# FIELDVUE® DVC6000 Series Digital Valve Controllers

FIELDVUE® DVC6000 Series digital valve controllers are communicating, microprocessor-based current-to-pneumatic instruments. In addition to the traditional function of converting a current signal to a 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 275 HART 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, so that 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.

## 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.


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

- **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 HART 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.

*(continued on page 3)*

FISHER®

FISHER-ROSEMOUNT™

D102758X012

## Specifications

### Available Configurations

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

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

### Input Signal(1)

**Point-to-Point:**
*Analog Input Signal:* 4–20 mA dc, nominal; split ranging available
Minimum Voltage Available at Instrument Terminals must be 10.5 volts dc for analog control, 11 volts dc 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 volts dc
*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 volts dc at approximately 8 mA
*Reverse Polarity Protection:* No damage occurs from reversal of loop current

### Output Signal(1)

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

**Minimum Recommended:** 0.3 bar (5 psig) higher than maximum actuator requirements
**Maximum:** 10.3 bar (150 psig) or maximum pressure rating of the actuator, whichever is lower

### Steady-State Air Consumption(1)(2)(3)

*At 1.4 bar (20 psig) supply pressure:* Less than 0.4 normal $m^3$/hr (14 scfh)
*At 5.5 bar (80 psig) supply pressure:* Less than 1.3 normal $m^3$/hr (47 scfh)

### Maximum Output Capacity(2)(3)

*At 1.4 bar (20 psig) supply pressure:* 10.7 normal $m^3$/hr (400 scfh)
*At 5.5 bar (80 psig) supply pressure:* 33.2 normal $m^3$/hr (1240 scfh)

### Independent Linearity(1)(4)

±0.5% of output span

### Electromagnetic Interference (EMI)

These instruments have the CE mark in accordance with the Electromagnetic Compatibility (EMC Directive. They meet the requirements of EN61326-1 (emissions for light industry, immunity for industrial environment).

### Electrical Classification

**Hazardous Area:** Approvals are pending from certifying agencies. Refer to Hazardous Area bulletins.
**Electrical Housing:** Designed to meet NEMA 4X, IEC 60529 IP65 (approvals pending)

### Connections

**Supply Pressure:** 1/4-inch NPT female and integral pad for mounting 67CFR regulator
**Output Pressure:** 1/4-inch NPT female
**Tubing:** 3/8-inch metal, recommended
**Vent (pipe-away):** 1/4-inch NPT female
**Electrical:** 1/2-inch NPT female conduit connection, M20 adaptor optional

### Operating Ambient Temperature Limits

–40 to 85°C (–40 to 185°F)

### Construction Materials

**Housing, module base and terminal box:** ANSI B360.0 low copper aluminum alloy
**Cover:** Valox
**Elastomers:** ■ Nitrile (standard), or ■ Fluorelastomer (optional)

### Stem Travel

**DVC6010:** 0 to 102 mm (4 inches) maximum
0 to 9.5 mm (3/8 inches) minimum
**DVC6020:** 0 to 606 mm (23-7/8 inches) maximum

### Shaft Rotation (DVC6020 and DVC6030)

0 to 50 degrees minimum
0 to 90 degrees maximum

(continued)

## Specifications (continued)

**Mounting**

Designed for direct actuator mounting. For weatherproof housing capability, the instrument must be mounted upright to allow the vent to drain.

**Weight**

3.5 kg (7.7 lbs)

**Options**

■ Supply and output pressure gauges or ■ tire valves, ■ integral mounted filter regulator, ■ Fluoroelastomer O-rings

1. These terms are defined in ISA Standard S51.1.
2. Normal $m^3$/hr—Normal cubic meters per hour at 0°C and 1.01325 bar, absolute; Scfh—Standard cubic feet per hour at 60°F and 14.7 psia.
3. Values at 1.4 bar (20 psig) based on a single-acting direct relay; values at 5.5 bar (80 psig) based on double-acting relay.
4. Not applicable for Type DVC6020 digital valve controllers in long-stroke applications.


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

- **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.

- **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 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 single master module 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.

## Diagnostics

- **Valve Assembly 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. Utilizing the valve stem travel feedback and actuator and supply pressure sensors, the health of the control valve can be evaluated. When compared with a benchmark Valve Signature, a later signature will reveal areas of valve degradation. This helps you pinpoint problems before the equipment fails.

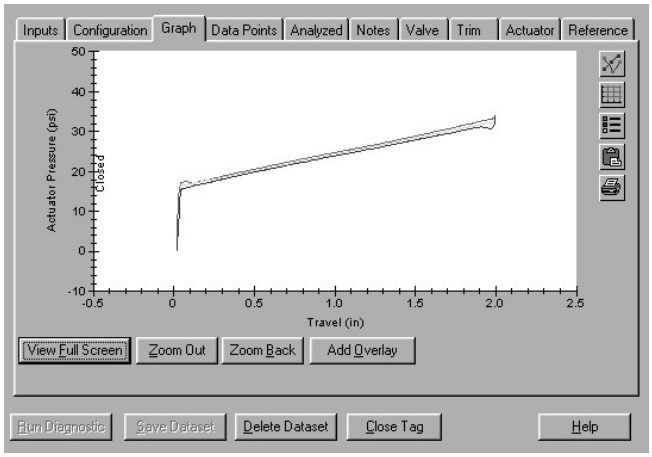


***Figure 3.*** *The Valve Signature Diagnostic Test Can Reveal Areas of Degradation*

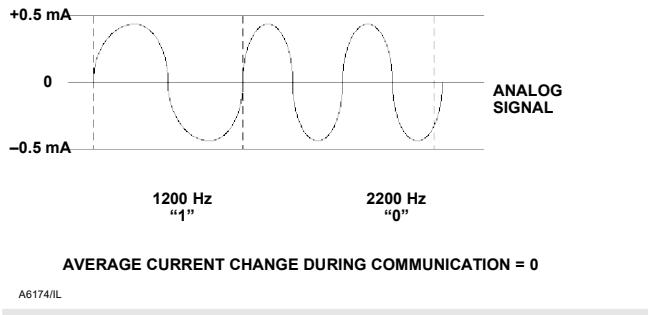


***Figure 4****. HART® Frequency Shift Keying Technique*

- **Emerson Performance Solutions**—Emerson Performance Solutions (EPS) can use instruments with on-line diagnostics capability to evaluate the valve and the process while the loop is running. Using Performance Diagnostics, EPS will be able to identify and isolate the process element that is currently causing quality problems. Additionally, with the diagnostic tools available, you can perform a predictive failure analysis on DVC6000 Series equipped valves so that problems can be identified before they affect the process.

## 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.

- **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. 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 275 HART Communicator

You can perform configuration and calibration at the valve or anywhere on the two-wire loop via a Model 275 HART Communicator. 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.

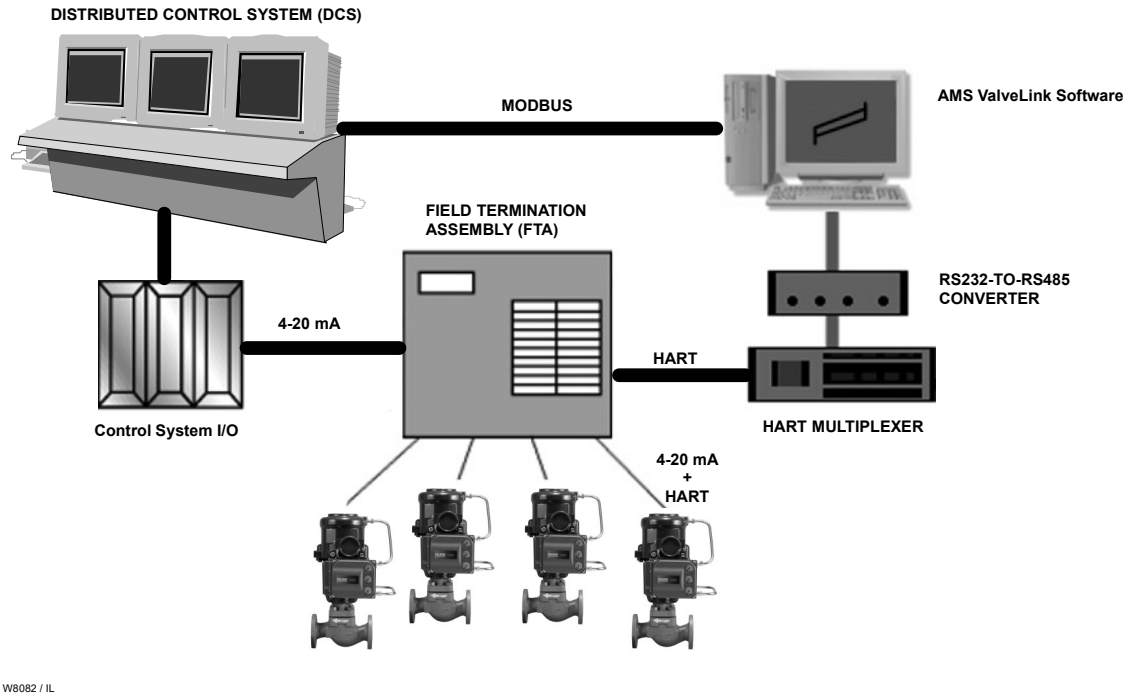


***Figure 5.*** *Integrate Information from the Digital Valve Controller into a Non-HART Compatible Control System With AMS ValveLink Software's Modbus Interface*


***Figure 6.*** *Perform Configuration and Calibration at the Valve or Anywhere on the 4 to 20 mA Loop with the Model 275 HART Communicator*

### 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. Valve Signature, Dynamic Error Band, and Step Response are displayed in an intuitive user-friendly environment that allows easy interpretation of data. 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.

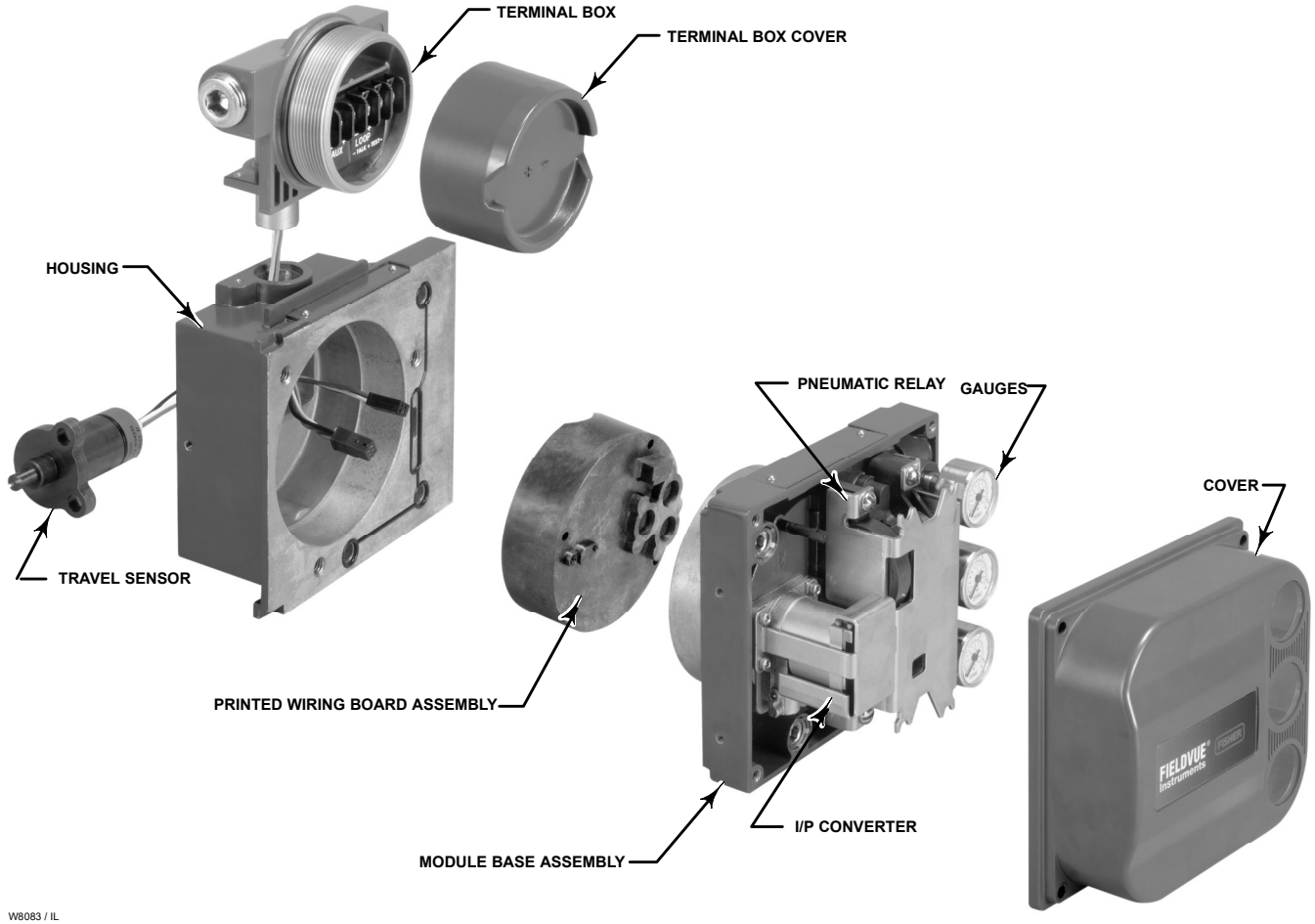


***Figure 7**. DVC6000 Series Digital Valve Controller Assembly*

## Principle of Operation

DVC6000 Series instruments 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.

- 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 (or potentiometer) 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.

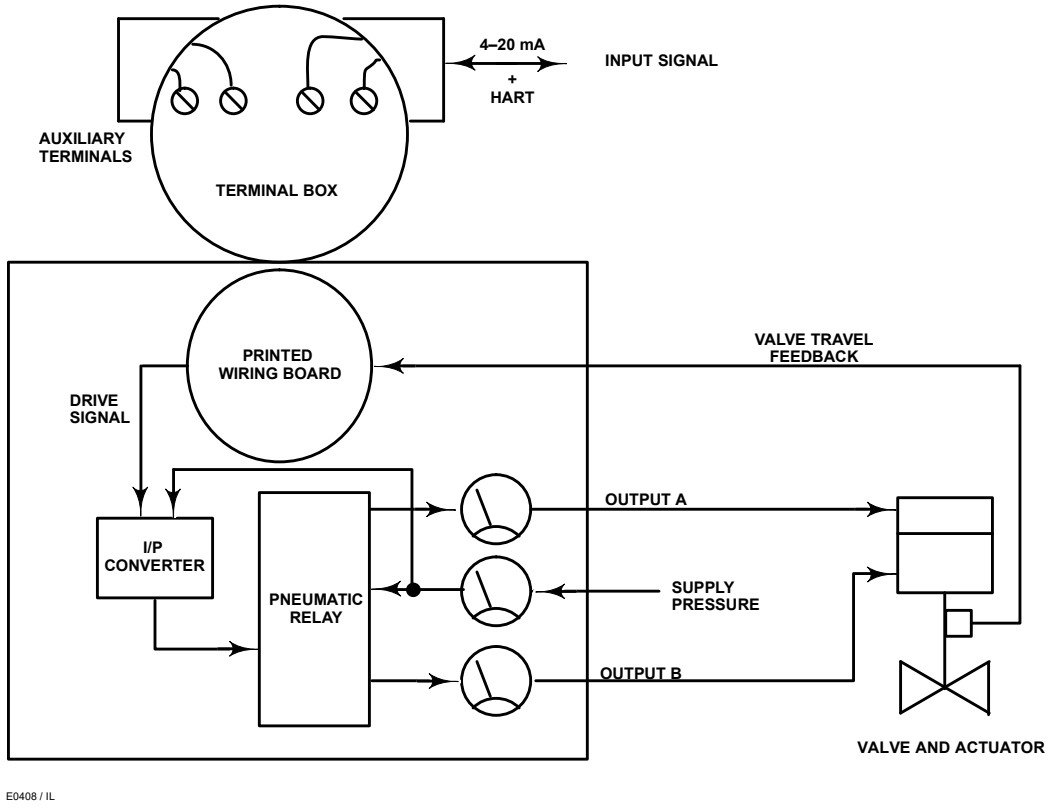


***Figure 8.*** *DVC6000 Series Digital Valve Controller Block Diagram*

## 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 are shown in figures 9, 10 and 11.

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-inch NPT female connections. The digital valve controller outputs are typically connected to the actuator inputs using 3/8-inch diameter tubing. Remote venting is available.

## Ordering Information

When ordering, specify:

1. Actuator type and size

2. Maximum actuator travel or rotation

3. Options

   a. Supply pressure regulator

   b. Supply and output gauges

   c. HART filter

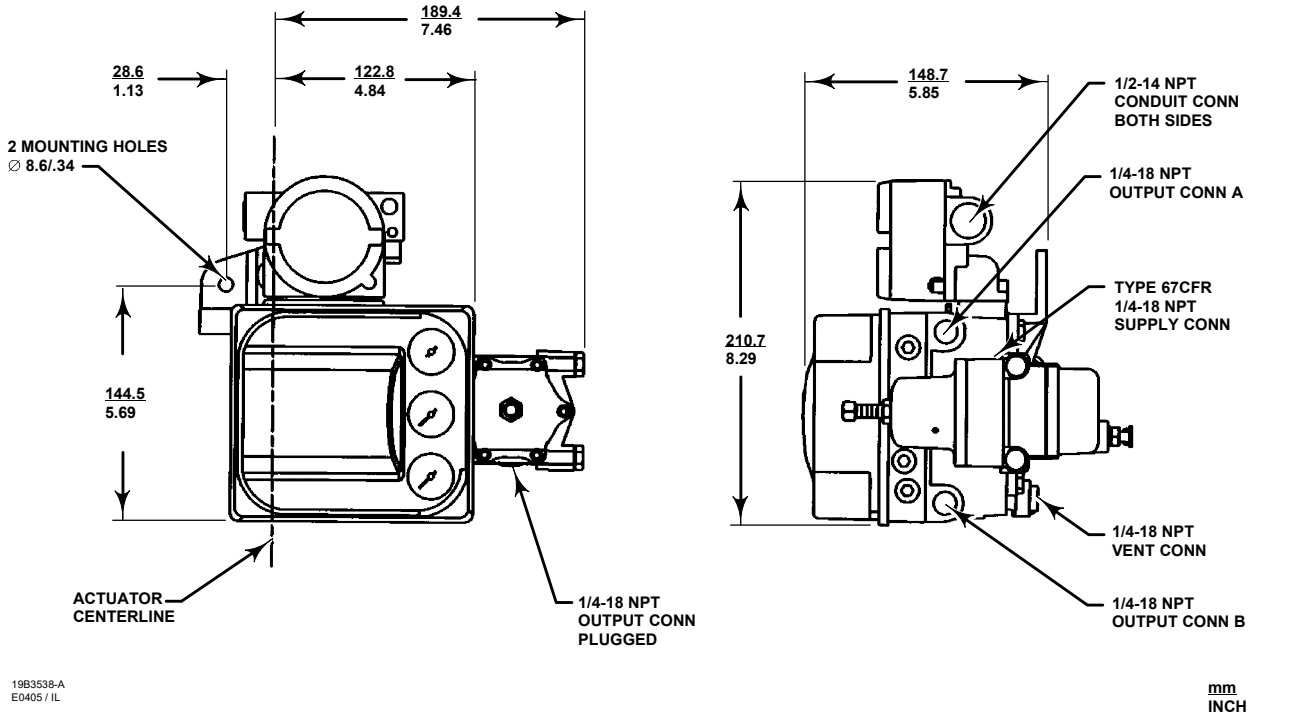


***Figure 9**. Dimensions for Type DVC6010 Digital Valve Controller with Integrally Mounted Filter Regulator*

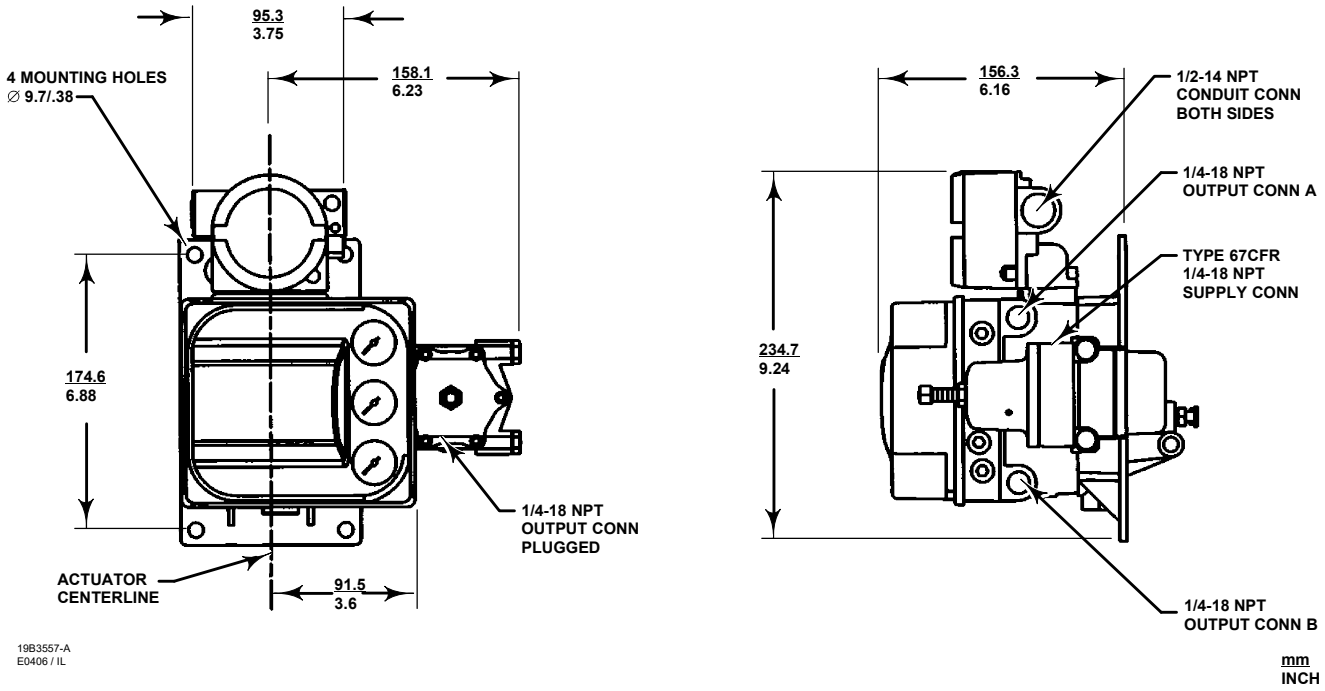


***Figure 10.** Dimensions for Type DVC6020 Digital Valve Controller with Integrally Mounted Filter Regulator*

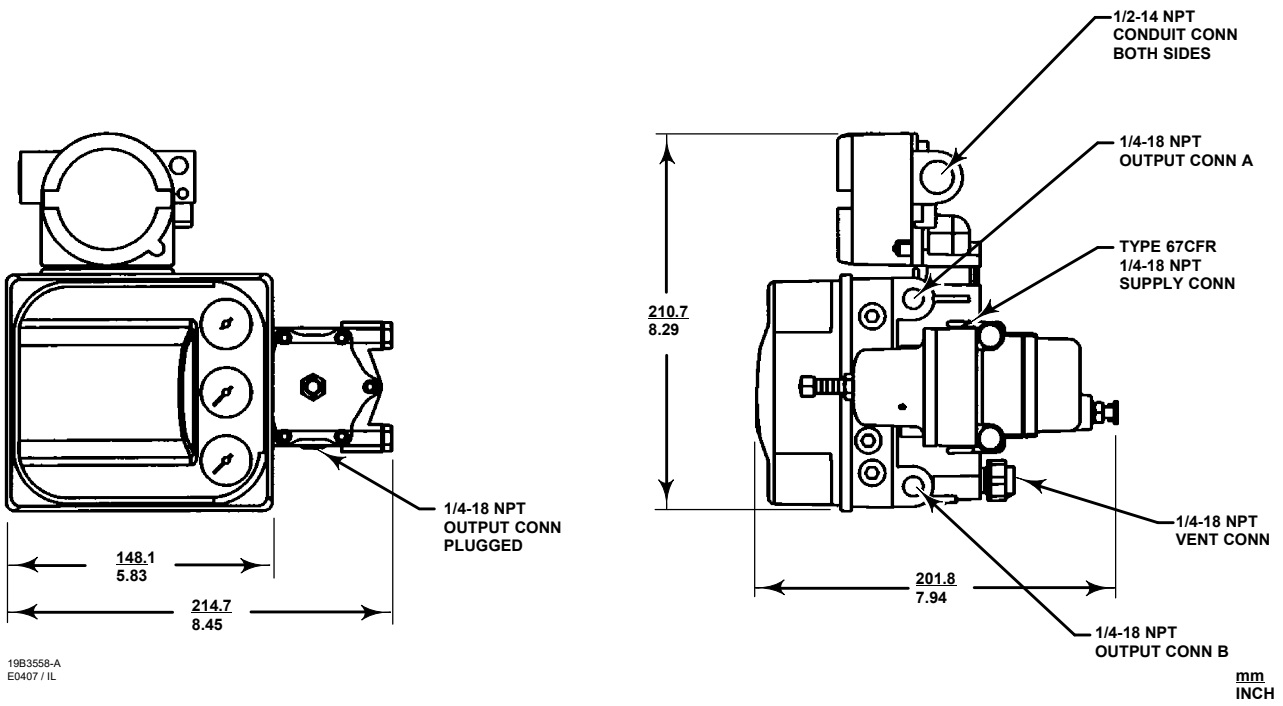


***Figure 11.*** *Dimensions for Type DVC6030 Digital Valve Controller with Integrally Mounted Filter Regulator*

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