

HART® Field Device Specification

Fisher® FIELDVUE™ DVC2000 Digital Valve Controller

HART Revision	Device Type	Device Revision	Firmware Revision
HART 5	05	1	1, 2, 3, 4, 5, 6

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W8755

Note

This document does not include the DVC2000 AC product (Device Type 13F5) which only supports Device Specific HART Commands and not Universal or Common Practice Commands.



Introduction

Product Overview

The DVC2000 digital valve controller is a communicating, microprocessor-based current-to-pneumatic valve positioner. It is designed to replace standard pneumatic and electro-pneumatic valve positioners.

In addition to the traditional function of converting an input current signal (4-20 mA) to a pneumatic output pressure, the DVC2000 digital valve controller communicates via a local display panel and/or via the HART protocol. An option is available which provides isolated circuitry for two (2) integrated limit switches (for open/close valve indication) and a valve position transmitter (for separate valve position feedback).

Purpose of this document

This specification is designed to be a technical reference for HART capable host application developers, system integrators and knowledgeable end-users. It also provides functional specifications (e.g., commands, enumerations and performance requirements) used during field device development, maintenance and testing. This document assumes the reader is familiar with HART Protocol requirements and terminology. Additional product information is available in DVC2000 product literature, available from Emerson Process Management.

Abbreviations and definitions

AR	Alert Record
Configuration Variables	Variables which represent nonvolatile values of manufacturing-initialized data or user-specified configuration information. These variables cannot be enumerated via Command 54 and as such stand on their own with no associated units or range information.
Device Variable	Measured variables that are exposed to HART and can be enumerated using Command 54. Generally there are variables whose ID is in the range of 0 to 10 and are associated with units codes, status, and range values.
Enumeration	A pre-defined set of values or text.
MV	Measured Variable, a physical input to the instrument.
NV	Named Variable – a logical point inside the device, hard-mapped to a given MV as the source of NV data.
Point	A term that applies to diagnostic data packets. It is defined as a collection of periodically sampled variables captured at a single instant in time. It does not include the “Monitor” point.
PS1	The PORT A output pressure which increases with increasing drive signal.
PS2	The PORT B output pressure which decreases with increasing drive signal.
PST	Partial Stroke Test, a limited form of ramped valve diagnostic.
Byte	An 8-bit unsigned integer.
Word	A 16-bit unsigned integer.
Float	Refers to the IEEE 754 floating point format.
Packed ASCII	A special form of characters defined by HART in which 6-bit ASCII characters are packed into byte data.
Standard Span Format	A proprietary 16-bit integer format for numerical values used by some of this device’s Device Specific commands.

Reference Documentation

HART Smart Communications Protocol Specification Revision 5; a group of documents specifying the HART Communication Protocol, physical layers, and Data Link Layers as defined by the HART Communications Foundation.

Bulletin 62.1:DVC2000 Fisher FIELDVUE DVC2000 Digital Valve Controller (D103167X012)

Fisher FIELDVUE DVC2000 Digital Valve Controllers Quick Start Guide (D103203X012)

Fisher FIELDVUE DVC2000 Digital Valve Controller Instruction Manual (D103176X012)

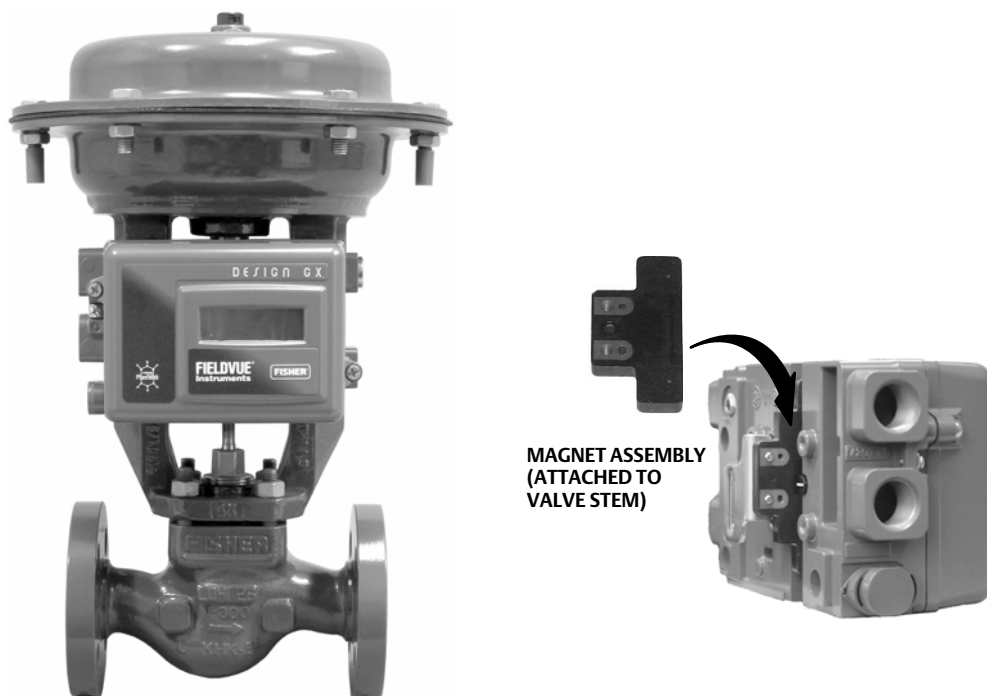
Device Identification

Manufacturer Name	Fisher Controls	Model Name(s)	DVC2000	
Manufacture ID Code	19	(13 Hex)	Device Type Code	5
				(05 Hex)
HART Protocol Revision	5		Device Revision	1
User Selectable HART Revision between HART 5 and HART 7	No			
Number of Device Variables	8			
Physical Layers Supported	FSK			
Physical Device Category	Valve Positioner			

Product Interfaces

Control Valve Interface

The DVC2000 digital valve controller is mechanically attached to the valve's actuator by means of a mounting bracket. The control valve's position is conveyed to the travel sensor of the DVC2000 digital valve controller by means of the feedback bracket and magnet assembly attached to the actuator's stem or rotating travel sensor.



Pneumatic tubing connected to the DVC2000 brings instrument supply air to the DVC2000 and takes controlled output air from the DVC2000 to the actuator. A pressure sensor in the DVC2000 measures the pressure signal and presents it as a device variable.

Host interface

The input to the DVC2000 can either be two-wire 4-to-20 mA current loop (in point-to-point mode). This input is connected in the DVC2000's terminal box on two terminals marked "LOOP +" and "LOOP -". Refer to the DVC2000 quick start guide for connection details.

Output Options Circuit

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.

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.

Local User Interface

The local user 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.

Refer to the DVC2000 instruction manual for additional details on using the Local User Interface to configure and calibrate the DVC2000.

Write Protection

There are two Write Protection states for the DVC2000: Not Protected or Protected. Protected prevents configuration and calibration changes to the instrument. The default setting is Not Protected. Protection is controlled under software control.

Firmware and Language Pack Upgrade

The firmware and language pack of any DVC2000 can be upgraded to the latest version using the "Firmware Download" tool in ValveLink™ software. The new firmware incorporates all of the new functionality and corrections and improvements made to the technology of the DVC2000 product.

The firmware download process requires:

- Around 30 minutes to complete
- The DVC2000's instrument mode must be "Out of Service"
- The DVC2000 is powered with 12 mA or greater
- That you isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid because the routine will cause the DVC2000 to restart.

Dynamic Variables

Four Dynamic Variables are implemented.

	Default Meaning	Units
PV	Analog Input	mA, %
SV	Travel Setpoint	%
TV	Pressure	PSI, BAR, KPA
FV	Travel	%

Device Variables

These variables represent measurements taken by the device, are read only values, and are all in float format. These can be read with Commands 33 and 54.

Variable ID	Meaning	Units
0	Analog Input	mA, %
2	Pressure Port A	PSI, BAR, KPA
3	Travel	%
4	Drive Signal	%
6	Travel Setpoint	%
9	Implied Valve Position (Travel Target)	%
10	Primary Feedback (user selected, either Travel or Pressure)	%
211	Temperature	°C or °F

Unit Codes

Variable Units Code	Units
0	No Units
6	Pounds per square inch, psi
7	Bar
10 (\$0A)	Kilograms per square centimeter, kg/cm ²
12 (\$0C)	Kilopascals, kPa
32 (\$20)	Celsius, °C
33 (\$21)	Fahrenheit, °F
39 (\$27)	Milliamps, mA
57 (\$39)	Percent, %

Status Information

Device Status

The Field Device Status Byte is the only status byte defined in the HART protocol. The order and meaning of each of the eight bits within the byte are fixed by the protocol. This byte is one of the status bytes included with each HART response. It is not part of the Command 48 data.

Bit	Name of Status Bit	Meaning
7	Field Device Malfunction	Set / cleared by the firmware based on self test results. This bit is set if the position or temperature sensors provide invalid readings.
6	Configuration Changed	Two such bits exist internally, one for each HART master. Both copies are set when any variable, HART message, tag, descriptor or date are changed from HART. Cleared by command 38, separately for each master. This bit survives loss of power.
5	Cold Start	Set by the firmware whenever a HARD RESET sequence is executed or at initial device power up. Cleared by the first HART command.
4	More Status	Active when any bit in command 48 is active.
3	Analog Input Fixed	Active if the Instrument Mode of the DVC2000 is in the "Out Of Service" condition or if the Control Mode of the DVC2000 is in one of the digital set point modes.
2	Not Used	
1	Internal Sensor Out of Limits	(This bit is named "Non-Primary Variable Out Of Limits" in the HART documentation for transmitters. It has been renamed to reflect the fact that these variables are INTERNAL INPUTS to FIELDVUE products). The firmware sets this bit when any sensor (pressure, position, temperature) exceeds its operating limits.
0	Loop Current Out of Range	Set when any variable 0 (Analog Input) is saturated.

Universal Commands

The DVC2000 field device implements all HART Revision 5 Universal Commands.

Command 0: Read Unique Identifier

Command 1: Read Primary Variable

Command 2: Read P.V. Current and Percent of Range

Command 3: Read Dynamic Variables and P.V. Current

Command 6: Write Polling Address

Command 11: Read Unique Identifier Associated with Tag

Command 12: Read Message

Command 13: Read Tag, Descriptor, Date

Command 14: Read Primary Variable Transducer Information

Command 15: Read Primary Variable Output Information

Command 16: Read Final Assembly Number

Command 17: Write Message

Command 18: Write Tag, Descriptor, Date

Command 19: Write Final Assembly Number

Command 0: Read Unique Identifiers

	Byte	Description	Format	Value
Request Data Bytes	none			
Response Data Bytes	0	Data type expansion code	Byte, hex	\$FE
	1	Manufacturer identification code	Byte, hex	\$13
	2	Manufacturer's Device Type code	Byte, hex	\$03
	3	Number of preambles	Byte, hex	\$05
	4	Universal command revision	Byte, hex	\$05
	5	Device revision	Byte, hex	\$01
	6	Software revision	Byte, unsigned integer	See table 1 below
	7	Hardware revision	Byte, unsigned integer	See table 2 below
	8	Device function flags	Not Used	\$00
	9	Device Identification number	3 Bytes, hex	
	Code	Description		
Command-Specific Response Codes	none			

Table 1. Device and Software Revision

Device Revision	Software Revision	Description
\$01	\$01	Firmware Revision 1
	\$02	Firmware Revision 2
	\$03	Firmware Revision 3
	\$04	Firmware Revision 4
	\$05	Firmware Revision 5
	\$06	Firmware Revision 6

Table 2. Hardware Revision

Hardware Revision	Description
\$08	Hardware Revision 1
\$11	Hardware Revision 2

Command 1: Read Primary Variable

This command reads the value of the DVC2000's Primary Variable, which is Analog Input (loop current). The units are either "mA" or "%" as configured in the device by Command 44.

	Byte	Format	Description
Request Data Bytes	none		
Response Data Bytes	0	Byte, hex	Primary Variable Unit Code, either 39 (mA) or 57(%)
	1-4	Float	Primary Variable value
	Code	Class	Description
Command-Specific Response Codes	none		

Command 2: Read Primary Variable and Percent of Range

This command reads the value of the DVC2000's loop current in implied units of "mA" (regardless of the configured setting by Command #44) and the measured Valve Travel in implied units of "%".

	Byte	Format	Description
Request Data Bytes	none		
Response Data Bytes	0-3	Float	Loop Current
	4-7	Float	Valve Travel
	Code	Class	Description
Command-Specific Response Codes	none		

Command 3: Read Dynamic Variables and Loop Current

This command is used to read the value of Loop Current and the four Dynamic Variables. The four dynamic variables returned depend upon the variable assignment as defined by Command 51 and read back via Command 50.

The default Dynamic Variable assignment and the Variable Units Codes are shown on page 6.

	Byte	Format	Description
Request Data Bytes	none		
Response Data Bytes	0-3	Float	Loop Current (implied units of "mA")
	4	Byte, hex	Primary Variable (PV) units code
	5-8	Float	Primary Variable (PV) value
	9	Byte, hex	Secondary Variable (SV) units code
	10-13	Float	Secondary Variable (SV) value
	14	Byte, hex	Tertiary Variable (TV) units code
	15-18	Float	Tertiary Variable (TV) value
	19	Byte, hex	Fourth Variable (FV or QV) units code
	20-23	Float	Fourth Variable (FV or QV) value
	Code	Class	Description
Command-Specific Response Codes	8		Warning – Value read invalid (one of the variables is out of range)

Command 14: Read Primary Variable Transducer Information

The transducer limits reported in this command indicate that these values are set to "Not Used"

Note

The Transducer Serial Number is not applicable to the DVC2000 and is set to "0". The other parameters will be set to "0x7F", "0xA0", "0x00", or "250" Not Used, when they are not applicable.

	Byte	Format	Description	Returned Value
Request Data bytes	None			
Response Data Bytes	0-2	UINT24	Transducer Serial Number	000000
	3	Enum	Transducer Limits and Minimum Span Units Code	250 (Not Used)
	4-7	Float	Upper Transducer Limit	7FA00000 (Not A Number NAN)
	8-11	Float	Lower Transducer Limit	7FA00000 (Not A Number NAN)
	12-15	Float	Minimum Span	7FA00000 (Not A Number NAN)
	Code	Class	Description	
Response Codes	None			

Command 15: Read Primary Variable Output Information

This command returns the upper/lower range values for the primary variable which is defined to be the loop current signal. These are the loop current values for the ends of physical travel, and are used to derive set point from the loop current. It reports the range supplied in Command 35.

For example, the lower range, for an increase to open valve, will be the current which will produce a 0% set point. However, for an increase to close valve, the lower range will be the loop current for a 100% set point.

The range values can be changed via Command 35.

The DVC2000 assumes 0% = 4mA and 100% = 20mA.

	Byte	Format	Description	Returned Value
Request Data bytes	None			
Response Data Bytes	0	Enum	PV Alarm Selection Code (see Common Table 6, Alarm Selection Codes). The Alarm Selection Code indicates the action taken by the device under error conditions. For Actuators, the action taken by the positioner is indicated.	250 (Not Used)
	1	Enum	PV Transfer Function Code (see Common Table 3, Transfer Function Codes). The Transfer Function Code must return "0", Linear, if transfer functions are not supported by the device.	250 (Not Used)
	2	Enum	AI Upper and Lower Range Values Units Code, as supplied in command 35.	From CMD 35
	3-6	Float	AI Upper Range Value	From CMD 35
	7-10	Float	AI Lower Range Value	From CMD 35
	11-14	Float	PV Damping Value (units of seconds)	0.0
	15	Enum	Write Protect Code (0=Disabled, 1=Enabled)	0 or 1
	16	Enum	Reserved. Must be set to "250", Not Used.	250
	Code	Class	Description	
Response Codes	None			

Common-Practice Commands

The DVC2000 field device supports the following common practice commands:

Supported Commands

- Command 33: Read Device Variables
- Command 35: Write Primary Variable Range Values
- Command 38: Reset Configuration Change Flag
- Command 42: Master Reset
- Command 44: Change Primary Variable Units Code
- Command 48: Read Additional Status
- Command 50: Read Dynamic Variable Assignments
- Command 54: Read Device Variable Information
- Command 108: Write Burst Mode Command Number
- Command 109: Burst Control Mode

Command 33: Read Device Variables

This command is used to read the value of up to four selected Device Variables.

The Device Variables and the Variable Units Code are listed on page 6.

Note: If any one of the requested variable IDs is invalid, the INVALID_SELECTION error will be returned along with no data bytes.

	Byte	Format	Description	Allowable choices
Request Data Bytes	0	Variable ID	Variable assigned to slot #0	See Device Variables on page 6
	1	Variable ID	Variable assigned to slot #1	See Device Variables on page 6
	2	Variable ID	Variable assigned to slot #2	See Device Variables on page 6
	3	Variable ID	Variable assigned to slot #3	See Device Variables on page 6
Response Data Bytes	0	Variable ID	Variable assigned to slot #0	
	1	Byte, hex	Slot #0 Variable units code	
	2-5	Float	Slot #0 Variable value	
	6	Variable ID	Variable assigned to slot #1	
	7	Byte, hex	Slot #1 Variable units code	
	8-11	Float	Slot #1 Variable value	
	12	Variable ID	Variable assigned to slot #2	
	13	Byte, hex	Slot #2 Variable units code	
	14-17	Float	Slot #2 Variable value	
	18	Variable ID	Variable assigned to slot #3	
19	Byte, hex	Slot #3 Variable units code		
20-23	Float	Slot #3 Variable value		
	Code	Class	Description	
Command-Specific Response Codes	2		Invalid selection – Invalid Variable ID (see note above)	

Command 35: Write Primary Variable Range Values

In the DVC2000, the Primary Variable is defined to be the Analog Input (loop current).

This command is used to write the ranging values reported in Command 15. It controls how the DVC2000 interprets the loop current when creating the Travel Target. The upper range must be greater than the lower range.

This command does not do units conversion, but requires that the units code supplied match the PV units configured in the device as set by Command 44.

If the range values are in percent, then they are assumed to be percent of 4-20 mA. For example, to range an increase to open unit from 8 mA to 16 mA, but using percent range numbers, specify lower_range = 25% and upper_range = 75%.

This ranging is done in conjunction with the zero power condition. For an Increase to Open valve, the lower range is the 0% setpoint level (valve plug in the valve seat), while the upper range is the 100% setpoint level. An Increase to Close valve is exactly opposite.

This command will be accepted when the DVC2000's Instrument Mode is In Service but will be rejected if Write Protection is in effect.

	Byte	Format	Description	Allowable choices
Request Data Bytes	0	UINT8	Upper and Lower Range Values Unit Code	Unit Code 39 (mA) or 57(%)
	1 - 4	Float	Primary Variable Upper Range Value	
	5 - 8	Float	Primary Variable Lower Range Value	
Response Data Bytes	0	UINT8	Upper and Lower Range Values Unit Code	Unit Code 39 (mA) or 57(%)
	1 - 4	Float	Primary Variable Upper Range Value	
	5 - 8	Float	Primary Variable Lower Range Value	
	Code	Class	Description	
Command-Specific Response Codes	2		Invalid selection - Units code did not match configured units	
	7		In Write Protect Mode	
	16		Access Restricted - other master has access locked.	
	32		Busy	

Command 38: Reset Configuration Change Flag

Resets the configuration changed flag in the DVC2000.

The DVC2000 contains two configuration changed bits, one for each master. Both bits are set when any write operation occurs. This command clears the bit corresponding to the master sending this command, leaving the other bit unmodified. Any write to the DVC2000 other than digital setpoint values and write protect status will cause the configuration change flag to be set.

	Byte	Format	Description
Request Data Bytes	none		
Response Data Bytes	none		
	Code	Class	Description
Command-Specific Response Codes	none		

Command 42: Perform Master Reset

This reset command has two options. If no data bytes are supplied, respond immediately and then perform a “warm” reset. This is not equivalent to power up in that restart modes and default IVP are not adopted and the real-time clock is not reset. All other data is read from nonvolatile memory and put into effect. The second option is hard reset. This requires two data bytes set as described below. If this form is received, the unit will save modes and counters, then execute a hard reset by exercising the watchdog timer. The next response will have the “cold_start” bit set.

A “soft reset” command will be honored while the DVC2000 Instrument Mode is in the “In Service” condition.

A “hard reset” command requires the DVC2000 Instrument Mode be in the “Out-of-Service” condition.

	Byte	Format	Description
Request Data bytes	0 - 1	Uint16	[Optional] If hex 0x6969 is supplied as request data bytes, a hard reset is performed. Otherwise a soft reset is performed.
Response Data Bytes	None		
	Code	Class	Description
Command-specific Response Codes	16	Error	Access Restricted

Command 44: Change Primary Variable Units Code

This command is issued to change the units of the Primary Variable, which is defined in the DVC2000 as the Analog Input (loop current). The choices for units are Percent (code 57) or Milliamps (code 39). This command should be sent prior to a Command 35 which sets the upper and lower Primary Variable range values.

In addition to changing the units code, execution of this command will also change the DVC2000’s Analog Input Upper and Lower Range values to reflect the new units (For example: When the DVC2000’s Analog Input is configured as “4-20 mA” and Command 44 with request Data Byte 57 is executed, the DVC2000’s Analog Input units and range values will change to “0-100%”. Likewise When the DVC2000’s Analog Input is configured as “0-100%” and Command 44 with request Data Byte 39 is executed, the DVC2000’s Analog Input units and range values will change to “4-20 mA”).

This command will be accepted when the DVC2000’s Instrument Mode is In Service, but will be rejected if Write Protection is in effect.

	Byte	Format	Description	Allowable choices
Request Data Bytes	0	UINT8	Primary Variable Units Code	Unit Code 39 (mA) or 57(%)
Response Data Bytes	0	UINT8	Primary Variable Units Code	Unit Code 39 (mA) or 57(%)
	Code	Class	Description	
Command-Specific Response Codes	2		Invalid selection - Units code did not match configured units	
	7		In Write Protect Mode	

Command 48: Read Additional Status

	Byte	Format	Description
Request Data bytes	0		None
Response Data Bytes	0	Uint8	Command 48 Response Byte 0
	1	Uint8	Command 48 Response Byte 1
	2	Uint8	Command 48 Response Byte 2
	3	Uint8	Command 48 Response Byte 3
	4	Uint8	Command 48 Response Byte 4
	5	Uint8	Command 48 Response Byte 5
	6	Uint8	Reserved
	7	Uint8	Reserved

Additional Device Status

Command 48 returns 8 bytes of data, with the following status information:

Byte	Bit	Name of Status Bit		Meaning
0	7	Flash Integrity Failure	1,2	Active if there is a failure associated with flash ROM (read only memory).
	6	Temperature Compensation Data Integrity Error	1,2	Active if the microprocessor detects a fault in the temperature compensation data.
	5	Reference Voltage Failure	1,2	Active if there is a failure associated with the internal voltage reference.
	4	Drive Current Failure	1,2	Active when the drive current to the I/P converter is not flowing as expected.
	3	Critical NVM Failure	1,2	Active if there is a failure of non-volatile memory used for configuration data critical for instrument operation.
	2	Temperature Sensor Failure	1,2	Active when the instrument temperature sensor fails or the sensor reading is outside of the range of -60° to 100°C (-76° to 212°F).
	1	Pressure Sensor Failure	2	Active if the pressure sensor reading is outside the range of -24.0% to 125.0% of the calibrated pressure for more than 60 seconds.
	0	Travel Sensor Failure	1,2	Active if the sensed travel is outside the range of -25.0% to 125.0% of calibrated travel.
1	7	Alert Record Not Empty Alert	2	Active when there are 1 or more alerts stored in the alert record.
	6	AutoTune in Progress	2	Active if AutoTune Routine is in progress.
	5	Calibration In Progress Alert	2	Active when calibration is in progress.
	4	Diagnostics in Progress Alert	2	Active when a diagnostic test is in progress.
	3	Pressure Fallback Active Alert		Active when the instrument has detected a problem with the travel feedback and is now controlling the output like an I/P transducer.
	2	Custom Characterization		Custom Characterization in Effect active if the user-defined Custom Characterization is enabled.
	1	Input Characterization		Input Characterization in Effect active if any of the user-defined Characterizations other than "Linear" is enabled.
	0	Auto Cal in Progress Alert	2	Active when auto calibration is in progress.
2	7	Reserved		
	6	Reserved		
	5	Cycle Counter Alert	2	Active if the Cycle Counter exceeds the Cycle Count Alert Point.
	4	Travel Accumulator High Alert	2	Active if the Travel Accumulator exceeds the Travel Accumulator Alert Point.
	3	Instrument Time is Invalid Alert		Active if the instrument has been powered down since the last time the instrument clock was set.
	2	Alert Record Full Alert	2	Active when the alert record contains the maximum number of 20 alerts.
	1	Offline / Failed Alert	2	Active if a shutdown alert has put the DVC2000 in a failed state.
	0	Reserved		

"Reserved" bits are always set to 0.

1. Sets "Field Device Malfunction".
2. Sets "More Status Available".

(continued)

Additional Device Status

Byte	Bit	Name of Status Bit	Meaning
3	7	Reserved	
	6	Reserved	
	5	Reserved	
	4	Reserved	
	3	Reserved	
	2	Reserved	
	1	Integrator Saturated High Alert	Active if the instrument integrator is saturated at the high extreme.
	0	Integrator Saturated Low Alert 2	Active if the instrument integrator is saturated at the low extreme.
4	7	Travel Alert Lo 2	Active when the Travel is below the Travel Alert Lo Point.
	6	Travel Alert Lo Lo 2	Active when the Travel is below the Travel Alert Lo Lo Point.
	5	Travel Alert Hi 2	Active when the Travel exceeds the Travel Alert Hi Point.
	4	Travel Alert Hi Hi 2	Active when the Travel exceeds the Travel Alert Hi Hi Point.
	3	Travel Deviation Alert 2	Active if the difference between the Travel Target and the Travel exceeds the Travel Deviation Alert Point for more than the Travel Deviation Time.
	2	Travel Limit/Cutoff Hi Alert	Active when the Travel exceeds the Hi Limit/Cutoff Point.
	1	Travel Limit/Cutoff Lo Alert	Active when the Travel falls below the Lo Limit/Cutoff Point.
	0	Drive Signal Alert 2	Active when the Drive Signal exceeds target limits (<10% or >90%) for more than 20 seconds when not in Cutoff condition.
5	7	Reserved	
	6	Reserved	
	5	Reserved	
	4	Reserved	
	3	Reserved	
	2	Option Module Error	
	1	Limit Switch 2 Status	Set to "1" if Limit Switch 2 is enabled, powered, and closed.
	0	Limit Switch 1 Status	Set to "1" if Limit Switch 1 is enabled, powered, and closed.
6	7	Reserved	
	6	Reserved	
	5	Reserved	
	4	Reserved	
	3	Reserved	
	2	Reserved	
	1	Reserved	
	0	Reserved	

"Reserved" bits are always set to 0.

1. Sets "Field Device Malfunction".

2. Sets "More Status Available".

Command 50: Read Dynamic Variable Assignments

This command returns a list of four device variable codes taken from table [DVC Device Variables](#) which are returned in Command 3. These Dynamic Variables are fixed and control the Command 3 response, whether burst or by request.

	Byte	Format	Description
Request Data Bytes	None		
Response Data Bytes	0	UINT8	ID of variable returned as the first variable (PV) in Command #3
	1	UINT8	ID of variable returned as the second variable (SV) in Command #3
	2	UINT8	ID of variable returned as the third variable (TV) in Command #3
	3	UINT8	ID of variable returned as the fourth variable (FV) in Command #3
	Code	Class	Description
Command-Specific Response Codes	None		

Command 54: Read Device Variable Information

Used to identify each of the Device Variables in the range of IDs 0...10 inclusive and 211. Responds with the Sensor Serial Number, Sensor range Units, Sensor ranges, Damping Value, and Minimum Span of the selected Variable. The Variable range values will be in the same units as the Variable Units.

	Byte	Format	Description
Request Data Bytes	0	Enum	Device Variable ID, this command is applicable to variables 0-10 or 211. All others will return invalid selection
Response Data Bytes	0	UINT8	Device Variable ID
	1-3		Device Variable Sensor Serial Number, 24-bit number (NOT USED - always zero)
	4	UINT8	Device variable units code
	5-8	Float	Device Variable Upper Range
	9-12	Float	Device Variable Lower Range
	13-16	Float	Device Variable Damping Value, (NOT USED - always zero)
	17-20	Float	Device Variable Minimum Span (NOT USED - always zero)
	Code	Class	Description
Command-Specific Response Codes	2		Invalid Selection

Device-Specific Commands

The DVC2000 field device supports device-specific commands. However, these device-specific commands require use of the ValveLink software application or DD methods and cannot be utilized outside of those controlled environments.

Burst Mode

This field device supports Burst Mode.

Catch Device Variable

This field device does not support Catch Device Variable.

Performance

Refer to the DVC2000 Instruction Manual (D103176X012) or Product Bulletin 62.1:DVC2000 (D103167X012) for details on DVC2000 performance.

Annex A Compatibility Checklist

Manufacturer, Model, and Revision	Fisher Controls DVC2000 Device Revision 1
Device Type	Pneumatic Control Valve Positioner
HART Protocol Revision	5
User switchable between HART 5 mode and HART 7 mode?	No
Device Description Available?	Yes
Number and type of process connections	None
Number of host connections	Input: Control signal to Loop \pm terminals
Number of Dynamic Variables	4
Mappable Dynamic Variables?	No
Number of Device Variables	8
Number of Supported Common Practice Commands	10
Burst Mode?	Yes
Capture Device Variables?	No
Write Protection?	Yes

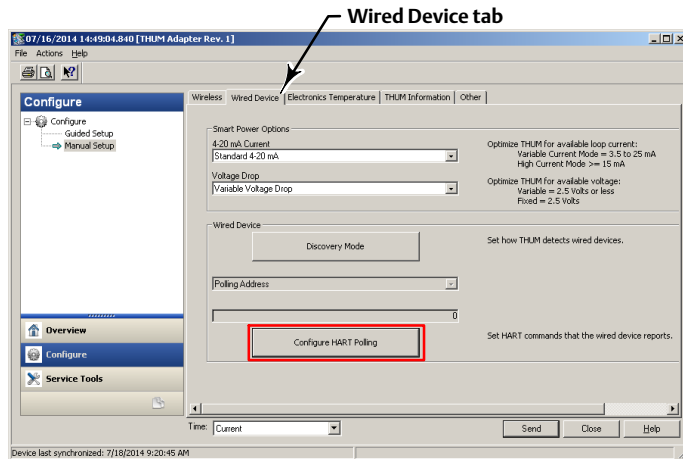
Annex B DVC2000 Parameters as part of a Rosemount 1410 / 1420 WirelessHART Gateway

A FIELDVUE DVC2000 can join a wireless network through the addition of a Rosemount 775 THUM *WirelessHART* adapter. The wireless adapter acts both as a HART modem for communications coming to the DVC2000 from application software and as an independent master issuing commands periodically to the wired device pertaining to the device's status. This independently gathered status information is relayed back to the Rosemount 1410 or 1420 Wireless Gateway and is made available to the user either through viewing the HTML interface or via mapping as "Published Data" parameters via the Gateway's MODBUS or OPC outputs.

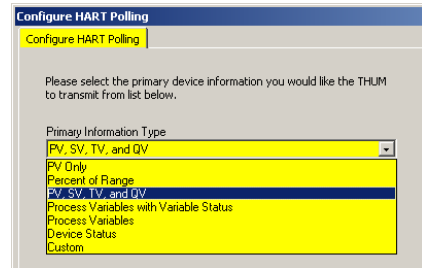
For HART 5 devices the PV, SV, TV, and QV variables can be mapped.

Configure the THUM as follows:

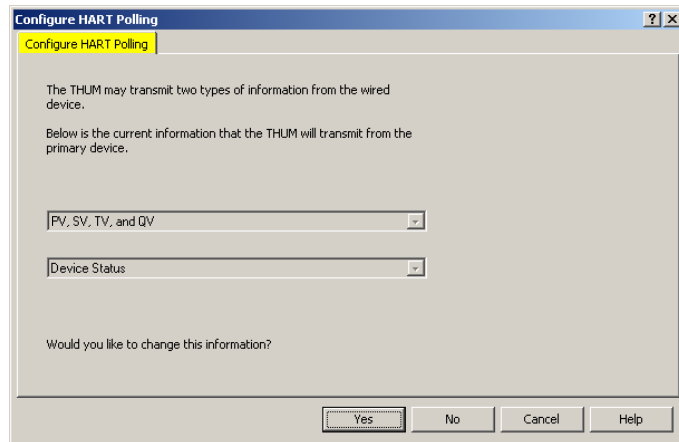
Navigate to Configure > Manual Setup
Under the *Wired Device* tab select *Configure HART Polling*



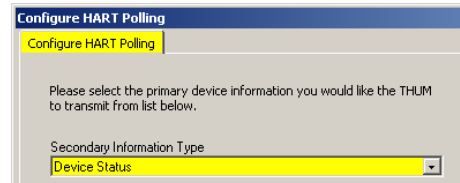
FOR PRIMARY DEVICE INFORMATION:
Select PV, SV, TV, and QV



Select Yes if changes are required



FOR SECONDARY DEVICE INFORMATION:
Select Device Status



The FIELDVUE instrument is defined on the Gateway by “Tag” (read from the device’s “Message” field).



For each Tag, the Gateway provides updated values for:

- Variables
- Additional Status
- Published Data

Published Data, used for the Gateway's OPC and Modbus outputs, falls into the following categories:

Field Device Identification Values:

Values that define the identity of the DVC2000. These include:

- MANUFACTURER (for "Fisher Controls" the value is "19")
- DEVICE_TYPE (for a DVC2000 the value is "5")
- DEVICE_REVISION
- HARDWARE_REVISION
- SOFTWARE_REVISION
- DEVICE_ID
- UNIVERSAL_REVISION (HART version)
- REQUEST_PREAMBLES

Variable information:

The Gateway receives updates concerning the DVC2000's four "Dynamic Variables". The information for any given device variable is displayed by:

1. Dynamic Variable indicator ("PV", "SV", etc.)
2. The Device Variable ID number assigned to that Dynamic Variable

	Dynamic Variable	Device Variable ID	Device Variable Name(s)
Analog Input	PV	0	LOOP_CURRENT
Travel Setpoint	SV	9	TRAVEL_SP
Pressure	TV	2	PRESSURE
Travel	QV	3	TRAVEL
Milliamp Current		245	CURRENT

Either of these choices (Dynamic Variable or Device Variable ID) can be substituted for the "#" sign in the Variable Identifier fields below.

Variable Identifier	Comments / Explanation
#	See any of the variable identifiers in the table immediately above.
#_CLASS	Always "0".
#_CODE	The "Device Variable ID" number in the table immediately above.
#_HEALTHY	A "true" or "false" indication of the health of the sensor providing this value.
#_STATUS	
#_UNITS	Decimal "Variable Units code" number from the "Units Codes" table on page 6.

Device Status:

The eight standard status conditions (present in ANY HART field device) are all represented by a Boolean “true” or “false” state. These eight conditions, discussed on page 7, are:

- DEVICE_MALFUNCTION
- CONFIGURATION_CHANGED
- COLD_START
- MORE_STATUS_AVAILABLE
- LOOP_CURRENT_FIXED
- LOOP_CURRENT_SATURATED
- NONPRIMARY_VALUE_OUT_OF_LIMITS
- PRIMARY_VALUE_OUT_OF_LIMITS

Detailed Device Alerts:

The Alert Groupings are:

- ADDITIONAL_STATUS_0
- ADDITIONAL_STATUS_1
- ADDITIONAL_STATUS_2
- ADDITIONAL_STATUS_3
- ADDITIONAL_STATUS_4
- ADDITIONAL_STATUS_5
- ADDITIONAL_STATUS_6
- ADDITIONAL_STATUS_7

Each of these status bytes represent eight individual bits with values that range from “00” to “255”. To determine which of the eight bits are active requires converting a decimal value to its binary equivalent value. Refer to Command 48 on page 17 for details on the individual alert bits inside of each Additional Status Byte.

ADDITIONAL_STATUS_0	According to Command 48:	As defined in the Gateway:
Bit 7	Flash Integrity Failure	FLASH_ROM_FAIL
Bit 6	Temperature Compensation Data Integrity Error	TEMPERATURE_COMPENSATION_FAIL
Bit 5	Reference Voltage Failure	REFERENCE_VOLTAGE_FAIL
Bit 4	Drive Current Failure	DRIVE_CURRENT_FAIL
Bit 3	Critical NVM Failure	NVM_FAIL
Bit 2	Temperature Sensor Failure	TEMPERATURE_SENSOR_FAIL
Bit 1	Pressure Sensor Failure	PRESSURE_SENSOR_FAIL
Bit 0	Travel Sensor Failure	TRAVEL_SENSOR_FAIL

ADDITIONAL_STATUS_1	According to Command 48:	As defined in the Gateway:
Bit 7	Alert Record Not Empty Alert	ALERT_RECORD_HAS_ENTRIES
Bit 6	Auto Tune in Progress	AUTO_TUNER_IN_PROGRESS
Bit 5	Calibration in Progress Alert	CALIBRATION_IN_PROGRESS
Bit 4	Diagnostics in Progress Alert	DIAGNOSTIC_IN_PROGRESS
Bit 3	Pressure Fallback Active Alert	PRESSURE_CONTROL_IS_ACTIVE
Bit 2	Reserved	
Bit 1	Reserved	
Bit 0	Auto Cal in Progress Alert	AUTO_TRAVEL_CALIBRATION_IN_PROGRESS

ADDITIONAL_STATUS_2	According to Command 48:	As defined in the Gateway:
Bit 7	Reserved	
Bit 6	Reserved	
Bit 5	Cycle Counter Alert	CYCLE_COUNT_ALERT
Bit 4	Travel Accumulator High Alert	TRAVEL_ACCUMULATOR_ALERT
Bit 3	Instrument Time is Invalid Alert	INSTRUMENT_TIME_IS_INVALID
Bit 2	Alert Record Full Alert	ALERT_RECORD_IS_FULL
Bit 1	Offline / Failed Alert	OFFLINE_FAILED_ALERT
Bit 0	Reserved	

ADDITIONAL_STATUS_3	According to Command 48:	As defined in the Gateway:
Bit 7	Reserved	
Bit 6	Reserved	
Bit 5	Reserved	
Bit 4	Reserved	
Bit 3	Reserved	
Bit 2	Reserved	
Bit 1	Integrator Saturated High Alert	INTEGRATOR_SATURATED_HIGH
Bit 0	Integrator Saturated Low Alert	INTEGRATOR_SATURATED_LOW

ADDITIONAL_STATUS_4	According to Command 48:	As defined in the Gateway:
Bit 7	Travel Alert Lo	TRAVEL_ALERT_LO
Bit 6	Travel Alert Lo Lo	TRAVEL_ALERT_LO_LO
Bit 5	Travel Alert Hi	TRAVEL_ALERT_HI
Bit 4	Travel Alert Hi Hi	TRAVEL_ALERT_HI_HI
Bit 3	Travel Deviation Alert	TRAVEL_DEVIATION_ALERT
Bit 2	Travel Limit/Cutoff Hi Alert	TRAVEL_LIMIT_HI_OR_ TRAVEL_CUTOFF_HI_IN_EFFECT
Bit 1	Travel Limit/Cutoff Lo Alert	TRAVEL_LIMIT_LOW_OR_ TRAVEL_CUTOFF_LOW_IN_EFFECT
Bit 0	Drive Signal Alert	DRIVE_SIGNAL_ALERT

ADDITIONAL_STATUS_5	According to Command 48:	As defined in the Gateway:
Bit 7	Reserved	
Bit 6	Reserved	
Bit 5	Reserved	
Bit 4	Reserved	
Bit 3	Reserved	
Bit 2	Option Module Error	LIMIT_SWITCH_ERROR
Bit 1	Limit Switch 2 Status	LIMIT_SWITCH_2_CLOSED
Bit 0	Limit Switch 1 Status	LIMIT_SWITCH_1_CLOSED

ADDITIONAL_STATUS_6	According to Command 48:	As defined in the Gateway:
Bit 7	Reserved	
Bit 6	Reserved	
Bit 5	Reserved	
Bit 4	Reserved	
Bit 3	Reserved	
Bit 2	Reserved	
Bit 1	Reserved	
Bit 0	Reserved	

ADDITIONAL_STATUS_7	According to Command 48:	As defined in the Gateway:
Bit 7	Reserved	
Bit 6	Reserved	
Bit 5	Reserved	
Bit 4	Reserved	
Bit 3	Reserved	
Bit 2	Reserved	
Bit 1	Reserved	
Bit 0	Reserved	

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