Fisher® FIELDVUE™ DVC2000 Digital Valve Controller

The FIELDVUE DVC2000 digital valve controller is simple to use, compact, and designed for easy mounting. It converts a 4-20 mA input signal into a pneumatic output signal, which feeds the control valve actuator. Instrument setup is performed with a push button and liquid crystal display (LCD) interface. This interface is protected from the environment within a sealed enclosure. The interface supports multiple languages, available in two language pack options.

The DVC2000 uses a two-stage positioner design. The pre-amplifier stage provides high static gain for responsiveness to small changes in the input signal. The power amplifier stage delivers the right volume of air to the actuator, combining superior dynamic performance with minimal steady-state air consumption.

The high performance, linkage-less feedback system eliminates physical contact between the valve stem and the positioner. There is no wear of parts so cycle life is maximized. Additionally, the elimination of levers and linkages reduces the number of mounting parts and the mounting complexity. Positioner replacement and maintenance is simplified because the feedback parts stay connected to the actuator stem.

Designed to meet intrinsically safe and non-incendive requirements, this instrument delivers scalable functionality and high performance in a small package.

W8755

Specifications

Available Mountings

- Integral mounting to the Fisher GX Control Valve and Actuator System
- Sliding-stem applications
- Quarter-turn rotary applications

DVC2000 digital valve controllers 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; can be configured for split range
Minimum Voltage: Voltage available at instrument terminals must be 8.5 volts for analog control, 9.0 volts for HART® communication
Maximum Voltage: 30 VDC
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, nonflammable 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 m^3/h (2.3 scfh)
At 4 bar (58 psig)(4): 0.12 normal m^3/h (4.4 scfh)

Air Capacity(2)

Supply pressure
At 1.5 bar (22 psig)(3): 4.48 normal m^3/h (167 scfh)
At 4 bar (58 psig)(4): 9.06 normal m^3/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 1 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 tables 2, 3, 4, and 5 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: 6.35 mm (0.25 inch)
Maximum: 606 mm (23-7/8 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)

Dimensions

Refer to figure 3

Options

■ **Airset:** Fisher 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 5 volts)
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)

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 m^3/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.

Features

■ **Simplicity**—The DVC2000 is easy to use. If you are mounting the instrument for the first time, the linkage-less feedback system is easy to install. Once a magnet array is assembled to the valve stem, positioner replacement is simple since there are no physically connected parts.

At its very basic functionality, the DVC2000 digital valve controller has a local user interface that will allow you to configure, calibrate, and tune the instrument. If the I/O Options Package is installed, you can calibrate the 4-20 mA transmitter and configure the limit switch action. Running the Quick Setup routine calibrates and tunes the instrument specifically for that actuator.

The full text display in the local interface is easy to navigate, in part due to the selection of languages. Each unit can be configured to display English, German, French, Italian, Spanish, Japanese or Chinese. The standard language pack also includes Portuguese, Russian, Polish, and Czech. An optional language pack replaces these four languages with Arabic.

- Reliability—The DVC2000 is based on the field-proven FIELDVUE technology. Years of control experience has brought this product line to a high level of reliability and dependability.

- Performance—The two-stage positioner design provides a mechanical platform that enables responsiveness to small input changes and tighter process control. The digital tuning algorithm allows optimal response to get the valve to its desired position quickly.

- Diagnostics—*Local User Interface:* DVC2000 instruments come standard with a liquid crystal display. Predefined instrument and valve diagnostics are built into the firmware to alert you if there are any problems with the mounting, electronics, hardware, or valve performance.

  Handheld Field Communicator: DVC2000 instruments are packed with user-configurable alerts and alarms. These flags provide notification of current status and potential valve and instrument problems through alerts such as travel deviation, travel limit, cycle count, and travel accumulation.

  ValveLink™ software: Tests can be performed to identify problems with the entire control valve assembly using ValveLink software. Using valve stem travel feedback, actuator pressure sensor, and other sensors on the instrument, the health of the control valve can be evaluated while the valve is still in service and fully operational. This helps to pinpoint problems without disrupting the process - before the equipment fails.

- I/O Options Package— The DVC2000 is available with an I/O Options Package which includes two (2) integral limit switches and a stem position transmitter. The limit switches are configurable for open and closed valve indication at any point throughout the calibrated travel range. The position transmitter provides a 4-20 mA signal for valve position feedback verification. As an integral component to the instrument, this option module avoids the need for difficult-to-mount external switches and transmitters.

Integration

Traditional 4-20 mA Systems

Because the DVC2000 instrument operates with a 4-20 mA control signal, it directly replaces older analog instruments. Microprocessor based electronics provide improved control performance along with repeatable and reliable configuration and calibration.

Modbus with ValveLink Software and HART Multiplexers

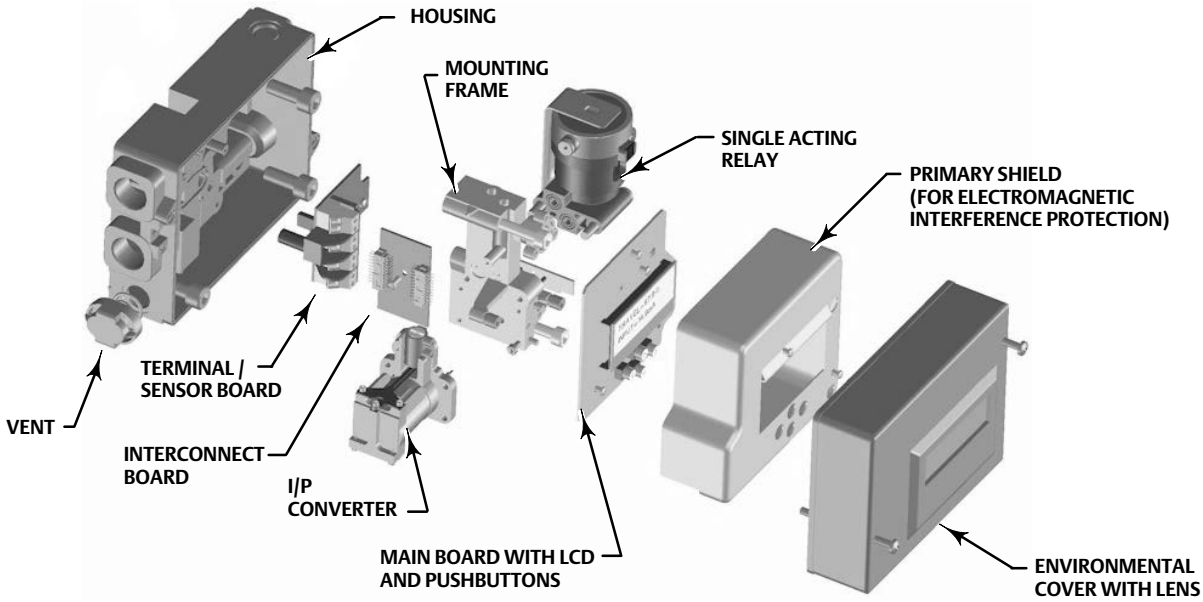
HART communication allows you to extract more value from the DVC2000 instrument beyond its inherent improved performance. When integrated into a multiplexer network and using ValveLink software, the device and valve information is real-time. From the safety of a control room, multiple instruments can be monitored for alerts and alarms.

Additionally, tasks such as configuration, calibration, and diagnostic testing do not require special trips to the field. ValveLink software can communicate via Modbus to the distributed control system (DCS) to provide critical information such as valve travel alerts and alarms.

Integrated Control System

A control system with HART communication capabilities has the ability to directly gather information from DVC2000 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.

Figure 1. FIELDVUE DVC2000 Digital Valve Controller Assembly (Exploded View)



Principle of Operation

The DVC2000 (figures 1 and 2) receives a 4-20 mA set point and position the valve by increasing or decreasing the air output to an actuator.

- The **input signal** provides electrical power and the set point simultaneously. The 4-20 mA signal is routed into the **terminals** through a twisted pair of wires.

- The unit's **mainboard** contains a microprocessor that continuously runs a digital control algorithm. This algorithm produces a “drive signal” to the I/P converter.

- The **I/P converter** assembly (or pre-amplifier) is connected to supply pressure and converts the electronic “drive signal” into a pneumatic “pressure signal.” This pressure signal is the input to the pneumatic relay assembly.

- The **relay** (or power amplifier) is also connected to supply pressure and amplifies the small pressure signal from the I/P converter into a larger pressure output signal used by the actuator. The change in relay output pressure to the actuator causes the valve to move.

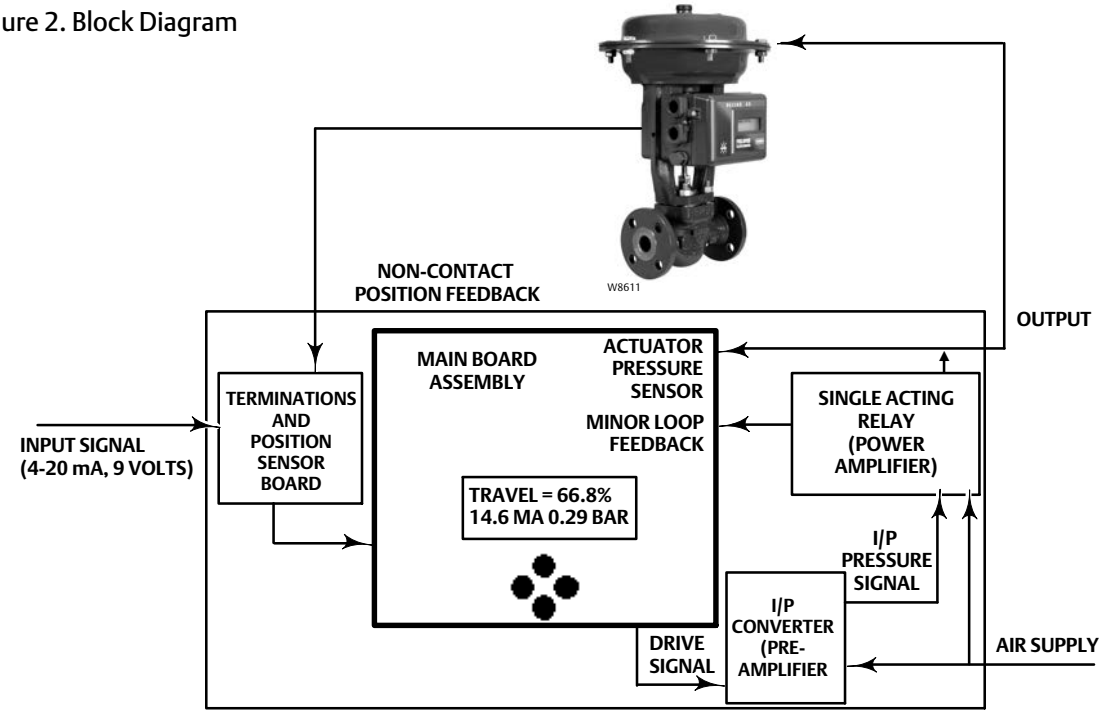
  There are two relay options. The low pressure relay operates with actuators that require less than 3.5 bar (50 psi) of supply air. The high pressure relay operates with actuators that require 3.5 to 7.0 bar (50 to 100 psi) of supply air.

- Valve position is sensed through the linkage-less feedback system. 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 DVC2000 is designed for mounting on any single acting pneumatic actuator up to 606 mm (23-7/8 inches) of travel. The envelope and travel feedback system conforms to VDI/VDE 3845, IEC 60534-6-1, and IEC 60534-6-2 standards.

Figure 2. Block Diagram



Furthermore, the DVC2000 instrument can be integrally mounted to the GX actuator, avoiding the need for complicated mounting brackets. The positioner mounts directly to an interface pad on the actuator yoke leg with a secure 3-point mounting. Internal passages inside the actuator yoke legs route the pneumatic output of the digital valve controller to the actuator casing, eliminating the need for external tubing (only for the air-to-open configuration).

Electrical connections are made on the termination strip, which uses cage clamp style wiring connectors. The electrical wiring entry point is available with either M20 or 1/2 NPT internal connections. Pressure connections are available with either G1/4 or 1/4 NPT internal connections.

Ordering Information

Refer to the Specifications section. Carefully review each specification and indicate your choice whenever a selection is to be made.

When ordering, specify:

1. Actuator type and size
2. Maximum actuator travel or rotation
3. Minimum actuator operating pressure
4. Hazardous area certification requirements
5. Options
   a. ■ G1/4 pneumatic and M20 conduit connections or ■ 1/4 NPT pneumatic and 1/2 NPT conduit connections
   b. Language pack: ■ Standard—English, German, French, Italian, Spanish, Japanese, Chinese, Portuguese, Russian, Polish, and Czech or ■ Optional—English, German, French, Italian, Spanish, Japanese, Chinese, and Arabic
   c. Supply pressure regulator
   d. Valve diagnostic level (online performance testing, offline advanced testing, basic alerts/alarms)
   e. I/O Options Package (includes position transmitter and two (2) limit switches)
   f. Pipe-away vent connector
   g. HART filter

Figure 3. Dimensions for FIELDVUE DVC2000 Digital Valve Controller

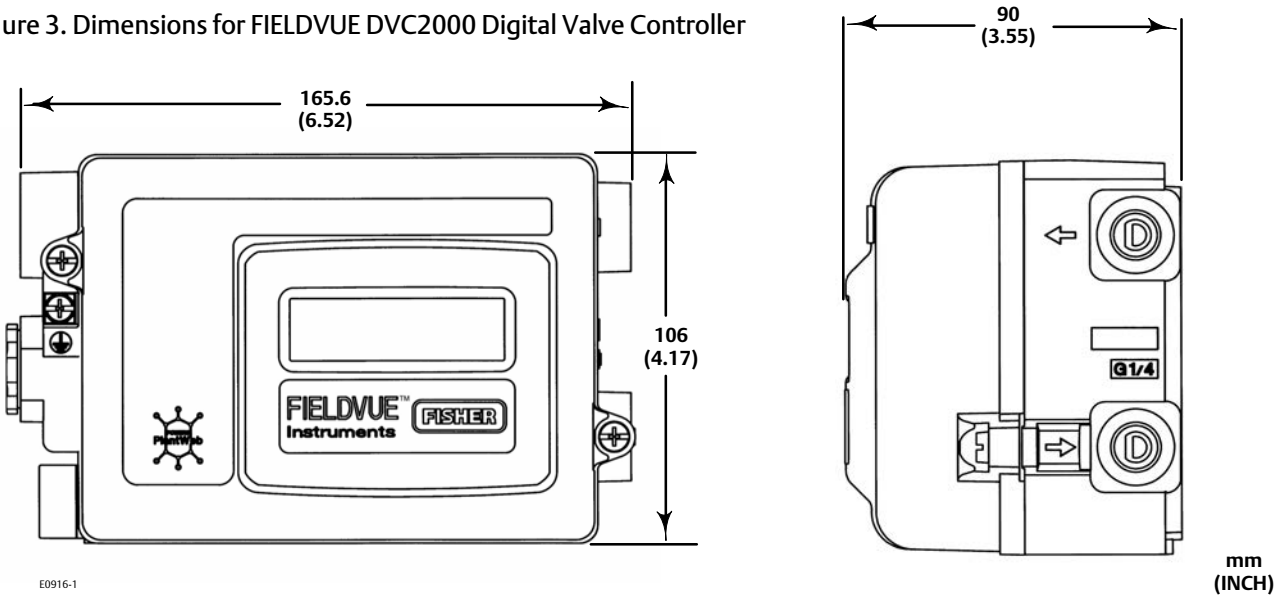


Table 1. EMC Summary Results—Immunity

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.

Table 2. Hazardous Area Classifications—CSA (Canada)

Certification Body	Certification Obtained	Entity Ratings	Temperature Code	Enclosure Rating
CSA	Intrinsically Safe Ex ia IIC T4/T5 per drawing GE12444 Class I Division 1 GP A,B,C,D per drawing GE12444	(Main Circuit) Vmax = 30 VDC Imax = 130 mA Pi = 1.0 W Ci = 10.5 nF Li = 0.55 mH	T4(Tamb ≤ 80C) T5(Tamb ≤ 40C)	IP66
	Non-incendive Class I Division 2 GP A,B,C,D T5	---	T5(Tamb ≤ 80C)	IP66

Table 3. Hazardous Area Classifications—FM (United States)

Certification Body	Certification Obtained	Entity Ratings	Temperature Code	Enclosure Rating
FM	IS Intrinsically Safe Class I Division 1 GP A,B,C,D T4/T5 per drawing GE10683 Class I Zone 0 AEx ia IIC per drawing GE10683	(Main Circuit) Vmax = 30 VDC Imax = 130 mA Pi = 1.0 W Ci = 10.5 nF Li = 0.55 mH	T4(Tamb ≤ 80C) T5(Tamb ≤ 40C)	IP66
	NI Non-incendive Class I Division 2 GP A,B,C,D T5	---	T5(Tamb ≤ 80C)	IP66

Table 4. Hazardous Area Classifications—ATEX

Certification	Certification Obtained	Entity Ratings	Temperature Code	Enclosure Rating
ATEX	Intrinsically Safe ⟨Ex⟩ II 1 G Gas Ex ia IIC T4/T5 Ga per drawing GE14685	(Main Circuit) Vmax = 30 VDC Imax = 130 mA Pi = 1.0 W Ci = 10.5 nF Li = 0.55 mH	T4(Tamb ≤ 80C) T5(Tamb ≤ 40C)	IP66

Table 5. Hazardous Area Classifications—IECEx

Certification	Certification Obtained	Entity Ratings	Temperature Code	Enclosure Rating
IECEx	Intrinsically Safe Gas Ex ia IIC T4/T5 per drawing GE14581	(Main Circuit) Vmax = 30 VDC Imax = 130 mA Pi = 1.0 W Ci = 10.5 nF Li = 0.55 mH	T4(Tamb ≤ 80C) T5(Tamb ≤ 40C)	IP66

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