Instruction Manual
Form 5335
May 1998

FIELDVUE® DVC5000 Series Digital Valve Controllers

This manual applies to:

DVC5000 Series			*Model 275 HART Communicator*
Device Revision	*Firmware Revision*	*Hardware Revision*	*Device Description Revison*
2	*3, 4*	*2, 3*	*11*
3	*5*	*4, 5*	*1, 2*

PlantWeb®

FISHER®

FISHER-ROSEMOUNT™ Managing The Process Better.™

D200442X012

Model 275 HART Communicator Fast-Key Sequence

Function/Variable	Fast–Key Sequence	Coordi-nates[1]	Function/Variable	Fast–Key Sequence	Coordi-nates[1]
Alert Record, Clear	1-2-7-7-2	6-H	Manual Setup	1-1-2	4-B
Alert Record, Display	1-2-7-7-1	6-H	Message	1-2-3-2	4-C
Alert Record, Enabling Alert Groups	1-2-7-7-4	6-H	Minimum Closing Time	1-2-6-6-2	6-D
Analog Input	2	1-E	Minimum Opening Time	1-2-6-6-1	6-D
Analog Input Units and Range Configuration	1-2-5-1	4-E	Polling Address	1-2-3-8	4-D
Auto Setup	1-1-1	4-A	Pressure, Output	3	1-E
Auxiliary Input	1-3-1-1	5-H	Pressure Units	1-2-5-4	4-E
Auxiliary Input Alert Enable	1-2-7-6-1	6-G	Protection	Hot Key-3	1-B
Burst Mode Command	1-2-1-5-2	5-C	Restart	1-2-1-4	4-C
Burst Mode Enable	1-2-1-5-1	5-C	Restart Control Mode	1-2-1-3	4-C
Calibrate	1-4	2-E	Self Test Shutdown	1-2-8	4-G
Calibrate, Analog Input	1-4-1	3-H	Setup Wizard	1-1-1-1	4-A
Calibrate, Travel (Auto)	1-4-2	3-H	Stabilize/Optimize	Hot Key-4	1-B
Calibrate, Travel (Manual)	1-4-3	4-H	Stroke Output	1-5	3-I
Calibrate, Pressure	1-4-4	3-H	Supply Pressure, Instrument	1-2-4-1	4-D
Calibration Location	1-4-6	3-H	Temperature, Internal	1-3-1-2	5-H
Calibration, Restore	1-4-5	3-H	Temperature Units	1-2-5-5	4-E
Control Mode	Hot Key-2	1-B	Travel	4	1-E
Cycle Count	1-2-7-4-4	5-H	Travel Accumulator	1-2-7-3-4	5-H
Cycle Counter Alert Enable	1-2-7-4-1	6-G	Travel Accumulator Alert Enable	1-2-7-3-1	6-F
Cycle Counter Alert Point	1-2-7-4-2	6-G	Travel Accumulator Alert Point	1-2-7-3-2	6-F
Cycle Counter Deadband	1-2-7-4-3	6-G	Travel Accumulator Deadband	1-2-7-3-3	6-F
Date	1-2-3-4	4-C	Travel Alert 1 Enable	1-2-7-1-1	6-E
Descriptor	1-2-3-3	4-C	Travel Alert 1 High Point	1-2-7-1-3	6-E
Device Description Revision, HART Communicator	1-3-3	3-G	Travel Alert 1 Low Point	1-2-7-1-4	6-E
Device Information	1-3-2	5-H	Travel Alert 2 Enable	1-2-7-1-2	6-E
Drive Alert Enable	1-2-7-5	4-G	Travel Alert 2 High Point	1-2-7-1-5	6-E
Drive Signal	5	1-F	Travel Alert 2 Low Point	1-2-7-1-6	6-E
Dynamic Bypass Enable	1-2-6-4	4-F	Travel Alert Deadband	1-2-7-1-7	6-E
Factory Instrument Serial Number	1-2-3-6	4-D	Travel Cutoff High	1-2-6-5-3	6-D
Feedback Characteristic	1-2-4-2	4-D	Travel Cutoff Low	1-2-6-5-4	6-D
Field Instrument Serial Number	1-2-3-7	4-D	Travel Deviation Alert Enable	1-2-7-2-1	6-F
Firmware Revision	1-3-2-3	5-I	Travel Deviation Alert Point	1-2-7-2-2	6-F
Free Time	1-3-1-5	5-H	Travel Deviation Time	1-2-7-2-3	6-F
HART Tag	1-2-3-1	4-C	Travel Limit High	1-2-6-5-1	6-D
Initial Setup	1-1	3-A	Travel Limit Low	1-2-6-5-2	6-D
Input Characterization	1-2-6-2	5-E	Travel Range High	1-2-5-2	4-E
Input Filter Time	1-2-6-3	4-F	Travel Range Low	1-2-5-3	4-E
Instrument Date and Time	1-2-7-7-3	6-H	Travel Sensor Adjust	1-4-7	3-H
Instrument Level	1-3-2-5[2]	5-I	Travel Sensor Counts	1-3-1-6	5-H
Instrument Mode	Hot Key-1	1-B	Tuning Set	1-2-6-1	4-E
Instrument Status	6	2-F	Valve Serial Number	1-2-3-5	4-D
Invert Feedback	1-2-4-4	4-D	Zero Control Signal	1-2-4-3	4-D

1. Coordinates are to help locate the item on the menu structure on the next page.
2. For device description revision 11, use key sequence 1-3-2-6 for instrument level.

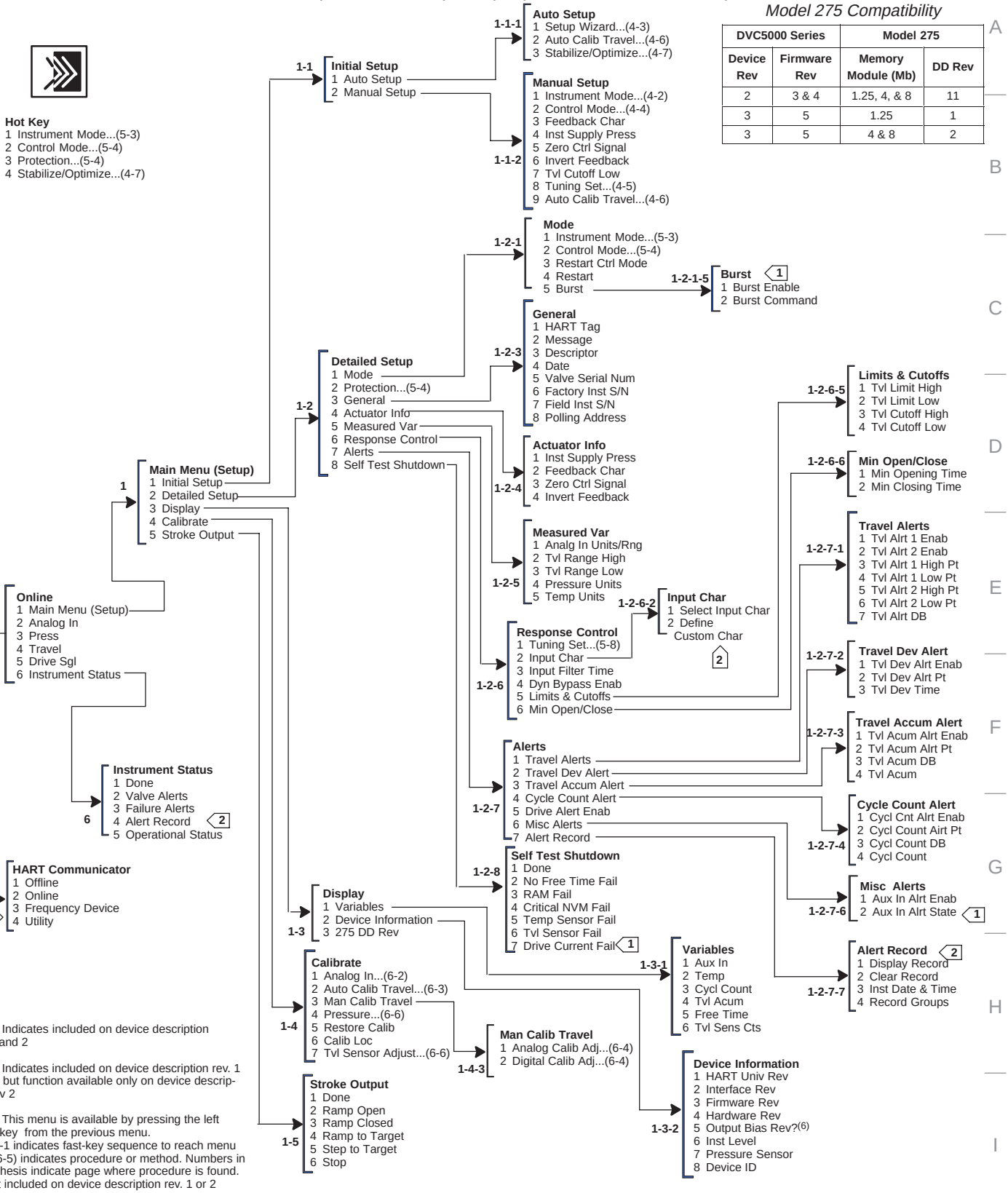
Unfold this sheet to see the Model 275 HART Communicator menu structure.

Model 275 HART Communicator Menu Structure for FIELDVUE DVC5000

(Device Description (DD) Revisions 1, 2, and 11)

Model 275 Compatibility

DVC5000 Series		Model 275	
Device Rev	Firmware Rev	Memory Module (Mb)	DD Rev
2	3 & 4	1.25, 4, & 8	11
3	5	1.25	1
3	5	4 & 8	2



Notes:

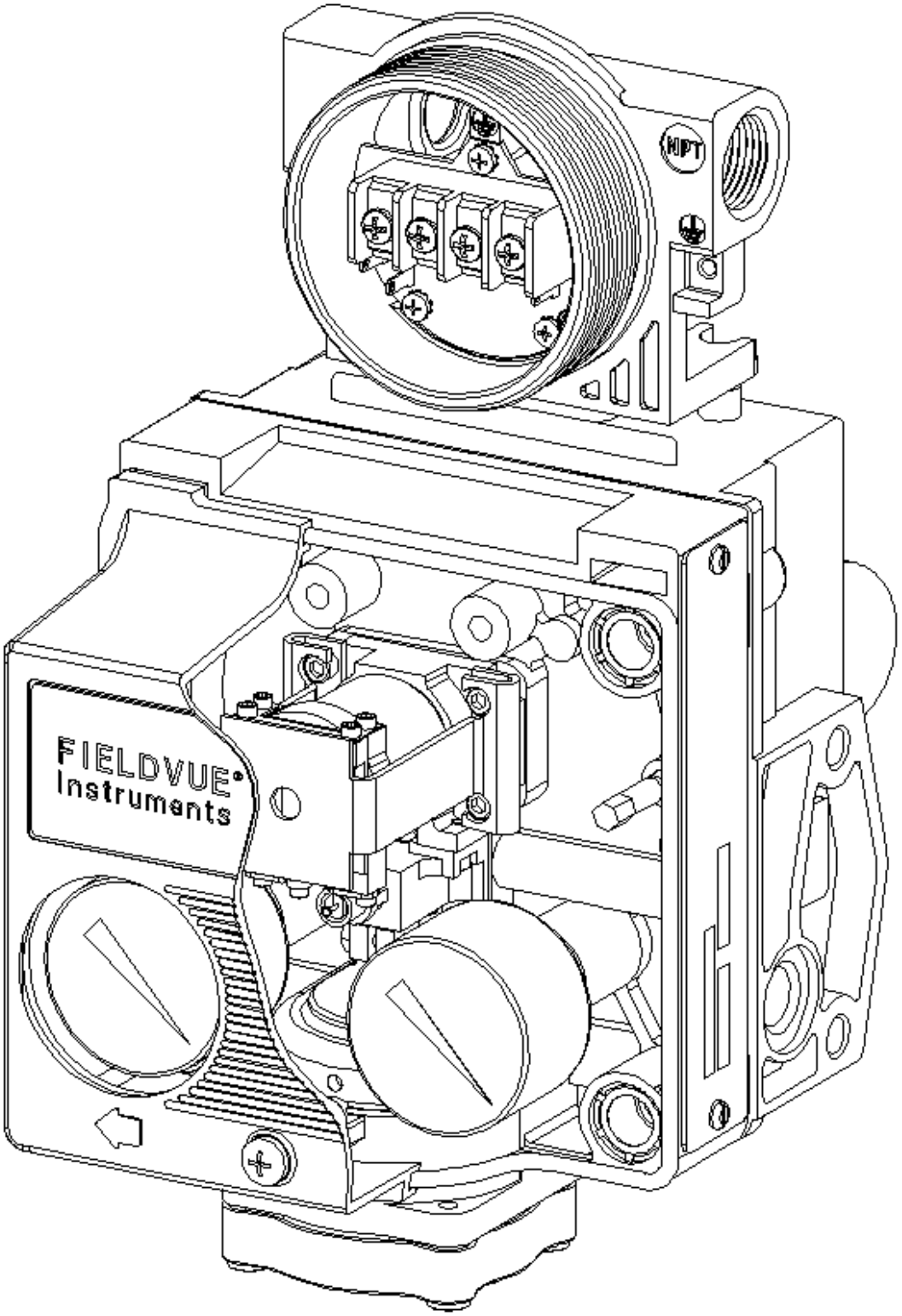
1 Indicates included on device description rev. 1 and 2

2 Indicates included on device description rev. 1 and 2, but function available only on device description rev 2

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

4. 1-1-1 indicates fast-key sequence to reach menu
5. ...(6-5) indicates procedure or method. Numbers in parenthesis indicate page where procedure is found.
6. Not included on device description rev. 1 or 2

Model 275 HART Communicator Menu Structure for Device Description Revision 11 and Device Description Revisions 1 and 2



Cutaway View of FIELDVUE® Type DVC5010 Digital Valve Controller Showing Master Module Assembly

Section 1 Introduction

Scope of Manual

This instruction manual includes specifications, installation, operating, and maintenance information for the DVC5000 Series digital valve controllers.

The manual describes the functionality of FIELDVUE® Instruments with Firmware Revision 5. It also applies to Firmware Revisions 3 and 4, except as noted.

This instruction manual supports the Model 275 HART® Communicator with device description revision 11, used with firmware revision 3 and 4 instruments. The manual also supports the Model 275 HART Communicator with device description revisions 1 and 2. Device description revisions 1 and 2 are used with firmware revision 5 instruments. Device description revision 1 is available in HART Communicators with 1.25 megabyte memory modules. Device description revision 2 is available in HART Communicators with 4 and 8 megabyte memory modules. For information on using the ValveLink™ VL2000 Series software with the instrument, refer to the *ValveLink VL2000 Series User Guide.*

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

Figure 1-1. Sliding-Stem Control Valve with Type DVC5010 Digital Valve Controller

Figure 1-2. Rotary Control Valve with Type DVC5020 Digital Valve Controller

Conventions Used in this Manual

Procedures that require the use of the Model 275 HART Communicator have the HART Communicator symbol in the heading.

Procedures that are accessible with the Hot Key on the HART 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 HART Communicator menu. For example, to access the *Auto Setup* menu, from the Online menu, press 1 (selects *Main Menu*) followed by a second 1 (selects *Initial Setup*) followed by a third 1 (selects *Auto Setup*). 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 HART Communicator menus, is also presented in textual format. Menu selections are shown in italics, e.g., *Calibrate.* An overview of the Model 275 HART Communicator menu structure is shown on the fold out page on the front cover of this manual.

Description

DVC5000 Series 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 DVC5000 Series 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 HART 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 an IBM compatible PC and FIELDVUE ValveLink software, Asset Management software, or a Model 275 HART Communicator, you can perform several operations with the DVC5000 Series 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. DVC5000 Series digital valve controllers can be calibrated with a PC or Model 275 HART Communicator.

Using the HART protocol, information from the field can be integrated into control systems or be received on a single loop basis. The DVC5000 Series digital valve controller can also be migrated to the FOUNDATION™ fieldbus communication protocol.

The DVC5000 Series digital valve controller is designed to directly replace standard pneumatic and electro-pneumatic valve mounted positioners.

Specifications

Specifications for the DVC5000 Series digital valve controllers are shown in table 1-1. Specifications for the HART Communicator can be found in the *Product Manual for The HART Communicator*.

Related Documents

Other documents containing information related to the DVC5000 Series digital valve controllers include:

- *FIELDVUE® DVC5000 Series Digital Valve Controller (Bulletin 62.1:DVC5000)*
- *FIELDVUE® Instrument Installation Requirements (PS Sheet 62.1:FIELDVUE(A))*
- *Mounting FIELDVUE® Instruments on Piston Actuators (PS Sheet 62.1:FIELDVUE(B))*
- *FIELDVUE® Instrument Split Ranging (PS Sheet 62.1:FIELDVUE(C))*
- *FIELDVUE® Instrument Status Flags on Rosemount RS3 DCS (PS Sheet 62.1:FIELDVUE(D))*
- Using Loop Tuners with FIELDVUE Instruments (PS Sheet 62.1:FIELDVUE(F))
- Audio Monitor for HART® Communications (PS Sheet 62.1:FIELDVUE (G))
- *Type HF100 FIELDVUE® HART® Filter Instruction Manual - Form 5340*
- *FIELDVUE® HF200 Series HART® Filters Instruction Manual - Form 5380*
- *Type 2530H1 HART® Interchange Multiplexer Instruction Manual - Form 5407*
- *FIELDVUE® ValveLink™ VL2000 Series User Guide*

Table 1-1. Specifications

Electrical Input

Point-to-Point:
Analog Input Signal: 4 to 20 mA dc, nominal
Minimum Voltage Available at instrument terminals must be 11.5 Vdc for analog control, 12 Vdc for HART communication (see Wiring Practices in the "Installation" section for details)
Minimum Control Current: 4.0 mA
Minimum Current w/o Microprocessor Restart: 3.5 mA
Maximum Voltage: 30 volts dc
Overcurrent Protection: Input circuitry limits current to prevent internal damage (Hardware revisions 4 and 5 only. Instruments with earlier hardware revisions may be damaged if connected directly to a voltage source while in point-to-point mode.)
Reverse Polarity Protection: No damage occurs from reversal of loop current
Multi-drop:
Instrument Power: 12 to 30 volts dc at approximately 8 mA
Reverse Polarity Protection: No damage occurs from reversal of loop current

Output Pressure(1)

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

Supply Pressure(1)

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

Independent Linearity(1)

±0.5% of output span

Operating Ambient Temperature Limits

–40°F to 175°F (–40°C to 80°C)

Electrical Classification

Hazardous Area: Explosion-proof, intrinsically safe, Division 2, and flameproof constructions available to CSA, FM, CENELEC, and SAA standards. Refer to Hazardous Area Classification Bulletins 9.2:001 series and 9.2:002.
Electrical Housing: Meets NEMA 4X, IEC 529 IP65
Complies with European EMC directive.

Connections

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

Mounting

Designed for direct actuator mounting. For weatherproof housing capability, the instrument must be mounted upright to allow the vent to drain.

Weight

Less than 6 lbs (2.7 Kg)

1. Defined in ISA Standard S51.1-1979.

Section 2 Installation

Mounting

Pneumatic Connections

Electrical Connections

Wiring Practices

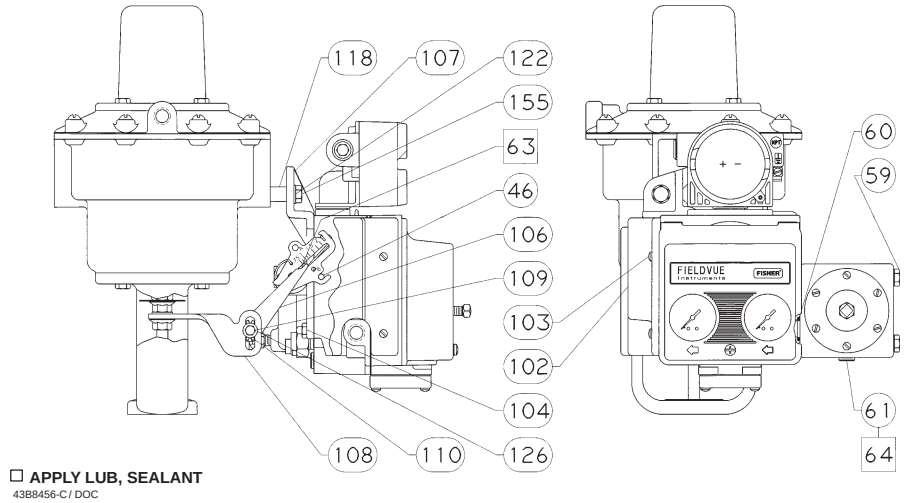


Figure 2-1. Type DVC5010 Digital Valve Controller with Integrally Mounted Filter Regulator Yoke-Mounted on Type 513 Size 20 Actuator

Mounting

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before mounting the DVC5000 Series digital valve controller:

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

Mounting Type DVC5010 on Fisher Sliding-Stem Actuators

513 and 513R Actuators

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

1. Isolate the control valve from the process line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut off all pressure lines to the 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. For Type 513 and 513R size 20 actuators, loosen the lower lock nut below the travel indicator disc. Insert the connector arm (key 108) between the lock nuts and tighten the lower lock nut against the connector arm. For Type 513 and 513R size 32 actuators, attach the spacers (key 119) and connector arm (key 108) to the valve stem connector with screws (key 120).

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

4. Insert the screws (key 155) with washers (key 122) through the slot and hole in the mounting bracket (key 107). Install the spacers (key 118) and tighten the screws.

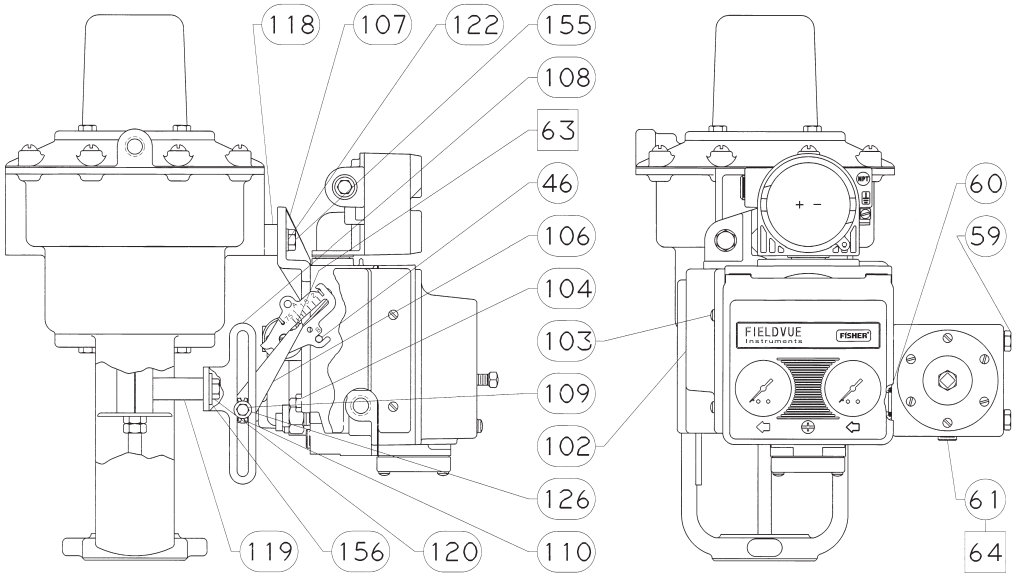


Figure 2-2. Type DVC5010 Digital Valve Controller with Integrally Mounted Filter Regulator Yoke-Mounted on Type 513 Size 32 Actuator

Note

The alignment pin (key 46) is stored inside the digital valve controller housing. It is located above the supply pressure gauge.

5. Set the position of the feedback arm (key 79, figure 10-1) on the digital valve controller by inserting the alignment pin (key 46) through the hole on the feedback arm marked ''A'' for Type 513R actuators or the slot marked ''B'' for Type 513 actuators.

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

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

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

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

10. Attach the shield (key 102) with two screws (key 103).

657 and 667 Actuators

Unless otherwise noted, refer to figures 2-3 and 2-4 for key number locations.

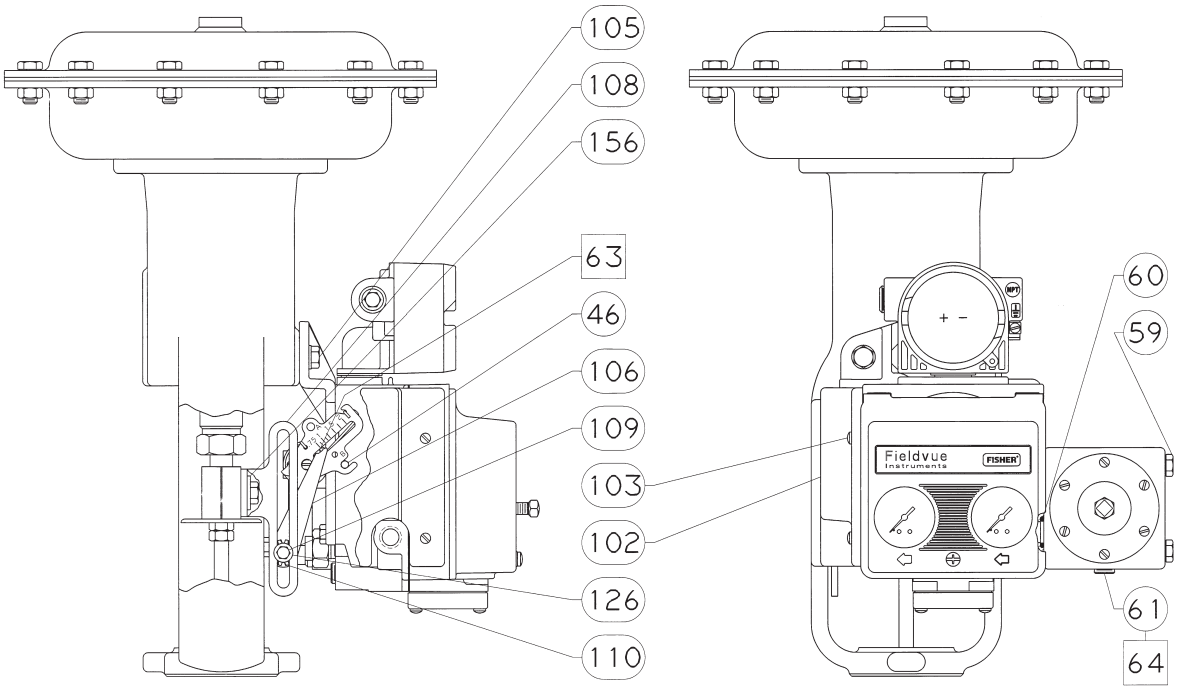
WARNING

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

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

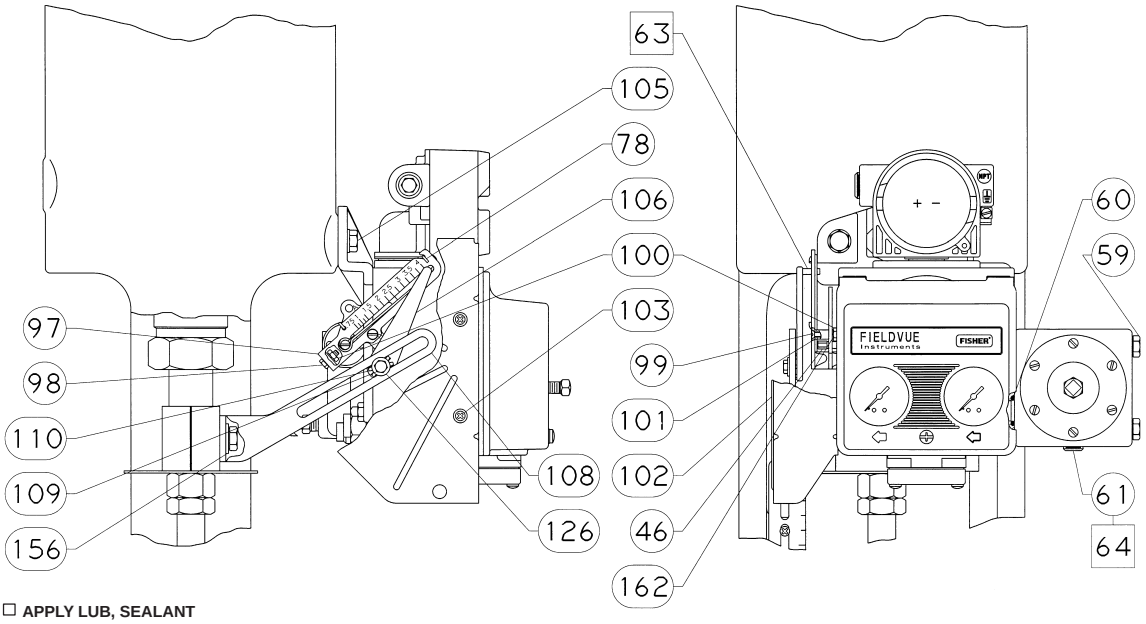
2. Attach the connector arm (key 108) to the valve stem connector.

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



☐ **APPLY LUB, SEALANT**
44B1852-C

Figure 2-3. Type DVC5010 Digital Valve Controller with Integrally Mounted Filter Regulator Yoke-Mounted on Type 657/667 Size 30-60 Actuator



☐ **APPLY LUB, SEALANT**
43B8442-C

Figure 2-4. Type DVC5010 Digital Valve Controller with Integrally Mounted Filter Regulator Yoke-Mounted on Type 657/667 Size 70-100 Actuator

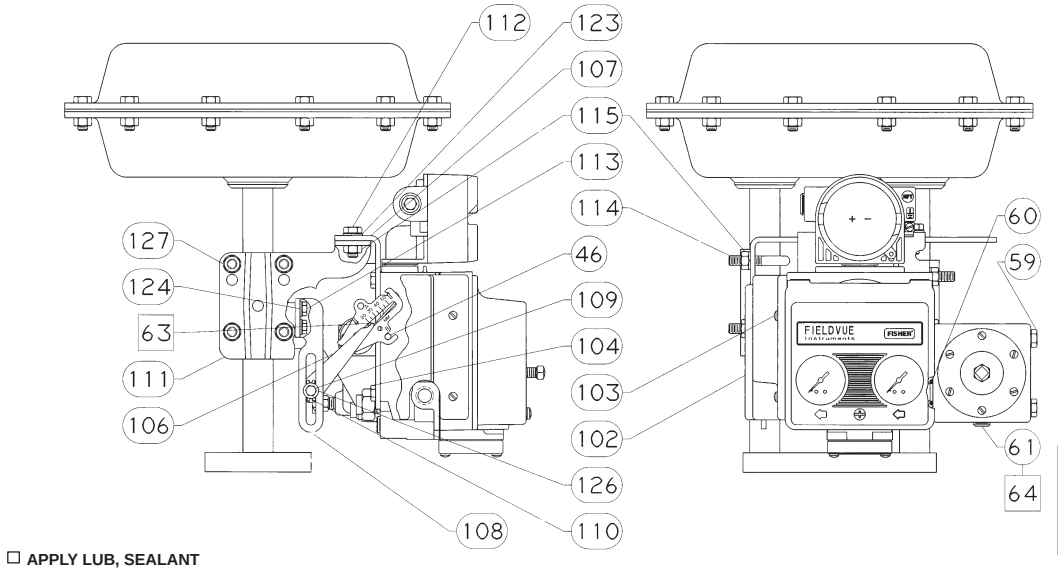


Figure 2-5. Type DVC5010 Digital Valve Controller with Integrally Mounted Filter Regulator Yoke-Mounted on Type 1250 Actuator

4. If valve travel exceeds 2 inches, a feedback arm extension (key 97) is required. Remove the bias spring (key 78) for up to 2-inch travel from the feedback arm (key 79, figure 10-1). Attach the bias spring (key 78) for up to 4-inch travel to the feedback arm extension. Attach the feedback arm extension to the feedback arm with screw (key 98), screw (key 99), spacer (key 101), lock washers (key 162), and hex nuts (key 100). Remove the pipe plug (key 61) from the output connection on the back of the housing, apply sealant (key 64), and reinstall in the output connection on the side of the housing.

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

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

Note

The alignment pin (key 46) is stored inside the digital valve controller housing. It is located above the supply pressure gauge.

7. Set the position of the feedback arm (key 79, figure 10-1) on the digital valve controller by inserting the alignment pin (key 46) through the hole on the feedback arm marked ‘‘A’’ for Type 667 actuators or the slot marked ‘‘B’’ for Type 657 actuators.

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

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

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

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

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

1250 and 1250R Actuators

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

1. Isolate the control valve from the process line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut off all pressure lines to the 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.

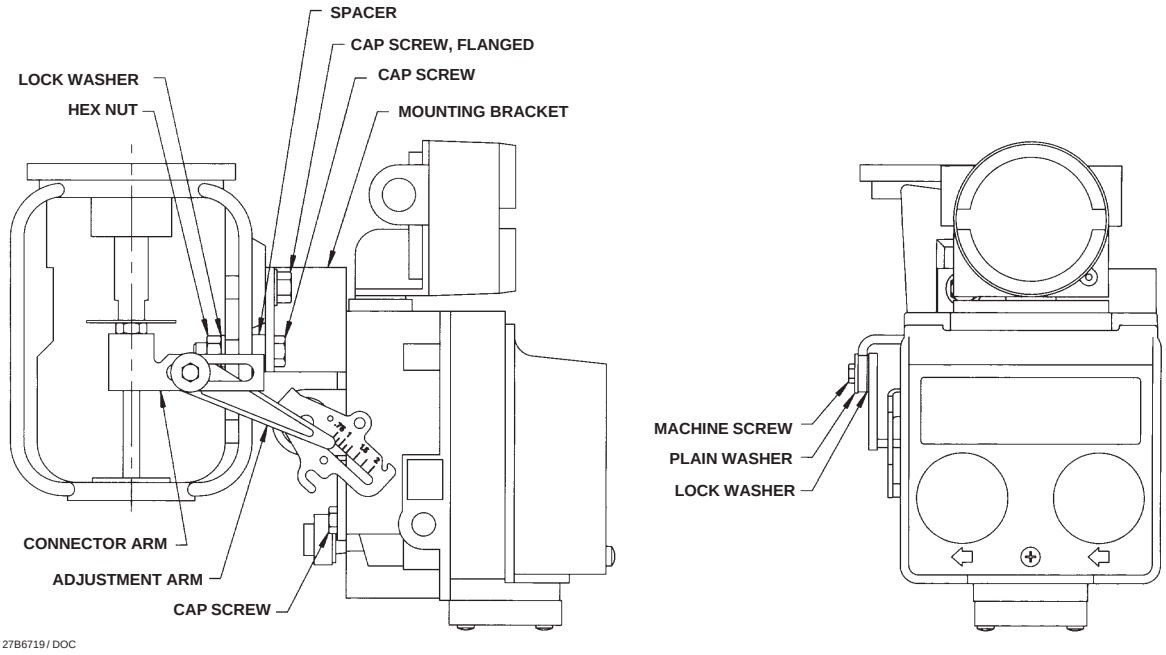


Figure 2-6. Type DVC5010 Digital Valve Controller Mounted on a Type 529 or Baumann Size 32, 54, or 70 Actuator

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

3. Attach the mounting bracket (key 107) to the housing (key 1) with screws (key 104).

4. Loosely attach the mounting bracket (key 107) to the leg post with U-bolts (key 114), washers (key 127), and hex nuts (key 115). Position the digital valve controller vertically so that the terminal box clears the diaphragm casing of the actuator. Tighten the hex nuts, securing the mounting bracket to the leg post.

Note

The alignment pin (key 46) is stored inside the digital valve controller housing. It is located above the supply pressure gauge.

5. Set the position of the feedback arm (key 79, figure 10-1) on the digital valve controller by inserting the alignment pin (key 46) through the hole on the feedback arm marked ‘‘A’’ for Type 1250R actuators or the slot marked ‘‘B’’ for Type 1250 actuators.

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

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

8. Loosely attach the brace (key 111) to the mounting bracket (key 107) with screws (key 112), washers (key 123), and hex nuts (key 115). Attach the brace (key 111) to the leg post with U-bolts (key 114), washers (key 127), and hex nuts (key 115). Tighten the screws and hex nuts (keys 112 and 115).

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

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

11. Attach the shield (key 102) with two screws (key 103).

Mounting Type DVC5010 on Other Sliding-Stem Actuators

529 and Baumann Size 32, 54, and 70 Actuators

Refer to figure 2-6 for parts locations.

1. Isolate the control valve from the process line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the

above measures stay in effect while working on the equipment.

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

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

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

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

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

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

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

Note

The alignment pin (key 46) is stored inside the digital valve controller housing. It is located above the supply pressure gauge.

9. Set the position of the feedback arm (key 79, figure 10-1) on the digital valve controller by inserting the alignment pin (key 46) through the hole on the feedback arm marked ‘‘A’’ for fail-closed actuators or the slot marked ‘‘B’’ for fail-open actuators.

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

11. As shown in figure 2-6, loosely fasten the adjustment arm to the connector arm with a machine screw, washer and lock washer.

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

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

Gulde Actuators

Refer to figure 2-7 for parts locations.

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

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

3. Attach the mounting bracket to the instrument housing.

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

Note

The alignment pin (key 46) is stored inside the digital valve controller housing. It is located above the supply pressure gauge.

5. Set the position of the feedback arm (key 79, figure 10-1) on the digital valve controller by inserting the alignment pin (key 46) through the hole on the feedback arm marked ‘‘A’’ for a P_O operating mode (air opens) or the slot marked ‘‘B’’ for P_S (air closes).

6. Apply lubricant to the pin of the adjustment arm. Place the pin into the slot of the feedback arm (key 79, figure 10-1) so that the bias spring loads the pin against the side of the arm with the valve travel markings.

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

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

9. Slide the adjustment arm pin in the slot of the connector arm until the pin is in line with the desired

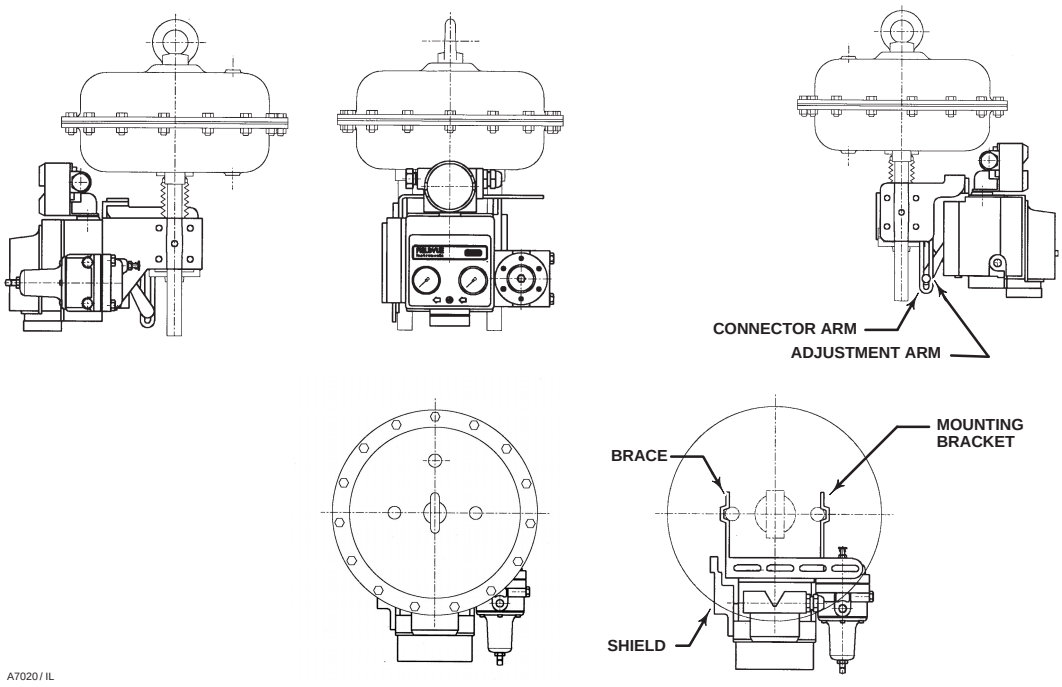


Figure 2-7. Type DVC5010 Digital Valve Controller with Integrally Mounted Filter Regulator Yoke-Mounted on Gulde Pneumatic Actuator Model GA

valve travel marking. Tighten the screw on the adjustment arm.

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

11. Attach the shield with two screws.

Mounting Type DVC5020 on Fisher Rotary Actuators

1051 and 1052 Actuators

Unless otherwise noted, refer to figure 2-8 or 2-9 for key number locations.

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

Note

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

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

3. Remove the cover plate from the actuator housing.

Note

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

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

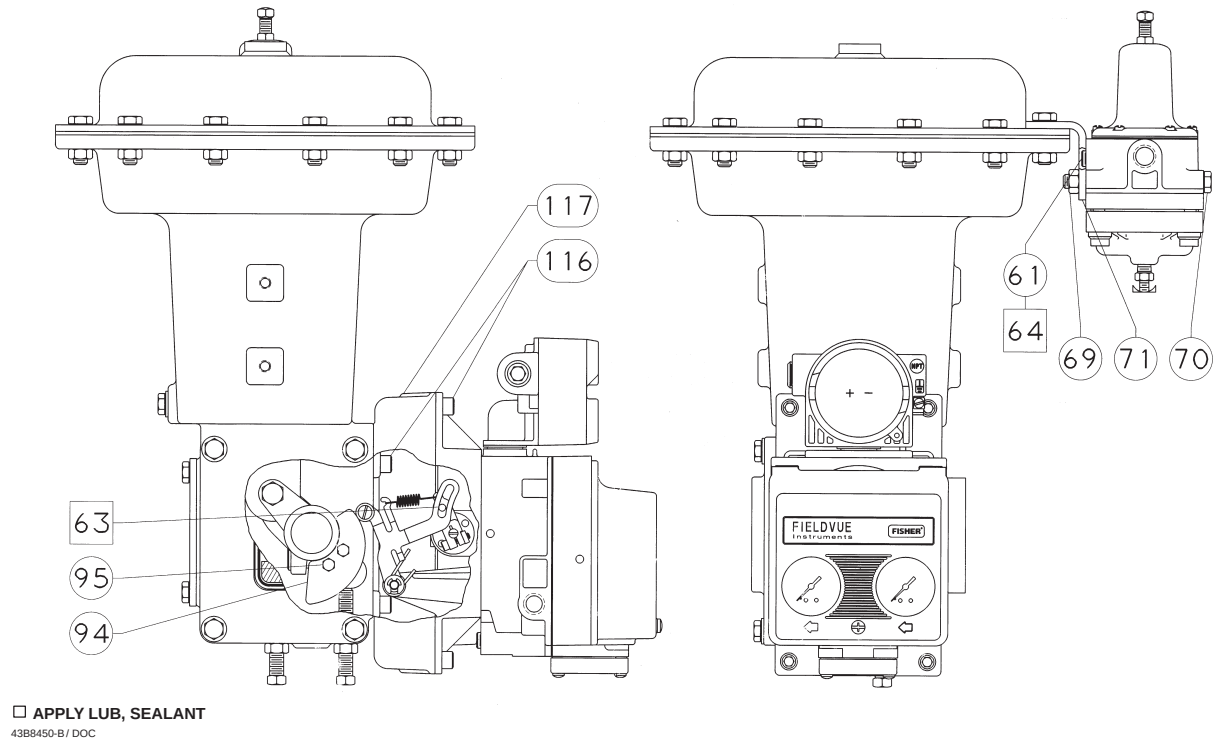


Figure 2-8. Type DVC5020 Digital Valve Controller Mounted on Type 1052 Size 33 Actuator with Casing-Mounted Filter Regulator

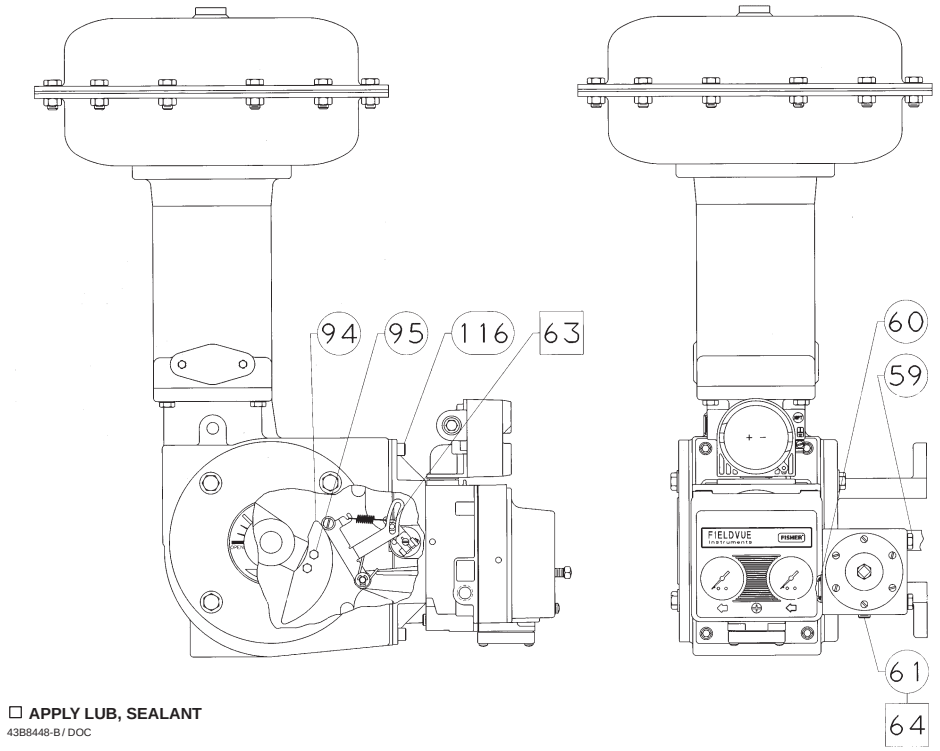


Figure 2-9. Type DVC5020 Digital Valve Controller with Integrally Mounted Filter Regulator Mounted on Type 1051 Size 40 Actuator

5. Disconnect the actuator turnbuckle from the lever arm.

Note

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

6. Loosen the lever clamping bolt in the lever.

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

Note

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

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

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

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

Note

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

11. Connect the turnbuckle and the lever arm.

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

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

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

Note

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

Mounting Type DVC5020 on Fisher Sliding-Stem Actuators

471 Actuators

Mounting the Type DVC5020 digital valve controller requires an actuator with a tapped lower yoke boss. Refer to figure 2-10 for parts location. Also refer to *PS Sheet 62.1:FIELDVUE(B) Mounting FIELDVUE Instruments on Piston Actuators* for guidelines on using the digital valve controller with the Fairchild Model 25463 reversing relay.

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

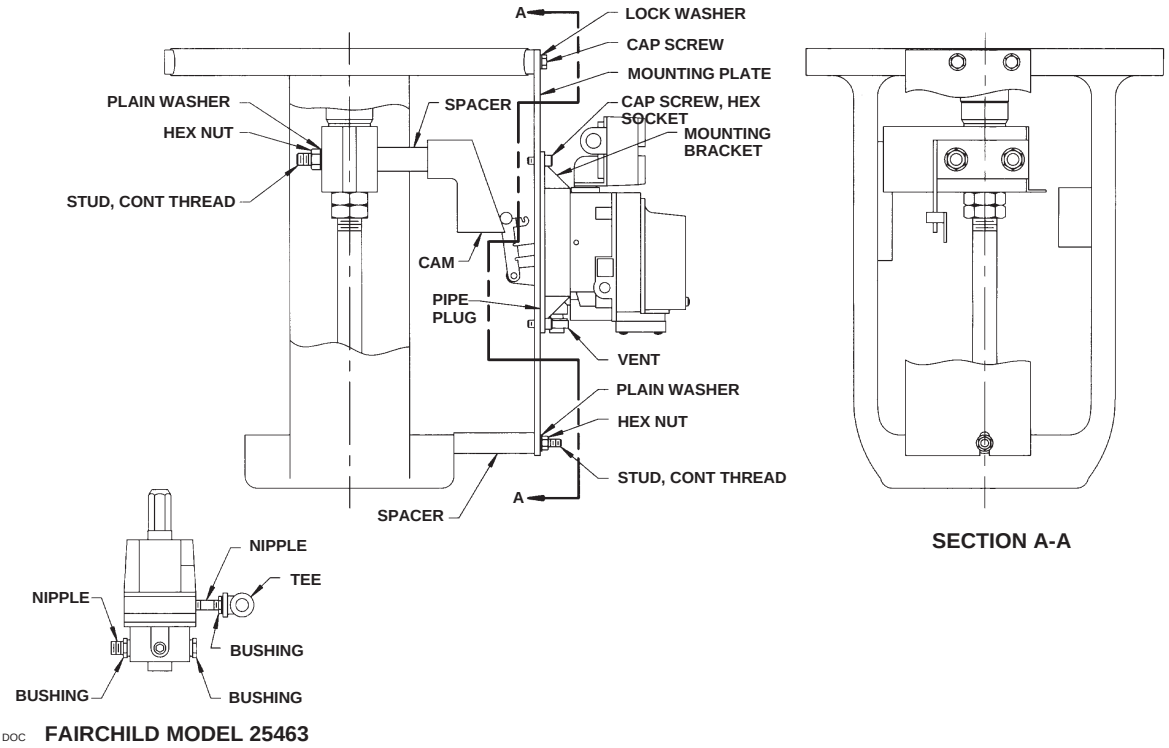


Figure 2-10. Type DVC5020 Digital Valve Controller with a Fairchild Model 25463 Relay Mounted on a 471 Size 100 Actuator.

WARNING

To avoid personal injury or property damage, in the following step do not loosen the stem connector cap screws when the stem connector has spring or loading pressure force applied to it.

2. Remove one of the stem connector cap screws and replace with the continuous thread stud. Thread the stud through the stem connector far enough to permit screwing a washer and hex nut onto the stud.

3. Place a washer and hex nut on the stud and tighten against the stem connector.

In steps 4 through 7 hold the two halves of the stem connector together, until the cam is fastened in place, to keep the valve stem and the actuator piston rod from separating.

4. Remove the second stem connector cap screw and replace with the continuous thread stud. Thread the stud through the stem connector far enough to permit screwing a washer and hex nut onto the stud.

5. Place a washer and hex nut on the stud and tighten against the stem connector.

6. Place a spacer on each of the studs extending from the stem connector.

7. Place the cam on the studs as shown in figure 2-10. Be sure the stem connector is still clamping the actuator piston rod and valve stem. Fasten the spacers and cam in place with two washers and hex nuts.

8. To mount the digital valve controller requires a tapped lower yoke boss. Screw the continuous thread stud into the tapped hole in the lower yoke boss.

9. Fasten the mounting plate to the actuator upper yoke boss with two cap screws and lock washers, and to the lower yoke boss with a washer and hex nut.

The mounting parts kit for the Type 471 actuator contains a mounting bracket with tapped holes for a pipe plug and vent. Steps 10 through 15 describe how to replace the existing mounting bracket on the digital valve controller with the mounting bracket from the parts kit and how to transfer the feedback parts from the existing mounting bracket to the mounting bracket in the kit. In the following step, refer to figure 10-2 for key number locations.

10. On the digital valve controller, disconnect the bias spring (key 82) from the arm assembly (key 91). Remove the mounting bracket (key 74) from the back of the digital valve controller.

11. On the mounting bracket just removed, note the orientation of the feedback parts, then remove the

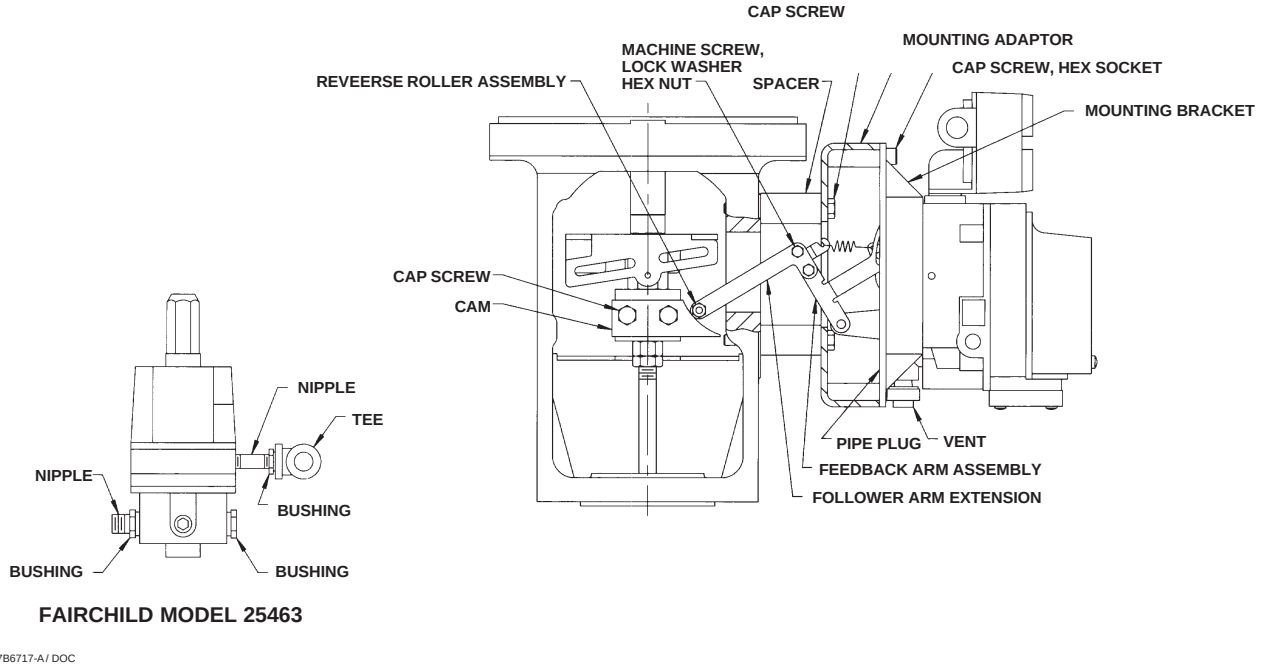


Figure 2-11. Type DVC5020 Digital Valve Controller with Fairchild Model 25463 Relay Mounted on a Type 585 Size 50 Actuator

E-ring that holds the feedback parts to the mounting bracket. Remove the feedback parts.

12. Assemble the feedback parts on the mounting bracket from the parts kit so that they are in the same orientation as they were before.

13. Assemble the mounting bracket with feedback parts to the back of the digital valve controller.

14. Reconnect the bias spring (key 82) between the feedback arm assembly (key 84) and the arm assembly (key 91). The long tang of the bias spring connects to the arm assembly (key 91).

15. Install the 1/8-inch NPT pipe plug in the tapped hole on the back of the mounting bracket. Install the vent in the 1/4-inch NPT tapped hole on the bottom of the mounting bracket.

16. Assemble the digital valve controller assembly to the mounting plate. The roller on the digital valve controller feedback arm will contact the actuator cam as it is being attached. Install and tighten the four hex socket cap screws.

17. Determine the valve actuator action and proceed as follows:

a. If an increasing input signal to the digital valve controller closes the valve, nipple mount the Fairchild relay to the lower cylinder connection.

b. If an increasing input signal to the digital valve controller opens the valve, nipple mount the Fairchild relay to the upper cylinder connection.

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

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

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

21. Make supply and electrical connections as described in the Pneumatic Connections and Electrical Connections subsections.

22. Refer to the Model 25463 spring adjustment description in this section and adjust the spring as necessary.

585 and 585R Actuators

Refer to figure 2-11 for parts location. Also refer to *PS Sheet 62.1:FIELDVUE(B) Mounting FIELDVUE Instruments on Piston Actuators* for guidelines on using the digital valve controller with the Fairchild Model 25463 reversing relay.

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

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

The mounting parts kit for the Type 585 actuator contains a mounting bracket with tapped holes for a pipe plug and vent. Steps 2 through 10 describe how to replace the existing mounting bracket on the digital valve controller with the mounting bracket from the parts kit and how to transfer the feedback parts from the existing mounting bracket to the mounting bracket in the kit. In the following step, refer to figure 10-2 for key number locations.

2. On the digital valve controller, disconnect the bias spring (key 82) from the arm assembly (key 91). Remove the mounting bracket (key 74) from the back of the digital valve controller.

3. On the mounting bracket just removed, note the orientation of the feedback parts, then remove the E-ring that holds the feedback parts to the mounting bracket. Remove the feedback parts.

4. Assemble the feedback parts on the mounting bracket from the parts kit so that they are in the same orientation as they were before.

5. Remove the follower post (key 87) from the feedback arm assembly (key 84).

6. Attach the follower arm extension to the feedback arm assembly with two machine screws, lock washers, and hex nuts as shown in figure 2-11.

7. Attach the follower post to the follower arm extension so that it is on the left side of the follower arm extension when viewing the back of the digital valve controller.

8. Assemble the mounting bracket with feedback parts to the back of the digital valve controller.

9. Reconnect the bias spring (key 82) between the feedback arm assembly (key 84) and the arm assembly (key 91). The long tang of the bias spring connects to the arm assembly (key 91).

10. Install the pipe plug in the tapped hole on the back of the mounting bracket. Install the vent in the tapped hole on the bottom of the mounting bracket.

In step 11, refer to the actuator instruction manual for key number locations, unless noted otherwise.

11. Loosen eight screws, and remove the front and back yoke covers (keys 18 and 20).

12. Loosen four screws, and remove the actuator blanking plate.

13. Insert the cap screws through the mounting adaptor as shown in figure 2-11. Place spacers on the cap screws.

14. Fasten the mounting adaptor to the actuator yoke. Tighten the cap screws.

In the next step hold the two halves of the stem connector together, until the cam is fastened in place, to keep the valve stem and the actuator piston rod from separating.

15. Remove the two cap screws from the stem connector and attach the cam as shown in figure 2-11.

16. Assemble the digital valve controller assembly to the mounting adaptor. The roller on the digital valve controller feedback arm will contact the actuator cam as it is being attached. Install and tighten the four cap screws.

17. Determine the valve actuator action and proceed as follows:

c. If an increasing input signal to the digital valve controller closes the valve, nipple mount the Fairchild relay to the lower cylinder connection.

d. If an increasing input signal to the digital valve controller opens the valve, nipple mount the Fairchild relay to the upper cylinder connection.

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

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

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

21. Replace the actuator front and back yoke covers. Discard the actuator blanking plate and four screws

22. Make supply and electrical connections as described in the Pneumatic Connections and Electrical Connections subsections.

23. Refer to Model 25463 spring adjustment description in this section and adjust the spring as necessary.

Fairchild Model 25463 Reversing Relay Spring Adjustment

The Fairchild Model 25463 is a spring biased reversing relay. It provides an output pressure which follows the equation $P_o = K – P_{S.}$ Where P_o is the output pressure, K is the spring bias and P_S is the signal pressure. The spring bias is adjusted during calibration as follows:

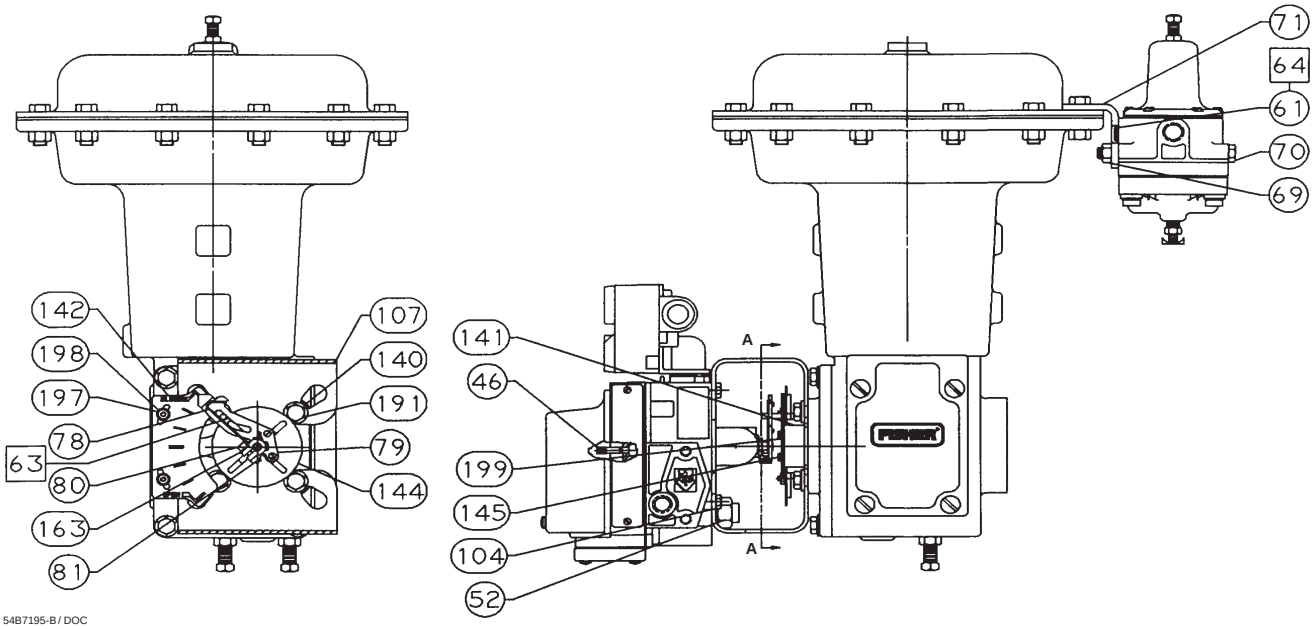


Figure 2-12. Type DVC5030 Digital Valve Controller Mounted on Type 1052 Size 33 Actuator with Casing-Mounted Filter Regulator

Set the Model 25463 spring adjustment with the valve off the travel stops. Adjust the spring so that the average of the top and bottom cylinder pressures is 50% of the minimum available supply pressure.

This is accomplished by adjusting the supply pressure to the minimum available, then adjusting the input current until the valve is off the stops. Next, turn the Model 25463 adjustment screw until the digital valve controller output gauge reads 50% of the minimum supply pressure. Restore the supply pressure to its normal operating pressure prior to placing the system in service.

The following example uses a minimum supply pressure of 80 psig with the digital valve controller output applied to the upper cylinder connection. With a minimum supply pressure of 80 psig, the spring adjustment method described establishes K at 80 psig.

An increasing DVC5000 output pressure moves the piston down. A DVC5000 output of 50 psig would yield a Model 25463 output of

$$P_o = K – P_S$$

80–50 = 30 psig

A decreasing DVC5000 output moves the piston up. A DVC5000 output of 30 psig would yield a Model 25463 output of

$$P_o = K – P_S$$

80–30 = 50 psig

Mounting Type DVC5030 on Fisher Rotary Actuators

1051 Size 33 and 1052 Size 20 and 33 Actuators

Unless otherwise noted, refer to figure 2-12 for key number locations.

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

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

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

Before attaching the mounting bracket and travel indicator assembly, determine the desired position of the travel indicator scale (key 142) relative to the actuator hub (above, below, left, or right). Figure 2-12 shows the travel indicator scale to the left of the actuator hub. The travel indicator scale is not installed at this time. The travel indicator scale is installed in step 11.

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

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

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

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

a. If the valve is open without pressure to the actuator [push-down-to-close (PDTC) actuator mounting], position the assembly so that the pointer on the travel indicator assembly will be over the open mark on the travel scale. Attach the travel indicator assembly (key 144) and spacer (key 141) to the actuator hub using two machine screws (key 145). For size 33 actuators only, also include two washers (key 199), as shown in figure 2-12.

b. If the valve is closed without pressure to the actuator [push-down-to-open (PDTO) actuator mounting], position the assembly so that the pointer on the travel indicator assembly will be over the closed mark on the travel scale. Attach the travel indicator assembly (key 144) and spacer (key 141) to the actuator hub using two machine screws (key 145). For size 33 actuators only, also include two washers (key 199), as shown in figure 2-12.

7. Position the feedback arm (key 79, figure 10-3) so that, when the digital valve controller is mounted on the actuator, the pin on the travel indicator assembly (key 144) will slide into the slot on the feedback arm.

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

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

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

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

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

Unless otherwise noted, refer to figure 2-12 for key number locations.

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

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

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

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

Before attaching the travel indicator assembly, determine the desired position of the travel indicator scale (key 142) relative to the actuator hub (above, below, left, or right). Figure 2-12 shows the travel indicator scale to the left of the actuator hub. The travel indicator scale is not installed at this time. The travel indicator scale is installed in step 11.

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

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

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

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

6. Position the feedback arm (key 79, figure 10-3) so that, when the digital valve controller is mounted on the actuator, the pin on the travel indicator assembly (key 144) will slide into the slot on the feedback arm.

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

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

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

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

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

1066SR Sizes 20, 27, and 75 Actuators

Unless otherwise noted, refer to figure 2-12 for key number locations.

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

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

2. Remove the machine screws (key 24) and the travel indicator (key 22).

3. Remove the travel indicator scale (key 21) by removing the four cap screws (key 20). Set aside the screws for later use.

Before attaching the mounting bracket and travel indicator assembly, determine the desired position of the travel indicator scale (key 142) relative to the actuator hub (above, below, left, or right). Figure 2-12 shows the travel indicator scale to the left of the actuator hub. The travel indicator scale is not installed at this time. The travel indicator scale is installed in step 12.

4. Position the mounting bracket (key 107) so that the travel indicator scale (key 142) will be in the desired position. The travel indicator scale is not installed at this time; it is installed in step 12.

5. Attach the mounting bracket (key 107) to the actuator using washers (key 140) and the four cap screws removed in step 3.

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

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

   a. If the valve is open without pressure to the actuator [push-down-to-close (PDTC) actuator mounting], position the assembly so that the pointer on the travel indicator assembly will be over the open mark on the travel scale. Attach the travel indicator assembly (key 144) and spacer (key 141) to the actuator hub using two machine screws (key 145) and washers (key 199). The washers are not required for size 75 actuators.

   b. If the valve is closed without pressure to the actuator [push-down-to-open (PDTO) actuator mounting], position the assembly so that the pointer on the travel indicator assembly will be over the closed mark on the travel scale. Attach the travel indicator assembly (key 144) and spacer (key 141) to the actuator hub using two machine screws (key 145) and washers (key 199). The washers are not required for size 75 actuators.

8. Position the feedback arm (key 79, figure 10-3) so that, when the digital valve controller is mounted on the actuator, the pin on the travel indicator assembly (key 144) will slide into the slot on the feedback arm.

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

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

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

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

Mounting Type DVC5030 to Replace Positioners

Replacing Masoneilan Type 4600 Positioners

Unless otherwise noted, refer to figure 2-13 for key number locations.

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

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

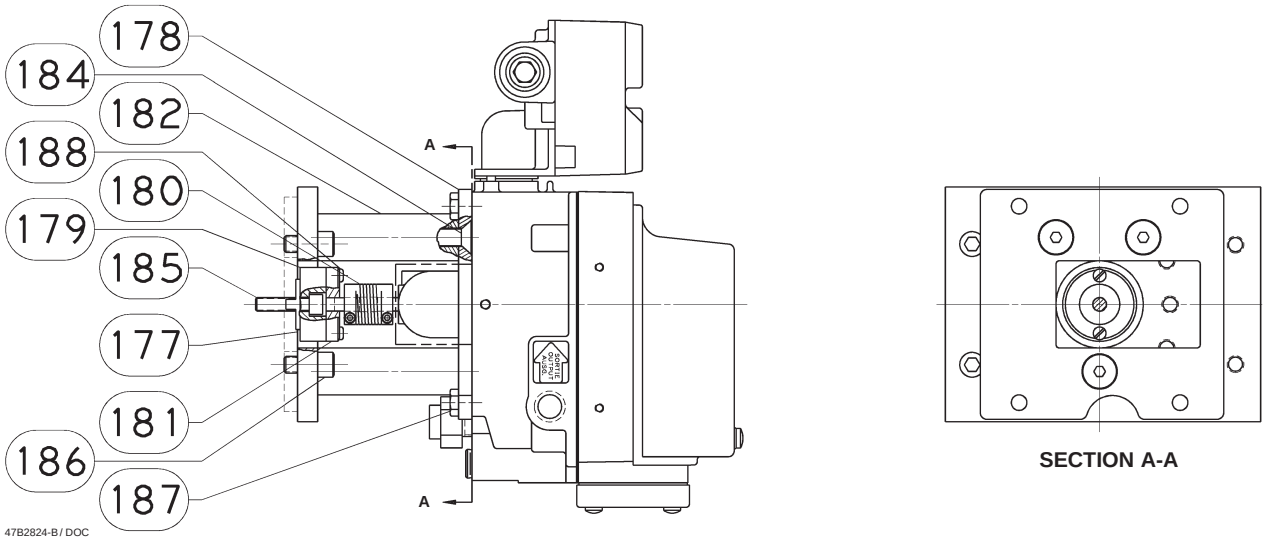


Figure 2-13. Type DVC5030 Digital Valve Controller Assembly for Replacing a Masoneilan Type 4600 Positioner

3. Attach the shaft connector (key 179) to the actuator shaft using the socket head cap screw (key 185).

4. Attach the shaft connector cap assembly (key 181) to the shaft connector using two machine screws (key 188).

5. Attach the emulator (key 177) to the actuator using two socket head cap screws (key 186).

The digital valve controller can mount to the actuator in any one of four possible mounting quadrants. Determine the desired mounting position then proceed with the next step.

6. Attach the positioner plate (key 178) to the emulator using the three spacers (key 182) and flathead cap screws (key 184).

7. On the Type DVC5030 digital valve controller, remove the feedback arm (key 79, figure 10-3) and slip the coupler (key 180) on the travel sensor shaft. Tighten the coupler set screw to secure the coupler on the travel sensor shaft.

8. Align the digital valve controller with the mounting holes in the positioner plate (key 178). Be sure the coupler slips onto the pin in the shaft connector cap assembly (key 181). Secure the controller to the positioner plate using four hex head cap screws (key 187). Leave the coupler loose on the connector cap assembly (key 181) until travel sensor adjustment is complete.

9. Perform the Travel Sensor Adjust procedure in the “Calibration” section, Section 6.

Replacing Neles-Jamesbury Type NE600, NP600, NE700 and NP700 Positioners

Unless otherwise noted, refer to figure 2-14 for key number locations.

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

2. Attach the emulator (key 177) to the actuator using three socket head cap screws (key 189).

3. Position the tie-bar assembly (key 190) in the actuator shaft slot so that it is approximately centered. Tighten the set screw to temporarily hold the tie-bar assembly in place.

The digital valve controller can mount to the actuator in any one of four possible mounting quadrants. Determine the desired mounting position then proceed with the next step.

4. Attach the positioner plate (key 178) to the emulator using the three spacers (key 182) and flathead cap screws (key 184).

5. On the Type DVC5030 digital valve controller, remove the feedback arm (key 79, figure 10-3) and slip the coupler (key 180) on the travel sensor shaft. Tighten the coupler set screw to secure the coupler on the travel sensor shaft.

6. Align the digital valve controller with the mounting holes in the positioner plate (key 178). Once the coupler passes through the hole in the positioner

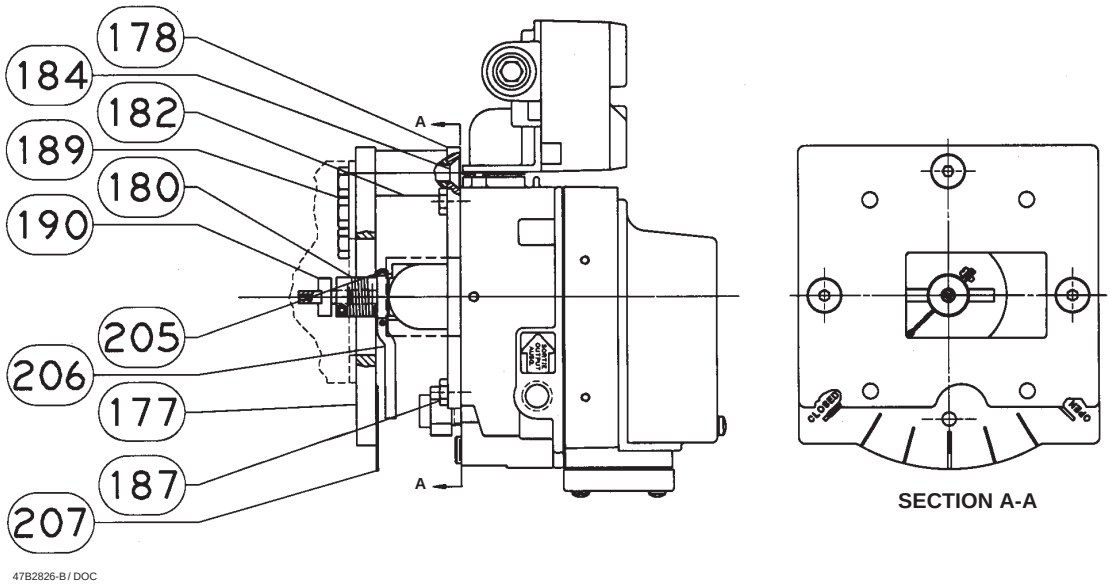


Figure 2-14. Type DVC5030 Digital Valve Controller Assembly for Replacing Neles-Jamesbury Positioners

plate, place the valve position pointer (key 206) on the coupler. Slide the pointer onto the coupler until it rests on the controller housing. Position the pointer so that, during normal operation, it will not contact any of the spacers (key 182) when the actuator shaft rotates.

7. Be sure the coupler slips onto the pin in the tie-bar assembly (key 190). If necessary, loosen the set screw to allow the tie-bar assembly to slide in the actuator shaft slot. Secure the controller to the positioner plate using four hex head cap screws (key 187).

8. Rotate the coupler (key 180) to be sure it does not bind, then tighten the set screw to hold the tie-bar assembly (key 190) in place. Leave the coupler loose on the tie-bar assembly (key 190) until the travel sensor adjustment is complete.

9. Perform the Travel Sensor Adjust procedure in the "Calibration" section, Section 6.

10. Determine the actuator action (clockwise shaft rotation opens the valve or clockwise shaft rotation closes the valve) and select the appropriate indicator scale (key 207). Remove the paper backing from the indicator scale to expose the adhesive.

11. Slip the indicator scale (key 207) under the pointer and fasten it to the emulator (key 177 by pressing the scale in place.

12. Position the pointer as follows:

a. If the valve is closed, position the pointer over the CLOSED mark on the indicator scale.

b. If the valve is open, position the pointer over the OPEN mark on the indicator scale.

13. Be sure the pointer (key 206) does not contact the emulator (key 177) or digital valve controller housing and tighten the screw (key 205) to secure the pointer on the coupler (key 180).

Replacing PMV Model P1200, P1250, and P2000 Positioners

Unless otherwise noted, refer to figure 2-15 for key number locations.

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

2. Remove the PMV positioner from the valve and remove the PMV spindle.

3. Machine the end of the spindle so that it matches the dimensions in figure 2-16.

4. Attach the emulator (key 177) to the actuator using three socket head cap screws (key 189).

The digital valve controller can mount to the actuator in any one of four possible mounting quadrants. Determine the desired mounting position then proceed with the next step.

5. Attach the positioner plate (key 178) to the emulator using the three spacers (key 182) and flathead cap screws (key 184).

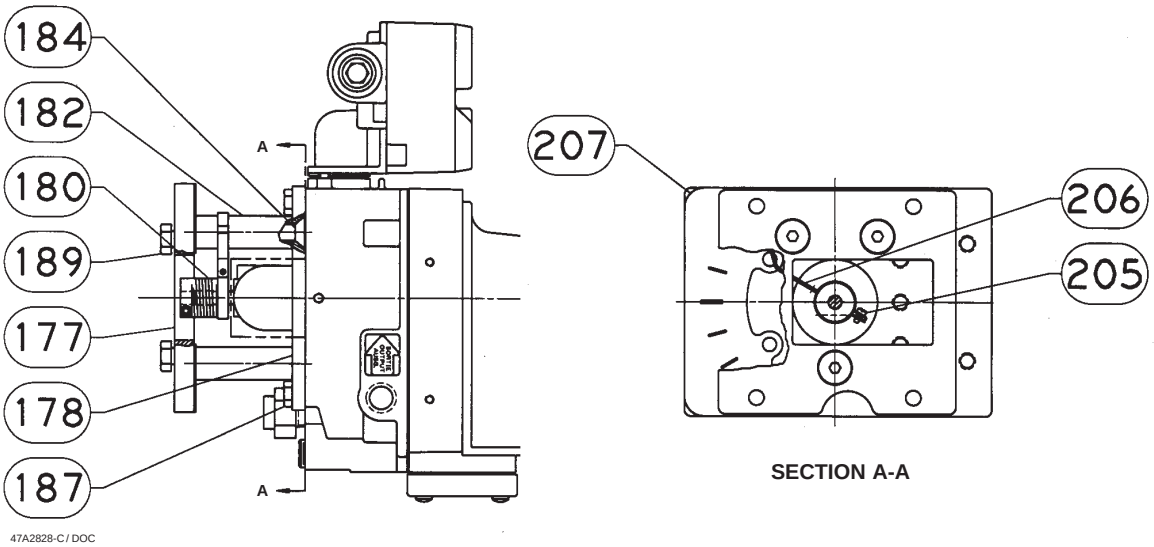


Figure 2-15. Type DVC5030 Digital Valve Controller Assembly for Replacing PMV Positioners

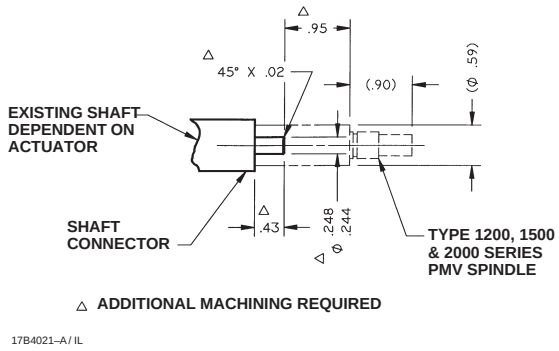


Figure 2-16. PMV Spindle Dimensions Required to Fit Coupler (key 180)

6. On the Type DVC5030 digital valve controller, remove the feedback arm (key 79, figure 10-3) and slip the coupler (key 180) on the travel sensor shaft. Tighten the coupler set screw to secure the coupler on the travel sensor shaft.

7. Align the digital valve controller with the mounting holes in the positioner plate (key 178). Once the coupler passes through the hole in the positioner plate, place the valve position pointer (key 206) on the coupler. Slide the pointer onto the coupler until it rests on the controller housing. Position the pointer so that, during normal operation, it will not contact any of the spacers (key 182) when the actuator shaft rotates.

8. Install the machined spindle into the coupler (key 180) then slide the controller in until the spindle engages the actuator shaft.

9. Secure the controller to the positioner plate using four hex head cap screws (key 187). Leave the coupler loose on the spindle until the travel sensor adjustment is complete.

10. Perform the Travel Sensor Adjust procedure in the “Calibration” section, Section 6.

11. Determine the actuator action (clockwise shaft rotation opens the valve or clockwise shaft rotation closes the valve) and select the appropriate indicator scale (key 207). Remove the paper backing from the indicator scale to expose the adhesive.

12. Slip the indicator scale (key 207) under the pointer and fasten it to the emulator (key 177 by pressing the scale in place.

13. Position the pointer as follows:

a. If the valve is closed, position the pointer over the CLOSED mark on the indicator scale.

b. If the valve is open, position the pointer over the OPEN mark on the indicator scale.

14. Be sure the pointer (key 206) does not contact the emulator (key 177) or digital valve controller housing and tighten the screw (key 205) to secure the pointer on the coupler (key 180).

Mounting Type DVC5040 on System 9000 Actuators

Refer to figures 2-17 and 10-4 for key numbers.

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

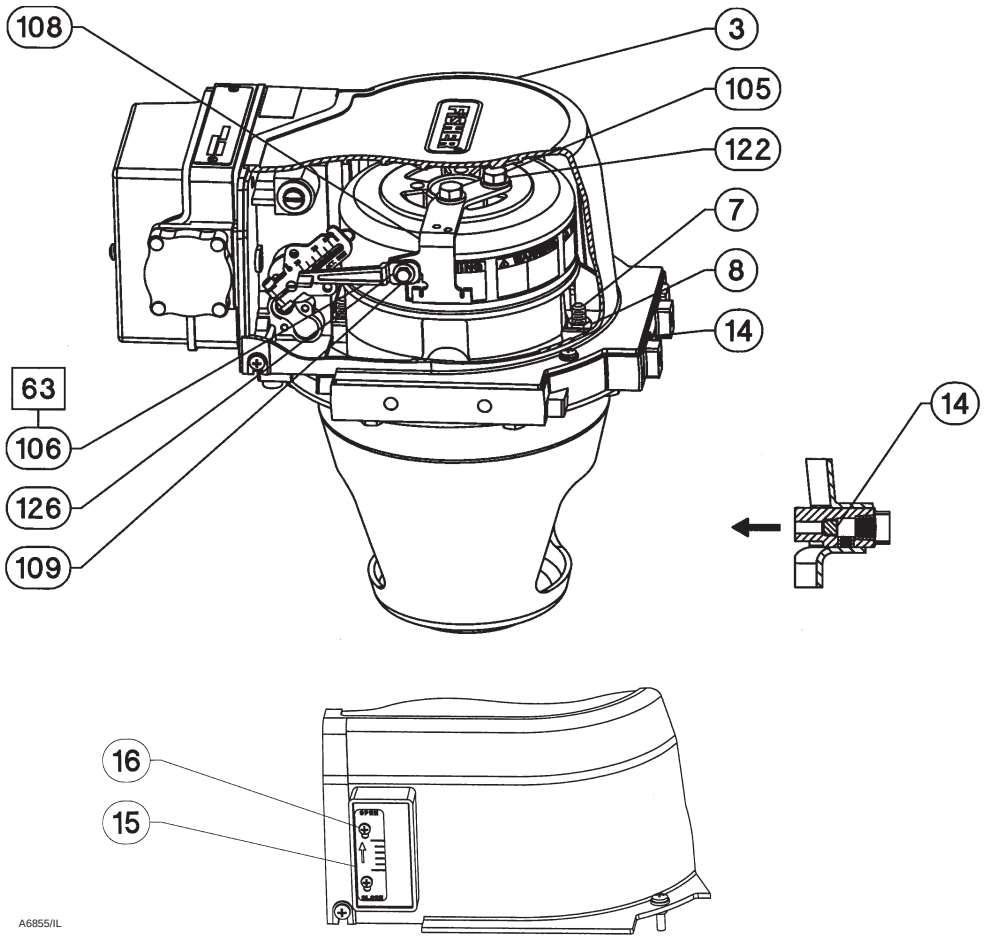


Figure 2-17. System 9000 Actuator Assembly with Type DVC5040 Digital Valve Controller

WARNING

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

2. Install the O-ring (key 167) as shown in figure 2-18 to the mounting flange of the digital valve controller.

3. Line up the O-ring from the previous step with its associated actuator port on the power module assembly and attach the digital valve controller to the System 9000 actuator power module assembly with two cap screws (key 116). See figure 2-18.

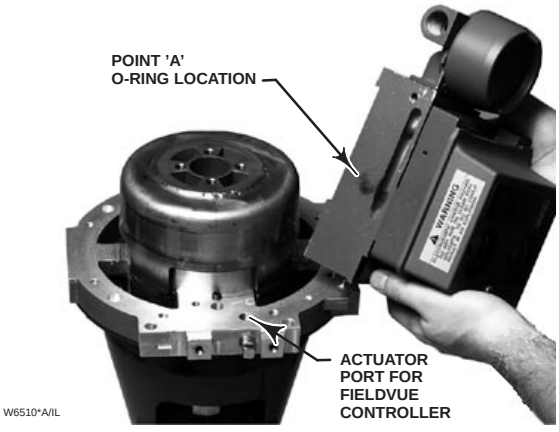


Figure 2-18. Digital Valve Controller Point of Connection

Note

The alignment pin (key 46) is stored inside the digital valve controller housing. It is located above the supply pressure gauge.

4. Set the position of the adjustment arm (key 106) by inserting the alignment pin (key 46) through the hole on the feedback arm marked ‘‘A’’ for a **fail-closed** configuration or the hole marked ‘‘B’’ for **fail-open** configurations.

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

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

7. Slide the adjustment arm pin in the slot of the feedback arm until the pin is in line with the desired valve travel marking (see figure 2-19). Tighten the machine screw (key 109).

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

9. Install the System 9000 actuator cover assembly.

Mounting the Type 67AF Filter Regulator

A Type 67AF filter regulator, when used with the DVC5000 Series digital valve controllers, can be mounted three ways.

Integral-Mounted Regulator

Refer to figures 2-1 through 2-5 and figure 2-9. Lubricate an O-ring (key 60) and insert it in the recess around the SUPPLY connection on the digital valve controller. Attach the Type 67AF filter regulator to the side of the digital valve controller. This is the standard method of mounting the filter regulator.

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

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

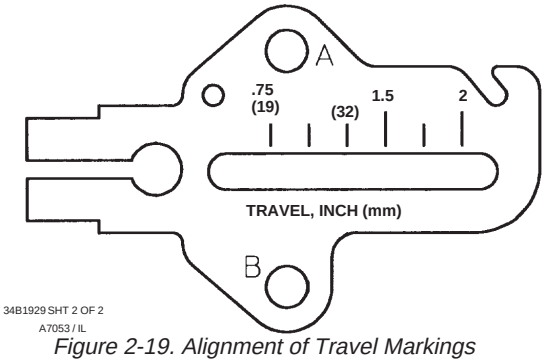


Figure 2-19. Alignment of Travel Markings

Yoke-Mounted Regulator

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

Casing-Mounted Regulator

Refer to figures 2-8 and 2-12. Use the separate Type 67AF filter regulator casing mounting bracket provided with the filter regulator. Attach the mounting bracket to the Type 67AF and then attach this assembly to the actuator casing. Thread a 1/4-inch socket-head pipe plug (key 61) into the unused outlet on the filter regulator. The O-ring (key 60) is not required.

Pneumatic Connections

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

Supply Connections

WARNING

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

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

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

Output Connection

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

Vent

WARNING

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

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

To connect a remote vent to Type DVC5010, DVC5030, and DVC5040 digital valve controllers—sliding-stem Remove the plastic vent (key 52, figure 10-1). The vent connection is 1/4-inch NPT or R 1/4 female. Typically, 3/8-inch (10 mm) tubing is used to provide a remote vent.

To connect a remote vent to Type DVC5020 digital valve controllers—rotary Replace the standard mounting bracket (key 74, figure 10-2) with the vent-away mounting bracket (key 74). Install a pipe plug (key 127, figure 10-2) in the vent-away mounting bracket (key 74). Mount the digital valve controller on the actuator as described in the “Installation” section of this manual.

Electrical Connections

4 to 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.

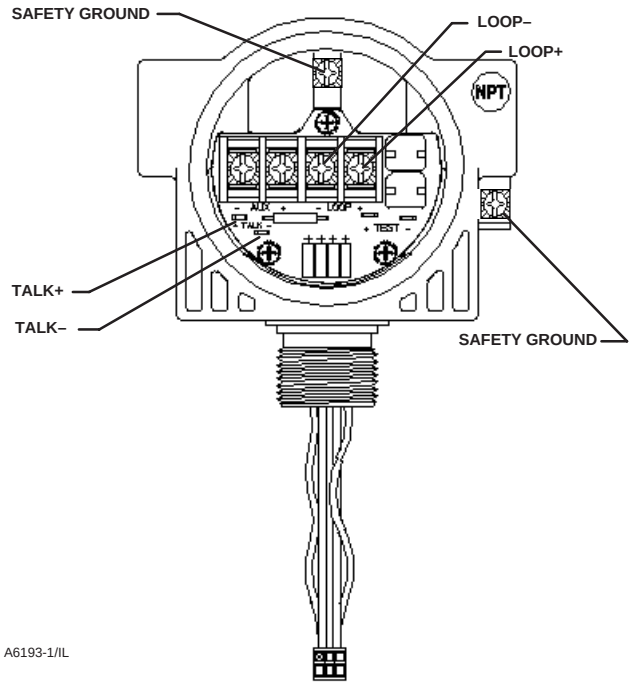


Figure 2-20. Type DVC5000 Series Digital Valve Controller Terminal Box

CAUTION

Do not connect the digital valve controller directly to a voltage source when implementing the point-to-point wiring mode, or damage to the pwb assembly submodule may result. In point-to-point wiring mode, the digital valve controller may only be connected to a 4–20 mA current source.

Wire the digital valve controller as follows: (refer to figures 10-1 through 10-4 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. Connect the positive wire from the control system output card ''current output'' to the LOOP + screw terminal on the pwb/terminal strip assembly in the terminal box. Connect the negative (or return) wire from the control system output card to the LOOP – screw terminal in the terminal box as shown in figure 2-20.

WARNING

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

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

4. Connect the safety ground and the earth ground as shown in figure 2-20. Replace and hand tighten the cover on the terminal box. When the loop is ready for startup, apply power to the control system output card.

Test Connections

WARNING

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

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 X 1000 = Loop Milliamps

0.004 X1000 = 4.0 milliamperes

0.020 X 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 an area which contains a potentially explosive atmosphere or has been classified as hazardous. Confirm that area classification and atmosphere conditions permit the safe removal of the terminal box cap before proceeding.

A HART communicating device, such as a Model 275 HART Communicator or a personal computer running ValveLink software communicating through a HART modem, interfaces with the DVC5000 Series digital valve controller from any wiring termination point in the 4–20 mA loop. If you choose to connect the HART communicating device directly to the instrument, attach the device to the LOOP + and LOOP – terminals or to the TALK + and TALK – connections inside the terminal box to provide local communications with the instrument.

Wiring Practices

Control System Requirements

There are several parameters that should be checked to ensure the control system is compatible with the DVC5000 Series digital valve controller.

HART Filter

Depending upon the control system you are using, a HART filter may be needed to isolate the control system output from modulated HART communication signals. The filter is inserted in the field loop wiring. For information and specifications, refer to the *Type HF100 FIELDVUE HART Filter Instruction Manual, Form 5340* or to the *FIELDVUE HF200 Series HART Filter Instruction Manual, Form 5380.*

To determine if your system requires a filter, refer to table 2-1. Table 2-1 lists control systems that have been tested with FIELDVUE instruments. If your control system is not listed, you can either:

- always install a filter, or
- contact your Fisher Controls sales office or sales representative for their recommendation.

Voltage Available

The voltage available at the DVC5000 Series digital valve controller must be at least 12 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 2-21, the voltage available at the instrument depends upon:

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

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

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

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

The calculated voltage available should be greater than or equal to 12 volts dc, minimum.

Table 2-1 lists the compliance voltage of tested control systems and other control system parameters. Table 2-2 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 Type HF230 HART filter, and 1000 feet of Belden 9501 cable:

Voltage available = [18.5 volts (at 21.05 mA)] – [2.3 volts] – [48 ohms $\times$ 0.02105 amps]

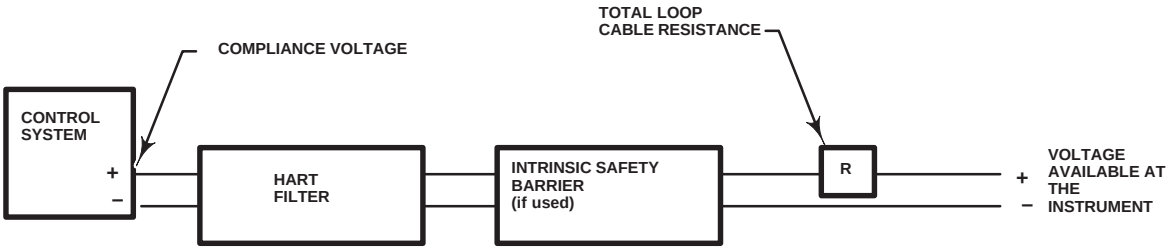
Voltage available = [18.5] – [2.3] – [1.01]

Voltage available = 15.19 volts

Compliance Voltage

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

1. Disconnect the field wiring from the control system and connect equipment as shown in figure 2-22 to the control system terminals.



Calculate Voltage Available at the Instrument as follows:	Example Calculation
Control system compliance voltage	18.5 volts (at 21.05 mA)
– Filter voltage drop (if used) 1	– 2.3 volts (for HF200 series filter)
– Intrinsic safety barrier resistance (if used) x maximum loop current	– 2.55 volts (121 ohms x 0.02105 amps)
– Total loop cable resistance x maximum loop current	– 1.01 volts (48 ohms x 0.02105 amps for 1000 feet of Belden 9501 cable)
= Voltage available at the instrument 2	= 15.19 volts, available

NOTES:

1. **Obtain filter voltage drop from table 2-1. 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 2.**
2. **The voltage available at the instrument is not the voltage measured at the instrument terminals. Once the instrument is connected, the instrument limits the measuired voltage to approximately 10.5 to 11.5 volts.**

Figure 2-21. Determining Voltage Available at the Instrument

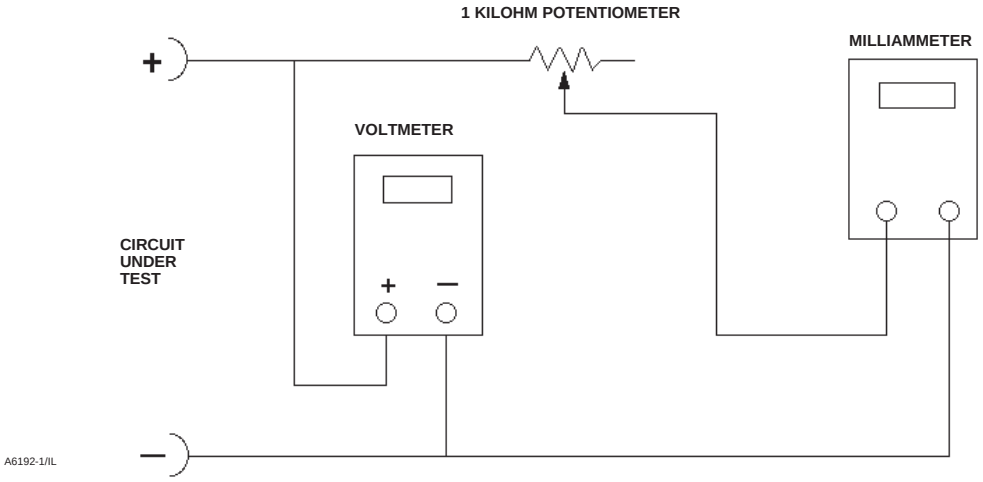


Figure 2-22. Voltage Test Schematic

2. Set the control system to provide maximum output current.

3. Increase the resistance of the 1 kilohm potentiometer, shown in figure 2-22, 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 Fisher Controls sales representative or sales office.

Maximum Cable Capacitance

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

Length(ft) = [160,000 – C_{master}(pF)] ÷ [C_{cable}(pF/ft)]

Length(m) = [160,000 – C_{master}(pF)] ÷ [C_{cable}(pF/m)]

where:

160,000 = a constant derived for FIELDVUE instruments to insure that the HART network RC time constant will be no greater than 0.65 μs (per the HART specification).

C_{master} = the capacitance of the control system or HART filter (see table 2-1)

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

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.

Length(ft) = [160,000 – 50,000pF] ÷ [50pF/ft]

Length = 2200 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 Fisher Controls sales representative or sales office for specific information relating to your control system.

HART Filter Use and Specifications

Depending on the control system being used, a filter may be needed to allow HART communication to work properly. The HART filter is an active device that is inserted in field wiring from the HART loop. 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

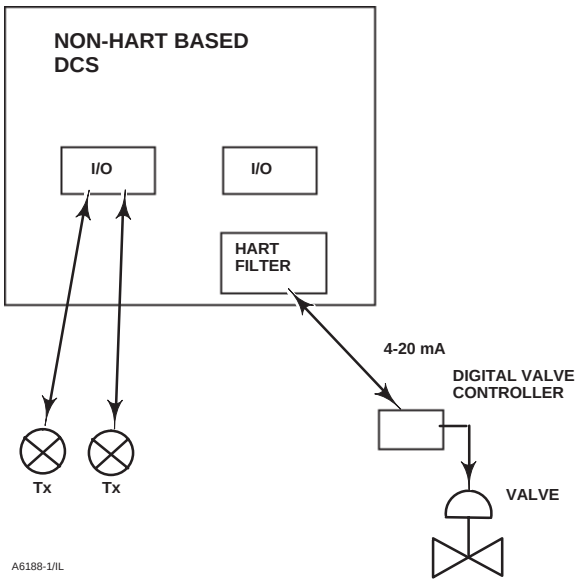


Figure 2-23. HART Filter Application

HART communication. The filter receives a 4 to 20 mA current signal from the control system, and drives the loop as a high impedance current source. The output current is a filtered replica of the input current. The current drive stage of the filter prevents the voltage modulation in the HART loop from being seen by, or having an effect on, the controller output. The filter requires a small amount of operating current (less than 60 microamps) and an input to output voltage drop of up to 2.3 Vdc to perform its function.

The filter is normally installed near the field wiring terminals of the control system I/O (see figure 2-23). HART communication is possible only between the filter and the field instrument, not on the control system side of the filter. The filter is not designed or intended for use in the process environment.

Refer to separate Type HF100 and HF200 Series filter instruction manuals for installation, calibration, and maintenance of the HART filter.

Table 2-1. Control System Parameters

Control System[1]		Compliance Voltage[2]	Installation Requirement
Bailey Infi 90		15.5 V @ 20.8 mA 15.8 V @ 4.0 mA	Filter required Watch compliance voltage
Fischer–Porter DCI 40PC2000C		18.2 V @ 20.75 mA 21.7 v @ 3.89 mA	Filter required
Honeywell TDC 2000		18.5 V @ 21.05 mA 20.7 V @ 3.84 mA	Filter required
Honeywell TDC 3000	Multi-function controller	18.5 V @ 21.05 mA 20.7 V @ 3.84 mA	Filter required
	High-density Process Manager (HPM) controller	18.4 V @ 20.0 mA 20.7 V @ 4.0 mA	No filter required
FOXBORO I/A (1988)		18.2 V @ 20.0 mA 22.2 V @ 3.99 mA	No filter required Assume 50,000 pF C_{master}
Moore 352		No data available	No filter required
Valumet (output configured for straight through, not for 250 ohms		No data available	No filter required
Rosemount RS-3 Multiport with HART I/O		22.8 V @ 20.05 mA 24.2 V @ 4.0 mA	No filter required
Fisher–Rosemount PROVOX Configurable, Computing, and Interactive (IAC) Controllers		20.7 V @ 22.09 mA 21.6 V @ 3.83 mA	Filter required
Fisher–Rosemount PROVOX MUX (parallel) I/O		17.51 V @ 20.39 mA 18.08 V @ 3.82 mA	No filter required Assume 100,000 pF C_{master}
Fisher–Rosemount PROVOX Control (serial) I/O	for AO	19.5 V @ 22.25 mA 20.3 V @ 3.85 mA	Filter required
	for HART I/O	No data available	No filter required
Fisher–Rosemount TL108 with 24 volt dc power		17.2 V @ 20.0 mA 21.67 v @ 4.0 mA	No filter required Assume 12,000 pF C_{master}
Fisher-Rosemount TL108 with 45 volt dc power		27.0 V @ 20.0 mA	No filter required Assume 12,000 pF C_{master}
Fisher–Rosemount DPR900		20.67 V @ 19.94 ma 24.82 V @ 3.80 mA	Filter required
Fisher–Rosemount ROC 364		17.32 V @ 20.40 mA 22.63 V @ 3.66 mA	No filter required Assume 0 pF C_{master}
Type HF100 Filter		2.0 volts less than the control system	Assume 25,000 pF C_{master}
HF200 Series Filters		2.3 volts less than the control system	Assume 25,000 pF C_{master}
Transmation Model 1028 mA Calibrator		No data available	Filter required

1. For control systems not listed, a filter is recommended, if the voltage available at the instrument is adequate (see Votage Available in this section). Filtering ensures proper communication and simplifies connecting a HART communicator or HART interchange.

2. Some control systems have a compliance voltage that is power supply dependent. If the power supply voltage is below nominal, for example, due to a switch to battery backup, the compliance voltages will drop as much as the power supply drops.

Table 2-2. 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.

Section 3 Model 275 HART Communicator Basics

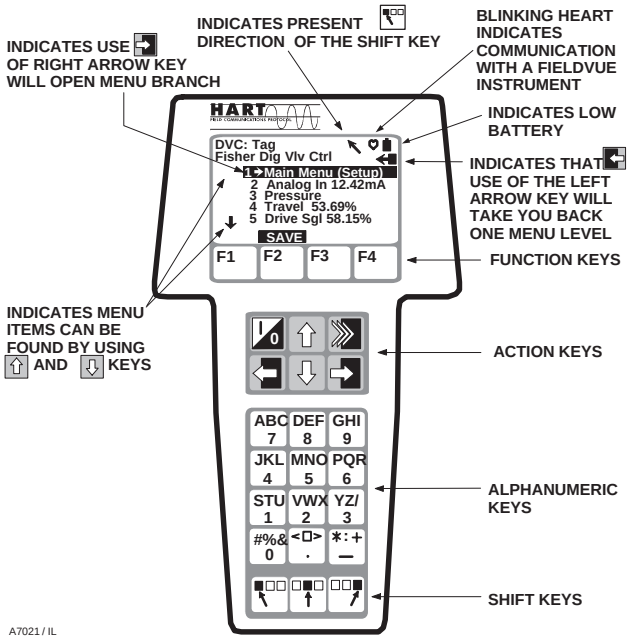


Figure 3-1. Model 275 HART Communicator

Note

The Model 275 HART Communicator device description revision (DD) determines how the HART Communicator interfaces with the instrument. For information on displaying the device description revision, see page 3-5.

This section discusses the display, keypad, and menu structure for the HART Communicator, shown in figure 3-1. This section also includes information for displaying the HART Communicator device description revision number. For information on connecting the HART Communicator to the instrument, see the "Installation" section, Section 2. For more information on the HART Communicator, such as specifications and servicing, see the *Product Manual for the HART Communicator– MAN4275A00*, included with the HART Communicator. This manual also is available from Rosemount Inc., Measurement Division.

Display

The HART Communicator communicates information to you through an eight-line by twenty-one character liquid crystal display (LCD). When connected to an instrument, the top two lines of the display indicate the instrument tag and type. The bottom line of the display is reserved for dynamic labels. These dynamic labels identify the software-defined functions assigned to the four function keys (F1 through F4) below the display.

Action Keys

On-Off Key

Use this key to turn the HART Communicator on and off. When the HART Communicator is turned on, it goes through a self test routine and then automatically searches for a HART-compatible device. If no device is found, it displays the message "No Device Found." then displays the main menu. Four choices are available from this screen: *Offline*, *Online*, *Frequency Device*, and *Utility*.

If a HART-compatible device is found, the HART Communicator displays the Online menu. For more information on the Online and Offline menus, see Menu Structure in this section, page 3-4.

When performing certain operations, the message "OFF KEY DISABLED" is displayed indicating the HART Communicator cannot be turned off. This feature helps to avoid situations where the HART Communicator could be unintentionally turned off while a device's output is fixed or when configuration data has not been sent to a device.

Up Arrow Key

Use this key to move the cursor up through a menu and to scroll through lists of available characters and options when editing a field.

Down Arrow Key

Use this key to move the cursor down through a menu and to scroll through lists of available characters and options when editing a field.

Left Arrow and Previous Menu Key

Use this dual-function key to move the cursor to the left or to return to the previous menu.

Right Arrow and Select Key

Use this dual-function key to move the cursor to the right or to select the highlighted menu option.

Hot Key 

Pressing this key turns on the HART Communicator and, if connected to a FIELDVUE instrument, displays the Hot Key menu. This menu allows you to quickly:

- Change the instrument mode
- Change the control mode
- Change the instrument protection
- Stabilize/Optimize—permits increasing or decreasing the tuning to improve response

For details on instrument mode, control mode, protection, tuning sets, and other configuration parameters, see the “Detailed Setup” section, Section 5, of this manual.

Software-Defined Function Keys

Use the four function keys, marked F1 through F4, located below the LCD to select the software functions indicated by the dynamic labels. On any given menu, the label appearing above a function key indicates the function of that key for the current menu.

As you move between menus, different dynamic labels appear over the four function keys. For example, in menus providing access to on-line help, the HELP label may appear above the F1 key. In menus providing access to the Home menu, the HOME label may appear above the F3 key. In many cases the SEND label appears indicating that you must press the corresponding function key to send the information you have entered on the keypad to the FIELDVUE instrument’s memory. Functions available include:

- **HELP**—gives you information regarding the display selection.
- **SEND**—sends the information you have entered to the instrument.
- **BACK**—takes you to the previously displayed menu.
- **HOME**—takes you back to the Online menu.
- **EXIT**—takes you back to the menu from which you had requested the value of a variable that can only be read.
- **ABORT**—cancels your entry and takes you back to the menu from which you had selected the current variable or routine. Values are not changed.
- **OK**—takes you to the next menu or instruction screen.
- **ENTER**—sends the information you have selected to the instrument or flags the value that is to be sent to the instrument. If it is flagged to be sent, the SEND dynamic label appears as a function key selection.
- **DEL**—deletes the character at the current cursor position when entering a variable.
- **ESC**—cancels your entry and takes you back to the menu from which you had selected the current variable. Values are not changed.

Note

From time to time the SAVE dynamic label will appear. Do not press the function key associated with SAVE. This key has no application to FIELDVUE instruments.

Alphanumeric and Shift Keys

Figure 3-2 shows the alphanumeric and shift keys. The alphanumeric keys perform two functions: the fast selection of menu options and data entry.

From within any menu, you can select available options in two ways. You can use the up and down arrow keys and the select key to access available options, or just press the corresponding number on the alphanumeric keypad to select the desired option.

Some menus require data entry. When you press an alphanumeric key alone from within an edit menu, the bold character in the center of the key appears. These large characters include the numbers zero through nine, the decimal point (.), and the dash symbol (–). To enter the other characters on the keys, first press and release the appropriate shift key. Do not press the keys simultaneously.

Example: to enter the letter “R”, press the following key sequence:

Pressing the right shift key activates shift and causes the right shift arrow icon to appear in the upper right

Figure 3-2. Model 275 HART Communicator Alphanumeric and Shift Keys

corner of the display. Pressing the '6' key causes an "R" to appear in the editable field.

Menu Structure

The HART Communicator is generally used in two environments: offline (when not connected to an instrument) and online (connected to an instrument).

Offline Menu

Pressing the On/Off key when not connected to a FIELDVUE instrument causes the unit to perform a self test and inform you of the firmware and module revision numbers. After displaying the message "No Device Found." the unit displays the main menu. Four choices are available from this screen: *Offline, Online, Frequency Device,* and *Utility.* The Offline menu allows you to configure the HART Communicator, view HART Communicator system information, and simulate an on-line connection. Offline configuration is not available for the DVC5000 Series digital valve controllers.

Polling

When several devices are connected in the same loop, such as for split ranging, each device must be assigned a unique polling address. Use the Polling options to configure the HART Communicator to automatically search for all or specific connected devices.

To enter a polling option, select *Utility* from the Offline menu. Select *Configure Communicator* then select *Polling.* Use the up and down arrow keys to highlight one of the listed polling options, and press ENTER (F4) to select the highlighted option.

The Polling options are:

1. **Never Poll**—connects to a device at address 0, and if not found will not poll for devices at address 1–15.

2. **Ask Before Polling**—connects to a device at address 0, and if not found asks if you want to poll for devices at address 1–15.

3. **Always Poll**—connects to a device at address 0, and if not found will automatically poll for devices at address 1–15.

4. **Digital Poll**—automatically polls for devices at address 0–15 and lists devices found by tag.

To find individual device addresses, use the Digital Poll option to find each connected device in the loop and list them by tag.

For more information on setting the polling address, see the "Detailed Setup" section, Section 5.

System Information

To access the HART Communicator system information, select *System Information* from the *Utility* menu.

The motherboard system information consists of the Serial Peripheral Interface Time (SPI Time) and the HART Communicator firmware revision number.

The module system information consists of hardware and software data. For example, you can find the hardware revision, RAM size, and Flash size; or, the different software revisions and binary sizes.

The Data Pack system information consists of the EEPROM size and revision number.

Reviewing Instrument Device Descriptions

The HART Communicator memory module contains device descriptions for specific HART-compatible devices. These descriptions make up the application software that the communicator needs to recognize particular devices.

If you cannot find a specific HART-compatible device on your communicator, then the device revision you are looking for is not programmed into the memory module. In this instance you are limited to what is available within a generic device description.

To review the device descriptions programmed into your HART Communicator, select *Simulation* from the *Utility* menu. The *Manufacturer Menu* appears. The *Manufacturer Menu* contains a list of each manufacturer with device descriptions currently installed in your communicator's memory module.

Once you select a manufacturer, the *Model Menu* appears. The *Model Menu* lists the currently installed device models, or types, provided by the selected manufacturer.

Select one of the instrument models or types to see the instrument device description and the Model 275 HART Communicator device description revision that supports that instrument.

Simulation

The HART Communicator provides a simulation mode that allows you to simulate an online connection to a HART-compatible device. The simulation mode is a training tool that enables you to become familiar with the various menus associated with a device without having the HART Communicator connected to the device.

To simulate an online connection, select *Utility* from the Offline menu. Select *Simulation* then select *Fisher Controls.* Select *DVC* to see the menu structure for the DVC5000 Series digital valve controller. Refer to the appropriate sections of this manual for information on the various menus.

Online Menu

Pressing the On/Off key when connected to a FIELDVUE instrument causes the unit to perform a self test and inform you of the firmware and module revision numbers. The unit then displays the device Online menu. The figure on the front cover foldout shows an overview of the DVC5000 Series digital valve controller menu structure.

Displaying the HART Communicator Device Description Revision

Device Description (DD) Revision is the revision number of the Fisher Controls Device Description that resides in the HART Communicator. It defines how the HART Communicator is to interact with the user and instrument.

HART Communicators with device description revision 11 are used with firmware 3 and 4 instruments. There are two device descriptions used with firmware revision 5 instruments: 1 and 2. Device Description Revision 1 is available in HART Communicators with 1.25 megabyte memory modules. Device Description Revision 2 is available in HART Communicators with 4 and 8 megabyte memory modules.

You can display the device description from the Offline or Online menu:

Offline Menu—To see the HART Communicator device description revision number from the Offline menu, select *Utility, Simulation, Fisher Controls,* and *DVC*.

Online Menu—To see the HART Communicator device description revision number from the Online menu, connect the HART Communicator to an instrument connected to a source supplying a 4 to 20 mA signal. From the Online menu, select *Main Menu, Display, 275 DD Rev.*

Section 4 Initial Setup and Calibration

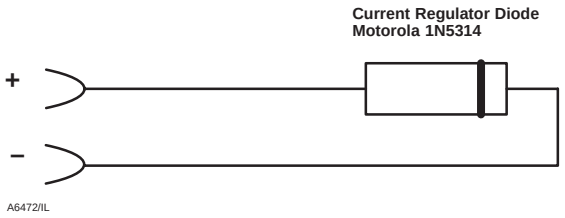


Figure 4-1. Configuration Protection Jumper

Configuration Protection

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

- If the Auxiliary terminals are used as a transmitter input (see table 9-2), use the configuration jumper shown in figure 4-1.

- If the Auxiliary terminals are used for a switch input (see table 9-2) use either the configuration jumper shown in figure 4-1 or a piece of wire with clips.

To remove protection:

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

Instrument Mode

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

To view 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 (F4).

Initial Setup

CAUTION

Changes to the instrument setup may cause changes in the output pressure or valve travel.

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.

When the DVC5000 Series 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 initial setup, be sure the instrument is correctly mounted as described in the “Installation” section, Section 2, and that the travel sensor is adjusted correctly. Refer to the Travel Sensor Adjust procedures in the “Calibration” section, Section 6.

There are two initial setup procedures:

- **Auto Setup**—(Recommended for initial setup.) This procedure automatically selects the appropriate configuration parameters depending upon the actuator type and size specified.

- **Manual Setup**—this procedure permits you to enter values for the following configuration parameters:
  - Instrument Mode
  - Control Mode
  - Feedback Char
  - Supply Pressure
  - Zero Control Signal
  - Invert Feedback

- Travel Cutoff Low
- Tuning Set
- Auto Calib Travel

Auto Setup (1-1-1)

Setup Wizard (1–1–1–1)

To have the HART Communicator automatically setup the instrument using specified actuator information, from the Online Menu select *Main Menu, Initial Setup, Auto Setup, and Setup Wizard*. Follow the prompts on the HART Communicator display to setup the instrument.

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

2. Enter the actuator type. If the actuator type is not listed, select Other.

3. Enter the actuator size.

4. Enter the instrument supply pressure.

5. Specify if factory defaults should be used for initial setup. If you select YES for factory default, the HART Communicator sets the setup parameters to the values listed in table 4-1. 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 type specified. However, if you enter other for the actuator manufacturer or the actuator type, then you will be prompted for setup parameters such as:

Actuator type (single-acting or double-acting),

Feedback characteristic (rotary shaft or sliding-stem),

Valve fail action (valve opens or closes when air is lost, see Zero Control Signal under Manual Setup),

Table 4-1. DVC5000 Series Factory Default Settings

Setup Parameter	Default Setting
Analog Input Units	mA
Input High	20.0 mA
Input Low	4.0 mA
Travel Range High	100%
Travel Range Low	0%
Control Mode	Analog (RSP)
Restart Control Mode	Resume Last
Self-Test Shutdown	All Failures Disabled
Dynamic Bypass Enabled	No
Input Filter Time	0 secs
Input Characteristic	Linear
Travel Limit High	125%
Travel Limit Low	–25%
Travel Cutoff High	99.5%
Travel Cutoff Low	0.5%
Minimum Opening Time	0 secs
Minimum Closing Time	0 secs
Polling Address	0

WARNING

If you answer YES to the prompt for permission to move the valve, the instrument may 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.

Travel sensor rotation. (increasing air pressure causes the travel sensor shaft to rotate clockwise or counterclockwise), The HART Communicator will ask if it can move the valve to determine travel sensor rotation. 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.

Instrument supply pressure range (see Instrument Supply Pressure under Manual Setup), and

Tuning set (see Tuning Set under Manual Setup).

After the Setup Wizard completes the setup, press OK to return to the *Auto Setup* menu. Select *Auto Calib Travel* to automatically calibrate the instrument travel. Follow the prompts on the HART Communicator display. The calibration procedure uses the valve and actuator stops as the 0% and 100% calibration points. For additional information, refer to Auto Calibrate Travel in this section.

If after completing auto setup and auto calibration the valve seems slightly unstable or unresponsive, you can improve operation by selecting *Stabilize/Optimize* from the *Auto Setup* menu. For additional information, refer to Stabilize/Optimize at the end of this section.

Manual Setup (1-1-2)

If you want to enter the individual parameters for the instrument initial setup, from the Online Menu select *Main Menu, Initial Setup, and Manual Setup*. The following describe the parameters that appear during manual setup.

- *Instrument Mode*—Instrument Mode allows you to either take the instrument *Out Of Service* or place it *In Service*. The instrument must be *Out Of Service* to change configuration variables that affect control provided the calibration/configuration protection is set to *None*.

- *Control Mode*—Control Mode lets you define where the instrument reads its set point. Choose one of the following control modes: Analog (RSP) or Digital.

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

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 HART

Communicator automatically switches to this mode whenever it needs to stroke the valve, for example

during calibration or stroke output. 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 (RSP) or Digital.

- *Feedback Char*—Select Rotary Shaft or Sliding Stem. Refer to table 4-2 to determine the required feedback characteristic.

- *Inst Supply Pressure*—Adjusts the range of the instrument pressure sensor. Supply Pressure is configured in pressure units of psi, bar, or kPa. Select a supply pressure range that includes the instrument supply pressure.

- *Zero Ctrl Signal*—Identifies whether the valve is fully open or fully closed when the input is 0%. If you are unsure how to set this parameter, disconnect the current source to the instrument. The resulting valve travel is the Zero Control Signal. (With direct acting digital valve controllers, disconnecting the current source is the same as setting the output pressure to zero.)

Table 4-2. Feedback Characteristic Selections for Various Actuator Types

Actuator Type	Feedback Characteristic
513 and 513R 657 and 667 1250 and 1250R System 9000 Baumann or Gulde	Sliding Stem
471 585 and 585R 1051 and 1052 1066SR and all Type DVC5030(1) applications	Rotary

1. Type DVC5030 digital valve controllers have the travel sensor shaft extending from the back of the housing as shown in figure 10-3.

Table 4-3. DVC5010 and DVC5020 Invert Feedback Selections

Actuator	Invert Feedback
Sliding-Stem Actuators	
513	Yes
513R	No
585C	Yes
585CR	No
657	Yes
667	No
1250	Yes
1250R	No
Rotary Actuators	
1051	Yes
1052	Yes
Baumann Actuators	
Air to Extend	Yes
Air to Retract	No

Table 4-4. DVC5030 Invert Feedback Selections

Type 1051, 1052, and 1066SR Actuators	
Mounting Style	**Invert Feedback**
A	Yes
B	No
C	No
D	Yes

Table 4-5. DVC5040 Invert Feedback Selections

Actuator	Invert Feedback
System 9000 fail-closed	No
System 9000 fail-open	Yes

- *Invert Feedback*—Select YES or NO, or AUTO SET. Invert feedback establishes the proper valve travel feedback orientation. Determine the Invert Feedback selection by viewing the rotation of the end of the travel sensor shaft. If increasing air pressure to the actuator causes the shaft to turn clockwise, enter YES. If it causes the shaft to turn counter-clockwise, enter NO. Tables 4-3 through 4-5 list the required Invert Feedback selections for Fisher Controls actuators. To have the instrument determine the invert feedback, select Auto Set.

Table 4-6. Tuning Set Selection Guidelines(Fisher Actuators)

Tuning Set	Actuator Type and Size						
	513 & 513R	585C & 585CR	657 & 667	1051 & 1052	1066SR	1250 & 1250R	System 9000
E	20, 32	- - -	- - -	- - -	- - -	- - -	- - -
F	- - -	25	- - -	- - -	- - -	- - -	12, 20
G	- - -	- - -	- - -	- - -	20	- - -	25, 50
H	- - -	- - -	30	20, 30, 33	- - -	225	- - -
I	- - -	- - -	- - -	- - -	- - -	- - -	- - -
J	- - -	50	- - -	- - -	- - -	450	- - -
K	- - -	- - -	34, 40	40	- - -	- - -	80
L	- - -	- - -	45, 50	- - -	27, 75	675	- - -
M	- - -	- - -	46, 60, 70, 87, 80, 100	60, 70	- - -	- - -	- - -

Table 4-7. Tuning Set Selection Guidelines (Baumann Actuators)

Tuning Set	Actuator Size
E	32
H	54
K	70

Table 4-8. Tuning Set Selection Guidelines (Gulde Actuators)

TUNING SET	ACTUATOR TYPE AND SIZE	
	3024	3025
E	GA 1.21	- - -
H	GA 1.31	- - -
K	GA 1.41	- - -
M	- - -	P460, P462, P900

Table 4-9. Tuning Set Selection Guidelines (Other Actuators)

TUNING SET	ACTUATOR TYPE AND SIZE		
	Neles-Jamesbury Quadra-Power II	Masoneilan Camflex II	Masoneilan Sigma F, Minitorque, & Ball II
D	- - -	4.5	A
H	QP2, QP3	6 or 7	B
I	- - -	- - -	- - -
J	QP4	- - -	- - -
K	QP5	- - -	C

● *Tvl Cutoff Low*—Travel Cutoff Low defines the low cutoff point for the travel. Travel Cutoff Low can be used to ensure proper seat load is applied to the valve. When travel is below the travel cutoff low, instruments with firmware revision 5 set the output to zero or to full supply pressure, depending upon the zero control signal. Instruments with firmware revision 3 or 4 set the travel target to –23.0% of the ranged travel. A Travel Cutoff Low of 0.5% is recommended to help ensure maximum shutoff seat loading.

Table 4-10. Gain and Rate Values for Preselected Tuning Sets(1)

TUNING SET	HIGH PERFORMANCE			STANDARD	
	GAIN	Tvl Rate	Press Rate	GAIN	Tvl Rate
C	0.8	10.0	75	0.40	13.0
D	1.4	10.0	43	0.50	13.0
E	1.8	10.0	33	0.60	13.0
F	2.2	10.0	27	0.75	13.0
G	2.8	10.5	35	1.00	13.0
H	3.4	11.6	51	1.30	13.0
I	4.0	12.7	62	2.00	13.0
J	5.0	14.5	50	3.00	13.0
K	6.0	16.2	42	3.99	13.0
L	8.0	18.0	31	5.25	13.0
M	10.0	18.0	25	6.99	13.0

1. For user adjusted, the high performance gain and standard gain may be independently adjusted over the range of 0.01 to 25.

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 –25.0%.

CAUTION

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

● *Tuning Set*—There are eleven tuning sets to choose from. Each tuning set provides a preselected value for the digital valve controller gain and rate settings. Tuning set C provides the slowest response and M provides the fastest response. Table 4-10 lists the high performance and standard gain and rate values for preselected tuning sets used with firmware 5. Normally the instrument uses the high performance values. However, should the pressure sensor fail, the unit will continue to operate using the standard values. Instruments with firmware revisions 3 and 4 always use the standard values.

In addition, you can select User Adjusted or Expert, which allows you to modify tuning of the digital valve controller. With User Adjusted you can specify the

high performance and standard gain. An algorithm in the HART Communicator calculates the rates. With Expert you can specify not only the high performance and standard gains but the rates as well.

To setup an instrument with firmware 5 to respond similar to an instrument with firmware 4, select Expert then adjust the high performance gain and travel rate to match the standard gain and travel rate. Set the high performance pressure rate to zero.

Note

For Firmware Revision 3, only the eleven tuning sets are available. User Adjusted and Expert tuning is not available.

Table 4-6 provides tuning set selection guidelines for Fisher Controls actuators. Tables 4-7 through 4-9 list tuning set guidelines for Baumann, Gulde, and other 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.

For an actuator not listed in the tables, you can estimate a starting tuning set by calculating the casing or cylinder volume. Then, in the tables, find an actuator with the closest equivalent volume and use the tuning set suggested for that actuator.

After completing the manual setup, select *Auto Calib Travel* from the *Manual Setup* menu. Follow the prompts on the HART Communicator display to automatically calibrate the instrument travel. The calibration procedure uses the valve and actuator stops as the 0% and 100% calibration points. For additional information, refer to Auto Calibrate Travel in this section.

Auto Calibrate Travel (1-1-1-2) or (1-1-2-9)

WARNING

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

User interaction is only required with Auto Calibrate Travel when the valve is sliding-stem. Rotary valves require no user interaction. For sliding-stem valves, interaction provides a more accurate crossover adjustment. Select *Auto Calib Travel* then follow the prompts on the HART Communicator display to automatically calibrate travel.

1. Select the method of crossover adjustment: manual, last value, or default.

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 4). If you select Default, an approximate value for the crossover is sent to the instrument and there are no further user interactions with the auto-calibration routine (go to step 4). If you select Manual, 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 2. If you wish to adjust the current source digitally, select Digital and go to step 3.

2. If you selected Analog as the crossover adjustment source, the HART Communicator prompts you to adjust the current source until the feedback arm is 90° to the actuator stem, as shown in figure 4-2. After you have made the adjustment, press OK and go to step 4.

3. If you selected Digital as the crossover adjustment source, the HART 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 4-2. Selecting large, medium, and small adjustments to the crossover causes changes of approximately 10.0°, 1.0°, and 0.1°, respectively, to the rotation of the feedback arm.

If another adjustment is required, repeat step 3. Otherwise, select Done and go to step 4.

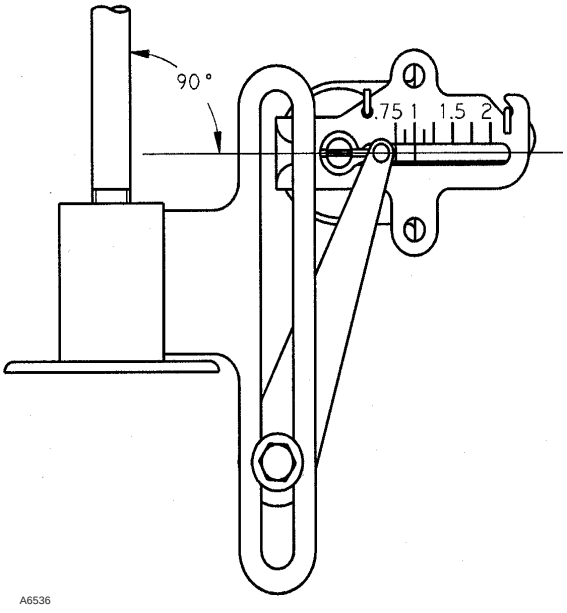


Figure 4-2. Crossover Point

4. The remainder of the auto-calibration procedure is automatic. It is completed when the *Calibrate* menu appears.

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

If the unit does not calibrate, refer to table 4-11 for error messages and possible remedies.

Stabilizing or Optimizing Valve Response

If after completing initial setup (either auto or manual) and auto 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 *Auto Setup* menu.

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

Table 4-11. 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 *Out of Service* and the Protection must be *None* 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 *Stabilize/Optimize* then *Increase Response* (selects next higher tuning set). 2. The tuning set selected is to high, valve operation is unstable and does not stay at an end point for the allotted time. Press the Hot Key, select *Stabilize/Optimize* then *Decrease Response* (selects next lower tuning set).
Invalid travel value. Check travel sensor and feedback arm adjustments, and inst supply press. Then, repeat Auto Calib.	Verify proper mounting by referring to the appropriate mounting procedure in the “Installation” section, Section 2. Verify instrument supply pressure by referring to the specifications in the appropriate actuator instruction manual. Verify travel sensor adjustment by performing the appropriate Travel Sensor Adjust procedure in the “Calibration” section, Section 6.

Section 5 Detailed Setup

Note

Detailed setup is not available for instrument level AC.

The *Detailed Setup* selection from the Main Menu allows you to configure the digital valve controller to your application. Table 5-1 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.

Setting Modes

To view or change the mode, select *Main Menu, Detailed Setup, Mode.* Follow the prompts on the HART Communicator display to view or change information in the following fields: *Instrument Mode, Control Mode, Restart Ctrl Mode* (Restart Control Mode), *Restart,* and *Burst Mode.*

Instrument Mode

You can change the instrument mode by selecting *Instrument Mode* from the *Mode* 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 configuration 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 5-1. Factory Default Detailed Setup Parameters

Setup Parameter	Default Setting(1)
Control Mode	Analog (RSP)
Restart Control Mode	Resume Last
Burst Mode Enabled	No
Burst Mode Command	3
HART Tag	As specified on order
Message	Blank
Descriptor	Blank
Date	Factory Calibration Date
Valve Serial Number	Blank
Polling Address	0
Inst Supply Pressure	20(2)
Feedback Characteristic	Rotary Shaft(2)
Zero Control Signal	Open(2)
Invert Feedback	Yes(2)
Analog Input Units	mA
Input Range High	20 mA
Input Range Low	4.0 mA
Travel Range High	100%
Travel Range Low	0%
Pressure Units	PSI
Temperature Units	F
Tuning Set	C(2)
Input Characteristic	Linear
Input Filter Time	Filter Off
Dynamic Bypass Enabled	No
Travel Limit High	125%
Travel Limit Low	–25%
Travel Cutoff High	99.5%
Travel Cutoff Low	0.5%
Minimum Opening Time	0 secs
Minimum Closing Time	0 secs
Travel Alert 1 Enabled	No
Travel Alert 2 Enabled	No
Travel Alert 1 High Point	125%
Travel Alert 1 Low Point	–25%
Travel Alert 2 High Point	125%
Travel Alert 2 Low Point	–25%
Travel Alert Deadband	3%
Travel Deviation Alert Enable	No
Travel Deviation Alert Point	125%
Travel Deviation Time	4 secs
Cycle Counter Alert Enable	No
Cycle Counter Alert Point	4,294,967,295
Cycle Counter Deadband	3%
Cycle Counter	0
Travel Accumulator Alert Enable	No
Travel Accumulator Alert Point	4,294,967,295%
Travel Accumulator Deadband	3%
Travel Accumulator	0
Auxiliary Input Alert Enable	No
Auxiliary Input Alert State	Closed
Drive Alert Enable	No
No Free Time Fail	No
RAM Fail	No
Drive Current Fail	No
Critical NVM Fail	No
Temperature Sensor Fail	No
Travel Sensor Fail	No

1. The settings listed are for standard factory configuration. DVC5000 Series instruments can also be ordered with custom configuration settings. For the default custom settings, refer to the order requistion.
2. If the instrument is shipped mounted on an actuator, these values depend upon the actuator on which the instrument is mounted.

Control Mode

You can change the control mode by selecting *Control Mode* from the *Mode* 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 HART Communicator display to choose one of the following control modes: Analog (RSP) or Digital.

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

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 HART Communicator automatically switches to this mode whenever it needs to stroke the valve, for example during calibration or stroke output. 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 (RSP) or Digital.

Restart Control Mode

(1-2-1-3)

Restart Control Mode (*Restart Ctrl Mode*) lets you choose which operating mode you want the instrument to be in after a restart. Follow the prompts on the HART Communicator display to define the restart control mode as Resume Last, Analog (RSP), or Digital.

Burst Mode

(1-2-1-5)

Enabling burst mode provides continuous communication from the digital valve controller. All DVC5000 Series digital valve controllers with firmware revision 5 are capable of burst mode communication. Burst mode applies only to the transmission of burst mode data (travel, travel set point, actuator pressure, and auxiliary input status) 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 Model 275 HART 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 HART 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.

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

Command 3 provides the following variables:

- Primary variable—travel in % of ranged travel,
- Secondary variable—travel setpoint in % of ranged travel,
- Tertiary variable—actuator pressure in psig, bar, or kPa
- Fourth variable—auxiliary input status in %; 0% equals open, 100% equals closed.

To enable burst mode, select *Main Menu*, *Detailed Setup, Mode, Burst,* and *Burst Enable.* To send a burst mode command, select *Main Menu*, *Detailed Setup, Mode, Burst,* and *Burst Command.* Burst mode must be enabled before you can change the burst mode command.

Restarting the Instrument

(1-2-1-4)

Restart resets the instrument in the same manner as when power to the instrument is interrupted. When Restart is issued, all of the newly entered configuration variables become active. Otherwise, they may not take effect until the instrument is placed In Service.

Setting Protection

Some setup parameters may require changing the protection with the HART Communicator. In some cases, a jumper must be placed across the Auxiliary terminals in the terminal box in order to change protection.

- If the Auxiliary terminals are used as a transmitter input (see table 9-2), use the configuration jumper shown in figure 5-1.
- If the Auxiliary terminals are used for a switch input (see table 9-2) use either the configuration

Table 5-2. Conditions for Modifying DVC5000 Series 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	✓	✓	✓	✓
Tag	- - -	✓	- - -	✓
Message	- - -	✓	- - -	✓
Descriptor	- - -	✓	- - -	✓
Date	- - -	✓	- - -	✓
Valve Serial Num	- - -	✓	- - -	✓
Field Inst S/N	- - -	- - -	- - -	✓
Polling Address	- - -	- - -	- - -	✓
Inst Supply Pressure	- - -	- - -	- - -	✓
Feedback Char	- - -	- - -	- - -	✓
Zero Ctrl Signal	- - -	- - -	- - -	✓
Invert Feedback	- - -	- - -	- - -	✓
Analog In Units/Rng	- - -	- - -	- - -	✓
Input Range High	- - -	- - -	- - -	✓
Input Range Low	- - -	- - -	- - -	✓
Tvl Range High	- - -	- - -	- - -	✓
Tvl Range Low	- - -	- - -	- - -	✓
Pressure Units	- - -	- - -	- - -	✓
Temp Units	✓	✓	✓	✓
Tuning Set	- - -	- - -	- - -	✓
Gain	- - -	- - -	- - -	✓
Input Char	- - -	- - -	- - -	✓
Define Custom Char	- - -	- - -	- - -	✓
Input Filter Time	- - -	- - -	- - -	✓
Dyn Bypass Enab	- - -	- - -	- - -	✓
Tvl Limit High	- - -	- - -	- - -	✓
Tvl Limit Low	- - -	- - -	- - -	✓
Tvl Cutoff High	- - -	- - -	- - -	✓
Tvl Cutoff Low	- - -	- - -	- - -	✓
Min Opening Time	- - -	- - -	- - -	✓
Min Closing Time	- - -	- - -	- - -	✓
Tvl Alrt 1 Enab	✓	✓	✓	✓
Tvl Alrt 2 Enab	✓	✓	✓	✓
Tvl Alrt 1 High Pt	✓	✓	✓	✓
Tvl Alrt 1 Low Pt	✓	✓	✓	✓
Tvl Alrt 2 High Pt	✓	✓	✓	✓
Tvl Alrt 2 Low 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 In Alrt Enab	✓	✓	✓	✓
Aux In Alrt State	✓	✓	✓	✓
Drive Alrt Enab	✓	✓	✓	✓

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

–Continued–

Table 5-2. Conditions for Modifying DVC5000 Series Digital Valve Controller Parameters (Continued)

Parameters	In Service/ Config Protected	In Service/ Config Unprotected	Out of Service/ Config Protected	Out of Service/ Config Unprotected
No Free Time Fail	- - -	- - -	- - -	✓
RAM Fail	- - -	- - -	- - -	✓
Drive Current Fail	- - -	- - -	- - -	✓
Critical NVM Fail	- - -	- - -	- - -	✓
Temp Sensor Fail	- - -	- - -	- - -	✓
Tvl Sensor Fail	- - -	- - -	- - -	✓

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

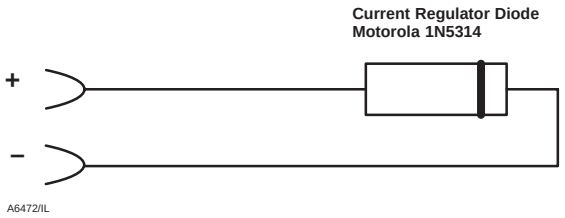


Figure 5-1. Configuration Protection Jumper

5

jumper shown in figure 5-1 or a piece of wire with clips.

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 5-2 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 HART Communicator and select *Protection.* Select the desired level of protection. Follow the prompts on the HART Communicator display to set the protection level. If necessary, temporarily attach the jumper to the AUX + and AUX – terminals in the instrument terminal box when prompted by the HART Communicator.

General Information

(1-2-3)

Select *Main Menu, Detailed Setup,* and *General*. Follow the prompts on the HART Communicator display to enter or view information in the following fields: HART *Tag*, *Message*, *Descriptor*, *Date*, *Valve Serial Num* (Valve Serial Number), *Factory Inst S/N* (Factory Instrument Serial Number), *Field Inst S/N* (Field Instrument Serial Number), and *Polling Address.*

- *HART Tag*—Enter an up to 8 character HART tag for the instrument.

- *Message*—Enter any message with up to 32 characters.

- *Descriptor*—Enter a descriptor for the application with up to 16 characters.

- *Date*—Enter a date with the format MM/DD/YY.

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

- *Factory Inst S/N*—The Factory Instrument Serial Number is displayed. You cannot change this.

- *Field Inst S/N*—The Field Instrument Serial Number is assigned to the printed wiring board by the factory and can be changed in the field.

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

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

- *Polling Address*—If the digital valve controller is used in a point-to-point configuration, 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 HART 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. For information on configuring the HART Communicator for automatic polling, see the “Model 275 HART Communicator Basics” section, Section 3.

Actuator Information

(1-2-4)

Select *Main Menu, Detailed Setup,* and *Actuator Info.* Follow the prompts on the HART Communicator display to enter or view information in the following fields: *Inst Supply Press* (Instrument Supply Pressure), *Feedback Char* (Feedback Characteristic), *Zero Ctrl Signal* (Zero Control Signal), and *Invert Feedback.*

- *Inst Supply Press*—Adjusts the range of the instrument pressure sensor. Supply Pressure is configured in pressure units of psi, bar, or kPa. Select a supply pressure range that includes the instrument supply pressure.

- *Feedback Char*—Select Rotary Shaft or Sliding Stem. Refer to table 5-3 to determine the required feedback characteristic.

- *Zero Ctrl Signal*—Identifies whether the valve is fully open or fully closed when the input is 0%. If you are unsure how to set this parameter, disconnect the current source to the instrument. The resulting valve travel is the Zero Control Signal. (With direct acting digital valve controllers, disconnecting the current source is the same as setting the output pressure to zero.)

- *Invert Feedback*—Select YES, NO, or AUTO SET. Invert feedback establishes the proper valve travel feedback orientation. Determine the Invert Feedback selection by viewing the rotation of the end of the travel sensor shaft. If increasing air pressure to the actuator causes the shaft to turn clockwise, enter YES. If it causes the shaft to turn counter-clockwise, enter NO. Tables 5-4 through 5-6 show the required Invert Feedback selections for Fisher Controls actuators. To have the instrument determine the invert feedback, select Auto Set.

Table 5-3. Feedback Characteristic Selections for Various Actuator Types

Actuator Type	Feedback Characteristic
513 and 513R 657 and 667 1250 and 1250R System 9000 Baumann or Gulde	Sliding Stem
471 585 and 585R 1051 and 1052 1066SR and all Type DVC5030(1) applications	Rotary

1. Type DVC5030 digital valve controllers have the travel sensor shaft extending from the back of the housing as shown in figure 10-3.

Table 5-4. DVC5010 and DVC5020 Invert Feedback Selections

Actuator	Invert Feedback
Sliding-Stem Actuators	
513	Yes
513R	No
585C	Yes
585CR	No
657	Yes
667	No
1250	Yes
1250R	No
Rotary Actuators	
1051	Yes
1052	Yes

Table 5-5. DVC5030 Invert Feedback Selections

Type 1051, 1052, and 1066SR Actuators	
Mounting Style	**Invert Feedback**
A	Yes
B	No
C	No
D	Yes

Table 5-6. DVC5040 Invert Feedback Selections

Actuator	Invert Feedback
System 9000 fail-closed	No
System 9000 fail-open	Yes

Measured Variable Units and Ranges

(1-2-5)

To define the measured variable units and ranges, select *Main Menu, Detailed Setup,* and *Measured Var.*

Follow the prompts on the HART Communicator display to enter or view information in the following fields: *Analog In Units/Rng* (Analog Input Units and High and Low Input Ranges), *Pressure Units,* and *Temp Units* (Temperature Units).

Table 5-7. Tuning Set Selection Guidelines (Fisher Actuators)

Tuning Set	Actuator Type and Size						
	513 & 513R	585C & 585CR	657 & 667	1051 & 1052	1066SR	1250 & 1250R	System 9000
E	20, 32	- - -	- - -	- - -	- - -	- - -	- - -
F	- - -	25	- - -	- - -	- - -	- - -	12, 20
G	- - -	- - -	- - -	- - -	20	- - -	25, 50
H	- - -	- - -	30	20, 30, 33	- - -	225	- - -
I	- - -	- - -	- - -	- - -	- - -	- - -	- - -
J	- - -	50	- - -	- - -	- - -	450	- - -
K	- - -	- - -	34, 40	40	- - -	- - -	80
L	- - -	- - -	45, 50	- - -	27, 75	675	- - -
M	- - -	- - -	46, 60, 70, 87, 80, 100	60, 70	- - -	- - -	- - -

5

- *Analog In Units/Rng*—Permits defining the Analog Input Units in mA or percent of 4–20 mA range. Also permits setting the Input Range High and Input Range Low values. Input Range High should correspond to Travel Range High and Input Range Low should correspond to Travel Range Low, if the Zero Control Signal is configured as closed. If the Zero Control Signal is configured as open, Input Range High corresponds to Travel Range Low and Input Range Low corresponds to Travel Range High. See figure 5-3.

- *Pressure Units*—Defines the output pressure units in either psi, bar, or kPa.

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

Setting Response

(1-2-6)

Select *Main Menu, Detailed Setup,* and *Response Control.* Follow the prompts on the HART Communicator display to configure the following response control parameters: *Tuning Set, Input Char, Input Filter Time, Dyn Bypass Enab* (Dynamic Bypass Enable).

CAUTION

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

Table 5-8. Gain and Rate Values for Preselected Tuning Sets(1)

TUNING SET	HIGH PERFORMANCE			STANDARD	
	GAIN	TRAVEL RATE	PRESSURE RATE	GAIN	TRAVEL RATE
C	0.8	10.0	75	0.40	13.0
D	1.4	10.0	43	0.50	13.0
E	1.8	10.0	33	0.60	13.0
F	2.2	10.0	27	0.75	13.0
G	2.8	10.5	35	1.00	13.0
H	3.4	11.6	51	1.30	13.0
I	4.0	12.7	62	2.00	13.0
J	5.0	14.5	50	3.00	13.0
K	6.0	16.2	42	3.99	13.0
L	8.0	18.0	31	5.25	13.0
M	10.0	18.0	25	6.99	13.0

1. For user adjusted, the standard gain and rate may be adjusted over the range of 0.01 to 25.
For expert, standard gain and rate may be independently adjusted over the range 0.01 to 25. High performance gain may be adjusted over the range 0.01 to 20; high performance travel rate may be adjusted over the range 5 to 25; and high performance pressure rate may be adjusted over the range 0 to 255.

- *Tuning Set*—There are eleven tuning sets to choose from. Each tuning set provides a preselected value for the digital valve controller gain and rate settings. Tuning set C provides the slowest response and M provides the fastest response. Table 5-8 lists the high performance and standard gain and rate values for preselected tuning sets. Instruments with firmware 5 normally use the high performance values. However, should the pressure sensor fail, these instruments will continue to operate using the standard values. Instruments with firmware revisions 3 and 4 always use the standard values.

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 high performance gain and standard gain; an algorithm in the HART Communicator calculates the rates. With Expert you can specify the high performance and standard gains and rates.

Table 5-9. Tuning Set Selection Guidelines (Baumann Actuators)

Tuning Set	Actuator Size
E	32
H	54
K	70

Table 5-10. Tuning Set Selection Guidelines (Gulde Actuators)

TUNING SET	ACTUATOR TYPE AND SIZE	
	3024	3025
E	GA 1.21	- - -
H	GA 1.31	- - -
K	GA 1.41	- - -
M	- - -	P460, P462, P900

Table 5-11. Tuning Set Selection Guidelines (Other Actuators)

TUNING SET	ACTUATOR TYPE AND SIZE		
	Neles-Jamesbury Quadra-Power II	Masoneilan Camflex II	Masoneilan Sigma F, Minitorque, & Ball II
D	- - -	4.5	A
H	QP2, QP3	6 or 7	B
I	- - -	- - -	- - -
J	QP4	- - -	- - -
K	QP5	- - -	C

To setup an instrument with firmware 5 to respond similar to an instrument with firmware 4, select Expert then adjust the high performance gain and travel rate to match the standard gain and travel rate. Set the high performance pressure rate to zero.

Note

For Firmware Revision 3, only the eleven tuning sets are available. User adjusted or Expert tuning is not available.

Table 5-7 provides tuning set selection guidelines for Fisher Controls actuators. Tables 5-9 through 5-11 list tuning set guidelines for Baumann, Gulde, and other 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.

For an actuator not listed in the tables, you can estimate a starting tuning set by calculating the casing or cylinder volume. Then, in the tables, find an actuator with the closest equivalent volume and use the tuning set suggested for that actuator.

- *Input Char*—Defines the relationship between the ranged travel and ranged set point. Ranged setpoint is the input to the characterization function. If the zero control signal equals closed, then a setpoint of 0% corresponds to a ranged input of 0%. If the zero control signal equals open, a setpoint of 0% corresponds to a ranged input of 100%. Ranged travel is the output from the characterization function.

You can select from the three fixed input characteristics shown in Figure 5-2 or, for instruments with firmware revision 5, you can select a custom characteristic. Figure 5-2 shows the relationship between the ranged travel and ranged set point for the fixed input characteristics, assuming the Zero Control Signal is configured as closed.

For instruments with firmware revision 5, you can specify 37 points on a custom characteristic curve. Each point defines a travel target, in % of ranged travel, for a corresponding ranged set point, in % of ranged set point. Set point values range from –6.25% to 106.25% in 3.125% increments. Before modification, the custom characteristic is linear.

To define a custom input characteristic, from the *Input Char* menu select *Define Custom Char.* Select the point you wish to define (1 to 37), then enter the desired ranged travel value corresponding to the ranged set point. When finished, select point 0 to return to the *Input Char* menu.

With input characterization you can modify the overall characteristic of the valve and instrument combination. Selecting an equal percentage, quick opening, or custom (other than the default of linear) input characteristic modifies the overall valve and instrument characteristic. However, if you select the linear input characteristic, the overall valve and instrument characteristic is the characteristic of the valve, which is determined by the valve trim (i.e., the plug or cage).

The factory default setting for input characterization is linear.

- *Input Filter Time*—Time constant for the input filter, in seconds. The input filter slows the response of the digital valve controller and is typically used with noisy or fast processes. The filter provides improved closed loop process control. Generally, an input filter is not required if dynamic bypass is enabled. To disable the filter, set the time constant to 0 seconds.

- *Dyn Bypass Enab*—Yes or No. Generally Dynamic Bypass is not required if the input filter is used. With Dynamic Bypass enabled, the instrument dynamic response to input changes will be similar to

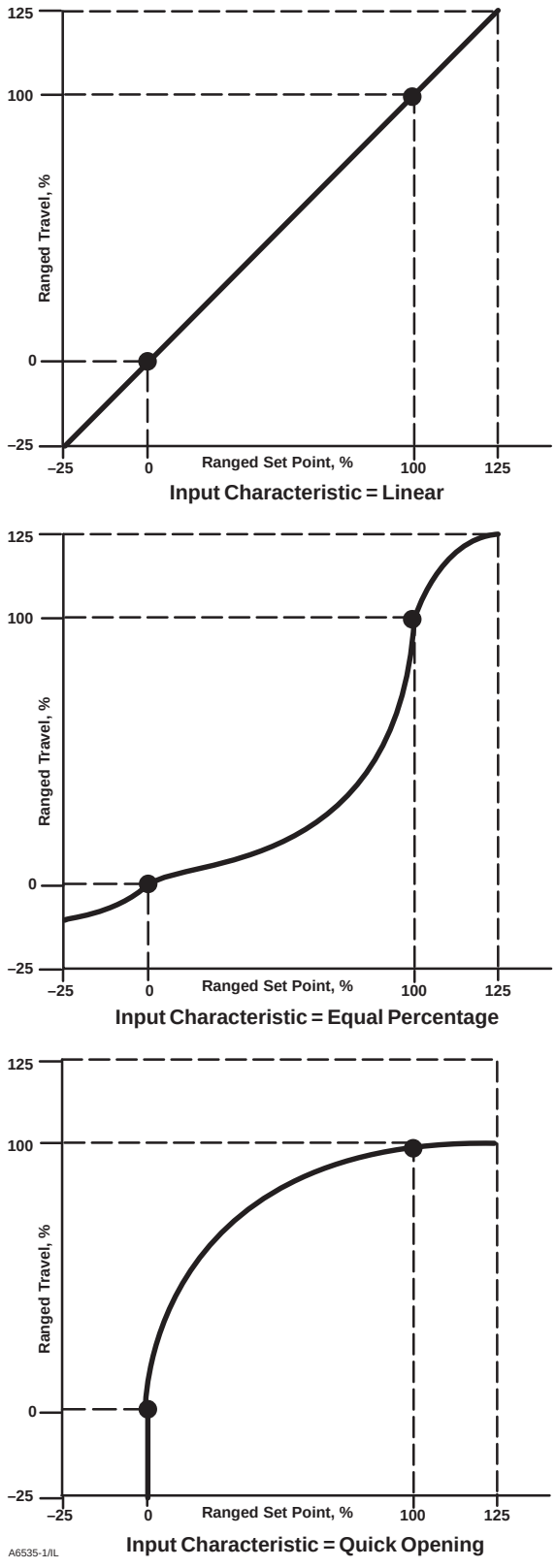


Figure 5-2. Ranged Travel Versus Ranged Set Point, for Various Input Characteristics (Zero Control Signal = Closed)

the first order lag exhibited by a Fisher Controls Type 546 I/P transducer connected directly to a large volume spring and diaphragm actuator.

This provides dampening to the final control element and can stabilize some process loops. It is generally beneficial in fast process loops and will improve process control. (See Fisher Controls technical monograph TM-36 for further discussion of positioner/booster guidelines.)

Position feedback to the instrument is maintained with Dynamic Bypass enabled. Static performance is not affected.

- *Min Opening Time*—Minimum Opening Time is configured in seconds and defines the minimum time for the travel to increase the entire ranged travel. This rate is applied to any travel increases. A value of 0.0 seconds deactivates this feature and allows the valve to stroke open as fast as possible.

- *Min Closing Time*—Minimum Closing Time is configured in seconds and defines the minimum time for the travel to decrease the entire ranged travel. This rate is applied to any travel decreases. A value of 0.0 seconds deactivates this feature and allows the valve to stroke closed as fast as possible.

Travel Ranges, Limits, and Cutoffs

Setting Travel Ranges (1-2-5)

Select *Main Menu, Detailed Setup,* and *Measured Var*. Follow the prompts on the HART Communicator display to set the *Tvl Range High* (Travel Range High), and *Tvl Range Low* (Travel Range Low).

Note

For Firmware Revision 5, the Travel Range High and Low values are preset in the instrument. Changing the Travel Range High and Low values has no effect. Travel Range High is set at 100%; Travel Range Low is set at 0%.

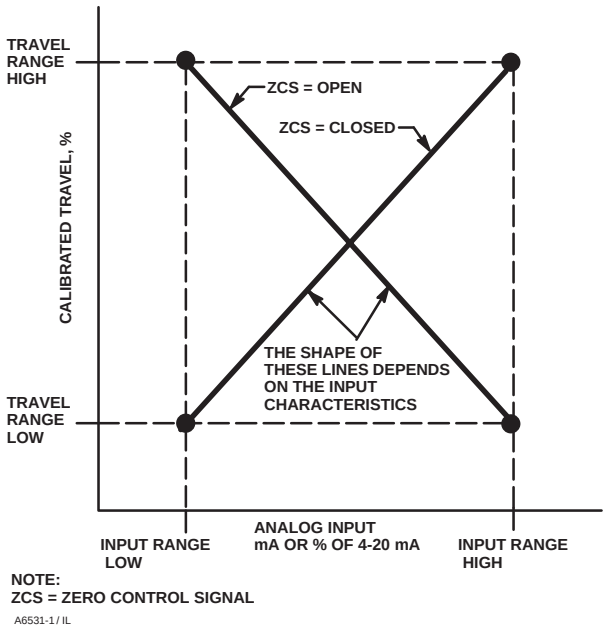


Figure 5-3. Calibrated Travel to Analog Input Relationship

- *Tvl Range High*—Travel Range High is the travel, in percent of calibrated travel, that corresponds to the Input Range High, if the Zero Control Signal is defined as closed. If the Zero Control Signal has been configured as open, the Travel Range High corresponds to the Input Range Low. See figure 5-3.

The factory default setting for Travel Range High is 100%.

- *Tvl Range Low*—Travel Range Low is the travel, in percent of calibrated travel, that corresponds to the Input Range Low, if the Zero Control Signal is configured as closed. If the Zero Control Signal has been configured as open, the Travel Range Low corresponds to the Input Range High. See figure 5-3.

The factory default setting for Travel Range Low is 0%.

Setting Travel Limits and Cutoffs

(1-2-6-5)

Select *Main Menu, Detailed Setup, Response Control,* and *Limits & Cutoffs*. Follow the prompts on the HART Communicator display to set the *Tvl Limit High* (Travel Limit High), *Tvl Limit Low* (Travel Limit Low), *Tvl Cutoff High* (Travel Cutoff High), and *Tvl Cutoff Low* (Travel Cutoff Low).

- *Tvl Limit High*—Travel Limit High 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%.

The factory default setting for Travel Limit High is 125%.

- *Tvl Limit Low*—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%.

The factory default setting for Travel Limit Low is –25%.

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

The factory default setting for Travel Cutoff High is 99.5%.

- *Tvl Cutoff Low*—Travel Cutoff Low defines the low cutoff point for the travel. Travel Cutoff Low can be used to ensure proper seat load is applied to the valve. When below the travel cutoff low, instruments with firmware revision 5 set the output to zero or to full supply pressure, depending upon the zero control signal. Instruments with firmware revision 3 or 4 set the travel target to –23.0% of the ranged travel. 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 –25.0%.

The factory default setting for Travel Cutoff Low is 0.5%.

Setting Alerts

The following menus are available for configuring Alerts. Items on the menus may be changed with the instrument In Service. Configuration does not need to be unprotected. Alerts are not processed when a Diagnostic is in progress.

Note

Alerts are not available with instrument level HC.

Note

For Firmware Revision 3, alerts are not processed if the instrument is Out of Service.

5

Setting Travel Alerts

(1-2-7-1)

Setting Alerts 1 and 2

Select *Main Menu, Detailed Setup, Alerts*, and *Travel Alerts*. Follow the prompts on the HART Communicator display to set: *Tvl Alrt 1 Enab* (Travel Alert 1 Enable), *Tvl Alrt 2 Enab* (Travel Alert 2 Enable), *Tvl Alrt 1 High Pt* (Travel Alert 1 High Point), *Tvl Alrt 1 Low Pt* (Travel Alert 1 Low Point), *Tvl Alrt 2 High Pt* (Travel Alert 2 High Point), *Tvl Alrt 2 Low Pt* (Travel Alert 2 Low Point), and *Tvl Alrt DB* (Travel Alert Deadband).

- *Tvl Alrt 1 Enab*—Yes or No. Travel Alert 1 Enable activates checking of the ranged travel against the Travel Alert 1 High and Low Points. Travel Alert 1 is set 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 is cleared. See figure 5-4.

- *Tvl Alrt 2 Enab*—Yes or No. Travel Alert 2 Enable activates checking of the ranged travel against the Travel Alert 2 High and Low Points. Travel Alert 2 is set 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 is cleared. See figure 5-4.

- *Tvl Alrt 1 High Pt*—Travel Alert 1 High Point is the value of the travel, in percent (%) of ranged travel, which, when exceeded, sets the Travel Alert 1 High alert.

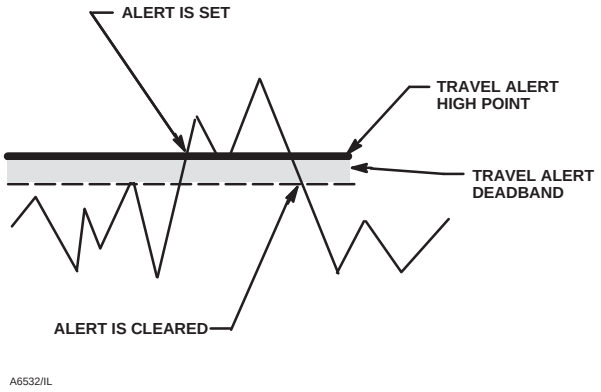


Figure 5-4. Travel Alert Deadband

- *Tvl Alrt 1 Low Pt*—Travel Alert 1 Low Point is the value of the travel, in percent (%) of ranged travel, which, when exceeded, sets the Travel Alert 1 Low alert.

- *Tvl Alrt 2 High Pt*—Travel Alert 2 High Point is the value of the travel, in percent (%) of ranged travel, which, when exceeded, sets the Travel Alert 2 High alert.

- *Tvl Alrt 2 Low Pt*—Travel Alert 2 Low Point is the value of the travel, in percent (%) of ranged travel, which, when exceeded, sets the Travel Alert 2 Low alert.

- *Tvl 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 1 and Travel Alert 2. See figure 5-4.

Note

For Firmware Revision 3, the Travel Alert Deadband applies to the Travel Deviation as well as Travel Alert 1 and Travel Alert 2.

Setting Travel Deviation Alert

(1-2-7-2)

Select *Main Menu, Detailed Setup, Alerts, and Travel Dev Alert*. Follow the prompts on the HART Communicator display to configure the following: *Tvl Dev Alrt Enab* (Travel Deviation Alert Enable), *Tvl Dev*

Alrt Pt (Travel Deviation Alert Point), and *Tvl Dev Time* (Travel Deviation Time).

- *Tvl Dev Alrt Enab*—Yes or No. Travel Deviation Alert Enable activates checking of 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 set. It remains set until the difference is less than the Travel Deviation Alert Point.

Note

For Firmware Revision 3, the Travel Deviation Alert remains set until the Travel difference between the target and the ranged travel is less than the Travel Deviation Alert Point minus the Travel Alert Deadband.

- *Tvl Dev Alrt Pt*—Travel Deviation Alert Point is the alert point for the difference, expressed in percent (%), between the targeted travel and the ranged travel. When the difference exceeds the alert point for more than the Travel Deviation Time, the Travel Deviation Alert is set.

- *Tvl Dev Time*—Travel Deviation Time is the time, in seconds, that the travel must exceed the Travel Deviation Alert Point before the alert is set.

Setting Travel Accumulation Alert

(1-2-7-3)

Select *Main Menu, Detailed Setup, Alerts,* and *Travel Accum Alert*. Follow the prompts on the HART Communicator display to configure the following: *Tvl Acum Alrt Enab* (Travel Accumulator Alert Enable), *Tvl Acum DB* (Travel Accumulator Deadband), *Tvl Acum Alrt Pt* (Travel Accumulator Alert Point), *Tvl Acum* (Travel Accumulator).

- *Tvl Acum Alrt Enab*—Yes or No. Travel Accumulator Alert Enable 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.

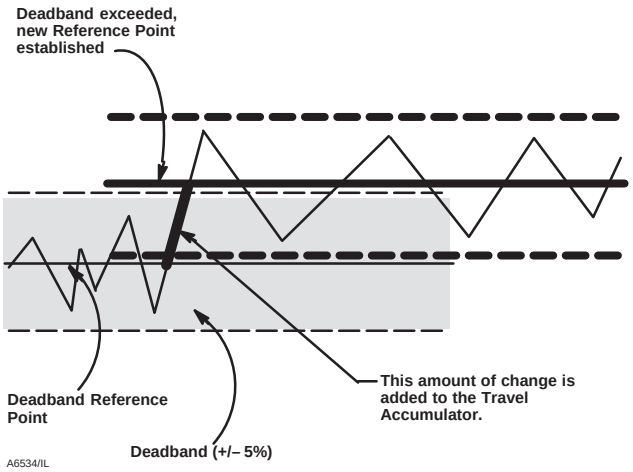


Figure 5-5. Travel Accumulator Deadband (set at 10%)

- *Tvl Acum DB*—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 5-5.

- *Tvl Acum Alrt Pt*—Travel Accumulator Alert Point is the value of the Travel Accumulator, in percent (%) of ranged travel, which, when exceeded, sets the Travel Accumulator Alert.

- *Tvl Acum*—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 5-5. You can reset the Travel Accumulator by configuring it to zero.

Cycle Counter Alert

(1-2-7-4)

Select *Main Menu, Detailed Setup, Alerts,* and *Cycle Count Alert*. Follow the prompts on the HART Communicator display to configure the following: *Cycl Cnt Alrt Enab* (Cycle Counter Alert Enable), *Cycl Count DB* (Cycle Counter Deadband), *Cycl Count Alrt Pt* (Cycle Counter Alert Point), *Cycl Count* (Cycle Counter).

- *Cycl Cnt Alrt Enab*—Yes or No. Cycle Counter Alert Enable 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.

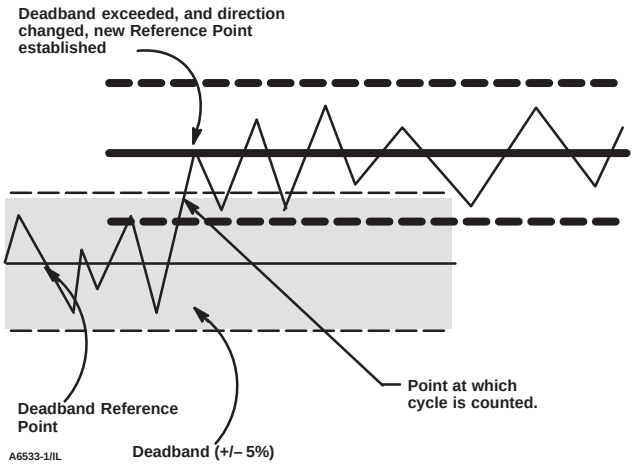


Figure 5-6. Cycle Counter Deadband (set at 10%)

- *Cycl Count DB*—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 5-6.

- *Cycl Count Alrt Pt*—Cycle Counter Alert Point is the value of the Cycle Counter, in cycles, which, when exceeded, sets the Cycle Counter Alert.

- *Cycle Count*—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 5-6. You can reset the Cycle Counter by configuring it as zero.

Drive Alert Enable

(1-2-7-5)

Select *Main Menu, Detailed Setup, Alerts,* and *Drive Alert Enab*. Follow the prompts on the HART Communicator display to configure the drive signal alert.

- *Drive Alrt Enab*—Yes or No. Drive Alert Enable activates checking of the relationship between the Drive Signal and the calibrated travel. If one of the following conditions exists for more than 20 seconds, the Drive Alert is set.

For the case where Zero Control Signal is defined as closed:

Drive Signal < 10% and Calibrated Travel > 3%

Drive Signal > 90% and Calibrated Travel < 97%

For the case where Zero Control Signal is defined as open:

Drive Signal < 10% and Calibrated Travel < 97%

Drive Signal > 90% and Calibrated Travel > 3%

Miscellaneous Alerts

(1-2-7-6)

Select *Main Menu, Detailed Setup, Alerts,* and *Misc Alerts*. Follow the prompts on the HART Communicator display to configure the *Aux In Alrt Enab* (Auxiliary Input Alert Enable) and *Aux In Alrt State* (Auxilliary Input Alert State).

- *Aux In Alrt Enab*—Yes or No. Auxiliary Input Alert Enable activates checking the status of the auxiliary input, which is a contact or discrete input. When enabled, the Auxiliary Input Alert is set when the auxiliary input terminals are either open or closed, depending upon the selection for the *Aux In Alrt State*.

- *Aux In Alrt State*—Open or Closed. Determines which state of the contacts (open or closed) connected to the auxiliary input terminals causes the auxiliary input alert to be active.

Alert Record

(1-2-7-7)

Firmware revision 5 instruments have an alert record that can store alerts from any of the enabled alert groups: Valve Alerts, Failure Alerts or Miscellaneous Alerts. Select *Main Menu, Detailed Setup, Alerts,* and *Alert Record*. Follow the prompts on the HART Communicator display to *Display Record, Clear Record*, set the *Inst Date & Time* (Instrument Date and Time), and enable *Record Groups*.

Alert Record is only available for instruments with firmware revision 5.

- **Display Record**—Displays all recorded alerts and the date and time the alerts were recorded.

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

- **Inst Date and Time**—Permits setting the instrument clock. When alerts are stored in the alert record, the date and time (obtained from the instrument clock) that they were stored is also stored in the record.

- **Record Groups**—Permits enabling one or more alert groups. Table 5-12 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.

Table 5-12. Alerts Included in Alert Groups for Alert Record

Alert Group	Alerts Include in Group
Valve Alerts	Travel 1 low Travel 1 high Travel 2 low Travel 2 high Travel deviation Drive signal
Failure Alerts(1)	No free time RAM fail Drive current fail NVM fail Temperature sensor fail Pressure sensor fail Travel sensor fail
Miscellaneous Alerts	Auxiliary input

1. The Failure Alerts group is only available for instruments with firmware revision 5 in hardware revision 5.

Self Test Failures for Instrument Shutdown (1-2-8)

Select *Main Menu, Detailed Setup,* and *Self Test Shutdown.* Follow the prompts on the HART

Communicator display to determine the self test shutdown criteria from the following selections: *Done*, *No Free Time Fail* (No Free Time Failure), *RAM Fail* (Random Access Memory Failure), *Critical NVM Fail* (Critical Non-Volatile Memory Failure), *Temp Sensor Fail* (Temperature Sensor Failure), *Tvl Sensor Fail* (Travel Sensor Failure), or *Drive Current Fail.* Upon shutdown, the instrument attempts to drive its output pressure to the zero current condition and no longer executes its control function. In addition, the appropriate failure statuses are set. Once the problem that caused the shutdown has been fixed, the instrument can be restarted by cycling the power or selecting Restart from the *Mode* menu of the HART Communicator. Also see the DVC5000 Series Digital Valve Controller Instrument Status section on page 7-3 for further details about failures.

- *Done*—Select this if you are done modifying the self test shutdown criteria.

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

- *RAM Fail*—When enabled, the instrument shuts down whenever there is a failure associated with RAM (random access memory).

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

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

- *Tvl Sensor Fail*—When enabled, the instrument shuts down whenever there is a failure associated with the travel sensor.

- *Drive Current Fail*—When enabled, the instrument shuts down whenever the drive current does not match the drive signal. Drive Current Fail is only available with instrument firmware revision 5 in hardware revision 5.

Section 6 Calibration

When a DVC5000 Series digital valve controller is ordered as part of a control valve assembly, the factory mounts the digital valve controller on the actuator and connects the necessary tubing, then sets up and calibrates the controller.

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

- **Analog Input**—This procedure permits calibrating the analog input sensor.

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

- **Manual Calibrate Travel**—This procedure permits manual calibration of the travel. This calibration procedure allows you to determine the 0% and 100% calibration points.

- **Pressure Sensor**—This procedure permits calibrating the pressure sensor.

- **Restore Calibration**—This procedure permits you to restore the calibration settings back to the factory settings.

- **Calibrate Location**—Indicates the location of the last instrument calibration. The calibration location is either FACTORY or FIELD. A new instrument will display FACTORY. As soon as calibration is performed on one of the measured variables, such as Analog Input, Travel, or if the tuning set is changed, the Calibration Location is set to FIELD. When you select *Restore Calib*, under the *Calibrate* menu, the calibration parameters are reset to the original factory settings.

- **Travel Sensor Adjust**—This procedure permits calibrating the travel sensor.

To display the calibrate menu, select *Calibrate* from the *Main Menu*.

Note

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

WARNING

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

Restoring Calibration to Factory Settings (1-4-5)

Select *Main Menu, Calibrate, and Restore Calib.* Follow the prompts on the HART 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.

Analog Input Calibration (1-4-1)

To calibrate the analog input sensor, connect a variable current source to the instrument terminals labeled LOOP+ and LOOP–. The current source should be capable of generating an output of 4 to 20 mA. Select *Analog In* from the *Calibrate* menu, then follow the prompts on the HART 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 target.

Press OK when you have read this message.

3. The value of the Analog Input appears on the display. Press OK to display the adjustment menu.

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. If the displayed value does not match the current source, press OK, then repeat this step (step 4) to further adjust the displayed value. When the displayed value 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 target.

Press OK when you have read this message.

7. The value of the Analog Input appears on the display. Press OK to display the adjustment menu.

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. If the displayed value does not match the current source, press OK, then repeat this step (step 8) to further adjust the displayed value. When the displayed value 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.

Auto Calibrate Travel (1-4-2)

User interaction is only required with Auto Calibrate Travel when the feedback characteristic is sliding-stem. A feedback characteristic of rotary requires no user interaction and you can start with

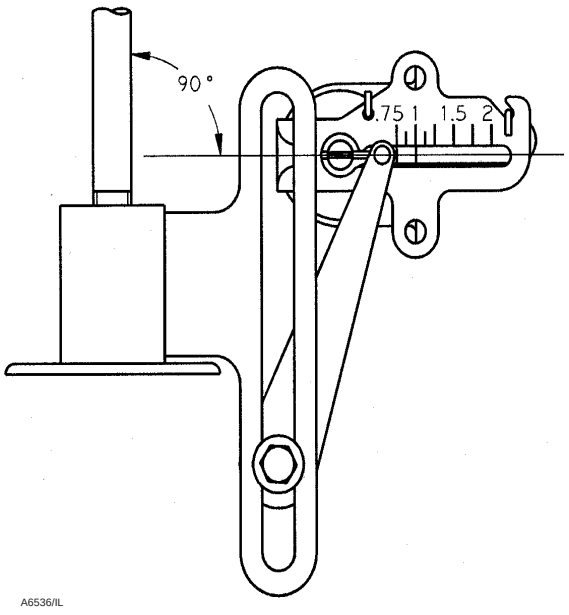


Figure 6-1. Crossover Point

step 4. For a sliding-stem feedback characteristic, interaction provides a more accurate crossover adjustment. Select *Auto Calib Travel* from the *Calibrate* menu, then follow the prompts on the HART Communicator display to automatically calibrate travel.

1. Select the method of crossover adjustment: manual, last value, or default.

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 4). 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 4). If you select Manual, 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 2. If you wish to adjust the current source digitally, select Digital and go to step 3.

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

3. If you selected Digital as the crossover adjustment source, the HART 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 6-1. Selecting large, medium, and small adjustments to the crossover causes changes of

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

If another adjustment is required, repeat step 3. Otherwise, select Done and go to step 4.

4. The remainder of the auto calibration procedure is automatic. It is completed when the *Calibrate* menu appears

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

Manual Calibrate Travel (1-4-3)

Two procedures are available to manually calibrate travel:

- Analog Calibration Adjust
- Digital Calibration Adjust

Analog Calibration Adjust (1-4-3-1)

Select *Main Menu, Calibrate, Man Calib Travel, and Analog Calib Adj.* Connect a variable current source to the instrument termination LOOP + and LOOP –. The current source should be capable of generating 4 to 20 mA. Follow the prompts on the HART Communicator display to calibrate the instrument's travel in percent.

Note

For firmware revisions 3 and 4, configure the Travel Range High at 100% and Travel Range Low at 0% before calibrating. If the travel is to be subranged, change Travel Range High and Low after completing the travel calibration.

Note

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

1. For firmware revisions 4 and 5, adjust the input current until the valve moves. Then, reduce the input current until the output pressure is 0. Press OK.

2. If the feedback characteristic is specified as rotary, go to step 6. If the feedback characteristic is specified as sliding-stem, 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 6-1. Then press OK.

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. Steps 9 and 10 repeat some of the above steps to further improve the accuracy of the calibration.

9. Adjust the current source until the valve is at 0% travel, then press OK.

10. Adjust the current source until the valve is at 100% travel, then press OK.

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

Digital Calibration Adjust (1-4-3-2)

Select *Main Menu, Calibrate, Man Calib Travel, and Digital Calib Adj.* 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 HART Communicator display to calibrate the instrument's travel in percent.

Note

For firmware revisions 3 and 4, configure the Travel Range High at 100% and Travel Range Low at 0% before calibrating. If the travel is to be subranged, change Travel Range High and Low after completing the travel calibration.

Note

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

1. For firmware revisions 4 and 5, from the adjustment menu, select the direction and size of change required to adjust the output until the valve moves. 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 1. Otherwise, reduce the output pressure to 0, select Done and go to step 2.

2. If the feedback characteristic is specified as rotary, go to step 8. If the feedback characteristic is specified as sliding-stem, adjust the feedback arm to the crossover point by pressing OK to get to the adjustment menu.

3. 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 6-1. 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 3. Otherwise, select Done and go to step 3.

4. The following message appears.

> **Adjust travel to the indicated value using the menu selections.**

Press OK to display the adjustment menu.

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 for a sliding-stem valve or to the travel for a rotary valve.

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 for a sliding-stem valve or to the travel for a rotary valve.

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 for a sliding-stem valve or to the travel for a rotary valve.

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 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 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 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 11. Otherwise, select Done and go to step 12.

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

Pressure Sensor Calibration

(1-4-4)

Select *Main Menu, Calibrate, and Pressure.* Follow the prompts on the HART Communicator display to calibrate the instrument's output pressure sensor.

1. Adjust the supply pressure regulator until the output pressure matches the target value shown on the display. Press OK.

2. The following message appears.

> **Use the Increase and Decrease selections until the displayed press matches the target.**

Press OK when you have read this message.

3. The value of the pressure appears on the display. Press OK to display the adjustment menu.

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. If the displayed value does not match the supply pressure, press OK, then repeat this step (step 4) to further adjust the displayed value. When the displayed value matches the supply pressure, select Done and go to step 5.

5. Set the supply pressure to the target value shown on the display. Press OK.

6. The following message appears.

> **Use the Increase and Decrease selections until the displayed press matches the target.**

Press OK when you have read this message.

7. The value of the pressure appears on the display. Press OK to display the adjustment menu.

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 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. If the displayed value does not match the supply pressure, press OK, then repeat this step (step 8) to further adjust the displayed value. When the displayed value matches the supply pressure, select Done and go to step 9.

9. Place the instrument In Service and verify that the displayed pressure matches the measured output pressure.

Travel Sensor Adjust (1-4-7)

DVC5010, DVC5030 on Fisher Actuators, and DVC5040 Digital Valve Controllers

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 following procedure. See the Maintenance section, Section 9 for travel sensor replacement procedures.

1. Remove supply air and remove the instrument from the actuator.

Note

The alignment pin (key 46) is stored inside the digital valve controller housing. It is located above the supply pressure gauge.

2. As shown in figure 6-2, 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. Position the feedback arm so that the surface with the travel markings is flush with the end of the travel sensor shaft.

3. Loosen the screw that secures the feedback arm to 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 HART 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. Select *Main Menu, Display, Device Information,* and *Hardware Revision.* Note the hardware revision number.

7. Select *Main Menu, Calibrate, Tvl Sensor Adjust.* Follow the prompts on the HART Communicator display to adjust the travel sensor counts to the value listed in table 6-1.

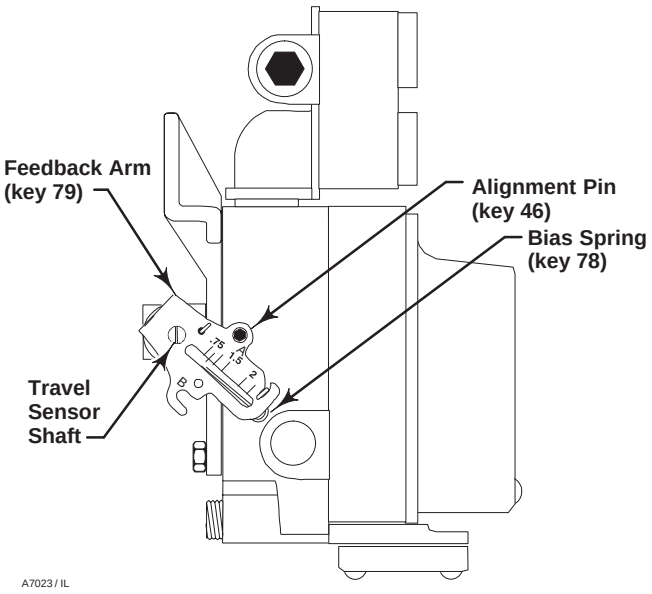


Figure 6-2. Type DVC5010 Digital Valve Controller Showing Feedback Arm in Position for Travel Sensor Adjustment

Table 6-1. DVC5000 Series Digital Valve Controller Travel Sensor Counts

Digital Valve Controller Type	Hardware Revision Number	
	Revision 2	Revisions 3, 4, & 5
Type 5010 or 5040	2000 ±300	4000 ±300
Type 5020	6700 ±300	7200 ±300
Type 5030 mounted on actuator Types 1051, 1052, and 1066SR	2000 ±300	3500 ±300
Type 5030 mounted on other actuators	clockwise shaft rotation(1) 10000 ±300	clockwise shaft rotation(1) 10000 ±300
	counterclockwise shaft rotation(1) 2000 ±300	counterclockwise shaft rotation(1) 3500 ±300

1. Travel sensor shaft rotation for actuator increasing air pressure, when viewing the end of the travel sensor shaft.

Note

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

8. 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 6-1. Paint the screw to discourage tampering with the connection.

9. Disconnect the HART Communicator and current source from the instrument.

10. Remove the alignment pin and store it in the instrument housing next to the supply gauge.

11. Install the digital valve controller on the actuator as described in the “Installation” section, Section 2.

Travel Sensor Adjust for DVC5020

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 following procedure. See the “Maintenance” section, Section 9, for travel sensor replacement procedures.

1. Remove supply air and remove the instrument from the actuator.

2. See figure 6-3 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 6-4.

3. Loosen the screw that secures the arm assembly to the travel sensor shaft. Position the arm assembly so that the outer surface is flush with the end of the travel sensor shaft.

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 HART 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. Select *Main Menu, Display, Device Information,* and *Hardware Revision.* Note the hardware revision number.

7. Select *Main Menu, Calibrate, Tvl Sensor Adjust.* Follow the prompts on the HART Communicator display to adjust the travel sensor counts to the value listed in table 6-1.

Note

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

8. While observing the travel sensor counts, tighten the screw that secures the arm assembly to the travel

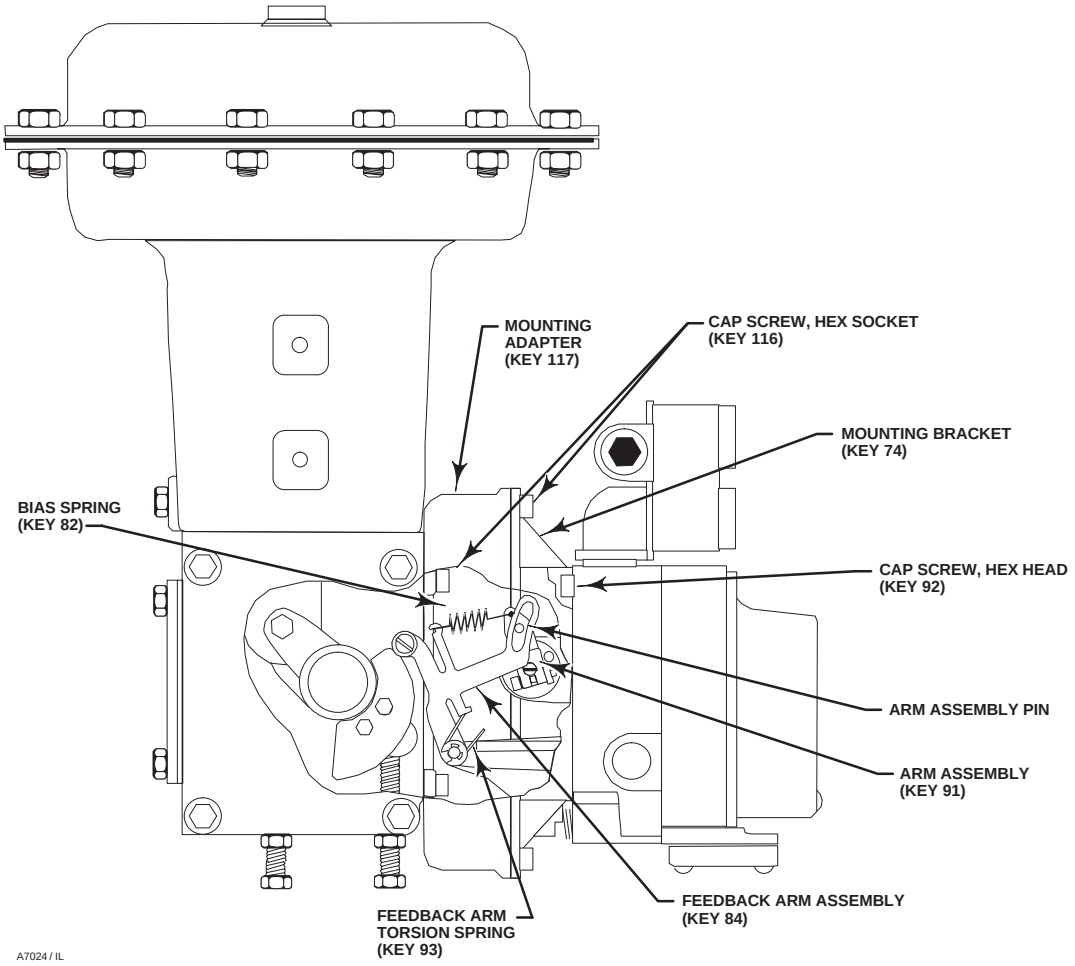


Figure 6-3. Type DVC5020 Digital Valve Controller Mounted on Type 1052, Size 33 Actuator

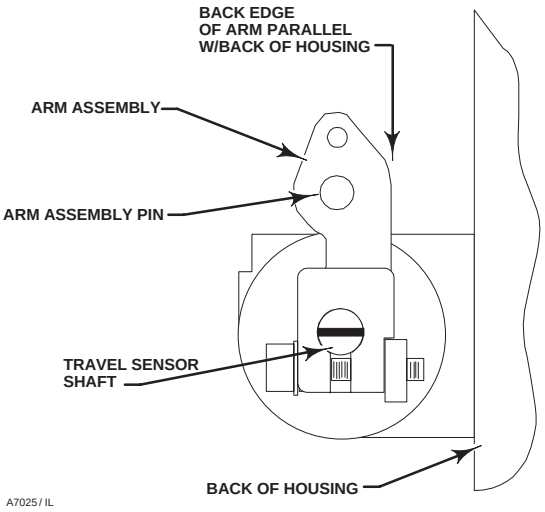


Figure 6-4. Type DVC5020 Travel Sensor Arm/Housing Back Plane Alignment

sensor shaft. Be sure the travel sensor counts remain within the tolerances listed in table 6-1. Paint the screw to discourage tampering with the connection.

9. Disconnect the HART Communicator and current source from the instrument.

10. Apply lubricant (key 63) to the pin portion of the arm assembly (key 91).

11. 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.

12. Install the digital valve controller on the actuator as described in the “Installation” section, Section 2.

Travel Sensor Adjust for DVC5030 on Other Actuators

Travel sensor adjustment is part of the installation procedure when installing the Type DVC5030 digital valve controller on other than Fisher actuators. Install the digital valve controller as described in the

"Installation" section, Section 2. When you are ready to perform the step that requires travel sensor adjustment, perform the following procedure:

1. 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 HART Communicator to the TALK terminals.

2. Before beginning the travel sensor adjustment, set the instrument mode to Out Of Service and the protection to None.

3. Select *Main Menu, Display, Device Information,* and *Hardware Revision.* Note the hardware revision number.

4. Select *Main Menu, Calibrate, Tvl Sensor Adjust.* Follow the prompts on the HART Communicator display to adjust the travel sensor counts to the value listed in table 6-1. Note the travel sensor shaft rotation with increasing air pressure and adjust the travel sensor counts accordingly.

5. Tighten the coupler set screw to secure the coupler to the shaft connector cap pin, tie bar assembly, or spindle. If the coupler set screw is not accessible due to obstructions, loosen the coupler set screw on the travel sensor shaft and rotate the coupler. Then, tighten the coupler set screw and repeat step 4.

6. After completing the travel sensor adjustment, perform the remainder of the installation procedure in the "Installation" section.

Section 7 Viewing Device Information

The following menus are available to define and/or view information about the instrument.

Viewing Variables

Analog Input, Output Pressure, Travel, and Drive Signal

Note

These variables are not available for instrument level AC.

The following variables are displayed on the Online menu:

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

Press shows the value of the instrument output pressure in psi, bar, or kPa.

Travel shows the value of the DVC5000 Series digital valve controller travel in % (percent) of ranged travel. Travel always represents how far the valve is open.

Drive Sgl shows the value of the instrument drive signal in % (percent) of maximum drive.

Additional Instrument Variables

(1-3-1)

Note

These variables are not available for instrument level AC.

The *Variables* menu is available to view additional variables, such as the status of the auxiliary input, the instrument internal temperature, cycle count, travel accumulation, device free time, and travel sensor counts. To view one of these variables, from the Online menu select *Main Menu, Display,* and *Variables.* If a value for a variable does not appear on the display, select the variable and a detail 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 the variable requires special processing, such as Free Time or Aux In.

- *Aux In*—The Auxiliary Input is a discrete input that can be used with an independent limit or pressure switch. Its value is either open or closed.

- *Temp*—The internal temperature of the instrument is displayed in either degrees Fahrenheit or Celsius.

- *Cycl Count*—Cycle Counter displays the number of times the instrument 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 *Cycle Counter Deadband* in Section 5 for more details.

- *Tvl Acum*—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 Accum Alert* menu. See *Travel Accumulator Deadband* in Section 5 for more details.

- *Free Time*—Free Time is the percent of time that the firmware is idle. A typical value is 25%. The actual value depends on the number of functions in the instrument that are enabled and also on the amount of communication currently in progress.

Note

Do not use the the following travel sensor counts 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 Section 6 to calibrate the travel sensor.

- *Tvl Sens Cts*—Travel Sensor Counts 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.

Viewing Device Information

(1-3-2)

The *Device Information* menu is available to view information about the instrument. From the Online menu, select *Main Menu, Display,* and *Device Information.* Follow the prompts on the HART Communicator display to view information in the following fields: *HART Univ Rev* (HART Universal Revision), *Interface Rev* (Interface Revision), *Firmware Rev* (Firmware Revision), *Hardware Rev* (Hardware Revision), *Output Bias Rev* (Output Bias Revision), *Instrument Level*, *Pressure Sensor* and *Device ID*.

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

- *Interface Rev*—Interface Revision is the revision number of the interface software for communications between the HART Communicator and the instrument. This is the same as the Device Revision defined in the HART communication protocol.

- *Firmware Rev*—Firmware Revision is the revision number of the Fisher Controls firmware in the instrument.

- *Hardware Rev*—Hardware Revision is the revision number of the Fisher Controls instrument hardware.

- *Output Bias Rev?*—Yes or No. Output Bias Revised indicates if the instrument output bias has been updated to the latest I/P and relay combination.

- *Inst Level*—Indicates the instrument level
  AC—Auto Calibrate
  HC—HART Communicating
  SD—Standard Diagnostics
  AD—Advanced Diagnostics

Table 7-1 lists the functions available for each instrument level.

- *Pressure Sensor*—Yes or No. Indicates if the instrument includes a pressure sensor.

Table 7-1. Functions Available for Instrument Level

Instrument Level	Functions Available
AC	Communicates with Model 275 HART Communicator Provides initial setup and calibration.
HC	Communicates with Model 275 HART 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). Diagnostics limited to: travel, cycle counter, drive signal, and pressure readback.
SD	Includes all functions listed above plus: Alerts: travel deviation, travel alert 1 & 2 (high and low), travel limits & cutoffs (high and low), drive signal, auxiliary terminal, cycle counter, travel accumulation. With ValveLink software, provides all offline diagnostic tests (dynamic error band, drive signal, output signal, and step response) except valve signature.
AD	Includes all functions listed above plus (with ValveLink software) valve signature diagnostic test

- *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.

7

Viewing Instrument Status

Note

Instrument status is not available for instrument level AC.

To view the instrument status, from the Online menu select *Instrument Status*. The following describes the various displays for the Instrument Status menu.

- **Done**—Select this when you are done viewing the instrument status.

Note

Alerts are not available with instrument level HC.

- **Valve Alerts**—If a valve alert is active, it will appear when the Valve Alerts menu item is selected. If

more than one alert is active, they will appear on the display one at a time in the order listed below.

1. Non-critical NVM Alert
2. Cycle Counter Alert
3. Tvl Accumulation Alert
4. Aux Terminal Alert
5. Tvl Alrt 1-High Alrt
6. Tvl Alrt 1-Low Alrt
7. Tvl Alrt 2-High Alrt
8. Tvl Alrt 2-Low Alrt
9. Tvl Deviation Alrt
10. Tvl Lim/Cutoff High
11. Tvl Lim/Cutoff Low
12. Drive Signal Alert

- **Failure Alerts**—If a self-test failure has occurred, it will appear when the Failure Alerts menu item is selected. If there are multiple failures, they will appear on the display one at a time in the order listed below.

1. *Offline/Failed*—This failure is indicated when a failure, enabled from the Self Test Shutdown menu, causes an instrument shutdown. Press Enter to see which of the specific failures caused the Offline/Failed indication.

2. *No Free Time*—This failure is indicated if the instrument is unable to complete all of the configured tasks. This will not occur with a properly functioning instrument.

3. *RAM Fail*—This failure is indicated when the Random Access Memory integrity test fails. Dynamic data is stored in RAM. If this failure is indicated, restart the instrument and see if it clears. If it does not clear, replace the PWB Assembly.

4. *Drive Current Fail*—This failure is indicated when the drive current does not match the drive signal. If this failure occurs, check the connection between the I/P converter and the pwb assembly. Try removing the I/P converter and re-installing it. If the failure does not clear, replace the I/P converter or the pwb assembly.

5. *Critical NVM Alert*—This failure is indicated when the Non-Volatile Memory integrity test fails. Configuration data is stored in NVM. If this failure is indicated, restart the instrument and see if it clears. If it does not clear, replace the PWB Assembly.

6. *Temperature Sensor Fail*—This failure is indicated when the instrument temperature sensor fails, or the sensor reading is outside of the range of –40 to 176°F (–40 to 80°C). The temperature reading is used internally for temperature compensation of inputs. If this failure is indicated, restart the instrument and see if it clears. If it does not clear, replace the PWB Assembly.

7. *Pressure Sensor Fail*—This failure is indicated when the actuator pressure is outside the range of –24.0 to 125.0% of the calibrated pressure for more than 60 seconds. If this failure is indicated, check the instrument supply pressure. If the failure persists, ensure the PWB assembly is properly mounted onto the Module Base Assembly, and the pressure sensor O-ring is properly installed. If the failure does not clear after restarting the instrument, replace the PWB Assembly.

8. *Travel Sensor Fail*—This failure is indicated when the sensed travel is outside of the range of –25.0 to 125.0% of the calibrated travel. If this failure 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 PWB assembly. After restarting the instrument, if the failure does not clear, replace the PWB Assembly.

- **Alert Record**—Firmware revision 5 instruments have an alert record that can store alerts from any of the enabled alert groups: Valve Alerts, Failure Alerts or Miscellaneous Alerts. Table 7-2 lists the alerts included in each of the groups. The alert record also includes the date and time (from the instrument clock) the alert occurred.

- **Operational Status**—This menu item indicates the status of the Operational items listed below. The status of more than one operational may be indicated. If more than one Operational status is set, they will appear on the display one at a time in the order listed below.

1. Out of Service
2. Input Char Selected
3. Custom Char Selected
4. High Performance in Effect
5. Diagnostic in Progress
6. Calibration in Progress
7. Dynamic Bypass Enabled
8. Calib—Valve Cntrl Inactive
9. Burst Mode is Enabled

Table 7-2. Alerts Included in Alert Groups for Alert Record

Alert Group	Alerts Include in Group
Valve Alerts	Travel 1 low Travel 1 high Travel 2 low Travel 2 high Travel deviation Drive signal
Failure Alerts(1)	No free time RAM fail Drive current fail NVM fail Temperature sensor fail Pressure sensor fail Travel sensor fail
Miscellaneous Alerts	Auxiliary input

1. The Failure Alerts group is only available for instruments with firmware revision 5 in hardware revision 5.

Section 8 Principle of Operation

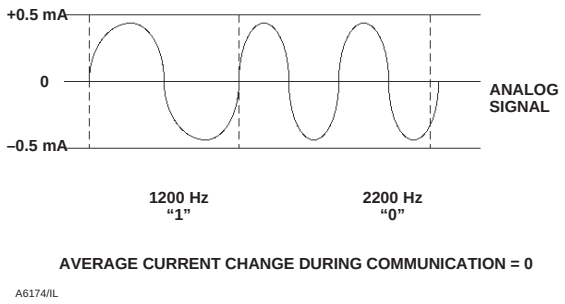


Figure 8-1. HART® Frequency Shift Keying Technique

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 the frequency shift keying (FSK) technique based on the Bell 202 communication standard. By superimposing a frequency signal over the 4–20 mA current, digital communication is attained. Two individual frequencies of 1200 and 2200 Hz are superimposed as a sinewave over the 4–20 mA current loop. These frequencies represent the digits 1 and 0 (see figure 8-1). The average value of this sinewave 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, 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 9-2 for instructions on changing the mode switch configuration to multidrop.

Digital Valve Controller Operation

DVC5000 Series digital valve controllers have a single master module that may be easily replaced in the field without disconnecting field wiring or tubing. This master module contains the following submodules: I/P converter, printed wiring board (printed wiring board) assembly, and pneumatic relay. The master module can be rebuilt by replacing the submodules. See figures 8-3 and 8-4.

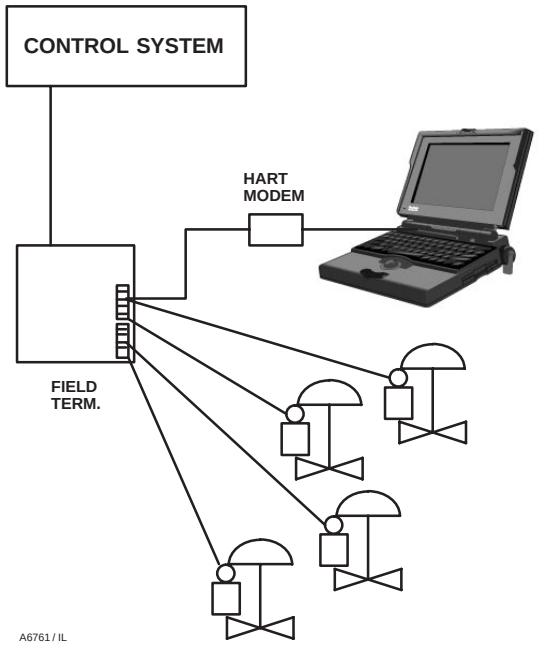


Figure 8-2. Typical FIELDVUE Instrument to Personal Computer Connections for ValveLink Type VL2010 or VL2020 Software

DVC5000 Series 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 direct acting Type DVC5010 digital valve controller mounted on a Type 657 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. This makes the magnetic attraction between the core and armature of the I/P converter increase, causing the flapper to restrict the nozzle, which increases the nozzle pressure. The nozzle pressure is routed to the input diaphragm of the pneumatic relay submodule. As the nozzle pressure increases, the pneumatic relay diaphragm assembly moves, causing the valve plug to open the supply port and close the exhaust port, increasing the output pressure to the actuator. The increased output pressure causes the actuator stem to move downward. Stem position is sensed through the feedback linkage by the travel sensor which is

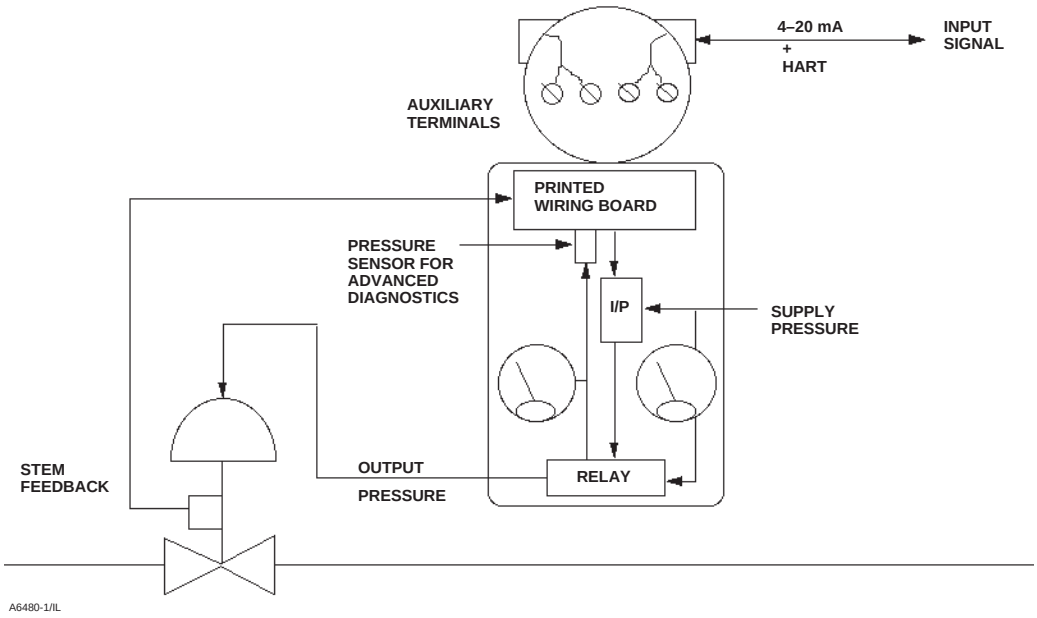


Figure 8-3. DVC5000 Series Digital Valve Controller Principle of Operation

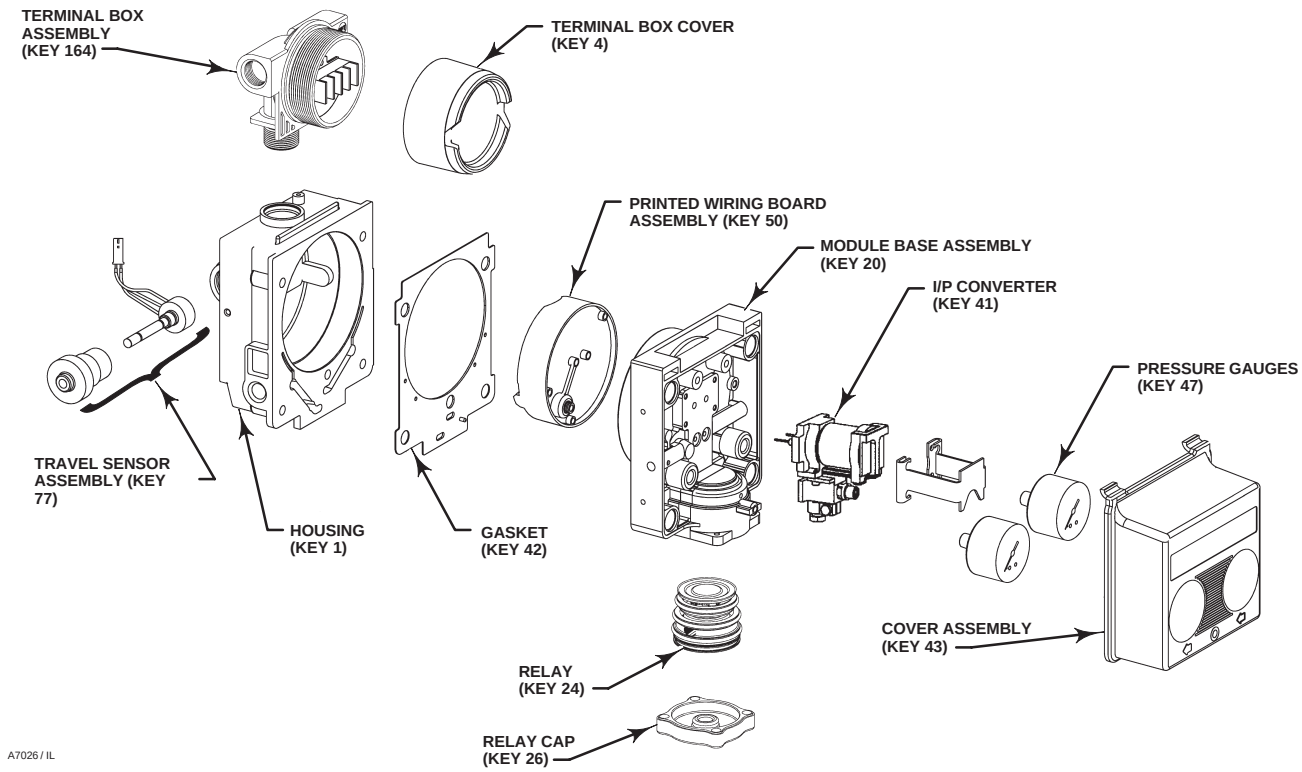


Figure 8-4. DVC5000 Series Digital Valve Controller Assembly

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 nozzle pressure. The pneumatic relay diaphragm assembly moves, causing the valve plug to close the supply port and open the exhaust port, releasing the actuator casing pressure to atmosphere. The stem

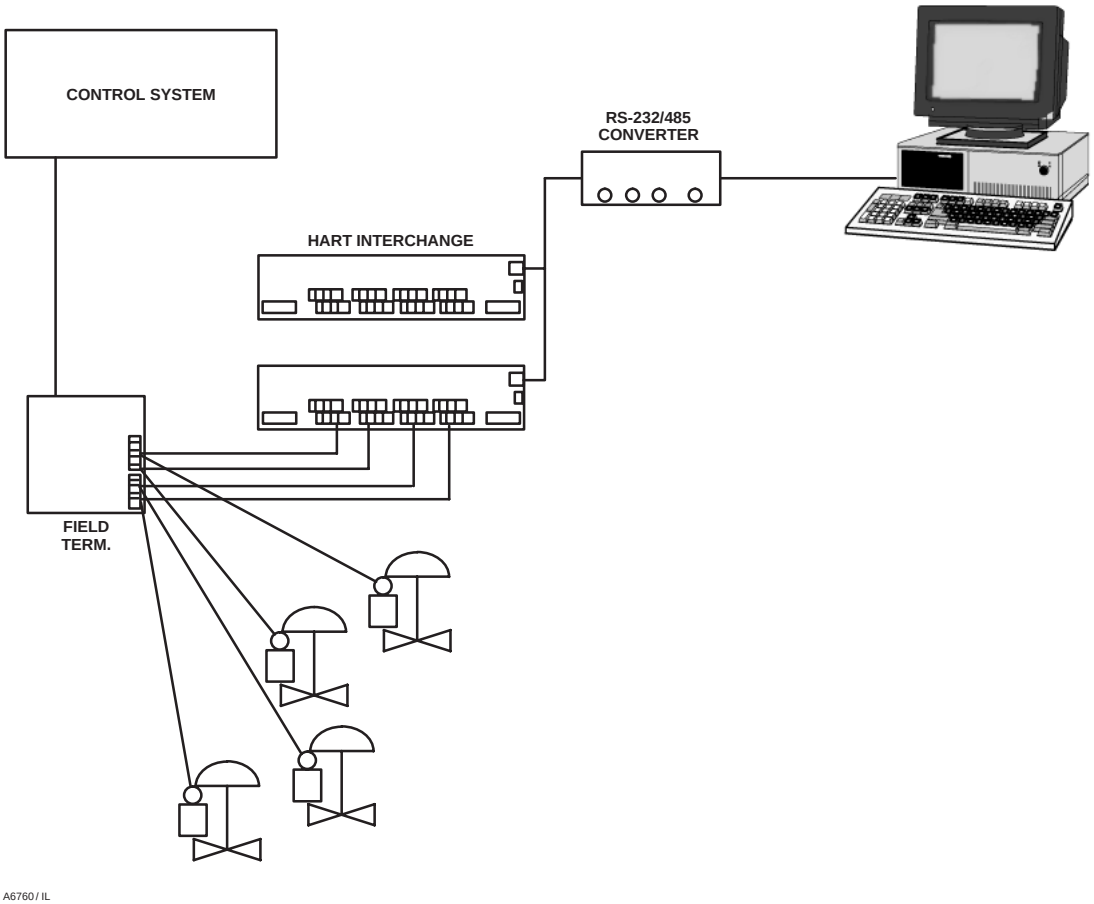


Figure 8-5. Typical FIELDVUE Instrument to Personal Computer Connections for ValveLink Type VL2030 Software

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.

Section 9 Maintenance

Note

If the feedback arm (key 79) or feedback arm assembly (key 84) is removed from the DVC5000 Series digital valve controller, the travel sensor (key 77) must be recalibrated.

Because of the diagnostic capability of the DVC5000 Series digital valve controllers, predictive maintenance is available through the use of FIELDVUE ValveLink Software. Using the digital valve controller, valve and instrument maintenance can be enhanced, thus avoiding unnecessary maintenance. For information on using the ValveLink software, see the *FIELDVUE ValveLink VL2000 Series Software User Guide*.

Stroking the Digital Valve Controller Output

Stroking the Output Using the 275 HART Communicator

(1-5)

Note

Stroke output is not available with instrument level AC.

From the Online menu, select *Main Menu* and *Stroke Output*. Follow the prompts on the HART Communicator display to select from the following: *Done, Ramp Open, Ramp Closed, Ramp to Target, Step to Target,* and *Stop*.

- *Done*—Select this if you are done. All ramping is stopped when DONE is selected.

- *Ramp Open*—ramps the travel toward open at the rate of 1.0% per second of the ranged travel.

- *Ramp Closed*—ramps the travel toward closed at the rate of 1.0% per second of the ranged travel.

- *Ramp to Target*—ramps the travel to the specified target at the rate of 1.0% per second of the ranged travel.

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

- *Stop*—stops the command.

Manually Stroking the Output

Refer to figure 9-1.

To increase output pressure, depress the I/P armature by gently pressing on the flapper mounting screw. After viewing the output pressure, gently lift the I/P armature by lifting on the flapper mounting screw to return the output pressure to its original value.

To decrease output pressure, gently lift the I/P armature by lifting on the flapper mounting screw. After viewing the output pressure, press on the flapper mounting screw slightly to return the output pressure to its original value.

Instrument Troubleshooting

If communication or output difficulties are experienced with the instrument, refer to the troubleshooting chart shown in table 9-1.

9

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 2-22 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 2-22 to zero.

Table 9-1. Instrument Troubleshooting

Symptom	Possible Cause	Action
1. Instrument will not communicate.	1a. Insufficient Voltage Available.	1a. Calculate Voltage Available (see Wiring Practices in the “Installation” section, Section 2). Voltage Available should be greater than or equal to 12 Vdc.
	1b. Controller output Impedance too low.	1b. Install a HART filter after reviewing Control System Compliance Voltage requirements (see Wiring Practices in the “Installation” section, Section 2).
	1c. Cable capacitance too high.	1c. Review maximum cable capacitance limits (see Wiring Practices in the “Installation” section, Section 2).
	1d. HART filter improperly adjusted.	1d. Check filter adjustment (see the appropriate HART filter instruction manual).
	1e. Improper field wiring.	1e. Check polarity of wiring and integrity of connections. Make sure cable shield is grounded only at the control system.
	1f. Controller output providing less than 4 mA to loop.	1f. Check control system minimum output setting, which should not be less than 3.8 mA.
	1g. Disconnected loop wiring cable at PWB.	1g. Verify connectors are plugged in correctly.
	1h. PWB DIP switches not set properly.	1h. Check for incorrect setting or broken DIP switches on the back of the PWB. Reset switches or replace PWB, if switches are broken. See table 9-2 for switch setting information
	1j. PWB failure.	1j. Use a 4–20 mA current source to apply power to the instrument. Terminal voltage across the LOOP+ and LOOP– terminals should be 10 to 11.5 Vdc. If the terminal voltage is not 10 to 11.5 Vdc; over 100mA has been applied to the input terminals. Replace the PWB.
	1k. Polling address incorrect.	1k. Use the HART Communicator to set the polling address (refer to the Detailed Setup section, Section 5). From the *Utilities* menu, select Always Poll. Set the polling address to 0.
	1l. Defective cable from terminal box.	1l. Check cable continuity. If necessary, replace the terminal box assembly.
	1m. Defective terminal box assembly printed wiring board.	1m Check for damaged printed wiring board lands and terminals. If necessary, replace the terminal box assembly.
	1n. Defective HART Communicator or ValveLink modem cable.	1n. If necessary, repair or replace cable.
	1p. ValveLink modem defective or not compatible with PC.	1p. Replace ValveLink modem.
	1q. ValveLink hardlock defective or not programmed.	1q. Replace if defective or return to factory for programming.
2. Instrument will not calibrate, has sluggish performance or oscillates.	2a. Travel sensor “frozen”, will not turn.	2a. Rotate feedback arm to ensure it moves freely. If not, replace the pot/bushing assy.
	2b. Broken travel sensor wire(s).	2b. Inspect wires for broken solder joint at pot or broken wire. Replace pot/bushing assy.
	2c. Travel sensor mis-adjusted.	2c. Perform Travel Sensor Adjust procedure in “Calibration” section, Section 6.
	2d. Open travel sensor.	2d. Check for continuity in electrical travel range. If necessary, replace pot/bushing assy.
	2e. Cables not plugged into PWB correctly.	2e. Inspect connections and correct.
	2f. Feedback arm loose on pot.	2f. Perform Travel Sensor Adjust procedure in “Calibration” section, Section 6.
	2g. Feedback arm bent/damaged or bias spring missing/damaged.	2g. Replace feedback arm and bias spring.

–continued–

Table 9-1. Instrument Troubleshooting (Continued)

Symptom	Possible Cause	Action
	2h. Configuration errors.	2h. Verify configuration: If necessary, set protection to None. If Out of Service, place In Service. Check: Invert feedback. Tuning set Zero control signal Feedback characteristic Control mode (should be RSP) Restart control mode (should be RSP) Tvl Range Low and High
	2j. I/P assy primary restriction plugged.	2j. Apply supply pressure and depress cleanout wire.
	2k. Air blockage in I/P assy nozzle block, not cleared by depressing cleanout wire.	2k. Replace I/P assy.
	2l. O-ring(s) between I/P assy missing or hard and flattened losing seal.	2l. Replace O-ring(s).
	2m. I/P assy damaged/corroded/clogged.	2m. Check for bent flapper, loose cleanout valve, open coil (continuity), contamination, staining, or dirty air supply. Coil resistance should be between 1680 - 1860 ohms. Tighten cleanout valve, replace I/P assy if damaged, corroded, clogged, or open coil.
	2n. I/P assy out of spec.	2n. I/P assy nozzle may have been adjusted. Verify drive signal (55% to 75%) Replace I/P assy if drive signal is continuously high or low.
	2p. Defective gasket.	2p. Check gasket for closed up holes, excessive deformation due to overtightening or “oozing”. If necessary, replace gasket.
	2q. Defective relay.	2q. Depress I/P assy armature, look for increase in output pressure. Remove relay, inspect for missing Belleville washer, missing valve spring, missing valve plug. Inspect “lip” under top O-ring for breakage due to relay removal. Inspect O-rings and replace if hard or damaged. Replace parts or relay if I/P assy good and air passages not blocked.
	2r. Defective 67AFR regulator, supply pressure gauge jumps around.	2r. Replace 67AFR regulator.
3. ValveLink diagnostic tests provide erroneous results.	3a. Bent or defective pressure sensor.	3a. Replace PWB.
	3b. Pressure sensor O-ring missing.	3b. Replace O-ring.
4. No advanced diagnostics indicated when instrument has pressure sensor.	4a. Variable not available in PWB.	4a. Replace PWB, return old PWB to factory for correction.
5. HART Communicator does not turn on.	5a. Dead AA batteries or battery pack not charged.	5a. Replace AA batteries or charge battery pack. Note: Battery pack will not charge if installed on HART communicator. Remove battery pack to charge.

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 12.0 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, Section 2.

Master Module Maintenance

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

Removing the Master Module

To remove the master module, perform the following steps. Refer to figures 10-1 through 10-4 for key number locations.

WARNING

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

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

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

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

Note

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

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

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

CAUTION

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

Replacing the Master Module

To replace the master module, perform the following steps. Refer to figures 10-1 through 10-4.

CAUTION

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

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

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

2. Connect the terminal box connector to the pwb assembly (key 50). Orientation of the connector is required.

3. Connect the travel sensor connector to the pwb assembly (key 50). Orientation of the connector is required.

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

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

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

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

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

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

Submodule Maintenance

The digital valve controller's master module contains the following submodules: I/P converter, pwb assembly, and pneumatic relay. If problems occur, these submodules may be removed from the master

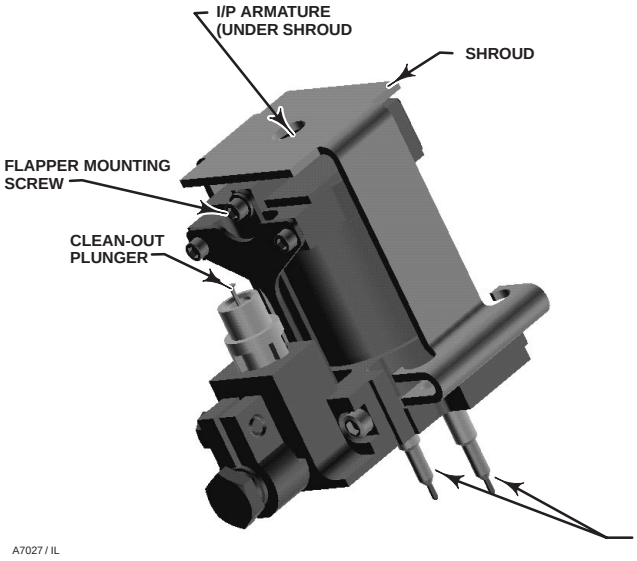


Figure 9-1. I/P Converter

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

Note

If the pwb assembly or I/P converter submodule is replaced, calibrate and configure the DVC5000 Series digital valve controller to maintain accuracy specifications. If any other submodule was replaced, recalibration or adjustment of the digital valve controller, master module, or submodules is not necessary.

Note

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

I/P Converter

Refer to figures 10-1 through 10-4 for key number locations. The I/P converter (key 41) is located on the front of the master module.

Clearing the Primary Orifice

If the primary orifice becomes clogged, affecting performance, depress the cleanout plunger (see figure 9-1). This operation runs a wire through the orifice to clear the hole. Unscrew the single captive screw in the cover (key 43) and remove the cover from the digital valve controller to gain access to the cleanout plunger.

Manual Output Test

Manually stroke the output as described on page 9-3.

Removing the I/P Converter

1. Remove the front cover (key 43), if not already removed.
2. Remove the four socket-head screws (key 23) that attach the I/P converter to the module base.
3. Pull the I/P converter (key 41) straight out of the module base. Be careful not to damage the two electrical leads that come out of the base of the I/P converter.
4. Ensure that the two O-rings (key 39) stay in the module base and do not come out with the I/P converter.

Replacing the I/P Converter

1. Inspect the condition of the two O-rings (key 39) in the module base. Replace them, if necessary. Apply sealant (key 65) to the O-rings.

2. Ensure the two boots (see figure 9-1) are properly installed on the electrical leads.

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

4. Install four socket-head screws (key 23) and evenly tighten them in a crisscross pattern to a final torque of 20.7 lbf•in (2 N•m).

PWB (Printed Wiring Board) Assembly

Refer to figures 10-1 through 10-4 for key number locations. The pwb assembly (key 50) is located on the back of the module base assembly.

Removing the Printed Wiring Board Assembly

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

2. Remove three screws (key 33).

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

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

Replacing the PWB Assembly and Setting the Mode Switches

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

Note

If the pwb assembly submodule is replaced, calibrate and configure the DVC5000 Series digital valve controller to maintain accuracy specifications.

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

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

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

5. Set the DIP switches on the pwb assembly according to table 9-2.

CAUTION

Do not connect the digital valve controller directly to a voltage source when implementing the point-to-point wiring mode, or damage to the PWB assembly submodule may result. In point-to-point wiring mode, the digital valve controller may only be connected to a 4–20 mA current source.

Pneumatic Relay

Refer to figures 10-1 through 10-4 for key number locations. The pneumatic relay (key 24) is located on the side of the master module.

Removing the Pneumatic Relay

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

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

Table 9-2. DIP Switch Configuration(1)

DIP SWITCH FUNCTION	SWITCH	SWITCH POSITION
Multidrop Loop	Multi-drop	UP
Point-to-Point Loop	Multi-drop	DOWN
Auxiliary Terminal, Transmitter	Auxiliary	UP (2)
Auxiliary Terminal, Switch	Auxiliary	DOWN

1. Refer to figure 9-2 for switch location..
2. Auxiliary terminal, transmitter is available only with the Process PID option.

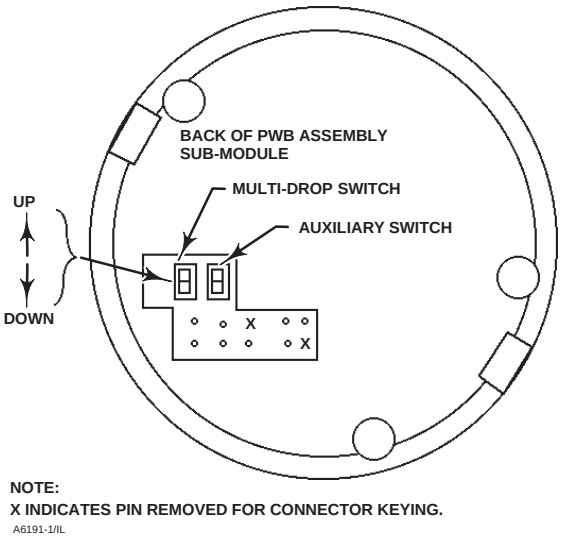


Figure 9-2. DVC5000 Series Digital Valve Controller DIP Switch Location

Note

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

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

CAUTION

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

Replacing the Pneumatic Relay

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

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

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

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

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

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

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

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

9. Install the relay cap on the module base. As the relay cap is installed, the spring washer fingers will grab the relay cap and retain the Belleville spring.

Tighten the screws, in an crisscross pattern, to a final torque of 20.7 lbf•in (2 N•m).

Gauges, Pipe Plugs, or Tire Valves

Depending on the options ordered, the DVC5000 Series digital valve controller will be equipped with either two gauges (key 47), two pipe plugs (key 66), or two tire valves (key 67). These are located on the top of the master module next to the I/P converter.

Perform the following procedure to replace the gauges, tire valves, or pipe plugs. Refer to figures 10-1 through 10-5 for key number locations.

1. Remove the front cover (key 43).

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

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

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

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

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

Terminal Box

Refer to figures 10-1 through 10-4 for key number locations.

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

Removing the Terminal Box

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

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

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

4. Remove the screw (key 72). Unscrew the terminal box assembly from the housing.

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

Replacing the Terminal Box

Note

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

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

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

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

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

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

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

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

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

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

Travel Sensor

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

Disassembly

Type DVC5010 and DVC5040 Digital Valve Controller

Refer to figure 10-1 or 10-4 for key number locations.

1. Remove piping and fittings from the instrument.

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

3. Remove the digital valve controller from the actuator.

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

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

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

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

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

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

Type DVC5020 Digital Valve Controller

Refer to figure 10-2 for key number locations.

1. Remove piping and fittings from the instrument.

2. Remove the digital valve controller from the actuator.

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

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

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

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

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

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

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

Type DVC5030 Digital Valve Controller

Refer to figure 10-3 for key number locations.

1. Remove piping and fittings from the instrument.

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

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

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

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

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

Assembly

9

Note

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

Type DVC5010 and DVC5040 Digital Valve Controllers

Refer to figure 10-1 or 10-4 for key number locations.

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

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

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

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

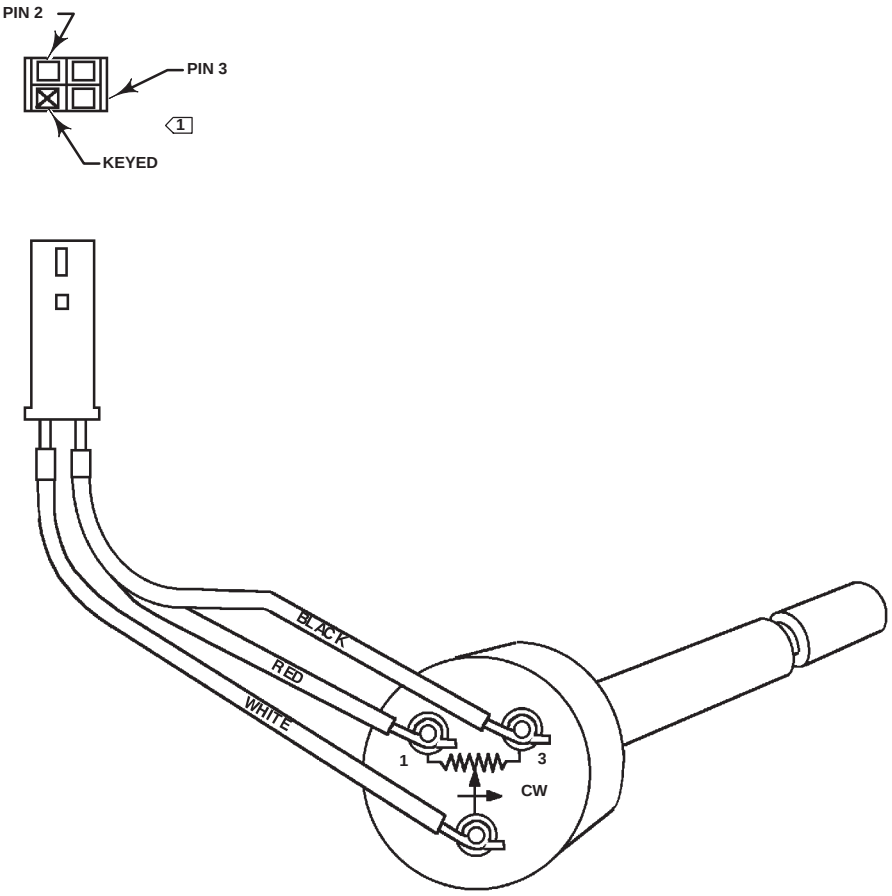


Figure 9-3. Potentiometer Resistance Measurement

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

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

Two methods are available for adjusting the travel sensor. You can use a multimeter to measure the potentiometer resistance, or if you have a HART Communicator with device description revision 9 or later, you can use the procedure in the “Calibration” section, Section 6. To use the multimeter, perform steps 7 through 13. To use the HART Communicator, skip to step 14.

Travel Sensor Adjustment with a Multimeter

7. Align the feedback arm (key 79) to the housing (key 1) by inserting the alignment pin (key 46) through the hole marked “A” on the feedback arm. Fully engage the alignment pin into the tapped hole in the side of the housing. Position the feedback arm so that the surface with the travel markings is flush with the end of the travel sensor shaft.

8. Connect a multimeter set to a resistance range of 1000 ohms to pins 2 and 3 of the travel sensor connector. Refer to figure 9-3 for pin location.

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

Note

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

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

11. Disconnect the multimeter from the travel sensor connector.

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

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

Travel Sensor Adjustment with the HART 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 HART Communicator.

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

15. Perform the appropriate Travel Sensor Adjust procedure in the “Calibration” section, Section 6.

Type DVC5020 Digital Valve Controller

Refer to figure 10-2 for key number locations.

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

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

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

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

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

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

Two methods are available for adjusting the travel sensor. You can use a multimeter to measure the potentiometer resistance, or if you have a HART Communicator with device description revision 9 or later, you can use the procedure in the “Calibration” section, Section 6. To use the multimeter, perform steps 7 through 17. To use the HART Communicator, skip to step 18.

Travel Sensor Adjustment with a Multimeter

7. Connect a multimeter set to a resistance range of 1000 ohms to pins 2 and 3 of the travel sensor connector. Refer to figure 9-3 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 a measured resistance of 6250 to 6350 ohms.

Note

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

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

11. Disconnect the multimeter from the travel sensor connector.

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

13. Push the feedback arm into the housing, engaging the pin of the arm assembly into the slot in the feedback arm.

14. Install the washer (key 86) and E-ring (key 85) next to the inboard flange bearing (key 83).

15. Install the bias spring (key 93).

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

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

Travel Sensor Adjustment with the HART 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 HART Communicator.

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

19. Perform the appropriate Travel Sensor Adjust procedure in the “Calibration” section, Section 6.

Type DVC5030 Digital Valve Controller

Refer to figure 10-3 for key number locations.

1. Apply lubricant (key 63) to the bushing O-ring and threads.

2. Screw the bushing into the housing until it is tight.

3. For units that mount on other than Fisher actuators, go to step 12.

4. For units that mount on Fisher actuators, attach the feedback arm (key 79) to the travel sensor shaft.

Two methods are available for adjusting the travel sensor. You can use a multimeter to measure the potentiometer resistance, or if you have a HART Communicator with device description revision 9 or later, you can use the procedure in the “Calibration” section, Section 6. To use the multimeter, perform steps 5 through 11. To use the HART Communicator, skip to step 12.

Travel Sensor Adjustment with a Multimeter

5. Align the feedback arm (key 79) to the housing (key 1) by inserting the alignment pin (key 46) through the hole marked “A” on the feedback arm. Fully engage the alignment pin into the tapped hole in the side of the housing. Position the feedback arm so that the outer surface is flush with the end of the travel sensor shaft.

6. Connect a multimeter set to a resistance range of 1000 ohms to pins 2 and 3 of the travel sensor connector. Refer to figure 9-3 for pin location.

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

Note

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

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

9. Disconnect the multimeter from the travel sensor connector.

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

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

Travel Sensor Adjustment with the HART 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 HART Communicator.

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

13. Perform the appropriate Travel Sensor Adjust procedure in the “Calibration” section, Section 6.

Section 10 Parts

Parts Ordering

Whenever corresponding with your Fisher Controls sales office or representative about this equipment, always mention the controller serial number. When ordering replacement parts, refer to the 11-character part number of each required part as found in the following parts list. Parts which do not show part numbers are not orderable.

Parts Kits

Conversion kit 6 listed below provides the parts required to convert a DVC5010 to a DVC5020. Conversion kit 7 provides the parts required to convert a DVC5020 to a DVC5010.

Key	Description	Part Number
1*	Elastomer Spare Parts Kit	14B5072X012
2*	Relay Spare Parts Kit	14B5072X022
3*	Small Hardware Spare Parts Kit	14B5072X032
6	Conversion Kit (DVC5010 to DVC5020) Also see note below	14B5072X102
7	Conversion Kit (DVC5020 to DVC5010)	14B5072X112
9	Alignment Pin Kit (kit contains 15 alignment pins)	14B5072X092

Note

Conversion kit key 6 contains a vent-away mounting bracket. Install a 1/4-inch NPT socket head pipe plug in the tapped hole in the side of the mounting bracket if Type DVC5020 digital valve controller is not for vent-away construction.

Parts List

Parts which do not show part numbers are not orderable.

Note

Parts with footnote numbers shown are available in parts kits. Also see footnote information at the bottom of the page.

Key	Description	Part Number
Common Parts		
1	Housing, aluminum	
23	Cap Screw, hex socket, SST(3) (4 req'd)	1H3697X0032
33	Mach Screw, pan hd, SST(3) (3 req'd)	14B1930X012
34*	O-ring, nitrile(1) (2 req'd)	10A3802X012
36*	O-ring nitrile(1)	1H8762X0012
38	Cap Screw, hex socket, SST(3) (4 req'd)	1P714638992
39*	O-ring, nitrile(1) (2 req'd)	1D687506992
40*	O-ring, nitrile(1)	14B1935X012
41	I/P Assembly (See I/P Assembly listing below)	
42*	Gasket, nitrile(1)	34B0601X022
43	Cover Assembly, plastic	
	For DVC5010, DVC5020, & DVC5030	34B0612X012
	For DVC5040	37B2518X012
48	Nameplate	
49	Drive Screw(3) (4 req'd)	
52	Vent, plastic(3)	
	Used w/DVC5010 and DVC5030 only	11B8279X012
58	Set Screw, hex socket, SST(3)	14B1559X012
61	Pipe Plug, hex socket, SST	1C3335X0032
62	Pipe Plug, hex hd, SST	1H5137X0012
63	Lubriplate Mag-1 Lubricant (not furnished with the instrument)	
64	Zink-Plate No. 770 Anti-Seize Compound (not furnished with the instrument)	
65	Dow Corning 111 Lubricant (not furnished with the instrument)	
74	Mounting Bracket(6)	
	DVC5020 only	
	Std	44B1219X022
	Vent-away	24B1376X012
75*	O-Ring, nitrile(1,6)	
	DVC5020 Vent-away only	11A8741X052
128	Pipe Plug, pl stl	
	DVC5020 Vent-away only	1E823128982
211	Lubricant, Nyogel 760G (not furnished with the instrument)	
I/P Assembly		
	I/P Converter w/shroud & boots	34B9710X022
41	I/P Converter	
169	Shroud	
210*	Boot, nitrile (2 req'd)	12B4131X012
Module Base		
	Master Module Assembly	14B5071X022
	The following parts are included in the master module assembly.	
2	Module Base Assembly	34B3169X012
23	Cap Screw, (4 req'd)	
24	Relay Module(2) (See Relay listing below)	
33	Machine Screw, (3 req'd)	
38	Cap Screw, hex socket(3) (4 req'd)	
39	O-ring, (2 req'd)	
41	I/P Assembly w/shroud & boots	
154	Retaining Ring (4 req'd)	

* Recommended spare
1. Available in the Elastomer Spare Parts Kit
2. Available in the Relay Spare Parts Kit
3. Available in the Small Hardware Spare Parts Kit
6. Available in the DVC5010 to DVC5020 Conversion Kit

Key	Description	Part Number
	Terminal Box	
4	Terminal Box Cap	34B0567X012
44	Wire Retainer, pl stl(3) (2 req'd)	14B3147X012
58	Set Screw, hex socket, SST(3)	14B1559X012
72	Cap Screw, hex socket, SST(3)	
	For DVC5010, DVC5020, DVC5030	1H3697X0032
	For DVC5040,	
	Inch	1L545438992
	Metric	17B5168X012
164	Terminal Box Assembly	
	For DVC5010, DVC5020, & DVC5030	34B8797X012
	For DVC5040	37B8798X012
	Relay	
24	Relay Module(2)	
24L	O-Ring(1, 2) (3 req'd)	
24M	O-Ring(1, 2)	
25	Mach Screw, pan hd(2) (4 req'd)	
26	Cap	34B0583X022
31	Belleville Spring(2)	
32	Washer(2)	
152	O-ring, (4 req'd)	
	PWB Assembly	
50*	PWB Assembly	
	For instrument level AC	17B8801X062
	For instrument level HC	17B8801X072
	For instrument level SD	17B8801X082
	For instrument level AD	17B8801X092
	Pressure Gauges, Pipe Plugs, or Tire Valve Assemblies	
47*	Pressure Gauge (2 req'd)	
	PSI/MPA/BAR Gauge Scale	
	Plastic case, brass connection	
	To 25 PSI, 170 kPa, 1.7 bar	11B4040X012
	To 50 PSI, 345 kPa, 3.4 bar	11B4040X022
	To 100 PSI, 690 kPa, 6.9 bar	11B4040X032
	SST case, SST connection	
	To 25 PSI, 170 kPa, 1.7 bar	11B4039X012
	To 50 PSI, 345 kPa, 3.4 bar	11B4039X022
	To 100 PSI, 690 kPa, 6.9 bar	11B4039X032
	PSI/KG/CM^2 Gauge Scale	
	Plastic case, brass connection	
	To 25 PSI, 1.8 kg/cm^2	11B4040X042
	To 50 PSI, 3.5 kg/cm^2	11B4040X052
	To 100 PSI, 7.0 kg/cm^2	11B4040X062
66	Pipe Plug, hex hd (2 req'd)	
	Plated steel	1D829328982
	SST	1D8293X0012
67	Tire Valve Assembly, pl stl (2 req'd)	1N908899012
	Feedback Parts	
46	Alignment Pin(9)	
	For DVC5010, DVC5030 & DVC5040 only	14B0656X022
77	Potentiometer and Bushing Assy	
	For DVC5010 & DVC5020	14B5070X052
	For DVC5030	17B4030X012
	For DVC5040	17B4031X012
78	Bias Spring, SST(3)	
	For DVC5010, DVC5030, & DVC5040	24B0654X032
79	Feedback Arm, SST	
	DVC5010	
	For 513, 513R, 529, 585C, 585CR, 656, 657/30-100, and 667/30-100	37B5270X012
	For all sizes 1250 and 1250R	37B5270X022
	DVC5040	
	For 9000/all sizes	34B1929X012
	DVC5030	
	For all sizes 1051, 1052, and 1066SR	34B2179X012
80	Cap Screw, hex socket, SST(3)	14B6978X012
81	Square Nut, SST(3)	16A6711X032
82	Bias Spring, SST(3) DVC5020 only	24B1532X012
83	Flange Bearing, Rulon(6) DVC5020 only (2 req'd)	13A1592X012
84	Feedback Arm Assy, SST(6)	
	DVC5020 only	
	For 471, 585, 585R 1051/30-60 and 1052/40-70	14B1557X022
	For 1051/33 and 1052/20, 33	14B1377X022
85	E-ring, pl stl(3) DVC5020 only (2 req'd)	1E455328982
86	Plain Washer, pl stl(6) DVC5020 only (2 req'd)	1A498828982
87	Follower Post, SST(6) DVC5020 only	13A1656X012
88	Roller, SST/PTFE(6) DVC5020 only	13A1657X012
89	Spring Lock Washer, pl stl(6) DVC5020 only	1H267228982
90	Hex Nut, pl stl(6) DVC5020 only	1A839628982
91	Arm Assy, SST(6) DVC5020 only	14B0659X022
92	Cap Screw, hex socket(6) DVC5020 only (4 req'd)	1L7325X0012
93	Torsion Spring, Feedback Arm(6) DVC5020 only	14B1426X012
104	Cap Screw, hex hd (4 req'd)	
	For DVC5010 only	1A3917X0052
	Not for mounting on 1250 and 1250R actuators, see mounting parts below.	
107	Mounting Bracket	
	For DVC5010 only	44B0655X022
	Not for mounting on 1250 and 1250R actuators, see mounting parts below.	
121	Thread Lock, Loctite 242 (not furnished with instrument)	
160	Sealant, Torque Seal (not furnished with instrument)	
163	Plain Washer, SST	14B6976X012

10

Mounting Parts

Type DVC5010 Digital Valve Controller

For Types 513 and 513R, size 20 actuators

Key	Description	Part Number
102	Shield, polyester	34B1428X012
103	Mach Screw, pan hd, pl stl(3) (2 req'd)	11A6514X012
106	Adjustment Arm, aluminum/SST	24B0651X032
108	Connector Arm, pl stl	24B8879X012
109	Mach Screw, hex hd, pl stl	13A1617X012
110	Lock Washer, ext, pl stl	14B0698X012
118	Spacer, pl stl (2 req'd)	1N254224102
119	Spacer, SST (2 req'd)	1L759024092
120	Cap Screw, hex hd, pl stl (2 req'd)	1C870224052
122	Plain Washer, pl stl (2 req'd)	1B865928982
126	Plain Washer, pl stl	14B4140X012

* Recommended spare
1. Available in the Elastomer Spare Parts Kit
2. Available in the Relay Spare Parts Kit
3. Available in the Small Hardware Spare Parts Kit
6. Available in the DVC5010 to DVC5020 Conversion Kit
9. Available in the Alignment Pin Kit

Key	Description	Part Number
155	Cap Screw, hex hd, pl stl (2 req'd)	1B787724052
	For Types 513 and 513R, size 32 actuators	
102	Shield, polyester	34B1428X012
103	Mach Screw, pan hd, pl stl(3) (2 req'd)	11A6514X012
106	Adjustment Arm, aluminum/SST	24B0651X032
108	Connector Arm, pl stl	24B0652X012
109	Mach Screw, hex hd, pl stl	13A1617X012
110	Lock Washer, ext, pl stl	14B0698X012
118	Spacer, pl stl (2 req'd)	1N254224102
119	Spacer, pl stl (2 req'd)	1L759024092
120	Cap Screw, hex hd, pl stl (2 req'd)	1C870224052
122	Plain Washer, pl stl (2 req'd)	1B865928982
126	Plain Washer, pl stl	14B4140X012
155	Cap Screw, hex hd, pl stl (2 req'd)	1B787724052
	For Types 657 & 667, size 30-60 actuators	
102	Shield, polyester	34B1428X012
103	Mach Screw, pan hd, SST(3) (2 req'd)	11A6514X022
105	Screw, hex flg, SST	
	W/o side-mtd h'wheel (2 req'd)	14B1379X032
	W/side-mtd h'wheel (none req'd)	– – –
106	Adjustment Arm, aluminum/SST	24B0651X032
108	Connector Arm, stl	
	W/o side-mtd h'wheel	24B0652X012
	W/side-mtd h'wheel	32B3526X012
109	Mach Screw, hex hd, SST	13A1617X022
110	Lock Washer, ext, pl stl	14B0698X012
126	Plain Washer, SST	14B4140X022
148	Spacer, pl stl	
	W/o side-mtd h'wheel (none req'd)	– – –
	W/side-mtd h'wheel (2 req'd)	
	For size 34, 40	1J830724092
	For size 45–60	1F906724092
155	Cap screw, hex hd, SST	
	W/o side-mtd h'wheel (none req'd)	– – –
	W/side-mtd h'wheel (2 req'd)	
	For size 34, 40	1A352538992
	For size 45–60	1B7877X0012
156	Washer, SST	
	W/o side-mtd h'wheel (2 req'd)	1B8659X0012
	W/side-mtd h'wheel (none req'd)	– – –
	For Types 657 & 667, size 70-100 actuators	
97	Feedback Arm Ext, SST	42B9010X012
98	Mach Screw, hex hd, SST	12B2922X012
99	Mach Screw, flat hd, SST	14B6701X012
100	Hex Nut, SST (2 req'd)	1A3303X0012
101	Spacer, SST	14B1554X012
102	Shield, SST	44B1429X012
103	Mach Screw, pan hd, SST(3) (2 req'd)	1N10183X022
105	Screw, hex flg, SST (2 req'd)	14B1379X032
106	Adjustment Arm, aluminum/SST	24B0651X032
108	Connector Arm, stl	
	W/o side-mtd h'wheel	22B9008X012
	W/side-mtd h'wheel	23B9247X012
109	Mach Screw, hex hd, SST	13A1617X022
110	Lock Washer, ext, pl stl	14B0698X012
126	Plain Washer, SST	14B4140X022
156	Washer, SST (2 req'd)	
	For 657 size 70	14B5349X022
	For 657 size 80–100	1K8995X0022
162	Lock Washer, split, SST	61000580X12
	For Types 1250 & 1250R actuators, all sizes and Gulde Model GA and P actuators	
102	Shield, polyester	34B1428X012
103	Mach Screw, pan hd, pl stl(3) (2 req'd)	11A6514X012
104	Cap Screw, hex hd, pl stl (4 req'd)	1A3917X0052
106	Adjustment Arm, aluminum/SST	24B0651X032
107	Mounting Bracket, pl stl	44B0224X012
108	Connector Arm, pl stl	34B0223X012
109	Mach Screw, hex hd, pl stl	13A1617X012
110	Lock Washer, ext, pl stl	14B0698X012
111	Brace	44B0225X012
112	Cap Screw, hex hd, pl stl (2 req'd)	19A4833X012
113	Cap Screw, hex hd, pl stl (2 req'd)	10B6605X012
114	U-Bolt, pl stl (4 req'd)	14B0226X012
115	Hex Nut, pl stl (10 req'd)	19A4788X012
123	Plain Washer, pl stl (2 req'd)	10B6633X012
124	Plain Washer, pl stl (2 req'd)	10B6609X012
125	Cap Screw, hex hd, pl stl	19A4775X012
126	Plain Washer, pl stl	14B4140X012
127	Lock Washer, pl stl (8 req'd)	11Y8560R082

Type DVC5020 Digital Valve Controller

	For Type 585 and 585R Actuators	
84	Feedback Arm Ass'y, SST	17B3156X012
94	Cam, SST	27B3157X012
98	Machine Screw, hex hd, SST (2 req'd)	13A1618X022
100	Hex Nut, SST (2 req'd)	1A6622X0012
116	Cap Screw, hex socket, pl stl (8 req'd)	1P7146X0022
117	Mounting Adaptor	44B1220X012
162	Lock Washer, SST (2 re'd)	1A3291X0012
170	Reversing Relay	15A8804X352
171	Pipe Bushing, hex (2 req'd)	
	Plated steel	1B6149X0012
	SST	1B6149X0032
172	Pipe Tee	
	Plated steel	1C597547362
	SST	1P506938982
173	Cap Screw, hex hd, pl stl (2 req'd)	1C631224052
174	Pipe Nipple	
	Plated steel	1C678926232
	SST	1P5068X0012
175	Pipe Nipple	
	Plated steel	1A385026012
	SST	1A3580X0012
176	Pipe Bushing, hex	
	Plated steel	1E253726232
	SST	1E2537K0012
203	Follower Arm Extension, SST	17B3158X012
	For Type 1051, size 30-60 and Type 1052, size 40-70 actuators	
116	Cap Screw, hex socket, SST (4 req'd)	1P714638992
	For Type 1051, size 33 and Type 1052 size 20 & 33 actuators	
116	Cap Screw, hex socket, SST (8 req'd)	1P714638992
117	Mounting Adaptor	44B1220X012

Type DVC5030 Digital Valve Controller

	For Types 1051, size 30-60 and Type 1052, size 40-70 actuators	
104	Cap Screw, hex head, SST (4 req'd)	1B2905X0012
107	Mounting Bracket Ass'y, stl/SST	34B9501X012
140	Washer, pl stl (4 req'd)	
	For 1051 size 30–40 & 1052 size 40	1H723125072
	For 1051 size 60 & 1052 size 60–70	1A518925072
142	Travel Indicator Scale, SST	24B2183X012
144	Travel Indicator Ass'y, SST	24B2178X012
145	Machine Screw, pan hd, SST (2 req'd)	59061180X12
198	Plain Washer, SST (2 req'd)	61000350X12
204	Hex Nut, SST (2 req'd)	1A3303X0012
	For Type 1051 and 1052, size 33 actuators	
104	Cap Screw, hex hd, SST (4 req'd)	1B2905X0012
107	Mounting Bracket Ass'y	34B9503X012

3. Available in the Small Hardware Spare Parts Kit.

Key	Description	Part Number
140	Washer, pl stl (4 req'd)	1B865928982
141	Spacer, pl stl	17B1702X012
142	Travel Indicator Scale, SST	24B2183X012
144	Travel Indicator Ass'y, SST	24B2178X012
145	Machine Screw, pan hd, SST (2 req'd)	13B9244X012
191	Cap Screw, hex hd, pl stl (4 req"d)	1A381624052
198	Plain Washer, SST (2 req'd)	61000350X12
199	Washer, pl stl (2 req'd)	1K261028992
204	Hex Nut, SST (2 req'd)	1A3303X0012
	For Type 1052, size 20 actuators	
104	Cap Screw, hex hd, SST (4 req'd)	1B2905X0012
107	Mounting Bracket Ass'y stl/SST	34B9502X012
141	Spacer, pl stl	17B1701X012
142	Travel Indicator Scale, SST	24B2183X012
144	Travel Indicator Ass'y, SST	24B2178X012
145	Machine Screw, pan hd, SST (2 req'd)	59061300X12
191	Cap Screw, hex hd, pl stl (4 req"d)	1A353124052
198	Plain Washer, SST (2 req'd)	61000350X12
204	Hex Nut, SST (2 req'd)	1A3303X0012
	For Type 1066SR actuators	
104	Cap Screw, hex hd, SST (4 req'd)	1B2905X0012
107	Mounting Bracket Ass'y	34B9503X012
140	Washer, pl stl (4 req'd)	
	For size 20	1B865928982
	For size 27	1H723125072
	For size 75	1A518925072
141	Spacer, pl stl	
	For sizes 20 & 27	17B1703X012
	For size 75	17B1710X012
142	Travel Indicator Scale, SST	24B2183X012
144	Travel Indicator Ass'y, SST	24B2178X012
145	Machine Screw, pan hd, SST (2 req'd)	
	For sizes 20 & 27	14B2026X012
	For size 75	14B2027X012
198	Plain Washer, SST (2 req'd)	61000350X12
199	Washer, pl stl	
	For sizes 20 & 27 (2 req'd)	1K261028992
	For size 75 (none req'd)	– – –
204	Hex Nut, SST (2 req'd)	1A3303X0012

Type DVC5030 Digital Valve Controller on Other Actuators

	To replace Masoneilan positioners	
177	Emulator, steel	37B2821X012
178	Positioner Plate, steel	37B2819X012
179	Shaft Connector, pl stl	27B2804X012
180	Coupler, SST	17B2810X012
181	Connector Cap Ass'y, stl/SST	17B3929X012
182	Spacer, pl stl (3 req'd)	17B2806X012
184	Cap Screw, SST (3 req'd)	17B2807X012
185	Cap Screw, SST	17B2978X012
186	Cap Screw, SST (2 req'd)	1P714638992
187	Cap Screw, SST (4 req'd)	1A391738992
188	Machine Screw, SST (2 req'd)	17B2808X012
	To replace Neles-Jamesbury positioners	
177	Emulator, steel	37B2811X012
178	Positioner Plate, steel	37B2817X012
180	Coupler, SST	17B2810X012
182	Spacer, pl stl (3 req'd)	17B2814X012
184	Cap Screw, SST (3 req'd)	17B2815X012
187	Cap Screw, SST (4 req'd)	1A391738992
189	Cap Screw, SST (3 req'd)	1C2752X0042
190	Tie Bar Ass'y, SST	27B2816X012

Key	Description	Part Number
205	Screw, self-tapping, pl stl	12B6373X012
206	Pointer, nylon	22B6372X012
207	Scale, plastic	
	For clockwise rotation opens valve	27B3853X012
	For clockwise rotation closes valve	27B3854X012
	To replace PMV positioners	
177	Emulator, steel	37B2821X012
178	Positioner Plate, steel	37B2819X012
180	Coupler, SST	17B2810X012
182	Spacer, pl stl (3 req'd)	1R793424492
184	Cap Screw, SST (3 req'd)	17B2822X012
187	Cap Screw, SST (4 req'd)	1A391738992
189	Cap Screw, SST (2 req'd)	1C2752X0042
205	Screw, self-tapping, pl stl	12B6373X012
206	Pointer, nylon	22B6371X012
207	Scale, plastic	
	For clockwise rotation opens valve	27B3906X012
	For clockwise rotation closes valve	27B3907X012

Cam

	For DVC5020 only	
	For Type 1051, size 30-60 and 1052, size 40-70 actuators	
94	Cam, SST	33A1613X022
95	Mach Screw, hex hd, SST (2 req'd)	13A1618X022
	For Type 1052, size 20 actuators	
94	Cam, SST	36A4653X022
95	Mach Screw, hex hd, SST (2 req'd)	13A1617X022
	For Type 1051 and 1052, size 33 actuators	
94	Cam, SST	30B1529X022
95	Mach Screw, hex hd, SST (2 req'd)	13A1617X022

Filter Regulator Mounting Parts

	For use only when filter regulator is specified.	
	For Integral Mounting	
59	Cap Screw, hex hd, SST (2 req'd)	1C3988X0022
60*	O-Ring, nitrile	1E591406992
61	Pipe Plug, hex socket, SST	1C3335X0012
	For Casing Mounting	
61	Pipe Plug, hex socket, SST	1C3335X0012
69	Hex Nut, pl stl (2 req'd)	1A352724122
70	Cap Screw, hex hd, pl stl (2 req'd)	1C197024052
71	Mounting Bracket, pl stl	1F401225072
	For Yoke Mounting	
59	Cap Screw, hex hd, SST (2 req'd)	1C3988X0022
61	Pipe Plug, hex socket, SST	1C3335X0012
	For Wall Mounting	
161	Pipe Nipple, galv stl	1C678926232
	For Universal Mounting	
59	Cap Screw, hex hd, SST (2 req'd)	1C3988X0022
60*	O-Ring, nitrile	1E591406992
61	Pipe Plug, hex socket, SST	1C3335X0012
69	Hex Nut, pl stl (2 req'd)	1A352724122
70	Cap Screw, hex hd, pl stl (2 req'd)	1C197024052
71	Mounting Bracket	1F401225072
161	Pipe Nipple, galv stl	1C678926232

* Recommended spare

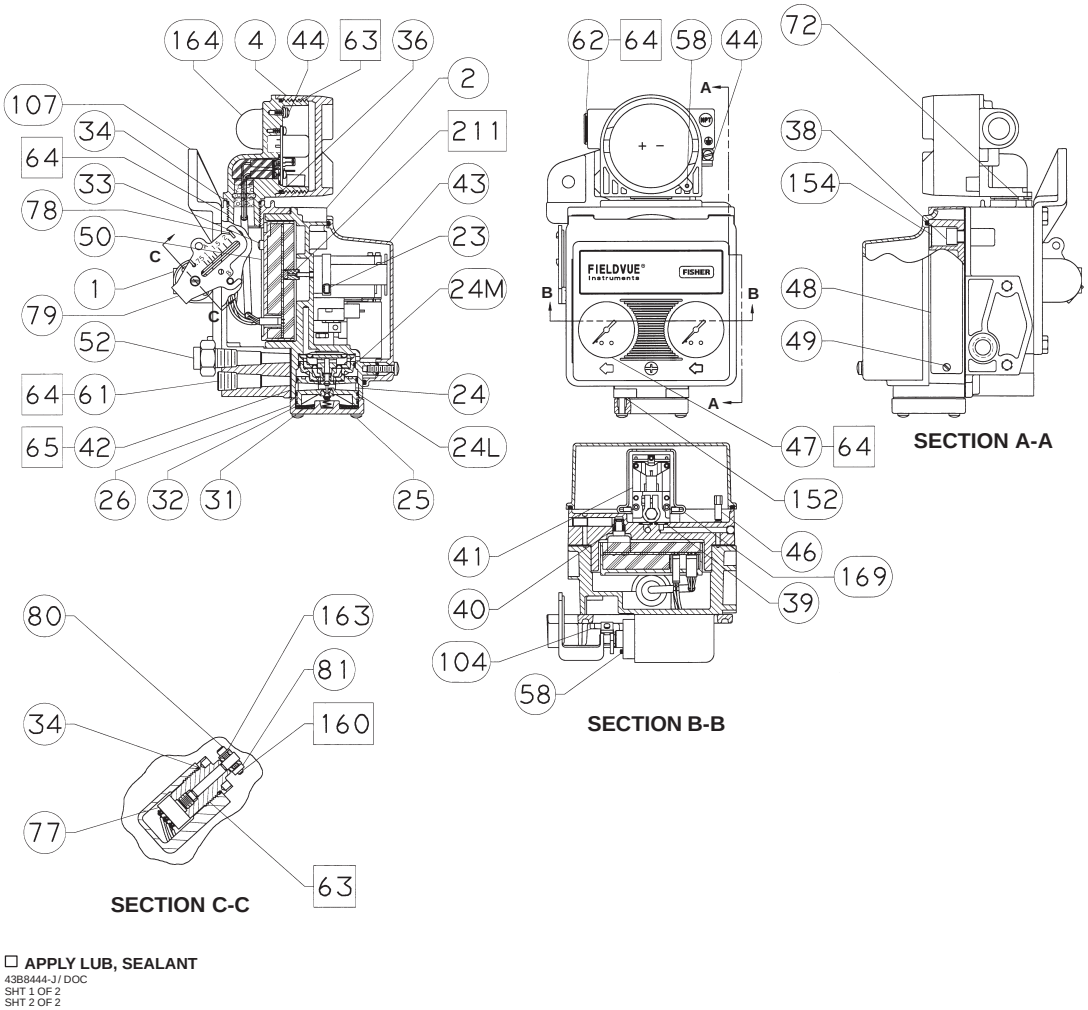


Figure 10-1. Type DVC5010 Digital Valve Controller Assembly

Key	Description	Part Number
	HART Filters	
	HF100, HART Filter	14B1934X012
	HF210, cage clamp, normal polarity	17B1181X012
	HF210, cage clamp, reverse polarity	17B1182X012
	HF220, screw terminal, normal polarity	17B1184X012
	HF220, screw terminal, reverse polarity	17B1185X012
	HF230, tiered terminal	17B1186X012
	HF240, DIN rail mount	17B1187X012
	HF240, DIN rail Mount, pass through (no filter)	17B1188X012

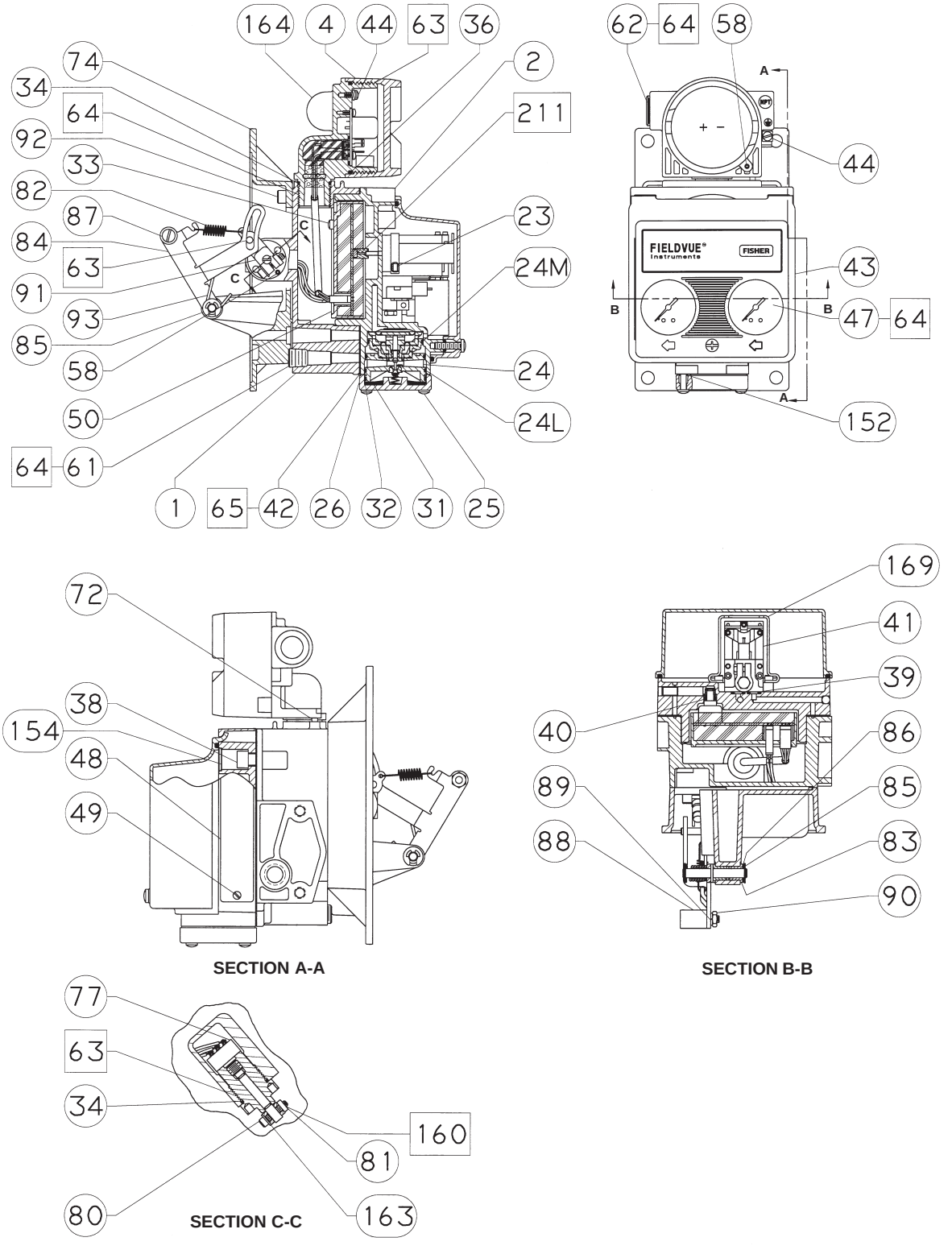


Figure 10-2. Type DVC5020 Digital Valve Controller Assembly

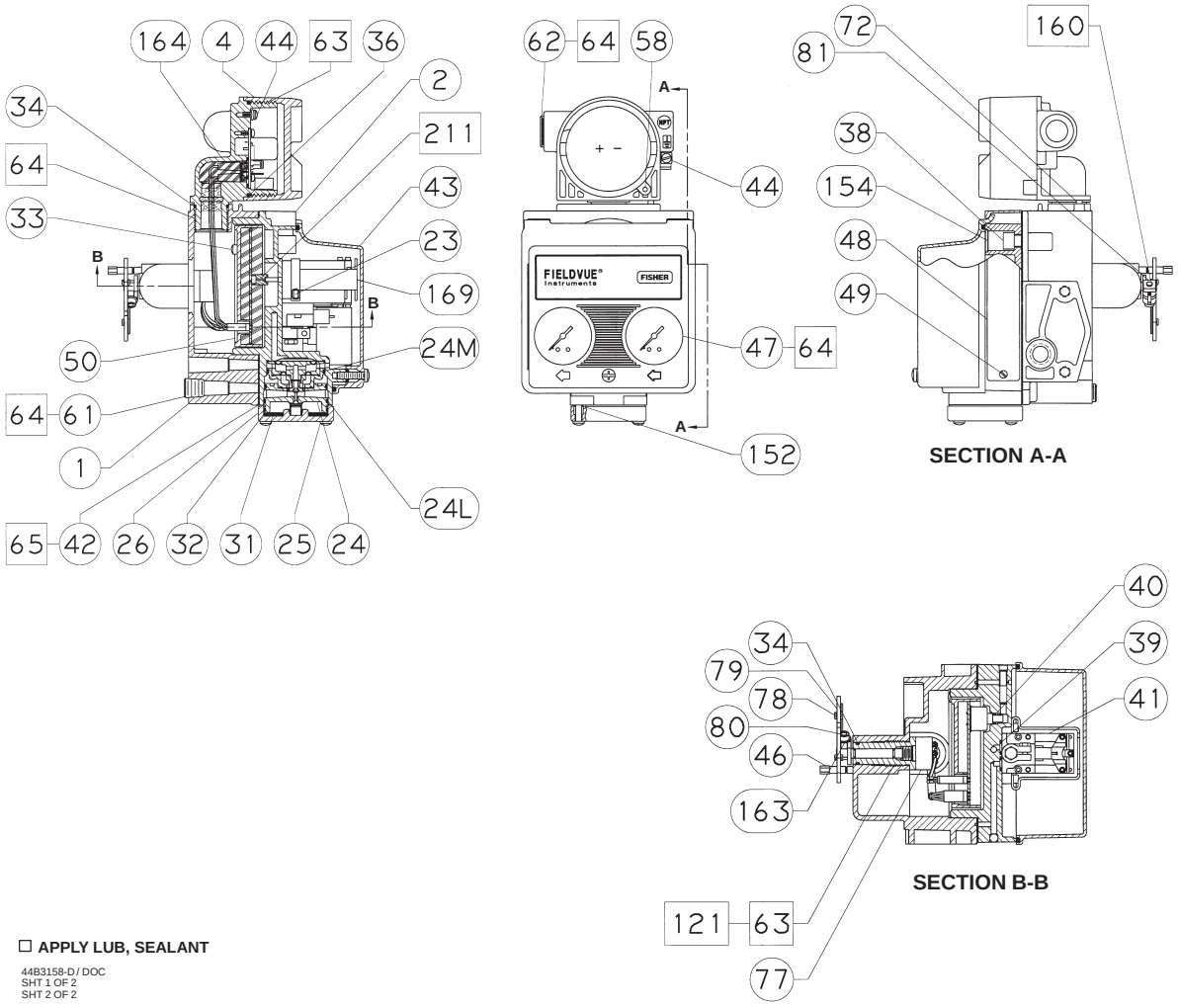


Figure 10-3. Type DVC5030 Digital Valve Controller Assembly

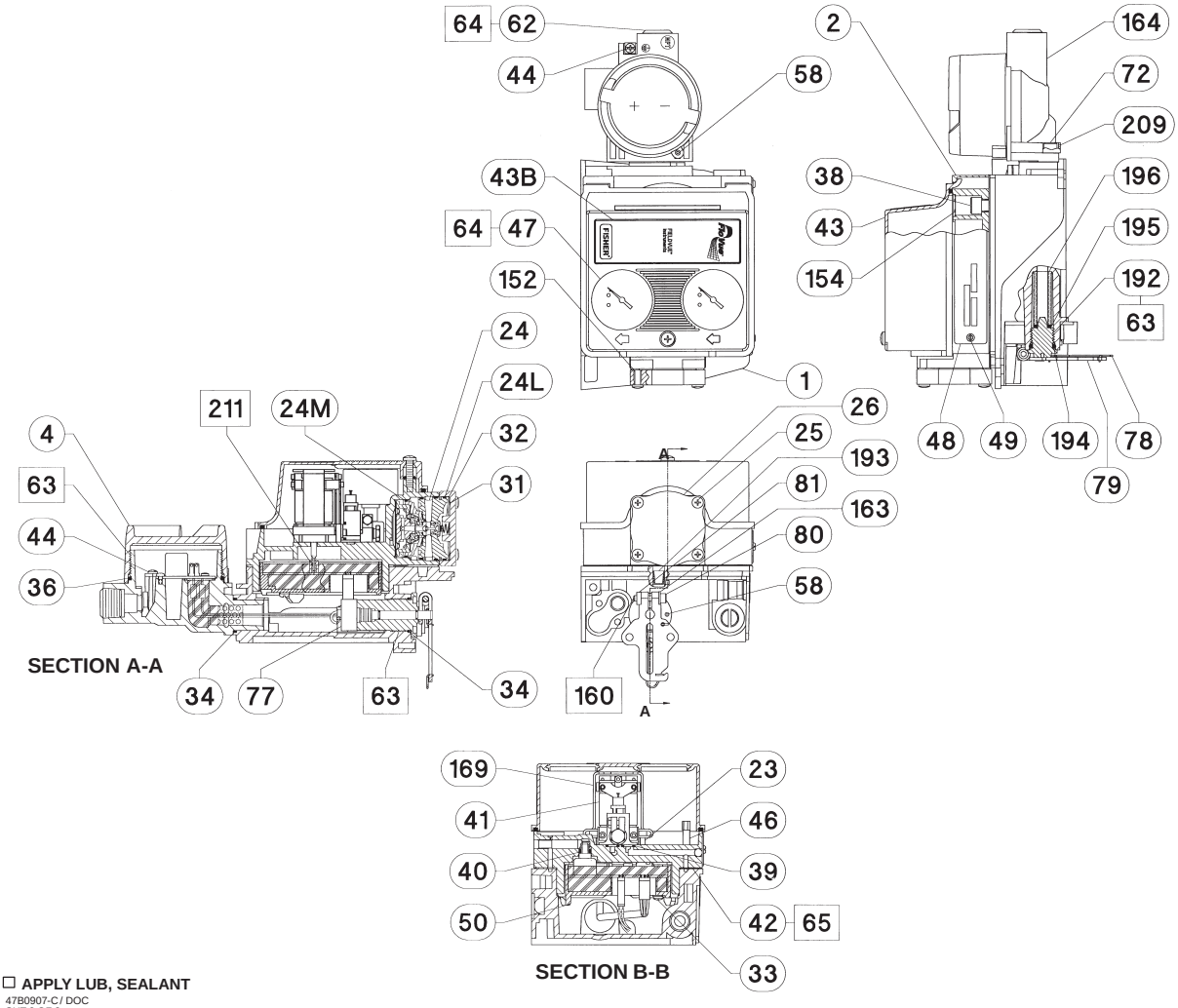


Figure 10-4. Type DVC5040 Digital Valve Controller Assembly

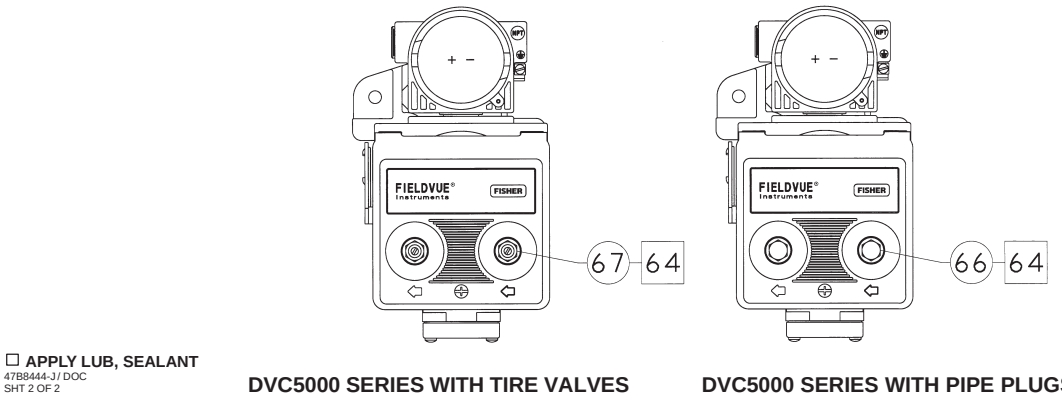


Figure 10-5. Typical DVC5000 Series Digital Valve Controller with Tire Valves and Pipe Plugs

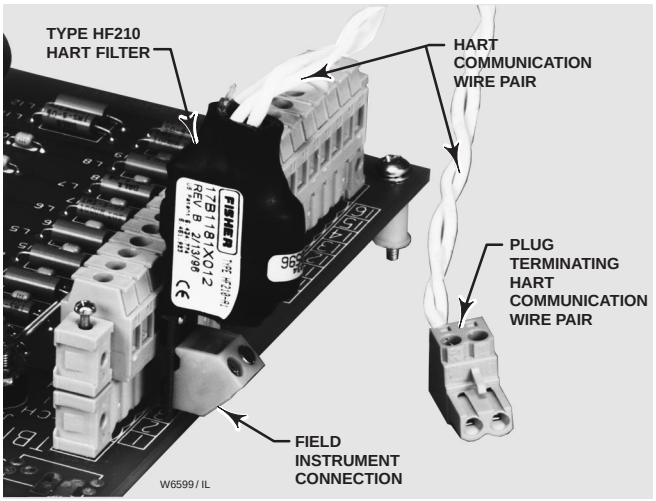


Figure 10-6. Type HF210 HART Filter Mounted on Control System Cage–Clamp Style Termination

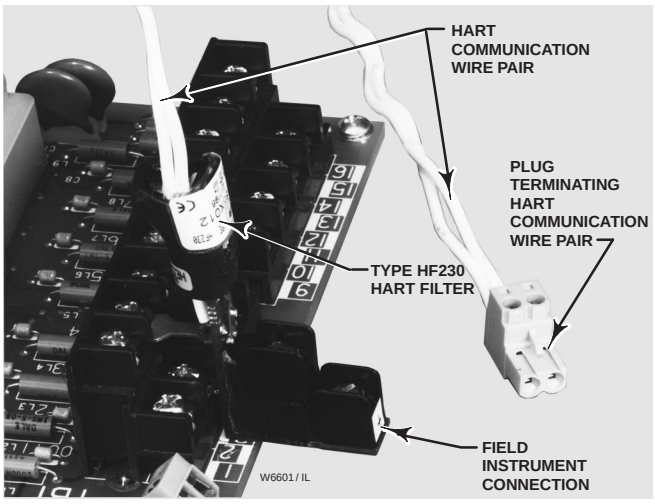


Figure 10-8. Type HF230 HART Filter Mounted on Control System Two–Tier–Screw–Terminal (Staggered) Termination

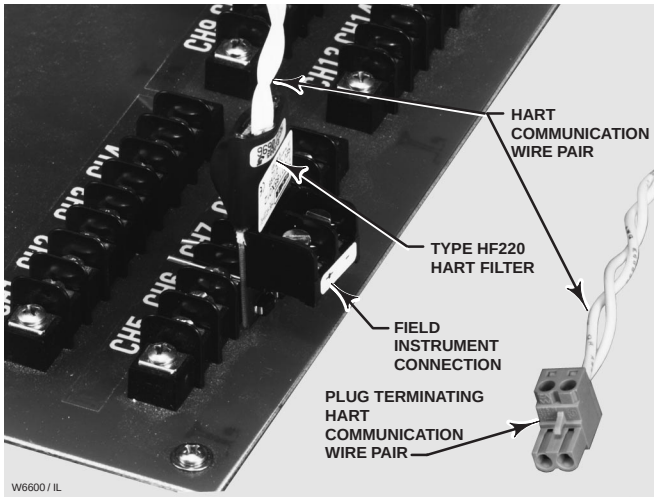


Figure 10-7. Type HF220 HART Filter Mounted on Control System Single–Row–Screw–Terminal Style Termination

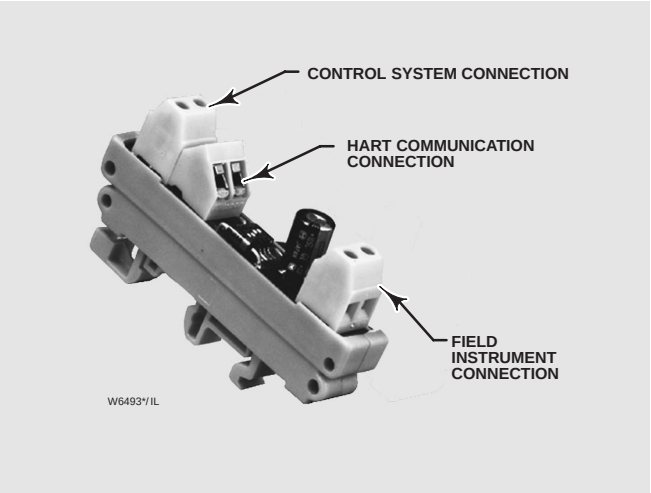


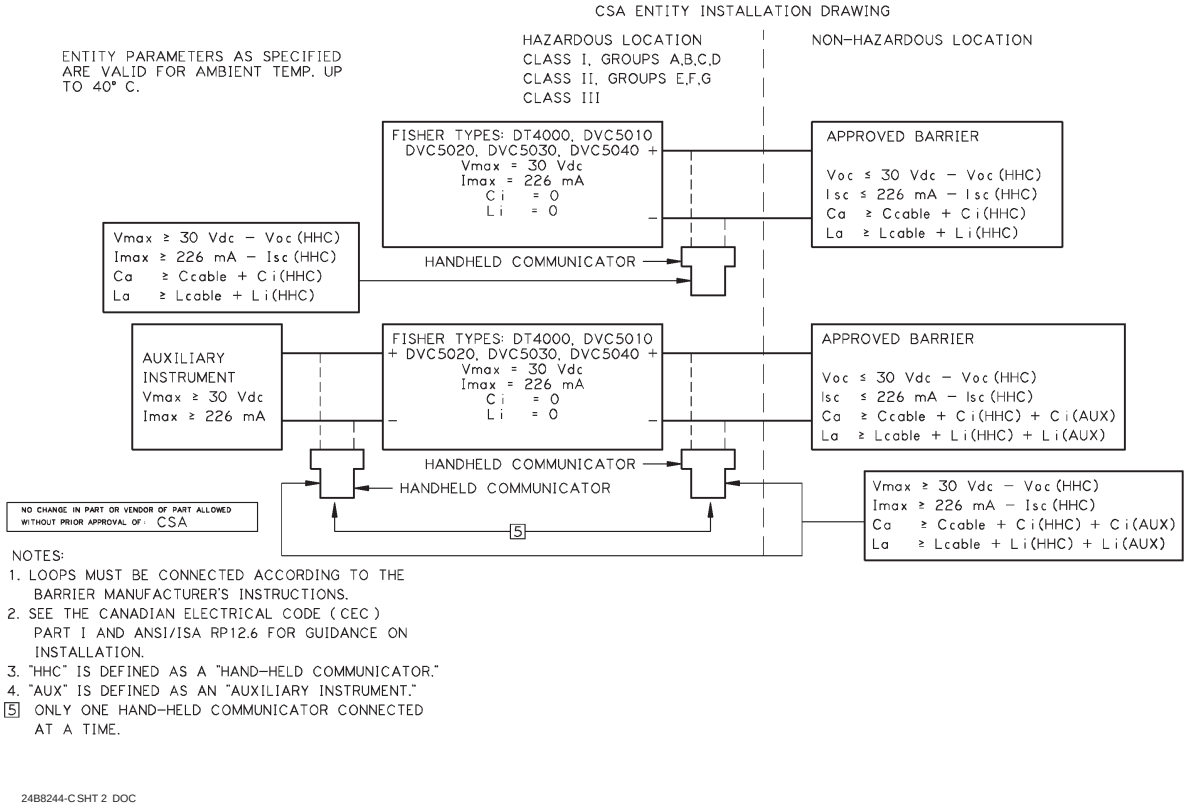
Figure 10-9. Type HF240 HART Filter (DIN Rail Mount)

10

Section 11 Loop Schematics

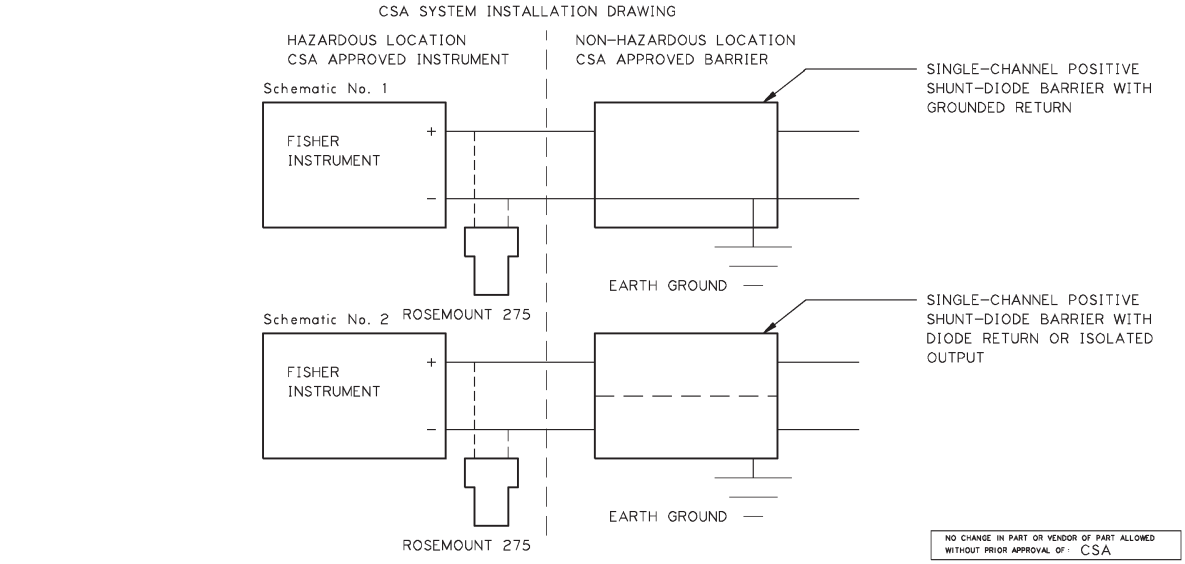
This section includes loop schematics required for wiring of intrinsically safe installations. If you have any questions, contact your Fisher Controls sales representative or sales office.

CSA Schematics



CSA Schematic Sheet 1

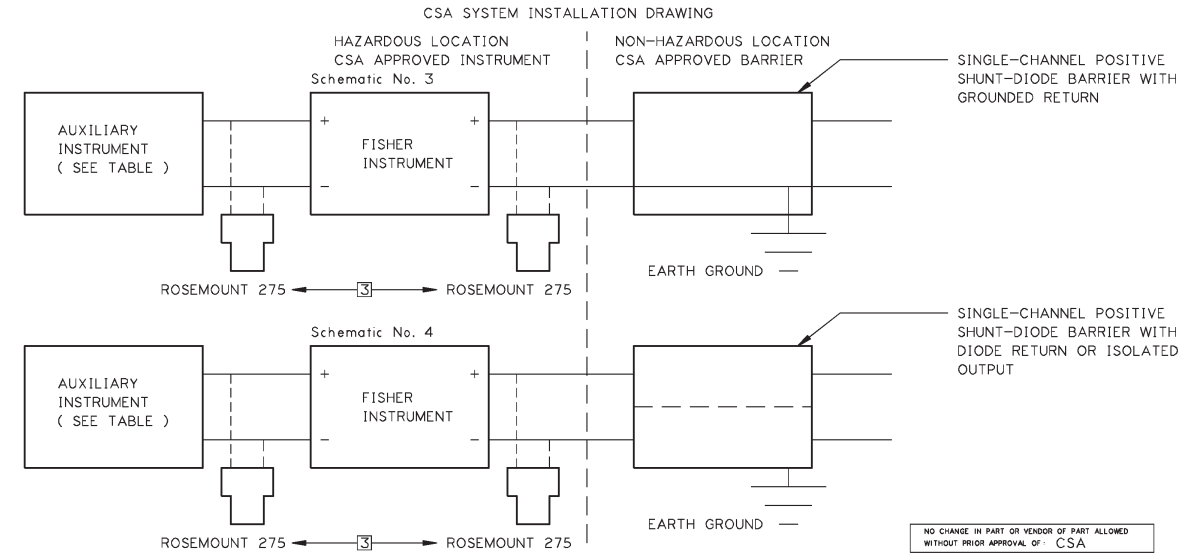
CSA Schematics (continued)



NOTES:
1. LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.
2. SEE THE CANADIAN ELECTRICAL CODE (CEC) PART I AND ANSI/ISA RP12.6 FOR GUIDANCE ON INSTALLATION.

24B8244-A SHT 3 / DOC

CSA Schematic Sheet 2



NOTES:
1. LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.
2. SEE ANSI/ISA RP12.6 FOR GUIDANCE ON INSTALLATION.
3. ONLY ONE HAND–HELD COMMUNICATOR CONNECTED AT A TIME.

24B8244-A SHT 4 / DOC

CSA Schematic Sheet 3

CSA Schematics (continued)

CSA PARAMETRIC RATINGS
FISHER TYPES DT4000, DVC5010, DVC5020, DVC5030, DVC5040

PARAMETERS FOR SCHEMATICS NO. 1 AND NO. 3

APPROVAL FOR CLASS I, DIV 1*	CSA APPROVED BARRIER PARAMETER
GROUPS A,B,C,D	30 V MAX, 330 OHM MIN 28 V MAX, 300 OHM MIN 25 V MAX, 200 OHM MIN 22 V MAX, 150 OHM MIN
GROUPS C,D	30 V MAX, 150 OHM MIN

PARAMETERS FOR APPROVED BARRIERS FOR SCHEMATICS NO. 1 AND NO. 3

BARRIER MFR.	BARRIER TYPE	APPLICABLE HAZARDOUS LOCATIONS*	CSA BARRIER RATING
MTL	722P **	CL 1, DIV 1, GP A,B,C,D	22 V, 101 OHM
	728P	CL 1, DIV 1, GP A,B,C,D	28 V, 234 OHM
	729P	CL 1, DIV 1, GP C,D	28 V, 164 OHM
STAHL	9001/01-280-110-10 **	CL 1, DIV 1, GP A,B,C,D	28 V, 280 OHM
	9001/01-280-165-10	CL 1, DIV 1, GP C,D	28 V, 180 OHM
ELCON	MODULE TYPE 126	CL 1, DIV 1, GP C,D	28 V, 148.5 OHM

PARAMETERS FOR SCHEMATICS NO. 2 AND NO. 4

APPROVAL FOR CLASS I, DIV 1*	CSA APPROVED BARRIER PARAMETER
GROUPS A,B,C,D	30 V MAX, 330 OHM MIN 28 V MAX, 300 OHM MIN 25 V MAX, 200 OHM MIN 22 V MAX, 150 OHM MIN
GROUPS C,D	30 V MAX, 150 OHM MIN

PARAMETERS FOR APPROVED BARRIERS FOR SCHEMATICS NO. 2 AND NO. 4

BARRIER MFR.	BARRIER TYPE	APPLICABLE HAZARDOUS LOCATIONS*	CSA BARRIER RATING
MTL	787SP	CL 1, DIV 1, GP A,B,C,D	28 V, 234 OHM/ 28 V (DIODE)
STAHL	9002/13-280-093-00	CL 1, DIV 1, GP A,B,C,D	28 V, 330 OHM/ 28 V (DIODE)
	9002/13-280-110-00 **	CL 1, DIV 1, GP A,B,C,D	28 V, 270 OHM/ 28 V (DIODE)
ELCON	MODULE TYPE 106 **	CL 1, DIV 1, GP A,B,C,D	29.4 V, 306 OHM

AUXILIARY INSTRUMENTS SCHEMATICS 3 AND 4
ROSEMOUNT SERIES 1151
ROSEMOUNT SERIES 3051C
ROSEMOUNT SERIES 2088
ROSEMOUNT SERIES 2024
ROSEMOUNT SERIES 3095
ROSEMOUNT SERIES 3044
ROSEMOUNT SERIES 3144
ROSEMOUNT SERIES 8712
ROSEMOUNT SERIES 8722
ROSEMOUNT SERIES 8800
ROSEMOUNT SERIES 3001

* ALSO APPLICABLE FOR CLASS II, DIV 1, GROUPS E,F,G WITH APPROPRIATE INSTRUMENT AND BARRIER APPROVAL.
** NOT FOR USE WITH AUXILIARY INSTRUMENTS.

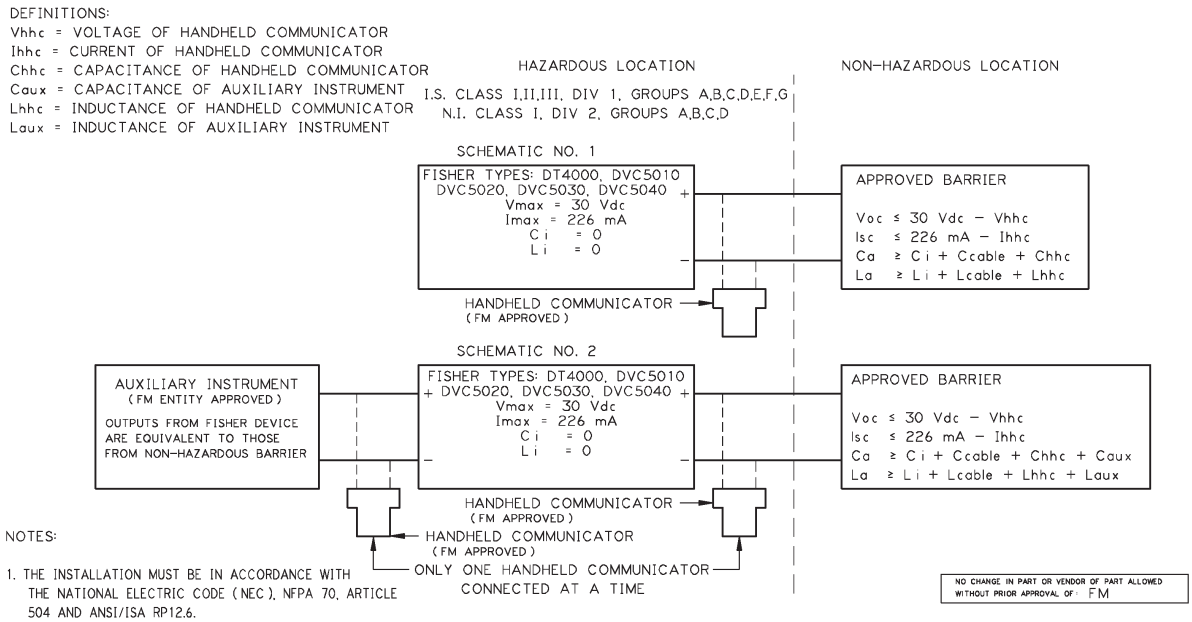
NO CHANGE IN PART OR VENDOR OF PART ALLOWED WITHOUT PRIOR APPROVAL OF: CSA

24B8244-B SHT 5 / DOC

CSA Schematic Sheet 4

11

FM Schematics



NOTES:

1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), NFPA 70, ARTICLE 504 AND ANSI/ISA RP12.6.
2. CLASS 1, DIV 2 APPLICATIONS MUST BE INSTALLED AS SPECIFIED IN NEC ARTICLE 501-4(B) WHEN BARRIERS ARE NOT USED.
3. LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.
4. MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 Vrms.
5. RESISTANCE BETWEEN BARRIER GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM.
6. NORMAL OPERATING CONDITIONS 30 Vdc 20 mADC.

24B8243-B SHT 1 OF 2 / DOC

FM Schematic Sheet 1

DEFINITIONS:
Vhhc = VOLTAGE OF HANDHELD COMMUNICATOR
Ihhc = CURRENT OF HANDHELD COMMUNICATOR
Chhc = CAPACITANCE OF HANDHELD COMMUNICATOR
Caux = CAPACITANCE OF AUXILIARY INSTRUMENT
Lhhc = INDUCTANCE OF HANDHELD COMMUNICATOR
Laux = INDUCTANCE OF AUXILIARY INSTRUMENT

For Schematic No. 1: Max Ccable = Ca – Chhc
Max Lcable is determined by the sum of Isc (barrier) + Isc (hhc) according to Table A

For Schematic No. 2: Max Ccable + Caux = Ca – Chhc
Max Lcable + Laux is determined by the sum of Isc (barrier) + Isc (hhc) according to Table A

Table A

Combined Isc (Barrier + hhc) (mA)	Group	Allowable System L (mH)
≤ 226	A,B	0.4
	C	3.7
	D	5.5
≤ 200	A,B	0.5
	C	4.0
	D	7.0
≤ 175	A,B	0.6
	C	5.0
	D	9.5
≤ 150	A,B	1.3
	C	7.0
	D	13
≤ 125	A,B	2.0
	C	9.0
	D	18

NOTES:

1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), NFPA 70, ARTICLE 504 AND ANSI/ISA RP12.6.
2. CLASS 1, DIV 2 APPLICATIONS MUST BE INSTALLED AS SPECIFIED IN NEC ARTICLE 501-4(B) WHEN BARRIERS ARE NOT USED.
3. LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.
4. MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 Vrms.
5. RESISTANCE BETWEEN BARRIER GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM.
6. NORMAL OPERATING CONDITIONS 30 Vdc 20 mADC.

NO CHANGE IN PART OR VENDOR OF PART ALLOWED
WITHOUT PRIOR APPROVAL OF FM

24B8243-B SHT 2 OF 2 / DOC

FM Schematic Sheet 2

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 closed (shorted).

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). Usually 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:
RSP (Remote Set Point) The instrument receives its travel set point over the 4–20 mA loop. COM and SUPV work the same.
COM Computer
SUPV Supervisory
AUTO (Automatic) The instrument receives its set point digitally, via the HART communications link.
MAN (Manual)
DDC (Direct Digital Control) The instrument receives its set point digitally, via the HART communications link.

Control Mode, Restart
Determines the instrument control mode after a restart. See Control Mode for the available restart control modes.

Controller
A device that operates automatically to regulate a controlled variable.

Crossover Point
The mid-point of the stroking range of a sliding-stem actuator. A visual indication of the crossover point is found when the slot in the instrument feedback arm forms a 90-degree angle with the valve stem.

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.

Drive Signal
The signal to the I/P converter from the printed wiring board. It is the percentage of the total microprocessor effort needed to drive the valve fully open. In most applications, drive signal ranges from 55% to 75% in the active travel range. The drive signal may be higher or lower at the travel end points.

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 Control Signal = Closed

The alert is active when:

drive signal <10% and calibrated travel >3%

drive signal >90% and calibrated travel <97%

If Zero Control Signal = 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.

Factory Instrument Serial Number
The serial number assigned to the printed wiring board by the factory that cannot be changed.

Feedback Arm
The mechanical connection between the valve stem linkage and the FIELDVUE Instrument travel sensor.

Feedback Characteristic
Identifies to the FIELDVUE Instrument if the feedback signal is coming from a rotary or sliding-stem valve.

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.

Field Instrument Serial Number
The serial number assigned to the printed wiring board by the factory but can be changed during setup. The field instrument serial number should match the serial number on the instrument nameplate.

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 Filter Time
The time constant, in seconds, for the first-order input filter.

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 7-1, page 7-3.

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 three types of instrument protection:
Configuration and Calibration: Prohibits changing protected setup parameters; prohibits calibration.
Configuration: Prohibits changing protected setup parameters; permits calibration.
None: Permits both configuration and calibration. The instrument is ”unprotected.”

Interface Revision

Revision number of the interface software that permits communication between the HART Communicator and the instrument.

Invert Feedback

Establishes feedback orientation. While viewing the end of the travel sensor shaft, if increasing air pressure to the actuator causes the shaft to rotate clockwise, invert feedback is YES. If increasing air pressure causes the shaft to rotate counterclockwise, invert feedback is NO.

Leak Class

Defines the allowable leakage by a valve when it is closed. Leak class numbers are listed in two standards: ANSI/FCI 70-2-1991 and IEC 534-4 (1986).

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. To deactivate, enter 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. To deactivate, enter 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 the output pressure from the pneumatic relay.

Primary Master
Masters are communicating devices. A primary master is a communicating device permanently wired to a field instrument. Typically, a computer running ValveLink VL2000 Series software is the primary master.

In contrast, a secondary master is not often permanently wired to a field instrument. The Model 275 HART 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.

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 Alert High and Low 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. Two travel alerts are available: Travel Alert 1 and Travel Alert 2.

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 High 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 Low alert. Valid entries are –25% to 125%.

Travel Cutoff
Defines the cutoff point for the travel, in percent of ranged travel. There are two travel cutoffs: high and low. Once travel exceeds the cutoff, the drive signal is set to either maximum or minimum, depending on the 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 closed 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.

Tuning
The adjustment of control terms or parameter values to produce a desired control effect.

Tuning Set
Preset values that identify gain and rate settings for a FIELDVUE instrument. The tuning set and supply pressure together determine an instrument’s response to input signal changes.

Watch Dog Timer

A timer that the microprocessor must recycle periodically. If the microprocessor is unable to recycle the timer, the instrument shuts down.

Zero Control Signal

A setup parameter that determines whether the valve is fully open or fully closed when the input signal is 0%.

Notes

Index

A

B

C

D

F

G

H

I

L

M

O

P

R

S

T

V

W

Z

This product may be covered by one or more of the following patents (5,451,923; 5,434,774; 5,439,021; 5,265,637) or under pending patent applications.

CE Fisher-Rosemount satisfies all obligations coming from legislation to harmonise product requirements in the European Union.

For information, contact Fisher Controls:
Marshalltown, Iowa 50158 USA
Cernay 68700 France
Sao Paulo 05424 Brazil
Singapore 128461

FISHER®

Printed in U.S.A. PRINTED WITH SOY INK recycled paper

FISHER-ROSEMOUNT™ Managing The Process Better.™