

Retrieving Valve Stroke Time in DeltaV™ SIS

This document describes a method for retrieving valve stroke time information from Fisher DVC6200SIS in DeltaV SIS via HART protocol.

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Introduction

There are multiple advantages on using HART instruments in safety instrumented systems (SIS). While the HART data should not be used for safety purposes, HART diagnostics provide valuable device information. DeltaV SIS makes HART data readily available for multiple purposes:

- **Direct use within DeltaV SIS logic solvers.** HART diagnostics could be used directly within the logic solver, not with the purposes of perform a safety function but to identify a malfunction device, for example, the logic solver could automatically remove a bad transmitter from a voting mechanism.
- **Passing information to an Asset Management system.** DeltaV SIS can easily route all HART data to AMS Device Manager and simplify configuration and maintenance.
- **Passing information to DeltaV.** DeltaV SIS is fully integrated with DeltaV and HART information from SIS field devices is readily available within both DeltaV and DeltaV SIS without cumbersome mapping and without the need of HART multiplexers.

This whitepaper describes a particular use case of passing HART data from DeltaV SIS to DeltaV DCS to retrieve valve stroke time from Fisher DVC6200SIS. For additional information on the DeltaV SIS HART capabilities please consult the whitepaper **DeltaV SIS HART capabilities**.

Valve Stroke Time

As mentioned, HART instrument provides much more diagnostics information than analog instruments. For example, the Fisher DVC6200SIS computes stroke time and reports it via HART. This is much precise than calculating the stroke time using the travel position information. The latency in the HART communication makes calculation methods challenging. When the stroke time is computed directly within the field device itself, the latency in the HART communication does not impact the precision of the stroke time value.

One of the main benefits of recording valve stroke time is the possibility for taking proof test credit from a process trip, as described in the article Valve Proof Test Credit for a process trip [2]. This article also mentions that diagnostic data captured during a process trip may reveal valve degradations that may not be detected during a proof test.

HART instruments are capable to provide four digital variables (HART_PV, HART_SV, HART_TV, and HART_FV). Fisher DVC6200SIS can report four additional configurable variables. DeltaV SIS can read those additional variables using what is called slot variables. The table 1 provides a list of the DVC6200 variables available for reading through slot variables.

Variable ID	Meaning	Units
0	Analog Input	mA, %
1	Internal Temperature	°C, °F
2	Pressure Port A	PSI, BAR, KPA, Kg/cm ²
3	Travel	%
4	Drive Signal	%
5	Pressure Port B	PSI, BAR, KPA, Kg/cm ²
6	Travel Setpoint	%
7	Differential Pressure (Port A – Port B)	PSI, BAR, KPA, Kg/cm ²
8	Supply Pressure	PSI, BAR, KPA, Kg/cm ²
9	Implied Valve Position	%
10	Primary Feedback (user selected, either Travel or Pressure)	%
11	Friction*	As defined in ValveLink software
12	Deadband*	As defined in ValveLink software
13	Stroke Time*	seconds

Table 1. Device Variables in DVC6200.

HART Variables from SIS Devices within DeltaV SIS

Since HART data is not safety rated, HART digital variables are not available within Logic Solver Function blocks. When a HART capable signal is link to a LS AI block, the only available option is the analog value (FIELD_VAL_PCT). However, based on user settings, the HART status can be used to flag device malfunction and the logic can respond based on status handling which is user configurable. Figure 1 shows the only parameter available for device tags associated with a HART device.

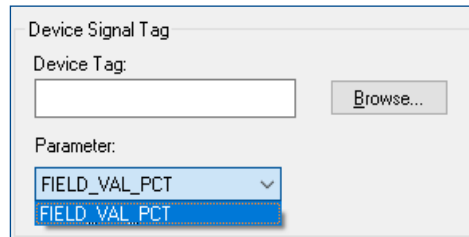


Figure 1. Parameter on LS AI function block.

HART Variables from SIS Devices within DeltaV

HART digital variables from safety devices is directly accessible within function blocks in DeltaV DCS which is one of the advantages of a integrated control and safety system (ICSS). Figure 2 shows the parameter available for device tags associated with a HART device connected to a logic solver.

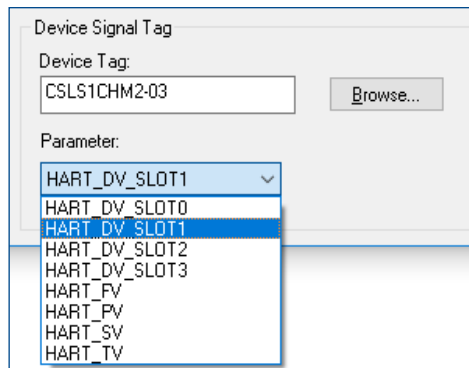


Figure 2. Parameter on AI function block.

DeltaV Configuration for Reading Slot Variables

As mentioned in the previous section, HART variables are transferred from DeltaV SIS to DeltaV without the need of custom mapping as would occur with interfaces such as Modbus TCP. HART data is directly accessible in DeltaV via Analog Input function blocks, the user simply needs to specify the variable to be read by the function block (as shown in figure 2).

The slot variables are configurable in terms of what information needs to be retrieve from the field devices.

For example, based on table 1, to read the supply pressure, a slot variable needs to be configured to read the variable with ID 8. In the same way, to read the valve stroke time, a slot variable needs to be configured to read the variable with ID 13.

Slot Configuration

The first step to configure slot variables in DeltaV is to enable them via DeltaV Explorer. Simply double click the parameter DV_SLOT_CONFIG under either a DVC CHARM or SLS1508 channel enabled as HART two-state output channel.

User can decide to enable some, or all four slot variables as described in figure 3. For reading stroke time, at least one slot variable needs to be enabled.

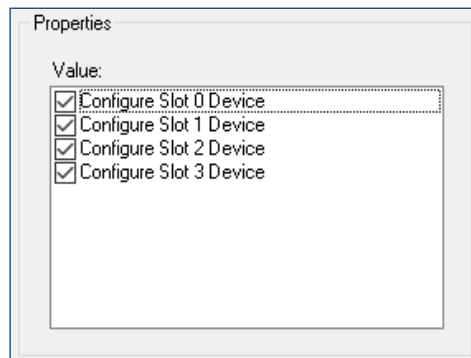


Figure 3. Slot Configuration in CHARM.

Once the required slot variables are enabled, the next step is to configure the variable code for each slot variable. For example, to read the stroke time (variable 13), one of slot variable must be configured to point to variable 13. This is done via the parameters DV_SLOT0_CODE, DV_SLOT1_CODE, DV_SLOT2_CODE, and DV_SLOT3_CODE. Figure 4 show an example where DV_SLOT0_CODE is assigned to variable 13 (valve stroke time).

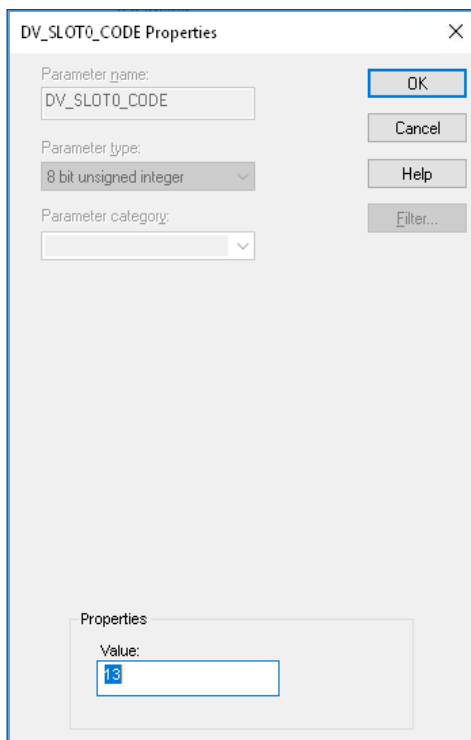


Figure 4. Slot Code Configuration.

The slot configuration process is the same for both CSLS and SLS1508.

Once the DeltaV module is downloaded, the time for the last valve stroke will be reported by function block reading the slot variable associated with variable 13 as shown in figure 5.

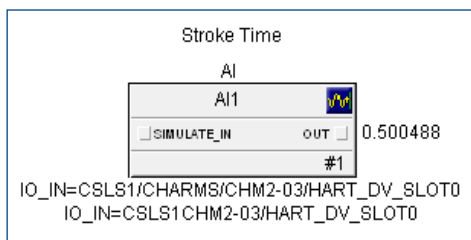


Figure 5. Valve stroke time via HART.

Consideration with Respect of Logic Solver Lock Behavior

The HART digital variables accessed via function block are available even if the logic solver is locked.

Additional Options

Once the stroke time has been read by a DeltaV module, all standard functionality is available. The user could decide to create additional configuration to:

- Alarm if the stroke time is above a defined value
- Display the stroke time in the graphic (e.g. faceplate)
- Historize the stroke time values
- Record a certain number of past stroke values. For example, the user could create an array variable to store the times from the last five valve strokes

System Prerequisite and Minimum Revisions

DeltaV SIS has supported reading slot variable since its introduction, and it is supported in both hardware platforms SLS1508 and CSLS. This functionality is independent of the firmware revision of the logic solvers and from the DeltaV release version.

With respect of the Fisher DVC, only the DVC6200SIS provides the valve stroke time as HART digital variable. Previous models such as DVC6000SIS does not compute the valve stroke time, the stroke time on those early models can be calculated from the demand and reset stroke information available within Valvelink.

Conclusions

DeltaV can retrieve the valve stroke time from Fisher DVC6200SIS. The ability to read the valve stroke time from safety valves enables taking credit from process trips as well as helping with compliance with regulatory requirements related to demonstrate that all safety valves closed as designed. Retrieving the time stroke time directly from the digital valve controller eliminates the need for limit switches and additional computations.

References

- [1] DeltaV SIS HART Capabilities whitepaper
- [2] Valve proof test credit for a process trip. Processing Magazine. Jan 8th, 2020

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