

# Supplement to HART® Based FIELDVUE® Digital Valve Controller Instruction Manuals

## FIELDVUE® Digital Valve Controller Split Ranging

Processes requiring extended rangeability may use two or more control valves. The first valve operates over the first portion of the range. When the first valve is nearly 100% open, the control action begins to open the second valve. This is called split ranging. When split ranging is performed a single signal from the control system is supplied to the valve actuators. This single signal is split among the positioning devices on each valve. The positioning devices are used to achieve full valve travel over the reduced input range. Most applications need a predictable overlap region in the middle of the signal range to avoid a zone of no control. Positioning devices provide accuracy to ensure the correct overlap exists.

When split ranging FIELDVUE® digital valve controllers, each device requires a minimum voltage available at the instrument terminals of at least 12 volts (See bulletin 62.1:DVC2000 or bulletin 62.1:DVC6000 and the appropriate instruction manual for details). Many control systems provide a compliance voltage that is less than the minimum requirement of 24 volts for two instruments wired in series. This supplement describes two methods to address the potential discrepancy between the compliance voltage and the requirements of FIELDVUE instruments.

### Limitations of Split Ranging FIELDVUE® Digital Valve Controllers

Split ranging FIELDVUE digital valve controllers provides the following limitations:

- Most control systems cannot provide the 24 volt compliance voltage. A device to boost the compliance voltage may be required, such as the Action Instruments Action Pak® AP4380-2000.
- To communicate with multiple HART® instruments on one pair of wires may require the polling addresses for the instruments be nonzero. This means the instrument polling addresses must be reset and the HART devices (either the Model 375 Field Communicator or AMS ValveLink® Software with a HART modem) must be programmed to poll for instruments at polling addresses other than zero.
- Use of the HART Tri-Loop™ is limited to communication with only one instrument.
- The instrument polling addresses may be nonzero, thus limiting communication with a HART multiplexer.



# FIELDVUE® Digital Valve Controllers

## Guidelines for Split Ranging FIELDVUE® Instruments

1. Check the voltage available at the instrument terminals using the method in the instrument instruction manual.
2. Verify that the control system compliance voltage is at least 24 volts dc at 20 mA output. If the compliance voltage is less than 24 volts dc, add a device to boost the compliance voltage (such as the Action Instruments Model AP4380–2000). (Note: Model AP4380–2000 does not have any hazardous area approvals. Appropriate non-hazardous installations should be selected.)
3. Verify that cable length will not limit HART communication. See the instruction manual for details.
4. For intrinsically safe installations, install approved intrinsic safety barriers between the non-hazardous and hazardous areas.

## Methods of Split Ranging

Two methods are available for split ranging FIELDVUE instruments: the traditional method and an alternate method.

### Traditional Method

The traditional method uses the traditional split-range wiring where the two instruments are connected in series to a single pair of wires from the control system, as shown in figure 1. With the traditional method:

- The device used to boost the compliance voltage may be required to operate beyond its specifications.
- To communicate with multiple HART instruments on one pair of wires requires the polling addresses for the instruments be nonzero. This means the instrument polling addresses must be reset and the HART devices (either the Model 375 Field Communicator or AMS ValveLink Software with a HART modem) must be programmed to poll for instruments at polling addresses other than zero.

- Because the instrument polling address for one of the instruments must be nonzero, communication with a HART multiplexer is not possible.

- Use of the HART Tri-Loop is limited to communication with only one instrument. In addition, because the default polling address for the Tri-Loop is one (1), the instrument polling addresses must be set in the range of 2 to 15.

### Alternate Method

The alternate method requires more field wiring, but this method:

- Allows the device used to boost the compliance voltage to operate within its specifications because it supplies a single instrument.
- The polling addresses can remain at zero (0) because the two instruments are not on the same HART loop.
- Allows communicating over a HART multiplexer network.
- Multiple Tri-Loops may be used allowing multiple instruments to operate in burst mode.
- Split ranging with more than two FIELDVUE digital valve controllers is possible.

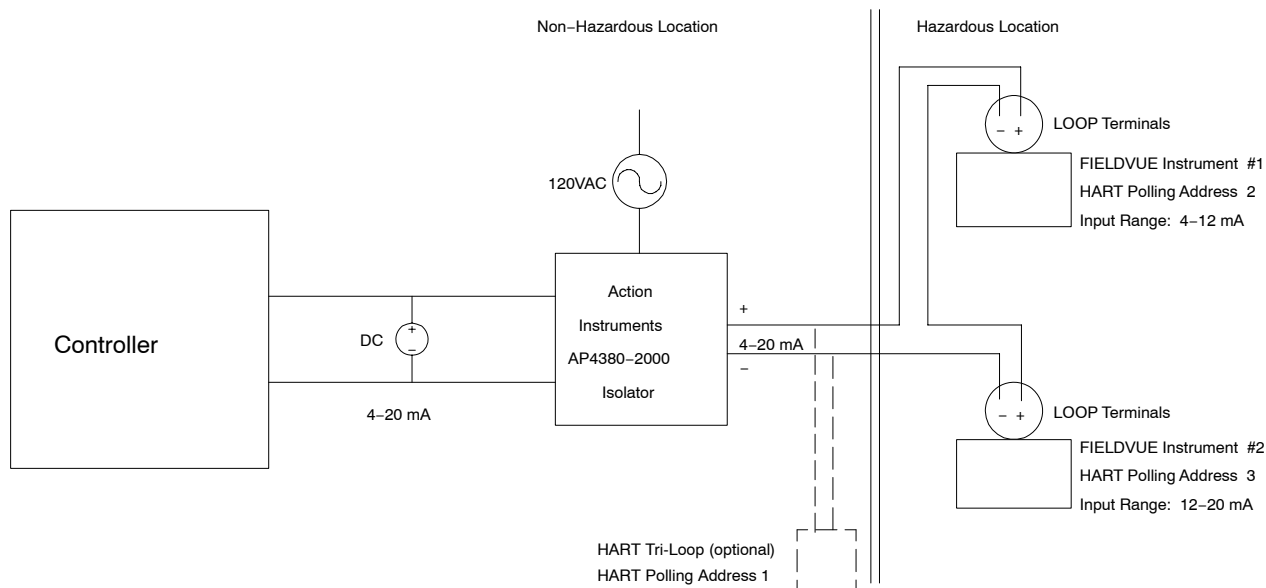


Figure 1. Typical Installation Schematic, Traditional Method

## Installation—Traditional Method

When connecting two instruments in series for a split range application, the compliance voltage must equal at least 24 volts dc. This is generally impractical with most DCS controllers, but quite possible with older analog controllers. As an example, a Fisher® Type TL108 controller with 45 volt dc power supply provides a compliance voltage of 27 volts dc at 20 mA output and a  $C_{master}$  of 10,000 pF. For other controllers or DCS systems, an Action Instruments Model AP4380-2000 isolator or other similar device may be used to increase the compliance voltage.

The published compliance voltage of the AP4380-2000 is less than 24 volts dc. However, typical compliance voltage for this isolator is much higher. To ensure sufficient compliance voltage, the Action Instruments distributor can check compliance voltage of the AP4380-2000 prior to shipment. This should be done using the technique described in the instrument instruction manual. Generally, a compliance voltage of 25 volts dc at 20 mA output with a guaranteed line voltage of 120 volts ac is adequate for normal lengths of field wiring.

## Wiring Hook-Up

The Action Instruments product bulletin describes the product details and limitations (available on the web at [www.actionio.com](http://www.actionio.com)). These should be read and observed. Before installation, configure each

instrument with different HART polling addresses (example HART polling addresses 2 and 3). The connections are shown in figure 1. A typical installation has the control system 4–20 mA dc output signal connected to the AP4380-2000 input terminals. The isolator can be installed in the rack room. Connect the 4–20 mA dc output from the AP4380-2000 to the field wiring. In the field, connect the AP4380-2000 positive (+) output terminal to the first FIELDVUE instrument LOOP + terminal. Connect the first FIELDVUE instrument LOOP – terminal to the second FIELDVUE instrument LOOP + terminal. Connect the second FIELDVUE instrument LOOP – terminal to the AP4380-2000 negative (–) output terminal.

## Configuration

Current flowing through the input terminals of the isolator is regenerated at the output terminals of the isolator (at a higher voltage) and flows through both FIELDVUE instruments. Input ranging of the FIELDVUE instruments is easily changed without recalibrating. This is done by configuring the Input Range Low and the Input Range High to the desired values. A typical configuration would be:

FIELDVUE Instrument	Input Range Low	Input Range High	Polling Address
#1	4 mA	12 mA	2
#2	12 mA	20 mA	3

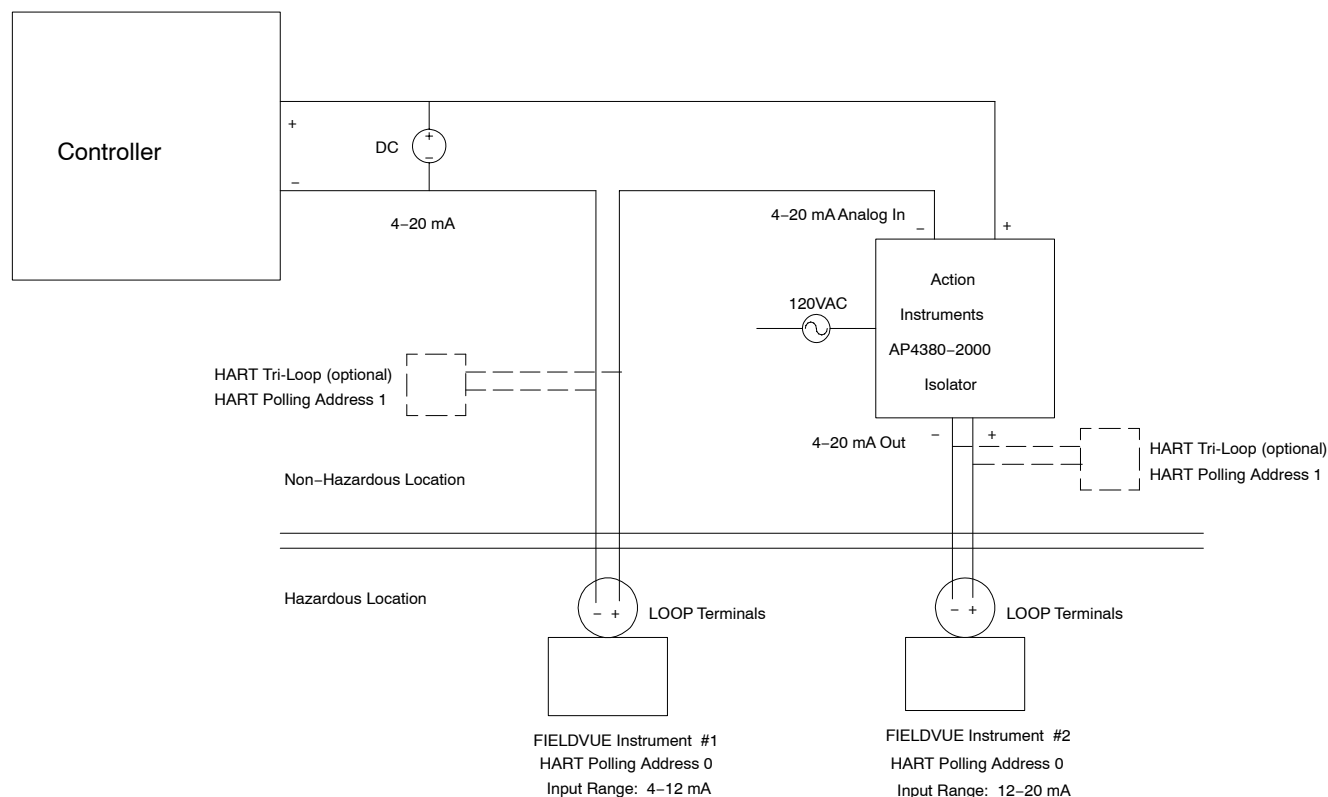


Figure 2. Typical Installation Schematic, Alternate Method

## Installation—Alternate Method

When connecting two instruments in series for this split range application, the compliance voltage requirement from the DCS controller is much lower. This is because the Action Instruments AP4380-2000 is in series with the first FIELDVUE instrument and requires minimum voltage (0.3 volts). The isolator powers only the second FIELDVUE instrument and therefore provides adequate voltage.

### Wiring Hook-Up

The Action Instruments product bulletin describes the product details and limitations (available on the web at [www.actionio.com](http://www.actionio.com)). These should be read and observed. The connections are shown in figure 2. For a typical installation, connect the control system positive (+) output terminal to the AP4380-2000 positive (+) input terminal. Connect the AP4380-2000 input negative (-) terminal to the first FIELDVUE instrument LOOP + terminal. Connect the first FIELDVUE instrument LOOP - terminal to the control system negative (-) terminal. Connect the AP4380-2000 positive (+) output

terminal to the second FIELDVUE instrument LOOP + terminal. Connect the AP4380-2000 negative (-) output terminal to the second FIELDVUE instrument LOOP - terminal.

### Configuration

Current flowing through the input terminal of the isolator is regenerated at the output terminals of the isolator (at a higher voltage) and flows through the second FIELDVUE instrument only. Input ranging of the FIELDVUE instruments is easily changed without recalibrating. This is done by configuring the Input Range Low and the Input Range High to the desired values. A typical configuration would be:

FIELDVUE Instrument	Input Range Low	Input Range High	Polling Address
#1	4 mA	12 mA	0
#2	12 mA	20 mA	0

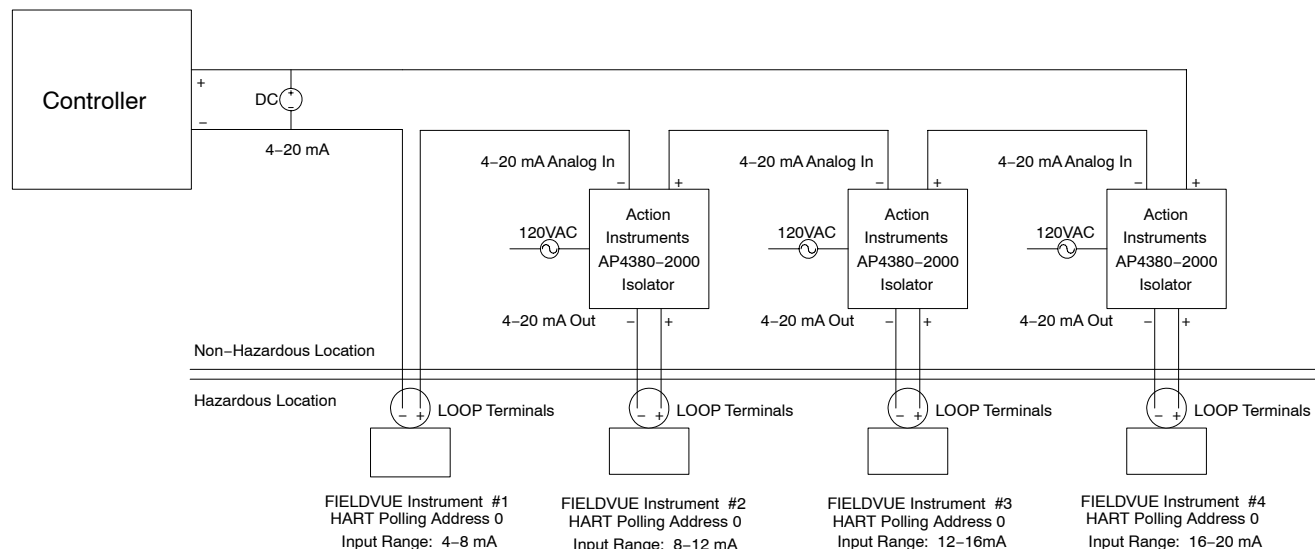


Figure 3. Typical Multiple Split Range Installation

## Multiple Split Range

The installation described for the alternate method can be extended to multiple instruments, as shown in figure 3. This architecture allows up to four units to be split ranged. Due to an increase in the signal to noise ratio as the input span decreases, the minimum input span should be limited to 4 mA. Be aware that as the number of units to be split ranged increases, the accuracy of each unit is affected.

## Related Fisher® Documents

- FIELDVUE® DVC5000 Series Digital Valve Controllers Instruction Manual – Form 5335

### Note

The DVC5000 digital valve controller is obsolete. Contact your Emerson Process Management™ sales office if a copy of this instruction manual is needed.

- Bulletin 62.1:DVC6000—FIELDVUE® DVC6000 Series Digital Valve Controllers

- Bulletin 62.1:DVC6000 (SIS)—FIELDVUE® DVC6000 Series Digital Valve Controllers for Safety Instrumented System (SIS) Solutions

- FIELDVUE® DVC6000 Series Digital Valve Controllers Instruction Manual – Form 5647

- Bulletin 62.1:DVC2000—FIELDVUE® DVC2000 Series Digital Valve Controllers

- FIELDVUE® DVC2000 Series Digital Valve Controllers Instruction Manual – Form 5772

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