



Western Water Constructors, Inc.
Submittal Cover

Job no. 16-05



CONTRACT NAME: Manteca WQCF Digester Improvements **SUB #:** 179
SPEC SECTION: 15521 Hot Water System Components **REV #:** 0
SUBMITTAL TITLE: 3-Way Valve Assembly O&M **CODE:** 15521-03
FILE NAME: 179-R0_15521-03_3-Way Valve Assembly-OM **DATE:** 9/11/2017

WWC REVIEW/COMMENTS: ☒ **NO EXCEPTIONS** ☐ **EXCEPTIONS / DEVIATIONS AS NOTED**

REVIEWED BY: ST

SIGNED: Katie

WWC HAS REVIEWED THIS SUBMITTAL FOR CONFORMANCE WITH THE PROJECT PLANS & SPECIFICATIONS.

OWNER REVIEW:

ITEM	DESCRIPTION	REVIEW STATUS				
		A	B	C	D	E
1	Instruction Manual: 3-Way Valves	☐	☐	☐	☐	☐
2	Instruction Manual: Diaphragm Actuator	☐	☐	☐	☐	☐
3	Instruction Manual: Digital Valve Controller	☐	☐	☐	☐	☐
4		☐	☐	☐	☐	☐
5		☐	☐	☐	☐	☐

LEGEND: **A** = No Exceptions Taken **B** = Make Correction Noted **C** = Correct & Resubmit
D = Rejected **E** = Accepted for Record

OWNER COMMENTS:

REVIEWER'S NAME: _____

REVIEWER'S SIGNATURE: _____ **DATE:** _____

EQUIPMENT SUMMARY FORM

1. EQUIPMENT ITEM YD3-Way Valve Assembly
2. MANUFACTURER Fisher
3. EQUIPMENT IDENTIFICATION NUMBER(S) Valve: YD-82-103647, Actuator: 667-39-3862149,
(maps equipment number) Positioner: DVC-3793-4346221
4. LOCATION OF EQUIPMENT Unknown
5. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) Valve, 150#s
6. NAMEPLATE DATA - Horsepower N/A
Amperage
Voltage
Service Factor (S.F.)
Speed
ENC Type
Capacity
Other
7. MANUFACTURER'S LOCAL REPRESENTATIVE
Name Caltrol
Address 1385 Pama Ln. Suite 111, Las Vegas NV 89119
Telephone
Number 702-966-1826
8. MAINTENANCE REQUIREMENTS None
9. LUBRICANT LIST None
10. SPARE PARTS (recommendations) See next page.
11. COMMENTS

10. Spare Parts:

Valve:

1	10A3442X012	20A	SEAL RING
1	10A3443X072	20B	RING,BACK-UP
1	10A3446X012	8	SEAT RING,BOTTOM
1	20A3422X102	K	PLUG/STEM,BAL
1	20A3431X012	3A	CAGE,UPPER,LINEAR
1	20A3434X012	4	CAGE,LOWER,LINEAR
1	RGASKETXB82	K	GASKET SET
1	RPACKX00022	K	KIT,REPAIR

Actuator:

1	1E845714012	7	BUSHING,SEAL
1	2E859602202	3	DIAPHRAGM
1	R667X000502	K	KIT,REPAIR

Fisher™ YD and YS 3-Way Valves

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Figure 1. Fisher YD Valve with 667 Actuator



W2081

Introduction

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 1/2 through 8 YD and NPS 1/2 through 6 YS control valves. Refer to separate manuals for instructions covering the actuators and accessories.

Do not install, operate, or maintain YD or YS valves without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Table 1. Specifications

Valve Sizes, Ratings, and End Connections^(1,2) Cast Iron Valves <i>Flanged:</i> NPS 1-1/2 through 6 CL125 flat-face or CL250 raised-face flanges per ASME B16.1 <i>Screwed:</i> NPS 1-1/2 and 2 consistent with ASME B16.4 Steel and Stainless Steel Valves <i>Flanged:</i> NPS 1 through 8 CL150, 300, and 600 raised-face or ring-type joint flanges per ASME B16.5 <i>Screwed or Socket Welding:</i> NPS 1/2 through 2 consistent with ASME B16.11 <i>Buttwelding:</i> NPS 1 through 8. All available ASME B16.25 schedules that are consistent with ASME B16.34 Also see table 2 Maximum Inlet Pressure⁽¹⁾ Cast Iron Valves <i>Flanged:</i> Consistent with CL125B or 250B per ASME B16.1 <i>Screwed:</i> Consistent with CL250 per ASME B16.4 WCC and Stainless Steel Valves <i>Flanged:</i> Consistent with CL150, 300, and 600⁽³⁾ per ASME B16.34 <i>Screwed or Welding:</i> Consistent with flanged CL600 per ASME B16.34	Do not exceed the pressure, temperature, and pressure drop conditions specified when the valve was ordered. See the Installation section for additional information. Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4 YD <i>Standard Design:</i> Class IV <i>High-Temperature Design:</i> Class II YS <i>Standard Class:</i> Class IV <i>Optional Class:</i> Class V Flow Characteristic Linear Approximate Shipping Weights NPS 1/2, 3/4 Valves: 14 kg (30 pounds) NPS 1 Valves: 18 kg (40 pounds) NPS 1-1/2 Valves: 27 kg (60 pounds) NPS 2 Valves: 39 kg (85 pounds) NPS 2-1/2 Valves: 50 kg (110 pounds) NPS 3 Valves: 68 kg (150 pounds) NPS 4 Valves: 109 kg (240 pounds) NPS 6 Valves: 227 kg (500 pounds) NPS 8 Valves: 447 kg (985 pounds)
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1. EN (or other) ratings and end connections can usually be supplied; consult your [Emerson sales office](#) or Local Business Partner.

2. The pressure or temperature limits in this manual, and any applicable standard limitations, should not be exceeded.

3. Certain bonnet bolting material selections may require a CL600 easy-e valve assembly to be derated. Contact your Emerson sales office or Local Business Partner.

Description

The YD and YS valves are three-way valves for throttling or on-off (flow switching) service with converging (flow mixing) or diverging (flow splitting) flow patterns. YS valves, when used in diverging service, are recommended for on-off applications only. These valves are generally shipped as part of a control valve assembly, having a diaphragm, piston, or manual actuator mounted on them. A typical construction is shown in figure 1.

Specifications

Specifications for the YD and YS valves are shown in table 1. Some specifications appear on the actuator nameplate if the valve is part of a complete control valve assembly.

Educational Services

For information on available courses for Fisher YD and YS valves, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure might result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.

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

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your [Emerson sales office](#) or Local Business Partner.

Before installing the valve, inspect the valve and pipelines for any damage and any foreign material which may cause product damage.

1. Before installing the valve, inspect it for any shipping damage and for any foreign material in the valve body cavity.
2. Clean out all pipelines to remove pipe scale, chips, welding slag, and other foreign materials.
3. Use accepted piping and welding practices when installing the valve. For flanged valves, use suitable gaskets between the valve and the pipeline flanges.
4. Do not install the valve in a system where the working pressures exceed those specified in the ASME pressure/temperature ratings or those specified by Emerson Automation Solutions.
5. If continuous operation is required during maintenance and inspection, install a conventional three-valve bypass around the valve so that the valve can be isolated.
6. Orient the valve so that flow will be in the direction indicated by the flow arrows.

Note

The common port for the YD is the bottom port as shown on the flow direction plates (key 17) in figure 10. The common port for the YS is the left-hand port as shown on the flow direction plates in figure 9.

CAUTION

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Threaded connections may also loosen. In general, if post weld

heat treating is to be performed, all trim parts should be removed. Contact your [Emerson sales office](#) or Local Business Partner for additional information.

7. YD or YS control valves can be installed in any position, although the recommended position is with the actuator vertical above the valve. For NPS 4 and 6 YS valves, size 80 or larger actuators mounted between 45 degrees above and 45 degrees below horizontal should be supported. If forces other than normal gravitational forces are experienced, such as vibrational forces, smaller size actuators might also need to be supported when they are not in a vertical position. For further information, consult your Emerson sales office or Local Business Partner.

Table 2. Valve Body Sizes and End Connections

VALVES SIZE, NPS	CAST IRON VALVES	STEEL OR STAINLESS STEEL VALVES
1/2, 3/4	---	NPT screwed or socket weld
1	---	NPT screwed; CL150, 300, or 600 raised-face or ring-type joint flanged; butt welding; or socket weld
1-1/2, 2	NPT screwed; CL125 flat-face flanged; or CL250 raised-face flanged	NPT screwed; CL150, 300, or 600 raised-face or ring-type joint flanged; butt welding; or socket weld
2-1/2, 3, 4, 6	CL125 flat-face or CL250 raised-face flanged	CL150, 300, or 600 raised face or ring-type joint flanged; or butt welding
8	---	CL150, 300, or 600 raised face, ring-type joint, or butt welding

WARNING

Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Valves with ENVIRO-SEAL live-loaded packing or HIGH-SEAL live-loaded packing will not require this initial re-adjustment. See the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves or HIGH-SEAL Live-Loaded Packing System (as appropriate) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the parts kit subsection near the end of this manual.

Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for trim maintenance, packing maintenance, and ENVIRO-SEAL bellows seal bonnet replacement. All maintenance operations may be performed with the valve in the line.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- 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.

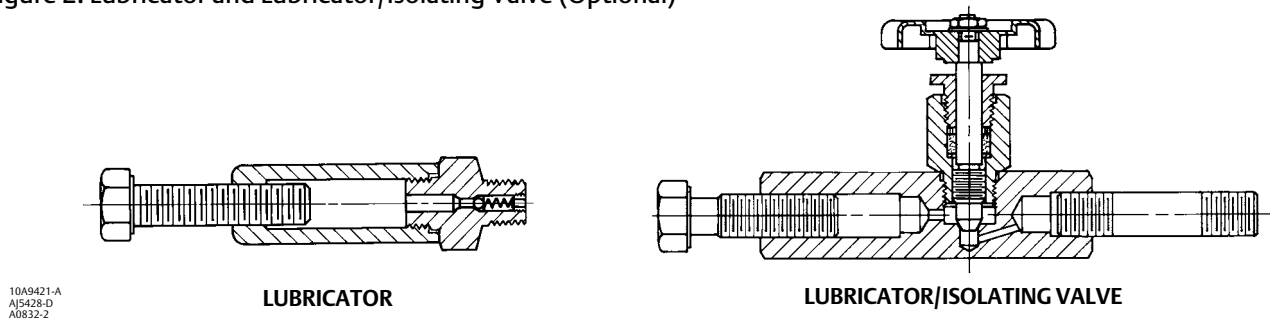
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.
- Vent the power actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

CAUTION

Follow instructions carefully to avoid damaging the product surfaces, which could result in damage to the product.

Packing Lubrication

Figure 2. Lubricator and Lubricator/Isolating Valve (Optional)



Note

ENVIRO-SEAL and HIGH-SEAL packing do not require lubrication.

⚠ WARNING

To avoid personal injury or property damage resulting from fire or explosion, do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F).

If a lubricator or lubricator/isolating valve (figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in place of the pipe plug (key 14, figure 13). Use a good quality silicon-base lubricant. Do not lubricate packing used in oxygen service or in processes with temperatures over 260°C (500°F). To operate the lubricator, simply turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve operates the same way except open the isolating valve before turning the cap screw and then close the isolating valve after lubrication is completed.

Packing Maintenance

Note

For valves with ENVIRO-SEAL packing, see the Fisher instruction manual ENVIRO-SEAL Packing System for Sliding-Stem Valves for packing instructions.

For valves with HIGH-SEAL packing, see the Fisher instruction manual HIGH-SEAL Live-Loaded Packing System for packing instructions.

Packing Replacement

⚠ WARNING

Observe the warning at the start of the Maintenance section.

Table 3. Recommended Torque for Packing Flange Nuts

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE TYPE PACKING				PTFE TYPE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
mm	Inches		N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in
9.5	3/8	CL125, 150	3	27	5	40	1	13	2	19
		CL250, 300	4	36	6	53	2	17	3	26
		CL600	6	49	8	73	3	23	4	35
12.7	1/2	CL125, 150	5	44	8	66	2	21	4	31
		CL250, 300	7	59	10	88	3	28	5	42
		CL600	9	81	14	122	4	39	7	58
19.1	3/4	CL125, 150	11	99	17	149	5	47	8	70
		CL250, 300	15	133	23	199	7	64	11	95
		CL600	21	182	31	274	10	87	15	131
25.4	1	CL300	26	226	38	339	12	108	18	162
		CL600	35	310	53	466	17	149	25	223
31.8	1-1/4	CL300	36	318	54	477	17	152	26	228
		CL600	49	437	74	655	24	209	36	314

The following procedure covers PTFE V-ring packing. A similar procedure can be followed for PTFE/composition packing. However, because PTFE/composition packing comes in split rings, it is possible to replace the rings without removing the actuator from the valve.

Installation of graphite ribbon/filament packing requires special care to avoid trapping air between the rings. Start only one ring at a time without forcing the top of the packing ring below the bottom of the entrance chamfer of the packing box. Thus, when a ring is added, the stack should not be pushed into the cavity more than the thickness of the added ring.

The arrangement of packing box parts is shown in figures 3, 4, 5, 6, and 7. Key numbers used in the following steps are shown in figures 13 and 14.

1. Remove the actuator and bonnet according to steps 1 through 4 of the Disassembly procedure in the Maintenance section on page 7.
2. With the stem and valve plug assembly removed from the bonnet, remove the packing nuts (key 5), packing flange (key 3), wiper ring (key 12), and packing follower (key 13) from the bonnet. The old packing can then be pulled out with a packing hook (take care to avoid scratching the packing box wall) or pushed out using a rod inserted through the bottom of the bonnet.
3. Clean the packing box and all metal parts.
4. Complete maintenance necessary on other parts and install the bonnet on the valve as indicated in the Assembly section (starting on page 12).
5. Install the new packing and associated parts in the sequence shown in figures 3, 4, 5, 6, and 7. Be careful not to damage the packing during installation.
6. Replace the packing flange and packing flange nuts.

For spring-loaded PTFE V-ring packing, tighten the packing flange nuts until the shoulder on the packing follower contacts the bonnet.

For graphite packing, tighten the packing flange nuts to the maximum recommended torque shown in table 3. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 3.

For other packing types, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 3. Then, tighten the remaining flange nut until the packing flange is level and at a 90-degree angle to the valve stem.

For ENVIRO-SEAL or HIGH-SEAL live-loaded packing, refer to the note at the beginning of the Packing Maintenance section.

7. Mount the actuator on the bonnet and make up the stem connection according to the procedure given in the appropriate actuator instruction manual.

Trim Maintenance

⚠ WARNING

Observe the warning at the start of the Maintenance section.

CAUTION

To avoid damaging parts, do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

Key numbers in the following procedures are shown in figure 10 for standard YD, in figure 11 for high-temperature YD, and in figure 9 for YS, except where indicated.

Disassembly

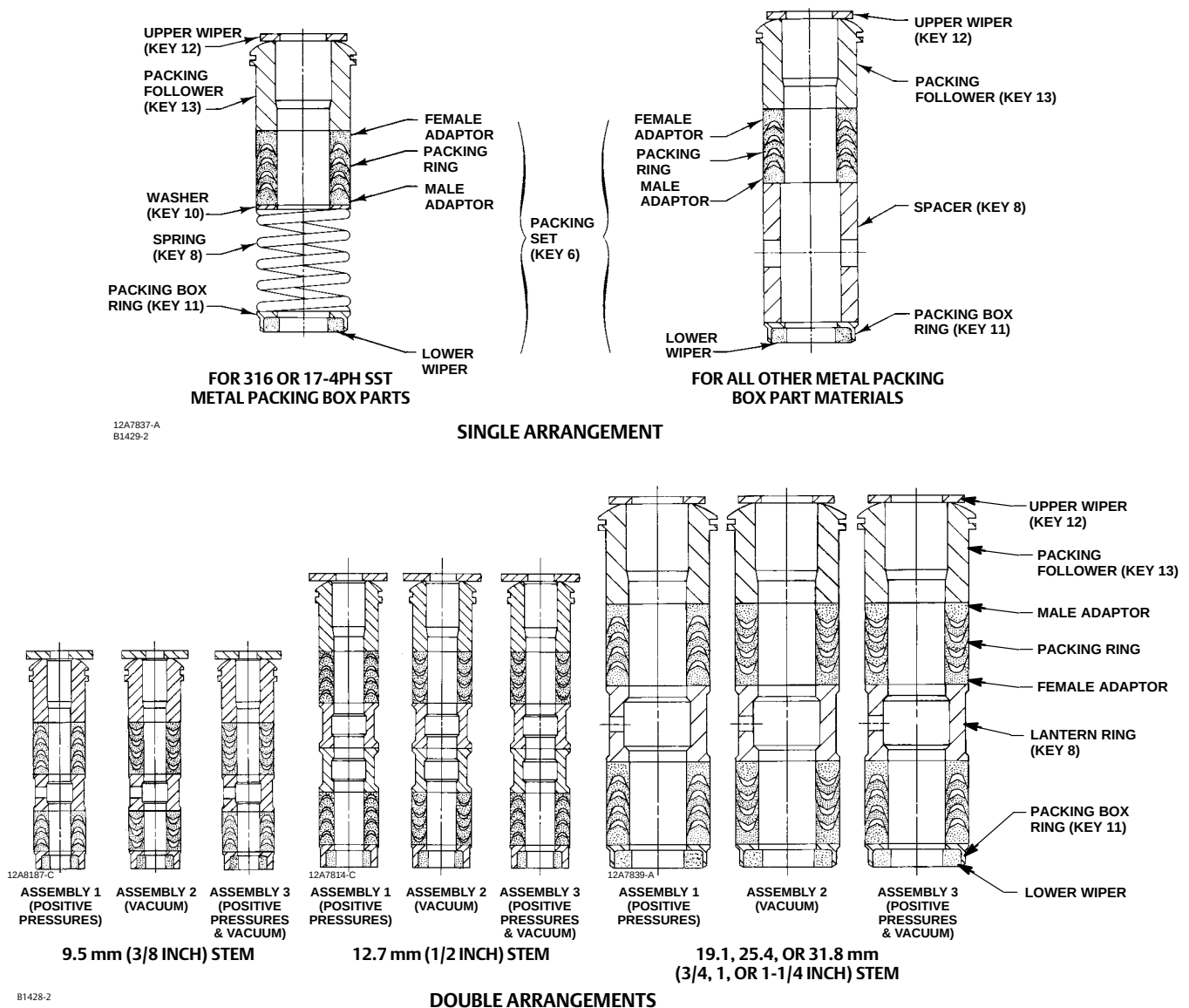
1. Isolate the control valve from the line pressure, release pressure from both sides of the valve, and drain the process media from both sides of the valve. Remove actuator supply pressure, and use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

⚠ WARNING

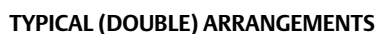
See the **WARNING** at the beginning of the Maintenance section for more information.

2. Disconnect the actuator stem connector and remove the locknut (key 15, figure 13) that holds the actuator to the valve. (Valves with a 127 mm (5-inch) yoke boss use cap screws and nuts to secure the actuator on the valve). Then lift the actuator from the valve.

Figure 3. Fisher PTFE V-Ring Packing Arrangements



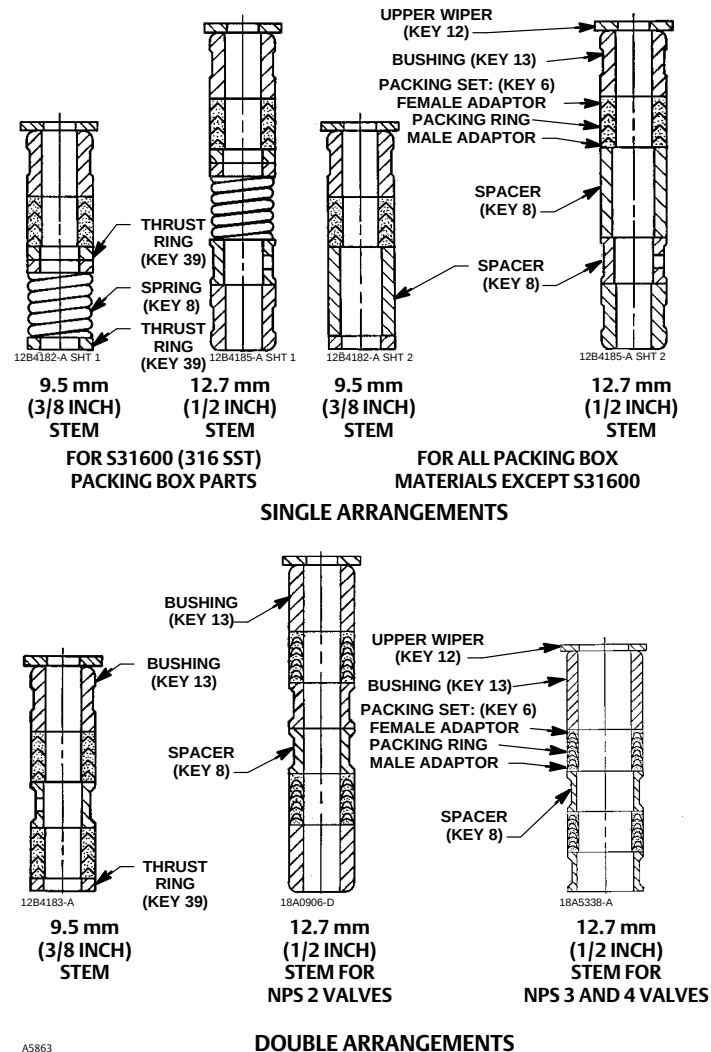
UPPER WIPER



NOTE:

- 1 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS. USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.
- 2 HAS THE APPEARANCE OF A WOVEN OR BRAIDED RING.

Figure 6. PTFE Packing Arrangements for Use in Fisher ENVIRO-SEAL Bellows Seal Bonnets

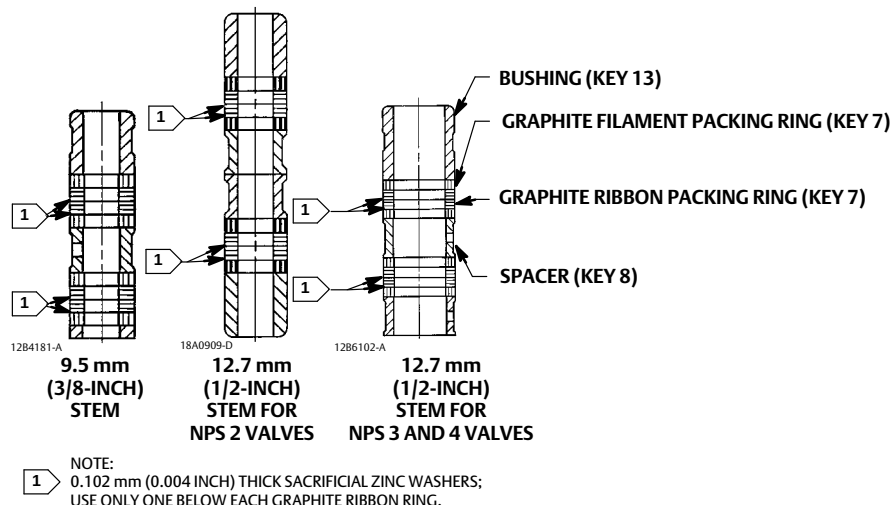


- Remove the nuts (key 16, figures 9 and 10) or cap screws from the bonnet flange.
- Lift off the bonnet along with the valve plug and stem (keys 2 and 5, figures 9 and 10). Due to the design of the valve, several other trim parts will be drawn out with the valve plug. They are as follows:
 YD (Standard)--The upper cage (key 3A) and associated seals, gaskets, and shim (keys 9, 11, 19, 20A, 20B, and 22).
 YD (High Temperature)--The upper cage (key 3B) and associated gaskets and shim (keys 9, 11, and 22).
 YS--The upper seat (key 7), upper cage (key 3), and associated gaskets and shim (keys 9, 11, and 22).

CAUTION

The exposed portion of the cage provides a guiding surface that must not be damaged during disassembly or maintenance. Damage could affect valve performance. If the cage is stuck in the valve, use a rubber mallet to strike the exposed portion at several points around the circumference.

Figure 7. Double Graphite Ribbon/Filament Arrangements for Use in Fisher ENVIRO-SEAL Bellows Seal Bonnets



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Take proper care not to damage any sealing or seating surfaces as nicks or scratches in these parts might cause leakage.

- Loosen the packing flange nuts (key 5, figures 13 and 14) and draw the valve plug and stem straight out the bottom of the bonnet. Lift all cage and seat parts off the valve plug and stem. If the stem for YD or YS requires replacing, drive the pin (key 6) out and unscrew the stem from the plug.

Table 4. Pin Drill Sizes

VALVE TYPE	VALVE STEM CONNECTION, mm (INCH)	DRILL SIZE, INCHES
YD & YS	9.5 (3/8)	3/32
	12.7 (1/2)	1/8
	19.1 (3/4)	3/16
	25.4 (1)	1/4

Table 5. Recommended Bolt Torques for B7 Body-to-Bonnet Bolting⁽¹⁾

VALVE SIZE, NPS	RECOMMENDED BOLT TORQUE, N•m (Lbf•ft)
1/2, 3/4	129 (95)
1, 1-1/2	129 (95)
2	96 (71)
2-1/2	96 (71)
3	169 (125)
4	271 (200)
6	549 (405)
8(2)	CL150/300: 373 (275) CL600: 522 (385)

1. For other materials, contact your [Emerson sales office](#) or Local Business Partner.
2. For NPS 8 YD valves, the bottom adaptor has shorter bolts than the bonnet, but the bolt torque is the same as the bonnet torque.

- To replace the adaptor (key 24, figure 15) on ENVIRO-SEAL bellows seal bonnets, place the plug stem assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out the pin (key 36, figure 15). Reverse the plug stem assembly in the soft-jaw chuck or vise. Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the valve plug/adaptor assembly (key 24, figure 15) from the valve stem assembly (key 20, figure 15).

CAUTION

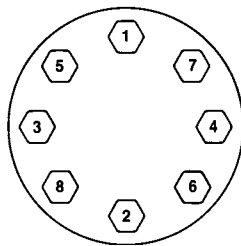
Never use an old stem with a new valve plug. The use of an old stem requires drilling a new pin hole through the stem (or adaptor, in case an ENVIRO-SEAL bellows seal bonnet is being used). This drilling weakens the stem or adaptor and may cause failure in service. However, a used valve plug may be reused with a new stem or adaptor.

7. The internal parts of the bonnet can now be disassembled, if necessary. For packing replacement, refer to the section entitled Packing Replacement on page 6.
8. *Standard YD Only*—It is recommended that the cage seal (key 19), seal ring (key 20A), and backup ring (key 20B) be replaced upon assembly. These can be removed by prying them out of the upper cage grooves with a screwdriver or a soft-tipped instrument. If a screwdriver is used, take care not to scratch the surfaces of the cage.
9. The remaining trim parts can now be lifted out of the valve. Under severe service conditions, some of these parts might have become stuck to the valve. In this case, it might be necessary to use a seat ring puller to remove these parts. Because there is a slight clearance around the outer circumference of the lower cage (key 4) and seat ring (key 8), it might be possible to remove these by tapping them loose, if interior room permits.

Assembly**YD (Standard)**

1. Use new gaskets, seals, and shim (keys 9, 11, 14, 19, 20A, 20B, and 22) on assembly and wipe all sealing surfaces with a clean cloth.
2. For NPS 8 YD, install the bottom flange adaptor (key 24) and gasket (key 9).
3. Install the seat ring gasket (key 14) and place the seat ring (key 8) on top of the gasket.
4. Install the lower cage (key 4) into the valve, being certain that it fits down over the raised portion of the seat ring. The narrow portion of the cage windows should point downward.
5. Slip the O-ring cage seal (key 19) over the bottom of the upper cage (key 3A) and into the cage groove.

Figure 8. Typical Bolting Pattern



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6. Press the backup ring (key 20B) and the seal ring (key 20A), respectively, into the inner groove of the upper cage. It might be necessary to bend one side of each of these in slightly to accomplish this. Take care not to distort the rings when doing this.
7. If a new stem (key 5) is to be used, screw the stem into the valve plug (key 2) until it wedges tight at the end of the valve stem thread.

CAUTION

Never use an old stem with a new valve plug. The use of an old stem requires drilling a new pin hole through the stem (or adaptor, in case an ENVIRO-SEAL bellows seal bonnet is being used). This drilling weakens the stem or adaptor and may cause failure in service. However, a used valve plug may be reused with a new stem or adaptor.

Locate the pilot hole in the valve plug and drill the hole through the plug and stem assembly (determine drill size from table 4). Drive in the pin to lock the assembly.

8. For ENVIRO-SEAL bellows seal bonnets, grip the flats of the stem extending out of the top of the bellows shroud with a soft-jaw chuck or other type of vise. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.

CAUTION

To prevent possible damage to the seal ring and cage seal, exercise care in the following procedure.

9. Place the upper cage (key 3A) over the plug assembly, being certain not to damage the seal ring, and lower this entire assembly into the valve. Due to the close fit between the valve body bore and the cage seal, it will be necessary to apply a steady force to the top of the cage for final positioning inside the valve body bore. Take care to ensure that the upper cage slips into the lower cage and the cage seal is not damaged.
10. Place the spiral wound gasket (key 11), shim (key 22), and bonnet gasket (key 9), respectively, over the upper cage.
11. Mount the bonnet onto the valve with the lubricator or pipe plug parallel with the pipeline.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson Automation Solutions representative immediately if a discrepancy between actual parts and approved parts is suspected.

12. Lubricate the valve stud bolts or cap screws (key 15) and install the nuts (key 16) on the bolts using accepted bolting practices. Tighten the nuts to the recommended bolt torques given in table 5. Follow a pattern similar to that shown in figure 8.

Note

It might be necessary to repeat the bolting pattern several times until the bonnet-to-body seal is made, because the tightening of one nut might loosen an adjacent nut. Repeat the pattern until none of the nuts will turn at the recommended torque.

13. Mount the actuator on the bonnet and make up the stem connection according to the procedure given in the appropriate actuator instruction manual.

YD (High Temperature)

1. Use new gaskets, seals, and shim (keys 9, 11, 13, 14, 19, 20, and 22) on assembly and wipe all sealing surfaces with a clean cloth.
2. For NPS 8 YD, install the bottom flange adaptor (key 24) and gasket (key 9).
3. Install the seat ring gasket (key 14) and place the seat ring (key 8) on top of the gasket followed by the spiral wound spring (key 13).
4. Install the lower cage (key 4) into the valve, being certain that it fits down over the raised portion of the seat ring. The narrow portion of the cage windows should point downward.
5. Place one of the retaining ring gaskets (key 19) into the valve.
6. If a new stem (key 5) is to be used, screw the stem into the valve plug (key 2) until it wedges tight at the end of the valve stem thread.

CAUTION

Never use an old stem with a new valve plug. The use of an old stem requires drilling a new pin hole through the stem (or adaptor, in case an ENVIRO-SEAL bellows seal bonnet is being used). This drilling weakens the stem or adaptor and may cause failure in service. However, a used valve plug may be reused with a new stem or adaptor.

Locate the pilot hole in the valve plug and drill the hole through the plug and stem assembly (determine drill size from table 4). Drive in the pin to lock the assembly.

7. For ENVIRO-SEAL bellows seal bonnets, grip the flats of the stem extending out of the top of the bellows shroud with a soft-jaw chuck or other type of vise. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.
8. Place the seal ring retainer (key 3C) into the valve and lower the valve plug assembly into the retainer orifice.
9. Carefully place the seal rings (key 20) over the valve plug, being certain that they rest against the retaining ring. Each of these has a cut through its cross section. These cuts should be oriented 180 degrees apart to ensure a proper seal.
10. Insert the other retaining ring gasket (key 19) on top of the retaining ring.
11. Lower the upper cage (key 3B) into the valve. When properly installed, the raised ring on the bottom of the cage should fit snugly into the groove formed by the seal rings and the retaining ring.
12. Place the spiral wound gasket (key 11), shim (key 22), and bonnet gasket (key 9), respectively, over the upper cage.

13. Mount the bonnet onto the valve with the lubricator or pipe plug parallel with the pipeline.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

14. Lubricate the valve stud bolts (key 15) and install the nuts (key 16) onto the bolts using good bolting practices. Tighten the nuts to the recommended bolt torques given in table 5. A pattern similar to that shown in figure 8 should be followed.

Note

It might be necessary to repeat the bolting pattern several times until the bonnet-to-body seal is made, because the tightening of one nut might loosen an adjacent nut. Repeat the pattern until none of the nuts will turn at the recommended torque.

15. Mount the actuator on the bonnet and make up the stem connection according to the procedure given in the appropriate actuator instruction manual.

YS

1. Use new gaskets and shim (keys 9, 11, 12, 13, 14 and 22) on assembly and wipe all sealing surfaces with a clean cloth.
2. Install the lower seat ring gasket (key 14) and place the lower seat ring (key 8) on top of the gasket followed by the spiral wound spring (key 13).
3. Install the lower cage (key 4) into the valve, being certain that it fits down over the raised portion of the seat ring. The narrow portion of the cage windows should point downward.
4. Place the upper seat ring gasket (key 12) into the valve.
5. If a new stem (key 5) is to be used, screw the stem into the valve plug (key 2) until it wedges tight at the end of the valve stem thread.

CAUTION

Never use an old stem with a new valve plug. The use of an old stem requires drilling a new pin hole through the stem (or adaptor, in case an ENVIRO-SEAL bellows seal bonnet is being used). This drilling weakens the stem or adaptor and may cause failure in service. However, a used valve plug may be reused with a new stem or adaptor.

Locate the pilot hole in the valve plug and drill the hole through the plug and stem assembly (determine drill size from table 4). Drive in the pin to lock the assembly.

6. For ENVIRO-SEAL bellows seal bonnets, grip the flats of the stem extending out of the top of the bellows shroud with a soft-jaw chuck or other type of vise. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.
7. Place the upper seat ring (key 7) and upper cage (key 3), respectively, over the plug and stem assembly, being certain not to scratch any sealing surfaces. Lower this entire assembly into the valve.
8. Place the spiral wound gasket (key 11), shim (key 22), and bonnet gasket (key 9), respectively, over the upper cage.
9. Mount the bonnet onto the valve with the lubricator or pipe plug parallel with the pipeline.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

10. Lubricate the valve stud bolts or cap screws (key 15) and install the nuts (key 16) onto the bolts using good bolting practices. Tighten the nuts to the recommended bolt torques given in table 5. A pattern similar to that shown in figure 8 should be followed.

Note

It might be necessary to repeat the bolting pattern several times until the bonnet-to-body seal is made, because the tightening of one nut might loosen an adjacent nut. Repeat the pattern until none of the nuts will turn at the recommended torque.

11. Mount the actuator onto the bonnet and make up the stem connection according to the procedure given in the appropriate actuator instruction manual.

ENVIRO-SEAL Bellows Seal Bonnet

Replacing a Plain or Extension Bonnet with an ENVIRO-SEAL Bellows Seal Bonnet (Stem/Bellows Assembly)

1. Remove the actuator and bonnet according to steps 1 through 4 of the Disassembly procedure in the Maintenance section on page 7.
2. With care, remove the valve plug and stem assembly from the valve. If necessary, also lift out the cage.

CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to protect the sealing surfaces and to prevent foreign material from getting into the valve body cavity.

3. Remove and discard the existing bonnet gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

Note

The ENVIRO-SEAL stem/bellows assembly for YD and YS valves is available only with a threaded and drilled plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed.

4. Inspect the existing valve plug. If the plug is in good condition, it can be reused with the new ENVIRO-SEAL stem/bellows assembly. To remove the existing valve plug from the stem, first, place the existing plug stem assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 8).
5. Reverse the plug stem assembly in the soft-jaw chuck or vise. Grip the valve stem in an appropriate place and unscrew the existing plug from the valve stem.

CAUTION

When installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

Note

The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

6. To attach the valve plug to the stem of the new ENVIRO-SEAL stem/bellows assembly, first attach the plug to the adaptor (key 24). Locate the adaptor. Notice that a hole has not been drilled in the threads where the plug screws onto the adaptor. Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor. Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Select the proper size of drill bit and drill through the adaptor using the hole in the valve plug as a guide. Remove any metal chips or burrs and drive in a new pin to lock the plug/adaptor assembly together.
8. Attach the plug/adaptor assembly to the ENVIRO-SEAL stem/bellows assembly by first securing the stem/bellows assembly in a soft-jaw chuck or other type of vise so that the jaws of the chuck or vise grip the flats of the stem extending out of the top of the bellows shroud. Screw the valve plug/adaptor assembly onto the valve stem. Tighten as necessary to align the pin hole in the stem with one of the holes in the adaptor. Secure the adaptor to the stem with a new pin.
9. Inspect the seat ring (key 9) and soft seat parts (keys 21, 22, and 23); replace, if necessary.
10. Place a new gasket (key 10) into the valve in place of the bonnet gasket. Install the new stem/bellows assembly with valve plug/adaptor by placing it into the valve on top of the new bellows gasket.

11. Place a new gasket (key 22) over the stem/bellows assembly. Place the new ENVIRO-SEAL bonnet over the stem/bellows assembly.

Note

Stud(s) and nut(s) should be installed such that the manufacturer's trademark and material grade marking is visible, allowing easy comparison to the materials selected and documented in the Emerson/Fisher serial card provided with this product.

⚠ WARNING

Personal injury or damage to equipment could occur if improper stud and nut materials or parts are used. Do not operate or assemble this product with stud(s) and nut(s) that are not approved by Emerson/Fisher engineering and/or listed on the serial card provided with this product. Use of unapproved materials and parts could lead to stresses exceeding the design or code limits intended for this particular service. Install studs with the material grade and manufacturer's identification mark visible. Contact your Emerson representative immediately if a discrepancy between actual parts and approved parts is suspected.

12. Properly lubricate the bonnet stud bolts. Install and tighten the bonnet hex nuts to the proper torque.
13. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 17 or 18.
14. Install the packing flange. Properly lubricate the packing flange stud bolts and the faces of the packing flange nuts.

For **graphite packing**, tighten the packing flange nuts to the maximum recommended torque shown in table 6. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 6.

For **other packing types**, tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 6. Then, tighten the remaining flange nut until the packing flange is level and at a 90-degree angle to the valve stem.

15. Install travel indicator parts and stem locknuts; mount the actuator onto the valve according to the procedure in the appropriate actuator instruction manual.

Replacement of an Installed ENVIRO-SEAL Bellows Seal Bonnet (Stem/Bellows Assembly)

1. Remove the actuator and bonnet according to steps 1 through 4 of the Disassembly procedure in the Maintenance section on page 7.

CAUTION

To prevent possible product damage, cover the opening in the valve in the following procedure to protect the sealing surfaces and to prevent foreign material from getting into the valve body cavity.

2. Carefully remove the ENVIRO-SEAL stem/bellows assembly. If necessary, also lift out the cage. Remove and discard the existing bonnet gasket and bellows gasket. Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

CAUTION

The ENVIRO-SEAL stem/bellows assembly for YD and YS valves is available only with a threaded and drilled plug/adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug

can be installed. If the existing valve plug is reused, and the adaptor is in good condition, it may also be reused. However, never reuse an old adaptor with a new valve plug. Using an old adaptor with a new valve plug requires drilling a new pin hole in the adaptor. This drilling weakens the adaptor and may cause failure in service. However, a used valve plug may be reused with a new adaptor.

3. Inspect the existing valve plug and adaptor. If they are in good condition, they can be reused with the new stem/bellows assembly and they do not need to be separated.

CAUTION

When removing/installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.

Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.

Note

The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.

4. If the valve plug and adaptor are not in good condition and must be replaced, first remove the valve plug/adaptor assembly from the stem/bellows assembly; then remove the valve plug from the adaptor. First, place the stem/bellows assembly and valve plug in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 6, figure 9, 10, or 11. Drive out the pin (key 36, figure 15).

Table 6. Recommended Torque for Fisher ENVIRO-SEAL Bellows Seal Packing Flange Nuts

VALVE SIZE, NPS	VALVE STEM DIAMETER THROUGH PACKING	MINIMUM TORQUE		MAXIMUM TORQUE	
		N•m	Lbf•in	N•m	Lbf•in
1/2 - 2	1/2	3	24	5	48
3 - 4	1	7	60	10	84

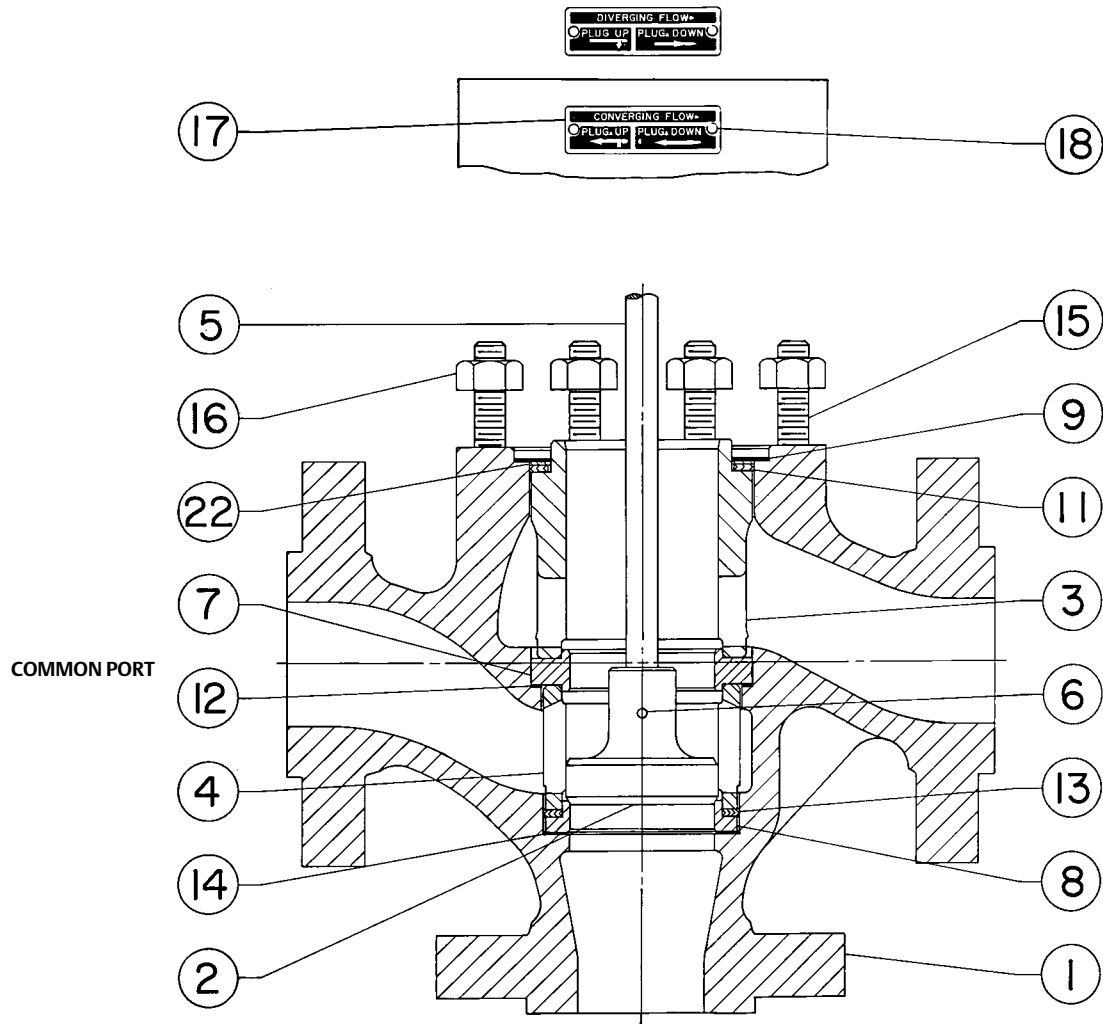
5. Reverse the stem/bellows and plug/adaptor assembly in the soft-jaw chuck or vise. Grip the flat areas on the valve stem just below the threads for the actuator/stem connection. Unscrew the plug/adaptor assembly from the stem/bellows assembly. Unscrew the valve plug from the adaptor.
6. To attach either the existing valve plug or a new one to the stem of the new ENVIRO-SEAL stem/bellows assembly, first attach the plug to the adaptor (if the valve plug was removed from the adaptor) as follows:
 - Locate the adaptor. Notice that a hole has not been drilled in the threads where the plug screws onto the adaptor.
 - Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor.
 - Thread the adaptor into the valve plug and tighten to the appropriate torque value.
7. Complete the installation by following steps 7 through 9 and steps 12 through 15 of the ENVIRO-SEAL Bellows Seal Bonnet installation instructions given above.

Purging the ENVIRO-SEAL Bellows Seal Bonnet

The ENVIRO-SEAL bellows seal bonnet can be purged or leak tested. Refer to figure 15 for an illustration of an ENVIRO-SEAL bellows seal bonnet, and perform the following steps for purging or leak testing.

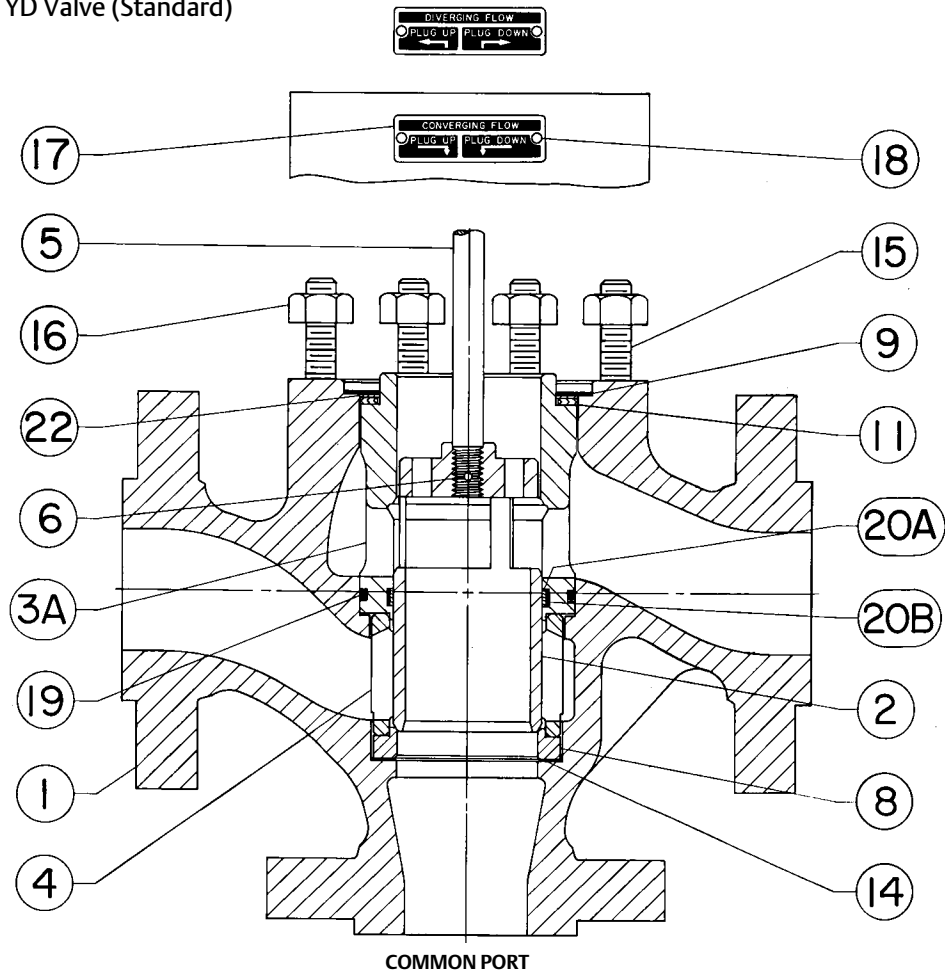
1. Remove the two diametrically opposed pipe plugs (key 16).
2. Connect a purging fluid to one of the pipe plug connections.
3. Install appropriate piping or tubing in the other pipe plug connection to pipe away the purging fluid or to make a connection to an analyzer for leak testing.

Figure 9. Fisher YS Valve



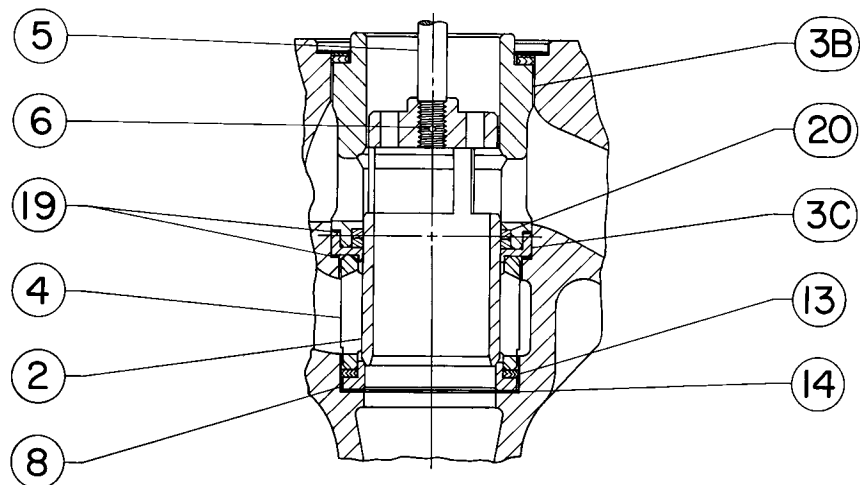
30A3554-D

Figure 10. Fisher YD Valve (Standard)



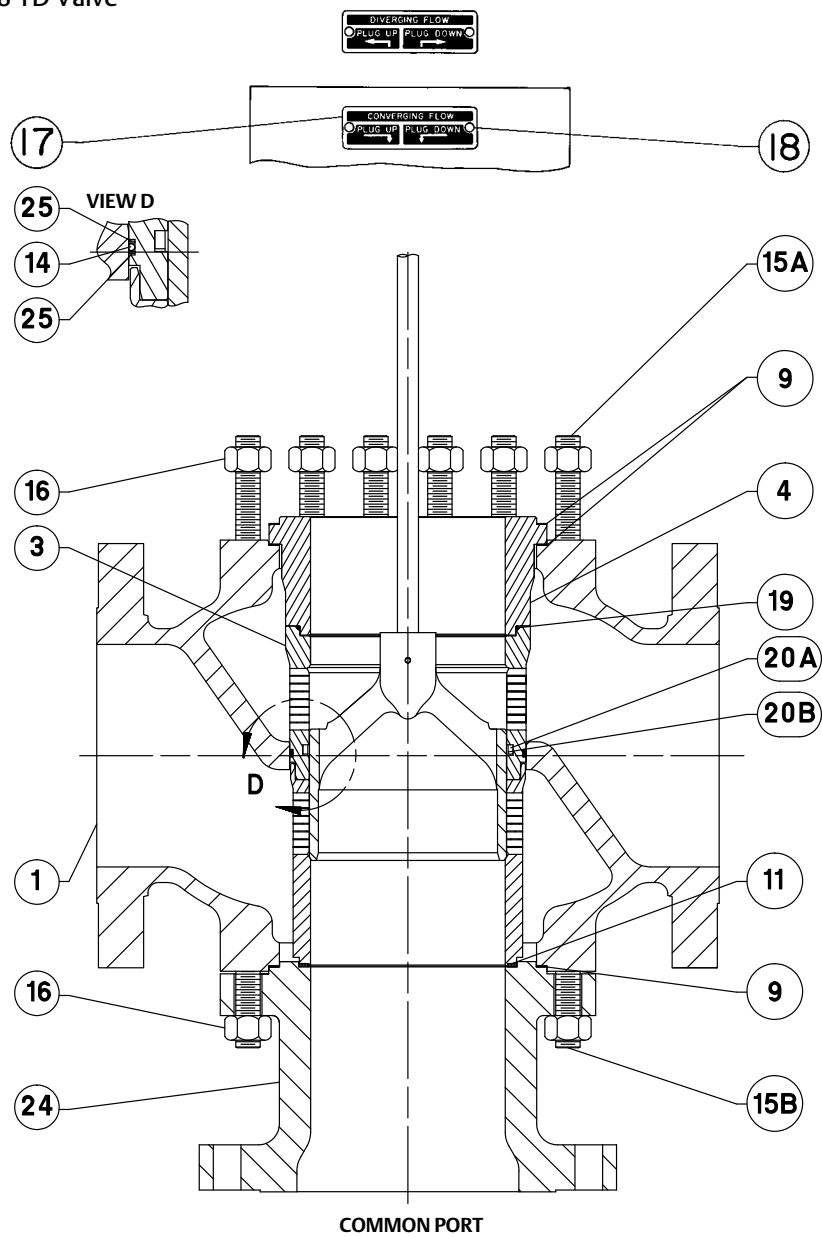
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Figure 11. Fisher YD Valve (High Temperature)



40A3552-F

Figure 12. Fisher NPS 8 YD Valve



5489114-A

Figure 13. Fisher Standard Bonnet

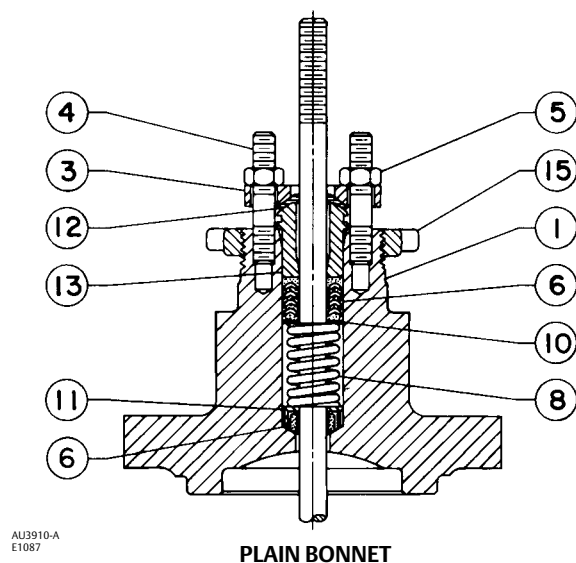


Figure 14. Fisher Extension Bonnet

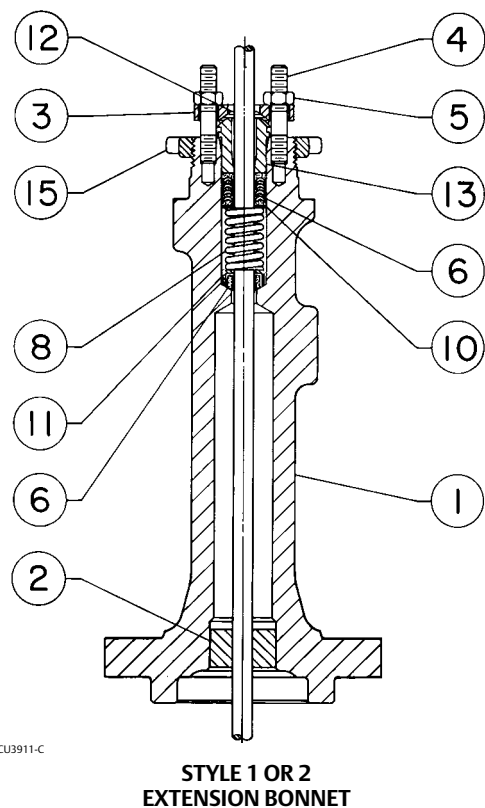
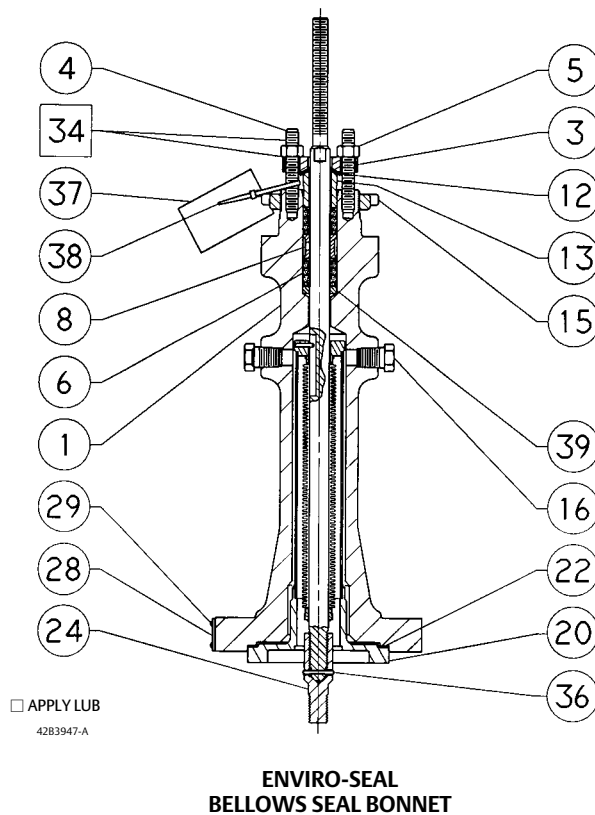


Figure 15. Fisher ENVIRO-SEAL Bellows Seal Bonnet



Parts Ordering

Each valve is assigned a serial number which can be found on the valve. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Always refer to the serial number when corresponding with your [Emerson sales office](#) or Local Business Partner about this equipment. When ordering replacement parts, also state the complete eleven-character part number for each part required from the following parts list.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Standard Packing Repair Kits (Non Live-Loaded)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)
PTFE (Contains keys 6, 8, 10, 11, and 12)	RPACKX00012	RPACKX00022	RPACKX00032	RPACKX00342
Double PTFE (Contains keys 6, 8, 11, and 12)	RPACKX00042	RPACKX00052	RPACKX00062	RPACKX00362
PTFE/Composition (Contains keys 7, 8, 11, and 12)	RPACKX00072	RPACKX00082	RPACKX00092	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00102	RPACKX00112	RPACKX00122	---
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], and 11)	---	---	---	RPACKX00532
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring])	RPACKX00132	RPACKX00142	RPACKX00152	---
Double Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00162	RPACKX00172	RPACKX00182	---

Packing Kits (ENVIRO-SEAL) Repair

PACKING MATERIAL	STEM DIAMETER AND YOKE BOSS DIAMETER, mm (INCH)			
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)
Double PTFE (contains keys 214, 215, & 218)	RPACKX00192	RPACKX00202	RPACKX00212	RPACKX00222
Graphite ULF (contains keys 207, 208, 209, 210, and 214)	RPACKX00592	RPACKX00602	RPACKX00612	RPACKX00622

Packing Kits (ENVIRO-SEAL) Retrofit

PACKING MATERIAL	STEM DIAMETER AND YOKE BOSS DIAMETER, mm (INCH)			
	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)	25.4 (1) 127 (5)
Double PTFE (contains keys 200, 201, 211, 212, 214, 215, 217, and 218)	RPACKXRT012	RPACKXRT022	RPACKXRT032	RPACKXRT042
Graphite ULF (contains keys 200, 201, 207, 208, 209, 210, 211, 212, 214, and 217)	RPACKXRT262	RPACKXRT272	RPACKXRT282	RPACKXRT292

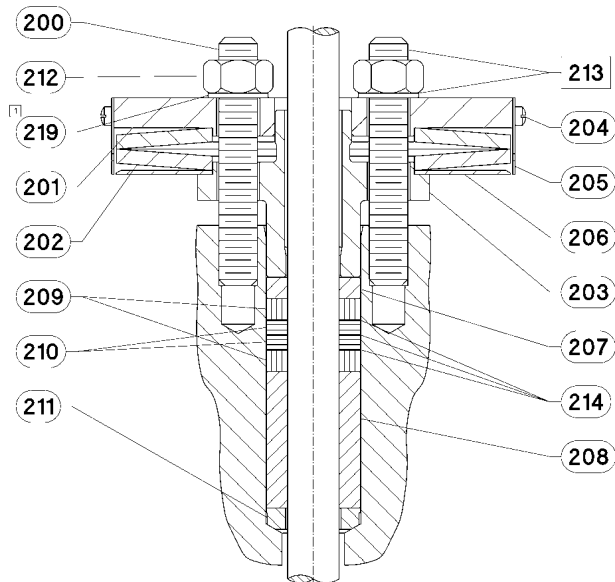
Gasket Kits

Gasket Kits

VALVE SIZE, NPS	YD (Includes keys 9, 11, 14, and 22)	YS (Includes keys 9, 11, 12, 13, 14, and 22)
	Part Number	Part Number
NPS 1/2 to 1-1/2 NPS 2 to 2-1/2 NPS 3 NPS 4 NPS 6	RGASKETXB62 RGASKETXB72 RGASKETXB82 RGASKETXB92 RGASKETXC12	RGASKETXC22 RGASKETXC32 RGASKETXC42 RGASKETXC52 RGASKETXC62

Valve Size, NPS	Key Number	YD Part Number	YS Part Number
1/2 through 1-1/2	Set	RGASKETXB62	RGASKETXC22
	9	1R2859X0042	1R2859X0042
	11	1R286099442	1R286099442
	12	---	10A3326X052
	13	---	10A3325X062
	14	10A3327X052	10A3327X052
	22	16A1936X012	16A1936X012
2 through 2-1/2	Set	RGASKETXB72	RGASKETXC32
	9	1R3299X0042	1R3299X0042
	11	1R329799442	1R329799442
	12	---	10A3384X042
	13	---	10A3383X042
	14	10A3385X042	10A3385X042
	22	16A1938X012	16A1938X012
3	Set	RGASKETXB82	RGASKETXC42
	9	1R3484X0042	1R3484X0042
	11	1R348299442	1R348299442
	12	---	10A3437X062
	13	---	10A3436X042
	14	10A3438X062	10A3438X062
	22	16A1940X012	16A1940X012
4	Set	RGASKETXB92	RGASKETXC52
	9	1R3724X0042	1R3724X0042
	11	1R372299442	1R372299442
	12	---	10A3479X052
	13	---	10A3478X052
	14	10A3480X052	10A3480X052
	22	16A1941X012	16A1941X012
6	Set	RGASKETXC12	RGASKETXC62
	9	1U5081X0052	1U5081X0052
	11	1U508599442	1U508599442
	12	---	10A3525X042
	13	---	10A3524X022
	14	11A9521X052	11A9521X052
	22	16A1942X012	16A1942X012

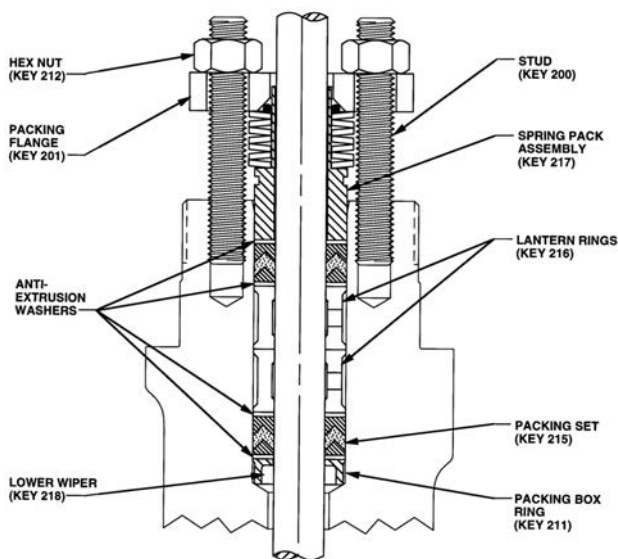
Figure 16. Typical Fisher HIGH-SEAL Graphite ULF Packing System



1. FIND NUMBER 219 NOT REQUIRED WITH 3/8 INCH STEM

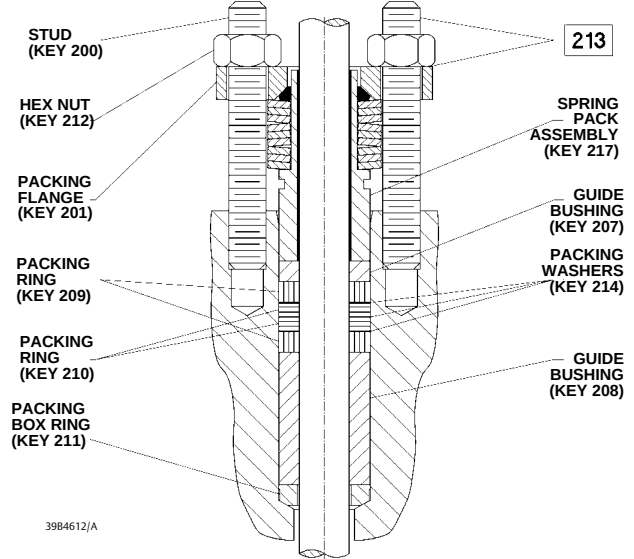
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Figure 17. Typical Fisher ENVIRO-SEAL Packing System with PTFE Packing



A6297-1

Figure 18. Typical Fisher ENVIRO-SEAL Packing System with Graphite ULF Packing



39B4612/A

Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your [Emerson sales office](#) or Local Business Partner.

Note

Part numbers for most key numbers are listed in tables which follow.

YD and YS Valve

Key	Description	Part Number
1	If you need a valve body as a replacement part, order by valve size, serial number, and desired material	
17	Flow Direction Plate, SST	
18	Drive Screw, SST (4 req'd)	
21	Nameplate	
23	Wire	

Bonnet for YD and YS

1	Bonnet If you need a bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.	
14	Pipe Plug	
16	Pipe Plug (Used With Tapped Extension Bonnet Only) (not shown)	
27	Pipe Nipple (Used with Lubr./Iso. Valve)	

*Recommended spare parts

Keys 2*, 5*, and 6* Valve Plug and Stem Assembly for Plain Bonnet

VALVE SIZE, NPS	STEM DIAMETER & VSC SIZE		YD STANDARD		YD HIGH TEMPERATURE		YS	
	mm	Inches	CB7Cu-1 (17-4PH SST)	CF8M (316 SST)	CB7Cu-1 (17-4PH SST)	CF8M (316 SST)	S41600 (416 SST)	S31600 (316 SST)
1/2 to 1-1/2	9.5 12.7	3/8 1/2	10A3315X032 ---	10A3315X052 ---	---	---	10A3317X202 10A9499X092	10A3317X072 ---
2 and 2-1/2	12.7	1/2	20A3369X052	20A3369X122	21A5078X032	---	10A3373X242	10A3373X232
3	12.7 19.1	1/2 3/4	20A3422X102 ---	20A3422X072 ---	---	---	10A3427X052 10A3428X102	10A3427X112 ---
4	12.7	1/2	20A3464X092	20A3464X072	---	---	20A3469X102	---
6	19.1	3/4	20A3507X092	20A3507X112	21A5073X062	---	20A3511X092	20A3511X082

Key 2* Valve Plug

VALVE SIZE, NPS	VALVE STEM CONNECTION		YD STANDARD		YD HIGH-TEMPERATURE	
	mm	Inch	CB7Cu-1 (17-4 PH SST)	CF8M (316 SST)	CB7Cu-1 (17-4 PH SST)	CF8M (316 SST)
1/2 to 1-1/2	9.5	3/8	10A3315X012	10A3315X022	11A5077X012	---
2 & 2-1/2	12.7	1/2	20A3369X012	20A3369X022	21A5078X012	21A5078X022
3	12.7 19.1	1/2 3/4	20A3422X092 20A3423X052	20A3422X022 ---	21A5071X042 21A5072X052	21A5071X022 ---
4	12.7 19.1	1/2 3/4	20A3464X082 20A3465X042	20A3464X022 20A3465X022	21A5076X042 21A5075X042	21A5076X022 21A5075X022
6	19.1 25.4	3/4 1	20A3507X042 20A3508X042	20A3507X022 ---	21A5073X052 21A5074X042	21A5073X022 ---

Key 2* Valve Plug (cont.)

VALVE SIZE, NPS	VALVE STEM CONNECTION		YS	
	mm	Inch	S41600 (416 SST)	S31600 (316 SST)
1/2 to 1-1/2	9.5 12.7	3/8 1/2	10A3317X012 10A9499X012	10A3317X022 10A9499X022
2 & 2-1/2	12.7 19.1	1/2 3/4	10A3373X012 ---	10A3373X022 10A3374X022
3	12.7 19.1	1/2 3/4	10A3427X012 10A3428X012	10A3427X022 10A3428X022
4	12.7 19.1	1/2 3/4	20A3469X012 20A3470X012	20A3469X022 20A3470X022
6	19.1 25.4	3/4 1	20A3511X012 20A3512X012	20A3511X022 20A3512X022

Keys 3* & 3A* Upper Cage (YS and Standard YD Only)

VALVE SIZE, NPS	KEY 3, UPPER CAGE (YS)		KEY 3A, UPPER CAGE (YD STANDARD)	
	CB7Cu-1 (17-4PH SST)	CF8M (316 SST), ENC	CB7Cu-1 (17-4PH SST)	CF8M (316 SST), ENC
1/2 - 1-1/2 2, 2-1/2	29A7516X012 2U223433272	29A7516X022 2U740448932	20A3363X012 20A3376X012	30A3319X022 30A3377X012
3	2U231833272	2U740648932	20A3431X012	30A3432X012
4	2U236033272	2U740748932	20A3473X012	30A3474X012
6	2U506333272	2U806948932	20A3516X012	30A3517X012

Keys 3B*, 3C*, & 4* Upper Cage and Retaining Ring (High Temp. YD Only) and Lower Cage

VALVE SIZE, NPS	KEY 3B, UPPER CAGE (YD HIGH TEMPERATURE)		KEY 3C, RETAINING RING (YD HIGH TEMPERATURE)		KEY 4, LOWER CAGE (ALL TRIM STYLES)	
	CB7Cu-1 (17-4PH SST)	CF8M (316 SST), ENC	S41600 (416 SST)	CF8M (316 SST)	CB7Cu-1 (17-4PH SST)	CF8M (316 SST), ENC
1/2 - 1-1/2 2, 2-1/2	20A3320X012 20A3378X012	---	10A3337X012 10A3394X012	---	20A3323X012 20A3381X012	20A3324X012 20A3382X012
3	20A3546X012	30A3547X012	10A3348X012	10A3348X022	20A3434X012	20A3435X012
4	20A3548X012	30A3549X012	10A3490X012	10A3490X012	20A3476X012	20A3477X012
6	20A3518X012	30A3519X012	10A3536X012	10A3536X022	20A3522X012	20A3523X012

Key 5* Valve Plug Stem

VALVE SIZE, NPS	STEM SIZE		VALVE STEM CONNECTION		YD, S31600 (316 SST)		YS, S31600 (316 SST)	
	mm	Inch	mm	Inch	Standard Bonnet	Style 1 Ext. Bonnet	Standard Bonnet	Style 1 Ext. Bonnet
For Use With Group 1 Actuators⁽¹⁾								
1/2 thru 1-1/2	9.5	3/8	9.5	3/8	10A8823X312	1U217735162	10A8823X292	10A3539X012
	12.7	1/2	9.5 12.7	3/8 1/2	1U530935162 ---	---	---	---
2, 2-1/2	12.7	1/2	12.7	1/2	10A3541X012	10A3540X012	1N821035162	1U218035162
	19.1	3/4	12.7 19.1	1/2 3/4	---	---	---	---
3	12.7	1/2	12.7	1/2	1U230535162	1U230635162	1U217935162	1U7965X0012
	19.1	3/4	19.1	3/4	1U230835162	---	1K5878X0012	---
4	12.7	1/2	12.7	1/2	1K586935162	1U230635162	1U230635162	1U294035162
	19.1	3/4	19.1	3/4	1K587735162	---	1K896535162	1P669735162
6	19.1	3/4	19.1	3/4	1L996435162	1U507135162	1U507135162	1P669735162
For Use With Group 100 Actuators⁽¹⁾								
6	25.4	1	25.4	1	---	---	1K928935162	---
For Use With Group 101 Actuators⁽¹⁾								
6	25.4	1	25.4	1	---	---	1K744735162	---

1. Actuator Groups 1, 100, and 101 are defined on the following page.

Actuator Groups

GROUP 1 54, 71, 90 mm (2-1/8, 2-13/16 & 3-9/16 INCH) YOKE BOSS	GROUP 100 127 mm (5-Inch) YOKE BOSS
585C Series 1B 644 & 645 655 657 & 667—Except 102 mm (4-Inch) Travel, Size 70 1008—Except 51 mm (2-Inch) Travel, 90 mm (3-9/16 Inch) Yoke Boss	585C Series 657 1008—51 mm (2-Inch) only
	Group 101 127 mm (5-Inch) Yoke Boss
	667

Key 6* Pin, 316 SST

VALVE SIZE, NPS	VALVE STEM CONNECTION		YD	YS
	mm	Inch		
1/2 to 1-1/2	9.5	3/8	1P730438992	1P730438992
	12.7	1/2	---	1B627035072
2 & 2-1/2	12.7	1/2	1B599635072	1B599635072
	19.1	3/4	---	1R7386X0012
3	12.7	1/2	1B599635072	1B599635072
	19.1	3/4	1R7386X0012	1R7386X0012
4	12.7	1/2	1D545735072	1D545735072
	19.1	3/4	1D5458X0012	1D5458X0012
6	19.1	3/4	1B600735072	1L302335072
	25.4	1	1R655435072	---

Keys 7* & 8* Upper and Lower Seat Rings

VALVE SIZE, NPS	KEY 7, UPPER SEAT RING		KEY 8, LOWER SEAT RING			
	YS		YD Standard		YD High Temperature and YS	
	S41600 (416 SST)	S31600 (316 SST)	S41600 (416 SST)	CF8M (316 SST)	S41600 (416 SST)	CF8M (316 SST)
1/2, 3/4, 1, 1-1/2	10A3336X012	10A3336X022	10A3335X012	10A3335X022	10A3334X012	10A3334X022
2, 2-1/2	---	10A3393X022	10A3392X012	10A3392X022	10A3391X012	10A3391X022
3	10A3447X012	10A3447X022	10A3446X012	10A3446X022	10A3445X012	10A3445X022
4	10A3489X012	10A3489X022	10A3488X012	10A3488X022	10A3487X012	10A3487X022
6	10A3535X012	10A3535X022	11A9076X012	11A9076X022	10A3533X012	10A3533X022

Key 9* Bonnet Gasket and Key 22* Shim

VALVE SIZE, NPS	KEY 9 (YD & YS)	KEY 22 (YD & YS)
	FGM (Graphite/S31600)	S31600 (316 SST)
1/2 - 1-1/2	1R2859X0042	16A1936X012
2, 2-1/2 3	1R3299X0042 1R3484X0042	16A1938X012 16A1940X012
4 6	1R3724X0042 1U5081X0052	16A1941X012 16A1942X012

Key 11* Spiral Wound Gasket and Key 13* Spiral Wound Spring

VALVE SIZE, NPS	KEY 11 (YD & YS)	KEY 13 (YS ONLY)
	N06600 and Graphite Laminate	N06600 and Graphite Laminate
	To 593°C (1100°F)	To 593°C (1100°F)
1/2 - 1-1/2	1R286099442	10A3325X062
2, 2-1/2 3	1R329799442 1R348299442	10A3383X042 10A3436X042
4 6	1R372299442 1U508599442	10A3478X052 10A3524X022 ⁽¹⁾

1. N06600 material only.

Key 12* Upper Seat Ring Gasket and Key 14* Lower Seat Ring Gasket

VALVE SIZE, NPS	KEY 12 (YS ONLY)	KEY 14 (YD & YS)
	FGM (Graphite/S31600)	FGM (Graphite/S31600)
1/2 - 1-1/2	10A3326X052	10A3327X052
2, 2-1/2 3	10A3384X042 10A3437X062	10A3385X042 10A3438X062
4 6	10A3479X052 10A3525X042	10A3480X052 11A9521X052

Key 19* O-Ring or Gasket (YD Only)

VALVE SIZE, NPS	O-RING (YD STANDARD)			RETAINING RING GASKET (YD HIGH TEMPERATURE) (2 REQ'D)
	Nitrile ⁽¹⁾ -29 to 93°C (-20 to 200°F)	Fluorocarbon ⁽²⁾ -18 to 204°C (0 to 400°F)	Ethylene-Propylene -40 to 232°C (-40 to 450°F)	FGM (Graphite/S31600)
1/2, 3/4, 1, 1-1/2	10A3328X012	10A3330X012	10A3329X022	10A3326X052
2, 2-1/2 3	1V3269X0012 14A5688X012	1V3269X0042 14A5688X022	1V3269X0062 14A5688X082	10A3384X042 10A3437X062
4 6	10A3481X012 1V3350X0022	10A3483X012 1V3350X0012	10A3482X022 1V3350X0042	10A3479X052 10A3525X042

1. For hydrocarbon service to 71°C (160°F).
2. -18 to 38°C (0° to 100°F) for H₂O service.

Keys 20*, 20A*, & 20B* Seals (YD Only)

VALVE SIZE, NPS	YD (STANDARD)				YD (HIGH TEMPERATURE)
	Key 20A Seal Ring	Key 20B Back Up Ring			Key 20 Valve Plug Seal
	PTFE	Nitrile ⁽¹⁾ -29 to 93°C (-20 to 200°F)	Fluorocarbon ⁽²⁾ -18 to 204°C (0 to 400°F)	Ethylene Propylene -40 to 232°C (-40 to 450°F)	Graphite (2 req'd)
1/2, 3/4, 1, 1-1/2	10A3331X012	10A3332X022	10A3332X032	10A3332X042	10A3333X012
2, 2-1/2 3	10A3388X012 10A3442X012	10A3389X022 10A3443X022	10A3389X032 10A3443X032	10A3389X052 10A3443X072	10A3390X012 10A3444X012
4 6	10A3484X012 10A3530X012	10A3485X022 10A3531X022	10A3485X032 10A3531X032	10A3485X042 10A3531X052	10A3486X012 10A3532X012

1. For hydrocarbon service to 71°C (160°F).
2. -18 to 38°C (0° to 100°F) for H₂O service.

Keys 3, 4, 9, 11, 14, and 19 (NPS 8 YD Only)

PLUG/ CAGE / STEM KEY 3		CAGE RETAINER KEY 4	GASKET, QTY 3, KEY 9	SPIRAL WOUND GASKET, KEY 11		O-RING KEY 14	O-RING KEY 19
Low Temperature	High Temperature			Low Temperature, Qty 1	High Temperature, Qty 2	Low Temperature	Low Temperature
27B4290X012	27B4290X022	34B9111X012	1C2515X0052	10B5412X032	10B5412X032	1H8623X0022	1D2692X0022

Keys 20, 20A, 20B, 24, and 25 (NPS 8 YD Only)

BACK-UP RING, KEY 20A	SEAL RING, KEY 20B	SEAL RING, QTY 3, KEY 20	FLANGE ADAPTOR, KEY 24		BACK-UP RING, QTY 2, KEY 25	GASKET, QTY 2, KEY 25
Low Temperature	Low Temperature	High Temperature	Low Temperature	High Temperature	Low Temperature	High Temperature
10A3531X032	10A3530X012	10A3532X012	CL300: 34B6974X012 CL600: 37B9811X012	CL300: 34B6974X012 CL600: ---	12A54898X012	10A3525X042

Keys 6*, 7*, 8, and 10 Packing Box Parts

DESCRIPTION		KEY NUMBER	STEM DIAMETER, mm (INCHES)			
			9.5 (3/8)	12.7 (1/2)	19.1 (3/4)	25.4 (1)
PTFE V-Ring Packing	Single packing set, PTFE (1 req'd for single, 2 req'd for double)	6	1R290001012	1R290201012	1R290401012	1R290601012
	Spring, stainless steel (for single only)	8	1F125437012	1F125537012	1F125637012	1D582937012
	Lantern Ring, stainless steel (for double only)	8	1F364135072	1J962335072	0N028435072	0U099735072
	Quantity required Double	---	1	2	1	1
	Special washer, stainless steel (for single only)	10	1F125236042	1F125136042	1F125036042	1H982236042
PTFE/ Composition Packing	Packing Ring, PTFE/Composition	7	1F3370X0012	1E319001042	1E319101042	1D7518X0012
	Quantity required Double	---	7	10	8	8
	Lantern Ring, stainless steel (1 required for double)	8	1F364135072	1J962335072	0N028435072	0U099735072
Graphite Ribbon/ Packing	Packing Ring, graphite filament	7	1F3370X0322	1E3190X0222	1E3191X0282	1D7518X0132
	Quantity required Single Double	--- ---	2 4	2 4	3 5	3 5
	Packing ring, graphite ribbon	7	1V3160X0022	1V3802X0022	1V2396X0022	1U6768X0022
	Quantity required Single Double	--- ---	2 3	2 3	2 3	2 3
	Lantern ring, S31600 (316 SST)	8	1F364135702	1J962335072	0N028435072	0U099735072
	Quantity required Single Double	--- ---	2 1	3 2	2 1	2 1

ENVIRO-SEAL Bellows Seal Parts

Key	Description	Part Number	Key	Description	Part Number
1	Bonnet/ENVIRO-SEAL bellows seal bonnet If you need a bonnet or an ENVIRO-SEAL bellows seal bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.			stem (2 req'd for double packing) PTFE for NPS 3 and 4 with 12.7 mm (1/2 inch) stem (2 req'd for double packing)	12A9016X012 12A8832X012
3	ENVIRO-SEAL bellows seal packing flange		7*	ENVIRO-SEAL bellows seal packing ring for low chloride graphite ribbon/filament packing arrangement	
4	ENVIRO-SEAL bellows seal stud bolt			Ribbon packing ring for 9.5 mm (3/8 inch) and NPS 2 with 12.7 mm (1/2 inch) stem (4 req'd)	18A0908X012
5	ENVIRO-SEAL bellows seal hex nut			Filament packing ring for 9.5 mm (3/8 inch) and NPS 2 with 12.7 mm (1/2 inch) stem (4 req'd)	1P3905X0172
6*	ENVIRO-SEAL bellows seal packing set PTFE for 9.5 mm (3/8 inch) stem (1 req'd for single packing, 2 req'd for double packing) PTFE for NPS 2 with 12.7 mm (1/2 inch)	12A9016X012		Ribbon packing ring for NPS 3 and 4 with 12.7 mm (1/2 inch) stem (4 req'd)	18A0918X012

Key	Description	Part Number	Key	Description	Part Number
	Filament packing ring for NPS 3 and 4 with 12.7 mm (1/2 inch) stem (4 req'd)	14A0915X042		NPS 1 w/ 9.5 mm (3/8 inch) stem	32B4224X012
8	ENVIRO-SEAL bellows seal spring			NPS 1-1/2 w/ 9.5 mm (3/8 inch) stem	32B4225X012
8	ENVIRO-SEAL bellows seal spacer			NPS 2 w/ 12.7 mm (1/2 inch) stem	32B4226X012
12*	ENVIRO-SEAL bellows seal upper wiper			NPS 3 w/ 12.7 mm (1/2 inch) stem	32B4227X012
	For 9.5 mm (3/8 inch) and NPS 2 with 12.7 mm (1/2 inch) stem	18A0868X012		NPS 4 w/ 12.7 mm (1/2 inch) stem	32B4228X012
	For NPS 3 and 4 with 12.7 mm (1/2 inch) stem	18A0870X012		N06022 trim mat'l, N06022 bellows mat'l	
13*	ENVIRO-SEAL bellows seal bushing			NPS 1 w/ 9.5 mm (3/8 inch) stem	32B4224X022
	For 9.5 mm (3/8 inch) stem (1 req'd), for NPS 2 with 12.7 mm (1/2 inch) stem (2 req'd)			NPS 1-1/2 w/ 9.5 mm (3/8 inch) stem	32B4225X022
	S31600/PTFE	18A0820X012		NPS 2 w/ 12.7 mm (1/2 inch) stem	32B4226X022
	R30006	18A0819X012		NPS 3 w/ 12.7 mm (1/2 inch) stem	32B4227X022
	S31600/Cr Coated	11B1155X012		NPS 4 w/ 12.7 mm (1/2 inch) stem	32B4228X022
	For NPS 3 and 4 with 12.7 mm (1/2 inch) stem (1 req'd)			2 Ply Bellows	
	S31600/PTFE	18A0824X012		S31600 trim mat'l, N06625 bellows mat'l	
	R30006	18A0823X012		NPS 1 w/ 9.5 mm (3/8 inch) stem	32B4224X032
	S31600/Cr Coated	11B1157X012		NPS 1-1/2 w/ 9.5 mm (3/8 inch) stem	32B4225X032
13*	ENVIRO-SEAL bellows seal bushing/liner			NPS 2 w/ 12.7 mm (1/2 inch) stem	32B4226X032
	For 9.5 mm (3/8 inch) stem (1 req'd), for NPS 2 with 12.7 mm (1/2 inch) stem (2 req'd)			NPS 3 w/ 12.7 mm (1/2 inch) stem	32B4227X032
	N10276 bushing, PTFE/glass liner	12B2713X012		NPS 4 w/ 12.7 mm (1/2 inch) stem	32B4228X032
	N10276 bushing, PTFE/carbon liner	12B2713X042		N06022 trim mat'l, N06022 bellows mat'l	
	For NPS 3 and 4 with 12.7 mm (1/2 inch) stem (1 req'd)			NPS 1 w/ 9.5 mm (3/8 inch) stem	32B4224X042
	N10276 bushing, PTFE/glass liner	12B2715X012		NPS 1-1/2 w/ 9.5 mm (3/8 inch) stem	32B4225X042
	N10276 bushing, PTFE/carbon liner	12B2715X042		NPS 2 w/ 12.7 mm (1/2 inch) stem	32B4226X042
15	ENVIRO-SEAL bellows seal Locknut			NPS 3 w/ 12.7 mm (1/2 inch) stem	32B4227X042
16	ENVIRO-SEAL bellows seal pipe plug (2 req'd)			NPS 4 w/ 12.7 mm (1/2 inch) stem	32B4228X042
20*	ENVIRO-SEAL bellows seal stem/bellows assembly		22*	ENVIRO-SEAL bellows seal bonnet gasket (graphite laminate)	
	1 Ply Bellows			NPS 1/2 through 1	12B6316X022
	S31600 trim mat'l, N06625 bellows mat'l			NPS 1-1/2	12B6317X022
				NPS 2	12B6318X022
				NPS 3	12B6319X022
				NPS 4	12B6320X022
			24	ENVIRO-SEAL bellows seal adaptor	
			28	ENVIRO-SEAL bellows seal nameplate, warning	
			29	ENVIRO-SEAL bellows seal drive screw (2 req'd)	
			36*	ENVIRO-SEAL bellows seal pin	12B3951X012
			37	ENVIRO-SEAL bellows seal warning tag	
			38	ENVIRO-SEAL bellows seal tie	
			39	ENVIRO-SEAL bellows seal thrust ring	

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Fisher™ 667 Diaphragm Actuator Sizes 30/30i-76/76i and 87

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Figure 1. Fisher 667 Actuator Mounted on easy-e™ Valve



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Introduction

Scope of Manual

This instruction manual provides information on installation, adjustment, maintenance, and parts ordering for the Fisher 667 actuator in sizes 30/30i through 76/76i and size 87. The 667-4 actuator in sizes 70/70i and 87 is also covered. Refer to separate instruction manuals for information about the valve positioner and other accessories used with these actuators.

Do not install, operate, or maintain a 667 actuator (see figure 1) without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) or Local Business Partner before proceeding.

Table 1. Specifications

SPECIFICATION ⁽¹⁾		ACTUATOR SIZE									
		30/30i	34/34i	40/40i	45/45i	46/46i	50/50i	60/60i	70/70i ⁽¹⁾	76/76i	87 ⁽¹⁾
Nominal Effective Area	Sq cm	297	445	445	667	1006	677	1006	1419	1006	1419
	Sq Inch	46	69	69	105	156	105	156	220	156	220
Yoke Boss Diameter	mm	54	54	71	71	71	90	90	90	90	125
	Inch	2-1/8	2-1/8	2-13/16	2-13/16	2-13/16	3-9/16	3-9/16	3-9/16	3-9/16	5
Acceptable Valve Stem Diameter	mm	9.5	9.5	12.7	12.7	12.7	19.1	19.1	19.1	19.1	25.4
	Inch	3/8	3/8	1/2	1/2	1/2	3/4	3/4	3/4	3/4	1
Maximum Allowable Output Thrust ⁽⁴⁾	N	10230	10230	12010	25131	33582	25131	30246	39142	30246	39142
	LB	2300	2300	2700	5650	7550	5650	6800	8800	6800	8800
Maximum Travel ⁽²⁾	mm	19	29	38	51	51	51	51	76 ⁽³⁾	51	76 ⁽³⁾
	Inch	0.75	1.125	1.5	2	2	2	2	3 ⁽³⁾	2	3 ⁽³⁾
Maximum Casing Pressure for Actuator Sizing ^(4,6)	Bar	3.8	4.8	4.8	4.5	3.8	4.5	3.8	3.4	3.4	3.4
	Psig	55	70	70	65	55	65	55	50	50	50
Maximum Excess Diaphragm Pressure ^(4,5)	Bar	3.8	1.4	1.4	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Psig	55	20	20	10	10	10	10	10	10	10
Maximum Diaphragm Casing Pressure ^(4,6,7)	Bar	7.6	6.2	6.2	5.2	4.5	5.2	4.5	4.1	4.1	4.1
	Psig	110	90	90	75	65	75	65	60	60	60
Approximate Weight	Kg	15/17	22/26	23/26	41/44	55/59	43/48	55/60	115/118	86/89	118
	Pounds	34/37	48/58	50/56	90/98	121/129	94/105	122/133	254/260	190/196	260
Material Temperature Capabilities	Nitrile Elastomers	-40 to 82°C (-40 to 180°F)									
	Silicone Elastomers	-54 to 149°C (-65 to 300°F)									

1. These values also apply to the 667-4 actuator construction.
 2. Actuator travel may be less than the value listed after connected to the valve.
 3. Maximum actuator travel for 667-4 is 102 mm (4 inches).
 4. See also the Specifications portion of the introduction section.
 5. Additional pressure may be added when the actuator is at full travel. If the Maximum Excess Diaphragm Pressure is exceeded, damage to the diaphragm or diaphragm casing might result. See the Maximum Pressure Limitation section.
 6. Maximum diaphragm casing pressure must not be exceeded and must not produce a force on the actuator stem greater than the maximum allowable actuator output thrust or the maximum allowable stem load. See the Maximum Pressure Limitation section.
 7. This maximum casing pressure is not to be used for normal operating pressure. Its purpose is to allow for typical regulator supply settings and/or relief valve tolerances.

Description

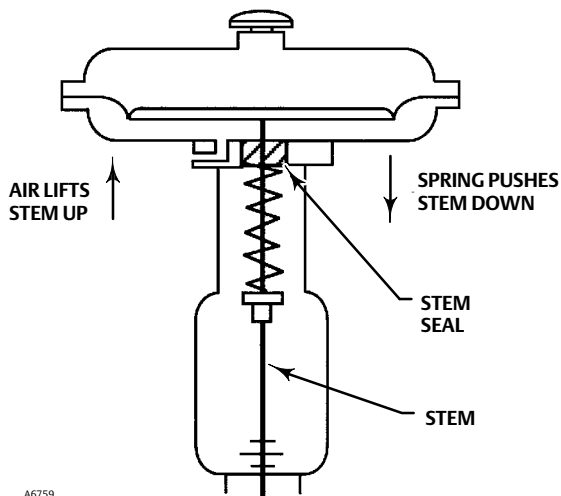
The 667 actuator (figure 1) and the 667-4 actuator are reverse-acting, spring-opposed diaphragm actuators. They provide automatic operation of control valves. The 667 actuator provides 76 mm (3 inches) maximum actuator travel. The 667-4 actuator provides 102 mm (4 inches) maximum actuator travel. Both actuators position the valve plug in response to varying pneumatic loading pressure on the diaphragm. Figure 2 shows the operation of these actuators.

A 667 or 667-4 actuator can be furnished with either a top-mounted or a side-mounted handwheel assembly. A top-mounted handwheel assembly is normally used as an adjustable down travel stop. (A down travel stop limits actuator travel in the down direction [when the stem is traveling out of the actuator]. Travel in the up direction is when the stem is traveling into the actuator.) A side-mounted handwheel assembly is normally used as an auxiliary manual actuator. The side-mounted handwheel can also be used as an adjustable up or down travel stop. Casing-Mounted adjustable up or down travel stops are also available on this actuator.

Note

If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel. The side-mounted handwheel is designed for more frequent use as a manual operator.

Figure 2. Schematic of Fisher 667 and 667-4 Actuators



Specifications

Refer to table 1 for Specifications of the 667 and 667-4 actuators. See the actuator nameplate for specific information for your actuator.

Educational Services

For information on available courses for Fisher 667 diaphragm actuators, as well as a variety of other products, contact:

Emerson Automation Solutions
Educational Services - Registration
Phone: 1-641-754-3771 or 1-800-338-8158
E-mail: education@emerson.com
emerson.com/fishervalvetraining

Instructional Videos

[Click here](#) or access the following QR code for a video on mounting a DVC6200 Digital Valve Controller on a 667 actuator.



[Click here](#) or access the following QR code for a video on installing a side-mounted handwheel on a 667 actuator.



⚠ WARNING

To avoid personal injury or damage to equipment that may result in the malfunction of the control valve or loss of control of the process caused by excessive pressure, do not exceed the Maximum Pressures listed in table 1. Refer to the Maximum Pressure Limitations section.

Maximum Pressure Limitations

The casing and diaphragm of 667 actuators are pressure operated. This air pressure provides energy to compress the spring, to stroke the actuator, and to seat the valve. The following explanations describe the maximum pressure limits for an actuator. Refer to the nameplate or table 1 for maximum values for your actuator.

- **Maximum Casing Pressure for Actuator Sizing:** This is the maximum pressure that can be applied at less than full travel of the actuator. If this stroking pressure is exceeded before the upper diaphragm plate contacts the travel stop, damage to the stem or other parts might result.
- **Maximum Excess Diaphragm Pressure:** Additional pressure may be added when the actuator is at full travel. If the Maximum Excess Diaphragm Pressure is exceeded, damage to the diaphragm or diaphragm casing might result.

Because the actuator has traveled its specified travel, and the diaphragm head is physically stopped from movement, the energy from any additional air pressure is transmitted to the diaphragm and diaphragm casings. The amount of air pressure that can be added once the actuator has traveled to the stops is limited by the resultant adverse effects that may occur. Exceeding this limiting factor could result in leakage or casing fatigue due to the deformation of the upper diaphragm casing.

- **Maximum Diaphragm Casing Pressure:** If the Maximum Diaphragm Casing Pressure is exceeded, damage to the diaphragm, diaphragm casing, or actuator might result.

Installation

⚠ WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations.

Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

Key number locations are shown in figures 6, 7, 8, 9, and 10, unless otherwise noted. Also, refer to figure 3 for location of parts.

CAUTION

To avoid parts damage, do not use an operating pressure that exceeds the Maximum Diaphragm Casing Pressure (table 1) or produces a force on the actuator stem greater than the Maximum Allowable Output Thrust (table 1) or the Maximum Allowable Valve Stem Load.

- **Valve/Actuator Assembly:** If the actuator and valve are shipped together as a control valve assembly, it has been adjusted at the factory, and may be installed in the pipeline. After installing the valve in the pipeline, refer to the Loading Connection procedures.
- **Actuator Mounting:** If the actuator is shipped separately or the actuator has been removed from the valve, it is necessary to mount the actuator on the valve before placing the valve in the pipeline. Refer to the following actuator mounting procedures before placing the valve in service. It is recommended that you perform the Bench Set Spring Adjustment procedures in this section to confirm that the actuator is adjusted correctly for the valve travel.
- **Positioner:** If a positioner is installed, or is to be installed on the actuator, refer to the positioner instruction manual for installation. During the adjustment procedures, it will be necessary to provide a temporary loading pressure to the actuator diaphragm.
- **Handwheel Cap:** If the handwheel cap (key 247, figures 11, 13, or 21) is not in place, install the cap by pushing it on by hand until it snaps into place.

Mounting the Actuator on the Valve

CAUTION

The 667 actuator spring load pushes the stem down out of the actuator yoke (see figure 2), and it can come in contact with the valve stem during actuator mounting.

If the valve stem is allowed to remain in the up position (towards the actuator) during actuator mounting, it can interfere with the actuator stem during mounting. It is possible to damage valve stem threads or bend the valve stem. Be sure the valve stem is pushed down (into the valve body), away from the actuator while mounting.

It may be necessary to apply a temporary loading pressure to the actuator to move the actuator stem away from the valve during installation.

If it is not possible to provide a temporary loading pressure, be very careful when lowering the actuator over the valve stem to prevent damage to valve stem and threads.

⚠ WARNING

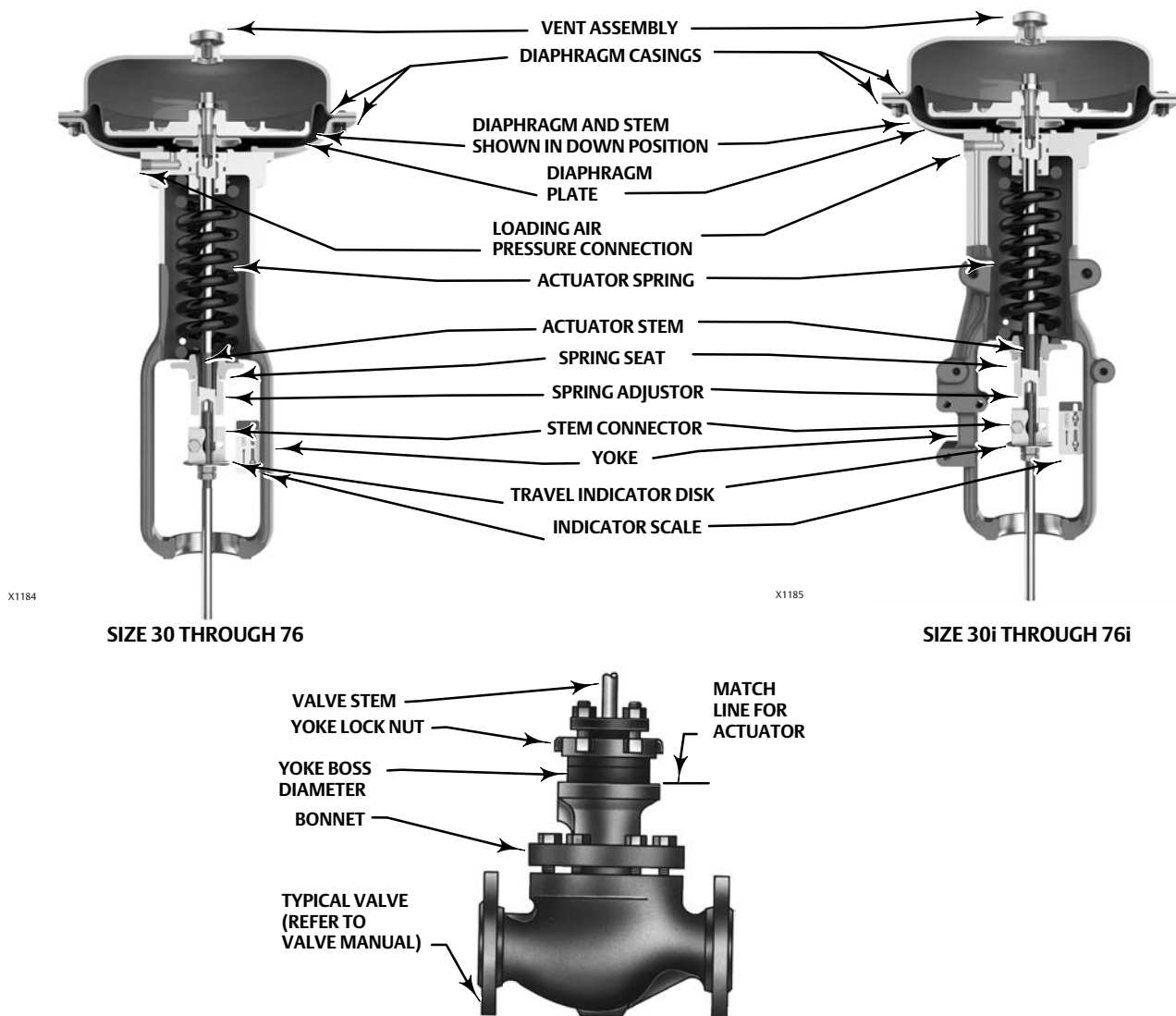
When moving the actuator stem with loading pressure applied, exercise caution to keep hands and tools out of the actuator stem travel path. If the loading pressure is accidentally disconnected, personal injury and property damage may result if something is caught between the actuator stem and other control valve parts.

1. Provide a vise or some other method of supporting the valve and the weight of the actuator during assembly. For direct or reverse acting valves, push the valve stem down away from the actuator while mounting the actuator.
2. Screw the stem locknuts all the way onto the valve stem. With the concave side of the travel indicator disk (key 34) facing the valve, install the travel indicator disk on the valve stem. (Note: The travel indicator disk is not used with size 87 actuators.)
3. Lift or hoist the actuator onto the valve bonnet:
 - a. For size 87 actuators: Slowly lower the actuator down onto the valve while guiding the valve stem into the opening in the end of the actuator stem (see figure 4). Once the actuator is in place, insert the cap screws and tighten the hex nuts, securing the actuator to the bonnet.

b. For all other size actuators:

- Slowly lower the actuator down onto the valve. As the yoke passes over the end of the valve stem, place the yoke locknut over the valve stem. (Note: On small size actuators, it may be necessary to remove the indicator disk and re-install it while lowering the actuator onto the valve because the disk will not go through the actuator yoke opening).
 - Continue to lower the actuator while guiding the valve stem into the opening in the end of the actuator stem until the actuator is in place (see figure 4).
 - Screw the yoke locknut onto the valve bonnet and tighten the locknut.
4. Do not connect the actuator stem to the valve stem at this time. Whenever the actuator is installed on the valve, it is recommended that you perform the Bench Set Spring Adjustment procedures below, to verify that the actuator is still adjusted correctly.

Figure 3. Actuator-Mounting Components for Size 30/30i through 70/70i Actuators



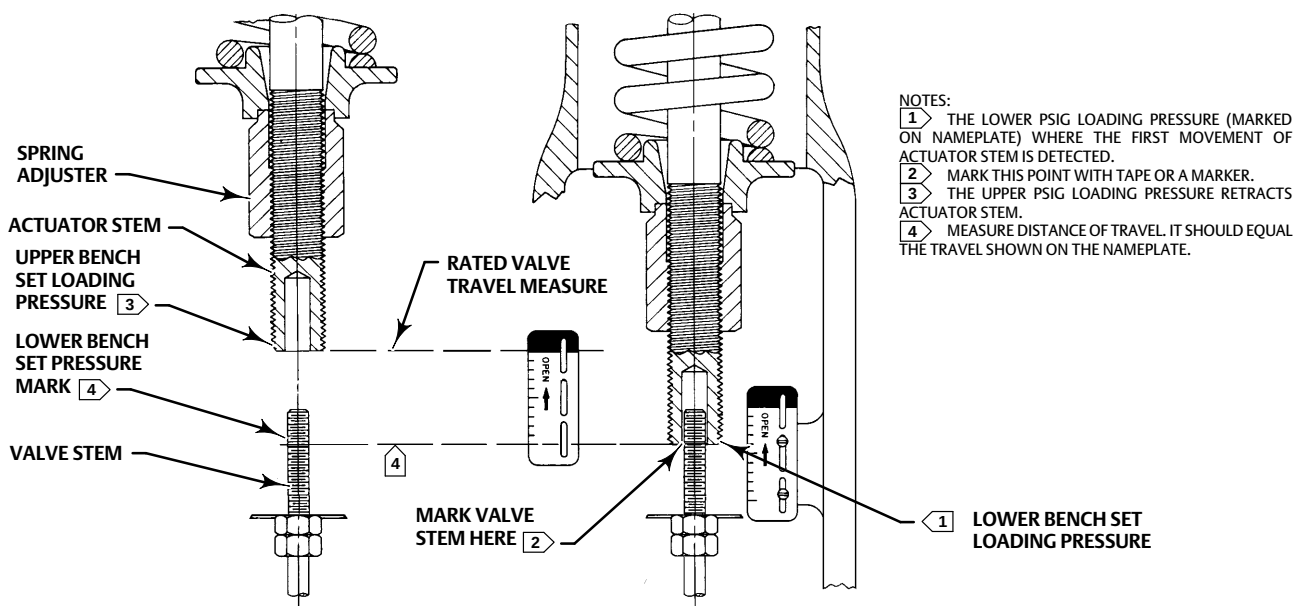
Discussion of Bench Set

The bench set pressure values are used to adjust the initial compression of the actuator spring with the valve-actuator assembly “on the bench.” The correct initial compression ensures that the valve-actuator assembly will function properly when it is put into service and the proper actuator diaphragm operating pressure is applied.

The bench set values are established with the assumption that there is no packing friction. When attempting to adjust the spring in the field, it is very difficult to ensure that there is no friction being applied by “loose” packing.

Accurate adjustment to the bench set range can be made during the actuator mounting process by making the adjustment before the actuator is connected to the valve (see the Spring Verification Procedure).

Figure 4. Bench Set Adjustment



Spring Verification

Ensure that the actuator diaphragm is at the bottom of its travel as shown in figure 4 and not connected to the valve. (Note: Some spring compression is required to move the diaphragm to the **bottom** of its travel.)

Also, provide a certified pressure gauge that will accurately read the diaphragm pressure from 0 through 0.3 bar (5 psig) above the upper operating range pressure marked on the nameplate. Apply loading pressure to the diaphragm.

Stroke the actuator a few times to ensure that the pressure gauge is working correctly, and that the actuator is functioning properly.

CAUTION

To prevent actuator damage, it is important to ensure that the actuator stem is stroking smoothly and not exhibiting binding or excessive friction between the actuator stem and the bushing (key 7). Binding or excessive friction could be an indicator of incorrect assembly or damaged parts.

Key numbers are shown in figures 6, 7, 8, 9, and 10.

Note

For 667 actuators installed on push-down-to-close (direct acting) valves with fail-close action, the valve plug seat is the limit for downward travel and the actuator is the limit for upward (away from the valve) movement.

For 667 actuators installed on push-down-to-open (reverse acting) valves with fail-open action, the actuator down stop is the limit for downward movement, and the valve seat is the limit for upward (away from the valve) movement.

Ensure the correct Spring Verification procedure is followed for the type of valve on which the 667 actuator is installed.

For Push Down to Close (Direct Acting) Valves

1. If not already accomplished, push the valve stem down away from the actuator to the closed position.
2. Set the diaphragm loading pressure to 0.3 bar (5 psig) over the upper operating range pressure. The travel stop cap screw (key 12) should be contacting the upper diaphragm casing.
3. Slowly decrease the pressure towards the upper bench set pressure, as indicated on the nameplate, while checking for the **first** linear movement of the actuator stem.

Note

Before turning the spring adjuster on size 70/70i, 76/76i, or 87 actuators, assemble the stem connector around the actuator stem and the anti-rotating lug on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.

4. If movement occurs before or after the upper bench set pressure is reached, adjust the spring adjuster (see figure 4). Thread the adjuster up or down on the actuator stem until the actuator stem movement is **first** detected at the upper bench set pressure. (Note: You may need to lower the loading pressure to reduce spring compression, allowing the spring adjuster to turn.)
5. Be sure the spring adjuster is adjusted to meet the requirements of step 4 above.
6. Slowly decrease diaphragm loading pressure to the lower bench set pressure, as indicated on the nameplate. This will extend the actuator stem toward the valve. Mark the end of the actuator stem on a nearby surface using tape or some other method.
7. Slowly increase the diaphragm loading pressure until the upper bench set pressure is reached. Again, the travel stop cap screw (key 12) should be against the upper diaphragm casing.
8. Measure the distance between the mark or tape to the end of the actuator stem. This distance should match the rated travel indicated on the nameplate.
9. If the measured travel matches the nameplate travel, bench set is complete. Proceed to the Installing the Stem Connector Assembly subsection.
10. If the measured travel is not exact, consider the spring free-length and spring rate tolerances may produce a slightly different bench set than specified. Contact your Emerson Automation Solutions sales office for assistance.

For Push Down to Open (Reverse Acting) Valves

1. If not already accomplished, push the valve stem down away from the actuator to the open position. Later, when installing the connector, pull up the valve stem to the closed position.

2. Set the diaphragm loading pressure to a value less than the lower bench set pressure, as indicated on the nameplate, or near zero. The down travel stops (key 77) should be contacting the yoke.
3. Slowly increase the pressure towards the lower bench set pressure while checking for the first linear movement of the actuator stem.

Note

Before turning the spring adjuster on size 70/70i, 76/76i, or 87 actuators, assemble the stem connector around the actuator stem and the anti-rotating lug on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.

4. If movement occurs before or after the lower pressure is reached, adjust the spring adjuster (see figure 4). Thread the adjuster up or down on the actuator stem until the actuator stem movement is first detected at the lower bench set pressure.
5. Apply the upper bench set pressure indicated on the nameplate to the diaphragm. This will retract the actuator stem away from the valve. Mark the end of the actuator stem on a nearby surface using tape or some other method.
6. Slowly decrease the diaphragm pressure until the lower bench set pressure is applied. Again, the down travel stops (key 77) should be against the yoke.
7. Measure the distance between the mark or tape to the end of the actuator stem. This distance should match the rated travel indicated on the nameplate.
8. If the measured travel matches the nameplate travel, bench set is complete. Proceed to the Installing the Stem Connector Assembly subsection.
9. If the measured travel is not exact, consider the spring free-length and spring rate tolerances may produce a slightly different bench set than specified. Contact your Emerson Automation Solutions sales office for assistance.

Installing the Stem Connector Assembly

When installing the stem connector assembly (key 31), the actuator and valve stem threads should engage the threads of the stem connector by a distance equal to the diameter of the stem.

⚠ WARNING

Install the stem connector securely before a positioner is mounted to the actuator and pressurized, using only a regulator-controlled air supply, not the positioner, to move the actuator stem.

To avoid personal injury or property damage, keep hands and tools out of the actuator stem travel path while applying loading pressure to move the actuator stem in the following steps.

CAUTION

To avoid damaging the seating surfaces, do not rotate the valve plug while it is seated. Exercise care while installing the stem connector assembly to avoid damage to the valve plug stem and valve stem threads.

Note

Replacement stem connectors are an assembly of two stem connector halves, cap screws, and a spacer between the connector halves. Remove the spacer and discard it, if present, before clamping the actuator and valve stems together. Use only a mated pair of stem connectors.

1. If necessary, push the valve stem down so that the valve plug is touching the seat ring on direct-acting valves. For reverse-acting valves, pull the stem up to the closed position. Always start with the valve plug on the seat.
2. If necessary, screw the valve stem locknuts down, away from the connector location. For all actuators except size 87, ensure that the travel indicator disk (key 34) is on top of the locknuts.
3. Adjust the diaphragm pressure to the lower bench set pressure (or, the upper bench set pressure for reverse-acting valves.) This should be the same pressure used in the Spring Verification steps, and it is marked on the nameplate.
4. Place the stem connector half with the threaded holes approximately half way between the actuator and valve stems, and align the actuator stem and valve stem with threads from both stems mated root-to-crest with the stem connector. If the threads from one of the stems do not fully align with the stem connector, a slight change to loading pressure may be necessary to align the threads. Refer to figures 6, 7, 8, 9, and 10 to help locate the connector position.

CAUTION

Incomplete engagement of either the valve stem or actuator stem in the stem connector can result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than one diameter of that stem. Damage to threads on either stem or in the stem connector can cause the parts to be replaced prematurely. Do not loosen the cap screws when the stem connector has spring or loading pressure force applied.

5. Install the other half of the stem connector and insert the cap screws and tighten them while ensuring even spacing between the stem connector halves on all sides. If installing a positioner, also attach the feedback bracket at the same time.

CAUTION

Over-tightening the valve stem locknuts can make disassembly difficult.

6. Screw the valve stem locknuts up against the stem connector for the size 87 actuator. For all other actuator sizes, screw the valve stem locknuts up until the indicator disk contacts the bottom of the stem connector. Do not overtighten the locknuts.
7. Slowly stroke the valve from fully open to fully closed and verify full rated travel is achieved.

Be sure that the valve is in the closed position. Loosen the screws on the travel indicator scale (key 32), and align it with the travel indicator disk (key 34). Stroke the valve full travel to ensure that the travel matches the rated valve travel on the nameplate. If valve travel is not correct, repeat the stem connector procedure.

Friction Discussion

If you are attempting to adjust the bench set after the actuator is connected to the valve and the packing tightened, you must take friction into account. Make the spring adjustment so full actuator travel occurs at the bench set values (a) plus the friction force divided by the effective diaphragm area with increasing diaphragm pressure or (b) minus the friction force divided by the effective diaphragm area with decreasing diaphragm pressure.

If the stem connector assembly has been installed, the valve friction may be determined by the following procedure:

1. Install a pressure gauge in the actuator loading pressure line that connects to the actuator diaphragm casing.

Note

Steps 2 and 4 require that you read and record the pressure shown on the pressure gauge.

2. Increase the actuator diaphragm pressure and read the diaphragm pressure as the actuator reaches a travel position in the rated travel of the valve that does not contact a travel stop. Make a reference mark on the travel indicator scale using tape or some other method at this point.
3. Increase the actuator diaphragm pressure until the actuator is at a travel position greater than the position referenced in step 2 using the reference point to identify first movement.
4. Decrease the actuator diaphragm pressure and read the diaphragm pressure as the actuator returns to the position referenced in step 2.

The difference between the two diaphragm pressure readings is the change in the diaphragm pressure required to overcome the friction forces in the two directions of travel.

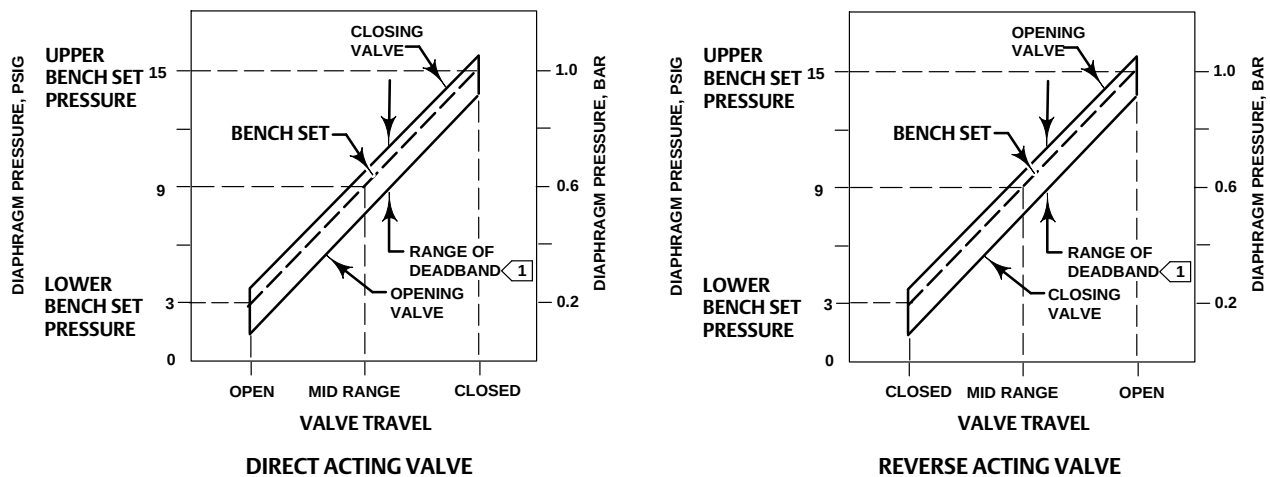
5. Calculate the actual friction force:

$$\text{Friction Force, = pounds} = 0.5 \left(\begin{array}{c} \text{Difference} \\ \text{in pressure} \\ \text{readings, psig} \end{array} \right) \times \left(\begin{array}{c} \text{Effective} \\ \text{diaphragm area,} \\ \text{inches}^2 \end{array} \right)$$

Refer to table 1 for the effective diaphragm area.

It is difficult to rotate the spring adjustor (key 74, figures 6, 7, 8, 9, and 10) when the full actuator loading pressure is applied to the actuator. Release the actuator loading pressure before adjusting. Then re-apply loading pressure to check the adjustment.

Figure 5. Typical Valve Response to Deadband



NOTE:
1

DEADBAND IS CAUSED BY FRICTION.

A6763-2

Deadband Measurement

Deadband is caused by packing friction, unbalanced forces, and other factors in the control valve assembly. Deadband is the range a measured signal can vary without initiating a response from the actuator (see figure 5). Each actuator spring has a fixed spring rate (force divided by compression). You have verified that the right spring was installed in the actuator by completing the Spring Verification steps.

Deadband is one factor that affects the control valve assembly operation during automatic loop control. The control loop tolerance for deadband varies widely depending on the loop response. Some common symptoms of the

deadband being too wide are no movement, a “jump” movement, or oscillating movements of the actuator during automatic loop control. The following steps are provided to determine the span of deadband. The percent of deadband is helpful in troubleshooting problems with the process control loop.

1. Start at a pressure near the lower bench set pressure, slowly increase pressure until the valve is approximately at mid-travel. Note this pressure reading.
2. Slowly decrease pressure until movement of the valve stem is detected, and note this pressure.
3. The difference between these two pressures is deadband, in psi.
4. Calculate the percent of deadband by:

Deadband, psi

$$\text{Deadband} = \frac{\text{Deadband, psi}}{\text{Bench Set Span, psi}} = \text{nn \%}$$

Loading Connection

Key number locations are shown in figures 6, 7, 8, 9, and 10, unless otherwise noted.

The loading pressure connections are made at the factory if the valve, actuator, and positioner come as a unit. Keep the length of tubing or piping as short as possible to avoid transmission lag in the control signal. If a volume booster, valve positioner, or other accessory is used, be sure that it is properly connected to the actuator. Refer to the positioner instruction manual or other manuals as necessary. For actuators shipped separately or whenever the actuator pressure connections are installed, use the following steps:

1. Connect the loading pressure piping to the NPT internal connection in the side of the yoke (key 73).
2. For size 70/70i and 87 actuators, if necessary, remove the 1/4 NPT bushing if a 1/2 NPT internal connection is needed to increase connection size. The connection can be made with either piping or tubing.
3. Cycle the actuator several times to be sure that the valve stem travel is correct when the correct pressure ranges are applied to the diaphragm.
4. If valve stem travel appears to be incorrect, refer to the Bench Set Spring Adjustment procedures at the beginning of this section. Do not place the valve in service if it is not reacting correctly to diaphragm loading pressure changes.

Maintenance

Actuator parts are subject to normal wear and must be inspected regularly and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when performing any maintenance operations to avoid personal injury.
- 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 power actuator loading pressure and relieve any actuator spring pre-compression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

The maintenance instructions are divided into several sections: Actuator, Top-Mounted Handwheel Assembly (Adjustable Down Travel Stop), Side-Mounted Handwheel Assembly for Size 34/34i through 60/60i Actuators (Manual Actuator), Side-Mounted Handwheel Assembly for Size 70, 76 and 87 Actuators (Manual Actuator), and Casing-Mounted Travel Stops.

Actuator

This procedure describes how the actuator can be completely disassembled and assembled. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job; then, start the assembly at the appropriate step.

Key numbers are shown in figures 6, 7, 8, 9, or 10, unless otherwise noted. Figure 6 shows the size 30 through 60 actuators, figure 7 shows the size 30i through 60i actuators, figure 8 shows the size 70 actuator, figure 9 shows the size 70i actuator, and figure 10 shows the size 87 actuator.

Actuator Disassembly

Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Also shut off all pressure lines to the power actuator, release 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.

1. If equipped, remove the tubing or piping from the connection in the top of the yoke (key 73).
2. Turn the spring adjuster (key 74) counterclockwise (**toward the valve body**) until all spring compression is relieved.

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.

3. If necessary, remove the actuator from the valve body by separating the stem connector (key 31). Loosen the stem locknuts for the size 87 actuator, and remove the stem connector nuts. For all other sizes, separate the stem connector by loosening the stem locknuts (keys 69 and 75) and unscrewing the two stem connector cap screws.
4. Unscrew the spring adjuster (key 74) from the actuator stem (key 144). Also lift the spring seat and spring (key 19 and 18) out of the yoke.
5. Remove the diaphragm casing cap screws and nuts (keys 13 and 14), and lift off the upper diaphragm casing (key 1).

CAUTION

Be careful during disassembly to avoid damaging the O-rings (key 8).

6. Remove the following connected parts: the diaphragm (key 3), upper diaphragm plate (key 4), spacer (key 2), cap screw (key 12), lower diaphragm plate (key 71), and actuator stem (key 144). Be careful when pulling the threads of the actuator stem through the seal bushing (key 7) to avoid damaging the O-rings (key 8).
7. Remove the cap screw (key 12) to separate the parts of this assembly.
8. To remove the seal bushing, remove the snap ring (key 72), and lift out the bushing. Inspect, and if necessary, replace O-rings (keys 8 and 9).
9. Remove cap screws (key 30), and take off the lower diaphragm casing (key 64) and the gasket (key 70, size 30/30i through 60/60i and 76/76i) or O-ring (key 70, size 70/70i or 87). If necessary, the down travel stops (key 77) can be removed.

Table 2. Actuator Assembly Recommended Torque Values

DESCRIPTION, KEY NUMBER	ACTUATOR SIZE	THREAD SIZE, INCH	TORQUE	
			N • m	Lbf • ft
Casing to yoke, key 30 ⁽¹⁾	30/30i to 60/60i and 76/76i	3/8-16	41	30
	70/70i and 87	1/2-13	95	70
Travel stop, key 12	30/30i	3/8-24	41	30
	34/34i and 40/40i	1/2-20	68	50
	45/45i to 76/76i and 87	3/4-16	183	135
MO U-bolt nut, key 170	34 and 40	1/2-13	81	60
	45 to 60	5/8-11	163	120
MO U-bolt nut, key 147	34 and 40	3/8-16	41	30
MO U-bolt nut, key 144	45 to 60	3/8-16	41	30
Diaphragm casing, key 14 ⁽¹⁾	30/30i to 76/76i and 87	3/8-24	27	20
Hex cap screw, key 256	34i to 40i	1/2-13	92	68
	45i to 60i	5/8-11	163	120
Hex cap screw, key 257	34i to 60i	3/8-16	39	29
Stem connector, key 26 ⁽²⁾	30/30i through 40/40i	5/16-18	23	17
	45/45i through 70/70i	3/8-16	39	29
	87	1/2-13	91	67

1. Observe tightening pattern and procedure described in the appropriate Actuator Assembly section.

2. Torque values when lithium grease is used on the threads.

Actuator Assembly

Refer to table 2 as appropriate.

1. Coat the O-rings (key 70/70i, sizes 70 and 87) with lithium grease (key 237), or, coat the gasket with lithium grease (key 237). Place a new gasket or O-ring (key 70) on the yoke (key 73). Position the lower diaphragm casing (key 64) on the yoke and align the holes. Insert the cap screws (key 30) and tighten evenly in a crisscross pattern to 41 N•m (30 lbf•ft) for size 30/30i-60/60i and 76/76i actuators or 95 N•m (70 lbf•ft) for size 70/70i and 87 actuators. If down travel stops (key 77) were removed, insert and tighten them.
2. Coat the O-rings (keys 8 and 9) with lithium grease (key 237) and place the O-rings in the seal bushing (key 7).
3. Fill the seal bushing with lithium grease (key 237), slide the bushing into the yoke (key 73), and install the snap ring (key 72).

CAUTION

Be careful during assembly to avoid damaging the O-rings (key 8).

4. Assemble the actuator stem (key 144), lower diaphragm plate (key 71), diaphragm (key 3), upper diaphragm plate (key 4), and the travel stop cap screw and spacer (keys 12 and 2). Coat the cap screw threads with lithium grease

(key 237). Tighten the cap screw (key 12) to the appropriate torque as shown in table 2. Place this assembly in the actuator. Take care when pushing the actuator stem through the seal bushing so that the threads do not damage the O-rings.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-76/76i and 87 actuators.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

5. Install the upper diaphragm casing (key 1), and install the cap screws and nuts (keys 13 and 14). Tighten the diaphragm cap screws and nuts in the following manner.
6. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
7. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
8. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
9. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
10. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
11. Once completed, no more tightening is recommended.
12. Install the actuator spring (key 18) and spring seat (key 19). Apply anti-seize lubricant (key 239) to the threads of the actuator stem and to the surface of the spring adjuster (key 74) that contacts the spring seat. Thread the spring adjuster onto the actuator stem.
13. Mount the actuator onto the valve in accordance with the procedures in the Installation section.

Top-Mounted Handwheel Assembly (Adjustable Down Travel Stop)

Actuator key numbers are shown in figures 6, 7, 8, 9, and 10. And, top-mounted handwheels are shown in figures 11, 12, 13, 14, and 15.

Note

If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel. The side-mounted handwheel is designed for more frequent use as a manual operator.

A top-mounted handwheel assembly (figures 11, 12, 13, 14, and 15) is usually used as an adjustable down travel stop to limit full extension of the actuator stem. Turning the handwheel counterclockwise pulls the extension rod (key 150, figures 11, 13, and 14) up, retracting the actuator stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Note

For size 70/70i and 87 actuators with handjack bars (figure 15) it is recommended that the handjack bar (key 58) be removed when not in use and the handwheel cap (key 247) be installed for weather protection of the internal components.

Disassembly for Top-Mounted Handwheel

1. Bypass the control valve, reduce loading pressure to atmospheric, and if equipped, remove the tubing or piping from the connection in the top of the yoke (key 73, figures 6, 8, 9, and 10).
2. Turn the handwheel (key 58) clockwise so that the handwheel assembly is not causing any spring compression.
3. Turn the actuator spring adjuster (key 74) to relieve all the compression from the spring (key 18).
4. If servicing just the thrust bearing, races, and handwheel screw (keys 180, 181, and 160), use the following steps:
 - Remove the cap and take out the cotter pin. Remove the castle nut, bearing retainer, thrust bearing, and races (keys 247, 167, 166, 180, and 181).
 - Use the handwheel to remove the handwheel screw (key 160) from the handwheel body (key 148).
 - If necessary, remove the extension rod (key 150) at this time. Most maintenance procedures do not require the rod to be removed.
 - Clean and inspect all parts or replace parts as necessary. Upon re-assembly, lubricate handwheel threads, bearings, and races with anti-seize lubricant (key 239).
 - Lubricate and re-install the handwheel screw into handwheel body (key 148). Lubricate and replace the races, bearing, and retainer (keys 181, 180, and 182). Replace the castle nut (key 166), tighten it, and insert the cotter pin (key 167). Replace the handwheel cap (key 247).
5. For size 30/30i through 60/60i and 76/76i actuator handwheels (figures 11 and 13):
 - Remove the cap screws (key 161). Make sure that the guide plate can turn between the handwheel body and the mounting plate (keys 157, 148 and 158).
 - Remove the cap (key 247) and cotter pin (key 167). Remove the castle nut (key 166) and, if necessary, unscrew the extension rod (key 150). Remove the rod, the handwheel body (key 148), and the attached parts.
 - Remove the hex nuts and cap screws (keys 14 and 13, figures 6, 7, 8, 9, and 10) from the diaphragm casings. Lift off the upper diaphragm casing (key 1) and the mounting plate (key 158).
 - Turn the handwheel (key 58) to remove the handwheel screw (key 160) from the handwheel body (key 148). Remove the retaining ring (key 60) if the handwheel (key 58) must be separated from the handwheel screw.
 - If necessary, perform other actuator maintenance before returning to the following assembly steps.

6. For size 70/70i and 87 actuator handwheels (figures 14 and 15):

- Remove the cap (key 247). Take out the cotter pin (key 167) and remove the castle nut, the bearing retainer, and thrust bearing (keys 166, 182, 181, and 180). It is not necessary to remove the extension rod (key 150) at this time.
- Remove the hex nuts and cap screws (keys 14 and 13, figures 6, 7, 8, 9, and 10) from the diaphragm casings. Lift off the upper diaphragm casing (key 1), handwheel body (key 148) and attached parts.
- If travel stops (key 152) are used, note and record their position relative to the cap screws (key 154) for use in assembly. Remove the travel stops and cap screws, and remove either the mounting plate (key 158, figure 14) or the handwheel body (key 148, figure 14) and attached parts.
- Turn the handwheel (key 58) to remove the handwheel screw (key 160) from the handwheel body (key 148). Remove the retaining ring (key 60) if the handwheel (key 58) must be separated from the handwheel screw.
- If necessary, perform other actuator maintenance before returning to the following assembly steps.

Assembly for Top-Mounted Handwheel

For size 30/30i through 60/60i and 76/76i actuator handwheels:

Refer to figures 11, 12, and 13 for top-mounted handwheel assemblies.

1. If it was removed, slide the handwheel (key 58) onto the end of the handwheel screw (key 160), and snap the retaining ring (key 60) into place. Also, install the guide post (key 150) if it was removed.
2. Generously coat the threads of the handwheel screw (key 160) with anti-seize lubricant (key 239). Turn the screw into the handwheel body (key 148).
3. Install the mounting plate (key 158) to the diaphragm casing (key 1, figures 6, 8, 9, and 10) with the cap screws (key 154). Finger tighten the screws.
4. If travel stops were used, install the travel stops to their original positions as recorded in the preceding Disassembly steps. Tighten the screws and travel stops.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-76/76i and 87 actuators.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

5. Position the diaphragm casing (key 1, figures 6, 7, 8, 9, and 10), mounting plate (key 158), travel stops (key 152), if used, and cap screws (key 154) on the diaphragm. Install the cap screws and hex nuts (keys 13 and 14, figures 6, 7, 8, 9, and 10) and tighten in the following manner.

6. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
7. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
8. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
9. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
10. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
11. Once completed, no more tightening is recommended.
12. If necessary, screw the extension rod (key 150) into the connector (key 27). Slide the guide plate (key 157) onto the extension rod (key 150). For size 45/45i through 76/76i, place the spacer (key 253) on top of the guide plate (key 157). If necessary, replace the extension rod (key 150). Slide the handwheel body (key 148) over the extension rod, position the handwheel body on the spacer (key 253), align the holes, and insert and tighten the cap screws (key 161).
13. Lubricate and install the thrust bearings (keys 181 and 180), install the bearing retainer (key 182), install the castle nut (key 166) on the extension rod. Do not overtighten the castle nut on the bearing. Install the cotter pin (key 167). Replace the cap (key 247).
14. Refer to the Assembly portion of the Actuator maintenance section.

For size 70/70i and 87 actuators handwheels (figures 14 and 15):

Refer to figure 14 for top-mounted handwheel assemblies and figure 15 for handjack bar assemblies.

1. If removed, slide the handwheel (key 58) onto the end of the handwheel screw (key 160), and snap the retaining ring (key 60) into place.
2. Generously coat the threads of the handwheel screw (key 160) with anti-seize lubricant (key 239). Turn the screw into the handwheel body (key 148).
3. If necessary, install the extension rod (key 150) into the connector (key 27) and tighten it. Position the handwheel body (key 148) on the diaphragm casing (key 1, figures 6, 7, 8, 9, and 10), and align the holes. Insert the cap screws (key 154). Finger tighten the screws.
4. If travel stops were used, return the travel stops to their original positions as recorded in the proceeding Disassembly steps. Tighten the screws and travel stops.

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-76/76i and 87 actuators.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

5. Slide the extension rod (key 150) into the handwheel screw (key 160), and position the diaphragm casing (key 1, figures 6, 7, 8, 9, and 10) with the attached parts on the diaphragm. Install the cap screws and hex nuts (keys 13 and 14, figures 6, 7, 8, 9, and 10) and tighten in the following manner.
6. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
7. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
8. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
9. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
10. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
11. Once completed, no more tightening is recommended.
12. Lubricate and install the thrust bearings (keys 180 and 181), install the bearing retainer (key 182), install the castle nut (keys 166) on the extension rod. Do not overtighten the castle nut on the bearing. Install the cotter pin (key 167). Replace the cap (key 247).
13. Refer to the Assembly portion of the Actuator maintenance section.

Side-Mounted Handwheel for Sizes 34 through 60 and 34i through 60i Actuators

A side-mounted handwheel assembly is normally used as a manual actuator for sizes 34 through 60 (figures 16 and 18) and 34i through 60i actuators (figures 17 and 19). Turning the handwheel counter-clockwise past the neutral position opens the valve. Two levers (key 146, figures 16, 17, 18, and 19) on a handwheel assembly operate the valve by moving the valve stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then begin the assembly at the appropriate step.

Disassembly for Side-Mounted Handwheel (Sizes 34-60 and 34i-60i)

1. Use step a. for size 34 through size 60 actuators, and use step b. for sizes 34i through 60i.
 - a. **For Size 34 through 60:** If desired, the handwheel assembly can be removed from the actuator yoke. To do this, remove the hex nuts (keys 147 and 170) from the U-bolts (key 166 and 143) that hold the assembly to the yoke for the size 30 and size 40. Remove the hex nuts (key 144 and 170) from the U-bolts (key 166 and 143) that hold the assembly to the yoke for the size 45 through size 60.
 - b. **For Size 34i through 60i:** If desired, the handwheel assembly can be removed from the actuator yoke. To do this, remove the cap screws (key 256 and 257) and spacers (key 258) that hold the assembly to the yoke for the size 30i through size 60i.
2. Remove the retaining ring (key 154) and drive out the lever pivot pin (key 153).
3. Two screws (key 156) hold the right- and left-hand levers (key 146) together. Remove the screw from the top of the levers so that the levers will drop down out of the assembly. Disassemble further, if necessary, by removing the other screw.
4. Remove the screw (key 161) and pointer mounting bolt (key 159, not shown) located behind the pointer (key 160).
5. Remove the stop nut (key 54), lockwasher (key 150), and washer (key 149). Then remove the handwheel (key 51), being careful not to lose the small ball (key 55) and spring (key 56).
6. Loosen the locking set screw (key 168, figure 19). Then, using a suitable tool, unscrew the bearing retainer (key 136).

7. Pull the handwheel screw assembly (key 145) out of the handwheel body. The operating nut (key 132) will come out with the screw. Also remove the bushing (key 151, figure 16 or 17) on size 34 and 40.
8. If required, remove the two ball bearings (key 152), one from the bearing retainer and the other from the handwheel body.

Assembly for Side-Mounted Handwheel (Sizes 34-60 and 34i-60i)



[Click here](#) or access the following QR code for a video on installing a side-mounted handwheel on a 667 actuator.

1. Pack the ball bearings (key 152) with anti-seize lubricant (key 244). Insert one bearing and the bushing (key 151, figure 16 or 17) into the handwheel body (key 142). The bushing is not used in a handwheel assembly for sizes 45/45i through 60/60i actuators.
2. Coat the handwheel screw assembly (key 145) threads with anti-seize lubricant (key 244), and thread the operating nut (key 132) onto the screw. Slide the second ball bearing (key 152) onto the screw, and insert the end of the screw into either the bushing (key 151, figure 16 or 17) for sizes 34/34i and 40/40i, or into the bearing for sizes 45/45i through 60/60i.
3. Thread the bearing retainer (key 136) into the body (key 142). Completely tighten the bearing retainer, and then loosen it one-quarter turn. Tighten the set screw (key 168, figure 16 or 17) to hold the bearing retainer in place.
4. Coat the groove in the handwheel body (key 142) with lithium grease (key 241). Insert the spring (key 56) and ball (key 55) into the handwheel (key 51). Holding the ball and spring in the handwheel, put the handwheel, the washer (key 149), the lockwasher (key 150), and the stop nut (key 54) onto the end of the end of the handwheel screw (key 145). Tighten the stop nut.
5. Position the pointer mounting bolt (key 159, not shown) and pointer (key 160). Insert and tighten the screw (key 161).
6. Assemble the two levers (key 146) with the cap screws (key 156) for handwheel assemblies for sizes 45/45i, 50/50i, and 60/60i actuators, or with the machine screws (key 156) for handwheel assemblies on sizes 34/34i and 40/40i actuators.
7. Use **step a.** for size 34 through size 60 actuators, and use **step b.** for sizes 34i through 60i.
 - a. **For Size 34 through 60:** If the handwheel assembly was removed from the yoke (key 9, figures 6, 8, or 10), remount the handjack assembly to the yoke using the dowel pins for alignment. For the size 34 and size 40, position the U-bolts and J-bolts (keys 166 and 143) on the yoke, and hand-tighten the hex nuts (keys 170 and 147) to hold the handwheel assembly in position. For the size 45 through size 60, position the U-bolts (keys 166 and 143) on the yoke, and hand-tighten the hex nuts (keys 170 and 144) to hold the handwheel assembly in position. Cap screws (key 163) should be tight against the yoke legs to provide stability. Tighten the nuts (key 144 for size 30 and size 40, key 158 for the size 45 through size 60). For the size 34 and size 40 finish tightening the U-bolt nuts to 81 N • m [60 lbf • ft] (key 170) and 41 N • m [30 lbf • ft] (key 147). For the sizes 45 through 60 finish tightening the U-bolt nuts to 163 N • m [120 lbf • ft] (key 170) and 41 N • m [30 lbf • ft] (key 144). Be sure the handwheel assembly remains flat against the mounting pad and perpendicular to the yoke.
 - b. **For Size 34i through 60i:** If the handwheel assembly was removed from the yoke (key 9, figures 7, 9, or 10), remount the handjack assembly to the yoke using the dowel pins for alignment. Position the upper cap screws (key 256) on the assembly and hand-tighten to hold the handwheel assembly in position. Place the spacers (key 258) between the yoke and handjack assembly, position cap screws (key 257), and hand-tighten. For the size 34i and size 40i finish tightening the cap screws (key 256) to 92 N • m [68 lbf • ft] and (key 257) to 39 N • m [29 lbf • ft]. For the sizes 45i through 60i finish tightening the cap screws (key 256) to 163 N • m [120 lbf • ft] and (key 257) to 39 N • m [29 lbf • ft].
8. Position the levers (key 146) as shown in figures 11 or 12. Insert the lever pivot pin (key 153), and snap the retaining ring (key 154) onto the lever pivot pin.

Side-Mounted Handwheel Assembly for Size 70, 76, and 87 Actuators

A side-mounted handwheel assembly (figure 20) is usually used as a manual actuator. Turning the handwheel clockwise past the neutral position always closes the valve body. A sleeve (key 123, figure 20) on a handwheel assembly for a size 70, 76 or 87 actuator opens the valve body by moving the valve stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; and then begin the assembly at the appropriate step.

Disassembly for Side-Mounted Handwheel (Sizes 70, 76, and 87)

1. Bypass the control valve. Reduce the loading pressure to atmospheric. Disconnect the loading pressure tubing or piping at the yoke.
2. Remove the cover band (key 87), and relieve spring compression by turning the spring adjuster (key 74) counterclockwise.
3. Remove the cap screws and nuts (keys 13 and 14) and lift off the upper diaphragm casing (key 1).
4. Remove the travel stop screw (key 12) and spacer (key 2), and take off the diaphragm plate (key 4), the diaphragm (key 3), and the lower diaphragm plate (key 71).
5. Unscrew the cap screws (key 90) and remove the following connected parts: the lower diaphragm casing (key 64), the O-ring (key 70), spring case adaptor (key 89), the seal bushing, O-rings, and snap ring (keys 7, 8, 9, and 72).
6. Remove the snap ring (key 72), and slide the seal bushing and O-rings (keys 7, 8, and 9) out of the spring case adaptor (key 89).
7. Take out the actuator spring (key 18).
8. Remove the stem connector (key 31) and stem connector cap screws.
9. Pull the actuator stem (key 144) up and out of the yoke. The spring seat (key 19), spring adjuster (key 74), thrust bearing (key 128), and the pinned adjusting screw (key 131) will come out with the actuator stem.
10. Turn the handwheel so that the lower sleeve (key 123) extends out of the bottom of the yoke. DO NOT move the neutral indicator scale (key 125).
11. Loosen two set screws (key 121), and unscrew the bearing retainer flange (key 45). Take out the worm gear and two thrust bearings (key 132), one on each side of the gear.
12. The worm shaft (key 51) and associated parts can be disassembled, if desired, by first removing the handwheel nut (key 127) and the handwheel (key 58). Do not lose the small ball (key 141) and spring (key 142).
13. Loosen the set screw (key 52) for each worm shaft retainer (keys 48 and 49). Unscrew the two worm retainers (keys 48 and 49). The ball bearings (key 50) will come out with the retainers.

Assembly for Side-Mounted Handwheel (Sizes 70, 76, and 87)

1. The front and back worm retainers (keys 48 and 49) each have a slot in their threads for a set screw (key 52). Pack the ball bearings (key 50) with anti-seize lubricant (key 239), and insert one ball bearing in the back worm retainer (key 49) as shown in figure 20.
2. Thread the back bearing retainer and ball bearing (keys 49 and 50) into the yoke. Align the slot in the bearing retainer with the set screw hole in the yoke, insert the set screw (key 52), and tighten it.
3. Coat the worm shaft (key 51) threads with anti-seize lubricant (key 239), and slide the shaft into the yoke so that the end of the shaft fits snugly into the back bearing retainer.
4. Insert the bearing in the front bearing retainer (key 49), and thread the retainer and ball bearing into the yoke. Align the slot in the retainer with the hole in the yoke, insert the set screw (key 52), and tighten it.
5. Put the spring and ball (keys 141 and 142) in the handwheel (key 58). Slide the handwheel onto the worm shaft (key 51). Thread the hex nut (key 127) onto the worm shaft.

6. Pack the two needle bearings (key 132) and coat the worm gear (key 44) threads with anti-seize lubricant (key 239). Insert the key (key 122), the bearings, and the worm gear in the yoke (key 73) as shown in figure 20.
7. Slots are cut in the threads of the bearing retainer flange (key 45). Thread the flange into the yoke so that the slots and the holes for the set screws (key 121) align. Insert the screws, and tighten them.
8. The lower sleeve (key 123) has a milled groove in one end. Coat the sleeve threads with anti-seize lubricant (key 239), slide the end of the lower sleeve with the groove into the bearing retainer flange, turn the handwheel, and feed the sleeve through the worm gear so that the slot in the lower sleeve engages the key (key 122) in the yoke. Continue turning the handwheel until the lower sleeve protrudes 81 mm (3.19 inches) below the surface of the yoke. The bottom of the lower sleeve should be even with the bottom of the extension on the neutral indicator.
9. Pack the thrust bearing (key 128) with anti-seize lubricant (key 239). Slide the actuator stem (key 144) and the attached adjusting screw (key 131), pin (key 130), thrust bearing (key 128), spring seat (key 19), and spring adjuster (key 74) into the yoke. The lower end of the stem slides through the lower sleeve (key 123) and the lower sleeve slides into the adjusting screw (key 131), as shown in figure 20.
10. Position the actuator stem (key 144) against the valve stem. Clamp both stems between the two halves of the stem connector (key 31), and be sure the threads are engaged properly on both stems. The stem connector should not be closer than 3.2 mm (1/8 inches) to the lower sleeve when the actuator stem is in the retracted position. This adjustment will provide approximately 3.2 mm (1/8 inches) of free travel of the lower sleeve in either direction for manual operation. Fasten the halves together with the cap screws.
11. Put the actuator spring (key 18) in the yoke on the spring seat (key 19).
12. Coat the O-rings (keys 8 and 9) with lithium grease (key 237), and insert them in the seal bushing (key 7). Slide the seal bushing and O-rings into the spring case adaptor (key 89).
13. Install the snap ring (key 72).
14. Slide the seal bushing and O-rings (keys 7, 8, and 9) over the actuator stem (key 144), and position the spring case adaptor (key 89), lower diaphragm casing (key 64), and O-ring (key 70) on the yoke.
15. Insert and tighten the cap screws (key 90).
16. Slide the lower diaphragm plate (key 71), the diaphragm (key 3) with the patterned side up, the diaphragm plate (key 4), the spacer (key 2), and the cap screw (key 12) on the actuator stem (key 144). Tighten the cap screw.
17. Put the diaphragm casing (key 1) on the diaphragm. Align the holes in the diaphragm (key 3) and the diaphragm casings (keys 1 and 64).

Note

When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30/30i-76/76i and 87 actuators.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

Note

Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.

18. Install the cap screws and hex nuts (keys 13 and 14) and tighten in the following manner.

19. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
20. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
21. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
22. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
23. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
24. Once completed, no more tightening is recommended.
25. Return the actuator to service after completing the Loading Connection procedure in the Installation section and the procedures in the Adjustments section.

Casing-Mounted Travel Stops

Note

If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel. The side-mounted handwheel is designed for more frequent use as manual operator.

Casing-mounted adjustable travel stops (shown in figures 21 through 25) are available to limit travel in the down direction (extending the actuator stem) or in the up direction (retracting the actuator stem). The travel stop in figure 21 is a down travel stop, the travel stop in figure 22 is an up and down travel stop, and the travel stops in figures 23, 24, and 25 are up travel stops.

Use the locknuts (key 151, figures 21 and 22), stem (key 150, figure 23), handwheel (key 58, figure 24) or cap screw (key 177, figure 25) to set the point at which the travel stop limits travel. Be sure to tighten the locknuts and replace the cap (key 149, figures 21 and 23; key 247, figure 22) after setting the travel stop.

Instructions are given below for disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

Key numbers are shown in figures 21 through 25.

1. Remove the cap (key 149 or 247) if the travel stop uses one. For down travel stops, loosen the locknuts (key 151, figures 21 and 22) so that the stop is not causing any spring compression.
2. Bypass the control valve, reduce loading pressure to atmospheric, and remove the tubing or piping from the connection on top of the yoke (key 73, figures 6, 8, and 10).
3. For down travel stops, turn the spring adjuster (key 74, figures 6, 8, and 10) out of the yoke toward the stem connector (key 31) to relieve all the compression in the spring (key 18).
4. For style 11 travel stops (figure 22), unscrew the cap screws (key 161), and make sure that the guide plate (key 157) can turn between the handwheel body (key 148) and the mounting plate (key 158).
5. Use a wrench on the nuts (key 151) to unscrew the extension rod (key 150). Remove the rod, the handwheel body (key 148), and the attached parts.
6. Unscrew the hex nuts and cap screws (keys 14 and 13, figures 6, 8, and 10) from the diaphragm casings. Lift off the upper diaphragm casing (key 1, figures 6, 8, and 10) and, for the style 11 travel stop, the mounting plate (key 158). For styles 10, 12 and 13, the travel stop assembly will be removed with the casing.
7. Note and record the position of travel stops (key 152) relative to the cap screws (key 154) for use in assembly. Unscrew the travel stops and cap screws, and remove either the mounting plate (key 158) or the handwheel body (key 148) and attached parts.

8. Separate the stem (key 150) and screw (key 160, figure 22) from the handwheel body.
9. Before reassembling, lubricate parts indicated by key 239 in figures 21 through 25. Use anti-seize lubricant (key 239).
10. Reassemble parts in the reverse order of removal.
11. When replacing the cap screws (key 154) and, if used, the travel stops (key 152), be sure to return them to their original position as recorded in step 7.

CAUTION

Over-tightening the diaphragm cap screws and nuts (keys 13 and 14), figures 6, 7, 8, 9, and 10 can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.

12. Install the cap screws and nuts (keys 13 and 14, figures 6, 7, 8, 9, and 10) and finger tighten. Tighten the diaphragm cap screws and nuts to 27 N•m (20 lbf•ft) torque in a crisscross pattern.
13. Return the spring adjuster (key 74, figure 6, 7, 8, 9, and 10) to its original position. Re-adjust the travel stop.

Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always mention this number when corresponding with your [Emerson sales office](#) or Local Business Partner regarding technical information or replacement parts. Also, reference the complete 11-character part number of each needed part as found in the following Parts Kits and Parts List sections.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Automation Solutions should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

Parts Kits

Actuator Repair Kits

Parts kit includes keys 8, 9, and 70. O-ring material is nitrile, and gasket material is composition.

Key	Description	Part Number
	Size 30/30i	R667X000302
	Sizes 34/34i & 40/40i	R667X000402
	Sizes 45/45i through 60/60i	R667X000502
	Sizes 70/70i & 87	R667X000702
	Size 76/76i	R667X000762

Side-Mounted Handwheels Retrofit Kits

Key	Description	Part Number
Retrofit Kit includes parts to add a Side-Mounted Handwheel.		
	Size 34 Push-Down-To-Close	30A8778X0E2
	Size 34 Push-Down-To-Open	30A8778X0F2
	Size 40 Push-Down-To-Close	30A8778X0G2
	Size 40 Push-Down-To-Open	30A8778X0H2
	Size 45 & 46 Push-Down-To-Close	40A8779X0A2
	Size 45 & 46 Push-Down-To-Open	40A8779X0B2
	Size 50 & 60 Push-Down-To-Close	40A8779X0C2
	Size 50 & 60 Push-Down-To-Open	40A8779X0D2
	Size 34i push down to close	GE71635X0E2
	Size 34i push down to open	GE71635X0F2
	Size 40i push down to close	GE71635X0G2
	Size 40i push down to open	GE71635X0H2
	Size 45i & 46i push down to close	GE71636X0A2
	Size 40i & 60i push down to open	GE71636X0B2
	Size 50i & 60i push down to close	GE71636X0C2
	Size 50i & 60i push down to open	GE71636X0D2

Transition Kits for Side-Mounted Handwheels

Transition kits include fasteners necessary to remount an existing side-mounted handwheel to an actuator where the yoke has been changed to a size i yoke.

Contains key numbers 256, 257, and 258.

Description	Part Number
Size 34i/40i push-down-to-close or push-down-to-open	GE71635X0J2
Size 45i - 60i push-down-to-close or push-down-to-open	GE71636X0E2

Top-Mounted Handwheels Retrofit Kits

Retrofit Kit includes parts to add a Top-Mounted Handwheel. Kit number 1 includes the handwheel assembly only. Kit number 2 includes Kit number 1 and a new diaphragm case that is required to mount the handwheel assembly.

Key	Description	Part Number
	Kit 1	
	Size 30/30i	30B3940X102
	Sizes 34/34i	30B3940X022
	Size 40/40i	30B3940X042
	Sizes 45/45i & 50/50i	33B9224X012
	Sizes 46/46i, 60/60i, & 76/76i	33B9224X012
	Sizes 70/70i & 87	CV8060X0012
	Kit 2	
	Size 30/30i	30B3940X052
	Size 34/34i	30B3940X062
	Size 40/40i	30B3940X092
	Sizes 45/45i & 50/50i	33B9224X022
	Sizes 46/46i, 60/60i, & 76/76i	33B9224X032
	Sizes 70/70i & 87	CV8060X0022

Parts List

Note

Contact your [Emerson sales office](#) or Local Business Partner for Part Ordering information.

Actuator Assembly

Key	Description
1	Upper Diaphragm Casing
2	Travel Stop Spacer

Key	Description
3*	Diaphragm Molded Nitrile/Nylon Molded Silicone/Polyester
4	Upper Diaphragm Plate
7*	Bushing, Seal Brass S41600 [416 stainless steel (SST)] PTFE w/25% Glass
8*	O-Ring Nitrile Fluorocarbon
9*	O-Ring Nitrile Fluorocarbon
12	Screw, Cap, hex hd
13	Hex hd Cap Screw
14	Hex Nut
17	Vent Assembly
18	Spring
19	Seat, Lower Spring
27	Extension Rod Conn
30	Hex hd Cap Screw
31	Stem Connector Assembly
32	Travel Indicator Scale
33	Screw, Self Tapping
33	Screw, Mach, Fill hd
34	Disk, Travel Indicator
39	Nameplate
40	Screw, Drive
64	Lower Diaphragm Casing
69	Nut, Hex, Jam
70*	Gasket Composition [up to 232°C (450°F)]
70*	O-Ring Nitrile
71	Lower Diaphragm Plate
72	Ring, Snap
73	Yoke
74	Spring Adjuster
75	Nut, Hex
76	Nut, Speed, Twin
77	Stop, Travel
78	Bushing, Pipe, Hex
79	Screw, Mach, Flat Hd
81	Screw, Mach, Rd Hd
82	Indicator, Travel, Adaptor
83	Washer, Plain
89	Spring Case Adaptor
90	Screw, Cap
102	Plug, Pipe, Hex Hd
144	Actuator Stem
227	Washer, Plain
228	Stem Disk Spacer
237	Lubricant, lithium grease not furnished with actuator
239	Lubricant, anti-seize not furnished with actuator
254	Caution Nameplate

Top-Mounted Handwheel (figures 11, 12, 13, 14, and 15)

Key	Description
-----	-------------

58	Handwheel / Handjack Bar
60	Retainer Ring
148	Handwheel Body
150	Extension Rod
152	Up Travel Stop
154	Cap Screw
156	Vent Assembly
157	Guide Plate
158	Mounting Plate

159	Lock Nut
160	Handwheel Screw
161	Cap Screw
166	Castle Nut
167	Cotter Pin
178	Machine Screw
179	Lockwasher
180	Thrust Bearing
181	Thrust Race
182	Bearing Retainer
183	Pipe Nipple
239	Lubricant, anti-seize not furnished with handwheel
247	Handwheel Cap
253	Spacer, Handjack

Figure 6. Fisher 667 Actuator Sizes 30 through 60

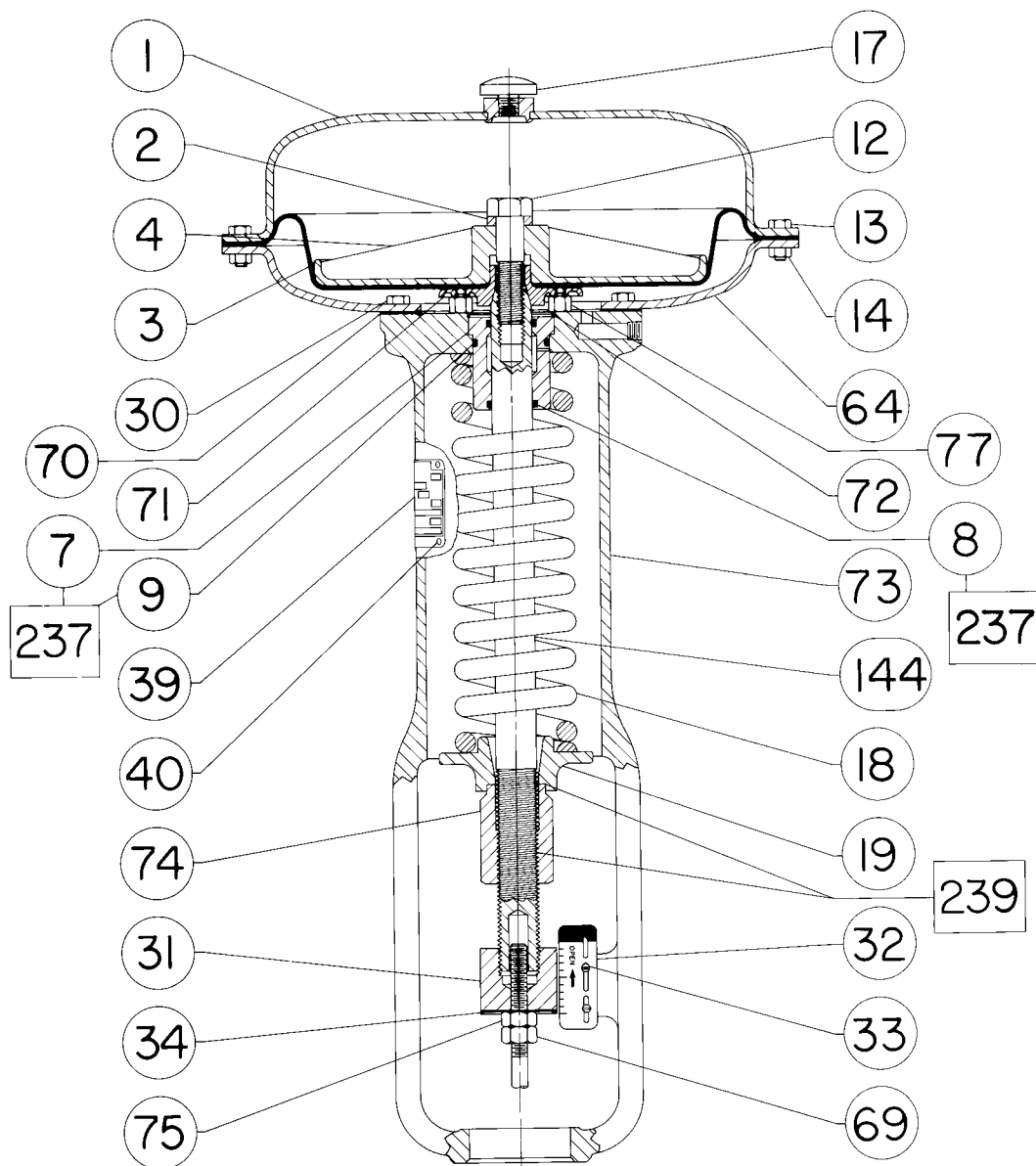
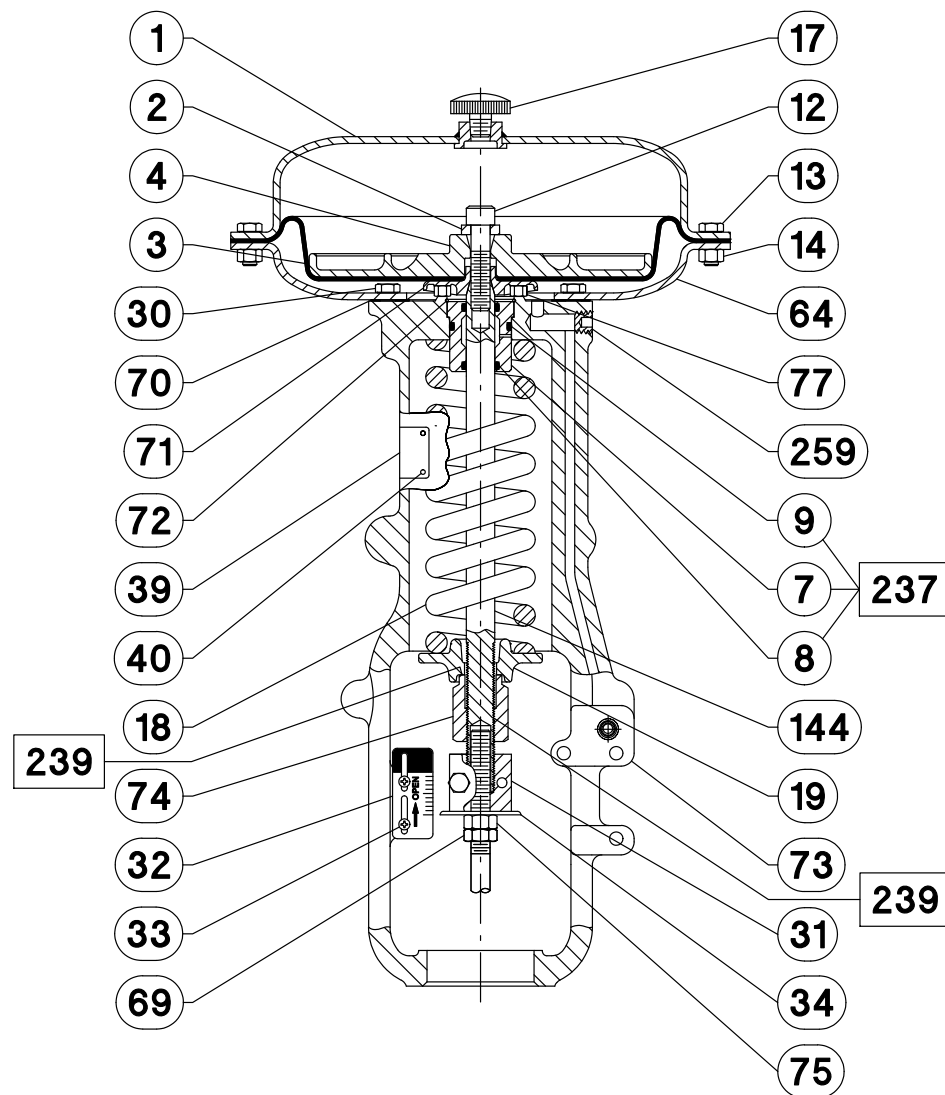


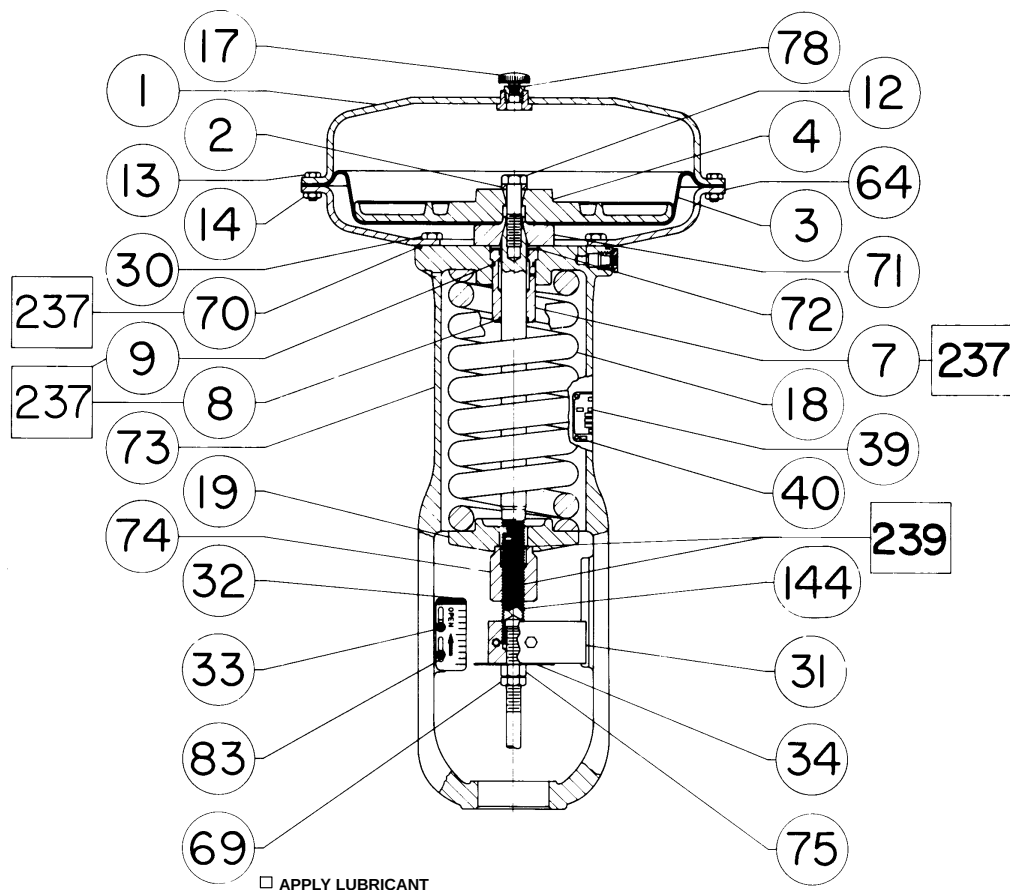
Figure 7. Fisher 667 Actuator Sizes 30i through 60i



□ APPLY LUB

PARTS NOT SHOWN: KEY 76 AND 254

Figure 8. Fisher 667 Size 70 and 76 Actuator



50A8598-E

Figure 9. Fisher 667 Size 70i and 76i Actuator

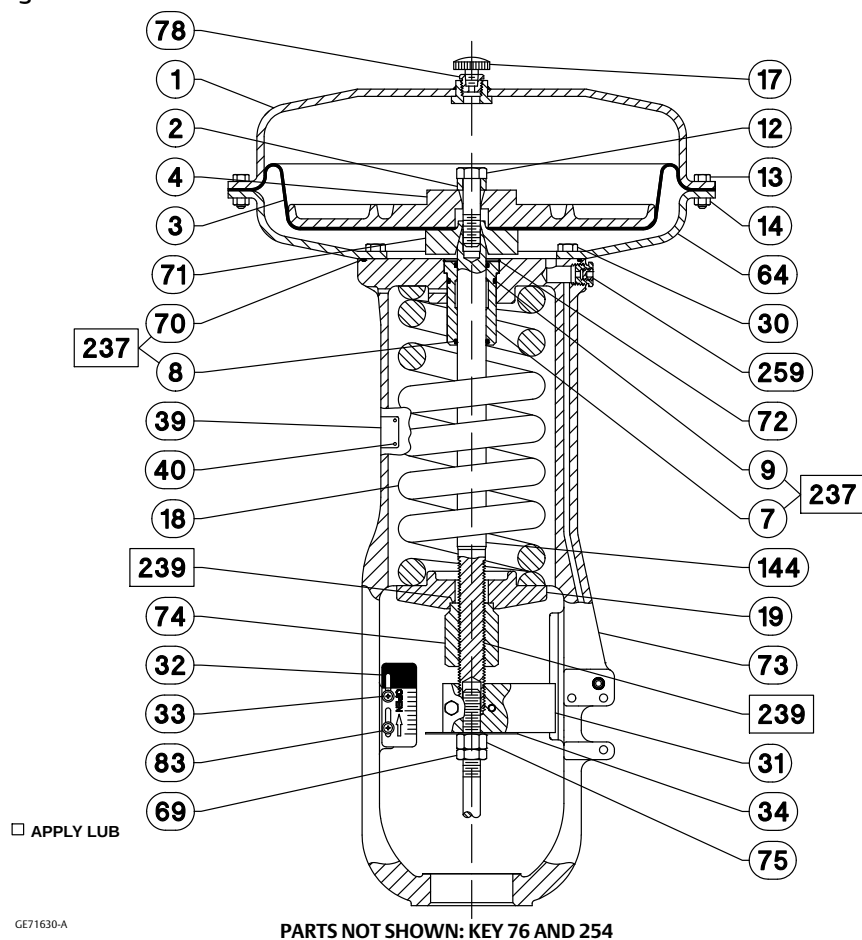
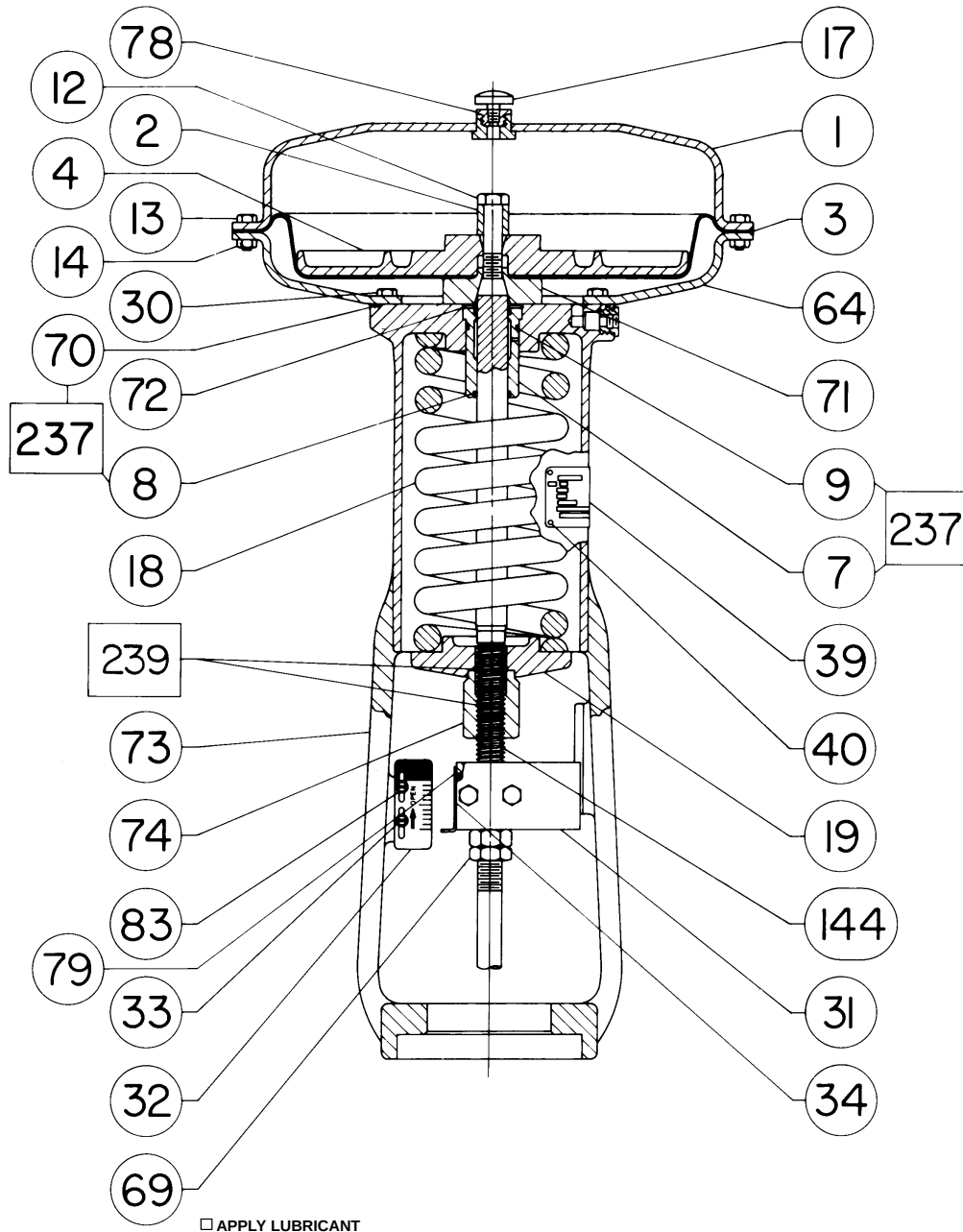
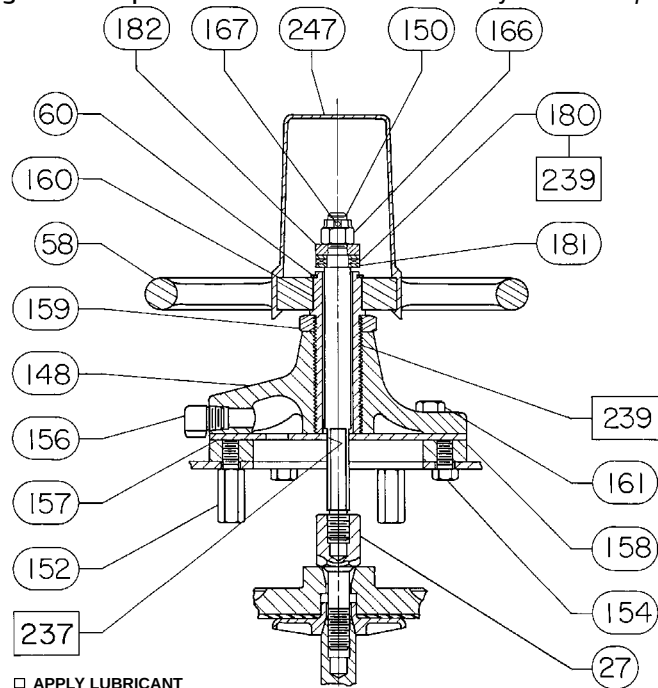


Figure 10. Fisher 667 Size 87 Actuator



50A8600-E

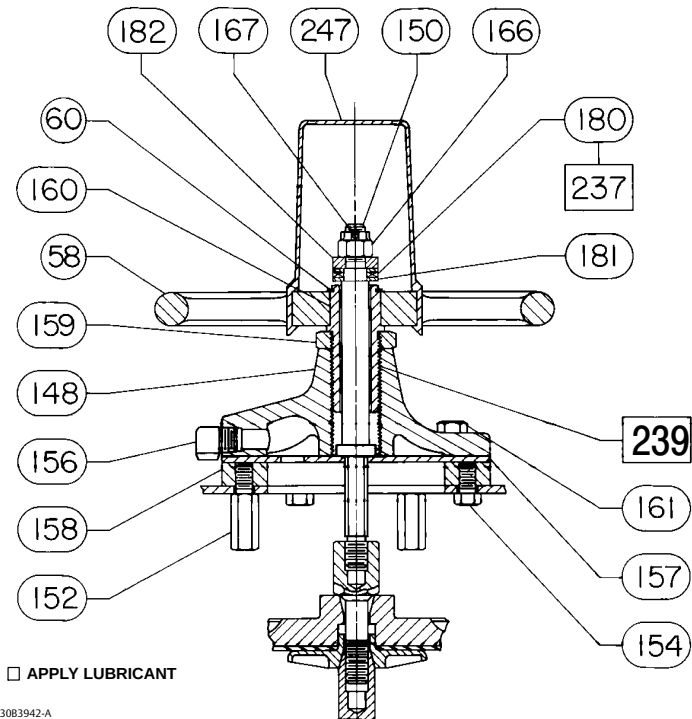
Figure 11. Top-Mounted Handwheel Assembly for Size 30/30i through 40/40i Actuators



NOTE:
THE TOP MOUNTED HANDWHEEL IS NOT DESIGNED FOR USE UNDER HEAVY LOAD OR FREQUENT USE.

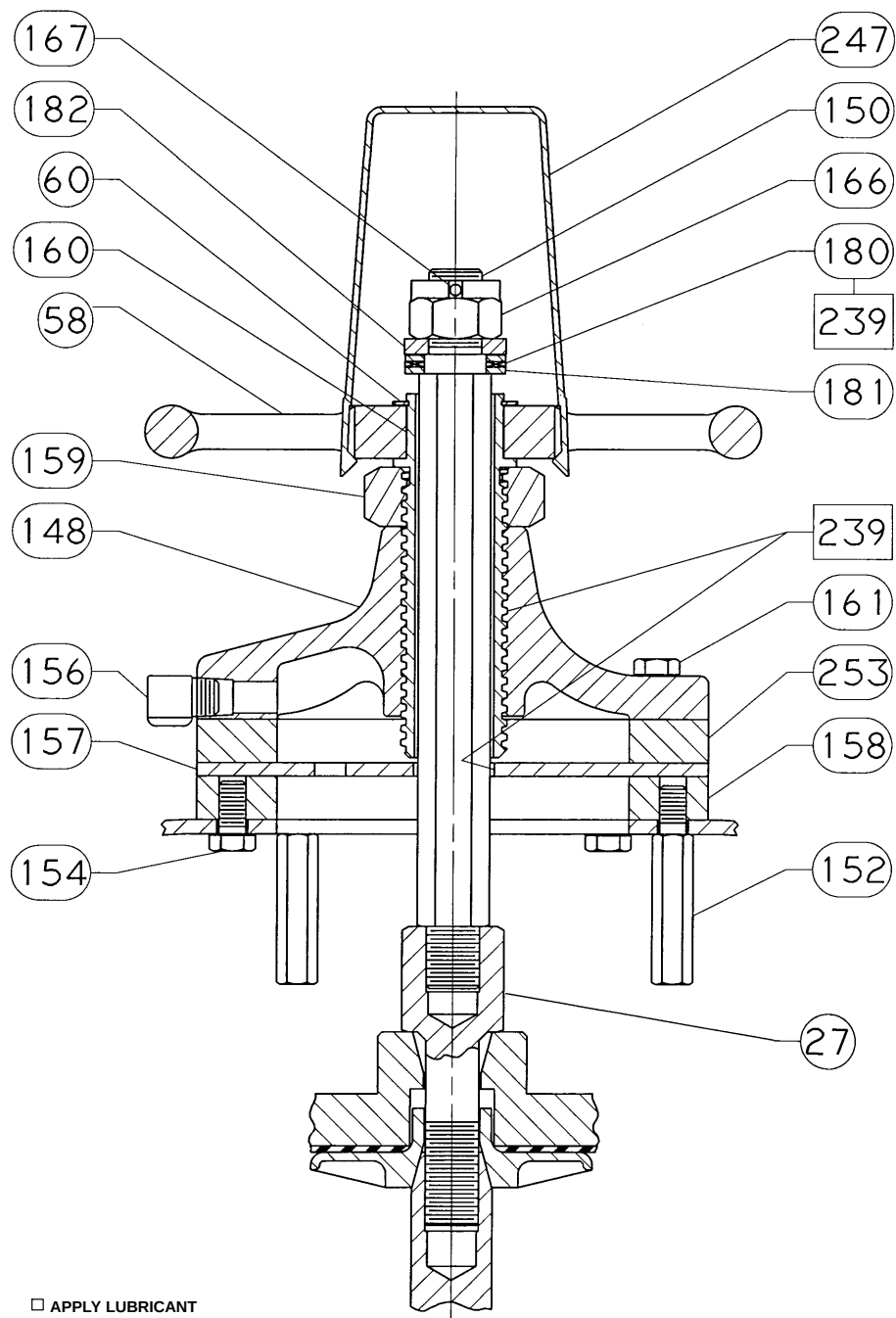
3083940-C

Figure 12. Top-Mounted Handwheel Assembly, Style P2 for Size 45/45i, 50/50i, 60/60i, and 76/76i Actuators



3083942-A

Figure 13. Top-Mounted Handwheel Assembly for Size 45/45i-76/76i Actuators



3389224-8

Figure 14. Top-Mounted Handwheel Assembly for Size 70/70i and 87 Actuators

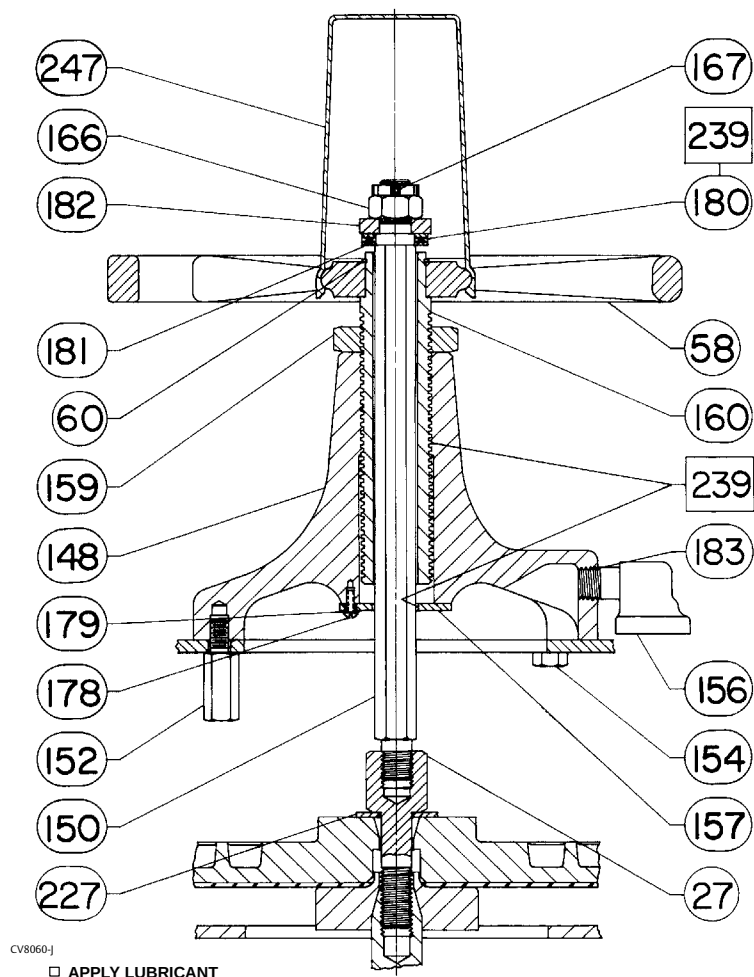
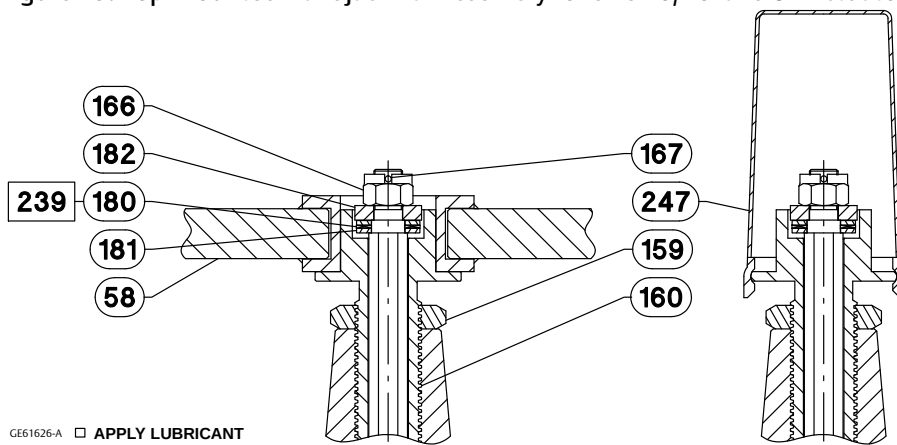


Figure 15. Top-Mounted Handjack Bar Assembly for Size 70/70i and 87 Actuators



NOTE:

THE TOP MOUNTED HANDJACK BAR SHOULD BE REMOVED WHEN NOT IN USE AND THE HANDWHEEL CAP INSTALLED FOR WEATHER PROTECTION OF INTERNAL COMPONENTS.

Figure 16. Side Mounted Handwheel Assembly for Size 34 and 40 Actuators

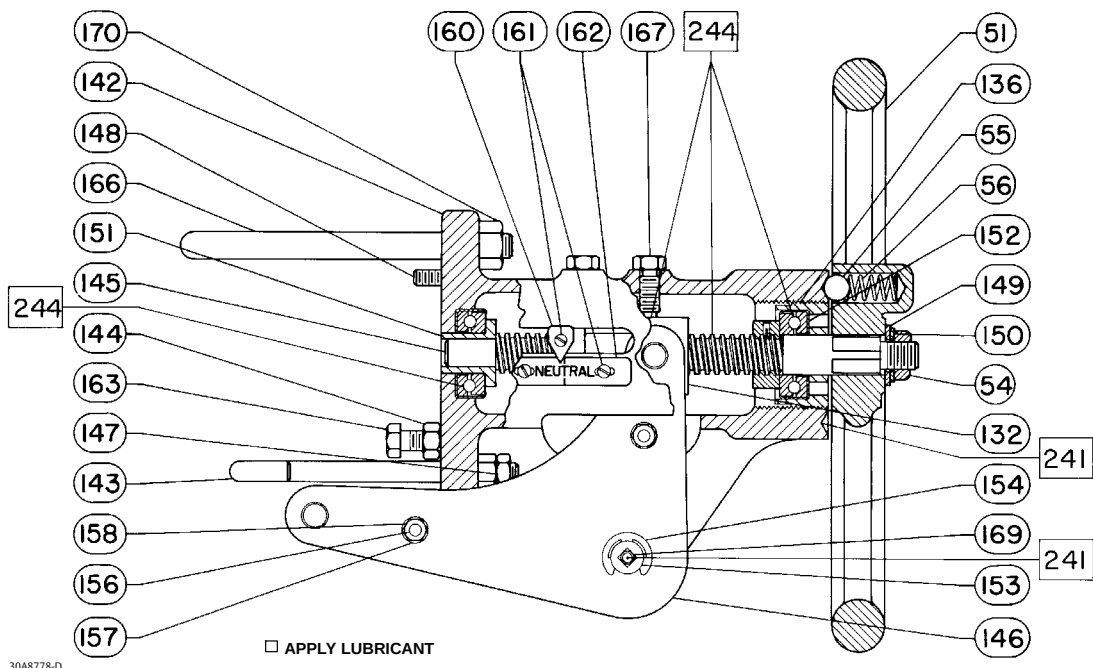
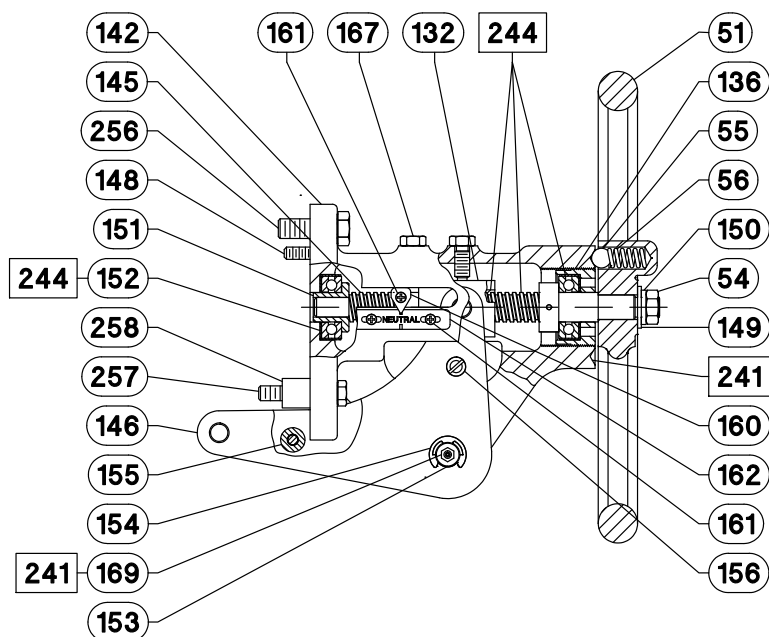


Figure 17. Side Mounted Handwheel Assembly for Size 34i and 40i Actuators



PARTS NOT SHOWN: KEY 157, 158, 159, and 168

40A8779-D

This diagram shows an exploded view of a mechanical assembly. The components are identified by the following numbers:

- 161, 160, 162, 256, 152, 148, 142, 257, 258, 146, 155, 156
- 178, 167, 132, 244
- 51, 136, 55, 56, 177, 54, 150, 149, 145, 154, 169, 153
- 241 (two locations)

PARTS NOT SHOWN: KEY 158, 159, and 168

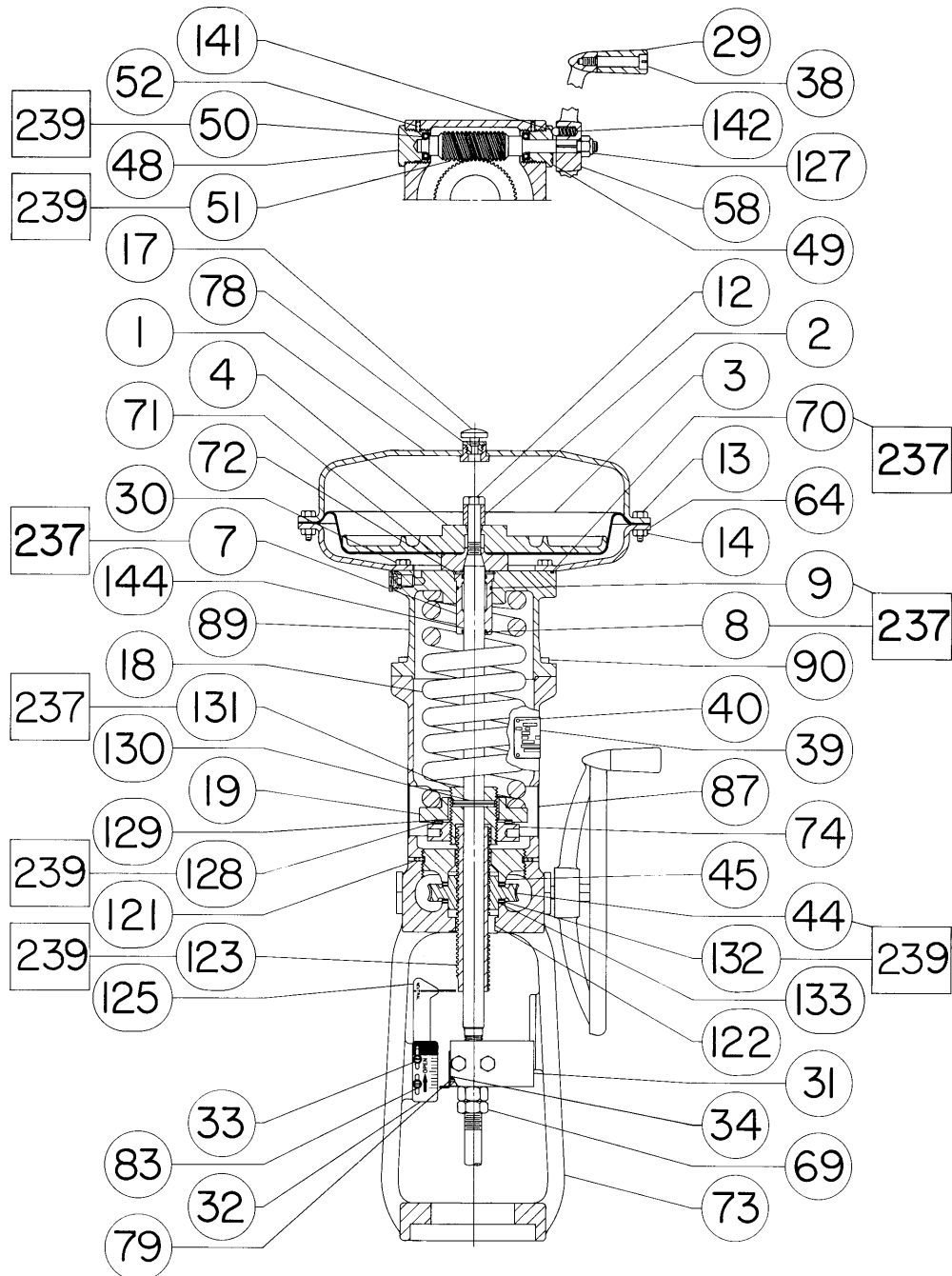
Side-Mounted Handwheel, Size 34-60 and 34i-60i (figures 16 and 18)

Key	Description
51	Handwheel
54	Hex Jam Nut
55	Ball
56	Spring
132	Operating Nut
136	Bearing Retainer
142	Handwheel Body
143	Mounting Bolts
144	Hex Nut
145	Handwheel Screw
146	Lever & Pin Assembly
147	Hex Jam Nut
148	Dowel Pin
149	Washer
150	Lockwasher
151	Bushing
152	Ball Bearing
153	Lever Pivot Pin
154	Retaining Ring
155	Spacer
156	Screw
157	Lockwasher
158	Hex Nut
159	Pointer Mounting Bolt
160	Pointer
161	Machine Screw
162	Indicator Plate (Aluminum)
163	Cap Screw
166	U-Bolt
167	Guide Bolt
168	Set Screw
169	Grease Fitting
170	Hex Nut
177	Spring Cap
178	Machine Screw
241	Lubricant, lithium grease Not furnished with handwheel
244	Lubricant, anti-seize Not furnished with handwheel
256	Cap Screw
257	Cap Screw
258	Spacer

Side-Mounted Handwheel, Size 70, 76 and 87 (figure 20)

Key	Description
29	Handgrip
38	Handgrip Bolt
44	Worm Gear
45	Bearing Retainer Flange
48	Back Worm Retainer
49	Front Worm Retainer
50	Ball Bearing
51	Worm Shaft
52	Set Screw
57	Grease Fitting
58	Handwheel
87	Cover Band Ass'y
89	Spring Case Adaptor
90	Cap Screw
121	Set Screw
122	Key
123	Lower Sleeve
125	Handwheel Indicator
127	Handwheel Cap
128	Needle Bearing
129	Needle Bearing Race
130	Roll Pin
131	Spring Adjusting Screw
132	Needle Bearing
133	Needle Bearing Race
141	Ball
142	Spring
237	Lubricant, lithium grease Not Furnished with Handwheel
239	Lubricant, anti-seize Not Furnished with Handwheel
245	Yoke Extension

Figure 20. Size 70, 76, and 87 Actuator with Side Mounted Handwheel Assembly



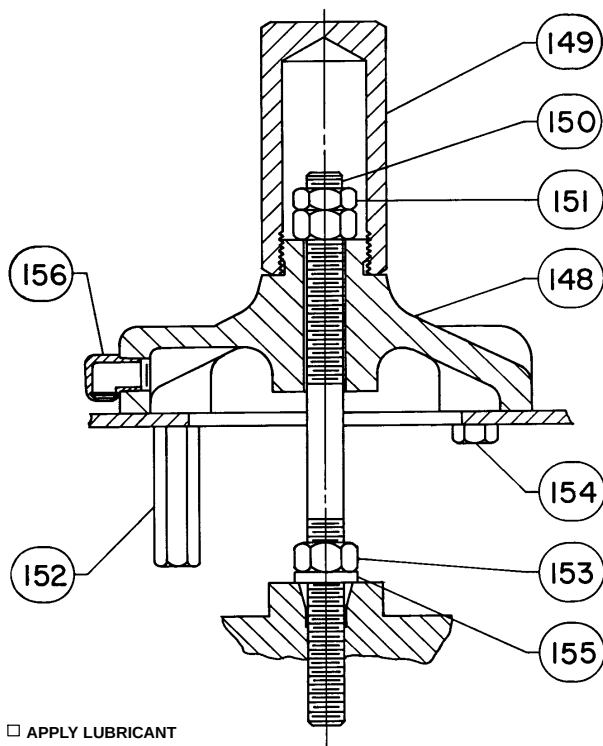
PART NOT SHOWN: 57
 □ APPLY LUBRICANT
 E0871

Casing-Mounted Travel Stops (figures 21 through 25)

Key Description

58	Handwheel
102	Plug, Pipe
127	Hex Nut
148	Travel Stop Body
149	Travel Stop Cap
150	Extension Rod
150	Travel Stop Stem
151	Hex Jam Nut
152	Up Travel Stop
153	Nut, Hex

Figure 21. Style 10 Down Travel Stop - For All Sizes
(Casing Mounted)

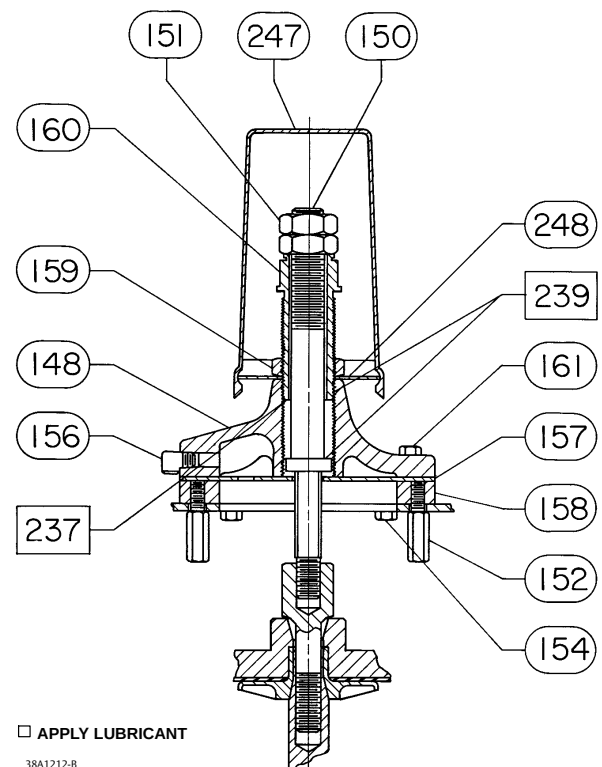


□ APPLY LUBRICANT
BV8094-B

Key Description

154	Screw, Cap, Hex Hd
155	Washer
156	Vent
157	Guide Plate
158	Mounting Plate
159	Nut, Travel Stop
160	Screw, Handwheel
161	Screw, Cap, Hex Hd
162	Washer
177	Travel Stop Screw
184	Nipple, Pipe, NPT
237	Lubricant, lithium grease
239	Lubricant, anti-seize
247	Travel Stop Cap
248	Mounting Plate

Figure 22. Style 11 Up Or Down Travel Stop - For
Sizes 30/30i to 60/60i and 76/76i (Casing Mounted)



□ APPLY LUBRICANT
38A1212-B

Figure 23. Style 12 Up Travel Stop (Casing Mounted)

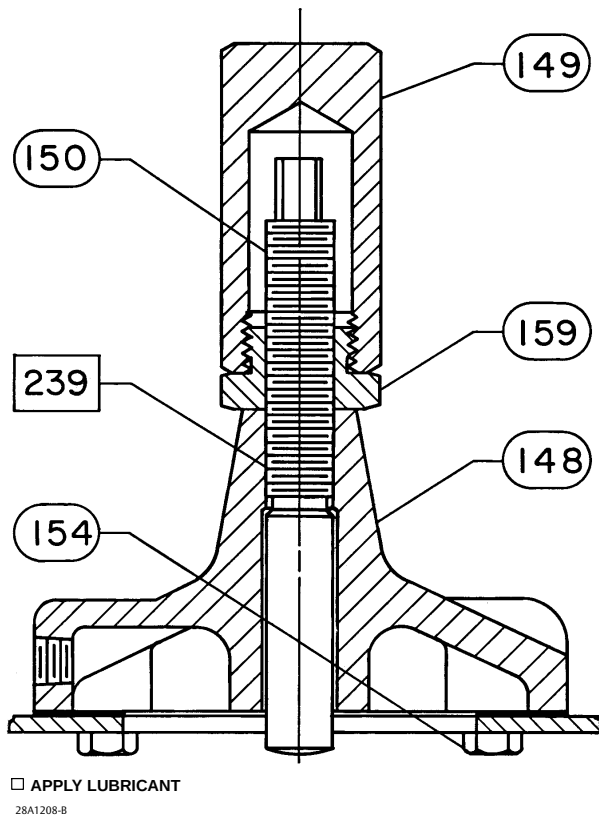


Figure 24. Style 13 Up Travel Stop - For Sizes 30/30i to 60/60i and 76/76i, Size 30/30i Shown (Casing Mounted)

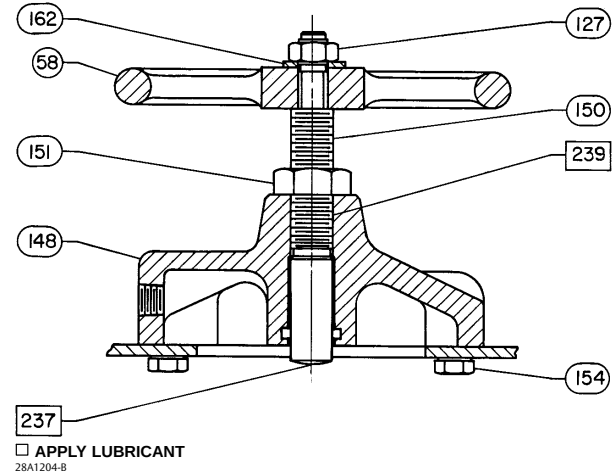
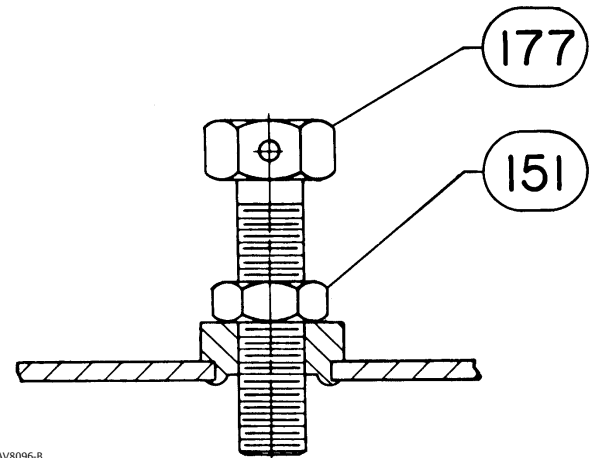


Figure 25. Style 14 Up Travel Stop (Casing Mounted)



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Fisher® FIELDVUE™ DVC6200 Digital Valve Controller

This manual applies to

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

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The FIELDVUE DVC6200 Digital Valve Controller is a core component of the PlantWeb™ digital plant architecture. The digital valve controller powers PlantWeb by capturing and delivering valve diagnostic data. Coupled with ValveLink™ software, the DVC6200 provides users with an accurate picture of valve performance, including actual stem position, instrument input signal, and pneumatic pressure to the actuator. Using this information, the digital valve controller diagnoses not only itself, but also the valve and actuator to which it is mounted.

Section 1 Introduction

Scope of Manual

This instruction manual is a supplement to the DVC6200 Series Quick Start Guide (D103556X012) that ships with every instrument. This instruction manual includes product specifications, installation information, reference materials, custom setup information, maintenance procedures, and replacement part details for the FIELDVUE DVC6200 digital valve controller, device revision 2, firmware revision 9, 10, and 11, instrument level AC, HC, AD, PD, and ODV.

Note

Firmware 9, 10, or 11 is required for the DVC6200 digital valve controller. A printed wiring board with earlier versions of firmware must be updated before using with the DVC6200.

Note

All references to the DVC6200 digital valve controller include the DVC6205 base unit unless otherwise indicated.

This instruction manual describes using the 475 Field Communicator with device description revisions 1 and 2 to setup and calibrate the instrument. You can also use Fisher ValveLink software version 10.2 or higher to setup, calibrate, and diagnose the valve and instrument. For information on using ValveLink software with the instrument refer to ValveLink software help or documentation.

Do not install, operate, or maintain a DVC6200 digital valve controller without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.

Conventions Used in this Manual

Navigation paths and fast-key sequences are included for procedures and parameters that can be accessed using the Field Communicator.

For example, to access Setup Wizard:

Field Communicator	Configure > Guided Setup > Setup Wizard (1-1-1)
--------------------	---

Refer to Appendix B for Field Communicator menu trees.

Note

Field Communicator menu sequences used in this manual are for instrument level HC, AD, PD, and ODV. Refer to the AC menu tree in Appendix B for AC menu sequences.

Description

DVC6200 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 DVC6200 digital valve controller, using the HART® communications protocol, gives easy access to information critical to process operation. You can gain information from the principal component of the process, the control valve itself, using the Field Communicator at the valve, or at a field junction box, or by using a personal computer or operator's console within the control room.

Using a personal computer and ValveLink software or AMS Suite: Intelligent Device Manager, or a Field Communicator, you can perform several operations with the DVC6200 digital valve controller. You can obtain general information concerning software revision level, messages, tag, descriptor, and date.

Figure 1-1. FIELDVUE DVC6200 Digital Valve Controller Mounted on a Fisher Sliding-Stem Valve Actuator



W9643

Figure 1-2. FIELDVUE DVC6200 Digital Valve Controller Integrally Mounted to a Fisher GX Control Valve



W9616

Diagnostic information is available to aid you when troubleshooting. Input and output configuration parameters can be set, and the digital valve controller can be calibrated. Refer to table 1-1 for details on the capabilities of each diagnostic tier.

Table 1-1. Instrument Level Capabilities

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

1. Refer to brochure part # D351146X012/D351146X412 for information on Fisher optimized digital valves for compressor antisurge applications.

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

The DVC6200 digital valve controller is designed to directly replace standard pneumatic and electro-pneumatic valve mounted positioners.

Specifications

WARNING

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

Specifications for DVC6200 digital valve controllers are shown in table 1-2. Specifications for the Field Communicator can be found in the product manual for the Field Communicator.

Table 1-2. Specifications

Available Mounting DVC6200 digital valve controller or DVC6215 feedback unit: ■ Integral mounting to the Fisher GX Control Valve and Actuator System ■ Window mounting to Fisher rotary actuators ■ Sliding-stem linear applications ■ Quarter-turn rotary applications DVC6205 base unit for 2 inch pipestand or wall mounting (for remote-mount) The DVC6200 digital valve controller or DVC6215 feedback unit can also be mounted on other actuators that comply with IEC 60534-6-1, IEC 60534-6-2, VDI/VDE 3845 and NAMUR mounting standards. Input Signal Point-to-Point: <i>Analog Input Signal:</i> 4-20 mA DC, nominal; split ranging available Minimum Voltage Available at Instrument Terminals must be 10.5 VDC for analog control, 11 VDC for HART communication <i>Minimum Control Current:</i> 4.0 mA <i>Minimum Current w/o Microprocessor Restart:</i> 3.5 mA <i>Maximum Voltage:</i> 30 VDC Overcurrent protected Reverse Polarity protected Multi-drop: <i>Instrument Power:</i> 11 to 30 VDC at 8 mA Reverse Polarity protected Supply Pressure⁽¹⁾ Minimum Recommended: 0.3 bar (5 psig) higher than maximum actuator requirements Maximum: 10.0 bar (145 psig) or maximum pressure rating of the actuator, whichever is lower Medium: Air or Natural Gas <i>Air:</i> Supply pressure must be clean, dry air that meets the requirements of ISA Standard 7.0.01. <i>Natural Gas:</i> Natural gas must be clean, dry, oil-free, and noncorrosive. H₂S content should not exceed 20 ppm. A maximum 40 micrometer particle size in the air system is acceptable. Further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimized.	Output Signal Pneumatic signal, up to full supply pressure Minimum Span: 0.4 bar (6 psig) Maximum Span: 9.5 bar (140 psig) Action: ■ Double, ■ Single Direct or ■ Reverse Steady-State Air Consumption⁽²⁾⁽³⁾ Standard Relay: <i>At 1.4 bar (20 psig) supply pressure:</i> Less than 0.38 normal m³/hr (14 scfh) <i>At 5.5 bar (80 psig) supply pressure:</i> Less than 1.3 normal m³/hr (49 scfh) Low Bleed Relay: <i>At 1.4 bar (20 psig) supply pressure:</i> Average value 0.056 normal m³/hr (2.1 scfh) <i>At 5.5 bar (80 psig) supply pressure:</i> Average value 0.184 normal m³/hr (6.9 scfh) Maximum Output Capacity⁽²⁾⁽³⁾ <i>At 1.4 bar (20 psig) supply pressure:</i> 10.0 normal m³/hr (375 scfh) <i>At 5.5 bar (80 psig) supply pressure:</i> 29.5 normal m³/hr (1100 scfh) Operating Ambient Temperature Limits⁽¹⁾⁽⁴⁾ -40 to 85°C (-40 to 185°F) -52 to 85°C (-62 to 185°F) for instruments utilizing the Extreme Temperature option (fluorosilicone elastomers) -52 to 125°C (-62 to 257°F) for remote-mount feedback unit Independent Linearity⁽⁵⁾ Typical Value: ±0.50% of output span Electromagnetic Compatibility Meets EN 61326-1 (First Edition) Immunity—Industrial locations per Table 2 of the EN 61326-1 standard. Performance is shown in table 1-3 below. Emissions—Class A ISM equipment rating: Group 1, Class A Lightning and Surge Protection—The degree of immunity to lightning is specified as Surge immunity in table 1-3. For additional surge protection commercially available transient protection devices can be used.
--	--

-continued-

Table 1-2. Specifications (continued)

Vibration Testing Method

Tested per ANSI/ISA-S75.13.01 Section 5.3.5. A resonant frequency search is performed on all three axes. The instrument is subjected to the ISA specified 1/2 hour endurance test at each major resonance.

Input Impedance

The input impedance of the DVC6200 active electronic circuit is not purely resistive. For comparison to resistive load specifications, an equivalent impedance of 550 ohms may be used. This value corresponds to 11V @ 20 mA.

Humidity Testing Method

Tested per IEC 61514-2

Electrical Classification

Hazardous Area Approvals:

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

FM— Intrinsically Safe, Explosion-proof,
Non-incendive, Dust Ignition-proof

ATEX— Intrinsically Safe, Flameproof, Type n

IECEX— Intrinsically Safe, Flameproof, Type n

Electrical Housing:

CSA— Type 4X, IP66

FM— Type 4X, IP66

ATEX— IP66

IECEX— IP66

Other Classifications/Certifications

Natural Gas Certified, Single Seal Device— CSA, FM,
ATEX, and IECEX

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

GOST-R— Russian GOST-R

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

KGS— Korea Gas Safety Corporation (South Korea)

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

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

TIIS— Technology Institution of Industrial
Safety (Japan)

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

Connections

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

Output Pressure: 1/4 NPT internal

Tubing: 3/8-inch recommended

Vent: 3/8 NPT internal

Electrical: 1/2 NPT internal, M20 adapter optional

Actuator Compatibility

Stem Travel (Sliding-Stem Linear):

Minimum: 6.5 mm (0.25 inch)

Maximum: 606 mm (23.875 inches)

Shaft Rotation (Quarter-Turn Rotary):

Minimum: 45°

Maximum: 90°

Weight

DVC6200: 3.5 kg (7.7 lbs)

DVC6205: 4.1 kg (9 lbs)

DVC6215: 1.4 kg (3.1 lbs)

Construction Materials

Housing, module base and terminal box: A03600 low
copper aluminum alloy (standard)

Cover: Thermoplastic polyester

Elastomers: Nitrile (standard)

Fluorosilicone (extreme temperature)

Options

■ Supply and output pressure gauges or

■ Tire valves ■ Integral mounted filter regulator

■ Low-Bleed Relay ■ Extreme Temperature

■ Natural Gas Certified, Single Seal Device ■ Remote
Mount⁽⁶⁾

Contact your Emerson Process Management sales
office, or go to www.FIELDVUE.com for additional
information.

-continued-

Table 1-2. Specifications (continued)

Declaration of SEP Fisher Controls International LLC declares this product to be in compliance with Article 3 paragraph 3 of the Pressure Equipment Directive (PED) 97 / 23 / EC. It was designed and manufactured in accordance	with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance. However, the product <i>may</i> bear the CE marking to indicate compliance with <i>other</i> applicable European Community Directives.
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NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 - Process Instrument Terminology.

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

2. Normal m³/hour - Normal cubic meters per hour at 0°C and 1.01325 bar, absolute. Scfh - Standard cubic feet per hour at 60°F and 14.7 psia.

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

4. Temperature limits vary based on hazardous area approval.

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

6. 4-conductor shielded cable, 18 to 22 AWG minimum wire size, in rigid or flexible metal conduit, is required for connection between base unit and feedback unit. Pneumatic tubing between base unit output connection and actuator has been tested to 91 meters (300 feet). At 15 meters (50 feet) there was no performance degradation. At 91 meters there was minimal pneumatic lag.

Table 1-3. EMC Summary Results—Immunity

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

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

Related Documents

This section lists other documents containing information related to the DVC6200 digital valve controller. These documents include:

- Bulletin 62.1:DVC6200 - Fisher FIELDVUE DVC6200 Digital Valve Controller (D103415X012)
- Bulletin 62.1:DVC6200 HC - Fisher FIELDVUE DVC6200 Digital Valve Controller (D103423X012)
- Bulletin 62.1:DVC6200(S1) Fisher FIELDVUE DVC6200 Digital Valve Controller Dimensions (D103543X012)
- Fisher FIELDVUE DVC6200 Series Digital Valve Controller Quick Start Guide (D103556X012)
- FIELDVUE Digital Valve Controller Split Ranging - Supplement to HART Communicating Fisher FIELDVUE Digital Valve Controller Instruction Manuals (D103262X012)
- Using FIELDVUE Instruments with the Smart HART Loop Interface and Monitor (HIM) - Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals (D103263X012)
- Using FIELDVUE Instruments with the Smart Wireless THUM™ Adapter and a HART Interface Module (HIM) - Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals
- Audio Monitor for HART Communications - Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals (D103265X012)

- HART Field Device Specification - Supplement to Fisher FIELDVUE DVC6000 and DVC6200 HW1 Digital Valve Controller Instruction Manuals (D103649X012)
- Using the HART Tri-Loop HART-to-Analog Signal Converter with FIELDVUE Digital Valve Controllers - Supplement to HART Communicating FIELDVUE Instrument Instruction Manuals (D103267X012)
- Lock-in-Last Strategy - Supplement to Fisher FIELDVUE DVC6000 or DVC6200 Digital Valve Controller Instruction Manual (D103261X012)
- Fisher HF340 Filter Instruction Manual (D102796X012)
- 475 Field Communicator User's Manual
- ValveLink Software Help or Documentation

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

Educational Services

For information on available courses for the DVC6200 digital valve controller, as well as a variety of other products, contact:

Emerson Process Management
Educational Services - Registration
P.O. Box 190
Marshalltown, IA 50158-2823
Phone: 800-338-8158 or 641-754-3771
FAX: 641-754-3431
e-mail: education@emerson.com

Section 2 Installation

⚠ WARNING

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

- Always wear protective clothing, gloves, and eyewear to prevent personal injury or property damage.
- If installing into an existing application, also refer to the WARNINGS at the beginning of the Maintenance section of this instruction manual.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

⚠ WARNING

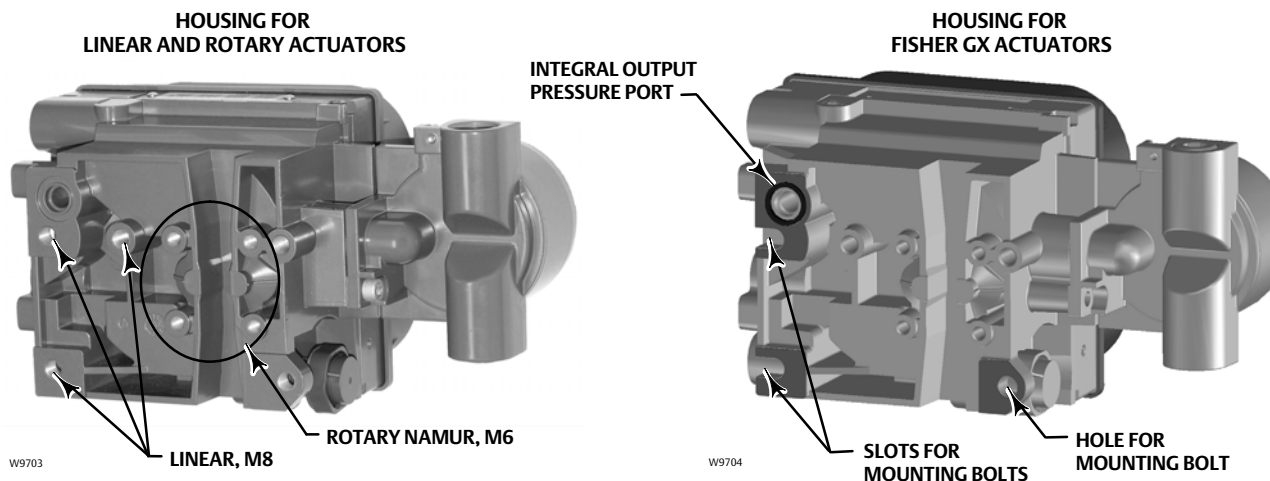
To avoid static discharge from the plastic cover when flammable gases or dust are present, do not rub or clean the cover with solvents. To do so could result in a spark that may cause the flammable gases or dust to explode, resulting in personal injury or property damage. Clean with a mild detergent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

Refer to the quick start guide that ships with the instrument (D103556X012) for Hazardous Area Approvals and Special Instructions for “Safe Use” and Installations in Hazardous Locations.

Mounting the DVC6200 Digital Valve Controller

The DVC6200 housing is available in two different configurations, depending on the actuator mounting method. Figure 2-1 shows the available configurations.

Figure 2-1. Housing Configurations



The feedback system for the DVC6200 digital valve controller utilizes a magnetic assembly for linkage-less, non-contacting position measurement. In order to prevent inadvertent stem movement while the instrument is in operation, magnetic tools (such as a magnetic-tipped screwdriver) should not be used.

Note

The magnet assembly may be referred to as a magnetic array in user interface tools.

CAUTION

The magnet assembly material has been specifically chosen to provide a long-term stable magnetic field.

However, as with any magnet, care must be taken when handling the magnet assembly. Another high powered magnet placed in close proximity (less than 25 mm) can cause permanent damage. Potential sources of damaging equipment include, but are not limited to: transformers, DC motors, stacking magnet assemblies.

CAUTION

General Guidelines for use of High Power Magnets with Positioners

Use of high power magnets in close proximity to any positioner which is operating a process should be avoided. Regardless of the positioner model, high power magnets can affect the positioner's ability to control the valve. Technicians should avoid the use of high power magnets in close proximity with any positioner.

Use of Magnetic Tools with the DVC6200

- **Magnetic Tip Screw Drivers** – Magnetic tip screw drivers can be used to work on the DVC6200. However, they should not be brought in close proximity to the magnet assembly (located at the back of the instrument) during process operations.
- **Calibrator Strap Magnets** – These are high power magnets used to hold 4-20 ma calibrators. Normally, these calibrators would not be used while an instrument is controlling the process. High power magnets should be kept at least 15 cm (6 inches) from the DVC6200.

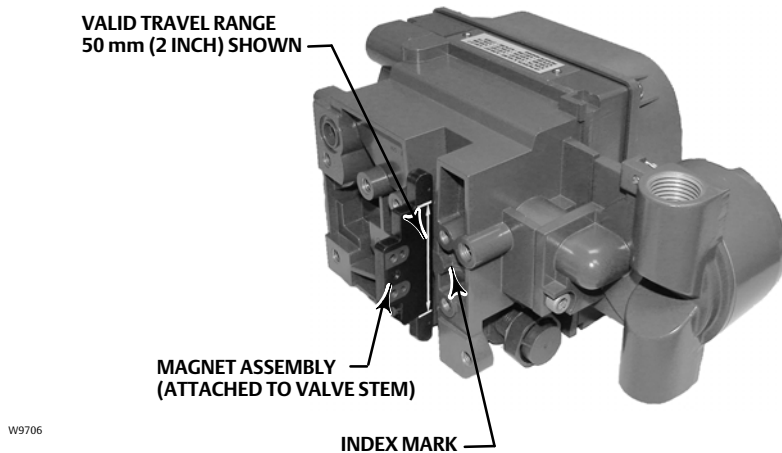


Note

As a general rule, do not use less than 60% of the magnet assembly travel range for full travel measurement. Performance will decrease as the assembly is increasingly subranged.

The linear magnet assemblies have a valid travel range indicated by arrows molded into the piece. This means that the hall sensor (on the back of the DVC6200 housing) has to remain within this range throughout the entire valve travel. See figure 2-2. The linear magnet assemblies are symmetrical. Either end may be up.

Figure 2-2. Travel Range



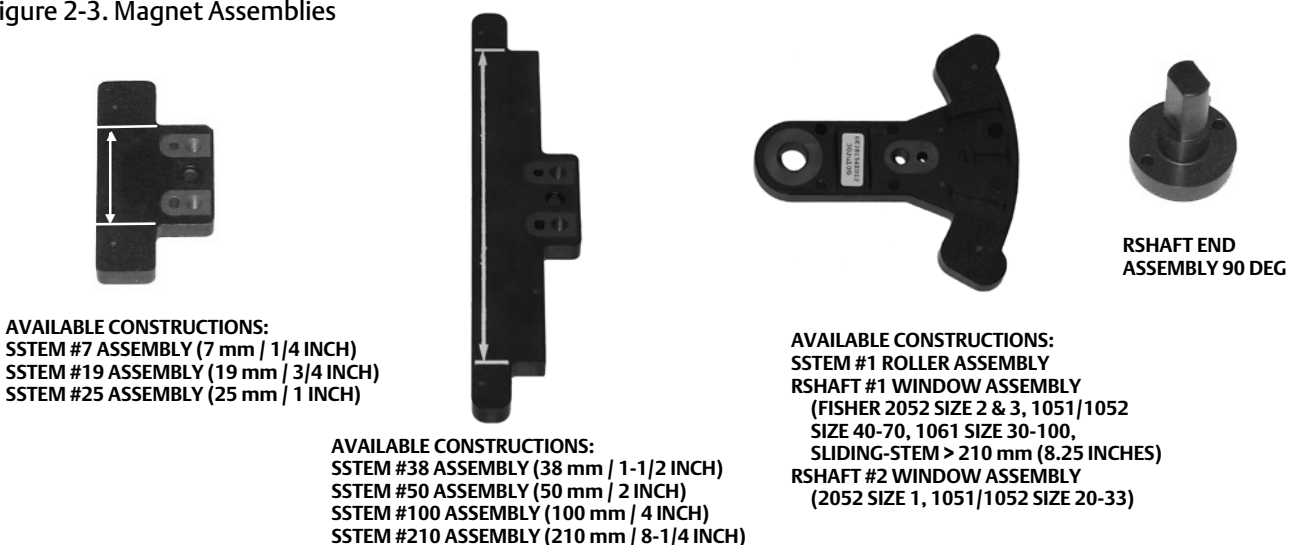
Note

Mounting the instrument vertically, with the vent at the bottom of the assembly, or horizontally, with the vent pointing down, is recommended to allow drainage of moisture that may be introduced via the instrument air supply.

There are a variety of mounting brackets and kits that are used to mount the DVC6200 to different actuators. Depending on the actuator, there will be differences in fasteners, brackets, and connecting linkages.

Each mounting kit will include one of the magnet assemblies illustrated in figure 2-3.

Figure 2-3. Magnet Assemblies



If ordered as part of a control valve assembly, the factory will mount the digital valve controller on the actuator and calibrate the instrument. If purchased separately, you will need a mounting kit to mount the digital valve controller on the actuator. Each mounting kit includes detailed information on mounting the digital valve controller to a specific actuator. Refer to table 2-1 for the more common Fisher actuator mounting instructions, available at www.fisher.com or your Emerson Process Management sales office.

For general mounting guidelines, refer to the DVC6200 Series quick start guide (D103556X012), available at www.fisher.com or your Emerson Process Management sales office.

Table 2-1. DVC6200 Mounting Instructions

Instructions for Mounting:	Part Number
585C/585CR Size 25 Actuator with or without Handjack	D103439X012
585C/585CR Size 50 Actuator with or without Handjack	D103440X012
657 and 667 Size 30-60 Actuators	D103441X012
657 and 667 Size 34-60 Actuators with Handwheel	D103442X012
657 and 667 Size 70, 76, and 87 Actuators (up to 2 inch travel)	D103443X012
657 and 667 Size 70, 76, and 87 Actuators (4 inch travel)	D103444X012
657 and 667 Size 80 Actuators (up to 2 inch travel)	D103445X012
657 and 667 Size 80 Actuators (4 inch travel)	D103446X012
1051 Size 33 and 1052 Size 20 and 33 Actuators (Window Mount)	D103447X012
1051 and 1052 Size 33 Actuators (End Mount)	D103448X012
1051 and 1052 Size 40-70 Actuators (Window Mount)	D103449X012
1051 and 1052 Size 40-70 Actuators (End Mount)	D103450X012
1052 Size 20 Actuator (End Mount)	D103451X012
1061 Size 30-68 Actuator (Window Mount)	D103453X012
1061 Size 80-100 Actuator (Window Mount)	D103452X012
2052 Size 1, 2, 3 Actuator (End Mount)	D103454X012
2052 Size 1, 2, 3 Actuator with Spacer (Window Mount)	D103455X012
Baumann Sliding-Stem Actuators	D103456X012
GX Control Valve and Actuator System	D103457X012
IEC60534-6-1 (NAMUR) Sliding Stem Actuators	D103458X012
IEC60534-6-2 (NAMUR) Rotary Actuators	D103459X012

Mounting the DVC6205 Base Unit

For remote-mounted digital valve controllers, the DVC6205 base unit ships separately from the control valve and does not include tubing, fittings or wiring. See the instructions that come with the mounting kit for detailed information on mounting the feedback unit to a specific actuator model.

Mount the DVC6205 base unit on a 50.8 mm (2 inch) pipestand or wall. The included bracket is used for either mounting method.

Wall Mounting

Refer to figures 2-4 and 2-5. Drill two holes in the wall using the dimensions shown in figure 2-4. Attach the mounting bracket to the base unit using four spacers and 25.4 mm (1-inch) 1/4-20 hex head screws. Attach the base unit to the wall using suitable screws or bolts.

Pipestand Mounting

Refer to figure 2-6. Position a standoff on the back of the base unit. Using two 101.6 mm (4-inch) 1/4-20 hex head screws loosely attach the base unit to the pipestand with the mounting bracket. Position the second standoff, then using the remaining 101.6 mm (4-inch) hex head screws, securely fasten the base unit to the pipe stand.

Figure 2-4. FIELDVUE DVC6205 Base Unit with Mounting Bracket (Rear View)

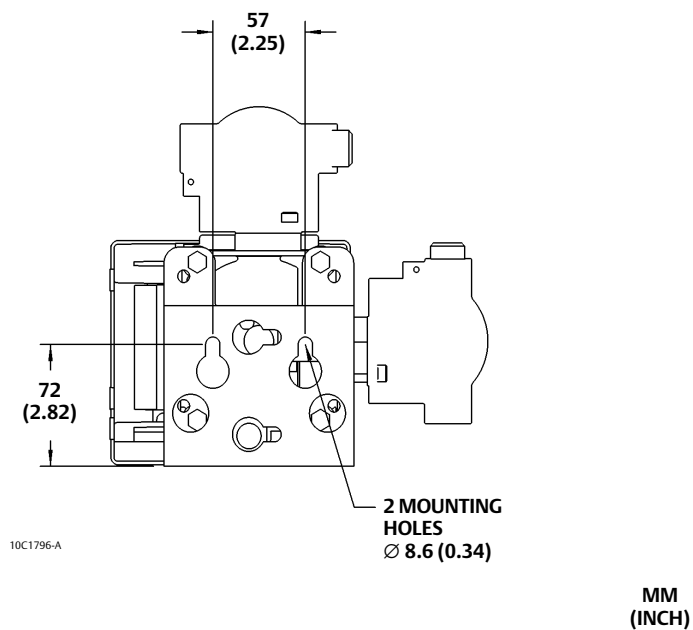


Figure 2-5. FIELDVUE DVC6205 Base Unit Wall Mounting

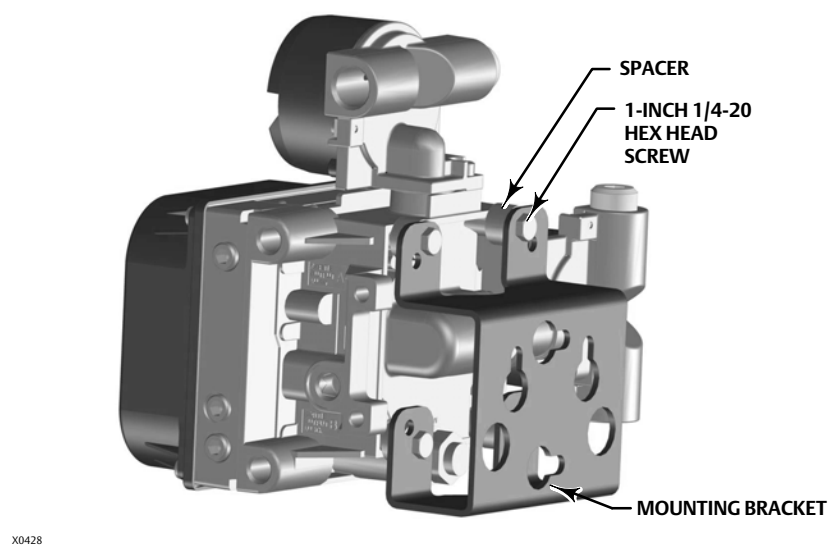
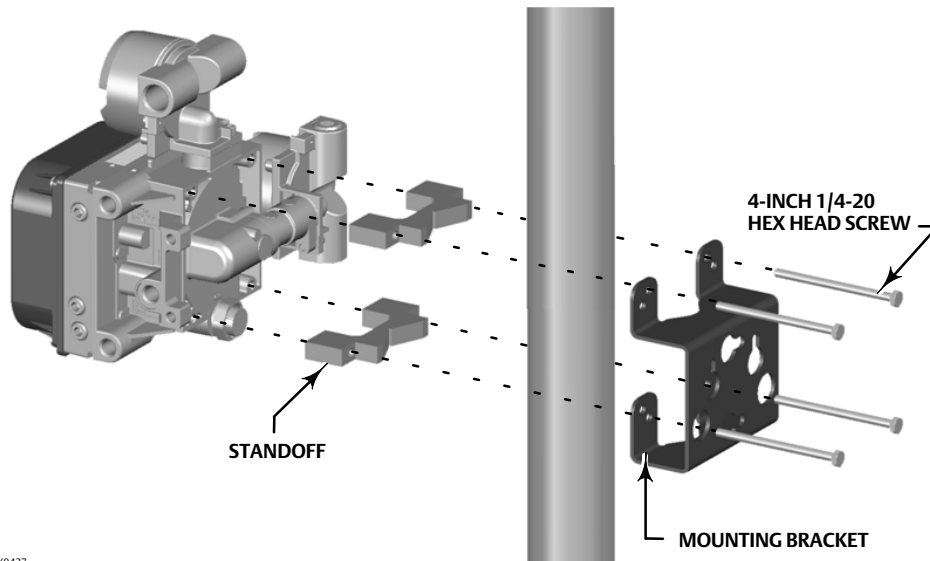


Figure 2-6. FIELDVUE DVC6205 Base Unit Pipestand Mounting

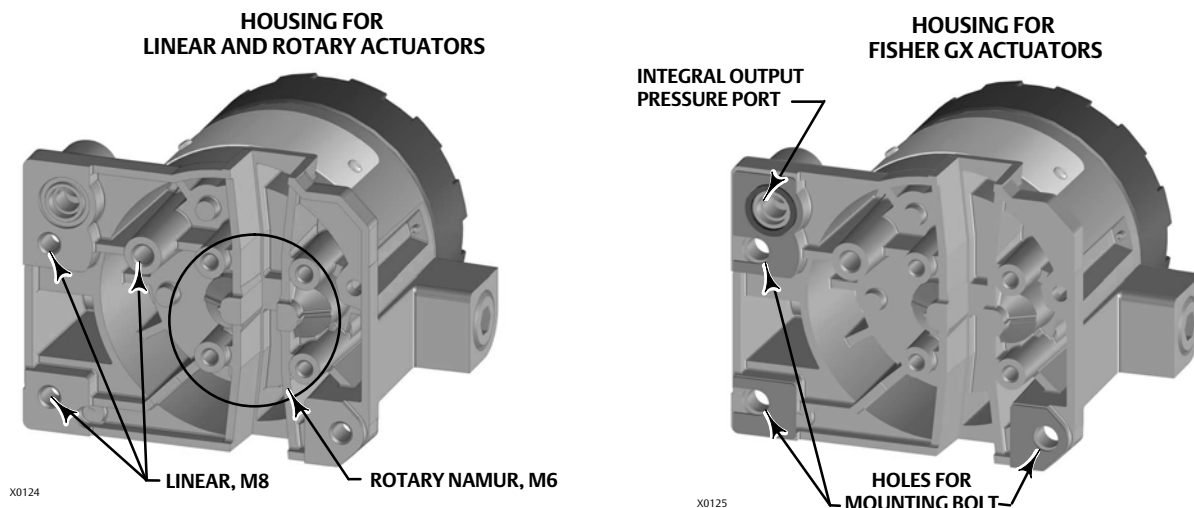


Mounting the DVC6215 Feedback Unit

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

The DVC6215 housing is available in two different configurations, depending on the actuator mounting method. Figure 2-7 shows the available configurations. The feedback system for the DVC6215 feedback unit utilizes a magnetic assembly for true linkage-less, non-contacting position measurement. In order to prevent inadvertent stem movement while the instrument is in operation, magnetic tools (such as a magnetic-tipped screwdriver) should not be used.

Figure 2-7. Feedback Unit Housing Configurations



CAUTION

The magnet assembly material has been specifically chosen to provide a long-term stable magnetic field.

However, as with any magnet, care must be taken when handling the magnet assembly. Another high powered magnet placed in close proximity (less than 25 mm) can cause permanent damage. Potential sources of damaging equipment include, but are not limited to: transformers, DC motors, stacking magnet assemblies.

CAUTION

General Guidelines for use of High Power Magnets with Positioners

Use of high power magnets in close proximity to any positioner which is operating a process should be avoided. Regardless of the positioner model, high power magnets can affect the positioner's ability to control the valve. Technicians should avoid the use of high power magnets in close proximity with any positioner.

Use of Magnetic Tools with the DVC6215

- Magnetic Tip Screw Drivers – Magnetic tip screw drivers can be used to work on the DVC6215. However, they should not be brought in close proximity to the magnet assembly (located at the back of the instrument) during process operations.
- Calibrator Strap Magnets – These are high power magnets used to hold 4-20 ma calibrators. Normally, these calibrators would not be used while an instrument is controlling the process. High power magnets should be kept at least 15 cm (6 inches) from the DVC6215.

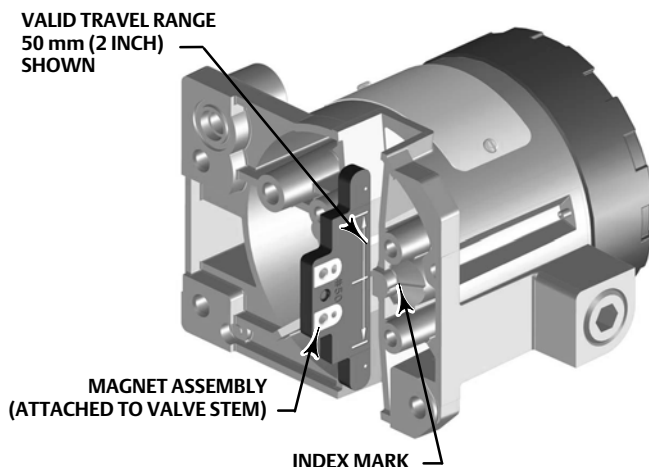


Note

As a general rule, do not use less than 60% of the magnet assembly travel range for full travel measurement. Performance will decrease as the assembly is increasingly subranged.

The linear magnet assemblies have a valid travel range indicated by arrows molded into the piece. This means that the hall sensor (on the back of the DVC6215 housing) has to remain within this range throughout the entire valve travel. See figure 2-8. The linear magnet assemblies are symmetrical. Either end may be up.

Figure 2-8. Travel Range



X0126

There are a variety of mounting brackets and kits that are used to mount the DVC6215 to different actuators.

Note

The DVC6215 feedback unit uses the same mountings as the DVC6200 digital valve controller.

However, despite subtle differences in fasteners, brackets, and connecting linkages, the procedures for mounting can be categorized as follows:

- Sliding-stem linear actuators
- Fisher rotary actuators
- GX actuator
- Quarter-turn actuators

See figure 2-3 for examples of the different travel feedback magnet assemblies.

Sliding-Stem Linear Actuators up to 210 mm (8.25 Inches) of Travel

The DVC6215 feedback unit has linkage-less, non-contact feedback on sliding-stem actuators with up to 210 mm (8.25 inches) travel. Figure 2-9 shows a typical mounting on a sliding stem actuator. For actuators with greater than 210 mm (8.25 inches) travel, see the guidelines on page 20.

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

Figure 2-9. Mounting Parts for Sliding-Stem Actuator with up to 210 mm (8.25 Inches) Travel



X0127

3. Loosely attach the feedback pieces and magnet assembly to the valve stem connector. Do not tighten the fasteners because fine adjustment is required.

CAUTION

Do not install a magnet assembly that is shorter than the physical travel of the actuator. Loss of control will result from the magnet assembly moving outside the range of the index mark in the feedback slot of the DVC6215 housing.

4. Using the alignment template (supplied with the mounting kit), position the magnet assembly inside the retaining slot.

5. Align the magnet assembly as follows:

For air-to-open actuators (e.g. Fisher 667) vertically align the magnet assembly so that the center line of the alignment template is lined up as close as possible with the upper extreme of the valid travel range on the magnet assembly. The magnet assembly should be positioned so that the index mark in the feedback slot of the DVC6215 housing is within the valid range on the magnet assembly throughout the range of travel. See figure 2-10.

For air-to-close actuators (e.g. Fisher 657) vertically align the magnet assembly so that the center line of the alignment template is lined up as close as possible with the lower extreme of the valid travel range on the magnet assembly. The magnet assembly should be positioned so that the index mark in the feedback slot of the DVC6215 housing is within the valid range on the magnet assembly throughout the range of travel. See figure 2-11.

Figure 2-10. Air-to-Open Magnet Assembly Alignment

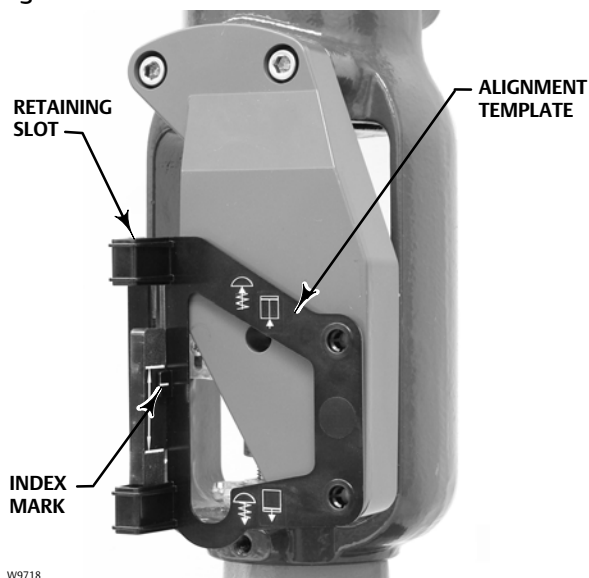
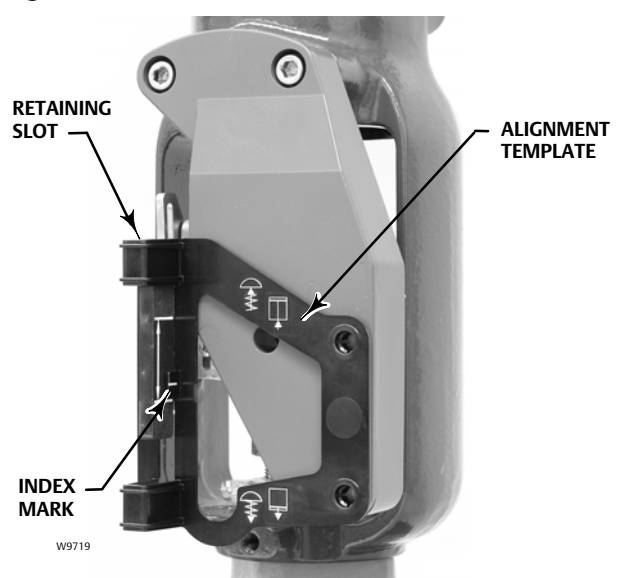


Figure 2-11. Air-to-Close Magnet Assembly Alignment



6. Tighten the fasteners and remove the alignment template.

Note

Use a flat end hex key to tighten the mounting assembly fasteners to a torque of 2.37 N•m (21 in•lbf) for 4 mm screws, and 5.08 N•m (45 in•lbf) for 5 mm screws. While tightening the fasteners using the hex key should be sufficient, blue (medium) thread locker may be used for additional security.

7. Mount the feedback unit to the mounting bracket, using the mounting bolts.
8. Check for clearance between the magnet assembly and the DVC6215 feedback slot.

Note

Ensure that there is clearance between the magnet assembly and the DVC6215 housing slot throughout the full range of travel.

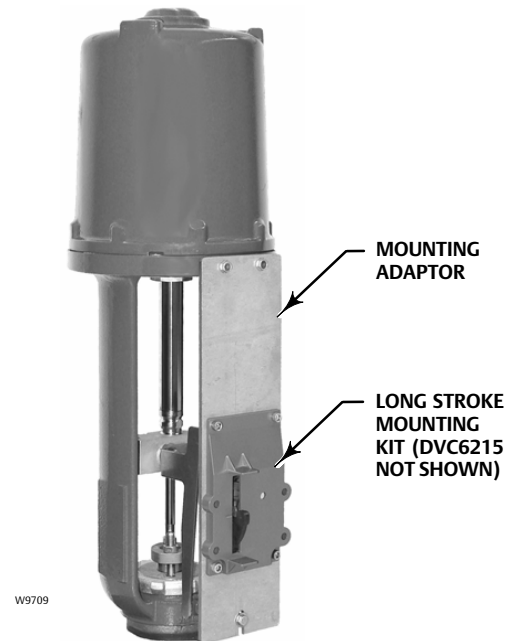
Fisher Rotary Actuators and Sliding-Stem Linear Actuators over 210 mm (8.25 Inches) Travel

The DVC6215 feedback unit uses a cam (designed for linear response) and roller as the feedback mechanism. See figures 2-12 and 2-13.

Figure 2-12. Mounting on Rotary Actuators



Figure 2-13. Mounting on Sliding-Stem (Linear) Actuators over 210 mm (8.25 Inches) Travel



Note

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

There are three different mounting adaptations, based on the actuator design (see figure 2-14).

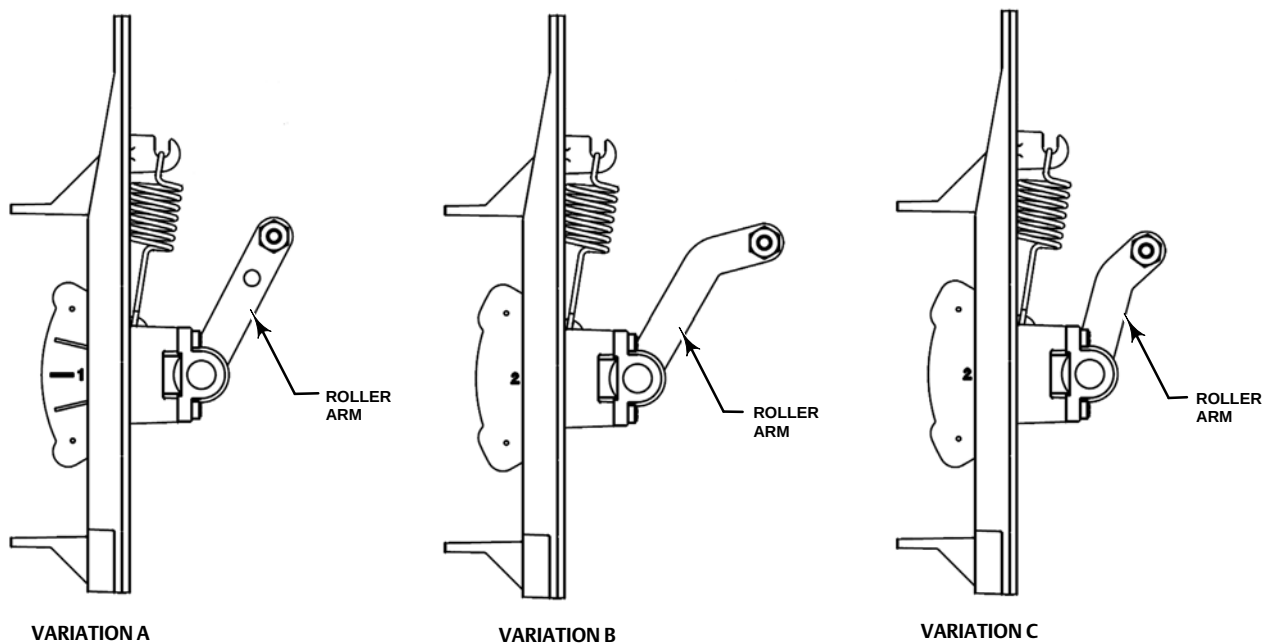
Fisher Rotary Actuators

Refer to the following guidelines when mounting on rotary actuators.

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

2. Verify that the appropriate cam is installed on the actuator as described in the instructions included with the mounting kit.
3. Mount the DVC6215 on the actuator as follows:
 - If required, a mounting adaptor is included in the mounting kit. Attach the adaptor to the feedback unit, then attach the feedback unit assembly to the actuator. The roller on the feedback arm will contact the actuator cam as it is being attached.
 - If no mounting adaptor is required, attach the feedback unit and mounting kit assembly to the actuator. The roller on the feedback arm will contact the actuator cam as it is being attached.

Figure 2-14. Mounting Variations



VARIATION	ACTUATOR
A	2052 Size 2 and 3
	1051/1052 size 40-70
	1061 Size 30-100
	Sliding-Stem > 210 mm (8.25 Inches)
B	2052 Size 1
C	1052 Size 20-33
	1051 Size 33

NOTE THE DIFFERENCE IN THE SHAPE AND LENGTH OF THE ROLLER ARM

E1229

Sliding-Stem Linear Actuators over 210 mm (8.25 Inches) Travel

Refer to the following guidelines when mounting on sliding-stem linear actuators over 210 mm (8.25 inches) travel (see figure 2-13).

1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.
2. Install the cam to the valve stem connector as described in the instructions included with the mounting kit.
3. Install the mounting adaptor to the actuator.
4. Attach the feedback unit and mounting kit assembly to the mounting adaptor. The roller on the feedback arm will contact the actuator cam as it is being attached.

GX Actuators

The DVC6215 feedback unit mounts directly on the GX actuator without the need for a mounting bracket.

Identify the yoke side to mount the DVC6215 feedback unit based on the actuator fail mode. Refer to the GX Control Valve and Actuator System instruction manual (D103175X012).

1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. Shut off all pressure lines to the actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Loosely attach the feedback pieces and magnet assembly to the valve stem connector. Do not tighten the fasteners because fine adjustment is required.

CAUTION

Do not install a magnet assembly that is shorter than the physical travel of the actuator. Loss of control will result from the magnet assembly moving outside the range of the index mark in the feedback slot of the DVC6215 housing.

3. Using the alignment template (supplied with the mounting kit), position the feedback assembly inside the retaining slot.
4. Align the magnet assembly as follows:

For air-to-open GX actuators vertically align the magnet assembly so that the center line of the alignment template is lined up as close as possible with the upper extreme of the valid travel range on the magnet assembly. The magnet assembly should be positioned so that the index mark in the feedback slot of the DVC6215 housing is within the valid range on the magnet assembly throughout the range of travel. See figure 2-15.

For air-to-close GX actuators vertically align the magnet assembly so that the center line of the alignment template is lined up as close as possible with the lower extreme of the valid travel range on the magnet assembly. The magnet assembly should be positioned so that the index mark in the feedback slot of the DVC6215 housing is within the valid range on the magnet assembly throughout the range of travel. See figure 2-16.

Figure 2-15. Air-to-Open Fisher GX Magnet Assembly Alignment

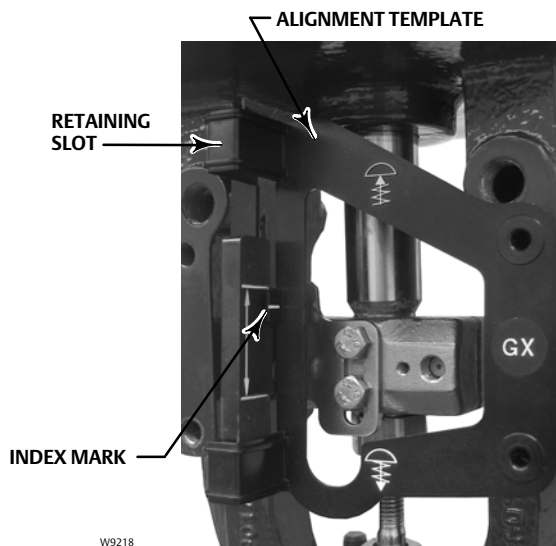
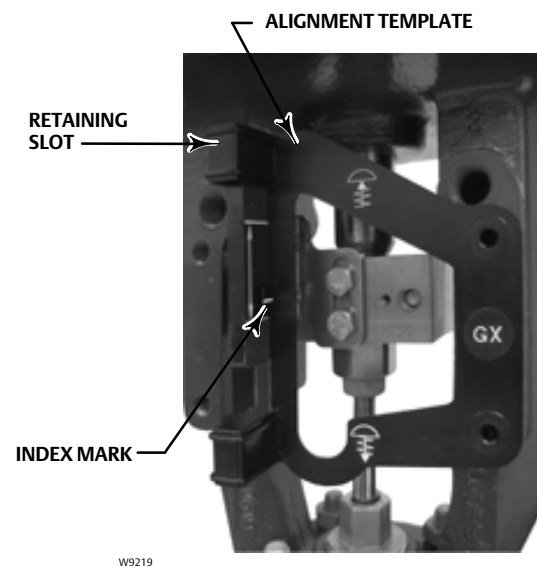


Figure 2-16. Air-to-Close Fisher GX Magnet Assembly Alignment



5. Tighten the fasteners and remove the alignment template. Continue on with the appropriate step 6 below.

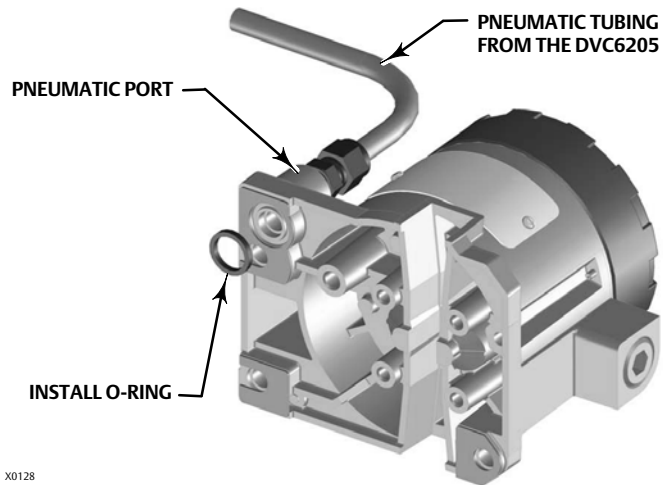
Note

Use a flat end hex key to tighten the mounting assembly fasteners to a torque of 2.37 N•m (21 in•lbf) for 4 mm screws, and 5.08 N•m (45 in•lbf) for 5 mm screws. While tightening the fasteners using the hex key should be sufficient, blue (medium) thread locker may be used for additional security.

Air-to-Open GX Actuators

6. The pneumatic output port on the DVC6215 lines up with the integral GX actuator pneumatic port. See figure 2-17.
7. Using a 5 mm hex wrench, attach the feedback unit to the GX actuator mounting pad on the side that has the open pneumatic port. Be sure to place the O-ring between the feedback units pneumatic output and the actuator mounting pad. Pneumatic tubing between the feedback unit and the actuator is not required because the air passages are internal to the actuator.
8. Connect the pneumatic tubing from the DVC6205 to the feedback units pneumatic port provided on the front of the DVC6215 as shown in figure 2-17.
9. Check for clearance between the magnet assembly and the DVC6215 feedback slot.
10. If not already installed, install a vent in the port on the upper diaphragm casing's air supply connection on the actuator yoke leg.

Figure 2-17. Modifications for Fisher GX Actuator; Air-to-Open Construction Only



X0128

Air-to-Close GX Actuators

6. Using a 5 mm hex wrench, attach the feedback unit to the GX actuator mounting pad.
7. Check for clearance between the magnet assembly and the DVC6215 feedback slot.
8. Install tubing between the actuator casing and the appropriate DVC6215 pneumatic output port.
9. If not already installed, install a vent in the port on the lower diaphragm casing.

Note

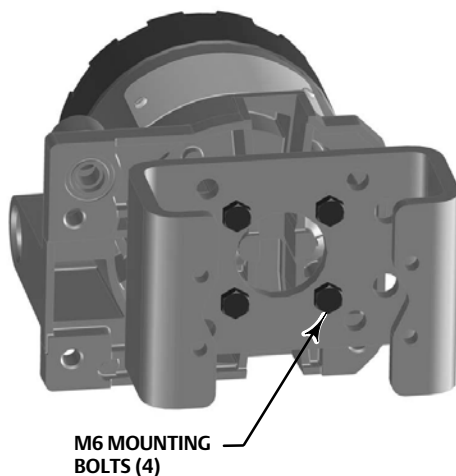
- To convert to air-to-open, install an O-ring between the feedback units pneumatic output and the actuator mounting pad. Connect pneumatic tubing from the DVC6205 to the DVC6215. Refer to figure 2-17.
- To convert to air-to-close, remove the O-ring between the feedback units pneumatic output and the actuator mounting pad. Disconnect the pneumatic tubing from the DVC6205 to the DVC6215. Install tubing between the pneumatic output connection of the DVC6205 to the pneumatic port on top of the actuator casing.

Quarter-Turn Rotary Actuators

The DVC6215 feedback unit can be mounted to any quarter-turn rotary actuator, as well as those that comply with the NAMUR guidelines. A mounting bracket and associated hardware are required. Refer to figure 2-18.

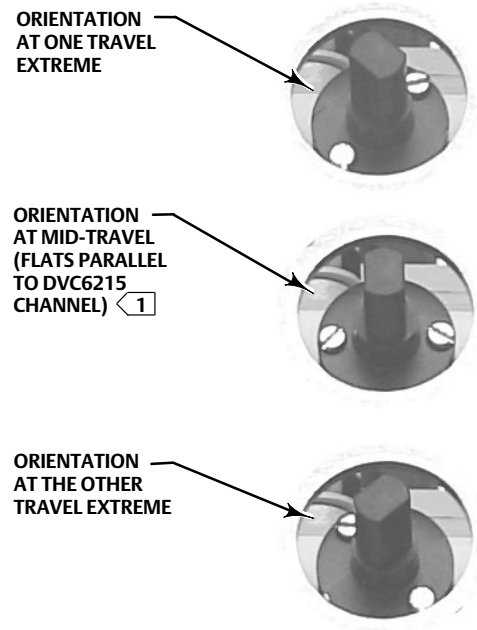
1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. Shut off all pressure lines to the actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Attach the magnet assembly to the actuator shaft. At mid-travel, the flats on the magnet assembly should be approximately parallel to the channel on the back of the DVC6215 housing, as shown in figure 2-19.
3. Install the mounting bracket on the actuator.
4. Attach the feedback unit to the mounting bracket using the 4 mounting bolts, as shown in figure 2-18.
5. Check for clearance between the magnet assembly and the DVC6215 feedback slot.
6. Install tubing between the actuator casing and the appropriate DVC6215 pneumatic output port.

Figure 2-18. Mounting on Quarter-Turn Actuators



X0129

Figure 2-19. Magnet Assembly Orientation on Quarter-Turn Actuators



1 THIS EXAMPLE SHOWS AN ACTUATOR WITH 90° TRAVEL. ON AN ACTUATOR THAT HAS LESS THAN 90° TRAVEL THE MAGNET ASSEMBLY MAY NOT BE PARALLEL AT THE MID-TRAVEL POINT. TO VERIFY THE MAGNET ASSEMBLY POSITION IS IN WORKING RANGE, CONFIRM TRAVEL COUNTS ARE WITHIN THE EXPECTED RANGE OF 175-3800 USING VALVELINK SOFTWARE OR A FIELD COMMUNICATOR.

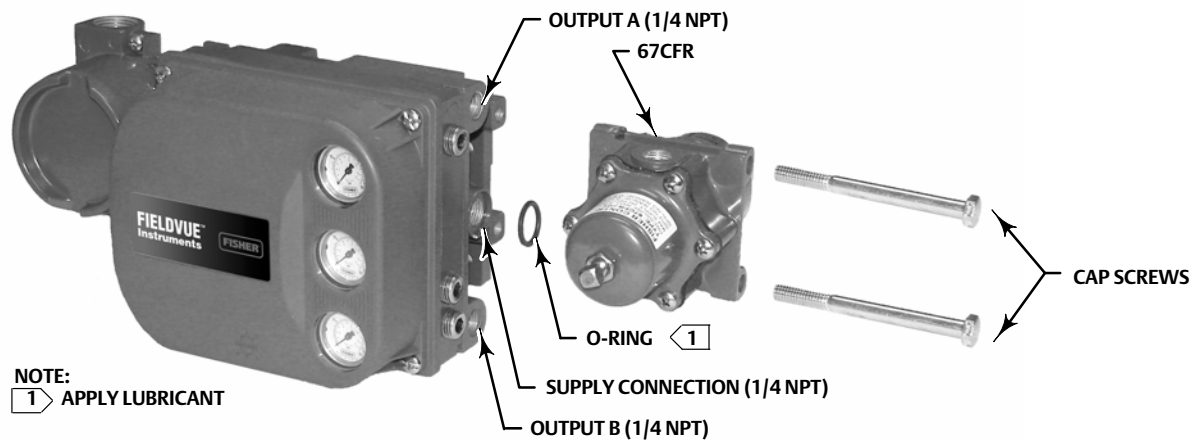
Mounting Fisher 67CFR Filter Regulator

A 67CFR filter regulator, when used with a DVC6200 digital valve controller, can be mounted one of three ways.

Integral-Mounted Regulator

Refer to figure 2-20. Lubricate an O-ring and insert it in the recess around the SUPPLY connection on the digital valve controller. Attach the 67CFR filter regulator to the side of the digital valve controller. Thread a 1/4-inch socket-head pipe plug into the unused outlet on the filter regulator. This is the standard method of mounting the filter regulator.

Figure 2-20. Mounting the Fisher 67CFR Regulator on a FIELDVUE DVC6200 Digital Valve Controller



Yoke-Mounted Regulator

Mount the filter regulator with two cap screws to the pre-drilled and tapped holes in the actuator yoke. Thread a 1/4-inch socket-head pipe plug into the unused outlet on the filter regulator. No O-ring is required.

Casing-Mounted Regulator

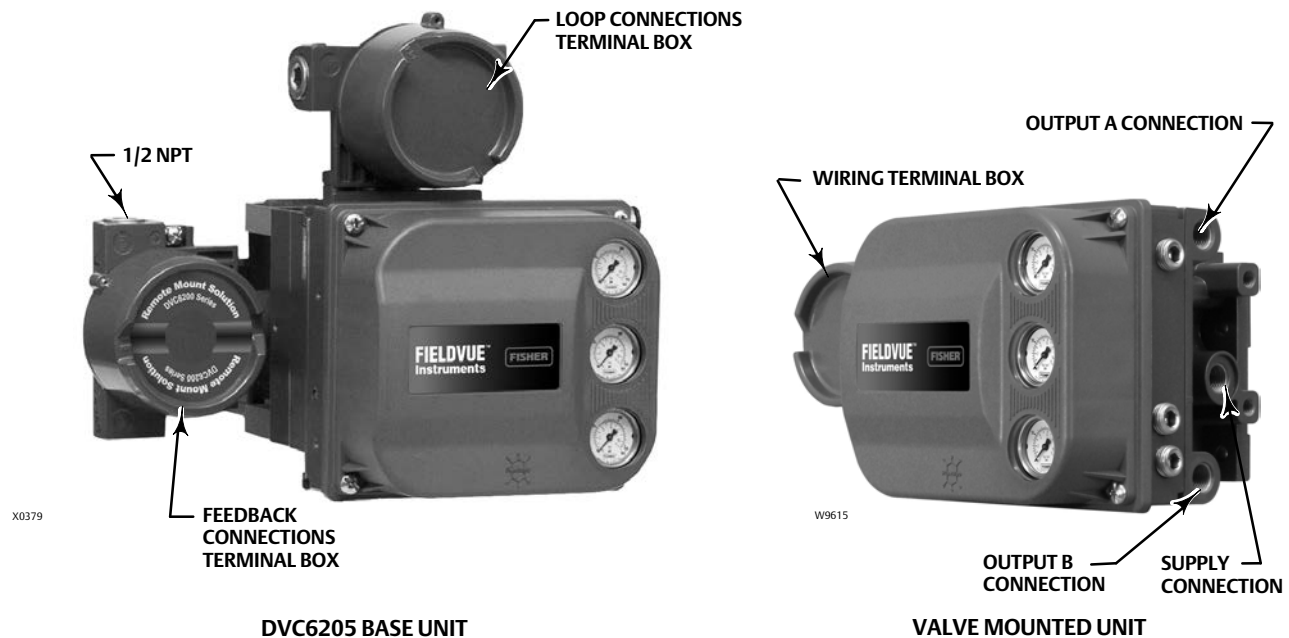
Use the separate 67CFR filter regulator casing mounting bracket provided with the filter regulator. Attach the mounting bracket to the 67CFR and then attach this assembly to the actuator casing. Thread a 1/4-inch socket-head pipe plug into the unused outlet on the filter regulator. No O-ring is required.

Pneumatic Connections

Pressure

Pressure connections are shown in figure 2-21. All pressure connections on the digital valve controller are 1/4 NPT internal connections. Use at least 10 mm (3/8-inch) tubing for all pressure connections. If remote venting is required a minimum of 12.7 mm (1/2-inch) tubing should be used. Refer to the vent subsection for remote venting information.

Figure 2-21. Pressure Connections



Supply

⚠ WARNING

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

Personal injury or property damage may result from fire or explosion if natural gas is used as the supply medium and appropriate preventive measures are not taken. Preventive measures may include, but are not limited to, one or more of the following: Remote venting of the unit, re-evaluating the hazardous area classification, ensuring adequate ventilation, and the removal of any ignition sources. For information on remote venting of this controller, refer to page 30.

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

⚠ WARNING

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

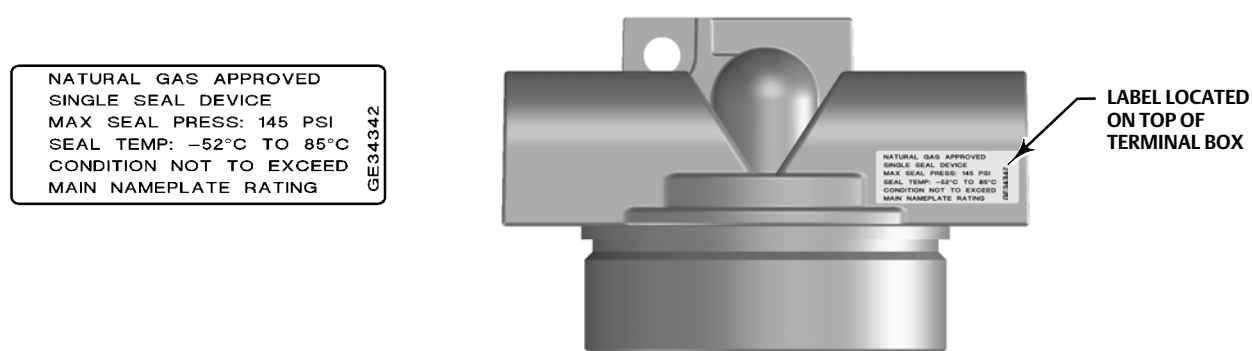
- Remove electrical power before removing the housing cap. Personal injury or property damage from fire or explosion may result if power is not disconnected before removing the cap.
- Remove electrical power before disconnecting any of the pneumatic connections.
- When disconnecting any of the pneumatic connections or any pressure retaining part, natural gas will seep from the unit and any connected equipment into the surrounding atmosphere. Personal injury or property damage may result from fire or explosion if natural gas is used as the supply medium and appropriate preventive measures are not taken. Preventive measures may include, but are not limited to, one or more of the following: ensuring adequate ventilation and the removal of any ignition sources.

- **Ensure that the cover is correctly installed before putting this unit back into service. Failure to do so could result in personal injury or property damage from fire or explosion.**

The DVC6200 can be used with air or natural gas as the supply medium. If using natural gas as the pneumatic supply medium, natural gas will be used in the pneumatic output connections of the DVC6200 to any connected equipment. In normal operation the unit will vent the supply medium into the surrounding atmosphere unless it is remotely vented.

Natural Gas Certified, Single Seal instruments can be identified by the natural gas approval label shown in figure 2-22. The Natural Gas Certified, Single Seal device option simplifies conduit sealing requirements. Read and follow all local, regional, and federal wiring requirements for natural gas installations. Contact your Emerson Process Management sales office for information on obtaining a Natural Gas Certified, Single Seal DVC6200 digital valve controller.

Figure 2-22. Gas Certified Label



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

Alternatively, natural gas must be clean, dry, oil-free, and noncorrosive. H₂S content should not exceed 20 ppm.

A maximum 40 micrometer particle size in the air system is acceptable. Further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimized.

If you are using a 67CFR filter regulator with standard 5 micrometer filter, connect the supply line to the 1/4 NPT IN connection and attach tubing from the output connection on the filter regulator to the SUPPLY connection on the instrument. If you are using an integral mounted 67CFR filter regulator, connect the supply to the IN connection on the regulator.

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, connect the 1/4 NPT digital valve controller output connection to the pneumatic actuator input connection.

Single-Acting Actuators

When using a single-acting direct digital valve controller (relay A or C) on a single-acting actuator, connect OUTPUT A to the actuator pneumatic input. When using a single-acting reverse digital valve controller (relay B) on a single-acting actuator, connect OUTPUT B to the actuator diaphragm casing.

Double-Acting Actuators

DVC6200 digital valve controllers on double-acting actuators always use relay A. With no input current, OUTPUT A is at 0 pressure and OUTPUT B is at full supply pressure when the relay is properly adjusted. To have the actuator stem extend from the cylinder with increasing input signal, connect OUTPUT A to the upper actuator cylinder connection. Connect OUTPUT B to the lower cylinder connection. To have the actuator stem retract into the cylinder with increasing input signal, connect OUTPUT A to the lower actuator cylinder connection. Connect OUTPUT B to the upper cylinder connection.

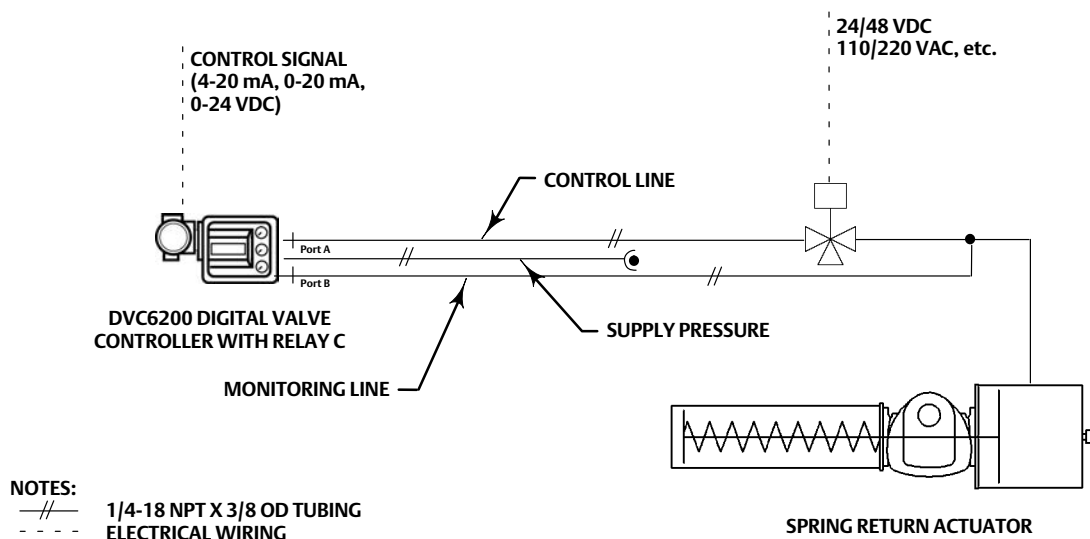
Special Construction to Support Solenoid Valve Testing

Note

Solenoid valve testing is only available for instrument level ODV.

In single-acting actuator applications with a solenoid valve installed, the DVC6200 can be configured to test the operation of the solenoid valve. This is accomplished by connecting the “unused” output port from the DVC6200 to the pneumatic line between the solenoid valve and the actuator, as shown in figure 2-23. When single-acting, direct relay C is installed, the “unused” output port is port B. When single-acting, reverse relay B is used, the unused port is port A.

Figure 2-23. Pneumatic Hookup for Solenoid Testing (Instrument Level ODV only)



Note

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

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

Vent

WARNING

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

WARNING

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

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

Vent line piping should comply with local and regional codes, should be as short as possible with a minimum inside diameter of 12.7 mm (1/2-inch), and few bends to reduce case pressure buildup.

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

The relay constantly bleeds a small amount of supply medium into the area under the cover. The vent opening, located below the wiring terminal box on the side of the housing, should be left open to prevent pressure buildup under the cover. If a remote vent is required, the vent lines must be as short as possible with a minimum number of bends and elbows.

To connect a remote vent, remove the plastic vent. The vent connection is 3/8 NPT. At a minimum, 12.7 mm (1/2-inch) tubing should be used when installing a remote vent to prevent excessive pressure from building up under the cover.

Wiring and Electrical Connections

WARNING

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

WARNING

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

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

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

The valve may move in an unexpected direction when power is applied to the DVC6200 digital valve controller. To avoid personal injury and property damage caused by moving parts, keep hands, tools, and other objects away from the valve/actuator assembly when applying power to the instrument.

4-20 mA Loop Connections

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

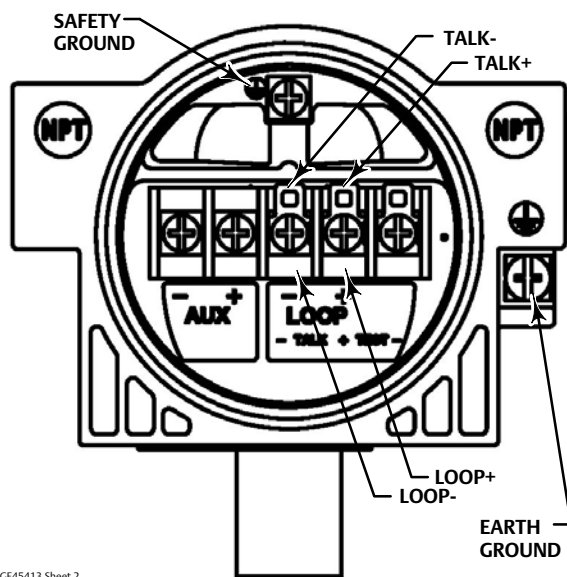
Note

Connect the digital valve controller to a 4-20 mA current source for operation in the point-to-point wiring mode. In the point-to-point wiring mode, the digital valve controller will not operate when connected to a voltage source.

Wire the digital valve controller as follows, refer to figure 2-24:

1. Remove the wiring terminal box cap (refer to figure 2-21).
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 control system output channel positive wire “current output” to the LOOP + screw terminal in the terminal box. Connect the control system output channel negative (or return) wire to the LOOP - screw terminal in the terminal box.

Figure 2-24. Loop Connections Terminal Box



GE45413 Sheet 2

⚠ WARNING

Personal injury or property damage, caused by fire or explosion, can result from the discharge of static electricity. Connect a 14 AWG (2.08 mm²) ground strap between the digital valve controller and earth ground when flammable or hazardous gases are present. Refer to national and local codes and standards for grounding requirements.

4. As shown in figure 2-24, two ground terminals are available for connecting a safety ground, earth ground, or drain wire. The safety ground is electrically identical to the earth ground. Make connections to these terminals following national and local codes and plant standards.

⚠ WARNING

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

5. Replace and hand tighten the terminal box cap. To secure the terminal box cap engage the lock screw. When the loop is ready for startup, apply power to the control system output channel.

Remote Travel Sensor Connections

The DVC6205 base unit is designed to receive travel information via the Emerson Process Management supplied DVC6215 feedback unit.

⚠ WARNING

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

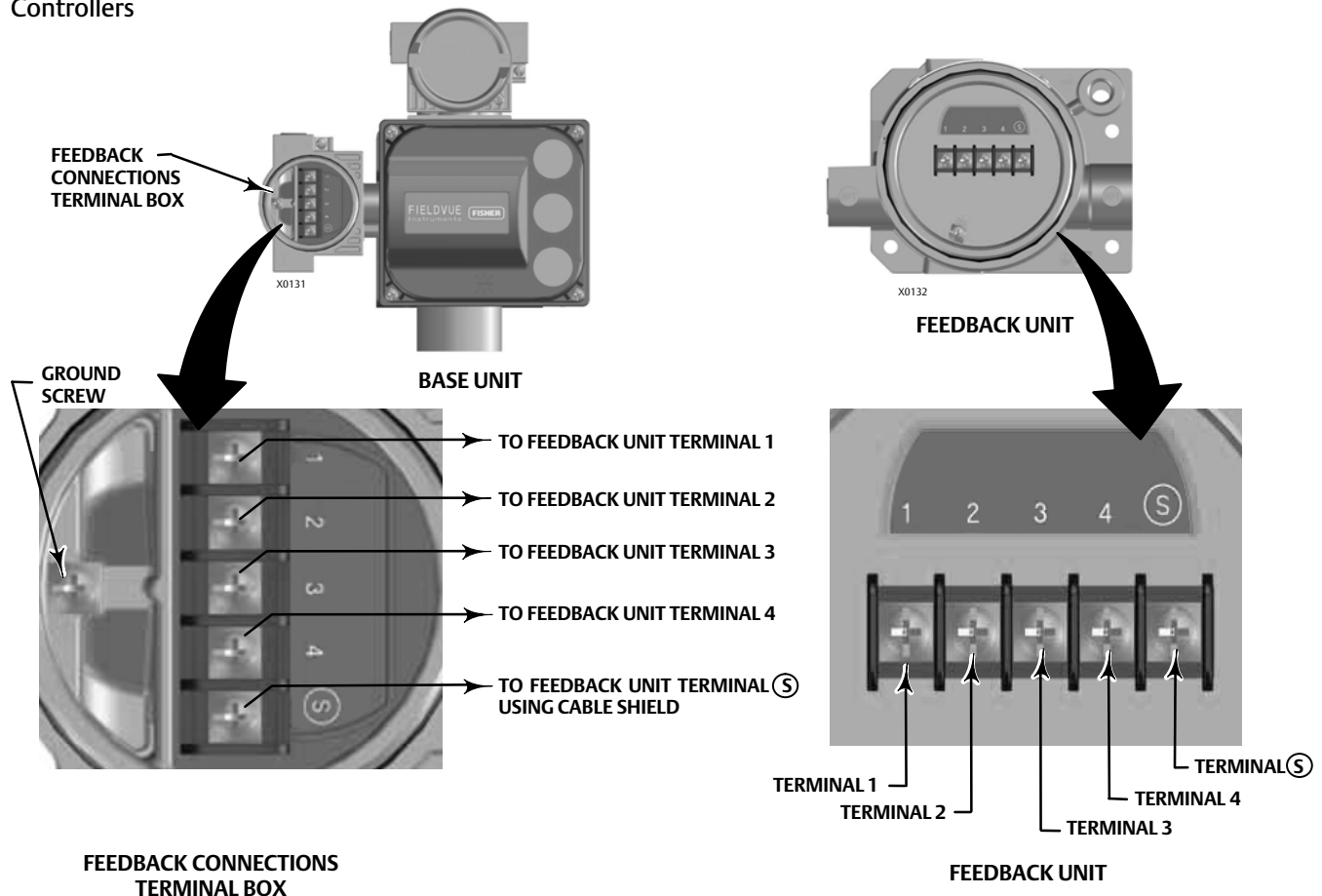
Do not place feedback wiring in the same conduit as other power or signal wiring.

Note

4-conductor shielded cable, 18 to 22 AWG minimum wire size, in rigid or flexible metal conduit, is required for connection between base unit and feedback unit. Pneumatic tubing between base unit output connection and actuator has been tested to 91 meters (300 feet). At 15 meters (50 feet) there was no performance degradation. At 91 meters there was minimal pneumatic lag.

1. On the feedback unit, remove the housing cap.
2. On the base unit, remove the feedback connections terminal box cap (see figure 2-21).
3. Install conduit between the feedback unit and the base unit following applicable local and national electrical codes. Route the 4-conductor shielded cable between the two units (refer to figure 2-25).
4. Connect one wire of the 4-conductor shielded cable between terminal 1 on the feedback unit and terminal 1 on the base unit.
5. Connect the second wire of the 4-conductor shielded cable between terminal 2 on the feedback unit and terminal 2 on the base unit.

Figure 2-25. Terminal Details for Connecting the Base Unit and Feedback Unit for Remote-Mounted Digital Valve Controllers



6. Connect the third wire of the 4-conductor shielded cable between terminal 3 on the feedback unit and terminal 3 on the base unit.
7. Connect the fourth wire of the 4-conductor shielded cable between terminal 4 on the feedback unit and terminal 4 on the base unit.

⚠ WARNING

The cable shield is typically not insulated. It is required that you insulate the cable shield prior to installation.

When connecting the cable shield in step 8 ensure that the uninsulated shield wiring does not contact the DVC6215 housing. Failure to do so can result in ground loop issues.

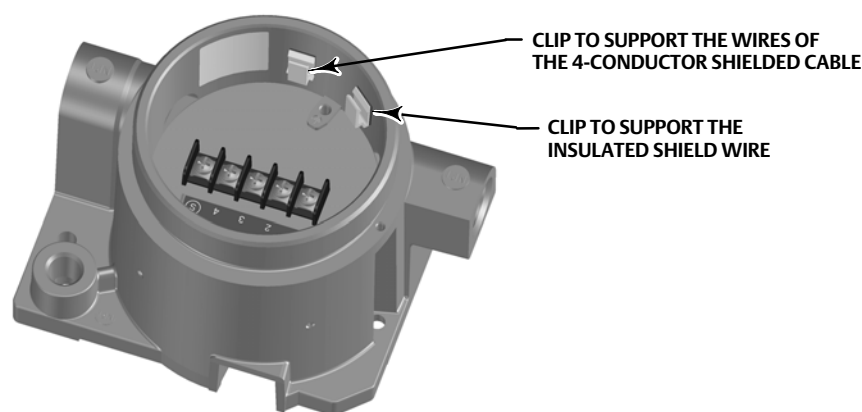
8. Connect the cable shield between terminal S on the feedback unit and terminal S on the base unit.

CAUTION

Failure to secure the cable wires in the support clips in step 9 can result in broken wires in applications with high levels of vibration.

9. Secure the cable wires, using the support clips in the DVC6215 feedback unit (as shown in figure 2-26), to help prevent shifting and movement of the wires.
10. Replace and hand-tighten all covers.

Figure 2-26. Secure Wires in Clips



Wiring Practices

Control System Requirements

There are several parameters that should be checked to ensure the control system is compatible with the DVC6200 digital valve controller.

HART Filter

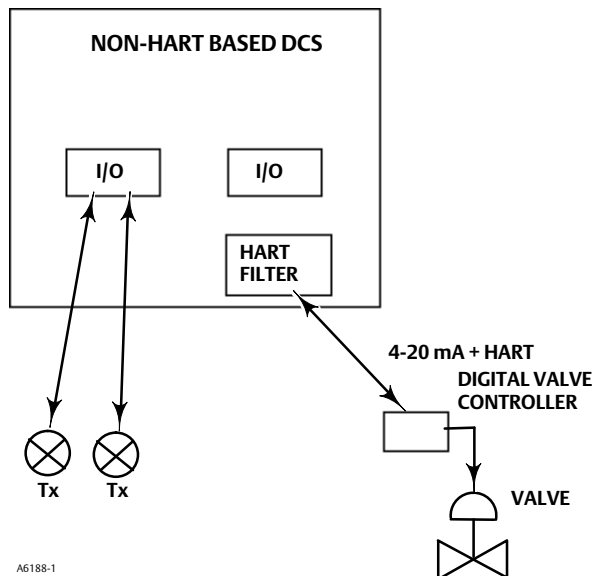
Depending on the control system you are using, a HART filter may be needed to allow HART communication. The HART filter is a passive device that is inserted in field wiring from the HART loop. The filter is normally installed near the field wiring terminals of the control system I/O (see figure 2-27). Its purpose is to effectively isolate the control system output from modulated HART communication signals and raise the impedance of the control system to allow HART communication. For more information on the description and use of the HART filter, refer to the appropriate HART filter instruction manual.

To determine if your system requires a filter contact your Emerson Process Management sales office.

Note

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

Figure 2-27. HART Filter Application



Voltage Available

The voltage available at the DVC6200 digital valve controller must be at least 11 volts DC. The voltage available at the instrument is not the actual voltage measured at the instrument when the instrument is connected. The voltage measured at the instrument is limited by the instrument and is typically less than the voltage available.

As shown in figure 2-28, the voltage available at the instrument depends upon:

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

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

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

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

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

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

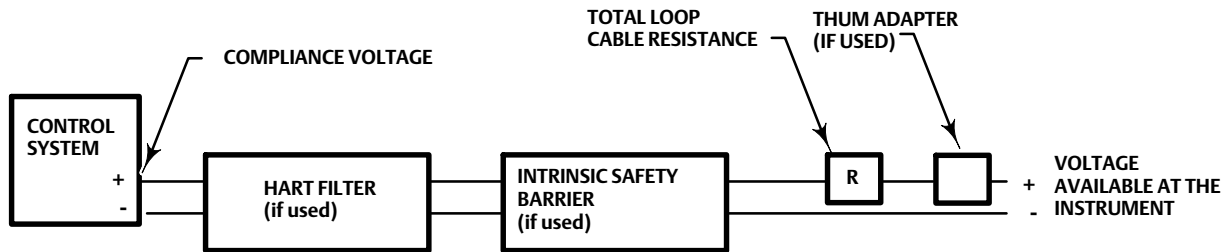
The following example shows how to calculate the voltage available for a Honeywell™ TDC2000 control system with a HF340 HART filter, and 1000 feet of Belden™ 9501 cable:

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

Figure 2-28. Determining Voltage Available at the Instrument



Calculate Voltage Available at the Instrument as follows:

Control system compliance voltage

- Filter voltage drop (if used) 1
- Intrinsic safety barrier resistance (if used) x maximum loop current
- Smart Wireless THUM adapter voltage drop (if used) 2
- Total loop cable resistance x maximum loop current

= Voltage available at the instrument 3

Example Calculation

18.5 volts (at 21.05 mA)

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

NOTES:

- 1 Obtain filter voltage drop. The measured drop will be different than this value. The measured filter voltage drop depends upon control system output voltage, the intrinsic safety barrier (if used), and the instrument. See note 3.
- 2 The voltage drop of the THUM adapter is linear from 2.25 volts at 3.5 mA to 1.2 volts at 25 mA.
- 3 The voltage available at the instrument is not the voltage measured at the instrument terminals. Once the instrument is connected, the instrument limits the measured voltage to approximately 9.0 to 10.5 volts.

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

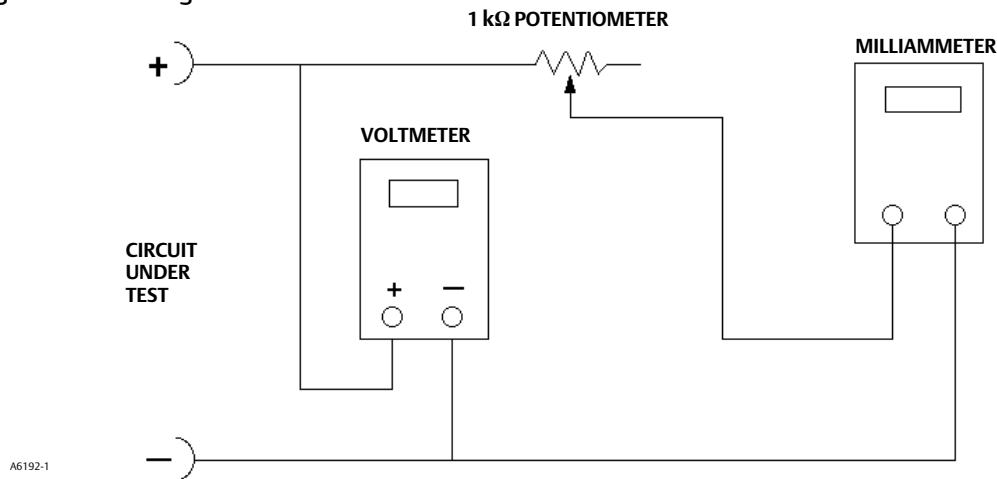
1. The capacitance values represent capacitance from one conductor to all other conductors and shield. This is the appropriate value to use in the cable length calculations.
2. The resistance values include both wires of the twisted pair.

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 2-29 to the control system terminals.

Figure 2-29. Voltage Test Schematic



2. Set the control system to provide maximum output current.
3. Increase the resistance of the 1 kΩ potentiometer, shown in figure 2-29, until the current observed on the milliammeter begins to drop quickly.
4. Record the voltage shown on the voltmeter. This is the control system compliance voltage.

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

Maximum Cable Capacitance

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

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

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

where:

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

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

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

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.

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

Length = 2200 ft.

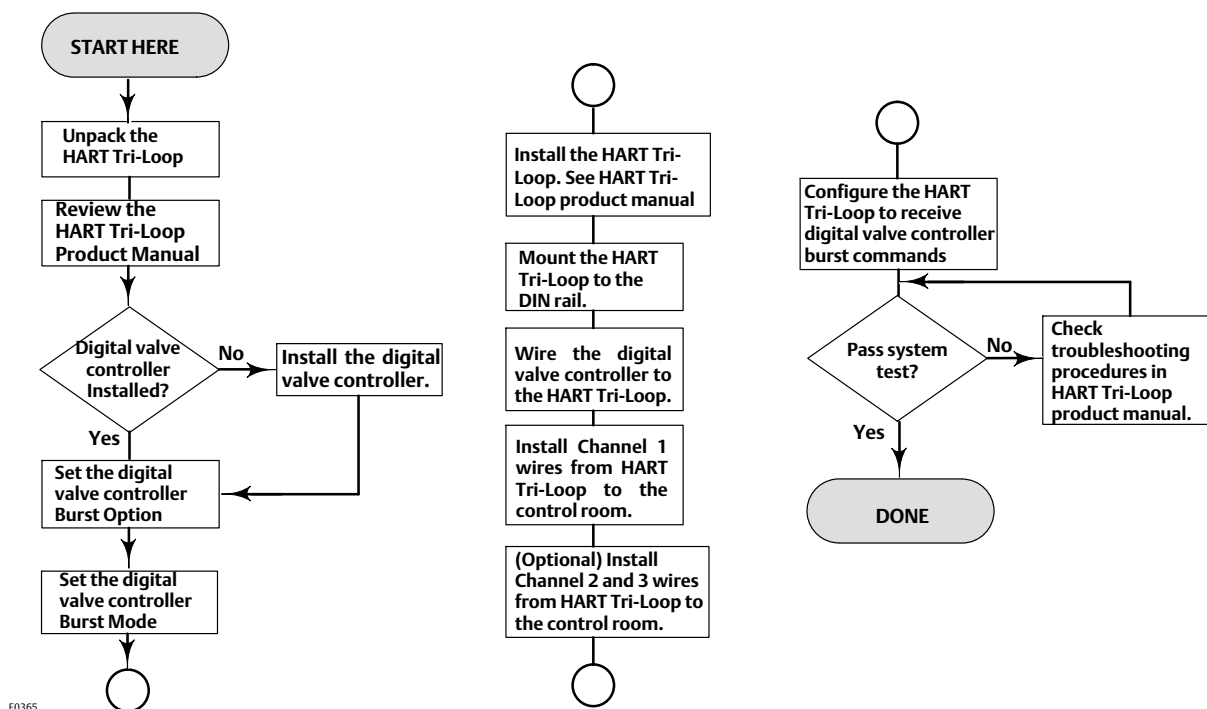
The HART communication cable length is limited by the cable characteristic capacitance. To increase cable length, select a wire with lower capacitance per foot. Contact your Emerson Process Management sales office for specific information relating to your control system.

Installation in Conjunction with a Rosemount 333 HART Tri-Loop HART-to-Analog Signal Converter

Use the DVC6200 digital valve controller in operation with a Rosemount 333 HART Tri-Loop HART-to-Analog Signal Converter to acquire an independent 4-20 mA analog output signal for the analog input, travel target, pressure, or travel. The HART Tri-Loop accepts any three of these digital signals and converts them into three separate 4-20 mA analog channels.

Refer to figure 2-30 for basic installation information. Refer to the 333 HART Tri-Loop HART-to-Analog Signal Converter Product Manual for complete installation information.

Figure 2-30. HART Tri-Loop Installation Flowchart



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

To prepare the digital valve controller for use with a 333 HART Tri-Loop, you must configure the digital valve controller to burst mode, and select Burst Command 3. In burst mode, the digital valve controller provides digital information to the HART Tri-Loop HART-to-Analog Signal Converter. The HART Tri-Loop converts the digital information to a 4 to 20 mA analog signal. Each burst message contains the latest value of the primary (analog input), secondary (travel target), tertiary (configured output pressure), and quaternary (travel) variables.

To commission a DVC6200 for use with a HART Tri-Loop, perform the following procedures.

Note

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

Set the Burst Operation

Field Communicator	Configure > Detailed Setup > Mode and Protection > Burst Mode (1-2-1-4)
--------------------	---

1. Select *Change Burst Enable*. Select *Enable* then press ENTER and SEND.
2. Select *Change Burst Command*. Select the desired command (HART Univ Command 3).
3. Select *Cmd 3 Configured Pressure*. Select the pressure you desire the HART Tri-Loop to use as the tertiary variable.

Command 3 provides the following variables:

Primary variable—analog input in % off mA,

Secondary variable—travel target in % of ranged travel,

Tertiary variable—supply or output pressure in psig, bar, kPa, or kg/cm². Select *Cmd 3 Press* from the *Burst* menu to select if the output A, output B, differential (A-B), or supply pressure is sent.

Quaternary variable—travel in % of ranged travel.

Section 3 Basic Setup

Instrument Mode

Field Communicator	» Hot Key > Instrument Mode (Hot Key-1)
	Configure > Detailed Setup > Mode and Protection > Instrument Mode (1-2-1-1)

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

If the mode is not *Out Of Service*, select *Out Of Service* from the *Instrument Mode* menu and press ENTER.

Configuration Protection

Field Communicator	» Hot Key > Protection (Hot Key-3)
	Configure > Detailed Setup > Mode and Protection > Protection (1-2-1-5)

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

To remove protection:

1. Connect a 4-20 mA source to the instrument.
2. Connect the Field Communicator to the instrument and turn it on.
3. Press the Hot Key on the Field Communicator and select *Protection*.

Note

If the Aux Terminal Mode is configured for Auto Calibration, be sure the jumper remains across the auxiliary terminals until the Field Communicator prompts you to remove it. Removing the jumper too soon will cause the instrument to begin auto calibration. Auto calibration can be terminated by shorting the Aux Terminals for one second.

⚠ WARNING

If the jumper is removed too soon, and auto calibration begins, the valve will move full stroke. To avoid personal injury and property damage caused by the release of pressure or process fluid, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

4. From the *Protection* menu, select *None*. When prompted by the Field Communicator, temporarily attach the jumper to the AUX + and AUX - terminals in the instrument terminal box.
5. Remove the jumper from the AUX terminals when prompted.

Basic Setup

Field Communicator	Configure > Guided Setup (1-1)
--------------------	--------------------------------

WARNING

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

Note

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

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

When the DVC6200 digital valve controller is ordered as part of a control valve assembly, the factory mounts the digital valve controller and sets up the instrument as specified on the order. When mounting to a valve in the field, the instrument needs to be set up to match the instrument to the valve and actuator.

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

Setup Wizard

Field Communicator	Configure > Guided Setup > Setup Wizard (1-1-1)
--------------------	---

Follow the prompts on the Field Communicator display to automatically setup the instrument using specified actuator information. Table 4-4 provides the actuator information required to setup and calibrate the instrument.

1. Enter the instrument family; select DVC6200.
2. Select travel or pressure control. Travel control is the typical mode of operation. Refer to page 56 for additional information on setting Travel/Pressure Control.
3. Enter the pressure units: psi, bar, kPa, or kg/cm².
4. Enter the maximum instrument supply pressure.

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

5. Enter the manufacturer of the actuator on which the instrument is mounted. If the actuator manufacturer is not listed, select Other.
6. Enter the actuator model or type. If the actuator model is not listed, select Other.
7. Enter the actuator size.
8. Select whether the valve is open or closed under the zero power condition.
9. Specify if a volume booster or quick release valve is present.
10. Specify if factory defaults should be used for Basic Setup. If you select YES for factory default, the Field Communicator sets the setup parameters to the values listed in table 3-1. If you select NO for the factory defaults, the setup parameters listed in the table remain at their previous settings.

Table 3-1. Factory Default Settings

Setup Parameter	Default Setting
Analog Input Units Analog In Range High Analog In Range Low Control Mode Restart Control Mode	mA 20.0 mA 4.0 mA Analog (Digital if Multidrop) Resume Last
Self-Test Shutdown Setpoint Filter Time (Lag Time) Input Characteristic Travel Limit High Travel Limit Low	All Failures Disabled Filter Off Linear 125% -25%
Travel Cutoff High Travel Cutoff Low Set Point Rate Open Set Point Rate Close Polling Address	99.5% 0.5% 0%/sec 0%/sec 0
Command 3 Pressure For double-acting actuators For single-acting actuators	differential output pressure actuator pressure

Typically the Setup Wizard determines the required setup information based upon the actuator manufacturer and model specified. However, if you enter *other* for the actuator manufacturer or the actuator model, then you will be prompted for setup parameters such as:

Actuator style (spring & diaphragm, piston double-acting without spring, piston single-acting with spring, piston double-acting with spring),

Valve style (rotary or sliding-stem),

On Loss of Instrument Signal (valve opens or closes), see Zero Power Condition on page 70.

⚠ WARNING

If you answer YES to the prompt for permission to move the valve when the Setup Wizard is determining the travel sensor motion, the instrument will move the valve through its full travel range. To avoid personal injury and property damage caused by the release of pressure or process fluid, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

Travel Sensor motion (increasing or decreasing air pressure causes the magnet assembly to move up or down or the rotary shaft to turn clockwise or counterclockwise) The Setup Wizard asks if it can move the valve to determine travel sensor motion. If you answer Yes, the instrument will stroke the valve the full travel span to determine travel sensor motion. If you answer No, then you must specify the direction of travel movement. For quarter-turn actuators determine rotation by viewing the rotation of the magnet assembly from the back of the instrument (see Travel Sensor Motion on page 71).

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

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

Note

Travel Sensor Motion in this instance refers to the motion of the magnet assembly. Note that the magnet assembly may be referred to as a magnetic array in user interface tools.

After completing the setup information, you will be prompted to run auto calibration. Follow the prompts on the Field Communicator display. The calibration procedure uses the valve and actuator stops as the 0% and 100% calibration points. For additional information, refer to Auto Calibration on page 78.

If a double-acting relay is used, you will be prompted to run the relay adjustment when auto calibration is selected. Select Yes to adjust the relay. For additional information refer to Relay Adjustment on page 83.

If after completing the Setup Wizard the valve seems slightly unstable or unresponsive, you can improve operation by selecting either *Performance Tuner* or *Stabilize/Optimize*.

Performance Tuner

Field Communicator	Configure > Guided Setup > Performance Tuner (1-1-2)
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Note

The Performance Tuner is available for instrument level AD, PD, and ODV.

WARNING

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

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

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

Stabilizing/Optimizing Valve Response

Field Communicator	 Hot Key > Stabilize/Optimize (Hot Key-4)
	Instrument level HC only Configure > Guided Setup > Stabilize/Optimize (1-1-2)

Note

Stabilize/Optimize is available for instrument level HC, AD, PD, and ODV.

WARNING

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

If after completing setup and calibration the valve seems slightly unstable or unresponsive, you can improve operation by pressing the Hot Key and selecting *Stabilize/Optimize*, or select *Stabilize/Optimize* from the *Guided Setup* menu (for instrument level HC only). *Stabilize/Optimize* can be accessed through the *Detailed Setup* menu for instrument level AD, PD, and ODV.

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

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

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

Section 4 Detailed Setup

Detailed Setup

Field Communicator	Configure > Detailed Setup (1-2)
--------------------	----------------------------------

Note

Detailed Setup is available for instrument level HC, AD, PD, and ODV.

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

Table 4-1. Default Detailed Setup Parameters

	Setup Parameter	Default Setting ⁽¹⁾
Instrument Configuration	Control Mode	Analog
	Restart Control Mode	Resume Last
	Zero Power Condition	Valve Open ⁽²⁾
	Analog In Range Low	4 mA
	Analog In Range High	20 mA
	Analog Input Units	mA
	Feedback Connection	Rotary - All ⁽²⁾
	Travel Sensor Motion	CW/To Bottom Inst. ⁽²⁾
	Auxiliary Terminal Action	Disabled
	Max Supply Pressure	20 ⁽²⁾
	Pressure Units	PSI ⁽³⁾
	Temperature Units	F ⁽³⁾
	Polling Address	0
	Burst Mode Enable	No
	Burst Command	3
	Cmd 3 Configured Pressure	A-B
Dynamic Response and Tuning	Tuning Set	F ⁽²⁾
	Input Characterization	Linear
	Travel Limit High	125%
	Travel Limit Low	-25%
	Travel/Pressure Cutoff High	99.46%
	Travel/Pressure Cutoff Low	0.50%
	Set Point Rate Open	0%/sec
	Set Point Rate Close	0%/sec
	Set Point Filter Time (Lag Time)	0 sec
	Integrator Enable	Yes
	Integral Gain	9.4 repeats/minute
	Integral Deadzone	0.26%

-continued on next page-

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

Setup Parameter		Default Setting ⁽¹⁾
Travel History Alerts	Cycle Counter Alert Enable	No
	Cycle Counter Alert Deadband	1%
	Cycle Counter Alert Point	1000000
	Travel Accumulator Alert Enable	No
	Travel Accumulator Deadband	1%
	Travel Accumulator Alert Point	1000000
Deviation & Other Alerts	Travel Deviation Alert Enable	Yes
	Travel Deviation Alert Point	5%
	Travel Deviation Time	9.99 sec
	Pressure Deviation Alert Enable	Yes
	Pressure Deviation Alert Point	5 psi ⁽³⁾
	Pressure Deviation Alert Time	9.99 sec
	Drive Signal Alert Enable	Yes
	Supply Pressure Alert Enable	Yes
	Supply Pressure Alert Point	19 psi ⁽³⁾
Travel Alerts	Travel Alert Lo Enable	No
	Lo Point	-25%
	Travel Alert Hi Enable	No
	Hi Point	125%
	Travel Alert Lo Lo Enable	No
	Lo Lo Point	-25%
	Travel Alert Hi Hi Enable	No
	Hi Hi Point	125%
	Deadband	5%
Electronics Alerts	Shutdown Activated	Yes
	Non-Critical NVM Alert Enable	No
Informational Status	Instrument Time Invalid Enable	Yes
	Calibration in Progress Enable	No
	Autocalibration in Progress Enable	No
	Diagnostics in Progress Enable	No
	Diagnostics Data Available Enable	Yes
	Integrator Saturated Hi Enable	Yes
	Integrator Saturated Lo Enable	Yes
	Pressure Control Active Enable	Yes
	Multi-Drop Alert Enable	No
Alert Record	Valve Alerts Enable	Yes
	Failure Alerts Enable	Yes
	Miscellaneous Alerts Enable	No
	Alert Record has Entries Enable	Yes
	Alert Record Full Enable	Yes

1. The settings listed are for standard factory configuration. DVC6200 instruments can also be ordered with custom configuration settings. For the default custom settings, refer to the order requisition.
2. If the instrument is shipped mounted on an actuator, these values depend upon the actuator on which the instrument is mounted.
3. U.S. Factory defaults only.

Mode and Protection

Mode

Instrument Mode

Field Communicator	 Hot Key > Instrument Mode (Hot Key-1)
	Configure > Detailed Setup > Mode and Protection > Instrument Mode (1-2-1-1)

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

Note

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

Control Mode

Field Communicator	 Hot Key > Instrument Mode (Hot Key-2)
	Configure > Detailed Setup > Mode and Protection > Instrument Mode (1-2-1-2)

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

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

Choose Digital if the instrument is to receive its set point digitally, via the HART communications link.

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

Restart Control Mode

Field Communicator	Configure > Detailed Setup > Mode and Protection > Restart Control Mode (1-2-1-3)
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Restart Control Mode lets you choose which operating mode you want the instrument to be in after a restart. Follow the prompts on the Field Communicator display to define the restart control mode as Resume Last, Analog, or Digital.

Burst Mode

Field Communicator	Configure > Detailed Setup > Mode and Protection > Burst Mode (1-2-1-4)
--------------------	---

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

Access to information in the instrument is normally obtained through the poll/response of HART communication. The Field Communicator or the control system may request any of the information that is normally available, even while

the instrument is in burst mode. Between each burst mode transmission sent by the instrument, a short pause allows the Field Communicator or control system to initiate a request. The instrument receives the request, processes the response message, and then continues “bursting” the burst mode data.

- *Burst Enable*—Yes or no. Burst mode must be enabled before you can change the burst mode command.
- *Change Burst Enable*— Turns Burst Mode on and off. Actual values are Burst Enable = Disabled(Polled), Enabled.
- *Burst Command*—There are four burst mode commands. Command 3 is recommended for use with the 333 HART Tri-Loop HART-to-analog signal converter. The other three are not used at this time.
- *Change Burst Command*— Allows you to pick the command to be sent from the instrument when Burst Mode is on. Select HART Univ Cmd 1, HART Univ Cmd 2, HART Univ Cmd 3, or DVC6000 Cmd 148.
- *Cmd 3 Configured Pressure*—Command 3 provides the following variables:

Primary variable—analog input in % or mA,

Secondary variable—travel target in % of ranged travel,

Tertiary variable—supply or output pressure in psig, bar, kPa, or kg/cm². Select *Cmd 3 Configured Pressure* from the *Burst* menu to select if the output A, output B, differential (A-B), or supply pressure is sent.

Quaternary variable—travel in % of ranged travel.

Protection

Protection

Field Communicator	»» Hot Key > Protection (Hot Key-3)
	Configure > Detailed Setup > Mode and Protection > Protection (1-2-1-5)

Some setup parameters may require changing the protection with the Field Communicator. To remove protection (change protection to *None*) requires placing a jumper across the auxiliary terminals in the terminal box in order to change protection.

Note

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

Auto calibration can be terminated by shorting the auxiliary terminals for one second.

⚠ WARNING

If the jumper is removed too soon, and auto calibration begins, the valve will move full stroke. To avoid personal injury and property damage caused by the release of pressure or process fluid, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

Two levels of protection are available:

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

Table 4-2 lists configurable parameters in the instrument and the requirements for modifying these parameters, in terms of instrument mode and protection.

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

Table 4-2. Conditions for Modifying FIELDVUE DVC6200 Digital Valve Controller Parameters

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

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

-Continued-

Table 4-2. Conditions for Modifying FIELDVUE DVC6200 Digital Valve Controller Parameters (continued)

Parameters	In Service/ Config Protected	In Service/ Config Unprotected	Out of Service/ Config Protected	Out of Service/ Config Unprotected
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 Accum Alrt Enab	✓	✓	✓	✓
Tvl Accum Alrt Pt	✓	✓	✓	✓
Tvl Accum DB	✓	✓	✓	✓
Tvl Accum	✓	✓	✓	✓
Aux Terminal Action	---	---	---	✓
Aux In Alrt Enab	✓	✓	✓	✓
Aux In Alrt State	✓	✓	✓	✓
Drive Alrt Enab	✓	✓	✓	✓
Supply Press Alrt	✓	✓	✓	✓
Flash ROM Fail	---	---	---	✓
Ref Voltage Fail	---	---	---	✓
Drive Current Fail	---	---	---	✓
Critical NVM Fail	---	---	---	✓
Temp Sensor Fail	---	---	---	✓
Press Sensor Fail	---	---	---	✓
Tvl Sensor Fail	---	---	---	✓

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

Response Control

Field Communicator Configure > Detailed Setup > Response Control (1-2-2)

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

Tuning

Field Communicator Configure > Detailed Setup > Response Control > Tuning (1-2-2-1)

Travel Tuning

⚠ WARNING

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

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

Table 4-3 lists the proportional gain, velocity gain and minor loop feedback gain values for preselected tuning sets.

Table 4-3. Gain Values for Preselected Travel Tuning Sets

Tuning Set	Proportional Gain	Velocity Gain	Minor Loop Feedback Gain
C	4.4	3.0	35
D	4.8	3.0	35
E	5.5	3.0	35
F	6.2	3.1	35
G	7.2	3.6	34
H	8.4	4.2	31
I	9.7	4.85	27
J	11.3	5.65	23
K	13.1	6.0	18
L	15.5	6.0	12
M	18.0	6.0	12
X (Expert)	User Adjusted	User Adjusted	User Adjusted

In addition, you can specify Expert tuning and individually set the proportional gain, velocity gain, and minor loop feedback gain. Individually setting or changing any tuning parameter or running the Performance Tuner or Stabilize/Optimize will automatically change the tuning set to X (expert).

Note

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

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

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

- **Integral Enable**—Yes or No. Enable the integral setting to improve static performance by correcting for error that exists between the travel target and actual travel. Travel Integral Control is enabled by default.
- **Integral Gain**—Travel Integral Gain is the ratio of the change in output to the change in input, based on the control action in which the output is proportional to the time integral of the input.
- **Stabilize/Optimize**—Stabilize/Optimize permits you to adjust valve response by changing the digital valve controller tuning. During this routine, the instrument must be out of service; however, the instrument will respond to setpoint changes.

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

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

Table 4-4. Actuator Information for Initial Setup

Actuator Manufacturer	Actuator Model	Actuator Size	Actuator Style	Starting Tuning Set	Travel Sensor Motion ⁽²⁾ Relay A or C ⁽³⁾	
Fisher	585C & 585CR	25 50 60 68, 80 100, 130	Piston Dbl w/ or w/o Spring. See actuator instruction manual and nameplate.	E I J L M	User Specified	
	657	30 34, 40 45, 50 46, 60, 70, 76, & 80-100	Spring & Diaphragm	H K L M	Away from the top of the instrument	
	667	30 34, 40 45, 50 46, 60, 70, 76, & 80-100	Spring & Diaphragm	H K L M	Towards the top of the instrument	
	1051 & 1052	20, 30 33 40 60, 70	Spring & Diaphragm (Window-mount)	H I K M	Away from the top of the instrument	
	1061	30 40 60 68, 80, 100, 130	Piston Dbl w/o Spring	J K L M	Depends upon pneumatic connections. See description for Travel Sensor Motion	
	1066SR	20 27, 75	Piston Sgl w/Spring	G L	Mounting Style	Travel Sensor Motion
					A	Away from the top of the instrument
					B	Towards the top of the instrument
					C	Towards the top of the instrument
					D	Away from the top of the instrument
	2052	1 2 3	Spring & Diaphragm (Window-mount)	H J M	Away from the top of the instrument	
	3024C	30, 30E 34, 34E, 40, 40E 45, 45E	Spring & Diaphragm	E H K	For P ₀ operating mode (air opens): Towards the top of the instrument For P _s operating mode (air closes): Away from the top of the instrument	
	GX	225	Spring & Diaphragm	X ⁽¹⁾	Air to Open Towards the top of the instrument	Air to Close Away from the top of the instrument
		750		K		
		1200		M		
Baumann	Air to Extend	16	Spring & Diaphragm	C	Towards the top of the instrument	
	Air to Retract	32		E	Away from the top of the instrument	
		54		H		
	Rotary	10 25 54		E H J	Specify	
NOTE: Refer to figure 2-3 and table 4-8 for feedback connection (magnet assembly) information. 1. X = Expert Tuning. Proportional Gain = 4.2; Velocity Gain = 3.0; Minor Loop Feedback Gain = 18.0 2. Travel Sensor Motion in this instance refers to the motion of the magnet assembly. 3. Values shown are for Relay A and C. Reverse for Relay B.						

- Performance Tuner

Note

The Performance Tuner is available for instrument level AD, PD, and ODV, and can only be run while in Travel control mode.

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

Integral Settings

- **Integral Dead Zone**—A window around the Primary Setpoint in which integral action is disabled. This feature is used to eliminate friction induced limit cycles around the Primary Setpoint when the integrator is active. The Dead Zone is configurable from 0% to 2%, corresponding to a symmetric window from 0% to +/-2% around the Primary Setpoint. Default value is 0.25%.
- **Integral Limit**—The Integral Limit provides an upper limit to the integrator output. The high limit is configurable from 0 to 100% of the I/P drive signal.

Pressure Tuning

⚠ WARNING

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

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

Tuning set B is appropriate for controlling a pneumatic positioner. Table 4-5 lists the proportional gain, pressure integrator gain and minor loop feedback gain values for preselected tuning sets.

Table 4-5. Gain Values for Preselected Pressure Tuning Sets

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

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

Note

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

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

- **Integral Enable**—Yes or No. Enable the pressure integral setting to improve static performance by correcting for error that exists between the pressure target and actual pressure. Pressure Integral Control is disabled by default.
- **Integral Gain**—Pressure Integral Gain (also called reset) is the gain factor applied to the time integral of the error signal between desired and actual pressure. Changing this parameter will also change the tuning set to Expert.

Travel/Pressure Control

Field Communicator	Configure > Detailed Setup > Response Control > Travel/Pressure Control (1-2-2-2)
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- **Travel/Pressure Select**

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

Note

Travel / Pressure Select must be set to Travel for double-acting actuators

Cutoffs and Limits

- *Cutoff Hi*

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

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

- *Cutoff Lo*

Travel Cutoff Low defines the low cutoff point for the travel set point. Travel Cutoff Low can be used to ensure proper seat load is applied to the valve. When below the travel cutoff low, the output is set to zero or to full supply

pressure, depending upon the zero power condition. A Travel Cutoff Low of 0.5% is recommended to help ensure maximum shutoff seat loading. When a Travel Cutoff Low is set, the Travel Limit Low is deactivated, since only one of these parameters can be active. Travel Cutoff Low is deactivated by setting it to -25%.

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

- *Change Cutoffs*—Allows you to set hi and lo cutoffs. When a cutoff is set the corresponding travel or pressure limit will be disabled.
- *Travel Limit Hi*—Defines the high limit for the travel in percent (%) of ranged travel. It is the maximum allowable travel (in percent of ranged travel) for the valve. During operation, the travel target will not exceed this limit. When a Travel Limit High is set, the Travel Cutoff High is deactivated, since only one of these parameters can be active. Travel Limit High is deactivated by setting it to 125.0%
- *Travel Limit Lo*—Defines the low limit for the travel in percent (%) of ranged travel. It is the minimum allowable travel (in percent of ranged travel) for the valve. During operation, the travel target will not exceed this limit. When a Travel Limit Low is set, the Travel Cutoff Low is deactivated, since only one of these parameters can be active. Travel Limit Low is deactivated by setting it to -25.0%.
- *Change Travel Limits*—Allows you to set hi and lo travel limits. Setting a travel limit will eliminate the corresponding Tv/Press Cutoff.

Pressure Control

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

End Point Pressure Control (Instrument Level ODV)

Note

End Point Pressure Control is available for instrument level ODV.

- *End Pt Control Enab*— Select Yes or No. End Point Pressure Control allows the digital valve controller to pull back from saturation of the pneumatic output after reaching the travel extreme. Rather than having the instrument provide full supply pressure (saturation) continuously at the travel extreme, the digital valve controller switches to an End Point Pressure Control where the output pressure (pressure controller set point) to the actuator is maintained at a certain value. This value is configured through the Upper Operating Pressure feature. Because the digital valve controller is constantly in control and not allowed to reach a dormant or saturated state, it is constantly testing its own pneumatic system. If there is an output pressure deviation, for example, the instrument will issue an alert. To ensure there is an alert when an output pressure deviation occurs, setup the alert as described under Pressure Deviation Alert.
- *PST Start Pt*—Defines the travel stop the valve needs to be at before a partial stroke test can be initiated. Also defines the travel stop for end point pressure control. Setting this value to Not Configured will disable partial stroke tests and end point pressure control.

- *Press Set Point*—Used in conjunction with End Point Pressure Control, Pressure Set Point allows the user to select a pressure to be delivered by the instrument at the travel extreme. For a fail-closed valve, this pressure must be sufficient to maintain the fully open position. For a fail-open valve, this pressure (which is automatically set to supply pressure) must be sufficient to fully close the valve and maintain its rated shutoff classification. For double-acting spring return actuators, this is the differential pressure required to either maintain the fully open or fully closed position, depending on the valve and actuator configuration. For a double-acting actuator without springs with a fail-close valve, this is 95% of the supply pressure. If the valve is fail-open, the upper operating pressure for all actuator is set to the supply pressure.
- *Press Sat Time*— Pressure Saturation Time is the time the digital valve controller stays in hard cutoff before switching to pressure control. Default is 45 seconds.

Input Characterization

Field Communicator	Configure > Detailed Setup > Response Control > Input Characterization (1-2-2-3)
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Input Characterization defines the relationship between the travel target and ranged set point. Ranged set point is the input to the characterization function. If the zero power condition equals closed, then a set point of 0% corresponds to a ranged input of 0%. If the zero power condition equals open, a set point of 0% corresponds to a ranged input of 100%. Travel target is the output from the characterization function.

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

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

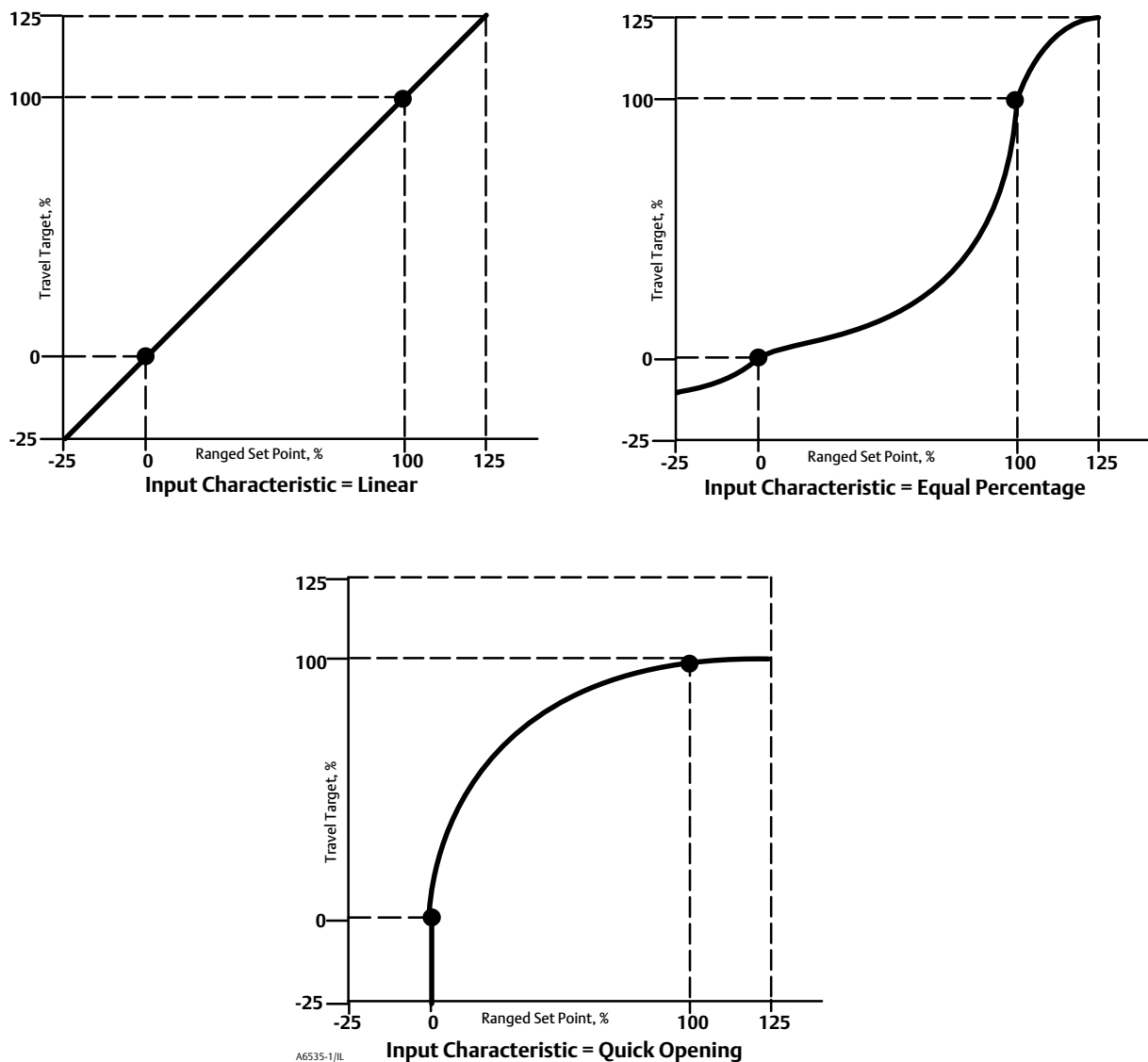
Custom Characterization Table

Field Communicator	Configure > Detailed Setup > Response Control > Custom Characterization Table (1-2-2-4)
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To define a custom input character select *Custom Characterization Table* from the *Response Control* menu. Select the point you wish to define (1 to 21), then enter the desired set point value. Press Enter then enter the desired travel target for the corresponding set point. When finished, select point 0 to return to the *Response Control* menu.

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

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



Dynamic Response

Field Communicator

Configure / Setup > Detailed Setup > Response Control > Dynamic Response (1-2-2-5)

- **SP Rate Open**—Maximum rate (% of valve travel per second) at which the digital valve controller will move to the open position regardless of the rate of input current change. A value of 0 will deactivate this feature and allow the valve to stroke open as fast as possible. In firmware 9 and 10 this parameter should be set to 0.
- **SP Rate Close**—Maximum rate (% of valve travel per second) at which the digital valve controller will move to the close position regardless of the rate of input current change. A value of 0 will deactivate this feature and allow the valve to stroke close as fast as possible. In firmware 9 and 10 this parameter should be set to 0.

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

Note

Set Point Filter Time (Lag Time) is available for instrument level HC, AD, and PD.

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

Note

Lead/Lag is only available for instrument level ODV.

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

When the valve is at its seat, the lead-lag filter also has a boost function that sets the initial conditions of the filter artificially low so that small amplitude signal changes appear to be large signal changes to the filter. The boost function introduces a large spike that momentarily overdrives the instrument and activates any external volume boosters that may be present. The lead-lag boost function is normally disabled except for those cases where the valve must respond to small command signals off the seat. By setting the lead/lag ratio in the opening and closing directions to 1.0, the boost function can be enabled without introducing lead-lag dynamics in the active control region. See table 4-6 for typical lead-lag filter settings.

Table 4-6. Typical Lead/Lag Filter Settings for Instrument Level ODV

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

Alert Setup

Field Communicator	Configure > Detailed Setup > Alert Setup (1-2-3)
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The following menus are available for configuring Alerts. Items on the menus may be changed with the instrument In Service. Protection does not need to be removed (no need to set to *None*). Alerts are not processed when a Diagnostic is in progress. Follow the prompts on the Field Communicator display to configure the following alerts: *Electronics Alerts*, *Sensor Alerts*, *Environment Alerts*, *Travel Alerts*, *Travel History Alerts*, *SIS Alerts* (instrument level ODV), and *Alert Record*.

Note

The Alerts section covers alerts and shutdowns. An alert, if enabled, can provide information on operation and performance issues. A shutdown, if enabled, and upon the occurrence of the associated failure alert, will cause the instrument air output to go to the

Zero Power Condition as per figure 4-6. It will remain latched in that condition until power to the instrument is cycled and the failure alert has cleared. While in shutdown condition the instrument will remain powered up and able to communicate via HART. Shutdown alerts are turned off by default.

Electronics Alerts

Field Communicator	Configure > Detailed Setup > Alert Setup > Electronics Alerts (1-2-3-1)
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Drive Current Shutdown

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

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

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

Drive Signal < 10% and Calibrated Travel > 3%

Drive Signal > 90% and Calibrated Travel < 97%

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

Drive Signal < 10% and Calibrated Travel < 97%

Drive Signal > 90% and Calibrated Travel > 3%

- *Drive Signal Alert Enable*—Yes or No. Drive Signal Alert Enable activates checking of the relationship between the Drive Signal and the calibrated travel. Factory default is Yes.
- *Drive Signal*—Shows the value of the instrument drive signal in % (percent) of maximum drive.

Processor Impaired Alerts

- *Offline/Failed Alert Enab*—If enabled, set when the device is in a failed state and not controlling the input.
- *Low Power Write Fail Enab*—When enabled, an alert is generated if a write to the instrument is attempted and fails when the loop current is less than 3.5 mA.
- *Non-Critical NVM Alrt Enab*—When enabled, an alert is generated whenever there is a failure associated with non-critical NVM (non-volatile memory).
- *Critical NVM Shutdown*—When enabled, the instrument shuts down whenever there is a failure associated with critical NVM (non-volatile memory).
- *Flash ROM Shutdown*—When enabled, the instrument shuts down whenever there is a failure associated with flash ROM (read only memory).
- *Reference Voltage Shutdown*—When enabled, the instrument shuts down whenever there is a failure associated with the internal voltage reference.

Sensor Alerts

Field Communicator	Configure > Detailed Setup > Alert Setup > Sensor Alerts (1-2-3-2)
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Travel Sensor Shutdown—When enabled, the instrument shuts down whenever there is a failure associated with the travel sensor.

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

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

Environment Alerts

Field Communicator	Configure > Detailed Setup > Alert Setup > Environment Alerts (1-2-3-3)
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Auxiliary Terminal Alert

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

Supply Pressure Lo Alert

Note

The Supply Pressure Lo alert is available for instrument level AD, PD, and ODV.

- **Supply Pressure Lo Alert Enable**—When enabled, the instrument sends an alert when the supply pressure falls below the supply pressure alert point. Factory default is Yes.
- **Supply**—Displays the instrument supply pressure in kPa, bar, psi, or kg/cm².
- **Supply Pressure Lo Alert Point**—When the supply pressure falls below the supply pressure alert point, the supply pressure alert is active. To disable the supply pressure alert, set Supply Pressure Alert Point to zero.

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

Note

Loop Current Validation Enable is available for instrument level AD, PD, and ODV.

Travel Alerts

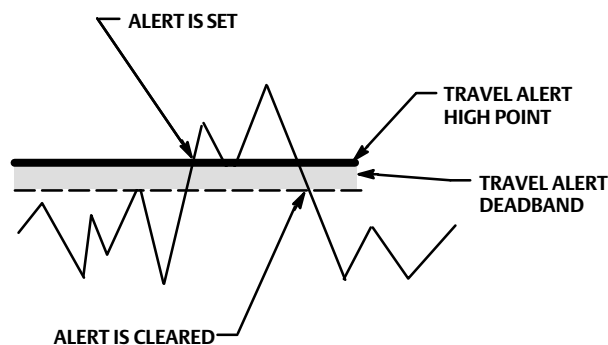
Field Communicator	Configure > Detailed Setup > Alert Setup > Travel Alerts (1-2-3-4)
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Travel—Travel displays the actual position of the valve in percent (%) of calibrated travel.

Setpoint—Setpoint is the input to the characterization function.

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

Figure 4-2. Travel Alert Deadband



A6532/JL

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

- **Travel Deviation Alert Enable**—Select Yes or No. When enabled, the Travel Deviation Alert checks the difference between the travel target and the actual travel. Factory default is Yes.
- **Travel Deviation Alert Point**—Travel Deviation Alert Point is the alert point for the difference, expressed in percent (%), between the travel target and the actual travel. When the difference exceeds the alert point for more than the Travel Deviation Time, the Travel Deviation Alert is set.
- **Travel Deviation Time**—Travel Deviation Time is the time, in seconds, that the travel deviation must exceed the Travel Deviation Alert Point before the alert is set.

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

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

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

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

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

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

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

Travel Limit / Cutoff Alerts

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

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

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

- *Cutoff Lo*

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

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

- *Change Cutoffs*—Allows you to set Cutoff Hi and Cutoff Lo. When a cutoff is set the corresponding travel or pressure limit is disabled.
- *Travel Limit 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%.

- *Travel Limit Lo*—Defines the low limit for the travel in percent (%) of ranged travel. It is the minimum allowable travel (in percent of ranged travel) for the valve. During operation, the travel target will not exceed this limit. When a Travel Limit Low is set, the Travel Cutoff Low is deactivated, since only one of these parameters can be active. Travel Limit Low is deactivated by setting it to -25.0%.
- *Change Travel Limits*— Allows you to set hi and lo travel limits. Setting a travel limit will eliminate the corresponding TvI/Press Cutoff.

Travel History Alerts

Field Communicator	Configure > Detailed Setup > Alerts > Travel History Alerts (1-2-3-5)
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Cycle Counter

- *Cycle Count Alert Enable*—Yes or No. Activates checking of the difference between the Cycle Counter and the Cycle Counter Alert point. The Cycle Counter Alert is set when the value exceeds the Cycle Counter Alert point. It is cleared after you reset the Cycle Counter to a value less than the alert point. Factory default is No.
- *Cycle Counter*—Records the number of times the travel changes direction. The change in direction must occur after the deadband has been exceeded before it can be counted as a cycle. See figure 4-3. You can reset the Cycle Counter by configuring it as zero.
- *Cycle Count Alert Point*—The value of the Cycle Counter, in cycles, which, when exceeded, sets the Cycle Counter Alert.

Cycle Count/Travel Accumulator Deadband

- *Deadband*—Cycle Counter Deadband is the area around the travel reference point, in percent (%) of ranged travel, that was established at the last increment of the Cycle Counter. This area must be exceeded before a change in travel direction can be counted as a cycle. See figure 4-3.

Travel Accumulator Deadband is the area around the travel reference point, in percent (%) of ranged travel, that was established at the last increment of the accumulator. This area must be exceeded before a change in travel can be accumulated. See figure 4-4.

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

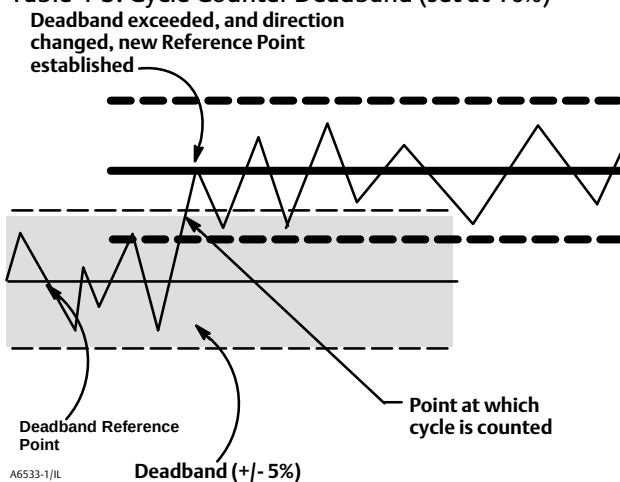
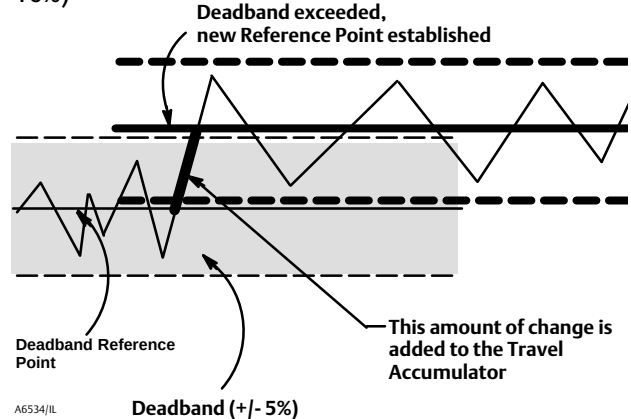


Figure 4-4. Travel Accumulator Deadband (set at 10%)



Travel Accumulator

- *Travel Accumulator Alert Enable*—Yes or No. Activates checking of the difference between the Travel Accumulator value and the Travel Accumulator Alert Point. The Travel Accumulation Alert is set when the Travel Accumulator value exceeds the Travel Accumulator Alert Point. It is cleared after you reset the Travel Accumulation to a value less than the alert point. Factory default is No.
- *Travel Accumulator*—Records the total change in travel, in percent (%) of ranged travel, since the accumulator was last cleared. The value of the Travel Accumulator increments when the magnitude of the change exceeds the Travel Accumulator Deadband. See figure 4-4. You can reset the Travel Accumulator by configuring it to zero.
- *Travel Accumulator Alert Point*—The value of the Travel Accumulator, in percent (%) of ranged travel, which, when exceeded, sets the Travel Accumulator Alert.

SIS Alerts (Instrument Level ODV)

Field Communicator	Configure > Detailed Setup > Alert Setup > SIS Alerts (1-2-3-6)
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Note

SIS Alerts are only available for instrument level ODV.

- *PST Press Limit*—Partial Stroke Test Pressure Limit defines the output pressure that will cause the partial stroke test to stop. For actuators that vent from the test starting point, the pressure limit will be a minimum value. For actuators that fill from the test starting point, the pressure limit will be a maximum value.
- *Press Dev Alrt Enab*—Select Yes or No. This alert notifies a monitoring system when a deviation in the actuator pressure has occurred. This is used when the instrument is controlling via pressure (Pressure Control Mode is enabled) to the actuator (rather than valve position) to prevent saturation of the pneumatic output. When enabled, this alert checks the difference between the target pressure and the actual pressure. If the difference exceeds the Pressure Deviation Alert Point for more than the pressure deviation time, the Pressure Deviation Alert is set. It remains set until the difference between the target pressure and the actual pressure is less than the Pressure Deviation Alert Point. The pressure deviation alert point and deviation alert time are configurable and can be disabled altogether. Factory default is Yes.
- *Press Dev Alrt Point*—The alert point for the difference between the pressure target and the actual pressure. When the difference exceeds the alert point for more than the Pressure Deviation Time, the Pressure Deviation Alert is set. After completion of the Setup Wizard or Auto Travel calibration a default value of 2 psi is set. This will generate an alert when the actuator pressure is not within ± 2 psi of the target pressure.
- *Press Dev Time*—The time, in seconds, that the pressure deviation must exceed the Pressure Deviation Alert Point before the alert is set. The Pressure Deviation Time is set to 30 seconds by default.

Alert Record

Field Communicator	HC, AD and PD Configure > Detailed Setup > Alert Setup > Alert Record (1-2-3-6)
	ODV Configure > Detailed Setup > Alert Setup > Alert Record (1-2-3-7)

To be recorded, an alert must both be enabled for reporting, and the group in which it resides must be enabled for recording. Table 4-7 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 4-7. Alerts Included in Alert Groups for Alert Record

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

Alert Record has Entries Enable—Yes or No. When enabled indicates when an alert has been recorded. Factory default is Yes.

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

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

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

Alert Groups

- **Failure Group Enable**—Permits enabling the Failure Alert group. Table 4-7 lists the alerts included in each of the groups. Factory default is Yes.
- **Valve Group Enable**—Permits enabling the Valve Alert group. Table 4-7 lists the alerts included in each of the groups. Factory default is Yes.
- **Miscellaneous Group Enable**—Permits enabling the Miscellaneous Alert group. Table 4-7 lists the alerts included in each of the groups. Factory default is No.

Status

Field Communicator	Configure > Detailed Setup > Status (1-2-4)
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Follow the prompts on the Field Communicator display to configure the following parameters: *Instrument Time*, *Calibration and Diagnostics*, *Operational*, and *Integrator*.

Instrument Time

- *Inst Time Invalid Enable*—Yes or No. When enabled indicates if the Instrument Time Invalid alert is active. Factory default is Yes.
- *Instrument Date and Time*—Permits setting the instrument clock. When alerts are stored in the alert record, the record includes the time and date. The instrument clock uses a 24-hour format.

Calibration and Diagnostics

- *Calibration in Progress Enable*—Yes or No. When enabled indicates that calibration is in progress. Factory default is No.
- *AutoCal in Progress Enable*—Yes or No. When enabled indicates that auto calibration is in progress. Factory default is No.
- *Diagnostic in Progress Enable*—Yes or No. When enabled indicates that a diagnostic test is in progress. Factory default is No.
- *Diagnostic Data Avail Enable*—Yes or No. When enabled indicates when there is diagnostic data available. Factory default is Yes.

Operational

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

Integrator Saturation

- *Integrator Sat Hi Enable*—Yes or No. When enabled indicates when the Integrator Saturated High alert is active. Factory default is Yes.
- *Integrator Sat Lo Enable*—Yes or No. When enabled indicates when the Integrator Saturated Lo alert is active. Factory default is Yes.
- *Integral Limit*—The Integral Limit provides an upper limit to the integrator output. The high limit is configurable from 0 to 100% of the I/P drive signal.
- *Integral Dead Zone*—Integral Dead Zone is the window around the Primary Setpoint in which integral action is disabled. This feature is used to eliminate friction induced limit cycles around the Primary Setpoint when the integrator is active. The Dead Zone is configurable from 0% to 2%, corresponding to a symmetric window from 0% to +/-2% around the Primary Setpoint. Default value is 0.25%.

Instrument

Field Communicator	Configure > Detailed Setup > Instrument (1-2-5)
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Follow the prompts on the Field Communicator display to configure the following Instrument parameters: *General, Units, Analog Input Range, Relay Type, Zero Power Condition, Maximum Supply Pressure, Auxiliary Terminal Mode, Instrument Date and Time, and Calibration Status and Type.*

General

- **HART Tag**—Enter an up to 8 character HART tag for the instrument. The HART tag is the easiest way to distinguish between instruments in a multi-instrument environment. Use the HART tag to label instruments electronically according to the requirements of your application. The tag you assign is automatically displayed when the Field Communicator establishes contact with the digital valve controller at power-up.
- **Message**—Enter any message with up to 32 characters. Message provides the most specific user-defined means for identifying individual instruments in multi-instrument environments.
- **Descriptor**—Enter a descriptor for the application with up to 16 characters. The descriptor provides a longer user-defined electronic label to assist with more specific instrument identification than is available with the HART tag.
- **Date**—Enter a date with the format MM/DD/YY. Date is a user-defined variable that provides a place to save the date of the last revision of configuration or calibration information.
- **Valve Serial Number**—Enter the serial number for the valve in the application with up to 12 characters.
- **Instrument Serial Number**—Enter the serial number on the instrument nameplate, up to 12 characters.
- **Polling Address**—If the digital valve controller is used in point-to-point operation, the Polling Address is 0. When several devices are connected in the same loop, such as for split ranging, each device must be assigned a unique polling address. The Polling Address is set to a value between 0 and 15. To change the polling address the instrument must be Out Of Service.

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

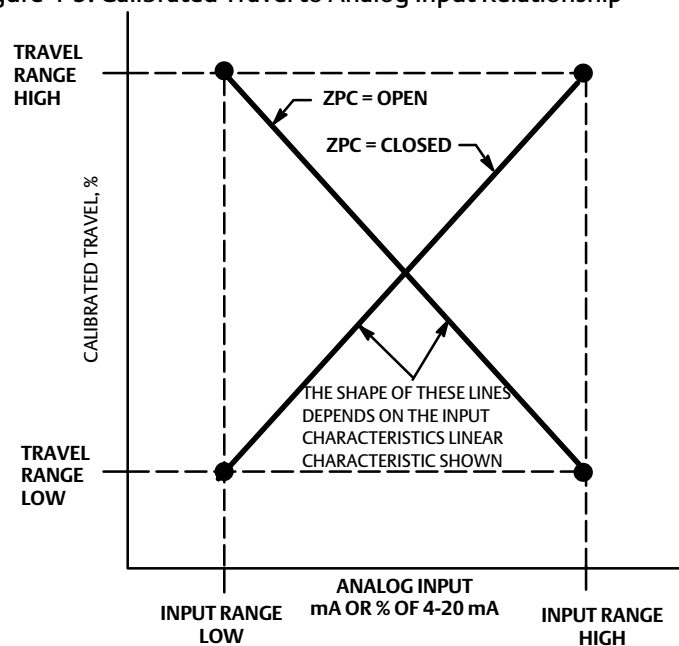
Units

- **Pressure Units**—Defines the output and supply pressure units in either psi, bar, kPa, or kg/cm².
- **Temperature Units**—Degrees Fahrenheit or Celsius. The temperature measured is from a sensor mounted on the digital valve controller's printed wiring board.
- **Analog In Units**—Permits defining the Analog Input Units in mA or percent of 4-20 mA range.

Analog Input Range

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

Figure 4-5. Calibrated Travel to Analog Input Relationship



NOTE:
ZPC = ZERO POWER CONDITION

A6531-1

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

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

A = double-acting or single-acting

B = single-acting, reverse

C = single-acting, direct

Special App: This is used in single-acting applications where the “unused” output port is configured to read the pressure downstream of a solenoid valve. See page 29 for additional information.

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

Zero Power Condition—The position of the valve (open or closed) when the electrical power to the instrument is removed. Zero Power Condition (ZPC) is determined by relay type, as shown in figure 4-6.

Figure 4-6. Zero Power Condition



Relay Type	Loss of Electrical Power
Single-Acting Direct (Relay C)	Port A pressure to zero.
Double-Acting (Relay A)	Port A pressure to zero. Port B pressure to full supply.
Single-Acting Reverse (Relay B)	Port B pressure to full supply.

Maximum Supply Pressure—Enter the maximum supply pressure in psi, bar, kPa, or kg/cm², depending on what was selected for pressure units.

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

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

Calib Status and Type

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

Valve and Actuator

Field Communicator	Configure > Detailed Setup > Valve & Actuator (1-2-6)
--------------------	---

Follow the prompts on the Field Communicator display to configure the following instrument parameters: *Manufacturer, Valve Serial Number, Valve Style, Actuator Style, Travel Sensor Motion, and View / Edit Feedback Connection.*

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

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

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

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

Travel Sensor Motion

⚠ WARNING

If you answer YES to the prompt for permission to move the valve when determining travel sensor motion, the instrument will move the valve through a significant portion of its travel range. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

Select Clockwise/Toward Bottom, or Counterclockwise/Toward Top. Travel Sensor Motion establishes the proper travel sensor rotation. For quarter-turn actuators determine rotation by viewing the rotation of the magnet assembly from the back of the instrument.

Note

Travel Sensor Motion in this instance refers to the motion of the magnet assembly. Note that the magnet assembly may be referred to as a magnetic array in user interface tools.

- **For instruments with Relay A and C:** If increasing air pressure at output A causes the magnet assembly to move down or the rotary shaft to turn clockwise, enter CW/To Bottom Inst. If it causes the magnet assembly to move up, or the rotary shaft to turn counterclockwise, enter CCW/To Top Inst.

- **For instruments with Relay B:** If decreasing air pressure at output B causes the magnet assembly to down, or the rotary shaft to turn clockwise, enter CW/To Bottom Inst. If it causes the magnet assembly to move up, or the rotary shaft to turn counterclockwise, enter CCW/To Top Inst.

View / Edit Feedback Connection—Refer to table 4-8 for Feedback Connection options. Choose the assembly that matches the actuator travel range.

Note

As a general rule, do not use less than 60% of the magnet assembly travel range for full travel measurement. Performance will decrease as the assembly is increasingly subranged.

The linear magnet assemblies have a valid travel range indicated by arrows molded into the piece. This means that the hall sensor (on the back of the DVC6200 housing) has to remain within this range throughout the entire valve travel. See figure 2-2. The linear magnet assemblies are symmetrical. Either end may be up.

Table 4-8. Feedback Connection Options

Magnet Assembly	Travel Range		
	mm	Inch	Degrees
Sstem #7	4.2-7	0.17-0.28	-
SStem #19	8-19	0.32-0.75	-
SStem #25	20-25	0.76-1.00	-
SStem #38	26-38	1.01-1.50	-
SStem #50	39-50	1.51-2.00	-
SStem #100	51-100	2.01-4.00	-
SStem #210	101-210	4.01-8.25	-
SStem #1 Roller	-	-	60-90°
RShaft Window #1	-	-	60-90°
RShaft Window #2	-	-	60-90°
RShaft End Mount	-	-	60-90°

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

SIS/Partial Stroke (Instrument Level ODV)

Field Communicator	Configure / Setup > Detailed Setup > SIS/Partial Stroke (1-2-7)
--------------------	---

Note

Partial Stroke is only available for instrument level ODV.

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

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

PST Vars View/Edit—Follow the prompts on the Field Communicator display to enter or view information for following PST Variables: *Max Travel Movement*, *Stroke Speed*, *Pause Time*, *PST Press Limit*, *PST Mode Enable*, *Pressure Set Point*, and *End Pt Control Enable*.

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

Note

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

Stroke Speed—The stroke speed can be set for 1%/second, 0.5%/second, 0.25%/second, 0.12%/second, or 0.06%/second. The default value for Partial Stroke Speed is 0.25%/second.

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

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

Relay Type	Pressure Signal
A or C	Port A - Port B
B	Port B - Port A
B Special App.	Port B
C Special App.	Port A

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

To set the partial stroke pressure limit manually for single acting actuators select *min pressure*. Select *min diff press* for double acting actuators.

Note

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

To manually set the partial stroke pressure limit, disable the travel deviation alert by setting Travel Dev Alert Pt to 125%. Also disable “end point pressure control” and disable the partial stroke pressure limit by setting the values shown in table 4-9.

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

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

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

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

The default value is 0.

For double acting valves, the differential pressure is used.

Table 4-10. Estimates for Partial Stroke Pressure Limits

Actuator Style	Relay Type	Zero Power Condition	PST Starting Point	Partial Stroke Pressure Limit ⁽¹⁾
Spring and Diaphragm	A or C	Closed	Open	$P_{min} - 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$
			Closed	$P_{max} + 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$
		Open	Open	$P_{max} + 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$
			Closed	$P_{min} - 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$
	B	Closed	Open	$P_{max} + 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$
			Closed	$P_{min} - 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$
		Open	Open	$P_{min} - 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$
			Closed	$P_{max} + 0.25 * (\text{Bench Set High} - \text{Bench Set Low})$
Single Acting Piston	A or C	Closed	Open	$0.5 * P_{min}$
			Closed	$P_{max} + 0.5 * (P_{supply} - P_{max})$
		Open	Open	$P_{max} + 0.5 * (P_{supply} - P_{max})$
			Closed	$0.5 * P_{min}$
	B	Closed	Open	$P_{max} + 0.5 * (P_{supply} - P_{max})$
			Closed	$0.5 * P_{min}$
		Open	Open	$0.5 * P_{min}$
			Closed	$P_{max} + 0.5 * (P_{supply} - P_{max})$
Double Acting Piston	A	Closed	Open	$P_{min} - 0.5 * (P_{supply} + P_{min})$
			Closed	$P_{max} + 0.5 * (P_{supply} - P_{max})$
		Open	Open	$P_{max} + 0.5 * (P_{supply} - P_{max})$
			Closed	$P_{min} - 0.5 * (P_{supply} + P_{min})$

Section 5 Calibration

Calibration Overview

When a DVC6200 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 then calibrate travel by selecting *Configure > Calibrate > Travel Calibration > Auto Calibration*. For more detailed calibration information, refer to the following calibration procedures.

Calibrate

Field Communicator	Configure > Calibrate (1-3)
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Travel Calibration

- **Auto Travel Calibration**—This procedure automatically calibrates the travel. The calibration procedure uses the valve and actuator stops as the 0% and 100% calibration points.
- **Manual Travel Calibration**—This procedure permits manual calibration of the travel. This calibration procedure allows you to determine the 0% and 100% calibration points.

Sensor Calibration

- **Pressure Sensors**—This procedure permits calibrating the three pressure sensors. Normally the sensors are calibrated at the factory and should not need calibration.
- **Analog In Calibration**—This procedure permits calibrating the analog input sensor. Normally the sensor is calibrated at the factory and should not need calibration.

Relay Adjustment—This procedure permits adjustment of the pneumatic relay.

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

Note

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

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

WARNING

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

Travel Calibration

Field Communicator	Configure > Calibrate > Travel Calibration (1-3-1)
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If a double-acting relay is used, you will be prompted to run the relay adjustment when auto or manual calibration is selected. Select Yes to adjust the relay, select No to proceed with calibration. For additional information, refer to Relay Adjustment in this section.

Note

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

Auto Travel Calibration

1. The auto calibration procedure is automatic. It is completed when the *Calibrate* menu appears.

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

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

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

Table 5-1. Auto Calibrate Travel Error Messages

Error Message	Possible Problem and Remedy
Power failure occurred during Auto Calib	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.
Auto Calib did not complete within the time limit.	The problem may be one or the other of the following: 1. The tuning set selected is too low and the valve does not reach an end point in the allotted time. Press the Hot Key, select <i>Stabilize/Optimize</i> then <i>Increase Response</i> (selects next higher tuning set). 2. The tuning set selected is too high, valve operation is unstable and does not stay at an end point for the allotted time. Press the Hot Key, select <i>Stabilize/Optimize</i> then <i>Decrease Response</i> (selects next lower tuning set).
Insufficient travel	Prior to receiving this message, did the instrument output go from zero to full supply? If not, verify instrument supply pressure by referring to the specifications in the appropriate actuator instruction manual. If supply pressure is correct, check instrument pneumatic components (I/P converter and relay). If the instrument output did go from zero to full supply prior to receiving this message, then verify proper mounting by referring to the appropriate mounting procedure in the Installation section and checking the magnet array for proper alignment.
Drive signal exceed low limit; check supply pressure	1. Check supply pressure (reverse-acting relay) 2. Friction is too high.
Drive signal exceed high limit; check supply pressure	1. Check supply pressure (direct-acting relay) 2. Friction is too high

Manual Travel Calibration

Two procedures are available to manually calibrate travel:

- Analog Adjust
- Digital Adjust

Analog Calibration Adjust

Connect a variable current source to the instrument LOOP + and LOOP - terminals. The current source should be capable of generating 4 to 20 mA.

Follow the prompts on the Field Communicator display to calibrate the instrument's travel in percent.

Note

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

1. Adjust the input current until the valve is near mid-travel. Press OK.

Note

In steps 2 through 7 the accuracy of the current source adjustment affects the position accuracy.

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

Digital Calibration Adjust

Connect a variable current source to the instrument LOOP + and LOOP - terminals. The current source should be set between 4 and 20 mA.

Follow the prompts on the Field Communicator display to calibrate the instrument's travel in percent.

1. Adjust the input current until the valve is near mid-travel. Press OK.

Note

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

2. 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.
If another adjustment is required, repeat step 2. Otherwise, select Done and go to step 3.
3. From the adjustment menu, select the direction and size of change required to set the travel to 100%.
If another adjustment is required, repeat step 3. Otherwise, select Done and go to step 4.
4. From the adjustment menu, select the direction and size of change required to set the travel at 0%.
If another adjustment is required, repeat step 4. Otherwise, select Done and go to step 5.
5. From the adjustment menu, select the direction and size of change required to set the travel to 100%.
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 5%.
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 95%.
If another adjustment is required, repeat step 7. Otherwise, select Done and go to step 8.
8. Place the instrument In Service and verify that the travel properly tracks the current source.

Calibration using the Aux Terminal Connections

Note

Pressure range is not captured during this procedure.

Travel calibration can also be accomplished by shorting the auxiliary terminal connections for 3 to 5 seconds. You can abort the procedure by shorting the auxiliary terminals for 1 second.

To enable this calibration *Auxiliary Terminal Action* must be set to *Auto Calibration*. The instrument *Operational Status* during calibration is *Calibration in Progress*.

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

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

Sensor Calibration

Field Communicator	Configure > Calibrate > Sensor Calibration (1-3-2)
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Pressure Sensors

Note

The pressure sensor is calibrated at the factory and should not require calibration.

Output Pressure Sensor

To calibrate the output pressure sensor, connect an external reference gauge to the output being calibrated. The gauge should be capable of measuring maximum instrument supply pressure. Depending upon the sensor you wish to calibrate, select either *Output A Sensor* or *Output B Sensor*. Follow the prompts on the Field Communicator display to calibrate the instrument's output pressure sensor.

1. Adjust the supply pressure regulator to the maximum instrument supply pressure. Press OK.
2. The instrument reduces the output pressure to 0. The following message appears.

Use the Increase and Decrease selections until the displayed pressure matches the output x pressure.

Press OK when you have read the message.

3. The value of the output 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 output pressure, press OK, then repeat this step (step 4) to further adjust the displayed value. When the displayed value matches the output pressure, select Done and go to step 5.

5. The instrument sets the output pressure to full supply. The following message appears.

Use the Increase and Decrease selections until the displayed pressure matches the output x pressure.

Press OK when you have read the message.

6. The value of the output pressure appears on the display. Press OK to display the adjustment menu.
7. From the adjustment menu, select the direction and size of adjustment to the displayed value. If the displayed value does not match the output pressure, press OK, then repeat this step (step 7) to further adjust the displayed value. When the displayed value matches the output pressure, select Done and go to step 8.
8. Place the instrument In Service and verify that the displayed pressure matches the measured output pressure.

Supply Pressure Sensor

Note

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

To calibrate the supply pressure sensor, connect an external reference gauge to the output side of the supply regulator. The gauge should be capable of measuring maximum instrument supply pressure. Follow the prompts on the Field Communicator display to calibrate the instrument's supply pressure sensor.

1. Select a) Zero Only, or b) Zero and Span (gauge required).
 - a. If Zero Only calibration is selected, adjust the supply pressure regulator to remove supply pressure from the instrument. Press OK. Once calibration is complete, go to step 5.
 - b. If Zero and Span calibration is selected, adjust the supply pressure regulator to remove supply pressure from the instrument. Press OK. Adjust the supply regulator to the maximum instrument supply pressure. Press OK. Proceed with step 2.
2. The following message appears:

Use the Increase and Decrease selections until the displayed pressure matches the instrument supply pressure.

Press OK when you have read this message.

3. The value of the pressure appears on the display.
4. From the adjustment menu, select the direction and size of adjustment to the displayed value.

Selecting large, medium, and small adjustments causes changes of approximately 3.0 psi/0.207 bar/20.7 kPa, 0.30 psi/0.0207 bar/2.07 kPa, and 0.03 psi/0.00207 bar/0.207 kPa, respectively.

Adjust the displayed value until it matches the supply pressure, select Done and go to step 5.

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

Analog Input Calibration

To calibrate the analog input sensor, connect a variable current source to the instrument LOOP+ and LOOP- terminals. The current source should be capable of generating an output of 4 to 20 mA. Follow the prompts on the Field Communicator display to calibrate the analog input sensor.

1. Set the current source to the target value shown on the display. The target value is the Input Range Low value. Press OK.
2. The following message appears:

Use Increase and Decrease selections until the displayed current matches the 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. 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.

Relay Adjustment

Field Communicator	Configure > Calibrate > Sensor Calibration > Relay Adjust (1-3-3)
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Before beginning travel calibration, check the relay adjustment. Replace the digital valve controller cover when finished.

Note

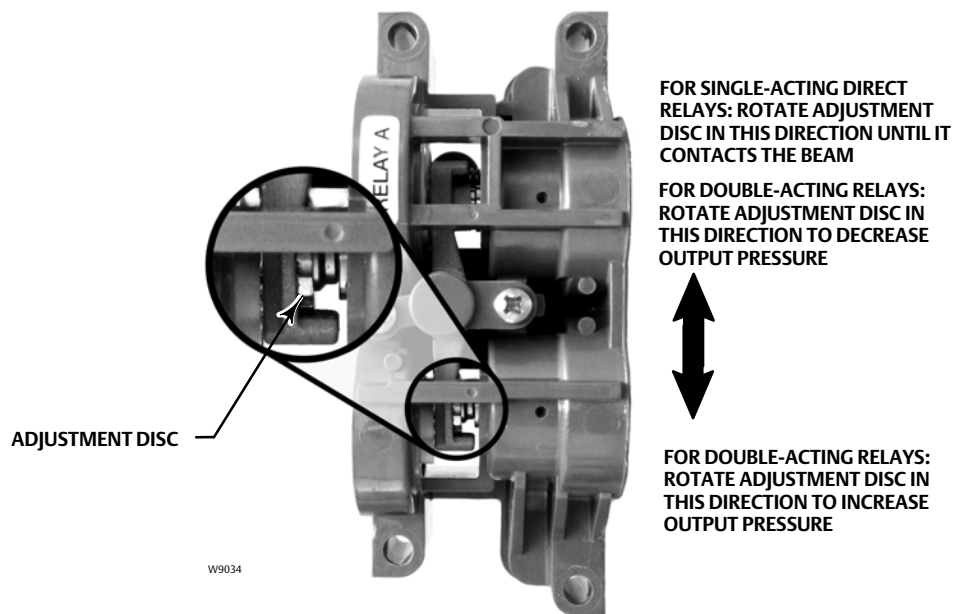
Relay B and C are not user-adjustable.

Double-Acting Relay

The double-acting relay is designated by “Relay A” on a label affixed to the relay itself. For double-acting actuators, the valve must be near mid-travel to properly adjust the relay. The Field Communicator will automatically position the valve when *Relay Adjust* is selected.

Rotate the adjustment disc, shown in figure 5-1, until the output pressure displayed on the Field Communicator is between 50 and 70% of supply pressure. This adjustment is very sensitive. Be sure to allow the pressure reading to stabilize before making another adjustment (stabilization may take up to 30 seconds or more for large actuators).

Figure 5-1. Relay A Adjustment (Shroud Removed for Clarity)



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

Relay A may also be adjusted for use in single-acting- direct applications. Rotate the adjustment disc as shown in figure 5-1 for single-acting direct operation.

CAUTION

Care should be taken during relay adjustment as the adjustment disc may disengage if rotated too far.

Single-Acting Relays

⚠ WARNING

For Instrument Level ODV only:

If the unused port is monitoring pressure, ensure that the pressure source conforms to ISA Standard 7.0.01 and does not exceed the pressure supplied to the instrument.

Failure to do so could result in personal injury or property damage caused by loss of process control.

Single-Acting Direct Relay

The single-acting direct relay is designated by “Relay C” on a label affixed to the relay itself. Relay C requires no adjustment.

Single-Acting Reverse Relay

The single-acting reverse relay is designated by “Relay B” on a label affixed to the relay itself. Relay B is calibrated at the factory and requires no further adjustment.

Restoring Factory Settings

Field Communicator	Configure > Calibrate > Restore Factory Settings (1-3-4)
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Note

After restoring factory settings you will need to re-configure and calibrate the instrument.

Follow the prompts on the Field Communicator display to restore calibration and all parameters to the factory settings. You should only restore the calibration if it is not possible to calibrate an individual sensor. Restoring calibration returns the calibration of all of the sensors and the tuning set to their factory settings. Following restoration of the factory calibration, the individual sensors should be recalibrated.

Section 6 Viewing Device Variables and Diagnostics

Service Tools

Note

Service Tools are not available for instrument level AC.

Alert Conditions

Field Communicator	Service Tools > Alert Conditions (2-1)
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Instrument Alert Conditions, when enabled, detect many operational and performance issues that may be of interest. To view these alerts navigate to *Alert Conditions*. The alert conditions for each group of alerts are listed below. If there are no alerts active for a particular group the group will not be displayed on the Field Communicator. See table 6-1 for alert groups.

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

Alert Group	Alerts Include in Group
Valve Alerts	Travel Alert Lo Travel Alert Hi Travel Alert Lo Lo Travel Alert Hi Hi Travel deviation Drive signal
Failure Alerts	Flash ROM fail Drive current fail Ref Voltage fail NVM fail Temperature sensor fail Pressure sensor fail Travel sensor fail
Miscellaneous Alerts	Auxiliary input

- **Electronics**— If an electronics alert is active it will appear under ELECT ALERTS.

Drive Current

Drive Current Alert—This alert is indicated when the drive current does not read as expected. If this alert occurs, check the connection between the I/P converter and the printed wiring board assembly. Try removing the I/P converter and re-installing it. If the failure does not clear, replace the I/P converter or the printed wiring board assembly.

Drive Signal

Drive Signal Alert—This alert is indicated when the Drive Signal is greater or less than the expected maximum or minimum.

Processor Impaired

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

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

Non-Critical NVM Alert—This alert is indicated if the checksum for data, which are not critical for instrument operation, has failed.

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

Flash ROM Alert—This alert indicates that the Read Only Memory integrity test failed. If this alert is indicated, restart the instrument and see if it clears. If it does not clear, replace the printed wiring board assembly.

Reference Voltage Alert—This failure is indicated whenever there is a failure associated with the internal voltage reference. If this alert is indicated replace the printed wiring board assembly.

Internal Sensor Out of Limits—This alert is indicated if there is a possible problem with either the pressure sensor or the printed wiring board assembly submodule.

Variable Out of Range—This alert is indicated if one or more of the measured analog sensor readings (loop current, pressure, temperature, or travel) is saturated or reading out of its configured range. The condition may be due to improper configuration or physical setup and not be due to a sensor malfunction.

Field device malfunction—The alert is indicated if the pressure, position, or temperature sensors are providing invalid readings.

- **Sensor**— If a sensor alert is active it will appear under *SENSOR ALERTS*.

Travel Sensor

Travel Sensor Alert—This alert is indicated if the sensed travel is outside the range of -25.0 to 125.0% of calibrated travel. If this alert is indicated, check the instrument mounting. Also, check that the electrical connection from the travel sensor is properly plugged into the printed wiring board assembly. After restarting the instrument, if the alert does not clear, troubleshoot the printed wiring board assembly or travel sensor.

Pressure Sensors

Pressure Sensor Alert—This alert is indicated if the actuator pressure is outside the range of -24.0 to 125.0% of the calibrated pressure for more than 60 seconds. If this alert is indicated, check the instrument supply pressure. If the failure persists, ensure the printed wiring board assembly is properly mounted onto the Module Base Assembly, and the pressure sensor O-rings are properly installed. If the alert does not clear after restarting the instrument, replace the printed wiring board assembly.

Note

The pressure sensor alert is used for output A, output B, and the supply pressure sensor. Check the pressure values to see which sensor is causing the alert.

Temperature Sensor

Temperature Sensor Alert—This alert is indicated when the instrument temperature sensor fails, or the sensor reading is outside of the range of -40 to 85°C (-40 to 185°F). The temperature reading is used internally for temperature compensation of inputs. If this alert is indicated, restart the instrument and see if it clears. If it does not clear, replace the printed wiring board assembly.

- **Environment**— If an environment alert is active it will appear under *ENVIRO ALERTS*.

Supply Pressure

Supply Pressure Lo Alert—This alert is indicated when supply pressure is lower than the configured limit.

Aux Terminal Alert

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

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

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

Travel Deviation

Travel Deviation Alert—The difference between Setpoint and Travel is greater than the configured limits.

Travel Limit

Travel Alert Hi Hi—This alert is indicated if the Travel is greater than the configured limit.

Travel Alert Lo Lo—This alert is indicated if the Travel is lower than the configured limit.

Travel Limit Hi/Lo

Travel Alert Hi—This alert is indicated if the Travel is greater than the configured limit.

Travel Alert Lo—This alert is indicated if the Travel is lower than the configured limit.

Travel Limit / Cutoff

Travel Limit/Cutoff Hi—This alert is indicated if the Travel is limited high or the high cutoff is in effect.

Travel Limit/Cutoff Lo—This alert is indicated if the Travel is limited low or the low cutoff is in effect.

- **Travel History**— If a travel history alert is active it will appear under TVL HIST ALERTS.

Cycle Count

Cycle Count Alert—This alert is indicated if the Cycle Counter exceeds the Cycle Count Alert Point.

Travel Accumulator

Travel Accumulator Alert—This alert is indicated if the Travel Accum exceeds the Travel Accumulator Alert Point.

- **SIS (ODV only)**— If an SIS alert is active it will appear under SIS ALERTS.

Partial Stroke Test (PST)

Valve Stuck or Pressure/Travel Path Obstructed—This alert is indicated if the valve is stuck or the pressure/travel path is obstructed.

End Point Pressure Deviation

Pressure Deviation Alert—The alert is indicated if the difference between the target pressure and the actual pressure exceeds the Pressure Deviation Alert Point for a period of time greater than the Pressure Deviation Time.

Locked in Safety Alert—This alert is indicated if the ODV unit is locked in the safety position.

- **Alert Record**

Alert Record has Entries Enable—This alert indicates that an alert has been saved to the alert record.

Alert Record Full—This alert indicates that the alert record is full.

Viewing Instrument Status

Field Communicator	Service Tools > Status (2-2)
--------------------	------------------------------

Status displays the status of the Operational items listed below. The status of more than one operational item may be indicated.

Instrument Time

Inst Time Invalid

Calibration and Diagnostics

Cal in Progress, Autocal in Progress, Diag in Progress, Diag Data Avail

Operational

Press Ctrl Active, Multi-Drop

Integrator

Integrator Sat Hi, Integrator Sat Lo

Device Record

Field Communicator	Service Tools > Device Record (2-3)
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Follow the prompts on the Field Communicator display to view the following Device Record parameters: *Maximum Recorded Temperature*, *Minimum Recorded Temperature*, *View Number of Days Powered Up*, and *Number of Power Ups*.

- *Maximum Temperature Recorded*—Shows the maximum temperature the instrument has experienced since installation.
- *Minimum Temperature Recorded*—Shows the minimum temperature the instrument has experienced since installation.
- *View Number of Days Powered Up*—Indicates in hours or days the total elapsed time the instrument has been powered up.
- *Number of Power Ups*—Indicates how many times the instrument has cycled power.

Stroking the Digital Valve Controller Output

Field Communicator	Service Tools > Stroke Valve (2-4)
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Follow the prompts on the Field Communicator display to select from the following:

- *Done*—Select this if you are done. All ramping is stopped when DONE is selected.
- *Ramp Open*—ramps the travel toward open at the rate of 1.0% per second of the ranged travel.
- *Ramp Closed*—ramps the travel toward closed at the rate of 1.0% per second of the ranged travel.

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

Partial Stroke Test (ODV only)

Field Communicator	Service Tools > Partial Stroke Test (2-5)
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Note

Partial Stroke Test is only available for instrument level ODV.

The Partial Stroke Test allows DVC6200 digital valve controllers with instrument level ODV to perform a Valve Signature type of test while the instrument is in service and operational. In some applications, it is important to be able to exercise and test the valve to verify that it will operate when commanded. This feature allows the user to partially stroke the valve while continually monitoring the input signal. If a demand arises, the test is aborted and the valve moves to its commanded position. The partial stroke valve travel is configurable between 1 and 30% maximum travel, in 0.1% increments. Data from the last partial stroke test is stored in the instrument memory for retrieval by ValveLink software.

The Partial Stroke Test allows you to perform a partial, 10%, stroke test (standard) or a custom stroke test. With the custom stroke test, the stroke may be extended up to 30%. Be sure to check plant guidelines before performing a custom stroke test. The purpose of this test is to ensure that the valve assembly moves upon demand.

A partial stroke test can be initiated when the valve is operating at either 4 or 20 mA (point-to-point mode). In applications where a spurious trip is to be minimized, 4 mA is the normal operating position.

When enabled, a partial stroke test may be initiated by the device (as a scheduled, auto partial stroke test), a remote push button located in the field or at the valve, a Field Communicator, or ValveLink software.

Device (Digital Valve Controller)

The Auto Partial Stroke Test allows the partial stroke test to be scheduled by the DVC6200. The test is scheduled in number of hours between tests. Any power cycle will reset the test clock timer.

Auxiliary Terminal

The auxiliary terminal can be used for different applications. The default configuration is for a partial stroke test initiated by shorting the contacts wired to the auxiliary +/- terminals of the DVC6200. Refer to Auxiliary Terminal Wiring Length Guidelines below.

• Local Push Button

A partial stroke test command may be sent to the digital valve controller using a set of contacts wired to the auxiliary +/- terminals. To perform a test, the contacts must be closed for 3 to 5 seconds and then opened. To abort the test, close the contacts for 1 second. The last set of diagnostic data is stored in the instrument memory for later retrieval via ValveLink software.

• Local DI

When configured by the user interface, the Auxiliary Terminal can be used as a discrete input from a pressure switch, temperature switch etc., to provide an alert.

Auxiliary Terminal Wiring Length Guidelines

The Auxiliary Input Terminals of a DVC6200 with instrument level ODV can be used with a locally-mounted switch for initiating a partial stroke test. Some applications require that the partial stroke test be initiated from a remote location.

The length for wiring connected to the Auxiliary Input Terminals is limited by capacitance. For proper operation of the Auxiliary Input Terminals capacitance should not exceed 18000 pF. As with all control signal wiring, good wiring practices should be observed to minimize adverse effect of electrical noise on the Aux Switch function.

Example Calculation: Capacitance per foot or per meter is required to calculate the length of wire that may be connected to the Aux switch input. The wire should not exceed the capacitance limit of 18000 pF. Typically the wire manufacturer supplies a data sheet which provides all of the electrical properties of the wire. The pertinent parameter is the highest possible capacitance. If shielded wire is used, the appropriate number is the "Conductor to Other Conductor & Shield" value.

Example — 18AWG Unshielded Audio, Control and Instrumentation Cable

Manufacturer's specifications include:

Nom. Capacitance Conductor to Conductor @ 1 KHz: 26 pF/ft
Nom. Conductor DC Resistance @ 20 Deg. C: 5.96 Ohms/1000 ft
Max. Operating Voltage - UL 200 V RMS (PLTC, CMG), 150 V RMS (ITC)
Allowable Length with this cable = $18000\text{pF} / (26\text{pF/ft}) = 692\text{ ft}$

Example — 18AWG Shielded Audio, Control and Instrumentation Cable

Manufacturer's specifications include:

Nom. Characteristic Impedance: 29 Ohms
Nom. Inductance: .15 $\mu\text{H/ft}$
Nom. Capacitance Conductor to Conductor @ 1 KHz: 51 pF/ft
Nom. Cap. Cond. to other Cond. & Shield @ 1 KHz 97 pF/ft
Allowable Length with this cable = $18000\text{pF} / (97\text{pF/ft}) = 185\text{ ft}$

The AUX switch input passes less than 1 mA through the switch contacts, and uses less than 5V, therefore, neither the resistance nor the voltage rating of the cable are critical. Ensure that switch contact corrosion is prevented. It is generally advisable that the switch have gold-plated or sealed contacts.

Field Communicator

1. Connect the Field Communicator to the LOOP terminals on the digital valve controller.
2. Turn on the Field Communicator.
3. From the *Online* menu, select *Service Tools > Partial Stroke Test*.
4. Select either *Standard (10%)* or *Custom*. With the Custom Stroke Test, the stroke may be entered up to 30% with configurable stroking speed and pause time.
5. The currently configured Stroke, Stroking Speed, and Pause Time is displayed. Choose "Yes" to run the test using these values. Choose "No" to modify the values. The default value for Stroke Speed is 0.25%/second.
6. The valve begins to move and the actual travel reported by the digital valve controller is displayed on the Field Communicator.
7. Once the valve has reached the endpoint, check that the valve has reached the desired set point. The valve should return to its original position.

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

Overview

Field Communicator	Overview (3)
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The following menus are available to define and/or view information about the instrument.

Note

Overview is not available for instrument level AC.

Analog In

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

Setpoint

Setpoint shows the requested valve position in % of ranged travel post characterization.

Travel

Travel shows the value of the DVC6200 digital valve controller travel in % (percent) of ranged travel. Travel always represents how far the valve is open.

Drive Signal

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

Pressure

Shows the value of the instrument supply and output pressures in psi, bar, kPa, or kg/cm². Also shows the output pressure differential. To display pressures may require selecting the variable; a detail display of that variable with its values will appear.

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

Variables

The *Variables* menu is available to view additional variables, including; *Auxiliary Input*, *Temperature*, *Maximum Recorded Temperature*, *Minimum Recorded Temperature*, *Cycle Counter*, *Travel Accumulator*, *Raw Travel Input*, *View Numbers of Days Powered Up*, and *Number of Power Ups*.

If a value for a variable does not appear on the display, select the variable and a detailed display of that variable with its value will appear. A variable's value does not appear on the menu if the value becomes too large to fit in the allocated space on the display, or if the variable requires special processing, such as Aux Input.

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

- *Temperature*—The internal temperature of the instrument is displayed in either degrees Fahrenheit or Celsius.
- *Maximum Recorded Temperature*—Shows the maximum temperature the instrument has experienced since installation.
- *Minimum Recorded Temperature*—Shows the minimum temperature the instrument has experienced since installation.
- *Cycle Counter*—Displays the number of times the valve travel has cycled. Only changes in direction of the travel after the travel has exceeded the deadband are counted as a cycle. Once a new cycle has occurred, a new deadband around the last travel is set. The value of the Cycle Counter can be reset from the *Cycle Count Alert* menu. See page 65 for additional information.
- *Travel Accumulator*—Contains the total change in travel, in percent of ranged travel. The accumulator only increments when travel exceeds the deadband. Then the greatest amount of change in one direction from the original reference point (after the deadband has been exceeded) will be added to the Travel Accumulator. The value of the Travel Accumulator can be reset from the *Travel Accumulator* menu. See page 66 for additional information.

Note

The following should only be used for a relative indication to be sure the travel sensor is working and that it is detecting movement of the magnet assembly.

- *Raw Travel Input*—Indicates the magnet assembly position in analog-to-digital converter counts. When the travel sensor is operating correctly, this number changes as the valve strokes.
- *View Number of Days Powered Up*—Indicates in hours or days the total elapsed time the instrument has been powered up.
- *Number of Power Ups*—Indicates how many times the instrument has cycled power.

Device Information

The *Device Information* menu is available to view information about the instrument, including; *HART Tag*, *Device ID*, *Manufacturer*, *Model*, *Device Revision*, *Firmware Revision*, *Hardware Revision*, *Instrument Level*, and *HART Universal Revision*.

- *Hart Tag*—A HART tag is a unique name (up to eight characters) that identifies the physical instrument.
- *Device ID*—Each instrument has a unique Device Identifier. The device ID provides additional security to prevent this instrument from accepting commands meant for other instruments.
- *Manufacturer*—Identifies the manufacturer of the instrument.
- *Model*—Identifies the instrument model.
- *Device Revision*—Device Revision is the revision number of the software for communication between the Field Communicator and the instrument.
- *Firmware Revision*—The revision number of the firmware in the instrument.

- *Hardware Revision*—The revision number of the electrical circuitry within the instrument printed wiring board.
- *Instrument Level*—Indicates the instrument level
 - AC—Auto Calibrate
 - HC—HART Communicating
 - AD—Advanced Diagnostics
 - PD—Performance Diagnostics
 - ODV—Optimized Digital Valve

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

Table 6-2. Functions Available for Instrument Level

Instrument Level	Functions Available
AC	Communicates with the Field Communicator. Provides Basic Setup and calibration.
HC	Communicates with the Field Communicator and ValveLink software. In addition, HC provides: travel cutoffs and limits, minimum opening and closing times, input characterization (linear, equal percentage, quick opening, and custom), trending with ValveLink Solo, and the following alerts: travel deviation; travel alert high, low, high high, and low low; drive signal; auxiliary terminal; cycle counter; and travel accumulation.
AD	Includes all functions listed above plus (with ValveLink software) all offline diagnostic tests (dynamic error band, drive signal, step response, and valve signature) plus online trending
PD	Includes all functions listed above plus all Performance Diagnostics online/in-service valve testing (valve friction, electronics, and mechanical condition)
ODV	Includes all functions listed above plus partial stroke test and lead/lag set point filter.

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

DD Information contains the device description in the Field Communicator.

Section 7 Maintenance and Troubleshooting

The DVC6200 digital valve controller enclosure is rated Type 4X and IP66, therefore periodic cleaning of internal components is not required. If the DVC6200 is installed in an area where the exterior surfaces tend to get heavily coated or layered with industrial or atmospheric contaminants, however, it is recommended that the vent (key 52) be periodically inspected to ensure it is fully open. If the vent appears to be clogged, it can be removed, cleaned and replaced. Lightly brush the exterior of the vent to remove contaminants and run a mild water/detergent solution through the vent to ensure it is fully open. Allow the vent to dry before reinstalling.

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance procedures on the DVC6200 digital valve controller:

- Always wear protective clothing, gloves, and eyewear.
- Do not remove the actuator from the valve while the valve is still pressurized.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression so the actuator is not applying force to the valve stem; this will allow for the safe removal of the stem connector.

⚠ WARNING

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

- Remove electrical power before removing the housing cap. Personal injury or property damage from fire or explosion may result if power is not disconnected before removing the cap.
- Remove electrical power before disconnecting any of the pneumatic connections.
- When disconnecting any of the pneumatic connections or any pressure retaining part, natural gas will seep from the unit and any connected equipment into the surrounding atmosphere. Personal injury or property damage may result

from fire or explosion if natural gas is used as the supply medium and appropriate preventive measures are not taken. Preventive measures may include, but are not limited to, one or more of the following: ensuring adequate ventilation and the removal of any ignition sources.

- Ensure that the cover is correctly installed before putting this unit back into service. Failure to do so could result in personal injury or property damage from fire or explosion.

CAUTION

When replacing components, use only components specified by the factory. Always use proper component replacement techniques, as presented in this manual. Improper techniques or component selection may invalidate the approvals and the product specifications, as indicated in table 1-2, and may also impair operations and the intended function of the device.

Because of the diagnostic capability of the DVC6200, predictive maintenance is available through the use of ValveLink software. Using the digital valve controller, valve and instrument maintenance can be enhanced, thus avoiding unnecessary maintenance. For information on using ValveLink software, refer to the ValveLink software online help.

Removing the Magnetic Feedback Assembly

To remove the magnet assembly from the actuator stem, perform the following basic steps.

1. Make sure that the valve is isolated from the process.
2. Remove the instrument terminal box cover.
3. Disconnect the field wiring from the terminal board.
4. Shut off the instrument air supply.
5. Disconnect the pneumatic tubing and remove the DVC6200 or the DVC6215 from the actuator.
6. Remove the screws holding the magnet assembly to the connector arm.

When replacing the instrument, be sure to follow the mounting guidelines in the Installation section. Setup and calibrate the instrument prior to returning to service.

Module Base Maintenance

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

Tools Required

Table 7-1 lists the tools required for maintaining the DVC6200 digital valve controller.

Table 7-1. Tools Required

Tool	Size	Component
Phillips Screwdriver		Relay, printed wiring board assembly, and cover screws
Hex key	5 mm	Terminal box screw
Hex key	1.5 mm	Terminal box cover screw
Hex key	2.5 mm	I/P converter screws
Hex key	6 mm	Module base screws

Component Replacement

When replacing any of the components of the DVC6200, the maintenance should be performed in an instrument shop whenever possible. Make sure that the electrical wiring and pneumatic tubing is disconnected prior to disassembling the instrument.

Removing the Module Base

Refer to figure 8-2 or 8-4 for key number locations.

⚠ WARNING

To avoid personal injury or equipment damage from bursting of parts, turn off the supply pressure to the digital valve controller and bleed off any excess supply pressure before attempting to remove the module base assembly from the housing.

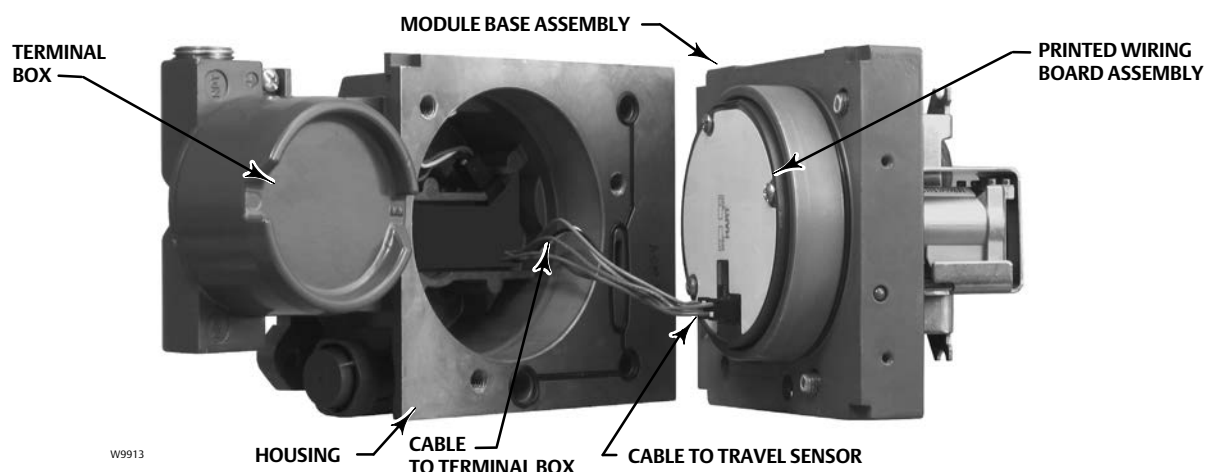
1. Unscrew the four captive screws in the cover (key 43) and remove the cover from the module base (key 2).
2. Using a 6 mm hex socket wrench, loosen the three-socket head screws (key 38). These screws are captive in the module base by retaining rings (key 154).

Note

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

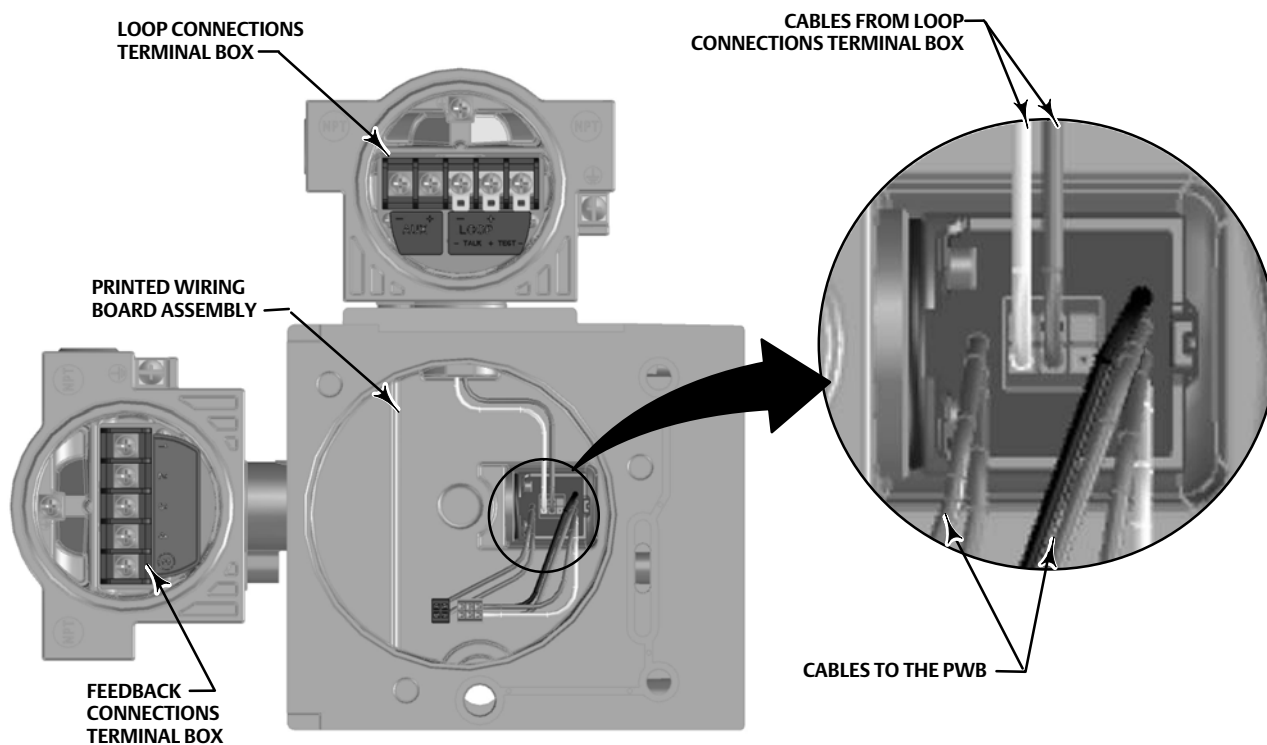
3. Pull the module base straight out of the housing (key 1). Once clear of the housing, swing the module base to the side of the housing to gain access to the cable assemblies.
4. The digital valve controller/base unit has two cable assemblies, shown in figure 7-1, which connect the module base, via the printed wiring board assembly, to the output of the travel feedback sensor board and the travel feedback sensor. Disconnect these cable assemblies from the printed wiring board assembly on the back of the module base.

Figure 7-1. Printed Wiring Board Cable Connections



5. For the DVC6205 only, disconnect the cable assembly from the LOOP connections terminal box, as shown in figure 7-2.

Figure 7-2. FIELDVUE DVC6205 Cable Connections



Replacing the Module Base

Refer to figure 8-2 or 8-4 for key number locations.

CAUTION

To avoid affecting performance of the instrument, take care not to damage the module base seal or guide surface. Do not bump or damage the bare connector pins on the PWB assembly. Damaging either the module base or guide surface may result in material damage, which could compromise the instruments ability to maintain a pressure seal.

Note

To avoid affecting performance of the instrument, inspect the guide surface on the module and the corresponding seating area in the housing before installing the module base assembly. These surfaces must be free of dust, dirt, scratches, and contamination. Ensure the module base seal is in good condition. Do not reuse a damaged or worn seal.

1. Ensure the module base seal (key 237) is properly installed in the housing (key 1). Ensure the O-ring (key 12) is in place on the module base assembly.

2. Connect the two cable assemblies from the sensor board to the PWB assembly (key 50). Orientation of the connector is required.
3. For DVC6205 only, connect the cable assembly from the LOOP connections terminal box to the Feedback Connections Terminal Box (see figure 7-2).
4. Insert the module base (key 2) into the housing (key 1).
5. Install three socket head screws (key 38) in the module base into the housing. If not already installed, press three retaining rings (key 154) into the module base. Evenly tighten the screws in a crisscross pattern to a final torque of 16 N•m (138 lbf•in).

CAUTION

Personal injury, property damage, or disruption of process control can result if the cable assemblies/wiring are damaged when attaching the cover to the module base assembly

Ensure that the cable assemblies/wiring are positioned in the cavity of the module base so they do not get compressed or damaged when attaching the cover to the module base assembly in step 6.

6. Attach the cover (key 43) to the module base assembly.

Submodule Maintenance

The module base of the DVC6200 contains the following submodules: I/P converter, PWB assembly, and pneumatic relay. If problems occur, these submodules may be removed from the module base and replaced with new submodules. After replacing a submodule, the module base may be put back into service.

CAUTION

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

In order to maintain accuracy specifications, do not strike or drop the I/P converter during submodule maintenance.

I/P Converter

Refer to figure 8-2 or 8-4 for key number locations. The I/P converter (key 41) is located on the front of the module base.

Note

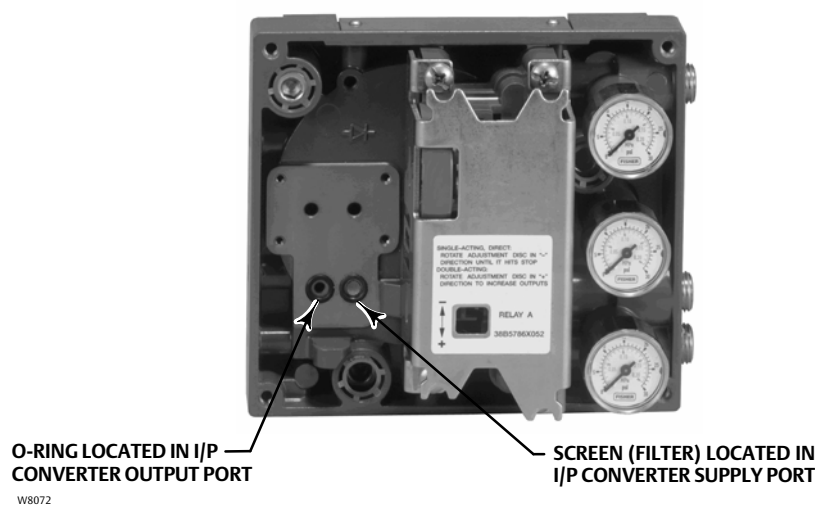
After I/P converter submodule replacement, calibrate the digital valve controller to maintain accuracy specifications.

Replacing the I/P Filter

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

1. Remove the I/P converter (key 41) and shroud (key 169) as described in the Removing the I/P Converter procedure.
2. Remove the screen (key 231) from the supply port.
3. Install a new screen in the supply port as shown in figure 7-3.

Figure 7-3. I/P Filter Location



4. Inspect the O-ring (key 39) in the I/P output port. if necessary, replace it.
5. Reinstall the I/P converter (key 41) and shroud (key 169) as described in the Replacing the I/P Converter procedure.

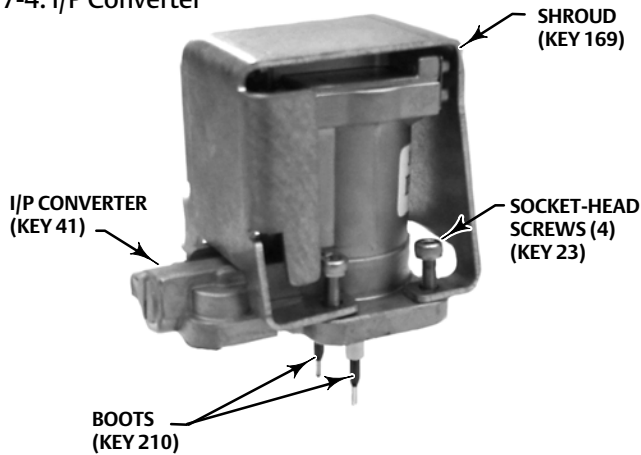
Removing the I/P Converter

1. Remove the front cover (key 43), if not already removed.
2. Refer to figure 7-4. Using a 2.5 mm hex socket wrench, remove the four socket-head screws (key 23) that attach the shroud (key 169) and I/P converter (key 41) to the module base (key 2).
3. Remove the shroud (key 169); then pull the I/P converter (key 41) straight out of the module base (key 2). Be careful not to damage the two electrical leads that come out of the base of the I/P converter.
4. Ensure that the O-ring (key 39) and screen (key 231) stay in the module base and do not come out with the I/P converter (key 41).

Replacing the I/P Converter

1. Refer to figure 7-3. Inspect the condition of the O-ring (key 39) and screen (key 231) in the module base (key 2). Replace them, if necessary. Apply silicone lubricant to the O-rings.
2. Ensure the two boots (key 210) shown in figure 7-4 are properly installed on the electrical leads.

Figure 7-4. I/P Converter



3. Install the I/P converter (key 41) straight into the module base (key 2), taking care that the two electrical leads feed into the guides in the module base. These guides route the leads to the printed wiring board assembly submodule.
4. Install the shroud (key 169) over the I/P converter (key 41).
5. Install the four socket-head screws (key 23) and evenly tighten them in a crisscross pattern to a final torque of 1.6 N•m (14 lbf•in).
6. After replacing the I/P converter, calibrate travel or perform touch-up calibration to maintain accuracy specifications.

Printed Wiring Board (PWB) Assembly

Refer to figure 8-2 or 8-4 for key number locations. The PWB assembly (key 50) is located on the back of the module base assembly (key 2).

Note

The PWB assembly must be firmware revision 9 or later.

Note

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

Removing the Printed Wiring Board Assembly

1. Separate the module base from the housing by performing the Removing the Module Base procedure.
2. Remove three screws (key 33).
3. Lift the PWB assembly (key 50) straight out of the module base (key 2).
4. Ensure that the O-rings (key 40) remain in the pressure sensor bosses on the module base assembly (key 2) after the PWB assembly (key 50) has been removed.

Replacing the Printed Wiring Board Assembly and Setting the DIP Switch

1. Apply silicone lubricant to the pressure sensor O-rings (key 40) and install them on the pressure sensor bosses in the module base assembly.

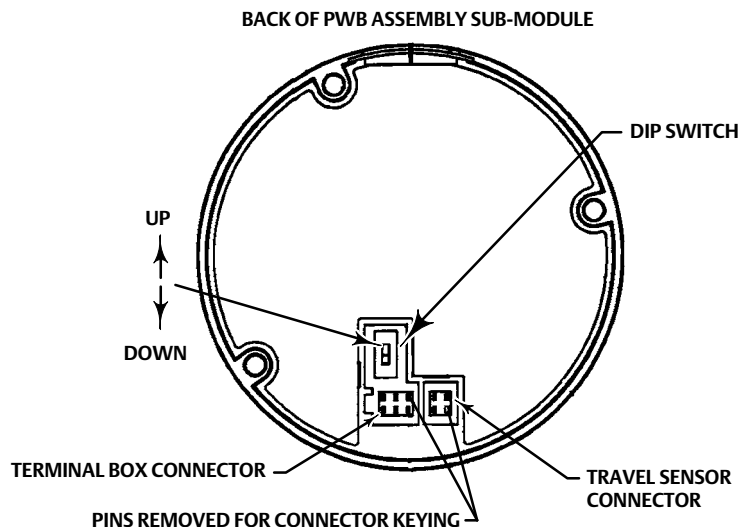
2. Properly orient the PWB assembly (key 50) as you install it into the module base. The two electrical leads from the I/P converter (key 41) must guide into their receptacles in the PWB assembly and the pressure sensor bosses on the module base must fit into their receptacles in the PWB assembly.
3. Push the PWB assembly (key 50) into its cavity in the module base.
4. Install and tighten three screws (key 33) to a torque of 1 N•m (10.1 lbf•in).
5. Set the DIP switch on the PWB assembly according to table 7-2.

Table 7-2. DIP Switch Configuration⁽¹⁾

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

1. Refer to figure 7-5 for switch location.

Figure 7-5. DIP Switch Location

**Note**

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

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

Pneumatic Relay

Refer to figure 8-2 or 8-4 for key number locations. The pneumatic relay (key 24) is located on the front of the module base.

Note

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

Removing the Pneumatic Relay

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

Replacing the Pneumatic Relay

1. Visually inspect the holes in the module base to ensure they are clean and free of obstructions. If cleaning is necessary, do not enlarge the holes.
2. Apply silicone lubricant to the relay seal and position it in the grooves on the bottom of the relay as shown in figure 7-6. Press small seal retaining tabs into retaining slots to hold relay seal in place.

Figure 7-6. Pneumatic Relay Assembly



3. Position the relay (with shroud) on the module base. Tighten the four screws, in a crisscross pattern, to a final torque of 2 N•m (20.7 lbf•in).
4. Using the Field Communicator, verify that the value for Relay Type parameter matches the relay type installed.
5. After replacing the relay and verifying the relay type, calibrate travel or perform touch-up calibration to maintain accuracy specifications

Gauges, Pipe Plugs, or Tire Valves

Depending on the options ordered, the DVC6200 or DVC6205 will be equipped with either gauges (key 47), pipe plugs (key 66), or tire valves (key 67). Single-acting direct instruments will also have a screen (key 236, figure 8-3). These are located on the top of the module base next to the relay.

Perform the following procedure to replace the gauges, tire valves, or pipe plugs. Refer to figure 8-2 and 8-3 for key number locations.

1. Remove the front cover (key 43).
2. Remove the gauge, pipe plug, or tire valve as follows:

For gauges (key 47), the flats are on the gauge case. Use a wrench on the flats of the gauge to remove the gauge from the module base. For double-acting instruments, to remove the supply gauge remove one of the output gauges.

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

3. Apply zinc based anti-seize 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

⚠ WARNING

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

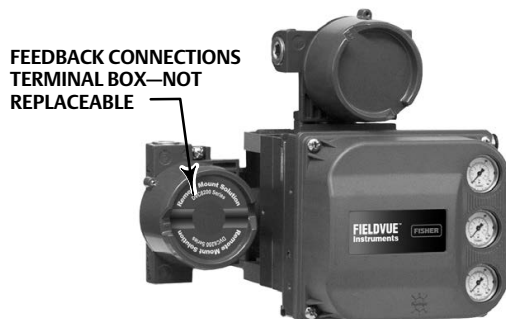
Refer to figure 8-2 or 8-4 for key number locations.

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

Note

The DVC6205 feedback connections terminal box (shown in figure 7-7) is not a replaceable part. Do not remove the tamper proof paint on the screw.

Figure 7-7. FIELDVUE DVC6205 Feedback Connections Terminal Box



X0379

Removing the Terminal Box

⚠ WARNING

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

1. Loosen the set screw (key 58) in the cap (key 4) so that the cap can be unscrewed from the terminal box.
2. After removing the cap (key 4), note the location of field wiring connections and disconnect the field wiring from the terminal box.
3. Separate the module base from the housing by performing the Removing the Module Base procedure.
4. Disconnect the terminal box wiring connector from the sensor board in the housing assembly (key 50).
5. Remove the screw (key 72). Pull the terminal box assembly straight out of the housing.

Replacing the Terminal Box

Note

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

1. Apply lubricant, silicone sealant to the O-ring (key 34) and install the O-ring over the stem of the terminal box.
2. Insert the terminal box assembly stem into the housing until it bottoms out. Position the terminal box assembly so that the hole for the screw (key 72) in the terminal box aligns with the threaded hole in the housing. Install the screw (key 72).
3. Connect the terminal box wiring connector to the sensor board in the housing assembly (key 50). Orientation of the connector is required.
4. Reassemble the module base to the housing by performing the Replacing the Module Base procedure.
5. Reconnect the field wiring as noted in step 2 in the Removing the Terminal Box procedure.
6. Apply lubricant, silicone sealant to the O-ring (key 36) and install the O-ring over the 2-5/8 inch threads of the terminal box. Use of a tool is recommended to prevent cutting the O-ring while installing it over the threads.
7. Apply lithium grease (key 63) to the 2-5/8 inch threads on the terminal box to prevent seizing or galling when the cap is installed.
8. Screw the cap (key 4) onto the terminal box.
9. Install a set screw (key 58) into the cap (key 4). Loosen the cap (not more than 1 turn) to align the set screw over one of the recesses in the terminal box. Tighten the set screw (key 58).

Troubleshooting

If communication or output difficulties are experienced with the instrument, refer to the troubleshooting chart in table 7-3. Also see the DVC6200 Technical Support Checklist on page 111.

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 2-29 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 2-29 to zero.
4. Record the current shown on the milliammeter.
5. Adjust the resistance of the 1 kilohm potentiometer until the voltage read on the voltmeter is 11.0 volts.
6. Record the current shown on the milliammeter.
7. If the current recorded in step 6 is the same as that recorded in step 4 (± 0.08 mA), the voltage available is adequate.
8. If the voltage available is inadequate, refer to Wiring Practices in the Installation section.

Checking the Loop Current Without Disturbing the Loop Wiring

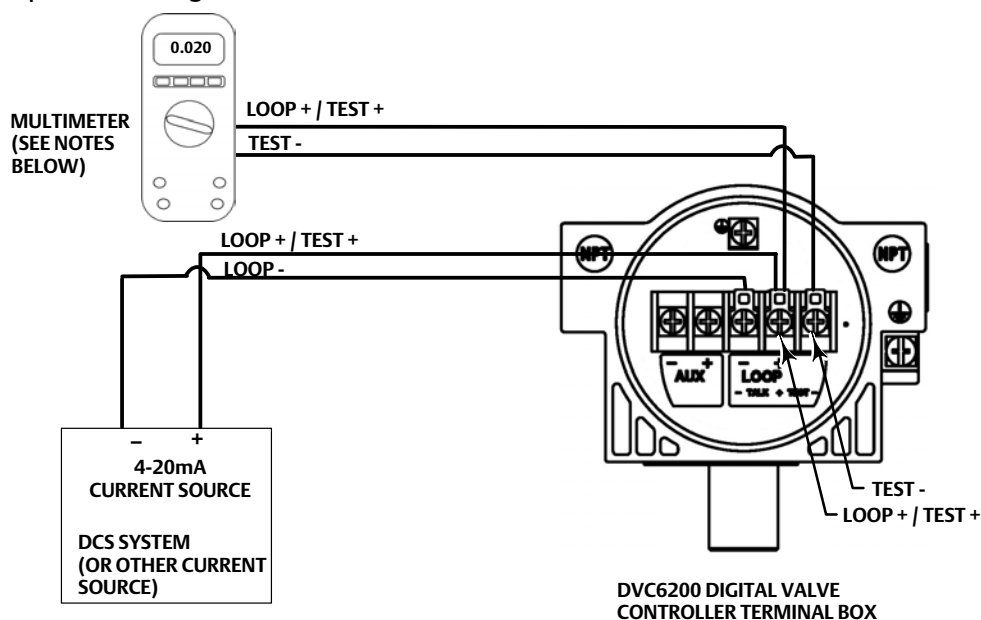
⚠ WARNING

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

To check the loop current without disturbing the loop wiring perform the following procedure.

1. With the FIELDVUE instrument connected to a current source connect a digital multimeter reading Volts DC (0 to 1 VDC or mV scale) to the TEST terminals as shown in figure 7-8.
2. The reading at the test terminals is proportional to the loop current [$0.004 \text{ V} = 0.004 \text{ A (4 MA)}$] mA of loop current). Refer to Specifications, table 1-2, to determine if the current is sufficient.

Figure 7-8. Check the Loop Current using the TEST Terminals



NOTES:

1. MULTIMETER MEASURING 0.000 TO 1.0000 VDC
2. TYPICAL READINGS 0.004 VDC TO 0.020 VDC
3. OHM'S LAW— $V = I \times R$, WHERE $R = \text{PRECISION 1 OHM RESISTOR}$, $V = I \times 1$, SO $V = I$

Table 7-3. Instrument Troubleshooting

Symptom	Possible Cause	Action
1. Analog input reading at instrument does not match actual current provided.	1a. Control mode not Analog.	1a. Check the control mode using the Field Communicator. If in the Digital or Test mode, the instrument receives its set point as a digital signal. Control is not based on input current. Change Control Mode to Analog.
	1b. Low control system compliance voltage.	1b. Check system compliance voltage (see Wiring Practices in the Installation section).
	1c. Instrument shutdown due to self test failure.	1c. Check instrument status using the Field Communicator (see Viewing Instrument Status in the Viewing Device Information section).
	1d. Analog input sensor not calibrated.	1d. Calibrate the analog input sensor (see Analog Input Calibration in the Calibration section).
	1e. Current leakage.	1e. Excessive moisture in the terminal box can cause current leakage. Typically the current will vary randomly if this is the case. Allow the inside of the terminal box to dry, then retest.
2. Instrument will not communicate.	2a. Insufficient Voltage Available.	2a. Calculate Voltage Available (see Wiring Practices in the Installation section). Voltage Available should be greater than or equal to 11 VDC.
	2b. Controller output Impedance too low.	2b. Install a HART filter after reviewing Control System Compliance Voltage requirements (see Wiring Practices in the Installation section).
	2c. Cable capacitance too high.	2c. Review maximum cable capacitance limits (see Wiring Practices in the Installation section).
	2d. HART filter improperly adjusted.	2d. Check filter adjustment (see the appropriate HART filter instruction manual).
	2e. Improper field wiring.	2e. Check polarity of wiring and integrity of connections. Make sure cable shield is grounded only at the control system.
	2f. Controller output providing less than 4 mA to loop.	2f. Check control system minimum output setting, which should not be less than 3.8 mA.
	2g. Disconnected loop wiring cable at PWB.	2g. Verify connectors are plugged in correctly.
	2h. PWB DIP switch not set properly.	2h. Check for incorrect setting or broken DIP switch on the back of the PWB. Reset switch or replace PWB, if switch is broken. See table 7-2 for switch setting information
	2j. PWB failure.	2j. Use a 4-20 mA current source to apply power to the instrument. Terminal voltage across the LOOP+ and LOOP- terminals should be 9 to 10.5 VDC. If the terminal voltage is not 9 to 10.5 VDC, replace the PWB.
	2k. Polling address incorrect.	2k. Use the Field Communicator to set the polling address (refer to the Detailed Setup section). From the <i>Utility</i> menu, select <i>Configure Communicator > Polling > Always Poll</i> . Set the instrument polling address to 0.
	2l. Defective terminal box.	2l. Check continuity from each screw terminal to the corresponding PWB connector pin. If necessary, replace the terminal box assembly.
	2m. Defective Field Communicator or ValveLink modem cable.	2m. If necessary, repair or replace cable.
	2n. ValveLink modem defective or not compatible with PC.	2n. Replace ValveLink modem.
	2p. ValveLink hardlock defective or not programmed.	2p. Replace if defective or return to factory for programming.
3. Instrument will not calibrate, has sluggish performance or oscillates.	3a. Configuration errors.	3a. Verify configuration: If necessary, set protection to None. If Out of Service, place In Service. Check: Travel Sensor Motion Tuning set Zero control signal Feedback Connection Control mode (should be Analog) Restart control mode (should be Analog)

Table 7-3. Instrument Troubleshooting (Continued)

Symptom	Possible Cause	Action
	3b. Restricted pneumatic passages in I/P converter.	3b. Check screen in I/P converter supply port of the module base. Replace if necessary. If passages in I/P converter restricted, replace I/P converter.
	3c. O-ring(s) between I/P converter ass'y missing or hard and flattened losing seal.	3c. Replace O-ring(s).
	3d. I/P converter ass'y damaged/corroded/clogged.	3d. Check for bent flapper, open coil (continuity), contamination, staining, or dirty air supply. Coil resistance should be between 1680 - 1860 ohms. Replace I/P assembly if damaged, corroded, clogged, or open coil.
	3e. I/P converter ass'y out of spec.	3e. I/P converter ass'y nozzle may have been adjusted. Verify drive signal (55 to 80% for double-acting; 60 to 85% for single-acting) with the valve off the stops. Replace I/P converter assembly if drive signal is continuously high or low.
	3f. Defective module base seal.	3f. Check module base seal for condition and position. If necessary, replace seal.
	3g. Defective relay.	3g. Depress relay beam at adjustment location in shroud, look for increase in output pressure. Remove relay, inspect relay seal. Replace relay seal or relay if I/P converter assembly is good and air passages not blocked. Check relay adjustment.
	3h. Defective 67CFR regulator, supply pressure gauge jumps around.	3h. Replace 67CFR regulator.
4. ValveLink diagnostic tests provide erroneous results.	4a. Defective pressure sensor.	4a. Replace PWB.
	4b. Pressure sensor O-ring missing.	4b. Replace O-ring.
5. Field Communicator does not turn on.	5a. Battery pack not charged.	5a. Charge battery pack. Note: Battery pack can be charged while attached to the Field communicator or separately. The Field Communicator is fully operable while the battery pack is charging. Do not attempt to charge the battery pack in a hazardous area.

DVC6200 Technical Support Checklist

Have the following information available prior to contacting your Emerson Process Management sales office for support.

1. Instrument serial number as read from nameplate _____
2. Is the digital valve controller responding to the control signal? Yes _____ No _____
If not, describe _____
3. Measure the voltage across the "Loop -" and Loop +" terminal box screws when the commanded current is 4.0 mA and 20.0 mA: _____ V @ 4.0 mA _____ V @ 20.0 mA.
(These values should be around 9.6 V @ 4.0 mA and 10.3 V @ 20 mA).
4. Is it possible to communicate via HART to the digital valve controller? Yes _____ No _____
5. What is the Diagnostic Tier of the digital valve controller? AC ____ HC ____ AD ____ PD ____ ODV ____
6. What is the firmware version of the digital valve controller? _____
7. What is the hardware version of the digital valve controller? _____
8. Is the digital valve controller's Instrument Mode "In Service"? Yes _____ No _____
9. Is the digital valve controller's Control Mode set to "Analog"? Yes _____ No _____
10. Is it on Travel or Pressure control?
11. What are the following parameter readings?
Input Signal _____ Drive Signal _____ %
Supply Pressure _____ Pressure A _____ Pressure B _____
Travel Target _____ % Travel _____ %
12. What are the following alert readings?
Fail alerts _____
Valve alerts _____
Operational status _____
Alert event record entries _____
13. Export ValveLink data (if available) for the device (Status Monitor, Detailed Setup, etc.).

Mounting

1. Which digital valve controller do you have? DVC6200 _____ DVC6205/DVC6215 _____
2. What Make, Brand, Style, Size, etc. actuator is the DVC6200 mounted on? _____
3. What is the full travel of the valve? _____
4. What is the Mounting Kit part number? _____
5. If mounting kits are made by LBP/Customer, please provide pictures of installation.
6. Is the Mounting kit installed per the instructions? Yes _____ No _____
7. What is the safe position of the valve? Fail closed _____ Fail open _____

Section 8 Parts

Parts Ordering

Whenever corresponding with your Emerson Process Management sales office about this equipment, always mention the controller serial number. When ordering replacement parts, refer to the 11-character part number of each required part as found in the following parts list. Part numbers are shown for kits and recommended spares only. For part numbers not shown, contact your Emerson Process Management sales office.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher instrument. Use of components not supplied by Emerson Process Management may void your warranty, might adversely affect the performance of the instrument, and could cause personal injury and property damage.

Parts Kits

Kit	Description	Part Number	Kit	Description	Part Number
1*	Elastomer Spare Parts Kit (kit contains parts to service one digital valve controller)		6*	Spare Module Base Assembly Kit, Aluminum [kit contains module base (key 2); drive screws, qty. 2, (key 11); shield/label (key 19); hex socket cap screw, qty. 3, (key 38); self tapping screw, qty. 2 (key 49); pipe plug, qty. 3 (key 61); retaining ring, qty. 3 (key 154); screen (key 236); and flame arrestors, qty. 3 (key 243)]	GE18654X012
	Standard	19B5402X012			
	Extreme Temperature option (fluorosilicone elastomers)	19B5402X022			
2*	Small Hardware Spare Parts Kit (kit contains parts to service one digital valve controller)	19B5403X012	7*	Spare Housing Assembly Kit, aluminum [kit contains housing (key 1); vent assembly (key 52); seal (only included in Housing A kits) (key 288); seal (key 237); O-ring (key 34); O-ring (only used with integrally mounted regulator) (key 5)]	
3*	Seal Screen Kit [kit contains 25 seal screens (key 231) and 25 O-rings (key 39)]			<i>Housing A (used for GX actuator)</i>	
	Standard and Extreme Temperature option (fluorosilicone elastomers)	14B5072X182		Standard (nitrile elastomers)	GE48798X012
4*	Terminal Box Kit, aluminum			Extreme Temperature option (fluorosilicone elastomers)	GE48798X022
	Standard	19B5401X012		<i>Housing B (used for all actuators except GX)</i>	
	Standard, Natural Gas approved	19B5401X032		Standard (nitrile elastomers)	GE48798X052
	Extreme Temperature option (fluorosilicone elastomers)	19B5401X022		Extreme Temperature option (fluorosilicone elastomers)	GE48798X062
	Extreme Temperature option (fluorosilicone elastomers) Natural Gas Approved	19B5401X042	8*	Spare I/P Shroud Kit [kit contains shroud (key 169) and hex socket cap screw, qty. 4 (key 23)]	GE29183X012
5*	I/P Converter Kit		9*	Remote Mount Feedback Unit Kit (see figure 8-5) [remote housing assembly (key 25); hex socket set screw (key 58); 1/2 NPT pipe plug (key 62); wire retainer, qty 2 (key 131); terminal cover (key 255); o-ring (key 256); gasket (Housing A only, used for GX actuator) (key 287); seal (Housing A only, used for GX actuator) (key 288)]	
	Standard	38B6041X152		Housing A (used for GX actuator)	GE46670X012
	For Extreme Temperature option (fluorosilicone elastomers)	38B6041X132		Housing B (used for all actuators except GX)	GE40178X012

Kit	Description	Part Number	Key	Description	Part Number
10*	Feedback Array Kit, Aluminum		248	Screw, hex head (4 req'd) (DVC6205 only)	
	Sliding Stem (Linear)		249	Screw, hex head (4 req'd) (DVC6205 only)	
	[kit contains feedback array and hex socket cap screws, qty. 2, with hex key and alignment template. 210 mm (8-1/4 inch) kit also contains insert]. Stainless steel kits only for use with stainless steel mounting kits.		250	Spacer (4 req'd) (DVC6205 only)	
	7 mm (1/4-inch)		267	Standoff (2 req'd) (DVC6205 only)	
	Aluminum	GG20240X012	271	Screen ⁽⁷⁾	
	19 mm (3/4-inch)		287	Gasket, Housing A only (used for GX actuator) (DVC6200 only)	
	Aluminum	GG20240X022	288	Seal, Housing A only (used for GX actuator) (DVC6200 only)	
	Stainless steel	GG13199X012			
	25 mm (1-inch)				
	Aluminum	GG20240X032			
	Stainless steel	GG13199X022			
	38 mm (1-1/2 inch)				
	Aluminum	GG20240X042			
	Stainless steel	GG13199X032			
	50 mm (2-inch)				
	Aluminum	GG20240X052			
	Stainless steel	GG13199X042			
	100 mm (4-inch)				
	Aluminum	GG20240X062			
	Stainless steel	GG13199X052			
	210 mm (8-1/4 inch)				
	Aluminum	GG20243X012			
	Stainless steel	GG13199X072			
	Rotary				
	[kit contains feedback assembly, pointer, and travel indicator scale]. Stainless steel kits only for use with stainless steel mounting kits.				
	Aluminum	GG10562X012			
	Stainless steel	GG10562X022			

Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson Process Management sales office.

Parts with footnote numbers shown are available in parts kits; see footnote information at the bottom of the page.

Key	Description
-----	-------------

Housing (see figure 8-2 and 8-4)

DVC6200 and DVC6205

- 1 Housing⁽⁷⁾
- 11 Drive Screw (2 req'd) (DVC6205 only)
- 20 Shield (DVC6205 only)
- 52 Vent, plastic⁽²⁾
- 74 Mounting Bracket (DVC6205 only)

Common Parts (see figure 8-2, 8-3, and 8-4)

DVC6200 and DVC6205

- 16* O-ring⁽¹⁾ (3 req'd)
- 29 Warning label, for use only with LCIE hazardous area classifications
- 33 Mach Screw, pan head, SST⁽²⁾ (3 req'd)
- 38 Cap Screw, hex socket, SST⁽²⁾⁽⁶⁾ (3 req'd)
- 43* Cover Assembly (includes cover screws)
 - Standard 38B9580X022
 - Extreme temperature option (fluorosilicone elastomers) 38B9580X032
- 48 Nameplate
- 49 Screw, self tapping (2 req'd)⁽⁶⁾
- 61 Pipe Plug, hex socket⁽⁶⁾
 - Housing A with relay C (2 req'd) (used for GX actuator)
 - Housing A with relay B (1 req'd) (used for GX actuator)
 - Housing B with relay B and C (1 req'd) (used for all actuators except GX)
 - Not required for relay A
- 63 Lithium grease (not furnished with the instrument)
- 64 Zinc based anti-seize compound (not furnished with the instrument)
- 65 Lubricant, silicone sealant (not furnished with the instrument)
- 154 Retaining Ring⁽²⁾ (3 req'd)
- 236 Screen (required for relay B and C only)⁽⁷⁾
- 237 Module Base Seal⁽¹⁾

Module Base (see figure 8-2 and 8-4)

DVC6200 and DVC6205

- 2 Module Base⁽⁶⁾
- 11 Drive Screw⁽⁶⁾ (2 req'd)
- 12 O-ring⁽¹⁾
- 19 Shield⁽⁶⁾
- 61 Pipe Plug, hex socket⁽⁶⁾ (3 req'd)
- 243 Slotted Pin (flame arrestor)⁽⁶⁾ (3 req'd)

* Recommended spare

1. Available in the Elastomer Spare Parts Kit

2. Available in the Small Hardware Spare Parts Kit

6. Available in the Spare Module Base Assembly Kit

7. Available in the Spare Housing Assembly Kit

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

I/P Converter Assembly (see figure 8-2 and 8-4)

DVC6200 and DVC6205

23	Cap Screw, hex socket, SST ⁽²⁾ (8) (4 req'd)
39*	O-ring ⁽¹⁾ (3)(5)
41	I/P Converter ⁽⁵⁾
169	Shroud ⁽⁵⁾ (8) (see figure 7-4)
210*	Boot, nitrile ⁽¹⁾ (5) (2 req'd) (see figure 7-4)
231*	Seal Screen ⁽¹⁾ (3)(5)

Relay (see figure 8-2 and 8-4)

DVC6200 and DVC6205

24*	Relay Assembly, (includes shroud, relay seal, mounting screws)
-----	--

Standard (nitrile elastomers)

Standard Bleed

Housing A (used for GX actuator)

Single-/acting direct (relay C)	38B5786X182
Single-acting reverse (relay B)	38B5786X172

Housing B (used for all actuators except GX)

Single-acting direct (relay C)	38B5786X132
Double-acting (relay A)	38B5786X052
Single-acting reverse (relay B)	38B5786X092

Low Bleed

Housing A (used for GX actuator)

Single-acting direct (relay C)	38B5786X202
Single-acting reverse (relay B)	38B5786X192

Housing B (used for all actuators except G)

Single-acting direct (relay C)	38B5786X152
Double-acting (relay A)	38B5786X072
Single-acting reverse (relay B)	38B5786X112

Extreme Temperature option (fluorosilicone elastomers)

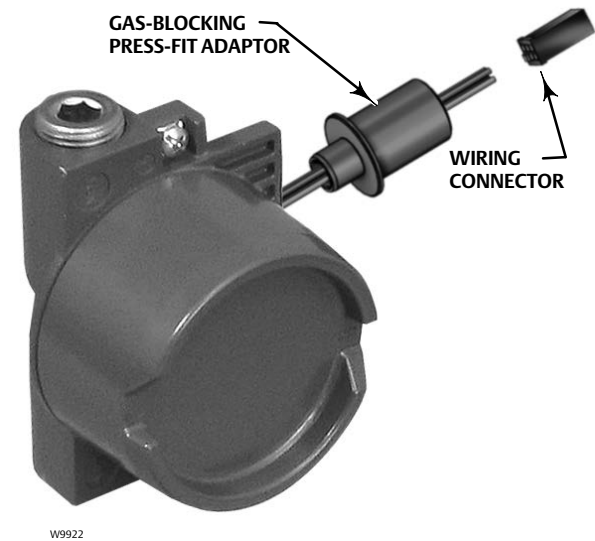
Standard Bleed

Single-acting direct (relay C)	38B5786X142
Double-acting (relay A)	38B5786X032
Single-acting reverse (relay B)	38B5786X102

Low Bleed

Single-acting direct (relay C)	38B5786X162
Double-acting (relay A)	38B5786X082
Single-acting reverse (relay B)	38B5786X122

Figure 8-1. Terminal Box of Natural Gas Certified FIELDVUE DVC6200 Digital Valve Controller



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

Loop Connections Terminal Box (see figure 8-2 and 8-4)

DVC6200 and DVC6205

4	Terminal Box Cap
34*	O-ring ⁽¹⁾ (4)
36*	O-ring ⁽¹⁾ (4)
58	Set Screw, hex socket, SST ⁽²⁾
72	Cap Screw, hex socket, SST ⁽²⁾
164	Terminal Box Assembly

Feedback Connections Terminal Box (see figure 8-4)

DVC6205

4	Terminal Box Cap	
34*	O-ring ⁽¹⁾ (4)	
36*	O-ring ⁽¹⁾ (4)	
58	Set Screw, hex socket, SST ⁽²⁾	
62	Pipe Plug, hex hd, SST	
262	Adapter	
263*	O-ring	
	Standard	1F463606992
	Extreme temperature option, (fluorosilicone)	1F4636X0092

* Recommended spare parts

1. Available in the Elastomer Spare Parts Kit
2. Available in the Small Hardware Spare Parts Kit
3. Available in the Seal Screen Kit
4. Available in the Terminal Box Kit
5. Available in the I/P Converter Kit
8. Available in the Spare Shroud Kit

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

PWB Assembly (see figure 8-2 and 8-4) DVC6200 and DVC6205

Note

Contact your Emerson Process Management sales office for PWB Assembly FS numbers.

- | | | |
|-----|--------------------------|--|
| 50* | PWB Assembly | |
| | Standard | |
| | For instrument level AC | |
| | For instrument level HC | |
| | For instrument level AD | |
| | For instrument level PD | |
| | For instrument level ODV | |

Extreme Temperature option (fluorosilicone elastomers)

- | | | |
|--|--------------------------|--|
| | For instrument level AC | |
| | For instrument level HC | |
| | For instrument level AD | |
| | For instrument level PD | |
| | For instrument level ODV | |

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

Pressure Gauges, Pipe Plugs, or Tire Valve Assemblies (see figure 8-3) DVC6200 and DVC6205

- | | | |
|-----|---|--|
| 47* | Pressure Gauge, nickel-plated brass case, brass connection
Double-acting (3 req'd); Single-acting (2 req'd)
PSI/MPA Gauge Scale
To 60 PSI, 0.4 MPa
To 160 PSI, 1.1 MPa
PSI/bar Gauge Scale
To 60 PSI, 4 bar
To 160 PSI, 11 bar
PSI/KG/CM ² Gauge Scale
To 60 PSI, 4 KG/CM ²
To 160 PSI, 11 KG/CM ² | 18B7713X042
18B7713X022
18B7713X032
18B7713X012
18B7713X072
18B7713X082 |
| 66 | Pipe Plug, hex head
For double-acting and single-acting direct w/gauges (none req'd)
For single-acting reverse w/gauges (1 req'd)
For all units w/o gauges (3 req'd) | |
| 67 | Tire Valve, used with Tire Valve Option only
Double-acting (3 req'd); Single-acting (2 req'd) | |

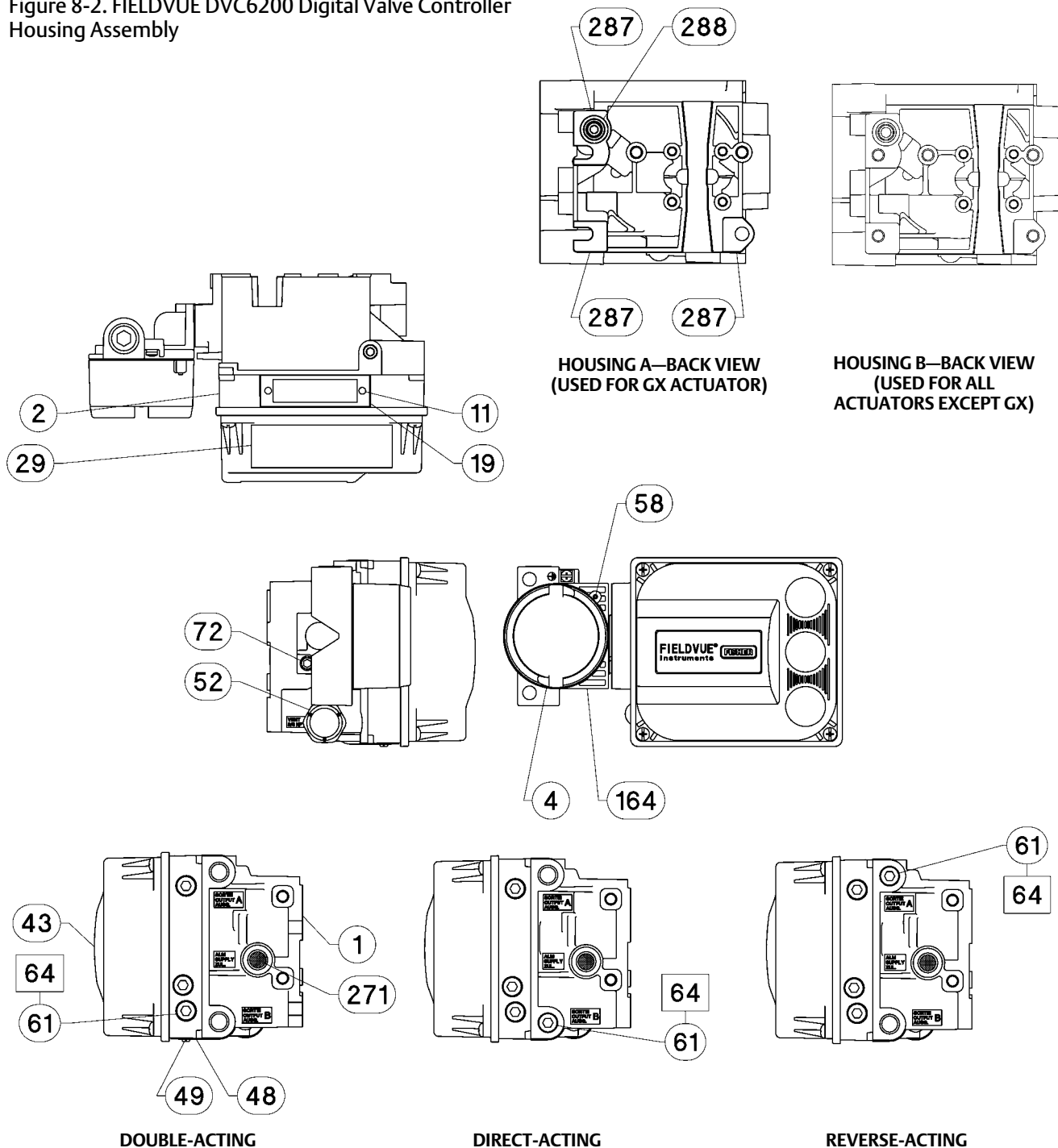
DVC6215 Feedback Unit (see figure 8-5)

- | | | |
|------|---|-------------|
| 65 | Lubricant, silicone sealant (not furnished with the instrument) | |
| 256* | O-Ring, fluorosilicone | 1K1810X0122 |

HART Filters

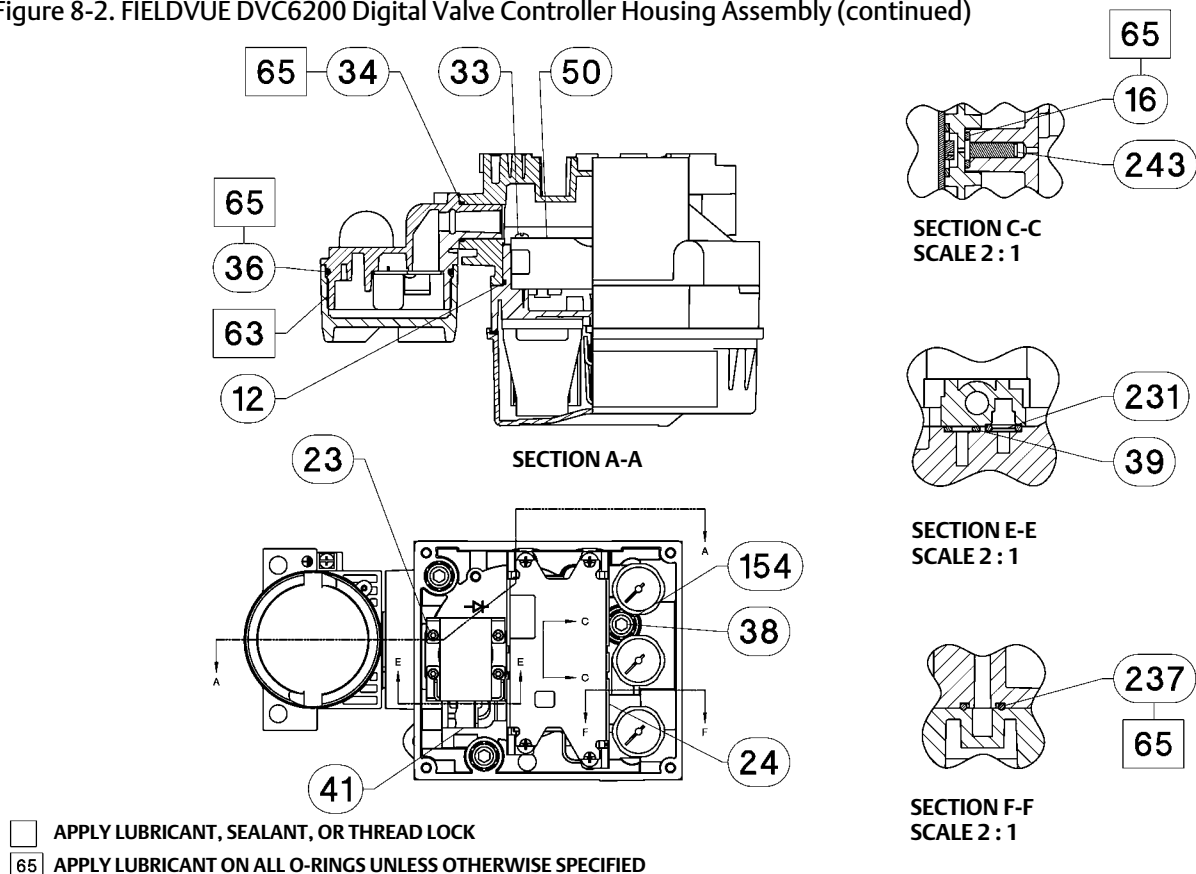
- | | |
|---|-------------|
| HF340, DIN rail mount | 39B5411X022 |
| HF341, DIN rail Mount, pass through (no filter) | 39B5412X012 |

Figure 8-2. FIELDVUE DVC6200 Digital Valve Controller Housing Assembly



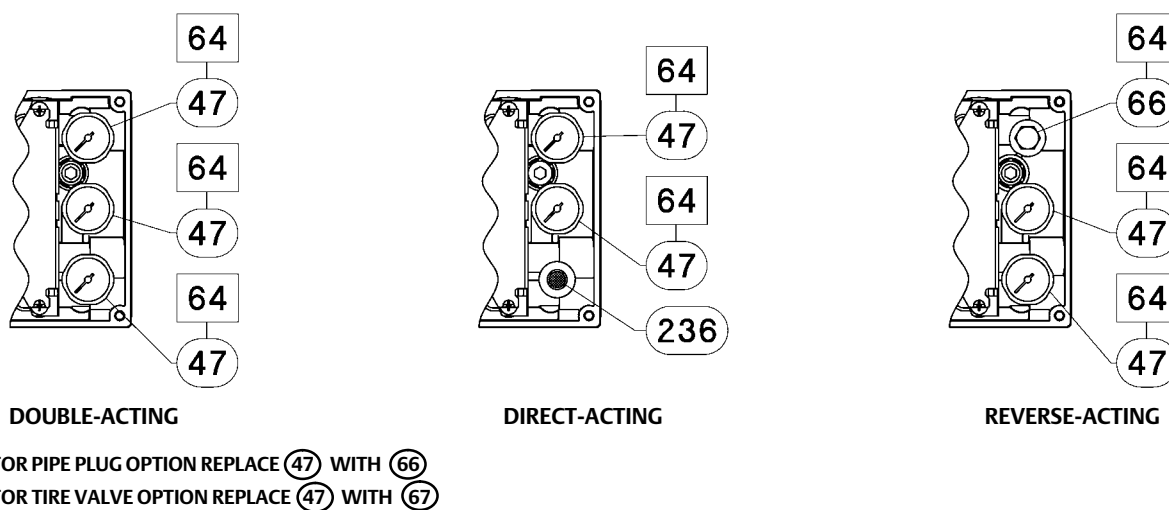
- ☐ APPLY LUBRICANT, SEALANT, OR THREAD LOCK
- ☒ 65 APPLY LUBRICANT ON ALL O-RINGS UNLESS OTHERWISE SPECIFIED

Figure 8-2. FIELDVUE DVC6200 Digital Valve Controller Housing Assembly (continued)



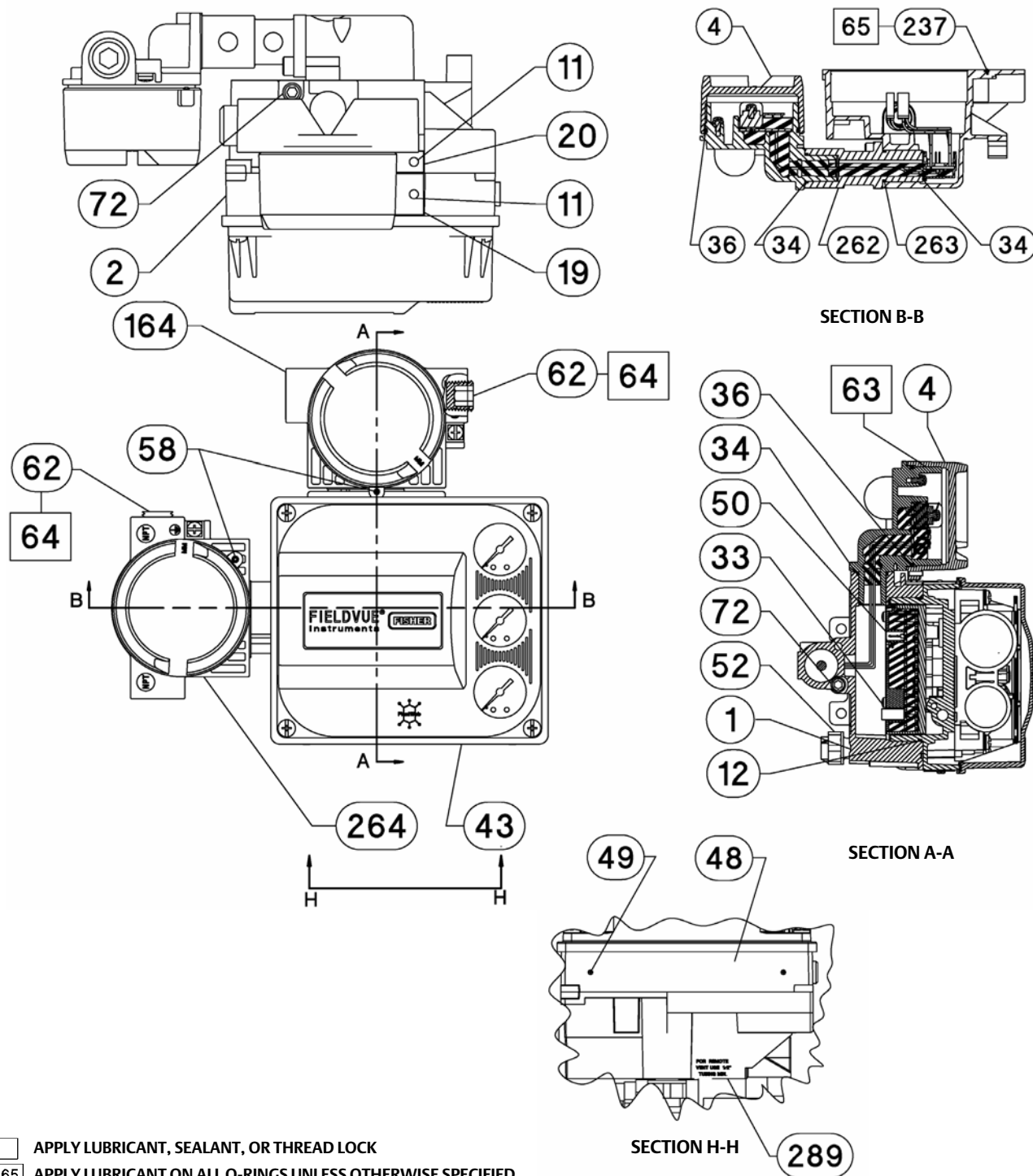
GE40185 sheet 2 of 3

Figure 8-3. Gauge Configuration



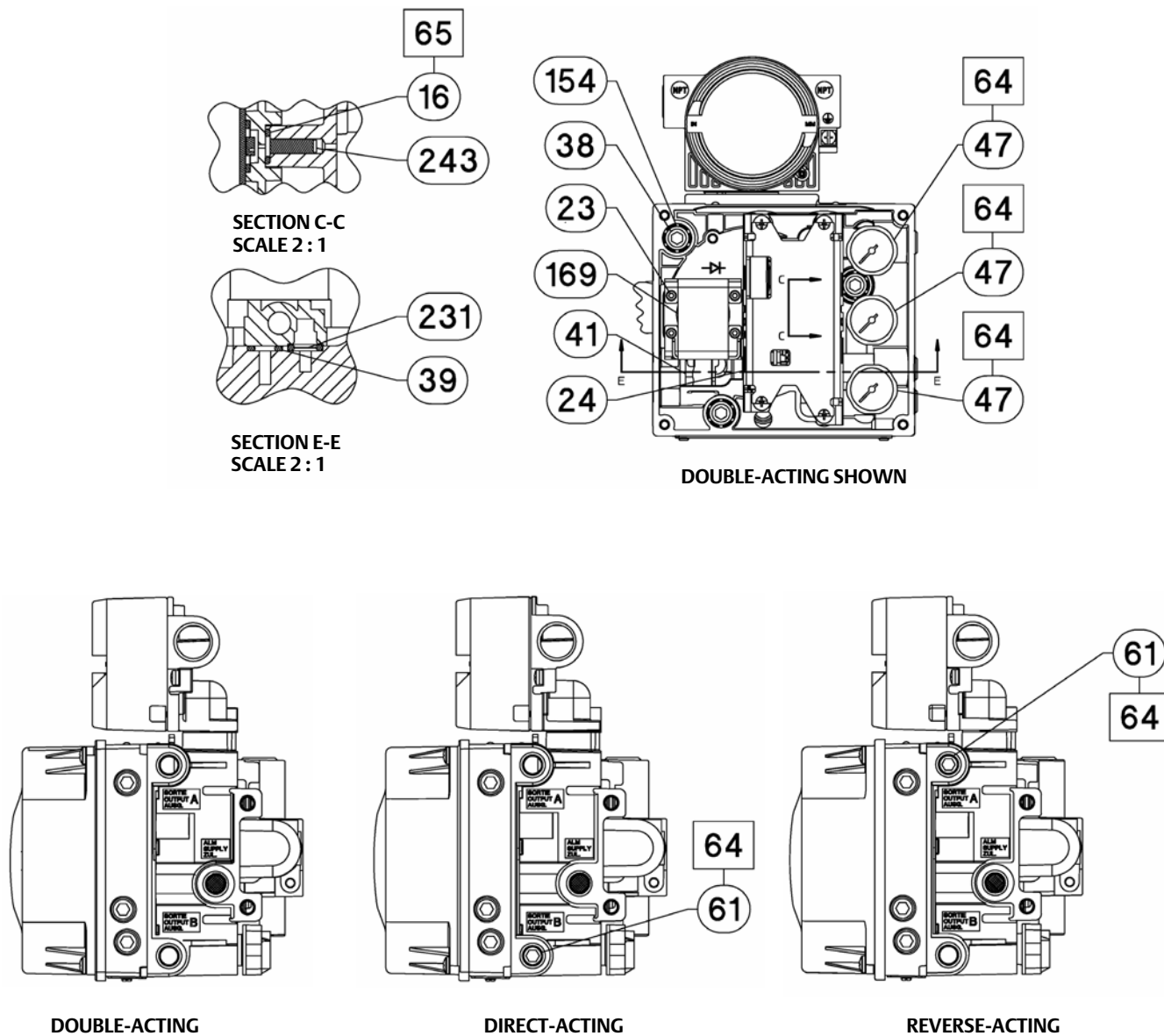
GE40185 sheet 3 of 3

Figure 8-4. FIELDVUE DVC6205 Base Unit Housing Assembly



GE40181

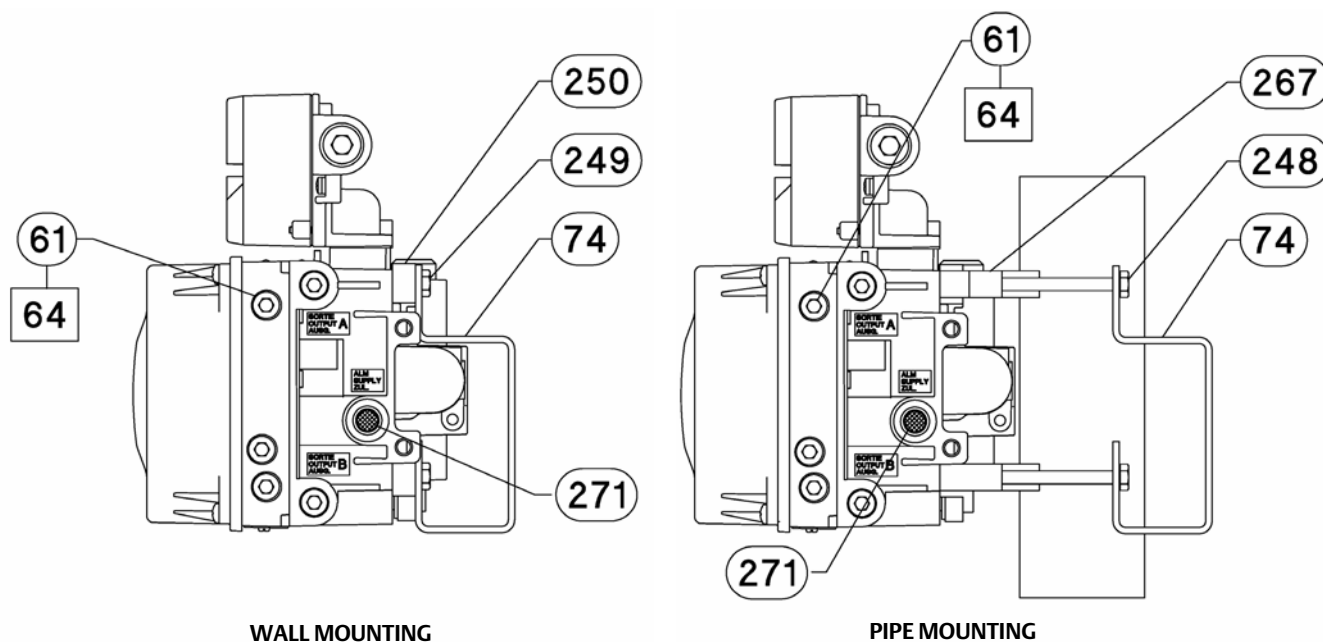
Figure 8-4. FIELDVUE DVC6205 Base Unit Housing Assembly (continued)



- APPLY LUBRICANT, SEALANT, OR THREAD LOCK
- 65 □ APPLY LUBRICANT ON ALL O-RINGS UNLESS OTHERWISE SPECIFIED

CE40181

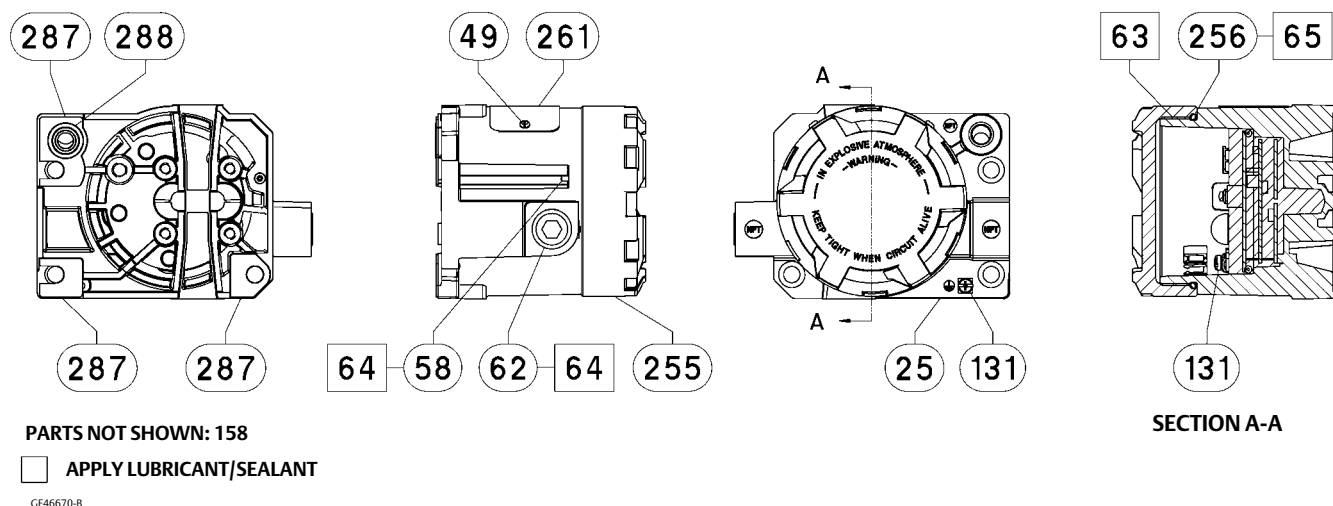
Figure 8-4. FIELDVUE DVC6205 Base Unit Housing Assembly (continued)



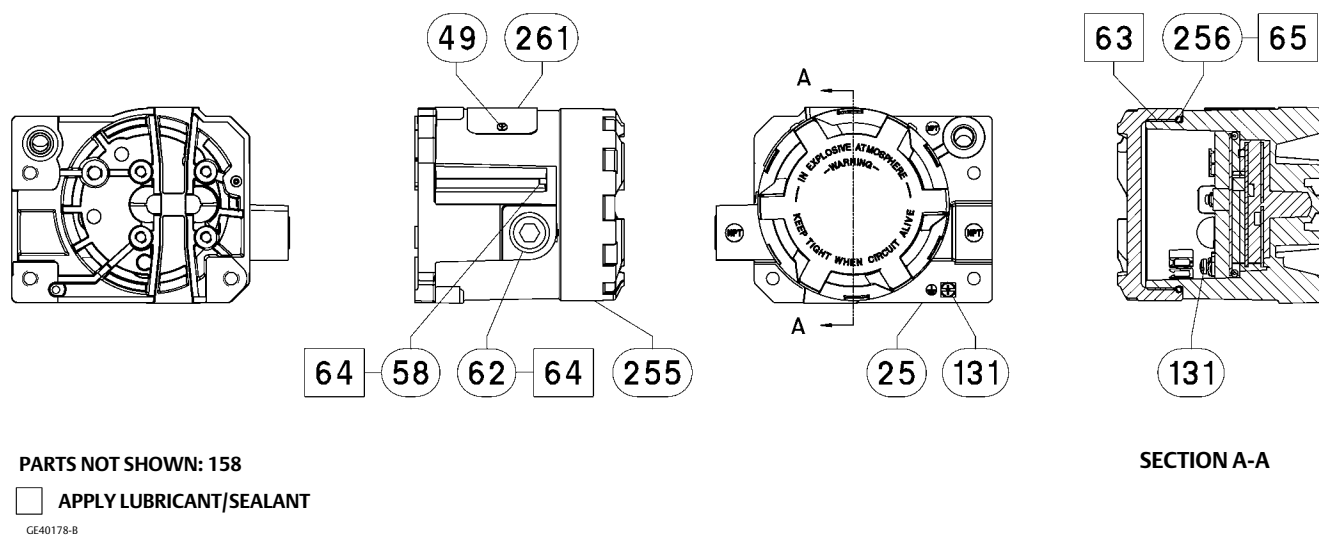
- ☐ APPLY LUBRICANT, SEALANT, OR THREAD LOCK
- ☒ 65 APPLY LUBRICANT ON ALL O-RINGS UNLESS OTHERWISE SPECIFIED

GE40181

Figure 8-5. FIELDVUE DVC6215 Remote Feedback Assembly



HOUSING A
(USED FOR GX ACTUATOR)



HOUSING B
(USED FOR ALL ACTUATORS EXCEPT GX)

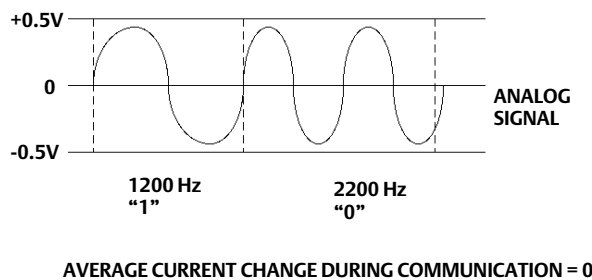
Appendix A Principle of Operation

HART Communication

The HART (Highway Addressable Remote Transducer) protocol gives field devices the capability of communicating instrument and process data digitally. This digital communication occurs over the same two-wire loop that provides the 4-20 mA process control signal, without disrupting the process signal. In this way, the analog process signal, with its faster update rate, can be used for control. At the same time, the HART protocol allows access to digital diagnostic, maintenance, and additional process data. The protocol provides total system integration via a host device.

The HART protocol uses frequency shift keying (FSK). Two individual frequencies of 1200 and 2200 Hz are superimposed over the 4-20 mA current signal. These frequencies represent the digits 1 and 0 (see figure A-1). By superimposing a frequency signal over the 4-20 mA current, digital communication is attained. The average value of the HART signal is zero, therefore no DC value is added to the 4-20 mA signal. Thus, true simultaneous communication is achieved without interrupting the process signal.

Figure A-1. HART Frequency Shift Keying Technique



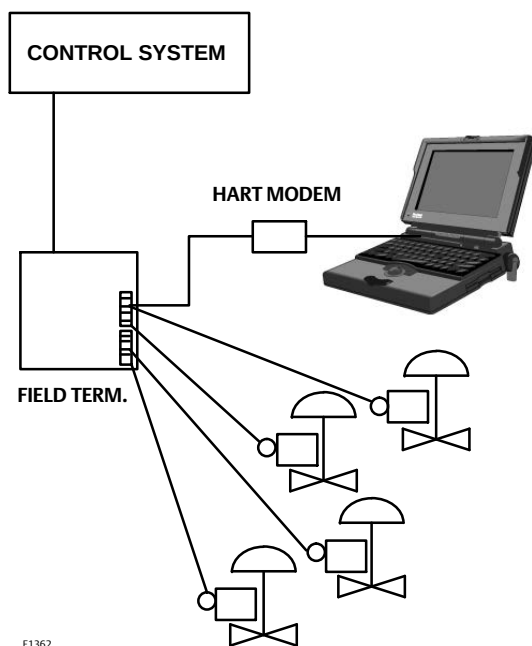
A6174

The HART protocol allows the capability of multidropping, i.e., networking several devices to a single communications line. This process is well suited for monitoring remote applications such as pipelines, custody transfer sites, and tank farms. See table 7-2 for instructions on changing the printed wiring board DIP switch configuration to multidrop.

DVC6200 Digital Valve Controller

The DVC6200 digital valve controller housing contains the travel sensor, terminal box, pneumatic input and output connections and a module base that may be easily replaced in the field without disconnecting field wiring or tubing. The module base contains the following submodules: I/P converter, printed wiring board (pwb) assembly, and pneumatic relay. The relay position is detected by sensing the magnet on the relay beam via a detector on the printed wiring board. This sensor is used for the minor loop feedback (MLFB) reading. The module base can be rebuilt by replacing the submodules. See figures A-3 and A-4.

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



E1362

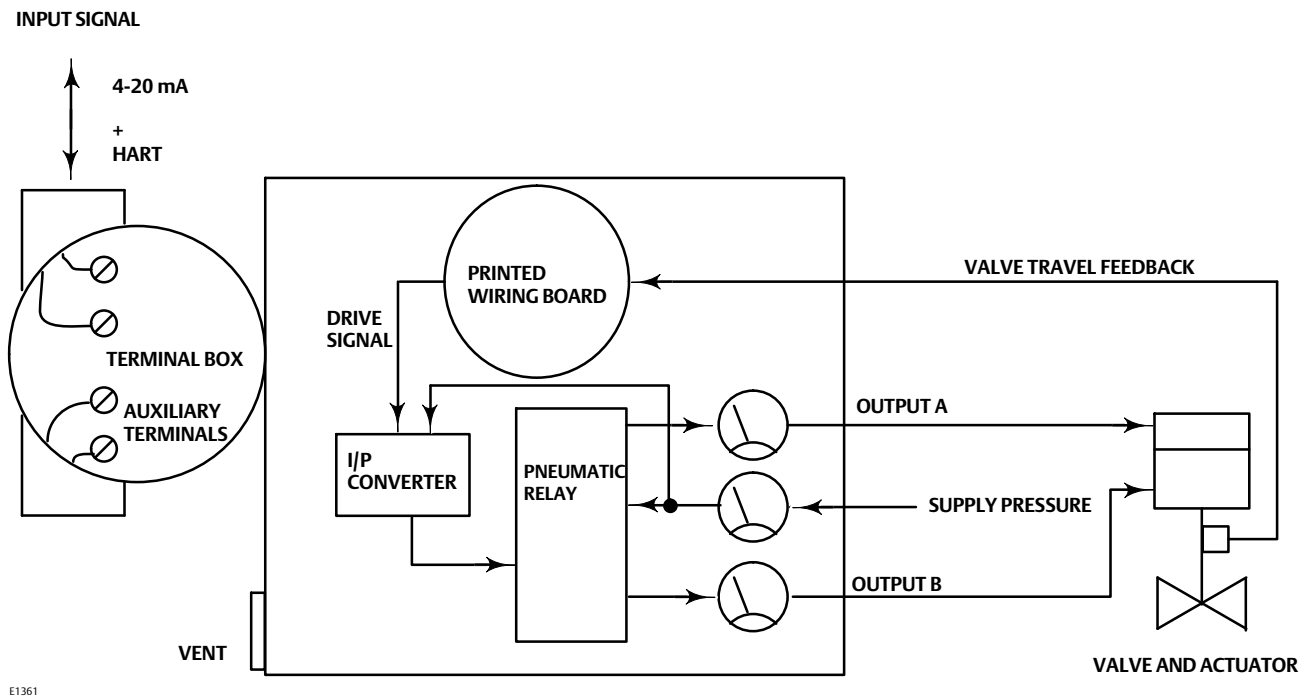
DVC6200 digital valve controllers are loop-powered instruments that provide a control valve position proportional to an input signal from the control room. The following describes a double-acting digital valve controller mounted on a piston actuator.

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

As the input signal increases, the drive signal to the I/P converter increases, increasing the I/P output pressure. The I/P output pressure is routed to the pneumatic relay submodule. The relay is also connected to supply pressure and amplifies the small pneumatic signal from the I/P converter. The relay accepts the amplified pneumatic signal and provides two output pressures. With increasing input (4 to 20 mA signal), the output A pressure always increases and the output B pressure decreases. The output A pressure is used for double-acting and single-acting direct applications. The output B pressure is used for double-acting and single-acting reverse applications. As shown in figure A-3 the increased output A pressure causes the actuator stem to move downward. Stem position is sensed by the non-contact travel feedback sensor. The stem continues to move downward until the correct stem position is attained. At this point the printed wiring board assembly stabilizes the I/P drive signal. This positions the flapper to prevent any further increase in nozzle pressure.

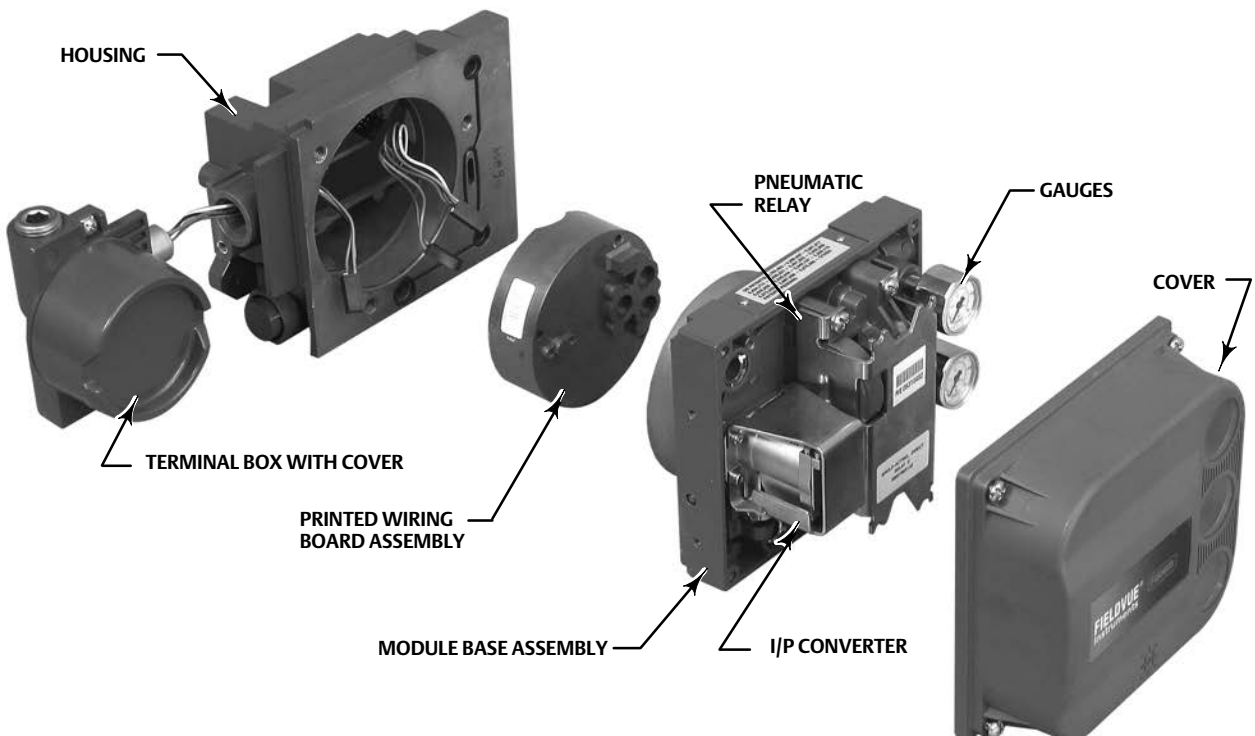
As the input signal decreases, the drive signal to the I/P converter submodule decreases, decreasing the I/P output pressure. The pneumatic relay decreases the output A pressure and increases the output B pressure. The stem moves upward until the correct position is attained. At this point the printed wiring board assembly stabilizes the I/P drive signal. This positions the flapper to prevent any further decrease in nozzle pressure.

Figure A-3. FIELDVUE DVC6200 Digital Valve Controller Block Diagram



E1361

Figure A-4. FIELDVUE DVC6200 Digital Valve Controller Assembly



W9914

Appendix B Field Communicator Menu Trees

This section contains the Field Communicator menu trees for instrument level HC, AD, PD, and ODV and instrument level AC. It also contains Fast Key Sequence tables with coordinates to help locate the function/variable on the appropriate menu tree.

Instrument Level HC, AD, PD, and ODV

Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾
A minus B	3-5-3	4-G
Actuator Style	1-2-6-4	3-D
Alert Conditions	2-1	2-F
Alert Record Full Enable	1-2-3-6-1	10-H
	1-2-3-7-1	
Alert Record has Entries Enable	1-2-3-6-2	10-H
	1-2-3-7-2	
Analog Input	3-1	2-G
Analog Input Calibration	1-3-2-2	4-E
Analog Input Range Hi	1-2-5-3-1	6-H
Analog Input Range Lo	1-2-5-3-2	6-H
Analog Input Units	1-2-5-2-3	6-G
Auto Calibration	1-3-1-1	4-E
Autocalibration in Progress Enable	1-2-4-2-2	8-H
Auxiliary Input	3-6-1	4-H
	1-2-3-3-1-2	12-D
Auxiliary Terminal Action	1-2-3-3-1-3	12-D
	1-2-5-7	4-G
Auxiliary Terminal Alert Enable	1-2-3-3-1-1	12-D
Burst Command	1-2-1-4-3	6-B
Burst Enable	1-2-1-4-1	6-B
Calibration in Progress Enable	1-2-4-2-1	8-H
Change Cutoffs	1-2-3-4-7-5	12-G
	1-2-2-2-2-3	10-C
Change Travel Limits	1-2-3-4-7-8	12-G
	1-2-2-2-2-6	10-C
Clear ALL Records	1-2-3-6-4	10-H
	1-2-3-7-4	
Command 3 Configured Pressure	1-2-1-4-3	5-A
Control Mode	Hot Key-2	1-A
	1-2-1-2	4-B
Critical NVM Shutdown	1-2-3-1-3-4	12-C
Cutoff Hi	1-2-3-4-7-3	12-F
	1-2-2-2-2-1	10-B
Cutoff Lo	1-2-3-4-7-4	10-F
	1-2-2-2-2-2	10-B
Custom Characterization Table	1-2-2-4	4-C
Cycle Counter	1-2-3-5-1-2	12-H
Cycle Counter	3-6-5	4-H
Cycle Count Alert Enable	1-2-3-5-1-1	12-H
Cycle Count Alert Point	1-2-3-5-1-3	12-H
Date	1-2-5-1-4	6-G
Dead Band (Cycle Count / Travel Accumulator)	1-2-3-5-3-1	12-H
Descriptor	1-2-5-1-3	6-F
Device Description Information	3-8	2-G
Device ID	3-7-2	2-H

Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾
Device Revision	3-7-5	2-H
Diagnostic Data Available Enable	1-2-4-2-4	8-H
Diagnostic in Progress Enable	1-2-4-2-3	8-H
Drive Current Shutdown	1-2-3-1-1	8-D
Drive Signal Alert Enable	1-2-3-1-2-1	10-D
Drive Signal	3-4	2-G
	1-2-3-1-2-2	10-D
End Point Control Enable ⁽³⁾	1-2-2-2-4-1	8-D
Failure Group Enable	1-2-3-6-5-1	10-I
	1-2-3-7-5-1	
Firmware Revision	3-7-6	2-H
Flash ROM Shutdown	1-2-3-1-3-5	12-C
Hardware Revision	3-7-7	2-H
HART Tag	1-2-5-1-1	6-F
	3-7-1	2-H
HART Universal Revision	3-7-9	2-H
Input Characterization	1-2-2-3	4-C
Instrument Date and Time	1-2-4-1-2	8-G
	1-2-5-8	4-G
Instrument Level	3-7-8	2-H
Instrument Mode	Hot Key-1	1-A
	1-2-1-1	4-B
Instrument Serial Number	1-2-5-1-6	6-G
Instrument Time Invalid Enable	1-2-4-1-1	8-G
Integral Dead Zone	1-2-4-4-4	8-I
	1-2-2-1-2-1	8-B
Integral Enable (Pressure)	1-2-2-1-3-2	8-C
Integral Enable (Travel)	1-2-2-1-1-2	8-A
Integral Gain (Pressure)	1-2-2-1-3-3	8-C
Integral Gain (Travel)	1-2-2-1-1-3	8-A
Integral Limit	1-2-4-4-3	8-I
	1-2-2-1-2-2	8-B
Integrator Saturated Hi Enable	1-2-4-4-1	8-I
Integrator Saturated Lo Enable	1-2-4-4-2	8-I
Last AutoCal Status	1-2-5-9-1	6-H
Last Calibration Type	1-2-5-9-2	6-H
Lead/Lag ⁽³⁾	1-2-2-5-3	5-D
Loop Current Validation Enable ⁽²⁾	1-2-3-3-3	9-E
Low Power Write Fail Enable	1-2-3-1-3-2	12-B
Manual Calibration	1-3-1-2	4-E
Manufacturer	3-7-3	2-H
	1-2-6-1	3-D
Maximum Recorded Temperature	2-3-1	3-F
	3-6-3	4-H
Maximum Supply Pressure	1-2-5-6	4-G
Message	1-2-5-1-2	6-F

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

1. Coordinates are to help locate the item on the menu tree on page 130 and 131.

2. Instrument level AD, PD, and ODV only.

3. Instrument level ODV only.

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

5. Instrument level HC only.

Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾
Minimum Recorded Temperature	2-3-2	3-F
	3-6-4	4-H
Miscellaneous Group Enable	1-2-3-6-5-3	10-I
	1-2-3-7-5-3	
Model	3-7-4	2-H
Multi-Drop Alert Enable	1-2-4-3-2	8-H
Non-Critical NVM Alert Enable	1-2-3-1-3-3	12-C
Number of Power Ups	2-3-4	4-G
Number of Power Ups	3-6-9	4-H
Offline/Failed Alert Enable	1-2-3-1-3-1	12-B
Partial Stroke Test ⁽³⁾	2-5	2-F
Partial Stroke Test Enable ⁽³⁾	1-2-7-1	3-D
Partial Stroke Test Pressure Limit ⁽³⁾	1-2-3-6-1	10-G
Partial Stroke Test Start Point ⁽³⁾	1-2-2-2-5-2	8-D
Partial Stroke Test Variables View/Edit ⁽³⁾	1-2-7-2	3-D
Performance Tuner ⁽²⁾	1-1-2	2-B
	1-2-2-1-1-5	8-A
Polling Address	1-2-5-1-7	6-G
Pressure A	3-5-1	4-G
Pressure B	3-5-2	4-G
Pressure Control Active Enable	1-2-4-3-1	8-H
Pressure Deviation Alert Enable ⁽³⁾	1-2-3-6-2	10-G
Pressure Deviation Alert Point ⁽³⁾	1-2-3-6-3	10-G
Pressure Deviation Time ⁽³⁾	1-2-3-6-4	10-G
Pressure Range Hi	1-2-2-2-3-1	10-D
Pressure Range Lo	1-2-2-2-3-2	10-D
Pressure Sat Time ⁽³⁾	1-2-2-2-4-4	8-D
Pressure Sensor Shutdown ⁽²⁾	1-2-3-2-3	12-C
Pressure Sensors—Calibration	1-3-2-1	4-E
Pressure Set Point ⁽³⁾	1-2-2-2-5-3	8-D
Pressure Tuning Set	1-2-2-1-3-1	10-B
Pressure Units	1-2-5-2-1	6-G
Protection	Hot Key-3	1-A
	1-2-1-5	4-B
Raw Travel Input	3-6-7	4-H
Reference Voltage Shutdown	1-2-3-1-3-7	12-C
Relay Adjust	1-3-3	3-E
Relay Type	1-2-5-4	4-F
Restart Control Mode	1-2-1-3	4-B
Restore Factory Settings	1-3-4	3-E
Setpoint (Travel)	1-2-3-4-2	9-E
	3-2	2-G
Set Point Rate Close	1-2-2-5-2	5-D
Set Point Rate Open	1-2-2-5-1	5-D
Setup Wizard	1-1-1	2-B
Stabilize/Optimize	Hot Key-4	1-A
	1-1-2 ⁽⁵⁾	2-B
	1-2-2-1-1-4	8-A

Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾
Status	2-2	2-F
Stroke Valve	2-4	2-F
Supply ⁽²⁾	3-5-4	4-G
	1-2-3-3-2-2	12-D
Supply Pressure Lo Alert Enable ⁽²⁾	1-2-3-3-2-1	12-D
Supply Pressure Lo Alert Point ⁽²⁾	1-2-3-3-2-3	12-D
Temperature	3-6-2	4-H
Temperature Sensor Shutdown	1-2-3-2-2	12-C
Temperature Units	1-2-5-2-2	6-G
Travel	3-3	2-G
	1-2-3-4-1	9-E
Travel / Pressure Select	1-2-2-2-1	5-C
Travel Accumulator	3-6-6	4-H
	1-2-3-5-3-2	12-H
Travel Accumulator Alert Enable	1-2-3-5-3-1	12-I
Travel Accumulator Alert Point	1-2-3-5-3-3	12-I
Travel Alert Dead Band	1-2-3-4-3	9-E
Travel Alert Hi Enable	1-2-3-4-6-1	10-F
Travel Alert Hi Hi Enable	1-2-3-4-5-1	12-E
Travel Alert Hi Hi Point	1-2-3-4-5-3	12-F
Travel Alert Hi Point	1-2-3-4-6-3	10-F
Travel Alert Lo Enable	1-2-3-4-6-2	10-F
Travel Alert Lo Lo Enable	1-2-3-4-5-2	12-E
Travel Alert Lo Lo Point	1-2-3-4-5-4	12-F
Travel Alert Lo Point	1-2-3-4-6-4	10-F
Travel Deviation Alert Enable	1-2-3-4-4-1	10-E
Travel Deviation Alert Point	1-2-3-4-4-2	10-E
Travel Deviation Time	1-2-3-4-4-3	10-E
Travel Limit/Cutoff Hi Alert Enable	1-2-3-4-7-1	12-F
Travel Limit/Cutoff Lo Alert Enable	1-2-3-4-7-2	12-F
Travel Limit Hi	1-2-3-4-7-6	12-G
	1-2-2-2-2-4	10-C
Travel Limit Lo	1-2-3-4-7-7	12-G
	1-2-2-2-2-3	10-C
Travel Sensor Motion	1-2-6-5	3-E
Travel Sensor Shutdown	1-2-3-2-1	12-C
Travel Tuning Set	1-2-2-1-1-1	10-A
Valve Group Enable	1-2-3-6-5-2	10-I
	1-2-3-7-5-2	
Valve Serial Number	1-2-5-1-5	6-F
	1-2-6-2	3-D
Valve Style	1-2-6-3	3-D
View Alert Records	1-2-3-6-3	10-H
	1-2-3-7-3	
View/Edit Feedback Connection	1-2-6-6	3-E
View/Edit Lag Time ⁽⁴⁾	1-2-2-5-3	5-D
View Number of Days Powered Up	2-3-3	3-F
	3-6-8	4-I
Zero Power Condition	1-2-5-5	4-G

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

1. Coordinates are to help locate the item on the menu tree on page 130 and 131.

2. Instrument level AD, PD, and ODV only.

3. Instrument level ODV only.

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

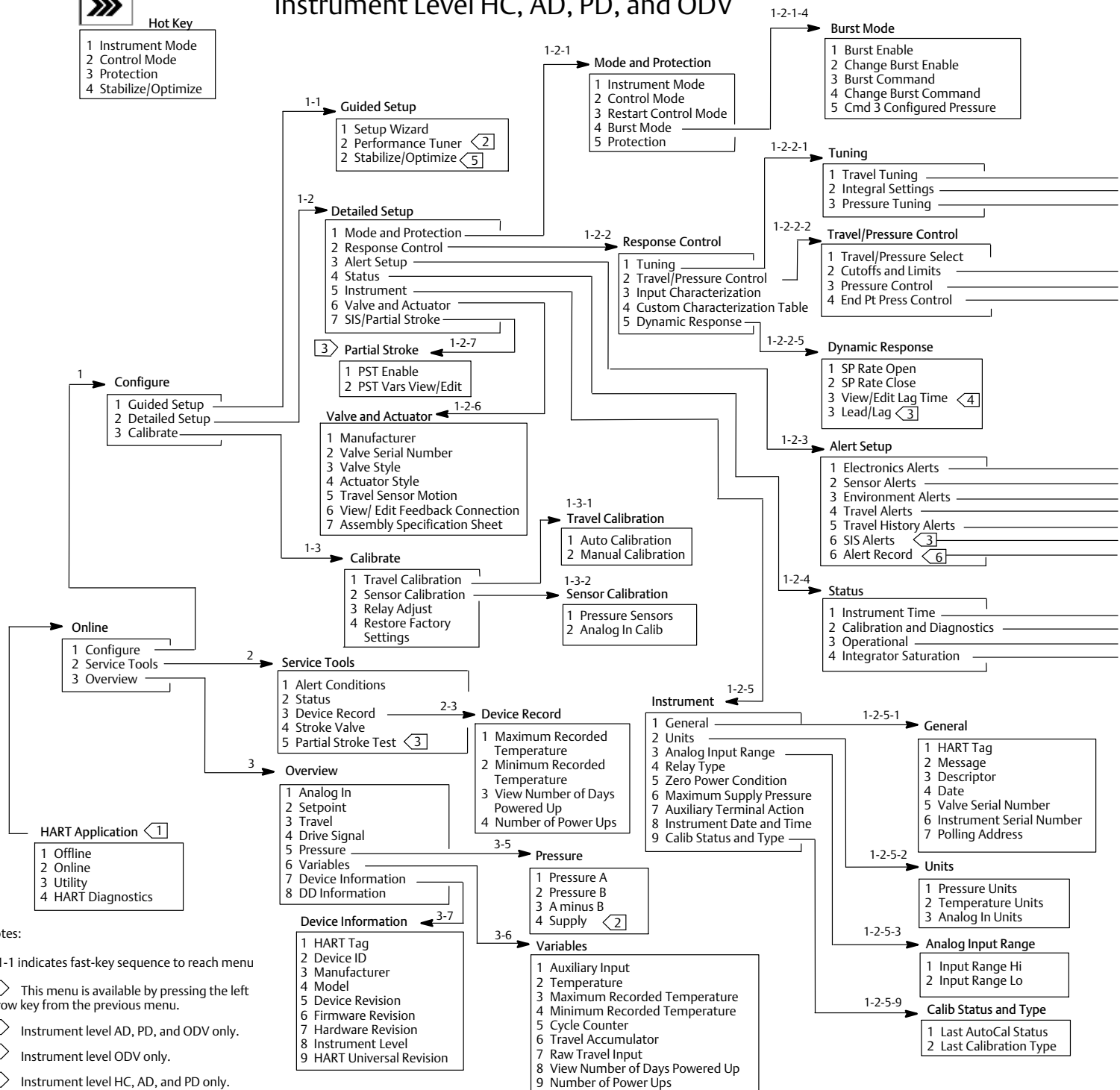
5. Instrument level HC only.

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



Hot Key

- 1 Instrument Mode
- 2 Control Mode
- 3 Protection
- 4 Stabilize/Optimize



Notes:

1-1-1 indicates fast-key sequence to reach menu
 [1] This menu is available by pressing the left arrow key from the previous menu.

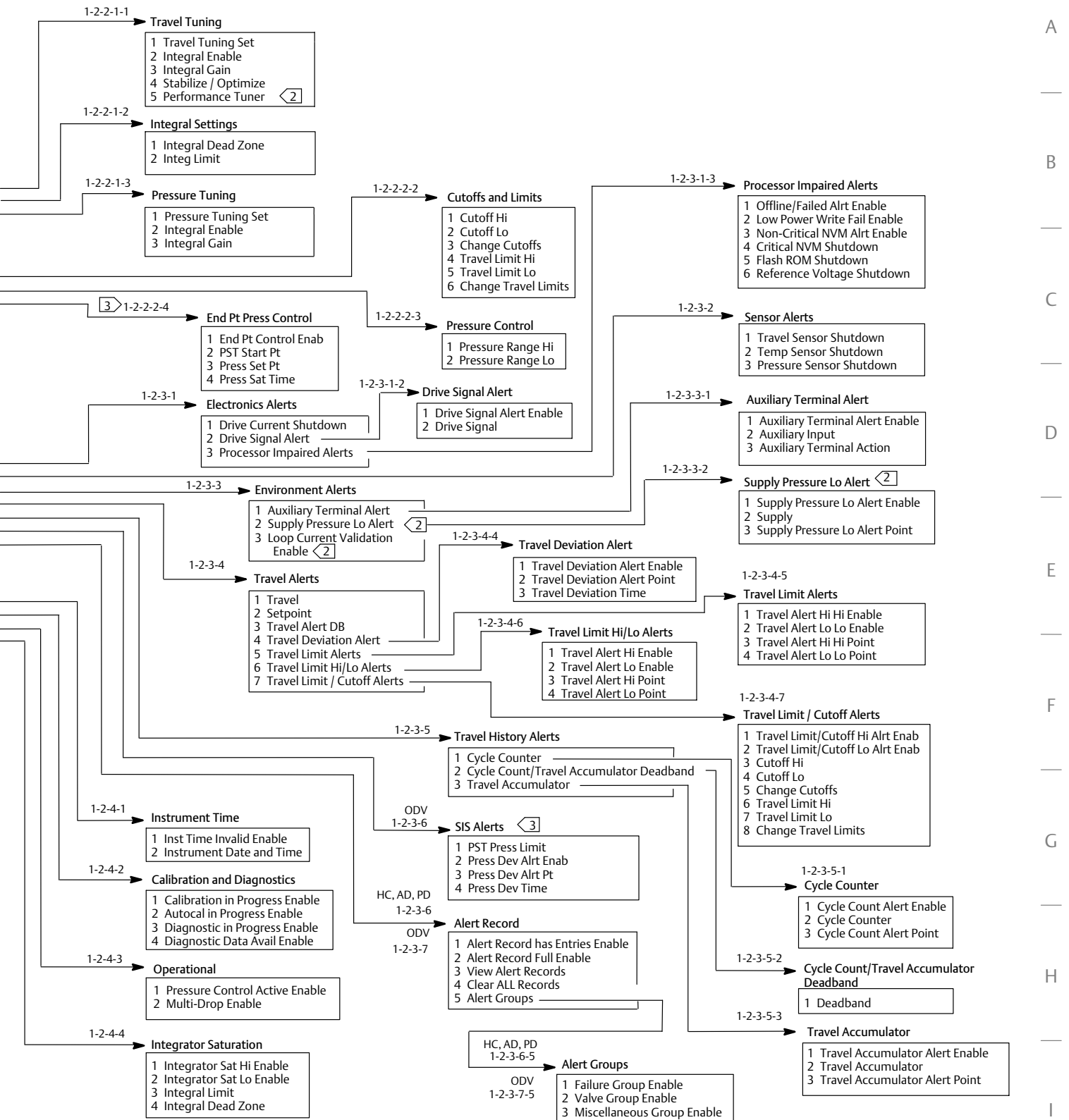
[2] Instrument level AD, PD, and ODV only.

[3] Instrument level ODV only.

[4] Instrument level HC, AD, and PD only.

[5] Instrument level HC only.

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



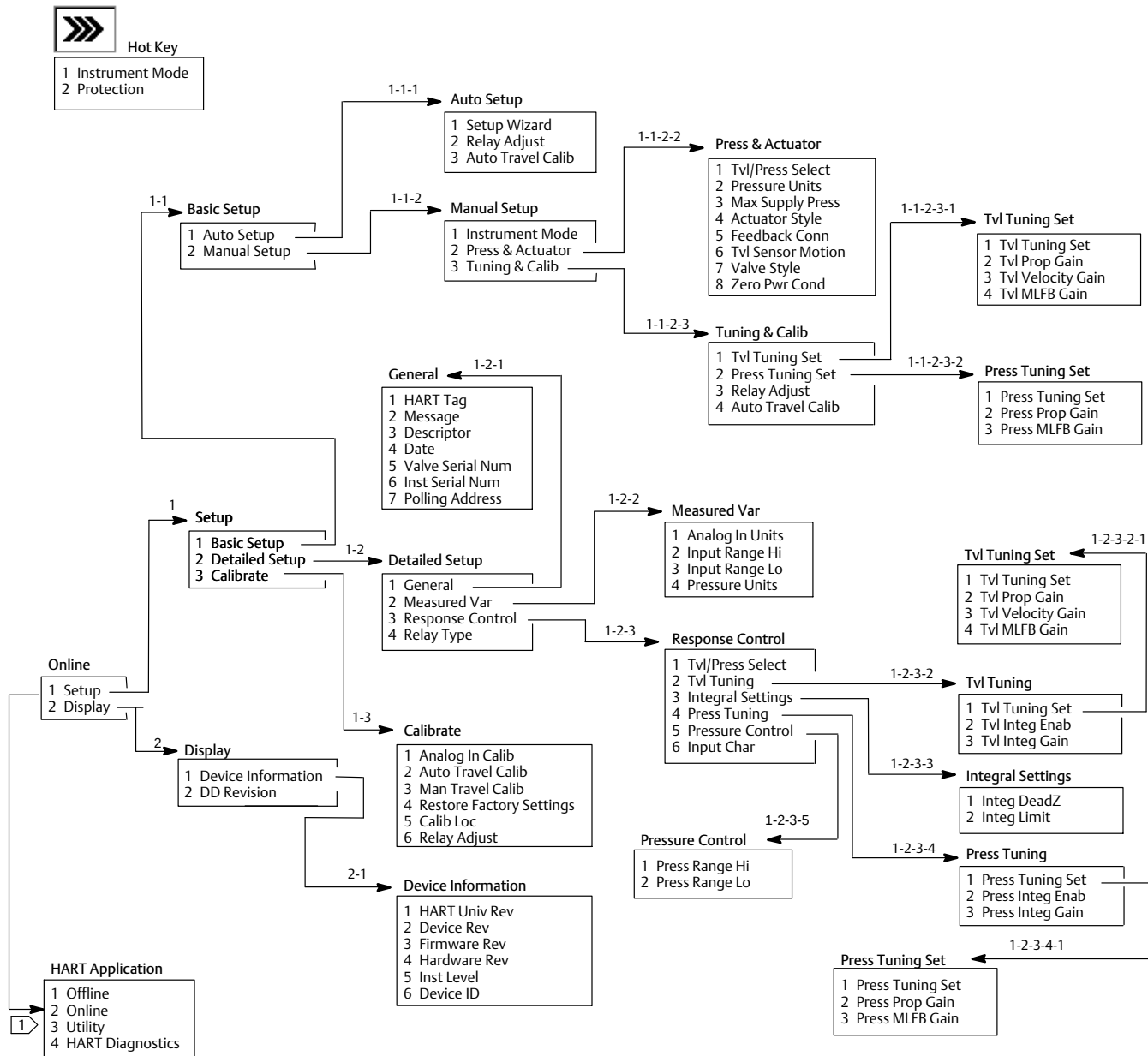
Instrument Level AC

Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾
Actuator Style	1-1-2-2-4	4-C
Analog Input Calibration	1-3-1	3-F
Analog Input Range Hi	1-2-2-2	4-E
Analog Input Range Lo	1-2-2-3	4-E
Analog Input Units	1-2-2-1	4-E
Auto Travel Calibration	1-1-2-3-4	4-D
	1-3-2	3-F
	1-1-1-3	3-C
Calibration Location	1-3-5	3-G
Date	1-2-1-4	3-D
Descriptor	1-2-1-3	3-D
Device Description Revision	2-2	2-F
Device Identification	2-1-6	3-H
Device Revision	2-1-2	3-G
Feedback Connection	1-1-2-2-5	4-C
Firmware Revision	2-1-3	3-G
Hardware Revision	2-1-4	3-G
HART Tag	1-2-1-1	3-D
HART Universal Revision	2-1-1	3-G
Input Characterization	1-2-3-6	4-F
Instrument Level	2-1-5	3-H
Instrument Mode	Hot Key-1	1-B
	1-1-2-1	3-C
Instrument Serial Number	1-2-1-6	3-D
Integral Dead Zone	1-2-3-3-1	6-F
Integral Limit	1-2-3-3-2	6-F
Manual Travel Calibration	1-3-3	3-F
Maximum Supply Pressure	1-1-2-2-3	4-C
Message	1-2-1-2	3-D
Polling Address	1-2-1-7	3-E
Pressure Integral Control Enable	1-2-3-4-2	6-G
Pressure Integral Gain	1-2-3-4-3	6-G
Pressure MLFB Gain	1-1-2-3-2-3	6-D
	1-2-3-4-1-3	5-H

Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾
Pressure Proportional Gain	1-1-2-3-2-2	6-D
	1-2-3-4-1-2	5-H
Pressure Range Hi	1-2-3-5-1	4-G
Pressure Range Lo	1-2-3-5-2	4-G
Pressure Tuning Set	1-1-2-3-2-1	6-D
	1-2-3-4-1-1	6-G
Pressure Units	1-1-2-2-2	4-C
	1-2-2-4	4-E
Protection	Hot Key-2	1-B
Relay Adjust	1-1-1-2	3-B
	1-1-2-3-3	4-D
	1-3-6	3-G
Relay Type	1-2-4	3-E
Restore Factory Settings	1-3-4	3-F
Setup Wizard	1-1-1-1	3-D
Travel Integral Gain	1-2-3-2-3	6-F
Travel Integral Enable	1-2-3-2-2	6-F
Travel MLFB Gain	1-1-2-3-1-4	6-C
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1. Coordinates are to help locate the item on the menu tree on page 133.

Field Communicator Menu Tree for Instrument Level AC



Notes:

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

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

Glossary

Alert Point

An adjustable value that, when exceeded, activates an alert.

Algorithm

A set of logical steps to solve a problem or accomplish a task. A computer program contains one or more algorithms.

Alphanumeric

Consisting of letters and numbers.

Analog Input Units

Units in which the analog input is displayed and maintained in the instrument.

ANSI (acronym)

The acronym ANSI stands for the American National Standards Institute

ANSI Class

Valve pressure/temperature rating.

Auxiliary Input Alert

Checks the status of the auxiliary input; a discrete input. When enabled, the Auxiliary Input Alert is active when the auxiliary input terminals are open or closed (shorted), depending upon the selection for Auxiliary Input Alert State.

Auxiliary Terminal (Indicator)

Indicates whether auxiliary wiring terminals are open or closed (such as by an external switch contact).

Bench Set

Pressure, supplied to an actuator, required to drive the actuator through rated valve travel. Expressed in pounds per square inch.

Byte

A unit of binary digits (bits). A byte consists of eight bits.

Calibration Location

Where the instrument was last calibrated; either in the factory or in the field.

Configuration

Stored instructions and operating parameters for a FIELDVUE Instrument.

Control Loop

An arrangement of physical and electronic components for process control. The electronic components of the loop continuously measure one or more aspects of the process, then alter those aspects as necessary to achieve a desired process condition. A simple control loop measures only one variable. More sophisticated control loops measure many variables and maintain specified relationships among those variables.

Control Mode

Defines where the instrument reads its set point. The following control modes are available for a FIELDVUE Instrument:

Analog The instrument receives its travel set point over the 4-20 mA loop.

Digital The instrument receives its set point digitally, via the HART communications link.

Test This is not a user-selectable mode. The Field Communicator or ValveLink software places the instrument in this mode whenever it needs to move the valve, such as for calibration or diagnostic tests.

Control Mode, Restart

Determines the instrument control mode after a restart. See Control Mode for the available restart control modes.

Controller

A device that operates automatically to regulate a controlled variable.

Current-to-Pressure (I/P) Converter

An electronic component or device that converts a milliamp signal to a proportional pneumatic pressure output signal.

Cycle Counter

The capability of a FIELDVUE instrument to record the number of times the travel changes direction. The change in direction must occur after the deadband has been exceeded before it can be counted as a cycle.

Cycle Counter Alert

Checks the difference between the Cycle Counter and the Cycle Counter Alert Point. Cycle Counter Alert is active when the cycle counter value exceeds the Cycle Counter Alert Point. It clears after you reset the Cycle Counter to a value less than the alert point.

Cycle Counter Alert Point

An adjustable value which, when exceeded, activates the Cycle Counter Alert. Valid entries are 0 to 4 billion cycles.

Cycle Counter Deadband

Region around the travel reference point, in percent of ranged travel, established at the last increment of the Cycle Counter. The deadband must be exceeded before a change in travel can be counted as a cycle. Valid entries are 0% to 100%. Typical value is between 2% and 5%.

Deviation

Usually, the difference between set point and process variable. More generally, any departure from a desired or expected value or pattern.

Device ID

Unique identifier embedded in the instrument at the factory.

Device Revision

Revision number of the interface software that permits communication between the Field Communicator and the instrument.

Drive Signal

The signal to the I/P converter from the printed wiring board. It is the percentage of the total microprocessor effort needed to drive the valve fully open.

Drive Signal Alert

Checks the drive signal and calibrated travel. If one of the following conditions exists for more than 20 seconds, the Drive Signal Alert is active. If none of the conditions exist, the alert is cleared.

If Zero Power Condition = Closed

The alert is active when:

drive signal <10% and calibrated travel >3%

drive signal >90% and calibrated travel <97%

If Zero Power Condition = Open

The alert is active when:

drive signal <10% and calibrated travel <97%

drive signal >90% and calibrated travel >3%

Equal Percentage

A valve flow characteristic where equal increments of valve stem travel produce equal percentage changes in existing flow. One of the input characteristics available for a FIELDVUE Instrument. See also, Linear and Quick Opening.

Feedback 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.

Firmware Revision

The revision number of the instrument firmware. Firmware is a program that is entered into the instrument at time of manufacture and cannot be changed by the user.

Free Time

Percent of time that the microprocessor is idle. A typical value is 25%. The actual value depends on the number of functions in the instrument that are enabled and on the amount of communication currently in progress.

Full Ranged Travel

Current, in mA, that corresponds with the point where ranged travel is maximum, i.e., limited by the mechanical travel stops.

Gain

The ratio of output change to input change.

Hardware Revision

Revision number of the Fisher Controls instrument hardware. The physical components of the instrument are defined as the hardware.

HART (acronym)

The acronym HART stands for Highway Addressable Remote Transducer.

HART Tag

An eight-character name that identifies the physical instrument.

HART Universal Revision

Revision number of the HART Universal Commands which are the communications protocol for the instrument.

Input Characteristic

The relationship between the ranged travel and ranged input. Possible values include: linear, equal percentage, and quick opening.

Input Current

The current signal from the control system that serves as the analog input to the instrument. See also Input Signal.

Input Range

The analog input signal range that corresponds to the travel range.

Input Signal

The current signal from the control system. The input signal can be displayed in milliamperes or in percent of ranged input.

Instrument Level

Determines the functions available for the instrument. See table 6-2, page 95.

Instrument Mode

Determines if the instrument responds to its analog input signal. There are two instrument modes:

In Service: For a fully functioning instrument, the instrument output changes in response to analog input changes. Typically changes to setup or calibration cannot be made when the instrument mode is In Service.

Out of Service: The instrument output does not change in response to analog input changes when the instrument mode is Out of Service. Some setup parameters can be changed only when the instrument mode is Out of Service.

Instrument Protection

Determines if commands from a HART device can calibrate and/or configure certain parameters in the instrument. There are two types of instrument protection:

Configuration and Calibration: Prohibits changing protected setup parameters; prohibits calibration.

None: Permits both configuration and calibration. The instrument is "unprotected."

Instrument Serial Number

The serial number assigned to the printed wiring board by the factory but can be changed during setup. The instrument serial number should match the serial number on the instrument nameplate.

Leak Class

Defines the allowable leakage by a valve when it is closed. Leak class numbers are listed in two standards: ANSI/FCI 70-2 and IEC 534-4.

Linear

A valve flow characteristic where changes in flow rate are directly proportional to changes in valve stem travel. One of the input characteristics available for a FIELDVUE Instrument. See also, Equal Percentage and Quick Opening.

Linearity, dynamic

Linearity (independent) is the maximum deviation from a straight line best fit to the opening and closing curves and a line representing the average value of those curves.

Memory

A type of semiconductor used for storing programs or data. FIELDVUE instruments use three types of memory: Random Access Memory (RAM), Read Only Memory (ROM), and Non-Volatile Memory (NVM). See also these listings in this glossary.

Menu

A list of programs, commands, or other activities that you select by using the arrow keys to highlight the item then pressing ENTER, or by entering the numeric value of the menu item.

Minimum Closing Time

Minimum time, in seconds, for the travel to decrease through the entire ranged travel. This rate is applied to any travel decrease. Valid entries are 0 to 400 seconds. Deactivate by entering a value of 0 seconds.

Minimum Opening Time

Minimum time, in seconds, for the travel to increase through the entire ranged travel. This rate is applied to any travel increase. Because of friction, actual valve travel may not respond in exactly the same time frame. Valid entries are 0 to 400 seconds. Deactivate by entering a value of 0 seconds.

Non-Volatile Memory (NVM)

A type of semiconductor memory that retains its contents even though power is disconnected. NVM contents can be changed during configuration unlike ROM which can be changed only at time of instrument manufacture. NVM stores configuration restart data.

Parallel

Simultaneous: said of data transmission on two or more channels at the same time.

Polling Address

Address of the instrument. If the digital valve controller is used in a point-to-point configuration, set the polling address to 0. If it is used in a multidrop configuration, or split range application, set the polling address to a value from 0 to 15.

Pressure Sensor

A FIELDVUE instrument internal device that senses pneumatic pressure. The DVC6200 has three pressure sensors: one to sense supply pressure and two to sense the output pressures.

Primary Master

Masters are communicating devices. A primary master is a communicating device permanently wired to a field instrument. Typically, a HART-compatible control system or a computer running ValveLink software is the primary master.

In contrast, a secondary master is not often permanently wired to a field instrument. The Field Communicator or a computer running ValveLink software communicating through a HART modem could be considered a secondary master.

Note: If one type of master takes an instrument Out Of Service, the same type must put it In Service. For example, if a device set up as a primary master takes an instrument Out Of Service, a device set up as a primary master must be used to place the instrument In Service.

Quick Opening

A valve flow characteristic where most of the change in flow rate takes place for small amounts of stem travel from the closed position. The flow characteristic curve is basically linear through the first 40 percent of stem travel. One of the input characteristics available for a FIELDVUE Instrument. See also, Equal Percentage and Linear.

Random Access Memory (RAM)

A type of semiconductor memory that is normally used by the microprocessor during normal operation that permits rapid retrieval and storage of programs and data. See also Read Only Memory (ROM) and Non-Volatile Memory (NVM).

Rate

Amount of change in output proportional to the rate of change in input.

Read-Only Memory (ROM)

A memory in which information is stored at the time of instrument manufacture. You can examine but not change ROM contents.

Seat Load

Force exerted on the valve seat, typically expressed in pounds force per lineal inch of port circumference. Seat load is determined by shutoff requirements.

Set Point Filter Time (Lag Time)

The time constant, in seconds, for the first-order input filter. The default of 0 seconds will bypass the filter.

Software

Microprocessor or computer programs and routines that reside in alterable memory (usually RAM), as opposed to firmware, which consists of programs and routines that are programmed into memory (usually ROM) when the instrument is manufactured. Software can be manipulated during normal operation, firmware cannot.

Stroking Time

The time, in seconds, required to move the valve from its fully open position to fully closed, or vice versa.

Temperature Sensor

A device within the FIELDVUE instrument that measures the instrument's internal temperature.

Travel

Movement of the valve stem or shaft which changes the amount the valve is open or closed.

Travel Accumulator

The capability of a FIELDVUE instrument to record total change in travel. The value of the Travel Accumulator increments when the magnitude of the change exceeds the Travel Accumulator Deadband. To reset the Travel Accumulator, set it to zero.

Travel Accumulator Alert

Checks the difference between the Travel Accumulator value and the Travel Accumulator Alert Point. The Travel Accumulator Alert is active when the Travel Accumulator value exceeds the Travel Accumulator Alert Point. It clears after you reset the Travel Accumulator to a value less than the alert point.

Travel Accumulator Alert Point

An adjustable value which, when exceeded, activates the Travel Accumulator Alert. Valid entries are 0% to 4 billion %.

Travel Accumulator Deadband

Region around the travel reference point established at the last increment of the accumulator. This region must be exceeded before a change in travel can be accumulated. Valid entries are 0% to 100%.

Travel Alert

Checks the ranged travel against the travel high and low alert points. The travel alert is active if either the high or low point is exceeded. Once a high or low point is exceeded, the ranged travel must clear that point by the Travel Alert Deadband before the alert clears. Four travel alerts are available: Travel Alert Hi, Travel Alert Lo, Travel Alert Hi Hi, and Travel Alert Lo Lo.

Travel Alert Deadband

Travel, in percent of ranged travel, required to clear a travel alert, once it is active. Valid entries are -25% to 125%.

Travel Alert High Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Hi alert. Valid entries are -25% to 125%.

Travel Alert High High Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Hi Hi alert. Valid entries are -25% to 125%.

Travel Alert Low Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Lo Lo alert. Valid entries are -25% to 125%.

Travel Alert Low Low Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Lo Lo alert. Valid entries are -25% to 125%.

Travel Cutoff

Defines the cutoff point for the travel, in percent of ranged travel. There are two travel cutoffs: high and low. Once travel exceeds the cutoff, the drive signal is set to either maximum or minimum, depending on the Zero Control Signal and if the cutoff is high or low. Minimum opening time or minimum closing time are not in effect while the travel is beyond the cutoff. Use the travel cutoff to obtain the desired seat load or to be sure the valve is fully open.

Travel Deviation

The difference between the analog input signal (in percent of ranged input), the “target” travel, and the actual “ranged” travel.

Travel Deviation Alert

Checks the difference between the target and the ranged travel. If the difference exceeds the Travel Deviation Alert Point for more than the Travel Deviation Time, the Travel Deviation Alert is active. It remains active until the difference is less than the Travel Deviation Alert Point.

Travel Deviation Alert Point

An adjustable value for the target travel and the ranged travel difference, expressed in percent. When this value is exceeded by the travel deviation for more than the Travel Deviation Time, the Travel Deviation Alert is active. Valid entries are 0% to 100%. Typically this is set to 5%.

Travel Deviation Time

The time, in seconds, that the travel deviation must exceed the Travel Deviation Alert Point before the alert is active. Valid entries are 1 to 60 seconds.

Travel Limit

A setup parameter that defines the maximum allowable travel (in percent of ranged travel) for the valve. During operation, the travel target will not exceed this limit. There are two travel limits: high and low. Typically the travel limit low will be used to keep the valve from going completely closed.

Travel Range

Travel, in percent of calibrated travel, that corresponds to the input range.

Travel Sensor

A device within the FIELDVUE instrument that senses valve stem or shaft movement. The travel sensor in the DVC6200 is the Hall Effect sensor that measures the position of the magnetic assembly.

Travel Sensor Motion

Increasing or decreasing air pressure causes the magnet assembly to move up or down or the rotary shaft to turn clockwise or counterclockwise. The Setup Wizard asks if it can move the valve to determine travel.

Tuning

The adjustment of control terms or parameter values to produce a desired control effect.

Tuning Set

Preset values that identify gain settings for a FIELDVUE instrument. The tuning set and supply pressure together determine an instrument's response to input signal changes.

Watch Dog Timer

A timer that the microprocessor must rearm periodically. If the microprocessor is unable to rearm the timer, the instrument goes through reset.

Zero Power Condition

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

Single Acting Direct (Relay C) Upon loss of electrical power instrument goes to zero air output at port A.

Double Acting (Relay A) Upon loss of electrical power instrument goes to full supply air output at port B. A goes to zero air output.

Single Acting Reverse (Relay B) Upon loss of electrical power instrument goes to full supply air output at Port B.

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