

Fisher® FIELDVUE™ DVC2000 Digital Valve Controller

This manual applies to

Instrument Level	HC, AD, PD	AC
Device Type	05	F5
Device Revision	1	1
Hardware Revision	1	1
Firmware Revision	1, 2, 3, 4 & 5	1, 2, 3, 4 & 5
DD Revision	3	1

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Section 1 Introduction and Specifications

Scope of Manual

This instruction manual is a supplement to the DVC2000 Quick Start Guide (D103203X012) that ships with every instrument. This instruction manual includes specifications, installation, initial setup, configuration, operation, troubleshooting, maintenance information and replacement part details.

This manual describes using the 475 or 375 Field Communicator to setup and calibrate the instrument. To accomplish these functions, as well as diagnostic and performance tests with ValveLink software, refer to the ValveLink software help.

Do not install, operate, or maintain a DVC2000 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 regarding these instructions, contact your Emerson Process Management sales office before proceeding.

Instrument Description

The DVC2000 digital valve controller is a communicating, microprocessor-based current-to-pneumatic valve positioner. It is designed to replace standard pneumatic and electro-pneumatic valve positioners.

In addition to the traditional function of converting an input current signal (4-20 mA) to a pneumatic output pressure, the DVC2000 digital valve controller communicates via a local display panel and/or via the HART® protocol. An option is available which provides isolated circuitry for two (2) integrated limit switches (for open/close valve indication) and a valve position transmitter (for separate valve position feedback).

Terminology

Instrument Level— There are four (4) levels of functionality available: AC, HC, AD and PD.

AC—This level provides the capability to setup and calibrate the positioner through the LCD or the Field Communicator.

HC—This level provides additional capability for advanced configuration of the positioner (such as travel limits/cutoffs, custom characterization, and minimum open/closing time). Also, information is available through the HART protocol for diagnostic alerts such as travel deviation, cycle count, and travel accumulation.

AD—This level provides advanced diagnostic capabilities for performance testing. When used with ValveLink software, instrument health can be evaluated with tests such as Valve Signature, step response and dynamic error band. The software program provides detailed analysis with graphics.

PD—This level provides automated, non-intrusive testing of the operating performance of the control valve assembly. When used with ValveLink software, tests to isolate component degradation can be run on the valve assembly without affecting the process.

Local Interface—The DVC2000 comes standard with a Liquid Crystal Display (LCD) and four (4) pushbuttons. The local interface provides the capability to setup and calibrate the positioner and view basic diagnostic messages.

Magnet Assembly—This is the feedback component that is mounted directly to the valve stem. It supplies a magnetic field that is sensed by the digital valve controller.

Option Boards—The DVC2000 digital valve controller is available with two (2) limit switches and a valve position transmitter. The option boards include the additional circuitry and terminations that are required to support these output signals.

Pole Piece—Inserted into the DVC2000 housing and protruding through the back of the instrument is a two-pronged fork that houses the magnetic sensor for position feedback.

Specifications

Specifications for the DVC2000 digital valve controller are shown in table 1-1. Specifications for the Field Communicator can be found in the Field Communicators User's Manual.

⚠ WARNING

This product is intended for a specific range of application specifications. Incorrect configuration of a positioning instrument could result in the malfunction of the product, property damage, or personal injury.

Table 1-1. Specifications

<p>Available Configurations</p> <ul style="list-style-type: none"> ■ Integral mounting to the Fisher GX Control Valve and Actuator System ■ Sliding-stem applications ■ Quarter-turn rotary applications <p>The DVC2000 digital valve controller 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.</p> <p>Input Signal</p> <p>Analog Input Signal: 4-20 mA DC, nominal; split ranging available</p> <p>Minimum Voltage: Voltage available at instrument terminals must be 8.5 volts for analog control, 9.0 volts for HART communication</p> <p>Maximum Voltage: 30 volts DC</p> <p>Minimum Control Current: 4.0 mA (below 3.5 mA may cause microprocessor restart)</p> <p>Overcurrent Protection: Input circuitry limits current to prevent internal damage</p> <p>Reverse Polarity Protection: No damage occurs from reversal of loop current</p> <p>Output Signal</p> <p>Pneumatic signal as required by the actuator, up to 95% of supply pressure</p> <p>Minimum Span: 0.5 bar (7 psig)</p> <p>Maximum Span: 7 bar (101 psig)</p> <p>Action: Single Acting, direct</p> <p>Supply Pressure⁽¹⁾</p> <p>Recommended: 0.5 bar (7 psig) greater than the maximum actuator requirements</p> <p>Maximum: 7 bar (101 psig)</p> <p>Supply pressure must be clean, dry air or noncorrosive gas that meets the requirements of ISA Standard 7.0.01. A maximum 40 micrometer particle size in the air system is acceptable. Further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimized</p> <p>Temperature Limits⁽¹⁾</p> <p>-40 to 85°C (-40 to 185°F). LCD may not be readable below -20°C (-4°F).</p>	<p>Air Consumption⁽²⁾</p> <p>Supply pressure:</p> <p>At 1.5 bar (22 psig)⁽³⁾: 0.06 normal m³/h (2.3 scfh)</p> <p>At 4 bar (58 psig)⁽⁴⁾: 0.12 normal m³/h (4.4 scfh)</p> <p>Air Capacity⁽²⁾</p> <p>Supply pressure:</p> <p>At 1.5 bar (22 psig)⁽³⁾: 4.48 normal m³/h (167 scfh)</p> <p>At 4 bar (58 psig)⁽⁴⁾: 9.06 normal m³/h (338 scfh)</p> <p>Independent Linearity</p> <p>±0.5% of output span</p> <p>Electromagnetic Compatibility</p> <p>Meets EN 61326-1 (First Edition)</p> <p>Immunity—Industrial locations per Table 2 of the EN 61326-1 standard. Performance is shown in table 1-2 below</p> <p>Emissions—Class A</p> <p>ISM equipment rating: Group 1, Class A</p> <p>Tested to NAMUR NE21 requirements.</p> <p>Vibration Testing Method</p> <p>Tested per ANSI/ISA 75.13.01 Section 5.3.5. A resonant frequency search is performed on all three axes. The instrument is subjected to the ISA specified 1/2 hour endurance test at each major resonance, plus an additional two million cycles.</p> <p>Input Impedance</p> <p>The input impedance of the DVC2000 active electronic circuit is not purely resistive. For comparison to resistive load specifications, an equivalent impedance of 450 ohms may be used. This value corresponds to 9 V @ 20 mA.</p> <p>Electrical Classification</p> <p>Hazardous Area:</p> <ul style="list-style-type: none"> CSA—Intrinsically Safe and Non-incendive FM—Intrinsically Safe and Non-incendive ATEX—Intrinsically Safe IECEX—Intrinsically Safe <p>Electrical Housing:</p> <ul style="list-style-type: none"> CSA—IP66 and Type 4X FM, ATEX, IECEX—IP66
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Table 1-1. Specifications (continued)

<p>Other Classifications/Certifications</p> <p>GOST-R—Russian GOST-R</p> <p>INMETRO—National Institute of Metrology, Quality and Technology (Brazil)</p> <p>NEPSI—National Supervision and Inspection Centre for Explosion Protection and Safety of Instrumentation (China)</p> <p>PESO CCOE—Petroleum and Explosives Safety Organisation - Chief Controller of Explosives (India)</p> <p>RTN—Russian Rostekhnadzor</p> <p>Contact your Emerson Process Management sales office for classification/certification specific information</p> <p>Connections</p> <p>Standard <i>Supply and Output Pressure:</i> G1/4 internal <i>Electrical:</i> M20 internal</p> <p>Optional <i>Supply and Output Pressure:</i> 1/4 NPT internal <i>Electrical:</i> 1/2 NPT internal</p> <p>Materials of Construction</p> <p><i>Housing and Cover:</i> A03600 low copper aluminum alloy <i>Elastomers:</i> nitrile, fluorosilicone</p> <p>Stem Travel</p> <p><i>Minimum:</i> 6.35 mm (0.25 inch) <i>Maximum:</i> 606 mm (23-7/8 inches)</p> <p>Shaft Rotation</p> <p><i>Minimum:</i> 45° <i>Maximum:</i> 90°</p>	<p>Mounting</p> <p>Designed for direct actuator mounting. For weatherproof housing capability, the vent must be positioned at the lowest point of the instrument.</p> <p>Weight</p> <p>1.5 kg (3.3 lbs)</p> <p>Options</p> <ul style="list-style-type: none"> ■ Airset: 67CFR with filter <p>Language Packs:</p> <ul style="list-style-type: none"> ■ Standard: English, German, French, Italian, Spanish, Japanese, Chinese, Portuguese, Russian, Polish, and Czech ■ Optional: English, German, French, Italian, Spanish, Japanese, Chinese, and Arabic ■ Pipe-away vent ■ Limit Switches: Two isolated switches, configurable throughout calibrated travel range <i>Supply Voltage:</i> 5-30 VDC <i>OFF State:</i> 0.5 to 1.0 mA <i>ON State:</i> 3.5 to 4.5 mA (above 5 V) <i>Reference Accuracy:</i> 2% of travel span⁽⁵⁾ ■ Transmitter: 4-20 mA output, isolated <i>Supply Voltage:</i> 8-30 VDC <i>Fault Indication:</i> offrange high or low <i>Reference Accuracy:</i> 1% of travel span⁽⁵⁾ <p>Declaration of SEP</p> <p>Fisher Controls International LLC declares this product to be in compliance with Article 3 paragraph 3 of the Pressure Equipment Directive (PED) 97 / 23 / EC. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.</p> <p>However, the product <i>may</i> bear the CE marking to indicate compliance with <i>other</i> applicable European Community Directives.</p>
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1. The pressure/temperature limits in this document and any applicable standard or code limitation should not be exceeded. Note: Temperature limits vary based on hazardous area approval.
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. Low pressure relay: 0 to 3.4 bar (0 to 50 psig).
4. High pressure relay: 3.5 to 7.0 bar (51 to 102 psig).
5. Typical values when calibrated at temperature.

Table 1-2. EMC Summary Results—Immunity

Port	Phenomenon	Basic Standard	Test Level	Performance Criteria ⁽¹⁾
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	6 kV contact 8 kV air	B
	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
	Rated power frequency magnetic field	IEC 61000-4-8	30 A/m at 50 Hz, 60 sec	A
I/O signal/control	Burst (fast transients)	IEC 61000-4-4	± 1 kV	A
	Surge	IEC 61000-4-5	± 1 kV (line to ground only, each)	B
	Conducted RF	IEC 61000-4-6	150 kHz to 80 MHz at 10 Vrms	A

Performance criteria is +/- 1% effect.
1. A = No degradation during testing. B = Temporary degradation during testing, but is self-recovering.

Related Documents

Other documents containing information related to the DVC2000 digital valve controller include:

- Fisher FIELDVUE DVC2000 Digital Valve Controller Quick Start Guide (D103203X012)
- Bulletin 62.1:DVC2000—Fisher FIELDVUE DVC2000 Digital Valve Controller (D103167X012)
- INMETRO Hazardous Area Approvals for FIELDVUE DVC2000 Digital Valve Controller (D103780X012)
- 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)
- Audio Monitor for HART Communications - Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals (D103265X012)
- HART Field Device Specification - Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals (D103267X012)
- Using the HART Tri-Loop™ HART-to-Analog Signal Converter with Fisher FIELDVUE Digital Valve Controllers - Supplement to HART Communicating Fisher FIELDVUE Digital Valve Controller Instruction Manuals (D103267X012)

These 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 DVC2000 digital valve controller, as well as a variety of other products, contact:

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

Section 2 Installation

Installation

Note

The DVC2000 is not designed to correct for significant stem rotation on sliding-stem actuators.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before mounting the DVC2000 digital valve controller:

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

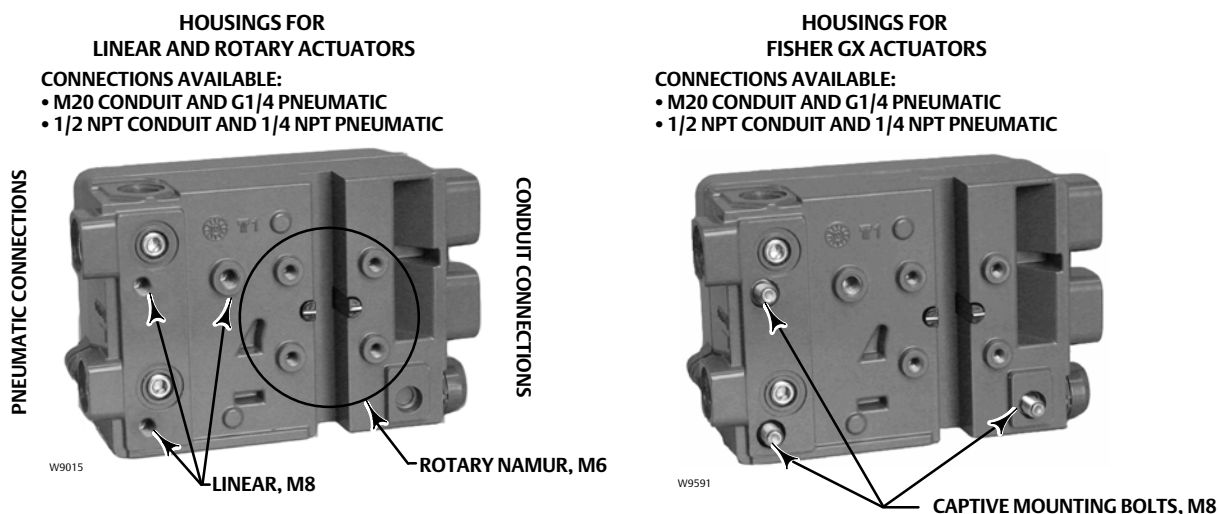
Refer to the quick start guide that ships with the instrument (D103203X012) for Hazardous Area Classifications and Special Instructions for “Safe Use” and Installations in Hazardous Locations.

Valve / Actuator Mounting

If ordered as a part of a control valve assembly, the factory will mount the digital valve controller on the actuator and calibrate the instrument. If you purchased the digital valve controller separately, you will need a mounting kit to mount the digital valve controller on the actuator. The following procedures are general guidelines you should consider when mounting the digital valve controller. See the instructions that come with the mounting kit for detailed information on mounting the digital valve controller to a specific actuator model.

The DVC2000 housing is available in four different configurations, depending on the actuator mounting method and threaded connection style. Figure 2-1 shows the available configurations.

Figure 2-1. FIELDVUE DVC2000 Housing Variations



The feedback system for the DVC2000 digital valve controller utilizes a magnetic field 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.

CAUTION

The magnet 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: transformers, DC motors, stacking magnet arrays, magnetic tipped screwdrivers.

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 DVC2000

- **Magnetic Tip Screw Drivers** – Magnetic tip screw drivers should not be brought in close proximity to the DVC2000 or the magnetic feedback array (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 DVC2000.



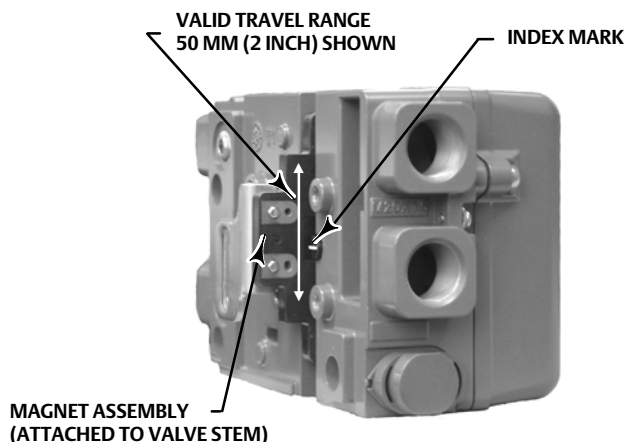
Note

As a general rule, do not use less than 50% of the magnet array for full travel measurement. Performance will decrease as the array is increasingly subbranged.

The linear magnet arrays have a valid travel range indicated by arrows molded into the piece. This means that the hall sensor (on the back of the DVC2000 housing) has to remain within this range throughout the entire valve travel. See figure 2-2.

The linear magnet arrays are symmetrical. Either end may be up.

Figure 2-2. Travel Range



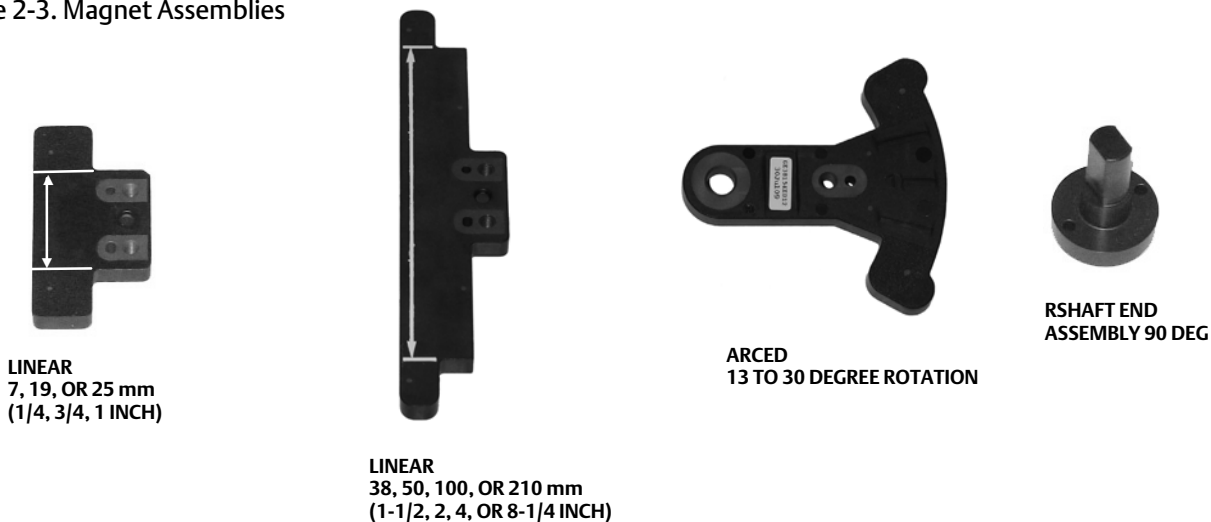
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There are a variety of mounting brackets and kits that are used to mount the DVC2000 to different actuators. However, despite subtle differences in fasteners, brackets, and connecting linkages, the procedures for mounting can be categorized as follows:

- Air-to-open sliding-stem (linear) actuators.
- Air-to-close sliding-stem (linear) actuators.
- Air-to-open GX actuator.
- Air-to-close GX actuator.
- Rotary actuators with travel up to 90 degrees.

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

Figure 2-3. Magnet Assemblies



Sliding-Stem (Linear) Actuators

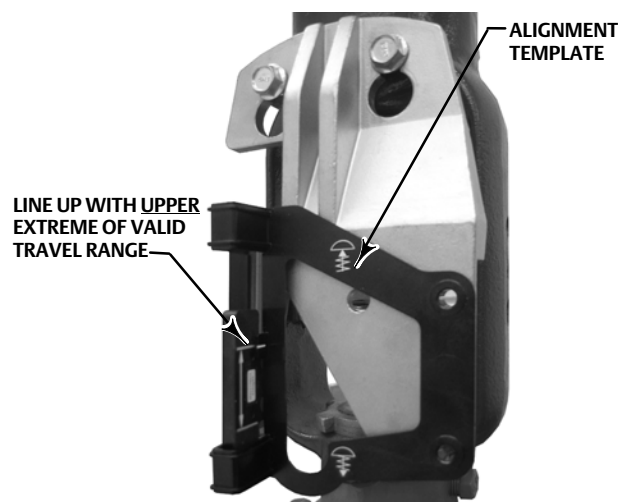
1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. Shut off all pressure lines to the actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Attach the mounting bracket to the actuator.
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 array that is shorter than the physical travel of the actuator. Loss of control will result from the magnet array moving outside the range of the index mark in the feedback slot of the DVC2000 housing.

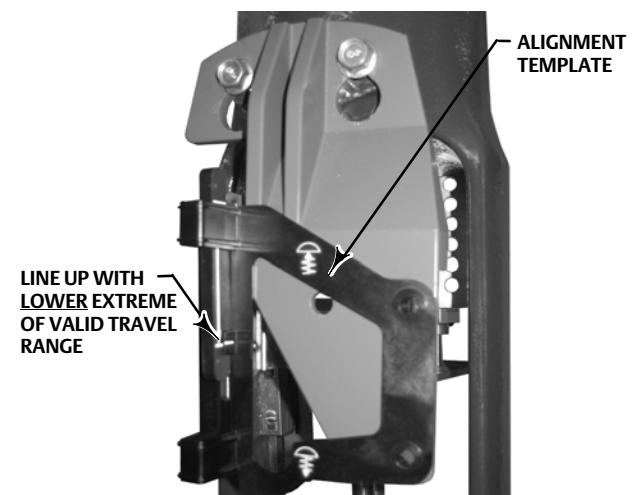
4. Using the alignment template (supplied with the mounting kit), position the feedback array inside the retaining slot.
5. Align the magnet array as follows:
 - For air-to-open actuators (e.g. Fisher 667) vertically align the magnet array so that the center line of the alignment template is lined up as close as possible with the upper extreme of the valid travel range on the feedback array. See figure 2-4.
 - For air-to-close actuators (e.g. Fisher 657) vertically align the magnet array 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 feedback array. See figure 2-5.
6. Tighten the fasteners and remove the alignment template.

Figure 2-4. Air-to-Open Magnet Array Alignment



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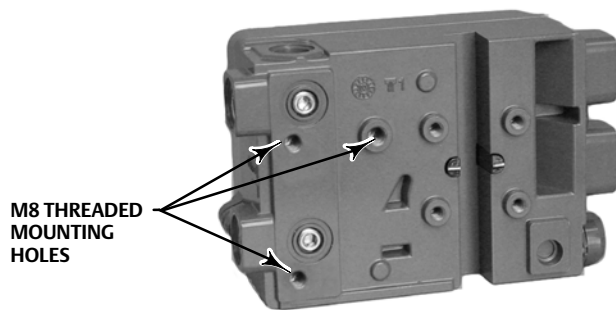
Figure 2-5. Air-to-Close Magnet Array Alignment



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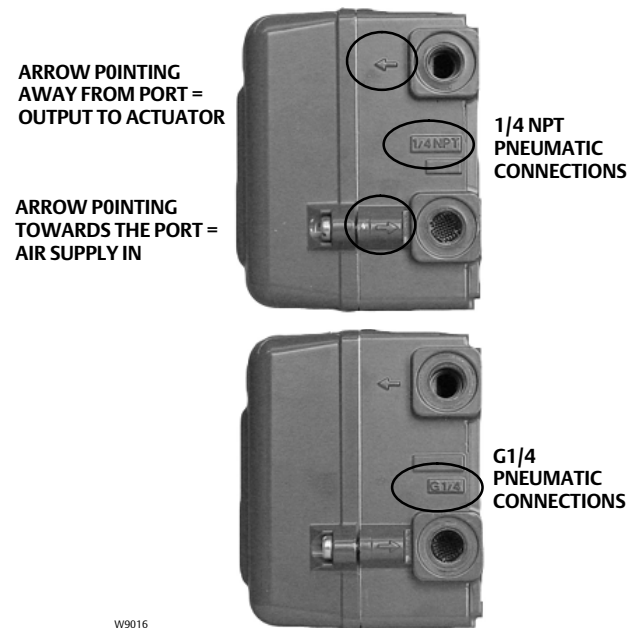
7. Mount the digital valve controller to the mounting bracket, using the mounting bolts. See figure 2-6.
8. Check for clearance between the magnet assembly and the DVC2000 feedback slot. The magnet assembly should be positioned so that the index mark in the feedback slot of the DVC2000 housing is within the valid range on the magnet assembly throughout the range of travel. See figure 2-2.
9. Install tubing between the actuator casing and the pneumatic positioner output connection that has the arrow pointing away from the opening. See figure 2-7.

Figure 2-6. Mounting Holes for Linear Actuators



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Figure 2-7. Conduit and Pneumatic Thread Variations



W9016

Mounting on GX Actuators

The DVC2000 digital valve controller mounts directly on the GX actuator without the need for a mounting bracket.

However, in applications where the process temperature exceeds 80°C (176°F), it may be necessary to apply an insulating gasket between the actuator yoke and the DVC2000, as shown in figure 2-8. The heat conducted from the process line will transmit through the valve body and actuator and ultimately to the DVC2000. Temperature seen at the DVC2000 is a function of the ambient temperature as well as the process temperature. Guidelines on when to apply the high temperature gasket set are shown in figure 2-9.

Figure 2-8. Mounting to Fisher GX Actuator with Insulating Gasket and O-Ring

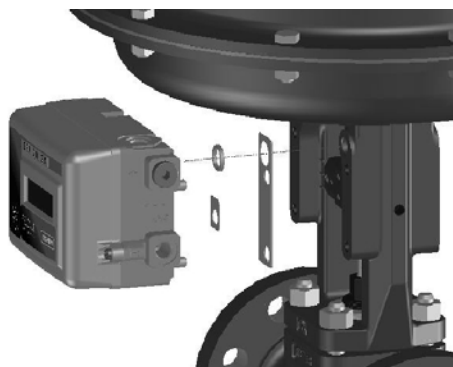
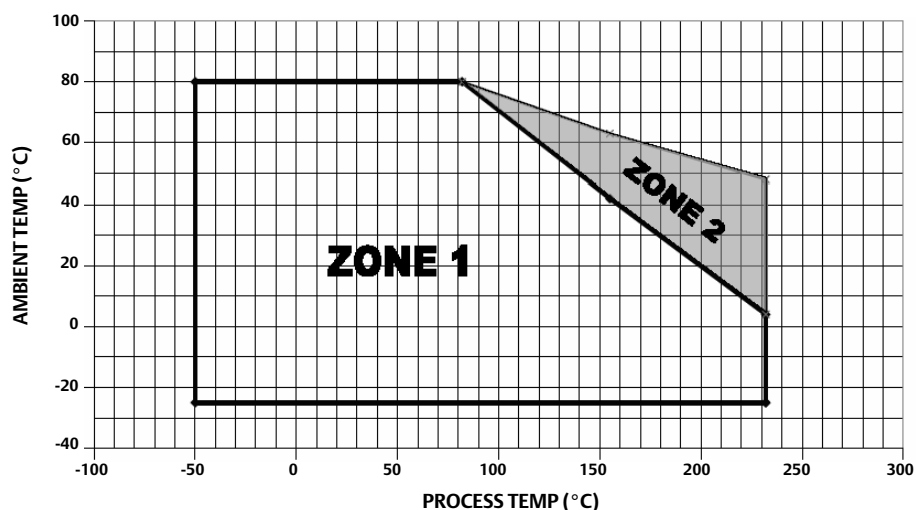


Figure 2-9. Guidelines for Applying High Process Temperature Solutions to the Fisher GX and FIELDVUE DVC2000



NOTES
 ZONE 1: STANDARD GX BONNET AND STANDARD DVC2000 MOUNTING APPLY.
 ZONE 2: REQUIRES GX EXTENSION BONNET OR HIGH TEMPERATURE DVC2000 GASKET SET.

Note

The GX extension bonnet option is an alternate way to address the high process temperature influence on the DVC2000. However, if the extension bonnet is used, the high temperature DVC2000 mounting kit is *not* required.

If the process and ambient temperatures exceed the limits indicated by zone 2, then the DVC2000 high temperature mounting kit can not be used. If temperatures exceed zone 2, you *must* use an extension bonnet or bracket mounted instrument.

Identify the yoke side to mount the DVC2000 digital valve controller 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.

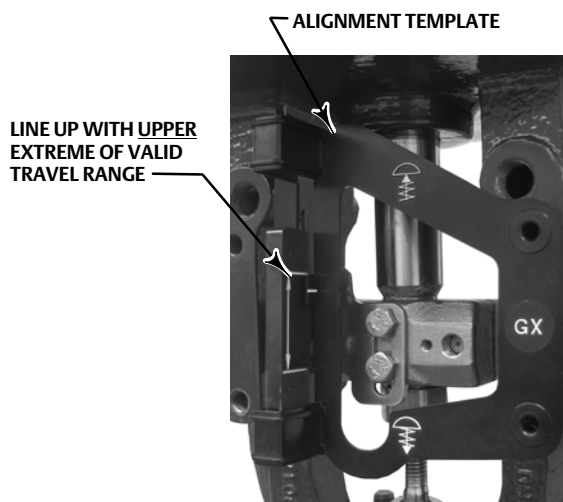
- Loosely attach the feedback pieces and magnet assembly to the valve stem connector. Do not tighten the fasteners because fine adjustment is required.

CAUTION

Do not install a magnet array that is shorter than the physical travel of the actuator. Loss of control will result from the magnet array moving outside the range of the index mark in the feedback slot of the DVC2000 housing.

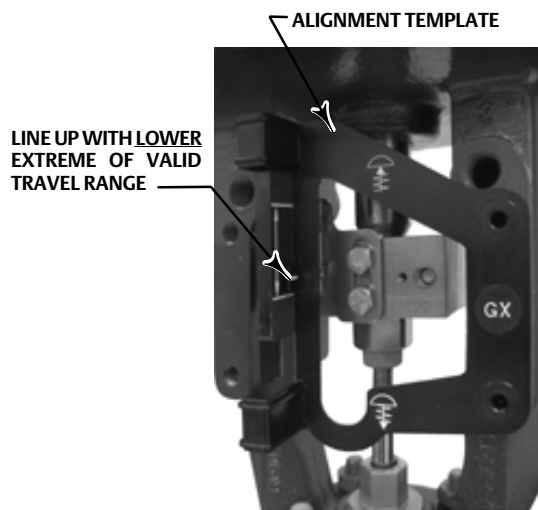
- Using the alignment template (supplied with the mounting kit), position the feedback array inside the retaining slot.
- Align the magnet array as follows:
 - For air-to-open GX actuators vertically align the magnet array so that the center line of the alignment template is lined up as close as possible with the upper extreme of the valid travel range on the feedback array without exceeding it. See figure 2-10.
 - For air-to-close GX actuators vertically align the magnet array 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 feedback array. See figure 2-11.

Figure 2-10. Air-to-Open Fisher GX Magnet Array Alignment



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Figure 2-11. Air-to-Close Fisher GX Magnet Array Alignment



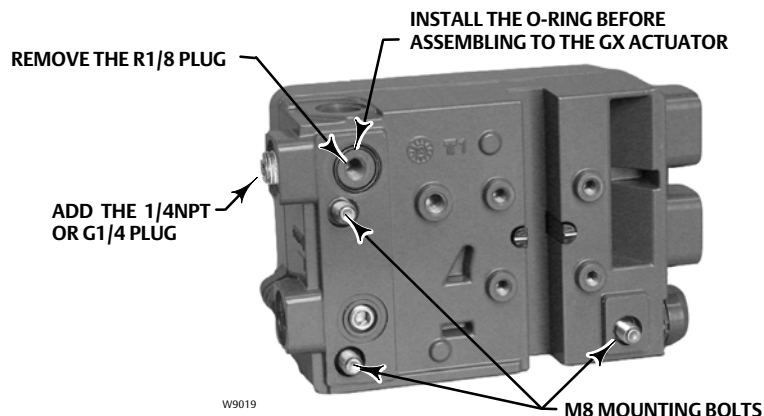
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- Tighten the fasteners and remove the alignment template. Continue on with the appropriate step 6 below.

For Air-to-Open GX Actuators

- Remove the top plug (R1/8) from the back of the DVC2000 housing. This pneumatic output port on the DVC2000 lines up with the integral GX actuator pneumatic port. See figure 2-12.

Figure 2-12. Modifications for Fisher GX Actuator - Air-to-Open Construction Only



7. Install the plug (either G1/4 or 1/4NPT, included in the mounting kit) to the external output pneumatic port.
8. Remove the cover of the digital valve controller.
9. Using a 6 mm hex wrench, attach the digital valve controller to the GX actuator mounting pad on the side that has the open pneumatic port. Be sure to place the O-ring between the digital valve controller's pneumatic output and the actuator mounting pad. Pneumatic tubing is not required because the air passages are internal to the actuator.
10. Check for clearance between the magnet assembly and the DVC2000 feedback slot. The magnet assembly should be positioned so that the index mark in the feedback slot of the DVC2000 housing is within the valid range on the magnet assembly throughout the range of travel. See figure 2-2.
11. Install a vent in the port on the upper diaphragm casing's air supply connection on the actuator yoke leg.

For Air-to-Close GX Actuators

6. Remove the cover of the digital valve controller.
7. Using a 6 mm hex wrench, attach the digital valve controller to the GX actuator mounting pad.

Note

The O-ring and G1/4 or 1/4 NPT plugs (supplied in the mounting kit) are not used with this actuator construction.

8. Check for clearance between the magnet assembly and the DVC2000 feedback slot. The magnet assembly should be positioned so that the index mark on the pole pieces (back of the positioner housing) is within the valid range on the magnet assembly throughout the range of travel. See figure 2-2.
9. Install tubing between the actuator casing and the pneumatic positioner output connection that has the arrow pointing away from the opening. See figure 2-7.
10. Install a vent in the port on the lower diaphragm casing.

Note

When field converting a GX actuator from fail-open to fail-closed (or vice-versa), you will need to change the plugs for the pneumatic passages in the DVC2000 housing.

- To convert to fail-closed, remove the R1/8 pneumatic plug on the back of the DVC2000 housing and install an O-ring. Plug the external pneumatic output with a 1/4 NPT or G1/4 plug (depending on the housing version). Refer to figure 2-12.
 - To convert to fail-open, remove the external pneumatic plug (1/4 NPT or G1/4 plug depending on the housing version). Install an R1/8 plug on the back of the DVC2000 housing. Install tubing between the pneumatic output connection of the DVC2000 to the pneumatic port on top of the actuator casing.
-

Guidelines for Mounting on Quarter-Turn (Rotary) Actuators

The DVC2000 digital valve controller 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 2-13.

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 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 must be parallel to the channel on the back of the DVC2000 housing, as shown in figure 2-14.

Figure 2-13. For Rotary Actuators (with Typical Mounting Bracket Shown)

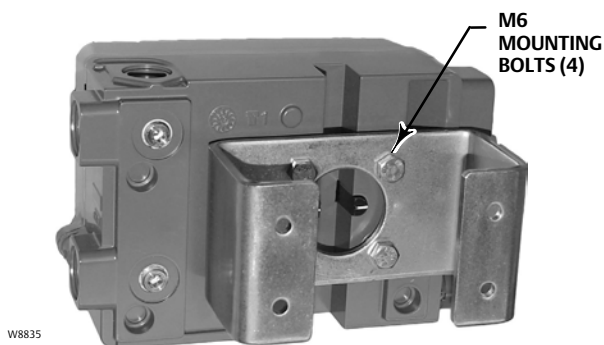
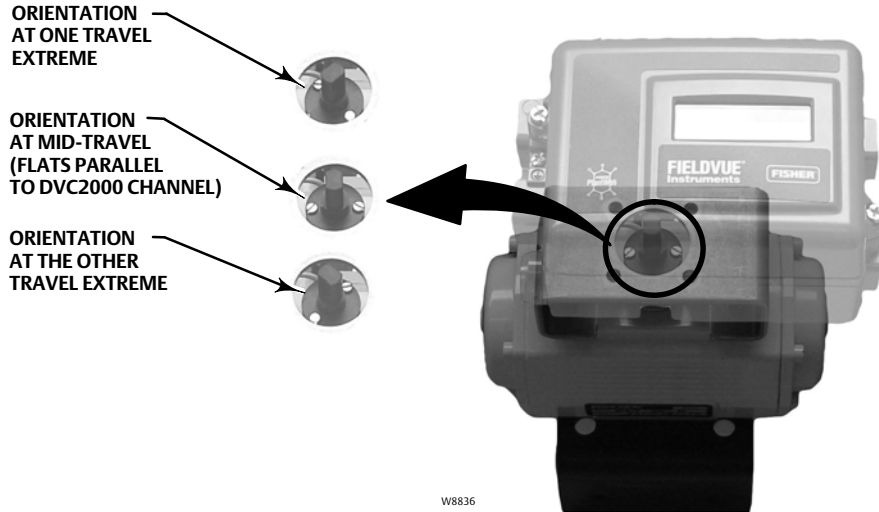


Figure 2-14. Magnetic Assembly Orientation on Quarter-Turn Actuators



3. Install the mounting bracket on the actuator.
4. Attach the digital valve controller to the mounting bracket using the 4 mounting bolts, as shown in figure 2-13.
5. Check for clearance between the magnet assembly and the positioner feedback slot.
6. Install tubing between the actuator casing and the pneumatic positioner output connection that has the arrow pointing away from the opening. See figure 2-7.

Electrical and Pneumatic Connections

The electrical and pneumatic connections on the digital valve controller are available with the following combinations:

- 1/4 NPT supply and output with 1/2 NPT conduit connections
- G1/4 supply and output with M20 conduit connections

Supply Connections

⚠ WARNING

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

Supply pressure must be clean, dry air or noncorrosive gas that meets the requirements of ISA Standard 7.0.01. A maximum 40 micrometer particle size in the air system is acceptable. Further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimized.

A 67CFR filter regulator with standard 5 micrometer filter, or equivalent, may be used to filter and regulate supply air. If pressure regulation is not required, a 10 micron in-line filter may be used.

Connect the nearest suitable supply source to the connection with the arrow pointing towards the opening (see figure 2-7).

Electrical Connections

⚠ 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.

The valve may move in an unexpected direction when power is applied to the 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.

The digital valve controller is normally powered by a control system output card. The use of shielded cable will ensure proper operation in electrically noisy environments. Wire size requirements are 14 AWG maximum, 26 AWG minimum.

Be sure to follow the appropriate I.S. circuit guidelines when installing field wiring to the loop terminals as well as the limit switch and transmitter terminals.

Wire the digital valve controller as follows:

1. Remove the main instrument cover.
2. Route the field wiring into the terminal box through the conduit connection. When applicable, install conduit using local and national electrical codes that apply to the application.
3. Connect the control system output card positive wire “current output” to the +11 terminal. Connect the control system output card negative (or return) wire “current output” to the -12 terminal.
4. Two ground terminals are available for connecting a safety ground, earth ground, or drain wire. These ground terminals are electrically identical. Make connections to these terminals following national and local codes and plant standards.
5. Replace the cover if the local interface is not being used for configuration or calibration.

Options Boards

All three options circuits (transmitter, switch 1 and switch 2) control current from an external power source similar to the operation of a 2-wire transmitter.

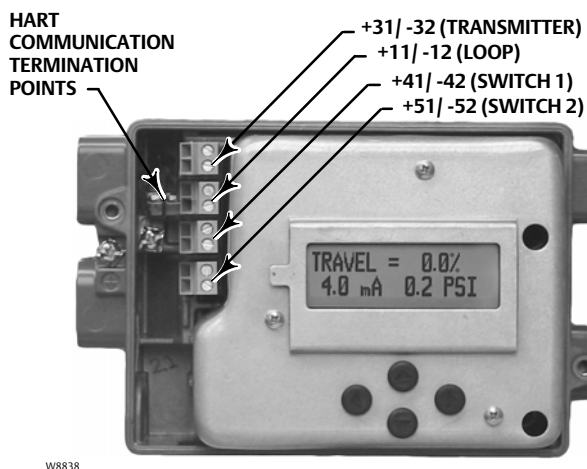
Limit Switches

On units that are supplied with integral limit switches, additional terminals provide the field wiring connection point. The limit switches are isolated from each other and from the digital valve controller's primary feedback. If only one switch is to be used, you must use channel 1. Although electrically isolated per Intrinsic Safety requirements, channel 2 derives its power from channel 1. Therefore channel 2 cannot be used alone.

Wire the limit switches as follows:

1. Remove the main instrument cover.
2. Route the field wiring into the terminal box through the conduit connection. When applicable, install conduit using local and national electrical codes that apply to the application.
3. Connect the control system input card positive wire “switch input” to the +41 terminal. Connect the control system input card negative wire “switch input” to the -42 terminal. Refer to figure 2-15.
4. If a second switch is to be used, connect the control system input card positive wire “switch input” to the +51 terminal. Connect the control system input card negative wire “switch input” to the -52 terminal.
5. Proceed to the Basic Setup section to configure the switch action.
6. Replace the cover if the local interface is not being used for configuration or calibration.

Figure 2-15. Loop, Transmitter, and Limit Switch Terminals



W8838

Position Transmitter

On units that are supplied with an integral valve position transmitter, additional terminals provide the field wiring connection point. The position transmitter circuit in the DVC2000 derives its operating power from the 4-20 mA control system input in the same manner as a 2-wire transmitter. In addition, the transmitter function gets position information (through an opto-isolator) from the digital valve controller so the 4-20 mA position control loop must also be powered in order for the position transmitter to provide an output representing the valve position.

Note

In an Intrinsically Safe installation with the options in use, the wire pairs must be shielded. Additionally, to prevent cross-wiring, the individual wires must not be exposed beyond the terminal barrier walls.

Wire the position transmitter as follows:

1. Remove the main instrument cover.
2. Route the field wiring into the terminal box through the conduit connection. When applicable, install conduit using local and national electrical codes that apply to the application.
3. Connect the control system input card positive wire “current input” to the +31 terminal. Connect the control system input card negative wire “current input” to the -32 terminal. Refer to figure 2-15.
4. Replace the cover if the local interface is not being used for configuration or calibration.

Vent

By design, the instrument exhausts supply air into the area under the cover. The vent should be left open to prevent pressure buildup under the cover and to drain any moisture that may accumulate in the housing. The control valve assembly should be installed such that the primary vent provides gravitational draining.

If a remote vent is required, the vent line must be as short as possible with a minimum number of bends and elbows.

Communications Connections

A HART communicating device, such as a Field Communicator or a personal computer running ValveLink software communicating through a HART modem, interfaces with the DVC2000 digital valve controller. You can connect at any point on the 4-20 mA loop. Alternatively, convenient termination points are located on the termination board (figure 2-15). The instrument must be powered before digital communication will commence.

Section 3 Basic Setup and Calibration with Local User Interface

The local user interface is available on all DVC2000 digital valve controllers. The interface consists of a liquid crystal display, four pushbuttons, and a switch for position transmitter configuration. The DVC2000 is supplied with one of three different language packs preinstalled, depending on the firmware revision and ordering option. Language pack options are shown in table 3-1. To configure the language, follow the procedure outlined in the Basic Setup section. The instrument must be powered with at least 8.5 volts and 3.5 mA to operate the local interface. Certain procedures require up to 20 mA of current.

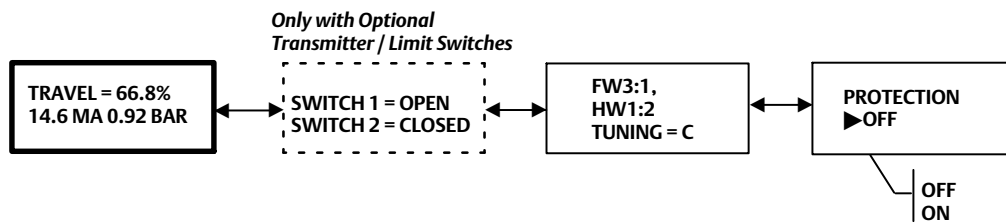
CAUTION

When accessing the terminals or pushbuttons, proper means of electrostatic discharge protection is required. Failure to provide appropriate protection can cause the valve to move, resulting in valve/actuator instability.

Status Information

The first (home) screen on the LCD that is displayed after applying power to the instrument contains basic status information. On an instrument that is calibrated and operating properly, the flow chart in figure 3-1 shows the available information by pressing the right (▶) arrow key.

Figure 3-1. Home Screen on the LCD



TRAVEL=##.##%—Current valve travel in percent of calibrated travel.

##.# MA—Current input signal applied to the instrument in mA.

##.## BAR—Current pressure output to the actuator in the configured units (BAR, PSI or MPA).

SWITCH1—Current status of the optional limit switch wired to terminals +41 and -42.

SWITCH2—Current status of the optional limit switch wired to terminals +51 and -52.

FW#—Version of firmware running in the device.

HW#—Version of electronics hardware installed. The first number (# : #) represents the main board, the second number (# : #) represents the secondary electronics.

TUNING = X—Current tuning set parameters configured in the device.

PROTECTION—Indicates whether the local interface is protected or not. With protection ON, the instrument cannot be configured or calibrated with the local pushbuttons.

Basic Setup

⚠ WARNING

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

When the DVC2000 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. Table 3-2 provides the actuator information required to setup and calibrate the instrument.

Before beginning basic setup, be sure the instrument is correctly mounted and powered electrically and pneumatically, as described in the Installation section, Section 2.

Selecting the Language

The DVC2000 is supplied with one of three different language packs preinstalled, depending on the firmware revision and the ordering option. See table 3-1 for language pack options.

Table 3-1. Language Pack Options

Firmware Revision	1 or 2	3	3
Language Pack	Standard	Standard	Optional
English	X	X	X
Japanese	X	X	X
Chinese	X	X	X
French	X	X	X
German	X	X	X
Italian	X	X	X
Spanish	X	X	X
Portuguese		X	
Russian		X	
Polish		X	
Czech		X	
Arabic			X

Only firmware revision 3 or later will allow you to download different language packs to the DVC2000 using ValveLink Software.

To access the language selection screen, press the four arrow keys simultaneously for three (3) seconds.

Use the UP or DOWN (▲ or ▼) arrow keys to select the appropriate language. Press the RIGHT (▶) arrow key to confirm your selection.

Table 3-2. Actuator Information for Setup

Actuator Manufacturer	Actuator Model	Actuator Style	Actuator Size	Starting Tuning Set ⁽¹⁾	Feedback Connection
Fisher	585C & 585CR	Piston Dbl w/ or w/o Spring. See actuator instruction manual and nameplate.	25, 50, 60, 68, 80, 100, 130	Undefined	SStem-Standard for travels up to 4 inches. SStem-Roller for longer travels
	657	Spring & Diaphragm	30	G	SStem-Standard
			34, 40	I	
			45, 50	J	
			46, 60, 70, 76, & 80-100	Undefined	
	667	Spring & Diaphragm	30	G	SStem-Standard
			34, 40	I	
			45, 50	J	
			46, 60, 70, 76, & 80-100	Undefined	
	1051 & 1052	Spring & Diaphragm	20, 30, 33, 40, 60, 70	Undefined	Rotary
	1066SR	Piston Sgl w/Spring	20, 27, 75	Undefined	Rotary
	3024	Spring & Diaphragm	GA 1.21 GA 1.31 GA 1.41	Undefined	SStem-Standard
	3025	Spring & Diaphragm	P460, P462, P900	Undefined	Rotary
	GX	Spring & Diaphragm	225	G	SStem-Standard
750			I		
1200			K		
GX 3-Way	Spring & Diaphragm	225	G	SStem-Standard	
		750	I		
Baumann	Air to Extend	Spring & Diaphragm	16	C	SStem-Standard
			32	D	
			54	Undefined	
			70	H	
	Air to Retract	Spring & Diaphragm	16	C	SStem-Standard
			32	D	
			54	Undefined	
			70	H	
	Rotary	Spring & Diaphragm	10	Undefined	Rotary
			25	Undefined	
			54	G	

1. If a volume booster is used, the starting tuning set = X4.

Quick Setup

When installing the DVC2000 digital valve controller on an actuator for the first time, the quick setup procedure will calibrate and tune the instrument automatically. Table 3-3 lists the values that are preconfigured at the factory.

Table 3-3. Factory Default Settings Accessible from the Local Interface

Setup Parameter	Default Setting
Zero Control Signal	Open ⁽¹⁾
Pressure Units	BAR or PSIG
Input Range Low	4 mA
Input Range High	20 mA
Characteristic	Linear
Transmitter (optional feature)	4 mA = Valve Closed
Switch 1 Trip Point (optional feature)	90%
Switch 1 Closed (optional feature)	Disabled
Switch 2 Trip Point (optional feature)	10%
Switch 2 Closed (optional feature)	Disabled

1. If the instrument is shipped mounted on an actuator, these values depend upon the actuator on which the instrument is mounted.

⚠ WARNING

During calibration the valve will move full stroke. Changes to the tuning set may also 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.

Note

If optional limits switches are being used, power must be applied to the switch circuits throughout the quick setup routine. Failure to power the switches may result in incorrect switch orientation.

Refer to the DETAILED SETUP procedure for further explanation of the parameters.

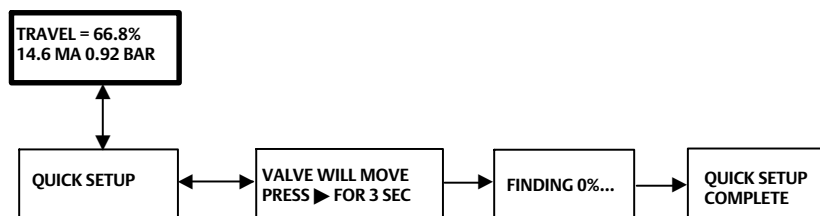
To access the QUICK SETUP routine from the home screen, press the DOWN (▼) arrow key and then the RIGHT (▶) arrow key. A warning will advise you that this procedure will cause the valve to move. Another RIGHT (▶) button press will begin the calibration process. Pressing the LEFT (◀) arrow key will bring you back to the main menu.

This procedure will automatically calibrate the instrument and apply tuning parameters specifically fit for the size of the actuator.

To abort the procedure at any time, press the RIGHT (▶) and LEFT (◀) arrow keys together for 3 seconds.

When the procedure is complete, press the RIGHT (▶) arrow key to return to the status screen. If the RIGHT (▶) button is not pressed within 30 seconds, the device will revert back to the status screen automatically.

Figure 3-2. Quick Setup



Travel Calibration

⚠ WARNING

During calibration you will be asked to move the valve 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.

Note

If optional limits switches are being used, power must be applied to the switch circuits throughout the automatic or manual calibration routine. Failure to power the switches may result in incorrect switch orientation.

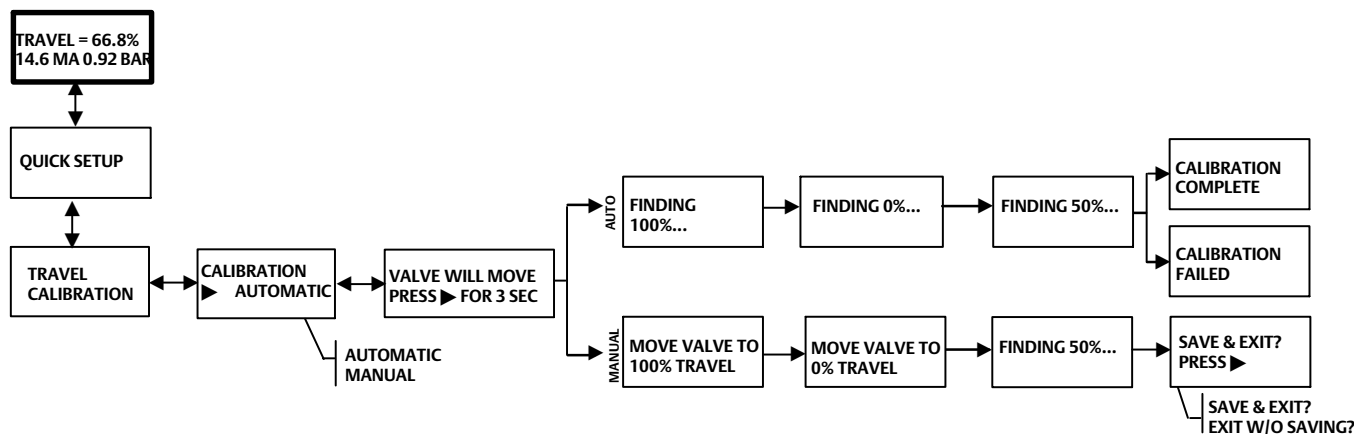
To manually calibrate the instrument or automatically calibrate the instrument without changing the tuning values, the TRAVEL CALIBRATION routine is available. To access this procedure from the home screen, press the DOWN (▼) arrow key two times and then the RIGHT (▶) arrow key once. From there follow the prompts as illustrated in figure 3-3.

Note

If the valve is manually calibrated to travel less than the physical travel stops allow, manual tuning (page 28) may be required to optimize the valve response.

Automatic calibration will provide status information as the procedure is running. Manual calibration will require you to first adjust the input current to move the valve and then to press the RIGHT (▶) arrow key. After manual calibration is complete, you will have the choice to save the calibration or exit the procedure without saving. If you exit without saving, the last saved calibration data will be restored.

Figure 3-3. Travel Calibration



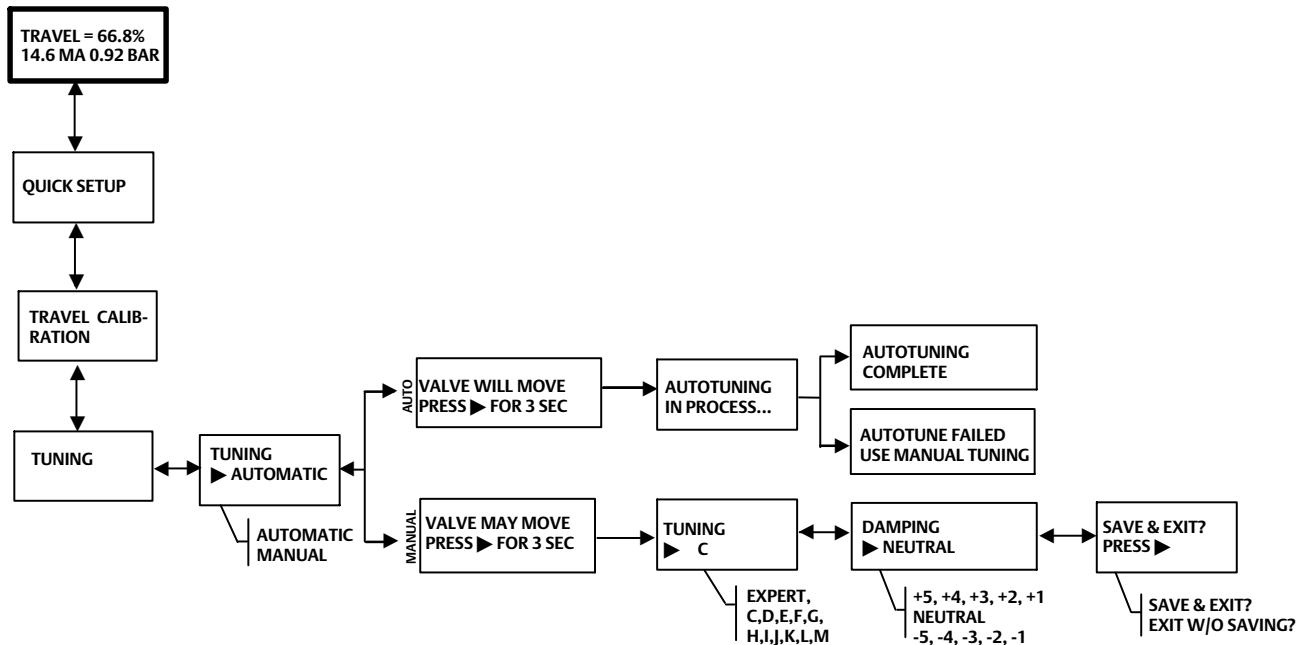
Tuning

⚠ 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.

To manually tune the instrument or automatically tune the instrument without changing the calibration values, the TUNING routine is available. To access this procedure from the home screen, press the DOWN (▼) arrow key three times and then the RIGHT (▶) arrow key once. From there follow the prompts as illustrated in figure 3-4 below.

Figure 3-4. Tuning



Automatic tuning will provide status information as the procedure is running. Manual tuning will require you to choose from one of eleven tuning sets. 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 3-4 lists the proportional gain, velocity gain, and minor loop feedback gain values for preselected tuning sets. Manual tuning is only recommended when the automatic tuning procedure results in failure.

Table 3-4. Gain Values for Preselected Turning Sets

Tuning Set	Proportional Gain	Velocity Gain	Minor Loop Feedback Gain
C	5	2	55
D	6	2	55
E	7	2	55
F	8	2	52
G	9	2	49
H	10	2	46
I	11	2	44
J	12	1	41
K	14	1	38
L	16	1	35
M	18	1	35

A typical starting point for most small actuators is “C”. Using the UP (▲) and DOWN (▼) arrow keys will apply the values immediately. You can then change the input current to observe the response. When you are satisfied with the response, press the RIGHT (▶) arrow key to fine tune the instrument. The UP (▲) and DOWN (▼) arrow keys will apply more or less damping to fine tune the overshoot after a step input change.

After manual tuning is complete, you will have the choice to save the tuning data or exit the procedure without saving. If you exit without saving, the last saved tuning data will be restored.

Detailed Setup

If the factory default configuration values need to be changed, the DETAILED SETUP procedure provides access. See figure 3-5 for the flowchart showing the sequence of screens. To access this procedure from the home screen, press the DOWN (▼) arrow key four times. The RIGHT (▶) arrow key brings you into the configuration items. Once you are in a particular configuration item, use the UP (▲) and DOWN (▼) arrow keys to select the appropriate choice.

To exit this procedure, press the RIGHT (▶) arrow key and view the remaining configuration items until you reach the exit screen. If you exit without saving, the last saved configuration data will be restored.

Below is an explanation of the configuration items.

Zero Control Signal—Identifies whether the valve is fully OPEN or fully CLOSED when the input is 0%. If you are unsure how to set this parameter, disconnect the current source to the instrument. The resulting valve travel is the Zero Control Signal. This corresponds to setting the output pressure to zero.

Pressure Units—Defines the pressure units in either PSI, BAR, or KPA.

Input Range Low—This will correspond to 0% travel if the Zero Control Signal is configured as closed. If the Zero Control Signal is configured as open, this will correspond to 100% travel.

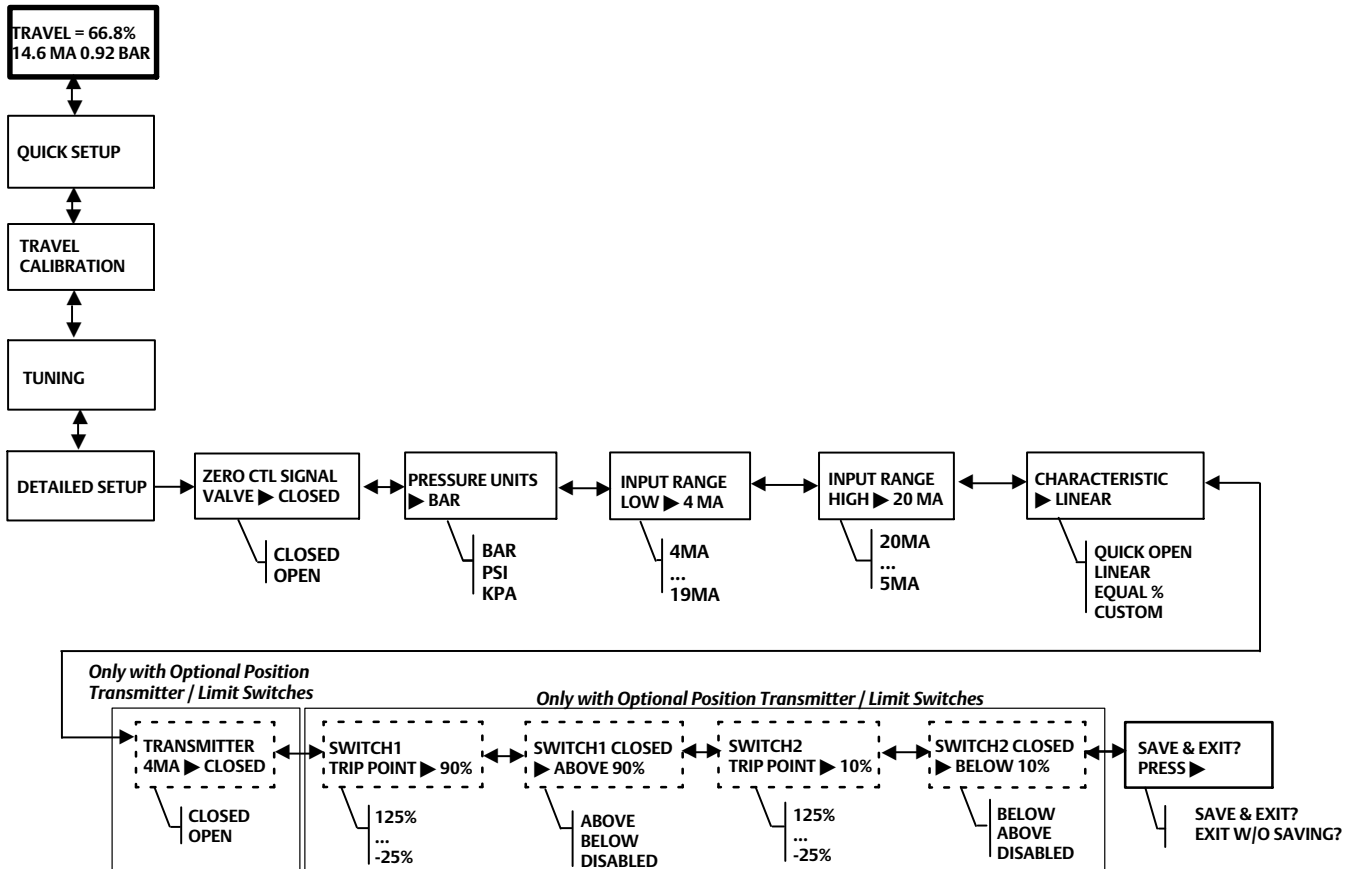
Input Range High—This will correspond to 100% travel if the Zero Control Signal is configured as closed. If the Zero Control Signal is configured as open, this will correspond to 0% travel.

Characteristic—Defines the relationship between the travel target and the ranged set point. Ranged set point is the input to the characterization function. If the Zero Control Signal is closed, then a set point of 0% corresponds to a ranged input of 0%. If the Zero Control Signal is open, a set point of 0% corresponds to a ranged input of 100%. Travel target is the output from the characterization function.

Note

Travel cutoffs are enabled by default on all units.

Figure 3-5. Detailed Setup Flow Chart

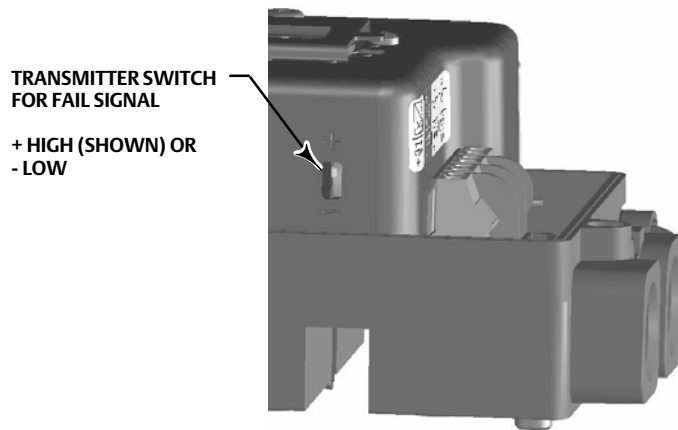


The factory default characteristic is LINEAR. You can also use a QUICK OPEN, EQUAL %, or CUSTOM function. However, the custom function is initially configured linear, unless you use a HART based host to reconfigure the custom points. Custom configuration can be selected, but the curve cannot be modified with the local interface.

Transmitter—This configures the relationship between the valve travel and the position transmitter output signal. If you select CLOSED, the transmitter will send 4 mA when the valve is closed. If you select OPEN, the transmitter will send 4 mA when the valve is open.

A switch is located on the options board to select the transmitter fail signal (high+ or low-). High+ will result in a current output of > 22.5 mA upon transmitter failure. Low- will result in a current output of < 3.6 mA. Refer to figure 3-6 for location and switch selection.

Figure 3-6. XMTR Switch



Switch #1 Trip Point—Defines the threshold for the limit switch wired to terminals +41 and -42 in percent of calibrated travel.

Switch #1 Closed—Configures the action of the limit switch wired to terminals +41 and -42. Selecting ABOVE configures the switch to be closed when the travel is above the trip point. Selecting BELOW configures the switch to be closed when the travel is below the trip point. Selecting DISABLED removes the icons and status from the display.

Switch #2 Trip Point—Defines the threshold for the limit switch wired to terminals +51 and -52 in percent of calibrated travel.

Switch #2 Closed—Configures the action of the limit switch wired to terminals +51 and -52. Selecting ABOVE configures the switch to be closed when the travel is above the trip point. Selecting BELOW configures the switch to be closed when the travel is below the trip point. Selecting DISABLED removes the icons and status from the display.

Note

Switch #2 is only operational if power is applied to switch #1 also. Switch #2 cannot be used alone.

Analog Input Calibration

⚠ WARNING

During calibration you will be asked to move the valve 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.

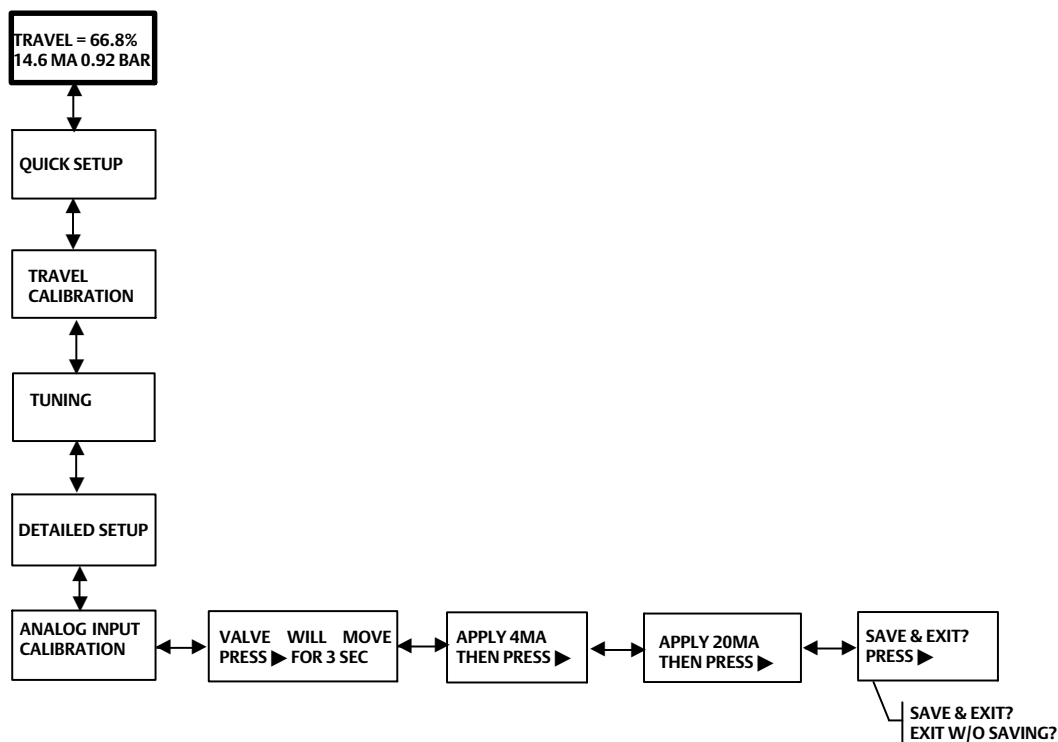
The DVC2000 digital valve controller is shipped from the factory with the analog input already calibrated. You do not normally need to perform this procedure. However, if you suspect that this needs adjustment, follow the procedure below, and refer to figure 3-7.

Connect a variable current source to the instrument +11 and -12 terminals. From the home screen, press the DOWN (▼) arrow key five times and then press the RIGHT (▶) arrow key. Acknowledge the warning if you are sure that you want to proceed.

1. Adjust the variable current source to 4 mA.
2. Press the RIGHT (▶) arrow key
3. Adjust the variable current source to 20 mA.
4. Press the RIGHT (▶) arrow key.

If you want to keep this calibration, select SAVE AND EXIT. If you exit without saving, the last saved configuration data will be restored.

Figure 3-7. Analog Input Calibration



Position Transmitter Calibration

Note

This procedure will not move the control valve. The instrument will simulate an output for calibration purposes only.

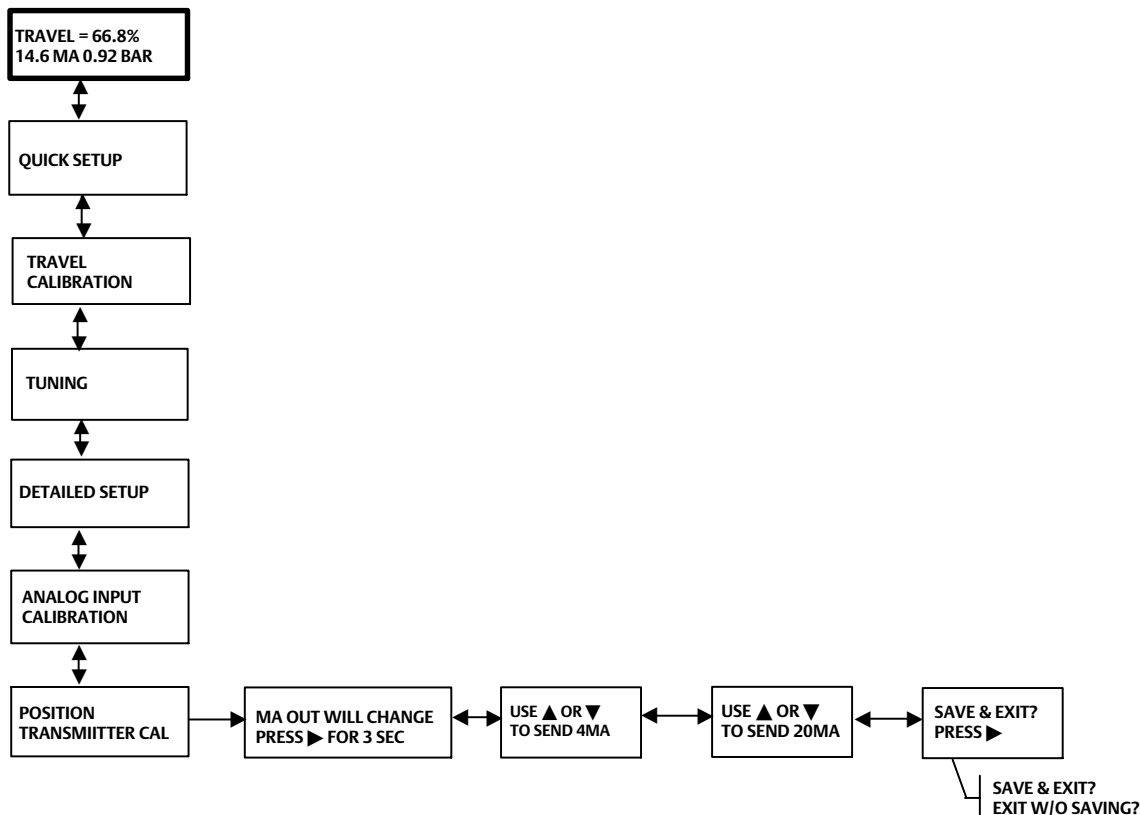
This procedure is only available on units that have the optional position transmitter / limit switch hardware installed. The DVC2000 digital valve controller is shipped from the factory with the position transmitter already calibrated. You do not normally need to perform this procedure. However, if you suspect that this needs adjustment, follow the procedure below and refer to figure 3-8.

Connect a current meter in series with the transmitter output terminals (+31 & -32) and a voltage source (such as the DCS analog input channel). From the home screen, press the DOWN (▼) arrow key six times and then press the RIGHT (▶) arrow key.

1. Use the UP (▲) and DOWN (▼) arrow keys to manipulate the output current read by the current meter. When 4 mA is read by the meter, press the RIGHT (▶) arrow key.
2. Again, use the UP (▲) and DOWN (▼) arrow keys to manipulate the output current read by the current meter. When 20 mA is read by the meter, press the RIGHT (▶) arrow key.

If you want to keep this calibration, select SAVE AND EXIT. If you exit without saving, the last saved configuration data will be restored.

Figure 3-8. Position Transmitter Calibration



Local Control

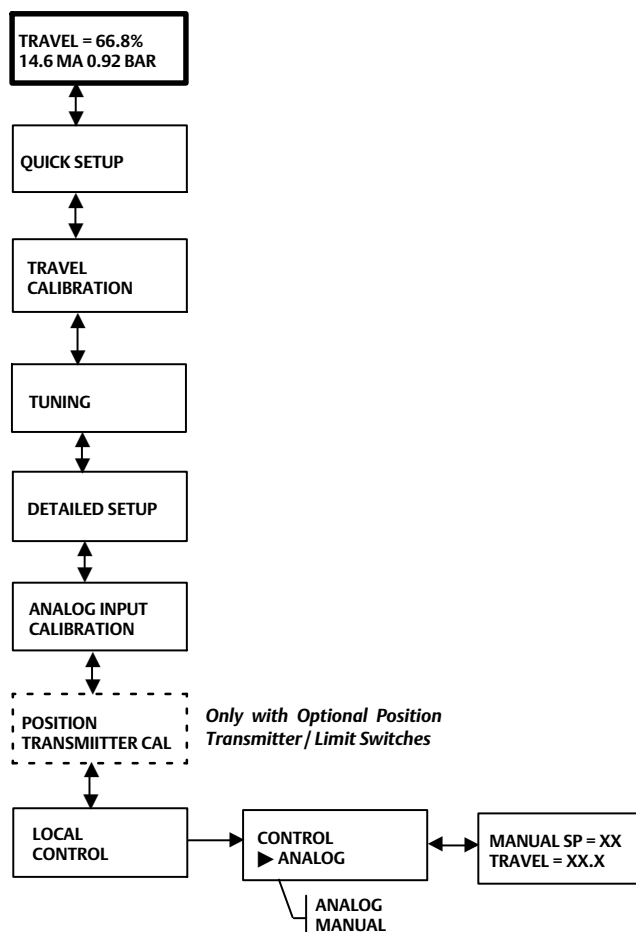
This procedure allows the user to manually control the position of the valve (see figure 3-9). To enter this procedure from the home screen, press the DOWN (▼) arrow key seven times and then press the RIGHT (▶) arrow key.

If you select ANALOG, you will return to the home screen and the digital valve controller will respond to the loop current. If you select MANUAL, you will move to the screen that shows the travel setpoint and the actual valve travel. The UP (▲) and DOWN (▼) arrow keys will allow you to change the setpoint and therefore move the valve manually. To exit the manual mode, use the LEFT (◀) arrow key to return to the choice list. Select ANALOG.


Note

When placing the instrument back into ANALOG, the valve will step back to the position commanded by the input current.

Figure 3-9. Local Control



Diagnostic Messages, Codes and Details

The DVC2000 digital valve controller is constantly diagnosing itself for abnormal conditions while powered-up. The following messages will appear on the local user interface if a fault condition exists (identified on the default screen by the alert symbol ).

SWITCH 1 ???

SWITCH 2 ???—The alert symbol in conjunction with the above text indicates that limit switch circuit 1 is not powered, or at least one of the switches is enabled. In order for either of the switches to work, switch circuit 1 must be powered. Switch 2 cannot be used alone. To eliminate the alert symbol, you can either apply 5 to 30 VDC to switch circuit 1 or disable both switches from DETAILED SETUP.

Once switch circuit 1 is powered properly, question marks (???) will indicate that the corresponding switch is disabled.

Shutdown Activated— This screen appears if the positioner has shut down and no air is being delivered to the actuator. Therefore, the valve is at its fail-safe position. An example of a source of this error is corrupt firmware code upon start-up. The factory default setting for this error is disabled. Therefore, this alert will only be enabled by actively configuring it with a HART based host (e.g. Field Communicator, ValveLink software).

Travel Deviation— This error message indicates that there is a difference between the input signal (after characterization) and the actuator travel reading from the position feedback element. The default setting is 7% for 5 seconds. These settings can be configured through a HART communicating host on any instrument HC tier or higher. Possible sources of this error are insufficient air supply or excessive valve friction.

Replace Main Board— A problem with the electronics has been detected. Sources of this error may include hardware or firmware problems. If this error is detected, the instrument may be operational, but performance will be degraded.

Check Mounting— The valve position feedback reading is valid, but it is outside the operating range. Sources of this error include loose or bent mounting brackets or a misaligned magnet array. This error does not identify faulty components, but rather faulty installation or alignment. This alert is also called a Travel Sensor Failure.

Check Supply— The valve is not able to reach its target position due to insufficient supply pressure. This error will most likely occur in conjunction with the Travel Deviation error.

Check I/P Converter— A problem relating to the I/P converter has been detected. Sources of this error include:

- Electronics problems indicated by the drive current read back being out of range
- Low supply pressure indicated by an active drive signal alert
- A stuck valve resulting in integrator wind-up.

Device Locked by HART— Another HART host (e.g. ValveLink software, AMS Suite: Intelligent Device Manager, or the Field Communicator) is communicating with the DVC2000. Typically this means that the instrument is “out of service”. In devices with firmware version 3 or later, you can clear this message by holding down the left button while cycling power to the DVC2000. This will place the instrument back “in service.”

FIELDVUE Instruments—This is displayed when there are no languages loaded on the DVC2000. This could occur during firmware download.

Pressure = ???—The actuator pressure reading is greater than 125% of the configured maximum supply pressure. For example, if the supply pressure range was set to 35 psi and the actual supply pressure was 45 psi, you will see ???’s when the DVC2000 is delivering full supply pressure to the actuator. If you reduce the supply pressure, or stroke the valve closed (air-to-open/fail closed setup), eventually there will be a point where numerical values appear.

This configuration parameter can be changed through the Field Communicator (1-1-2-2-3) or ValveLink software (Detailed Setup > Pressure).

Section 4 Detailed Setup and Calibration via HART Communication

Detailed Setup

The DVC2000 digital valve controller has the capability to communicate via the HART protocol. This section describes the advanced features that can be accessed with the Field Communicator.

Setting Modes

Field Communicator	Setup & Diag > Detailed Setup > Mode (1-2-1)
--------------------	--

Instrument Mode

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

Instrument Mode allows you to either take the instrument Out Of Service or place it In Service. Taking the instrument Out Of Service allows you to perform instrument calibration and also allows you to change 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

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

Control Mode lets you define where the instrument receives 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, for example during

calibration or stroke valve. However, if you abort from a procedure where the instrument is in the Test mode, it may remain in this mode. To take the instrument out of the Test mode, select *Control Mode* then select either Analog or Digital.

Restart Control Mode

Restart Control Mode (*Restart Cont 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.

Restarting the Instrument

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

Burst Mode

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

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

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

Command 3 provides the following variables:

- Primary variable—analog input in % or mA,
- Secondary variable—travel target (valve set point) in % of ranged travel,
- Tertiary variable—output pressure in psig, bar, or kPa,
- Quaternary variable—travel in % of ranged travel.

To enable burst mode select *Mode > Burst > Burst Enable*. To send a burst mode command, select *Burst Command*. Burst mode must be enabled before you can change the burst mode command.

Table 4-1. Factory Default Detailed Setup Parameters

Setup Parameter	Default Setting ⁽¹⁾
Control Mode	Analog
Restart Control Mode	Resume Last
Burst Mode Enabled	No
Burst Mode Command	3
HART Tag	As specified on order
Message	Blank
Descriptor	Blank
Date	Factory Calibration Date
Valve Serial Number	Blank
Polling Address	0
Max Supply Pressure	100 ⁽²⁾
Zero Control Signal	Open ⁽²⁾
Analog Input Units	mA
Analog In Range High	20 mA
Analog In Range Low	4.0 mA
Travel Range High	100%
Travel Range Low	0%
Pressure Units	PSI ⁽²⁾
Temperature Units	F
Input Characteristic	Linear
Set Point Filter Time	Filter Off
Travel Limit High	125%
Travel Limit Low	-25%
Travel Cutoff High	99.5%
Travel Cutoff Low	0.5%
Minimum Opening Time	0 secs
Minimum Closing Time	0 secs
Integral Gain	1 repeat/minute
Integral Deadband	0.5%
Travel Hi/Lo Alert Enabled	No
Travel Hi Hi/Lo Lo Alert Enabled	No
Travel Alert High Point	125%
Travel Alert Low Point	-25%
Travel Alert High-High Point	125%
Travel Alert Low-Low Point	-25%
Travel Alert Deadband	1%
Travel Deviation Alert Enable	Yes
Travel Deviation Alert Point	7%
Travel Deviation Time	5 secs
Cycle Counter Alert Enable	No
Cycle Counter Alert Point	2,147,483,646
Cycle Counter Deadband	3%
Cycle Counter	0
Travel Accumulator Alert Enable	No
Travel Accumulator Alert Point	2,147,483,646%
Travel Accumulator Deadband	3%
Travel Accumulator	0
Drive Alert Enable	No
Flash ROM Fail	No
No Free Time	No
Ref Voltage Fail	No
Drive Current Fail	No
Critical NVM Fail	No
Temperature Sensor Fail	No
Pressure Sensor Fail	No
Travel Sensor Fail	No

1. The settings listed are for standard factory configuration. DVC2000 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.

Setting Protection

Field Communicator	Setup & Diag > Detailed Setup > Protection (1-2-2)
--------------------	--

Some setup parameters may require changing the protection with the Field Communicator.

Two levels of protection are available:

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

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

Table 4-2. Conditions for Modifying FIELDVUE DVC2000 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	---	---	---	✓
Max Supply Pressure	---	---	---	✓
Zero Ctrl Signal	---	---	---	✓
Analog In Units	---	---	---	✓
Input Range High	---	---	---	✓
Input Range Low	---	---	---	✓
Pressure Units	---	---	---	✓
Temp Units	✓	✓	✓	✓
Tuning Set	---	✓	---	✓
Prop Gain	---	✓	---	✓
Velocity Gain	---	✓	---	✓
MLFB Gain	---	✓	---	✓
Input Char	---	---	---	✓
Define Custom Char	---	---	---	✓
Set Pt Filter Time	---	---	---	✓
Tvl Limit High	---	---	---	✓
Tvl Limit Low	---	---	---	✓
Tvl Cutoff High	---	---	---	✓
Tvl Cutoff Low	---	---	---	✓

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

-Continued-

Table 4-2. Conditions for Modifying FIELDVUE DVC2000 Digital Valve Controller Parameters (Continued)

Parameters	In Service/ Config Protected	In Service/ Config Unprotected	Out of Service/ Config Protected	Out of Service/ Config Unprotected
Min Opening Time Min Closing Time	---	---	---	✓
Integral Gain Integral Deadband	---	✓	---	✓
Tvl Hi/Lo Enab Tvl HH/LL Enab Tvl Alert Hi Pt Tvl Alert Lo Pt Tvl Alert HiHi Pt Tvl Alert LoLo Pt Tvl Alrt DB	✓	✓	✓	✓
Tvl Dev Alrt Enab Tvl Dev Alrt Pt Tvl Dev Time	✓	✓	✓	✓
Cycl Cnt Alrt Enab Cycl Count Alrt Pt Cycl Count DB Cycl Count	✓	✓	✓	✓
Tvl Acum Alrt Enab Tvl Acum Alrt Pt Tvl Acum DB Tvl Acum	✓	✓	✓	✓
Drive Alrt Enab	✓	✓	✓	✓
Flash ROM Fail No Free Time Ref Voltage Fail Drive Current Fail Critical NVM Fail Temp Sensor Fail Press Sensor Fail Tvl Sensor Fail	---	---	---	✓

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

To change an instrument's protection, press the Hot key on the Field Communicator display window and select *Protection* or select *Protection* from the *Detailed Setup* menu. Select the desired level of protection. Follow the prompts on the Field Communicator display to set the protection level.

General Information

Field Communicator	Setup & Diag > Detailed Setup > General (1-2-3)
--------------------	---

Follow the prompts on the Field Communicator to enter or view information in the following fields:

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

- *LUI Language*—Select the language to be displayed on the local user interface; English, French, German, Italian, Spanish, Chinese and Japanese.

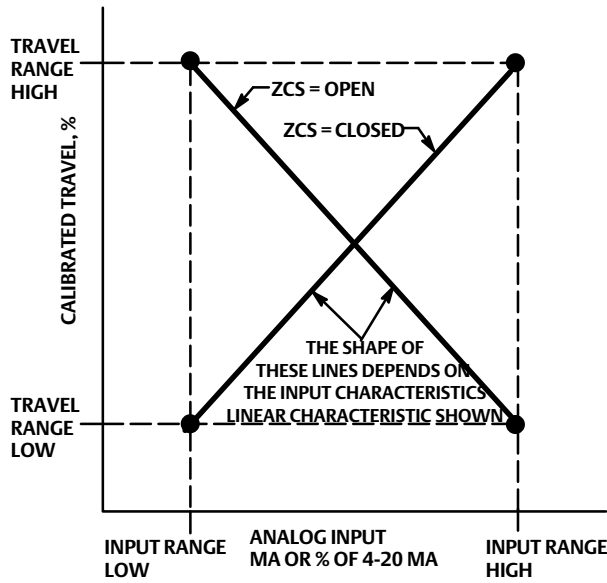
Measured Variable Units and Ranges

Field Communicator	Setup & Diag > Detailed Setup > Measured Var (1-2-4)
--------------------	--

Follow the prompts on the Field Communicator to define the following measured variables units and ranges:

- *Analog In Units*—Permits defining the Analog Input Units in mA or percent of 4-20 mA range.
- *Input Range Hi*—Permits setting the Input Range High value. Input Range High should correspond to Travel Range High, if the Zero Control Signal is configured as closed. If the Zero Control Signal is configured as open, Input Range High corresponds to Travel Range Low. See figure 4-1.
- *Input Range Lo*—Permits setting the Input Range Low value. Input Range Low should correspond to Travel Range Low, if the Zero Control Signal is configured as closed. If the Zero Control Signal is configured as open, Input Range Low corresponds to Travel Range High. See figure 4-1.
- *Pressure Units*—Defines the output and supply pressure units in either psi, bar, or kPa.
- *LUI Pressure Units*—Enter the pressure units displayed on the local user interface; psi, bar, or kPa.
- *Temp Units*—Degrees Fahrenheit or Celsius. The temperature measured is from a sensor mounted on the digital valve controller's printed wiring board.

Figure 4-1. Calibrated Travel to Analog Input Relationship



NOTE:
ZCS = ZERO CONTROL SIGNAL

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Actuator and Valve Information

Field Communicator	Setup & Diag > Detailed Setup > Actuator & Valve (1-2-5)
--------------------	--

Follow the prompts on the Field Communicator to edit or view information in the following fields:

- *Max Supply Press*—Enter the maximum supply pressure in psi, bar, or kPa, depending on what was selected for pressure units.

Note

If the actual measured pressure exceeds this setting by 25%, the pressure measurement will not be displayed.

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

Setting Response

Field Communicator	Setup & Diag > Detailed Setup > Response Control (1-2-6)
--------------------	--

Follow the prompts on the Field Communicator to configure the following response control parameters:

⚠ 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.

- *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 3-4 lists the proportional gain, velocity gain, and minor loop feedback gain values for preselected tuning sets.
- *Damping Factor*—If after selecting a tuning set the valve travel overshoot is excessive or unsatisfactory, the damping factor allows you to either decrease damping to allow more overshoot, or increase damping to decrease the overshoot.
- *Expert Tuning Gains*—With Expert Tuning, you can specify the proportional gain, velocity gain, and minor loop feedback gain.
- *Input Char*—Defines the relationship between the travel target and ranged set point. Ranged set point is the input to the characterization function. If the zero control signal equals closed, then a set point of 0% corresponds to a ranged input of 0%. If the zero control signal equals open, a set point of 0% corresponds to a ranged input of 100%. Travel target is the output from the characterization function.

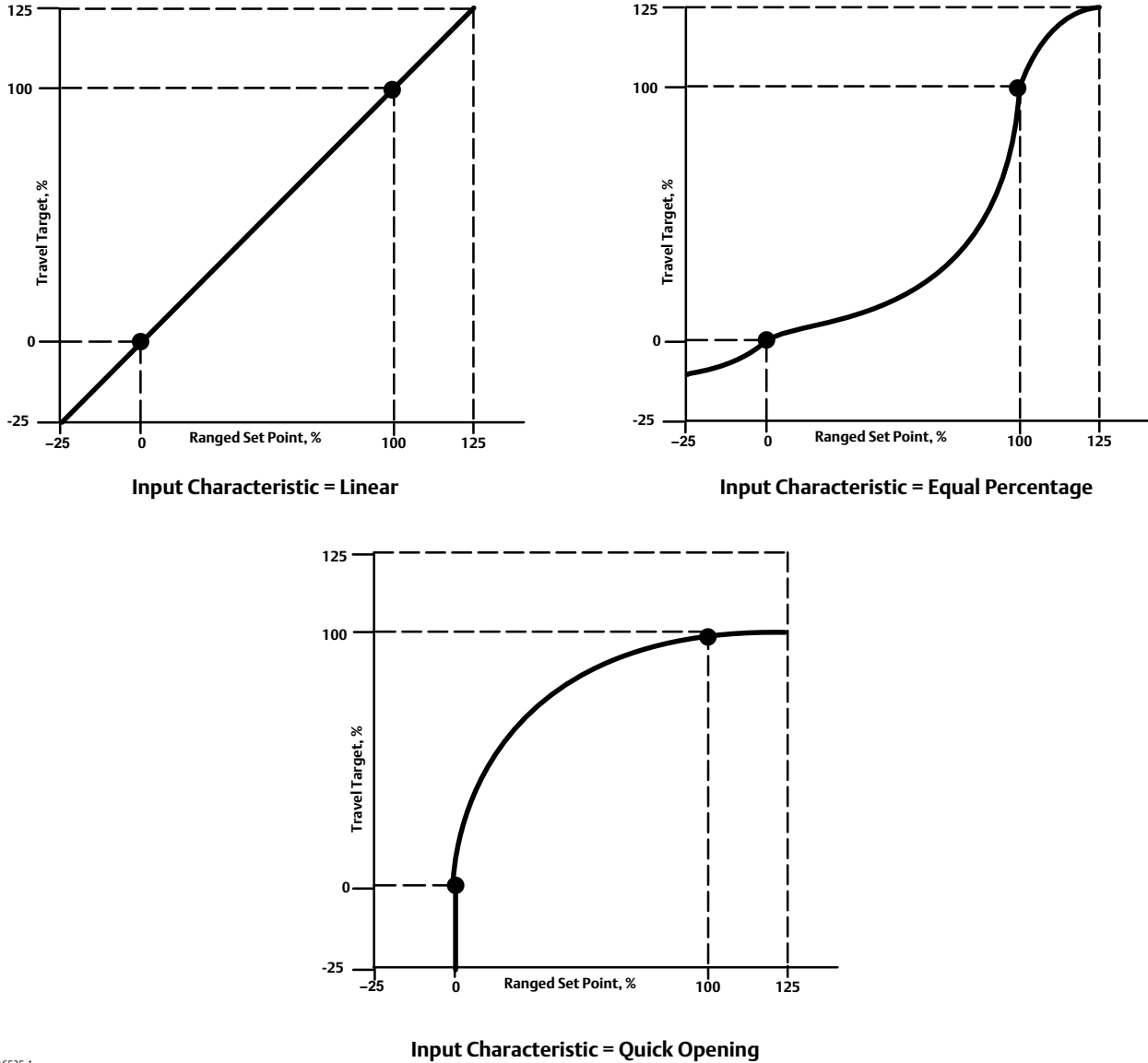
You can select from the three fixed input characteristics shown in figure 4-2 or you can select a custom characteristic. Figure 4-2 shows the relationship between the travel target and ranged set point for the fixed input characteristics, assuming the Zero Control Signal is configured as closed.

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.

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).

- *Custom Char Table*—To define a custom input characteristic, select *Custom Char Table*. 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.

Figure 4-2. Travel Target Versus Ranged Set Point, for Various Input Characteristics (Zero Control Signal = Closed)



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- **Setpt Filter Time**—Time constant for the set point filter, in seconds. The set point filter slows the response of the digital valve controller and is typically used with noisy or fast processes. The filter provides improved closed loop process control. To disable the filter, set the time constant to 0 seconds.
- **Limits and Cutoffs**

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%.

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

Travel Cutoff Lo—Defines the low cutoff point for the travel. Travel Cutoff Low can be used to ensure proper seat load is applied to the valve. When below the travel cutoff low, the output is set to zero or to full supply pressure, depending upon the zero control signal. A Travel Cutoff Low of 0.5% is recommended to help ensure maximum shutoff seat loading.

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

- Min Open/Close

Min Opening Time—Minimum Opening Time is configured in seconds and defines the minimum time for the travel to increase the entire ranged travel. This rate is applied to any travel increases. A value of 0.0 seconds deactivates this feature and allows the valve to stroke open as fast as possible. This parameter should be set to 0 in firmware 1, 2, 3, and 4.

Min Closing Time—Minimum Closing Time is configured in seconds and defines the minimum time for the travel to decrease the entire ranged travel. This rate is applied to any travel decreases. A value of 0.0 seconds deactivates this feature and allows the valve to stroke closed as fast as possible. This parameter should be set to 0 in firmware 1, 2, 3, and 4.

- Integral Settings

Enab Int Control—Select Yes or No

Integral Gain—By setting this value to 0.0 the positioner integrator is disabled. Any other value will provide reset action to improve static performance.

Integral Dead Zone—When the travel target and actual target deviate by less than this amount, the integrator is automatically disabled. This prevents the positioner integrator from fighting with the process controller integrator which may result in valve oscillation.

Setting Alerts

Field Communicator

Setup & Diag > Detailed Setup > Alerts (1-2-7)
--

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 alerts.

Note

Alerts are not available with instrument level AC.

Setting Travel Alerts

Setting High, High-High, Low and Low-Low Alerts

Follow the prompts on the Field Communicator to set the following travel alerts:

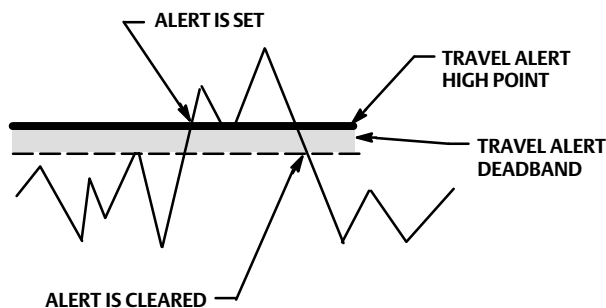
- *Tvl Hi/Lo Enab*—Yes or No. Travel Hi/Lo Enable activates checking of the ranged travel against the Travel Alert High and Low Points. Travel Alert Hi is set if the ranged travel rises above the alert high point. Once the alert is set, the ranged travel must fall below the alert high point by the Travel Alert Deadband before the alert is cleared. See figure 4-3.

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. See figure 4-3.

- *Tvl HH/LL Enab*—Yes or No. Travel HH/LL Enable activates checking of the ranged travel against the Travel Alert High-High and Low-Low Points. Travel Alert Hi Hi is set if the ranged travel rises above the alert high-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 4-3.

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. See figure 4-3.

Figure 4-3. Travel Alert Deadband



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

- *Tvl Alrt DB*—Travel Alert Deadband is the travel, in percent (%) of ranged travel, required to clear a travel alert, once it has been set. The deadband applies to both Travel Alert Hi/Lo and Travel Alert Hi Hi/Lo Lo. See figure 4-3.

Note

The Travel Alert Deadband applies to the Travel Deviation as well as Travel Alert Hi/Lo and Travel Alert Hi Hi/Lo Lo.

Setting Travel Deviation Alert

Follow the prompts on the Field Communicator to set the following travel deviation alerts:

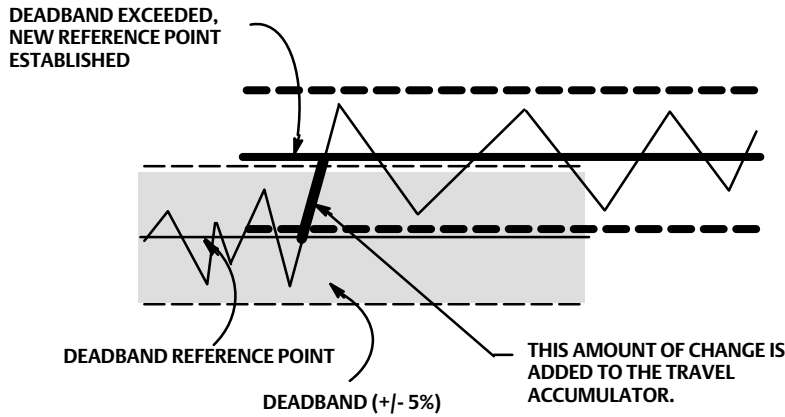
- *Tvl Dev Alrt Enab*—Yes or No. When enabled, checks the difference between the travel target and the actual travel. If the difference exceeds the Travel Deviation Alert Point for more than the Travel Deviation Time, the Travel Deviation Alert is set. It remains set until the difference between the travel target and the actual travel is less than the Travel Deviation Alert Point minus the Travel Alert Deadband.
- *Tvl Dev Alrt Pt*—Travel Deviation Alert Point is the alert point for the difference, expressed in percent (%), between the 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.
- *Tvl Dev 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.

Setting Travel Accumulation Alert

Follow the prompts on the Field Communicator to set the following travel accumulation alerts:

- *Tvl Accum Alrt Enab*—Yes or No. Travel Accumulator Alert Enable activates checking of the difference between the Travel Accumulator value and the Travel Accumulator Alert Point. The Travel Accumulator Alert is set when the Travel Accumulator value exceeds the Travel Accumulator Alert Point. It is cleared after you reset the Travel Accumulator to a value less than the alert point.
- *Tvl Accum Alrt Pt*—Travel Accumulator Alert Point is the value of the Travel Accumulator, in percent (%) of ranged travel, which, when exceeded, sets the Travel Accumulator Alert.
- *Tvl Accum DB*—Travel Accumulator Deadband is the area around the travel reference point, in percent (%) of ranged travel, that was established at the last increment of the accumulator. This area must be exceeded before a change in travel can be accumulated. See figure 4-4.
- *Tvl Accum*—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 Dead- band. See figure 4-4. You can reset the Travel Accumulator by configuring it to zero.

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



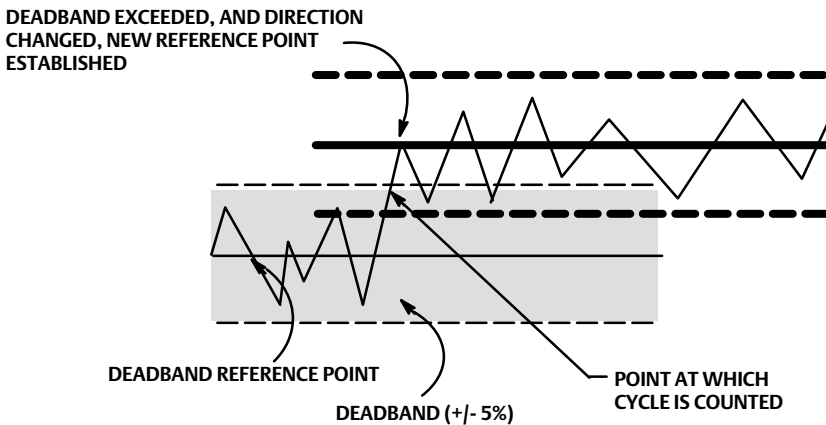
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Cycle Counter Alert

Follow the prompts on the Field Communicator to set the following cycle counter alerts:

- *Cycl Cnt Alrt Enab*—Yes or No. Cycle Counter Alert Enable activates checking of the difference between the Cycle Counter and the Cycle Counter Alert point. The Cycle Counter Alert is set when the value exceeds the Cycle Counter Alert point. It is cleared after you reset the Cycle Counter to a value less than the alert point.
- *Cycl Cnt Alrt Pt*—Cycle Counter Alert Point is the value of the Cycle Counter, in cycles, which, when exceeded, sets the Cycle Counter Alert.
- *Cycle Count DB*—Cycle Counter Deadband is the area around the travel reference point, in percent (%) of ranged travel, that was established at the last increment of the Cycle Counter. This area must be exceeded before a change in travel direction can be counted as a cycle. See figure 4-5.

Figure 4-5. Cycle Counter Deadband (set at 10%)



A6533-1

- *Cycle Count*—Cycle Counter records the number of times the travel changes direction. The change in direction must occur after the deadband has been exceeded before it can be counted as a cycle. See figure 4-5. You can reset the Cycle Counter by configuring it as zero.

Other Alerts

Follow the prompts on the Field Communicator to configure Drive Alert Enable:

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

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

Drive Signal < 10% and Calibrated Travel > 3%

Drive Signal > 90% and Calibrated Travel < 97%

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

Drive Signal < 10% and Calibrated Travel < 97%

Drive Signal > 90% and Calibrated Travel > 3%

Alert Record

The alert record can store up to 20 alerts from any of the enabled alert groups: Valve Alerts, Failure Alerts, or Miscellaneous Alerts. Starting from a cleared database, the first 20 alerts that become active will be stored in memory.

Follow the prompts on the Field Communicator to set or display the following:

- *Display Record*—Displays all recorded alerts and the date and time the alerts were recorded.
- *Clear Record*—Clears the alert record. To clear the alert record, all alerts in enabled groups must be inactive.
- *Inst Date & Time*—Permits setting the instrument clock. When alerts are stored in the alert record, the date and time (obtained from the instrument clock) that they were stored is also stored in the record. The instrument clock uses a 24-hour format. Enter the date and time in the form: MM/DD/YYYY HH:MM:SS, where MM is two digits for the month (1 through 12), DD is two digits for the day (1 through 31), and YYYY is four digits for the year (1980 through 2040), HH is two digits for the hour (00 to 23), MM is two digits for the minutes (00 to 59), and SS is two digits for the seconds (00 through 59).
- *Record Group Enab*—Permits enabling one or more alert groups. Table 5-2 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.

Self Test Failures for Instrument Shutdown

Field Communicator	Setup & Diag > Detailed Setup > Self Test Shutdown (1-2-8)
--------------------	--

Upon shutdown, the instrument attempts to drive its output pressure to the zero current condition and no longer executes its control function. In addition, the appropriate failure statuses are set. Once the problem that caused the shutdown has been fixed, the instrument can be restarted by cycling the power or selecting Restart from the *Mode* menu of the Field Communicator. Also see the Viewing Instrument Status section on page 61 for further details about failures.

Follow the prompts on the Field Communicator display to determine the self test shutdown criteria from the following:

- *Done*—Select this if you are done modifying the self test shutdown criteria.
- *Flash ROM Fail*—When enabled, the instrument shuts down whenever there is a failure associated with flash ROM (read only memory).
- *No Free Time*—When enabled, the instrument shuts down whenever there is a failure associated with No Free Time.
- *Temp Comp Fail*—When enabled, the instrument shuts down whenever this is a failure associated with Temperature Compensation.
- *Ref Voltage Fail*—When enabled, the instrument shuts down whenever there is a failure associated with the internal voltage reference.
- *Drive Current Fail*—When enabled, the instrument shuts down whenever the drive current does not read as expected.
- *NVM Fail*—When enabled, the instrument shuts down whenever there is a failure associated with NVM (non-volatile memory).
- *Temp Sensor Fail*—When enabled, the instrument shuts down whenever there is a failure associated with the internal temperature sensor.
- *Press Sensor Fail*—When enabled, the instrument shuts down whenever there is a failure associated with the pressure sensor.
- *Travel Sensor Fail*—When enabled, the instrument shuts down whenever there is a failure associated with the travel sensor.

Transmitters/Switches

Field Communicator | Setup & Diag > Detailed Setup > Transmitter/Switches (1-2-9)

Note

These menu items are only available on units that have the optional position transmitter / limit switch hardware installed.

If optional limit switches are being used, power must be applied to the switch circuits throughout the calibration routine. Failure to power the switches may result in incorrect switch orientation.

Follow the prompts on the Field Communicator display to configure the following:

- *Switch 1 Trip Point*—Defines the threshold for the limit switch wired to terminals +41 and -42 in percent of calibrated travel.
- *Switch 1 Closed*—Configures the action of the limit switch wired to terminals +41 and -42. Selecting ABOVE configures the switch to be closed when the travel is above the trip point. Selecting BELOW configures the switch to be closed when the travel is below the trip point. Selecting DISABLED removes the icons and status from the display.
- *Switch 2 Trip Point*—Defines the threshold for the limit switch wired to terminals +51 and -52 in percent of calibrated travel.
- *Switch 2 Closed*—Configures the action of the limit switch wired to terminals +51 and -52. Selecting ABOVE travel is above the trip point. Selecting BELOW configures the switch to be closed when the travel is below the trip point. Selecting DISABLED removes the icons and status from the display.

Note

Switch #2 is only operational if power is applied to switch #1 also. Switch #2 cannot be used alone.

- *Transmitter Action*—This configures the relationship between the valve travel and the position transmitter output signal. If you select CLOSED, the transmitter will send 4 mA when the valve is closed. If you select OPEN, the transmitter will send 4 mA when the valve is open.

A switch is located on the options board to select the transmitter fail signal (high+ or low-). High+ will result in a current output of > 22.5 mA upon transmitter failure. Low- will result in a current output of < 3.6 mA. Refer to figure 3-6 for location and switch selection.

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.

Automatic

Field Communicator	Calibrate > Calibrate > Auto Tuner (1-4-5)
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The auto tuner is used to optimize digital valve controller tuning. It can be used on most sliding-stem and rotary designs, including Fisher and other manufacturers' products. Moreover, because the auto tuner can detect internal instabilities before they become apparent in the travel response, it can generally optimize tuning more effectively than manual tuning.

Manual

If the auto tuner does not provide the desired responsiveness, you can manually tune the DVC2000. Refer to Setting Response, page 44.

Calibration

Field Communicator	Calibrate > Calibrate (1-4)
--------------------	-----------------------------

⚠ 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.

Note

If optional limit switches are being used, power must be applied to the switch circuits throughout the calibration routine. Failure to power the switches may result in incorrect switch orientation.

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. Select *Analog In Calib* from the *Calibrate* menu, then 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. Selecting large, medium, and small adjustments causes changes of approximately 0.4 mA, 0.04 mA, and 0.004 mA, respectively. If the displayed value does not match the current source, press OK, then repeat this step (step 8) to further adjust the displayed value. When the displayed value matches the current source, select Done and go to step 9.
9. Place the instrument In Service and verify that the analog input displayed matches the current source.

Auto Calibrate Travel

1. 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 beam position sensor.

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

Adjusting the output bias aligns the travel set point with the actual travel by computing the drive signal required to produce 0% error. This is done while the valve is at 50% travel, making very small adjustments.

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

Manual Calibrate Travel

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 4, 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 50% travel, then press OK.
5. 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.

Note

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

1. 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 1. Otherwise, select Done and go to step 2.
- 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 2. Otherwise, select Done and go to step 3.
 - From the adjustment menu, select the direction and size of change required to set the travel to 50%.
If another adjustment is required, repeat step 3. Otherwise, select Done and go to step 4.
 - Place the instrument In Service and verify that the travel properly tracks the current source.

Pressure Sensor Calibration

Note

The pressure sensor is calibrated at the factory and should not require calibration.

Output Pressure Sensor Calibration

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. From the *Calibrate* menu, select *Pressure Calib*. Follow the prompts on the Field Communicator display to calibrate the instrument's output pressure sensor.

- Adjust the supply pressure regulator to the maximum instrument supply pressure. Press OK.
- 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.

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

Position Transmitter Calibration

Note

The position transmitter is calibrated at the factory and should not require calibration.

Note

This procedure will not move the control valve. The instrument will simulate an output for calibration purposes only.

This procedure is only available on units that have the optional position transmitter / limit switch hardware installed. The DVC2000 digital valve controller is shipped from the factory with the position transmitter already calibrated.

To calibrate the position transmitter, select *Transmitter Calibration* from the *Calibrate* menu. Connect a current meter in series with the +31 and -32 terminals, and a voltage source (such as the DCS analog input channel). Follow the prompts on the Field Communicator display to manipulate the output current read by the current meter to 4 mA, and then to 20 mA.

Section 5 Viewing Device Variables and Diagnostics

Viewing Variables

Note

These variables are not available for instrument level AC.

Analog Input, Travel, Valve Set Point, Drive Signal and Output Pressure

The following variables are displayed on the Online menu:

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

Travel shows the value of the DVC2000 digital valve controller travel in % (percent) of ranged travel. Travel always represents how far the valve is open.

Valve SP shows the requested valve position in % of ranged travel.

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

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

Additional Instrument Variables

Field Communicator	Setup & Diag > Display > Variables (1-3-1)
--------------------	--

Note

These variables are not available for instrument level AC.

The *Variables* menu is available to view additional variables, such as the status of the auxiliary input, the instrument internal temperature, cycle count, travel accumulation and device free time. 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 Free Time.

- *Temp*—The internal temperature of the instrument is displayed in either degrees Fahrenheit or Celsius.
- *Cycl Count*—Cycle Counter displays the number of times the 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.

- *Tvl Accum*—Travel Accumulator contains the total change in travel, in percent of ranged travel. The accumulator only increments when travel exceeds the deadband. Then the greatest amount of change in one direction from the original reference point (after the deadband has been exceeded) will be added to the Travel Accumulator. The value of the Travel Accumulator can be reset from the *Travel Accum Alert* menu.

Viewing Device Information

Field Communicator	Setup & Diag > Display > Device Information (1-3-2)
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The *Device Information* menu is available to view information about the instrument.

Follow the prompts on the Field Communicator display to view information in the following fields:

- *HART Univ Rev*—HART Universal Revision is the revision number of the HART Universal Commands which are used as the communications protocol for the instrument.
- *Device Rev*—Device Revision is the revision number of the software for communication between the Field Communicator and the instrument.
- *Firmware Rev*—Firmware Revision is the revision number of the Fisher firmware in the instrument.
- *Firmware Date*—Firmware Date is the revision date of the firmware being used.
- *Main Elec Rev*—Main Electronics Revision is the revision number of the main electronics component.
- *Sec Elec Rev*—Secondary Electronics Revision is the revision number of the secondary electronics component.
- *Sensor Serial Num*—Sensor Serial Number is the serial number of the sensor
- *Inst Level*—Indicates the instrument level
 - AC—Auto Calibrate
 - HC—HART Communicating
 - AD—Advanced Diagnostics
 - PD—Performance Diagnostics

Table 5-1 lists the functions available for each instrument level.

Table 5-1. Functions Available for Instrument Level

Instrument Level	Functions Available
AC	Communicates via the LCD or with Field Communicator. Provides basic setup and calibration.
HC	Communicates via the LCD, the Field Communicator and ValveLink Software. Provides basic setup, calibration, travel cutoffs and limits, minimum opening and closing times, input characterization (linear, equal percentage, quick opening, and custom) 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 online valve signature test (friction analysis)

- *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.

Viewing Instrument Status

Field Communicator	Instrument Status (7)
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Note

Instrument Status is not available for instrument level AC.

The following describes the various displays for the Instrument Status menu.

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

Note

Alerts are not available with instrument level AC.

- **Valve Alerts**—If a valve alert is active, it will appear when the Valve Alerts menu item is selected. If more than one alert is active, they will appear on the display one at a time in the order listed below.
 1. Alert Record has Entries
 2. Alert Record is full
 3. Instrument Time is Invalid
 4. Tvl Accumulation Alert
 5. Cycle Counter Alert
 6. Non-critical NVM Alert
 7. Power Starvation Alert
 8. Drive Signal Alert
 9. Tvl Lim/Cutoff Low
 10. Tvl Lim/Cutoff High
 11. Tvl Deviation Alrt
 12. Tvl Alert Hi Hi
 13. Tvl Alert Hi
 14. Tvl Alert Lo Lo
 15. Tvl Alert Lo

- **Failure Alerts**—If a self-test failure has occurred, it will appear when the Failure Alerts menu item is selected. If there are multiple failures, they will appear on the display one at a time in the order listed below.
 1. *Offline/Failed*—This failure indicates 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.
 2. *Travel Sensor Fail*—This failure indicates the sensed travel is outside the range of -25.0 to 125.0% of calibrated travel. If this failure is indicated, check the instrument mounting.
 3. *Pressure Sensor Fail*—This failure indicates the actuator pressure is outside the range of -24.0 to 125.0% of the calibrated pressure for more than 60 seconds. If this failure is indicated, check the instrument supply pressure. If the failure persists, ensure the printed wiring board assembly is properly mounted onto the mounting frame, and the pressure sensor O-rings are properly installed. If the failure does not clear after restarting the instrument, replace the printed wiring board assembly.
 4. *Temperature Sensor Fail*—This failure is indicated when the instrument temperature sensor fails, or the sensor reading is outside of the range of -40 to 85°C (-40 to 185°F). The temperature reading is used internally for temperature compensation of inputs. If this failure is indicated, restart the instrument and see if it clears. If it does not clear, replace the printed wiring board assembly.
 5. *NVM Fail*—This failure is indicated when the Non-Volatile Memory integrity test fails. Configuration data is stored in NVM. If this failure is indicated, restart the instrument and see if it clears. If it does not clear, replace the printed wiring board Assembly.
 6. *Drive Current Fail*—This failure is indicated when the drive current does not read as expected. If this failure 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.
 7. *Ref Voltage Fail*—This failure is indicated whenever there is a failure associated with the internal voltage reference. If this failure is indicated, restart the instrument and see if it clears. If it does not clear, replace the printed wiring board assembly.
 8. *No Free Time*—This failure is indicated if the instrument is unable to complete all of the configured tasks. This will not occur with a properly functioning instrument.
 9. *Flash ROM Fail*—This failure indicates the Read Only Memory integrity test failed. If this failure is indicated, restart the instrument and see if it clears. If it does not clear, replace the printed wiring board assembly.
- **Alert Record**—The instrument contains an alert record that can store up to 20 alerts from any of the enabled alert groups: Valve Alerts or Failure Alerts. See the Advanced Setup section for information on enabling alert groups. Table 5-2 lists the alerts included in each of the groups. The alert record also includes the date and time (from the instrument clock) the alerts occurred.

Table 5-2. Alerts Included in Alert Groups for Alert Record

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

- **Operational Status**—This menu item indicates the status of the Operational items listed below. The status of more than one operational may be indicated. If more than one Operational status is set, they will appear on the display one at a time in the order listed below.
 1. Out of Service
 2. Auto Calibration in Progress
 3. Input Char Selected
 4. Custom Char Selected
 5. Diagnostic in Progress
 6. Calibration in Progress
 7. Set Point Filter Active

Section 6 Maintenance and Troubleshooting

The DVC2000 digital valve controller has the capability to provide predictive maintenance information through the use of ValveLink software. This software allows you to pinpoint instrument and valve problems without disrupting the process. For information on using ValveLink software, see the ValveLink software User Guide.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance procedures on the the DVC2000 digital valve controller:

- Always wear protective clothing, gloves, and eyewear when performing any maintenance procedures to avoid personal injury or property damage.
- 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 control valve.
- Use bypass valves or completely shut off the process to isolate the control valve from process pressure. Relieve process pressure from both sides of the control 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.

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 1-1 and may also impair operations and the intended function of the device.

Stroking the Digital Valve Controller Output

Field Communicator	Setup & Diag > Stroke Valve (1-5)
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Note

Stroke Valve is not available with instrument level AC.

Follow the prompts on the Field Communicator display to select from the following: *Done*, *Ramp Open*, *Ramp Closed*, *Ramp to Target*, *Step to Target*, and *Stop*.

- *Done*—Select this if you are done. All ramping is stopped when DONE is selected.
- *Ramp Open*—ramps the travel toward open at the rate of 1.0% per second of the ranged travel.
- *Ramp Closed*—ramps the travel toward closed at the rate of 1.0% per second of the ranged travel.
- *Ramp to Target*—ramps the travel to the specified target at the rate of 1.0% per second of the ranged travel.
- *Step to Target*—steps the travel to the specified target.
- *Stop*—stops the command.

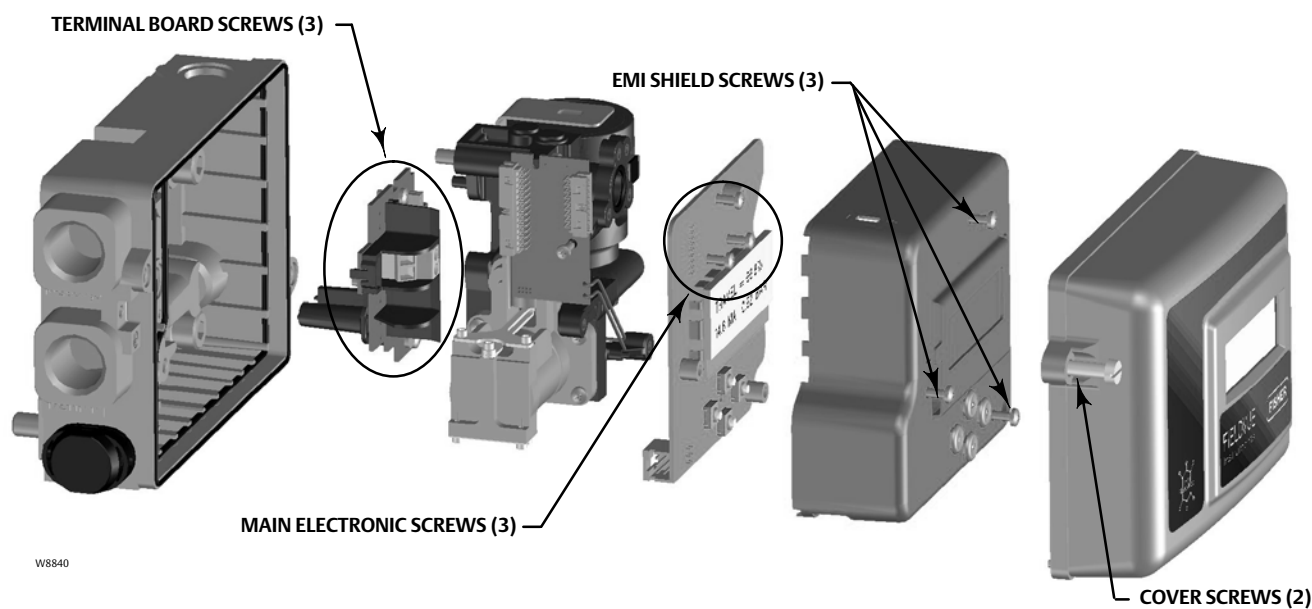
Replacing the Instrument

To replace an instrument that has been previously mounted to a control valve, perform the following basic steps:

Instrument Removal

1. Make sure that the valve is isolated from the process.
2. Remove the instrument cover (refer to figure 6-1).

Figure 6-1. FIELDVUE DVC2000 Exploded View



3. Disconnect the field wiring from the terminal board.
4. Shut off the instrument air supply and disconnect the tubing to the supply port.
5. Disconnect the tubing from the output port.

6. Remove the bolts connecting the DVC2000 housing to the mounting bracket.

Note

The magnet assembly may remain on the valve stem (or shaft).

When replacing the instrument, be sure to follow the mounting procedure outlined in Section 2. Once the instrument is mounted, perform the Quick Setup routine outlined in Section 3. If changes need to be made to the default settings, use the Detailed Setup routine to make the appropriate modifications.

Replacing 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 cover.
3. Disconnect the field wiring from the terminal board.
4. Shut off the instrument air supply.
5. Remove the DVC2000 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 procedure outlined in Section 2. Once the instrument is mounted, perform the Quick Setup routine outlined in Section 3. If changes need to be made to the default settings, use the Detailed Setup routine to make the appropriate modifications.

Component Replacements

When replacing any of the components of the DVC2000, 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.

CAUTION

When replacing components, proper means of electrostatic discharge protection is required. Failure to use a grounding strap, or other means of electrostatic discharge protection can result in damage to the electronics.

Replacing the Main Electronics

The main electronics contains the liquid crystal display, pushbuttons, and microprocessor with firmware. Calibration and configuration data is stored on the main electronics board.

Note

After replacing the main electronics board, recalibrate and configure the digital valve controller to maintain accuracy specifications.

Removal

1. Remove the main cover.
2. Remove three screws that hold the EMI shield and remove the shield (refer to figure 6-1).
3. Remove the three screws holding the electronics board to the mounting frame (refer to figure 6-1).
4. Pull the main electronics straight off of the mounting frame. The board is electrically connected to an interconnecting board with a rigid connector.

Installation

When installing a new board, follow the reverse procedure as outlined above and recalibrate the instrument. Take care to align the rigid connector properly, and install the pressure sensor O-ring before installing the three fasteners.

Replacing the Secondary Electronics

The secondary electronics contains the wiring terminations and the feedback sensor circuitry. Additionally, any optional electronics (limit switches and position transmitter) reside on the secondary electronics.

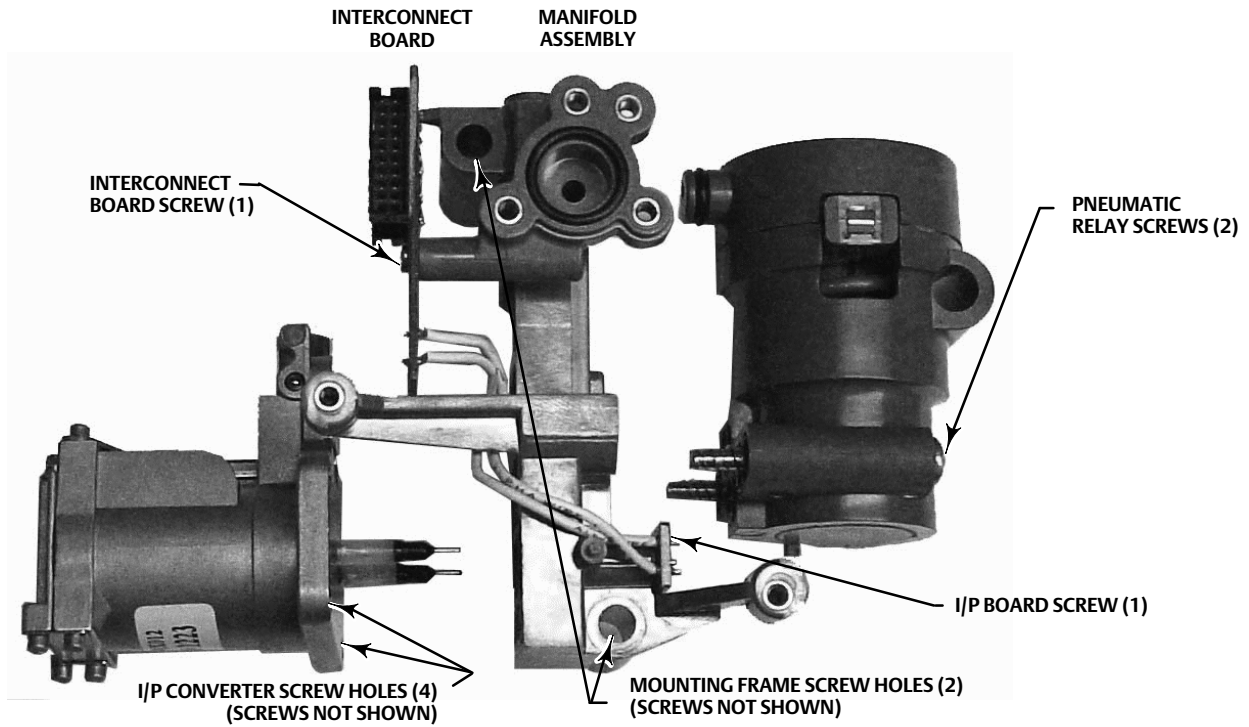
Note

After secondary electronics replacement, calibrate the digital valve controller to maintain accuracy specifications.

Removal

1. Remove the main cover.
2. Remove three screws that hold the EMI shield and remove the shield (refer to figure 6-1).
3. Remove the three screws holding the electronics board to the mounting frame (refer to figure 6-1).
4. Pull the main electronics straight off of the mounting frame. The board is electrically connected to an interconnecting board with a rigid connector.
5. Remove the two screws holding the mounting frame to the instrument housing (refer to figure 6-2).
6. Pull the mounting frame straight out. The interconnecting board is electrically connected to the termination board with a rigid connector.
7. Remove the small board from the I/P converter pins.
8. Remove the interconnect board from the mounting frame.
9. Remove the three screws holding the terminal board to the housing (refer to figure 6-1).
10. Pull the terminal board straight out of the housing.

Figure 6-2. Mounting Frame Assembly



Assembly

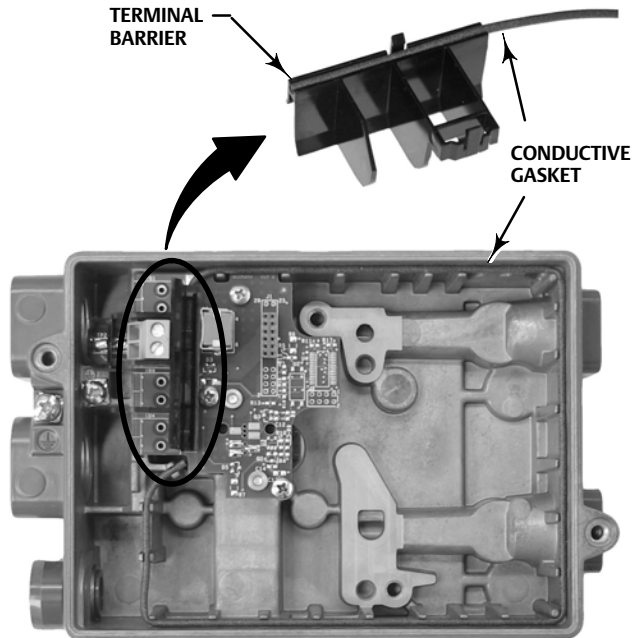
1. Replace the short conductive gasket (key 24) if necessary.
2. Place the O-ring seal (key 32) into the groove where the feedback sensor extends out through the housing.

Note

The proper placement of this O-ring is critical to maintaining proper ingress protection.

3. Place the termination/sensor board in the housing, taking care not to pinch the O-ring seal.
4. Tighten the 3 fasteners (keys 11 and 15).
5. Place the long conductive gasket (key 29) in the terminal barrier (key 36) as shown in figure 6-3.
6. Snap the terminal barrier to the terminal board assembly and place the conductive gasket along the perimeter of the DVC2000 housing.
7. Install the I/P and Interconnect boards to the Mounting Frame. Do not tighten the self-tapping screws on the interconnect board (key 42) at this point. The two wires must be inserted into the plastic wire retainer on the mounting frame (Intrinsically Safe units).
8. Install the Mounting Frame to the housing, making sure that the O-rings (keys 45 and 51) are in place.
9. Install the Main Electronics to the mounting frame, making sure that the pressure sensor seal (key 16) is in place.

Figure 6-3. Installation of Conductive Gasket



W8844

10. Tighten the self-tapping screw (key 42) on the Interconnect Board.
11. Install the Primary Shield (key 37) with three screws.
12. Recalibrate the instrument and install the cover.

Replacing the I/P Converter

The I/P converter is fastened to the mounting frame. On the I/P mounting surface is a replaceable screen with O-ring seal.

Note

After I/P converter replacement, calibrate the digital valve controller to maintain accuracy specifications.

Removal

1. Remove the main cover.
2. Remove three screws that hold the EMI shield and remove the shield (refer to figure 6-1).
3. Remove the three screws holding the electronics board to the mounting frame.

4. Pull the main electronics straight off of the mounting frame. The board is electrically connected to an interconnecting board with a rigid connector.
5. Remove the two screws holding the mounting frame to the instrument housing (refer to figure 6-2 for location of screws).
6. Pull the manifold assembly straight out. The interconnecting board is electrically connected to the termination board with a rigid connector.
7. Remove the interconnect board from the mounting frame.
8. Remove the four screws holding the I/P converter to the mounting frame (refer to figure 6-2 for location of screws).
9. Pull the I/P converter straight out taking care to capture the two o-rings (one has a screen).

Assembly

When installing a new I/P converter, follow the reverse procedure as outlined above and recalibrate the instrument.

1. Install the I/P converter, making sure the screen O-ring is installed on the I/P supply port (the circular port on the mounting frame), and that the two manifold O-rings are in place.
2. Install the interconnect board on the mounting frame. Do not tighten the self-tapping screw on the interconnect board (key 42) at this time.
3. Replace the manifold assembly.
4. Install the mounting frame to the housing, making sure that the O-rings (keys 45 and 51) are in place.
5. Install the main electronics to the mounting frame, making sure that the pressure sensor seal (key 16) is in place.
6. Tighten the self-tapping screw (key 42) on the Interconnect Board.
7. Install the primary shield (key 37) with three screws.
8. Recalibrate the instrument and install the cover.

Replacing the Pneumatic Relay

The pneumatic relay is fastened to the mounting frame. There are two versions, 0 to 3.4 bar (0 to 49 psig), indicated by a white label, and 3.5 to 7 bar (50 to 100 psig), indicated by a green label.

Note

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

Removal

1. Remove the main cover.
2. Remove three screws that hold the EMI shield and remove the shield (refer to figure 6-1).
3. Remove the three screws holding the electronics board to the mounting frame.
4. Pull the main electronics straight off of the mounting frame. The board is electrically connected to an interconnecting board with a rigid connector.
5. Remove the two screws holding the mounting frame to the instrument housing (refer to figure 6-2).
6. Pull the mounting frame straight out. The interconnecting board is electrically connected to the termination board with a rigid connector.

7. Remove the two screws holding the pneumatic relay to the mounting frame.
8. Pull the pneumatic relay straight out.

Assembly

When installing a new pneumatic relay, follow the reverse procedure as outlined above and recalibrate the instrument.

Troubleshooting

What is a healthy unit?

In order to troubleshoot the DVC2000 digital valve controller, it is critical to understand how a healthy unit is supposed to behave. Below is a list of behaviors you should see if the instrument is performing well.

- LCD correctly displaying characters
- Pushbuttons allow navigation
- Valve travels full stroke
- No diagnostics messages
- No alerts or alarms
- Hall sensor within the valid range of travel on the magnet array
- Slight audible air venting
- Minimal overshoot
- Quick response
- Functionality matches the tier level

What are the observable symptoms?

The next thing to do is to identify the symptoms of the unhealthy unit. Are there any obvious discrepancies that can be identified? Work through the following items to help gather information about the faulty behavior and identify the core problem(s). Also see the DVC2000 Troubleshooting Checklist on page 75.

1. Check the relay pressure range.

There are two available relays for the DVC2000:

- Low pressure: 0-3.4 bar (0-49 psi) — white label
- High pressure: 3.5-7 bar (50-100 psi) — green label

The supply pressure feeding the instrument must fall within the rated pressure range of the installed relay for proper operation.

2. Check the instrument protection (LCD via pushbuttons and Configure/Calibrate via HART)
3. Check for local device diagnostic messages
4. Check the alerts via HART
5. Check the feedback setup
 - Is the pole piece on the DVC2000 housing within the valid travel range of the feedback array?
6. Observe the stem movement and pressure delivery

Determine the logical causes.

With the discrepancies identified, logic can now be applied to isolate the component that is in need of repair or replacement. There are seven main categories of problems:

1. Wiring and Terminations
2. Air Supply
3. Electronics
4. Firmware
5. Pneumatics
6. Travel feedback
7. Mounting

Repair or replace the faulty components.

By isolating the problem to one of these categories, component replacement or repair becomes simple and straightforward. Refer to section 6 for component replacement instructions.

Checking Voltage Available

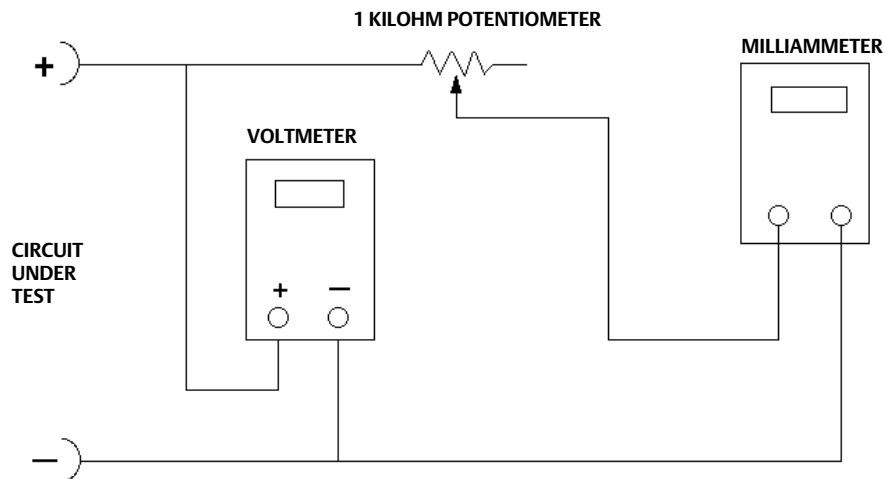
⚠ WARNING

Personal injury or property damage caused by fire or explosion may occur if this test is attempted in any 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. Disconnect the field wiring from the control system and connect equipment as shown in figure 6-4 to the control system terminals.”
2. Set the control system to provide maximum output current.
3. Set the resistance of the 1 kilOhm potentiometer shown in figure 6-4 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 9.0 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.

Figure 6-4. Voltage Test Schematic



A6192-1

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 "+11" and "-12" 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 8.0 V @ 4.0 mA and 8.25 V @ 20 mA.)

4. Is the front panel LCD functional? Yes _____ No _____

5. Is it possible to communicate with the DVC2000 via the LUI pushbuttons? Yes _____ No _____

6. Are Travel, Input Signal, and Output Pressure in the LCD shown correctly? Yes _____ No _____

7. Is it possible to communicate via HART to the DVC2000? Yes _____ No _____

8. What is the Diagnostic Tier of the digital valve controller? AC ____ HC ____ AD ____ PD ____

9. What is the firmware version of the DVC2000? _____

10. What is the hardware version of the DVC2000? _____

11. Is the digital valve controller's Instrument Mode "In Service"? Yes _____ No _____

12. Is the digital valve controller's Control Mode set to "Analog"? Yes _____ No _____

13. What are the following parameter readings?

Input Signal _____ Drive Signal _____% Pressure _____

Travel Target _____ Travel _____%

14. What are the following alert readings?

Fail alerts _____

Valve alerts _____

Operational status _____

Alert event record entries _____

15. Export ValveLink data (if available) for the device (Status Monitor, Detailed Setup, etc.).

Mounting

1. Actuator application: Sliding Stem? _____ Rotary? _____
2. What Make, Brand, Style, Size, etc. actuator is the DVC6000 SIS mounted on? _____
3. What is the Mounting Kit part number? _____
4. If mounting kits are made by LBP/Customer, please provide pictures of installation.
5. If sliding stem:
What is the full travel of the valve? _____
Which Magnet Array? 25 mm (1 inch) _____ 50 mm (2 inch) _____ 100 mm (4 inch) _____
Does the Magnet Array move through marked areas? Yes _____ No _____
6. If Rotary: Is the actuator rotation $\leq 90^\circ$? Yes _____ No _____

Section 7 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. Parts which do not show part numbers cannot be ordered.

⚠ WARNING

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

The DVC2000 digital valve controller is designed with all metric fasteners and threaded connections. However, optional inch connections are available for the two conduit entrance points (1/2 NPT) and the supply/output pneumatic ports (1/4 NPT). Even with this option, all other fasteners and threaded connections are metric.

Parts Kits

Description	Part Number	Description	Part Number
		Feedback Array Kit	
		Sliding Stem (Linear)	
		[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.	
Terminal Board Kit (positioner only)	GE08906X012	7 mm (1/4-inch)	
Terminal Board Kit (positioner, transmitter, limit switches)	GE08907X012	Aluminum	GG20240X012
I/P Converter Kit		19 mm (3/4-inch)	
For GX Acuator	38B6041X182	Aluminum	GG20240X022
For non-GX Rotary and Sliding-Stem	38B6041X122	Stainless steel	GG13199X012
Low Pressure Relay Kit (white label)		25 mm (1-inch)	
Housing A (for GX Actuator) (0 - 49 psig)	GE59274X012	Aluminum	GG20240X032
Housing B (for non-GX Rotary and Sliding-Stem) (0 - 3.3 bar/0 - 49 psig)	GE08910X012	Stainless steel	GG13199X022
High Pressure Relay Kit (green label)		38 mm (1-1/2 inch)	
Housing A (for GX Actuator) (50 - 100 psig)	GE59275X012	Aluminum	GG20240X042
Housing B (for non-GX Rotary and Sliding-Stem) (3.4 - 7.0 bar/50 - 100 psig)	GE08911X012	Stainless steel	GG13199X032
Mounting Frame Kit	GE08912X012	50 mm (2-inch)	
Main Cover Assembly (see figure 7-1, key 13)	GE12427X012	Aluminum	GG20240X052
EMI Shield Kit	GE08913X012	Stainless steel	GG13199X042
		100 mm (4-inch)	
		Aluminum	GG20240X062
		Stainless steel	GG13199X052
		210 mm (8-1/4 inch)	
		Aluminum	GG20243X012
		Stainless steel	GG13199X072

Description	Part Number
Feedback Array Kit (cont'd)	
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
Elastomer Kit - includes all accessible elastomers for one complete DVC2000 unit	GE08917X012
Small Hardware Kit -includes all fasteners and plugs (except mounting hardware) for one complete DVC2000 unit	GE08918X012
High Temperature Gasket Set Includes O-ring seal (qty 1) and insulation gaskets (qty 2)	GE26550X012
Replacement housing	
Plastic Vent Construction	
Housing A (for GX Actuator)	
G 1/4 & M20 Metric threaded ports	GE24013X012
1/4 NPT & 1/2 NPT Imperial threaded ports	GE24011X012
Housing B (for non-GX Rotary and Sliding-Stem)	
G 1/4 & M20 Metric threaded ports	GE24012X012
1/4 NPT & 1/2 NPT Imperial threaded ports	GE24010X012
Metal Vent Construction	
Housing A (for GX Actuator)	
G 1/4 & M20 Metric threaded ports	GE24013X022
1/4 NPT & 1/2 NPT Imperial threaded ports	GE24011X022
Housing B (for non-GX Rotary and Sliding-Stem)	
G 1/4 & M20 Metric threaded ports	GE24012X022
1/4 NPT & 1/2 NPT Imperial threaded ports	GE24010X022

Parts List (refer to figures 7-1, 7-2 and 7-3)

Note

The parts contained in the Parts List are not available as individual components. All parts are included in the Parts Kits.

Terminal Board Assembly⁽¹⁾

Key	Description
4	Feedback Sensor & Termination Boards , with Options
11	Fasteners
15	Fastener

Key	Description
24	Conductive Gasket (PWB)
29	Conductive Gasket (Shield)
30	Fastener
32	O-ring seal
36	Terminal Barrier
42	Fasteners
43	Interconnect and I/P Boards

Main Board Assembly

Note

Contact your Emerson Process Management sales office for Main Board Assembly FS Numbers.

15	Fasteners
16	Pressure Sensor Seal
35	Main Board with LCD and Pushbuttons

I/P Converter Assembly⁽²⁾

25	Fasteners
26	O-Ring
41	I/P Converter
231	Screen O-Ring

Relay Assembly⁽³⁾

2	Relay
45	O-Rings

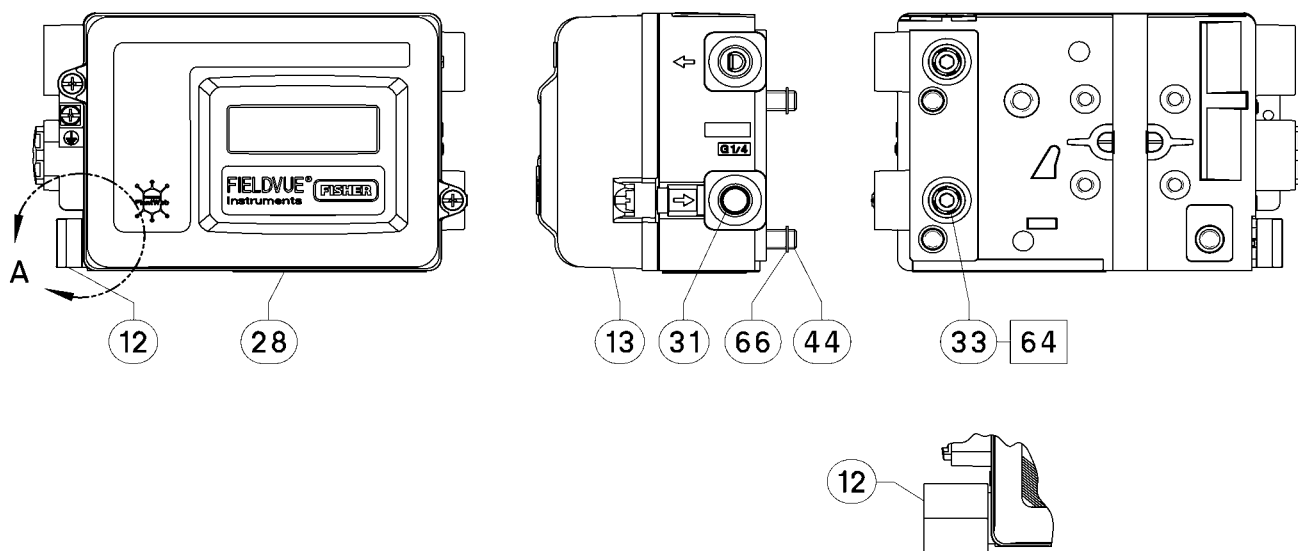
Mounting Frame Assembly⁽⁴⁾

3	Mounting Frame
16	Pressure Sensor Seal
19	Fasteners
45	O-Ring
51	O-Ring

EMI Shield Assembly⁽⁵⁾

11	Fasteners (3 req'd)
29	Conductive Gasket (Shield)
37	Primary Shield

Figure 7-1. FIELDVUE DVC2000 Digital Valve Controller Assembly, Housing A



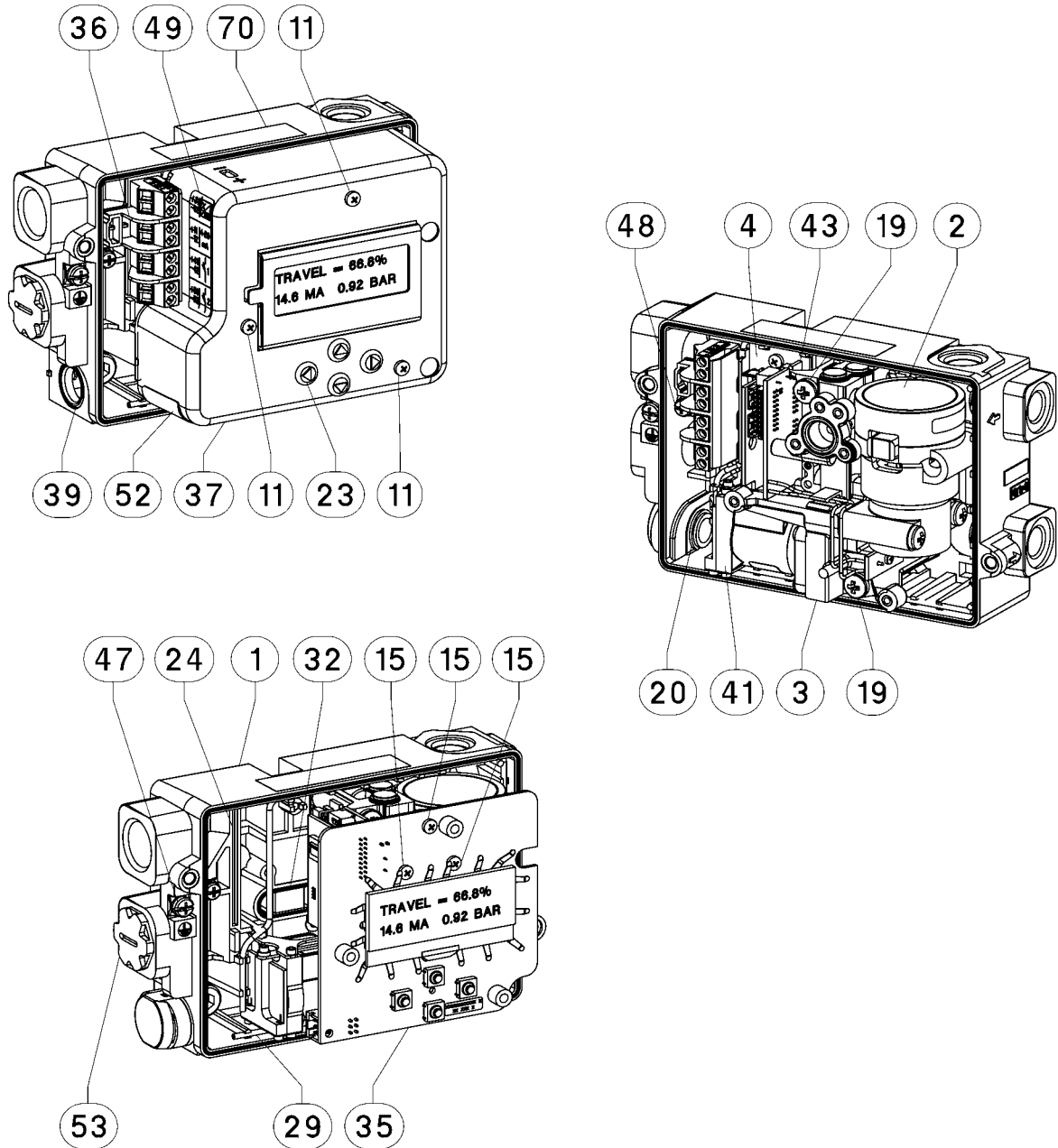
□ APPLY LUBRICANT/SEALANT

NOTE:

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

GE13174-B, SHEET 1 OF 3

Figure 7-2. FIELDVUE DVC2000 Digital Valve Controller Assembly, Housing A



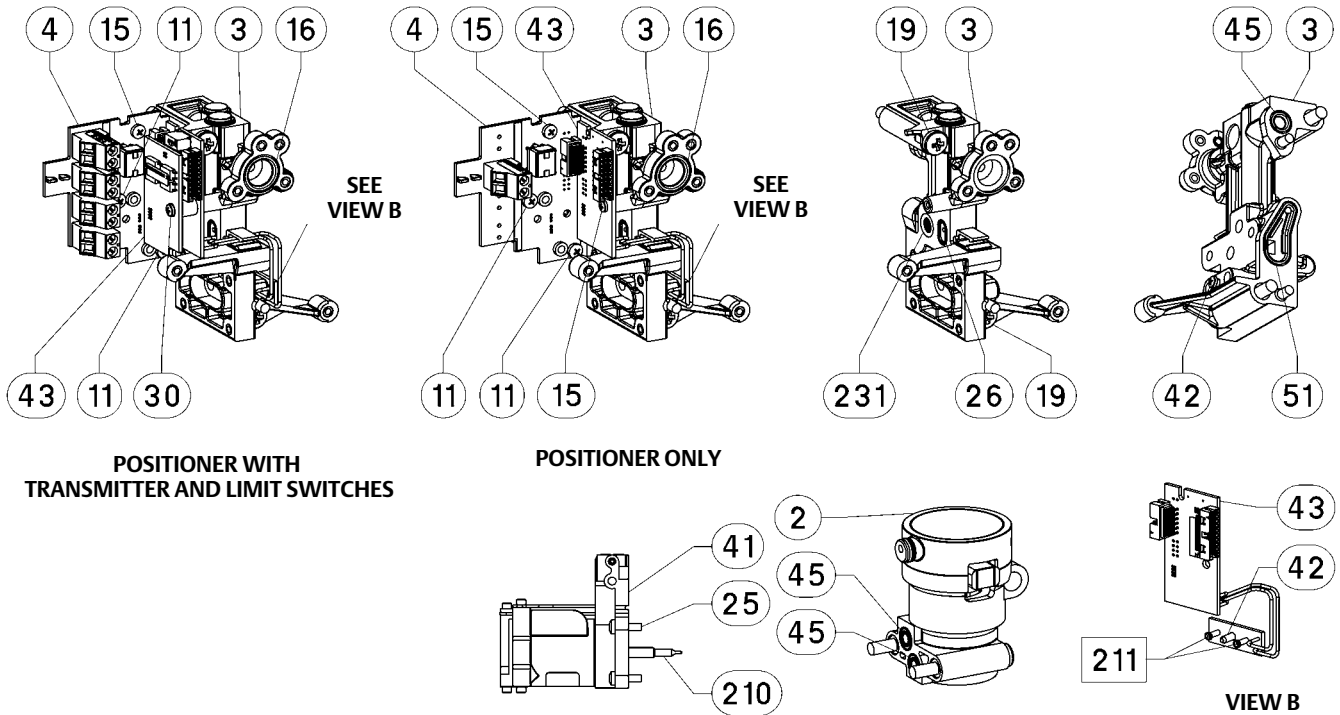
□ APPLY LUBRICANT/SEALANT

NOTE:

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

GE13174-B, SHEET 2 OF 3

Figure 7-3. FIELDVUE DVC2000 Digital Valve Controller Assembly, Housing A



POSITIONER WITH TRANSMITTER AND LIMIT SWITCHES

POSITIONER ONLY

□ APPLY LUBRICANT/SEALANT

NOTE:

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

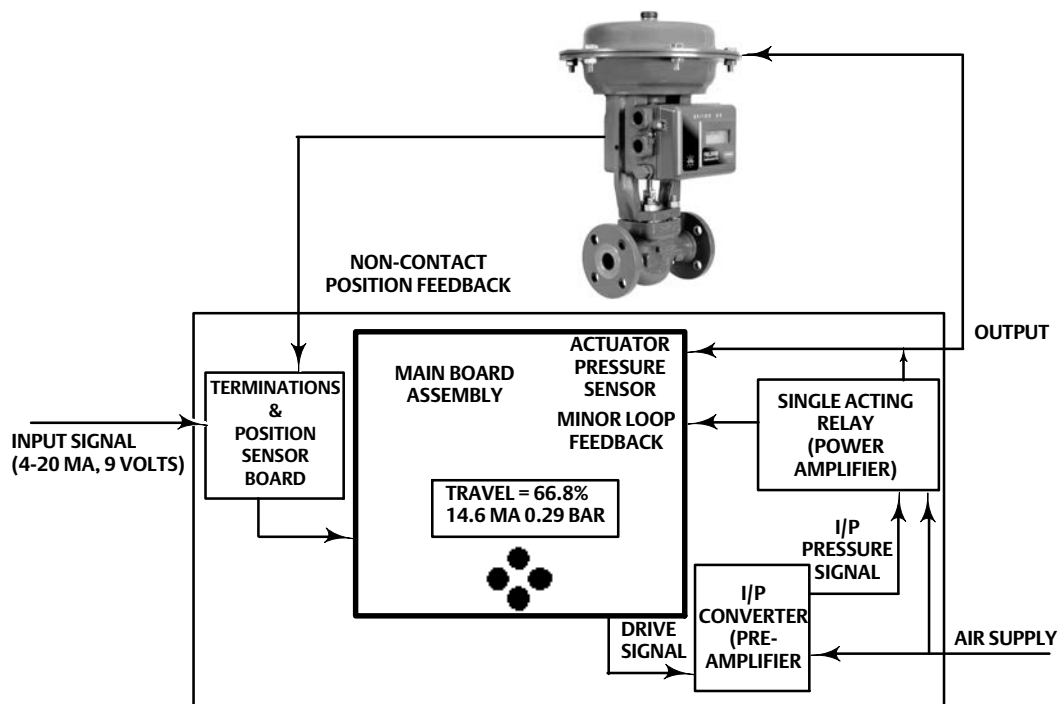
GE13174-B, SHEET 3 OF 3

Appendix A Principle of Operation

DVC2000 Operation

The DVC2000 digital valve controller uses a traditional 4-20 mA input signal and converts it into a pneumatic output pressure that is delivered to the control valve actuator. Accurate control of the position of the valve is enabled by valve stem position feedback. The way in which the DVC2000 accomplishes this is through a two-stage positioner design. Refer to figure A-1 for a block diagram of the positioner operation.

Figure A-1. FIELDVUE DVC2000 Digital Valve Controller Block Diagram



A traditional 4-20 mA signal provides the set point and power to the instrument. At the same time, the HART protocol provides instrument and process data through digital communications. The instrument receives this set point and positions the valve where it needs to be.

- The input signal provides electrical power and the set point simultaneously. It is routed into the terminal board through a twisted pair of wires. The terminal board contains the termination points for the loop signal (+11/-12). If the options board is installed, an additional options board set includes additional terminals for the transmitter output (+31/-32), switch #1 output (+41/-42), and switch #2 output (+51/-52).
- The input signal is then directed to the main electronics board assembly where the microprocessor runs a digital control algorithm resulting in a drive signal to the I/P converter.

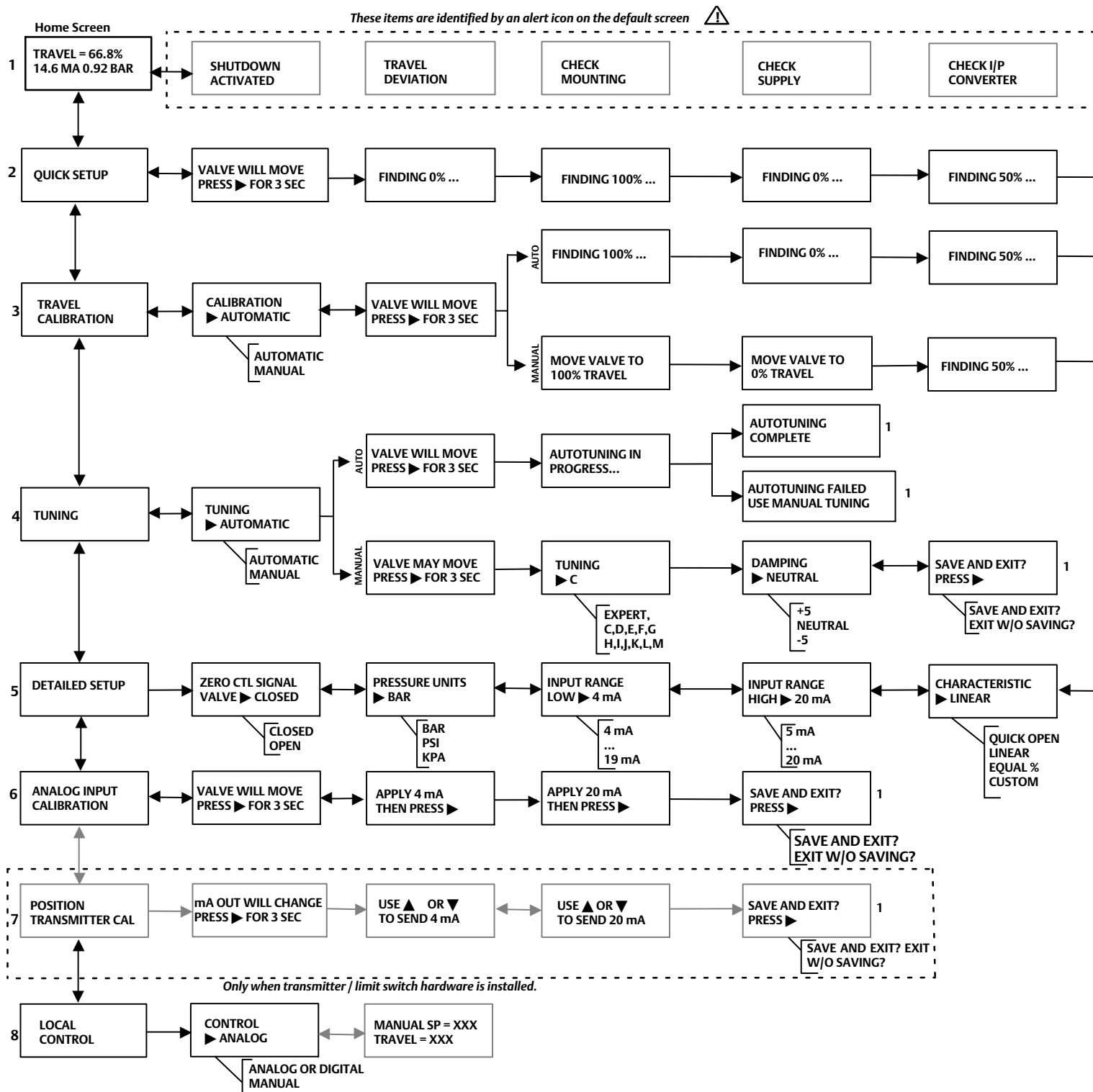
- The I/P converter assembly is connected to supply pressure and converts the drive signal into a **pressure signal**. The I/P converter is the pre-amplifier stage in the two-stage positioner design. This component enables high static gain for responsiveness to small changes in the input signal.
- The I/P output is sent to the pneumatic relay assembly. The relay is also connected to supply pressure and amplifies the small pressure signal from the I/P converter into a larger **pneumatic output signal** used by the actuator. The pneumatic relay is the power amplifier stage in the two-stage positioner design. This component enables superior dynamic performance with minimal steady-state air consumption.
- A sensor on the printed wiring board measures the motion of the small valve inside the pneumatic relay. This measurement is used for minor loop feedback to the control algorithm resulting in stable, robust tuning.
- The change in relay output pressure to the actuator causes the valve to move.
- Valve position is sensed through the non-contact, linkage-less feedback sensor. There are no moving linkages and the DVC2000 is physically separated from the valve stem through the use of a magnetic Hall effect sensor. A magnetic array is mounted to the valve stem and the sensor is embedded in the DVC2000 housing. The sensor is electrically connected to the printed wiring board to provide a travel feedback signal used in the control algorithm.

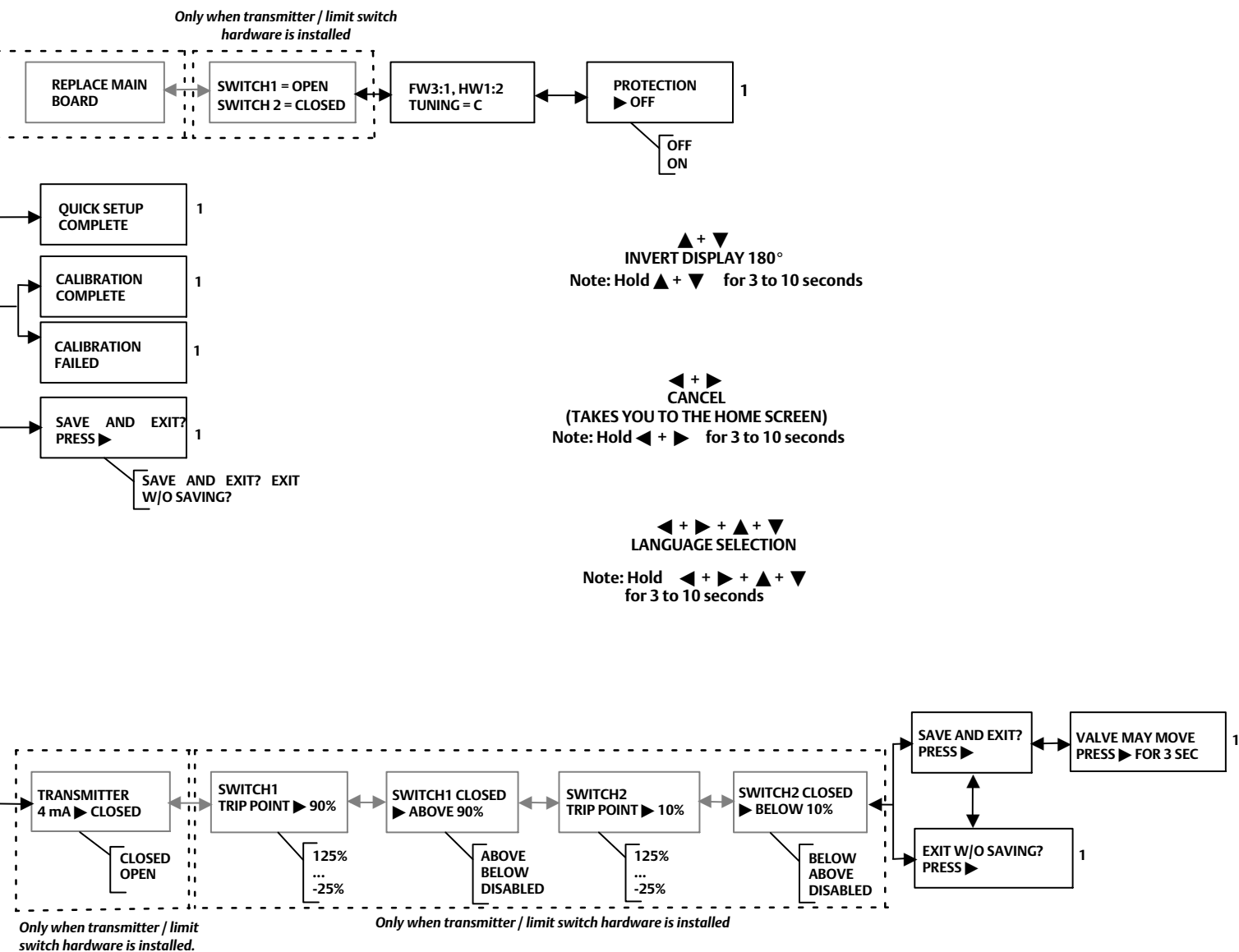
The valve continues to move until the correct position is attained.

Appendix B Local Interface Flow Chart and Field Communicator Menu Trees

This section contains the Local Interface Flow Chart and the Field Communicator menu trees for instrument level HC, AD, and PD and instrument level AC. It also contains Fast Key Sequence tables with coordinates to help locate the function/variable on the appropriate menu tree.

Local Interface Flow Chart





Field Communicator Fast-Key Sequence (Instrument Level HC, AD and PD)

Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾
Actuator Style	1-2-5-2	4-E
Alert Record	1-2-7-6	4-G
Analog Input	2	1-E
Analog Input Calibration	1-4-1	2-E
Analog Input Range High	1-2-4-2	4-D
Analog Input Range Low	1-2-4-3	4-D
Analog Input Units	1-2-4-1	4-D
Auto Calibrate Travel	1-4-2	2-E
Auto Setup	1-1-1	2-B
Auto Tuner	1-1-1-3	3-B
Basic Setup	1-1	2-B
Burst	1-2-1-5	4-C
Calibrate	1-4	2-E
Control Mode	1-2-1-2	3-C
Custom Characteristic Table	1-2-6-5	4-F
Cycle Count	1-2-7-4-4	6-H
Cycle Count Alert	1-2-7-4	6-H
Cycle Count Alert Enable	1-2-7-4-1	6-H
Cycle Count Alert Point	1-2-7-4-2	6-H
Cycle Count Deadband	1-2-7-4-3	6-H
Damping Factor	1-1-2-3-2	4-C
Date	1-2-3-4	5-D
Descriptor	1-2-3-3	5-D
Device Description Revision	1-3-3	2-F
Device Identification	1-3-2-9	2-H
Device Information	1-3-2	2-G
Device Revision	1-3-2-2	2-G
Drive Alert Enable	1-2-7-5-1	5-H
Drive Current Fail	1-2-8-4	3-F
Drive Signal	5	1-E
Enable Integral Control	1-2-6-9-1	6-G
Expert Tuning Gains	1-1-1-4-3	5-B
Failure Alerts	7-2	1-G
Failure Group Enable	1-2-7-6-4-2	6-I
Firmware Date	1-3-2-4	2-G
Firmware Revision	1-3-2-3	2-G
Flash Rom Failure	1-2-8-1	3-E
HART Tag	1-2-3-1	5-D
HART Universal Revision	1-3-2-1	2-G
Input Characterization	1-2-6-4	4-F
Instrument Level	1-3-2-8	2-G
Instrument Mode	Hot Key	1-A
Instrument Serial Number	1-2-3-6	5-D
Instrument Status	7	1-E
Integral Dead Zone	1-2-6-9-3	6-G
Integral Gain	1-2-6-9-2	6-G
Integral Settings	1-2-6-9	6-G
Limit Switch Stat Enable	1-2-7-6-4-3	6-I
LUI Language	1-2-3-8	5-D
LUI Pressure Units	1-2-4-5	4-D
Main Electronics Revision	1-3-2-5	2-G
Manual Calibrate Travel	1-4-3	2-E
Manual Setup	1-1-2	3-B
Maximum Supply Pressure	1-2-5-1	4-E
Message	1-2-3-2	5-D
Minimum Opening Time	1-2-6-8-1	6-F
Minimum Closing Time	1-2-6-8-2	6-F
NVM Fail	1-2-8-5	3-F
Operational Status	7-3	1-G

Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾
Polling Address	1-2-3-7	5-D
Pressure	6	1-E
Pressure Calibration	1-4-4	2-E
Pressure Sensor Failure	1-2-8-7	3-F
Pressure Units	1-2-4-4	4-D
Protection	Hot Key	1-A
Reference Voltage Failure	1-2-8-3	3-F
Response Control	1-2-6	4-E
Restart	1-2-1-4	3-C
Restart Control Mode	1-2-1-3	3-C
Secondary Electronics Revision	1-3-2-6	2-G
Self Test Shutdown	1-2-8	2-D
Sensor Serial Number	1-3-2-7	2-G
Set Point Filter Time	1-2-6-6	4-F
Setup Wizard	1-1-1-1	3-B
Stroke Valve	1-5	1-D
Switch 1 Closed ⁽²⁾	1-2-9-2	3-E
Switch 1 Trip Point ⁽²⁾	1-2-9-1	3-D
Switch 2 Closed ⁽²⁾	1-2-9-4	3-E
Switch 2 Trip Point ⁽²⁾	1-2-9-3	3-E
Temperature	1-3-1-1	3-G
Temperature Comp Fail	1-2-8-2	3-F
Temperature Sensor Failure	1-2-8-6	3-F
Temperature Units	1-2-4-6	4-D
Transmitter Action ⁽²⁾	1-2-9-5	3-E
Transmitter Calibration ⁽²⁾	1-4-6	2-E
Travel	3	1-E
Travel Accumulator	1-2-7-3-4	5-H
Travel Accumulator Alert Enable	1-2-7-3-1	5-G
Travel Accumulator Alert Point	1-2-7-3-2	5-G
Travel Accumulator Dead Band	1-2-7-3-3	5-G
Travel Alert Deadband	1-2-7-1-7	5-G
Travel Alert High Point	1-2-7-1-3	5-G
Travel Alert High High Point	1-2-7-1-5	5-G
Travel Alert Low Point	1-2-7-1-4	5-G
Travel Alert Low Low Point	1-2-7-1-6	5-G
Travel Cutoff Low	1-2-6-7-4	6-F
Travel Cutoff High	1-2-6-7-3	6-F
Travel Deviation Alert Enable	1-2-7-2-1	6-G
Travel Deviation Alert Point	1-2-7-2-2	6-G
Travel Deviation Time	1-2-7-2-3	6-G
Travel High / Low Enable	1-2-7-1-1	5-F
Travel High High / Low Low Enable	1-2-7-1-2	5-F
Travel Limit High	1-2-6-7-1	6-E
Travel Limit Low	1-2-6-7-2	6-F
Travel Sensor Failure	1-2-8-8	3-F
Travel Setpoint	4	1-E
Tuning	Hot Key	1-B
Tuning Set	1-1-2-3-1	4-C
Valve Group Enable	1-2-7-6-4-1	6-I
Valve Style	1-2-5-3	4-E
Valve Serial Number	1-2-3-5	5-D
Zero Control Signal	1-2-5-4	4-E

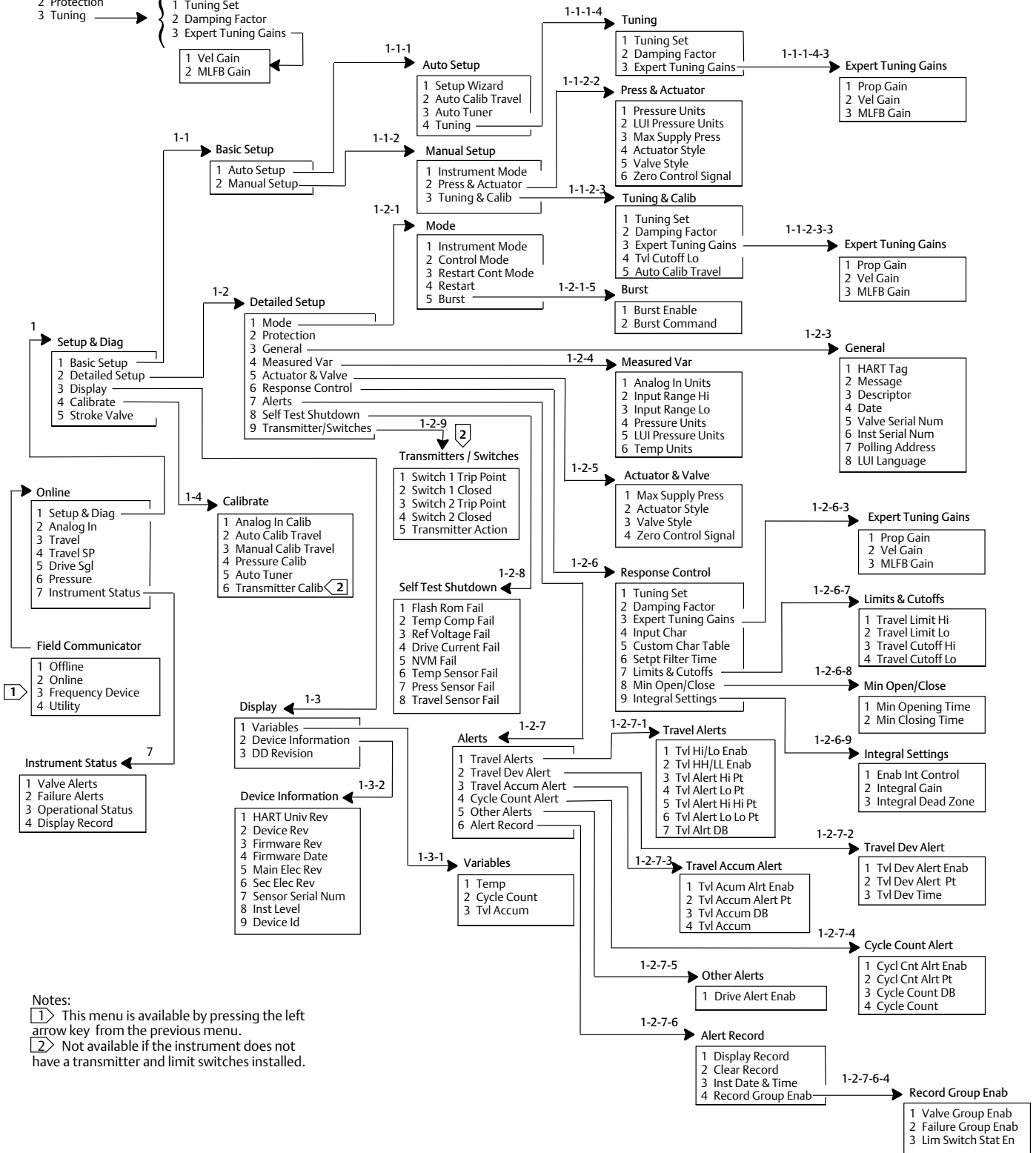
1. Coordinates are to help locate the item on the menu tree on the facing page.

2. Available only if the instrument has a transmitter and limit switches installed.

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



- Hot Key
 1 Instrument Mode
 2 Protection
 3 Tuning



Notes:
 ① This menu is available by pressing the left arrow key from the previous menu.
 ② Not available if the instrument does not have a transmitter and limit switches installed.

1 | 2 | 3 | 4 | 5 | 6

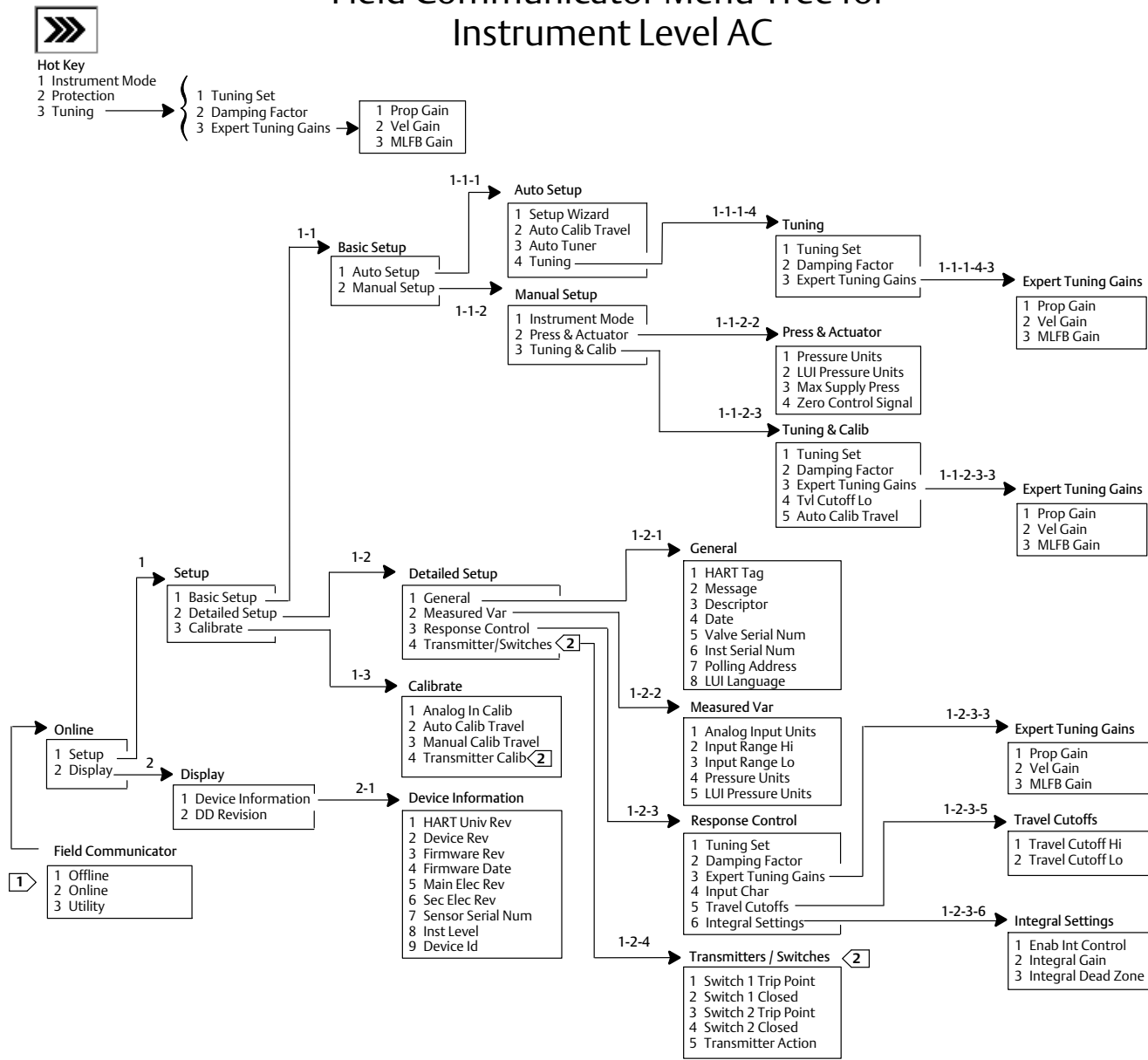
Field Communicator Fast-Key Sequence (Instrument Level AC)

Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾
Analog Input Calibration	1-3-1	3-E
Analog Input Units	1-2-2-1	4-E
Auto Calibrate Travel	1-3-2	3-E
Auto Setup	1-1-1	3-B
Auto Tuner	1-1-1-3	3-B
Basic Setup	1-1	3-B
Calibrate	1-3	3-E
Damping Factor	1-1-1-4-2	5-B
Date	1-2-1-4	4-D
Descriptor	1-2-1-3	4-D
Detailed Setup	1-2	3-D
Device Description Revision	2-2	2-F
Device Identification	2-1-9	3-F
Device Information	2-1	3-F
Device Revision	2-1-2	3-F
Display	2	1-E
Enable Integral Control	1-2-3-6-1	6-F
Expert Tuning Gains	1-1-1-4-3	6-C
Firmware Date	2-1-4	3-F
Firmware Revision	2-1-3	3-F
HART Tag	1-2-1-1	4-D
HART Universal Revision	2-1-1	3-F
Input Characterization	1-2-3-4	4-F
Input Range High	1-2-2-2	4-E
Input Range Low	1-2-2-3	4-E
Instrument Level	2-1-8	3-F
Instrument Mode	Hot Key	1-A
Instrument Serial Number	1-2-1-6	4-E
Integral Dead Zone	1-2-3-6-3	6-F

Function/Variable	Fast-Key Sequence	Coordinates ⁽¹⁾
Integral Gain	1-2-3-6-2	6-F
Integral Settings	1-2-3-6	6-F
LUI Language	1-2-1-8	4-E
LUI Pressure Units	1-2-2-5	4-E
Manual Calibrate Travel	1-3-3	3-E
Manual Setup	1-1-2	3-B
Measured Variable	1-2-2	4-E
Main Electronics Revision	2-1-5	3-F
Maximum Supply Pressure	1-1-2-2-3	5-C
Message	1-2-1-2	4-D
Polling Address	1-2-1-7	4-E
Pressure Units	1-2-2-4	4-E
Protection	Hot Key	1-A
Secondary Electronics Revision	2-1-6	3-F
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- Coordinates are to help locate the item on the menu tree on the facing page.
- Available only if the instrument has a transmitter and limit switches installed.

Field Communicator Menu Tree for Instrument Level AC



A
—
B
—
C
—
D
—
E
—
F
—
G
—
H
—
I

Notes:
 1 This menu is available by pressing the left arrow key from the previous menu.
 2 Available only if the instrument has a transmitter and limit switches installed.

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.

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 Control Signal = Closed

The alert is active when:

drive signal <10% and calibrated travel >3%

drive signal >90% and calibrated travel <97%

If Zero Control Signal = Open

The alert is active when:

drive signal <10% and calibrated travel <97%

drive signal >90% and calibrated travel >3%

Equal Percentage

A valve flow characteristic where equal increments of valve stem travel produce equal percentage changes in existing flow. One of the input characteristics available for a FIELDVUE Instrument. See also, Linear and Quick Opening.

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 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 5-1.

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 70-2-1991 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. DVC2000 digital valve controllers have one actuator pressure sensor.

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 375 Field Communicator or a computer running ValveLink Software communicating through a HART modem could be considered a secondary master.

Note: If one type of master takes an instrument Out Of Service, the same type must put it In Service. For example, if a device set up as a primary master takes an instrument Out Of Service, a device set up as a primary master must be used to place the instrument In Service.

Quick Opening

A valve flow characteristic where most of the change in flow rate takes place for small amounts of stem travel from the closed position. The flow characteristic curve is basically linear through the first 40 percent of stem travel. One of the input characteristics available for a FIELDVUE Instrument. See also, Equal Percentage and Linear.

Random Access Memory (RAM)

A type of semiconductor memory that is normally used by the microprocessor during normal operation that permits rapid retrieval and storage of programs and data. See also Read Only Memory (ROM) and Non-Volatile Memory (NVM).

Rate

Amount of change in output proportional to the rate of change in input.

Read-Only Memory (ROM)

A memory in which information is stored at the time of instrument manufacture. You can examine but not change ROM contents.

Seat Load

Force exerted on the valve seat, typically expressed in pounds force per lineal inch of port circumference. Seat load is determined by shutoff requirements.

Set Point Filter Time

The time constant, in seconds, for the first-order input filter.

Software

Microprocessor or computer programs and routines that reside in alterable memory (usually RAM), as opposed to firmware, which consists of programs and routines that are programmed into memory (usually ROM) when the instrument is manufactured. Software can be manipulated during normal operation, firmware cannot.

Stroking Time

The time, in seconds, required to move the valve from its fully open position to fully closed, or vice versa.

Temperature Sensor

A device within the FIELDVUE instrument that measures the instrument's internal temperature.

Travel

Movement of the valve stem or shaft which changes the amount the valve is open or closed.

Travel Accumulator

The capability of a FIELDVUE instrument to record total change in travel. The value of the Travel Accumulator increments when the magnitude of the change exceeds the Travel Accumulator Deadband. To reset the Travel Accumulator, set it to zero.

Travel Accumulator Alert

Checks the difference between the Travel Accumulator value and the Travel Accumulator Alert Point. The Travel Accumulator Alert is active when the Travel Accumulator value exceeds the Travel Accumulator Alert Point. It clears after you reset the Travel Accumulator to a value less than the alert point.

Travel Accumulator Alert Point

An adjustable value which, when exceeded, activates the Travel Accumulator Alert. Valid entries are 0% to 4 billion %.

Travel Accumulator Deadband

Region around the travel reference point established at the last increment of the accumulator. This region must be exceeded before a change in travel can be accumulated. Valid entries are 0% to 100%.

Travel Alert

Checks the ranged travel against the travel high and low alert points. The travel alert is active if either the high or low point is exceeded. Once a high or low point is exceeded, the ranged travel must clear that point by the Travel Alert Deadband before the alert clears. Four travel alerts are available: Travel Alert Hi, Travel Alert Lo, Travel Alert Hi Hi, and Travel Alert Lo Lo.

Travel Alert Deadband

Travel, in percent of ranged travel, required to clear a travel alert, once it is active. Valid entries are -25% to 125%.

Travel Alert High Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Hi alert. Valid entries are -25% to 125%.

Travel Alert High High Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Hi Hi alert. Valid entries are -25% to 125%.

Travel Alert Low Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Lo alert. Valid entries are -25% to 125%.

Travel Alert Low Low Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Lo Lo alert. Valid entries are -25% to 125%.

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.

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 Control Signal

A setup parameter that determines whether the valve is fully open or fully closed when the input signal is 0%.

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