

Fisher® FIELDVUE™ DVC2000 Digital Valve Controller

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<i>Instrument Level</i>	<i>HC, AD, PD</i>	<i>AC</i>
<i>Device Type</i>	5	5
<i>Device Revision</i>	1	1
<i>Hardware Revision</i>	1 & 2	1 & 2
<i>Firmware Revision</i>	1, 2, 3, 4 & 5	1, 2, 3, 4 & 5
<i>DD Revision</i>	3	1



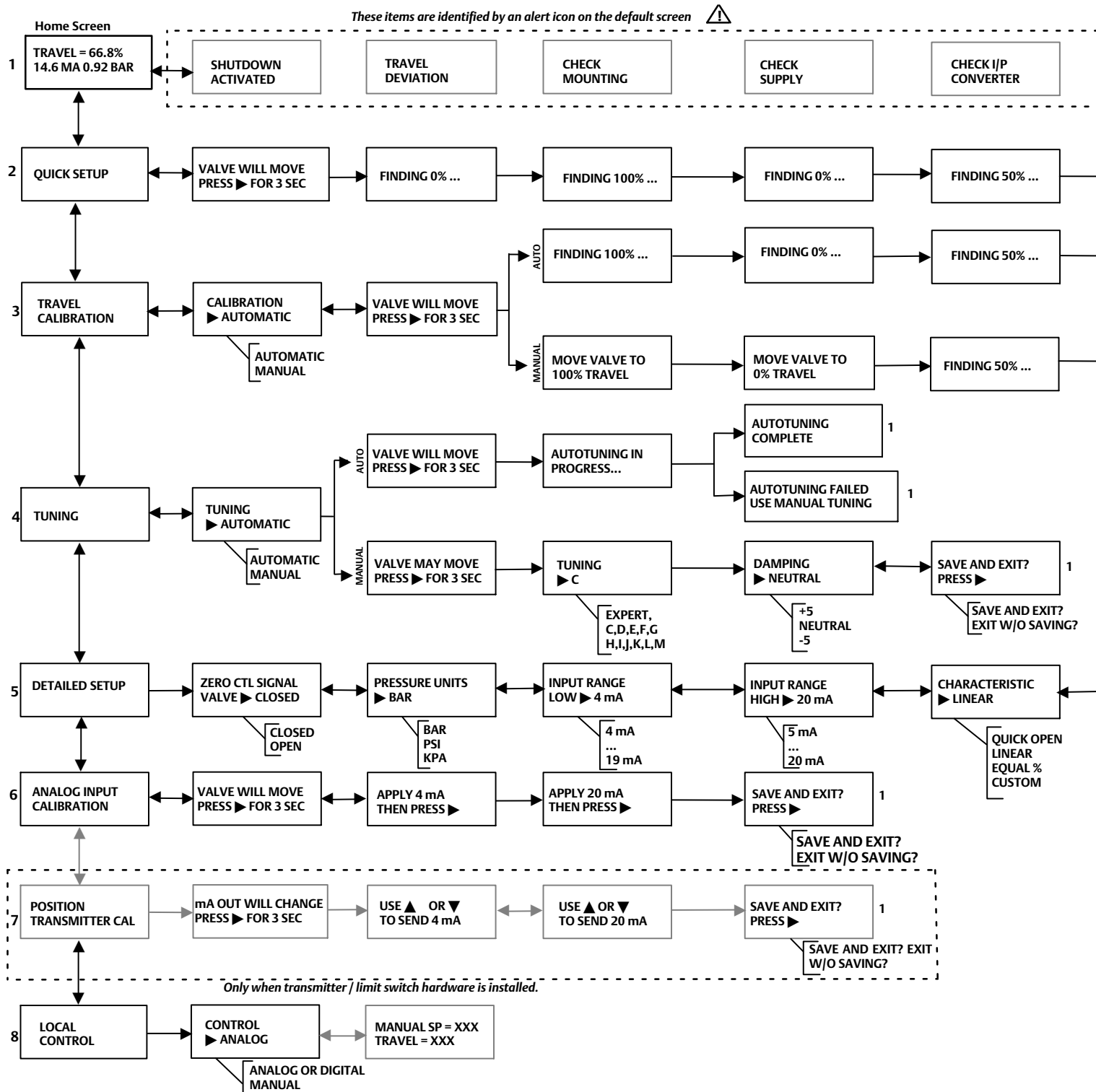
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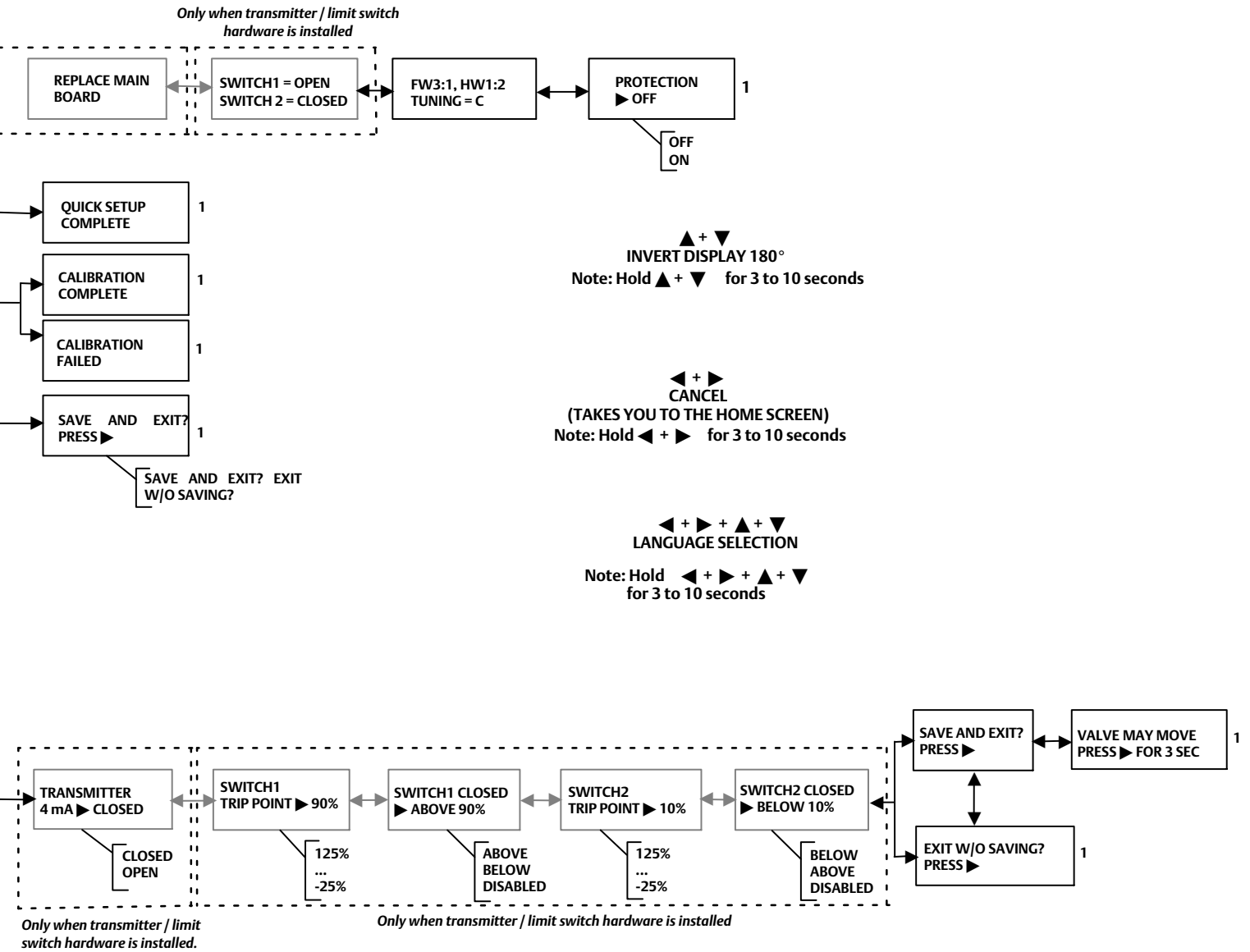
Note

This guide provides installation, initial setup, and calibration information for the DVC2000 digital valve controller. See the FIELDVUE DVC2000 Digital Valve Controller Instruction Manual (D103176X012), available from your Emerson Process Management sales office, for additional information, or visit our website at www.FIELDVUE.com.



Local Interface Flow Chart





THE FIELDVUE DVC2000 DIGITAL VALVE CONTROLLER IS A CORE COMPONENT OF THE PLANTWEB™ DIGITAL PLANT ARCHITECTURE. THE DIGITAL VALVE CONTROLLER POWERS PLANTWEB BY CAPTURING AND DELIVERING VALVE DIAGNOSTIC DATA. COUPLED WITH VALVELINK™ SOFTWARE, THE DVC2000 PROVIDES USERS WITH AN ACCURATE PICTURE OF VALVE PERFORMANCE, INCLUDING ACTUAL STEM POSITION, INSTRUMENT INPUT SIGNAL AND PNEUMATIC PRESSURE TO THE ACTUATOR. USING THIS INFORMATION, THE DIGITAL VALVE CONTROLLER DIAGNOSES NOT ONLY ITSELF, BUT ALSO THE VALVE AND ACTUATOR TO WHICH IT IS MOUNTED.

Use of this Guide

This guide describes how to install the digital valve controller and setup and calibrate using the local operator interface. 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 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.

You can also setup and calibrate the instrument using a Field Communicator, a personal computer with ValveLink software or AMS Suite: Intelligent Device Manager. For information on using the software with a FIELDVUE instrument, refer to the appropriate user guide or help.

Additional information for installing, operating, and maintaining the DVC2000 digital valve controller can be found in the related documents listed on page 32.

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 contents of this quick start guide, including all safety cautions and warnings.** Refer to Hazardous Area Approvals and Special Instructions for “Safe Use” and Installations in Hazardous Locations, on page 33, for approval specific safe use information. If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.

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.
 - 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.
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⚠ WARNING

This product is intended for a specific range of application specifications, found in the Specifications table on page 29. Incorrect configuration of a positioning instrument could result in the malfunction of the product, property damage or personal injury.

Note

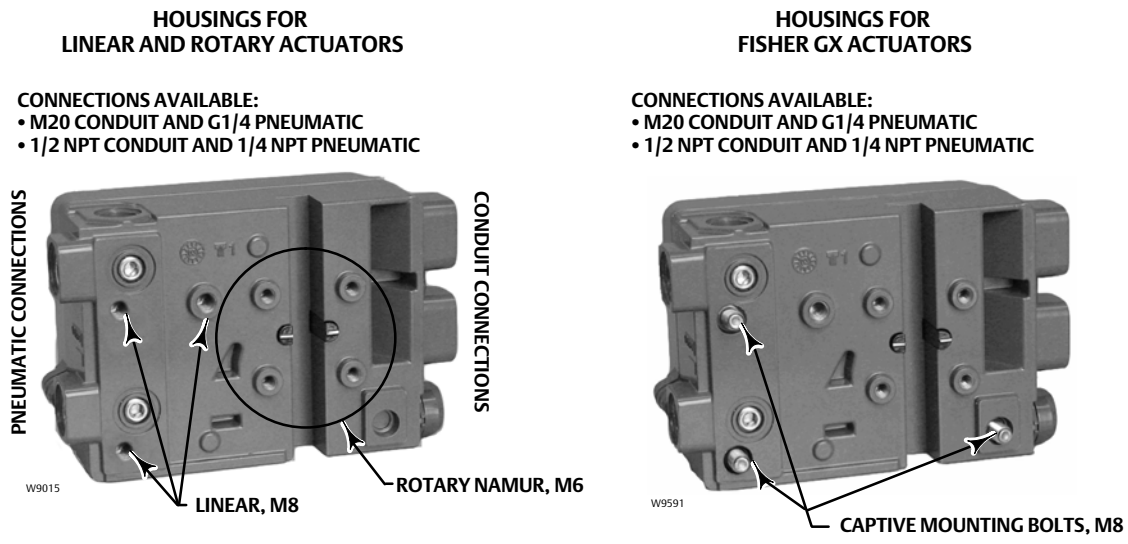
Refer to Hazardous Area Approvals and Special Instructions for "Safe Use" and Installations in Hazardous Locations, on page 33, for approval specific safe use and installation information.

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 1 shows the available configurations.

Figure 1. 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 include, but are not limited to: transformers, DC motors, stacking magnet arrays.

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 subranged.

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.

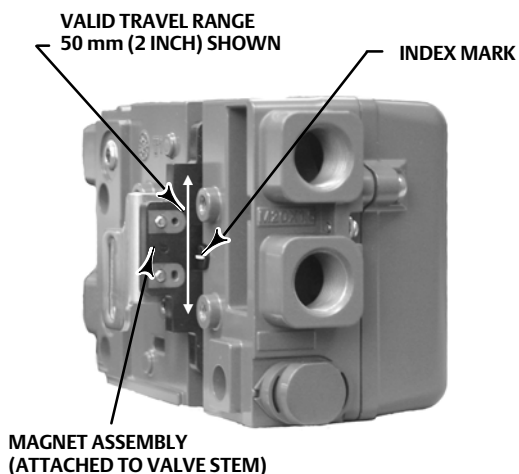
The linear magnet arrays are symmetrical. Either end may be up.

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 Fisher GX actuator
- Air-to-close GX actuator
- Rotary actuators with travel up to 90 degrees

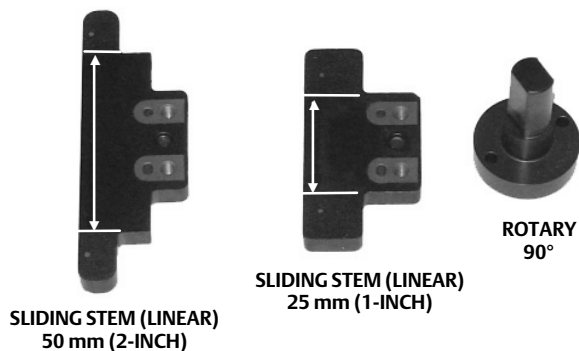
See figure 3 for the different travel feedback magnet pieces.

Figure 2. Travel Range



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Figure 3. Magnet Assemblies



NOTE: VALID TRAVEL RANGE INDICATED BY WHITE ARROWS

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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 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 5.

Figure 4. Air-to-Open Magnet Array Alignment

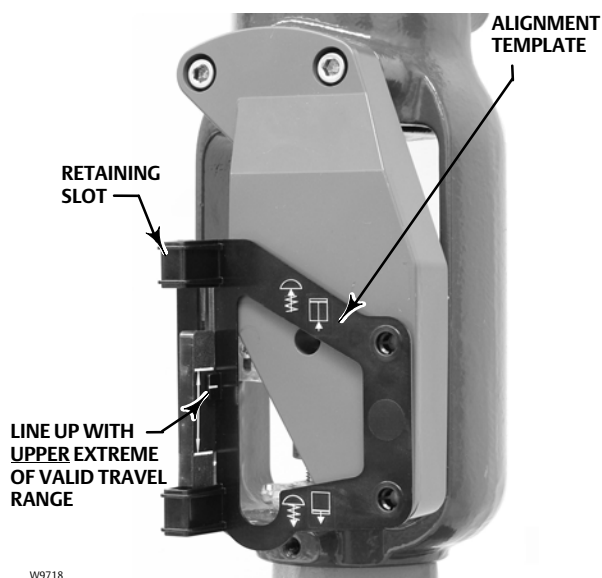
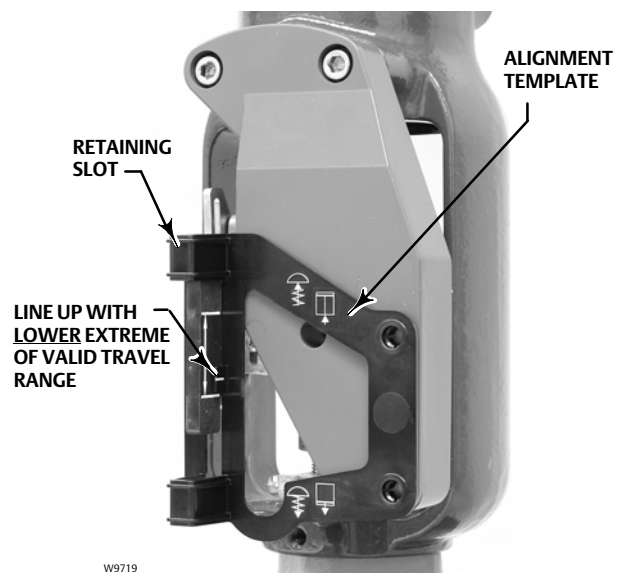


Figure 5. Air-to-Close Magnet Array Alignment



6. Tighten the fasteners and remove the alignment template.

Note

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

- 7. Mount the digital valve controller to the mounting bracket, using the mounting bolts. See figure 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.
- 9. Install tubing between the actuator casing and the pneumatic positioner output connection that has the arrow pointing away from the opening. See figure 7.

Figure 6. Mounting Holes for Linear Actuators

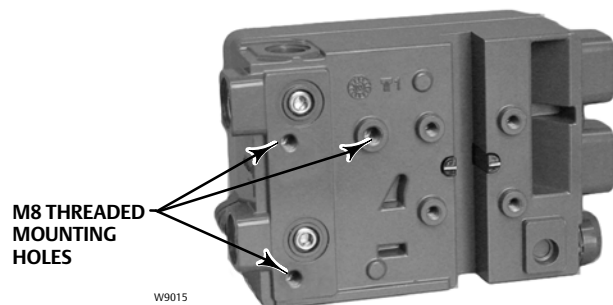
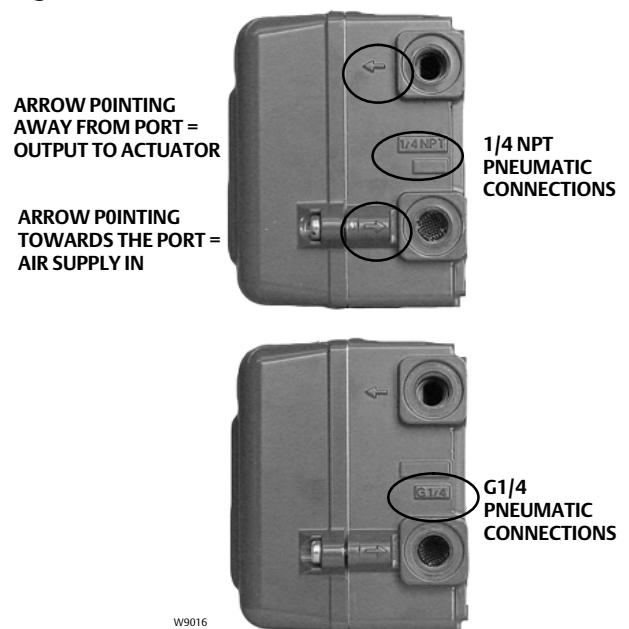


Figure 7. Conduit and Pneumatic Thread Variations



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 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 9.

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

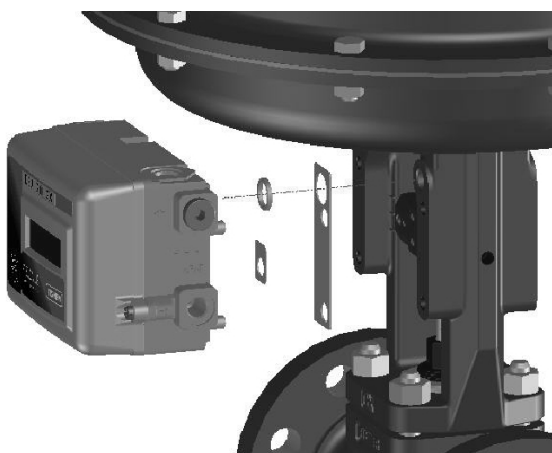
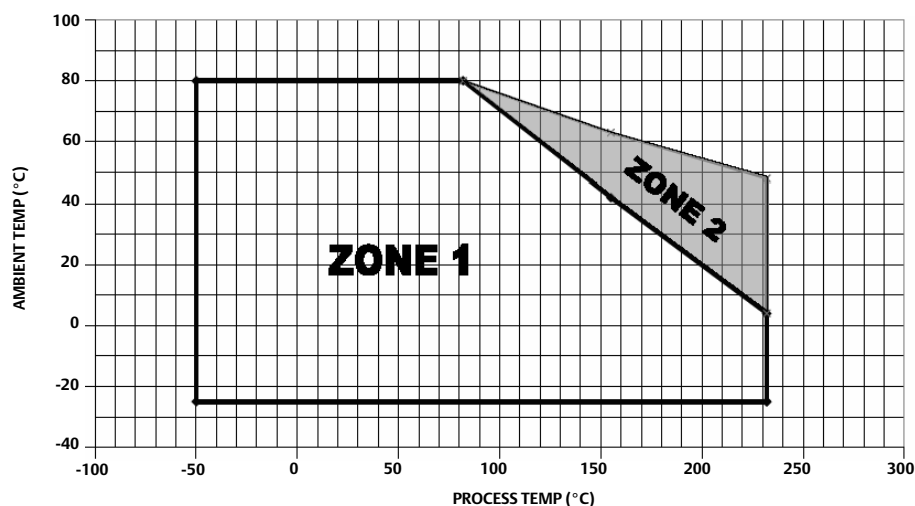


Figure 9. Guidelines for Applying High Process Temperature Solutions to the Fisher GX and FIELDVUE DVC2000



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).

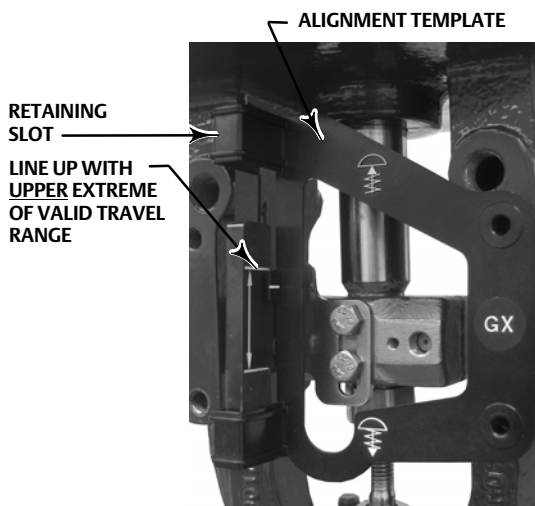
1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. Shut off all pressure lines to the actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.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

CAUTION

Do not install a magnet 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.

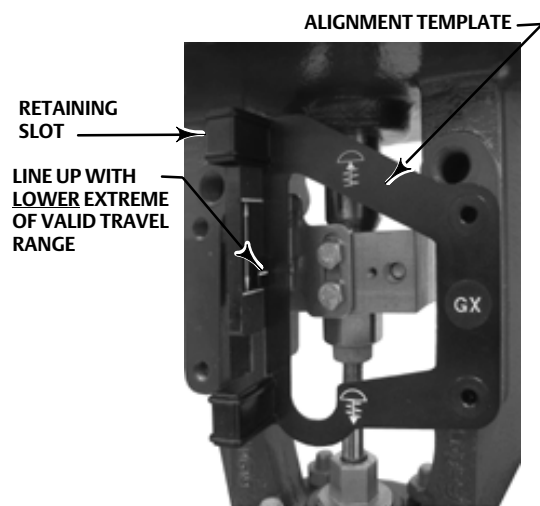
3. Using the alignment template (supplied with the mounting kit), position the feedback array inside the retaining slot.
4. Align the magnet array as follows:
 - For air-to-open GX actuators vertically align the magnet array so that the center line of the alignment template is lined up as close as possible with the upper extreme of the valid travel range on the feedback array. See figure 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 11.

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



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



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

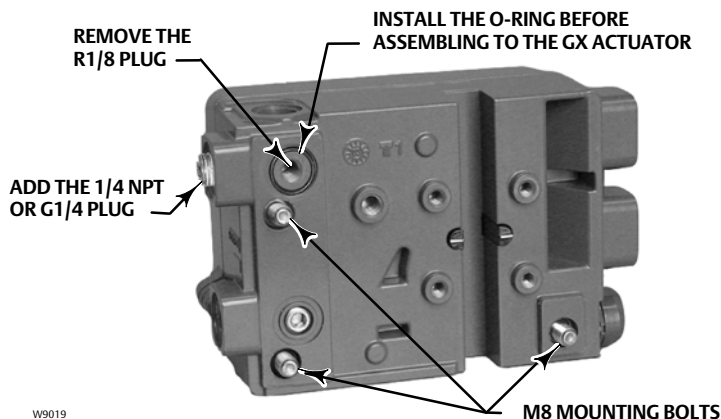
Note

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

For Air-to-Open GX Actuators

6. 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 12.

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



7. Install the plug (either G1/4 or 1/4 NPT, 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.
11. Install a vent in the port on the upper diaphragm casing's air supply connection on the actuator yoke leg.

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.
9. Install tubing between the actuator casing and the pneumatic positioner output connection that has the arrow pointing away from the opening. See figure 7.
10. Install a vent in the port on the lower diaphragm casing.

Note

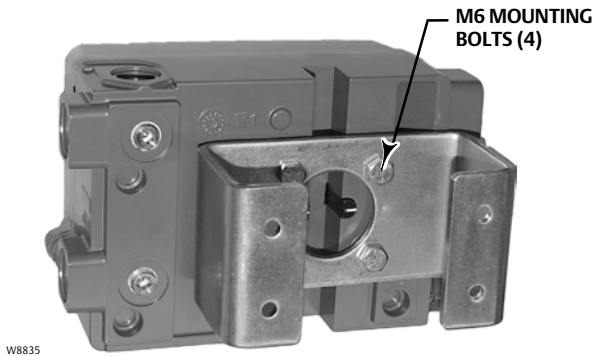
When field converting a GX actuator from fail-open to fail-closed (or vice-versa), you will need to change the plugs for the pneumatic passages in the DVC2000 housing.

- 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 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.
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Guidelines for Mounting on Quarter-Turn (Rotary) Actuators

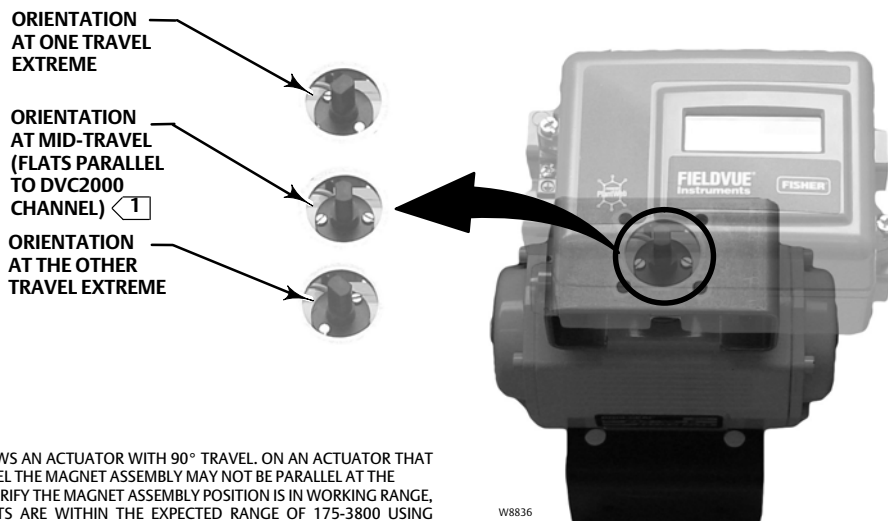
The DVC2000 digital valve controller can be mounted to any quarter-turn (rotary) actuator, as well as those that comply with the NAMUR guidelines. A mounting bracket and associated hardware are required. Refer to figure 13.

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



1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. Shut off all pressure lines to the actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Attach the magnet assembly to the actuator shaft. At mid-travel, the flats on the magnet assembly should be approximately parallel to the channel on the back of the DVC2000 housing, as shown in figure 14.
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 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 7.

Figure 14. Magnetic Assembly Orientation on Quarter-Turn Actuators



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

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 an 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 Fisher 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 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.

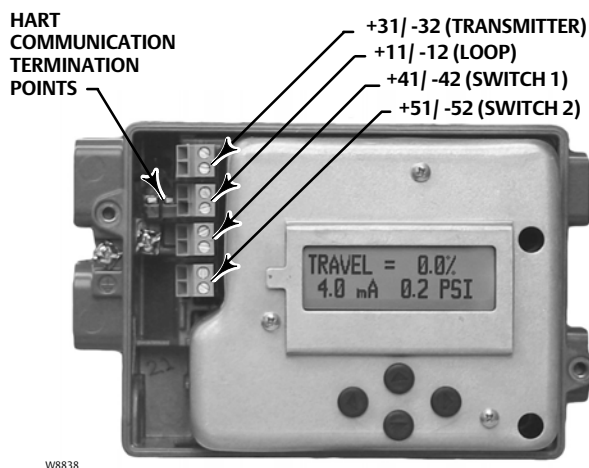
Limit Switches

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 15.

Figure 15. Loop, Transmitter, and Limit Switch Terminals



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.

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 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 so 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 15). The instrument must be powered before digital communication will commence.

Basic Setup and Calibration

The local operator 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 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.

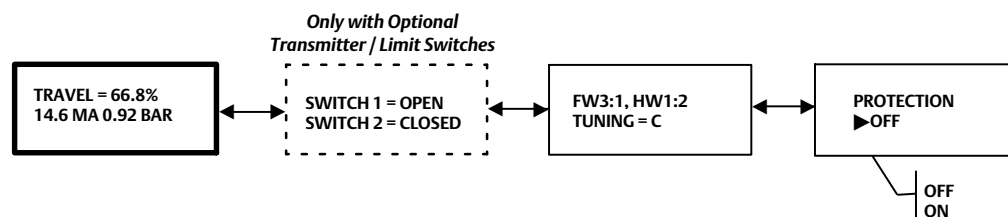
CAUTION

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 16 shows the available information by pressing the right (▶) arrow key.

Figure 16. 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 setup to match the instrument to the valve and actuator.

Before beginning basic setup, be sure the instrument is correctly mounted and powered electrically and pneumatically.

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 1 for language pack options.

Table 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 on the DVC2000 local interface 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.

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 2 lists the values that are preconfigured at the factory.

Table 2. 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)	Above 90%
Switch 2 Trip Point (optional feature)	10%
Switch 2 Closed (optional feature)	Below 10%

1. If the instrument is shipped mounted on an actuator, this value depends 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.

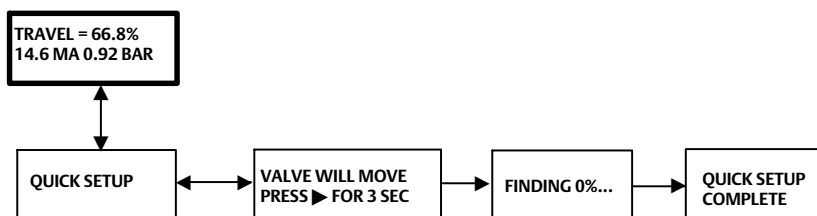
To access the QUICK SETUP routine from the home screen, press the DOWN (▼) arrow key and then the RIGHT (▶) arrow key. A warning will advise you that this procedure will cause the valve to move. Another RIGHT (▶) button press will begin the calibration process. Pressing the LEFT (◀) arrow key will bring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

Figure 17. Quick Setup



Travel Calibration

⚠ WARNING

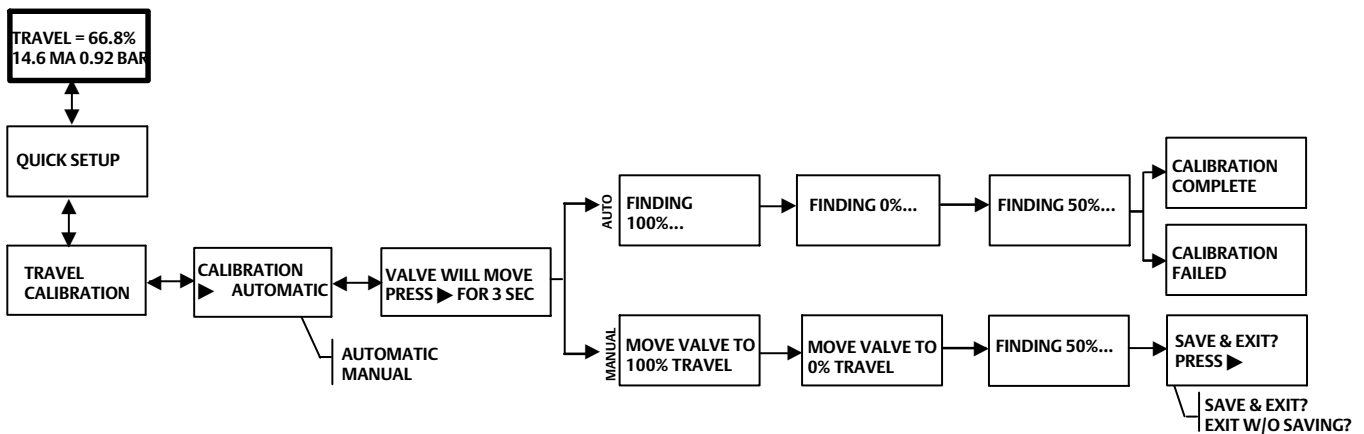
During calibration the valve will move full stroke. To avoid personal injury and property damage caused by the release of pressure or process fluid, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

Note

If optional 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 18.

Figure 18. Travel Calibration



Note

If the valve is manually calibrated to travel less than the physical travel stops allow, manual tuning (page 22) 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.

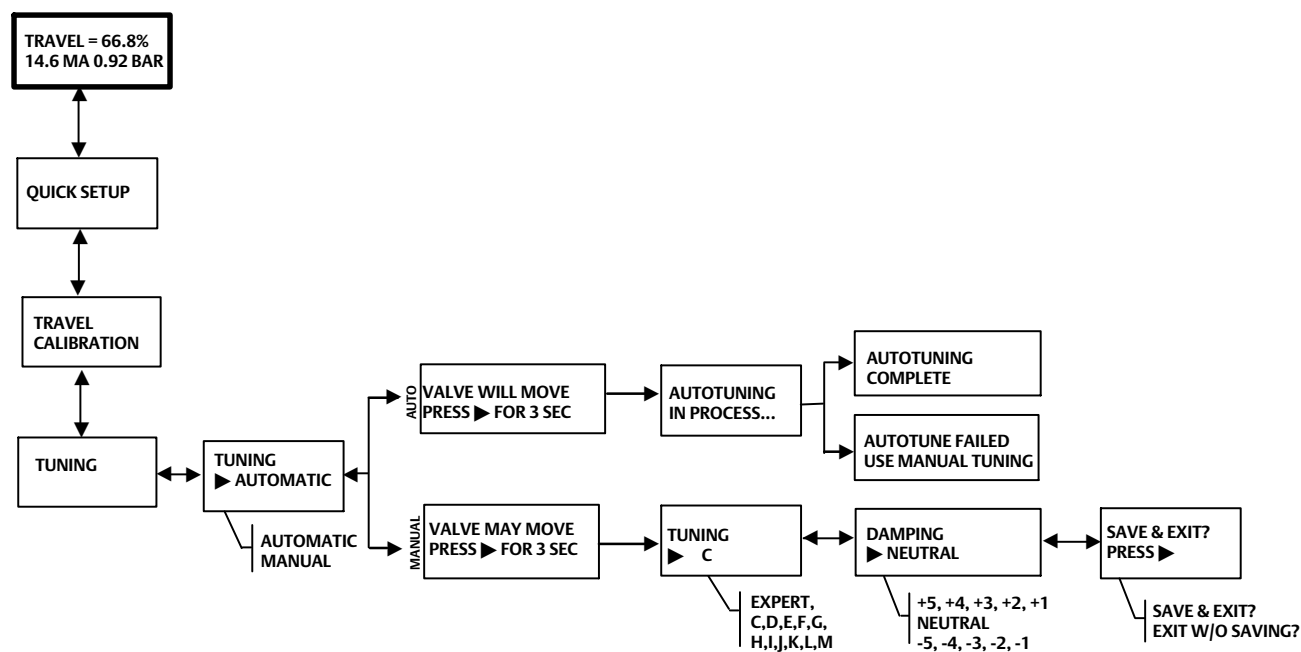
Tuning

⚠ 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 19 below.

Figure 19. 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 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. 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 20 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.

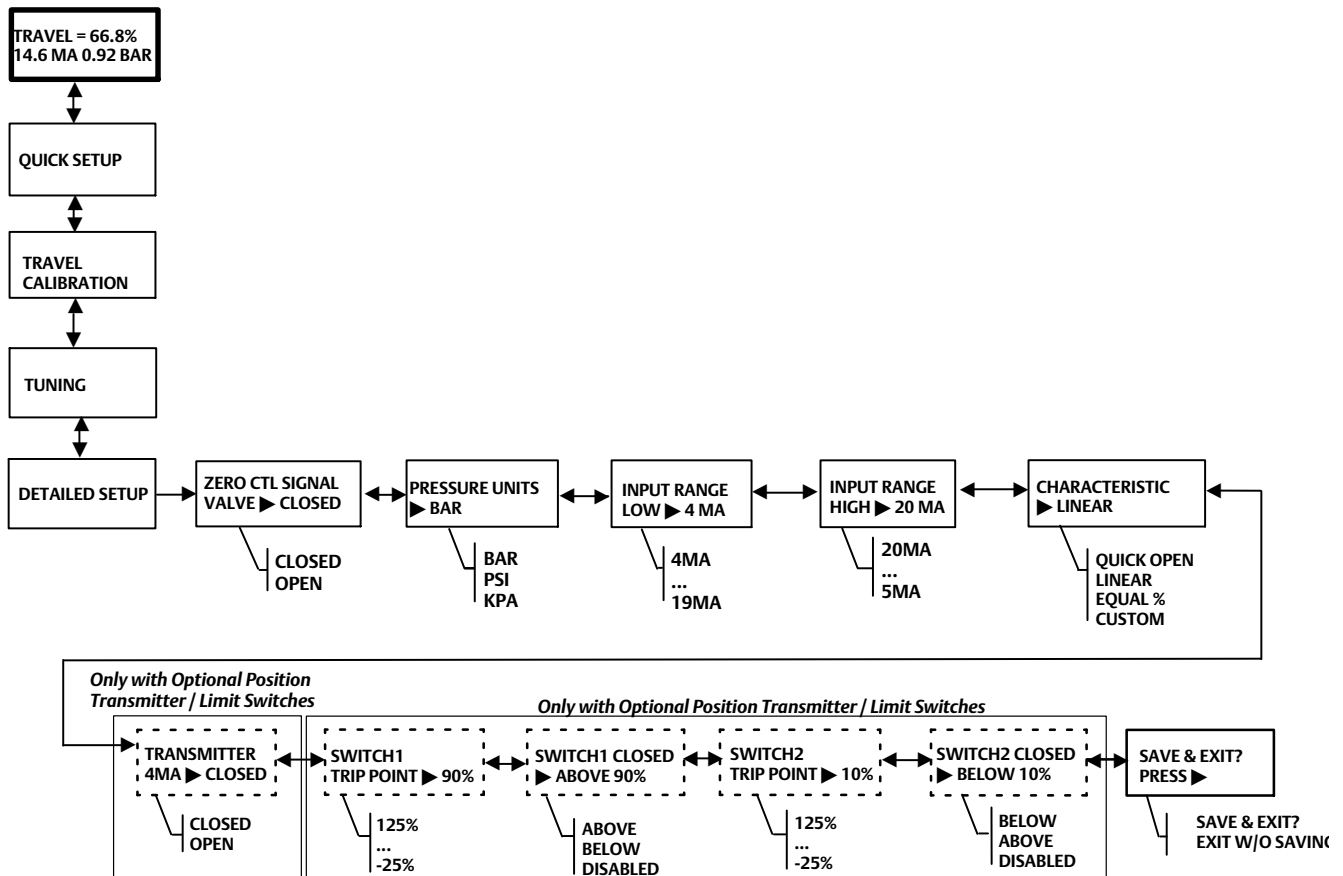
Characteristic—Defines the relationship between the travel target and the ranged set point. Ranged set point is the input to the characterization function. If the Zero Control Signal is closed, then a set point of 0% corresponds to a ranged input of 0%. If the Zero Control Signal is open, a set point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

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.

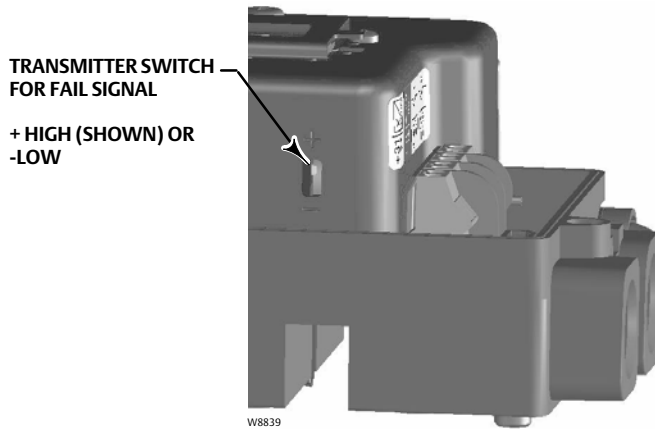
Figure 20. Detailed Setup Flow Chart



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 21 for location and switch selection.

Figure 21. 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.

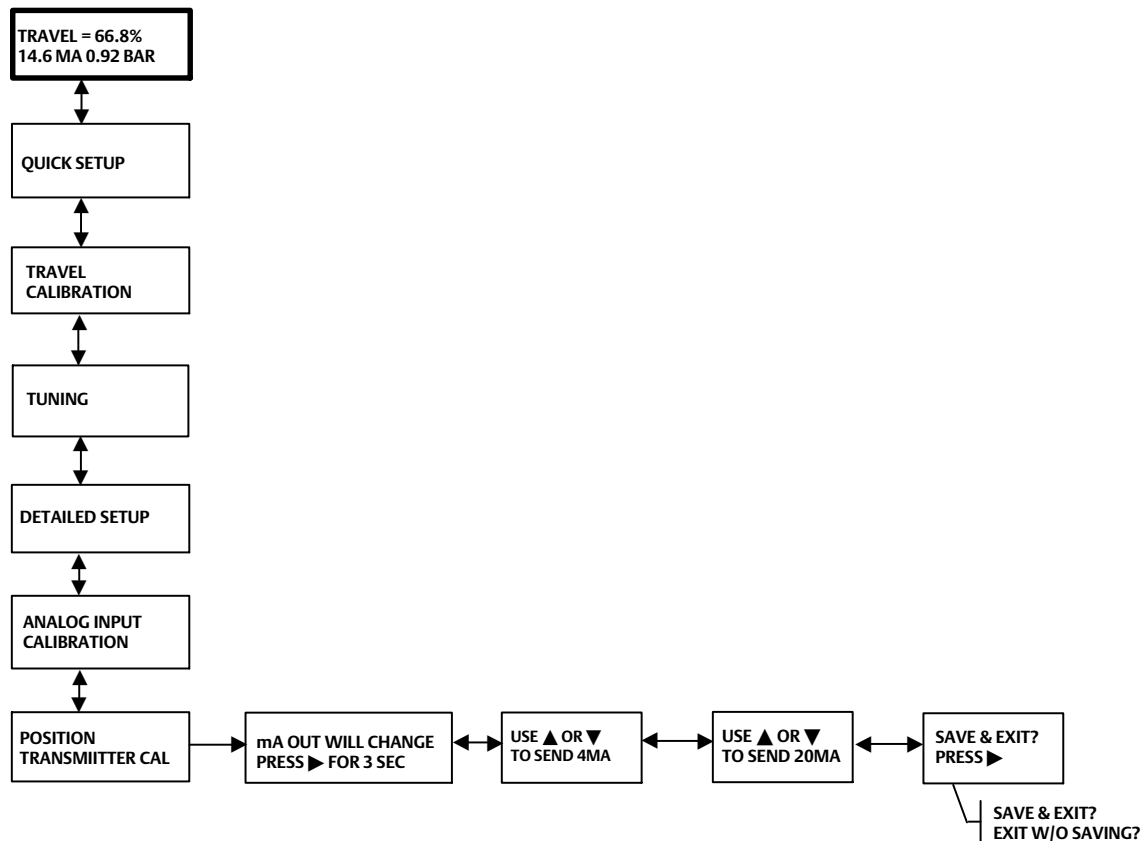
Position Transmitter Calibration

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 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 22.

Figure 22. Position Transmitter Calibration



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.

Local Control

This procedure allows the user to manually control the position of the valve (see figure 23). To enter this procedure from the home screen, press the DOWN (▼) arrow key seven times and then press the RIGHT (►) arrow key.

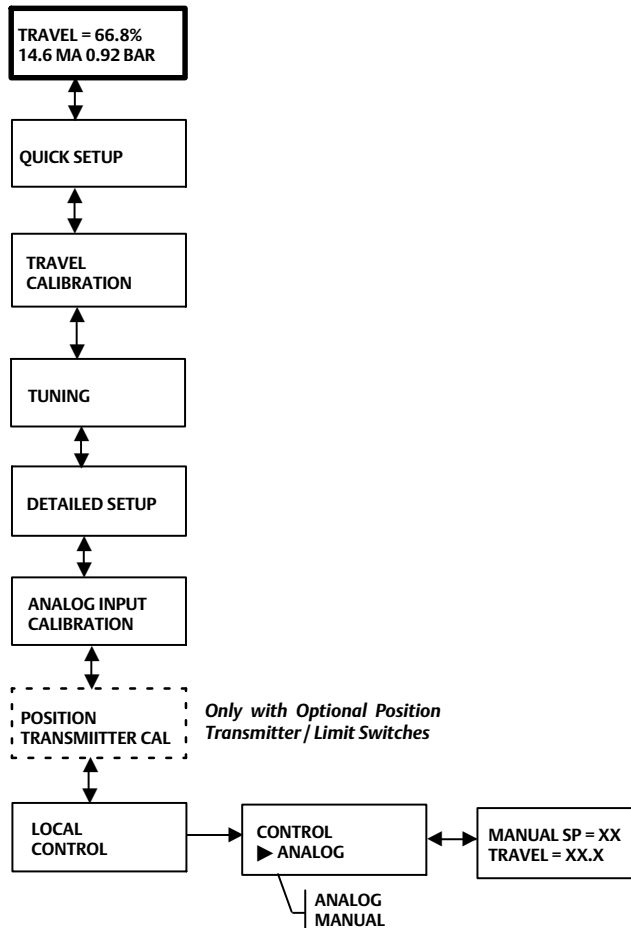
If you select ANALOG, you will return to the home screen and the digital valve controller will respond to the loop current. If you select MANUAL, you will move to the screen that shows the travel setpoint and the actual valve travel.

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 23. 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).

Specifications

Available Configurations

- Integral mounting to the GX actuator
- Sliding-stem applications
- Quarter-turn rotary applications

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.

Input Signal

Analog Input Signal: 4-20 mA DC, nominal; split ranging available.

Minimum Voltage: Voltage available at instrument terminals must be 8.5 volts for analog control, 9.0 volts for HART communication.

Maximum Voltage: 30 volts DC

Minimum Control Current: 4.0 mA (below 3.5 mA may cause microprocessor restart)

Overcurrent Protection: Input circuitry limits current to prevent internal damage.

Reverse Polarity Protection: No damage occurs from reversal of loop current.

Output Signal

Pneumatic signal as required by the actuator, up to full supply pressure

Minimum Span: 0.5 bar (7 psig)

Maximum Span: 7 bar (101 psig)

Action: Single Acting, direct

Supply Pressure⁽¹⁾

Recommended: 0.5 bar (7 psig) greater than the maximum actuator requirements

Maximum: 7 bar (101 psig)

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

Temperature Limits⁽¹⁾

-40 to 85°C (-40 to 185°F). LCD may not be readable below -20°C (-4°F).

Air Consumption⁽²⁾

Supply pressure

At 1.5 bar (22 psig)⁽³⁾: 0.06 normal m³/h (2.3 scfh)

At 4 bar (58 psig)⁽⁴⁾: 0.12 normal m³/h (4.4 scfh)

Air Capacity⁽²⁾

Supply pressure

At 1.5 bar (22 psig)⁽³⁾: 4.48 normal m³/h (167 scfh)

At 4 bar (58 psig)⁽⁴⁾: 9.06 normal m³/h (338 scfh)

Independent Linearity

±0.5% of output span

Electromagnetic Compatibility

Meets EN 61326-1 (First Edition)

Immunity—Industrial locations per Table 2 of the EN 61326-1 standard. Performance is shown in table 4 below

Emissions—Class A

ISM equipment rating: Group 1, Class A

Tested to NAMUR NE21 requirements.

Vibration Testing Method

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.

Input Impedance

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.

Electrical Classification

Hazardous Area:

CSA—Intrinsically Safe and Non-incendive

FM—Intrinsically Safe and Non-incendive

ATEX—Intrinsically Safe

IECEx—Intrinsically Safe

Refer to Hazardous Area Classifications and Special Instructions for “Safe Use” and Installations in Hazardous Locations, starting on page 33, for additional information.

Electrical Housing:

CSA—IP66, Type 4X

FM, ATEX, IECEx—IP66

-continued-

Specifications (continued)

Other Classifications/Certifications

GOST-R—Russian GOST-R
 INMETRO—National Institute of Metrology, Quality and Technology (Brazil)
 KGS—Korea Gas Safety Corporation (South Korea)
 NEPSI—National Supervision and Inspection Centre for Explosion Protection and Safety of Instrumentation (China)
 PESO CCOE—Petroleum and Explosives Safety Organisation - Chief Controller of Explosives (India)
 RTN—Russian Rostekhnadzor

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

Connections

Standard

Supply and Output Pressure: G1/4 internal
Electrical: M20 internal

Optional

Supply and Output Pressure: 1/4 NPT internal
Electrical: 1/2 NPT internal

Materials of Construction

Housing and Cover: A03600 low copper aluminum alloy
 Elastomers: nitrile, fluorosilicone

Stem Travel

Minimum: 8 mm (0.3125 inch)
Maximum: 102 mm (4 inches)

Shaft Rotation

Minimum: 45°
Maximum: 90°

Mounting

Designed for direct actuator mounting. For weatherproof housing capability, the vent must be positioned at the lowest point of the instrument.

Weight

1.5 kg (3.3 lbs)

Options

■ **Airset:** 67CFR with filter

Language Packs:

■ **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

Supply Voltage: 5-30 VDC

OFF State: 0.5 to 1.0 mA

ON State: 3.5 to 4.5 mA (above 5V)

Reference Accuracy: 2% of travel span⁽⁵⁾

■ **Transmitter:** 4-20 mA output, isolated

Supply Voltage: 8-30 VDC

Fault Indication: offrange high or low

Reference Accuracy: 1% of travel span⁽⁵⁾

Declaration of SEP

Fisher Controls International LLC declares this product to be in compliance with Article 3 paragraph 3 of the Pressure Equipment Directive (PED) 97 / 23 / EC. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.

However, the product *may* bear the CE marking to indicate compliance with *other* applicable European Community Directives.

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 4. 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:

- Bulletin 62.1:DVC2000 - Fisher FIELDVUE DVC2000 Digital Valve Controller (D103167X012)
- Fisher FIELDVUE DVC2000 Digital Valve Controller Instruction Manual (D103176X012)
- 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— Fisher FIELDVUE DVC2000 Digital Valve Controller (D103783X012)
- Using the HART Tri-Loop™ HART-to-Analog Signal Converter with Fisher FIELDVUE Digital Valve Controllers— Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals (D103267X012)

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

Educational Services

For information on available courses for the DVC2000 digital valve controller, as well as a variety of other products, contact:

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

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

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

Note

This information supplements the nameplate markings affixed to the product.

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

⚠ WARNING

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

CSA

Intrinsically Safe, Non-Incendive

No special conditions for safe use.

Refer to figure 24 for a typical DVC2000 CSA approval nameplate and figure 25 for installation drawing GE12444.

Figure 24. Typical CSA Nameplate

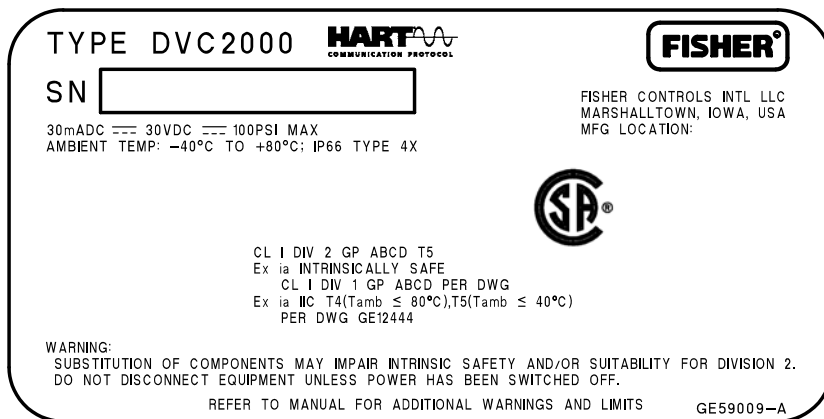


Figure 25. CSA Installation Drawing

1 EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE (CEC) PART 1:

2 BARRIERS MUST BE CSA APPROVED WITH ENTITY PARAMETERS AND ARE TO BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S I.S. INSTALLATION INSTRUCTIONS.

3 THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS, NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (Vmax) AND THE CURRENT (Imax) OF THE INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (Voc) AND CURRENT (Isc) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAXIMUM UNPROTECTED CAPACITANCE (Ci) AND INDUCTANCE (Li) OF EACH INTRINSICALLY SAFE APPARATUS, AND THE INTERCONNECTING WIRING, MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (Ca) AND INDUCTANCE (La) DEFINED BY THE ASSOCIATED APPARATUS. IF THESE CRITERIA ARE MET, THEN THE COMBINATION MAY BE CONNECTED.
 FORMULAS - $V_{max} > V_{oc}$, $I_{max} > I_{sc}$, $C_i + C_{cable} < C_a$, $L_i + L_{cable} < L_a$

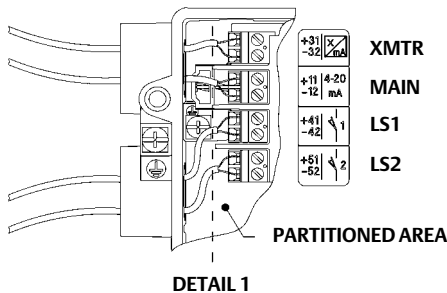
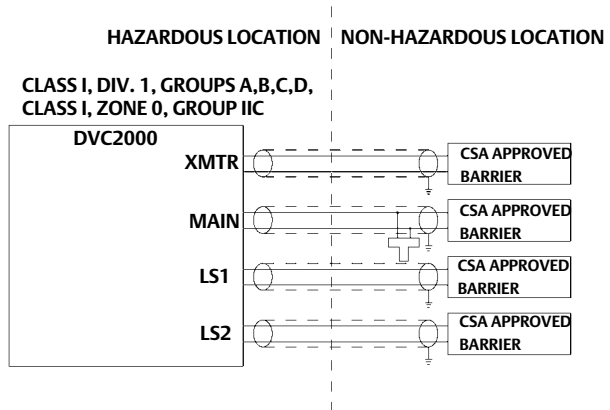
4 ENTITY PARAMETERS FOR EACH I.S. CIRCUIT ARE AS FOLLOWS:

CIRCUIT	VMax (Ui)	IMAX(Ii)	Ci	Li	PMAX
XMTR	28Vdc	100mA	5nF	0 mH	1W
MAIN	30Vdc	130mA	10.5nF	0.55 mH	1W
LS1	16Vdc	76mA	5nF	0 mH	1W
LS2	16Vdc	76mA	5nF	0 mH	1W

5 WHERE MULTIPLE IS CIRCUITS ARE USED:

- EACH I.S. CIRCUIT MUST BE SHIELDED TWISTED PAIR CABLE.
- I.S. CIRCUITS MUST ENTER ENCLOSURE VIA CONDUIT ENTRIES AS SPECIFIED IN DETAIL 1.
- CABLE INSULATION AND SHIELD MUST EXTEND TO WITHIN PARTITIONED AREA (SEE DETAIL 1).
- XMTR, LS1, AND LS2 CIRCUITS ARE OPTIONAL.

6 IF HAND-HELD COMMUNICATOR OR MULTIPLEXOR IS USED, IT MUST BE CSA CERTIFIED WITH ENTITY PARAMETERS AND INSTALLED PER THE MANUFACTURER'S CONTROL DRAWING.



GE12444-C

WARNING

THE APPARATUS ENCLOSURE CONTAINS ALUMINUM AND IS CONSIDERED TO CONSTITUTE A POTENTIAL RISK OF IGNITION BY IMPACT OR FRICTION. CARE MUST BE TAKEN DURING INSTALLATION AND USE TO PREVENT IMPACT OR FRICTION.

FM

Special Conditions of Use

Intrinsically Safe, Non-Incendive

The apparatus enclosure contains aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.

Refer to figure 26 for a typical DVC2000 FM approval nameplate and figure 27 for installation drawing GE10683.

Figure 26. Typical FM Nameplate

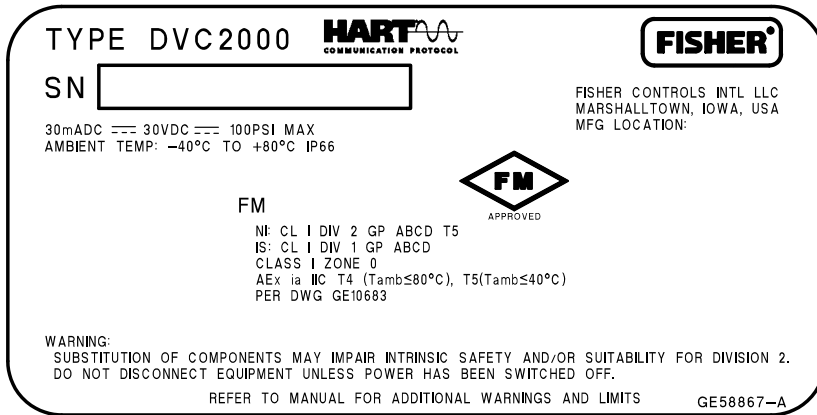


Figure 27. FM Installation Drawing

1 INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND ANSI/ISA RP12.6.

2 BARRIERS MUST BE CONNECTED PER MANUFACTURER'S INSTALLATION INSTRUCTIONS.

3 THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS, NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (V_{max}) AND THE CURRENT (I_{max}) OF THE INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (V_{oc}) AND CURRENT (I_{sc}) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAXIMUM UNPROTECTED CAPACITANCE (C_i) AND INDUCTANCE (L_i) OF EACH INTRINSICALLY SAFE APPARATUS, AND THE INTERCONNECTING WIRING, MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (C_a) AND INDUCTANCE (L_a) DEFINED BY THE ASSOCIATED APPARATUS. IF THESE CRITERIA ARE MET, THEN THE COMBINATION MAY BE CONNECTED. FORMULAS - $V_{max} > V_{oc}$, or V_t , $C_i + C_{cable} < C_a$, $P_i > P_o$, or P_t , $I_{max} > I_{sc}$, or I_t , $L_i + L_{cable} < L_a$

4 ENTITY PARAMETERS FOR EACH I.S. CIRCUIT ARE AS FOLLOWS:

CIRCUIT	V_{Max} (U_i)	I_{MAX} (I_i)	C_i	L_i	P_{MAX}
XMTR	28Vdc	100mA	5nF	0 mH	1W
MAIN	30Vdc	130mA	10.5nF	0.55 mH	1W
LS1	16Vdc	76mA	5nF	0 mH	1W
LS2	16Vdc	76mA	5nF	0 mH	1W

5 WHERE MULTIPLE IS CIRCUITS ARE USED:

- EACH I.S. CIRCUIT MUST BE SHIELDED TWISTED PAIR CABLE.
- I.S. CIRCUITS MUST ENTER ENCLOSURE VIA CONDUIT ENTRIES AS SPECIFIED IN DETAIL 1.
- CABLE INSULATION AND SHIELD MUST EXTEND TO WITHIN PARTITIONED AREA (SEE DETAIL 1).
- XMTR, LS1, AND LS2 CIRCUITS ARE OPTIONAL.

6 CLASS I, DIV 2 APPLICATIONS MUST BE INSTALLED AS SPECIFIED IN NEC ARTICLE 501-4(B). EQUIPMENT AND FIELD WIRING IS NON-INCENDIVE WHEN CONNECTED TO APPROVED BARRIERS WITH ENTITY PARAMETERS.

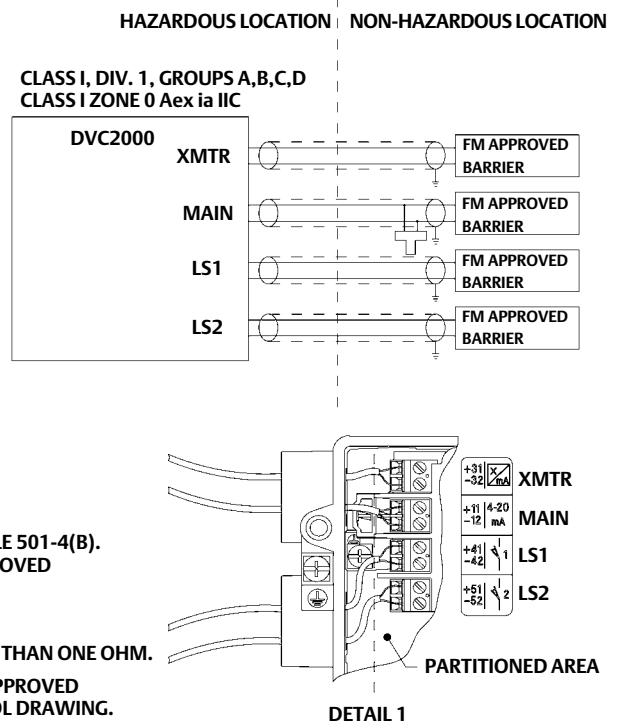
7 MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 V_{rms} .

8 RESISTANCE BETWEEN BARRIER GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM.

9 IF HAND-HELD COMMUNICATOR OR MULTIPLEXOR IS USED, IT MUST BE FM APPROVED WITH ENTITY PARAMETERS AND INSTALLED PER THE MANUFACTURER'S CONTROL DRAWING.

WARNING

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ATEX

Special Conditions for Safe Use

Intrinsically Safe

The equipment is an intrinsically safe equipment. It can be mounted in hazardous area.

The terminal blocks can be only connected to certified intrinsically safe equipments and these combinations must be compatible as regard intrinsic safety rules.

The equipment shall be connected in accordance with manufacturer's installation instructions in drawing GE14685 (figure 29).

The equipment must not be submitted to mechanical impacts or frictions.

Temperature Classification:

T4 at $T_a \leq 80^\circ\text{C}$

T5 at $T_a \leq 40^\circ\text{C}$

Refer to figure 28 for a typical DVC2000 ATEX approval nameplate.

Figure 28. Typical ATEX Nameplate

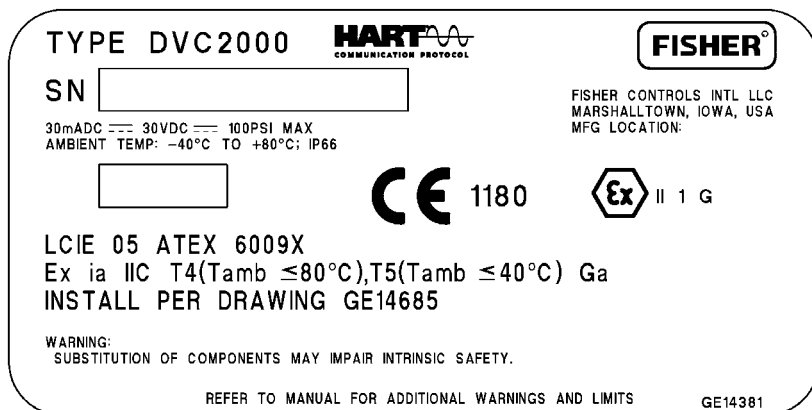


Figure 29. ATEX Installation Drawing

- 1 INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL WIRING PRACTICES OF THE COUNTRY IN USE.
- 2 BARRIERS MUST BE CONNECTED PER MANUFACTURER'S INSTALLATION INSTRUCTIONS.
- 3 INTRINSICALLY SAFE APPARATUS MAY BE CONNECTED TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (Ui) AND THE CURRENT (Ii) OF THE INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (Uo) AND CURRENT (Io) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAXIMUM UNPROTECTED CAPACITANCE (Ci) AND INDUCTANCE (Li) OF EACH INTRINSICALLY SAFE APPARATUS, AND THE INTERCONNECTING WIRING, MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (Co) AND INDUCTANCE (Lo) DEFINED BY THE ASSOCIATED APPARATUS. IF THESE CRITERIA ARE MET, THEN THE COMBINATION MAY BE CONNECTED.

FORMULAS

$$U_i > U_o$$

$$I_i > I_o$$

$$C_i + C_{cable} < C_o$$

$$L_i + L_{cable} < L_o$$

$$P_i > P_o$$

4 ENTITY PARAMETERS FOR EACH I.S. CIRCUIT ARE AS FOLLOWS:

CIRCUIT	VMax (Ui)	IMAX(Ii)	Ci	Li	PMAX
XMTR	28Vdc	100mA	5nF	0 mH	1W
MAIN	30Vdc	130mA	10.5nF	0.55 mH	1W
LS1	16Vdc	76mA	5nF	0 mH	1W
LS2	16Vdc	76mA	5nF	0 mH	1W

5 WHERE MULTIPLE IS CIRCUITS ARE USED:

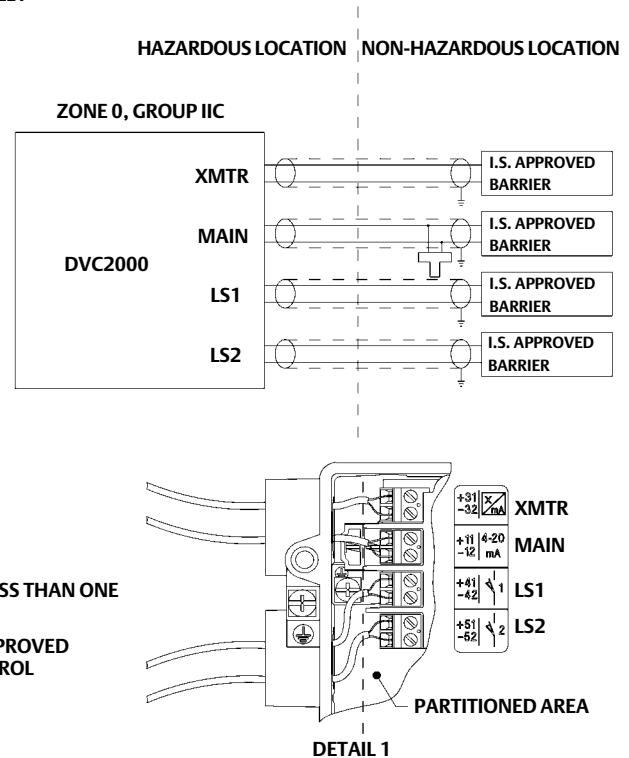
- EACH I.S. CIRCUIT MUST BE SHIELDED TWISTED PAIR CABLE.
- I.S. CIRCUITS MUST ENTER ENCLOSURE VIA CONDUIT ENTRIES AS SPECIFIED IN DETAIL 1.
- CABLE INSULATION AND SHIELD MUST EXTEND TO WITHIN PARTITIONED AREA (SEE DETAIL 1).
- XMTR, LS1, AND LS2 CIRCUITS ARE OPTIONAL.

6 RESISTANCE BETWEEN BARRIER GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM.

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

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GE14685-C

IECEX

Conditions of Certification

Intrinsically Safe

This equipment shall be connected in accordance with the manufacturer's installation instructions (drawing GE14581, figure 31) to intrinsic safety barriers that satisfy the following parameters for each set of terminals.

Main 4-20 mA: $U_i = 30\text{ V}$, $I_i = 130\text{ mA}$, $P_i = 1\text{ W}$, $L_i = 0.55\text{ mH}$, $C_i = 10.5\text{ nF}$

XMTR circuit: $U_i = 28\text{ V}$, $I_i = 100\text{ mA}$, $P_i = 1\text{ W}$, $L_i = 0\text{ mH}$, $C_i = 5\text{ nF}$

Limit Switch 1 (LS1): $U_i = 16\text{ V}$, $I_i = 76\text{ mA}$, $P_i = 1\text{ W}$, $L_i = 0\text{ mH}$, $C_i = 5\text{ nF}$

Limit Switch 2 (LS2): $U_i = 16\text{ V}$, $I_i = 76\text{ mA}$, $P_i = 1\text{ W}$, $L_i = 0\text{ mH}$, $C_i = 5\text{ nF}$

Refer to figure 30 for a typical DVC2000 IECEx approval nameplate.

Figure 30. Typical IECEx Nameplate

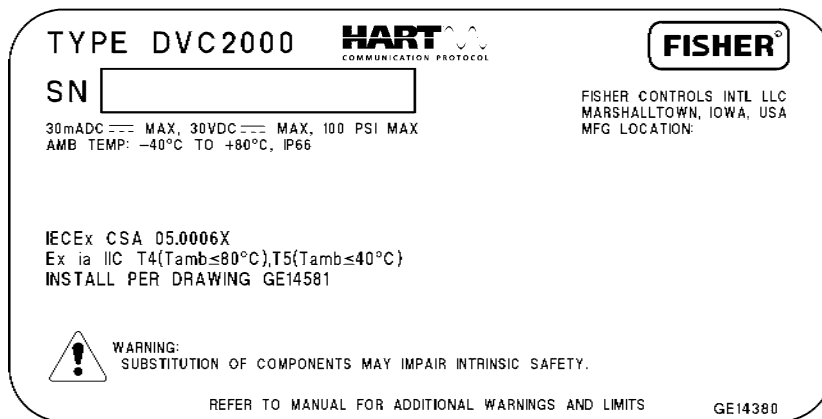


Figure 31. IECEx Installation Drawing

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

2 BARRIERS MUST BE CONNECTED PER MANUFACTURER'S INSTALLATION INSTRUCTIONS.

3 INTRINSICALLY SAFE APPARATUS MAY BE CONNECTED TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (Ui) AND THE CURRENT (Ii) OF THE INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (Uo) AND CURRENT (Io) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAXIMUM UNPROTECTED CAPACITANCE (Ci) AND INDUCTANCE (Li) OF EACH INTRINSICALLY SAFE APPARATUS, AND THE INTERCONNECTING WIRING, MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (Co) AND INDUCTANCE (Lo) DEFINED BY THE ASSOCIATED APPARATUS. IF THESE CRITERIA ARE MET, THEN THE COMBINATION MAY BE CONNECTED.

FORMULAS $U_i > U_o$

$I_i > I_o$

$C_i + C_{cable} < C_o$

$L_i + L_{cable} < L_o$

$P_i > P_o$

4 ENTITY PARAMETERS FOR EACH I.S. CIRCUIT ARE AS FOLLOWS:

CIRCUIT	VMax (Ui)	IMAX(Ii)	Ci	Li	PMAX
XMTR	28Vdc	100mA	5nF	0 mH	1W
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LS1	16Vdc	76mA	5nF	0 mH	1W
LS2	16Vdc	76mA	5nF	0 mH	1W

5 WHERE MULTIPLE I.S. CIRCUITS ARE USED:

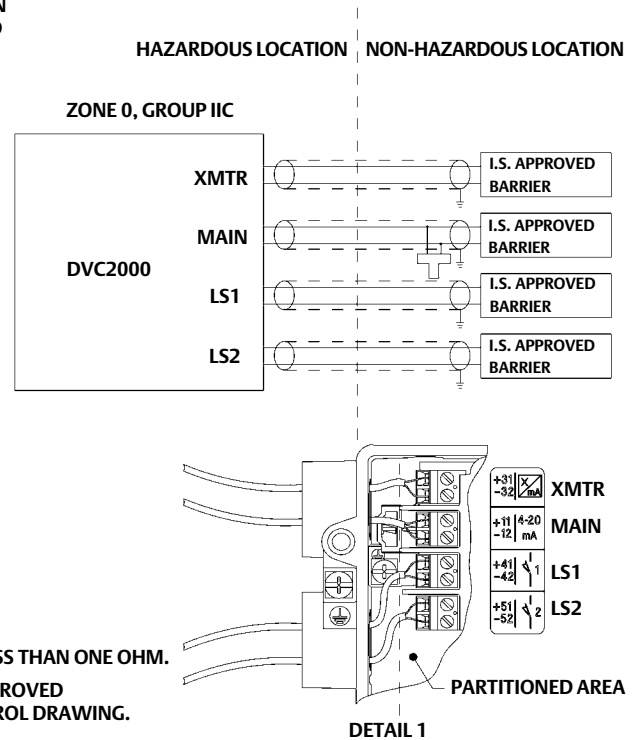
- EACH I.S. CIRCUIT MUST BE SHIELDED TWISTED PAIR CABLE.
- I.S. CIRCUITS MUST ENTER ENCLOSURE VIA CONDUIT ENTRIES AS SPECIFIED IN DETAIL 1.
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