

DVC6000 Series FIELDVUE® Digital Valve Controllers

DVC6000 Series FIELDVUE® digital valve controllers (figures 1 and 2) are communicating, microprocessor-based current-to-pneumatic instruments. In addition to the traditional function of converting a current signal to a valve-position pressure signal, DVC6000 Series digital valve controllers, using HART® communications protocol, give easy access to information critical to process operation. This can be done using a Model 375 Field Communicator at the valve or at a field junction box, or by using a personal computer or a system console within the control room. Using HART communication protocol, information can be integrated into a control system or received on a single loop basis.

DVC6000 Series digital valve controllers can be used on single- or double-acting actuators. The digital valve controller receives feedback of the valve travel position plus supply and actuator pneumatic pressure. This allows the instrument to diagnose

not only itself, but also the valve and actuator to which it is mounted. This provides you with very cost effective maintenance information, as the required maintenance can be performed on the instrument and valve when there really is a need.

Wiring is economical because DVC6000 Series digital valve controllers use two-wire 4 to 20 mA loop power. This provides for low cost replacement of existing analog instrumentation. The DVC6000 Series digital valve controller's two-wire design avoids the high cost of running separate power and signal wiring.

Note

Neither Emerson, Emerson Process Management, nor any of their affiliated entities assumes responsibility for the selection, use and maintenance of any product. Responsibility for the selection, use and maintenance of any product remains with the purchaser and end-user.



Figure 1. Type DVC6010 Digital Valve Controller Mounted on a Sliding-Stem Valve Actuator



Figure 2. Type DVC6010 Digital Valve Controller Mounted on Type 585C Piston Actuator



Specifications

Available Configurations

Valve-Mounted Instrument:

DVC6010: Sliding-stem applications
DVC6020: Rotary applications and long-stroke sliding-stem applications
DVC6030: Quarter-turn rotary applications

Remote-Mounted Instrument⁽¹⁾:

DVC6005: Base unit for 2-inch pipestand or wall mounting
DVC6015: Feedback unit for sliding-stem applications
DVC6025: Feedback unit for rotary or long-stroke sliding-stem applications
DVC6035: Feedback unit for quarter-turn rotary applications

DVC6000 Series digital valve controllers can be mounted on Fisher and other manufacturers rotary and sliding-stem actuators.

Input Signal⁽²⁾

Point-to-Point:

Analog Input Signal: 4–20 mA DC, nominal; split ranging available
 Minimum Voltage Available at Instrument Terminals must be 10.5 VDC for analog control, 11 VDC for HART communication (see instrument instruction manual for details)
Minimum Control Current: 4.0 mA
Minimum Current w/o Microprocessor Restart: 3.5 mA
Maximum Voltage: 30 VDC
Overcurrent Protection: Input circuitry limits current to prevent internal damage
Reverse Polarity Protection: No damage occurs from reversal of loop current

Multi-drop:

Instrument Power: 11 to 30 VDC at approximately 8 mA
Reverse Polarity Protection: No damage occurs from reversal of loop current

Output Signal⁽²⁾

Pneumatic signal as required by the actuator, up to 95% of supply pressure
Minimum Span: 0.4 bar (6 psig)
Maximum Span: 9.5 bar (140 psig)
Action: ■ Double, ■ Single Direct, and ■ Single Reverse

Supply Pressure⁽³⁾

Minimum Recommended: 0.3 bar (5 psig) higher than maximum actuator requirements
Maximum: 10.0 bar (145 psig) or maximum pressure rating of the actuator, whichever is lower

Steady-State Air Consumption^(4,5)

Standard Relay:

At 1.4 bar (20 psig) supply pressure: Less than 0.38 normal m³/hr (14 scfh)
At 5.5 bar (80 psig) supply pressure: Less than 1.3 normal m³/hr (49 scfh)

Low Bleed Relay⁽⁶⁾:

At 1.4 bar (20 psig) supply pressure: Average value 0.056 normal m³/hr (2.1 scfh)
At 5.5 bar (80 psig) supply pressure: Average value 0.184 normal m³/hr (6.9 scfh)

Maximum Output Capacity^(4,5)

At 1.4 bar (20 psig) supply pressure: 10.0 normal m³/hr (375 scfh)
At 5.5 bar (80 psig) supply pressure: 29.5 normal m³/hr (1100 scfh)

Independent Linearity^(2,7)

±0.50% of output span

Electromagnetic Interference (EMI)

Tested per IEC 61326-1 (Edition 1.1). Meets emission levels for Class A equipment (industrial locations) and Class B equipment (domestic locations). Meets immunity requirements for industrial locations (Table A.1 in the IEC specification document). Immunity performance is shown in table 2.

IEC 61010 Compliance Requirements (Valve-Mounted Instruments Only)

Power Source: The loop current must be derived from a separated extra-low voltage (SELV) power source

Environmental Conditions: Installation Category I

(continued)

Specifications (continued)

Electrical Classification

Hazardous Area:



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



Explosion proof, Non-incendive, Dust-Ignition proof, Intrinsic Safety

ATEX Flameproof, Type n, Intrinsic Safety

IECEX Flameproof, Type n, Intrinsic Safety



Flameproof, Intrinsic Safety

Refer to tables 3, 4, 5, 6, and 7 for specific approval information

Electrical Housing: Meets NEMA 4X, CSA Type 4X, IEC 60529 IP66

Connections

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

Output Pressure: 1/4 NPT internal

Tubing: 3/8-inch metal, recommended

Vent (pipe-away): 3/8 NPT internal

Electrical: 1/2 NPT internal conduit connection, optional—M20 internal conduit connection, spring clamp terminal connection⁽⁸⁾

Operating Ambient Temperature Limits⁽³⁾

–40 to 80°C (–40 to 176°F) for most approved valve-mounted instruments

–60 to 125°C (–76 to 257°F) for remote-mounted feedback unit.

–52 to 80°C (–62 to 176°F) for valve-mounted instruments utilizing the Extreme Temperature option (fluorosilicone elastomers).

Construction Materials

Housing, module base and terminal box: ASTM B85 A03600 low copper aluminum alloy (standard)

CF8M (cast 316 stainless steel) (optional for valve-mounted instruments only)

Cover: Thermoplastic polyester

Elastomers

Standard: Nitrile

Optional: Fluorosilicone

Stem Travel

DVC6010, DVC6015:

0 to 102 mm (4 inches) maximum travel span
0 to 9.5 mm (3/8 inches) minimum travel span

DVC6020, DVC6025: 0 to 606 mm (23-7/8 inches) maximum travel span

Shaft Rotation (DVC6020, DVC6025, DVC6030 and DVC6035)

0 to 50 degrees minimum

0 to 90 degrees maximum

Mounting

Designed for direct actuator mounting or remote pipestand or wall mounting. Mounting the instrument vertically, with the vent at the bottom of the assembly, or horizontally, with the vent pointing down, is recommended to allow drainage of moisture that may be introduced via the instrument air supply.

Weight

Valve-Mounted Instruments.

Aluminum: 3.5 kg (7.7 lbs)

Stainless steel: 7.7 kg (17 lbs)

Remote-Mounted Instruments.

DVC6005 Base Unit: 4.1 kg (9 lbs)

DVC6015 Feedback Unit: 1.3 kg (2.9 lbs)

DVC6025 Feedback Unit: 1.4 kg (3.1 lbs)

DVC6035 Feedback Unit: 0.9 kg (2.0 lbs)

Options

- Supply and output pressure gauges or ■ Tire valves,
- Integral mounted filter regulator,
- Stainless steel housing, module base and terminal box (valve-mounted instruments only),
- Low-Bleed Relay, ■ Extreme Temperature

1. 3-conductor shielded cable, 22 AWG minimum wire size, is recommended for connection between base unit and feedback unit. Pneumatic tubing between base unit output connection and actuator has been tested to 15 meters (50 feet) maximum without performance degradation.

2. These terms are defined in ISA Standard S51.1.

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

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

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

6. The Low Bleed Relay is offered as standard relay for DVC6000 SIS tier, used for On/Off applications.

7. Typical value. Not applicable for DVC6020 digital valve controllers in long-stroke applications or remote-mounted DVC6005 digital valve controllers with long pneumatic tubing lengths.

8. ATEX/IEC approvals only.

Table 1. DVC6000 Product Level Capabilities

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

1. Refer to Bulletin 62.1:DVC6000 SIS for information on DVC6000 Series FIELDVUE[®] digital valve controllers for Safety Instrumented System (SIS) Solutions.
2. Refer to brochure part # D351146X012 / D351146X412 for information on Fisher optimized digital valves for compressor antisurge applications.

Features

- **Improved Control**—Two-way digital communications give you current valve conditions. You can rely on this real-time information to make sound process management decisions. By analyzing valve dynamics through AMS[™] ValveLink[®] Software you can identify control areas needing improvement and maintain a high level of system performance.

- **Environmental Protection**—You can avoid additional field wiring by connecting a leak detector or limit switch to the auxiliary terminals in the DVC6000 Series digital valve controller. In this way, the instrument will issue an alert if limits are exceeded.

- **Enhanced Safety**—You can check instrument and valve operation and keep the process running smoothly and safely from a remote location. Access is possible at a field junction box, marshalling panel, or within the safety of the control room using either a 375 Field Communicator, a notebook PC, or a system workstation. Your exposure to hazardous environments is minimized and you can avoid having to access hard-to-reach valve locations.

- **Hardware Savings**—DVC6000 Series digital valve controllers, when used in an integrated system, allow you to realize significant hardware and installation cost savings by replacing other devices in the process loop, such as positioners and limit switches, with a FIELDVUE digital valve controller.

- **Built to Survive**—Field-tough DVC6000 Series digital valve controllers have fully encapsulated printed wiring boards that resist the effects of vibration, temperature, and corrosive atmospheres. A separate weather-tight field wiring terminal box isolates field-wiring connections from other areas of the instrument.

- **Increased Uptime**—With the self-diagnostic capability of DVC6000 Series digital valve controllers, you can answer questions about a valve's performance, without pulling the valve from the line. You can run diagnostics (I/P and relay integrity, travel deviation, and on-line friction and deadband analysis and trending) while the valve is in service and operating. You can also compare the present valve/actuator signature (bench set, seat load, friction, etc.) against previously stored signatures to discover performance changes, before they cause process control problems.

- **Faster Commissioning**—The two-way communication capability allows you to quickly commission loops by remotely identifying each instrument, verifying its calibration, reviewing stored maintenance notes, and more.

- **Easy Maintenance**—DVC6000 Series digital valve controllers are modular in design. The module base can be removed from the instrument housing without disconnecting the field wiring, pneumatic connections or stem linkages. This module contains the critical sub-modules so component removal is quick and simple.

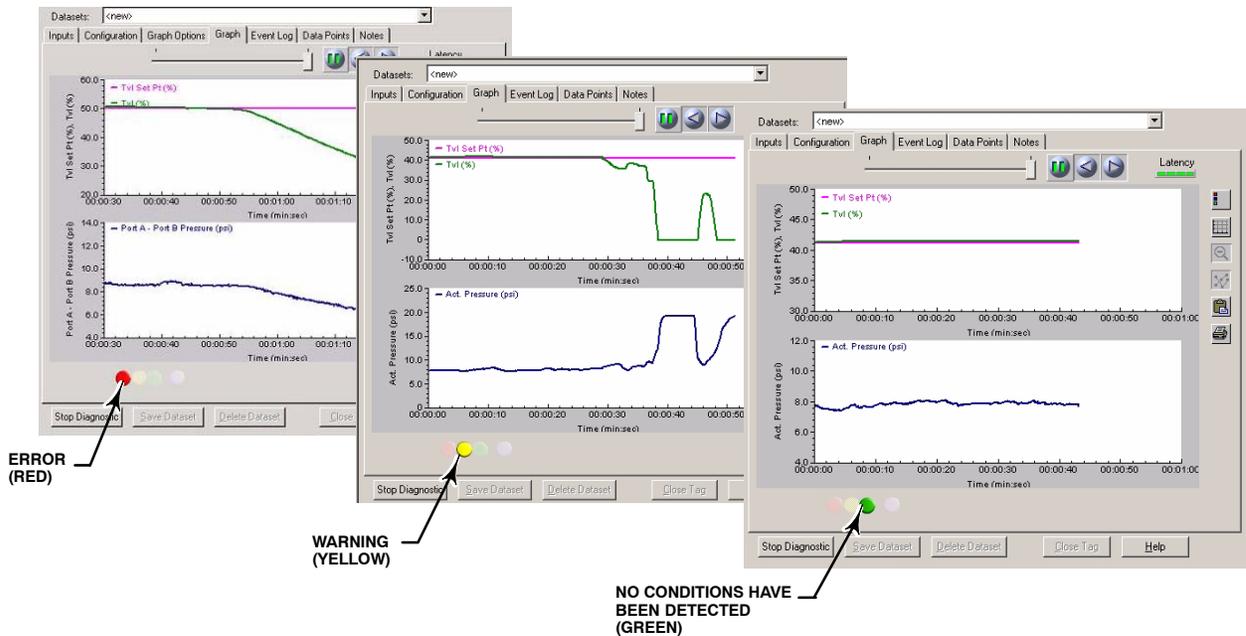


Figure 3. Red/Yellow/Green Condition Indicators, Shown in AMS™ ValveLink® Software

● **Travel Control — Pressure Fallback**—Valve position feedback is critical to the operation of a digital valve controller. Without this feedback, the control valve assembly traditionally goes to its fail safe position. DVC6000 Series digital valve controllers can detect position feedback problems caused by a travel sensor failure or linkage failure and continue to operate in “pressure control” mode. If a problem with the valve position feedback is detected, the instrument will automatically disable the travel sensor, send an alert, and control its output pressure much like an I/P transducer. This allows the valve assembly to continue to operate with reduced accuracy until maintenance can be scheduled.

Diagnostics

DVC6000 Series digital valve controllers are packed with user-configurable alerts and alarms. When integrated with a HART communication-based system, these flags provide real-time notification of current and potential valve and instrument problems. With AMS ValveLink Software, tests can be performed to identify problems with the entire control

valve assembly. Diagnostic capabilities available are Performance Diagnostics (PD) and Advanced Diagnostics (AD). Refer to table 1 for details on the capabilities of each diagnostic tier.

Performance Diagnostics

Performance Diagnostics enables the use of diagnostics while the valve is in service and operating.

- Red/Yellow/Green Condition Indicator (see figure 3)
- I/P and Relay Integrity Diagnostic
- Travel Deviation Diagnostic
- One-Button Diagnostic

The One-Button Diagnostic, (shown in figure 4), is a 20 second sweep which runs the I/P and Relay Integrity, Relay Adjustment Travel Deviation, Supply Pressure, and Air Mass Performance Diagnostic tests. When the sweep is complete, AMS ValveLink Software will show any errors, possible causes, and recommended actions to resolve the error(s).

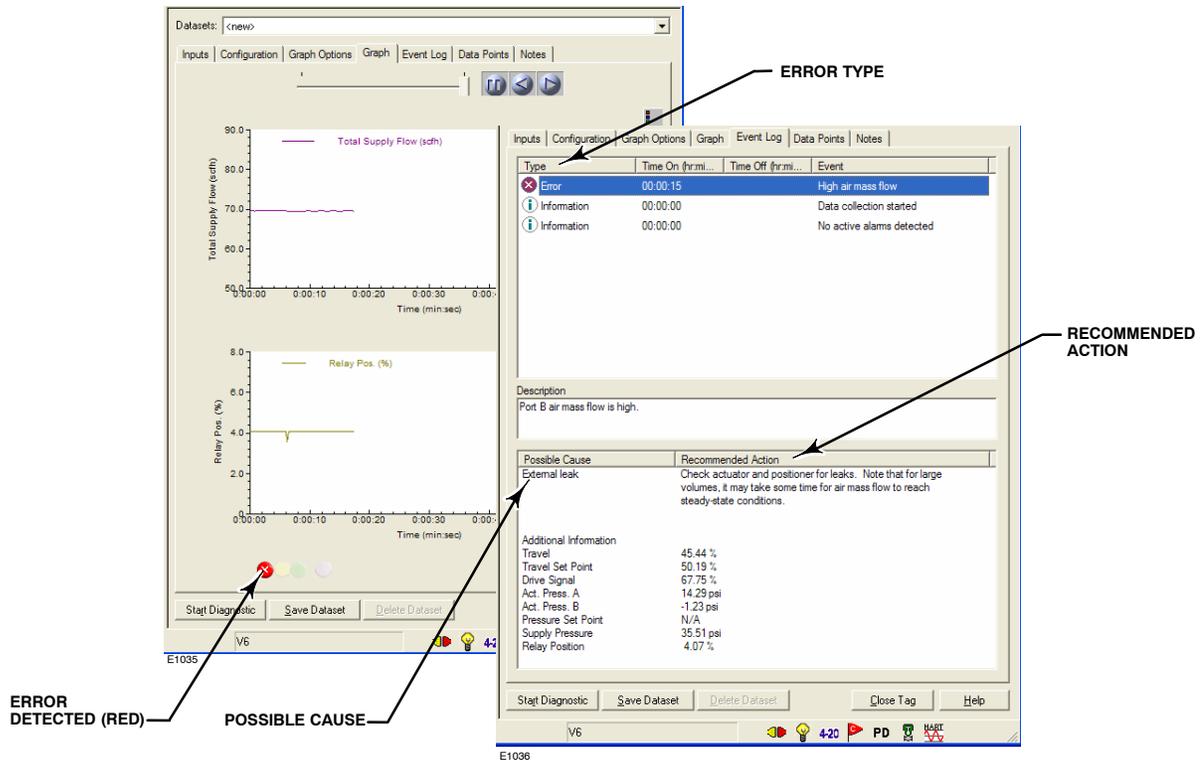


Figure 4. One-Button Sweep—Air Mass Flow Diagnostic

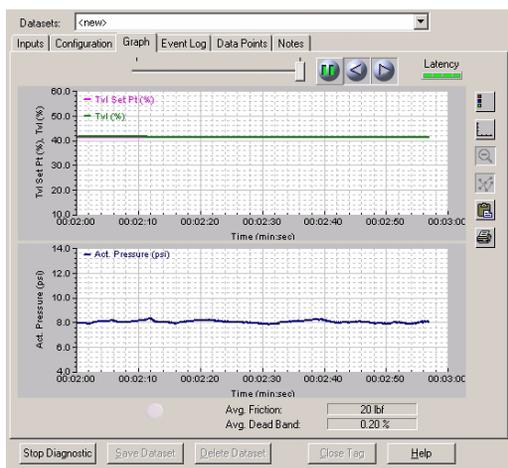


Figure 5. Valve Friction and Deadband Analysis

- On-Line/In-Service Friction and Deadband Analysis (see figure 5)
- Friction and Deadband Trending

While all diagnostics can be run while the valve is inline, only the Performance Diagnostics can be performed while the valve is in service and operating.

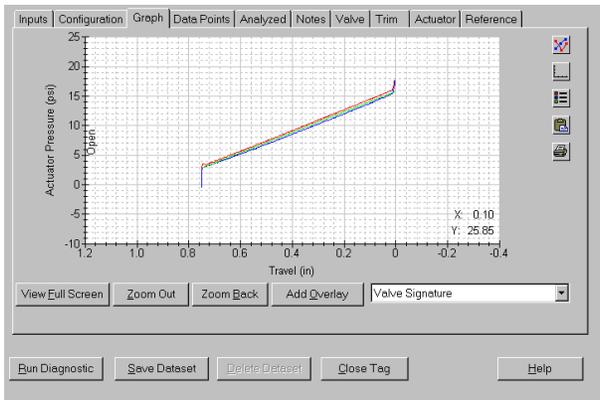


Figure 6. The Valve Signature Display

The Step Response Test checks the valve assemblies response to a changing input signal, and plots travel versus time. The end results of this test allow you to evaluate the dynamic performance of the valve. The Performance Step Test (25 pre-configured points) provides a standardized step test with which to evaluate your valve performance. It utilizes small, medium and large changes.

Advanced Diagnostics are performed with AMS ValveLink Software. The valve must be out of service for Advanced Diagnostics to be performed.

Integration

- **Non-HART® Systems**—Because DVC6000 Series digital valve controllers operate with a traditional 4 to 20 mA control signal, they directly replace older analog instruments. Microprocessor-based electronics provide improved performance along with repeatable and reliable configuration and calibration.

- **Modbus with AMS™ ValveLink® Software and HART® Multiplexers**—HART communication allows you to extract more value from DVC6000 Series digital valve controllers beyond their inherent improved performance. When integrated into a multiplexer network and using AMS ValveLink Software, the device and valve information is

real-time. From the safety of a control room, multiple instruments can be monitored for alerts and alarms. Additionally, tasks such as configuration, calibration and diagnostic testing do not require special trips to the field. AMS ValveLink Software can communicate via Modbus to the distributed control system (DCS) to provide critical information such as valve travel alerts and alarms (figure 7).

- **Integrated Control System**—A control system with HART communication capabilities has the ability to directly gather information from DVC6000 Series digital valve controllers. Information such as valve travel, alerts and alarms can be seamlessly accessed to provide a view into the field device from the safety of the control room.

Communication

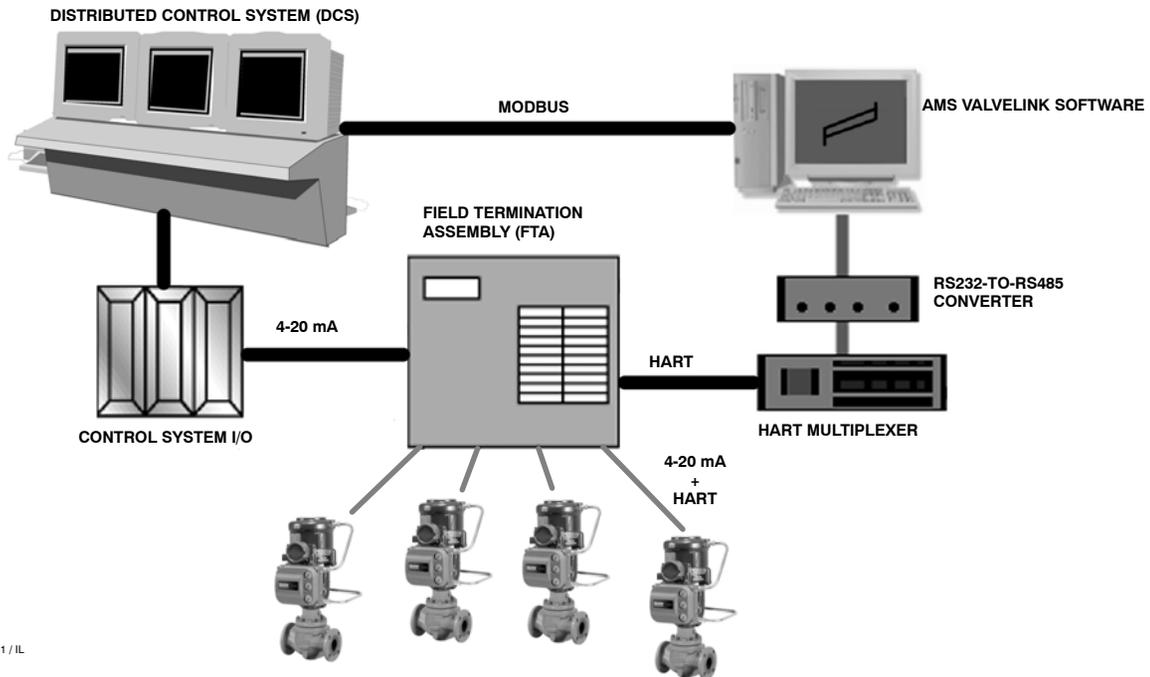
HART® Protocol Overview

The HART (Highway Addressable Remote Transducer) protocol gives field devices the capability of communicating instrument and process data digitally. This digital communication occurs over the same two-wire loop that provides the 4 to 20 mA process control signal, without disrupting the process signal (figure 8). In this way, the analog process signal, with its faster response, can be used for control. At the same time, the HART digital communication gives access to calibration, configuration, diagnostic, maintenance, and additional process data. The protocol provides total system integration via a host device.

The HART protocol gives you the capability of multidropping, where you can network several devices to a single communications line. This process is well suited for remote applications such as pipelines, custody transfer sites, and tank farms.

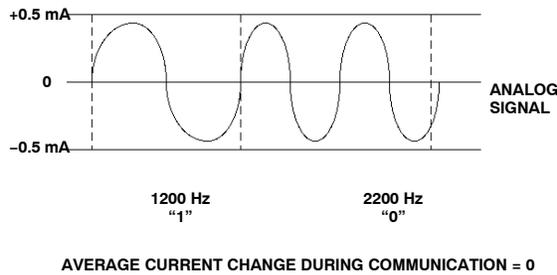
Model 375 Field Communicator

You can perform configuration and calibration at the valve or anywhere on the two-wire loop via a Model 375 Field Communicator (figure 9). Powerful tools such as the Setup Wizard and Auto Travel Calibration automate the tasks of commissioning DVC6000 Series digital valve controllers. These automation tools not only save time, but also provide accurate and repeatable results.



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Figure 7. Integrate Information from the Digital Valve Controller into a Non-HART® Compatible Control System With AMS™ ValveLink® Software's Modbus Interface



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Figure 8. HART® Frequency Shift Keying Technique

AMS™ ValveLink® Software

AMS ValveLink Software is a Windows®-based software package that allows easy access to the information available from DVC6000 Series digital valve controllers.

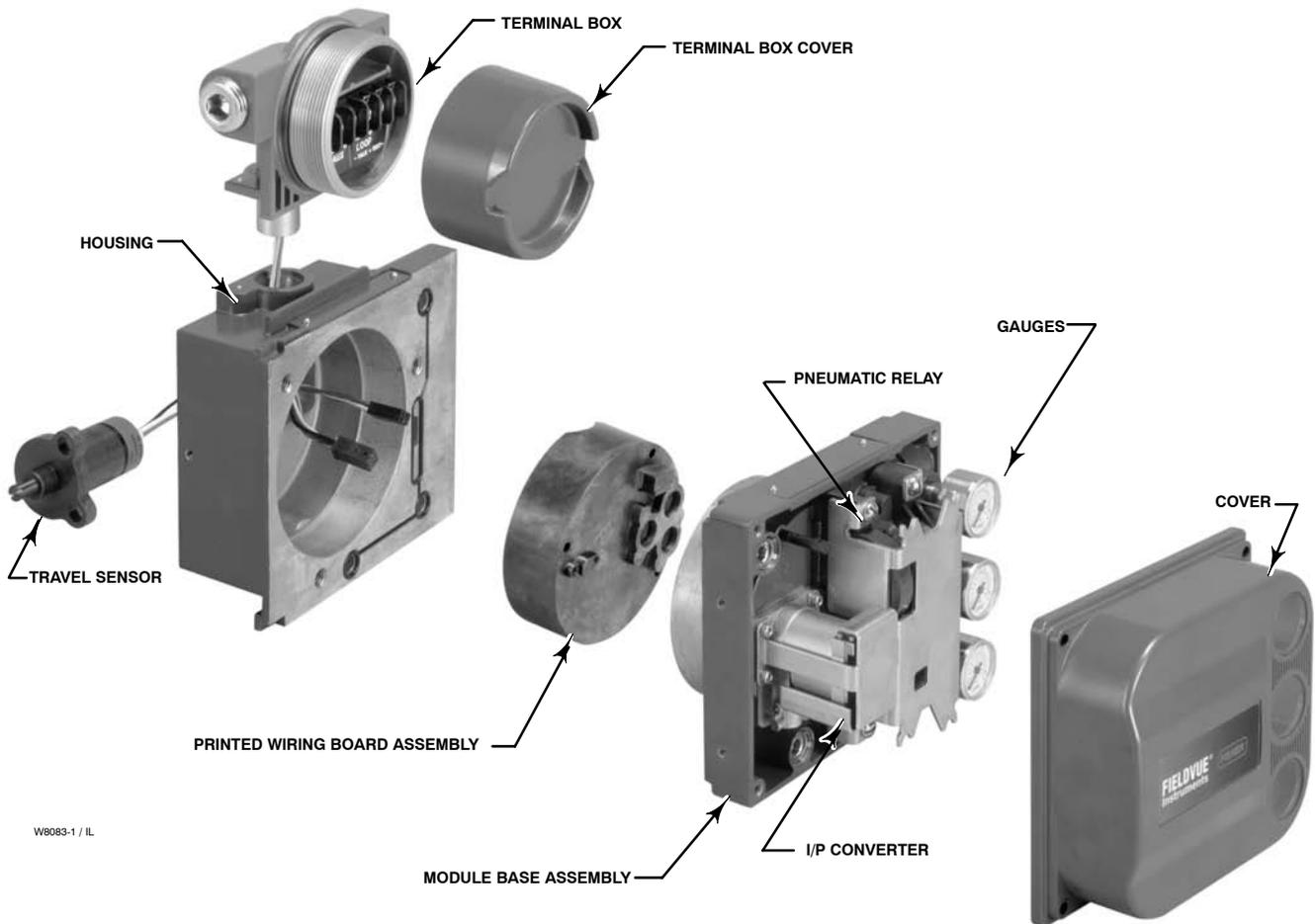
Using AMS ValveLink Software, you can monitor the performance characteristics of the valve and obtain vital information without having to pull the valve from the line. I/P and Relay Integrity and Travel Deviation



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Figure 9. Perform Configuration and Calibration at the Valve or Anywhere on the 4 to 20 mA Loop with the Model 375 Field Communicator

Diagnostics, as well as On-Line Friction and Deadband Analysis and Trending can be run while the valve is in service and operating. Valve Signature, Dynamic Error Band, and Step Response are displayed in an intuitive user-friendly environment that allows easy interpretation of data.



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Figure 10. DVC6000 Series Digital Valve Controller Assembly (Valve-Mounted Instrument)

Diagnostic graphs can be superimposed over those previously stored to view areas of valve degradation. This allows plant personnel to concentrate efforts on equipment that needs repair, avoiding unnecessary maintenance. This diagnostic capability is readily accessible and available to you either in the control room or on the plant floor. In addition to the diagnostic features, AMS ValveLink Software contains an Audit Trail, Batch Runner for automating repetitive tasks, and Trending to view valve performance.

AMS ValveLink Software provides integration into AMS and DeltaV™ systems, with HART and Fieldbus communications.

Principle of Operation

DVC6000 Series instruments (figures 10 and 11) receive a set point and position the valve where it needs to be.

- The input signal provides electrical power and the set point simultaneously. It is routed into the terminal box through a twisted pair of wires.
- The input signal is then directed to the printed wiring 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 output signal.

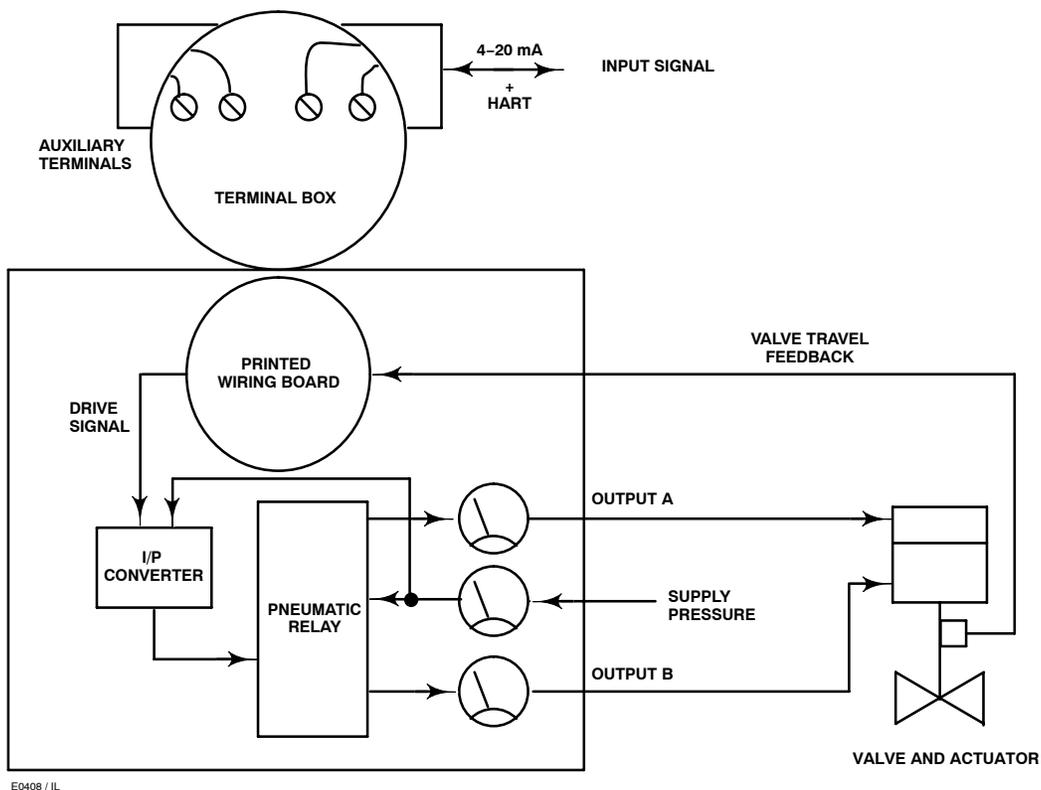


Figure 11. DVC6000 Series Digital Valve Controller Block Diagram

- The I/P output is sent to the pneumatic relay assembly. The relay is also connected to supply pressure and amplifies the small pneumatic signal from the I/P converter into a single larger pneumatic output signal used by a single-acting actuator. For double-acting actuators, the relay accepts the pneumatic signal from the I/P converter and provides two pneumatic output signals.

- The change in relay output pressure to the actuator causes the valve to move.

- Valve position is sensed through the feedback linkage by the instrument's travel sensor. The travel 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.

Installation

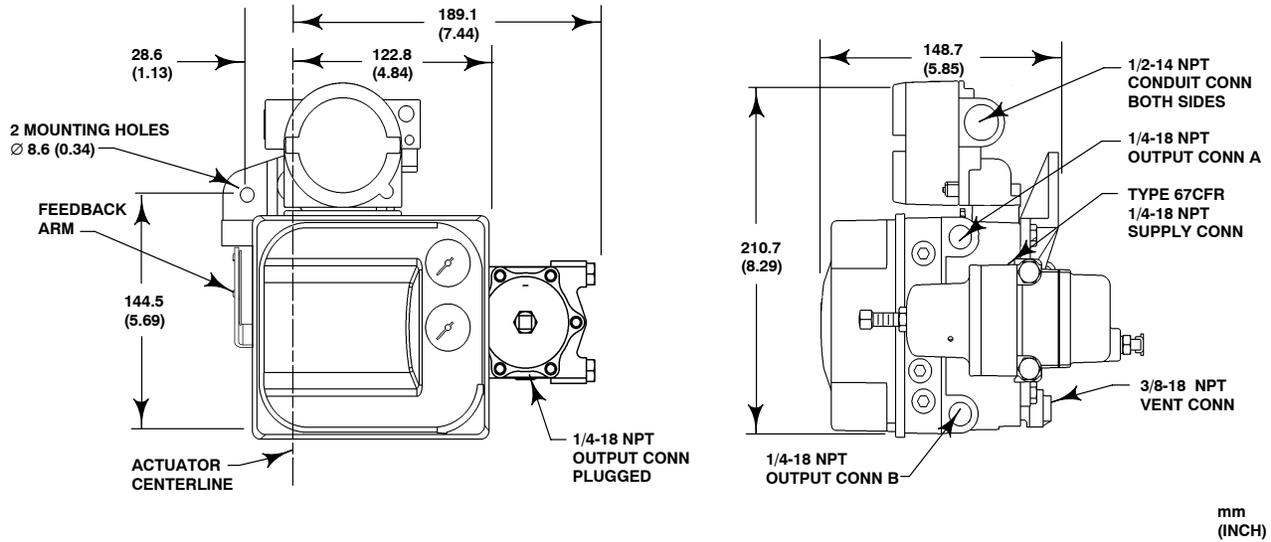
The Type DVC6010 digital valve controller is designed for yoke mounting to sliding stem actuators. Type DVC6020 digital valve controllers are designed for mounting to rotary actuators or long stroke sliding stem actuators (over 4-inches travel). Type DVC6030 digital valve controllers are designed for mounting on virtually any quarter-turn actuator. Dimensions for valve-mounted instruments are shown in figures 12, 13, and 14. Dimensions for remote-mounted instruments are shown in figures 15 and 16.

The Type DVC6005 digital valve controller base unit may be remote mounted on 2-inch pipestand or wall. The remote-mounted DVC6005 base unit connects to the DVC6015, DVC6025, or DVC6035 feedback unit mounted on the actuator. Feedback wiring and pneumatic tubing to the control valve assembly must be connected in the field.

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Figure 12. Dimensions for Type DVC6010 Digital Valve Controller with Integrally Mounted Filter Regulator

The digital valve controllers are 4 to 20 mA loop powered and do not require additional power. Electrical connections are made in the terminal box.

All pressure connections on the digital valve controllers are 1/4 NPT internal connections. The digital valve controller outputs are typically connected to the actuator inputs using 3/8-inch diameter tubing. Remote venting is available.

- a. Supply pressure regulator
- b. Supply and output gauges
- c. HART filter
- d. Stainless steel housing (valve-mounted instruments only)
- e. Remote mounting

Ordering Information

When ordering, specify:

- 1. Actuator type and size
- 2. Maximum actuator travel or rotation
- 3. Options

Note

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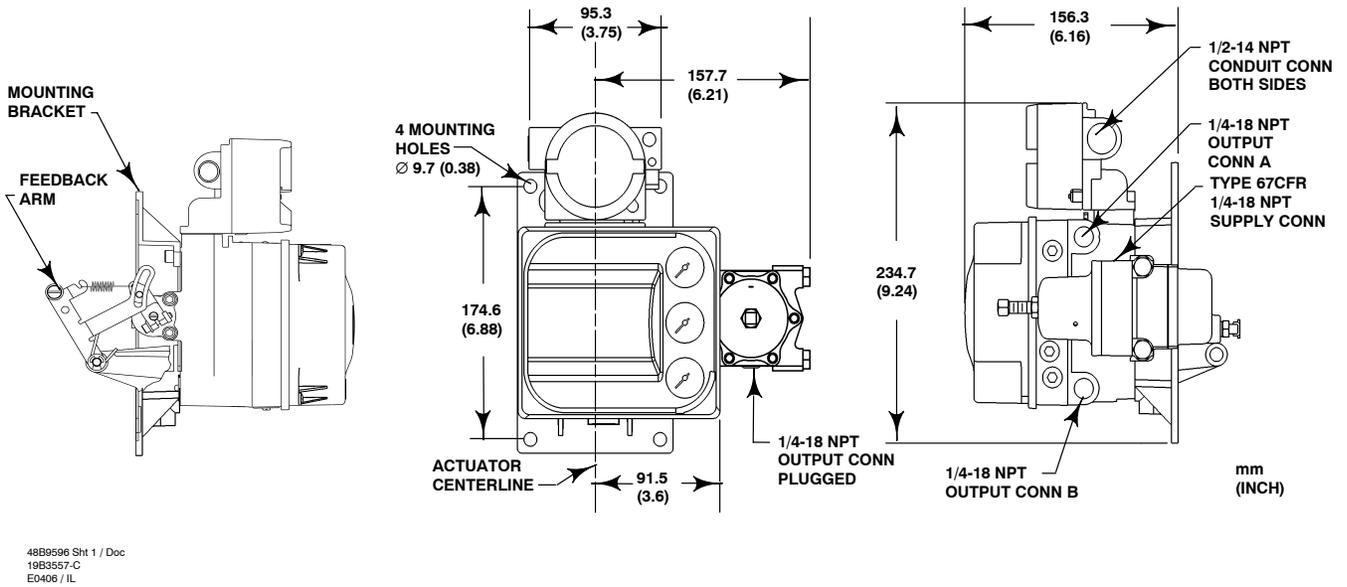


Figure 13. Dimensions for Type DVC6020 Digital Valve Controller with Integrally Mounted Filter Regulator

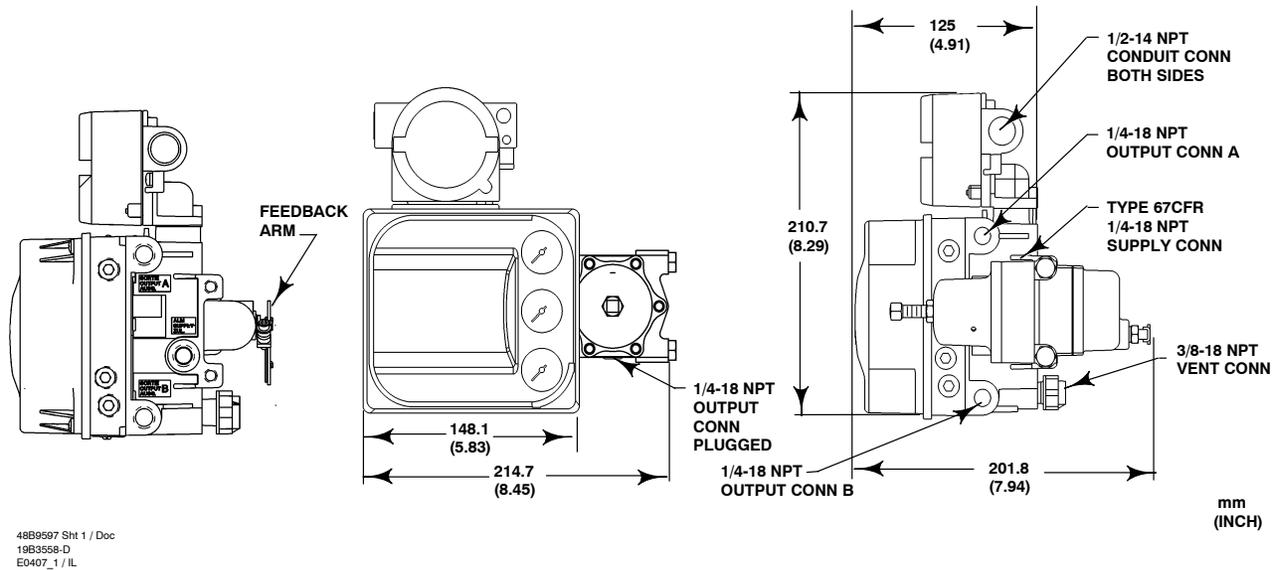
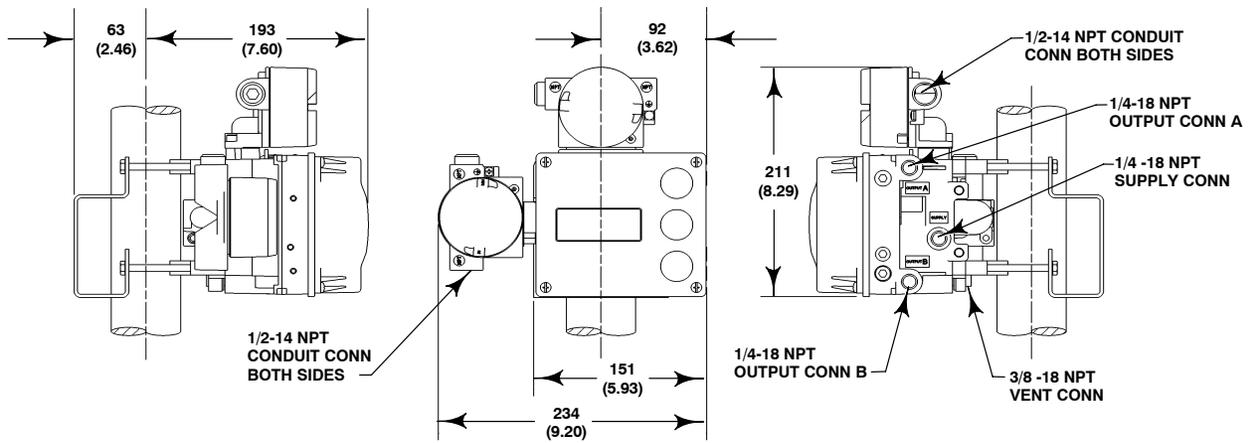


Figure 14. Dimensions for Type DVC6030 Digital Valve Controller with Integrally Mounted Filter Regulator

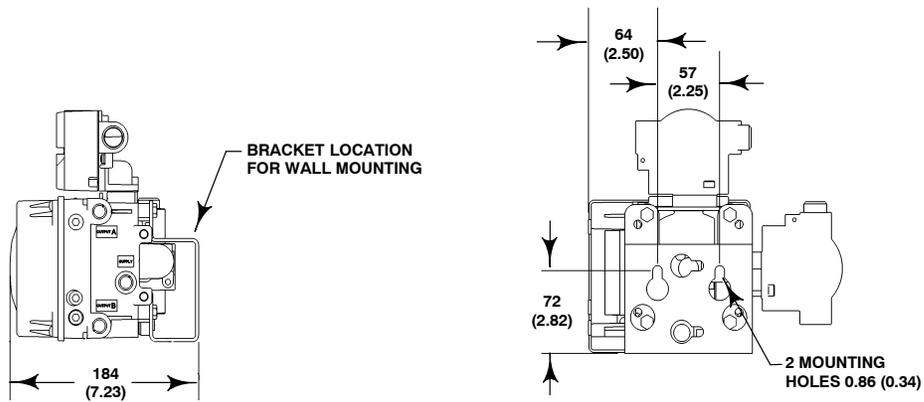
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PIPESTAND MOUNTED

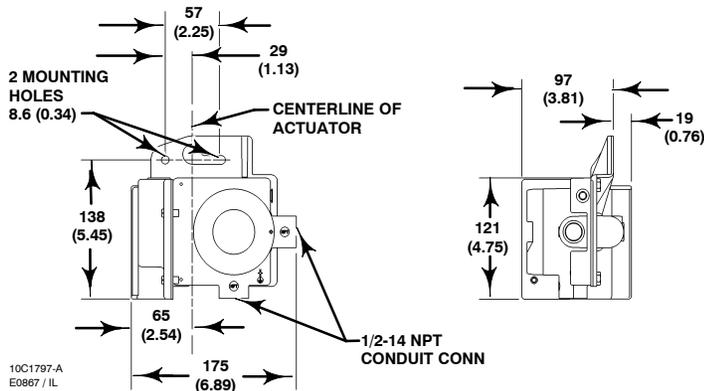


WALL MOUNTED

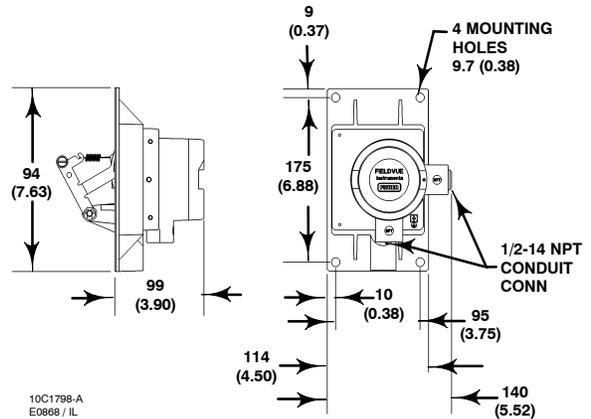
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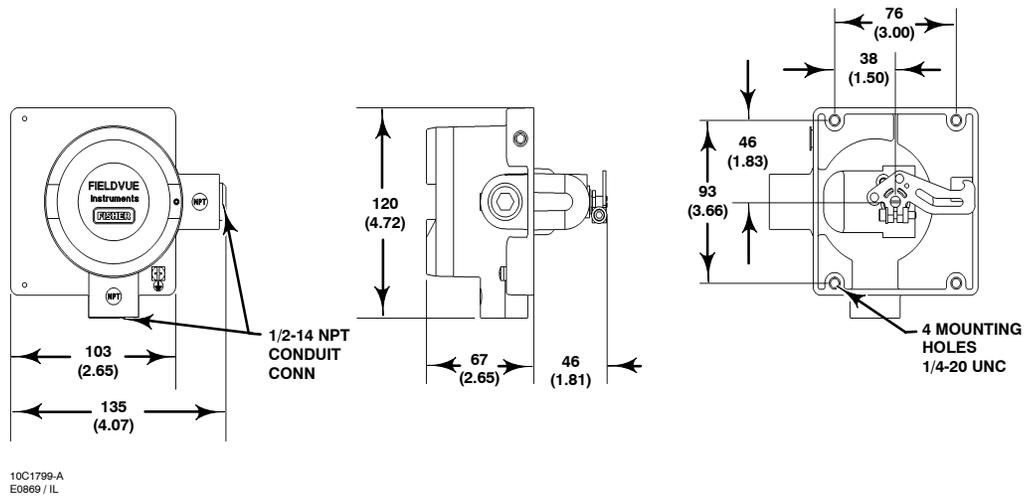
Figure 15. Dimensions for Remote-Mounted Instruments—Type DVC6005 Base Unit



**TYPE DVC6015 SLIDING STEM ACTUATOR MOUNTING
UP TO 102 mm (4-INCH) TRAVEL**



**TYPE DVC6025 ROTARY AND LONG-STROKE SLIDING STEM
ACTUATOR MOUNTING**



TYPE DVC6035 ROTARY ACTUATOR SHAFT MOUNTING

mm
(INCH)

Figure 16. Dimensions for Remote-Mounted Instruments—Feedback Units

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Table 2. Immunity Performance

PORT	PHENOMENON	BASIC STANDARD	PERFORMANCE CRITERIA ⁽¹⁾	
			Point-to-Point Mode	Multi-drop Mode
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	A ⁽²⁾	A
	Radiated EM field	IEC 61000-4-3	A	A
	Rated power frequency magnetic field	IEC 61000-4-8	A	A
I/O signal/control	Burst	IEC 61000-4-4	A ⁽²⁾	A
	Surge	IEC 61000-4-5	A ⁽²⁾	A
	Conducted RF	IEC 61000-4-6	A	A

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

Table 3. Type DVC6000 Series, Hazardous Area Classifications for Canada—CSA

CERTIFICATION BODY	TYPE	CERTIFICATION OBTAINED	ENTITY RATING		TEMPERATURE CODE	ENCLOSURE RATING	
CSA	DVC60x0 DVC60x0S (x = 1,2,3)	(Intrinsic Safety) Class/Division Class I,II,III Division 1 GP A,B,C,D, E,F,G per drawing 29B3428	$V_{max} = 30$ VDC $I_{max} = 226$ mA $C_i = 5$ nF $L_i = 0.55$ mH		T5($T_{amb} \leq 80^\circ\text{C}$)	4X	
		(Explosion Proof) Class/Division Class I, Division 1 GP B,C,D		---	T6($T_{amb} \leq 80^\circ\text{C}$)	4X	
		Class I Division 2 GP A,B,C,D Class II Division 1 GP E,F,G Class III Division 1		---	T6($T_{amb} \leq 80^\circ\text{C}$)	4X	
	DVC6005	(Intrinsic Safety) Class/Division Class I,II,III Division 1 GP A,B,C,D,E, F,G per drawing 29B3520	$V_{max} = 30$ VDC $I_{max} = 226$ mA $C_i = 5$ nF $L_i = 0.55$ mH	$V_{oc} = 9.6$ VDC $I_{sc} = 3.5$ mA $C_a = 3.6$ μ F $L_a = 100$ mH		T6($T_{amb} \leq 60^\circ\text{C}$)	4X
		(Explosion Proof) Class/Division Class I, Division 1 GP C,D		---	T6($T_{amb} \leq 60^\circ\text{C}$)	4X	
		Class I Division 2 GP A,B,C,D Class II Division 1 GP E,F,G Class III Division 1		---	T6($T_{amb} \leq 60^\circ\text{C}$)	4X	
	DVC60x5 (x = 1,2,3)	(Intrinsic Safety) Class/Division Class I,II,III Division 1 GP A,B,C,D, E,F,G per drawing 29B3520	$V_{max} = 10$ VDC $I_{max} = 4$ mA $C_i = 0$ nF $L_i = 0$ mH			T4($T_{amb} \leq 125^\circ\text{C}$) T5($T_{amb} \leq 95^\circ\text{C}$) T6($T_{amb} \leq 80^\circ\text{C}$)	4X
		(Explosion Proof) Class/Division Class I, Division 1 GP B,C,D		---	T4($T_{amb} \leq 125^\circ\text{C}$) T5($T_{amb} \leq 95^\circ\text{C}$) T6($T_{amb} \leq 80^\circ\text{C}$)	4X	
		Class I Division 2 GP A,B,C,D Class II Division 1 GP E,F,G Class III Division 1		---	T4($T_{amb} \leq 125^\circ\text{C}$) T5($T_{amb} \leq 95^\circ\text{C}$) T6($T_{amb} \leq 80^\circ\text{C}$)	4X	

Table 4. Type DVC6000 Series, Hazardous Area Classifications for United States—FM

CERTIFICATION BODY	TYPE	CERTIFICATION OBTAINED	ENTITY RATING		TEMPERATURE CODE	ENCLOSURE RATING	
FM	DVC60x0 DVC60x0S (x = 1,2,3)	(Intrinsic Safety) Class/Division Class I,II,III Division 1 GP A,B,C,D,E, F,G per drawing 29B3427	$V_{max} = 30$ VDC $I_{max} = 226$ mA $C_i = 5$ nF $L_i = 0.55$ mH $P_i = 1.4$ W		T5($T_{amb} \leq 80^\circ\text{C}$)	4X	
		(Explosion Proof) Class/Division Class I, Division 1 GP B,C,D		---	T6($T_{amb} \leq 80^\circ\text{C}$)	4X	
		Class I Division 2 GP A,B,C,D Class II,III Division 1 GP E,F,G Class II,III Division 2 GP F,G		---	T6($T_{amb} \leq 80^\circ\text{C}$)	4X	
	DVC6005	(Intrinsic Safety) Class/Division Class I,II,III Division 1 GP A,B,C,D, E,F,G per drawing 29B3521	$V_{max} = 30$ VDC $I_{max} = 226$ mA $C_i = 5$ nF $L_i = 0.55$ mH $P_i = 1.4$ W	$V_{oc} = 9.6$ VDC $I_{sc} = 3.5$ mA $C_a = 3.6$ μ F $L_a = 100$ mH $P_o = 8.4$ mW		T6($T_{amb} \leq 60^\circ\text{C}$)	4X
		(Explosion Proof) Class/Division Class I, Division 1 GP C,D		---		T6($T_{amb} \leq 60^\circ\text{C}$)	4X
		Class I Division 2 GP A,B,C,D Class II,III Division 1 GP E,F,G Class II,III Division 2 GP F,G		---		T6($T_{amb} \leq 60^\circ\text{C}$)	4X
	DVC60x5 (x = 1,2,3)	(Intrinsic Safety) Class/Division Class I,II,III Division 1 GP A,B,C,D, E,F,G per drawing 29B3521	$V_{max} = 10$ VDC $I_{max} = 4$ mA $C_i = 0$ nF $L_i = 0$ mH $P_i = 10$ mW			T4($T_{amb} \leq 125^\circ\text{C}$) T5($T_{amb} \leq 95^\circ\text{C}$) T6($T_{amb} \leq 80^\circ\text{C}$)	4X
		(Explosion Proof) Class/Division Class I, Division 1 GP A,B,C,D		---		T4($T_{amb} \leq 125^\circ\text{C}$) T5($T_{amb} \leq 95^\circ\text{C}$) T6($T_{amb} \leq 80^\circ\text{C}$)	4X
		Class I Division 2 GP A,B,C,D Class II,III Division 1 GP E,F,G Class II,III Division 2 GP F,G		---		T4($T_{amb} \leq 125^\circ\text{C}$) T5($T_{amb} \leq 95^\circ\text{C}$) T6($T_{amb} \leq 80^\circ\text{C}$)	4X

Table 5. Type DVC6000 Series, Hazardous Area Classifications—ATEX

CERTIFICATE	TYPE	CERTIFICATION OBTAINED	ENTITY RATING		TEMPERATURE CODE	ENCLOSURE RATING	
ATEX	DVC60x0 DVC60x0S (x = 1,2,3)	Ⓔ II 1 G D Gas EEx ia IIC T5/T6—Intrinsic Safety Dust T85°C (T _{amb} ≤ 80°C)	U _i = 30 VDC I _i = 226 mA C _i = 5 nF L _i = 0.55 mH P _i = 1.4 W		T5(T _{amb} ≤ 80°C) T6 (T _{amb} ≤ 75°C)	IP66	
		Ⓔ II 2 G D Gas EEx d IIB+H2 T5/T6—Flameproof Dust T90°C (T _{amb} ≤ 85°C)		---	T5(T _{amb} ≤ 85°C) T6 (T _{amb} ≤ 75°C)	IP66	
		Ⓔ II 3 G D Gas EEx nCL IIC T5/T6—Type n Dust T85°C (T _{amb} ≤ 80°C)		---	T5(T _{amb} ≤ 80°C) T6 (T _{amb} ≤ 75°C)	IP66	
	DVC6005	Ⓔ II 1 G D Gas EEx ia IIC T5/T6—Intrinsic Safety Dust T85°C (T _{amb} ≤ 80°C)	U _i = 30 VDC I _i = 226 mA C _i = 5 nF L _i = 0.55 mH P _i = 1.4 mW	U _o = 9.6 VDC I _o = 3.5 mA C _o = 3.6 uF L _o = 100 mH P _o = 8.4 mW		T5(T _{amb} ≤ 80°C) T6(T _{amb} ≤ 75°C)	IP66
		Ⓔ II 2 G D Gas EEx d IIB T5/T6—Flameproof Dust T90°C (T _{amb} ≤ 80°C)		---	T5(T _{amb} ≤ 80°C) T6 (T _{amb} ≤ 70°C)	IP66	
		Ⓔ II 3 G D Gas EEx nL IIC T5/T6—Type n Dust T85°C (T _{amb} ≤ 80°C)		---	T5(T _{amb} ≤ 80°C) T6 (T _{amb} ≤ 75°C)	IP66	
	DVC60x5 (x = 1,2,3)	Ⓔ II 1 G D Gas EEx ia IIC T4/T5/T6—Intrinsic Safety Dust T130°C (T _{amb} ≤ 125°C)	U _i = 10 VDC I _i = 4 mA C _i = 0 nF L _i = 0 mH P _i = 10 mW			T4(T _{amb} ≤ 125°C) T5(T _{amb} ≤ 95°C) T6(T _{amb} ≤ 80°C)	IP66
		Ⓔ II 2 G D Gas EEx d IIC T4/T5/T6—Flameproof Dust T130°C (T _{amb} ≤ 125°C)		---		T4(T _{amb} ≤ 125°C) T5(T _{amb} ≤ 95°C) T6(T _{amb} ≤ 80°C)	IP66
		Ⓔ II 3 G D Gas EEx nA IIC T4/T5/T6—Type n Dust T130°C (T _{amb} ≤ 125°C)		---		T4(T _{amb} ≤ 125°C) T5(T _{amb} ≤ 95°C) T6(T _{amb} ≤ 80°C)	IP66

Table 6. Type DVC6000 Series, Hazardous Area Classifications—IECEX

CERTIFICATE	TYPE	CERTIFICATION OBTAINED	ENTITY RATING		TEMPERATURE CODE	ENCLOSURE RATING	
IECEX	DVC60x0 DVC60x0S (x = 1,2,3)	Gas Ex ia IIC T5/T6—Intrinsic Safety	U _i = 30 VDC I _i = 226 mA C _i = 5 nF L _i = 0.55 mH P _i = 1.4 W		T5(T _{amb} ≤ 80°C) T6 (T _{amb} ≤ 75°C)	IP66	
		Gas Ex d IIB+H2 T5/T6—Flameproof	---		T5(T _{amb} ≤ 80°C) T6 (T _{amb} ≤ 75°C)	IP66	
		Gas Ex nC IIC T5/T6—Type n	---		T5(T _{amb} ≤ 80°C) T6 (T _{amb} ≤ 75°C)	IP66	
	DVC6005	Gas Ex ia IIC T5/T6—Intrinsic Safety	U _i = 30 VDC I _i = 226 mA C _i = 5 nF L _i = 0.55 mH P _i = 1.4 W	U _o = 9.6 VDC I _o = 3.5 mA C _o = 3.6 μF L _o = 100 mH P _o = 8.4 mW	T5(T _{amb} ≤ 80°C) T6 (T _{amb} ≤ 75°C)	IP66	
		Gas Ex d IIB T5/T6—Flameproof	---		T5(T _{amb} ≤ 80°C) T6 (T _{amb} ≤ 75°C)	IP66	
		Gas Ex nC IIC T5/T6—Type n	---		T5(T _{amb} ≤ 80°C) T6 (T _{amb} ≤ 75°C)	IP66	
	DVC60x5 (x = 1,2,3)	Gas Ex ia IIC T4/T5/T6—Intrinsic Safety	U _i = 10 VDC I _i = 4 mA C _i = 0 nF L _i = 0 mH P _i = 10 mW			T4(T _{amb} ≤ 125°C) T5(T _{amb} ≤ 95°C) T6(T _{amb} ≤ 80°C)	IP66
		Gas Ex d IIC T4/T5/T6—Flameproof	---		T4(T _{amb} ≤ 125°C) T5(T _{amb} ≤ 95°C) T6(T _{amb} ≤ 80°C)	IP66	
		Gas Ex nA IIC T4/T5/T6—Type n	---		T4(T _{amb} ≤ 125°C) T5(T _{amb} ≤ 95°C) T6(T _{amb} ≤ 80°C)	IP66	

Table 7. Hazardous Area Classifications—NEPSI

CERTIFICATE	TYPE	CERTIFICATION OBTAINED	ENTITY RATING		TEMPERATURE CODE	ENCLOSURE RATING
NEPSI	DVC60x0 (x = 1,2,3)	Gas Ex ia IIC T5/T6 —Intrinsic Safety Dust DIP A21 T5	U _i = 30 V I _i = 226 mA C _i = 5 nF L _i = 0.55 mH P _i = 1.4 W		T5(T _{amb} ≤ 80°C) T6 (T _{amb} ≤ 75°C)	IP66
		Gas Ex d IIC T5/T6 ⁽¹⁾ —Flameproof Dust DIP A21 T5	---		T5(T _{amb} ≤ 80°C) T6 (T _{amb} ≤ 75°C)	IP66

1. Except acetylene.



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