

Fisher® FIELDVUE™ DVC6000 Digital Valve Controllers Instruction Manual (Supported)

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DVC6000 Digital Valve Controllers

Fisher® FIELDVUE™ DVC6000 Digital Valve Controllers

This manual applies to:

Instrument Level	AC, HC, AD, PD	HC, AD, PD, ODV	AC
Device Type	03	03	07
Device Revision	1	2	2
Hardware Revision	1	1	1
Firmware Revision	2–6	7, 9, 10, 11	7, 9, 10, 11
DD Revision	4	8	1

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Refer to Related Documents on page 1-3 for other documents containing information related to DVC6000 digital valve controllers



DVC6000 Digital Valve Controllers

Fast Key Sequence for Instrument Level HC, AD, PD, and ODV

Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾	Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾
A Minus B	3-5-3	4-G	End Point Pressure Control ⁽³⁾	<i>1-2-2-2-4</i>	8-D
Actuator Style	1-2-6-4	3-D	Failure Group Enable	1-2-3-6-5-1	11-I
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	<i>1-2-3-7-1</i>		HART Tag	1-2-5-1-1	6-F
Analog Input	3-1	2-G		3-7-1	2-H
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Analog Input Range Hi	1-2-5-3-1	6-H	Input Characterization	1-2-2-3	4-C
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Auto Calibration	1-3-1-1	4-E	Instrument Level	3-7-8	2-H
Autocalibration in Progress Enable	1-2-4-2-2	8-H	Instrument Mode	Hot Key-1	1-A
	3-6-1	4-H		1-2-1-1	4-B
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	1-2-3-3-1-3	12-E	Instrument Time Invalid Enable	1-2-4-1-1	8-G
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Calibration in Progress Enable	1-2-4-2-1	8-G	Integral Gain (Pressure Tuning)	1-2-2-1-3-3	8-C
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	<i>1-2-3-7-4</i>			1-2-2-1-2-2	8-B
Command 3 Configured Pressure	1-2-1-4-5	6-B	Integrator Saturated Hi Enable	1-2-4-4-1	8-I
Control Mode	Hot Key-2	1-A	Integrator Saturated Lo Enable	1-2-4-4-2	8-I
	1-2-1-2	4-B	Last AutoCalibration Status	1-2-5-9-1	6-H
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Cycle Counter	1-2-3-5-1-2	12-H	Maximum Recorded Temperature	3-6-3	4-H
	3-6-5	4-H		2-3-1	3-F
Cycle Counter Alert Enable	1-2-3-5-1-1	12-G	Maximum Supply Pressure	1-2-5-6	4-G
Cycle Count Alert Point	1-2-3-5-1-3	12-H	Message	1-2-5-1-2	6-F
Date	1-2-5-1-4	6-G	Minimum Recorded Temperature	2-3-2	3-F
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Drive Signal Alert Enable	1-2-3-1-2-1	10-D		3-6-9	4-H
Drive Signal	3-4	2-G	Offline/Failed Alert Enable	1-2-3-1-3-1	12-B
	1-2-3-1-2-2	10-D			

NOTE: *Italicized Fast-Key Sequence* indicates fast-key sequence is applicable only for instrument level ODV.

1. Coordinates are to help locate the item on the menu tree on the following pages.

3. Instrument level ODV only.

5. Instrument level HC, AD, and PD only.

6. Firmware 9 and 10 only.

DVC6000 Digital Valve Controllers

Fast Key Sequence for Instrument Level HC, AD, PD, and ODV

Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾	Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾
Partial Stroke Test ⁽³⁾	2-5	2-F	Travel	3-3	2-G
Partial Stroke Test Enable ⁽³⁾	1-2-7-1	3-D		1-2-3-4-1	9-E
Partial Stroke Test Pressure Limit ⁽³⁾	1-2-3-6-1	10-G	Travel / Pressure Select	1-2-2-2-1	6-C
Partial Stroke Test Start Point ⁽³⁾	1-2-2-2-4-2	8-D	Travel Accumulatorv	3-6-6	4-H
Partial Stroke Test Variables View/Edit ⁽³⁾	1-2-7-2	3-D		1-2-3-5-3-2	12-H
Performance Tuner ⁽²⁾	1-1-2	2-B	Travel Accumulator Alert Enable	1-2-3-5-3-1	12-H
	1-2-2-1-1-5	8-A	Travel Accumulator Alert Point	1-2-3-5-3-3	12-I
Polling Address	1-2-5-1-7	6-G	Travel Alert Dead Band	1-2-3-4-3	9-E
Pressure A	3-5-1	4-G	Travel Alert Hi Enable	1-2-3-4-6-1	10-F
Pressure B	3-5-2	4-G	Travel Alert Hi Hi Enable	1-2-3-4-5-1	12-E
Pressure Control Active Enable	1-2-4-3-1	8-H	Travel Alert Hi Hi Point	1-2-3-4-5-3	12-F
Pressure Deviation Alert Enable ⁽³⁾	1-2-3-6-2	10-G	Travel Alert Hi Point	1-2-3-4-6-3	10-F
Pressure Deviation Alert Point ⁽³⁾	1-2-3-6-3	10-G	Travel Alert Lo Enable	1-2-3-4-6-2	10-F
Pressure Deviation Time ⁽³⁾	1-2-3-6-4	10-G	Travel Alert Lo Lo Enable	1-2-3-4-5-2	12-E
Pressure Range Hi	1-2-2-2-3-1	10-D	Travel Alert Lo Lo Point	1-2-3-4-5-4	12-F
Pressure Range Lo	1-2-2-2-3-2	10-D	Travel Alert Lo Point	1-2-3-4-6-4	10-F
Pressure Sensor Shutdown ⁽²⁾	1-2-3-2-3	12-D	Travel Deviation Alert Enable	1-2-3-4-4-1	10-E
Pressure Sensors—Calibration	1-3-2-1	4-E	Travel Deviation Alert Point	1-2-3-4-4-2	10-E
Pressure Tuning Set	1-2-2-1-3-1	8-B	Travel Deviation Time	1-2-3-4-4-3	10-E
Pressure Units	1-2-5-2-1	6-G	Travel Limit / Cutoff Hi Enable	1-2-3-4-7-1	12-F
	Hot Key-3	1-A	Travel Limit / Cutoff Lo Enable	1-2-3-4-7-2	12-F
Protection	1-2-1-5	4-B	Travel Limit Hi	1-2-3-4-7-6	12-G
	3-6-7	4-H		1-2-2-2-2-4	10-C
Raw Travel Input	3-6-7	4-H	Travel Limit Lo	1-2-3-4-7-7	12-G
Reference Voltage Shutdown	1-2-3-1-3-7	12-C		1-2-2-2-2-5	10-C
Relay Adjust	1-3-3	3-E	Travel Sensor Adjust	1-3-2-2	4-E
Relay Type	1-2-5-4	4-F	Travel Sensor Motion	1-2-6-5	3-E
Restart Control Mode	1-2-1-3	4-B	Travel Sensor Shutdown	1-2-3-2-1	12-C
Restore Factory Settings	1-3-4	3-E	Travel Setpoint	1-2-3-4-2	9-E
Set Point Rate Close	1-2-2-5-2	5-D		3-2	2-G
Set Point Rate Open	1-2-2-5-1	5-D	Travel Tuning Set	1-2-2-1-1-1	8-A
Setup Wizard	1-1-1	2-B	Valve Group Enable	1-2-3-6-5-2	10-H
	Hot Key-4	1-A		1-2-3-7-5-2	
	Stabilize/Optimize	1-1-2 ⁽⁴⁾	2-B	Valve Serial Number	1-2-5-1-5
Status	2-2	2-F	Valve Style	1-2-6-2	3-D
	2-4	2-F		1-2-6-3	3-D
Supply Pressure ⁽²⁾	3-5-4	4-G	View Alert Records	1-2-3-6-3	10-H
	1-2-3-3-2-2	12-E		1-2-3-7-3	
Supply Pressure Lo Alert Enable ⁽⁵⁾	1-2-3-3-2-1	12-E	View/Edit Feedback Connection	1-2-6-6	3-E
Supply Pressure Lo Alert Point ⁽⁵⁾	1-2-3-3-2-3	12-E	View/Edit Lag Time ⁽⁵⁾	1-2-2-5-3	5-D
Temperature	3-6-2	4-H	View/Edit Lead/Lag ⁽³⁾	1-2-2-5-3	5-D
Temperature Sensor Shutdown	1-2-3-2-2	12-D	View Number of Days Powered Up	2-3-3	3-F
Temperature Units	1-2-5-2-2	6-G		3-6-8	4-H
			Zero Power Condition	1-2-5-5	4-G

NOTE: *Italicized Fast-Key Sequence* indicates fast-key sequence is applicable only for instrument level ODV.

1. Coordinates are to help locate the item on the menu tree on the following pages.

2. Not available in instrument level HC.

3. Instrument level ODV only.

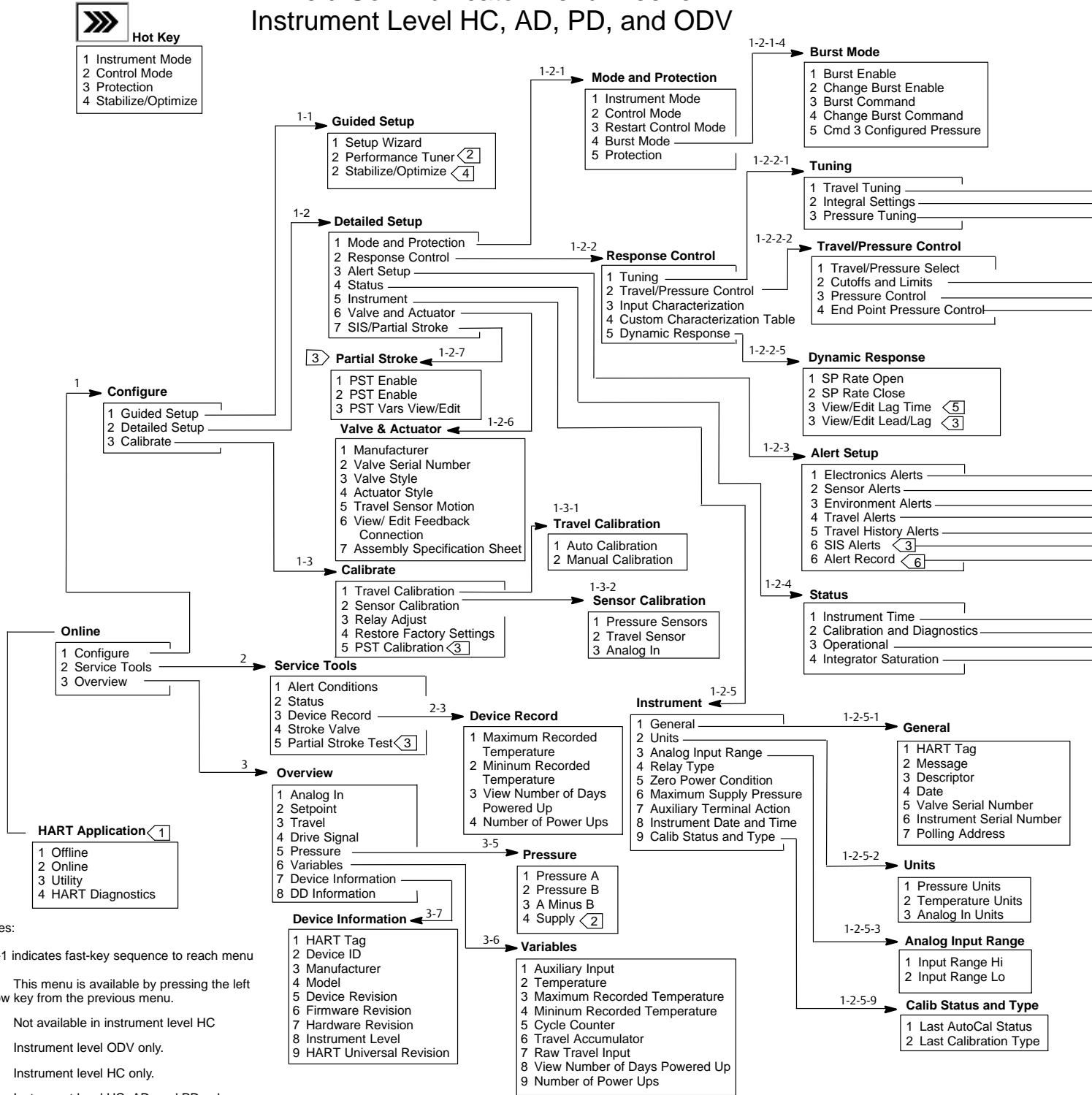
4. Instrument level HC only.

5. Instrument level HC, AD, and PD only.

7. Firmware 7 only.

DVC6000 Digital Valve Controllers

Field Communicator Menu Tree for Instrument Level HC, AD, PD, and ODV



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 Not available in instrument level HC

3 Instrument level ODV only.

4 Instrument level HC only.

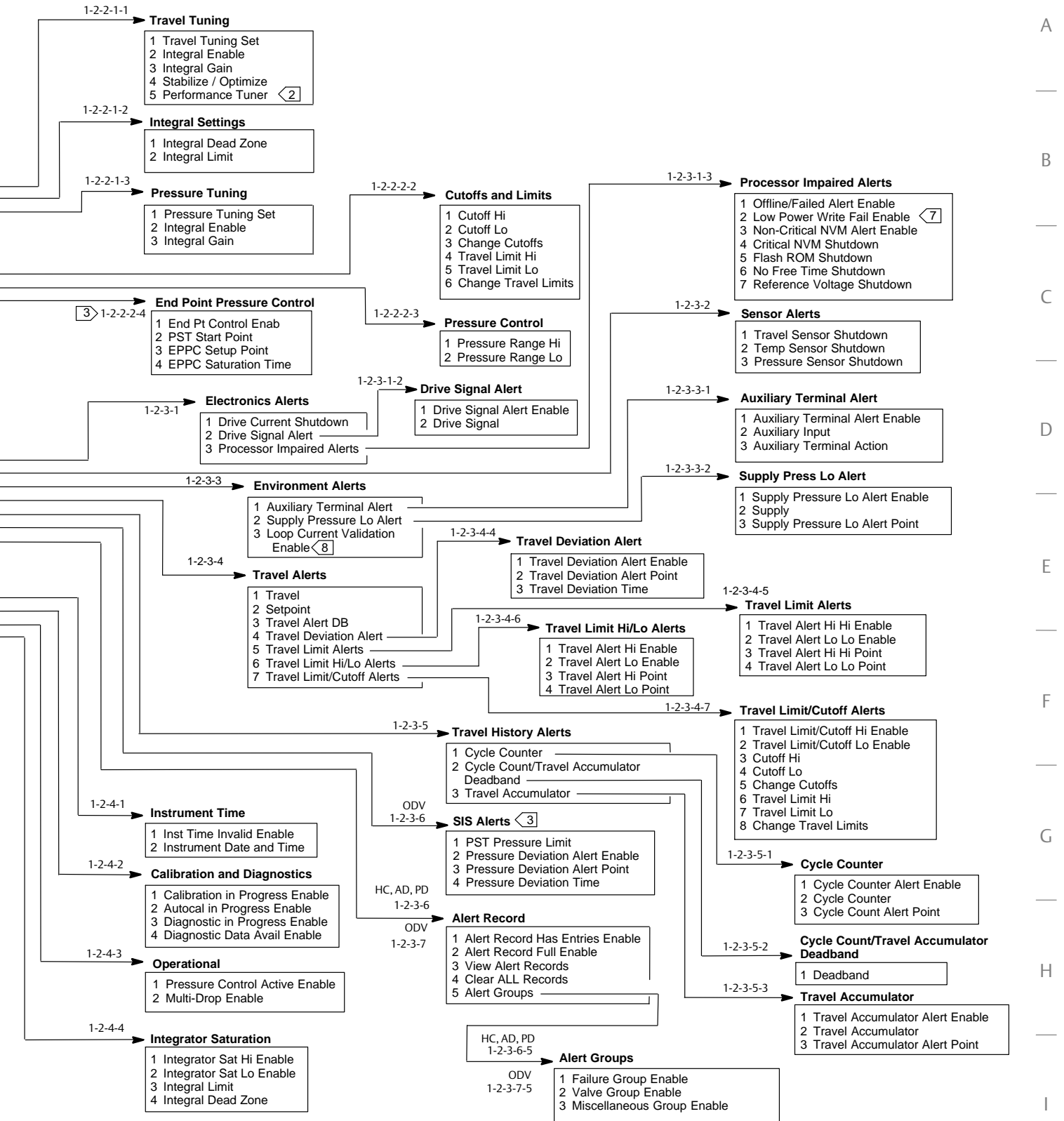
5 Instrument level HC, AD, and PD only.

6 Fast key sequence for Alert Record with instrument level ODV is 1-2-3-7.

7 This menu item reads Power Starvation Alrt Enab in firmware 7 and below.

8 Only available in firmware 9, 10, and 11.

DVC6000 Digital Valve Controllers



DVC6000 Digital Valve Controllers

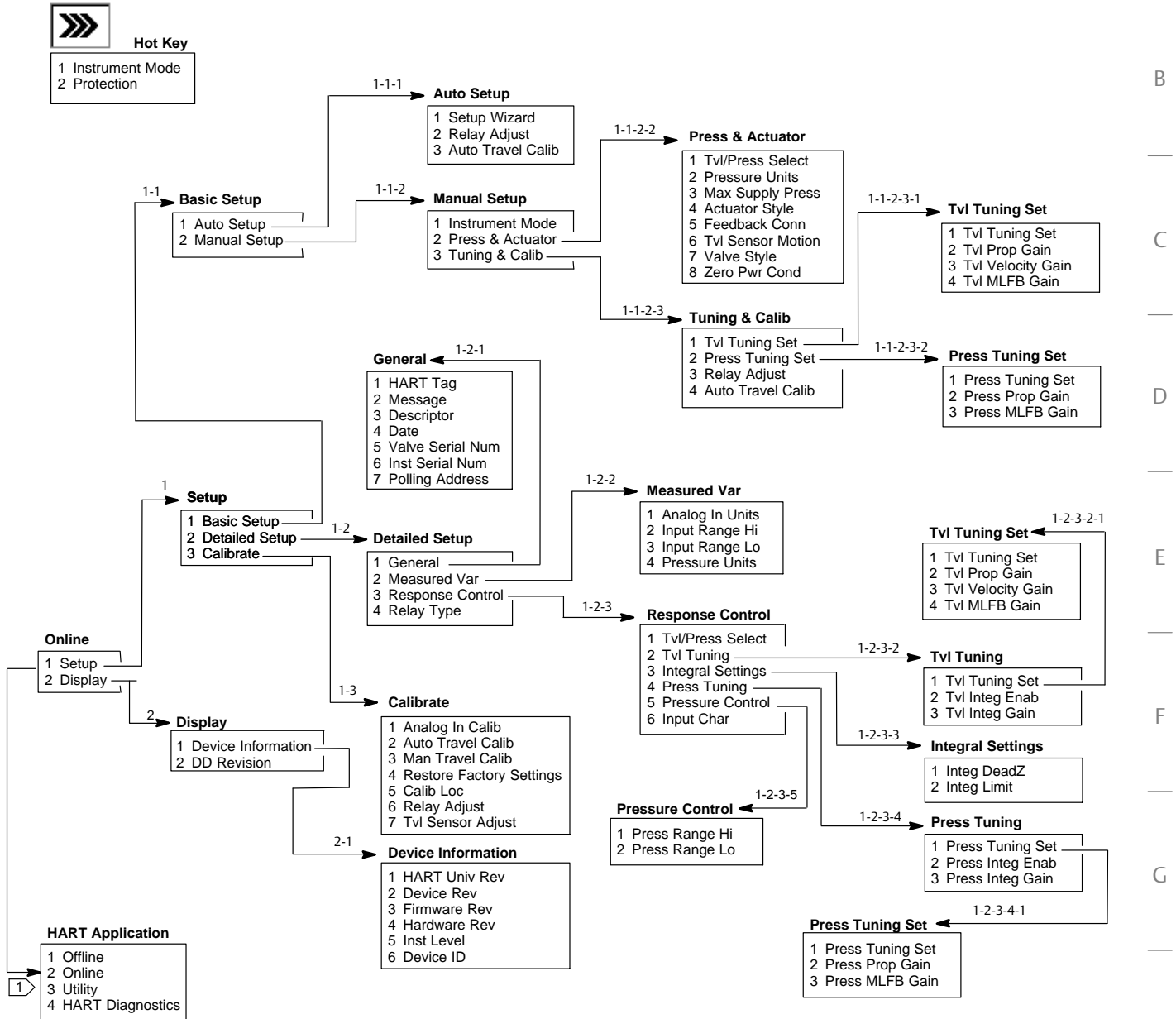
Fast Key Sequence for Instrument Level AC

Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾	Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾
Actuator Style	1-1-2-2-4	4-C	Pressure Proportional Gain	1-1-2-3-2-2	6-D
Analog Input Calibration	1-3-1	3-F		1-2-3-4-1-2	5-H
Analog Input Range Hi	1-2-2-2	4-E	Pressure Range Hi	1-2-3-5-1	4-G
Analog Input Range Lo	1-2-2-3	4-E	Pressure Range Lo	1-2-3-5-2	4-G
Analog Input Units	1-2-2-1	4-E	Pressure Tuning Set	1-1-2-3-2-1	6-D
Auto Travel Calibration	1-1-2-3-4	4-D		1-2-3-4-1-1	6-G
	1-3-2	3-F	Pressure Units	1-1-2-2-2	4-C
	1-1-1-3	3-C		1-2-2-4	4-E
Calibration Location	1-3-5	3-G	Protection	Hot Key-2	1-B
Date	1-2-1-4	3-D	Relay Adjust	1-1-1-2	3-B
Descriptor	1-2-1-3	3-D		1-1-2-3-3	4-D
Device Description Revision	2-2	2-F		1-3-6	3-G
Device Identification	2-1-6	3-H	Relay Type	1-2-4	3-E
Device Revision	2-1-2	3-G	Restore Factory Settings	1-3-4	3-F
Feedback Connection	1-1-2-2-5	4-C	Setup Wizard	1-1-1-1	3-D
Firmware Revision	2-1-3	3-G	Travel Integral Gain	1-2-3-2-3	6-F
Hardware Revision	2-1-4	3-G	Travel Integral Enable	1-2-3-2-2	6-F
HART Tag	1-2-1-1	3-D	Travel MLFB Gain	1-1-2-3-1-4	6-C
HART Universal Revision	2-1-1	3-G		1-2-3-2-1-4	6-E
Input Characterization	1-2-3-6	4-F	Travel / Pressure Select	1-1-2-2-1	4-C
Instrument Level	2-1-5	3-H		1-2-3-1	4-F
Instrument Mode	Hot Key-1	1-B	Travel Proportional Gain	1-1-2-3-1-2	6-C
	1-1-2-1	3-C		1-2-3-2-1-2	6-E
Instrument Serial Number	1-2-1-6	3-D	Travel Sensor Adjust	1-3-7	3-G
Integral Dead Zone	1-2-3-3-1	6-F	Travel Sensor Motion	1-1-2-2-6	4-C
Integral Limit	1-2-3-3-2	6-F	Travel Tuning Set	1-1-2-3-1-1	6-C
Manual Travel Calibration	1-3-3	3-F		1-2-3-2-1-1	6-E
Maximum Supply Pressure	1-1-2-2-3	4-C	Travel Velocity Gain	1-1-2-3-1-3	6-C
Message	1-2-1-2	3-D		1-2-3-2-1-3	6-E
Polling Address	1-2-1-7	3-E	Valve Serial Number	1-2-1-5	3-D
Pressure Integral Control Enable	1-2-3-4-2	6-G	Valve Style	1-1-2-2-7	4-C
Pressure Integral Gain	1-2-3-4-3	6-G	Zero Power Condition	1-1-2-2-8	4-C
Pressure MLFB Gain	1-1-2-3-2-3	6-D			
	1-2-3-4-1-3	5-H			

1. Coordinates are to help locate the item on the menu tree on the facing page.

DVC6000 Digital Valve Controllers

Field Communicator Menu Tree for Instrument Level AC



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.

1

2

3

4

5

6

DVC6000 Digital Valve Controllers



THE FIELDVUE DVC6000 DIGITAL VALVE CONTROLLERS 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 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 Digital Valve Controller

Section 1 Introduction

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DVC6000 Digital Valve Controllers

Table 1-1. Instrument Level Capabilities

CAPABILITY	DIAGNOSTIC LEVEL ⁽¹⁾				
	AC	HC	AD	PD	ODV
Auto Calibration	X	X	X	X	X
Custom Characterization	X	X	X	X	X
Burst Communication		X	X	X	X
Alerts		X	X	X	X
Step Response, Drive Signal Test & Dynamic Error Band			X	X	X
Advanced Diagnostics (Valve Signature)			X	X	X
Performance Tuner			X	X	X
Travel Control - Pressure Fallback			X	X	X
Performance Diagnostics				X	X
Solenoid Valve Testing				X	X
Lead/Lag Input Filter ⁽²⁾					X

1. See page 6-8 for additional diagnostic level information.
2. Refer to brochure part # D351146X012/D351146X412 for information on Fisher optimized digital valves for compressor antisurge applications.

1

Scope of Manual

This instruction manual includes specifications, installation, operating, and maintenance information for device revision 1, firmware revision 2–6 and device revision 2, firmware 7, 9, 10, and 11 digital valve controllers, instrument level AC, HC, AD, PD, and ODV.

This instruction manual describes using the 475 Field Communicator with device description revision 8 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 ValveLink software help or documentation.

Do not install, operate, or maintain a DVC6000 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.



W7957 / IL

Figure 1-1. Sliding-Stem Control Valve with FIELDVUE DVC6010 Digital Valve Controller

Conventions Used in this Manual



Procedures that require the use of the 475 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 the *Setup Wizard*, from the Online menu, press 1 (selects *Configure*) followed by a second 1 (selects *Basic Setup*) followed by a third 1 (selects *Setup Wizard*). The key sequence in the procedure heading is shown as (1-1-1). The path required to accomplish various tasks, the sequence of steps through the Field Communicator menus, is also presented in textual format. Menu selections are shown in italics, e.g., *Calibrate*. An overview of the Field Communicator menu trees are shown at the beginning of this manual.



W9418

Figure 1-2. Rotary Control Valve with FIELDVUE DVC6020 Digital Valve Controller

with the DVC6000 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 each diagnostic tier.

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

DVC6000 digital valve controllers are designed to directly replace standard pneumatic and electro-pneumatic valve mounted positioners.

Specifications

WARNING

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

Specifications for DVC6000 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.



Note

475 Field Communicator menu sequences used in this manual are for instrument level HC, AD, PD, and ODV, firmware 7 and above. Refer to the AC menu tree at the beginning of this manual for AC menu sequences.

These menu sequences are also applicable to the 375 Field Communicator.

Description

DVC6000 digital valve controllers (figures 1-1 and 1-2) are communicating, microprocessor-based current-to-pneumatic instruments. In addition to the normal function of converting an input current signal to a pneumatic output pressure, the DVC6000 digital valve controller, using the HART® communications protocol, gives 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.

Using a personal computer and ValveLink software or AMS Suite: Intelligent Device Manager, or a Field Communicator, you can perform several operations

Related Documents

Other documents containing information related to DVC6000 digital valve controllers include:

- Bulletin 62.1:DVC6000—Fisher FIELDVUE DVC6000 Digital Valve Controllers (D102758X012)
- Bulletin 62.1:DVC6000(S1)—Fisher FIELDVUE DVC6000 Digital Valve Controller Dimensions (D103308X012)
- Fisher FIELDVUE DVC6000 Digital Valve Controllers Quick Start Guide (D102762X012)

DVC6000 Digital Valve Controllers

1

- FIELDVUE Digital Valve Controller Split Ranging – Supplement to HART Communicating Fisher FIELDVUE Digital Valve Controller Instruction Manuals (D103262X012)

- Using FIELDVUE Instruments with the Smart HART Loop Interface and Monitor (HIM) – Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals (D103263X012)

- Using FIELDVUE Instruments with the Smart Wireless THUM™ Adapter and a HART Interface Module (HIM) – Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals

- Audio Monitor for HART Communications – Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals (D103265X012)

- HART Field Device Specification – Supplement to Fisher FIELDVUE DVC6000 Digital Valve Controller Instruction Manual (D103649X012)

- Using the HART Tri-Loop™ HART -to-Analog Signal Converter with FIELDVUE Digital Valve Controllers – Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals (D103267X012)

- Hot Swap Procedure – Supplement to HART Communicating Fisher FIELDVUE DVC5000 (Obsolete Product) and DVC6000 Digital Valve Controllers Instruction Manuals (D103264X012)

- Implementation of Lock-in-Last Strategy – Supplement to Fisher FIELDVUE DVC6000 and DVC6200 Digital Valve Controllers Instruction Manual (D103261X012)

- Fisher HF340 Filter Instruction Manual (D102796X012)

- ValveLink software help or documentation

- Field Communicator User's Manual

All documents are available from your Emerson Process Management sales office. Also visit our website at www.FIELDVUE.com.

Educational Services

For information on available courses for DVC6000 digital valve controllers, 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

Introduction and Specifications

Table 1-2. Specifications

Available Configurations	
<p>DVC6010: Sliding-stem applications DVC6020: Rotary and long-stroke sliding-stem applications [over 102 mm (4 inch) travel] DVC6030: Quarter-turn rotary applications</p>	<p>Maximum: 10 bar (145 psig) or maximum pressure rating of the actuator, whichever is lower</p> <p>Medium: Air or Natural Gas</p>
<p>Remote-Mounted Instrument⁽¹⁾</p>	<p><i>Air:</i> Supply pressure must be clean, dry air that meets the requirements of ISA Standard 7.0.01.</p>
<p>DVC6005: Base unit for 2 inch pipestand or wall mounting DVC6015: Feedback unit for sliding-stem applications DVC6025: Feedback unit for rotary or long-stroke sliding-stem applications DVC6035: Feedback unit for quarter-turn rotary applications</p> <p>DVC6000 digital valve controllers can be mounted on Fisher and other manufacturers rotary and sliding-stem actuators.</p>	<p><i>Natural Gas:</i> Natural gas must be clean, dry, oil-free, and noncorrosive. H₂S 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>Input Signal</p>	<p>Steady-State Air Consumption⁽³⁾⁽⁴⁾</p>
<p>Point-to-Point: <i>Analog Input Signal:</i> 4-20 mA DC, nominal Minimum Voltage Available at instrument terminals must be 10.5 volts DC for analog control, 11 volts DC for HART communication <i>Minimum Control Current:</i> 4.0 mA <i>Minimum Current w/o Microprocessor Restart:</i> 3.5 mA <i>Maximum Voltage:</i> 30 volts DC <i>Overcurrent Protection:</i> Input circuitry limits current to prevent internal damage. <i>Reverse Polarity Protection:</i> No damage occurs from reversal of loop current.</p> <p>Multi-drop: <i>Instrument Power:</i> 11-30 volts DC at approximately 8 mA <i>Reverse Polarity Protection:</i> No damage occurs from reversal of loop current.</p>	<p>Standard Relay: <i>At 1.4 bar (20 psig) supply pressure:</i> Less than 0.38 normal m³/hr (14 scfh) <i>At 5.5 bar (80 psig) supply pressure:</i> Less than 1.3 normal m³/hr (49 scfh)</p> <p>Low Bleed Relay: <i>At 1.4 bar (20 psig) supply pressure:</i> Average value 0.056 normal m³/hr (2.1 scfh) <i>At 5.5 bar (80 psig) supply pressure:</i> Average value 0.184 normal m³/hr (6.9 scfh)</p> <p>Maximum Output Capacity⁽³⁾⁽⁴⁾ <i>At 1.4 bar (20 psig) supply pressure:</i> 10.0 normal m³/hr (375 scfh) <i>At 5.5 bar (80 psig) supply pressure:</i> 29.5 normal m³/hr (1100 scfh)</p> <p>Independent Linearity⁽⁵⁾ ±0.50% of output span</p> <p>Electromagnetic Compatibility 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</p> <p><i>Lightning and Surge Protection</i>—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.</p>
<p>Output Signal</p>	
<p>Pneumatic signal as required by the actuator, up to full supply pressure. Minimum Span: 0.4 bar (6 psig) Maximum Span: 9.5 bar (140 psig) Action: Double, Single direct, and Single reverse</p>	
<p>Supply Pressure⁽²⁾</p> <p>Recommended: 0.3 bar (5 psi) higher than maximum actuator requirements, up to maximum supply pressure</p>	

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-continued-

DVC6000 Digital Valve Controllers

Table 1-2. Specifications (continued)

Vibration Testing Method

Tested per ANSI/ISA-S75.13.01 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

The input impedance of the DVC6000 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 11V @ 20 mA.

Operating Ambient Temperature Limits⁽²⁾⁽⁶⁾

-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

Refer to tables 1-4, 1-5, 1-6, and 1-7, Hazardous Areas Classifications and Special Instructions for "Safe Use" and Installation in Hazardous Locations in section 2, and Appendix B.

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

Electrical Housing:

CSA—Type 4X, IP66

FM—Type 4X, IP66

ATEX—IP66

IECEX—IP66

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

Connections

Supply Pressure: 1/4 NPT internal and integral pad for mounting 67CFR regulator

Output Pressure: 1/4 NPT internal

Tubing: 3/8-inch, recommended

Vent: 3/8 NPT internal

Electrical: 1/2 NPT internal conduit connection, M20 adapter optional

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Introduction and Specifications

Table 1-2. Specifications (continued)

<p>Stem/Shaft Travel</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>Mounting⁽⁷⁾</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>Weight</p> <p>Valve-Mounted Instruments Aluminum: 3.5 kg (7.7 lbs) Stainless Steel: 7.7 kg (17 lbs)</p> <p>Remote-Mounted Instruments <i>DVC6005 Base Unit:</i> 4.1 kg (9 lbs) <i>DVC6015 Feedback Unit:</i> 1.3 kg (2.9 lbs) <i>DVC6025 Feedback Unit:</i> 1.4 kg (3.1 lbs) <i>DVC6035 Feedback Unit:</i> 0.9 kg (2.0 lbs)</p> <p>Construction Materials</p> <p>Housing, module base and terminal box: A03600 low copper aluminum alloy</p>	<p>Cover: Thermoplastic polyester Elastomers: Nitrile (standard)</p> <p>Options</p> <ul style="list-style-type: none"> ■ Supply and output pressure gauges or ■ Tire valves, ■ Integral mounted filter regulator, ■ Stainless steel housing, module base and terminal box ■ Low bleed relay, ■ Inline 10 micrometer air filter ■ Safety Instrumented System (SIS) Solutions ■ Safety Related Nuclear Applications ■ Natural Gas Certified, Single Seal Device ■ Feedback Assembly PTFE Sleeve Protective Kit for aluminum units in saltwater or particulate environments <p>Declaration of SEP</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 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 m³/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 digital valve controllers in long-stroke applications.
6. Temperature limits vary based on hazardous area approval.
7. Do not use the DVC6010S or DVC6020S in high vibration service where the mounting bracket uses standoffs (spacers) to mount to the actuator. Due to NAMUR mounting limitations, do not use the DVC6030S in high vibration service.

Table 1-3. EMC Summary Results—Immunity

Port	Phenomenon	Basic Standard	Test Level	Performance Criteria ⁽¹⁾	
				Point-to-Point Mode	Multi-drop Mode
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	4 kV contact 8 kV air	A ⁽²⁾	A
	Radiated EM field	IEC 61000-4-3	80 to 1000 MHz @ 10V/m with 1 kHz AM at 80% 1400 to 2000 MHz @ 3V/m with 1 kHz AM at 80% 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 ⁽²⁾	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.

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

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

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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 DVC60x0S (x = 1,2,3)	IS Intrinsically Safe Class I,II,III Division 1 GP A,B,C,D, E,F,G per drawing GE42819 Natural Gas Approved	Vmax = 30 VDC Imax = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	Type 4X, IP66 Single Seal Device
		XP Explosion-proof Class I Division 1 GP B,C,D NI Non-incendive Class I Division 2 GP A,B,C,D DIP Dust Ignition-proof Class II, III Division 1 GP E,F,G S Suitable for Use Class II, III Division 2 GP F,G Natural Gas Approved	---		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	Type 4X, IP66 Single Seal Device
	DVC6005	IS Intrinsically Safe Class I,II,III Division 1 GP A,B,C,D,E, F,G per drawing GE42819 Natural Gas Approved	Vmax = 30 VDC Imax = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W	Voc = 9.6 VDC Isc = 3.5 mA Ca = 3.6 uF La = 100 mH Po = 8.4 mW	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	Type 4X, IP66 Single Seal Device
		XP Explosion-proof Class I Division 1 GP B,C,D NI Non-incendive Class I Division 2 GP A,B,C,D DIP Dust Ignition-proof Class II, III Division 1 GP E,F,G S Suitable for Use Class II, III Division 2 GP F,G Natural Gas Approved	---		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	Type 4X, IP66 Single Seal Device
	DVC60x5 (x = 1,2,3)	IS Intrinsically Safe Class I,II,III Division 1 GP A,B,C,D, E,F,G per drawing GE42819	Vmax = 30 VDC Imax = 100 mA Ci = 0 uF Li = 0 mH Pi = 160 mW		T4(Tamb ≤ 125°C) T5(Tamb ≤ 95°C) T6(Tamb ≤ 80°C)	Type 4X, IP66
		XP Explosion-proof Class I Division 1 GP A,B,C,D NI Non-incendive Class I Division 2 GP A,B,C,D DIP Dust Ignition-proof Class II, III Division 1 GP E,F,G S Suitable for Use Class II, III Division 2 GP F,G	---		T4(Tamb ≤ 125°C) T5(Tamb ≤ 95°C) 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 DVC60x0S (x = 1,2,3)	Ⓔ II 1 G & D Intrinsically Safe Gas Ex ia IIC T5/T6 Ga Dust Ex ia IIIC T85°C (Ta ≤ +73°C), T92°C (Ta ≤ +80°C) Da Per drawing GE60771 Natural Gas Approved	Ui = 30 VDC Ii = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66 Single Seal Device
		Ⓔ II 2 G Flameproof Gas Ex d IIC T5/T6 Gb Natural Gas Approved	---		T5(Tamb ≤ 85°C) T6(Tamb ≤ 80°C)	IP66 Single Seal Device
		Ⓔ II 3 G Type n Gas Ex nC IIC T5/T6 Gc	---		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66 Single Seal Device
	DVC6005	Ⓔ II 1 G & D Intrinsically Safe Gas Ex ia IIC T5/T6 Ga Dust Ex ia IIIC T85°C (Ta ≤ +76°C), T89°C Ta ≤ +80°C) Da Per drawing GE60771 Natural Gas Approved	Ui = 30 VDC Ii = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W	Uo = 9.6 VDC Io = 3.5 mA Co = 3.6 uF Lo = 100 mH Po = 8.4 mW	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66 Single Seal Device
		Ⓔ II 2 G Flameproof Gas Ex d IIC T5/T6 Gb Natural Gas Approved	---		T5(Tamb ≤ 85°C) T6(Tamb ≤ 80°C)	IP66 Single Seal Device
		Ⓔ II 3 G Type n Gas Ex nC IIC T5/T6 Gc	---		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66 Single Seal Device
	DVC60x5 (x = 1,2,3)	Ⓔ II 1 G & D Intrinsically Safe Gas Ex ia IIC T4/T5/T6 Ga Dust Ex ia IIIC T85°C (Tamb ≤ +64°C) T100°C (Tamb ≤ +79°C), T135°C (Tamb ≤ +114°C) T146°C (Tamb ≤ +125°C) Da Per drawing GE60771	Ui = 30 VDC Ii = 100 mA Ci = 0 uF Li = 0 mH Pi = 160 mW		T4(Tamb ≤ 125°C) T5(Tamb ≤ 95°C) T6(Tamb ≤ 80°C)	IP66
		Ⓔ II 2 G Flameproof Gas Ex d IIC T4/T5/T6 Gb	---		T4(Tamb ≤ 125°C) T5(Tamb ≤ 95°C) T6(Tamb ≤ 80°C)	IP66
		Ⓔ II 3 G Type n Gas Ex nA IIC T4/T5/T6 Gc	---		T4(Tamb ≤ 125°C) T5(Tamb ≤ 95°C) T6(Tamb ≤ 80°C)	IP66

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Introduction and Specifications

Table 1-7. Hazardous Area Classifications—IECEX

Certificate	Type	Certification Obtained	Entity Rating		Temperature Code	Enclosure Rating	
IECEX	DVC60x0 DVC60x0S (x = 1,2,3)	Intrinsically Safe Gas Ex ia IIC T5/T6 per drawing GE42990 Natural Gas Approved	U _i = 30 VDC I _i = 226 mA C _i = 5 nF L _i = 0.55 mH P _i = 1.4 W		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66 Single Seal Device	
		Flameproof Gas Ex d IIC T5/T6 Natural Gas Approved		---	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66 Single Seal Device	
		Type n Gas Ex nC IIC T5/T6 Natural Gas Approved		---	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66 Single Seal Device	
	DVC6005	Intrinsically Safe Gas Ex ia IIC T5/T6 per drawing GE42990 Natural Gas Approved	U _i = 30 VDC I _i = 226 mA C _i = 5 nF L _i = 0.55 mH P _i = 1.4 W	U _o = 9.6 VDC I _o = 3.5 mA C _a = 3.6 uF L _a = 100 mH P _o = 8.4 mW		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66 Single Seal Device
		Flameproof Gas Ex d IIC T5/T6 Natural Gas Approved			---	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66 Single Seal Device
		Type n Gas Ex nC IIC T5/T6 Natural Gas Approved			---	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66 Single Seal Device
	DVC60x5 (x = 1,2,3)	Intrinsically Safe Gas Ex ia IIC T4/T5/T6 per drawing GE42990	U _i = 30 VDC I _i = 100 mA C _i = 0 uF L _i = 0 mH P _i = 160 mW			T4(Tamb ≤ 125°C) T5(Tamb ≤ 95°C) T6(Tamb ≤ 80°C)	IP66
		Flameproof Gas Ex d IIC T4/T5/T6			---	T4(Tamb ≤ 125°C) T5(Tamb ≤ 95°C) T6(Tamb ≤ 80°C)	IP66
		Type n Gas Ex nA IIC T4/T5/T6			---	T4(Tamb ≤ 125°C) T5(Tamb ≤ 95°C) T6(Tamb ≤ 80°C)	IP66

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Section 2 Installation

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

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Installation

The DVC6000 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 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 federal 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 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.

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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 federal 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.

DVC6000 Digital Valve Controllers

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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

Intrinsically Safe, Explosion-proof, Division 2, Dust Ignition-proof

No special conditions for safe use.

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

FM

Special Conditions of Safe Use

Intrinsically Safe, 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. Part of the enclosure is constructed from plastic. To prevent the risk of electrostatic sparking the plastic surface should only be cleaned with a damp cloth.

Refer to table 1-5 for approval information, figures B-6 and B-7 for FM loop schematics, and figures 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:
 $U_o \leq 30 \text{ V}$; $I_o \leq 226 \text{ mA}$; $P_o \leq 1.4 \text{ W}$

3. Operating ambient temperature: -52°C or -40°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, figure 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°C or -40°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°C or -40°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 nA / Ex d

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

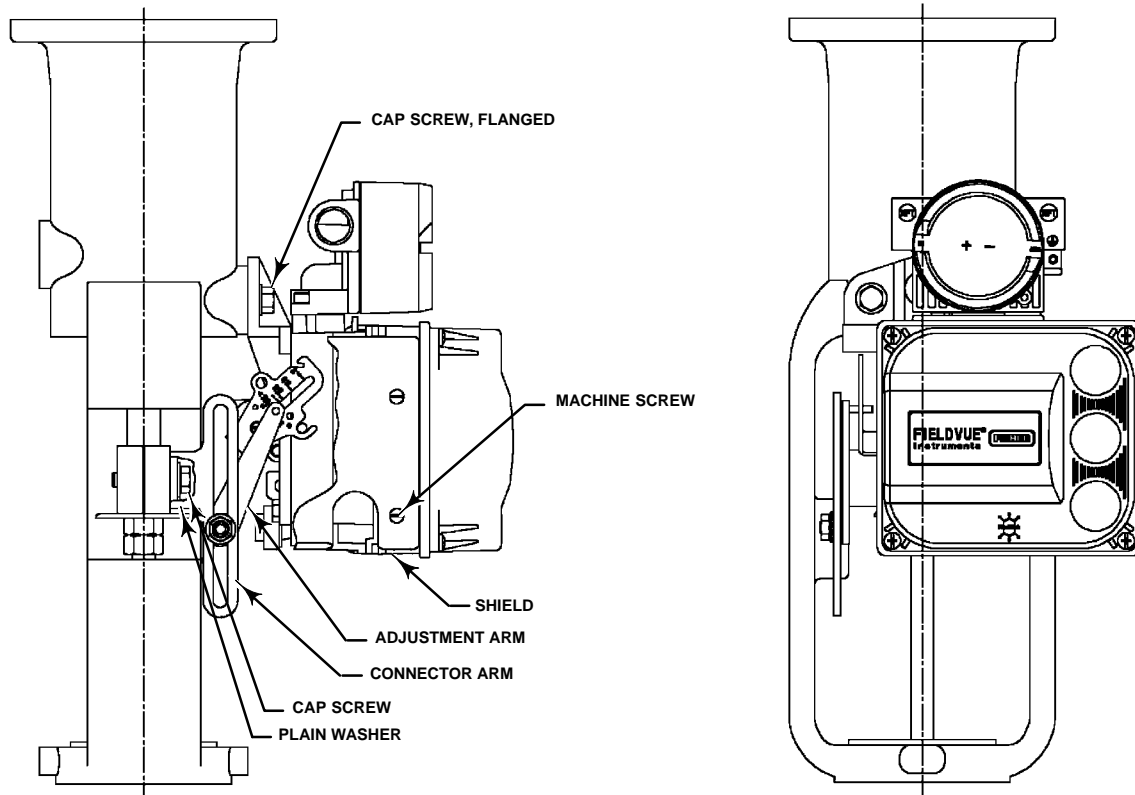
Ex nC / Ex nA, Ex d

2. Do not open while energized.

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

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29B1674-A / DOC

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

Mounting Guidelines

DVC6010 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 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 digital valve controller.



Note

Do not use the stainless steel DVC6010S 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 8-2.

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.

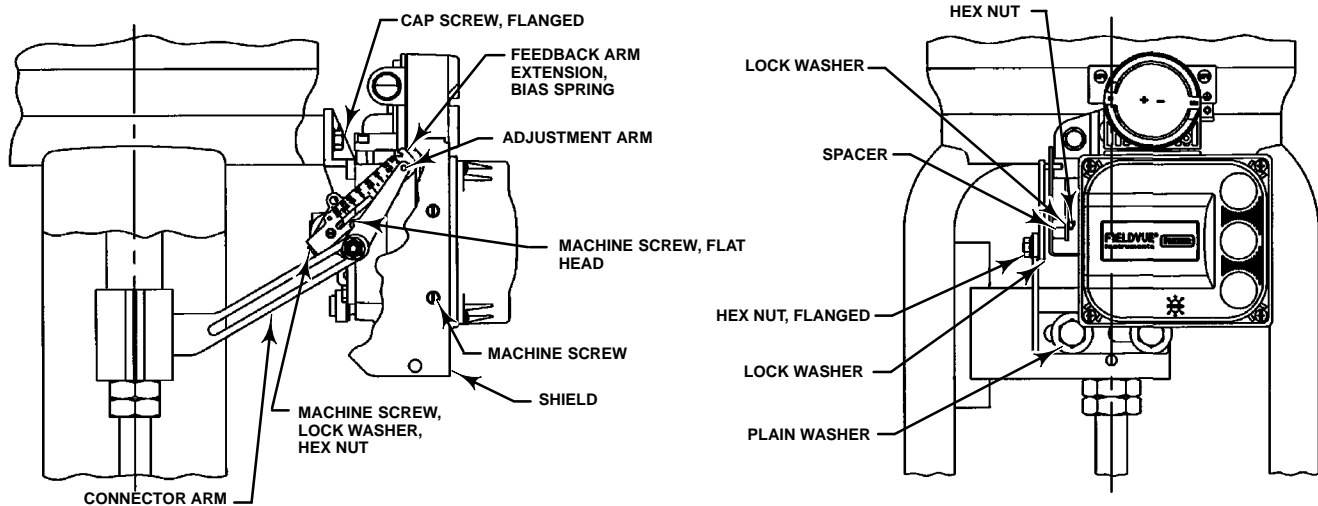
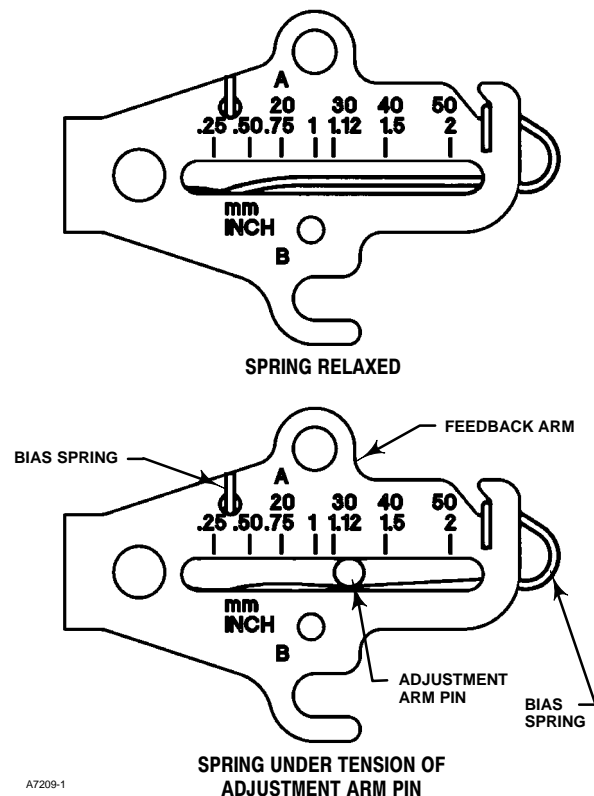


Figure 2-2. FIELDVUE DVC6010 Digital Valve Controller Mounted on Sliding-Stem Actuator with 2 to 4 Inches Travel

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



A7209-1

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

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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.



Note

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

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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.

DVC6020 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.

DVC6020 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 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 8-3. 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 digital valve controller with the pipe-away bracket and to transfer the feedback parts from the existing mounting bracket to the pipe-away bracket.



Note

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

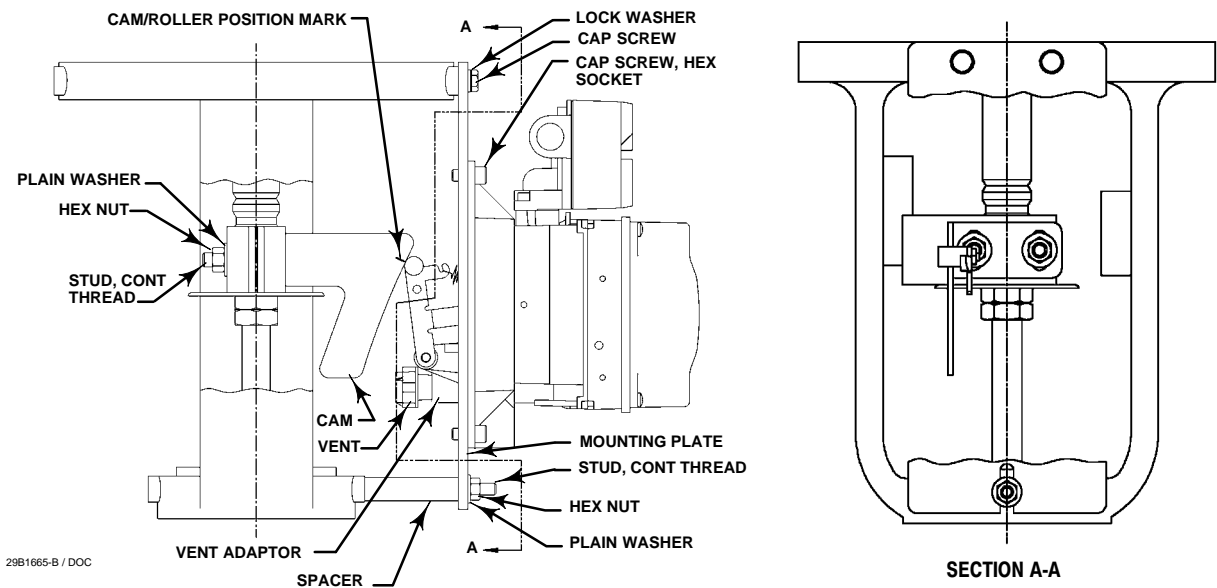


Figure 2-4. FIELDVUE DVC6020 Digital Valve Controller Mounted on Long-Stroke Sliding-Stem Actuator

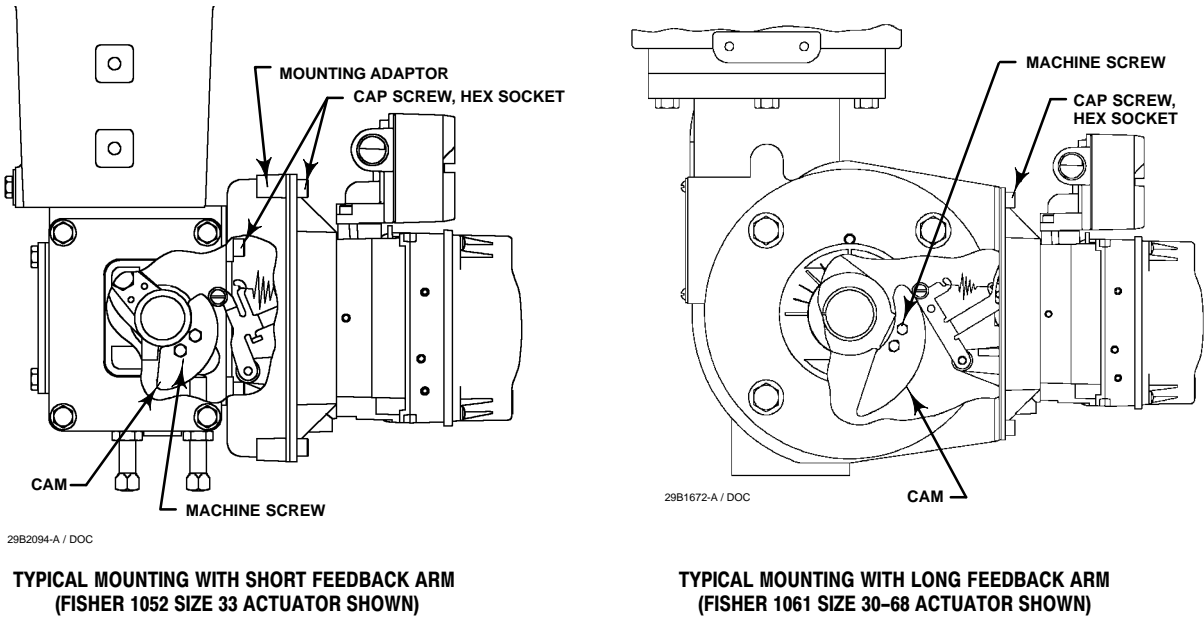


Figure 2-5. FIELDVUE DVC6020 Digital Valve Controller Mounted on Rotary Actuator

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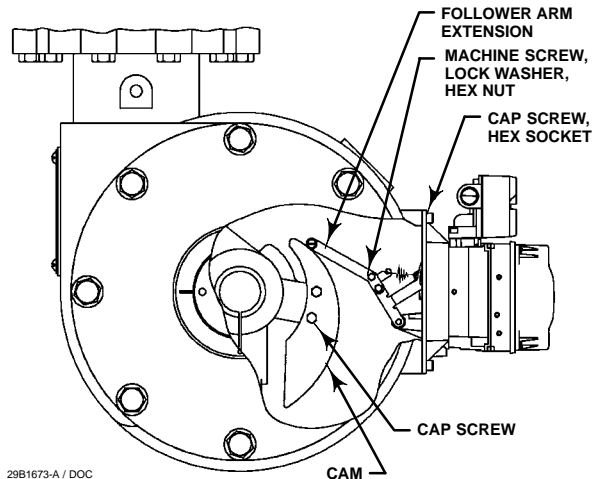


Figure 2-6. FIELDVUE DVC6020 Digital Valve Controller with Long Feedback Arm and Follower Arm Extension Mounted on a Rotary Actuator

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 arm assembly pin as shown in figure 2-7.

7. Mount the DVC6020 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.

- 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.

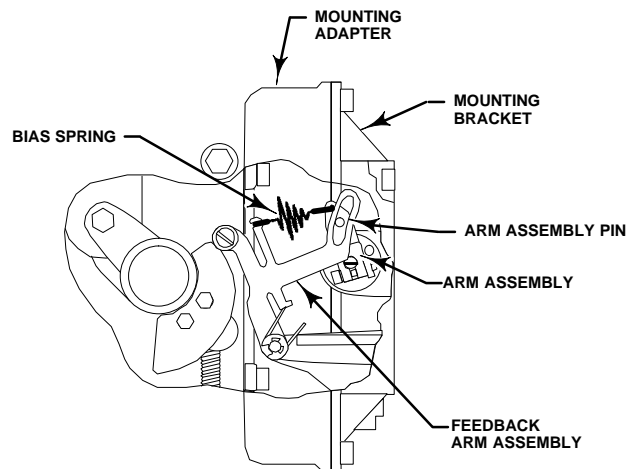


Figure 2-7. Locating Adjustment Arm Pin in Feedback Arm of a FIELDVUE DVC6020 Digital Valve Controller

DVC6030 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 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 in high vibration service.

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.

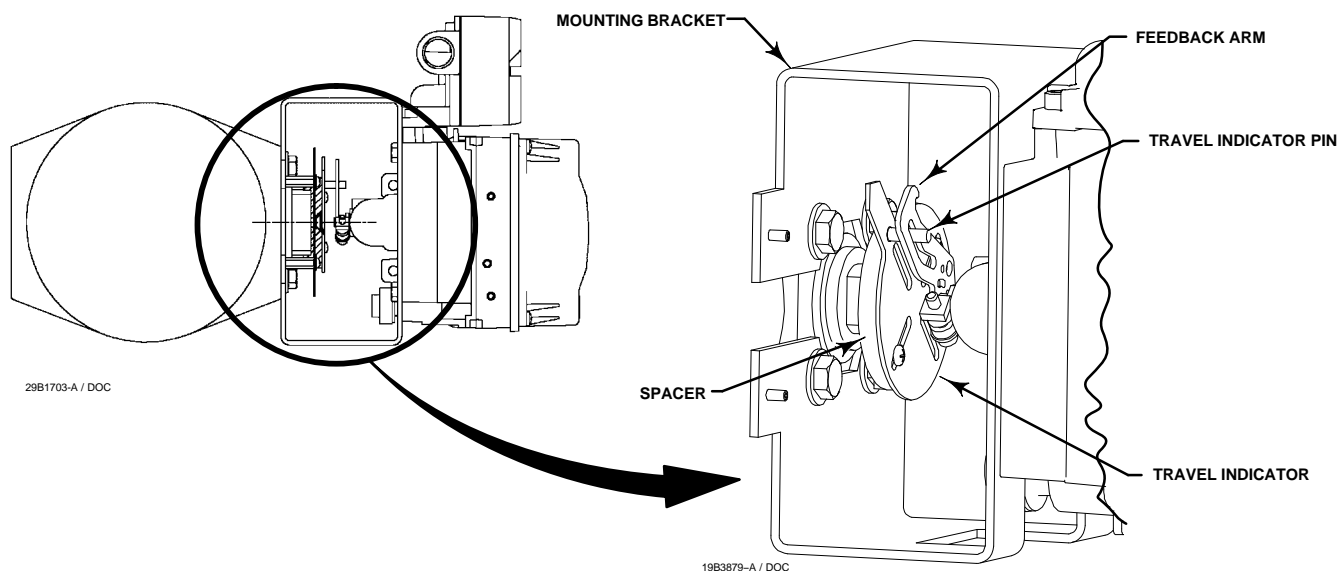


Figure 2-8. Mounting a FIELDVUE DVC6030 Digital Valve Controller on a Rotary Actuator (Fisher 1032 Size 425A Shown)

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.



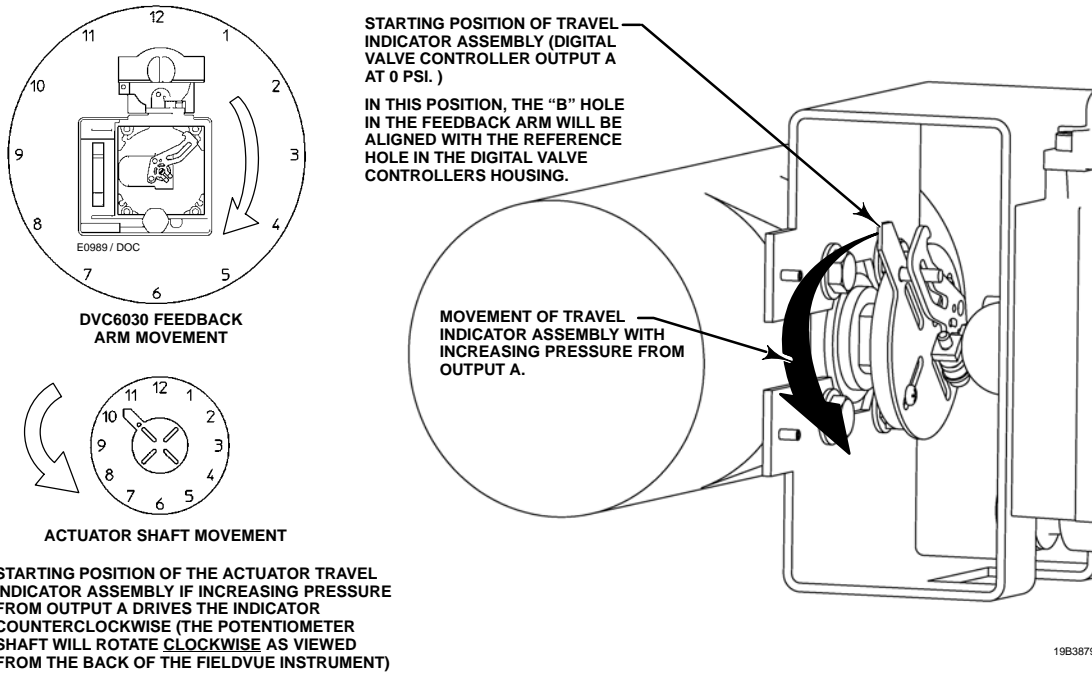
Note

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 that 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.

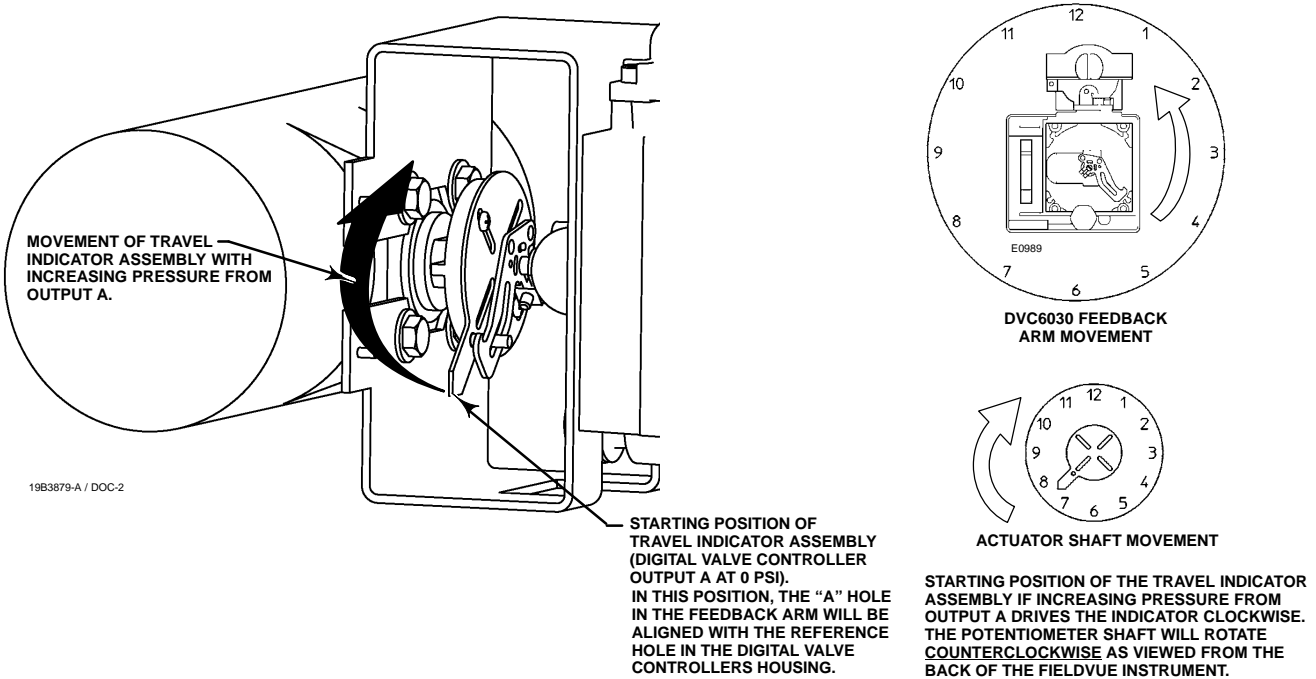
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2



NOTE: DVC6030 TRAVEL COUNTS (CLOCKWISE) = 3400 ± 200

Figure 2-9. Explanation of FIELDVUE DVC6030 Travel Indicator Starting Position and Movement, if **Clockwise** Orientation is Selected for "Travel Sensor Motion" in ValveLink Software or the Field Communicator



NOTE: DVC6030 TRAVEL COUNTS (COUNTERCLOCKWISE) = 600 ± 200

Figure 2-10. Explanation of FIELDVUE DVC6030 Travel Indicator Starting Position and Movement if **Counterclockwise** Orientation is Selected for "Travel Sensor Motion" in ValveLink Software or the Field Communicator

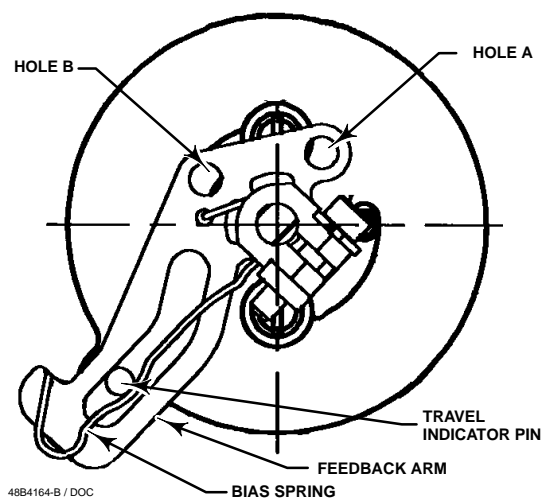


Figure 2-11. Positioning Travel Indicator Pin in the Feedback Arm (Viewed as if Looking from the FIELDVUE DVC6030 toward the Actuator)

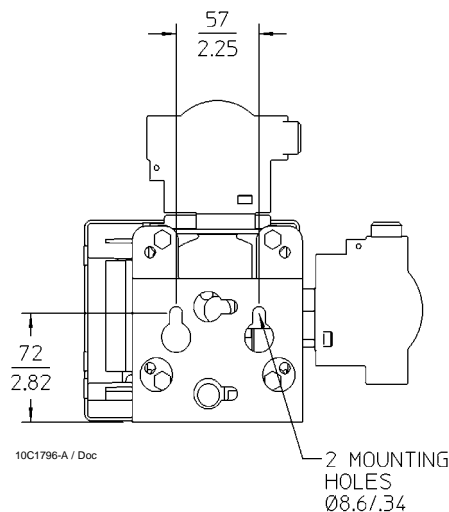


Figure 2-12. FIELDVUE DVC6005 Base Unit with Mounting Bracket (Rear View)

DVC6005 Base Unit

For remote-mounted digital valve controllers, the DVC6005 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 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.

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, 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 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.

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Note

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

2

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 8-7.

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.

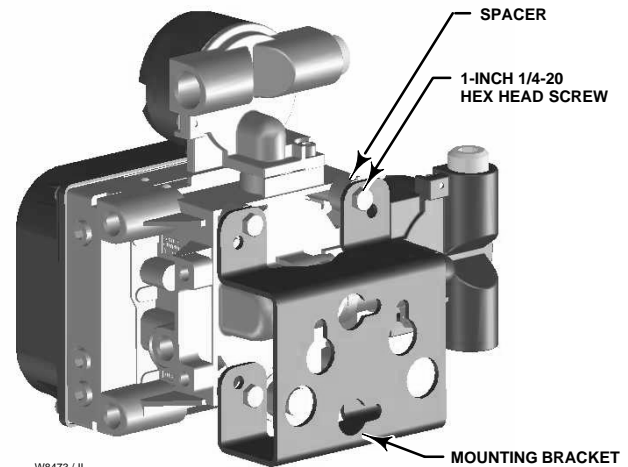
4. If valve travel exceeds 2 inches, a feedback arm extension is attached to the existing 2-inch feedback arm. Remove the existing bias spring (key 78) from the 2-inch feedback arm (key 79). Attach the feedback arm extension to the feedback arm (key 79) as shown in figure 2-2.

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

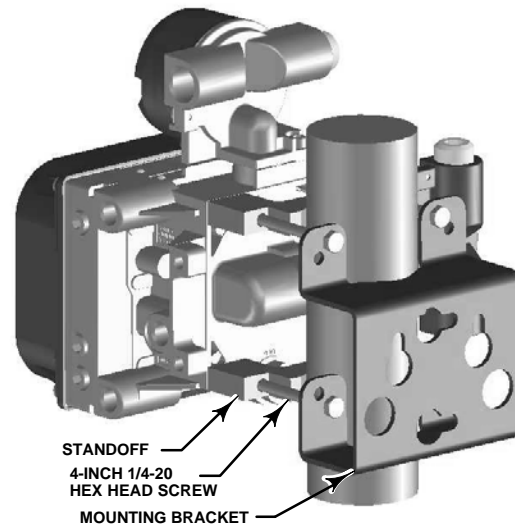
6. Set the position of the feedback arm (key 79) on the remote feedback unit to the no air position by inserting the alignment pin (key 46) through the hole on the feedback arm as follows:

- **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.



WALL MOUNTING



PIPESTAND MOUNTING

Figure 2-13. FIELDVUE DVC6005 Base Unit Mounting



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 lubricant 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 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, 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:

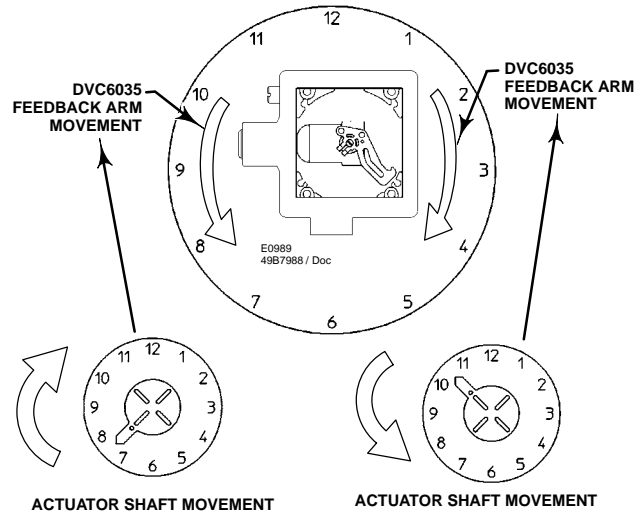
1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working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

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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.



STARTING POSITION OF THE TRAVEL INDICATOR ASSEMBLY IF INCREASING PRESSURE FROM OUTPUT A DRIVES THE INDICATOR CLOCKWISE. THE POTENTIOMETER SHAFT WILL ROTATE COUNTERCLOCKWISE AS VIEWED FROM THE BACK OF THE INSTRUMENT.

NOTE: DVC6035 TRAVEL COUNTS (COUNTERCLOCKWISE) = 600 ± 200

STARTING POSITION OF THE TRAVEL INDICATOR ASSEMBLY IF INCREASING PRESSURE FROM OUTPUT A DRIVES THE INDICATOR COUNTERCLOCKWISE. THE POTENTIOMETER SHAFT WILL ROTATE CLOCKWISE AS VIEWED FROM THE BACK OF THE INSTRUMENT

NOTE: DVC6035 TRAVEL COUNTS (CLOCKWISE) = 3400 ± 200

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.

2



Note

Refer to the DVC6005 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, 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.



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 that 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.

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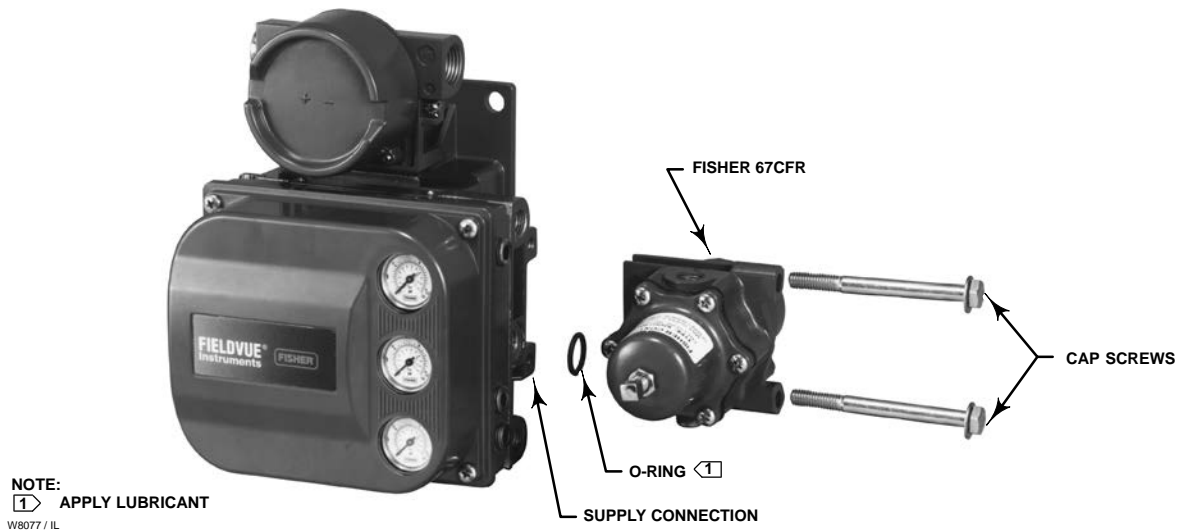


Figure 2-15. Mounting the Fisher 67CFR Regulator on a FIELDVUE DVC6000 Digital Valve Controller

67CFR Filter Regulator

A 67CFR filter regulator, when used with DVC6000 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.

Pressure Connections



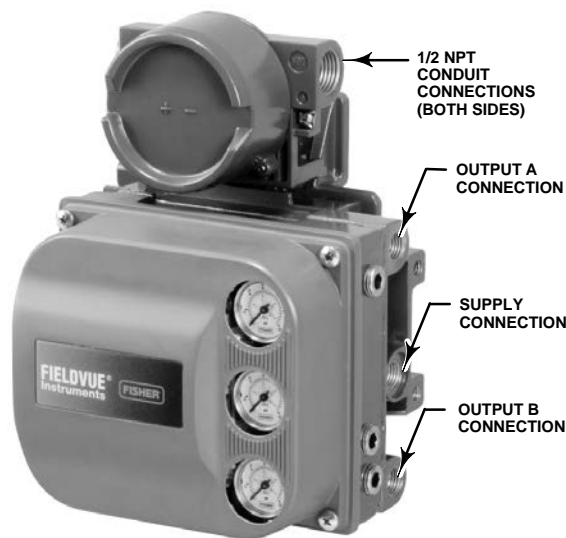
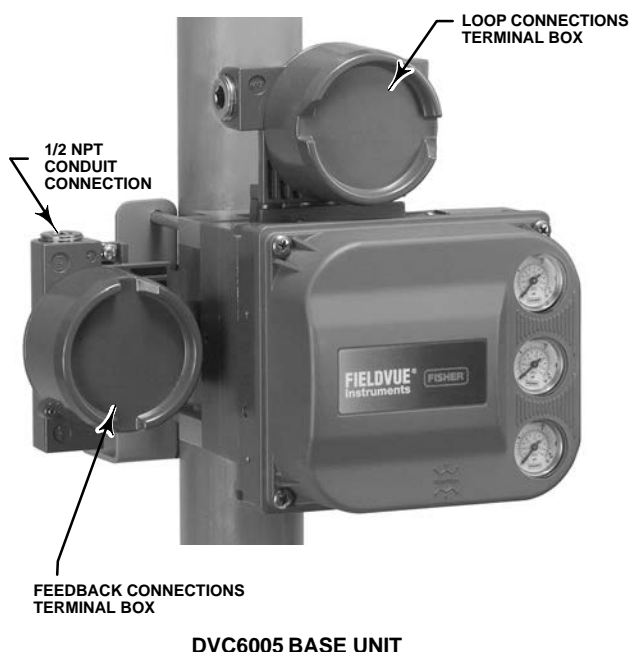
WARNING

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

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

2



VALVE MOUNTED UNIT

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

Figure 2-16. FIELDVUE DVC6000 Digital Valve Controller 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.

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.

DVC6000 Digital Valve Controllers

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- 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 that the covers is 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.

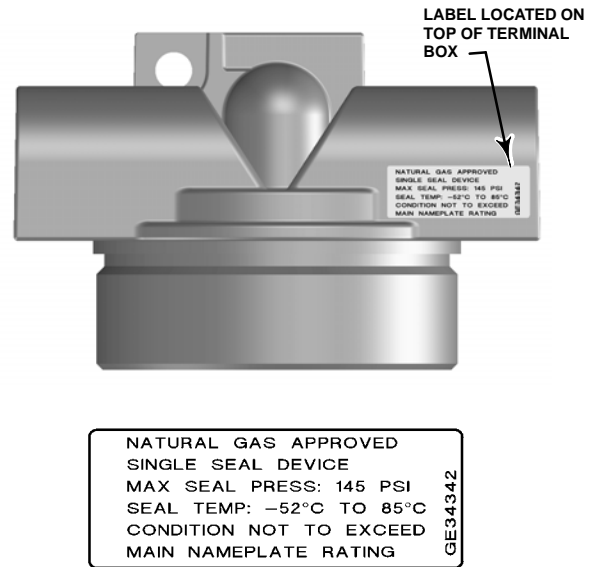


Figure 2-17. Gas Certified Label

The DVC6000 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 to any connected equipment. In normal operation the unit will vent the supply medium into the surrounding atmosphere unless it is remotely vented.

Natural 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 digital valve controller.

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. H₂S content should not exceed 20 ppm.

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.

A 67CFR filter regulator with standard 5 micrometer filter, or equivalent, may be used to filter and regulate supply medium. 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).

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, or installing the remote-mounted DVC6005 base unit, 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 connect OUTPUT A to the actuator pneumatic input.

When using a single-acting reverse digital valve controller (relay B) on a single-acting actuator connect OUTPUT B to the actuator diaphragm casing.

Double-Acting Actuators

DVC6000 digital valve controllers on double-acting actuators always use relay A. With no input current, OUTPUT A is at 0 pressure and OUTPUT B is at full supply pressure when the relay is properly adjusted.

To have the actuator stem extend from the cylinder with increasing input signal, connect OUTPUT A to the upper actuator cylinder connection. Connect OUTPUT B to the lower cylinder connection. Figure 2-18 shows the digital valve controller connected to a double-acting piston actuator.



W9131-1

Figure 2-18. FIELDVUE DVC6010 Digital Valve Controller Mounted on Fisher 585C Piston Actuator

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

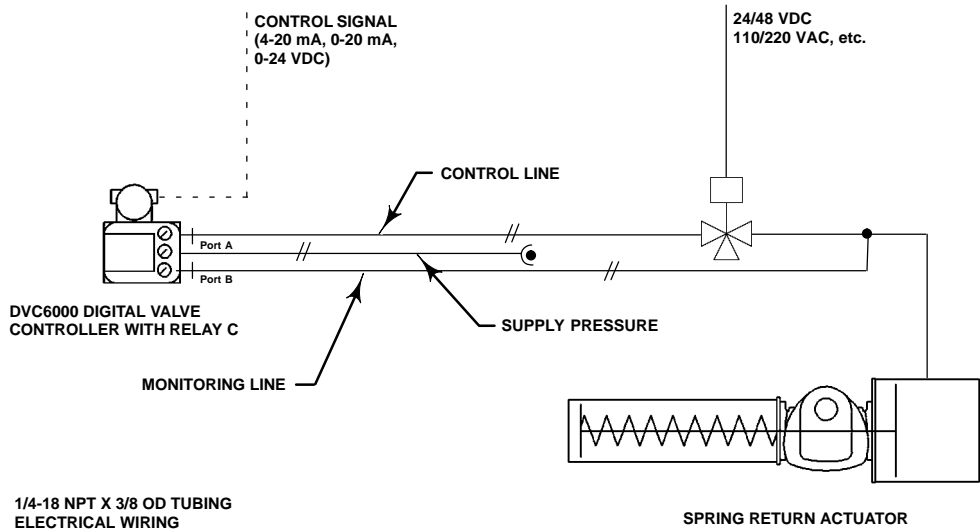


Figure 2-19. Pneumatic Hookup for Solenoid Testing

Special Construction to Support Solenoid Valve Testing

In single-acting actuator applications with a solenoid valve installed, the DVC6000 can be configured to test the operation of the solenoid valve. This is accomplished by connecting the “unused” output port from the DVC6000 to the pneumatic 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.



Note

Solenoid valve testing is only available for instrument level PD and ODV.

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 federal 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 medium 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 and DVC6030 digital valve controllers and DVC6005 base unit—remove the plastic vent (key 52, figures 8-2 and 8-5). 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 digital valve controllers—replace the standard mounting bracket (key 74, figures 8-3 and 8-5) 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.

2

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.

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 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.

DVC6000 Digital Valve Controllers

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.

2

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 8-2 through 8-4 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.

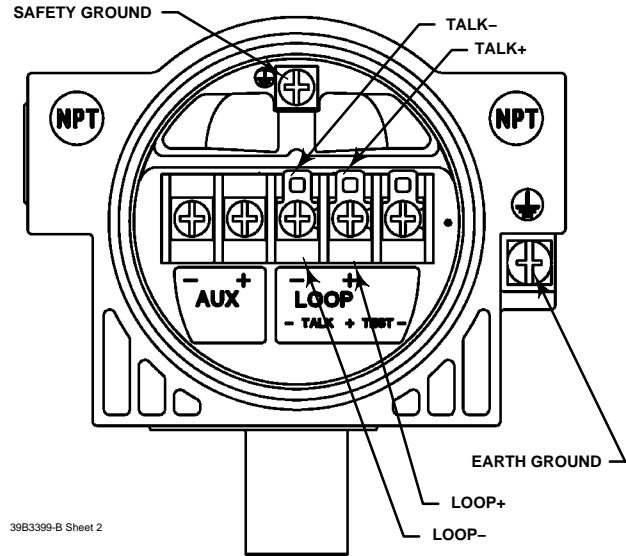


Figure 2-20. FIELDVUE DVC6000 Digital Valve Controller Terminal Box

WARNING

Personal injury or property damage, caused by fire or explosion, can result from the discharge of static electricity. Connect a 14 AWG (2.08 mm²) 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.

Remote Travel Sensor Connections

The DVC6005 base unit is designed to receive travel information via a remote sensor. The remote 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.

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.

2



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.

DVC6000 Digital Valve Controllers

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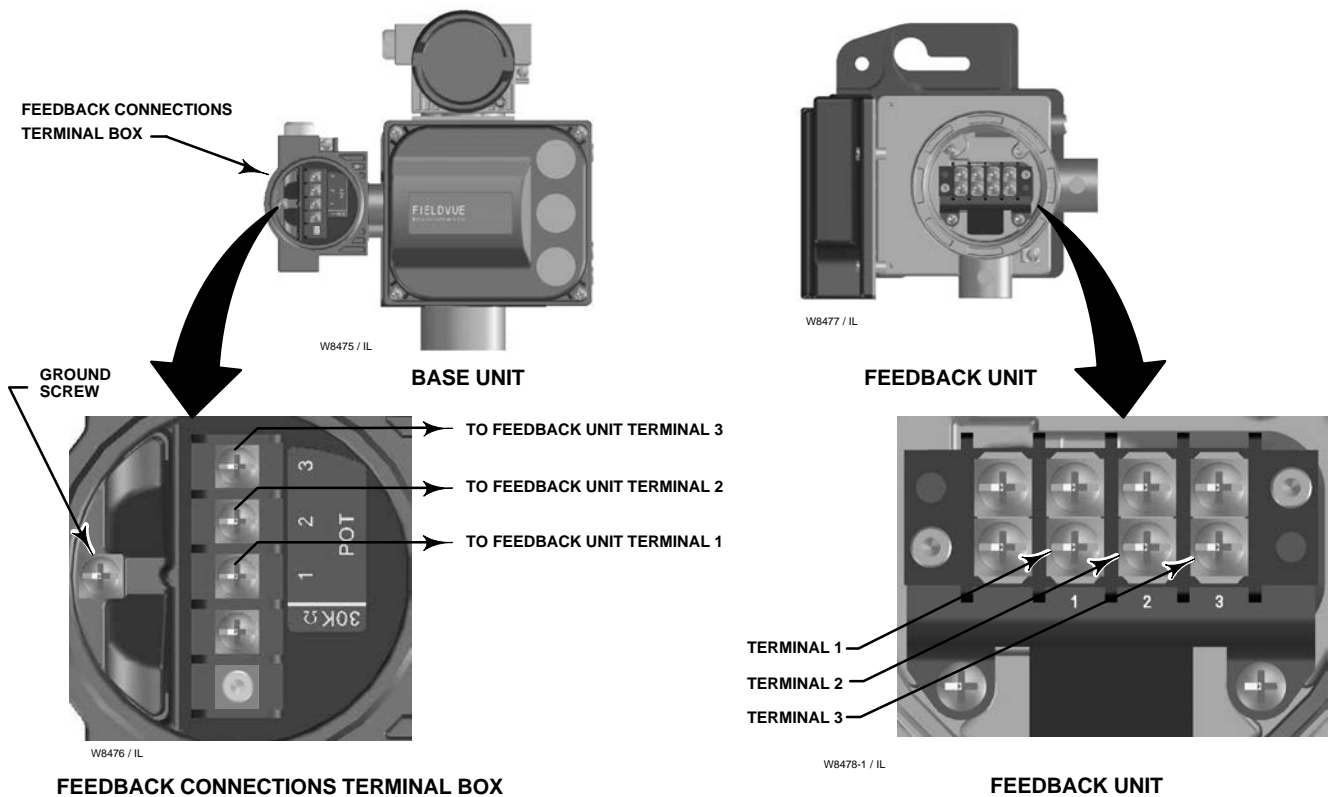


Figure 2-21. Terminal Details for Connecting Base Unit and Feedback Units of Remote-Mounted Digital Valve Controllers



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) 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 connections terminal box of the DVC6005 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.

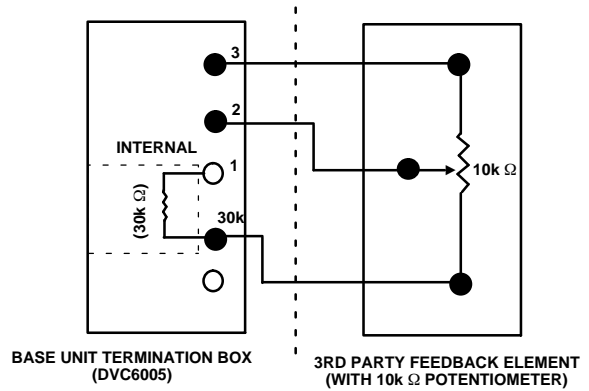


Figure 2-22. Terminal Details for Connecting a FIELDVUE DVC6005 Base Unit and a 10k Ohm External Potentiometer

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).

4. Connect one wire of the 3-conductor shielded cable between the terminal labeled "30kΩ" 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

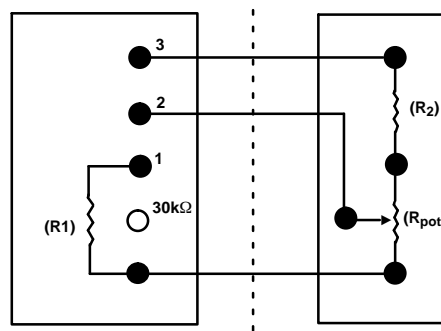
To prevent damage to the potentiometer, ensure that it is free to travel the entire length of the actuator's travel.



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:



BASE UNIT TERMINATION BOX (DVC6005)

THREE-RESISTOR SERIES

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

- 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.
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.

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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.

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 475 Field Communicator or a personal computer running ValveLink software communicating through a HART modem, interfaces with the DVC6000 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.

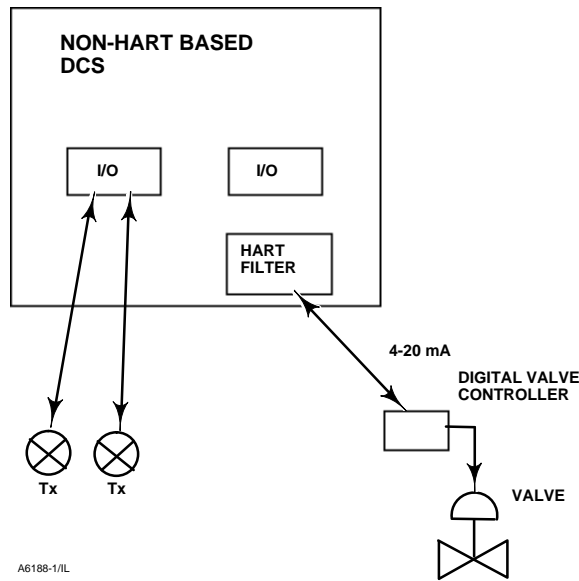


Figure 2-24. HART Filter Application

Wiring Practices

Control System Requirements

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

HART Filter

Depending on the control system you are using, a HART filter may be needed to allow HART communication. The HART filter is a passive device that is inserted in field wiring from the HART loop. The filter is normally installed near the field wiring terminals of the control system I/O (see figure 2-24). Its purpose is to effectively isolate the control system output from modulated HART communication signals and raise the impedance of the control system to allow HART

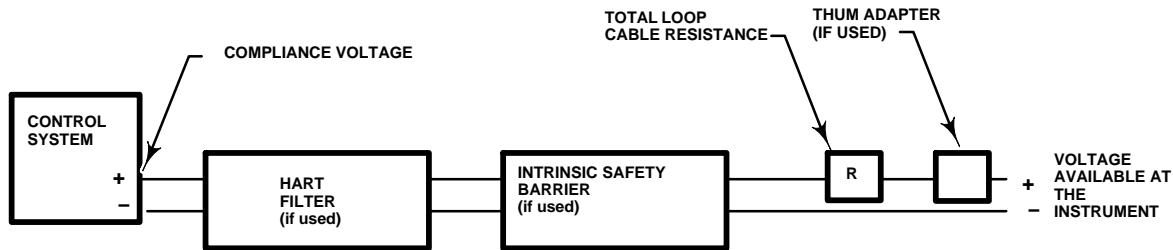
communication. For more information on the description and use of the HART filter, refer to the separate HART filter instruction manual.

Contact your Emerson Process Management sales office if assistance is needed to determine if your system requires a filter.



Note

A HART filter is typically NOT required for any of the Emerson Process Management control systems, including PROVOX™, RS3™, and DeltaV™ systems.



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

– Smart Wireless THUM adapter voltage drop (if used) 2

– Total loop cable resistance x maximum loop current

= Voltage available at the instrument 3

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 drop of the THUM adapter is linear from 2.25 volts at 3.5 mA to 1.2 volts at 25 mA.

3 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 2-25. Determining Voltage Available at the Instrument

Voltage Available

The voltage available at the DVC6000 digital valve controller must be at least 11 volts DC. 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 2-25, the voltage available at the instrument depends upon:

- the control system compliance voltage
- if a filter, wireless THUM adapter, 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 × maximum current] – [barrier resistance x maximum current].

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

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

DVC6000 Digital Valve Controllers

Table 2-1. Cable Characteristics

Cable Type	Capacitance ⁽¹⁾ pF/Ft	Capacitance ⁽¹⁾ pF/m	Resistance ⁽²⁾ Ohms/ft	Resistance ⁽²⁾ 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.

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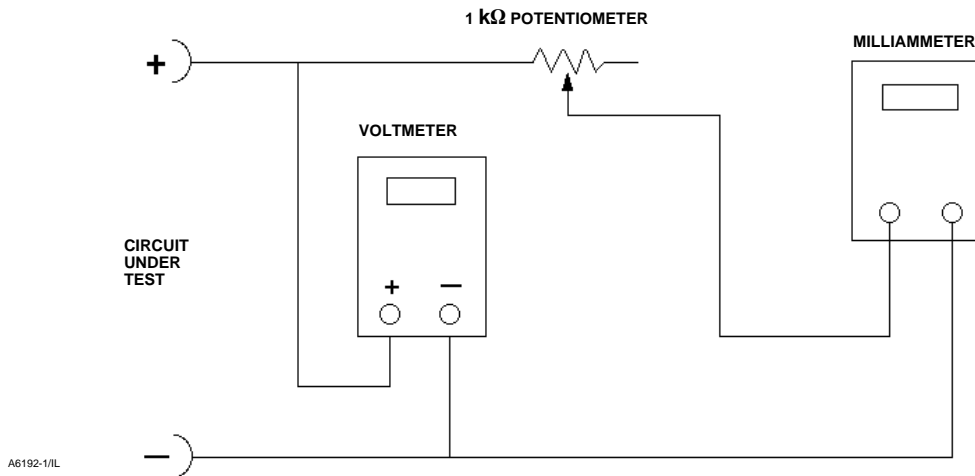


Figure 2-26. Voltage Test Schematic

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 2-26 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 2-26, 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.

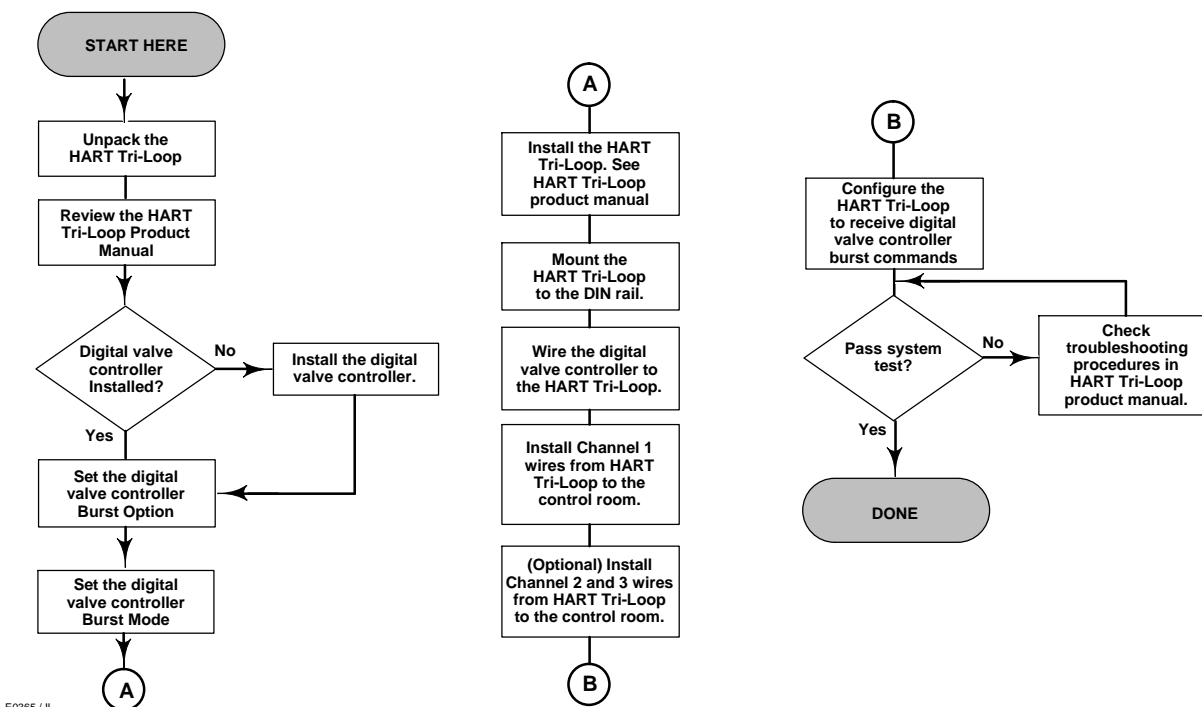


Figure 2-27. HART Tri-Loop Installation Flowchart

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 ensure that the HART network RC time constant will be no greater than 65 μs (per the HART specification).

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

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

The following example shows how to calculate the cable length for a Foxboro™ I/A control system (1988) with a C_{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 Conjunction with a Rosemount™ 333 HART Tri-Loop HART-to-Analog Signal Converter

Use the DVC6000 digital valve controller in operation with a Rosemount 333 HART Tri-Loop HART-to-Analog Signal Converter to acquire an independent 4-20 mA analog output signal for the analog input, travel target, pressure, or travel. The HART Tri-Loop accepts any three of these digital signals and converts them into three separate 4-20 mA analog channels.

Refer to figure 2-27 for basic installation information. Refer to the 333 HART Tri-Loop HART-to-Analog Signal Converter Product Manual for complete installation information.

Commissioning the Digital Valve Controller for use with the HART Tri-Loop Signal Converter

To prepare the digital valve controller for use with a 333 HART Tri-Loop, you must configure the digital valve controller to burst mode, and select Burst Command 3. In burst mode, the digital valve controller provides digital information to the HART Tri-Loop

DVC6000 Digital Valve Controllers

HART-to-Analog Signal Converter. The HART Tri-Loop converts the digital information to a 4 to 20 mA analog signal. Each burst message contains the latest value of the primary (analog input), secondary (travel target), tertiary (configured output pressure), and quaternary (travel) variables.

To commission a DVC6000 digital valve controller for use with a HART Tri-Loop, perform the following procedures.

2



Note

Instrument level AC does not support HART Command 3 or Burst Mode communications.



Set the Burst Operation (1-2-1-4)

1. From the Online menu, select *Configure, Detailed Setup, Mode and Protection*, and *Burst Mode*.
2. Select *Change Burst Enable*. Select *Enable* then press ENTER and SEND.
3. Select *Change Burst Command*. Select the desired command (HART Univ Command 3).
4. Select *Cmd 3 Configured Pressure*. Select the pressure you want the HART Tri-Loop to use as the tertiary variable.

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/cm². Select *Cmd 3 Press* 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.

Section 3 Basic Setup



Instrument Mode	3-2
Configuration Protection	3-2
Guided Setup	3-2
Setup Wizard	3-2
Using the Performance Tuner	3-4
Stabilizing/Optimizing Valve Response	3-4

Instrument Mode

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

To view 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.

Basic Setup (1-1)

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 may result in personal injury or property damage.

3

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.

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*.



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.

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



Note

If the *Auxiliary Terminal Action* is configured for *Auto Calibration*, be sure the jumper remains across the auxiliary terminals until the Field Communicator prompts you to remove it. Removing the jumper too soon will cause the instrument to begin auto travel calibration.

When the DVC6000 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 setup to match the instrument to the valve and actuator.

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

Setup Wizard (1-1-1)

To have the Field Communicator automatically setup the instrument using specified actuator information, from the *Online* Menu select *Configure, Guided Setup, and Setup Wizard*. Follow the prompts on the Field Communicator display to setup the instrument. Table 4-5 provides the actuator information required to setup and calibrate the instrument.

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.

1. Select travel or pressure control. Travel control is the typical mode of operation.
2. Enter the pressure units: psi, bar, kPa, or kg/cm².

Table 3-1. Factory Default Settings

Setup Parameter	Default Setting
Analog Input Units	mA
Analog In Range High	20.0 mA
Analog In Range Low	4.0 mA
Control Mode	Analog
Restart Control Mode	Resume Last
Self-Test Shutdown	All Failures Disabled
Setpoint Filter Time	0 secs
Input Characterization	Linear
Travel Limit High	125%
Travel Limit Low	-25%
Travel Cutoff High	99.5%
Travel Cutoff Low	0.5%
Set Point Rate Open(1)	0 %/secs
Set Point Rate Close(2)	0 %/secs
Polling Address	0
Auxiliary Terminal Action	Auxiliary Input Alert
Cmd 3 Configured Pressure	
For double-acting actuators	differential output pressure
For single-acting actuators	actuator pressure
<small>1. In firmware 2 thru 6 this parameter is labeled Minimum Opening Time. In firmware 10 and below this parameter should be set to zero. 2. In firmware 2 thru 6 this parameter is labeled Minimum Closing Time. In firmware 10 and below this parameter should be set to zero.</small>	

3. Enter the maximum instrument supply pressure.

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

4. Enter the manufacturer of the actuator on which the instrument is mounted. If the actuator manufacturer is not listed, select Other.

5. Enter the actuator model or type. If the actuator model is not listed, select Other.

6. Enter the actuator size.

7. Select whether the valve is open or closed under the zero power condition.

WARNING

In the next step, 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.

8. Specify if a volume booster or quick release valve is present.

9. Specify if factory defaults should be used for basic setup. If you select YES for factory default, the Field

Communicator sets the setup parameters to the values listed in table 3-1. 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 (spring & diaphragm, piston double-acting without spring, piston single-acting with spring, piston double-acting with spring),

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 (rotary-all, sstem-roller, or sstem-standard), see Feedback Connection in the Detailed Setup section.

Travel Sensor motion (increasing air pressure causes the travel sensor shaft to rotate clockwise or counterclockwise). The Field Communicator 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: clockwise or counterclockwise. (see Travel Sensor Motion in the Detailed Setup section).

Volume booster (indicate if volume booster or quick release is present)

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

After completing the setup information, travel is automatically calibrated. 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 on page 5-2 of the Calibration section.

When travel 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 on page 5-10 of the Calibration section.



Note

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

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If after completing the Setup Wizard the valve seems slightly unstable or unresponsive, you can improve operation by selecting either *Performance Tuner* or *Stabilize/Optimize* from the *Guided Setup* menu. For additional information on using the Performance Tuner, refer to Using the Performance Tuner in this section. For additional information on stabilizing or optimizing valve response, refer to Stabilize/Optimize at the end of this section.

Stabilizing/Optimizing or (1-1-2) Valve Response



Note

Stabilize/Optimize is only available through the Guided Setup menu for instrument level HC.

3

Using the Performance Tuner (1-1-2)



Note

Performance Tuner is not available for instrument level AC or HC.



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.



WARNING

During Stabilize/Optimize 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 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.

If after completing setup and calibration the valve seems slightly unstable or unresponsive, you can improve operation by pressing the Hot Key and selecting *Stabilize/Optimize*, or select *Stabilize/Optimize* from the *Guided Setup* menu.

Stabilize/Optimize permits you to adjust valve response by changing the digital valve controller

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).

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*.

Section 4 Detailed Setup



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DVC6000 Digital Valve Controllers

Detailed Setup (1-2)



Note

Detailed Setup is not available for instrument level AC.

4

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.

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.



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.

Table 4-1. Factory Default Detailed Setup Parameters

	Setup Parameter	Default Setting ⁽¹⁾
Instrument Configuration	Control Mode	Analog
	Restart Control Mode	Resume Last
	Zero Power Condition	Valve Open ⁽²⁾
	Analog In Range Low	4 mA
	Analog In Range High	20 mA
	Analog Input Units	mA
	Feedback Connection	Rotary – All ⁽²⁾
	Travel Sensor Motion	Clockwise ⁽²⁾
	Auxiliary Terminal Action	Disabled
	Maximum Supply Pressure	20 ⁽²⁾
	Pressure Units	PSI
	Temperature Units	F
	Polling Address	0
	Burst Mode Enable	No
Burst Command	3	
Cmd 3 Configured Pressure	A-B	
Dynamic Response and Tuning	Tuning Set	F ⁽²⁾
	Input Characteristic	Linear
	Travel Limit High	125%
	Travel Limit Low	-25%
	Travel/Pressure Cutoff High	99.46%
	Travel/Pressure Cutoff Low	0.50%
	Set Point Rate Open ⁽³⁾	0%/sec
	Set Point Rate Close ⁽⁴⁾	0%/sec
	Set Point Filter Lag Time ⁽⁵⁾	0 sec
	Integrator Enable	Yes
	Integral Gain	9.4 repeats/minute
Integral Dead Zone	0.26%	
Travel History Alerts	Cycle Counter Alert Enable	No
	Cycle Counter Alert Deadband	1%
	Cycle Counter Alert Point	1000000
	Travel Accumulator Alert Enable	No
	Travel Accumulator Deadband	1%
	Travel Accumulator Alert Point	1000000
Deviation & Other Alerts	Travel Deviation Alert Enable	Yes
	Travel Deviation Alert Point	5%
	Travel Deviation Time	9.99 sec
	Pressure Deviation Alert Enable	Yes
	Pressure Deviation Alert Point	5 psi
	Pressure Deviation Alert Time	9.99 sec
	Drive Signal Alert Enable	Yes
	Supply Pressure Alert Enable	Yes
Supply Pressure Alert Point	19 psi	
Travel Alerts	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%
	Travel Alert Hi Hi Enable	No
	Hi Hi Point	125%
Deadband	5%	
Electronic Alerts	Shutdown Activated	Yes
	Low Power Write Fail Enable	No
	Non-Critical NVM Alert Enable	No

–continued on next page–

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

Setup Parameter		Default Setting ⁽¹⁾
Informational Status	Instrument Time Invalid Enable	No
	Calibration in Progress Enable	No
	Autocal 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 Has Entries Enable	Yes
	Alert Record Full Enable	No

1. The settings listed are for standard factory configuration. DVC6000 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. In firmware 2 thru 6 this parameter is labeled Minimum Opening Time. In firmware 10 and below this parameter should be set to zero (0).
 4. In firmware 2 thru 6 this parameter is labeled Minimum Closing Time. In firmware 10 and below this parameter should be set to zero (0).
 5. Only available in firmware 7 and above. In firmware 7, 9, and 10 this parameter should be set to zero (0).

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

Choose Digital if the instrument is to receive its set point digitally, 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**—Lets you choose which operating mode you want the instrument to be in after a restart. Access 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 (1-2-1-4)

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.

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 values are Burst Enable = Disabled(Polled), Enabled.
- **Burst Command**—There are four burst mode commands. Command 3 is recommended for use with the 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.
- **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/cm². 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**—Some setup parameters may require changing the protection with the Field Communicator. To remove protection (change protection to *None*) requires placing a jumper across the Auxiliary terminals in the terminal box in order to change protection.



Note

If the Auxiliary Terminal Action is configured for Auto Travel Calibration, be sure the jumper remains across the auxiliary terminals until the Field Communicator prompts you to remove it. Removing the jumper too soon will cause the instrument to begin auto travel calibration.

terminal box when prompted by the Field Communicator.

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)

4

WARNING

If the jumper is removed too soon, and auto travel calibration begins, the valve will move full stroke. To avoid personal injury and property damage caused by the release of pressure or process fluid, provide some temporary means of control for the process.

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.

Two levels of protection are available:

- *Config & Calib*—Both setup and calibration are protected. Prohibits changing calibration and protected setup parameters.
- *None*—Neither setup nor calibration is protected. Allows changing calibration and 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.

To change an instrument's protection, press the Hot key on the Field Communicator and select *Protection* or from the *Online* menu, select *Configure*, *Detailed Setup*, *Mode and Protection*, and *Protection*. Select the desired level of protection. Follow the prompts on the Field Communicator display to set the protection level. If necessary, temporarily attach the jumper to the AUX + and AUX – terminals in the instrument

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.

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

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

Parameters	In Service/ Config Protected	In Service/ Config Unprotected	Out of Service/ Config Protected	Out of Service/ Config Unprotected
Control Mode	---	---	✓	✓
Restart Ctrl Mode	---	---	---	✓
Burst Mode Enable	✓	✓	✓	✓
Burst Mode Command Protection	---	---	---	✓
	✓	✓	✓	✓
HART Tag	---	✓	---	✓
Message	---	✓	---	✓
Descriptor	---	✓	---	✓
Date	---	✓	---	✓
Valve Serial Num	---	✓	---	✓
Inst Serial Num	---	---	---	✓
Polling Address	---	---	---	✓
Relay Type	---	---	---	✓
Max Supply Pressure	---	---	---	✓
Actuator Style	---	---	---	✓
Feedback Connection	---	---	---	✓
Travel Sensor Motion	---	---	---	✓
Valve Style	---	---	---	✓
Zero Ctrl Signal	---	---	---	✓
Analog In Units	---	---	---	✓
Input Range High	---	---	---	✓
Input Range Low	---	---	---	✓
Pressure Units	---	---	---	✓
Temp Units	✓	✓	✓	✓
Tuning Set	---	✓	---	✓
Prop Gain	---	---	---	✓
Velocity Gain	---	---	---	✓
MLFB Gain	---	---	---	✓
Input Char	---	---	---	✓
Define Custom Char	---	---	---	✓
Set Pt Filter Time	---	---	---	✓
Tvl Limit High	---	---	---	✓
Tvl Limit Low	---	---	---	✓
Tvl Cutoff High	---	---	---	✓
Tvl Cutoff Low	---	---	---	✓
Set Point Rate Open ⁽¹⁾	---	---	---	✓
Set Point Rate Close ⁽²⁾	---	---	---	✓
Tvl Hi/Lo Enab	✓	✓	✓	✓
Tvl HH/LL Enab	✓	✓	✓	✓
Tvl Alert Hi Pt	✓	✓	✓	✓
Tvl Alert Lo Pt	✓	✓	✓	✓
Tvl Alert HiHi Pt	✓	✓	✓	✓
Tvl Alert LoLo Pt	✓	✓	✓	✓
Tvl Alrt DB	✓	✓	✓	✓
Tvl Dev Alrt Enab	✓	✓	✓	✓
Tvl Dev Alrt Pt	✓	✓	✓	✓
Tvl Dev Time	✓	✓	✓	✓
Cycl Cnt Alrt Enab	✓	✓	✓	✓
Cycl Count Alrt Pt	✓	✓	✓	✓
Cycl Count DB	✓	✓	✓	✓
Cycl Count	✓	✓	✓	✓
Tvl Acum Alrt Enab	✓	✓	✓	✓
Tvl Acum Alrt Pt	✓	✓	✓	✓
Tvl Acum DB	✓	✓	✓	✓
Tvl Acum	✓	✓	✓	✓
Aux Terminal Mode	---	---	---	✓
Aux In Alrt Enab	---	---	---	✓
Aux In Alrt State	---	---	---	✓
Drive Alrt Enab	✓	✓	✓	✓
Supply Press Alrt	✓	✓	✓	✓

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

–Continued–

DVC6000 Digital Valve Controllers

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

Parameters	In Service/ Config Protected	In Service/ Config Unprotected	Out of Service/ Config Protected	Out of Service/ Config Unprotected
Flash ROM Fail	---	---	---	✓
No Free Time	---	---	---	✓
Ref Voltage Fail	---	---	---	✓
Drive Current Fail	---	---	---	✓
Critical NVM Fail	---	---	---	✓
Temp Sensor Fail	---	---	---	✓
Press Sensor Fail	---	---	---	✓
Tvl Sensor Fail	---	---	---	✓

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

4



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.

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.



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.

Table 4-5 provides tuning set selection guidelines for Fisher, Baumann, and Gulde 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.

- **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 enabled 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.

- **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).

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*.

- **Performance Tuner**



Note

The Performance Tuner is not available for instrument level HC.

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**—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 B provides the fastest response.

Table 4-4. 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.	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

4

Tuning set B is appropriate for controlling a pneumatic positioner. Table 4-4 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).



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.



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.

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Table 4-5. Actuator Information for Initial 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 50 60 68, 80 100, 130	Piston Dbl w/ or w/o Spring. See actuator instruction manual and nameplate.	E I J L 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 34, 40 45, 50 46, 60, 70, 76, & 80-100	Spring & Diaphragm	H K L M	SStem-Standard	Clockwise	Counterclockwise
	667	30 34, 40 45, 50 46, 60, 70, 76, & 80-100	Spring & Diaphragm	H K L M	SStem-Standard	Counterclockwise	Clockwise
	1051 & 1052	20, 30 33 40 60, 70	Spring & Diaphragm	H I K M	Rotary	Clockwise	Counterclockwise
	1061	30 40 60 68, 80, 100, 130	Piston Dbl w/o Spring	J K L M	Rotary	Depends upon pneumatic connections. See description for Travel Sensor Motion	
	1066SR	20 27, 75	Piston Sgl w/Spring	G L	Rotary	Depends upon mounting style, see actuator instruction manual and table 4-6	
	2052	1 2 3	Spring & Diaphragm	H J M	Rotary	Clockwise	Counterclockwise
	3024C	30, 30E 34, 34E, 40, 40E 45, 45E	Spring & Diaphragm	E H K	SStem-Standard	For P _o operating mode (air opens), Counterclockwise For P _s operating mode (air closes), Clockwise	For P _o operating mode (air opens), Clockwise For P _s operating mode (air closes), Counterclockwise
	GX	225 750 1200	Spring & Diaphragm	X ⁽¹⁾ K M	SStem-Standard	Air to Open Close Counterclockwise Clockwise	
Baumann	Air to Extend	16 32	Spring & Diaphragm	C E H	SStem-Standard	Clockwise	Counterclockwise
	Air to Retract	570		H		Counterclockwise	Clockwise
	Rotary	10 25 54		E H J	Rotary	Specify	

1. X = Expert Tuning. Proportional Gain = 4.2; Velocity Gain = 3.0; Minor Loop Feedback Gain = 18.0

Table 4-6. Travel Sensor Motion Selections for the FIELDVUE DVC6030 on a Fisher 1066SR Actuator

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

• **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 (1-2-2-2)

● **Travel/Pressure Select**—Determines if the instrument is set up for position or pressure control. Select Travel, Pressure, Travel with Pressure Fallback/Auto recovery or Travel with Pressure Fallback/Manual Recovery. If the travel sensor fails, and Travel with Pressure Fallback/Auto Recovery is selected, it will return to travel control when the travel sensor starts working again. Travel with Pressure Fallback/Manual recovery will stay in pressure control until Travel Pressure Select is changed to Travel or Travel with Pressure Fallback/Auto recovery. It is not necessary to enable the Travel Sensor Alert for Pressure Fallback to occur.

Cutoffs and Limits (1-2-2-2-2)● **Cutoff Hi**

Travel Cutoff High defines the high cutoff point for the travel in percent (%) of ranged input current. Above this cutoff, the travel target is set to 123.0% of the ranged input current. When a Travel Cutoff High is set, the Travel Limit High is deactivated, since only one of these parameters can be active. Travel Cutoff Hi is deactivated by setting it to 125.0%.

Pressure Cutoff Hi defines the high cutoff point for the pressure in percent (%) of pre-characterized setpoint. Above this cutoff, the pressure target is set to 123.0%. A Pressure Cutoff Hi of 99.5% is recommended to ensure valve goes fully open. Pressure Cutoff Hi is deactivated by setting it to 125%.

● **Cutoff Lo**

Travel Cutoff Low defines the low cutoff point for the travel set point. Travel Cutoff Low can be used to ensure proper seat load is applied to the valve. When below the travel cutoff low, the output is set to zero or to full supply pressure, depending upon the zero power condition. A Travel Cutoff Low of 0.5% is recommended to help ensure maximum shutoff seat loading. When a Travel Cutoff Low is set, the Travel Limit Low is deactivated, since only one of these parameters can be active. Travel Cutoff Low is deactivated by setting it to -25%.

Pressure Cutoff Lo defines the low cutoff point for the pressure in percent (%) of pre-characterized setpoint. Below this cutoff, the pressure target is set to -23%. A Pressure Cutoff Lo of 0.5% is recommended to help ensure maximum shutoff seat loading. Pressure Cutoff Lo is deactivated by setting it to -25.0%

● **Change Cutoffs**—Allows you to set hi and lo cutoffs. When a cutoff is set the corresponding travel or pressure limit will be disabled.

● **Travel Limit Hi**—Defines the high limit for the travel in percent (%) of ranged travel. It is the maximum allowable travel (in percent of ranged travel) for the valve. During operation, the travel target will not exceed this limit. When a Travel Limit High is set, the Travel Cutoff High is deactivated, since only one of these parameters can be active. Travel Limit High is deactivated by setting it to 125.0%

● **Travel Limit Lo**—Travel Limit Low defines the low limit for the travel in percent (%) of ranged travel. It is the minimum allowable travel (in percent of ranged travel) for the valve. During operation, the travel target will not exceed this limit. When a Travel Limit Low is set, the Travel Cutoff Low is deactivated, since only one of these parameters can be active. Travel Limit Low is deactivated by setting it to -25.0%.

● **Change Travel Limits**—Allows you to set hi and lo travel limits. Setting a travel limit will eliminate the corresponding Tvl/Press Cutoff.

Pressure Control (1-2-2-2-3)

● **Pressure Range Hi**—The high end of output pressure range. Enter the pressure that corresponds with 100% valve travel when Zero Power Condition is closed, or 0% valve travel when Zero Power Condition is open. This pressure *must be greater* than the Pressure Range Lo.

● **Pressure Range Lo**—The low end of the output pressure range. Enter the pressure that corresponds to 0% valve travel when Zero Power Condition is closed, or 100% valve travel when Zero Power Condition is open. This pressure *must be less* than the Pressure Range Hi.

End Point Pressure Control (1-2-2-2-5)**Note**

End Point Pressure Control is only available for instrument level ODV.

● **End Pt Control Enab**— Select 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 maintained at a certain value. This value is configured through the

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Upper Operating Pressure feature. 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 ensure there is an alert when an output pressure deviation occurs, setup 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.

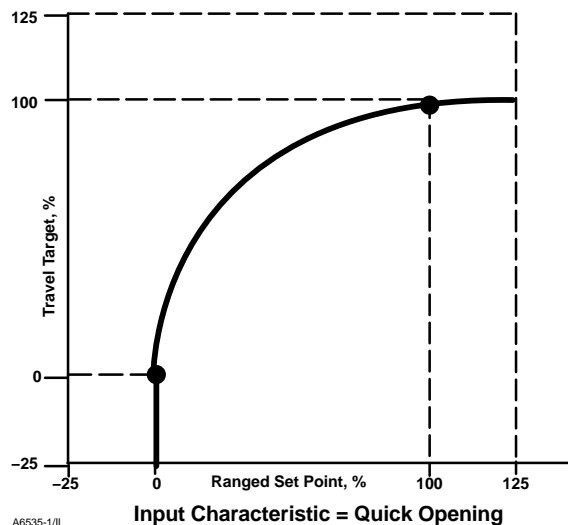
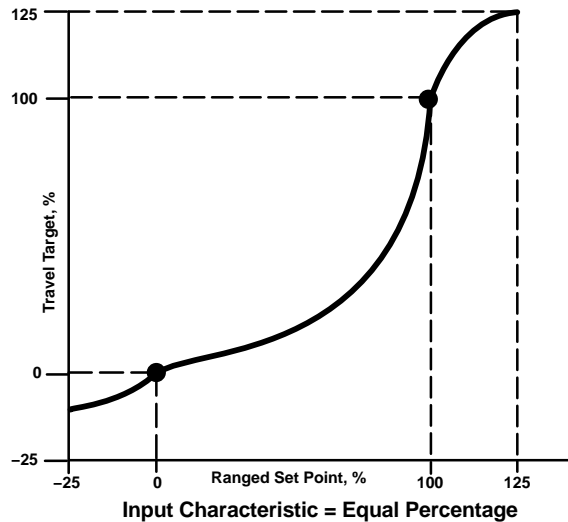
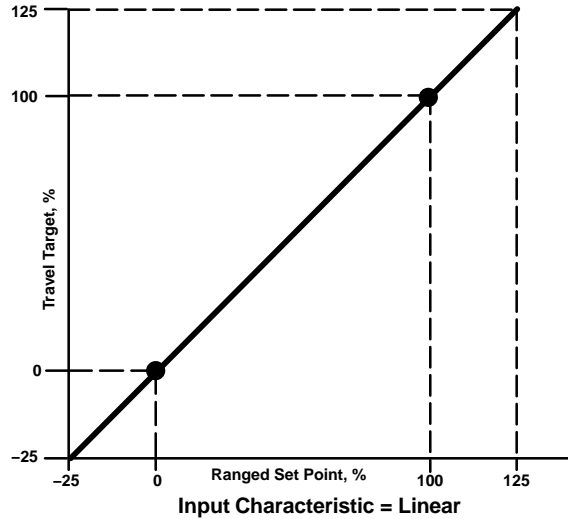
- **EPPC Setup Point**—Used in conjunction with End Point Pressure Control, Pressure Set Point allows the user to select a pressure to be delivered by the instrument at the travel extreme. For a fail-closed valve, this pressure must be sufficient to maintain the fully open position. For a fail-open valve, this pressure (which is automatically set to supply pressure) must be sufficient to fully close the valve and 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.

- **EPPC Saturation Time**—Pressure Saturation Time is 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.



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

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

Select *Custom Characterization Table* from the Response Control menu and follow the prompts to define a custom input character.

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 2–6)—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 2–6)—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.

- **Set Point Filter Time (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.



Note

Lead/Lag is only available for instrument level ODV.

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- **Lead/Lag Set Point Filter**—ODV devices have access to a lead-lag input filter that can be used to improve a valve's dynamic response. The lead-lag input filter is part of the set point processing routine that reshapes the input signal before it becomes travel set point. Lead-lag filters are characterized by lead and lag time constants.

When the valve is in its active control region (off the seat), the lead-lag filter improves small amplitude response by momentarily overdriving the travel set point. This is useful when the actuator is large and equipped with accessories. As a result, any volume boosters that are present will be activated. The longer the lag time, the more pronounced the overdrive. Since the lead-lag input filter is used to enhance the dynamic response of a control valve, filter parameters should be set after the tuning parameters have been established.

When the valve is at its seat, the lead-lag filter also has a boost function that sets the initial conditions of the filter artificially low so that small amplitude signal changes appear to be large signal changes to the filter. The boost function introduces a large spike that momentarily overdrives the instrument and activates any external volume boosters that may be present. The lead-lag boost function is normally disabled except for those cases where the valve must respond to small command signals off the seat. By setting the lead/lag ratio in the opening and closing directions to 1.0, the boost function can be enabled without introducing lead-lag dynamics in the active control region. See table 4-7 for typical lead-lag filter settings.



Note

Set Point Filter Time (Lag Time) is only available for instrument level HC, AD, and PD, firmware 7, 9, 10, and 11.

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Table 4-7. Typical Lead/Lag Filter Settings for Instrument Level ODV

Parameter	Description	Typical Value
Lag Time	First order time constant. A value of 0.0 will disable the lead-lag filter.	0.2 sec
Opening Lead/Lag Ratio	Initial response to the filter in the opening direction.	2.0
Closing Lead/Lag Ratio	Initial response to the filter in the closing direction.	2.0
Lead-Lag Boost	Initial conditions of the lead-lag filter when the lower travel cutoff is active.	Off

Alert Setup (1-2-3)

The following menus are available for configuring Alerts. 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 *Alerts*. 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* (instrument level ODV only), and *Alert Record*.

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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**— When enabled, the instrument shuts down whenever the drive current does not read as expected.

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. 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.

- **Power Starvation Alrt Enab**—When enabled, an alert is generated whenever power starvation is detected. Firmware 2–7.

- **Low Power Write Fail 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. Firmware 9, 10 and 11.

- **Non-Critical NVM Alert Enable**—When enabled, an alert is generated whenever there is a failure associated with non-critical NVM (non-volatile memory).

- **Critical NVM Shutdown**—When enabled, the instrument shuts down whenever there is a failure associated with critical NVM (non-volatile memory).

- **Flash ROM Shutdown**—When enabled, the instrument shuts down whenever there is a failure associated with flash ROM (read only memory).

- **No Free Time Shutdown**—When enabled, the instrument shuts down whenever there is a failure associated with No Free Time.

- **Reference Voltage Shutdown**—When enabled, the instrument shuts down whenever there is a failure associated with the internal voltage reference.

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.
- **Temp Sensor Shutdown**—When enabled, the instrument shuts down whenever there is a failure associated with the temperature sensor.
- **Pressure Sensor Shutdown**—When enabled, the instrument shuts down whenever there is a failure associated with the pressure sensor.

Environment Alerts (1-2-3-3)

Auxiliary Terminal Alerts (1-2-3-3-1)

- **Auxiliary Terminal Alert Enable**—Yes or No. Activates checking the status of the auxiliary input when the Auxiliary Terminal Mode is Auxiliary Input Alert. When enabled, the Auxiliary Input Alert is set when the auxiliary input terminals are either open or closed, depending upon the selection for the Auxiliary Input Alert State. Factory default is No.
- **Auxiliary Input**—The auxiliary input is a contact or discrete input, which may be open or closed.
- **Auxiliary Terminal Action**—Disabled, Alert on Open Contact, Alert on Close Contact, or Auto Travel Calibration. Selecting Alert on Open or Closed Contact activates checking the status of the auxiliary input contacts. Selecting Auto Travel Calibration permits starting an automatic travel calibration procedure by placing a jumper across the auxiliary input terminals for 3 to 5 seconds.

Supply Press Lo Alert (1-2-3-3-2)



Note

The Supply Pressure Lo alert is not available in instrument level HC.

- **Supply Pressure Lo Alert Enable**—When enabled, the instrument sends an alert when the supply pressure falls below the supply pressure alert point. Factory default is Yes.
- **Supply**—Supply Pressure displays the instrument supply pressure in kPa, bar, psi, or kg/cm².
- **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 Pressure 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. Firmware 9, 10, and 11.

Travel Alerts (1-2-3-4)

- **Travel**—Displays the actual position of the valve in percent (%) of calibrated travel.
- **Setpoint**—The input to the characterization function.
- **Travel Alrt 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)

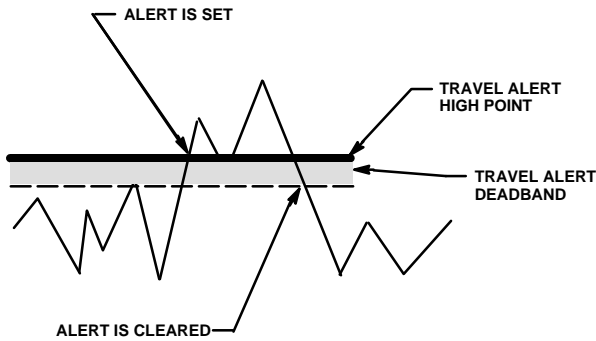
If the difference between the travel target and the actual target exceeds the Travel Deviation Alert Point for more than the Travel Deviation Time, the Travel Deviation Alert is set. It remains set until the difference between the travel target and the actual travel is less than the Travel Deviation 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. Factory default is Yes.
- **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.
- **Travel Deviation Time**—The time, in seconds, that the travel deviation must exceed the Travel Deviation Alert Point before the alert is set.

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.



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Figure 4-2. Travel Alert Deadband

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- **Travel Alert Hi Hi Enable**—Yes or No. Activates checking of the ranged travel against the Travel Alert Hi Hi points. Factory default is No.

- **Travel Alert Lo Lo Enable**—Yes or No. Activates checking of the ranged travel against the Travel Alert Lo Lo points. Factory default is No.

- **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.

- **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.

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 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. Factory default is No.

- **Travel Alert Lo Enable**—Yes or No. Activates checking of the ranged travel against the Travel Alert Lo Point. Factory default is No.

- **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 Alert Enable**—Yes or No. Activates the Travel Limit/Cutoff Lo alert.

- **Cutoff Hi**

Travel Cutoff Hi defines the high cutoff point for the travel in percent(%) of pre-characterized set point. Above this cutoff, the travel target is set to 123.0% of the ranged travel. Travel Cutoff Hi is deactivated by setting it to 125.0%.

Pressure Cutoff Hi defines the high cutoff point for the pressure in percent (%) of pre-characterized set point. Above this cutoff, the pressure target is set to 123.0%. A Pressure Cutoff Hi of 99.5% is recommended to ensure valve goes fully open. Pressure Cutoff Hi is deactivated by setting it to 125%

- **Cutoff Lo**

Travel Cutoff Lo defines the low cutoff point for the travel in percent (%) of pre-characterized set point. Below this cutoff, the travel target is set to -23%. A Travel Cutoff Lo of 0.5% is recommended to help ensure maximum shutoff seat loading. Travel Cutoff Lo is deactivated by setting it to -25.0%

Pressure Cutoff Lo defines the low cutoff point for the pressure in percent (%) of pre-characterized set point. Below this cutoff, the pressure target is set to -23%. A Pressure Cutoff Lo of 0.5% is recommended to help ensure maximum shutoff seat loading. Pressure Cutoff Lo is deactivated by setting it to -25.0%

- **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 Limit Hi**—Defines the high limit for the travel in percent (%) of ranged travel. It is the maximum allowable travel (in percent of ranged travel) for the valve. During operation, the travel target will not exceed this limit. When a Travel Limit High is set, the Travel Cutoff High is deactivated, since only one of these parameters can be active. Travel Limit High is deactivated by setting it to 125.0%.

- **Travel Limit Lo**—Defines the low limit for the travel in percent (%) of ranged travel. It is the minimum allowable travel (in percent of ranged travel) for the valve. During operation, the travel target will not exceed this limit. When a Travel Limit Low is set,

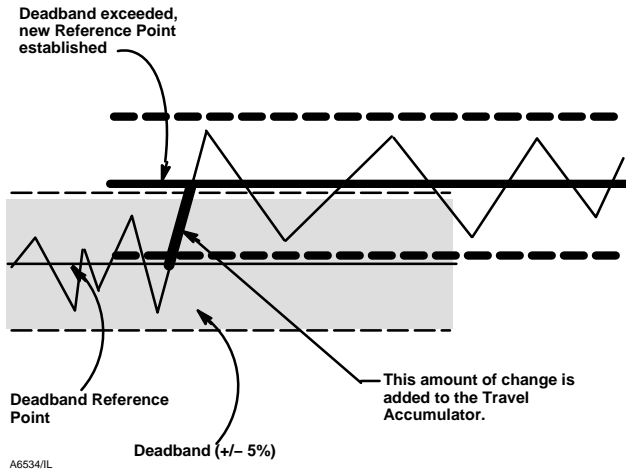


Figure 4-3. Travel Accumulator Deadband (set at 10%)

the Travel Cutoff Low is deactivated, since only one of these parameters can be active. Travel Limit Low is deactivated by setting it to -25.0% .

- **Change Travel Limits**—Allows you to set hi and lo travel limits. Setting a travel limit will eliminate the corresponding Tvl/Press Cutoff.

Travel History Alerts (1-2-3-5)

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

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

- **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 4-4. You can reset the Cycle Counter by configuring it as zero.

- **Cycle Counter 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 4-4.

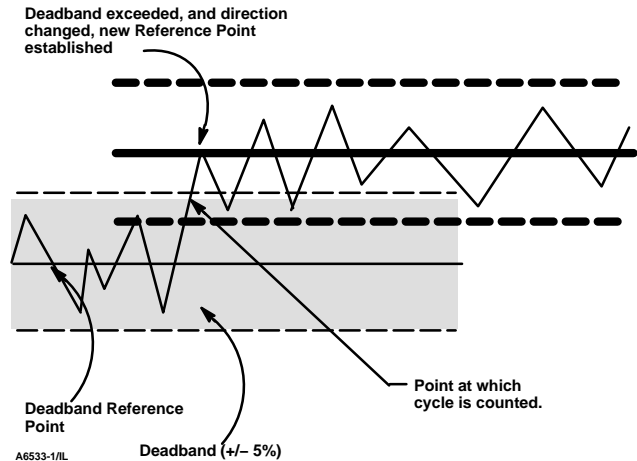


Figure 4-4. Cycle Counter Deadband (set at 10%)

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 4-3.

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 Accumulator Alert is set when the Travel Accumulator value exceeds the Travel Accumulator Alert Point. It is cleared after you reset the Travel Accumulator to a value less than the alert point. Factory default is No.

- **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 4-3. 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)



Note

SIS Alerts are only available for instrument level ODV.

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- **PST 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 limit will be a maximum value.

- **Pressure Deviation Alert Enable**— Select 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. Factory default is Yes.

- **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 ± 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 (1-2-3-6) HC, AD, and PD (1-2-3-7) ODV

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. Factory default is Yes.

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

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

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

- **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 (1-2-3-6-5) HC, AD, and PD (1-2-3-7-5) ODV

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

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

- **Miscellaneous Group Enable**—Permits enabling the Miscellaneous Alert group. Factory default is No. 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 Saturation*.

Instrument Time (1-2-4-1)

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

- **Instrument Date and Time**—Permits setting the instrument clock. When alerts are stored in the alert record, the record includes the time and date. The instrument clock uses a 24-hour format.

Calibration and Diagnostics (1-2-4-2)

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

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

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

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

Operational (1-2-4-3)

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

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

Integrator Saturation(1-2-4-4)

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

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

- *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.

- *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%.

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*.

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, 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.

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/cm².

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

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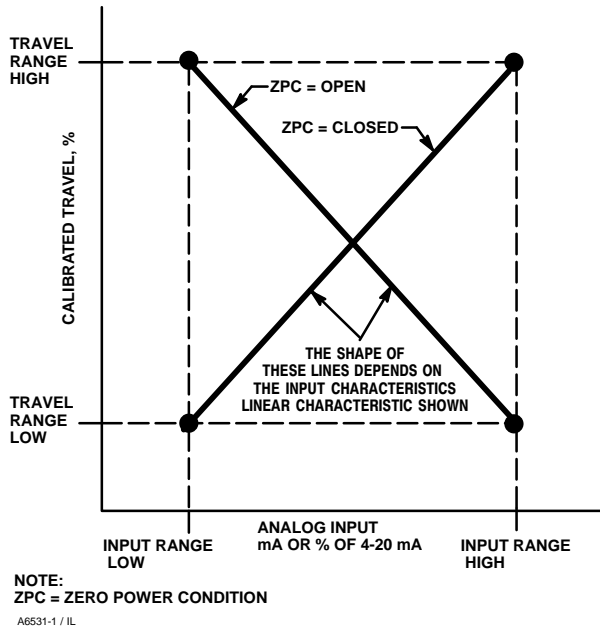


Figure 4-5. Calibrated Travel to Analog Input Relationship

- **Analog In Units**—Permits defining the Analog Input Units in mA or percent of 4–20 mA range.

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**—There are three categories of relays that result in 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 in single-acting applications where the “unused” output port is configured to read the pressure downstream of a

solenoid valve. See page 2-22 for additional information.

Lo Bleed: The label affixed to the relay body indicates whether it is a low bleed version.

- **Zero Power Condition** (Zero Control Signal in firmware 2–6)—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/cm², depending on what was selected for pressure units.

- **Auxiliary Terminal Action**—Disabled, Alert on Open Contact, Alert on Close Contact, or Auto Travel Calibration. Selecting Alert on Open or Closed Contact activates checking the status of the auxiliary input contacts. Selecting Auto Travel Calibration permits starting an automatic travel calibration procedure by placing a jumper across the auxiliary input terminals for 3 to 5 seconds.

- **Instrument Date and Time**—Permits setting the instrument clock. When alerts are stored in the alert record, the record includes the time and date. The instrument clock uses a 24-hour format.

Calib 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 and Actuator (1-2-6)

Select *Configure*, *Detailed Setup*, and *Valve and 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*, and *View/Edit Feedback Connection*.

- **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.



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

- 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 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.

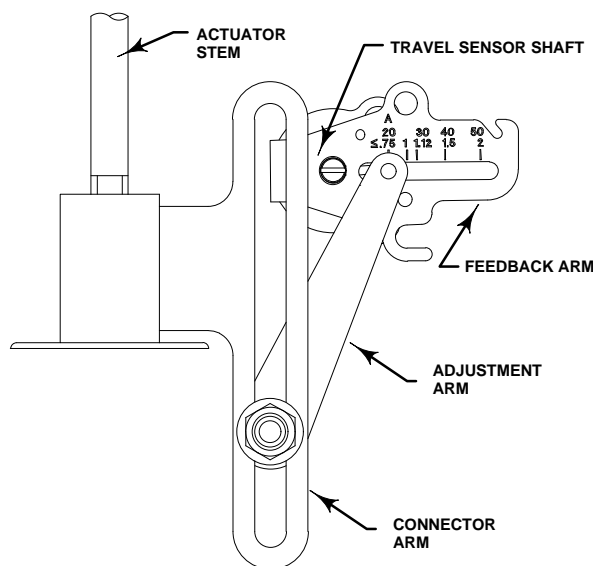


Figure 4-7. Feedback Connection for Typical Sliding-Stem Actuator (Up to 4 inch Travel)

Partial Stroke (1-2-7)



Note

Partial Stroke is only available for instrument level ODV.

Select *Configure*, *Detailed Setup*, and *Partial Stroke*. Follow the prompts on the Field Communicator display to configure the following partial stroke parameters: *PST Enable* and *View/Edit PST Variables*.

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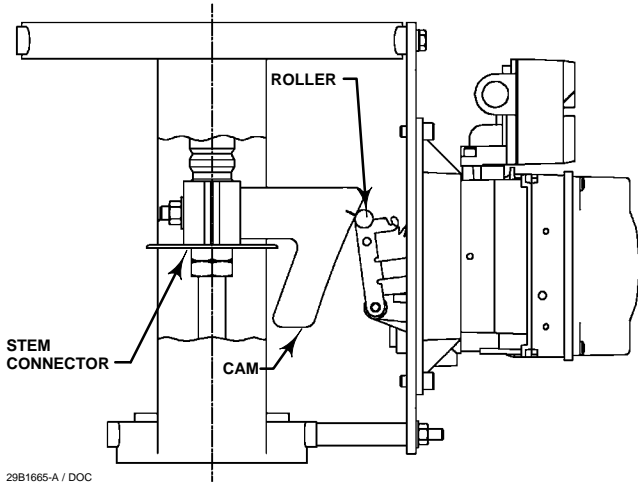


Figure 4-8. Feedback Connection for Typical Long-Stroke Sliding-Stem Actuator (4 to 24 Inches Travel)

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- **PST Enable**—Yes or No. Enables or disables the Partial Stroke Test.
- **PST Variables View/Edit**—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*.

Max Travel Movement—The default value for Max Travel Movement is 10%. It may be set to a value between 1 and 30% in 0.1% increments.

Pause Time—The 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 the Setup Wizard, or Auto Calibration, the Partial Stroke Pressure Limit value will be set to a positive value for single-acting actuator. 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	Pressure Signal
A or C	Port A – Port B
B	Port B – Port A
B Special App.	Port B
C Special App.	Port A

PST Press Limit (double-acting actuators)— During the 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.



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.



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. It is then possible to set the partial stroke pressure limit with the information generated by the valve signature test.

To manually set the partial stroke pressure limit, disable the travel deviation alert by setting Travel Dev Alert Pt to 125%. Also disable “end point pressure control” and disable the partial stroke pressure limit 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.

Select the Press/Time radio button from the partial stroke valve signature graph. If actuator pressure starts high and moves low, find the minimum actuator pressure, Pmin. Otherwise, find the maximum actuator pressure, Pmax. Use table 4-10 to estimate the partial stroke pressure limit.

The default value is 0.

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

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

Table 4-10. Estimates for Partial Stroke Pressure Limits

Actuator Style	Relay Type	Zero Power Condition	PST Starting Point	Partial Stroke Pressure Limit ⁽¹⁾
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	$P_{min} - 0.5 * (P_{supply} + P_{min})$

Section 5 Calibration



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Calibration Overview

When a DVC6000 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 remote-mounted digital valve controllers, the DVC6005 base unit ships separately from the control valve and does not include tubing, fittings or wiring.

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:

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

Relay Adjustment—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.

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 with calibration. Once calibration is complete, burst mode may then be turned back on.



WARNING

During calibration the valve will move full stroke. 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

Once the travel is calibrated by performing either the Auto Calibration or Manual Calibration procedures, the travel calibration can be “touched-up” using Touch-Up Travel Calibration.

Auto Calibration (1-3-1-1)

User interaction is only required with Auto Calibrate Travel 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 Travel Calibration is selected. Select Yes to adjust the relay. Select No to proceed with Auto Travel Calibration. For additional information, refer to Relay Adjustment in this section.

Select *Calibrate*, *Travel Calibration*, *Auto Calibration*, 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. 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.

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

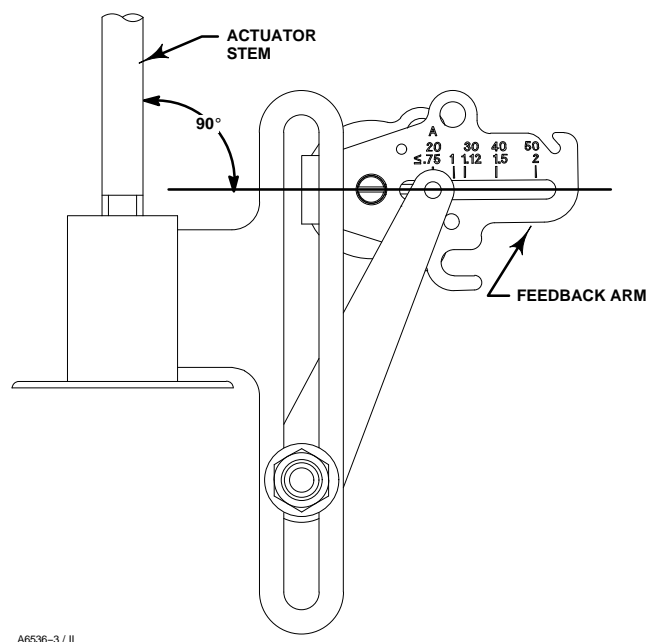


Figure 5-1. Crossover Point

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.

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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).

5

Two procedures are available to manually calibrate travel:

- Analog Adjust
- Digital Adjust

Analog Calibration Adjust

Select *Calibrate*, *Travel Calibration*, *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 to 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.

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: 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). 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).
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). 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. 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.
Aborting due to response code or device status.	The instrument may have been taken out of service by a primary master. Put the instrument into service with the primary master or cycle the power off and on.



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

Select *Calibrate, Travel Calibration, 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.
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.

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

Touch-Up Travel Calibration

Once the travel is calibrated by performing either the Auto or Manual Calibration procedure, the travel calibration can be “touched-up” by shorting the Auxiliary Terminal Connections for 3 to 5 seconds to activate Touch-Up Calibration. Touch-Up Travel Calibration uses Last Value for the crossover adjustment. You can abort the procedure by shorting the auxiliary terminals for 1 second.

To enable Touch-Up Travel Calibration the *Aux Terminal Mode* must be set to *Auto Calibration*. The instrument *Operational Status* during calibration is *Calibration in Progress*.

5

Use Touch-Up Calibration to calibrate the digital valve controller travel whenever the I/P converter or relay is replaced. Do not use Touch-Up calibration for initial calibration when mounting the instrument on an actuator, or if the travel sensor assembly or printed wiring board assembly was replaced.

You can use Touch-Up Travel Calibration to calibrate the digital valve controller if you suspect calibration has changed due to drift. However, prior to initiating Touch-Up Travel Calibration, perform a Valve Signature diagnostic test, using ValveLink software. This will capture the as-found data for future root cause analysis.

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 *Press 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



Note

Supply Pressure Sensor Calibration is not available for instrument level HC.

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.

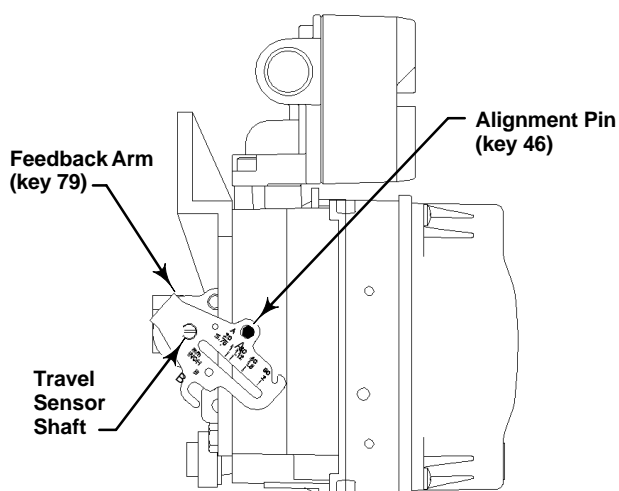
1. Select a) Zero Only, or b) Zero and Span (gauge required).
 - a. If Zero Only calibration is selected, adjust the supply pressure regulator to remove supply pressure from the instrument. Press OK. Once calibration is complete, go to step 5.
 - b. If Zero and Span calibration is selected, adjust the 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.



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Figure 5-2. FIELDVUE DVC6010 Digital Valve Controller Showing Feedback Arm in Position for Travel Sensor Adjustment

5. Place the instrument In Service and verify that the displayed pressure matches the measured supply pressure.

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.

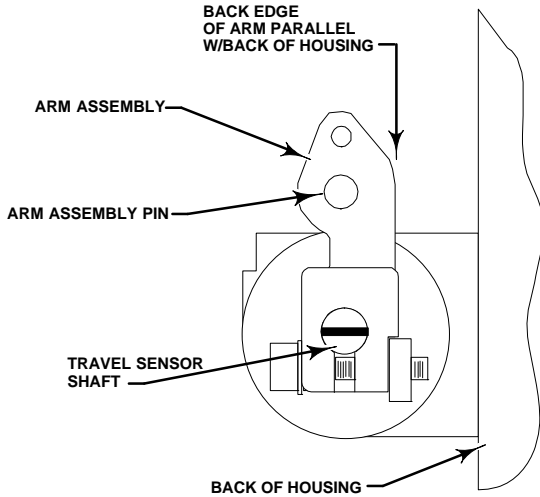
DVC6010, DVC6015, DVC6030 and DVC6035 Digital Valve Controllers

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.

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A7025 / IL

Figure 5-3. FIELDVUE DVC6020 Travel Sensor Arm/Housing Back Plane Alignment

5

Table 5-2. Travel Sensor Counts

Digital Valve Controller	Travel Sensor Counts
DVC6010 / DVC6015	700 ±200
DVC6020 / DVC6025	2100 ±200
DVC6030 ⁽¹⁾ / DVC6035 ⁽²⁾ Counterclockwise shaft rotation	600 ±200
DVC6030 ⁽³⁾ / DVC6035 ⁽²⁾ Clockwise shaft rotation	3400 ±200

1. Refer to figure 2-9 to determine the desired starting position for the DVC6030 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 based on clockwise potentiometer shaft rotation.



Note

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



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, Travel Sensor*. Follow the prompts on the Field Communicator display to adjust the travel sensor counts to the value listed in table 5-2.

- 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.
- 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 and DVC6025 Digital Valve Controllers



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

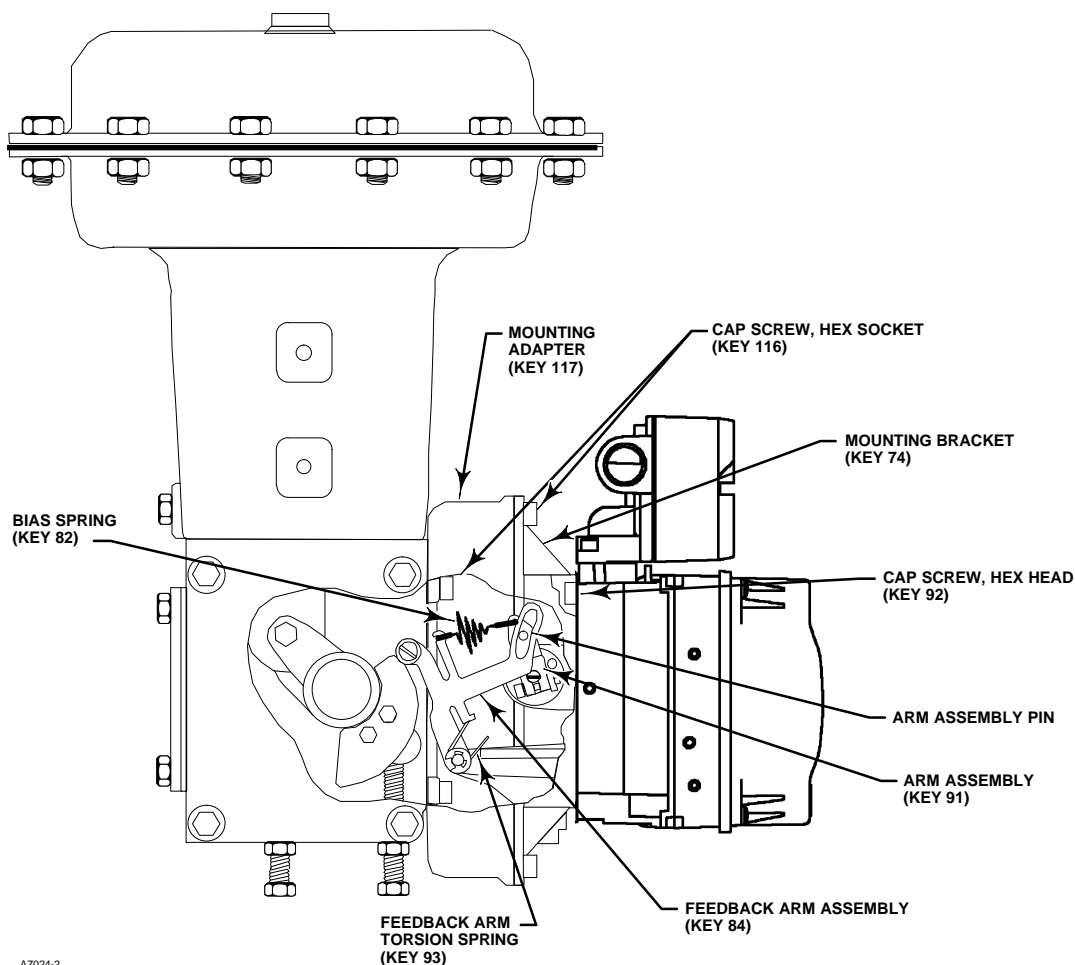


Figure 5-4. FIELDVUE DVC6020 Digital Valve Controller Mounted on Fisher 1052, Size 33 Actuator

so that the outer surface is flush with the end of the travel sensor shaft.

4. 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.

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, 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.

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9. Apply lubricant (key 63) 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)

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.

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* 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).

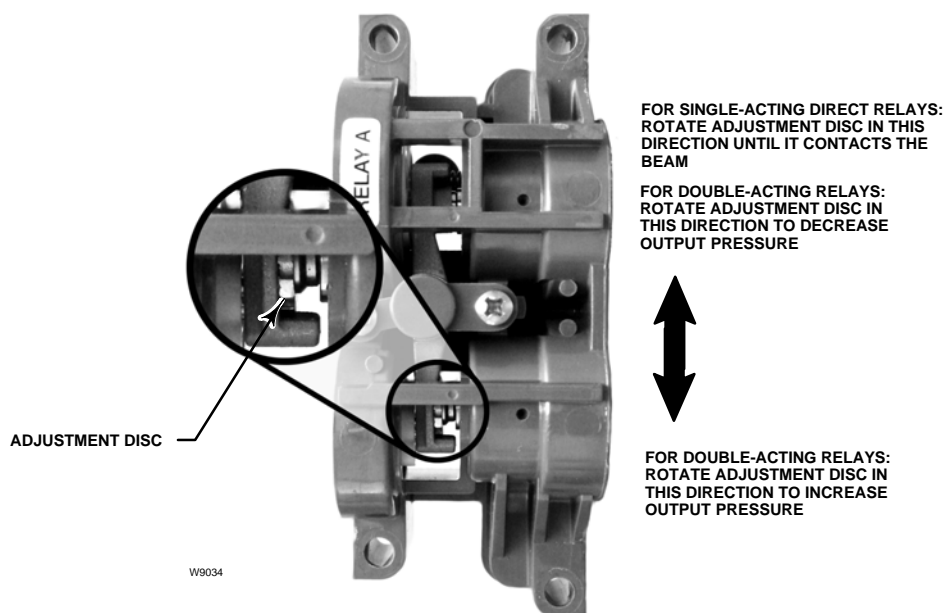


Figure 5-5. Relay A Adjustment (Shroud Removed for Clarity)

If the low bleed relay option has been ordered stabilization may take approximately two minutes longer than the standard relay.

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.

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*, *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.

Section 6 Viewing Device Variables and Diagnostics



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Service Tools



Note

Service Tools are not available for instrument level AC.

Alert Conditions (2-1)

6

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, 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. See table 6-1 for alert groups.

- **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.

Power Starvation Alert— This alert is activated if the instrument does not have enough power to function properly. Firmware 7 and below.

Low Power Write Alert— This alert is activated if a write to the instrument is attempted when the loop current is less than approximately 3.5 mA. Firmware 9, 10, and 11.

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 printed wiring board 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 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

Viewing Device Variables and Diagnostics

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.

Temperature Sensor

Temperature Sensor Alert—This alert is indicated when the instrument temperature sensor fails, or the 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

Aux Terminal Alert—This alert is set when the auxiliary input terminals are either open or closed, depending upon the selection for the Auxiliary Input Alert State.

Loop Current Validation Alert— This alert is activated if the loop current is out of valid range. If the control system is known to output currents outside of this range, the loop current shutdown should not be enabled. If this alert is indicated, clear the alert by restarting the instrument with the loop current verified to be in the valid range. If the alert does not clear, replace the printed wiring board. Only available in firmware 9, 10, and 11.

- **Travel**— If a travel alert is active it will appear under TRAVEL ALERTS.

Table 6-1. Alerts Included in Alert Groups for Alert Record

Alert Group	Alerts Include in Group
Valve Alerts	Travel Alert Lo Travel Alert Hi Travel Alert Lo Lo Travel Alert Hi Hi Travel deviation Drive signal
Failure Alerts	No free time Flash ROM fail Drive current fail Ref Voltage fail NVM fail Temperature sensor fail Pressure sensor fail Travel sensor fail
Miscellaneous Alerts	Auxiliary input

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.

- **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 (ODV tier only)**— 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

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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 ODV unit is locked in the safety position.

- **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)

6



Note

Status is not available with instrument level AC.

To view the instrument status, from the *Service Tools* menu select *Status*. This menu item indicates the status of the Operational items listed below. The status of more than one operational item may be indicated.

Instrument Time

Inst Time Invalid

Calibration and Diagnostics

Cal in Progress

Autocal in Progress

Diag in Progress

Diag Data Avail

Operational

Press Ctrl Active

Multi-Drop

Integrator

Integrator Sat Hi

Integrator Sat Lo

Device Record (2-3)



Note

Device Record is not available for instrument level AC.

From the *Online* menu, select *Service Tools, Device Record*. Follow the prompts on the Field Communicator display to view the following 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)



Note

Stroke Valve is not available with instrument level AC.

From the *Online* menu, select *Service Tools, 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.

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- *Step to Target*—Steps the travel to the specified target.

Partial Stroke Test (2-5)



Note

Partial Stroke Test is only available for instrument level ODV.



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, provide some temporary means of control for the process.

The Partial Stroke Test allows the DVC6000 digital valve controllers with instrument level ODV to perform a Valve Signature type of test while the instrument is in service and operational. In some 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 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 475 Field Communicator, or ValveLink software.

Device (*Digital Valve Controller*)

The Auto Partial Stroke Test allows the partial stroke test to be scheduled by the DVC6000. The test is scheduled in number of hours between tests. Any power cycle will reset the test clock 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. Refer to Auxiliary Terminal Wiring Length Guidelines below.

• Local Push Button

A partial stroke test command may be sent to the 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 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 with instrument level ODV 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.

DVC6000 Digital Valve Controllers

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 $\mu\text{H/ft}$
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 = $18000\text{pF} / (97\text{pF/ft}) = 185\text{ ft}$

6

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

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, 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. Once the valve has reached the endpoint, check that the valve has reached the desired set point. The valve should return to its original position.

For information on configuring the Partial Stroke Test, see Partial Stroke Variables in the Detailed Setup section.

Viewing Device Variables and Diagnostics

Overview (3)

The following menus are available to define and/or view information about the instrument. From the Online menu select *Overview*.



Note

These variables are not available for instrument level AC. Supply Pressure alert is not available for instrument level HC.

Analog In—the value of the instrument analog input in mA (milliamperes) or % (percent) of ranged input.

Setpoint—the requested valve position in % of ranged travel.

Travel—the value of the DVC6000 digital valve controller travel in % (percent) of ranged travel. Travel always represents how far the valve is open.

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

Pressure

Shows the value of the instrument supply and output pressures in psi, bar, kPa, or kg/cm². 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**—the value of Output Pressure A in psi, bar, kPa, or kg/cm².
- **Pressure B**— the value of Output Pressure A in psi, bar, kPa, or kg/cm².
- **A Minus B**—the value of the output pressure differential in psi, bar, kPa, or kg/cm².
- **Pressure**—the instrument supply pressure in psi, bar, kPa, or kg/cm². Not available in instrument level HC.

Variables

The *Variables* menu is available to view additional variables, including; *Auxiliary Input*, *Temperature*, *Maximum Temperature*, *Minimum Temperature*, *Cycle Counter*, *Travel Accumulator*, *Raw Travel Input*, *Run Time*, and *Number of Power Ups*.



Note

These variables are not available for instrument level AC.

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 4-15 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 4-15 of the Detailed Setup section for additional information.

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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.

6

- **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

The *Device Information* menu is available to view information about the instrument. Follow the prompts on the Field Communicator display to view information in the following fields: *HART Tag*, *Device ID*, *Manufacturer*, *Model*, *Device Revision*, *Firmware Revision*, *Hardware Revision*, *Instrument Level*, and *HART Universal Revision*.

- **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

Instrument Level	Functions Available
AC	Communicates with the Field Communicator. Provides basic setup and calibration.
HC	Communicates with the Field Communicator and ValveLink software. In addition to above, 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.
AD	Includes all functions listed above plus (with ValveLink software) all offline diagnostic tests (dynamic error band, drive signal, step response, and valve signature) plus online trending
PD	Includes all functions listed above plus all Performance Diagnostics online/in-service valve testing (valve friction, electronics, and mechanical condition)
ODV	Includes all functions listed above plus partial stroke test and lead/lag input filter.

- **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

- AC—Auto Calibrate
- HC—HART Communicating
- AD—Advanced Diagnostics
- PD—Performance Diagnostics
- ODV—Optimized Digital Valve

Table 6-2 lists the functions available for each instrument level.

- **HART Universal Revision**—The revision number of the HART Universal Commands which are used as the communications protocol for the instrument.

DD Information

Contains the device description in the Field Communicator.

Section 7 Maintenance and Troubleshooting

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DVC6000 Digital Valve Controllers

The DVC6000 digital valve controller enclosure is rated NEMA 4X and IP66, therefore periodic cleaning of internal components is not required. If the DVC6000 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.

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.

7

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 the 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:

- 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.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance procedures on the DVC6000 digital valve controller:

- Always wear protective clothing, gloves, and eyewear.
- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be

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.

Because of the diagnostic capability of the DVC6000, 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 the ValveLink software, refer to the ValveLink software online help.

Module Base Maintenance

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.

Tools Required

Table 7-1 lists the tools required for maintaining the DVC6000 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

Removing the Module Base

To remove the module base for DVC6010, DVC6020 and DVC6030 digital valve controllers, perform the following steps. Refer to figures 8-2, 8-3 and 8-4, respectively, for key number locations.

7



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).

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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.

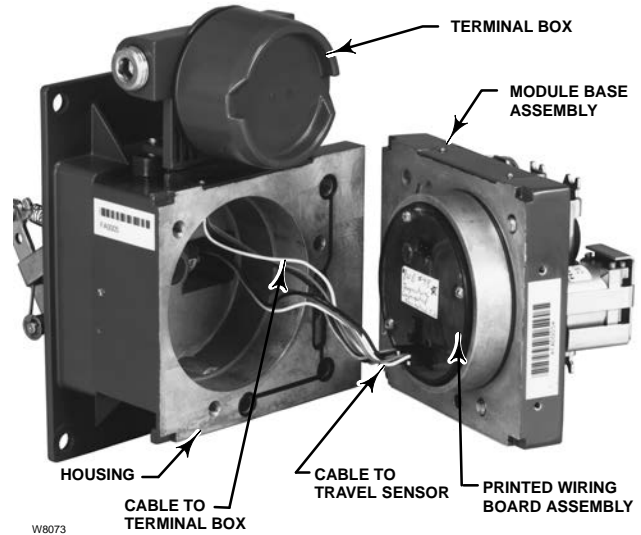


Figure 7-1. Printed Wiring Board Cable Connections

7

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.

Replacing the Module Base

To replace the module base, for DVC6010, DVC6020 and DVC6030 digital valve controllers, perform the following steps. Refer to figures 8-2, 8-3 and 8-4, respectively, for key number locations.



Note

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

Ensure the 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).

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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).

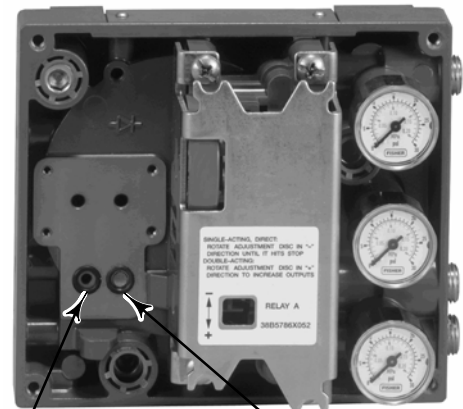
Submodule Maintenance

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 and replaced with new submodules. After replacing a submodule, the module base may be put back into service.

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.



O-RING LOCATED IN I/P CONVERTER OUTPUT PORT

W8072

SCREEN (FILTER) LOCATED IN I/P CONVERTER SUPPLY PORT

Figure 7-2. I/P Filter Location

I/P Converter

Refer to figures 8-2 through 8-9 for key number locations. The I/P converter (key 41) is located on the front of the module base.

7



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.
5. Reinstall the I/P converter (key 41) and shroud (key 169) as described in the Replacing the I/P Converter procedure.

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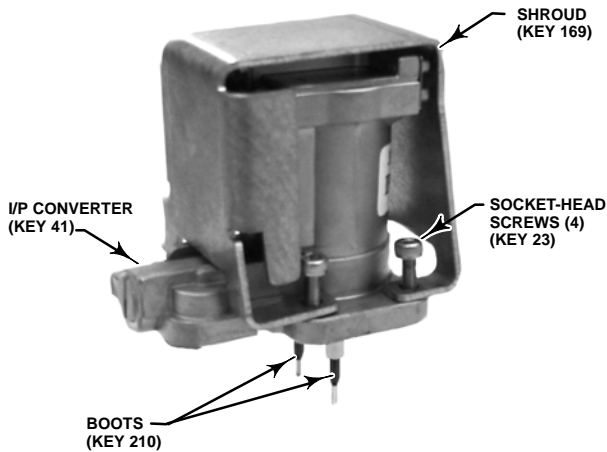


Figure 7-3. I/P Converter

W9328

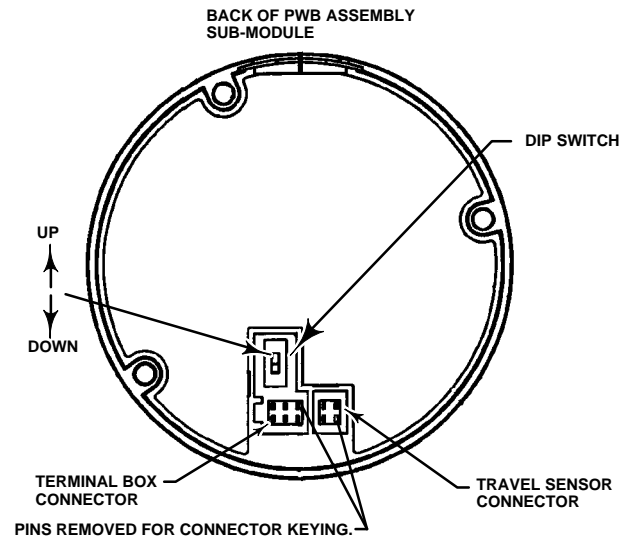


Figure 7-4. DIP Switch Location

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 8-2 through 8-9 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.

Table 7-2. DIP Switch Configuration⁽¹⁾

Operational Mode	Switch Position
Multidrop Loop	UP  ↑
Point-to-Point Loop	DOWN  ↓

1. Refer to figure 7-4 for switch location.

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.



Note

For the digital valve controller to operate with a 4 to 20 mA control signal, be sure the DIP switch is in the point-to-point loop position, i.e., switch in down position.

6. Reassemble the module base to the housing by performing the Replacing the Module Base procedure.
7. Setup and calibrate the digital valve controller.

Pneumatic Relay

Refer to figures 8-2 through 8-9 for key number locations. The pneumatic relay (key 24) is located on the front of the module base.

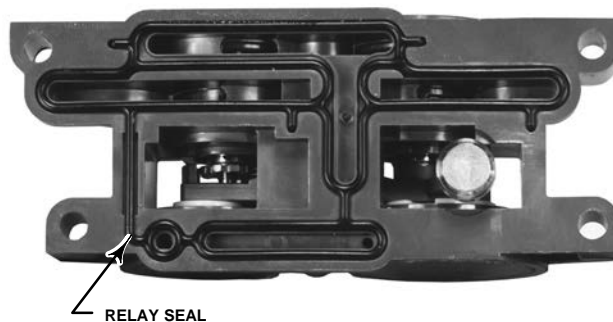


Figure 7-5. Pneumatic Relay Assembly



Note

After relay submodule replacement, calibrate the digital valve controller to maintain accuracy specifications.

Removing the Pneumatic Relay

1. Loosen the four screws that attach the relay (key 24) to the module base. These screws are captive in the relay.
2. Remove the relay.

Replacing the Pneumatic Relay

1. 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.
2. 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.
3. 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).
4. Using the Field Communicator, verify that the value for the parameter Relay matches the relay type installed.
5. After replacing the relay and verifying the relay type, calibrate travel or perform touch-up calibration to maintain accuracy specifications.

Gauges, Pipe Plugs, or Tire Valves

Depending on the options ordered, the DVC6000 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 8-6). These are located on the top of the module base next to the relay.

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Perform the following procedure to replace the gauges, tire valves, or pipe plugs. Refer to figures 8-5 through 8-6 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.

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

3. Apply sealant (key 64) to the threads of the replacement gauges, pipe plugs, or tire valves.
4. Using a wrench, screw the gauges, pipe plugs, or tire valves into the module base.

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.

Terminal Box



WARNING

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

Refer to figures 8-2 through 8-9 for key number locations.

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

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



Note

This procedure also applies to the DVC6005 remote terminal box.

Maintenance and Troubleshooting

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 sealant (key 64) to the conduit entrance plug (key 62) and install it into the unused conduit entry of the terminal box.

Travel Sensor

WARNING

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

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 Digital Valve Controller and DVC6015 Remote Feedback Unit

Refer to figure 8-2 for DVC6010 and 8-7 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 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 terminals.
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 Digital Valve Controller and DVC6025 Remote Feedback Unit

Refer to figure 8-3 for DVC6020 and 8-8 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 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.
b. Disconnect the three potentiometer assembly wires from the terminals.

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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 Digital Valve Controller and DVC6035 Remote Feedback Unit

Refer to figure 8-4 for DVC6030 and 8-9 for DVC6035 key number locations.

1. Remove piping and fittings from the instrument.
2. Remove the digital valve controller from the actuator. Loosen the screw (key 80) that secures the feedback arm (key 79) to the travel sensor shaft. Remove the feedback arm from the travel sensor shaft.

If disassembling a DVC6030 digital valve controller use step 3a. If disassembling a DVC6035 remote feedback unit use step 3b.

3. 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 terminals.
4. 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 Digital Valve Controller and DVC6015 Remote Feedback Unit

Refer to figure 8-2 for DVC6010 and 8-7 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:

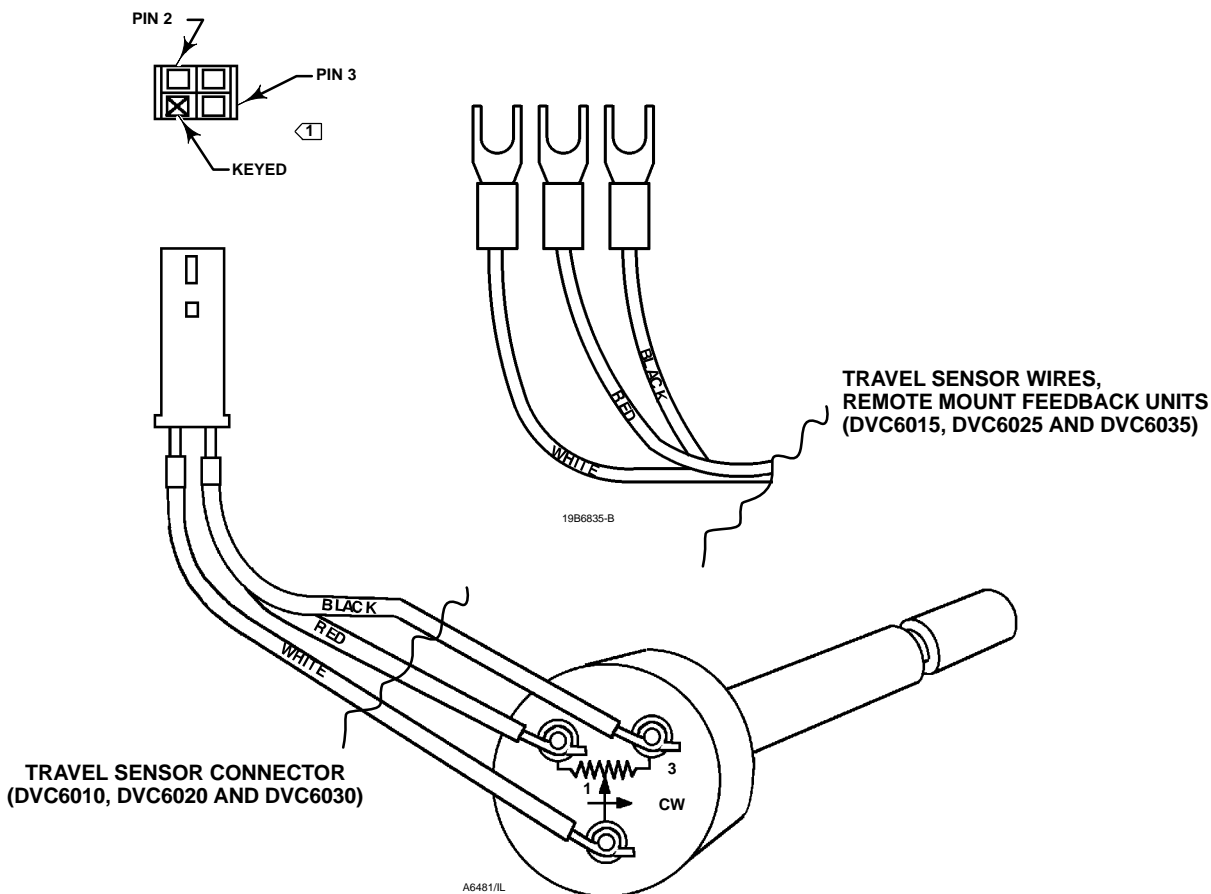
- red** → terminal 1
- white** → terminal 2
- black** → terminal 3

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.
9. Adjust the travel sensor shaft to obtain the calculated resistance determined in step 7, ± 100 ohms.



NOTE:

① THE POTENTIOMETER RESISTANCE BETWEEN PINS 2 AND 3 CAN BE MEASURED AT THE CONNECTOR. INSERT TWO SHORT LENGTHS OF 22 AWG WIRE INTO THE PIN 2 AND 3 RECEPTACLES IN THE CONNECTOR. CLIP ON LEADS FROM A DVM (DIGITAL VOLTMETER) TO MEASURE THE RESISTANCE.

Figure 7-6. Potentiometer Resistance Measurement



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 at the calculated resistance determined in step 7, ± 100 ohms. Paint the screw to discourage tampering with the connection.

11. Disconnect the multimeter from the travel sensor connector.

12. For the DVC6010, 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.

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, connect the travel sensor connector to the PWB as described in Replacing the Module Base.

DVC6000 Digital Valve Controllers

15. For both the DVC6010 and the DVC6015, perform the appropriate Travel Sensor Adjust procedure in the Calibration section.

DVC6020 Digital Valve Controller and DVC6025 Remote Feedback Unit

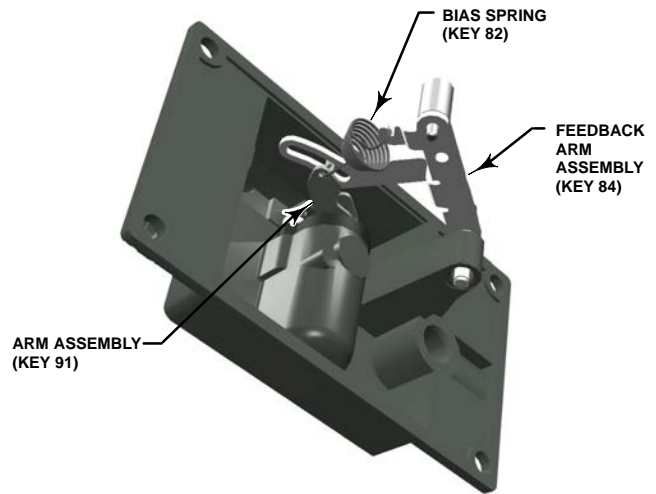
Refer to figure 8-3 for DVC6020 and 8-8 for DVC6025 key number locations.

1. Insert the travel sensor assembly (key 223) into the housing. Secure the travel sensor assembly with screw (key 72).

If assembling a DVC6020 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:
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 digital Valve Controller, Bias Spring (key 82) Installation

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, ± 100 ohms.



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.



Note

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

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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 at the calculated resistance determined in step 6, ± 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 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 only, connect the travel sensor connector to the PWB as described in Replacing the Module Base.

19. For both the DVC6020 and the DVC6025, perform the appropriate Travel Sensor Adjust procedure in the Calibration section.

DVC6030 Digital Valve Controller and DVC6035 Remote Feedback Unit

Refer to figure 8-4 for DVC6030 and 8-9 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 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, ± 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 at the calculated resistance determined in step 8, ± 100 ohms. Paint the screw to discourage tampering with the connection.
12. Disconnect the multimeter from the travel sensor connector.
13. For the DVC6030 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 only, connect the travel sensor connector to the PWB as described in Replacing the Module Base.
16. For both the DVC6030 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 Troubleshooting Checklist on page 7-18.

Checking Voltage Available

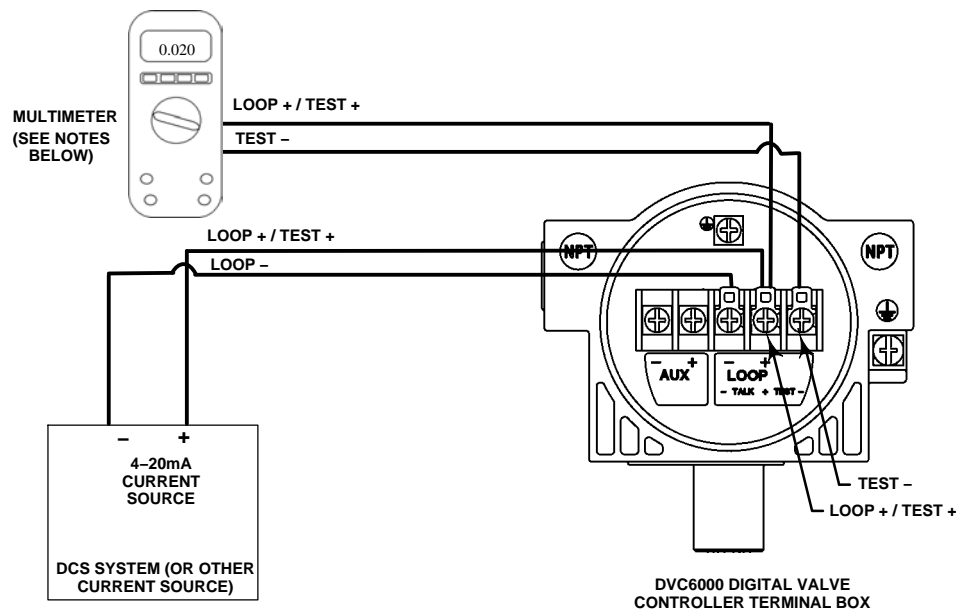


WARNING

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 2-26 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 2-26 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 (± 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 $R = \text{PRECISION } 1 \text{ OHM RESISTOR}$, $V = I \times 1$, 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.

DVC6000 Digital Valve Controllers

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>Utility</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 assy.
	3b. Broken travel sensor wire(s).	3b. Inspect wires for broken solder joint at pot or broken wire. Replace pot/bushing assy.
	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 assy.
	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.

Maintenance and Troubleshooting

Table 7-3. Instrument Troubleshooting (Continued)

Symptom	Possible Cause	Action
3. Instrument will not calibrate, has sluggish performance or oscillates.	3h. Configuration errors.	3h. Verify configuration: If necessary, set protection to None. If Out of Service, place In Service. Check: Travel Sensor Motion Tuning set Zero control signal Feedback Connection Control mode (should be Analog) 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 assy 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 ass'y 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. 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 Digital Valve Controllers

DVC6000 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.
(For a DVC6000 pwb built prior to 2003, these values should be around 9.4 V @ 4.0 mA. For a DVC6000 pwb built after 2003, 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? AC ____ HC ____ AD ____ PD ____ ODV ____
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 do you have? DVC6010 ____ DVC6020 ____ DVC6030 ____ Remote Mount? ____
2. What Make, Brand, Style, Size, etc. actuator is the DVC6000 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 or DVC6030: 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 _____

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DVC6000 Digital Valve Controllers

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 instrument, 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 Extreme Temperature option (fluorosilicone elastomers)	19B5402X012 19B5402X022
2*	Small Hardware Spare Parts Kit (kit contains parts to service one digital valve controller)	19B5403X012
3	Conversion Kit (To convert a DVC6010 to DVC6020 or a DVC6015 to DVC6025) Also see note below	19B5405X012

Note

When converting a DVC6010 to a DVC6020 for pipe-away construction, also order pipe-away bracket kit, item 7.

Key	Description	Part Number
4	Conversion Kit (to convert a DVC6020 to DVC6010 or a 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) [kit contains mounting bracket (key 74) and O-ring (key 75)] Standard Extreme Temperature option (fluorosilicone elastomers)	19B5404X012 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 Standard, Natural Gas approved Extreme Temperature option (fluorosilicone elastomers) Extreme Temperature option (fluorosilicone elastomers) Natural Gas Approved Stainless Steel, Natural Gas Approved Stainless Steel, Extreme Temperature option (fluorosilicone elastomers), Natural Gas approved	19B5401X012 19B5401X072 19B5401X022 19B5401X082 19B5401X092 19B5401X112
10*	I/P Converter Kit Standard For Extreme Temperature option (fluorosilicone elastomers)	38B6041X152 38B6041X132
11	Adjustment Arm Kit (includes washer, nut and adjustment arm)	14B5072X132
12*	PTFE Sleeve Kit [For pot bushing assembly (kit includes 10 sleeves and Lubricant)] DVC6010 and DVC6020 DVC6030	GE08726X012 GE08727X012
13*	Spare Module Base Assembly Kit [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 Stainless Steel	GE18654X012 GE18654X022

*Recommended spare

Kit	Description	Part Number	Kit	Description	Part Number
14*	Spare Housing Assembly Kit, [kit contains housing (key 1); drive screw, qty. 2 (key 11); shield (key 20); and screen (key 271)]		25	Kit, Spring	
	Aluminum			DVC6010 0.25 to 2 inch travel [kit contains 10 bias springs w/tungsten carbon coating]	GE37413X012
	DVC6010/DVC6020	GE18652X012		DVC6010 2 to 4 inch travel, [kit contains 10 bias springs w/tungsten carbon coating]	GE37414X012
	DVC6030	GE18653X012			
	Stainless Steel				
	DVC6010/DVC6020	GE18652X022			
	DVC6030	GE18653X022			
15	DVC6020 Cam Adjustment Tool	GE12742X012			
16*	Spare Shroud Kit	GE29183X012			
17	Travel Sensor with Feedback Arm Assembly and PTFE Sleeve Kit				
	DVC6010	GG09947X012			
	DVC6015	GG09948X012			
	DVC6020	GG09949X012			
	DVC6025	GG09950X012			

Remote Mount Kits

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

Note

This kit converts an existing DVC6000 in the remote mounted version. Note that the DVC6030 cannot be converted to the DVC6035.

DVC6010 to DVC6005/DVC6015	DVC6015RMTR
DVC6010 to DVC6005/DVC6035	DVC6035RMTR
DVC6020 to DVC6005/DVC6025 (short arm)	DVC6025RMSA
DVC6020 to DVC6005/DVC6025 (long arm)	DVC6025RMLA

21	Feedback Unit Termination Strip Kit	GE00419X012
22	Pipestand/Wall Mounting Kit	GE00420X012

Severe Service Linkage Kits

Note

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.

23	Corrosion Kit	
	DVC6010 0.25 to 2 Inch travel	GE22667X012
	DVC6010 2 to 4 Inch travel	GE22668X012
	DVC6020 short arm	GE22670X012
	DVC6020 long arm	GE22671X012
	DVC6030 rotary	GE22672X012
	DVC6030 linear	GE22673X012
24	Wear Kit	
	DVC6010 0.25 to 2 Inch travel	GE22674X012
	DVC6010 2 to 4 Inch travel	GE22675X012
	DVC6020 short arm	GE22676X012
	DVC6020 long arm	GE22677X012
	DVC6030 rotary	GE22678X012
	DVC6030 linear	GE22679X012

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

Housing

DVC6010, DVC6020, DVC6030, DVC6005
(see figures 8-2, 8-3, 8-4, and 8-5)

1	Housing ⁽¹⁴⁾
11	Drive Screw ⁽¹⁴⁾ (2 req'd)
20	Shield ⁽¹⁴⁾
52	Vent, plastic ⁽²⁾ DVC6010, DVC6030, and DVC6005 only
74	Mounting Bracket DVC6020 Std ⁽³⁾ or pipe-away ⁽⁷⁾ , and DVC6005 ⁽²²⁾
75*	O-Ring ⁽⁷⁾ , DVC6020 only
245	Pipe Plug, pl stl ⁽⁷⁾ , DVC6020 Vent-away only
248	Screw, hex head ⁽²²⁾ (4 req'd), (DVC6005 only)
249	Screw, hex head ⁽²²⁾ (4 req'd), (DVC6005 only)
250	Spacer ⁽²²⁾ (4 req'd), (DVC6005 only)
267	Standoff ⁽²²⁾ (2 req'd), (DVC6005 only)
271	Screen ⁽¹⁴⁾

Common Parts

DVC6010, DVC6020, DVC6030, DVC6005
(see figures 8-2, 8-3, 8-4, and 8-5)

16*	O-ring ⁽¹⁾ (3 req'd)
29	Warning label, for use only with LCIE hazardous area classifications
33	Mach Screw, pan hd, SST ⁽²⁾ (3 req'd)
38	Cap Screw, hex socket, SST ^(2,13) (3 req'd)

*Recommended spare

- Available in the Elastomer Spare Parts Kit
- Available in the Small Hardware Spare Parts Kit
- Available in the DVC6010 to DVC6020 Conversion Kit
- Available in the Pipe-Away Bracket Kit
- Available in the Spare Module Base Assembly Kit
- Available in the Spare Housing Assembly Kit
- Available in the Pipestand/Wall Mounting Kit

DVC6000 Digital Valve Controllers

Key	Description	Part Number
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) ⁽¹³⁾	
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 ⁽²⁾ (3 req'd)	
237	Module Base Seal ⁽¹⁾	

Module Base

DVC6010, DVC6020, DVC6030, DVC6005
(see figures 8-2, 8-3, 8-4, 8-5, and 8-6)

2	Module Base ⁽¹³⁾
11	Drive Screw ⁽¹³⁾ (2 req'd)
12	O-ring ⁽¹⁾
19	Label, Shield Assembly ⁽¹³⁾
61	Pipe Plug, hex socket ⁽¹³⁾ (3 req'd)
236	Screen, for single-acting direct units only ⁽¹³⁾
243	Flame Arrestor Assy ⁽¹³⁾ (3 req'd)

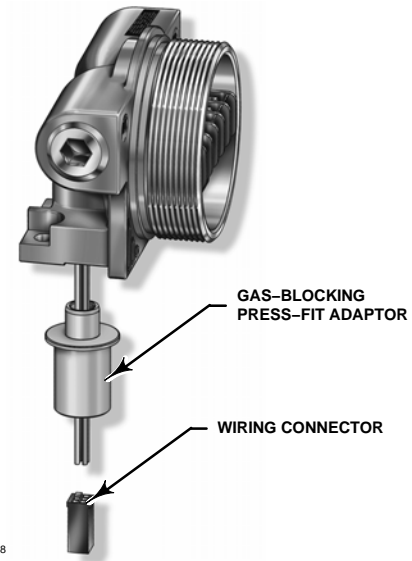


Figure 8-1. Terminal Box of Natural Gas Certified FIELDVUE DVC6000 Digital Valve Controller

8

I/P Converter Assembly

DVC6010, DVC6020, DVC6030, DVC6005
(see figures 8-2, 8-3, 8-4, and 8-5)

23	Cap Screw, hex socket, SST ^(2,16) (4 req'd)
39*	O-ring ^(1,10)
41	I/P Converter ⁽¹⁰⁾
169	Shroud ^(10,16)
210*	Boot, nitrile ^(1,10) (2 req'd) (also see figure 7-3)
231*	Seal Screen ^(1,8,10)

Relay

DVC6010, DVC6020, DVC6030, DVC6005
(see figures 8-2, 8-3, 8-4, and 8-5)

24*	Relay Assembly, (includes shroud, relay seal, mounting screws)	
	Standard	
	Single-acting direct (relay C)	38B5786X132
	Double-acting (relay A)	38B5786X052
	Single-acting reverse (relay B)	38B5786X092
	Low Bleed	
	Single-acting direct (relay C)	38B5786X152
	Double-acting (relay A)	38B5786X072
	Single-acting reverse (relay B)	38B5786X112
	Extreme Temperature option (fluorosilicone elastomers)	
	Standard Bleed	
	Single-acting direct (relay C)	38B5786X142
	Double-acting (relay A)	38B5786X032
	Single-acting reverse (relay B)	38B5786X102
	Low Bleed	
	Single-acting direct (relay C)	38B5786X162
	Double-acting (relay A)	38B5786X082
	Single-acting reverse (relay B)	38B5786X122

Key	Description	Part Number
-----	-------------	-------------

Terminal Box

DVC6010, DVC6020, DVC6030, DVC6005
(see figures 8-1, 8-2, 8-3, 8-4, and 8-5)

4	Terminal Box Cap ⁽¹⁸⁾
34*	O-ring ^(1,9,18)
36*	O-ring ^(1,9,18)
44	Wire Retainer, pl stl ⁽²⁾ (6 req'd) (not shown)
58	Set Screw, hex socket, SST ^(2,18)
72	Cap Screw, hex socket, SST ^(2,18)
164	Terminal Box Assembly ⁽⁹⁾

Feedback Connections Terminal Box

DVC6005 (see figure 8-5)

4	Terminal Box Cap ⁽¹⁸⁾	
34*	O-ring ^(1,9,18)	
36*	O-ring ^(1,9,18)	
44	Wire Retainer, pl stl ^(2,19) (5 req'd) (not shown)	
58	Set Screw, hex socket, SST ^(2,18)	
62	Pipe Plug, hex hd, SST ⁽¹⁸⁾	
72	Cap Screw, hex socket, SST ^(2,18) (3 req'd)	
262	Adapter ⁽¹⁸⁾	
263*	O-ring ⁽¹⁸⁾	
	Standard	1F463606992
	Extreme temperature option, (fluorosilicone)	1F4636X0092
264	Terminal Box Assembly, remote ⁽¹⁸⁾	

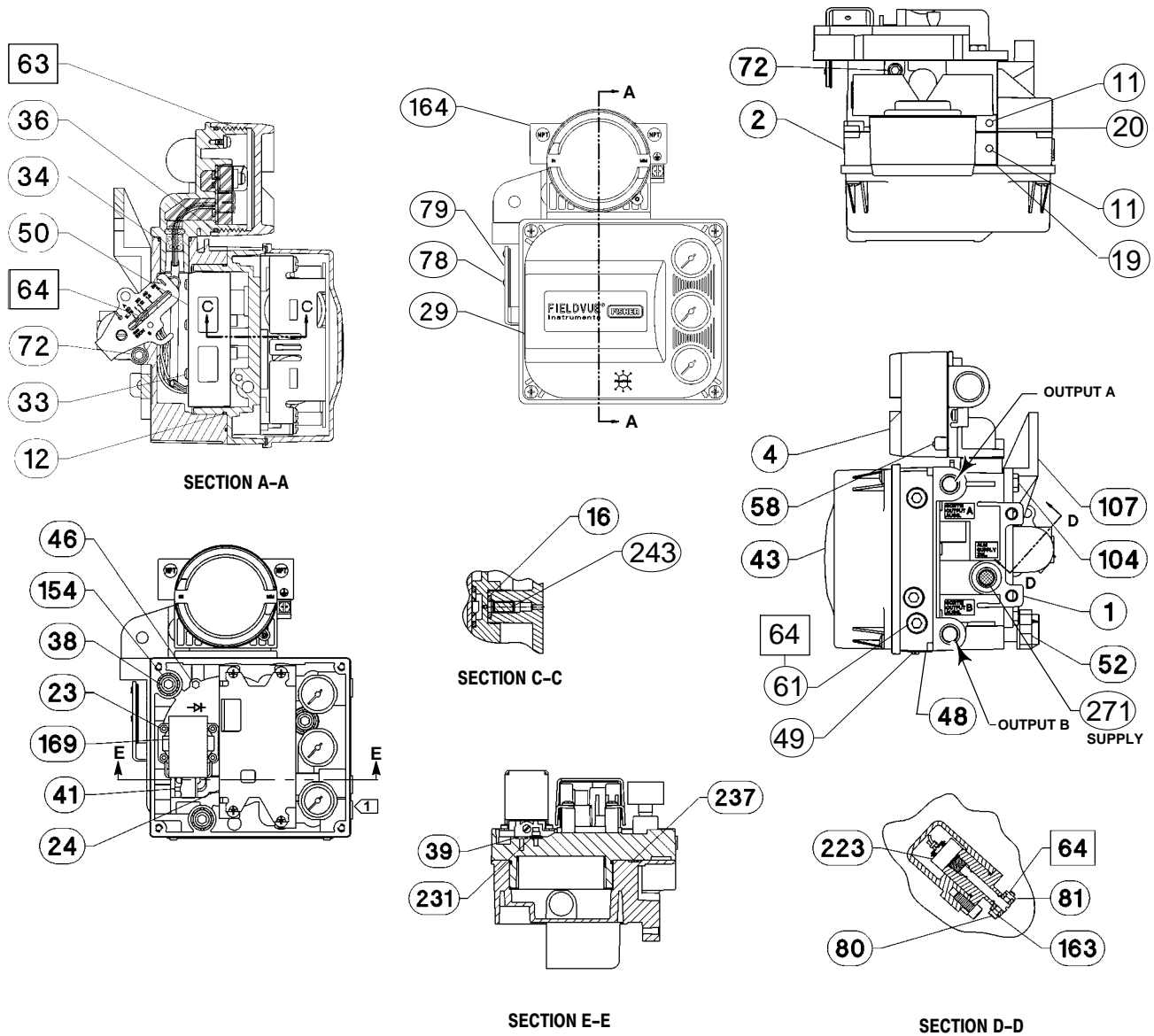
*Recommended spare

1. Available in the Elastomer Spare Parts Kit
2. Available in the Small Hardware Spare Parts Kit
8. Available in the Seal Screen Kit
9. Available in the Terminal Box Kit
10. Available in the I/P Converter Kit
13. Available in the Spare Module Base Assembly Kit
16. Available in the Spare Shroud Kit
18. Available in the Remote Terminal Box Kit
19. Available in Feedback Unit Kit

Key	Description	Part Number	Key	Description	Part Number
PWB Assembly DVC6010, DVC6020, DVC6030, DVC6005 (see figures 8-2, 8-3, 8-4, and 8-5)			79	Feedback Arm for DVC6010, DVC6015, DVC6030 and DVC6035	
			80	Cap Screw, hex socket, SST ^(2,19)	
			81	Square Nut, SST ^(2,19)	
			104	Cap Screw, hex hd ⁽¹⁹⁾ (4 req'd) Aluminum Construction DVC6010 and DVC6015 Not for mounting on 1250 and 1250R actuators. Mounting parts for 1250 and 1250R actuators are included in the mounting kit for these actuators.	
	Note Contact your Emerson Process Management sales office for PWB Assembly FS numbers.		107	Mounting Bracket ^(4,19) , DVC6010 and DVC6015 only Not for mounting on 1250 and 1250R actuators. Mounting parts for 1250 and 1250R actuators are included in the mounting kit for these actuators.	
50*	PWB Assembly Standard For instrument level AC For instrument level HC For instrument level AD For instrument level PD For instrument level ODV Extreme Temperature option (fluorosilicone elastomers) For instrument level AC For instrument level HC For instrument level AD For instrument level PD For instrument level ODV		---	Feedback Linkage Shield, see figures 2-1 and 2-2 Up to 50.4 mm (2 inch) travel All sliding-stem actuators except 585C size 60 50.4 mm (2 inch) to 104mm (4 inch) travel All sliding-stem actuators except 585C size 60 585C size 60, 19 mm (0.75 inch) to 104 mm (4 inch) travel	39B2268X012 49B2267X012 49B3844X012
Pressure Gauges, Pipe Plugs, or Tire Valve Assemblies (see figure 8-6)			163	Plain Washer, SST ^(2,19)	
47*	Pressure Gauge, nickel-plated brass case, brass connection Double-acting (3 req'd); Single-acting (2 req'd) PSI/MPA Gauge Scale To 60 PSI, 0.4 MPa To 160 PSI, 1.1 MPa PSI/bar Gauge Scale To 60 PSI, 4 bar To 160 PSI, 11 bar PSI/KG/CM ² Gauge Scale To 60 PSI, 4 KG/CM ² To 160 PSI, 11 KG/CM ²	18B7713X042 18B7713X022 18B7713X032 18B7713X012 18B7713X072 18B7713X082	223*	Potentiometer/Bushing Assy Standard Elastomers DVC6010, DVC6020 DVC6030 Extreme Temperature option (fluorosilicone elastomers) DVC6010 and DVC6020 DVC6030 DVC6015 and DVC6025 ⁽¹⁹⁾ DVC6035 ⁽¹⁹⁾	GE31447X012 GE31448X012 GE31450X012 GE31451X012 GE31453X012 GE31454X012
66	Pipe Plug, hex hd For double-acting and single acting direct w/gauges (none req'd) For Single-acting reverse w/gauges (1 req'd) For all units w/o gauges (3 req'd)		DVC6020 and DVC6025 (see figures 8-3 and 8-8)		
67	Tire Valve Assembly (3 req'd) Stainless Steel Construction DVC6010 (oversized) (4 req'd) Not for mounting on 1250 and 1250R actuators.		74	Mounting Bracket, DVC6025 only (also in Housing parts for DVC6020)	
Feedback / Remote Travel Sensor Parts Common Feedback Parts DVC6010, DVC6020, DVC6030, DVC6015, DVC6025, and DVC6035 (see figures 8-2, 8-3, 8-4, 8-7, 8-8, and 8-9)			82	Bias Spring, SST ⁽³⁾	
46	Alignment Pin ^(6,19) for DVC6010, DVC6030, DVC6015 and DVC6035		83	Bearing Flange, PTFE-based ⁽³⁾ (2 req'd)	
64	Anti-seize compound (not furnished with the instrument)		84	Feedback Arm Assy, SST ⁽³⁾	
65	Lubricant, silicone sealant (not furnished with the instrument)		85	E-ring, pl stl ⁽³⁾ (2 req'd)	
72	Cap Screw, hex socket ^(2,19) (2 req'd) for DVC6010, DVC6020, DVC6015, and DVC6025		86	Plain Washer, pl stl ⁽³⁾ (2 req'd)	
78	Bias Spring, SST ^(2,19) for DVC6010, DVC6030, DVC6015 and DVC6035		87	Follower Post, SST ⁽³⁾	
			88	Roller, SST/PTFE ⁽³⁾	
			89	Spring Lock Washer, pl stl ⁽³⁾	
			90	Hex Nut, pl stl ⁽³⁾	
			91	Arm Assy, SST	
			92	Cap Screw, hex socket ⁽³⁾ (4 req'd)	
			93	Torsion Spring, Feedback Arm ⁽³⁾	
			DVC6015, DVC6025, and DVC6035 (see figures 8-7, 8-8, and 8-9)		
			23	Cap Screw, hex socket ^(19,21) (2 req'd)	
			44	Wire Retainer, pl stl ^(19,21) (9 req'd)	
			49	Screw, self tapping (2 req'd)	
			58	Set Screw, hex socket ⁽¹⁹⁾	
			62	Pipe Plug, hex hd, SST ⁽¹⁹⁾	

*Recommended spare
2. Available in the Small Hardware Spare Parts Kit
3. Available in the DVC6010 to DVC6020 Conversion Kit
4. Available in the DVC6020 to DVC6010 Conversion Kit
6. Available in Alignment Pin Kit
19. Available in Feedback Unit Kit
21. Available in Feedback Unit Termination Strip Kit

DVC6000 Digital Valve Controllers



□ APPLY LUB, SEALANT

NOTES:

1. SEE FIGURE 8-6 FOR GAUGE CONFIGURATIONS

2. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

48B7710-K SHT 1 & 2 / DOC

Figure 8-2. FIELDVUE DVC6010 Digital Valve Controller Assembly

Key	Description	Part Number
131	Retainer Wire	
251	Feedback housing ⁽¹⁹⁾	
252	Assembly Plate Shield ⁽¹⁹⁾ (DVC6015 only)	
253	Terminal bracket ^(19,21)	
254	Terminal Strip ^(19,21)	
255	Terminal Cap ⁽¹⁹⁾	
256	O-ring, fluorosilicone ⁽¹⁹⁾	
257	Machine Screw, pan head ⁽¹⁹⁾ (2 req'd) (DVC6015 only)	
258	Label, cover ⁽¹⁹⁾	
260	Hex Nut, SST (2 req'd)	

Key	Description	Part Number
261	Nameplate	
265	Plug ⁽¹⁹⁾ (DVC6015 and DVC6035 only)	

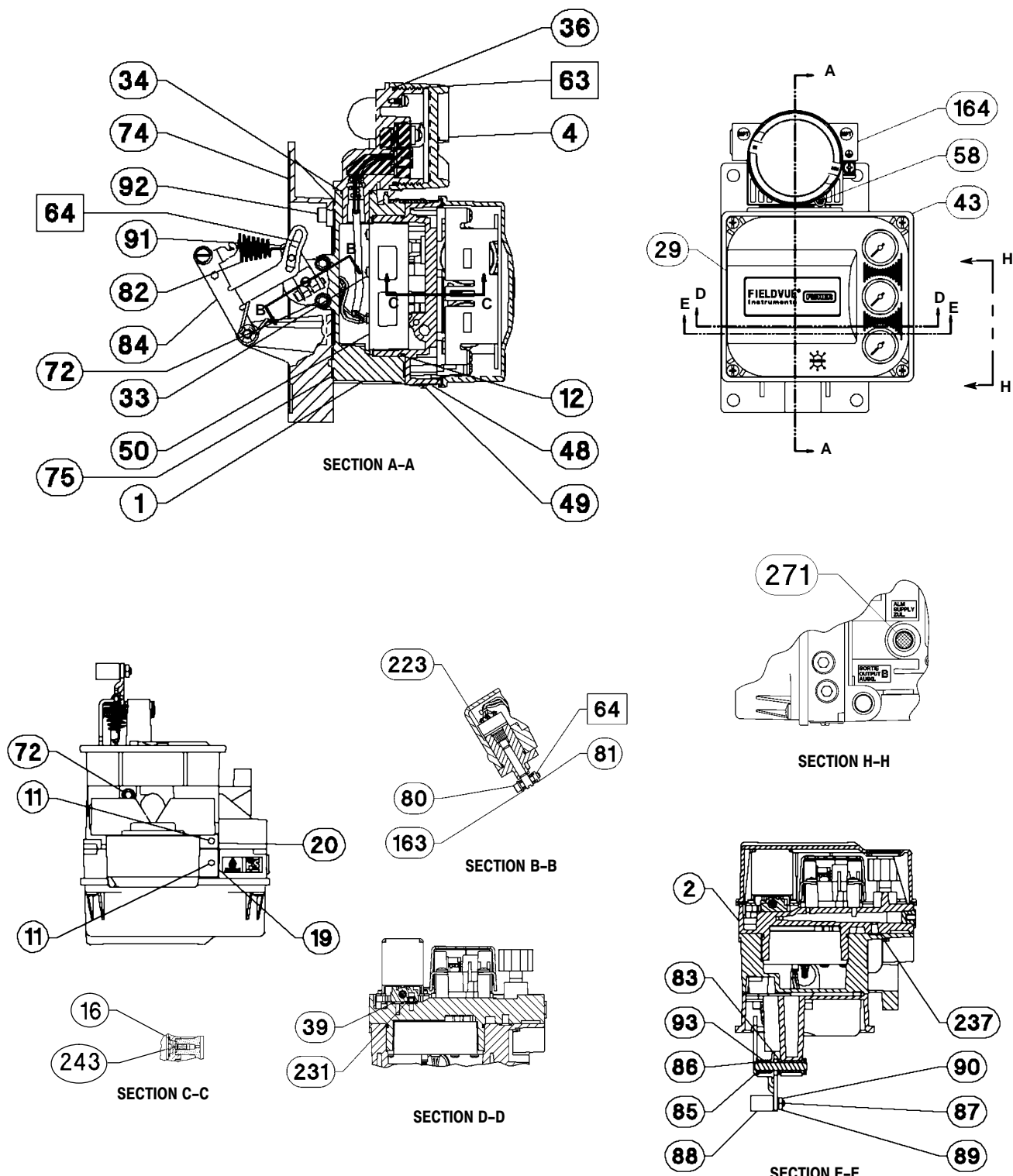
HART Filters

HF340, DIN rail mount	39B5411X022
HF341, DIN rail Mount, pass through (no filter)	39B5412X012

*Recommended spare

19. Available in Feedback Unit Kit

21. Available in Feedback Unit Termination Strip Kit

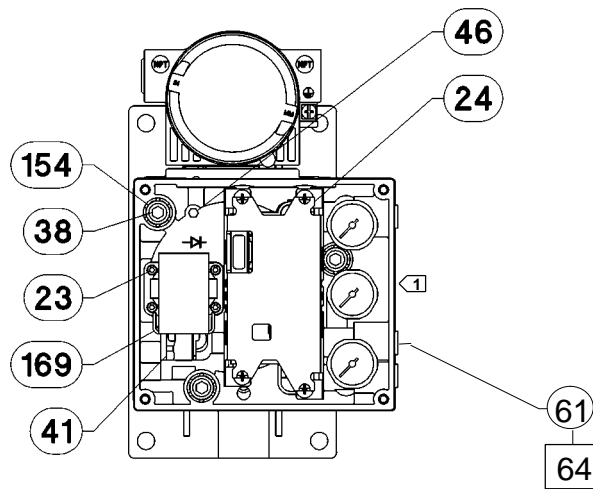


□ APPLY LUB, SEALANT
 1. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

48B9596-KIL SHT 1 & 2 / DOC

Figure 8-3. FIELDVUE DVC6020 Digital Valve Controller Assembly

DVC6000 Digital Valve Controllers



□ APPLY LUB, SEALANT

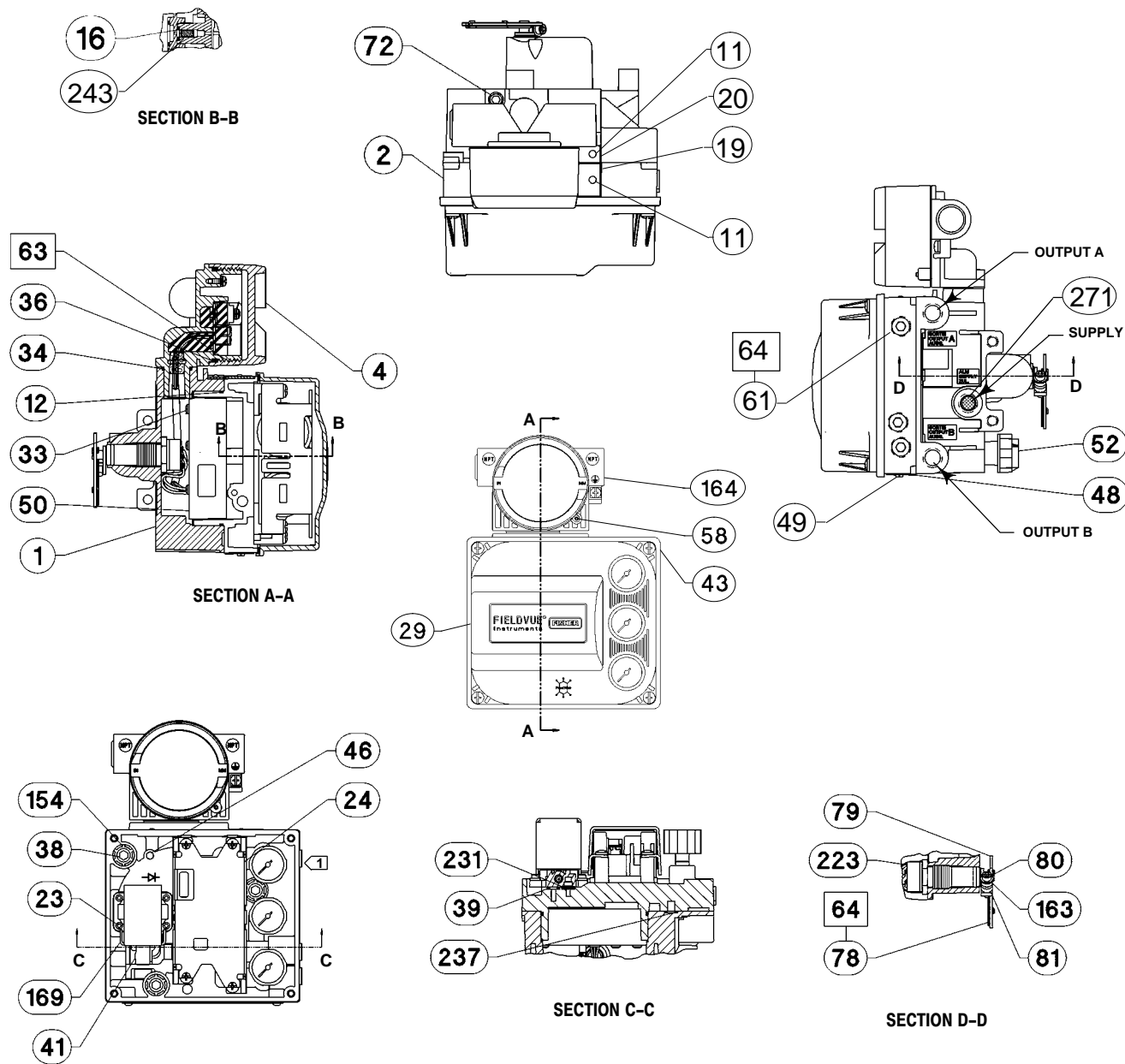
NOTES:

1 SEE FIGURE 8-6 FOR GAUGE CONFIGURATIONS

2. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

48B9596-K SHT 3 / DOC

Figure 8-3. FIELDVUE DVC6020 Digital Valve Controller Assembly (continued)



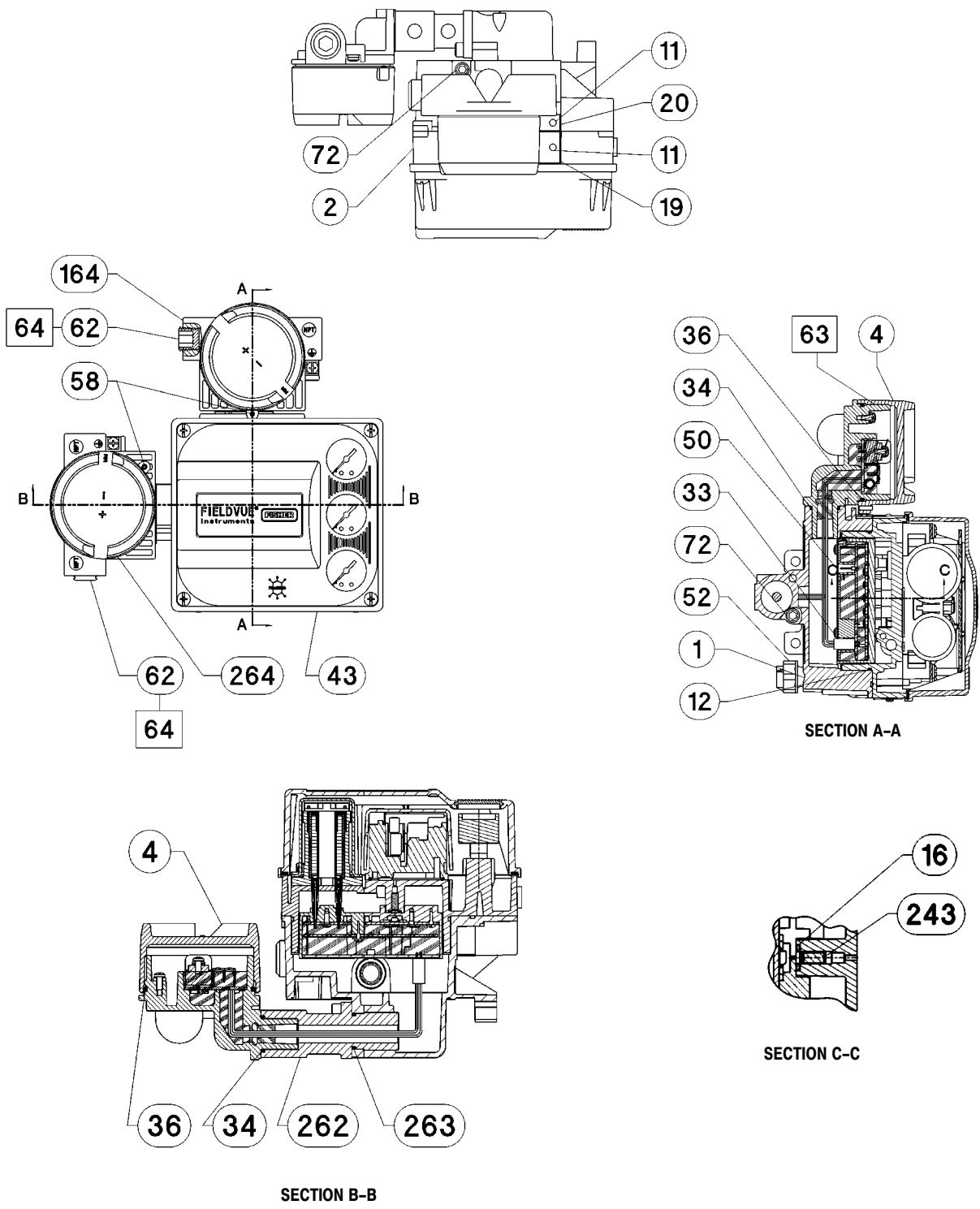
- APPLY LUB, SEALANT, THREAD LOCK
 NOTES:
 1 SEE FIGURE 8-6 FOR GAUGE CONFIGURATIONS
 2. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

48B9597-K SHT 1 & 2 / DOC

Figure 8-4. FIELDVUE DVC6030 Digital Valve Controller Assembly

DVC6000 Digital Valve Controllers

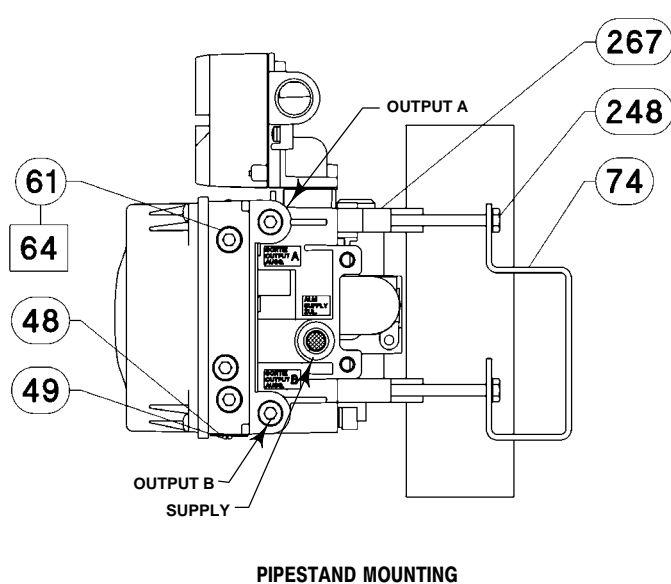
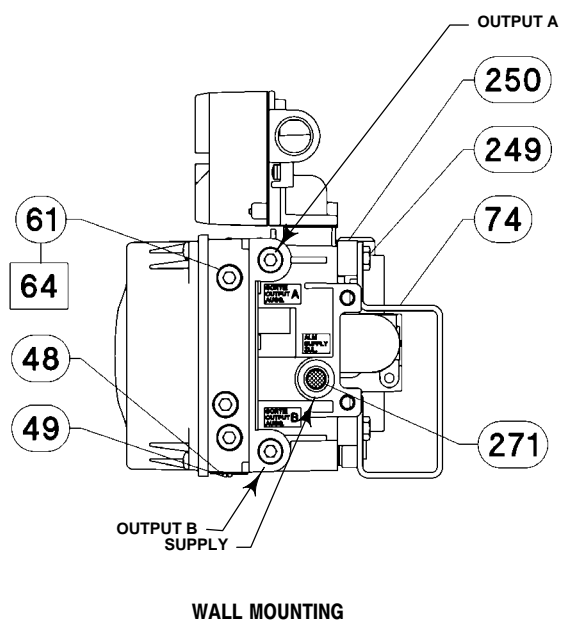
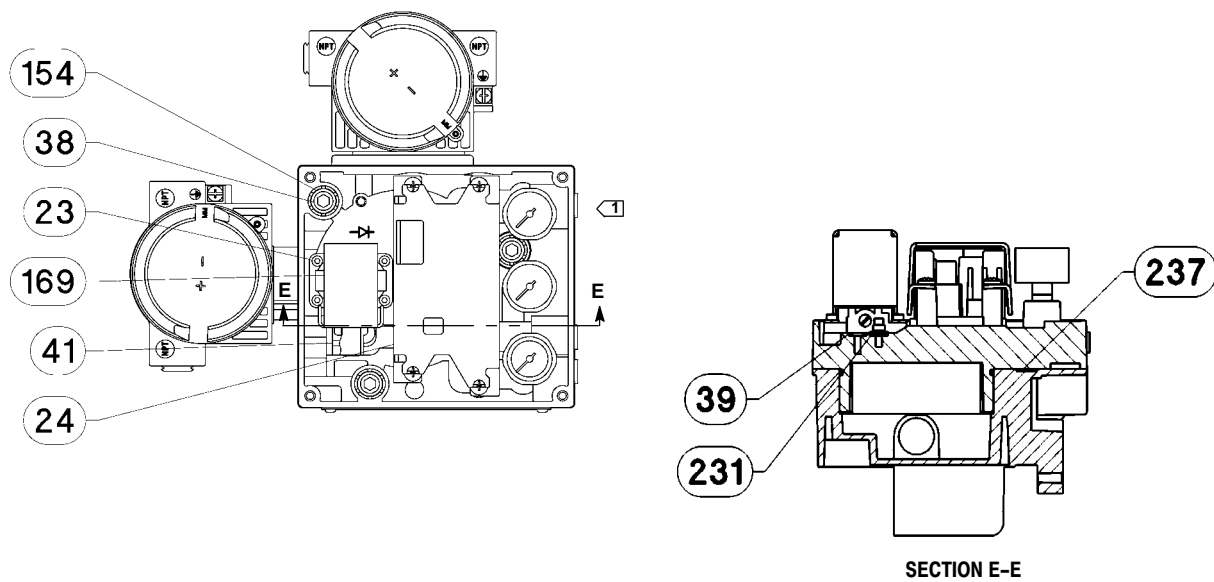
8



□ APPLY LUB, SEALANT
 NOTES:
 1. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

49B3261-C SHT 1 & 2

Figure 8-5. FIELDVUE DVC6005 Base Unit



8

□ APPLY LUB, SEALANT

NOTES:

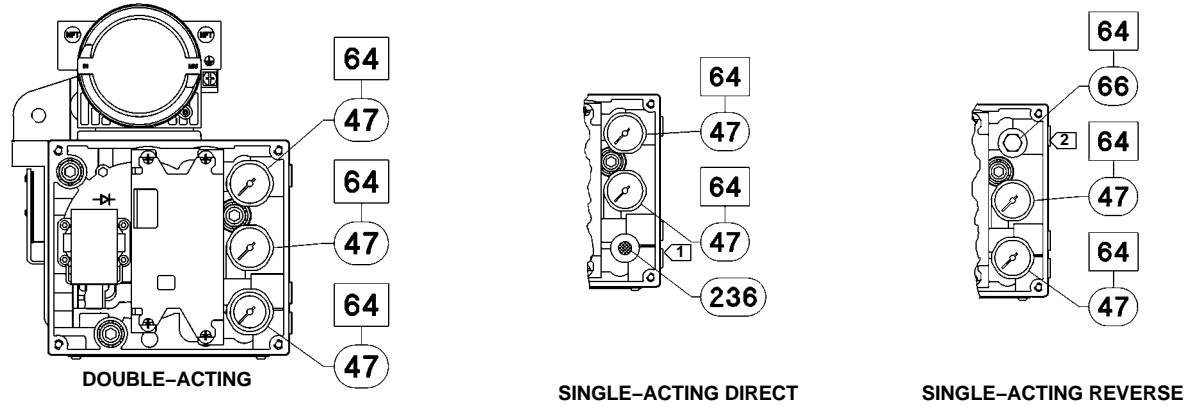
1 SEE FIGURE 8-6 FOR GAUGE CONFIGURATIONS

2. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

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Figure 8-5. FIELDVUE DVC6005 Base Unit (continued)

DVC6000 Digital Valve Controllers



□ APPLY LUB, SEALANT

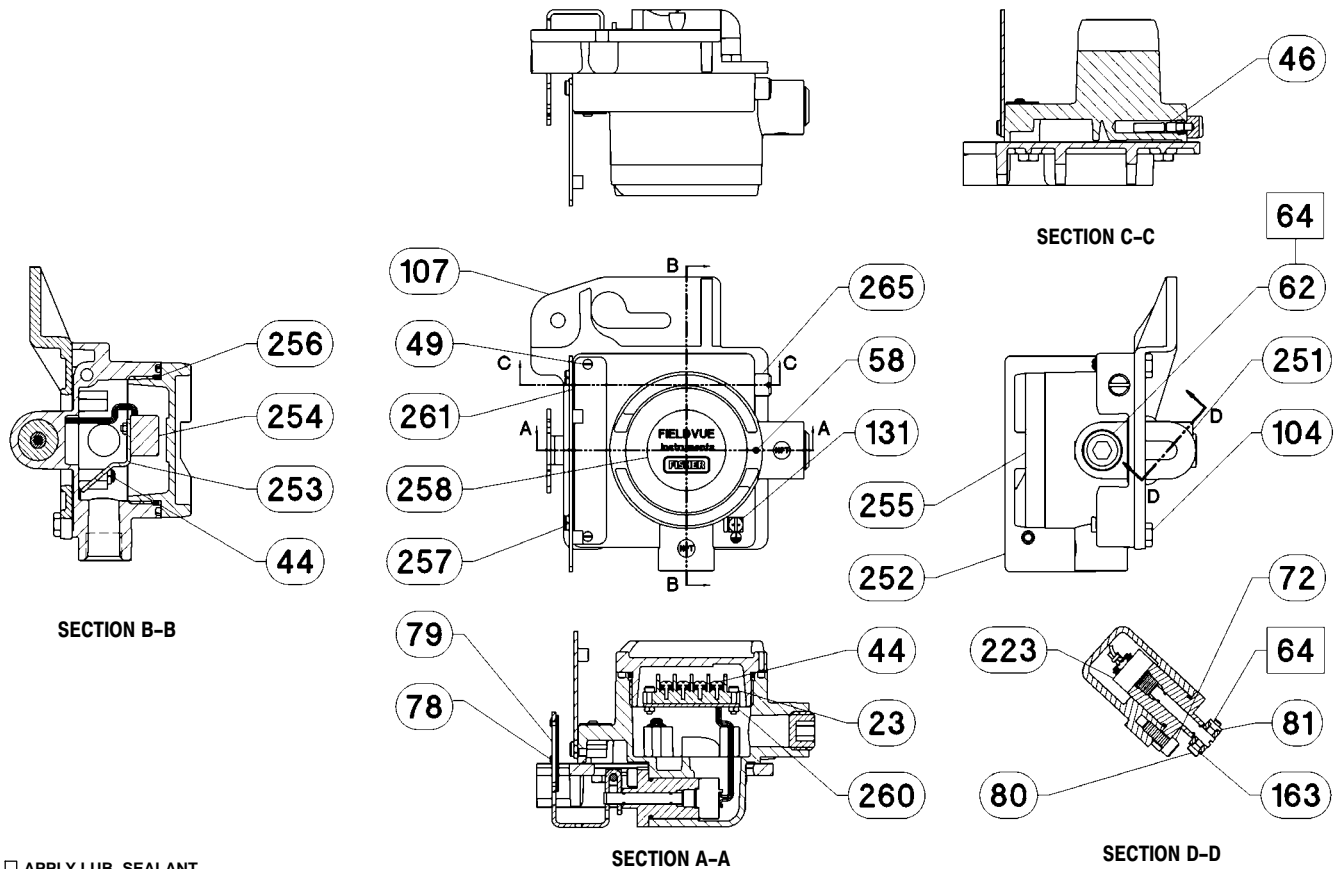
NOTE:

- 1 FOR SINGLE-ACTING DIRECT, OUTPUT B IS PLUGGED.
- 2 FOR SINGLE-ACTING REVERSE, OUTPUT A IS PLUGGED.

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Figure 8-6. Typical FIELDVUE DVC6000 Digital Valve Controller Gauge Configuration

8



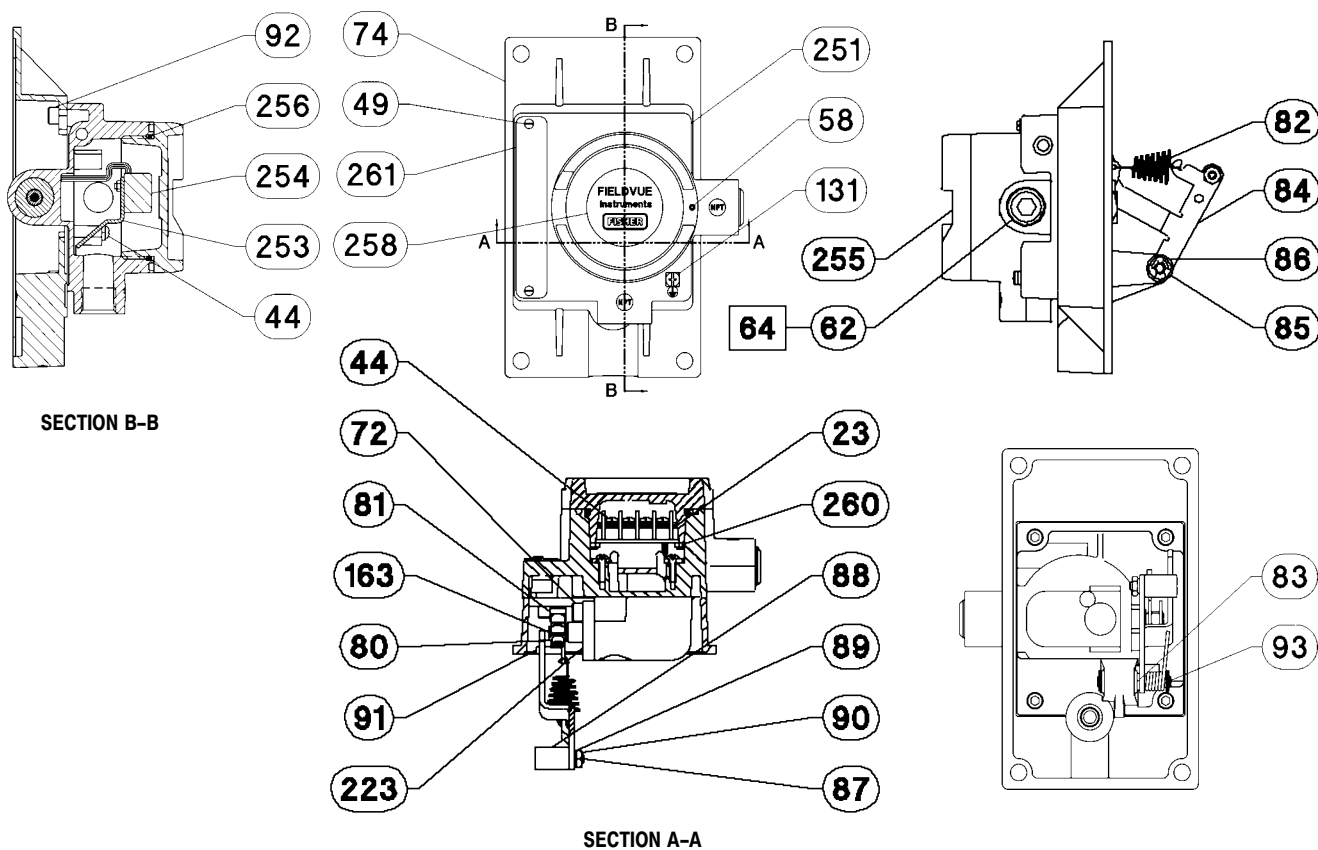
□ APPLY LUB, SEALANT

NOTE:

- 1. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

49B7986-A

Figure 8-7. FIELDVUE DVC6015 Digital Valve Controller Assembly



□ APPLY LUB, SEALANT, THREAD LOCK

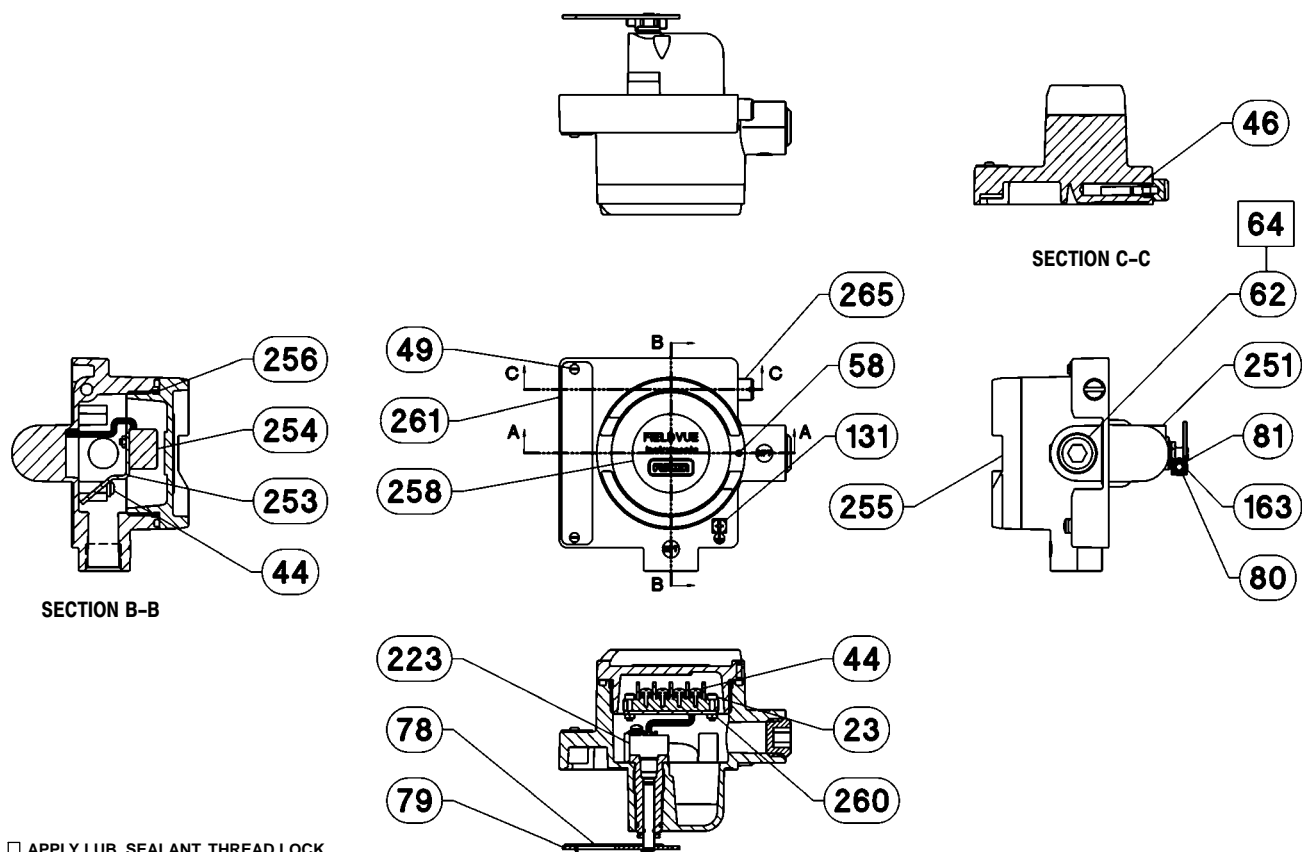
NOTE:

1. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

49B7967-A/IL

Figure 8-8. FIELDVUE DVC6025 Digital Valve Controller Assembly

DVC6000 Digital Valve Controllers



SECTION B-B

SECTION C-C

SECTION A-A

8

□ APPLY LUB, SEALANT, THREAD LOCK

NOTE:

1. APPLY LUBRICANT KEY 65 TO ALL O-RINGS
UNLESS OTHERWISE SPECIFIED

4987988-A

Figure 8-9. FIELDVUE DVC6035 Digital Valve Controller Assembly

Appendix A Principle of Operation

HART Communication	A-2
DVC6000 Operation	A-2



DVC6000 Digital Valve Controllers

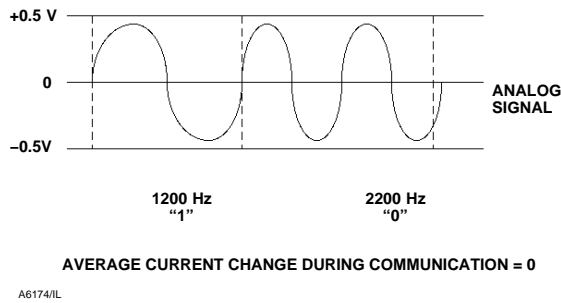


Figure A-1. HART Frequency Shift Keying Technique

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 multidropping, 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 multidrop.

DVC6000 Operation

The DVC6000 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. The module base contains the

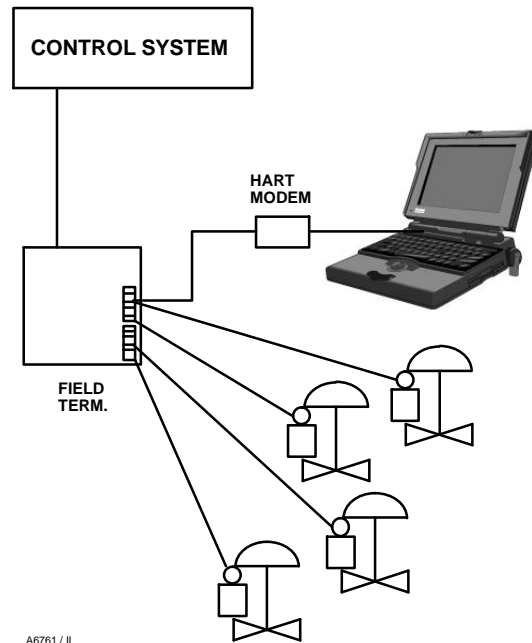


Figure A-2. Typical FIELDVUE Instrument to Personal Computer Connections for ValveLink Software

following submodules: I/P converter, printed wiring board (pwb) assembly, and pneumatic relay. The relay position is detected by sensing the magnet on the relay beam via a detector on the printed wiring board. This sensor is used for the minor loop feedback (MLFB) reading. The module base can be rebuilt by replacing the submodules. See figures A-3 and A-4.

DVC6000 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 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

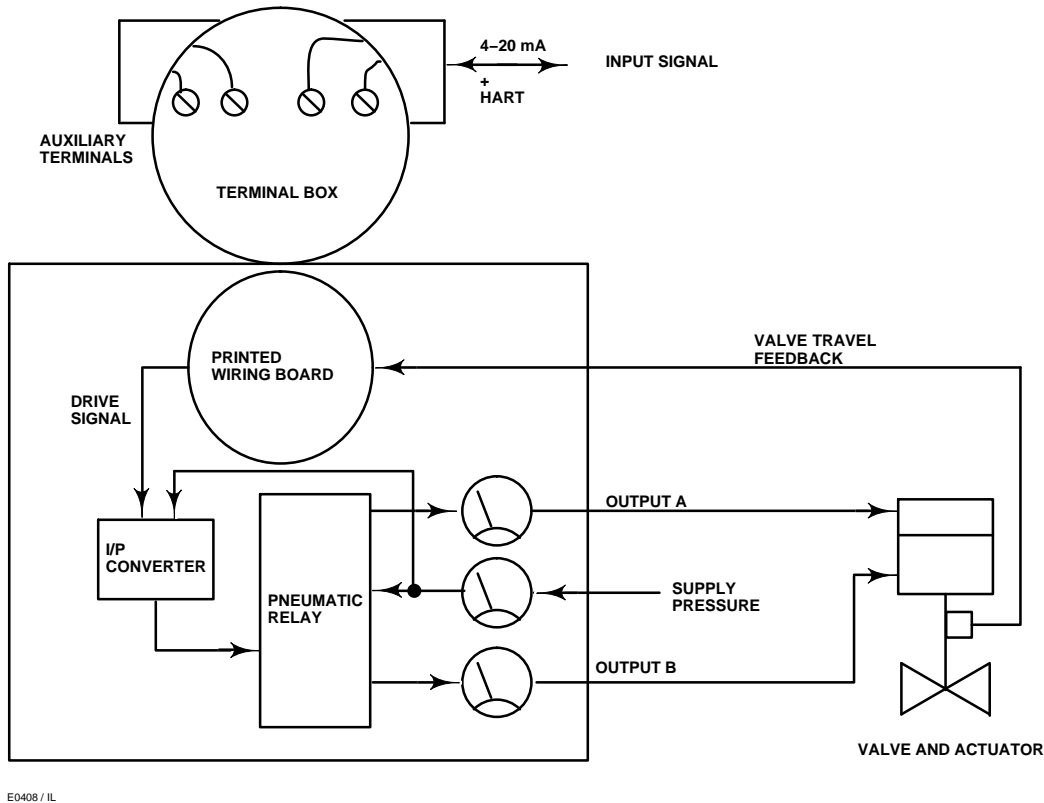


Figure A-3. FIELDVUE DVC6000 Digital Valve Controller Block Diagram

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 double-acting and single-acting reverse applications. 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.

A

DVC6000 Digital Valve Controllers

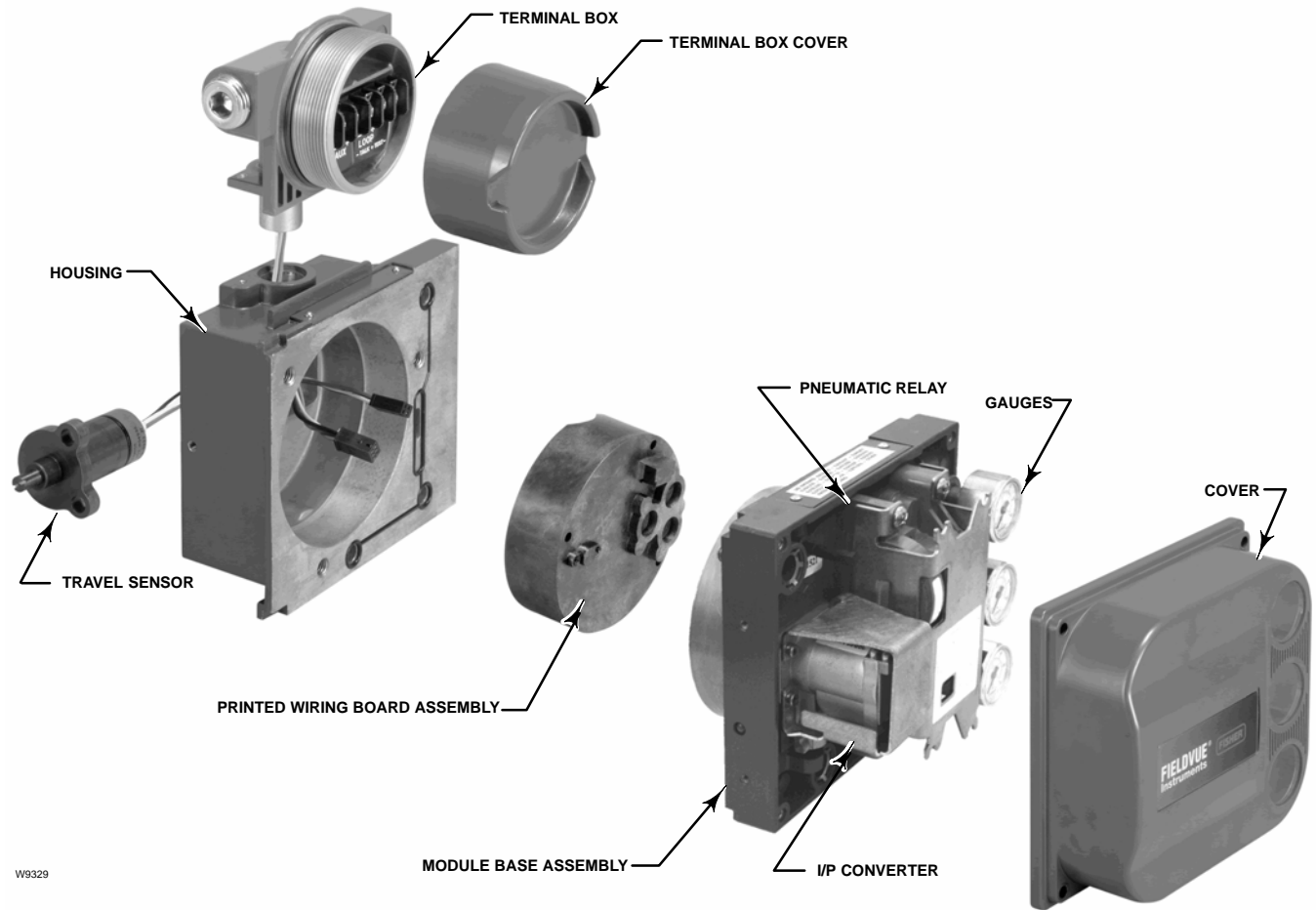


Figure A-4. FIELDVUE DVC6000 Digital Valve Controller Assembly

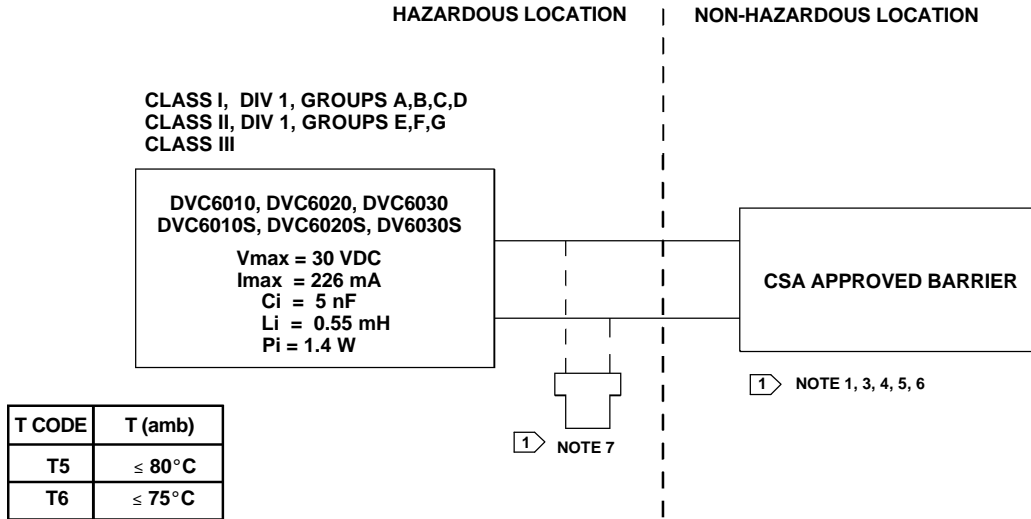
A

Appendix B Loop Schematics/Nameplates

B

DVC6000 Digital Valve Controllers

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

Figure B-1. CSA Loop Schematic for FIELDVUE DVC6010, DVC6020, and DVC6030

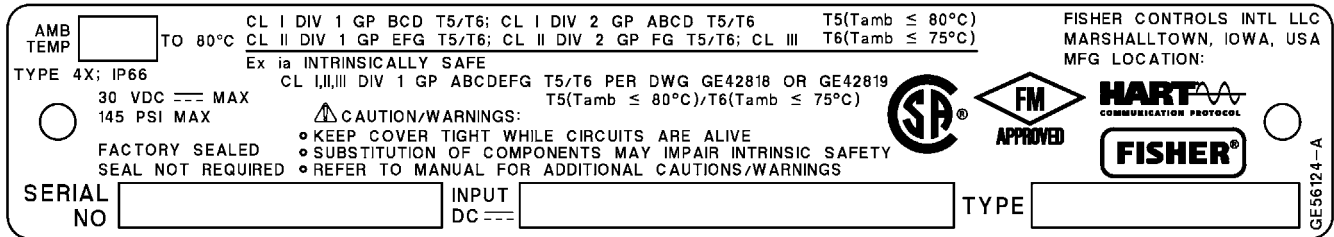
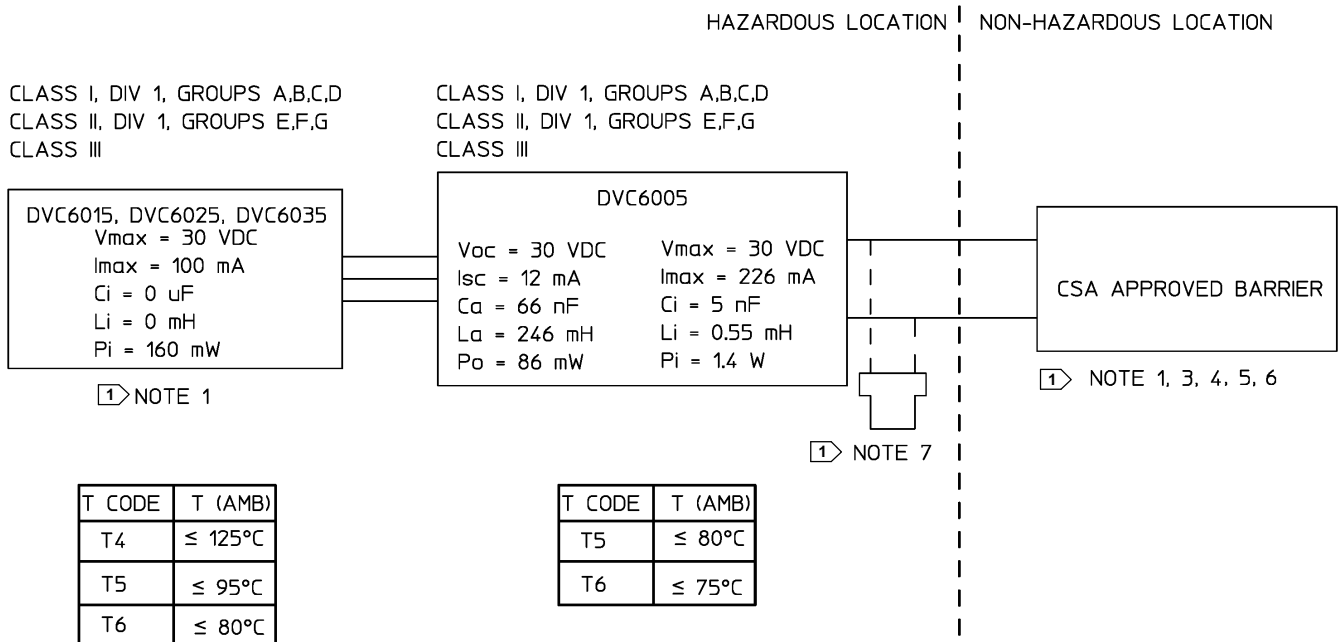


Figure B-2. Typical CSA/FM Nameplate for FIELDVUE DVC6010, DVC6020, DVC6030, and DVC6005

Loop Schematics/Nameplates



SEE NOTES IN FIGURE B-4

GE42818 sheet 5, Rev. E

Figure B-3. CSA Loop Schematic for FIELDVUE DVC6005 with DVC6015, DVC6025, and DVC6035

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.

$$V_{max} \text{ or } U_i \geq V_{oc} \text{ or } U_o \quad I_{max} \text{ or } I_i \geq I_{sc} \text{ or } I_o \quad P_{max} \text{ or } P_i \geq P_o \quad C_i + C_{cable} \leq C_a \quad L_i + L_{cable} \leq L_a$$

INSTALLATION MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC) AND ANSI/ISA RP12.6.

MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 V_{rms} .

RESISTANCE BETWEEN INTRINSICALLY SAFE GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM

LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.

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

Figure B-4. Notes for CSA Loop Schematics

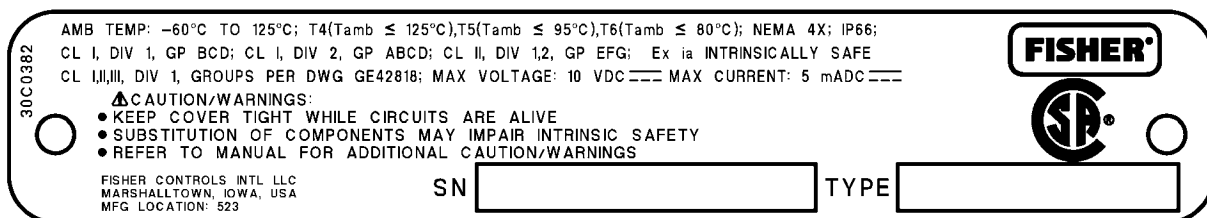
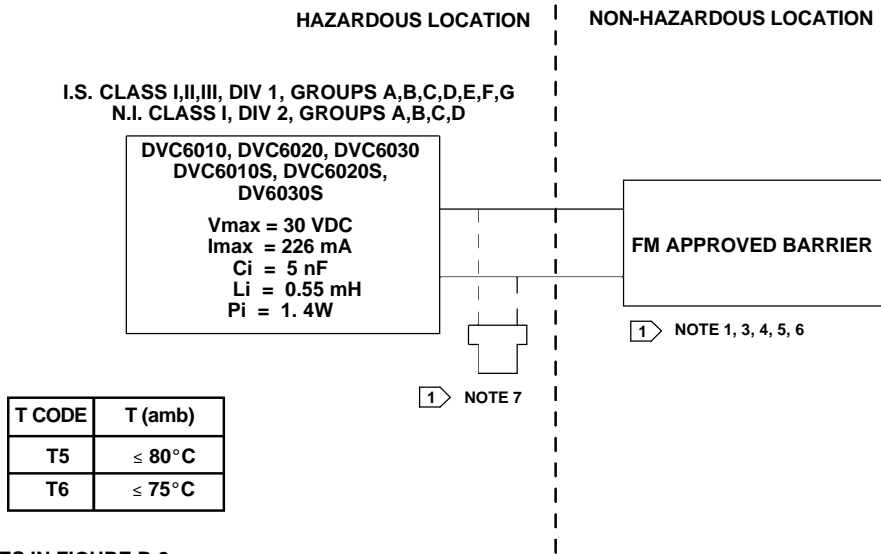


Figure B-5. Typical CSA Nameplate for FIELDVUE DVC6015, DVC6025, and DVC6035

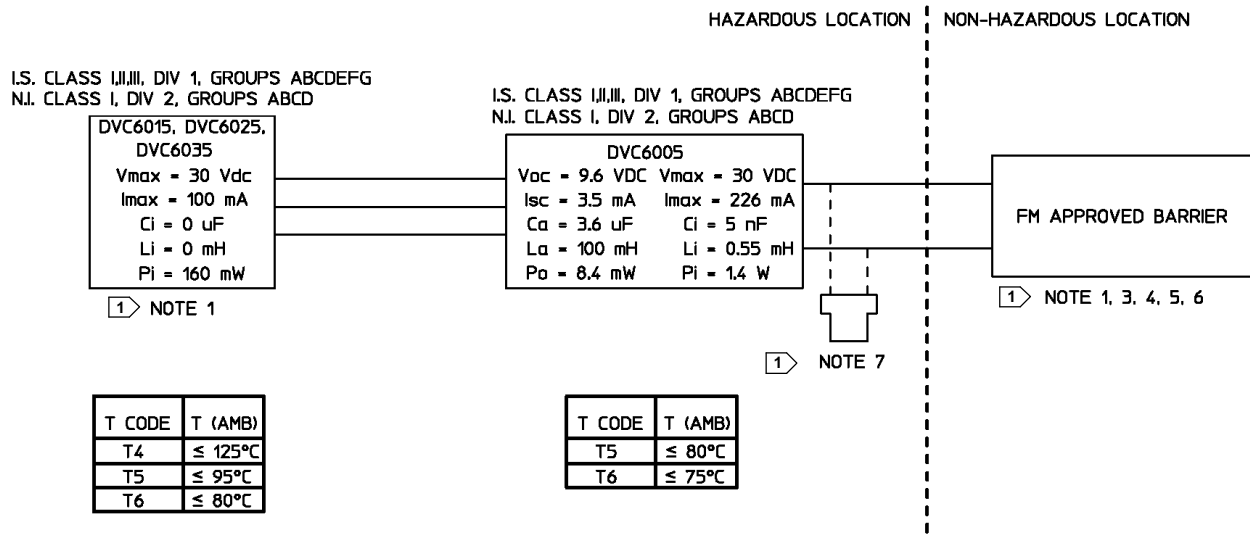
DVC6000 Digital Valve Controllers



SEE NOTES IN FIGURE B-8

GE42819 Sheet 2, Rev. D

Figure B-6. FM Loop Schematic for FIELDVUE DVC6010, DVC6020, and DVC6030



SEE NOTES IN FIGURE B-8

GE42819 Sheet 5, Rev. D

Figure B-7. FM Loop Schematic for FIELDVUE DVC6005 with DVC6015, DVC6025, and DVC6035

B

Loop Schematics/Nameplates

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 ELECTRICAL CODE (NEC) NFPA70 AND ANSI/ISA RP12.6.01

4 MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 V_{rms} .

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

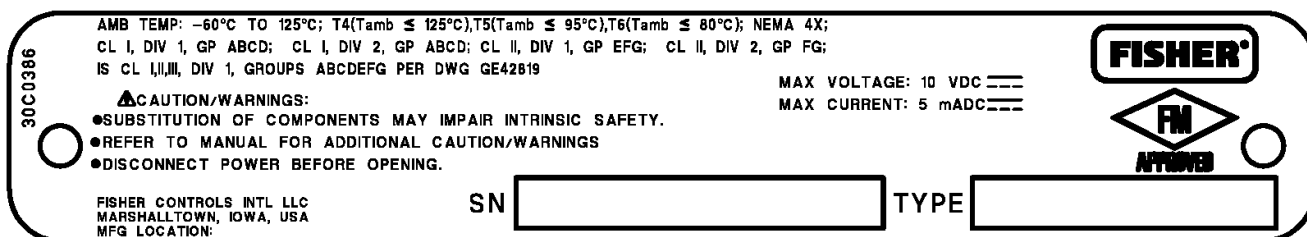
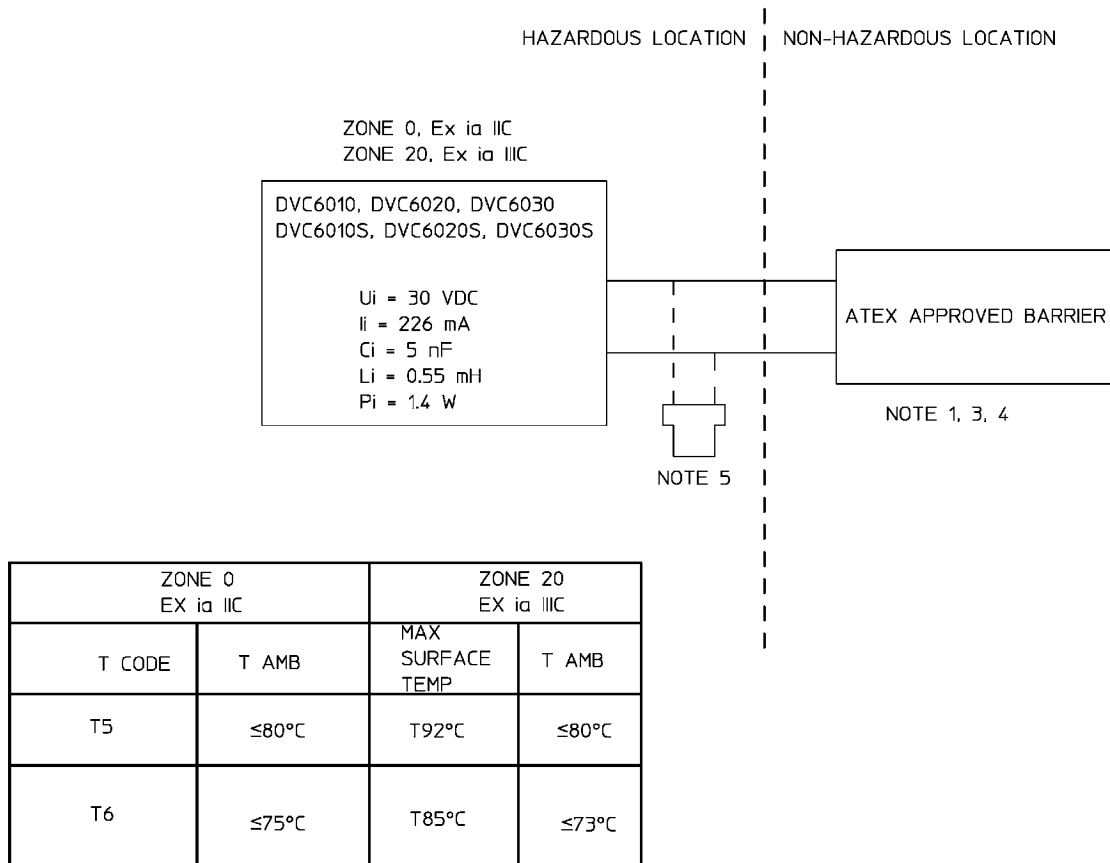


Figure B-9. Typical FM Nameplate for FIELDVUE DVC6015, DVC6025, and DVC6035

DVC6000 Digital Valve Controllers



1 SEE NOTES IN FIGURE B-13

GE60771 sheet 3, Rev. B

Figure B-10. ATEX Loop Schematic For FIELDVUE DVC6010, DVC6020, and DVC6030

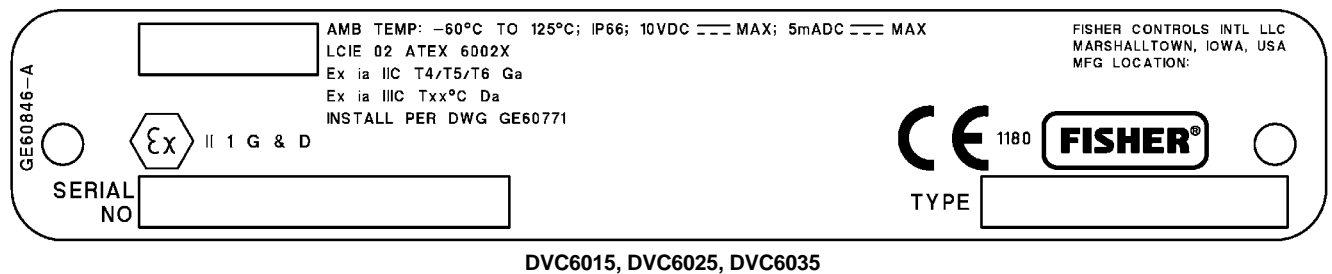
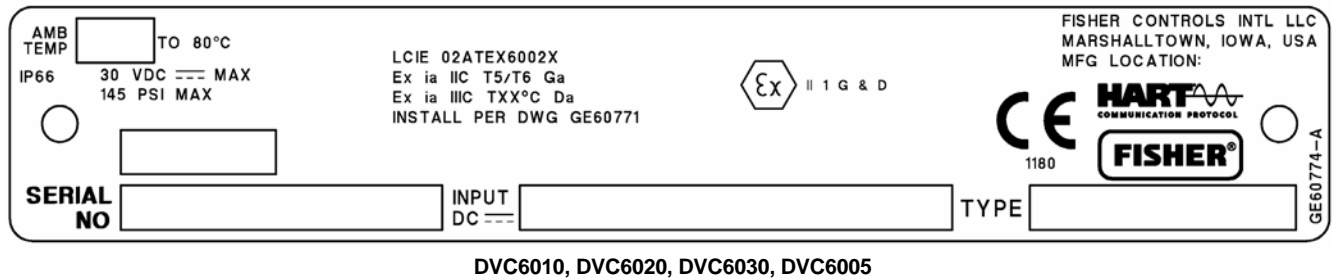
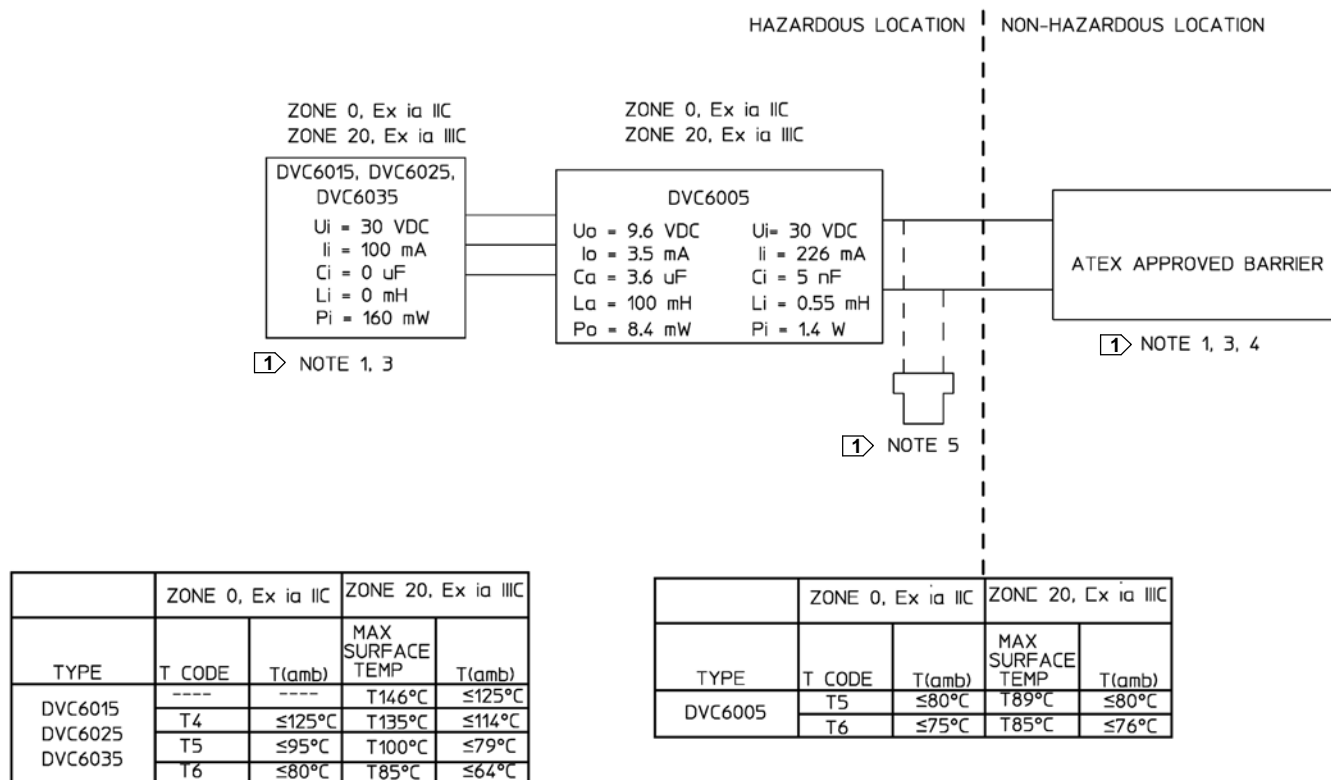


Figure B-11. Typical ATEX Nameplates; Intrinsically Safe

Loop Schematics/Nameplates



SEE NOTES IN FIGURE B-13

GE60771 sheet 6, Rev. B

Figure B-12. ATEX Loop Schematic for DVC6005 with DVC6015, DVC6025, and DVC6035

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.

$$V_{max} \text{ or } U_i \geq V_{oc} \text{ or } U_o \quad I_{max} \text{ or } I_i \geq I_{sc} \text{ or } I_o \quad P_{max} \text{ or } P_i \geq P_o \quad C_i + C_{cable} \leq C_a \quad L_i + L_{cable} \leq L_a$$

INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL WIRING PRACTICES OF THE COUNTRY IN USE.

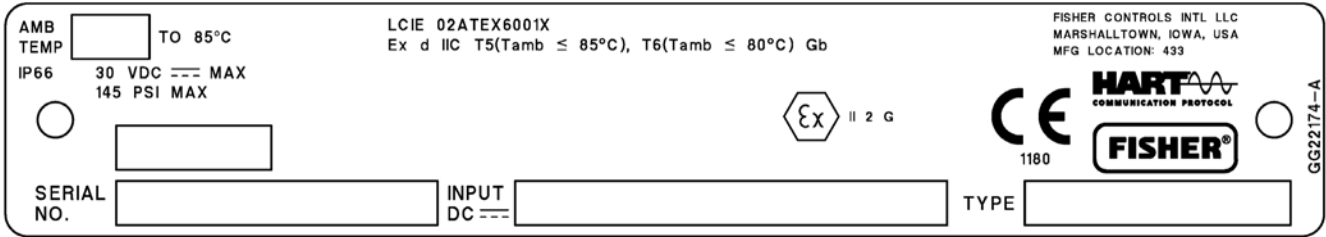
LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.

IF HAND-HELD COMMUNICATOR OR MULTIPLEXER IS USED, IT MUST BE ATEX APPROVED WITH ENTITY PARAMETERS AND INSTALLED PER THE MANUFACTURER'S CONTROL DRAWINGS.

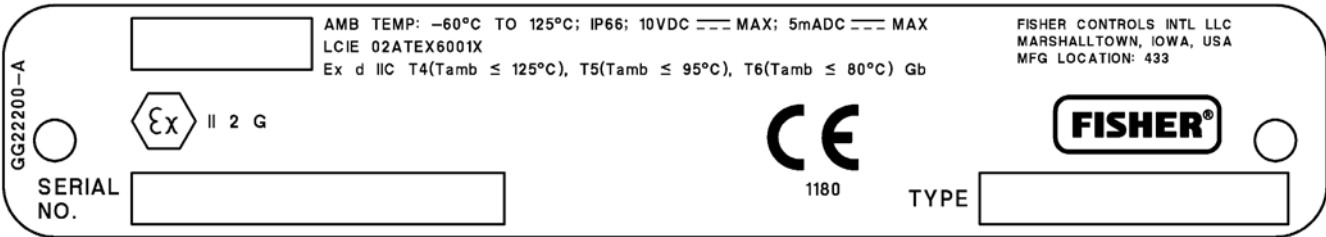
GE60771, Sheet 2

Figure B-13. Notes for ATEX Schematics

DVC6000 Digital Valve Controllers

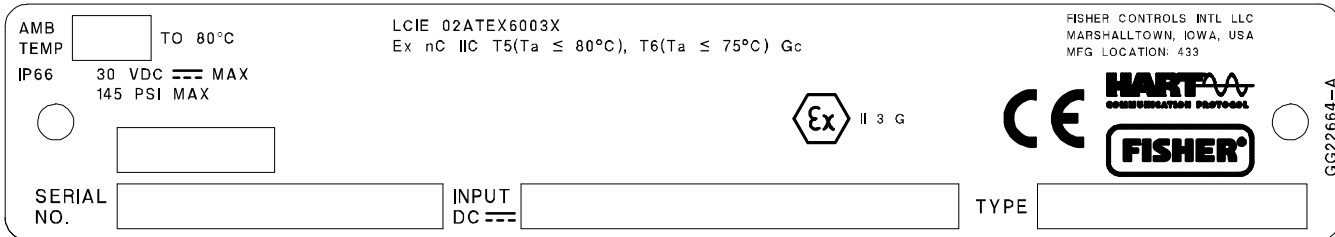


DVC6010, DVC6020, DVC6030, DVC6005

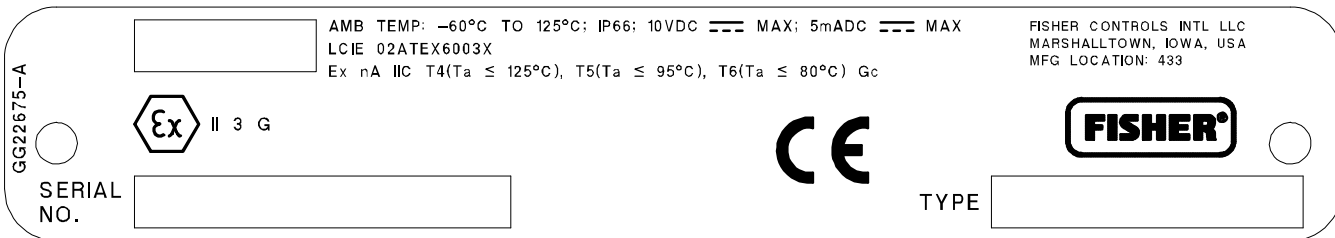


DVC6015, DVC6025, DVC6035

Figure B-14. Typical ATEX Nameplates; Flameproof



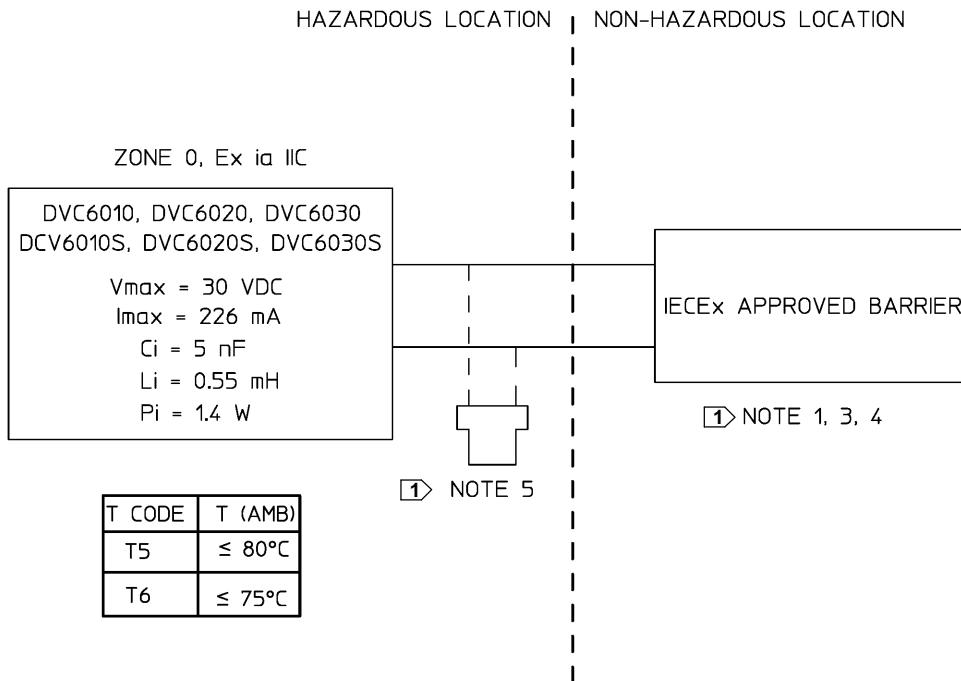
DVC6010, DVC6020, DVC6030, DVC6005



DVC6015, DVC6025, DVC6035

Figure B-15. Typical ATEX Nameplates; Type n

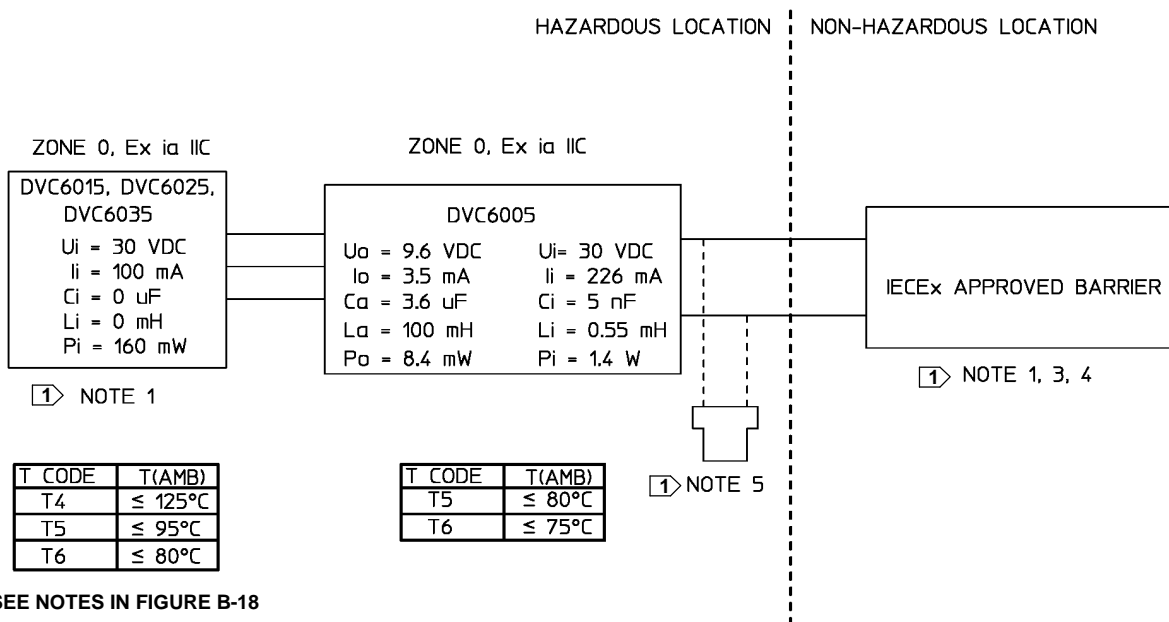
Loop Schematics/Nameplates



SEE NOTES IN FIGURE B-18

GE42990 Sheet 2, Rev. E

Figure B-16. IECEx Loop Schematic for FIELDVUE DVC6010, DVC6020, and DVC6030



SEE NOTES IN FIGURE B-18

GE42990 Sheet 5, Rev. D

Figure B-17. IECEx Loop Schematic for FIELDVUE DVC6005 with DVC6015, DVC6025, and DVC6035

B

DVC6000 Digital Valve Controllers

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

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 MARSHALLTOWN, IOWA, USA MFG LOCATION:
IP66 30 VDC --- MAX 145 PSI MAX	Ex ia IIC T5(Ta ≤ 80°C), T6(Ta ≤ 75°C) PER DWG GE42990	HART COMMUNICATION PROTOCOL
<input type="text"/>	Ex d IIC T5(Ta ≤ 80°C), T6(Ta ≤ 75°C)	FISHER
<input type="text"/>	Ex nC IIC T5(Ta ≤ 80°C), T6(Ta ≤ 75°C)	GE6058-A
SERIAL NO <input type="text"/>	INPUT DC --- <input type="text"/>	TYPE <input type="text"/>

Figure B-19. Typical IECEx Nameplate for FIELDVUE DVC6010, DVC6020, DVC6030, and DVC6005

GE09616-E	AMB TEMP: -60°C TO 125°C	CERT NO. IECEx CSA 04.0004X	FISHER
	TYPE 4X, IP66	Ex ia IIC T4(Ta ≤ 125°C), T5(Ta ≤ 95°C), T6(Ta ≤ 80°C) Ga	<input type="text"/>
	MAX VOLTAGE: 10VDC ---	U _i =30VDC, I _i =100mA, P _i =160mW, C _i =0uF, L _i =0mH	<input type="text"/>
	MAX CURRENT: 5 mADC ---	Ex d IIC T4(Ta ≤ 125°C), T5(Ta ≤ 95°C), T6(Ta ≤ 80°C) Gb	<input type="text"/>
FISHER CONTROLS INTL LLC MARSHALLTOWN, IOWA, USA MFG LOCATION 088	Ex nA IIC T4(Ta ≤ 125°C), T5(Ta ≤ 95°C), T6(Ta ≤ 80°C) Gc	SN <input type="text"/>	TYPE <input type="text"/>

Figure B-20. Typical IECEx Nameplate for DVC6015, DVC6025, and DVC6035

B

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.

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 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.

DVC6000 Digital Valve Controllers

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%

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 Instrument. See also, Linear and Quick Opening.

Feedback Arm

The mechanical connection between the valve stem linkage and the FIELDVUE Instrument 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 Fisher Controls instrument hardware. The physical components of the instrument are defined as the hardware.

HART (acronym)

The acronym HART stands for Highway Addressable Remote Transducer.

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. See table 6-2, page 6-8.

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.

DVC6000 Digital Valve Controllers

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 Instrument. 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.

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 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 ValveLink software is the primary master.

In contrast, a secondary master is not often permanently wired to a field instrument. The 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 Instrument. 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%.

DVC6000 Digital Valve Controllers

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 Zero Control Signal 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 (open or closed) when the electrical power to the instrument is removed. Zero Power Condition (ZPC) is determined by relay and actuator action as follows:

Single Acting Direct (Relay C) Upon loss of power instrument goes to zero air output at port A. On loss of pneumatic supply failure direction is per the actuator fail mode.

Double Acting (Relay A) Upon loss of power instrument goes to full supply air output at port B. A goes to zero air output. The failure direction upon loss of pneumatic supply cannot be determined.

Single Acting Reverse (Relay B) Upon loss of power instrument goes to full supply air output at Port B. On loss of pneumatic supply failure direction is per the actuator fail mode.

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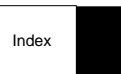
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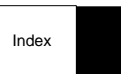
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