Baumer

Passion for Sensors

HART® Field Device Specification

Baumer CombiPress™ PFMN/PFMH

Revision 1

Document 81178192, rev. 1

Initial release: 7th of October 2015
Current release: 7th of October 2015

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1 Table of Contents

2 Introduction

2.1 Scope

Baumer CombiPress™ PFMN/PFMH HART pressure transmitter has built-in support for the HART 7.4 protocol. Since the HART version of the transmitter operates identically with the non-HART version of the transmitter, this document focuses solely on the HART functionalities of the transmitter. For all other operational aspects of the transmitter, please consult the data sheet and the operators instructions.
This document contains the necessary data for an operator, familiar with the HART protocol, to access all functions of the transmitter from a master system.

2.2 Purpose

This specification is designed to complement other documentation (e.g., the *Operators instructions for CombiPress™, type PFMx*) by providing a complete, unambiguous description of this Field Device from a HART Communication perspective

2.3 Who should use this document?

The 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.

2.4 Abbreviations and definitions

CT	Common Table
DT	Device Specific Table
uint-8	8-bit unsigned integer, representing value 0 .. 255, can also be used for single bit flags
uint-16	16-bit unsigned integer, representing value 0 .. 65535
float	32-bit IEEE-754 (IEC 559) compatible single floating point variable
ASCII	ISO Latin-1 (ISO 8859) string text
packed	HART specific Packed ASCII format
PV	Primary Variable
SV	Secondary Variable

2.5 References

HART Smart Communications Protocol Specification. HCF_SPEC-12. Available from the HCF.
Operators instructions CombiPress™, type PFMx, Document 11120948. Available from www.baumer.com.

3 Device Identification

Manufacturer Name:	Baumer	**Model Name(s):**	CombiPress™ PFMx
Manufacture ID Code:	96 (60 Hex)	**Device Type Code:**	240 (F0 Hex)
HART Protocol Revision	7.4	**Device Revision:**	1
Number of Device Variables	4		
Physical Layers Supported	FSK		
Physical Device Category	Transmitter		

4 Product Overview

The CombiPress™ PFMN/PFMH is a loop powered 4-20mA pressure transmitter, that comes in both an industrial and a hygienic version, for which both absolute and relative pressure transmitters are available. The HART version of the transmitters have the HART signal connected directly on the 4-20mA pressure output. The transmitter also features an internal temperature sensor, used for internal temperature compensation of the pressure. The temperature measured is only avaliable via digital communication, either via HART, on the Baumer FlexProgram or on an attached CombiView DFON display.

5 Product Interfaces

5.1 Process Interface

5.1.1 Sensor Input Channels

The pressure sensors come in many different shapes and for many different pressure ranges.
The pressure sensor also acts a temperature sensor, providing a temperature reading of the media temperature, which is used for temperature compensation, as well as being availabe for digital readout.

5.2 Host interface

The transmitter has a single 4-20mA current output channel, configurable with linear over-range from 3.5 to 23 mA. Within the 4 to 20 mA range, a 30 point pressure table can be used to make non-linear pressure-to-current output. This current output channel supports HART Communication on the HART version of the transmitter.
The error output current, to be used in case of transmitter error, is fully configurable in the range 3.5 to 23 mA.

	Direction	Values (% of range)	Values (mA or V)
Linear over-range	Down	-3.13% to -0.01%	3.50 to 3.99 mA
	Up	100.01% to 118.75%	20.01 to 23.00 mA
Device malfunction indication	Fixed value	-3.13% to 118.75%	3.50 to 23.00 mA
Maximum current		118.75%	23.0 mA
Multi-Drop current draw			4.0 mA
Lift-off voltage			10.0 V

5.2.1 Analog Output: Process pressure

The two-wire 4-20mA pressure loop current output is connected on two terminals marked "Supply" (+/-). Refer to the Operating instructions for detail on connecting the device.
The output current corresponds to the transmitter's Primary Variable, which is the device variable for pressure. HART Communication is supported on this current loop output.

5.3 Local Interfaces

5.3.1 Local Controls and Displays

This device can be attached to a DFON display, providing local in-situ measurement readout and configuration possibilities. A DFON display is connected with the provided flat ribbon cable provided with the display unit. FlexProgram configuration is also possible on the two Com. terminals 1 and 2. A PC and a Baumer FlexProgrammer 9701 must be used for this. Standalone configuration with the FlexProgrammer is also possible, using the FlexProgrammer 9701 as a vessel for configuration data.
Please refer to the Operating instructions manual for more information.

6 Device Variables

This Field Device does not expose any Device Variables.

DV No.	Name	Description	Unit codes	Classification code
0, 246	Pressure PV	Process Pressure	2 "Hg 5 mmHg 6 psi 7 bar 8 mbar 10 kg/cm^2 12 kPa 14 atm 177 $´H_20$	65 Pressure

			237 MPa 238 “H_20 239 mmH_20 241 mH_20 *(dev. spec.)*	
1, 247	Temperature SV	Cell temperature	32 ^0C 33 ^0F	64 Temperature
3, 244	Percent of Range	Output in % of full scale	57 %	0 Not Class’d
4, 245	Loop Current	Loop Current associated with Device Variable 0, representing process pressure	39 mA	84 Current

Only Pressure (PV) and Temperature (SV) allow changing of unit codes.
The different H_20 column units are defined at 4 ^0C.
NOTE: Device specific unit code mH_20 is used instead of HCF common table unit code for mH_20.

7 Dynamic Variables

Two Dynamic Variables are implemented.

Dyn var.	Meaning	Unit codes
PV	Pressure	2 “Hg 5 mmHg 6 psi 7 bar 8 mbar 10 kg/cm^2 12 kPa 14 atm 177 ´H_20 237 MPa 238 “H_20 239 mmH_20 241 mH_20 (dev. spec.)
SV	Temperature	32 ^0C 33 ^0F

8 Status Information

8.1 Device Status

The Field Device Status byte is contained in the second data byte in messages from the device. The following table defines the meaning of the different status bits.

Bit	Definition	Description
7	Device Malfunction	Is set if an electronic defect or memory defect is detected.
6	Configuration Changed	Is set if a HART command results in writing new data to a configuration register. The bit is set no matter if the value written is changed or identical to the already stored value.
5	Cold Start	Is set upon restart. It is reset for each master after responding to the first command from that specific master.
4	More Status Available	NOT USED
3	Loop Current Fixed	This bit is set if device is running with fixed loop current, eg. in Fixed Current Mode (Command 40) or if Loop Current Signaling mode is turned off (e.g. in Multidrop Mode).
2	Loop Current Saturated	Is set if the loop current is capped by either the upper or lower current limits.
1	Non-Primary Variable Out of Limits	Is set if SV is high or low limited.
0	Primary Variable Out of Limits	Is set if PV is high or low limited.

8.2 Extended Device Status

Extended Device Status is returned along with Additional Device Status by HART Command 48. Two bits are supported in this device.

Bit	Definition	Description
3..7	NOT USED	
2	Critical Power Failure	Is set if the device detects that the power supply is not performing as expected.
1	Device Variable Alert	This bit is set if any Device Variable is simulated/fixed, or the environmental conditions are out of range. It will also be se if an electronic defect or memory defect is detected.
0	NOT USED	

8.3 Additional Device Status (Command #48)

Command #48 returns 14 bytes of data, with the following status information:

Byte	Bit	Definition	Description
0	Device Specific Error Status Flags		
	7-2	NOT USED	
	1	ADC Comm Error	Is set if ADC communication fails
	0	Wire Break	Is set if wire break is detected
1	Device Specific 0		
	7-0	NOT USED	
2	Device Specific 1		
	7-0	NOT USED	
3	Device Specific 2		
	7-0	NOT USED	

4	Device Specific 3		
	7-0	NOT USED	
5	Device Specific 4		
	7-0	NOT USED	
6	Extended Device Status		
	7-3	NOT USED	
	2	Critical Power Failure	See Extended Device Status
	1	Device Variable Alert	See Extended Device Status
	0	NOT USED	
7	NOT USED		
	7-0	NOT USED	
8	Standardized Status 0		
	7	NOT USED	
	6	Electronic Defect	Is set in case of wire break
	5	Environment Conditions out of Range	This bit is set if either ambient temperatures are out of range.
	4	Power Supply Conditions out of Range	Is set if the device detects that the power supply is not performing as expected.
	3	Watchdog Reset Executed	This bit is set in case of the watchdog resetting the device, in case of firmware running into a software dead-lock.
	2	Non-volatile Memory Defect	This bit is set if a problem with the system memory is detected.
	1	Device Variable Simulation Active	Is set if any device variable is being simulated, e.g. by in-factory system test.
	0	NOT USED	
9	Standardized Status 1		
	7-3	NOT USED	
	2	Event Notification Overflow	This bit is set if the internal processor becomes overworked, not able to execute all tasks given within the allowed time.
	1	Discrete Variable Simulation	Is set if any device variable is being simulated, e.g. by in-factory system test.
	0	Simulation Active	Is set if any device variable is being simulated, e.g. by in-factory system test.

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10	Analog Channel Saturated		
	7-2	NOT USED	
	1	Analog Channel 1	Is set if Analog Channel 1 is capped by either the upper or lower current limit.
	0	NOT USED	
11	Standardized Status 2		
	7-0	NOT USED	
12	Standardized Status 3		
	7-0	NOT USED	
13	Analog Channel Fixed		
	7-3	NOT USED	
	1	Analog Channel 1	Is set if Analog Channel 1 is fixed by either Fixed Current Mode (Command 40) or if Loop Current Signaling mode is turned off (e.g. in Multidrop Mode). It can also be caused by a running in-factory system test.
	0	NOT USED	

NOT USED bits are always set to 0.

These status bits are updated immediately before and immediatley after each command to the device is handled..

9 Universal Commands

9.1 Supported Universal Commands

All Universal Commands are mandatory and are supported. Following Universal Commands are implemented:

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 Configuration
8	Read Dynamic Variable Classifications
9	Read Device Variables with Status
11	Read Unique Identifier Associated With Tag
12	Read Message
13	Read Tag, Descriptor, Date
14	Read Primary Variable Transducer Information
15	Read Device 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
38	Reset Configuration Changed Flag
48	Read Additional Device Status

10 Special notes on Universal Commands

Command #3: Returns PV and SV. This totals in 14 data bytes.
Command #9: This command supports up to 4 device variables. This totals in up to 37 data bytes, including the time stamp.
If more than 4 device variables are requested, only the first 4 are returned, along with a warning.
Command #14: Transducer serial number is not supported. The units code for limits and minimum span is equal to that of the Primary Variable.
Command #15: Write protect is not implemented, and Write Protect Code is therefore always returned as “251” (None). The unit code for Primary Variable range values is the same as is used for the Primary Variable.

11 Common-Practice Commands

11.1 Supported Common Practice Commands

The following common-practice commands are implemented:

34	Write Primary Variable Damping Value
35	Write Primary Variable Range Values
36	Set Primary Variable Upper Range Value
37	Set Primary Variable Lower Range Value
38	Reset "Configuration Changed" Flag
40	Enter/Exit Fixed Current Mode
42	Perform Device Reset
43	Set Primary Variable Zero
44	Write Primary Variable Units
45	Trim Loop Current Zero
46	Trim Loop Current Gain
47	Write Primary Variable Transfer Function
48	Read Additional Device Status
50	Read Dynamic Variable Assignment
80	Read Device Variable Trim Points
81	Read Device Variable Trim Guidelines
82	Write Device Variable Trim Point
83	Reset Device Variable Trim Points

11.2 Special notes on Common Practice Commands

Command #45: Prior to issuing this command, the loop current must be fixed at exactly 4.000mA (set with command 40).
Command #46: Prior to issuing this command, the loop current must be fixed at exactly 20.000mA (set with command 40).
Command #48: Returns 14 bytes of data.
Command #80: This command can only be used on PV / Device Variable 0.
Command #81: This command can only be used on PV / Device Variable 0.
Command #82: This command can only be used on PV / Device Variable 0.
Command #83: This command can only be used on PV / Device Variable 0.

12 Pressure Family Commands

The following conductivity family commands are taken from the Pressure Family Specification revision 1.0, Draft L.
The upper byte of all the 16-bit command codes is set to 0x05 for Pressure Family Commands, and in theory there are command codes enough for 256 commands in the family, from 0x0500 to 0x05FF.

For details on the Pressure Family Commands, please refer to the Pressure Device Family Specification HCF_SPEC-160.5, available from the HART Communications Foundation.

12.1 Supported Pressure Family Commands

Implemented pressure family commands are as follows:

12.1.1 General Pressure Device Family Commands (Read)

1280	Read Pressure Status
1281	Read Capabilities
1282	Read Supported Status Mask
1283	Read Pressure Sensor Information
1284	Read Process Connection
1285	Read Associated Device Variables

12.2 Special notes on Pressure Family Commands

Command #1283: On the CombiPress™ PFMN / PFMH the returned Minimum Absolute Pressure represents the Lower Range of the sensor, while Maximum Static Pressure represents the Upper Range of the sensor.

13 Device-Specific Commands

The following device-specific commands are implemented:

Command 130 – Read Minimum And Maximum Measured Pressure Values
Command 131 – Reset Minimum And Maximum Measured Pressure Values
Command 132 – Read Output Current Mainiml and Maximum Limits
Command 133 – Write Output Current Mainiml and Maximum Limits
Command 134 – Read Sensor Offset And Gain
Command 135 – Write Sensor Offset And Gain
Command 138 – Read Table Value
Command 139 – Write Table Value
Command 140 – Read Product Data
Command 141 – Write Pressure And Temperature Unit
Command 142 – Read Current Output Range
Command 143 – Write Current Output Range
Command 144 – Read Error Current Output Value
Command 145 – Write Error Current Output Value

13.1 Command #130 – Read Minimum And Maximum Measure Pressure Values

This command returns the Minimum and Maximum measured pressure since startup/reset.
The values are of the currently selected unit.

Request data frame

Byte	Format	Description
-	-	No request bytes

Response data frame

Byte	Format	Description
0..3	float	Minimum Measured Value
4..7	float	Maximum Measured Value

13.2 Command #131 – Reset Minimum And Maximum Measure Pressure Values

This command resets the Minimum and Maximum measured pressure since startup/reset.

Request data frame

Byte	Format	Description
-	-	No request bytes

Response data frame

Byte	Format	Description
-	-	No response bytes

13.3 Command #132 – Read Output Current Minimum And Maximum Limits

This command returns the Minimum and Maximum limits for the output loop current.
The output will not go beyond this current.

Request data frame

Byte	Format	Description
-	-	No request bytes

Response data frame

Byte	Format	Description
0..3	float	Output Current Minimum Limit
4..7	float	Output Current Maximum Limit

13.4 Command #133 – Write Ouput Current Minimum And Maximum Limits

This command is used to setup the Minimum and Maximum limits for the output loop current.
The unit used is mA.

Request data frame

Byte	Format	Description
0..3	float	Output Current Minimum Limit
4..7	float	Output Current Maximum Limit

Response data frame

Byte	Format	Description
0..3	float	Output Current Minimum Limit
4..7	float	Output Current Maximum Limit

Command specific Response Codes

Code	Type	Description
10	Error	Current Minimum Limit Too Low
11	Error	Current Maximum Limit Too High
12	Error	Current Minimum Limit Is higher Than Current Maximum Limit
13	Error	Current Minimum Limit And Current Maximum Limit Are Both Out Of Range

13.5 Command #134 – Read Sensor Offset And Gain

This command is used read the sensor offset and gain values.

Request data frame

Byte	Format	Description
-	-	No request bytes

Response data frame

Byte	Format	Description
0..3	float	Sensor Offset Value
4..7	float	Sensor Gain Value

CombiPress™ PFMN / PFMH specific: The returned values represent gain factor and offset values for the PV. The offset is of the currently active PV unit. Default gain is 1 and offset is 0 bar.

13.6 Command #135 – Write Sensor Offset And Gain

This command is used to setup new values for the sensor offset and gain.

Request data frame

Byte	Format	Description
0..3	float	Sensor Offset Value
4..7	float	Sensor Gain Value

Response data frame

Byte	Format	Description
0..3	float	Sensor Offset Value
4..7	float	Sensor Gain Value

Command specific Response Codes

Code	Type	Description
9	Error	Offset Value Too High
10	Error	Offset Value Too Low
11	Error	Gain Value Too High
12	Error	Gain Value Too Low
13	Error	Offset And Gain Values Are Both Out Of Limits

CombiPress™ PFMN / PFMH specific:
The written values represent gain factor and offset values for the PV. The offset must be of the currently active PV unit. Default gain is 1 and offset is 0 bar.

13.7 Command #138 – Read Table Value

This command is used read values of the specified table point.
The table is used for linearization in the pressure to loop current output conversion. Each table point is comprised of a Pressure Value and an associated Loop Current Value. For pressure values in between two points on the table, the appropriate loop current value is linearly interpolated.

Request data frame

Byte	Format	Description
0	uint-8	Table Point Number

Response data frame

Byte	Format	Description
0	uint-8	Table Point Number
1	uint-8	Number Of Table Points
2..5	float	Table Point Pressure Value
6..9	float	Table Point Loop Current Value

CombiPress™ PFMN / PFMH specific:
The unit of the Loop Current Value is mA, while The Pressure value is of the currently selected pressure unit.
NOTE: In conformance with the FlexBar HRT (which is replaced by the CombiPress), table point numbers are in the range 1 through 30, and not 0 throught 29 which would be the most common notation.

13.8 Command #139 – Write Table Value

This command is used to write the specified table point. It also sets the number of table points.
The table is used for linearization in the pressure to loop current output conversion. Each table point is comprised of a Pressure Value and an associated Loop Current Value. For pressure values in between two points on the table, the appropriate loop current value is linearly interpolated.

Request data frame

Byte	Format	Description
0	uint-8	Table Point Number
1	uint-8	Number Of Table Points
2..5	float	Table Point Pressure Value
6..9	float	Table Point Loop Current Value

Response data frame

Byte	Format	Description
0	uint-8	Table Point Number
1	uint-8	Number Of Table Points
2..5	float	Table Point Pressure Value
6..9	float	Table Point Loop Current Value

CombiPress™ PFMN / PFMH specific:
The unit of the Loop Current Value is mA, while The Pressure value is of the currently selected pressure unit.
NOTE: In conformance with the FlexBar HRT (which is replaced by the CombiPress), table point numbers are in the range 1 through 30, and not 0 throught 29 which would be the most common notation.

13.9 Command #140 – Read Product Data

This command is used read Baumer specific product data. These are not necessarily connected to common values of the HART specification.

Request data frame

Byte	Format	Description
-	-	No request bytes

Response data frame

Byte	Format	Description
0	uint-8	Cell Type
1	uint-8	Features
2	uint-8	Process Connection Position
3	uint-8	Electrical Connection
4	uint-8	Nipple Type
5	uint-8	Nipple Material
6	uint-8	Coating
7	uint-8	Abs/Rel
8	uint-8	Safety
9	uint-8	Fill Material

13.10 Command #141 – Write Pressure And Temperature Unit

This command is used to setup both the pressure unit and the cell temperature unit at the same time.

Request data frame

Byte	Format	Description
0	uint-8	Pressure Unit (CT 2)
1	uint-8	Cell Temperature Unit (CT 2)

Response data frame

Byte	Format	Description
0	uint-8	Pressure Unit (CT 2)
1	uint-8	Cell Temperature Unit (CT 2)

13.11 Command #142 – Read Current Output Range

This command returns the current range of the Loop Current output in the unit of mA.

Request data frame

Byte	Format	Description
-	-	No request bytes

Response data frame

Byte	Format	Description
0..3	float	Loop Current Output at 0%
4..7	float	Loop Current Output at 100%

13.12 Command #143 – Write Current Output Range

This command sets up the current range of the Loop Current output in the unit of mA.

Request data frame

Byte	Format	Description
0..3	float	Loop Current Output at 0%
4..7	float	Loop Current Output at 100%

Response data frame

Byte	Format	Description
0..3	float	Loop Current Output at 0%
4..7	float	Loop Current Output at 100%

Command specific Response Codes

Code	Type	Description
10	Error	Loop Current At 0% Too Low
11	Error	Loop Current At 100% Too High
12	Error	Loop Current At 0% Is Higher Than Loop Current At 100%
13	Error	Loop Current At 0% And 100% Are Both Out Of Range

13.13 Command #144 – Read Error Current Output Value

This command returns the value of the Loop Current output used to indicate error conditions, in the unit of mA.

Request data frame

Byte	Format	Description
-	-	No request bytes

Response data frame

Byte	Format	Description
0..3	float	Loop Current Output at Error

13.14 Command #145 – Write Error Current Output Value

This command sets up the value of the Loop Current output used to indicate error conditions, in the unit of mA.

Request data frame

Byte	Format	Description
0..3	float	Loop Current Output at Error

Response data frame

Byte	Format	Description
0..3	float	Loop Current Output at Error

Command specific Response Codes

Code	Type	Description
10	Error	Error Loop Current Too Low
11	Error	Error Loop Current Too High

14 Pressure Family Device Specific Tables

14.1 Pressure Family Device Spec. Table 1 – Pressure Device Family Device Variable Status

Code	Description
0x01	Reserved
0x02	Reserved
0x04	Reserved
0x08	More Device Variable Status Available
0x30	Limit Status: 11 Constant (i.e. value cannot be changed by the process) 01 Low Limited (eg. A/D Converter has reached its lower limit) 10 High Limited (eg. A/D Converter has reached its upper limit) 00 Not Limited
0xC0	Process Data Quality Status: 11 Good 01 Poor accuracy (eg. value is beyond rated conductivity or hardware zoom, temperature out of range) 10 Manual / Fixed (eg. value is simulated or forced)

14.2 Pressure Family Device Specific Table 2 – Pressure Status 0

Code	Description
0x01	Pressure Sensor Break
0x02	Temperature Sensor Break
0x04	Static Pressure Sensor Break
0x08	Pressure Calibration Required
0x10	Pressure Operating Range Exceeded
0x20	Temperature Operating Range Exceeded
0x40	Statuc Pressure Operating Range Exceeded
0x80	Reserved

14.3 Pressure Family Device Specific Table 3 – Pressure Family Capabilities 0

Code	Description
0x01	Command 1287 – Read Min/Max Pressure Observation (NOT IMPLEMENTED)
0x02	Command 1288 – Read Min/Max Temperature Observation (NOT IMPLEMENTED)
0x04	Command 1289 – Read Min/Max Static Pressure Observation (NOT IMPLEMENTED)
0x08	Command 1286 – Read Optional Gasket Material Data (NOT IMPLEMENTED)
0x10	Command 1290 – Read Remote Seal Information (NOT IMPLEMENTED)
0x20	Command 1408 – Write Process Connection (NOT IMPLEMENTED)
0x40	Command 1409 – Write Optional Gasket Material Data (NOT IMPLEMENTED)
0x80	Command 1410 – Write Remote Seal Information (NOT IMPLEMENTED)

14.4 Pressure Family Device Specific Table 4 – Pressure Family Capabilities 1

Code	Description
0x01	Reserved
0x02	Reserved
0x04	Reserved
0x08	Reserved
0x10	Reserved
0x20	Reserved
0x40	Reserved
0x80	Reserved

15 Device Specific Tables

15.1 Cell Type Codes

Sensor Type codes

Code	Description
0x01	0.0 .. 0.345 bar
0x02	-1.0 .. 1.0 bar
0x03	-1.0 .. 5.0 bar
0x04	-1.0 .. 20.0 bar
0x05	-1.0 .. 34.0 bar
0x06	-1.0 .. 68.0 bar
0x07	-1.0 .. 400.0 bar
0x81	0.0 .. 5.0 psi
0x82	-15.0 .. 15.0 psi
0x83	-15.0 .. 70.0 psi
0x84	-15.0 .. 300.0 psi
0x85	-15.0 .. 500.0 psi
0x86	-15.0 .. 1000.0 psi
0x87	-15.0 .. 5800.0 psi

15.2 Features Codes

Features codes

Code	Description
0x41	4 .. 20mA 0.25%
0x43	4 .. 20mA + HART 0.25%
0x51	4 .. 20mA 0.10%
0x53	4 .. 20mA + HART 0.10%

15.3 Process Connection Position Codes

Process connection position codes

Code	Description
5	Bottom process connection
6	Rear process connection
Other	Not specified

15.4 Electrical Connection Codes

Electrical connection codes

Code	Description
0x11	M12, 5 pins, Plastic *(OBSOLETE)*
0x21	M12, 8 pins, Plastic *(OBSOLETE)*
0x31	Cable gland, M16, Plastic
0x13	M12, 5 pins, AISI 304
0x23	M12, 8 pins, AISI 304
0x33	Cable gland, M16, AISI 304

15.5 Nipple Type Codes

Nipple type codes

Code	Description
41	G½" A flush DIN3852
44	G1" flush cone
48	G½" Hygienic
49	½" NPT
50	DN38 3A Hygienic Connection, 3A
51	DN38 ISO 2852 / TriClamp 1½", 3A
54	DN51 ISO 2852 Clamp, 3A
56	DN76 Hygienic Connection, 3A
61	DN40/125 GEA Tuchenhagen Varivent
71	G½" A flush DIN3852, cooling neck
74	G1" flush cone, cooling neck
80	DN38 3A Hygienic Connection, 3A, cooling neck
81	DN38 ISO 2852 / TriClamp 1½", 3A, cooling neck
84	DN51 ISO 2852 Clamp, 3A, cooling neck
99	Other

15.6 Nipple Material Codes

Nipple material codes

Code	Description
3	Hastelloy C
19	Stainless Steel 316L
252	Unknown

15.7 Coating Codes

Coating codes

Code	Description
1	Standard diaphragm surface coating

15.8 Abs/Rel Codes

Absolute / relative pressure type codes

Code	Description
1	Relative
2	Absolute

15.9 Safety Codes

Safety codes

Code	Description
1	Relative
2	Absolute

15.10 Fill Material Codes

Fill material codes

Code	Description
1	Silicon oil
2	FDA approved white oil

15.11 Unit Codes

Subset of HART Common Table 2, Unit Codes (with added PFMx specific unit code for mH_2O)
Pressure Unit Codes

Code	Description
2	“Hg
5	mmHg
6	psi
7	bar
8	mbar
10	kg/cm^2
12	kPa
14	atm
177	´H_20
237	MPa
238	“H_20
239	mmH_20
241	mH_20 (dev. spec.)

Other Unit Codes

Code	Description
32	ºC
33	ºF
39	mA
57	%

16 Performance

16.1 Sampling Rates

Typical sampling rates are shown in the following table.

Sensor	Sampling rate
Pressure	At least 5 times per second
Temperature	At least 5 times per second

16.2 Power-Up

On power up, the transmitter runs through a startup initialization procedure, which takes approximately 2 seconds. During this period, the device will not be able to respond to HART commands, and the analog output is set at 3.5mA.
The first stable measurements are ready in less than 5 seconds, allowing valid Device Variable readouts. Fixed-current mode is cancelled upon startup / reset.

16.3 Reset

Command 42 - Perform Device Reset causes the device to reset its microprocessor. The resulting restart is identical to the normal power up sequence.

16.4 Self-Test

The CombiPress™ PFMN/PFMH does not support command 41 – Self Test. Self-testing is performed periodically during normal operation.

16.5 Command Response Times

HART command response time depends on the command number issued and the internal state of the device. If write commands result in writing in non-volatile memory, the response is sent upon completion of the write, causing a small delay of up to 140ms.

Generalization	Response times
Minimum	5ms
Typical	15ms
Maximum	160ms

16.6 Busy and Delayed-Response

Delayed-response is not used.

16.7 Long Messages

The largest data field used is in the response to Command 9, where up to 36 bytes (not including the two status bytes) are returned. Total length of data field is then 38 bytes. However, Command 9 can be used with much data less bytes if needed.
Command 20, 21, and 22 all use command lengths of 32, containing the Long tag, and are thereby use the largest static data field size.

16.8 Non-Volatile Memory

Built-in flash memory of the micro controller is used to hold user configuration. New data is written to this memory immediately on execution of a write command, before the response is sent. If the new data to be written is identical to the data already stored, the write is performed again. Care must be taken when continuously writing data to the device, as it will wear out the non-volatile memory.

16.9 Modes

Fixed current mode is implemented, using Command 40. This mode is cleared at startup or reset.

16.10 Burst Mode

This Field Device does not support Burst Mode.

16.11 Write Protection

This Field Device does not support Write Protect.

16.12 Catch Device Variable

This Field Device does not support Catch Device Variable.

16.13 Damping

Damping is implemented on the PV output current value. It therefore only affects the output, and not the input. This means that the PV value read digitally via HART, or by other means, is not affected by the damping!

ANNEX A. CAPABILITY CHECKLIST

Manufacturer, model and revision	Baumer CombiPress™ PFMN/PFMH HART
Device type	2-wire Pressure Transmitter
HART revision	7.4
Device Description available	Yes
Number and type of sensors	One internal pressure sensor One internal temperature sensor
Number and type of actuators	None
Number and type of host side signals	One 4 – 20 mA analog output w/ HART
Number of Device Variables	4
Number of Dynamic Variables	2
Mapable Dynamic Variables?	No
Number of common-practice commands	18
Number of device-specific commands	14
Bytes of additional device status	14
Alternative operating modes?	No
Burst mode?	No
Write-protection?	No

ANNEX B. DEFAULT CONFIGURATION

Parameter	Default value
Poll Address	0
Loop Current Signaling Mode	Enabled
Pressure at 100%	CELL SPECIFIC
Pressure at 0%	CELL SPECIFIC
Linearization table	Disabled
Loop Current at 100%	20 mA
Loop Current at 0%	4 mA
Error Current	3.5 mA
Damping	0 sec

NOTE: By default, all strings are cleared (all space characters)

ANNEX C. REVISION HISTORY

A1. 2015-10-07 First Revision 1.0

Document created.