- **Pressure Sensors**—This procedure permits calibrating the three pressure sensors. Normally the sensors are calibrated at the factory and should not need calibration.

- **Travel Sensor**—This procedure permits calibrating the travel sensor. Normally the travel sensor is calibrated at the factory. Calibrating the travel sensor should only be necessary if the travel sensor is replaced.

- **Analog Input**—This procedure permits calibrating the analog input sensor. Normally the sensor is calibrated at the factory and should not need calibration.



### Note

Analog Input is only available when the DVC6000 SIS is operating in Point-to-Point mode with 4-20 mA or 0-20 mA current.

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**Relay Adjust**—This procedure permits adjustment of the pneumatic relay.

**Restore Factory Settings**—This procedure permits you to restore the calibration settings back to the factory settings.

**PST Calibration**—This procedure permits you to run the PST calibration procedure.

To display the calibrate menu, from the *Online* menu, select *Configure* and *Calibrate*.



### Note

The Instrument Mode must be Out Of Service and the Protection set to None before the instrument can be calibrated.

If you are operating in burst mode, we recommend that you disable burst before continuing calibration. Once calibration is complete, burst mode may then be turned back on.



### Note

In the event of a power failure the DVC6000 SIS automatically restores the device to In Service upon restoration of power. This is to provide greater availability of the safety function.

If power is inadvertently interrupted while performing set up or maintenance, you may need to return the DVC6000 SIS to out of service if the interrupted task requires that mode of operation.



### WARNING

During calibration, the valve may move. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

---

## Travel Calibration

There are two procedures available for calibrating travel:

- Auto Calibration
- Manual Calibration

### Auto Calibration (1-3-1-1)

User interaction is only required with Auto Calibration when the feedback connection is SStem - Standard (Sliding Stem - Standard). A feedback connection of Rotary - All, SStem - Roller (Sliding Stem - Roller) requires no user interaction and you can start with step 6.

For a SStem - Standard feedback connection, interaction provides a more accurate crossover adjustment. Setting crossover establishes the zero degree point for the geometric correction used to translate the rotary motion observed by the travel sensor into the linear motion of the sliding-stem valve.

When a double-acting actuator is used, you will be prompted to run the Relay Adjustment when Auto Calibration is selected. Select Yes to adjust the relay. Select No to proceed with Auto Calibration. For additional information, refer to Relay Adjustment in this section.

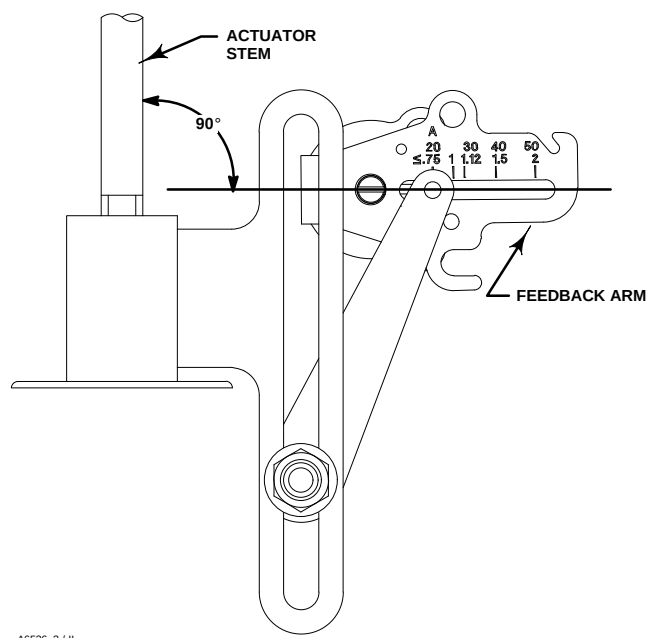
Select *Auto Calibration* from the *Calibrate* menu, then follow the prompts on the Field Communicator display to automatically calibrate travel.

1. Select the method of crossover adjustment: manual, last value, or default. Manual is the recommended choice. If you select Manual, the Field Communicator will prompt you to adjust the crossover in step 3.

If you select Last Value, the crossover setting currently stored in the instrument is used and there are no further user interactions with the auto-calibration routine (go to step 6). Use this selection if you cannot use manual, such as when you cannot see the valve.

If you select Default, an approximate value for the crossover is written to the instrument and there are no further user interactions with the auto-calibration routine (go to step 6). 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.

2. The instrument seeks the high and low drive points and the minor loop feedback (MLFB) and output bias.



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Figure 5-1. Crossover Point

No user interaction is required in this step. For a description of these actions see step 6.

3. If you select Manual in step 1, you are asked to select an adjustment source, either analog or digital. If you use a current source to adjust the crossover, select Analog and go to step 4. If you wish to adjust the current source digitally, select Digital and go to step 5.



## Note

**The analog option is not available when the DVC6000 SIS is operated by 0-24 VDC in multi-drop mode.**

4. If you selected Analog as the crossover adjustment source, the Field Communicator prompts you to adjust the current source until the feedback arm is 90° to the actuator stem, as shown in figure 5-1. After you have made the adjustment, press OK and go to step 6.

5. If you selected Digital as the crossover adjustment source, the Field Communicator displays a menu to allow you to adjust the crossover.

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. Selecting large, medium, and small adjustments to the crossover causes changes of

approximately 10.0°, 1.0°, and 0.1°, respectively, to the rotation of the feedback arm.

If another adjustment is required, repeat step 5. Otherwise, select Done and go to step 6.

6. The remainder of the auto calibration procedure is automatic.

During calibration, the instrument seeks the high and low end points and the minor loop feedback (MLFB) and output bias. By searching for the end points, the instrument establishes the limits of physical travel, i.e., the actual travel 0 and 100% positions. This also determines how far the relay beam swings to calibrate the sensitivity of the beam position sensor.

Adjusting the minor loop feedback bias is done around mid travel. The valve position is briefly moved back and forth to determine the relay beam position at quiescence. Essentially, it establishes the zero point for the Minor Loop Feedback circuit. The back and forth motion is performed to account for hysteresis.

Adjusting the output bias aligns the travel set point with the actual travel by computing the drive signal required to produce 0% error. This is done while the valve is at 50% travel, making very small adjustments. Calibration is complete when the “Auto Calibration has completed” message appears.

7. Place the instrument In Service and verify that the travel properly tracks the current source.

If the unit does not calibrate, refer to table 5-1 for error messages and possible remedies.

## Manual Calibration (1-3-1-2)

It is recommended that you adjust the relay before manually calibrating travel. For additional information refer to Relay Adjustment in this section.



### Note

Relay Adjustment is only available for the double-acting relay (Relay A).

Two procedures are available to manually calibrate travel:

- Analog Adjust
- Digital Adjust

Table 5-1. Auto Calibrate Travel Error Messages

| Error Message                                                                                                           | Possible Problem and Remedy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input current must exceed 3.8 mA for calibration.                                                                       | The analog input signal to the instrument must be greater than 3.8 mA. Adjust the current output from the control system or the current source to provide at least 4.0 mA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Place Out Of Service and ensure Calibrate Protection is disabled before calib.                                          | The Instrument Mode must be <i>Out of Service</i> and the Protection must be <i>None</i> before the instrument can be calibrated. For information on changing instrument protection and mode, see the beginning of this section.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Calibration Aborted. An end point was not reached.                                                                      | The problem may be one or the other of the following: <ol style="list-style-type: none"> <li>1. The tuning set selected is too low and the valve does not reach an end point in the allotted time. Press the Hot Key, select <i>Stabilize/Optimize</i> then <i>Increase Response</i> (selects next higher tuning set).</li> <li>2. The tuning set selected is too high, valve operation is unstable and does not stay at an end point for the allotted time. Press the Hot Key, select <i>Stabilize/Optimize</i> then <i>Decrease Response</i> (selects next lower tuning set).</li> </ol>                                                                                                                                                                                                      |
| Invalid travel value. Check travel sensor and feedback arm adjustments, and inst supply press. Then, repeat Auto Calib. | Prior to receiving this message, did the instrument output go from zero to full supply? If not, verify instrument supply pressure by referring to the specifications in the appropriate actuator instruction manual. If supply pressure is correct, check instrument pneumatic components (I/P converter and relay).<br><br>If the instrument output did go from zero to full supply prior to receiving this message, then verify proper mounting by referring to the appropriate mounting procedure in the Installation section.<br><br>Verify travel sensor adjustment by performing the appropriate Travel Sensor Adjust procedure in the Calibration section. Making the crossover adjustment with the valve positioned at either end of its travel will also cause this message to appear. |

## Analog Calibration Adjust



### Note

Analog Calibration Adjust is only available in 4-20 mA or 0-20 mA systems (point-to-point operation).

From the *Calibrate* menu, select *Manual Calibration* and *Analog Adjust*. Connect a variable current source to the instrument LOOP + and LOOP – terminals. The current source should be capable of generating 4-20 mA. Follow the prompts on the Field Communicator display to calibrate the instrument's travel in percent.



## Note

0% Travel = Valve Closed  
100% Travel = Valve Open

1. Adjust the input current until the valve is near mid-travel. Press OK.
2. If the feedback connection is Rotary - All, SStem - Roller, go to step 6. If the feedback connection is SStem - Standard, you are prompted to set the crossover point. Adjust the current source until the feedback arm is 90° to the actuator stem, as shown in figure 5-1. Then press OK.



## Note

In steps 3 through 7, the accuracy of the current source adjustment affects the position accuracy.

3. Adjust the current source until the valve is at 0% travel, then press OK.
4. Adjust the current source until the valve is at 100% travel, then press OK.
5. Adjust the current source until the valve is at 50% travel, then press OK.
6. Adjust the current source until the valve is at 0% travel, then press OK.
7. Adjust the current source until the valve is at 100% travel, then press OK.
8. Adjust the current source until the valve is near 5% travel, then press OK.
9. Adjust the current source until the valve is near 95% travel, then press OK.
10. Place the instrument In Service and verify that the travel properly tracks the current source.

### Digital Calibration Adjust

From the *Calibrate* menu, select *Manual Calibration* and *Digital Adjust*. Connect a variable current source to the instrument LOOP + and LOOP – terminals. The current source should be set between 4 and 20 mA. Follow the prompts on the Field Communicator display to calibrate the instrument's travel in percent.



## Note

0% Travel = Valve Closed  
100% Travel = Valve Open

1. Adjust the input current until the valve is near mid-travel. Press OK.
2. From the adjustment menu, select the direction and size of change required to adjust the output until the valve is near mid-travel. Selecting large, medium, and small adjustments causes changes of approximately 10.0°, 1.0°, and 0.1°, respectively, to the feedback arm rotation.

If another adjustment is required, repeat step 2. Otherwise, select Done and go to step 3.

3. If the feedback connection is Rotary - All, SStem - Roller, go to step 8. If the feedback connection is SStem - Standard, adjust the feedback arm to the crossover point by using the adjustment menu.

4. From the adjustment menu, 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. Selecting large, medium, and small adjustments to the crossover causes changes of approximately 10.0°, 1.0°, and 0.1°, respectively, to the feedback arm rotation.

If another adjustment is required, repeat step 4. Otherwise, select Done and go to step 5.

5. From the adjustment menu, select the direction and size of change required to set the travel at 0%. Selecting large, medium, and small adjustments causes changes of approximately 10.0°, 1.0°, and 0.1°, respectively, to the feedback arm rotation.

If another adjustment is required, repeat step 5. Otherwise, select Done and go to step 6.

6. From the adjustment menu, select the direction and size of change required to set the travel to 100%. Selecting large, medium, and small adjustments causes changes of approximately 10.0°, 1.0°, and 0.1°, respectively, to the feedback arm rotation.

If another adjustment is required, repeat step 6. Otherwise, select Done and go to step 7.

7. From the adjustment menu, select the direction and size of change required to set the travel to 50%. Selecting large, medium, and small adjustments causes changes of approximately 10.0°, 1.0°, and 0.1°, respectively, to the feedback arm rotation.

If another adjustment is required, repeat step 7. Otherwise, select Done and go to step 8.

8. From the adjustment menu, select the direction and size of change required to set the travel to 0%. Selecting large, medium, and small adjustments causes changes of approximately 10.0°, 1.0°, and 0.1°, respectively, to the feedback arm rotation for a sliding-stem valve or to the travel for a rotary valve.

If another adjustment is required, repeat step 8. Otherwise, select Done and go to step 9.

9. From the adjustment menu, select the direction and size of change required to set the travel to 100%. Selecting large, medium, and small adjustments causes changes of approximately 10.0°, 1.0°, and 0.1°, respectively, to the feedback arm rotation for a sliding-stem valve or to the travel for a rotary valve.

If another adjustment is required, repeat step 9. Otherwise, select Done and go to step 10.

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10. From the adjustment menu, select the direction and size of change required to set the travel to near 5%. Selecting large, medium, and small adjustments causes changes of approximately 10.0°, 1.0°, and 0.1°, respectively, to the feedback arm rotation for a sliding-stem valve or to the travel for a rotary valve.

If another adjustment is required, repeat step 10. Otherwise, select Done and go to step 11.

11. From the adjustment menu, select the direction and size of change required to set the travel to near 95%. Selecting large, medium, and small adjustments causes changes of approximately 10.0°, 1.0°, and 0.1°, respectively, to the feedback arm rotation for a sliding-stem valve or to the travel for a rotary valve.

If another adjustment is required, repeat step 11. Otherwise, select Done and go to step 12.

12. Place the instrument In Service and verify that the travel properly tracks the current source.

13. After manual calibration is completed manually set the SIS parameters as described in Section 4. See page 4-11 for End Point Pressure Control; page 4-14 Travel Deviation Alert Point and Travel Deviation Time; and page 4-21 for Partial Stroke Pressure Limit.

## Sensor Calibration

### Pressure Sensors (1-3-2-1)

There are three pressure sensors: output A, output B and supply. Select the appropriate menu depending upon which pressure sensor you are calibrating.



### Note

The pressure sensors are calibrated at the factory and should not require calibration.

### Output Pressure Sensor Calibration

To calibrate the output pressure sensors, connect an external reference gauge to the output being calibrated. The gauge should be capable of measuring maximum instrument supply pressure. From the *Calibrate* menu, select *Sensor Calibration* and *Pressure Sensors*. Depending upon the sensor you wish to calibrate, select either *Output A Sensor* or *Output B Sensor*. Follow the prompts on the Field Communicator display to calibrate the instrument's output pressure sensor.

1. Adjust the supply pressure regulator to the desired supply pressure. Press OK.

2. Select a) Zero only, or b) Zero and Span (gauge required) sensor calibration.

a. If Zero only calibration is selected, wait until output x pressure has completely exhausted, then continue. Once calibration is completed, go to step 6. The output x pressure corresponds to A or B, depending on which output you are calibrating.

b. If Zero and Span calibration is selected, wait until output x pressure has completely exhausted, then continue. You will then be asked to wait until output x pressure has reached full supply, then continue. The output x pressure corresponds to A or B, depending on which output you are calibrating. Proceed with step 3.

3. The instrument sets the output pressure to full supply. The following message appears:

**Use the Increase and Decrease selections until the displayed pressure matches the output x pressure.**

The output x pressure corresponds to A or B, depending on which output you are calibrating. Press OK when you have read the message.

4. The value of the output pressure appears on the display.

5. From the adjustment menu, select the direction and size of adjustment to the displayed value. Selecting

large, medium, and small adjustments causes changes of approximately 3.0 psi/0.207 bar/20.7 kPa, 0.30 psi/0.0207 bar/2.07 kPa, and 0.03 psi/0.00207 bar/0.207 kPa, respectively. Adjust the displayed value until it matches the output pressure, select Done and go to step 6.

6. Place the instrument In Service and verify that the displayed pressure matches the measured output pressure.

## Supply Pressure Sensor Calibration

To calibrate the supply pressure sensor, connect an external reference gauge to the output side of the supply regulator. The gauge should be capable of measuring maximum instrument supply pressure. From the *Calibrate* menu, select *Sensor Calibration*, *Pressure Sensors*, and *Supply Sensor*. Follow the prompts on the Field Communicator display to calibrate the instrument's supply pressure sensor.

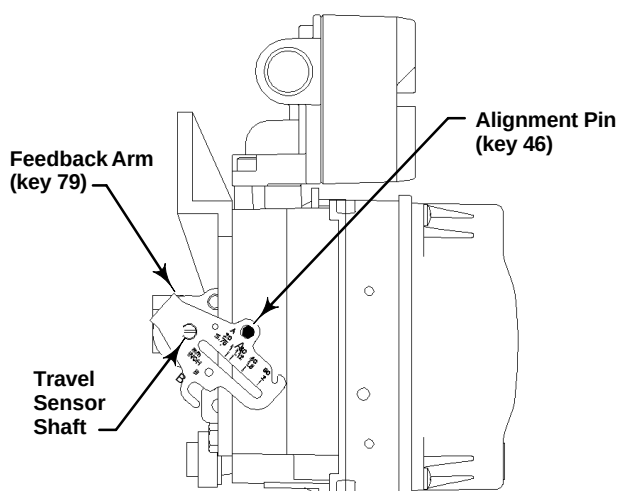
1. Select a) Zero Only, or b) Zero and Span (gauge required).
  - a. If Zero Only calibration is selected, adjust the supply pressure regulator to remove supply pressure from the instrument. Press OK. Once calibration is complete, go to step 5.
  - b. If Zero and Span calibration is selected, adjust the supply pressure regulator to remove supply pressure from the instrument. Press OK. Adjust the supply regulator to the maximum instrument supply pressure. Press OK. Proceed with step 2.

2. The following message appears:

**Use the Increase and Decrease selections until the displayed pressure matches the instrument supply pressure.**

Press OK when you have read this message.

3. The value of the pressure appears on the display.
4. From the adjustment menu, select the direction and size of adjustment to the displayed value. Selecting large, medium, and small adjustments causes changes of approximately 3.0 psi/0.207 bar/20.7 kPa, 0.30 psi/0.0207 bar/2.07 kPa, and 0.03 psi/0.00207 bar/0.207 kPa, respectively. Adjust the displayed value until it matches the supply pressure, select Done and go to step 5.
5. Place the instrument In Service and verify that the displayed pressure matches the measured supply pressure.



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Figure 5-2. FIELDVUE DVC6010 SIS Digital Valve Controller Showing Feedback Arm in Position for Travel Sensor Adjustment

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## Travel Sensor (1-3-2-2)

The travel sensor is normally adjusted at the factory and should not require adjustment. However, if the travel sensor has been replaced, adjust the travel sensor by performing the appropriate procedure. See the Maintenance section for travel sensor replacement procedures.

## DVC6010 SIS, DVC6015, DVC6030 SIS, and DVC6035

### WARNING

**Failure to remove air pressure may cause personal injury or property damage from bursting parts.**

1. Remove supply air and remove the instrument from the actuator.
2. As shown in figure 5-2, align the feedback arm (key 79) with the housing 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.

Table 5-2. Travel Sensor Counts

| Digital Valve Controller                                                               | Travel Sensor Counts |
|----------------------------------------------------------------------------------------|----------------------|
| DVC6010 SIS / DVC6015                                                                  | 700 $\pm$ 200        |
| DVC6020 SIS / DVC6025                                                                  | 2100 $\pm$ 200       |
| DVC6030 SIS <sup>(1)</sup> / DVC6035 <sup>(2)</sup><br>Counterclockwise shaft rotation | 600 $\pm$ 200        |
| DVC6030 SIS <sup>(3)</sup> / DVC6035 <sup>(2)</sup><br>Clockwise shaft rotation        | 3400 $\pm$ 200       |

1. Refer to figure 2-9 to determine the desired starting position for the DVC6030 SIS based on counterclockwise potentiometer shaft rotation.  
2. Refer to figure 2-14 to determine the desired starting position for the DVC6035 based on potentiometer shaft; counterclockwise or clockwise.  
3. Refer to figure 2-10 to determine the desired starting position for the DVC6030 SIS based on clockwise potentiometer shaft rotation.



## Note

The alignment pin (key 46) is stored inside the digital valve controller housing.

- Loosen the screw that secures the feedback arm to the travel sensor shaft. Position the feedback arm so that the surface of the feedback arm is flush with the end of the travel sensor shaft.
- Connect a current source to the instrument LOOP – and LOOP + terminals. Set the current source to any value between 4 and 20 mA. Connect the Field Communicator to the TALK terminals.
- Before beginning the travel sensor adjustment, set the instrument mode to Out Of Service and the protection to None.
- From the *Calibrate* menu select *Sensor Calibration*, and *Travel Sensor*. Follow the prompts on the Field Communicator display to adjust the travel sensor counts to the value listed in table 5-2.



## Note

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

- 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 tolerances listed in table 5-2. Paint the screw to discourage tampering with the connection.

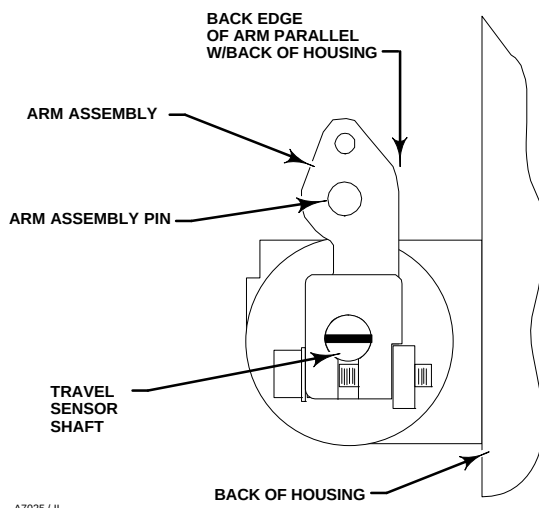


Figure 5-3. FIELDVUE DVC6020 SIS Travel Sensor Arm/Housing Back Plane Alignment

- Disconnect the Field Communicator and current source from the instrument.
- Remove the alignment pin and store it in the instrument housing.
- Install the digital valve controller on the actuator.

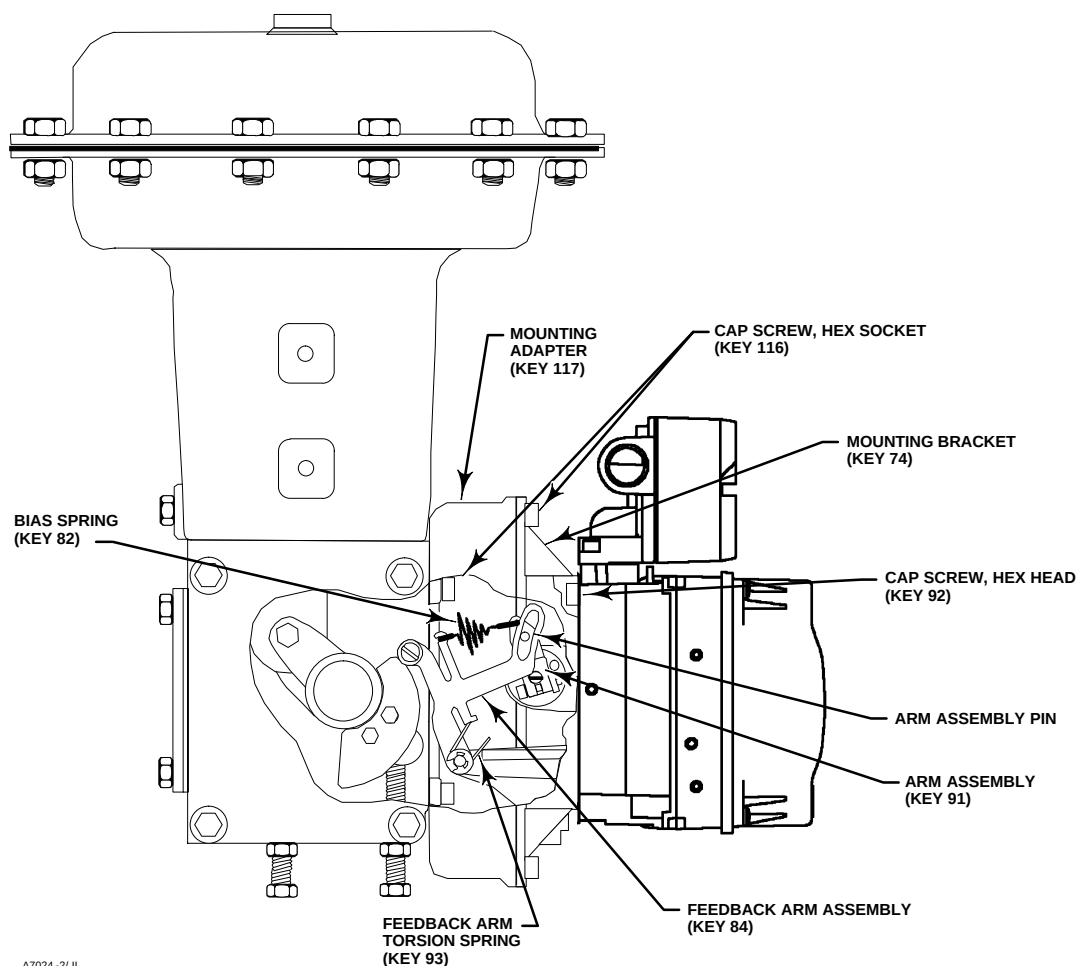
## DVC6020 SIS and DVC6025



## WARNING

Failure to remove air pressure may cause personal injury or property damage from bursting parts.

- Remove supply air and remove the instrument from the actuator.
- See figure 5-4 for parts identification. 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. 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 5-3.
- Loosen the screw that secures the arm assembly to the travel sensor shaft. Position the arm assembly so that the outer surface is flush with the end of the travel sensor shaft.
- Connect a current source to the instrument LOOP – and LOOP + terminals. Set the current source to any value between 4 and 20 mA. Connect the Field Communicator to the TALK terminals.



A7024-2/IL

Figure 5-4. FIELDVUE DVC6020 SIS Digital Valve Controller Mounted on a Fisher 1052 Size 33 Actuator

5. Before beginning the travel sensor adjustment, set the instrument mode to Out Of Service and the protection to None.
6. From the *Calibrate* menu, select *Sensor Calibration* and *Travel Sensor*. Follow the prompts on the Field Communicator display to adjust the travel sensor counts to the value listed in table 5-2.



## Note

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

7. While observing the travel sensor counts, tighten the screw that secures the arm assembly to the travel sensor shaft. Be sure the travel sensor counts remain within the tolerances listed in table 5-2. Paint the screw to discourage tampering with the connection.
8. Disconnect the Field Communicator and current source from the instrument.
9. Apply anti-seize (key 64) to the pin portion of the arm assembly (key 91).
10. Replace the mounting bracket on the back of the instrument and reconnect the bias spring between the feedback arm assembly and the arm assembly on the travel sensor shaft.
11. Install the digital valve controller on the actuator.

## Analog Input (1-3-2-3)



### Note

**Analog Input Calibration is only available in 4-wire systems (point-to-point operation).**

To calibrate the analog input sensor, connect a variable current source to the instrument LOOP+ and LOOP- terminals. The current source should be capable of generating an output of 4 to 20 mA. From the *Configure* menu select *Calibrate, Sensor Calibration*, and *Analog In*. Follow the prompts on the Field Communicator display to calibrate the analog input sensor.

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1. Set the current source to the target value shown on the display. The target value is the Input Range Low value. Press OK.
2. The following message appears:

**Use Increase and Decrease selections until the displayed current matches the current source.**

Press OK when you have read this message.

3. The value of the Analog Input appears on the display.
4. From the adjustment menu, select the direction and size of adjustment to the displayed value. Selecting large, medium, and small adjustments causes changes of approximately 0.4 mA, 0.04 mA, and 0.004 mA, respectively. Adjust the displayed value until it matches the current source, select Done and go to step 5.
5. Set the current source to the target value shown on the display. The target value is the Input Range High value. Press OK.
6. The following message appears:

**Use Increase and Decrease selections until the displayed current matches the current source.**

Press OK when you have read this message.

7. The value of the Analog Input appears on the display.

8. From the adjustment menu, select the direction and size of adjustment to the displayed value. Selecting large, medium, and small adjustments causes changes of approximately 0.4 mA, 0.04 mA, and 0.004 mA, respectively. Adjust the displayed value until it matches the current source, select Done and go to step 9.

9. Place the instrument In Service and verify that the analog input displayed matches the current source.

## Relay Adjust (1-3-3)

Before beginning travel calibration, check the relay adjustment. To check relay adjustment, select *Relay* from the *Calibrate* menu, then follow the prompts on the Field Communicator display. Replace the digital valve controller cover when finished.



### Note

**Relay B and C are not user-adjustable.**

## Double-Acting Relay

The double-acting relay is designated by "Relay A" on a label affixed to the relay itself. For double-acting actuators, the valve must be near mid-travel to properly adjust the relay. The Field Communicator will automatically position the valve when *Relay Adjust* is selected.

Rotate the adjustment disc, shown in figure 5-5, until the output pressure displayed on the Field Communicator is between 50 and 70% of supply pressure. This adjustment is very sensitive. Be sure to allow the pressure reading to stabilize before making another adjustment (stabilization may take up to 30 seconds or more for large actuators).

Relay A may also be adjusted for use in single-acting direct applications. Rotate the adjustment disc as shown in figure 5-5 for single-acting direct operation.

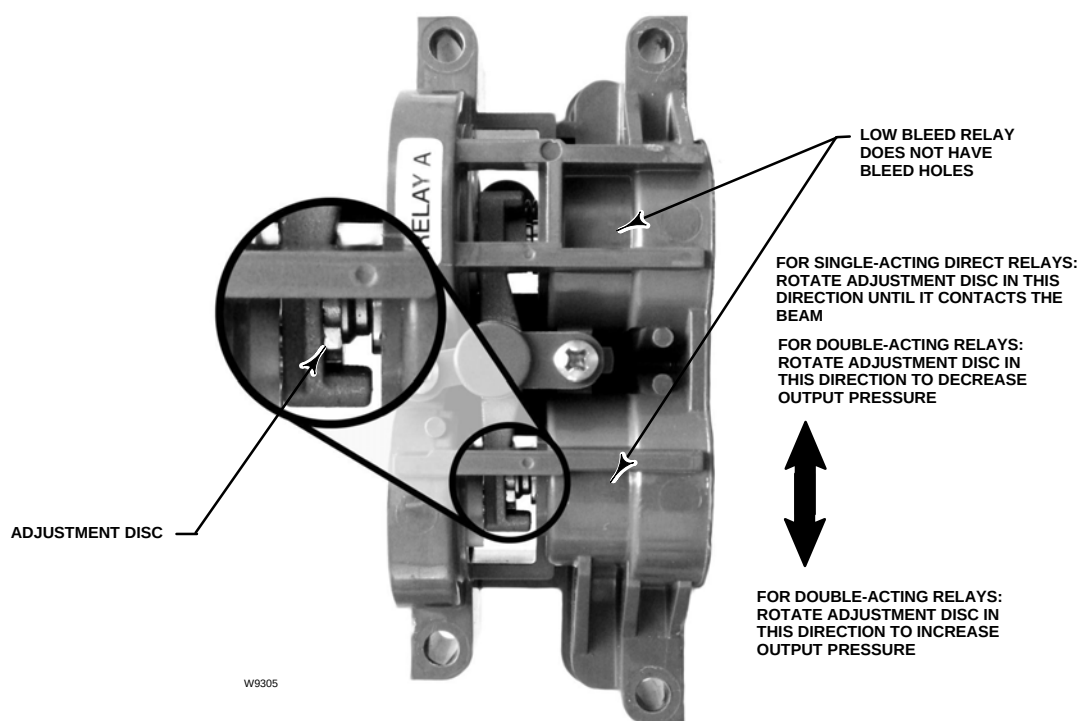


Figure 5-5. Location of Relay Adjustment (Shroud Removed for Clarity)

## Single-Acting Relays

### WARNING

If the unused port is monitoring pressure, ensure that the pressure source conforms to ISA Standard 7.0.01, and does not exceed the pressure supplied to the instrument.

Failure to do so could result in personal injury or property damage caused by loss of process control.

### Single-Acting Direct Relay

The single-acting direct relay is designated by "Relay C" on a label affixed to the relay itself. Relay C requires no adjustment.

### Single-Acting Reverse Relay

The single-acting reverse relay is designated by "Relay B" on a label affixed to the relay itself. Relay B is calibrated at the factory and requires no further adjustment.

## Restoring Factory Settings (1-3-4)

From the *Online* menu, select *Configure*, then select *Calibrate* and *Restore Factory Settings*. Follow the prompts on the Field Communicator display to restore calibration to the factory settings. You should only restore the calibration if it is not possible to calibrate an individual sensor. Restoring calibration returns the calibration of all of the sensors and the tuning set to their factory settings. Following restoration of the factory calibration, the individual sensors should be recalibrated.

## PST Calibration (1-3-5)

Access PST Calibration by selecting *PST Calibration* from the *Calibrate* menu. Follow the prompts on the Field Communicator display to complete the PST calibration.

This procedure permits you to run the Partial Stroke Calibration, which enables the Partial Stroke Test. It establishes values for Partial Stroke Pressure Limit, Pressure Set Point and Pressure Saturation Time for End Point Pressure Control, Travel Deviation Alert Point and Travel Deviation Time. The Partial Stroke Calibration also sets default values for max travel movement, test speed, and test pause time.



### Note

**You must take the instrument out of service before running Partial Stroke Calibration.**

**Ensure that the instrument is put back in service after the completing the calibration procedure.**

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## Section 6 Viewing Device Variables and Diagnostics



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## Service Tools

### Alert Conditions (2-1)

Instrument Alert Conditions, when enabled, detect many operational and performance issues that may be of interest. To view these alerts, from the *Online* menu select *Service Tools* and *Alert Conditions*. The alert conditions for each group of alerts are listed below. If there are no alerts active for a particular group the group will not be displayed on the Field Communicator.

- **Electronics**— If an electronics alert is active it will appear under ELECT ALERTS.

#### Drive Current

*Drive Current Alert*—This alert is indicated when the drive current does not read as expected. If this alert occurs, check the connection between the I/P converter and the printed wiring board assembly. Try removing the I/P converter and re-installing it. If the failure does not clear, replace the I/P converter or the printed wiring board assembly.

#### Drive Signal

*Drive Signal Alert*—This alert is indicated when the Drive Signal is greater or less than the expected maximum or minimum.

#### Processor Impaired

*Offline/Failed Alert*—This alert is indicated if a failure, enabled from the Self Test Shutdown menu, caused an instrument shutdown. Press Enter to see which of the specific failures caused the Offline/Failed indication.

*Low Power Write Fail Alert*—This alert is activated if a write to the instrument is attempted when the loop current is less than approximately 3.5 mA.

*Non-Critical NVM Alert*—This alert is indicated if the checksum for data, which are not critical for instrument operation, has failed.

*Critical NVM Alert*—This alert is indicated when the Non-Volatile Memory integrity test fails. Configuration data is stored in NVM. If this failure is indicated, restart the instrument and see if it clears. If it does not clear, replace the PWB Assembly.

*Flash ROM Alert*—This alert indicates that the Read Only Memory integrity test failed. If this alert is indicated, restart the instrument and see if it clears. If it does not clear, replace the printed wiring board assembly.

*No Free Time Alert*—This alert is indicated if the instrument is unable to complete all of the configured tasks. This will not occur with a properly functioning instrument.

*Reference Voltage Alert*—This failure is indicated whenever there is a failure associated with the internal voltage reference. If this alert is indicated, restart the instrument and see if it clears. If it does not clear, replace the printed wiring board assembly.

*Internal Sensor Out of Limits*—This alert is indicated if there is a possible problem with either the pressure sensor or the printed wiring board assembly submodule.

*Variable Out of Range*—This alert is indicated if there is a possible problem with one or more of the following: the Analog Input Signal, the I/P converter submodule, the pneumatic relay submodule, or the printed wiring board.

*Field device malfunction*—The alert is indicated if the pressure, position, or temperature sensors are providing invalid readings.

- **Sensor**— If a sensor alert is active it will appear under SENSOR ALERTS.

#### Travel Sensor

*Travel Sensor Alert*—This alert is indicated if the sensed travel is outside the range of -25.0 to 125.0% of calibrated travel. If this alert is indicated, check the instrument mounting and the travel sensor adjustment. Also, check that the electrical connection from the travel sensor is properly plugged into the printed wiring board assembly. After restarting the instrument, if the alert does not clear, troubleshoot the printed wiring board assembly or travel sensor.

#### Pressure Sensors

*Pressure Sensor Alert*—This alert is indicated if the actuator pressure is outside the range of -24.0 to 125.0% of the calibrated pressure for more than 60 seconds. If this alert is indicated, check the instrument supply pressure. If the failure persists, ensure the printed wiring board assembly is properly mounted onto the Module Base Assembly, and the pressure sensor O-rings are properly installed. If the alert does not clear after restarting the instrument, replace the printed wiring board assembly.



## Note

**The pressure sensor alert is used for output A, output B, and the supply pressure sensor. Check the pressure values to see which sensor is causing the alert.**

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#### Temperature Sensor

*Temperature Sensor Alert*—This alert is indicated when the instrument temperature sensor fails, or the

# Viewing Device Variables and Diagnostics

sensor reading is outside of the range of -40 to 85°C (-40 to 185°F). The temperature reading is used internally for temperature compensation of inputs. If this alert is indicated, restart the instrument and see if it clears. If it does not clear, replace the printed wiring board assembly.

- **Environment**— If an environment alert is active it will appear under ENVIRO ALERTS.

## Supply Pressure

*Supply Pressure Lo Alert*—This alert is indicated when supply pressure is lower than the configured limit.

## Auxiliary Terminal Alert

*Auxiliary Terminal Alert*—This alert is set when the auxiliary input terminals are either open or closed, depending upon the selection for the Aux In Alrt State.

- **Travel**— If a travel alert is active it will appear under TRAVEL ALERTS.

## Travel Deviation

*Travel Deviation Alert*—The difference between Setpoint and Travel is greater than the configured limits.

## Travel Limit

*Travel Alert Hi Hi*—This alert is indicated if the Travel is greater than the configured limit.

*Travel Alert Lo Lo*—This alert is indicated if the Travel is lower than the configured limit.

## Travel Limit Hi/Lo

*Travel Alert Hi*—This alert is indicated if the Travel is greater than the configured limit.

*Travel Alert Lo*—This alert is indicated if the Travel is lower than the configured limit.

## Travel Limit / Cutoff

*Travel Limit/Cutoff Hi*—This alert is indicated if the Travel is limited high or the high cutoff is in effect.

*Travel Limit/Cutoff Lo*—This alert is indicated if the Travel is limited low or the low cutoff is in effect.

Table 6-1. Alerts Included in Alert Groups for Alert Record

| Alert Group          | Alerts Include in Group                                                                                                                                       |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Valve Alerts         | Travel Alert Lo<br>Travel Alert Hi<br>Travel Alert Lo Lo<br>Travel Alert Hi Hi<br>Travel deviation<br>Drive signal                                            |
| Failure Alerts       | No free time<br>Flash ROM fail<br>Drive current fail<br>Ref Voltage fail<br>NVM fail<br>Temperature sensor fail<br>Pressure sensor fail<br>Travel sensor fail |
| Miscellaneous Alerts | Auxiliary input                                                                                                                                               |

- **Travel History**— If a travel history alert is active it will appear under TVL HIST ALERTS.

## Cycle Count

*Cycle Count Alert*—This alert is indicated if the Cycle Counter exceeds the Cycle Count Alert Point.

## Travel Accumulator

*Travel Accumulator Alert*—This alert is indicated if the Travel Accumulator exceeds the Travel Accumulator Alert Point.

- **SIS**— If an SIS alert is active it will appear under SIS ALERTS.

## Partial Stroke Test (PST)

*Valve Stuck or Pressure/Travel Path Obstructed*—This alert is indicated if the valve is stuck or the pressure/travel path is obstructed.

## End Point Pressure Deviation

*Pressure Deviation Alert*—The alert is indicated if the difference between the target pressure and the actual pressure exceeds the Pressure Deviation Alert Point for a period of time greater than the Pressure Deviation Time.

*Locked in Safety Alert*—This alert is indicated if the unit is locked in the safety position.

*SIS Panel Comm Error*—This alert is indicated if the SIS panel is not communicating.

- **Alert Record**

*Alert Record has Entries*—This alert indicates that an alert has been saved to the alert record.

*Alert Record Full*—This alert indicates that the alert record is full.

## Viewing Instrument Status (2-2)

To view the instrument status, from the *Device Diagnostics* menu select *Status*. This menu item

# DVC6000 SIS

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indicates the status of the Operational items listed below. The status of more than one operational item may be indicated.

## Instrument Time

*Instrument Time Invalid*

## Calibration and Diagnostics

*Calibration in Progress*

*Autocal in Progress*

*Diagnostic in Progress*

*Diagnostic Data Available*

## Operational

*Pressure Control Active*

*Multi-Drop*

## Integrator

*Integrator Sat Hi*

*Integrator Sat Lo*

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## Device Record (2-3)

From the *Online* menu, select *Service Tools* and *Device Record*. Follow the prompts on the Field Communicator display to view the following Device Record parameters:

- **Maximum Recorded Temperature**—Shows the maximum temperature the instrument has experienced since installation.
- **Minimum Recorded Temperature**—Shows the minimum temperature the instrument has experienced since installation.
- **View Number of Days Powered Up**—Indicates in hours or days the total elapsed time the instrument has been powered up.
- **Number of Power Ups**—Indicates how many times the instrument has cycled power.

## Stroking the Digital Valve Controller Output (2-4)

From the *Online* menu, select *Service Tools* and *Stroke Valve*. Follow the prompts on the Field Communicator display to select from the following:

- **Done**—Select this if you are done. All ramping is stopped when DONE is selected.
- **Ramp Open**—ramps the travel toward open at the rate of 1.0% per second of the ranged travel.

- **Ramp Closed**—ramps the travel toward closed at the rate of 1.0% per second of the ranged travel.

- **Ramp to Target**—ramps the travel to the specified target at the rate of 1.0% per second of the ranged travel.

- **Step to Target**—steps the travel to the specified target.

## Partial Stroke Test (2-5)



### WARNING

During the partial stroke test the valve will move. To avoid personal injury and property damage caused by the release of pressure or process fluid, when used in an application where the valve is normally closed, provide some temporary means of control for the process.

The Partial Stroke Test allows the DVC6000 SIS digital valve controller to perform a Valve Signature type of test while the instrument is in service and operational. In SIS applications, it is important to be able to exercise and test the valve to verify that it will operate when commanded. This feature allows the user to partially stroke the valve while continually monitoring the input signal. If a demand arises, the test is aborted and the valve moves to its commanded position. The partial stroke valve travel is configurable between 1 and 30% maximum travel, in 0.1% increments. Data from the last partial stroke test is stored in the instrument memory for retrieval by ValveLink software.

The Partial Stroke Test allows you to perform a partial, 10%, stroke test (standard) or a custom stroke test. With the custom stroke test, the stroke may be extended up to 30%. Be sure to check plant guidelines before performing a custom stroke test. The purpose of this test is to ensure that the valve assembly moves upon demand.

A partial stroke test can be initiated when the valve is operating at either 4 mA or 20 mA (point-to-point mode). In applications where a spurious trip is to be minimized, 4 mA is the normal operating position.

When enabled, a partial stroke test may be initiated by the device (as a scheduled, auto partial stroke test), a remote push button located in the field or at the valve, the optional LCP100 local control panel, the Field Communicator, or ValveLink software.

# Viewing Device Variables and Diagnostics

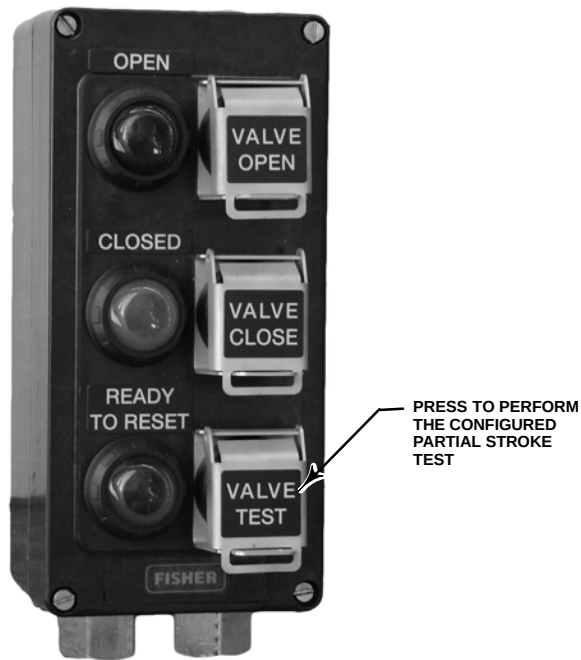


Figure 6-1. Local Control Panel

## Device (Digital Valve Controller)

The Auto Partial Stroke Test allows the partial stroke test to be scheduled by the DVC6000 SIS. The test is scheduled in number of hours between tests. Any power cycle will reset the test interval timer.

## Auxiliary Terminal

The auxiliary terminal can be used for different applications. The default configuration is for a partial stroke test initiated by shorting the contacts wired to the auxiliary +/- terminals of the DVC6000 SIS. Refer to Auxiliary Terminal Wiring Length Guidelines below.

### • Local Push Button

A partial stroke test command may be sent to the DVC6000 SIS digital valve controller using a set of contacts wired to the auxiliary +/- terminals. To perform a test, the contacts must be closed for 3 to 5 seconds and then opened. To abort the test, close the contacts for 1 second. The last set of diagnostic data is stored in the instrument memory for later retrieval via ValveLink software.

### • Local Control Panel

The LCP100 local control panel is wired directly to the DVC6000 SIS digital valve controller.

The black “Valve Test” push button (see figure 6-1) allows the valve to perform the configured partial stroke test.

- Press and hold for 3 to 10 seconds

The test can be overridden by the “Valve Close” button, “Valve Open” button, or if an emergency demand occurs.

### • Local DI

When configured by the user interface, the Auxiliary Terminal can be used as a discrete input from a pressure switch, temperature switch, etc., to provide an alert.

## Auxiliary Terminal Wiring Length Guidelines

The Auxiliary Input Terminals of a DVC6000 SIS can be used with a locally-mounted switch for initiating a partial stroke test. Some applications require that the partial stroke test be initiated from a remote location.

The length for wiring connected to the Auxiliary Input Terminals is limited by capacitance. For proper operation of the Auxiliary Input Terminals capacitance should not exceed 18000 pF. As with all control signal wiring, good wiring practices should be observed to minimize adverse effect of electrical noise on the Aux Switch function.

**Example Calculation:** Capacitance per foot or per meter is required to calculate the length of wire that may be connected to the Aux switch input. The wire should not exceed the capacitance limit of 18000 pF. Typically the wire manufacturer supplies a data sheet which provides all of the electrical properties of the wire. The pertinent parameter is the highest possible capacitance. If shielded wire is used, the appropriate number is the “Conductor to Other Conductor & Shield” value.

## Example — 18AWG Unshielded Audio, Control and Instrumentation Cable

Manufacturer’s specifications include:

Nom. Capacitance Conductor to Conductor @ 1 KHz: 26 pF/ft

Nom. Conductor DC Resistance @ 20 Deg. C: 5.96 Ohms/1000 ft

Max. Operating Voltage – UL 200 V RMS (PLTC, CMG), 150 V RMS (ITC)

Allowable Length with this cable =  $18000\text{pF} / (26\text{pF/ft}) = 692\text{ ft}$

## Example — 18AWG Shielded Audio, Control and Instrumentation Cable

Manufacturer's specifications include:

Nom. Characteristic Impedance: 29 Ohms

Nom. Inductance: .15  $\mu$ H/ft

Nom. Capacitance Conductor to Conductor @ 1 KHz: 51 pF/ft

Nom. Cap. Cond. to other Cond. & Shield @ 1 KHz 97 pF/ft

Allowable Length with this cable =  $18000\text{pF} / (97\text{pF/ft}) = 185\text{ ft}$

The AUX switch input passes less than 1 mA through the switch contacts, and uses less than 5V, therefore, neither the resistance nor the voltage rating of the cable are critical. Ensure that switch contact corrosion is prevented. It is generally advisable that the switch have gold-plated or sealed contacts.

## Field Communicator

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1. Connect the Field Communicator to the LOOP terminals on the digital valve controller.
2. Turn on the Field Communicator.
3. From the *Online* menu, select *Service Tools* and *Partial Stroke Test*.
4. Select either *Standard (10%)* or *Custom*. With the Custom Stroke Test, the stroke may be entered up to 30% with configurable stroking speed and pause time.
5. The currently configured Stroke, Stroking Speed, and Pause Time is displayed. Choose "Yes" to run the test using these values. Choose "No" to modify the values. The default value for Stroke Speed is 0.25%/second.
6. The valve begins to move and the actual travel reported by the digital valve controller is displayed on the Field Communicator.
7. Observe the valve as it runs the Partial Stroke Test to verify that it moves to the desired setpoint and then returns to the original position.

For information on configuring the Partial Stroke Test, see Partial Stroke Variables in the Detailed Setup section.

## Additional SIS Diagnostics

### Manual Reset

The DVC6000 SIS digital valve controller can be configured to hold the trip state until a local reset button is pressed. It is configurable by the Field Communicator or ValveLink software. Manual Reset can be initiated by shorting the AUX terminals with a user-supplied push button for at least 3 seconds, but less than 5 seconds or by pressing the button next to

the green light on the optional LCP100 local control panel when the current is at it's normal state. The digital valve controller will drive the valve to its normal operating position.

## Demand Mode Tests

The following steps assume the use of single acting spring and diaphragm actuators or double-acting spring assist piston actuators.

Perform the following steps to confirm valve operation:

- a. Point-to-Point Mode (DVC6000 SIS powered with 4–20 mA current source)

If the DVC6000 SIS is in series with a solenoid valve,

1. Disconnect the power from the solenoid valve, but maintain the 20 mA current to the digital valve controller. The valve should move to its "fail safe" position.
2. Maintain power to the solenoid valve and adjust the current to the digital valve controller from 20 mA to 4mA. The valve should move to its "fail safe" position.
3. Remove power from the solenoid valve and adjust the current to the digital valve controller from 20mA to 4mA. The valve should go to its "fail safe" position.

If a solenoid is not used with a DVC6000 SIS,

1. Adjust the current to the digital valve controller from 20 mA to 4 mA. The valve should move to its "fail safe" position.



## Note

**The above tests are applicable for single-acting direct relay A and C. If single-acting reverse relay B is used adjust the current from 4 mA (normal state) to 20 mA (trip state).**

---

- b. Multi-drop Mode (DVC6000 SIS is powered by a 24 VDC power source)

If the DVC6000 SIS is pneumatically in series with a solenoid valve, and shares a single power source,

Disconnect power to both devices. The valve should go to its "fail safe" position.

If the DVC6000 SIS is pneumatically in series with a solenoid valve, with independent power sources,

# Viewing Device Variables and Diagnostics

Connect a 24 VDC power supply to the solenoid valve and a second 24 VDC power supply to the DVC6000 SIS. Disconnect the solenoid valve power supply, but maintain the power supply to the DVC6000 SIS. The valve should go to its “fail safe” position quickly. Then, maintain the power supply to the solenoid valve and disconnect the DVC6000 SIS power supply. The valve should go to its “fail safe” position, although not as quickly as it does in the previous scenario.

If DVC6000 SIS is alone, without a solenoid valve,

Disconnect power to the digital valve controller. The valve should go to its “fail safe” position.



## Note

**The above tests are not applicable for single-acting reverse relay B when no solenoid valve is present.**

**If the LCP100 is used, conduct the following tests:**

### Successful Partial Stroke Test

1. Press the “Valve Test” (black) push button for more than 3 seconds (but less than 10 seconds).
2. Observe that the green light starts flashing when the valve starts moving.
3. Observe that the valve moves no more than the configured PST travel limit.
4. Observe that the valve returns to the normal operating position and the green light comes on solid.

### Manually Aborted Partial Stroke Test

1. Press the “Valve Test” (black) push button for more than 3 seconds (but less than 10 seconds).
2. Observe that the green light starts flashing when the valve starts moving.
3. Before the valve reaches the travel limit of the configured partial stroke test, press the “Valve Test” push button, or the push button next to the green light.
4. Observe that the valve immediately returns to the normal operating position and the green light comes on solid.

### Emergency Demand through the Logic Solver

1. Reduce the current to the DVC6000 to 4 mA for de-energize to trip operation.



## Note

**You may remove the power completely; however, the lights in step 3 will be off. Without power to the DVC6000 SIS, the LCP100 cannot function.**

2. Observe that the valve moves to its fail safe state.
3. Observe that the red light comes on solid and the amber light stays off (valve is not ready to open).
4. Press the push button next to the green light and observe that the valve does not move.
5. Increase the current to the DVC6000 to 20 mA and observe that the valve remains in its fail safe state.
6. Observe that the red light stays on solid and the amber light comes on solid (ready to reset).
7. Press the push button next to the green light.
8. Observe that the green light starts flashing, then becomes solid and the red light is off.

### Emergency Demand through Local Control Panel

1. Press the push button next to the red light.
2. Observe that the valve moves to its fail safe position.
3. Observe that the red light starts flashing, then becomes solid and the amber light comes on solid (ready to reset).
4. Press the push button next to the green light.
5. Observe that the red light goes off, the valve moves to its normal operating position, and the green light comes on solid.

## Solenoid Valve Health Monitoring

The following steps assume the use of a single-acting actuator with a solenoid valve installed. The DVC6000 SIS digital valve controller, with single-acting, direct relay C, must be powered separately from the solenoid. The unused output of the DVC6000 SIS must be connected between the solenoid and the actuator as described in the Installation section. The relay configuration selection must be “special application” and ValveLink Software must have the triggered profile enabled.

1. When allowed by the Logic Solver, momentarily remove and then restore power to the solenoid (typically 100 to 200 milliseconds). This process should occur quickly enough that the valve assembly does not move when the solenoid is de-energized.
2. With ValveLink Software, upload the diagnostic data from the triggered profile menu.
3. Examine the graph and observe that there was a change in the pressure reading downstream of the solenoid.

## Overview

The following menus are available to define and/or view information about the instrument. Select *Overview* from the Online menu.

### 6

**Analog In (3-1)**—Analog Input shows the value of the instrument analog input in mA (milliamperes) or % (percent) of ranged input.

**Set Point (3-2)**—Travel Set Point shows the requested valve position in % of ranged travel.

**Travel (3-3)**—Travel shows the value of the DVC6000 SIS digital valve controller travel in % (percent) of ranged travel. Travel always represents how far the valve is open.

**Drive Signal (3-4)**—Drive Signal shows the value of the instrument drive signal in % (percent) of maximum drive.

### Pressure (3-5)

Shows the value of the instrument supply and output pressures in psi, bar, kPa, or kg/cm<sup>2</sup>. Also shows the output pressure differential. To display pressures may require selecting the variable; a detail display of that variable with its values will appear.

- **Pressure A**—Shows the value of Output Pressure A in psi, bar, kPa, or kg/cm<sup>2</sup>.

- **Pressure B**—Shows the value of Output Pressure A in psi, bar, kPa, or kg/cm<sup>2</sup>.

- **A Minus B**—Shows the value of the output pressure differential in psi, bar, kPa, or kg/cm<sup>2</sup>.

- **Supply**—Displays the instrument supply pressure in psi, bar, kPa, or kg/cm<sup>2</sup>.

## Variables (3-6)

The *Variables* menu is available to view additional variables, including; *Auxiliary Input*, *Temperature*, *Maximum Recorded Temperature*, *Minimum Recorded Temperature*, *Cycle Counter*, *Travel Accumulator*, *Raw Travel Input*, *View Number of Days Powered Up*, and *Number of Power Ups*.

To view one of these variables, from the *Online* menu select *Overviews* and *Variables*. If a value for a variable does not appear on the display, select the variable and a detailed display of that variable with its value will appear. A variable's value does not appear on the menu if the value becomes too large to fit in the allocated space on the display, or if the variable requires special processing, such as Aux Input.

- **Auxiliary Input**—A discrete input that can be used with an independent limit or pressure switch. Its value is either open or closed.

- **Temperature**—The internal temperature of the instrument is displayed in either degrees Fahrenheit or Celsius.

- **Maximum Recorded Temperature**—Shows the maximum temperature the instrument has experienced since installation.

- **Minimum Recorded Temperature**—Shows the minimum temperature the instrument has experienced since installation.

- **Cycle Counter**—Displays the number of times the valve travel has cycled. 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. The value of the Cycle Counter can be reset from the *Cycle Count Alert* menu. See page 4-16 of the Detailed Setup section for additional information.

- **Travel Accumulator**—Contains 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. The value of the Travel Accumulator can be reset from the *Travel Accumulator* menu. See page 4-16 of the Detailed Setup section for additional information.

# Viewing Device Variables and Diagnostics



## Note

**Do not use the following raw travel input indication for calibrating the travel sensor. The following should only be used for a relative indication to be sure the travel sensor is working and that it is moving in the correct direction. Perform the Travel Sensor Adjust procedure in the Calibration section to calibrate the travel sensor.**

- **Raw Travel Input**—Raw travel input indicates the travel sensor position in analog-to-digital converter counts. When the travel sensor is operating correctly, this number changes as the valve strokes.

- **View Number of Days Powered Up**—Indicates in hours or days the total elapsed time the instrument has been powered up.

- **Number of Power Ups**—Indicates how many times the instrument has cycled power.

### Device Information (3-7)

The *Device Information* menu is available to view information about the instrument. From the *Online* menu, select *Overview* and *Device Information*. Follow the prompts on the Field Communicator display to view information in the following fields:

- **Hart Tag**—A HART tag is a unique name (up to eight characters) that identifies the physical instrument.

- **Device ID**—Each instrument has a unique Device Identifier. The device ID provides additional security to prevent this instrument from accepting commands meant for other instruments.

Table 6-2. Functions Available for Instrument Level

| Functions Available                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Communicates with Field Communicator and ValveLink software. Provides: travel cutoffs and limits, minimum opening and closing times, input characterization (linear, equal percentage, quick opening, and custom), trending with ValveLink Solo, and the following alerts: travel deviation; travel alert high, low, high high, and low low; drive signal; auxiliary terminal; cycle counter; and travel accumulation. With ValveLink Software, all offline diagnostic tests (dynamic error band, drive signal, step response, and valve signature) plus online trending and partial stroke test |

- **Manufacturer**—Identifies the manufacturer of the instrument.

- **Model**—Identifies the instrument model.

- **Device Revision**—The revision number of the software for communication between the Field Communicator and the instrument.

- **Firmware Revision**—The revision number of the firmware in the instrument.

- **Hardware Revision**—The revision number of the electrical circuitry within the instrument printed wiring board.

- **Instrument Level**—Indicates the instrument level – SIS

Table 6-2 lists the functions available instrument level SIS.

- **HART Universal Revision**—The revision number of the HART Universal Commands which are used as the communications protocol for the instrument.

**DD Information (3-8)**—DD Information contains the device description in the Field Communicator. To access DD Information from the Online menu, select *Overview* and *DD Information*.



## Section 7 Maintenance and Troubleshooting

### Module Base Maintenance

|                                 |     |
|---------------------------------|-----|
| Removing the Module Base .....  | 7-4 |
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### Submodule Maintenance

|                                                   |     |
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| Printed Wiring Board (PWB) Assembly               |     |
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### Terminal Box

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### Travel Sensor

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| DVC6030 SIS Digital Valve Controller and DVC6035 Remote<br>Feedback Unit (Rotary) .....       | 7-10 |
| Assembly                                                                                      |      |
| DVC6010 SIS Digital Valve Controller and DVC6015 Remote<br>Feedback Unit (Sliding-Stem) ..... | 7-10 |
| DVC6020 SIS Digital Valve Controller and DVC6025 Remote<br>Feedback Unit (Rotary) .....       | 7-12 |
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|                                  |      |
|----------------------------------|------|
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|----------------------------------|------|

|                                  |      |
|----------------------------------|------|
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|----------------------------------|------|

|                             |      |
|-----------------------------|------|
| Checking Loop Current ..... | 7-15 |
|-----------------------------|------|

# DVC6000 SIS

---

The DVC6000 SIS digital valve controller enclosure is rated NEMA 4X and IP66, therefore periodic cleaning of internal components is not required. If the DVC6000 SIS is installed in an area where the exterior surfaces tend to get heavily coated or layered with industrial or atmospheric contaminants, however, it is recommended that the vent (key 52) be periodically inspected to ensure it is fully open. If the vent appears to be clogged, the vent can be removed, cleaned and replaced. Lightly brush the exterior of the vent to remove contaminant and run a mild water/detergent solution through the vent to ensure it is fully open.



## WARNING

Personal injury or property damage can occur from cover failure due to overpressure. Ensure that the housing vent opening is open and free of debris to prevent pressure buildup under the cover.

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.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression so the actuator is not applying force to the valve stem; this will allow for the safe removal of the stem connector.

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## WARNING

To avoid static discharge from the plastic cover when flammable gases or dust are present, do not rub or clean the cover with solvents. To do so could result in a spark that may cause flammable gases or dust to explode, resulting in personal injury or property damage. Clean with a mild detergent and water only.



## WARNING

When using natural gas as the supply medium, or for explosion proof applications, the following warnings also apply:

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance procedures on the DVC6000 SIS digital valve controller:

- Always wear protective clothing, gloves, and eyewear to prevent personal injury.
- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power,

Remove electrical power before removing the housing cap. Personal injury or property damage from fire or explosion may result if power is not disconnected before removing the cap.

- Remove electrical power before disconnecting any of the pneumatic connections.
- When disconnecting any of the pneumatic connections or any pressure retaining part, natural gas will seep from the unit and any connected equipment into the surrounding atmosphere. Personal injury or property damage may result from fire or explosion if natural gas is used as the supply medium and appropriate preventive measures are not taken. Preventive measures may include, but are not limited to, one or more of the following: Remote venting of the unit, re-evaluating the hazardous area classification, ensuring adequate ventilation, and the removal of any ignition sources. For information on remote venting of this controller, refer to page 2-22.

# Maintenance and Troubleshooting

- Ensure that all caps and covers are correctly installed before putting this unit back into service. Failure to do so could result in personal injury or property damage from fire or explosion.

## CAUTION

When replacing components, use only components specified by the factory. Always use proper component replacement techniques, as presented in this manual. Improper techniques or component selection may invalidate the approvals and the product specifications, as indicated in table 1-2. It may also impair operations and the intended function of the device.



## Note

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



## Note

In the event of a power failure the DVC6000 SIS automatically restores the device to In Service upon restoration of power. This is to provide greater availability of the safety function.

If power is inadvertently interrupted while performing set up or maintenance, you may need to return the DVC6000 SIS to out of service if the interrupted task requires that mode of operation.

Because of the diagnostic capability of the DVC6000 SIS digital valve controller, predictive maintenance is available through the use of ValveLink software. Using

the digital valve controller, valve and instrument maintenance can be enhanced, thus avoiding unnecessary maintenance. For information on using ValveLink software, refer to the ValveLink software online help.

## Tools Required

Table 7-1 lists the tools required for maintaining the DVC6000 SIS digital valve controller.

Table 7-1. Tools Required

| Tool                 | Size      | Component                                              |
|----------------------|-----------|--------------------------------------------------------|
| Phillips Screwdriver |           | Relay, printed wiring board assembly, and cover screws |
| Hex key              | 5 mm      | Terminal box screw                                     |
| Hex key              | 1.5 mm    | Terminal box cover screw                               |
| Hex key              | 2.5 mm    | I/P converter screws                                   |
| Hex key              | 5 mm      | Travel sensor screws                                   |
| Hex key              | 6 mm      | Module base screws                                     |
| Open-end wrench      | 1/2-inch  | Connector Arm screw (DVC6010)                          |
| Hex key              | 9/64-inch | Feedback arm screw                                     |
| Open-end wrench      | 7/16-inch | DVC6010 mounting bolts                                 |
| Hex key              | 3/16-inch | DVC6020 mounting bolts                                 |

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## Module Base Maintenance

*For DVC6010 SIS, DVC6020 SIS, DVC6030 SIS, and DVC6005 SIS*

## CAUTION

To avoid affecting performance of the instrument, take care not to damage the module base seal or guide surface. Do not bump or damage the bare connector pins on the PWB assembly. Damaging either the module base or guide surface may result in material damage, which could compromise the instruments ability to maintain a pressure seal.

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

## Removing the Module Base

To remove the module base perform the following steps. Refer to figures 8-1, 8-2, 8-3, and 8-4 for key number locations.



### WARNING

To avoid personal injury or equipment damage from bursting of parts, turn off the supply pressure to the digital valve controller and bleed off any excess supply pressure before attempting to remove the module base assembly from the housing.

1. For sliding-stem applications only, a protective shield for the feedback linkage is attached to the side of the module base assembly (see figures 2-1 and 2-2). Remove this shield and keep for reuse on the replacement module. The replacement module will not have this protective shield.

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

3. Using a 6 mm hex socket wrench, loosen the three-socket head screws (key 38). These screws are captive in the module base by retaining rings (key 154).



### Note

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

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

5. The digital valve controller has two cable assemblies, shown in figure 7-1, which connect the module base, via the printed wiring board assembly, to the travel sensor and the terminal box. Disconnect these cable assemblies from the printed wiring board assembly on the back of the module base.

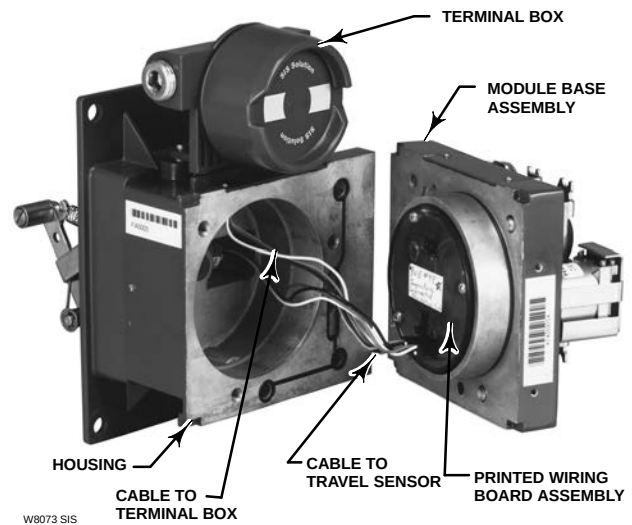


Figure 7-1. Printed Wiring Board Cable Connections

## Replacing the Module Base

To replace the module base perform the following steps. Refer to figures 8-1, 8-2, 8-3, and 8-4 for key number locations.



### Note

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

Ensure the module base seal is in good condition. Do not reuse a damaged or worn seal.

1. Ensure the module base seal (key 237) is properly installed in the housing (key 1). Ensure the O-ring (key 12) is in place on the module base assembly.

2. Connect the terminal box connector to the PWB assembly (key 50). Orientation of the connector is required.

3. Connect the travel sensor connector to the PWB assembly (key 50). Orientation of the connector is required.

4. Insert the module base (key 2) into the housing (key 1).
5. Install three socket head screws (key 38) in the module base into the housing. If not already installed, press three retaining rings (key 154) into the module base. Evenly tighten the screws in a crisscross pattern to a final torque of 16 N•m (138 lbf•in).



## WARNING

**Personal injury, property damage, or disruption of process control can result if the cable assemblies/wiring are damaged when attaching the cover to the module base assembly.**

**Ensure that the cable assemblies/wiring are position in the cavity of the module base so they do not get compressed or damaged when attaching the cover to the module base assembly in step 6.**

6. Attach the cover (key 43) to the module base assembly.
7. For sliding-stem applications only, install the protective shield onto the side of the replacement module base assembly (see figures 2-1 and 2-2).

## Submodule Maintenance

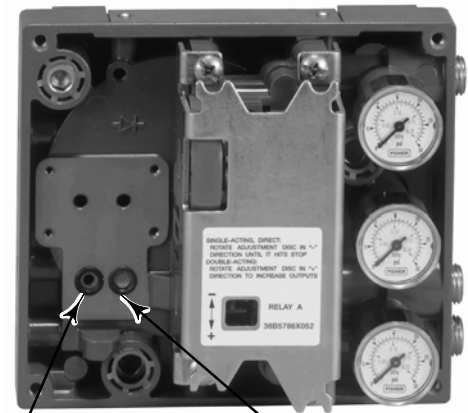
*For DVC6010 SIS, DVC6020 SIS, DVC6030 SIS, and DVC6005 SIS*

## CAUTION

**Exercise care when performing maintenance on the module base. Reinstall the cover to protect the I/P converter and gauges when servicing other submodules.**

**In order to maintain accuracy specifications, do not strike or drop the I/P converter during submodule maintenance.**

The digital valve controller's module base contains the following submodules: I/P converter, PWB assembly, and pneumatic relay. If problems occur, these submodules may be removed from the module base



O-RING LOCATED  
IN I/P CONVERTER  
OUTPUT PORT

WB072-1

SCREEN (FILTER)  
LOCATED IN I/P  
CONVERTER  
SUPPLY PORT

Figure 7-2. I/P Filter Location

and replaced with new submodules. After replacing a submodule, the module base may be put back into service.

## I/P Converter

Refer to figures 8-1 through 8-4 for key number locations. The I/P converter (key 41) is located on the front of the module base.



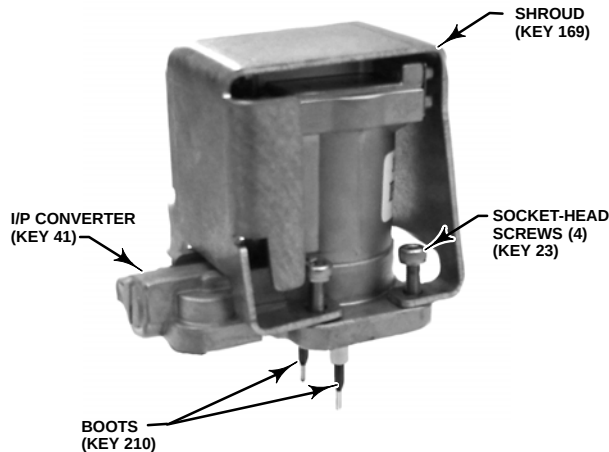
## Note

**After I/P converter submodule replacement, calibrate the digital valve controller to maintain accuracy specifications.**

## 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 (key 41) and shroud (key 169) as described in the Removing the I/P Converter procedure.
2. Remove the screen (key 231) from the supply port.
3. Install a new screen in the supply port as shown in figure 7-2.
4. Inspect the O-ring (key 39) in the I/P output port. if necessary, replace it.



W9328-1

Figure 7-3. I/P Converter

5. Reinstall the I/P converter (key 41) and shroud (key 169) as described in the Replacing the I/P Converter procedure.

## 7

### Removing the I/P Converter

1. Remove the front cover (key 43), if not already removed.
2. Refer to figure 7-3. Using a 2.5 mm hex socket wrench, remove the four socket-head screws (key 23) that attach the shroud (key 169) and I/P converter (key 41) to the module base (key 2).
3. Remove the shroud (key 169); then pull the I/P converter (key 41) straight out of the module base (key 2). 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 (key 39) and screen (key 231) stay in the module base and do not come out with the I/P converter (key 41).

### Replacing the I/P Converter

1. Refer to figure 7-2. Inspect the condition of the O-ring (key 39) and screen (key 231) in the module base (key 2). Replace them, if necessary. Apply silicone lubricant to the O-rings.
2. Ensure the two boots (key 210) shown in figure 7-3 are properly installed on the electrical leads.
3. Install the I/P converter (key 41) straight into the module base (key 2), 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 (key 169) over the I/P converter (key 41).

5. Install the four socket-head screws (key 23) and evenly tighten them in a crisscross pattern to a final torque of 1.6 N•m (14 lbf•in).

6. After replacing the I/P converter, calibrate travel or perform touch-up calibration to maintain accuracy specifications.

### PWB (Printed Wiring Board) Assembly

Refer to figures 8-1 through 8-4 for key number locations. The PWB assembly (key 50) is located on the back of the module base assembly (key 2).



### Note

**If the PWB assembly submodule is replaced, calibrate and configure the digital valve controller to maintain accuracy specifications.**

### Removing the Printed Wiring Board Assembly

1. Separate the module base from the housing by performing the Removing the Module Base procedure.
2. Remove three screws (key 33).
3. Lift the PWB assembly (key 50) straight out of the module base (key 2).
4. Ensure that the O-rings (key 40) remain in the pressure sensor bosses on the module base assembly (key 2) after the PWB assembly (key 50) has been removed.

### Replacing the PWB Assembly and Setting the DIP Switch

1. Apply silicone lubricant to the pressure sensor O-rings (key 40) and install them on the pressure sensor bosses in the module base assembly.
2. Properly orient the PWB assembly (key 50) as you install it into the module base. The two electrical leads from the I/P converter (key 41) must guide into their receptacles in the PWB assembly and the pressure sensor bosses on the module base must fit into their receptacles in the PWB assembly.
3. Push the PWB assembly (key 50) into its cavity in the module base.
4. Install and tighten three screws (key 33) to a torque of 1 N•m (10.1 lbf•in).
5. Set the DIP switch on the PWB assembly according to table 7-2.

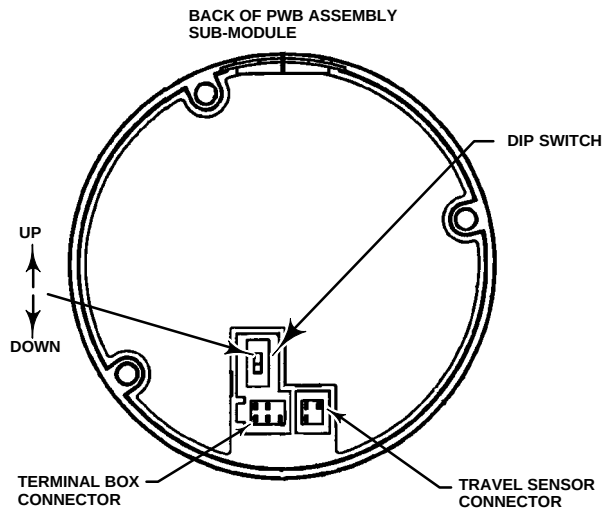


Figure 7-4. DIP Switch Location

Table 7-2. DIP Switch Configuration<sup>(1)</sup>

| Operational Mode                            | Switch Position                                                                            |
|---------------------------------------------|--------------------------------------------------------------------------------------------|
| Multi-drop Loop                             | UP  ↑    |
| Point-to-Point Loop                         | DOWN  ↓ |
| 1. Refer to figure 7-4 for switch location. |                                                                                            |



## Note

For the digital valve controller to operate with a 4-20 mA control signal, the DIP switch must be in the point-to-point loop position, as shown in table 7-2.

For the digital valve controller to operate with a 24 VDC voltage control signal, the DIP switch must be in the multi-drop loop position, as shown in table 7-2.

- Reassemble the module base to the housing by performing the Replacing the Module Base procedure.
- Setup and calibrate the digital valve controller.



Figure 7-5. Pneumatic Relay Assembly

## Pneumatic Relay

Refer to figures 8-1 through 8-4 for key number locations. The pneumatic relay (key 24) is located on the front of the module base.



## Note

After relay submodule replacement, calibrate the digital valve controller to maintain accuracy specifications.

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## Removing the Pneumatic Relay

- Loosen the four screws that attach the relay (key 24) to the module base. These screws are captive in the relay.
- Remove the relay.

## Replacing the Pneumatic Relay

- Visually inspect the holes in the module base to ensure they are clean and free of obstructions. If cleaning is necessary, do not enlarge the holes.
- Apply silicone lubricant to the relay seal and position it in the grooves on the bottom of the relay as shown in figure 7-5. Press small seal retaining tabs into retaining slots to hold relay seal in place.
- Position the relay (with shroud) on the module base. Tighten the four screws, in a crisscross pattern, to a final torque of 2 N•m (20.7 lbf•in).
- Using the Field Communicator, verify that the value for Relay Type parameter matches the relay type installed.
- After replacing the relay and verifying the relay type, calibrate travel to maintain accuracy specifications.

## Gauges, Pipe Plugs, or Tire Valves

Depending on the options ordered, the DVC6000 SIS digital valve controller will be equipped with either gauges (key 47), pipe plugs (key 66), or tire valves (key 67). Single-acting direct instruments will also have a screen (key 236, figure 8-5). These are located on the top of the module base next to the relay.

Perform the following procedure to replace the gauges, tire valves, or pipe plugs. Refer to figures 8-1 through 8-5 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)**, the flats are on the gauge case. Use a wrench on the flats of the gauge to remove the gauge from the module base. For double-acting instruments, to remove the supply gauge remove one of the output gauges.

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

3. Apply anti-seize (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

**For DVC6010 SIS, DVC6020 SIS, DVC6030 SIS, and DVC6005 SIS**

Refer to figures 8-1 through 8-4 for key number locations.

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



### Note

**This procedure also applies to the DVC6005 SIS remote terminal box.**

---

## Removing the Terminal Box



### WARNING

**To avoid personal injury or property damage caused by fire or explosion, remove power to the instrument before removing the terminal box cover in an area which contains a potentially explosive atmosphere or has been classified as hazardous.**

---

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. Separate the module base from the housing by performing the Removing the Module Base procedure.
4. Remove the screw (key 72). Pull the terminal box assembly straight out of the housing.
5. 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 silicone lubricant to the O-ring (key 35) and install the O-ring over the stem of the terminal box.
3. Insert the terminal box assembly stem into the housing until it bottoms out. Position the terminal box assembly so that the hole for the screw (key 72) in the terminal box aligns with the threaded hole in the housing. Install the screw (key 72).
4. Connect the terminal box connector to the PWB assembly (key 50). Orientation of the connector is required.
5. Reassemble the module base to the housing by performing the Replacing the Module Base procedure.
6. Reconnect the field wiring as noted in step 2 in the Removing the Terminal Box procedure.

7. Apply silicone lubricant to the O-ring (key 36) and install the O-ring over the 2-5/8 inch threads of the terminal box. Use of a tool is recommended to prevent cutting the O-ring while installing it over the threads.
8. 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.
9. Screw the cap (key 4) onto the terminal box.
10. 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 one of the recesses in the terminal box. Tighten the set screw (key 58).
11. Apply anti-seize (key 64) to the conduit entrance plug (key 62) and install it into the unused conduit entry of the terminal box.

## Travel Sensor

**For DVC6010 SIS, DVC6015, DVC6020 SIS, DVC6025, DVC6030 SIS, and DVC6035**

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



### WARNING

To avoid personal injury or property damage caused by fire or explosion, remove power to the instrument before removing the potentiometer in an area which contains a potentially explosive atmosphere or has been classified as hazardous.

## Disassembly



### Note

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

## DVC6010 SIS Digital Valve Controller and DVC6015 Remote Feedback Unit

Refer to figure 8-1 for DVC6010 SIS and 8-6 for DVC6015 key number locations.

1. Remove piping and fittings from the instrument.
2. Disconnect the adjustment arm from the connector arm and the feedback arm (see figures 2-1 and 2-2).
3. Remove the instrument 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.

If disassembling a DVC6010 SIS digital valve controller, use step 6a. If disassembling a DVC6015 remote feedback unit, use step 6b.

6. a. Separate the module base from the housing by performing the Removing the Module Base procedure.

b. Disconnect the three potentiometer assembly wires from the terminal.

7. Remove the screw (key 72) that fastens the travel sensor assembly to the housing.

8. Pull the travel sensor assembly (key 223) straight out of the housing.

## DVC6020 SIS Digital Valve Controller and DVC6025 Remote Feedback Unit

Refer to figure 8-2 for DVC6020 SIS and 8-7 for DVC6025 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. If the torsion spring (key 93) needs to be replaced, ensure that the shaft on which it is installed is smooth and free of rough spots. Replace the entire feedback arm assembly if necessary.

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.

If disassembling a DVC6020 SIS digital valve controller, use step 6a. If disassembling a DVC6025 remote feedback unit, use step 6b.

6. a. Separate the module base from the housing by performing the Removing the Module Base procedure.

# DVC6000 SIS

- b. Disconnect the three potentiometer assembly wires from the terminal.
7. Remove the screw (key 72) that fastens the travel sensor assembly to the housing.
8. Pull the travel sensor assembly (key 223) straight out of the housing.

## **DVC6030 SIS Digital Valve Controller and DVC6035 Remote Feedback Unit**

Refer to figure 8-3 for DVC6030 SIS and 8-8 for DVC6035 key number locations.

1. Remove piping and fittings from the instrument.
2. Remove the digital valve controller from the actuator.
3. Loosen the screw (key 80) that secures the feedback arm (key 79) to the travel sensor shaft and remove the feedback arm from the travel sensor shaft.

If disassembling a DVC6030 SIS digital valve controller, use step 4a. If disassembling a DVC6035 remote feedback unit, use step 4b.

4. a. Separate the module base from the housing by performing the Removing the Module Base procedure.
  - b. Disconnect the three potentiometer assembly wires from the terminal.
5. From within the housing, unscrew the travel sensor assembly (key 223) from the housing.

## **Assembly**



### **Note**

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

## **DVC6010 SIS Digital Valve Controller and DVC6015 Remote Feedback Unit**

Refer to figure 8-1 for DVC6010 SIS and 8-6 for DVC6015 key number locations.

1. Insert the travel sensor assembly (key 223) into the housing (key 1). Secure the travel sensor assembly with screw (key 72).

If assembling a DVC6010 digital valve controller, use step 2a. If assembling a DVC6015 remote feedback unit, use step 2b.

2. a. Connect the travel sensor connector to the PWB as described in the Replacing the Module Base procedure.

b. Connect the three travel sensor wires to the terminals.



### **Note**

For the DVC6015 feedback unit, connect the potentiometer assembly (key 223) wires to the terminals as follows:

red → terminal 1  
white → terminal 2  
black → terminal 3

3. Loosely assemble the bias spring (key 78), screw (key 80), plain washer (key 163), and nut (key 81) to the feedback arm (key 79), if not already installed.

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

Two methods are available for adjusting the travel sensor. You can use a multimeter to measure the potentiometer resistance, or if you have a Field Communicator, you can use the procedure in the Calibration section. To use the multimeter, perform steps 5 through 13. To use the Field Communicator, skip to step 14.

### **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. Position the feedback arm so that the surface is flush with the end of the travel sensor shaft.

6. Connect a multimeter set to a resistance range of 50,000 ohms. Measure the resistance between pins 1 and 3 of the travel sensor connector. Refer to figure 7-6 for pin location. The resistance should be between 40,000 and 50,000 ohms.

7. Multiply the result in step 6 by 0.046 to get a calculated resistance. The calculated resistance should be in the range of 1840 to 2300 ohms.

8. Re-range the multimeter to a resistance of 3000 ohms between pins 2 and 3 of the travel sensor connector. Refer to figure 7-6 for pin location.

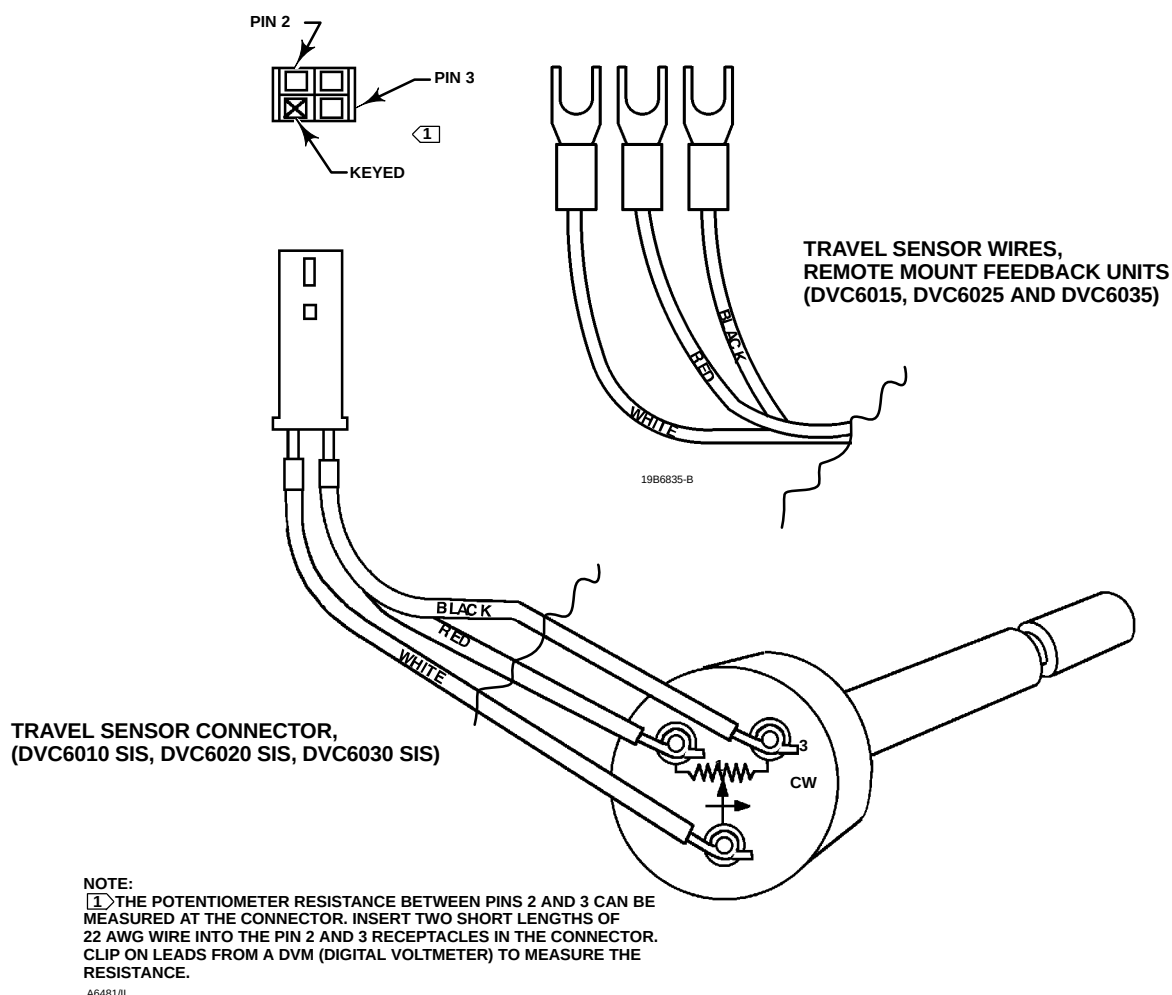


Figure 7-6. Potentiometer Resistance Measurement

9. Adjust the travel sensor shaft to obtain the calculated resistance determined in step 7,  $\pm 100$  ohms.

12. For the DVC6010 SIS only, connect the travel sensor connector to the PWB as described in Replacing the Module Base.

13. Travel sensor replacement is complete. Install the digital valve controller on the actuator.



## Note

In the next step, be sure the feedback arm 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 7,  $\pm 100$  ohms. Paint the screw to discourage tampering with the connection.

11. Disconnect the multimeter from the travel sensor connector.

## Travel Sensor Adjustment with the Field Communicator

The next two steps do not apply if you used a multimeter to adjust the travel sensor. Perform these steps only if you elected to adjust the travel sensor using the Field Communicator.

14. For the DVC6010 SIS, connect the travel sensor connector to the PWB as described in Replacing the Module Base.

15. For both DVC6010 SIS and DVC6015, perform the appropriate Travel Sensor Adjust procedure in the Calibration section.

## **DVC6020 SIS Digital Valve Controller and DVC6025 Remote Feedback Unit**

Refer to figure 8-2 for DVC6020 SIS and 8-7 for DVC6025 key number locations.

1. Insert the travel sensor assembly (key 223) into the housing. Secure the travel sensor assembly with screw (key 72).

If assembling a DVC6020 SIS digital valve controller, use step 2a. If assembling a DVC6025 remote feedback unit, use step 2b.

2. a. Connect the travel sensor connector to the PWB as described in Replacing the Module Base.

b. Connect the three travel sensor wires to the terminals.



### **Note**

**For the DVC6025 feedback unit, connect the potentiometer assembly (key 223) wires to the terminals as follows:**

**red → terminal 1**  
**white → terminal 2**  
**black → terminal 3**

3. Loosely assemble the screw (key 80), plain washer (key 163), and nut (key 81) to the arm assembly (key 91), if not already installed.

4. Attach the arm assembly (key 91) to the travel sensor assembly (key 223) shaft.

Two methods are available for adjusting the travel sensor. You can use a multimeter to measure the potentiometer resistance, or if you have a Field Communicator, you can use the procedure in the Calibration section. To use the multimeter, perform steps 5 through 17. To use the Field Communicator, skip to step 18.

### **Travel Sensor Adjustment with a Multimeter**

5. Connect a multimeter set to a resistance range of 50,000 ohms. Measure the resistance between pins 1 and 3 of the travel sensor connector. Refer to figure 7-6 for pin location. The resistance should be between 40,000 and 50,000 ohms.

6. Multiply the result in step 5 by 0.142 to get a calculated resistance. The calculated resistance should be in the range of 5680 to 7100 ohms.

7. Re-range the multimeter to a resistance of 7000 ohms between pins 2 and 3 of the travel sensor connector. Refer to figure 7-6 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. Position the arm assembly so that the outer surface is flush with the end of the travel sensor shaft.

9. Adjust the travel sensor shaft to obtain the calculated resistance determined in step 6,  $\pm 100$  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 6,  $\pm 100$  ohms. Paint the screw to discourage tampering with the connection.

11. Disconnect the multimeter from the travel sensor connector.

12. Apply anti-seize (key 64) to the pin portion of the arm assembly (key 91).

13. Position the mounting bracket over the back of the digital valve controller. Push the feedback arm assembly (key 84) toward the housing and engage the pin of the arm assembly into the slot in the feedback arm.

14. Install the mounting bracket (key 74).

15. Install the bias spring (key 82) as shown in figure 7-7.

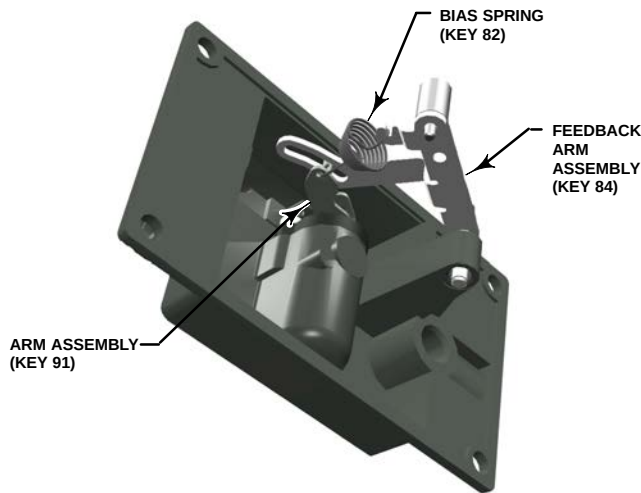
16. For the DVC6020 SIS only, connect the travel sensor connector to the PWB as described in Replacing the Module Base.

17. Travel sensor replacement is complete. Install the digital valve controller on the actuator.

### **Travel Sensor Adjustment with the Field Communicator**

The next two steps do not apply if you used a multimeter to adjust the travel sensor. Perform these steps only if you elected to adjust the travel sensor using the Field Communicator.

18. For the DVC6020 SIS only, connect the travel sensor connector to the PWB as described in Replacing the Module Base.



**NOTE:**  
INSTALL BIAS SPRING WITH SMALLER DIAMETER HOOK CONNECTED TO ARM ASSEMBLY (KEY 91) AND WITH BOTH HOOK OPENINGS TOWARD CENTER OF BRACKET.

Figure 7-7. FIELDVUE DVC6020 SIS Bias Spring (key 82) Installation

19. For both the DVC6020 SIS and the DVC6025, perform the appropriate Travel Sensor Adjust procedure in the Calibration section.

## DVC6030 SIS Digital Valve Controller and DVC6035 Remote Feedback Unit

Refer to figure 8-3 for DVC6030 SIS and 8-8 for DVC6035 key number locations.

1. Apply lubricant (key 63) to the travel sensor assembly threads.
2. Screw the travel sensor assembly (key 223) into the housing until it is tight.

If assembling a DVC6030 SIS digital valve controller, use step 3a. If assembling a DVC6035 remote feedback unit, use step 3b.

3. a. Connect the travel sensor connector to the PWB as described in the Replacing the Module Base procedure.

b. Connect the three travel sensor wires to the terminals.



## Note

For the DVC6035 feedback unit, connect the potentiometer assembly (key 223) wires to the terminals as follows:  
red → terminal 1  
white → terminal 2  
black → terminal 3

4. Loosely assemble the bias spring (key 78), screw (key 80), plain washer (key 163), and nut (key 81) to the feedback arm (key 79), if not already installed.
5. Attach the feedback arm (key 79) to the travel sensor shaft.

Two methods are available for adjusting the travel sensor. You can use a multimeter to measure the potentiometer resistance, or if you have a Field Communicator, you can use the procedure in the Calibration section. To use the multimeter, perform steps 6 through 14. To use the Field Communicator, skip to step 15.

## Travel Sensor Adjustment with a Multimeter

6. 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 housing. Position the feedback arm so that the outer surface is flush with the end of the travel sensor shaft.
7. Connect a multimeter set to a resistance range of 50,000 ohms. Measure the resistance between pins 1 and 3 of the travel sensor connector. Refer to figure 7-6 for pin location. The resistance should be between 40,000 and 50,000 ohms.
8. Multiply the result in step 7 by 0.042 to get a calculated resistance. The calculated resistance should be in the range of 1680 to 2100 ohms.
9. Re-range the multimeter to a resistance of 3000 ohms between pins 2 and 3 of the travel sensor connector. Refer to figure 7-6 for pin location.
10. Adjust the travel sensor shaft to obtain the calculated resistance determined in step 8,  $\pm 100$  ohms.



## Note

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

11. 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 8,  $\pm 100$  ohms. Paint the screw to discourage tampering with the connection.

12. Disconnect the multimeter from the travel sensor connector.

13. For the DVC6030 SIS only, connect the travel sensor connector to the PWB as described in Replacing the Module Base.

14. Travel sensor replacement is complete. Install the digital valve controller on the actuator as described in the Installation section.

## Travel Sensor Adjustment with the Field Communicator

The next two steps do not apply if you used a multimeter to adjust the travel sensor. Perform these steps only if you elected to adjust the travel sensor using the Field Communicator.

15. For the DVC6030 SIS only, connect the travel sensor connector to the PWB as described in Replacing the Module Base.

16. For both the DVC6030 SIS and the DVC6035, perform the appropriate Travel Sensor Adjust procedure in the Calibration section.

## Troubleshooting

If communication or output difficulties are experienced with the instrument, refer to the troubleshooting chart in table 7-3. Also see the DVC6000 SIS Troubleshooting Checklist on page 7-18.

## Checking Voltage Available



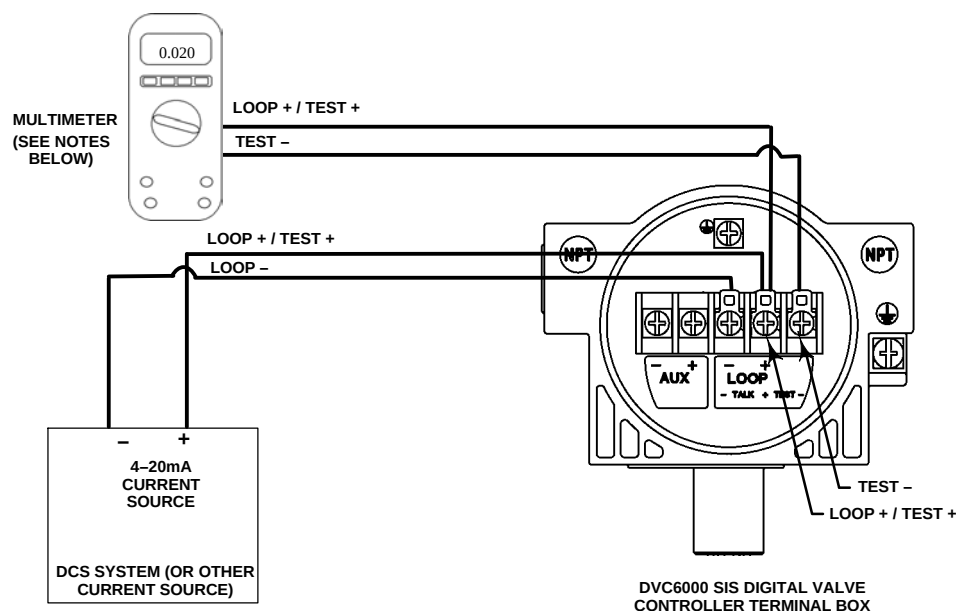
### WARNING

**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. Connect the equipment in figure 2-25 to the field wiring in place of the FIELDVUE instrument.
2. Set the control system to provide maximum output current.
3. Set the resistance of the 1 kilohm potentiometer shown in figure 2-25 to zero.
4. Record the current shown on the milliammeter.
5. Adjust the resistance of the 1 kilohm potentiometer until the voltage read on the voltmeter is 11.0 volts.
6. Record the current shown on the milliammeter.
7. If the current recorded in step 6 is the same as that recorded in step 4 ( $\pm 0.08$  mA), the voltage available is adequate.
8. If the voltage available is inadequate, refer to Wiring Practices in the Installation section.



NOTES:

1. MULTIMETER MEASURING 0.000 TO 1.0000 VDC
2. TYPICAL READINGS 0.004 VDC TO 0.020 VDC
3. OHM'S LAW— $V = I \times R$ , WHERE  $R = \text{PRECISION 1 OHM RESISTOR}$ ,  $V = I \times 1$ , SO  $V = I$

Figure 7-8. Check the Loop Current using the TEST Terminals

## Checking the Loop Current Without Disturbing the Loop Wiring



### 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 loop current without disturbing the loop wiring perform the following procedure.

1. With the FIELDVUE instrument connected to a current source connect a digital multimeter reading Volts DC ( 0 to 1 VDC or mV scale) to the TEST terminals as shown in figure 7-8.
2. The reading at the test terminals is proportional to the loop current [0.004 V = 0.004 A (4 MA)] mA of loop current). Refer to Specifications, table 1-2, to determine if the current is sufficient.

Table 7-3. Instrument Troubleshooting

| Symptom                                                                       | Possible Cause                                                | Action                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Analog input reading at instrument does not match actual current provided. | 1a. Control mode not Analog.                                  | 1a. Check the control mode using the Field Communicator. If in the Digital or Test mode, the instrument receives its set point as a digital signal. Control is not based on input current. Change Control Mode to Analog.                                       |
|                                                                               | 1b. Low control system compliance voltage.                    | 1b. Check system compliance voltage (see Wiring Practices in the Installation section).                                                                                                                                                                         |
|                                                                               | 1c. Instrument shutdown due to self test failure.             | 1c. Check instrument status using the Field Communicator (see Viewing Instrument Status in the Viewing Device Information section).                                                                                                                             |
|                                                                               | 1d. Analog input sensor not calibrated.                       | 1d. Calibrate the analog input sensor (see Analog Input Calibration in the Calibration section).                                                                                                                                                                |
|                                                                               | 1e. Current leakage.                                          | 1e. Excessive moisture in the terminal box can cause current leakage. Typically the current will vary randomly if this is the case. Allow the inside of the terminal box to dry, then retest.                                                                   |
| 2. Instrument will not communicate.                                           | 2a. Insufficient Voltage Available.                           | 2a. Calculate Voltage Available (see Wiring Practices in the Installation section). Voltage Available should be greater than or equal to 11 VDC.                                                                                                                |
|                                                                               | 2b. Controller output Impedance too low.                      | 2b. Install a HART filter after reviewing Control System Compliance Voltage requirements (see Wiring Practices in the Installation section).                                                                                                                    |
|                                                                               | 2c. Cable capacitance too high.                               | 2c. Review maximum cable capacitance limits (see Wiring Practices in the Installation section).                                                                                                                                                                 |
|                                                                               | 2d. HART filter improperly adjusted.                          | 2d. Check filter adjustment (see the appropriate HART filter instruction manual).                                                                                                                                                                               |
|                                                                               | 2e. Improper field wiring.                                    | 2e. Check polarity of wiring and integrity of connections. Make sure cable shield is grounded only at the control system.                                                                                                                                       |
|                                                                               | 2f. Controller output providing less than 4 mA to loop.       | 2f. Check control system minimum output setting, which should not be less than 3.8 mA.                                                                                                                                                                          |
|                                                                               | 2g. Disconnected loop wiring cable at PWB.                    | 2g. Verify connectors are plugged in correctly.                                                                                                                                                                                                                 |
|                                                                               | 2h. PWB DIP switch not set properly.                          | 2h. Check for incorrect setting or broken DIP switch on the back of the PWB. Reset switch or replace PWB, if switch is broken. See table 7-2 for switch setting information                                                                                     |
|                                                                               | 2j. PWB failure.                                              | 2j. Use a 4–20 mA current source to apply power to the instrument. Terminal voltage across the LOOP+ and LOOP– terminals should be 9 to 10.5 VDC. If the terminal voltage is not 9 to 10.5 VDC, replace the PWB.                                                |
|                                                                               | 2k. Polling address incorrect.                                | 2k. Use the Field Communicator to set the polling address (refer to the Detailed Setup section). From the <i>Utilities</i> menu, select <i>Configure Communicator</i> and <i>Polling</i> . Select <i>Always Poll</i> . Set the instrument polling address to 0. |
|                                                                               | 2l. Defective terminal box.                                   | 2l. Check continuity from each screw terminal to the corresponding PWB connector pin. If necessary, replace the terminal box assembly.                                                                                                                          |
|                                                                               | 2m. Defective Field Communicator or ValveLink modem cable.    | 2m. If necessary, repair or replace cable.                                                                                                                                                                                                                      |
|                                                                               | 2n. ValveLink modem defective or not compatible with PC.      | 2n. Replace ValveLink modem.                                                                                                                                                                                                                                    |
|                                                                               | 2p. ValveLink hardlock defective or not programmed.           | 2p. Replace if defective or return to factory for programming.                                                                                                                                                                                                  |
| 3. Instrument will not calibrate, has sluggish performance or oscillates.     | 3a. Travel sensor seized, will not turn.                      | 3a. Rotate feedback arm to ensure it moves freely. If not, replace the pot/bushing assembly.                                                                                                                                                                    |
|                                                                               | 3b. Broken travel sensor wire(s).                             | 3b. Inspect wires for broken solder joint at pot or broken wire. Replace pot/bushing assembly.                                                                                                                                                                  |
|                                                                               | 3c. Travel sensor misadjusted.                                | 3c. Perform Travel Sensor Adjust procedure in the Calibration section.                                                                                                                                                                                          |
|                                                                               | 3d. Open travel sensor.                                       | 3d. Check for continuity in electrical travel range. If necessary, replace pot/bushing assembly.                                                                                                                                                                |
|                                                                               | 3e. Cables not plugged into PWB correctly.                    | 3e. Inspect connections and correct.                                                                                                                                                                                                                            |
|                                                                               | 3f. Feedback arm loose on pot.                                | 3f. Perform Travel Sensor Adjust procedure in the Calibration section.                                                                                                                                                                                          |
|                                                                               | 3g. Feedback arm bent/damaged or bias spring missing/damaged. | 3g. Replace feedback arm and bias spring.                                                                                                                                                                                                                       |

–continued–

# Maintenance and Troubleshooting

Table 7-3. Instrument Troubleshooting (Continued)

| Symptom                                                  | Possible Cause                                                                       | Action                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                          | 3h. Configuration errors.                                                            | 3h. Verify configuration:<br>If necessary, set protection to None.<br>If Out of Service, place In Service.<br>Check:<br>Travel Sensor Motion<br>Tuning set<br>Zero power condition<br>Feedback Connection<br>Control mode (should be Analog)<br>Restart control mode (should be Analog) |
|                                                          | 3j. Restricted pneumatic passages in I/P converter.                                  | 3j. Check screen in I/P converter supply port of the module base. Replace if necessary. If passages in I/P converter restricted, replace I/P converter.                                                                                                                                 |
|                                                          | 3k. O-ring(s) between I/P converter ass'y missing or hard and flattened losing seal. | 3k. Replace O-ring(s).                                                                                                                                                                                                                                                                  |
|                                                          | 3l. I/P converter ass'y damaged/corroded/clogged.                                    | 3l. Check for bent flapper, open coil (continuity), contamination, staining, or dirty air supply. Coil resistance should be between 1680 - 1860 ohms. Replace I/P assembly if damaged, corroded, clogged, or open coil.                                                                 |
|                                                          | 3m. I/P converter ass'y out of spec.                                                 | 3m. I/P converter ass'y nozzle may have been adjusted. Verify drive signal (55 to 80% for double-acting; 60 to 85% for single-acting) with the valve off the stops. Replace I/P converter ass'y if drive signal is continuously high or low.                                            |
|                                                          | 3n. Defective module base seal.                                                      | 3n. Check module base seal for condition and position. If necessary, replace seal.                                                                                                                                                                                                      |
|                                                          | 3p. Defective relay.                                                                 | 3p. Depress relay beam at adjustment location in shroud, look for increase in output pressure. Remove relay, inspect relay seal. Replace relay seal or relay if I/P converter assembly good and air passages not blocked. Check relay adjustment.                                       |
|                                                          | 3q. Defective 67CFR regulator, supply pressure gauge jumps around.                   | 3q. Replace 67CFR regulator.                                                                                                                                                                                                                                                            |
| 4. ValveLink diagnostic tests provide erroneous results. | 4a. Bent or defective pressure sensor.                                               | 4a. Replace PWB.                                                                                                                                                                                                                                                                        |
|                                                          | 4b. Pressure sensor O-ring missing.                                                  | 4b. Replace O-ring.                                                                                                                                                                                                                                                                     |
| 5. Field Communicator does not turn on.                  | 5a. Battery pack not charged.                                                        | 5a. Charge battery pack.<br>Note: Battery pack can be charged while attached to the Field communicator or separately. The Field Communicator is fully operable while the battery pack is charging. Do not attempt to charge the battery pack in a hazardous area.                       |

# DVC6000 SIS

## DVC6000 SIS Troubleshooting Checklist

1. Instrument serial number as read from nameplate \_\_\_\_\_
2. Is the digital valve controller responding to the control signal? Yes \_\_\_\_\_ No \_\_\_\_\_  
If not, describe \_\_\_\_\_
3. Measure the voltage across the "Loop –" and Loop +" terminal box screws when the commanded current is 4.0 mA and 20.0 mA: V @ 4.0 mA \_\_\_\_\_ V @ 20.0 mA. \_\_\_\_\_  
(These values should be around 9.6 V @ 4.0 mA and 10.3 V @ 20 mA.)
4. Is it possible to communicate via HART to the digital valve controller? Yes \_\_\_\_\_ No \_\_\_\_\_
5. What is the Diagnostic Tier of the digital valve controller? SIS
6. What is the firmware version of the digital valve controller? \_\_\_\_\_
7. What is the hardware version of the digital valve controller? \_\_\_\_\_
8. Is the digital valve controller's Instrument Mode "In Service"? Yes \_\_\_\_\_ No \_\_\_\_\_
9. Is the digital valve controller's Control Mode set to "Analog"? Yes \_\_\_\_\_ No \_\_\_\_\_
10. Is it on Travel or Pressure control? \_\_\_\_\_
11. What are the following parameter readings?  
Input Signal \_\_\_\_\_ Drive Signal \_\_\_\_\_ %  
Supply Pressure \_\_\_\_\_ Pressure A \_\_\_\_\_ Pressure B \_\_\_\_\_  
Travel Target \_\_\_\_\_ % Travel \_\_\_\_\_ %
12. What are the following alert readings?  
Fail alerts \_\_\_\_\_  
Valve alerts \_\_\_\_\_  
Operational status \_\_\_\_\_  
Alert event record entries \_\_\_\_\_
13. Export ValveLink data (if available) for the device (Status Monitor, Detailed Setup, etc.).

## Mounting

1. Which DVC6000 SIS do you have? DVC6010 \_\_\_\_\_ DVC6020 \_\_\_\_\_ DVC6030 \_\_\_\_\_ Remote Mount? \_\_\_\_\_
2. What Make, Brand, Style, Size, etc. actuator is the DVC6000 SIS mounted on? \_\_\_\_\_
3. What is the full travel of the valve? \_\_\_\_\_
4. What is the Mounting Kit part number? \_\_\_\_\_
5. If mounting kits are made by LBP/Customer, please provide pictures of installation.
6. Is the Mounting kit installed per the instructions? Yes \_\_\_\_\_ No \_\_\_\_\_
7. What is the safe position of the valve? Fail closed \_\_\_\_\_ Fail open \_\_\_\_\_
8. For a DVC6010 SIS or DVC6030 SIS: During full travel of the actuator, does the DVC6000 feedback arm move below the "A" or above the "B" alignment positions? (It should not) Yes \_\_\_\_\_ No \_\_\_\_\_

## Section 8 Parts

|                                                             |     |
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## Parts Ordering

Whenever corresponding with your Emerson Process Management sales office 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.



### WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher instrument. Use of components not supplied by Emerson Process Management may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

8



### Note

All part numbers are for both aluminum and stainless steel constructions, unless otherwise indicated.

## Parts Kits

| Kit                                                                                                                                        | Description                                                                                                                | Part Number |
|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------|
| 1*                                                                                                                                         | Elastomer Spare Parts Kit (kit contains parts to service one digital valve controller)                                     |             |
|                                                                                                                                            | Standard                                                                                                                   | 19B5402X012 |
|                                                                                                                                            | Extreme Temperature option (fluorosilicone elastomers)                                                                     | 19B5402X022 |
| 2*                                                                                                                                         | Small Hardware Spare Parts Kit (kit contains parts to service one digital valve controller)                                | 19B5403X012 |
| 3                                                                                                                                          | Conversion Kit (DVC6010 SIS to DVC6020 SIS or DVC6015 to DVC6025)                                                          |             |
|                                                                                                                                            | Also see note below                                                                                                        | 19B5405X012 |
| <b>Note</b><br><b>When converting a DVC6010 SIS to a DVC6020 SIS for pipe-away construction, also order pipe-away bracket kit, item 6.</b> |                                                                                                                            |             |
| 4                                                                                                                                          | Conversion Kit (DVC6020 SIS to DVC6010 SIS or DVC6025 to DVC6015)                                                          | 14B5072X112 |
| 5                                                                                                                                          | Feedback Arm Kit (contains feedback arm assembly, qty. 5, to convert a 2052 size 2 and 3 DVC6020 to a 2051 size 1 DVC6020) | GE44419X012 |
| 6                                                                                                                                          | Alignment Pin Kit [kit contains 15 alignment pins (key 46)]                                                                | 14B5072X092 |
| 7                                                                                                                                          | Pipe-Away Bracket Kit (DVC6020 SIS) [kit contains mounting bracket (key 74) and O-ring (key 75)]                           |             |
|                                                                                                                                            | Standard                                                                                                                   | 19B5404X012 |
|                                                                                                                                            | Extreme Temperature option (fluorosilicone elastomers)                                                                     | 19B5404X022 |
| 8*                                                                                                                                         | Seal Screen Kit [kit contains 25 seal screens (key 231) and 25 O-rings (key 39)]                                           |             |
|                                                                                                                                            | Standard and Extreme Temperature option (fluorosilicone elastomers)                                                        | 14B5072X182 |
| 9                                                                                                                                          | Terminal Box Kit                                                                                                           |             |
|                                                                                                                                            | Aluminum                                                                                                                   |             |
|                                                                                                                                            | Standard                                                                                                                   | 19B5401X012 |
|                                                                                                                                            | Standard, Natural Gas approved                                                                                             | 19B5401X072 |
|                                                                                                                                            | Extreme Temperature option (fluorosilicone elastomers)                                                                     | 19B5401X022 |
|                                                                                                                                            | Extreme Temperature option (fluorosilicone elastomers) Natural Gas approved                                                | 19B5401X082 |
|                                                                                                                                            | Stainless Steel,                                                                                                           |             |
|                                                                                                                                            | Natural Gas approved                                                                                                       | 19B5401X092 |
|                                                                                                                                            | Extreme Temperature option (fluorosilicone elastomers) Natural Gas approved                                                | 19B5401X112 |
| 10*                                                                                                                                        | I/P Converter Kit                                                                                                          |             |
|                                                                                                                                            | Standard                                                                                                                   | 38B6041X152 |
|                                                                                                                                            | Extreme Temperature option (fluorosilicone elastomers)                                                                     | 38B6041X132 |

\*Recommended spare parts

| Kit                      | Description                                                                                                                                                                                                                                                                                                                      | Part Number | Kit                                                                                                                                                                                                                                                | Description                                                                             | Part Number |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------|
| 11                       | Adjustment Arm Kit<br>(includes washer, nut and adjustment arm)                                                                                                                                                                                                                                                                  | 14B5072X132 | 21                                                                                                                                                                                                                                                 | Feedback Unit Termination Strip Kit                                                     | GE00419X012 |
| 12*                      | PTFE Sleeve Kit<br>[For pot bushing assembly (kit includes 10 sleeves and Lubricant)]                                                                                                                                                                                                                                            |             | 22                                                                                                                                                                                                                                                 | Pipestand/Wall Mounting Kit                                                             | GE00420X012 |
|                          | DVC6010 SIS and DVC6020 SIS                                                                                                                                                                                                                                                                                                      | GE08726X012 | <b>Severe Service Linkage Kits</b><br><br><b>Note</b><br><br><b>All metallic parts (except coil springs) in the corrosion kit and parts that experience rubbing or wear in the wear kit are coated with a proprietary tungsten carbon coating.</b> |                                                                                         |             |
|                          | DVC6030 SIS                                                                                                                                                                                                                                                                                                                      | GE08727X012 |                                                                                                                                                                                                                                                    |                                                                                         |             |
| 13*                      | Spare Module Base Assembly Kit,<br>[kit contains module base (key 2); drive screws, qty. 2, (key 11); shield/label (key 19); hex socket cap screw, qty. 3, (key 38); self tapping screw, qty. 2 (key 49); pipe plug, qty. 3 (key 61); retaining ring, qty. 3 (key 154); screen (key 236); and flame arrestors, qty. 3 (key 243)] |             |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | Aluminum                                                                                                                                                                                                                                                                                                                         | GE18654X012 |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | Stainless Steel                                                                                                                                                                                                                                                                                                                  | GE18654X022 | 23                                                                                                                                                                                                                                                 | Corrosion Kit                                                                           |             |
|                          |                                                                                                                                                                                                                                                                                                                                  |             |                                                                                                                                                                                                                                                    | DVC6010 SIS 0.25–2 Inch travel                                                          | GE22667X012 |
|                          |                                                                                                                                                                                                                                                                                                                                  |             |                                                                                                                                                                                                                                                    | DVC6010 SIS 2–4 Inch travel                                                             | GE22668X012 |
|                          |                                                                                                                                                                                                                                                                                                                                  |             |                                                                                                                                                                                                                                                    | DVC6020 SIS short arm                                                                   | GE22670X012 |
|                          |                                                                                                                                                                                                                                                                                                                                  |             |                                                                                                                                                                                                                                                    | DVC6020 long arm                                                                        | GE22671X012 |
|                          |                                                                                                                                                                                                                                                                                                                                  |             |                                                                                                                                                                                                                                                    | DVC6030 SIS rotary                                                                      | GE22672X012 |
|                          |                                                                                                                                                                                                                                                                                                                                  |             |                                                                                                                                                                                                                                                    | DVC6030 SIS linear                                                                      | GE22673X012 |
| 14*                      | Spare Housing Assembly Kit,<br>[kit contains housing (key 1); drive screw, qty. 2 (key 11); shield (key 20); and screen (key 271)]                                                                                                                                                                                               |             | 24                                                                                                                                                                                                                                                 | Wear Kit                                                                                |             |
|                          | Aluminum                                                                                                                                                                                                                                                                                                                         |             |                                                                                                                                                                                                                                                    | DVC6010 SIS 0.25–2 Inch travel                                                          | GE22674X012 |
|                          | DVC6010 SIS/DVC6020 SIS                                                                                                                                                                                                                                                                                                          | GE18652X012 |                                                                                                                                                                                                                                                    | DVC6010 SIS 2–4 Inch travel                                                             | GE22675X012 |
|                          | DVC6030 SIS                                                                                                                                                                                                                                                                                                                      | GE18653X012 |                                                                                                                                                                                                                                                    | DVC6020 SIS short arm                                                                   | GE22676X012 |
|                          | Stainless Steel                                                                                                                                                                                                                                                                                                                  |             |                                                                                                                                                                                                                                                    | DVC6020 SIS long arm                                                                    | GE22677X012 |
|                          | DVC6010 SIS/DVC6020 SIS                                                                                                                                                                                                                                                                                                          | GE18652X022 |                                                                                                                                                                                                                                                    | DVC6030 SIS rotary                                                                      | GE22678X012 |
|                          | DVC6030 SIS                                                                                                                                                                                                                                                                                                                      | GE18653X022 |                                                                                                                                                                                                                                                    | DVC6030 SIS linear                                                                      | GE22679X012 |
| 15                       | DVC6020 SIS Cam Adjustment Tool                                                                                                                                                                                                                                                                                                  | GE12742X012 | 25                                                                                                                                                                                                                                                 | Kit, Spring                                                                             |             |
| 16*                      | Spare Shroud Kit                                                                                                                                                                                                                                                                                                                 | GE29183X012 |                                                                                                                                                                                                                                                    | DVC6010 SIS 0.25–2 inch travel [kit contains 10 bias springs w/tungsten carbon coating] | GE37413X012 |
| 17                       | Travel Sensor with Feedback Arm Assembly and PTFE Sleeve Kit                                                                                                                                                                                                                                                                     |             |                                                                                                                                                                                                                                                    | DVC6010 SIS 2–4 inch travel, [kit contains 10 bias springs w/tungsten carbon coating]   | GE37414X012 |
|                          | DVC6010 SIS                                                                                                                                                                                                                                                                                                                      | GG09947X012 | <b>Safety Instrumented System Kits</b>                                                                                                                                                                                                             |                                                                                         |             |
|                          | DVC6015                                                                                                                                                                                                                                                                                                                          | GG09948X012 |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | DVC6020 SIS                                                                                                                                                                                                                                                                                                                      | GG09949X012 |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | DVC6025                                                                                                                                                                                                                                                                                                                          | GG09950X012 |                                                                                                                                                                                                                                                    |                                                                                         |             |
| <b>Remote Mount Kits</b> |                                                                                                                                                                                                                                                                                                                                  |             | 26*                                                                                                                                                                                                                                                | SIS Preventative Maintenance Kits                                                       |             |
|                          |                                                                                                                                                                                                                                                                                                                                  |             |                                                                                                                                                                                                                                                    | DVC6010 SIS and DVC6020 SIS                                                             | 19B4032X012 |
|                          |                                                                                                                                                                                                                                                                                                                                  |             |                                                                                                                                                                                                                                                    | DVC6030 SIS                                                                             | 19B4031X012 |
| 18                       | Remote Terminal Box Kit                                                                                                                                                                                                                                                                                                          |             |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | Standard                                                                                                                                                                                                                                                                                                                         | GE00418X012 |                                                                                                                                                                                                                                                    |                                                                                         |             |
| 19                       | Feedback Unit                                                                                                                                                                                                                                                                                                                    |             |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | DVC6015                                                                                                                                                                                                                                                                                                                          | 49B7986X012 |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | DVC6025 long arm                                                                                                                                                                                                                                                                                                                 | 49B7987X012 |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | DVC6025 Short Arm                                                                                                                                                                                                                                                                                                                | 49B7987X022 |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | DVC6035                                                                                                                                                                                                                                                                                                                          | 49B7988X012 |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | DVC6035 (for GX actuator)                                                                                                                                                                                                                                                                                                        | 49B7988X022 |                                                                                                                                                                                                                                                    |                                                                                         |             |
| 20*                      | Remote Mount Retrofit Kit                                                                                                                                                                                                                                                                                                        |             |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | <b>Note</b>                                                                                                                                                                                                                                                                                                                      |             |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | <b>This kit converts an existing DVC6000 SIS to the remote mounted version. Note that the DVC6030 SIS cannot be converted to the DVC6035.</b>                                                                                                                                                                                    |             |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | DVC6010 SIS to DVC6005 SIS/DVC6015                                                                                                                                                                                                                                                                                               | DVC6015RMTR |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | DVC6010 SIS to DVC6005 SIS/DVC6035                                                                                                                                                                                                                                                                                               | DVC6035RMTR |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | DVC6020 SIS to DVC6005 SIS/DVC6025 (short arm)                                                                                                                                                                                                                                                                                   | DVC6025RMSA |                                                                                                                                                                                                                                                    |                                                                                         |             |
|                          | DVC6020 SIS to DVC6005 SIS/DVC6025 (long arm)                                                                                                                                                                                                                                                                                    | DVC6025RMLA |                                                                                                                                                                                                                                                    |                                                                                         |             |

\*Recommended spare parts

# DVC6000 SIS

## Parts List

Parts which do not show part numbers are not orderable as individual parts. In most cases, they are available in one of the parts kits listed under Parts Kits.



## 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 |
|-----|-------------|-------------|
|-----|-------------|-------------|

## Housing

**DVC6010 SIS, DVC6020 SIS, DVC6030 SIS, DVC6005 SIS (see figures 8-1, 8-2, 8-3, and 8-4)**

|     |                                                               |  |
|-----|---------------------------------------------------------------|--|
| 1   | Housing <sup>(14)</sup>                                       |  |
| 11  | Drive Screw (2 req'd) <sup>(14)</sup>                         |  |
| 20  | Shield <sup>(14)</sup>                                        |  |
| 52  | Vent, plastic DVC6010 SIS and DVC6030 SIS only <sup>(2)</sup> |  |
| 74  | Mounting Bracket                                              |  |
|     | DVC6020 SIS Std <sup>(3)</sup> or pipe-away <sup>(7)</sup>    |  |
| 75* | O-Ring, DVC6020 SIS only <sup>(7)</sup>                       |  |
| 245 | Pipe Plug, pl stl <sup>(7)</sup> , DVC6020 SIS Vent-away only |  |
| 248 | Screw, hex head (4 req'd), (DVC6005 SIS only) <sup>(22)</sup> |  |
| 249 | Screw, hex head (4 req'd), (DVC6005 SIS only) <sup>(22)</sup> |  |
| 250 | Spacer (4 req'd), (DVC6005 SIS only) <sup>(22)</sup>          |  |
| 267 | Standoff (2 req'd), (DVC6005 SIS only) <sup>(22)</sup>        |  |
| 271 | Screen <sup>(14)</sup>                                        |  |

## Common Parts

**DVC6010 SIS, DVC6020 SIS, DVC6030 SIS, DVC6005 SIS (see figures 8-1, 8-2, 8-3, and 8-4)**

|     |                                                                      |             |
|-----|----------------------------------------------------------------------|-------------|
| 16* | O-ring (3 req'd) <sup>(1,26)</sup>                                   |             |
| 23  | Cap Screw, hex socket, SST (4 req'd) <sup>(2,16)</sup>               |             |
| 29  | Warning label, for use only with LCIE hazardous area classifications |             |
| 33  | Mach Screw, pan hd, SST (3 req'd) <sup>(2)</sup>                     |             |
| 38  | Cap Screw, hex socket, SST (3 req'd) <sup>(2,13)</sup>               |             |
| 43* | Cover Assembly (includes cover screws)                               |             |
|     | Standard                                                             | 38B9580X022 |
|     | Extreme temperature option (fluorosilicone elastomers)               |             |
|     | Aluminum Construction                                                | 38B9580X032 |
|     | Stainless Steel Construction                                         | 38B9580X042 |
| 48  | Nameplate                                                            |             |
| 49  | Screw, self tapping (2 req'd) <sup>(13)</sup>                        |             |
| 63  | Lithium grease (not furnished with the instrument)                   |             |
| 64  | Anti-seize compound (not furnished with the instrument)              |             |
| 65  | Lubricant, silicone sealant (not furnished with the instrument)      |             |
| 154 | Retaining Ring (3 req'd) <sup>(2)</sup>                              |             |
| 237 | Module Base Seal <sup>(1,26)</sup>                                   |             |

| Key | Description | Part Number |
|-----|-------------|-------------|
|-----|-------------|-------------|

## Module Base

**DVC6010 SIS, DVC6020 SIS, DVC6030 SIS, DVC6005 SIS (see figures 8-1, 8-2, 8-3, 8-4 and 8-5)**

|     |                                                             |  |
|-----|-------------------------------------------------------------|--|
| 2   | Module Base <sup>(13)</sup>                                 |  |
| 11  | Drive Screw (2 req'd) <sup>(13)</sup>                       |  |
| 12  | O-ring <sup>(1,26)</sup>                                    |  |
| 19  | Label, Shield Assembly <sup>(13)</sup>                      |  |
| 61  | Pipe Plug, hex socket (3 req'd) <sup>(13)</sup>             |  |
| 236 | Screen, for single-acting direct units only <sup>(13)</sup> |  |
| 243 | Flame Arrestor Assy (3 req'd) <sup>(13)</sup>               |  |

## I/P Converter Assembly

**DVC6010 SIS, DVC6020 SIS, DVC6030 SIS, DVC6005 SIS (see figures 8-1, 8-2, 8-3, and 8-4)**

|      |                                                               |  |
|------|---------------------------------------------------------------|--|
| 39*  | O-ring (1,8,10,26)                                            |  |
| 41   | I/P Converter <sup>(10,26)</sup>                              |  |
| 169  | Shroud <sup>(10,16,26)</sup>                                  |  |
| 210* | Boot, nitrile (2 req'd) <sup>(1,10,26)</sup> (see figure 7-3) |  |
| 231* | Seal Screen <sup>(1,8,10,26)</sup>                            |  |

## Relay

**DVC6010 SIS, DVC6020 SIS, DVC6030 SIS, DVC6005 SIS (see figures 8-1, 8-2, 8-3, and 8-4)**

|     |                                                                                |  |
|-----|--------------------------------------------------------------------------------|--|
| 24* | Relay Assembly, (includes shroud, relay seal, mounting screws) <sup>(26)</sup> |  |
|-----|--------------------------------------------------------------------------------|--|

### Note

Relay B and C are not TÜV approved.

|                                |             |
|--------------------------------|-------------|
| Low Bleed, nitrile             |             |
| Relay A, double-acting         | 38B5786X072 |
| Relay B, single-acting reverse | 38B5786X112 |
| Relay C, single-acting direct  | 38B5786X152 |

Extreme Temperature option (fluorosilicone elastomers)

|                                |             |
|--------------------------------|-------------|
| Low Bleed                      |             |
| Relay A, double-acting         | 38B5786X082 |
| Relay B, single-acting reverse | 38B5786X122 |
| Relay C, single-acting direct  | 38B5786X162 |

\*Recommended spare parts

1. Available in the Elastomer Spare Parts Kit
2. Available in the Small Hardware Spare Parts Kit
3. Available in the DVC6010 SIS to DVC6020 SIS Conversion Kit
7. Available in the Pipe-Away Bracket Kit
8. Available in the Seal Screen Kit
10. Available in the I/P Converter Kit
13. Available in the Spare Module Base Assembly Kit
14. Available in the Spare Housing Assembly Kit
16. Available in the Spare Shroud Kit
22. Available in the Pipestand/Wall Mounting Kit
26. Available in the SIS Preventative Maintenance Kit



# DVC6000 SIS

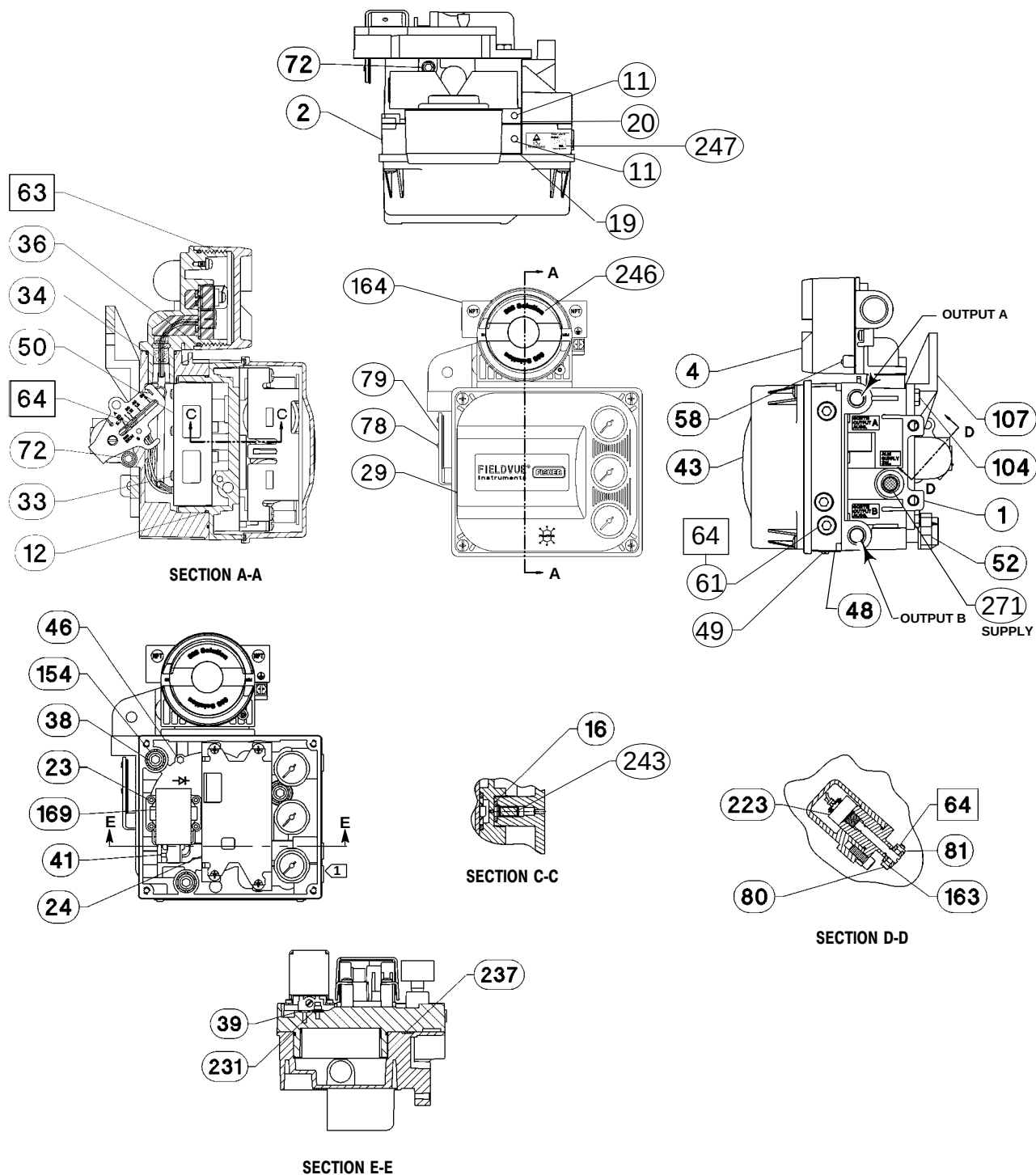
| Key                                                                  | Description                                         | Part Number | Key                     | Description                                                      | Part Number |
|----------------------------------------------------------------------|-----------------------------------------------------|-------------|-------------------------|------------------------------------------------------------------|-------------|
| <b>DVC6020 SIS and DVC6025 (see figure 8-2 and 8-7)</b>              |                                                     |             |                         |                                                                  |             |
| 74                                                                   | Mounting Bracket                                    |             | 58                      | Set Screw, hex socket <sup>(19)</sup>                            |             |
| 82                                                                   | Bias Spring, SST <sup>(3)</sup>                     |             | 62                      | Pipe Plug, hex hd, SST <sup>(19)</sup>                           |             |
| 83                                                                   | Bearing Flange, PTFE-based (2 req'd) <sup>(3)</sup> |             | 131                     | Retainer Wire                                                    |             |
| 84                                                                   | Feedback Arm Assy, SST <sup>(3)</sup>               |             | 251                     | Feedback housing <sup>(19)</sup>                                 |             |
| 85                                                                   | E-ring, pl stl (2 req'd) <sup>(3)</sup>             |             | 252                     | Assembly Plate Shield (DVC6015 only) <sup>(19)</sup>             |             |
| 86                                                                   | Plain Washer, pl stl (2 req'd) <sup>(3)</sup>       |             | 253                     | Terminal bracket <sup>(19,21)</sup>                              |             |
| 87                                                                   | Follower Post, SST <sup>(3)</sup>                   |             | 254                     | Terminal Strip <sup>(19,21)</sup>                                |             |
| 88                                                                   | Roller, SST/PTFE <sup>(3)</sup>                     |             | 255                     | Terminal Cap <sup>(19)</sup>                                     |             |
| 89                                                                   | Spring Lock Washer, pl stl <sup>(3)</sup>           |             | 256                     | O-ring, fluorosilicone <sup>(19)</sup>                           |             |
| 90                                                                   | Hex Nut, pl stl <sup>(3)</sup>                      |             | 257                     | Machine Screw, pan head (2 req'd) (DVC6015 only) <sup>(19)</sup> |             |
| 91                                                                   | Arm Assy, SST                                       |             | 258                     | Label, cover <sup>(19)</sup>                                     |             |
| 92                                                                   | Cap Screw, hex socket (4 req'd) <sup>(3)</sup>      |             | 260                     | Hex Nut, SST (2 req'd)                                           |             |
| 93                                                                   | Torsion Spring, Feedback Arm <sup>(3)</sup>         |             | 261                     | Nameplate                                                        |             |
|                                                                      |                                                     |             | 265                     | Plug (DVC6015 and DVC6035 only) <sup>(19)</sup>                  |             |
| <b>DVC6015, DVC6025, and DVC6035 (see figures 8-6, 8-7, and 8-8)</b> |                                                     |             |                         |                                                                  |             |
| 23                                                                   | Cap Screw, hex socket (2 req'd) <sup>(19,21)</sup>  |             | <b>Line Conditioner</b> |                                                                  |             |
| 44                                                                   | Wire Retainer, pl stl (9 req'd) <sup>(19,21)</sup>  |             | LC340 Line conditioner  |                                                                  |             |
| 49                                                                   | Screw, self tapping (2 req'd)                       |             |                         |                                                                  | 39B5416X012 |

## Line Conditioner

LC340 Line conditioner

39B5416X012

\*Recommended spare parts  
3. Available in the DVC6010 SIS to DVC6020 SIS Conversion Kit  
19. Available in Feedback Unit Kit  
21. Available in Feedback Unit Termination Strip Kit



□ APPLY LUB, SEALANT

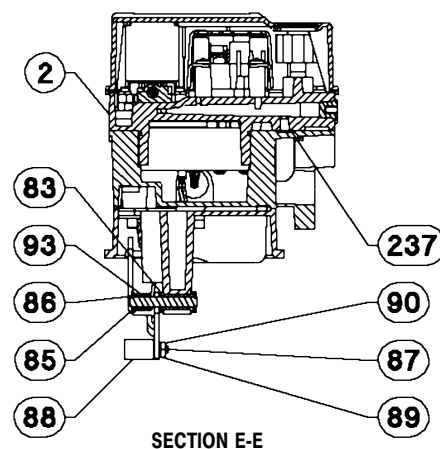
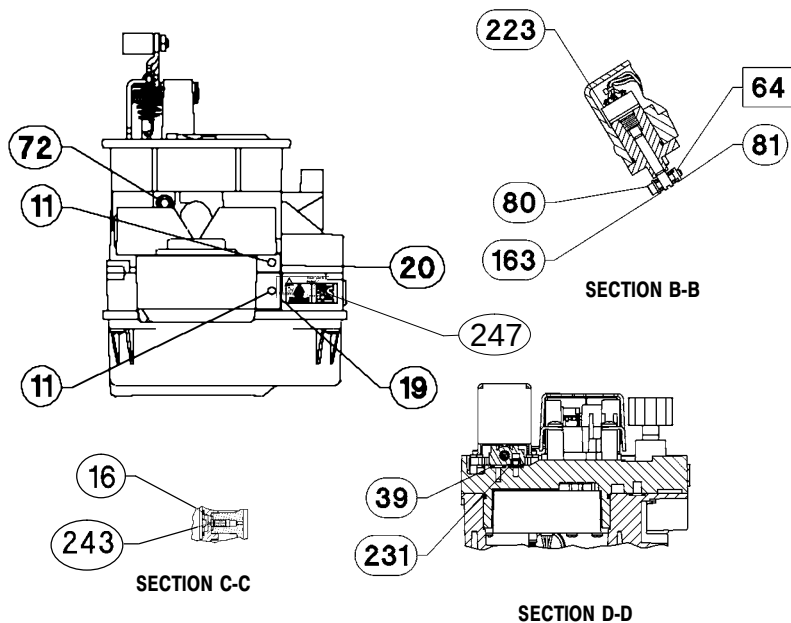
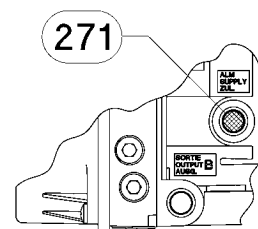
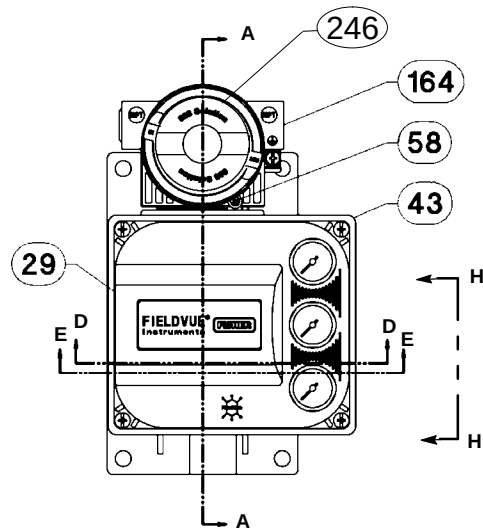
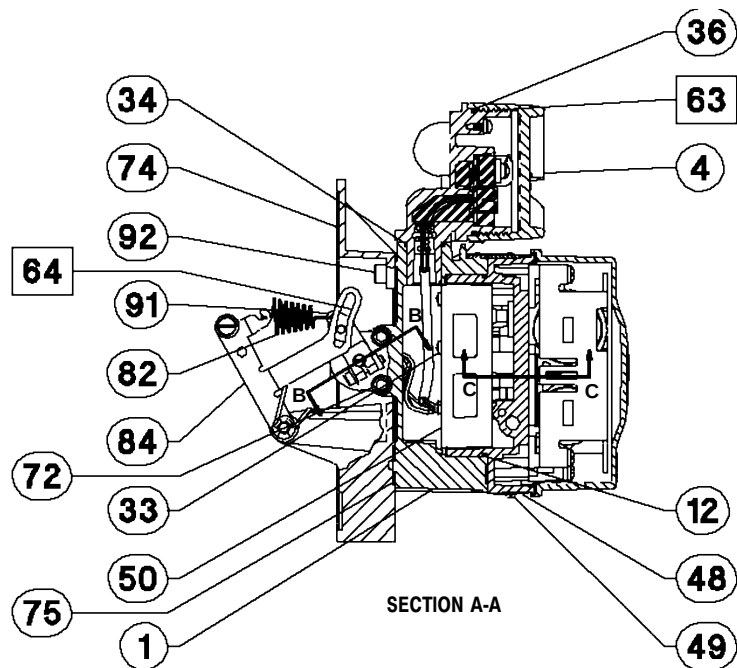
NOTES:

1 SEE FIGURE 8-5 FOR GAUGE CONFIGURATIONS

2. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

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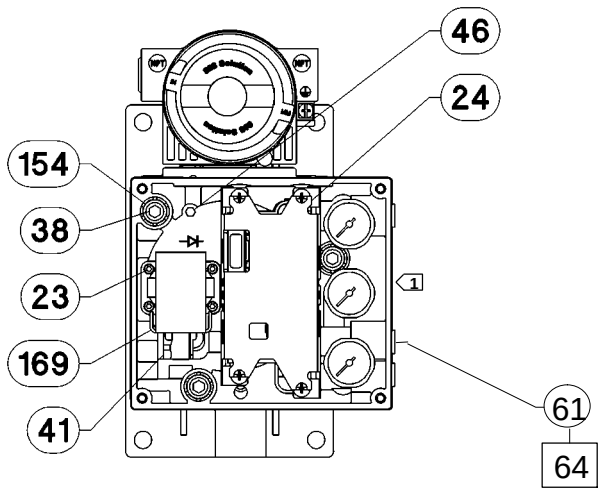
Figure 8-1. FIELDVUE DVC6010 SIS Digital Valve Controller Assembly



□ APPLY LUB, SEALANT  
1. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

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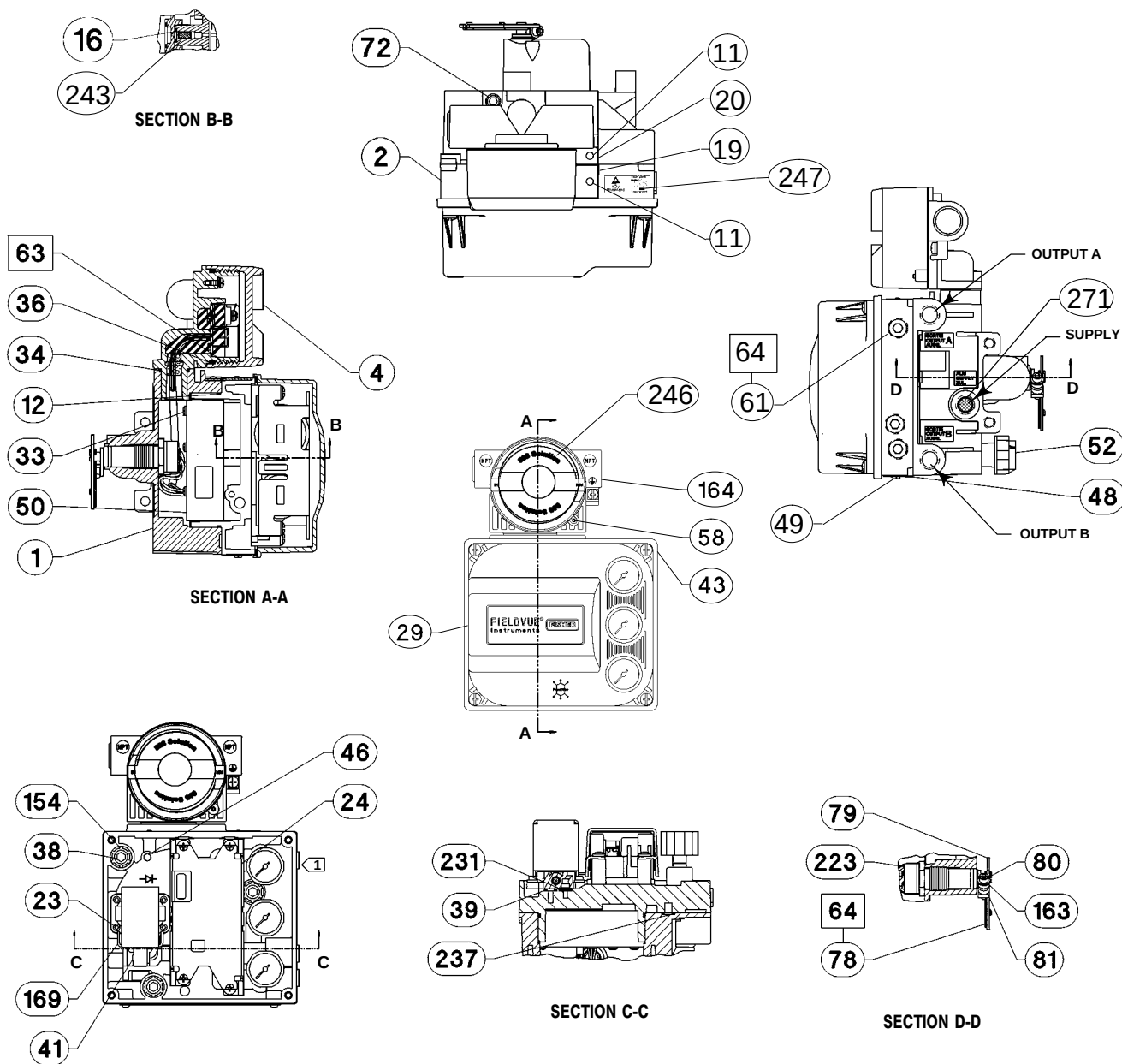
Figure 8-2. FIELDVUE DVC6020 SIS Digital Valve Controller Assembly



□ APPLY LUB, SEALANT  
NOTES:  
1 SEE FIGURE 8-5 FOR GAUGE CONFIGURATIONS  
2. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

48B9596-K SHT 3 / DOC

Figure 8-2. FIELDVUE DVC6020 SIS Digital Valve Controller Assembly (continued)



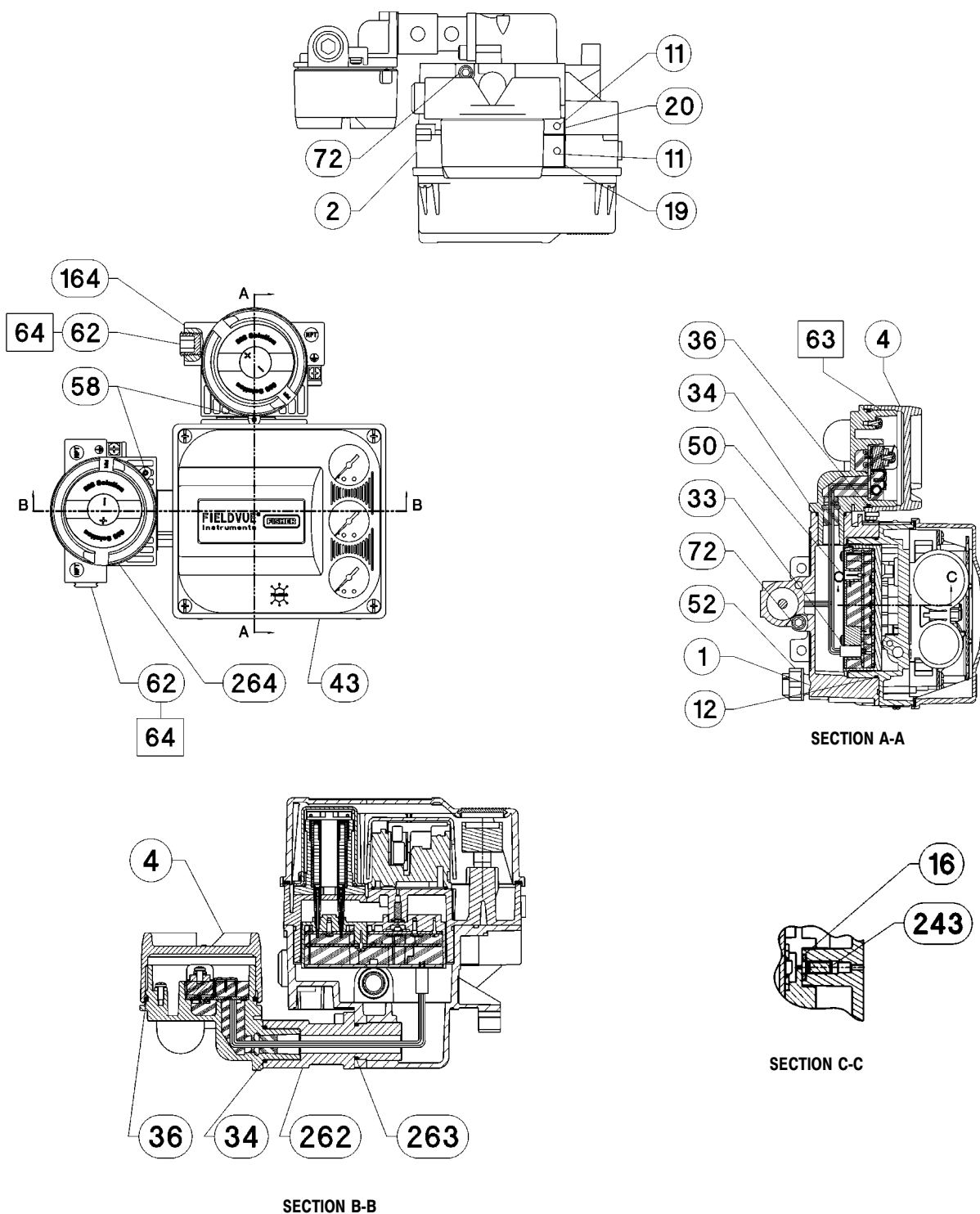
□ APPLY LUB, SEALANT, THREAD LOCK  
NOTES:

1. SEE FIGURE 8-5 FOR GAUGE CONFIGURATIONS

2. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

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Figure 8-3. FIELDVUE DVC6030 SIS Digital Valve Controller Assembly



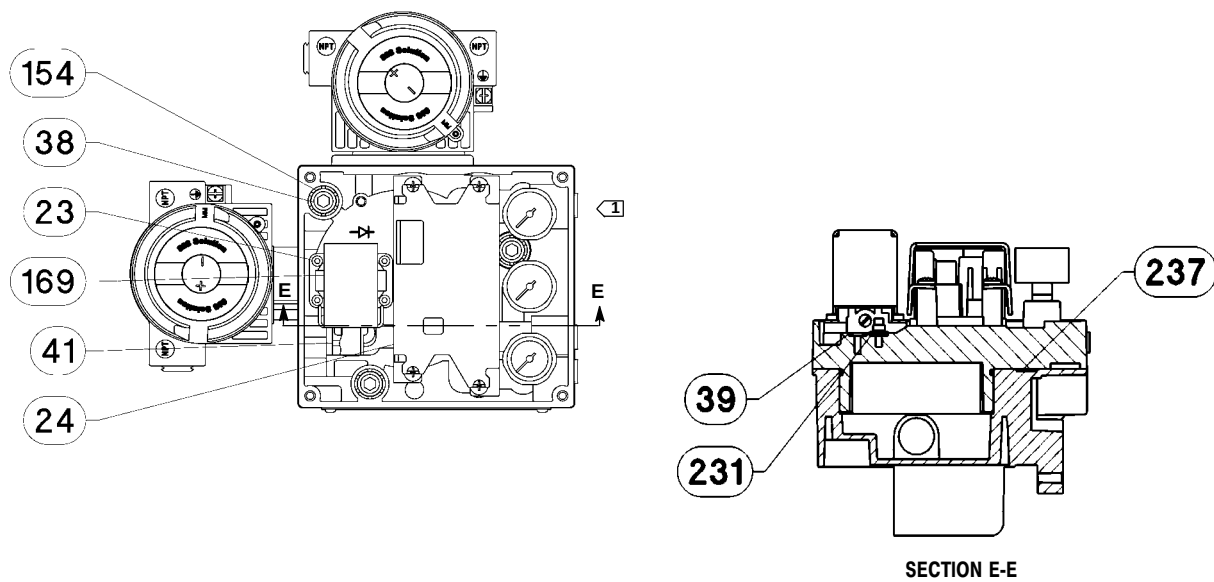
□ APPLY LUB, SEALANT

NOTES:

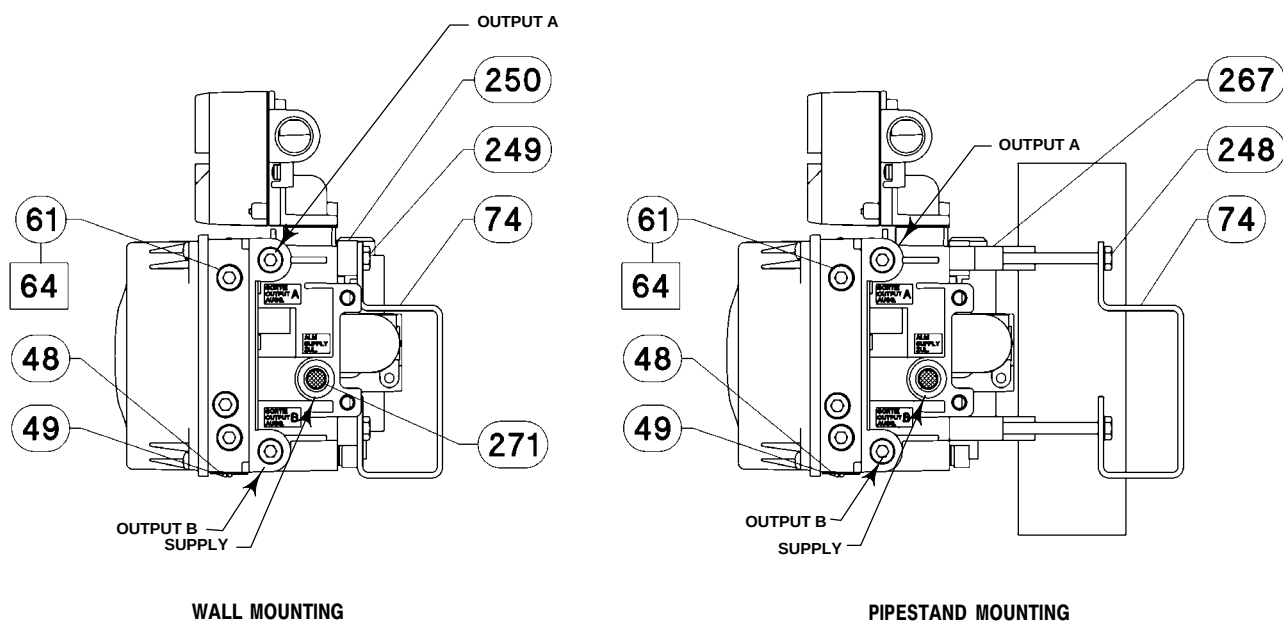
1. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

49B3261-C SHT 1 & 2

Figure 8-4. FIELDVUE DVC6005 SIS Base Unit



8



□ APPLY LUB, SEALANT

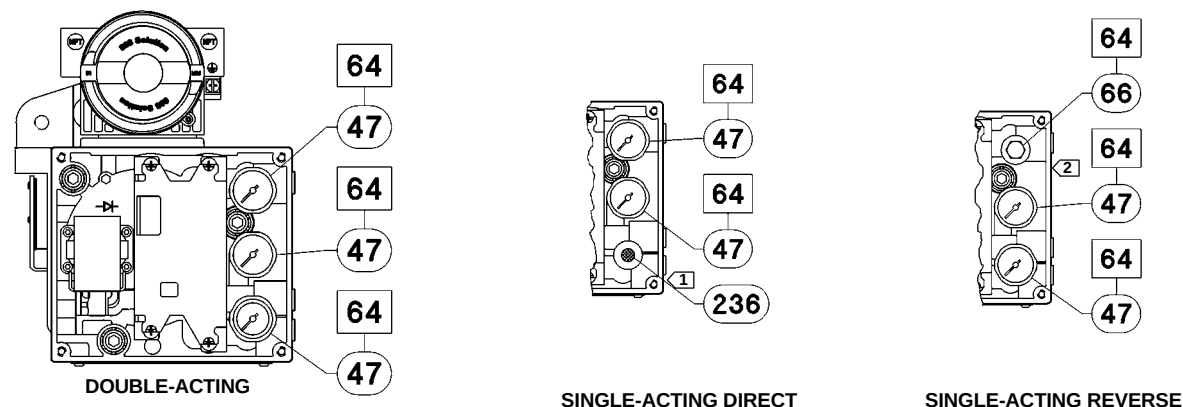
NOTES:

1. SEE FIGURE 8-5 FOR GAUGE CONFIGURATIONS

2. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

49B3261-C SHT 2 & 3 / DOC

Figure 8-4. FIELDVUE DVC6005 SIS Base Unit (continued)



□ APPLY LUB, SEALANT

NOTE:

DRAWING IS REPRESENTATIVE OF A DVC6000 SIS DIGITAL VALVE CONTROLLER.

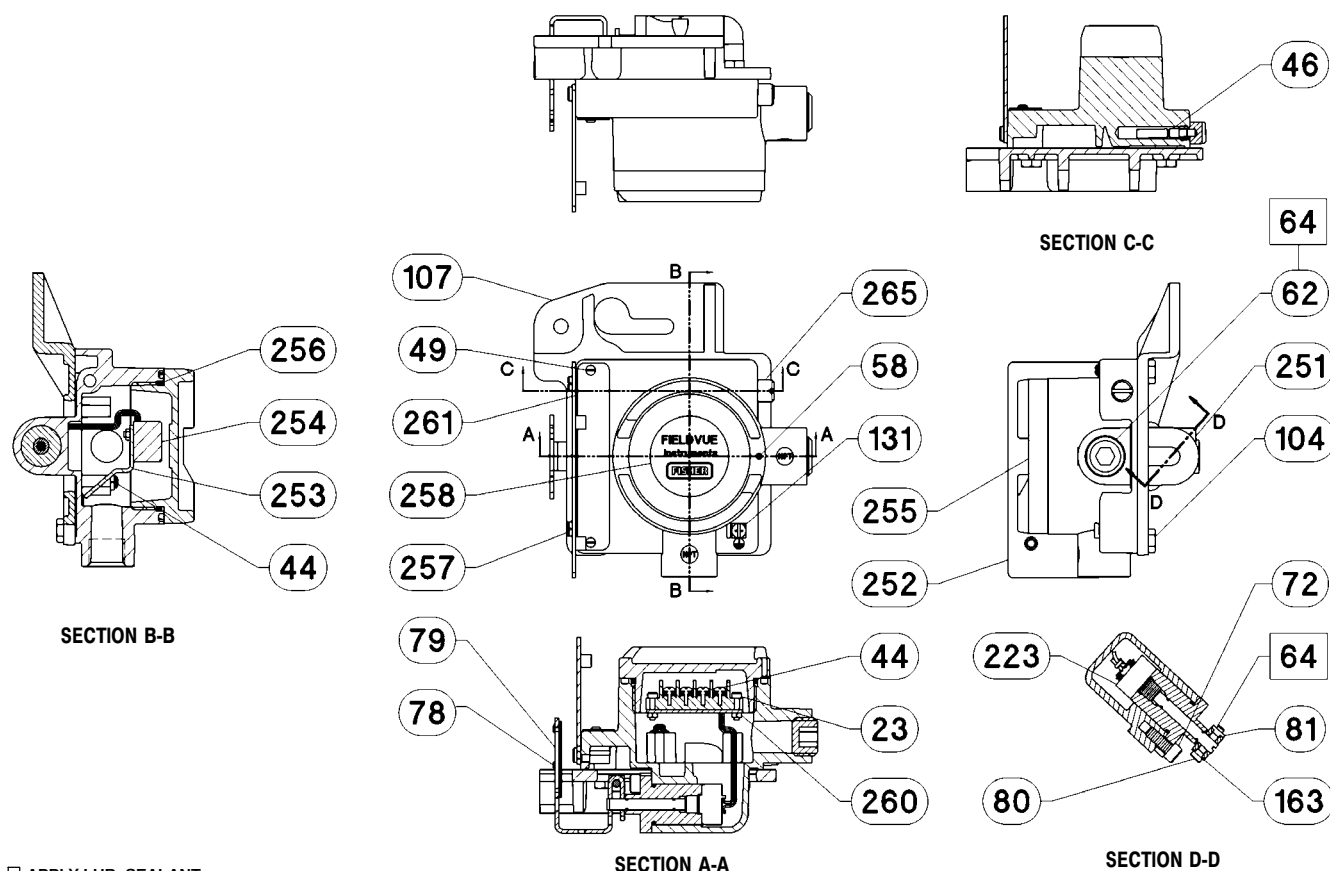
GAUGE CONFIGURATION IS REPRESENTATIVE OF BOTH DVC6000 SIS AND DVC6005 SIS.

1 FOR SINGLE-ACTING DIRECT, OUTPUT B IS PLUGGED.

2 FOR SINGLE-ACTING REVERSE, OUTPUT A IS PLUGGED.

48B7710-K SHT 2 / DOC

Figure 8-5. Typical FIELDVUE DVC6000 SIS / DVC6005 SIS Base Unit Gauge Configuration



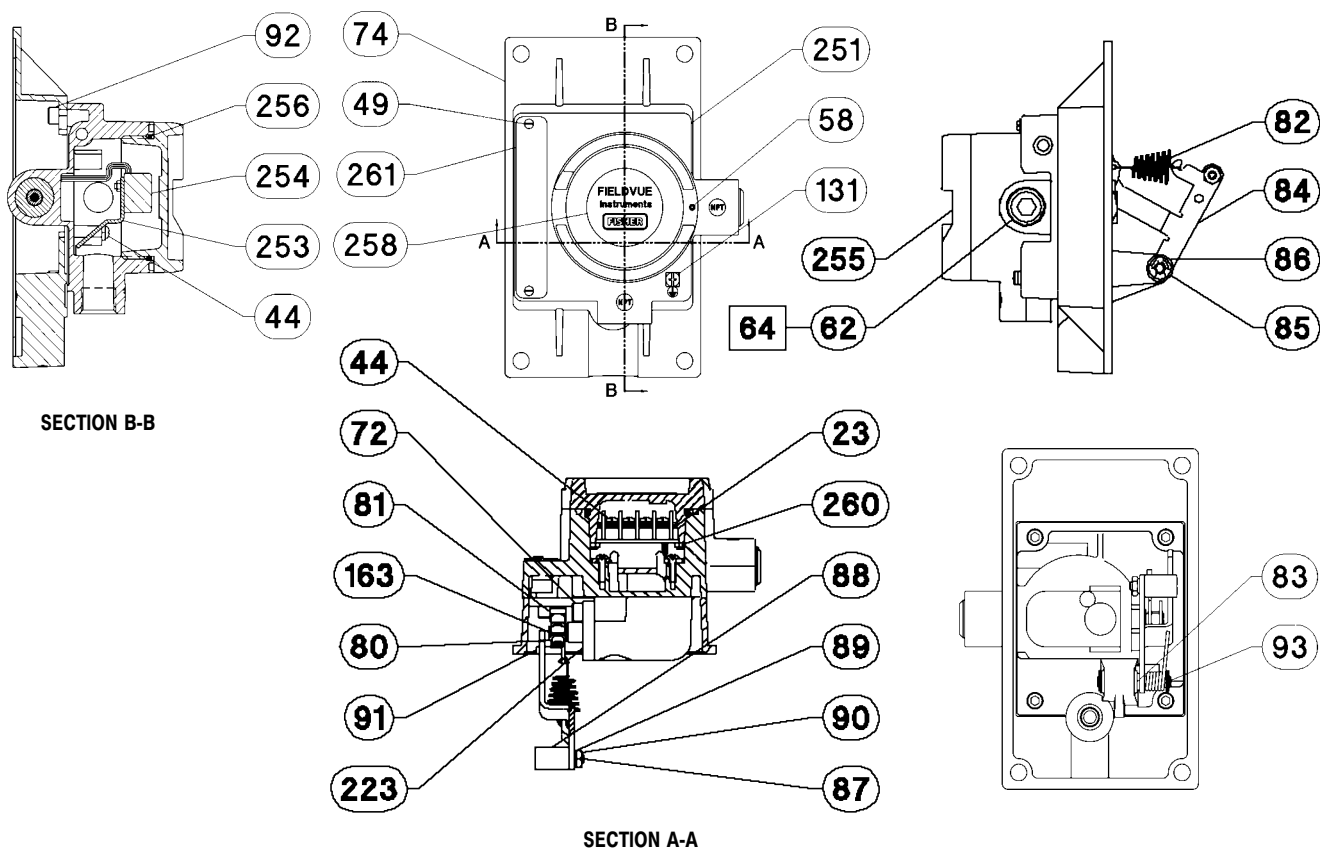
□ APPLY LUB, SEALANT

NOTE:

1. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

49B7986-A

Figure 8-6. FIELDVUE DVC6015 Feedback Unit Assembly



□ APPLY LUB, SEALANT, THREAD LOCK

NOTE:

1. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

49B7987-A/IL

Figure 8-7. FIELDVUE DVC6025 Feedback Unit Assembly

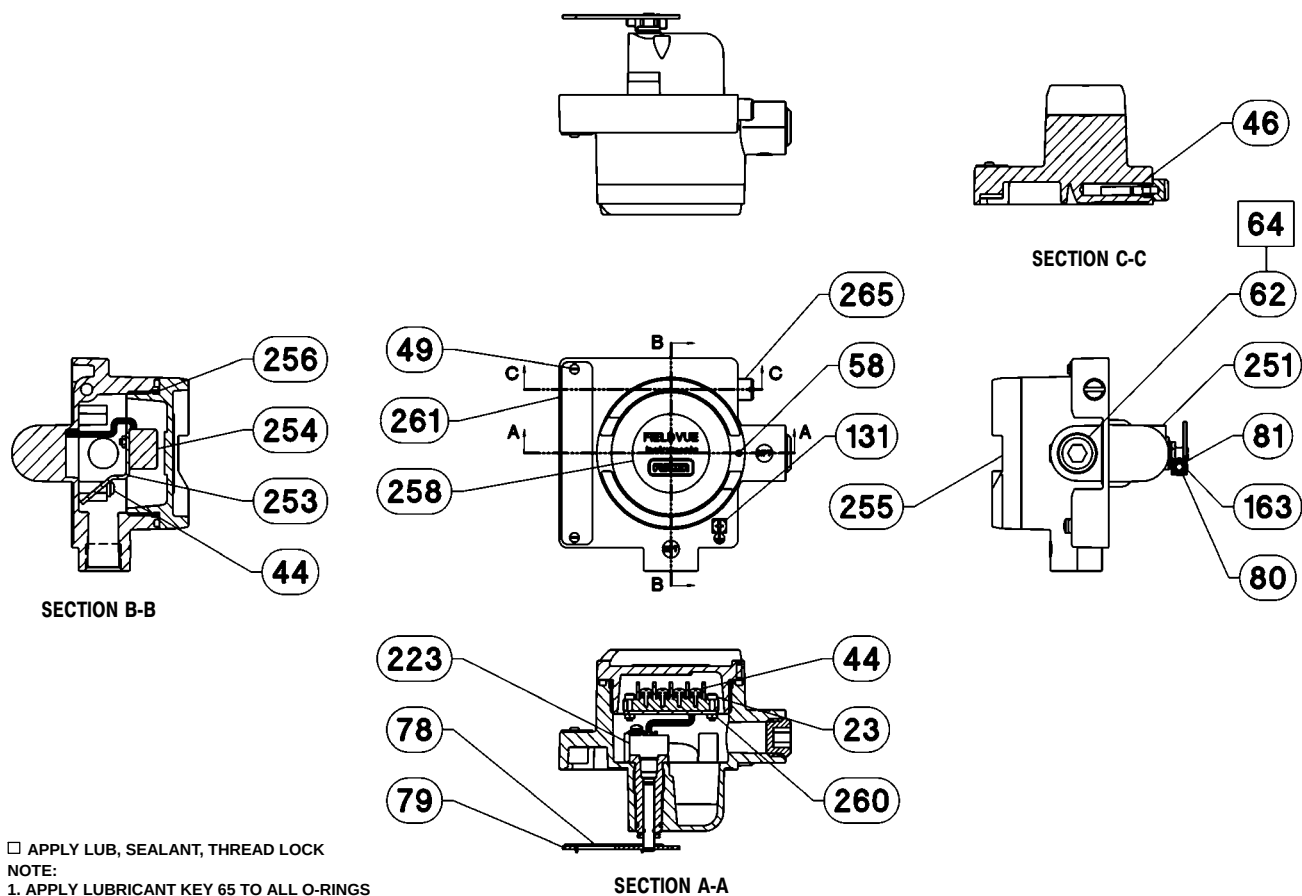


Figure 8-8. FIELDVUE DVC6035 Feedback Unit Assembly



## Appendix A Principle of Operation

HART Communication ..... A-2

Digital Valve Controller Operation ..... A-2

**A**

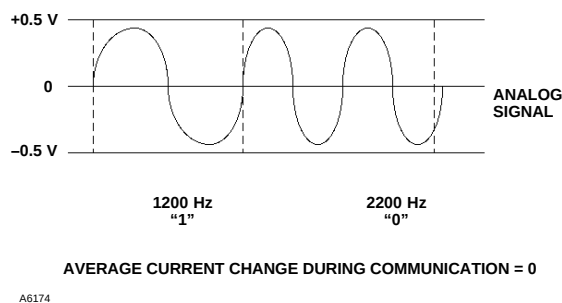


Figure A-1. HART Frequency Shift Keying Technique

## HART Communication

The HART (Highway Addressable Remote Transducer) protocol gives field devices the capability of communicating instrument and process data digitally. This digital communication occurs over the same two-wire loop that provides the 4-20 mA process control signal, without disrupting the process signal. In this way, the analog process signal, with its faster update rate, can be used for control. At the same time, the HART protocol allows access to digital diagnostic, maintenance, and additional process data. The protocol provides total system integration via a host device.

The HART protocol uses frequency shift keying (FSK). Two individual frequencies of 1200 and 2200 Hz are superimposed over the 4-20 mA current signal. These frequencies represent the digits 1 and 0 (see figure A-1). By superimposing a frequency signal over the 4-20 mA current, digital communication is attained. The average value of the HART signal is zero, therefore no DC value is added to the 4-20 mA signal. Thus, true simultaneous communication is achieved without interrupting the process signal.

The HART protocol allows the capability of multi-dropping, i.e., networking several devices to a single communications line. This process is well suited for monitoring remote applications such as pipelines, custody transfer sites, and tank farms. See table 7-2 for instructions on changing the printed wiring board DIP switch configuration to multi-drop.

## Digital Valve Controller Operation

The DVC6000 SIS digital valve controller housing contains the travel sensor, terminal box, pneumatic input and output connections and a module base that may be easily replaced in the field without disconnecting field wiring or tubing. This master module contains the following submodules: I/P

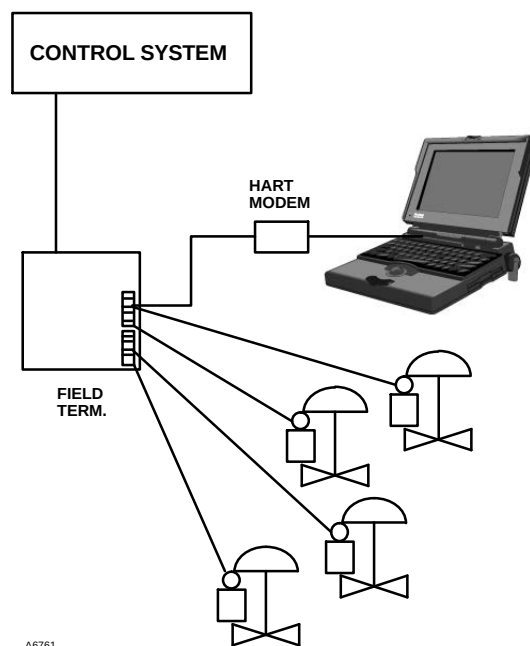


Figure A-2. Typical FIELDVUE Instrument to Personal Computer Connections for ValveLink Software

converter, printed wiring board (pwb) assembly, and pneumatic relay. The module base can be rebuilt by replacing the submodules. See figures A-3 and A-4.

## Process Applications

DVC6000 SIS digital valve controllers are loop-powered instruments that provide a control valve position proportional to an input signal from the control room. The following describes a double-acting DVC6010 SIS digital valve controller mounted on a piston actuator.

The input signal is routed into the terminal box through a single twisted 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 signal increases, the drive signal to the I/P converter increases, increasing the I/P output pressure. The I/P output pressure is routed to the pneumatic relay submodule. The relay is also connected to supply pressure and amplifies the small pneumatic signal from the I/P converter. The relay accepts the amplified pneumatic signal and provides two output pressures. With increasing input (4 to 20 mA signal), the output A pressure always increases and the output B pressure decreases. The output A pressure is used for double-acting and single-acting direct applications. The output B pressure is used for

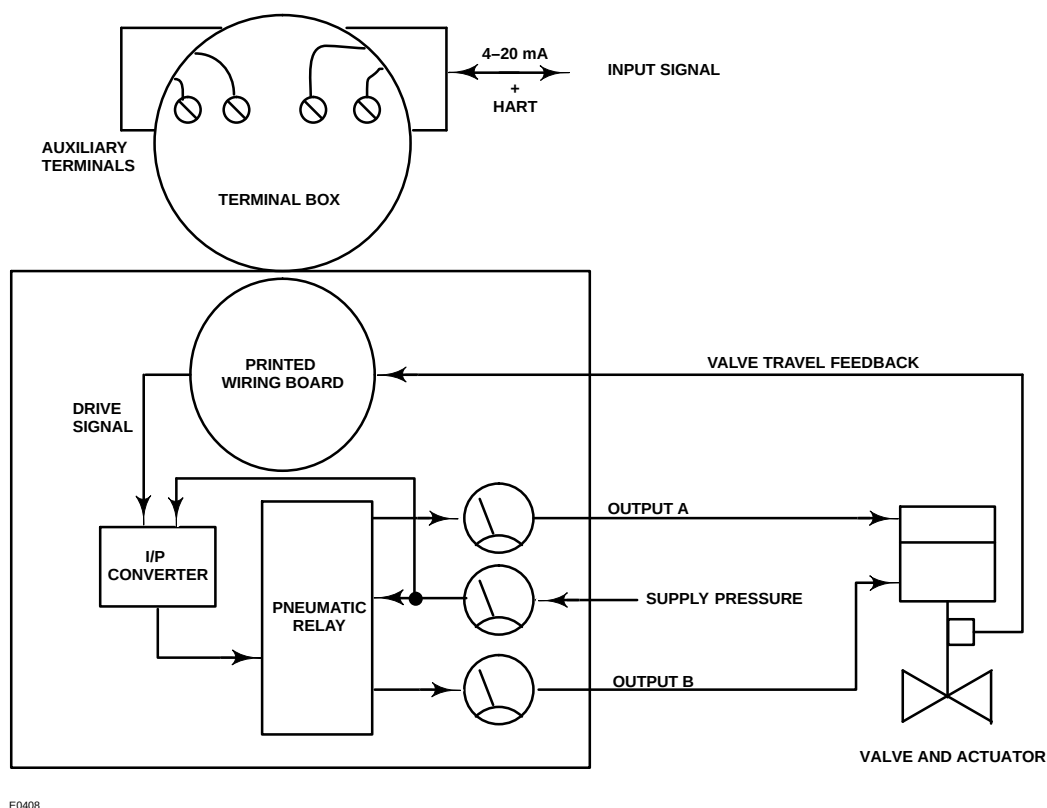


Figure A-3. FIELDVUE DVC6000 SIS Digital Valve Controller Block Diagram

A

double-acting and single-acting reverse applications. For single-acting actuators, unused ports can also be used to monitor the actuator pressure if any accessories are used in the output of the digital valve controller. As shown in figure A-3 the increased output A 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 stabilizes the I/P drive signal. This positions the flapper to prevent any further increase in nozzle pressure.

As the input signal decreases, the drive signal to the I/P converter submodule decreases, decreasing the I/P output pressure. The pneumatic relay decreases the output A pressure and increases the output B

pressure. The stem moves upward until the correct position is attained. At this point the printed wiring board assembly stabilizes the I/P drive signal. This positions the flapper to prevent any further decrease in nozzle pressure.

## Safety Instrumented System Applications

The principle of operation of the DVC6000 SIS is the same for safety instrumented system applications as for process applications. However, when used in a safety instrumented system application the DVC6000 SIS can be configured for two output positions. Depending on relay action (direct or reverse) the DVC6000 SIS can be configured for full pneumatic output during normal operation and minimum output during trip condition, or vice versa.

# DVC6000 SIS

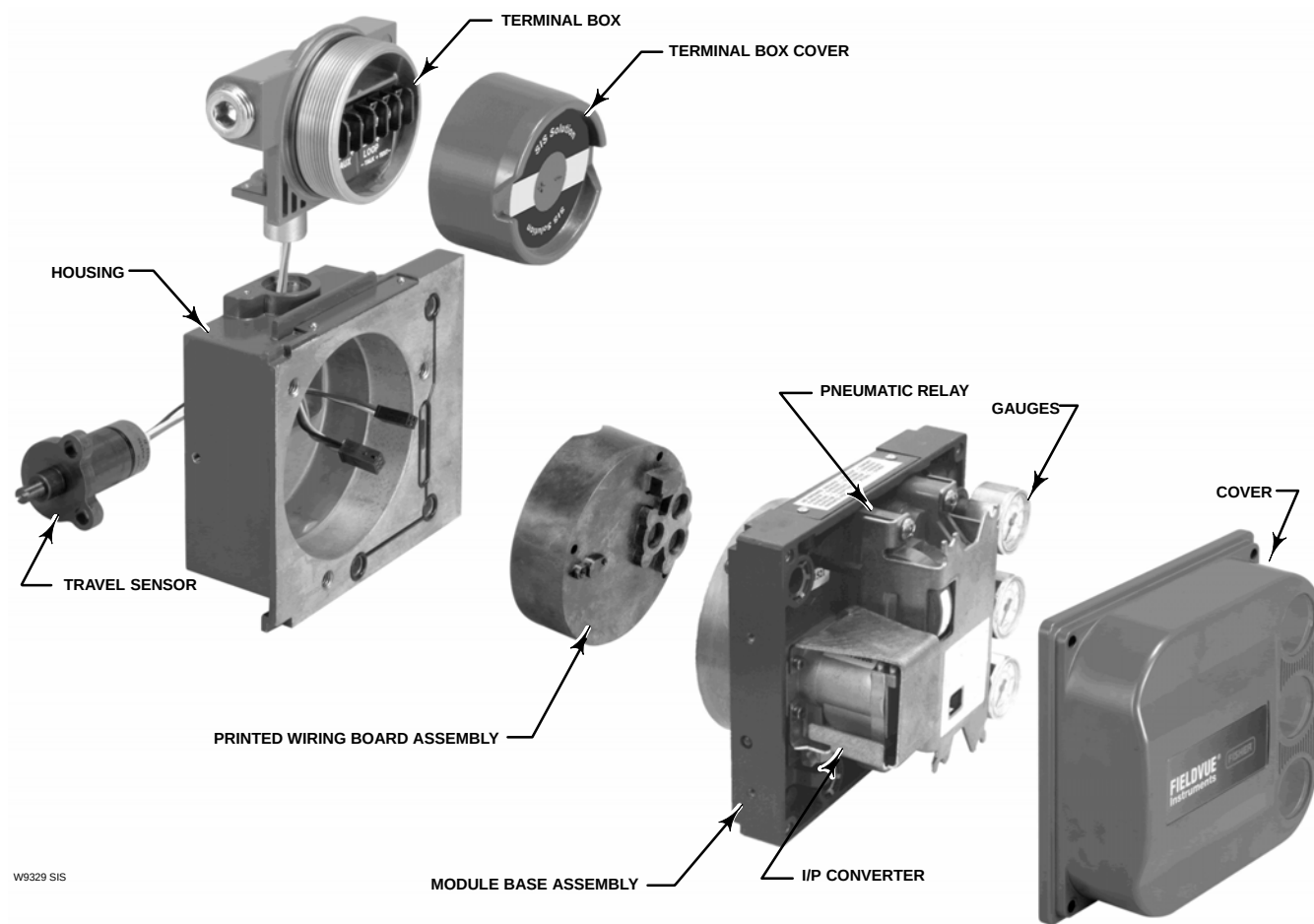


Figure A-4. FIELDVUE DVC6000 SIS Digital Valve Controller Assembly

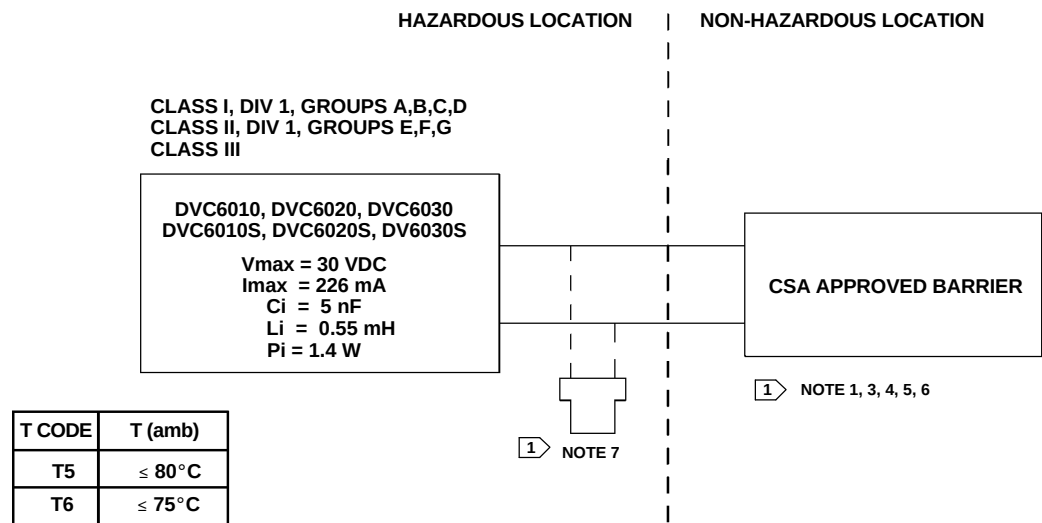
A

## Appendix B Loop Schematics/Nameplates

**B**

# DVC6000 SIS

This section includes loop schematics required for wiring of intrinsically safe installations. It also contains the approvals nameplates. If you have any questions, contact your Emerson Process Management sales office.



SEE NOTES IN FIGURE B-4

GE42818 sheet 2, Rev. E

B

Figure B-1. CSA Schematic for FIELDVUE DVC6010 SIS, DVC6020 SIS, and DVC6030 SIS

AMB  
TEMP

TO 80°C

TYPE 4X; IP66

30 VDC --- MAX  
145 PSI MAX

SERIAL  
NO

CL I DIV 1 GP BCD T5/T6; CL I DIV 2 GP ABCD T5/T6  
CL II DIV 1 GP EFG T5/T6; CL II DIV 2 GP FG T5/T6; CL III  
Ex ia INTRINSICALLY SAFE  
CL I,II,III DIV 1 GP ABCDEFG T5/T6 PER DWG GE42818 OR GE42819  
T5(Tamb ≤ 80°C)  
T6(Tamb ≤ 75°C)

CAUTION/WARNINGS:

• KEEP COVER TIGHT WHILE CIRCUITS ARE ALIVE  
• SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY  
• REFER TO MANUAL FOR ADDITIONAL CAUTIONS/WARNINGS

INPUT  
DC ---

TYPE

FISHER CONTROLS INTL LLC  
MARSHALLTOWN, IOWA, USA  
MFG LOCATION:

SP

FM  
APPROVED

HART  
COMMUNICATION PROTOCOL  
FISHER

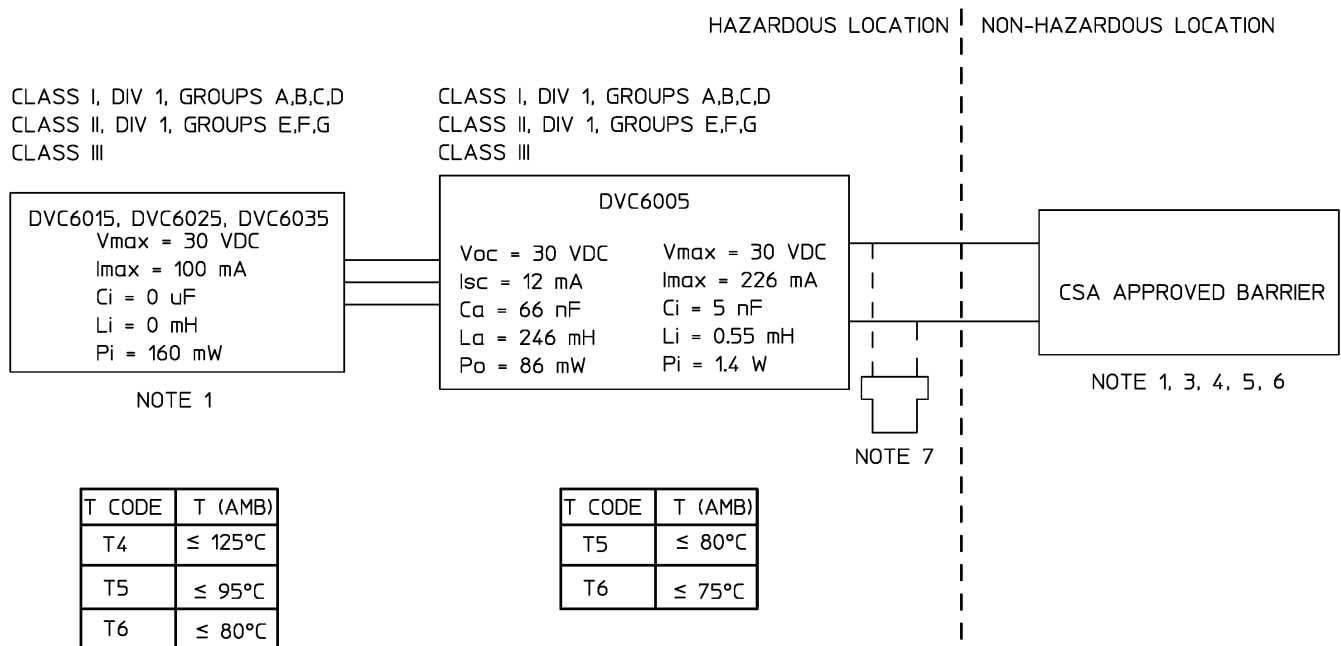
GE56124-A

Figure B-2. Typical CSA/FM Nameplate for FIELDVUE DVC6010 SIS, DVC6020 SIS, DVC6030 SIS, and DVC6005 SIS

B-2

September 2013

# Loop Schematics/Nameplate



1 SEE NOTES IN FIGURE B-4

GE42818 sheet 5, Rev. E

Figure B-3. CSA Schematic for FIELDVUE DVC6005 SIS with DVC6015, DVC6025, and DVC6035

## 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 (V<sub>max</sub> or U<sub>i</sub>), THE CURRENT (I<sub>max</sub> or I<sub>i</sub>), AND THE POWER (P<sub>max</sub> or P<sub>i</sub>) OF THE INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (V<sub>oc</sub> or U<sub>o</sub>), AND THE CURRENT (I<sub>sc</sub> or I<sub>o</sub>), AND THE POWER (P<sub>o</sub>) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAX UNPROTECTED CAPACITANCE (C<sub>i</sub>) AND MAX UNPROTECTED INDUCTANCE (L<sub>i</sub>), INCLUDING THE INTERCONNECTING CABLING CAPACITANCE (C<sub>cable</sub>) AND CABLING INDUCTANCE (L<sub>cable</sub>) MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (C<sub>a</sub>) AND INDUCTANCE (L<sub>a</sub>) DEFINED BY THE ASSOCIATED APPARATUS. IF THE ABOVE CRITERIA IS MET, THEN THE COMBINATION MAY BE CONNECTED.

V<sub>max</sub> or U<sub>i</sub> ≥ V<sub>oc</sub> or U<sub>o</sub>   I<sub>max</sub> or I<sub>i</sub> ≥ I<sub>sc</sub> or I<sub>o</sub>   P<sub>max</sub> or P<sub>i</sub> ≥ P<sub>o</sub>   C<sub>i</sub> + C<sub>cable</sub> ≤ C<sub>a</sub>   L<sub>i</sub> + L<sub>cable</sub> ≤ L<sub>a</sub>

3 INSTALLATION MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC) AND ANSI/ISA RP12.6.

4 MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 Vrms.

5 RESISTANCE BETWEEN INTRINSICALLY SAFE GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM

6 LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.

7 IF HAND-HELD COMMUNICATOR OR MULTIPLEXER IS USED, IT MUST BE CSA APPROVED WITH ENTITY PARAMETERS AND INSTALLED PER THE MANUFACTURER'S CONTROL DRAWINGS.

GE42818, Sheet 8, Rev. D

Figure B-4. Notes for CSA Schematics

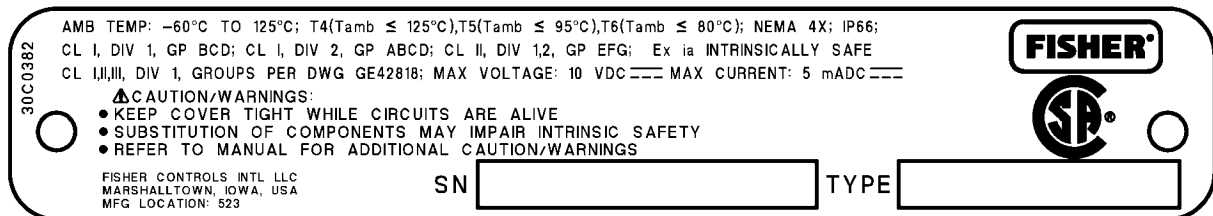


Figure B-5. Typical CSA Nameplates for FIELDVUE DVC6015, DVC6025, and DVC6035

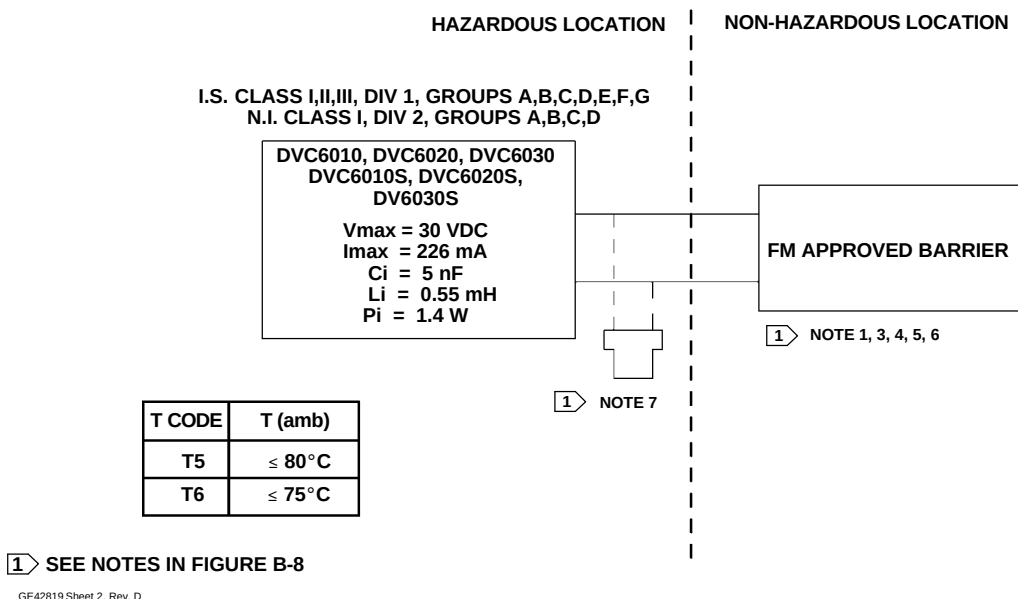


Figure B-6. FM Schematic for FIELDVUE DVC6010 SIS, DVC6020 SIS, and DVC6030 SIS Digital Valve Controllers

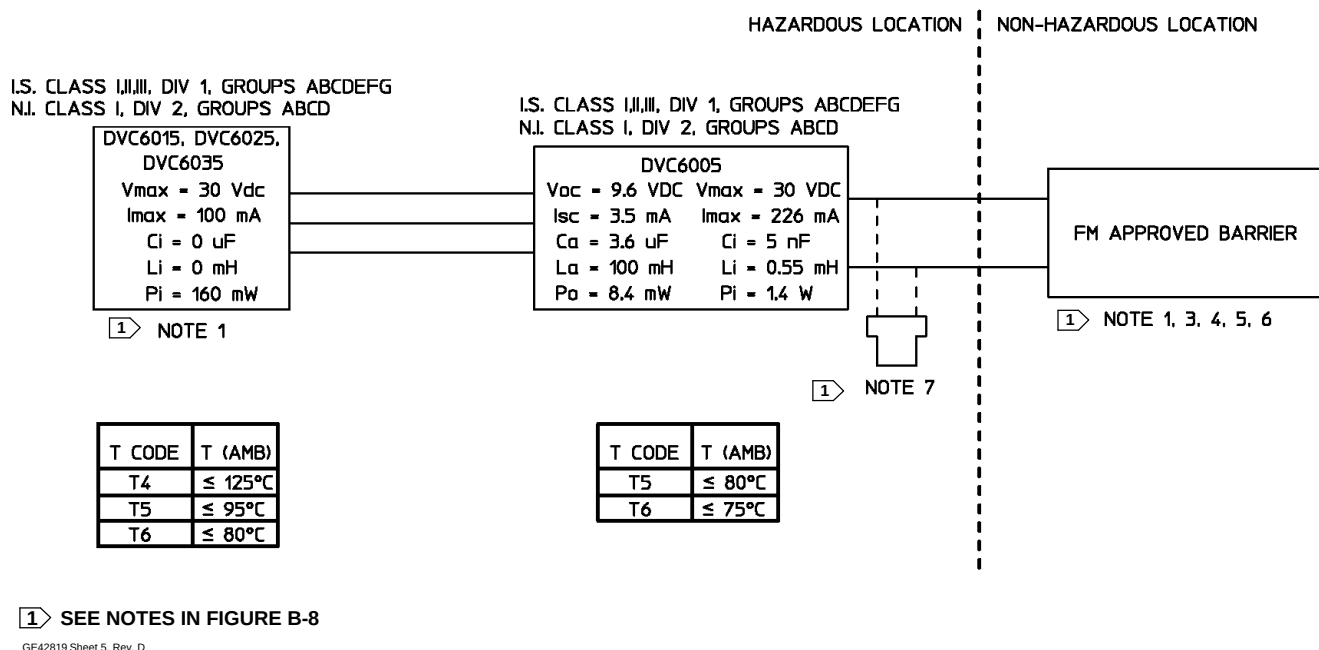


Figure B-7. FM Schematic for FIELDVUE DVC6005 SIS with DVC6015, DVC6025, and DVC6035

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 or Ui), THE CURRENT (Imax or Ii), AND THE POWER (Pmax or Pi) OF THE INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (Voc or Uo), AND THE CURRENT (Isc or Io), AND THE POWER (Po) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAX UNPROTECTED CAPACITANCE (Ci) AND MAX UNPROTECTED INDUCTANCE (Li), INCLUDING THE INTERCONNECTING CABLING CAPACITANCE (Ccable) AND CABLING INDUCTANCE (Lcable) MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (Ca) AND INDUCTANCE (La) DEFINED BY THE ASSOCIATED APPARATUS. IF THE ABOVE CRITERIA IS MET, THEN THE COMBINATION MAY BE CONNECTED.
- $V_{max} \text{ or } U_i \geq V_{oc} \text{ or } U_o$     $I_{max} \text{ or } I_i \geq I_{sc} \text{ or } I_o$     $P_{max} \text{ or } P_i \geq P_o$     $C_i + C_{cable} \leq C_a$     $L_i + L_{cable} \leq L_a$
- 3 INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) NFPA70 AND ANSI/ISA RP12.6.01
- 4 MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 Vrms.
- 5 RESISTANCE BETWEEN INTRINSICALLY SAFE GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM
- 6 LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTION
- 7 IF HAND-HELD COMMUNICATOR OR MULTIPLEXER IS USED IT MUST BE FM APPROVED WITH ENTITY PARAMETERS AND INSTALLED PER THE MANUFACTURER'S CONTROL DRAWING

GE42819 Sheet 8, Rev. E

Figure B-8. Notes for FM Loop Schematics

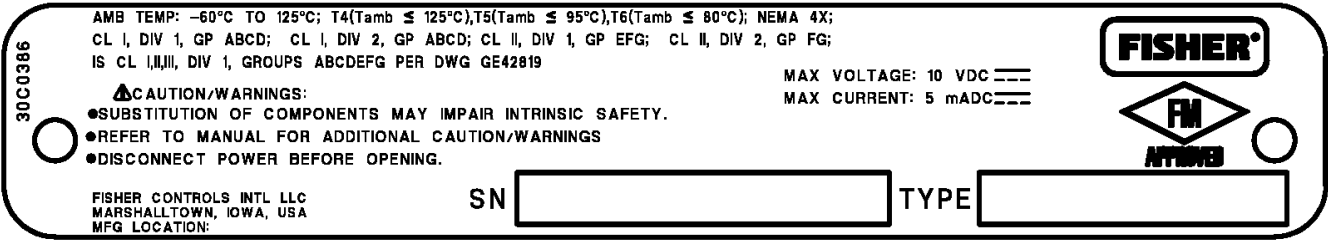
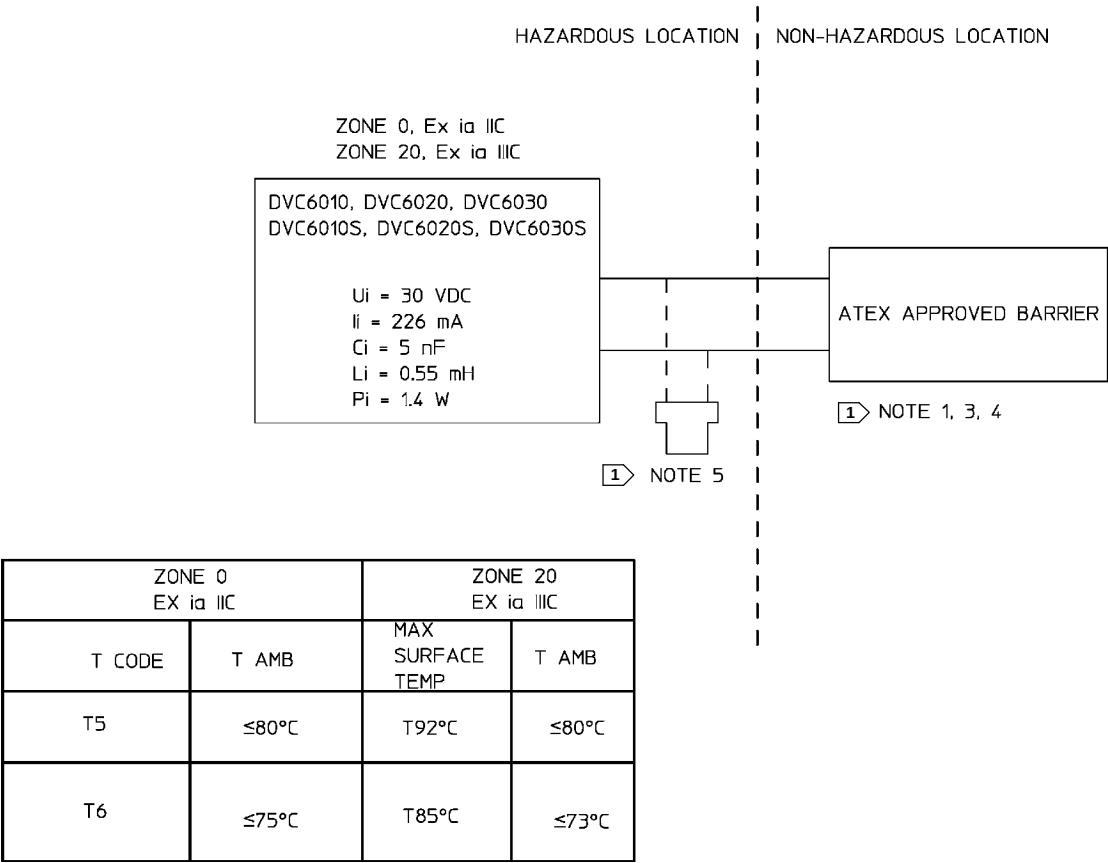


Figure B-9. Typical FM Nameplates for FIELDVUE DVC6015, DVC6025, and DVC6035

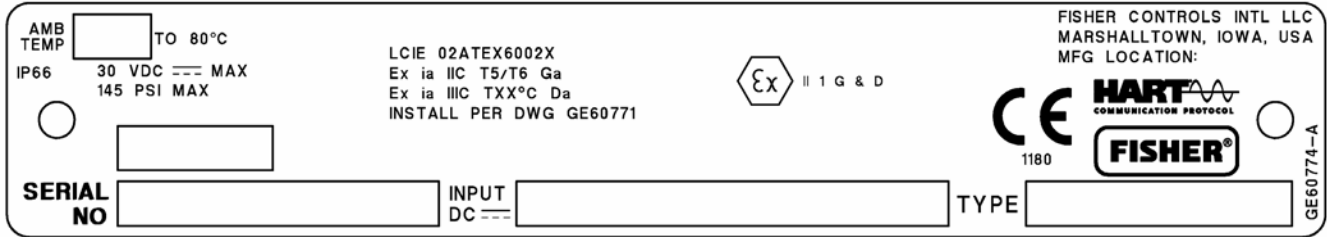
# DVC6000 SIS



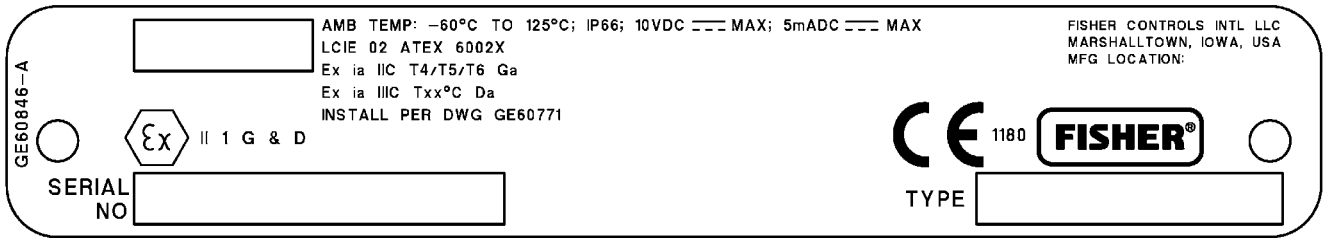
SEE NOTES IN FIGURE B-13

GE60771 sheet 3, Rev. B

Figure B-10. ATEX Loop Schematic For FIELDVUE DVC6010 SIS, DVC6020 SIS, and DVC6030 SIS



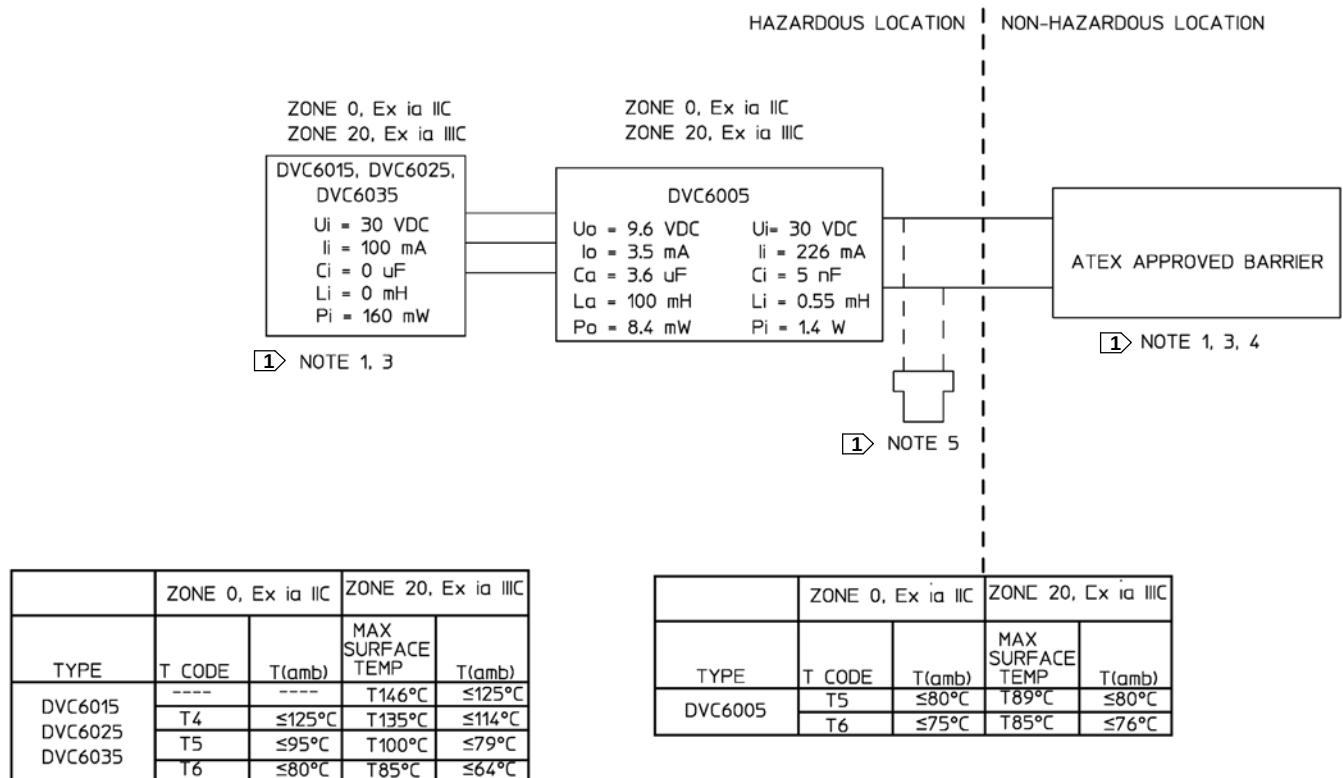
DVC6010 SIS, DVC6020 SIS, DVC6030 SIS, DVC6005 SIS



DVC6015, DVC6025, DVC6035

Figure B-11. Typical ATEX Nameplates; Intrinsically Safe

## Loop Schematics/Nameplate



**1 SEE NOTES IN FIGURE B-13**

GE60771 sheet 6, Rev. B

Figure B-12. ATEX Loop Schematic for DVC6005 SIS with DVC6015, DVC6025, and DVC6035

## 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 ( $V_{max}$  or  $U_i$ ), THE CURRENT ( $I_{max}$  or  $I_i$ ), AND THE POWER ( $P_{max}$  or  $P_i$ ) OF THE INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE ( $V_{oc}$  or  $U_o$ ), AND THE CURRENT ( $I_{sc}$  or  $I_o$ ), AND THE POWER ( $P_o$ ) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAX UNPROTECTED CAPACITANCE ( $C_i$ ) AND MAX UNPROTECTED INDUCTANCE ( $L_i$ ), INCLUDING THE INTERCONNECTING CABLING CAPACITANCE ( $C_{cable}$ ) AND CABLING INDUCTANCE ( $L_{cable}$ ) MUST BE LESS THAN THE ALLOWABLE CAPACITANCE ( $C_a$ ) AND INDUCTANCE ( $L_a$ ) DEFINED BY THE ASSOCIATED APPARATUS. IF THE ABOVE CRITERIA IS MET, THEN THE COMBINATION MAY BE CONNECTED.

$$V_{\max} \text{ or } U_i \geq V_{oc} \text{ or } U_o \quad I_{\max} \text{ or } I_i \geq I_{sc} \text{ or } I_o \quad P_{\max} \text{ or } P_i \geq P_o \quad C_i + C_{cable} \leq C_a \quad L_i + L_{cable} \leq L_a$$

**③ INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL WIRING PRACTICES OF THE COUNTRY IN USE.**

**④ LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.**

**5 IF HAND-HELD COMMUNICATOR OR MULTIPLEXER IS USED, IT MUST BE ATEX APPROVED WITH ENTITY PARAMETERS AND INSTALLED PER THE MANUFACTURER'S CONTROL DRAWINGS.**

GE60771, Sheet 2, Rev. B

Figure B-13. Notes for ATEX Schematics

# DVC6000 SIS

|                                                                             |                                                                  |                                                                          |
|-----------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------|
| AMB TEMP <input type="text"/> TO 85°C<br>IP66 30 VDC --- MAX<br>145 PSI MAX | LCIE 02ATEX6001X<br>Ex d IIC T5(Tamb ≤ 85°C), T6(Tamb ≤ 80°C) Gb | FISHER CONTROLS INTL LLC<br>MARSHALLTOWN, IOWA, USA<br>MFG LOCATION: 433 |
| SERIAL NO. <input style="width: 150px;" type="text"/>                       | INPUT DC --- <input style="width: 150px;" type="text"/>          | TYPE <input style="width: 100px;" type="text"/>                          |

II 2 G

1180

GG22174-A

DVC6010 SIS, DVC6020 SIS, DVC6030 SIS, DVC6005 SIS

|                                                                                                                                                    |                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| AMB TEMP: -60°C TO 125°C; IP66; 10VDC --- MAX; 5mADC --- MAX<br>LCIE 02ATEX6001X<br>Ex d IIC T4(Tamb ≤ 125°C), T5(Tamb ≤ 95°C), T6(Tamb ≤ 80°C) Gb | FISHER CONTROLS INTL LLC<br>MARSHALLTOWN, IOWA, USA<br>MFG LOCATION: 433 |
| SERIAL NO. <input style="width: 150px;" type="text"/>                                                                                              | TYPE <input style="width: 100px;" type="text"/>                          |

II 2 G

1180

GG22200-A

DVC6015, DVC6025, DVC6035

Figure B-14. Typical ATEX Nameplates; Flameproof

|                                                                             |                                                               |                                                                          |
|-----------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------------------------|
| AMB TEMP <input type="text"/> TO 80°C<br>IP66 30 VDC --- MAX<br>145 PSI MAX | LCIE 02ATEX6003X<br>Ex nC IIC T5(Ta ≤ 80°C), T6(Ta ≤ 75°C) Gc | FISHER CONTROLS INTL LLC<br>MARSHALLTOWN, IOWA, USA<br>MFG LOCATION: 433 |
| SERIAL NO. <input style="width: 150px;" type="text"/>                       | INPUT DC --- <input style="width: 150px;" type="text"/>       | TYPE <input style="width: 100px;" type="text"/>                          |

II 3 G

1180

GG22664-A

DVC6010 SIS, DVC6020 SIS, DVC6030 SIS, DVC6005 SIS

|                                                                                                                                               |                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| AMB TEMP: -60°C TO 125°C; IP66; 10VDC --- MAX; 5mADC --- MAX<br>LCIE 02ATEX6003X<br>Ex nA IIC T4(Ta ≤ 125°C), T5(Ta ≤ 95°C), T6(Ta ≤ 80°C) Gc | FISHER CONTROLS INTL LLC<br>MARSHALLTOWN, IOWA, USA<br>MFG LOCATION: 433 |
| SERIAL NO. <input style="width: 150px;" type="text"/>                                                                                         | TYPE <input style="width: 100px;" type="text"/>                          |

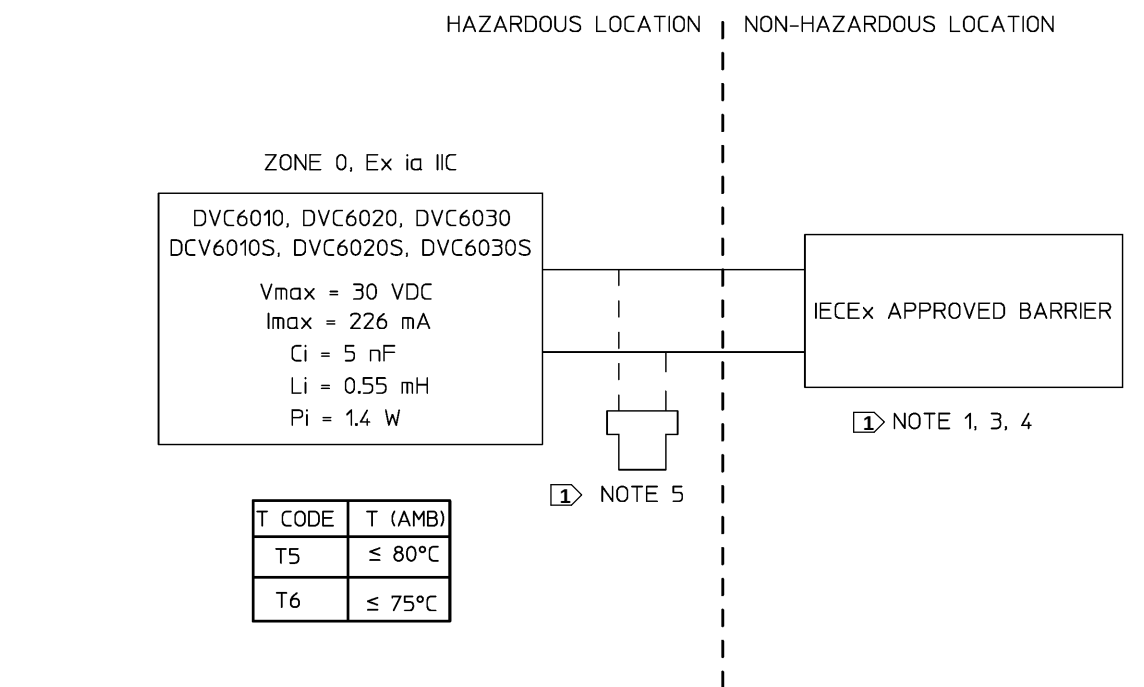
II 3 G

GG22675-A

DVC6015, DVC6025, DVC6035

Figure B-15. Typical ATEX Nameplates; Type n

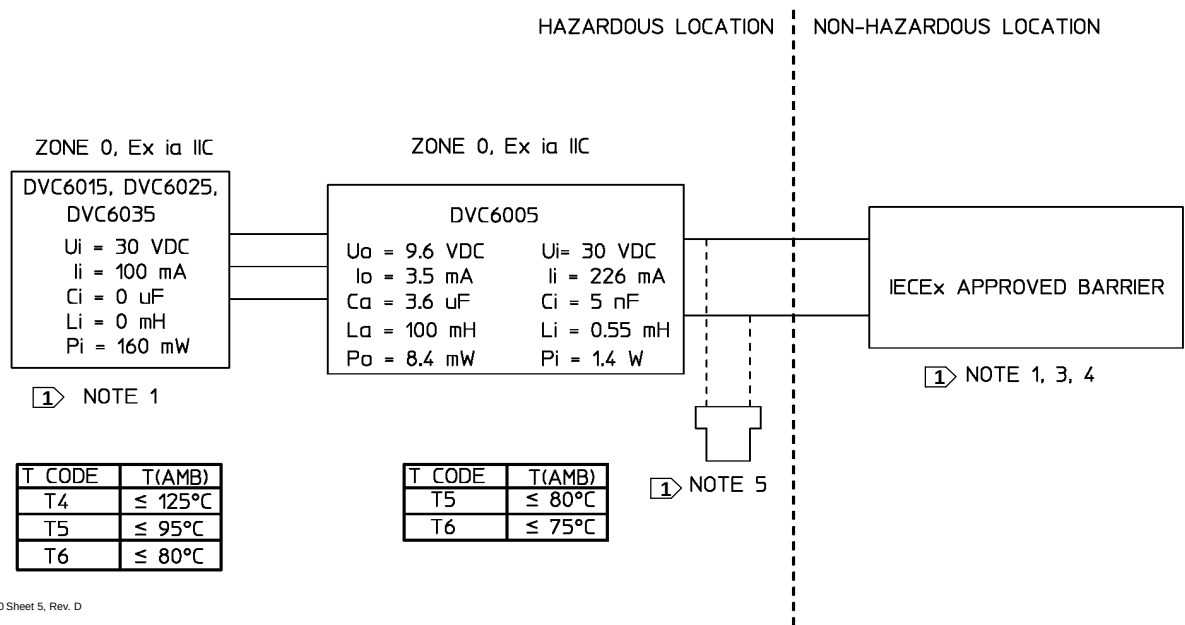
# Loop Schematics/Nameplate



SEE NOTES IN FIGURE B-18

GE42990 Sheet 2, Rev. E

Figure B-16. IECEx Loop Schematic for FIELDVUE DVC6010 SIS, DVC6020 SIS, and DVC6030 SIS



SEE NOTES IN FIGURE B-18

GE42990 Sheet 5, Rev. D

Figure B-17. IECEx Loop Schematic for FIELDVUE DVC6005 SIS with DVC6015, DVC6025, and DVC6035

# DVC6000 SIS

## 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 ( $V_{max}$  or  $U_i$ ), THE CURRENT ( $I_{max}$  or  $I_i$ ), AND THE POWER ( $P_{max}$  or  $P_i$ ) OF THE INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE ( $V_{oc}$  OR  $U_o$ ), AND THE CURRENT ( $I_{sc}$  or  $I_o$ ), AND THE POWER ( $P_o$ ) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAX UNPROTECTED CAPACITANCE ( $C_i$ ) AND MAX UNPROTECTED INDUCTANCE ( $L_i$ ), INCLUDING THE INTERCONNECTING CABLING CAPACITANCE ( $C_{cable}$ ) AND CABLING INDUCTANCE ( $L_{cable}$ ) MUST BE LESS THAN THE ALLOWABLE CAPACITANCE ( $C_a$ ) AND INDUCTANCE ( $L_a$ ) DEFINED BY THE ASSOCIATED APPARATUS. IF THE ABOVE CRITERIA IS MET, THEN THE COMBINATION MAY BE CONNECTED.

$$V_{max} \text{ or } U_i \geq V_{oc} \text{ or } U_o \quad I_{max} \text{ or } I_i \geq I_{sc} \text{ or } I_o \quad P_{max} \text{ or } P_i \geq P_o \quad C_i + C_{cable} \leq C_a \quad L_i + L_{cable} \leq L_a$$

3 INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL WIRING PRACTICES OF THE COUNTRY IN USE

4 LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS

5 IF HAND-HELD COMMUNICATOR OR MULTIPLEXER IS USED IT MUST BE IECEx APPROVED WITH ENTITY PARAMETERS AND INSTALLED PER THE MANUFACTURERS CONTROL DRAWING

GE42990 Sheet 8, Rev.

Figure B-18. Notes for IECEx Schematics

|                                       |                                                                                                                                                                                                                                                                   |                                                                      |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| AMB TEMP <input type="text"/> TO 80°C | CERT NO. IECEx CSA 04.0004X                                                                                                                                                                                                                                       | FISHER CONTROLS INTL LLC<br>MARSHALLTOWN, IOWA, USA<br>MFG LOCATION: |
| IP66 30 VDC --- MAX<br>145 PSI MAX    | Ex ia IIC T5( $T_a \leq 80^\circ\text{C}$ ), T6( $T_a \leq 75^\circ\text{C}$ ) PER DWG GE42990<br>Ex d IIC T5( $T_a \leq 80^\circ\text{C}$ ), T6( $T_a \leq 75^\circ\text{C}$ )<br>Ex nC IIC T5( $T_a \leq 80^\circ\text{C}$ ), T6( $T_a \leq 75^\circ\text{C}$ ) | HART<br>COMMUNICATION PROTOCOL<br><b>FISHER®</b>                     |
| SERIAL NO <input type="text"/>        | INPUT DC --- <input type="text"/>                                                                                                                                                                                                                                 | TYPE <input type="text"/>                                            |

Figure B-19. Typical IECEx Nameplate for FIELDVUE DVC6010 SIS, DVC6020 SIS, DVC6030 SIS, and DVC6005 SIS

|           |                                                                         |                                                                                                                       |                |
|-----------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------|
| GE09606-E | AMB TEMP: -60°C TO 125°C                                                | CERT NO. IECEx CSA 04.0004X                                                                                           | <b>FISHER®</b> |
|           | TYPE 4X, IP66                                                           | Ex ia IIC T4( $T_a \leq 125^\circ\text{C}$ ), T5( $T_a \leq 95^\circ\text{C}$ ), T6( $T_a \leq 80^\circ\text{C}$ ) Ga |                |
|           | MAX VOLTAGE: 10VDC ---                                                  | $U_i=30\text{VDC}$ , $I_i=100\text{mA}$ , $P_i=160\text{mW}$ , $C_i=0\mu\text{F}$ , $L_i=0\text{mH}$                  |                |
|           | MAX CURRENT: 5 mADC ---                                                 | Ex d IIC T4( $T_a \leq 125^\circ\text{C}$ ), T5( $T_a \leq 95^\circ\text{C}$ ), T6( $T_a \leq 80^\circ\text{C}$ ) Gb  |                |
|           | FISHER CONTROLS INTL LLC<br>MARSHALLTOWN, IOWA, USA<br>MFG LOCATION 088 | Ex nA IIC T4( $T_a \leq 125^\circ\text{C}$ ), T5( $T_a \leq 95^\circ\text{C}$ ), T6( $T_a \leq 80^\circ\text{C}$ ) Gc |                |
|           | SN <input type="text"/>                                                 | TYPE <input type="text"/>                                                                                             |                |

Figure B-20. Typical IECEx Nameplate for DVC6015, DVC6025, and DVC6035

## Glossary

### **Alert Point**

An adjustable value that, when exceeded, activates an alert.

### **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.

### **Analog Input Units**

Units in which the analog input is displayed and maintained in the instrument.

### **ANSI (acronym)**

The acronym ANSI stands for the American National Standards Institute

### **ANSI Class**

Valve pressure/temperature rating.

### **Auto Test**

The digital valve controller can be configured to automatically run the partial stroke test.

### **Auxiliary Input Alert**

Checks the status of the auxiliary input; a discrete input. When enabled, the Auxiliary Input Alert is active when the auxiliary input terminals are open or closed (shorted), depending upon the selection for Auxiliary Input Alert State.

### **Auxiliary Terminal (Indicator)**

Indicates whether auxiliary wiring terminals are open or closed (such as by an external switch contact).

### **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). A byte consists of eight bits.

### **Calibration Location**

Where the instrument was last calibrated; either in the factory or in the field.

### **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.

### **Control Mode**

Defines where the instrument reads its set point. The following control modes are available for a FIELDVUE instrument:

**Analog** The instrument receives its travel set point over the 4-20 mA loop.

**Digital** The instrument receives its set point digitally, via the HART communications link.

**Test** This is not a user-selectable mode. The Field Communicator or AMS ValveLink Software places the instrument in this mode whenever it needs to move the valve, such as for calibration or diagnostic tests.

### **Control Mode, Restart**

Determines the instrument control mode after a restart. See Control Mode for the available restart control modes.

## Controller

A device that operates automatically to regulate a controlled variable.

## Crossover Point

The point at which the feedback pin is closest to the axis of rotation of the travel sensor. 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.

## Current-to-Pressure (I/P) Converter

An electronic component or device that converts a milliamp signal to a proportional pneumatic pressure output signal.

## Cycle Counter

The capability of a FIELDVUE instrument to record the number of times the travel changes direction. The change in direction must occur after the deadband has been exceeded before it can be counted as a cycle.

## Cycle Counter Alert

Checks the difference between the Cycle Counter and the Cycle Counter Alert Point. Cycle Counter Alert is active when the cycle counter value exceeds the Cycle Counter Alert Point. It clears after you reset the Cycle Counter to a value less than the alert point.

## Cycle Counter Alert Point

An adjustable value which, when exceeded, activates the Cycle Counter Alert. Valid entries are 0 to 4 billion cycles.

## Cycle Counter Deadband

Region around the travel reference point, in percent of ranged travel, established at the last increment of the Cycle Counter. The deadband must be exceeded before a change in travel can be counted as a cycle. Valid entries are 0% to 100%. Typical value is between 2% and 5%.

## 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.

## Device Revision

Revision number of the interface software that permits communication between the Field Communicator and the instrument.

## 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.

## Drive Signal Alert

Checks the drive signal and calibrated travel. If one of the following conditions exists for more than 20 seconds, the Drive Signal Alert is active. If none of the conditions exist, the alert is cleared.

### If Zero Power Condition = Closed

The alert is active when:

drive signal <10% and calibrated travel >3%

drive signal >90% and calibrated travel <97%

### If Zero Power Condition = Open

The alert is active when:

drive signal <10% and calibrated travel <97%

drive signal >90% and calibrated travel >3%

## DVC Power Up

Defines the power up behavior of the DVC6000. Auto Reset allows the valve to track the command signal when power is applied to the device. Manual Reset will lock the device in its safety position until the digital valve controller is reset.

## Equal Percentage

A valve flow characteristic where equal increments of valve stem travel produce equal percentage changes in existing flow. One of the input characteristics available for a FIELDVUE digital valve controller. See also, Linear and Quick Opening.

## Feedback Arm

The mechanical connection between the valve stem linkage and the FIELDVUE digital valve controller travel sensor.

## Feedback Connection

Identifies the type of feedback linkage: rotary, sliding-stem roller or sliding-stem standard.

## 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 Revision

The revision number of the instrument firmware. Firmware is a program that is entered into the instrument at time of manufacture and cannot be changed by the user.

## Free Time

Percent of time that the microprocessor is idle. A typical value is 25%. The actual value depends on the number of functions in the instrument that are enabled and on the amount of communication currently in progress.

## Full Ranged Travel

Current, in mA, that corresponds with the point where ranged travel is maximum, i.e., limited by the mechanical travel stops.

## Gain

The ratio of output change to input change.

## Hardware Revision

Revision number of the instrument hardware. The physical components of the instrument are defined as the hardware.

## HART (acronym)

The acronym HART stands for Highway Addressable Remote Transducer.

## HART Tag

An eight-character name that identifies the physical instrument.

## HART Universal Revision

Revision number of the HART Universal Commands which are the communications protocol for the instrument.

## Input Characteristic

The relationship between the ranged travel and ranged input. Possible values include: linear, equal percentage, and quick opening.

## Input Current

The current signal from the control system that serves as the analog input to the instrument. See also Input Signal.

## Input Range

The analog input signal range that corresponds to the travel range.

## Input Signal

The current signal from the control system. The input signal can be displayed in milliamperes or in percent of ranged input.

## Instrument Level

Determines the functions available for the instrument.

## Instrument Mode

Determines if the instrument responds to its analog input signal. There are two instrument modes:

**In Service:** For a fully functioning instrument, the instrument output changes in response to analog input changes. Typically changes to setup or calibration cannot be made when the instrument mode is In Service.

**Out of Service:** The instrument output does not change in response to analog input changes when the instrument mode is Out of Service. Some setup parameters can be changed only when the instrument mode is Out of Service.

## Instrument Protection

Determines if commands from a HART device can calibrate and/or configure certain parameters in the instrument. There are two types of instrument protection:

**Configuration and Calibration:** Prohibits changing protected setup parameters; prohibits calibration.

**None:** Permits both configuration and calibration. The instrument is "unprotected."

## Instrument Serial Number

The serial number assigned to the printed wiring board by the factory but can be changed during setup. The instrument serial number should match the serial number on the instrument nameplate.

## 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 and IEC 534-4.

## Linear

A valve flow characteristic where changes in flow rate are directly proportional to changes in valve stem travel. One of the input characteristics available for a FIELDVUE digital valve controller. See also, Equal Percentage and Quick Opening.

## 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.

## Local Control Panel

The LCP100 local control panel is used with the FIELDVUE DVC6000 SIS digital valve controller. This panel is used to monitor and manually open and close a safety shutdown valve. The LCP100 also provides a manual reset feature and a button for initiating a partial stroke test.

## Manual Reset

The DVC6000 SIS digital valve controller can be configured to hold the trip state until a local reset button is pressed.

## 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). See also these listings in this glossary.

## Menu

A list of programs, commands, or other activities that you select by using the arrow keys to highlight the item then pressing ENTER, or by entering the numeric value of the menu item.

## Minimum Closing Time

Minimum time, in seconds, for the travel to decrease through the entire ranged travel. This rate is applied to any travel decrease. Valid entries are 0 to 400 seconds. Deactivate by entering a value of 0 seconds.

## Minimum Opening Time

Minimum time, in seconds, for the travel to increase through the entire ranged travel. This rate is applied to any travel increase. Because of friction, actual valve travel may not respond in exactly the same time frame. Valid entries are 0 to 400 seconds. Deactivate by entering a value of 0 seconds.

## 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.

## Parallel

Simultaneous: said of data transmission on two or more channels at the same time.

## Polling Address

Address of the instrument. If the digital valve controller is used in a point-to-point configuration, set the polling address to 0. If it is used in a multidrop configuration, or split range application, set the polling address to a value from 0 to 15.

## Pressure Sensor

A FIELDVUE instrument internal device that senses pneumatic pressure. DVC6000 SIS digital valve controllers have three pressure sensors: one to sense supply pressure and two to sense the output pressures.

## Primary Master

Masters are communicating devices. A primary master is a communicating device permanently wired to a field instrument. Typically, a HART-compatible control system or a computer running AMS ValveLink Software is the primary master.

In contrast, a secondary master is not often permanently wired to a field instrument. The Model 375 Field Communicator or a computer running ValveLink software communicating through a HART modem could be considered a secondary master.

**Note:** If one type of master takes an instrument Out Of Service, the same type must put it In Service. For example, if a device set up as a primary master takes an instrument Out Of Service, a device set up as a primary master must be used to place the instrument In Service.

## Quick Opening

A valve flow characteristic where most of the change in flow rate takes place for small amounts of stem travel from the closed position. The flow characteristic curve is basically linear through the first 40 percent of stem travel. One of the input characteristics available for a FIELDVUE digital valve controller. See also, Equal Percentage and Linear.

## 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.

## Set Point Filter Time

The time constant, in seconds, for the first-order input filter.

## Software

Microprocessor or computer programs and routines that reside in alterable memory (usually RAM), as opposed to firmware, which consists of programs and routines that are programmed into memory (usually ROM) when the instrument is manufactured. Software can be manipulated during normal operation, firmware cannot.

## Stroking Time

The time, in seconds, required to move the valve from its fully open position to fully closed, or vice versa.

## 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 Accumulator

The capability of a FIELDVUE instrument to record total change in travel. The value of the Travel Accumulator increments when the magnitude of the change exceeds the Travel Accumulator Deadband. To reset the Travel Accumulator, set it to zero.

## Travel Accumulator Alert

Checks the difference between the Travel Accumulator value and the Travel Accumulator Alert Point. The Travel Accumulator Alert is active when the Travel Accumulator value exceeds the Travel Accumulator Alert Point. It clears after you reset the Travel Accumulator to a value less than the alert point.

## Travel Accumulator Alert Point

An adjustable value which, when exceeded, activates the Travel Accumulator Alert. Valid entries are 0% to 4 billion %.

## Travel Accumulator Deadband

Region around the travel reference point established at the last increment of the accumulator. This region must be exceeded before a change in travel can be accumulated. Valid entries are 0% to 100%.

## Travel Alert

Checks the ranged travel against the travel high and low alert points. The travel alert is active if either the high or low point is exceeded. Once a high or low point is exceeded, the ranged travel must clear that point by the Travel Alert Deadband before the alert clears. Four travel alerts are available: Travel Alert Hi, Travel Alert Lo, Travel Alert Hi Hi, and Travel Alert Lo Lo.

## Travel Alert Deadband

Travel, in percent of ranged travel, required to clear a travel alert, once it is active. Valid entries are -25% to 125%.

## Travel Alert High Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Hi alert. Valid entries are -25% to 125%.

## Travel Alert High High Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Hi Hi alert. Valid entries are -25% to 125%.

## Travel Alert Low Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Lo alert. Valid entries are -25% to 125%.

## Travel Alert Low Low Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Lo Lo alert. Valid entries are -25% to 125%.

## Travel Cutoff

Defines the cutoff point for the travel, in percent of ranged travel. There are two travel cutoffs: high and low. Once travel exceeds the cutoff, the drive signal is set to either maximum or minimum, depending on the aero power condition and if the cutoff is high or low. Minimum opening time or minimum closing time are not in effect while the travel is beyond the cutoff. Use the travel cutoff to obtain the desired seat load or to be sure the valve is fully open.

## Travel Deviation

The difference between the analog input signal (in percent of ranged input), the "target" travel, and the actual "ranged" travel.

## Travel Deviation Alert

Checks the difference between the target and the ranged travel. If the difference exceeds the Travel Deviation Alert Point for more than the Travel Deviation Time, the Travel Deviation Alert is active. It remains active until the difference is less than the Travel Deviation Alert Point.

## Travel Deviation Alert Point

An adjustable value for the target travel and the ranged travel difference, expressed in percent. When this value is exceeded by the travel deviation for more than the Travel Deviation Time, the Travel Deviation Alert is active. Valid entries are 0% to 100%. Typically this is set to 5%.

## Travel Deviation Time

The time, in seconds, that the travel deviation must exceed the Travel Deviation Alert Point before the alert is active. Valid entries are 1 to 60 seconds.

## Travel Limit

A setup parameter that defines the maximum allowable travel (in percent of ranged travel) for the valve. During operation, the travel target will not exceed this limit. There are two travel limits: high and low. Typically the travel limit low will be used to keep the valve from going completely closed.

## Travel Range

Travel, in percent of calibrated travel, that corresponds to the input range.

## 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.

## Travel Sensor Motion

Establishes motion of the travel sensor. While viewing the end of the travel sensor shaft, if increasing air pressure to the actuator causes the shaft to rotate clockwise, travel sensor motion is CW. If increasing air pressure causes the shaft to rotate counterclockwise, travel sensor motion is CCW.

## Tuning

The adjustment of control terms or parameter values to produce a desired control effect.

## Tuning Set

Preset values that identify gain 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 rearm periodically. If the microprocessor is unable to rearm the timer, the instrument goes through reset.

## **Zero Power Condition**

The position of the valve when the power to the positioner is turned off. It is used to reference 0% travel. For Relay A and C, Port A will be at atmosphere pressure, and if double-acting, Port B will be at supply pressure. For Relay B, Port B will be at supply pressure.



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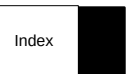
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