HART FIELD DEVICE SPECIFICATION

FOCUS-1
SW_v1.4.4

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Document name: HART Field Device Specifications
Document no (rev.)   TD-048(6)_v1.4.4
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1. Introduction

1.1   Scope

The FOCUS-1 smart control device complies with HART Protocol Revision 7.2. This document specifies features and documents HART Protocol implementation details. The functionality of this smart field device is described sufficiently to allow its proper integration and functionality in process and its support in HART capable host applications.

1.2   Purpose

FOCUS-1 is a smart device which offers much more functionality than can be covered with the HART protocol. The purpose of these chapters is to achieve the most optimal integration of FOCUS-1 with regard to HART.

1.3   Who should use this document?

This specification is created to be technical reference for HART capable Host application developers, system integrators and knowledgeable end users. This document assumes the reader is familiar with the HART protocol requirements and technology.

1.4   References

For more information on HART visit:

https://fieldcommgroup.org/hart-specifications

for more information on FOCUS-1, please check the manual, quick-start and datasheet located in the documents folder of the FOCUS-1 device.

For more information on NAMUR NE43 standardization of 4–20mA signal levels; please visit

https://www.namur.net/de/

1.5   Device identification

Manufacturer Name :	FOCUS-ON VoF	Model Name :	FOCUS-1
Manufacturer ID code:	66	Device Type Code :	00
HART protocol revision:	7.2	Device Revision	1
Number of device variables	10		
Physical layers supported	FSK		
Physical Device Category	HART Process Automation Device		

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1.6   Product overview

FOCUS-1 is a smart control device. In addition to normal globe valve control, it has e.g. the possibility to control flow by a given setpoint in flow. FOCUS-1 has one single button for interacting and configuration of the device. When pressed you can connect to all devices with a working Wi-Fi and/or ethernet connection like a smartphone, tablet or laptop. Please see the datasheet and manual for more information on the device capabilities.

FOCUS-1 has a 4-20mA analog input with HART functionality and a passive analog 4-20mA output. The device is externally powered by 230 VAC

2. FOCUS-1 interfaces

2.1   FOCUS-1 input interface

The FOCUS-1 HART analog 4-20mA interface is freely configurable in the device. The behavior of the globe control valve functionality depends on the given chosen settings by you as customer. When facing the connection terminal the 4-20mA HART loop is connected on the two left terminals marked "+" and "-"

The following options are available when configuring the 4-20mA input of FOCUS-1:

1. Standard control valve
    If FOCUS-1 is configured as a standard control valve, the given input in mA results in a valve position. The range is fixed, 4mA is either fully open or fully closed depending if the valve is fail to open or fail to close. The same holds true for the 20mA value.
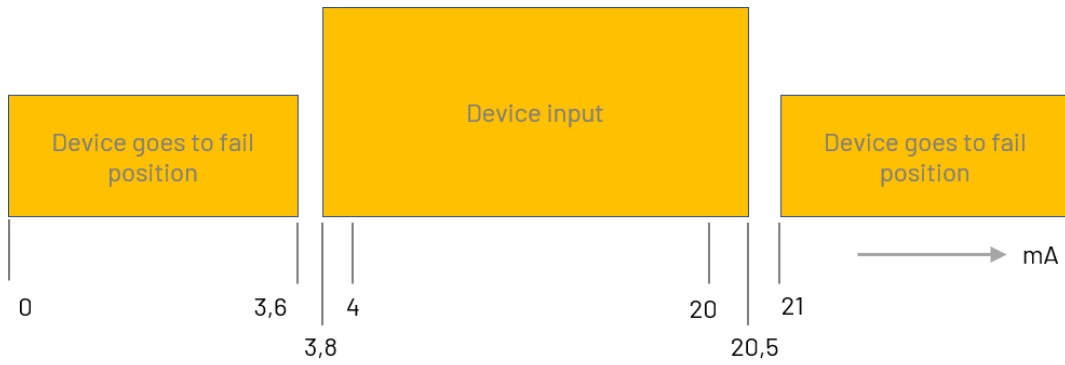
2. Flow control
    The analog input can also be configured as a setpoint for flow. The 4-20mA input signal now corresponds to a required setpoint in volume flow. 4-mA corresponds to a minimum flow and 20mA to a maximum flow value, both configurable on the device. The range is freely configurable.

3. Pressure control
    The analog input can also be configured as a setpoint for pressure at the valve inlet or outlet. Alternatively, the pressure difference between valve inlet and outlet can be used for pressure control. The 4-20mA input signal now corresponds to a required setpoint in the selected pressure sensor(s). 4-mA corresponds to a minimum pressure and 20mA to a maximum pressure value, both configurable on the device. The range is freely configurable.

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2.2 FOCUS-1 response to analog input signal

Device goes to fail position	Device input	Device goes to fail position

0   3,6   4   20   21   mA
   3,8   20,5

FOCUS-1 response to the given 4-20mA input value, is according to NAMUR NE-43. It accepts an input signal value for setpoint between 3,8 and 20,5 mA. Below 3,6 and above 21 mA device will go into its fail-safe position (either closed or open depending on the device configuration).

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2.3 Analog Output

When facing the connection box (flow from right to left) the 2-wire passive 4-20mA current loop is connected to the two right terminals marked "+" and "-". The current output is freely selectable and can communicate your desired process value.

1. Valve position.
    Just like a "normal" globe valve you can configure the output to communicate the valve position.

2. Volume Flow
    The actual volume flow can be communicated like a "normal" flow meter over the 4- 20mA output. The range is preconfigured by Focus-ON but is freely configurable in the device set-up.

3. Inlet pressure
    The actual upfront process pressure can be communicated like a "normal" pressure sensor over the 4-20mA output. The range is preconfigured by Focus-ON but is freely configurable in the device set-up.

4. Outlet pressure
    The actual process pressure after FOCUS-1 can be communicated like a "normal" pressure sensor over the 4-20mA output. The range is preconfigured by Focus-ON but is freely configurable in the device set-up.

5. Delta pressure
    The pressure difference over the valve can be communicated as well over the 4-20mA Fully opened results in minimal pressure difference and fully closed in maximum pressure difference. The range is freely configurable in the device configuration.

FOCUS-1 output analog range
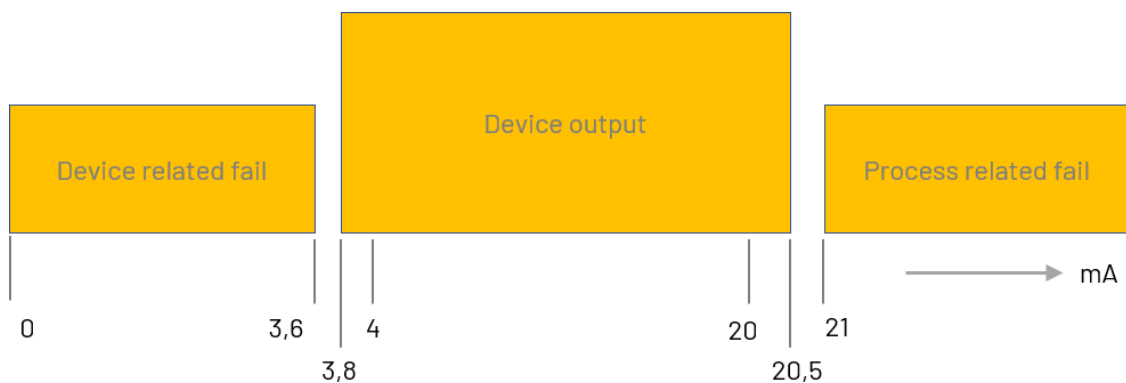
The analog output range is also according NAMUR NE-43. The normal output range is between 4-20mA and has a linear overrange between 3.8 and 4mA and between 20 and 20.5 mA.

Below 3.6mA FOCUS-1 is in the configured failsafe position due to critical FOCUS-1 device failure.

Above 21mA FOCUS-1 is also in the configured failsafe position but this time due to a critical process error.

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2.4 Local Interfaces, Jumpers and Switches

FOCUS-1 does not have any physical jumpers and or switches.

2.4.1 Local Controls and Displays

FOCUS-1 does not have a display, however it has a single button that creates access to any tablet, smartphone and computer with Wi-Fi functionality. This way a tablet, phone or computer acts as a display.

2.4.2 Internal Jumpers and Switches

FOCUS-1 does not have any physical jumpers and or switches

2.5 Device Variables & Dynamic Variables

Device variables

Device Variable Code	Device Variable Name	Type	Comment	Dynamic variable FOCUS-1	Dynamic variable FOCUS-1_EX	Device Variable Classification
0	Volume Flow setpoint	linear	Volume flow setpoint value	PV		66
1	Valve position setpoint	linear	Valve setpoint value	PV		91
2	Pressure setpoint	linear	Pressure setpoint value	PV		65
3	Volume flow	linear	Measured volume flow	SV, TV, QV	PV, SV, TV, QV	66
4	Valve position	linear	Valve position	SV, TV, QV	PV, SV, TV, QV	91
5	Delta pressure	linear	Delta value of pressure sensor 1 and 2	SV, TV, QV	PV, SV, TV, QV	65
6	Pressure 1	linear	Measured value of pressure sensor 1	SV, TV, QV	PV, SV, TV, QV	65
7	Pressure 2	linear	Measured value of pressure sensor 2	SV, TV, QV	PV, SV, TV, QV	65
8	Temperature 1	linear	Measured value of temperature sensor 1	SV, TV, QV	SV, TV, QV	64
9	Temperature 2	linear	Measured value of temperature sensor 2	SV, TV, QV	SV, TV, QV	64

FOCUS-ON gives the user the ultimate freedom to configure the FOCUS-1 device to your liking and specific process conditions.

For FOCUS-1 _Ex (explosion safety device variant):

- Set points from 4 to 7 can be used as PV for ANALOG OUT values
- Set points from 1 to 3 cannot be used as PV for ANALOG INPUT

2.5.1 Primary Variable

In FOCUS-1 you can configure primary variables, which follow the ANALOG INPUT signal, typically used for setpoint conveyance:
1. Volume flow actual setpoint
2. Valve position actual setpoint
3. Pressure actual setpoint (via the configuration menu you can select Delta Pressure, inlet- or outlet Pressure)

In FOCUS-1_EX (ATEX certified) you can configure primary variables, which follow the ANALOG OUTPUT

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signal, typically used for resulting process values:

1. Measured volume flow
2. Valve position
3. Delta value of pressure sensor 1 and 2
4. Measured value of pressure sensor 1
5. Measured value of pressure sensor 2

2.5.2 Secondary, Tertiary & Quaternary Variable.

Depending on the chosen Primary Variable, the user can select freely from the remaining Device Variables which need to be communicated via the remaining dynamic variables.

1. Measured volume flow
2. Valve position
3. Delta value of pressure sensor 1 and 2
4. Measured value of pressure sensor 1 (inlet)
5. Measured value of pressure sensor 2 (outlet)
6. Measured value of temperature sensor 1 (inlet)
7. Measured value of temperature sensor 2 (outlet)

3. Configuration

FOCUS-1 HART7 feature s are configured using the device dashboard v ia WIFI or through the ethernet connection.
If you want to configure HART via the HART protocol, please use a generic DTM.

4. Status information

4.1 Universal commands

All universal commands are assumed common knowledge for you as user. Only a few commands need some additional information and are explained per command.

Command 1:   Read Primary Variable

Within FOCUS-1 the metrological visualization of the device is freely configurable. For the communication over HART we have selected:

- Kelvin for temperature measurement
- Pascal for pressure measurement
- m^3/h for volume flow
- % for valve opening

Byte 0	unit code of the PV
Byte 1-4	Measured value

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Command 3: Read dynamic variables and loop current

The configuration of FOCUS-1 strongly depends on your specific process conditions. Depending on your selection of control, FOCUS-1 (non-ATEX) can be configured as a :
- Standard control valve (PV is set for percentage opening)
- Flow control (PV represents the setpoint for volume flow through FOCUS-1)
- Pressure control: Delta Pressure, Pressure inlet or outlet. (PV represents the setpoint for pressure)

For SV, TV and QV a selection can be made from table.

Byte 0-3	PV current in mA
Byte 4	PV unit code
Byte 5-8	Received PV
Byte 9	SV unit code
Byte 10-13	Measured SV
Byte 14	TV unit code
Byte 15-18	Measured TV
Byte 19	QV unit code
Byte 20-23	Measured QV

Command 9: Read device variables with status

The explanation given by Command 3 is also valid for Command 9. However, with Command 9 it is possible to receive all device variables in one string.

Byte 0: Slot 0 - Device Variable Code	Byte 0: Extended Field Device Status
Byte 1: Slot 1 - Device Variable Code	Byte 1: Slot 0 - Device Variable Code
Byte 2: Slot 2 - Device Variable Code	Byte 2: Slot 0 - Device Variable Classification
Byte 3: Slot 3 - Device Variable Code	Byte 3: Slot 0 - Unit Code
Byte 4: Slot 4 - Device Variable Code	Byte 4-7: Slot 0 - Device Variable Value
Byte 5: Slot 5 - Device Variable Code	Byte 8: Slot 0 - Device Variable Status (bit level)
Byte 6: Slot 6 - Device Variable Code	Byte 9: Slot 1 - Device Variable Code
Byte 7: Slot 7 - Device Variable Code	Byte 10: Slot 1 - Device Variable Classification
Byte 6: Slot 8 - Device Variable Code	Byte 11: Slot 1 - Unit Code
Byte 7: Slot 9 - Device Variable Code	Byte 12-15: Slot 1 - Device Variable Value
	Byte 16: Slot 1 - Device Variable Status (bit level)
	Byte 17: Slot 2 - Device Variable Code
	Byte 18: Slot 2 - Device Variable Classification
	Byte 19: Slot 2 - Unit Code
	Byte 20-23: Slot 2 - Device Variable Value
	Byte 24: Slot 2 - Device Variable Status (bit level)
	Byte 25: Slot 3 - Device Variable Code
	Byte 26: Slot 3 - Device Variable Classification
	Byte 27: Slot 3 - Unit Code
	Byte 28-31: Slot 3 - Device Variable Value
	Byte 32: Slot 3 - Device Variable Status (bit level)
	Byte 33: Slot 4 - Device Variable Code
	Byte 34: Slot 4 - Device Variable Classification
	Byte 35: Slot 4 - Unit Code
	Byte 36-39: Slot 4 - Device Variable Value
	Byte 40: Slot 4 - Device Variable Status (bit level)
	Byte 41: Slot 5 - Device Variable Code
	Byte 42: Slot 5 - Device Variable Classification
	Byte 43: Slot 5 - Unit Code
	Byte 44-47: Slot 5 - Device Variable Value
	Byte 48: Slot 5 - Device Variable Status (bit level)

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Byte 49: Slot 6 - Device Variable Code	
Byte 50: Slot 6 - Device Variable Classification	
Byte 51: Slot 6 - Unit Code	
Byte 52-55: Slot 6 - Device Variable Value	
Byte 56: Slot 6 - Device Variable Status (bit level)	
Byte 57: Slot 7 - Device Variable Code	
Byte 58: Slot 7 - Device Variable Classification	
Byte 59: Slot 7 - Unit Code	
Byte 60-63: Slot 7 - Device Variable Value	
Byte 64: Slot 7 - Device Variable Status (bit level)	
Byte 65: Slot 8 - Device Variable Code	
Byte 66: Slot 8 - Device Variable Classification	
Byte 67: Slot 8 - Unit Code	
Byte 68-71: Slot 8 - Device Variable Value	
Byte 72: Slot 8 - Device Variable Status (bit level)	
Byte 73: Slot 9 - Device Variable Code	
Byte 74: Slot 9 - Device Variable Classification	
Byte 75: Slot 9 - Unit Code	
Byte 76-79: Slot 9 - Device Variable Value	
Byte 80: Slot 9 - Device Variable Status (bit level)	
Byte 81-84: Slot 0 data time stamp	

4.2   Common Practice Commands

Next to the Universal commands, FOCUS-1 has the following Common Practice Commands:

Command 50:   Read Dynamic Variable Assignments

This command gives insight how the dynamic variables are configured on FOCUS-1. Dynamic variables can either be configured via the HART protocol with command 51 or via the configuration screen of the FOCUS-1 device.

Byte 0	Device variable assigned to PV
Byte 1	Device variable assigned to SV
Byte 2	Device variable assigned to TV
Byte 3	Device variable assigned to QV

Command 51:   Write Dynamic Variable Assignments

Command 51 can be used to configure the Dynamic Variables. Configuration can either be done via a generic HART DTM but it is much easier to do via the device interface. Please make a selection on the possible device variables from table 1. Please keep in mind that the PV used for controlling FOCUS-1.

Byte 0	Device variable assigned to PV
Byte 1	Device variable assigned to SV
Byte 2	Device variable assigned to TV
Byte 3	Device variable assigned to QV

Command 72:   Squawk

If command 72 is used to locate the FOCUS-1 device on site, the LED's on the device will start blinking orange.

Byte 0	0 = off, 1=on 2=once

Command 73:   Find device

To identify FOCUS-1 please double press the button on FOCUS-1 shortly. For a time period of 10
? seconds the unique identifier is being transmitted.

Command 95:   Read Device Communications Statistics

Need input from HART/software team, what does this mean?

Byte 0-1	Received STX
Byte 2-3	Sent ACK
Byte 4-5	Sent BACK

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