

USER MANUAL

HART

DVC-UM-005



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1 General

This manual covers software version:

Software ID (HART): DVC-SW-001
Software Version: 2.10

1.1 Safety instructions

For a safe installation of a positioner, the following must be observed. The module must only be installed by qualified personnel who are familiar with the national and international laws, directives and standards that apply to this product as well as all instructions in this manual.

The information in this user manual is subject to changes without notice.

2 Purpose

It is the purpose of this document, to list specifications, protocol commands and functions, the HART communication protocol in Val Control products.

3 Specifications

3.1 Electrical specifications

Control loop	
Impedance	< 470 ohm @20mA and 9.4VDC
Linearity	< 0.1%
Temperature coefficient	0.025% / 1°C
HART	FSK, 1200Hz / 2200Hz 400-800mVpp
Galvanic isolated	
Transmitter loop	
Impedance	< 470 ohm @20mA and 9.4VDC
Linearity	< 0.1%
Temperature coefficient	0.015% / 1°C
Galvanic isolated	

Note: Control loop and transmitter loop equipment must be HART compatible.

3.1.1 Terminals

The chart below shows how to connect to the terminals on the positioner.

Control loop
1. Control loop (+)
2. Control loop (-)
Transmitter loop
3. Transmitter loop (+)
4. Transmitter loop (-)

4 Device Identification

Manufacturer Name:	<u>Val Controls</u>	Model Name(s):	<u>IVC24</u>
Manufacture ID Code:	<u>24622</u> <u>(602E Hex)</u>	Device Type Code:	<u>57840</u> <u>(E1F0 Hex)</u>
HART Protocol Revision	<u>7.1</u>	Device Revision:	<u>3</u>
Number of Device Variables	<u>6</u>		
Physical Layers Supported	<u>FSK</u>		
Physical Device Category	<u>Control loop, DC-isolated Bus Device</u>		

Default node ID: 0, can be changed.

5 Universal Commands

All universal commands are implemented

Command	Description
0	Read unique identifier
1	Read primary variable
2	Read loop current and percent of range
3	Read dynamic variables and loop current
6	Write polling address
7	Read loop current mode
8	Read Dynamic Variable Classification
9	Read Device Variables with Status
11	Read loop configuration
12	Read message
13	Read device variable status
14	Read unique identifier associated with tag
15	Read Primary Variable output information
16	Read final assembly number
17	Write message
18	Write TAG, descriptor, date
19	Write final assembly number
20	Read Long Tag
21	Read unique identifier associated with long tag
22	Write long tag

Val Controls Definitions:

- Universal Primary Variable : Control Signal
- Universal Secondary Variable : Transmitter Signal
- Universal Tertiary Variable: Position Signal
- Universal Quaternary Variable : Pressure Sensor

5.1 Burst Mode

The field device does not support burst mode

6 Device Specific Commands

All universal commands are implemented

Command	Description
38	Reset Configuration Counter
42	Device Reboot
48	Additional Status
59	Write Number of preambles

7 User specific Commands

Command 128 – 247 is user specific commands.

8 Live Status – Identification

8.1 Read (139) Software version

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
1-4	U32	Software Version Format: Decimal Example : 10203 decimal = '1.02.03'

8.2 Read (140) Software Id

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-13	ASCII14	Software – ID Format: ASCII 14 Example 'DDP-SW-004'

8.3 Read (141) Manufacturer ID

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-13	ASCII14	Manufacturer ID Format: ASCII 14 Default Value: 'Val Controls '

8.4 Read (143) Type Name

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-13	ASCII	Type Name Format: ASCII 14 Default Value: 'IHP24-B'

8.5 Read (144) PCB Number

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	U32	PCB Number Value: 0 – 4294967295 Format: U32 MSB First

9 Command

9.1 Write (211) Start test and calibration commands

This command starts a system test

Request data bytes

Byte	Format	Description
0-1	U16	1: Start partial stroke 2: Start full stroke 3: Start solenoid test 4: Abort test 5: Open 6: Close 7: Start auto calibration 8: Start partial stroke reference 9: Start full stroke reference 10: Start solenoid reference

Response data bytes

Byte	Format	Description
0-1	U16	1: Start partial stroke 2: Start full stroke 3: Start solenoid test 4: Abort test 5: Open 6: Close 7: Start auto calibration 8: Start partial stroke reference 9: Start full stroke reference 10: Start solenoid reference 15: Start scheduler action

10 Clock Functions

10.1 Read (128) Read Clock

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U8	Seconds Values: 0 – 59
1	U8	Minutes Values: 0 – 59
2	U8	Hour Values 0 – 23
3	U8	Reserved
4	U8	Day Values: 1 - 31
5	U8	Month Values: 1 – 12
6-7	U16	Year Values: 0 -2200

10.2 Write (129) Write Clock

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U8	Seconds Values: 0 – 59
1	U8	Minutes Values: 0 – 59
2	U8	Hour Values 0 – 23
3	U8	Reserved
4	U8	Day Values: 1 - 31
5	U8	Month Values: 1 – 12
6-7	U16	Year Values: 0 -2200

11 Valve testing

11.1 Read (159) Last stroke test information

This command reads the values recorded during the last partial stroke test

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	Time	Time of the last PST Values: Bit 0 – 7 = Seconds (0 .. 59) Bit 8 – 15 = Minutes (0 - 59) Bit 16-31 = Hour (0 - 23)
4-7	Date	Date of the last PST Values: Bit 0 – 7 = Day (1 .. 31) Bit 8 – 15 = Month (1 .. 12) Bit 16-31 = Year (2010 .. 2100)
8-9	U16	Last PST Status Values: 0 = Never Run 1 = Ok 2 = Warning 3 = Error
10-13	Time	Time of the last FST Values: Bit 0 – 7 = Seconds (0 .. 59) Bit 8 – 15 = Minutes (0 - 59) Bit 16-31 = Hour (0 - 23)
14-17	Date	Date of the last FST Values: Bit 0 – 7 = Day (1 .. 31) Bit 8 – 15 = Month (1 .. 12) Bit 16-31 = Year (2010 .. 2100)
18-19	U16	Last FST Status Values: 0 = Never Run 1 = Ok 2 = Warning 3 = Error
20-23	Time	Time of the last SOT Values: Bit 0 – 7 = Seconds (0 .. 59) Bit 8 – 15 = Minutes (0 - 59)

		Bit 16-31 = Hour (0 - 23)
24-27	Date	Date of the last SOT Values: Bit 0 – 7 = Day (1 .. 31) Bit 8 – 15 = Month (1 .. 12) Bit 16-31 = Year (2010 .. 2100)
28-29	U16	Last SOT Status Values: 0 = Never Run 1 = Ok 2 = Warning 3 = Error

11.2 Read (160) Live test information

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-1	U16	ESD Line Power Status Values: 1 = Power on ESD Line (On) 2 = No Power on ESD Line (Off)
2-3	U16	Valve Test Service Values: 2 = Auto calibration 3 = Parital stroke 4 = Full stroke 5 = Solenoid test 6 = ESD

11.3 Read (161) Live test information

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-1	U16	Is scheduler action required? Values: 1 = Yes 2 = No

11.4 Read (163) Last PST data

This command reads the values recorded during the last partial stroke test

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	TIME	Time of the last PST Values: Bit 0 – 7 = Seconds (0 .. 59) Bit 8 – 15 = Minutes (0 - 59) Bit 16-31 = Hour (0 - 23)
4-7	DATE	Date of the last PST Values: Bit 0 – 7 = Day (1 .. 31) Bit 8 – 15 = Month (1 .. 12) Bit 16-31 = Year (2010 .. 2100)
8-11	U32	Breakaway time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
12-15	U32	Closing time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
16-19	U32	Opening time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
20-23	U32	Total time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
24-26	U16	Max travel Range: 0 – 10000 Units: 0 – 100%

11.5 Read (164) Last reference PST data

This command reads the values recorded during the last partial stroke test

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	TIME	Time of the last reference PST Values: Bit 0 – 7 = Seconds (0 .. 59) Bit 8 – 15 = Minutes (0 - 59) Bit 16-31 = Hour (0 - 23)
4-7	DATE	Date of the last reference PST Values: Bit 0 – 7 = Day (1 .. 31) Bit 8 – 15 = Month (1 .. 12) Bit 16-31 = Year (2010 .. 2100)
8-11	U32	Breakaway time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
12-15	U32	Closing time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
16-19	U32	Opening time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
20-23	U32	Total time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
24-26	U16	Max travel Range: 0 – 10000 Units: 0 – 100%

11.6 Read (165) Last FST data

This command reads the values recorded during the last full stroke test

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	TIME	Time of the last FST Values: Bit 0 – 7 = Seconds (0 .. 59) Bit 8 – 15 = Minutes (0 - 59) Bit 16-31 = Hour (0 - 23)
4-7	DATE	Date of the last FST Values: Bit 0 – 7 = Day (1 .. 31) Bit 8 – 15 = Month (1 .. 12) Bit 16-31 = Year (2010 .. 2100)
8-11	U32	Breakaway time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
12-15	U32	Closing time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
16-19	U32	Opening time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
20-23	U32	Total time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms

11.7 Read (166) Last reference FST data

This command reads the values recorded during the last reference full stroke test

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	TIME	Time of the last reference FST Values: Bit 0 – 7 = Seconds (0 .. 59) Bit 8 – 15 = Minutes (0 - 59) Bit 16-31 = Hour (0 - 23)
4-7	DATE	Date of the last reference FST Values: Bit 0 – 7 = Day (1 .. 31) Bit 8 – 15 = Month (1 .. 12) Bit 16-31 = Year (2010 .. 2100)
8-11	U32	Breakaway time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
12-15	U32	Closing time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
16-19	U32	Opening time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
20-23	U32	Total time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms

11.8 Read (167) Last SOT data

This command reads the values recorded during the last solenoid test

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	TIME	Time of the last SOT Values: Bit 0 – 7 = Seconds (0 .. 59) Bit 8 – 15 = Minutes (0 - 59) Bit 16-31 = Hour (0 - 23)
4-7	DATE	Date of the last SOT Values: Bit 0 – 7 = Day (1 .. 31) Bit 8 – 15 = Month (1 .. 12) Bit 16-31 = Year (2010 .. 2100)
8-9	U16	Start pressure: Range: 0 – 50000 Units: 0.00 – 500.00 bar
10-13	U32	Reaction time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
14-17	U32	Breakaway time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
18-19	U16	Breakaway pressure: Range: 0 – 50000 Units: 0.00 – 500.00 bar
20-23	U32	Total time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms

11.9 Read (168) Last reference SOT data

This command reads the values recorded during the last reference solenoid test

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	TIME	Time of the last reference SOT Values: Bit 0 – 7 = Seconds (0 .. 59) Bit 8 – 15 = Minutes (0 - 59) Bit 16-31 = Hour (0 - 23)
4-7	DATE	Date of the last reference SOT Values: Bit 0 – 7 = Day (1 .. 31) Bit 8 – 15 = Month (1 .. 12) Bit 16-31 = Year (2010 .. 2100)
8-9	U16	Start pressure: Range: 0 – 50000 Units: 0.00 – 500.00 bar
10-13	U32	Reaction time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
14-17	U32	Breakaway time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
18-19	U16	Breakaway pressure: Range: 0 – 50000 Units: 0.00 – 500.00 bar
20-23	U32	Total time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms

11.10 Read (169) Last EST data

This command reads the values recorded during the last emergency shut down

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	TIME	Time of the last EST Values: Bit 0 – 7 = Seconds (0 .. 59) Bit 8 – 15 = Minutes (0 - 59) Bit 16-31 = Hour (0 - 23)
4-7	DATE	Date of the last EST Values: Bit 0 – 7 = Day (1 .. 31) Bit 8 – 15 = Month (1 .. 12) Bit 16-31 = Year (2010 .. 2100)
8-11	U32	Breakaway time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
12-15	U32	Closing time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms
16-19	U32	Total time Range: 0 – 4294967295 ms Units: 0 – 4294967295 ms

12 Log functions

12.1 Read (130) Error log

This command reads the entries in the error log and the arguments. See manual for Error messages

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U8	Number of errors in the error log
1-2	U16	Error 1
3-4	U16	Error 2
5-6	U16	Error 3
7-8	U16	Error 4
9-10	U16	Error 5
11-12	U16	Error 6
13-14	U16	Error 7
15-16	U16	Error 8
17-18	U16	Error 9
19-20	U16	Error 10

12.2 Read (131) Diagnostic Log

This command reads the entries in the error log and the arguments

See manual for Log messages

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U8	Number of logs
1-2	U16	Diagnostic log 1
3-4	U16	Diagnostic log 2
5-6	U16	Diagnostic log 3
7-8	U16	Diagnostic log 4
9-10	U16	Diagnostic log 5
11-12	U16	Diagnostic log 6
13-14	U16	Diagnostic log 7
15-16	U16	Diagnostic log 8
17-18	U16	Diagnostic log 9
19-20	U16	Diagnostic log 10

12.3 Read (132) Read Event log 1 – 2

See manual for Event messages

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-1	U16	Event type – for Event number 1 Values: See manual for values
2-5	U32	Event Date – for Event number 1 Values: Bit 0 – 7 = Day (1 .. 31) Bit 8 – 15 = Month (1 .. 12) Bit 16-31 = Year (2010 .. 2100)
6-9	U32	Event Time – for Event number 1 Bit 0 – 7 = Seconds (0 .. 59) Bit 8 – 15 = Minutes (0 - 59) Bit 16-31 = Hour (0 - 23)
10-11	U16	Event Error – for Event number 1
12-13	U16	Event type – for Event number 2
14-17	U32	Event Date – for Event number 2
18-21	U32	Event Time – for Event number 2
22-23	U16	Event Error – for Event number 2

12.4 Read (133) Read Event log 3 - 4

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-1	U16	Event type – for Event number 3
2-5	U32	Event Date – for Event number 3
6-9	U32	Event Time – for Event number 3
10-11	U16	Event Error – for Event number 3
12-13	U16	Event type – for Event number 4
14-17	U32	Event Date – for Event number 4
18-21	U32	Event Time – for Event number 4
22-23	U16	Event Error – for Event number 4

12.5 Read (134) Read Event log 5 - 6

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-1	U16	Event type – for Event number 5
2-5	U32	Event Date – for Event number 5
6-9	U32	Event Time – for Event number 5
10-11	U16	Event Error – for Event number 5
12-13	U16	Event type – for Event number 6
14-17	U32	Event Date – for Event number 6
18-21	U32	Event Time – for Event number 6
22-23	U16	Event Error – for Event number 6

12.6 Read (135) Read Event log 7 - 8

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-1	U16	Event type – for Event number 7
2-5	U32	Event Date – for Event number 7
6-9	U32	Event Time – for Event number 7
10-11	U16	Event Error – for Event number 7
12-13	U16	Event type – for Event number 8
14-17	U32	Event Date – for Event number 8
18-21	U32	Event Time – for Event number 8
22-23	U16	Event Error – for Event number 8

12.7 Read (136) Read Event log 9 - 10

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-1	U16	Event type – for Event number 9
2-5	U32	Event Date – for Event number 9
6-9	U32	Event Time – for Event number 9
10-11	U16	Event Error – for Event number 9
12-13	U16	Event type – for Event number 10
14-17	U32	Event Date – for Event number 10
18-21	U32	Event Time – for Event number 10

22-23	U16	Event Error – for Event number 10
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13 HART Response Codes

All commands can return all the following response codes

Byte	Class	Description
0	Success	
2	Error	Invalid poll address
2	Error	Invalid selection
3	Error	Passed parameter too large
4	Error	Passed parameter too small
5	Error	Too few data bytes received
6	Error	Device specific command error
7	Error	In write protect mode
8	Warning	Update failure
8	Warning	Update in progress
8	Warning	Set to nearest possible value
9	Error	Invalid data code detected
9	Error	Configuration counter mismatch
12	Error	Invalid mode selection
14	Warning	Dynamic variable returned
16	Error	Access restricted
30	Warning	Command response truncated
32	Error	Busy
33	Error	Device initiated
34	Error	Device running
35	Error	Device dead
36	Error	Device conflict
64	Warning	Command not implemented