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In accordance with

- WELMEC 8.8: 2017 “General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments under the MID”.
- WELMEC 7.2: 2018 “Software Guide”
- OIML R117-1:2019 “Dynamic measuring systems for liquids other than water”.
- OIML R81:1998 “Dynamic measuring devices and systems for cryogenic liquids”.

Producer

Endress+Hauser Flowtec AG  
Kägenstrasse 7  
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Switzerland

Part

A **flow transmitter** (calculating/indicating device for Endress+Hauser Coriolis meters), intended to be used as a part of a measuring instrument.  
Producers mark or name : Endress+Hauser Flowtec AG  
Designation : Promass z00<sup>[1]</sup>  
Accuracy class : 0,3 / 0,5 / 1,0 / 1,5 / 2,5

Further properties and test results are described in the annexes:

- Description TC10822 revision 15.
- Documentation folder TC10822-4.

Initially issued

22 December 2016

Remarks

- This revision replaces the previous revisions.
- The documentation folder is not changed.

**[1]** With z being 3 or 5.

Issuing Authority

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## 1 General information on the flow transmitter

Properties of the flow transmitter, whether mentioned or not, shall not conflict with the legislation.

This Evaluation Certificate is the positive result of the applied voluntary, modular approach, for a component of a measuring instrument, as described in WELMEC guide 8.8.

The complete measuring instrument must be covered by relevant metrological certification that is valid in the country where the instrument is put into use.

This Evaluation Certificate is valid for the Endress+Hauser flow transmitter, as described in paragraph 1.1 of the description and may only be used in combination with Coriolis measurement sensors manufactured by Endress+Hauser Flowtec AG:

- That are covered by an Evaluation Certificate.
- Directly mentioned in the relevant metrological certification of the complete measuring system.

### 1.1 Essential parts

#### 1.1.1 Hardware-components

Description	Documentation number	Remarks
<b>Power Supply</b>		
100 – 240 V AC / 50/60 Hz	10822/0-02; 10822/0-03; 10822/2-05; 10822/2-06	-
24 V DC	10822/0-04; 10822/0-05; 10822/2-07; 10822/2-08	-
100 – 240 V AC / 50/60 Hz; 24 V DC	10822/0-06; 10822/0-07; 10822/2-09; 10822/2-10 10822/8-01; 10822/8-02	-
<b>Amplifier</b>		
For Exi Zone 1 Standard	10822/0-08; 10822/0-09; 10822/2-11; 10822/2-12	
For Exi Zone 1 IIC – 200 °C	10822/0-10; 10822/0-11; 10822/2-13; 10822/2/14	
For Zone 2 (non-ex)	10822/0-12; 10822/0-13; 10822/2-15; 10822/2-16	
For Exd Zone 1 standard	10822/0-14; 10822/0-15; 10822/2-17; 10822/2-18	
For Exd Zone 1 IIC – 200 °C	10822/0-16; 10822/0-17; 10822/2-19; 10822/2-20	
<b>CPU Modem (type C300)</b>		
For Exi hart devices	10822/0-18; 10822/0-19	I/O 1 = Exi current output + Hart
For Non-Ex Hart devices	10822/0-20; 10822/0-21	I/O 1 = Current output + Hart
For Modbus devices	10822/0-22; 10822/0-23	I/O 1 = Modbus

Description	Documentation number	Remarks
<b>CPU Modem (type C303)</b>		
For Exi hart devices	10822/8-03; 10822/8-04	I/O 1 = Current output (passive) + Hart
	10822/8-05; 10822/8-06	I/O 1 = Current output (active) + Hart
For Non-Ex Hart devices	10822/8-07; 10822/8-08	I/O 1 = Current output + Hart
For Modbus devices	10822/8-09; 10822/8-10	I/O 1 = Modbus
<b>I/O Modules</b>		
Multi I/O module Non-Ex	10822/0-24; 10822/0-25; 10822/2-27; 10822/2-28	Frequency, pulse, status in/out, current in/out
Multi I/O module Ex	10822/0-26; 10822/0-27	
Double pulse	10822/0-28; 10822/0-29	Pulse
Status output	10822/2-29; 10822/2-30	Relay module
<b>Display module</b>		
Promass 300; Promass 500 analog	10822/0-30; 10822/0-31	Integrated in flow transmitter or remote (external) module
Promass 500 digital	10822/2-31; 10822/2-32	
<b>WLAN Display module</b>		
Promass 300; Promass 500 analog	10822/2-33; 10822/2-34	Integrated in flow transmitter or remote (external) module
Promass 500 digital	10822/2-35; 10822/2-36	
<b>Terminal boards Promass 300 and Promass 500 analog</b>		
Terminal board	10822/0-32; 10822/0-33	For Ex devices
Terminal board	10822/0-34; 10822/0-35; 10822/2-37; 10822/2-38	For Non-Ex devices
Terminal board	10822/0-36	Used at remote display module
<b>Terminal boards Promass 500 digital</b>		
Terminal board	10822/2-39; 10822/2-40	For Ex-d devices
<b>Connection boards</b>		
Promass 500 analog	10822/2-41; 10822/2-42	Sensor side
Promass 500 analog	10822/2-43; 10822/2-44	Transmitter side
Promass 500 digital	10822/2-45; 10822/2-46	Sensor side; Ex-i version
Promass 500 digital	10822/2-47; 10822/2-48	Transmitter side; Ex-i version
Promass 500 digital	10822/2-49; 10822/2-50	Sensor side; non-Ex version
Promass 500 digital	10822/2-51; 10822/2-52	Transmitter side; non-Ex version
Promass 300 Promass 500 analog	10822/13-01; 10822/13-02; 10822/13-03	Amplifier connector, for details see chapter 1.3.3.

Description	Documentation number	Remarks
<b>Back plane</b>		
For Ex devices	10822/0-37; 10822/0-38	-
For non Ex devices	10822/0-39; 10822/0-40	-

## 1.1.2 Inputs (sensor side)

From the connected Coriolis sensor, the Promass z00 receives:

- Two pick-off signals for each tube pair; analogue mV signals from which the mass flow and density are determined.
- One two-wire Pt-1000 temperature transmitter for each tube pair for the measurement of the tube temperature.
- One two-wire Pt-1000 temperature transmitter for the measurement of the carrier tube temperature.  
Please note that these temperatures shall not be used for Custody Transfer related purposes, but only for the correction given above.

## 1.1.3 Outputs (sensor side)

The Promass z00 uses an alternating current to set the sensor's measurement tubes in a vibrating motion. The frequency of the vibration is automatically adjusted to the resonant frequency of the measurement tubes. This output is referred to as:

- Drive current output.

## 1.1.4 Input/output (electronic calculator/indicating device)

The Promass z00 can be equipped (depending on the configuration) with the following Custody Transfer outputs:

- Double, 90° or 180° phase shifted pulse-output for the transmission of volume- or mass-information. Phase shift is selectable.
- 4 – 20 mA output for the transmission of density. Other information can also be transmitted via this output (for example flow rate), but this information is not W&M approved.
- Hart protocol (digital) which is superimposed on the current output. This option is only possible if I/O number 1 is current output. The Hart protocol can be used for input and/or output simultaneously.  
Note: Hart protocol parameters (Hart address, tag, message, etc.) must be sealed by choosing locking status "all parameter", see chapter 1.2.9 for details.
- 4 – 20 mA input for the transmission of product temperature. The (external) temperature is used for automatic correction of the temperature influence on the fluid expansion properties.
- 4 – 20 mA input for the transmission of product pressure. The pressure is used for automatic correction of the pressure influence on the connected measurement sensor and for the correction of the pressure influence on the fluid expansion properties.

Note: Alternative input for product temperature and pressure can be Modbus or Hart protocol.

- Status input or status output (depending on version)
- Modbus RS485 serial protocol. Data transmission is safe guarded with CRC checksum over the data package. If the Modbus protocol is used for the transmission of the legally W&M relevant data, the dual pulse output is optional.

- Multi I/O, single pulse/frequency output for the transmission of mass, volume, or density.  
Note: The single pulse/frequency output parameter is sealed by choosing locking status: "all parameter", see chapter 1.2.9.  
The pulse/frequency security is guaranteed by checking against Modbus registry of volume/mass.

## 1.2 Essential characteristics

### 1.2.1 Temperature range ambient

- -40 °C / +55 °C
- -10 °C / +55 °C (if display is primary indication)

### 1.2.2 Environment classes: M3 / E2 / H3

### 1.2.3 Software specification (refer to WELMEC 7.2 "Software Guide"):

- Software type P
- Risk Class C
- Extensions T and I-5 apply
- Software-versions

Version numbers	Checksum		Version numbers	Checksum	
	(Modbus)	(Hart)		(Modbus)	(Hart)
01.00.02	0xE87F	0x321F	01.02.00	0x5645	-
01.00.03	0x79B5	0x1585	01.02.01	0x559B	-
01.00.04	0xE109	0xB075	01.02.02	0x0A92	-
01.01.01	0xA476	0x977D	01.02.03	0xECE3	-
01.01.02	0x2AAB	0xED44	01.05.00	0xA9EE	0xB4A1
01.01.03	0x6A37	0x86FC	01.05.01	0x2B95	0x59D4
01.01.04	0x6D79	0x674	01.05.02	0xF1B7	0xE6B5
01.01.05	0x4670	0x559B	01.05.03	-	0xD79D
01.01.06	-	0x0891	01.06.00	0x8894	0x4BDD
01.01.07	-	0xB7B2	01.06.01	0x58FD	0x9BB4

The software version and checksum can be verified on the display via menu items:

- Software version, menus Diagnostics – Device Info – Firmware Version or webserver
- Software version, menus Operation – Custody Transfer – Firmware version from software version 01.01.01 onwards.
- Checksum, menus Operation – Custody Transfer – Checksum

Note the software version includes the software of all modules mentioned in paragraph 1.1.

Alternative method is via Modbus registers 7277 (software version) and 6117 (checksum).

### 1.2.4 Minimum Measured Quantity (MMQ)

The MMQ is not smaller than the largest of the following values:

- The minimum measured quantity of the connected sensor
- n times the scale interval of the display
- n times the scale interval of the display of the connected additional electronic calculating/indicating device, if applicable

- n times the scale interval of the printer, if applicable  
Please note that the scale interval of the printer may not be smaller than the scale interval of the display.

Where n is given in the table below:

Accuracy Class	0,3	0,5	1,0	1,5	2,5
n	334	200	100	66	100

The MMQ is rounded up to the nearest value of  $1 \cdot 10^n$ ;  $2 \cdot 10^n$ ; or  $5 \cdot 10^n$ , with n being a whole number (positive or negative or zero).

## 1.2.5 Conversion to reference conditions

The liquid temperature and, if needed, pressure must be measured with external sensors. It is not allowed to use the temperature probe of the connected measurement sensor.

### 1.2.5.1 Conversion of hydrocarbon products

From software version 01.01.01, the Promass z00 has the possibility to calculate the density and volume under reference conditions as specified in API Manual of Petroleum Measurement Standards, Chapter 11, Physical Properties Data, Section 1 and 2(2007) (also known as ASTM D1250-07). The following conversion methods are possible:

- API tables 53/54A, 53/54B, 53/54C, 53/54D and 53/54E, with 15 °C as reference temperature.
- API tables 59/60A, 59/60B, 59/60C, 59/60D and 59/60E, with 20 °C as reference temperature.
- API tables 5/6A, 5/6B, 5/6C and 5/6D, with 60 F as reference temperature.
- API tabled 23/24A, 23/24B, 23/24C, 23/224D and 23/24E, with 60 F as reference temperature.
- A programmable alternative reference temperature and pressure (stored behind a seal) is valid for any of the above listed API tables.

### 1.2.5.2 Conversion of Asphalt

From software version 01.06.00, the Promass z00 has the possibility to calculate the density and volume under reference conditions for asphalt products as specified in ASTM D4311/D4311M-15. The user has to select if the A or B table of the standard is used, this setting is stored behind seal.

## 1.2.6 Concentration measurement

From software version 01.05.00, the Promass z00 has the possibility to calculate the concentration of the following products:

### 1.2.6.1 Water / ethanol mixtures according OIML R22, using the revised formula of Bettin-Spieweck OIML IST-90 (modification of R22 formula to the ITS-90 temperature scale).

The following quantities can be calculated:

- %Mass
- ABV value (%Vol at a fixed reference temperature of 20 °C)

In addition to OIML R22:

- %Vol of ethanol at actual temperature
- %StdVol of ethanol at a programmable reference temperature
- Mass of pure ethanol
- Volume of pure ethanol at a programmable reference temperature

Note: The calculations are valid for the concentration range of 0 ... 100% and a temperature range of -20 ... +40 °C.

- 1.2.6.2 Water / sugar mixtures according ICUMSA<sup>[1]</sup> norm SPS-4 (1998) for:
- Sucrose
  - Glucose
  - Fructose
  - Invert sugar

The following quantities can be indicated:

- %Mass (also known as °Brix or °Bx for sucrose)
- SGU (Specific Gravity).

Note: The calculations are valid for the concentration range of 0 ... 100% and a temperature range of 0 ... +80 °C.

1.2.7 Heartbeat verification

Can be used in Custody Transfer mode, as it has no influence on the measurement accuracy. With heartbeat enabled, the transmitter collects and stores data about the meter's behaviour for evaluation.

1.2.8 Reset of totalizer 3

Totalizer 3 of the Promass z00 can be reset to zero when the device is under legal control. For this feature, the low flow cut off must be enabled (see Annex 1 for more information on the low flow cut off settings).

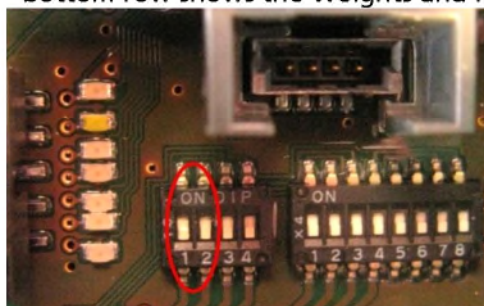
When the actual flow is below low flow cut off, the totalizer can be reset via display, web server, Modbus, or status input. When the actual flow is above low flow cut off, the totalizer is sealed and cannot be reset.

1.2.9 Custody Transfer parameters

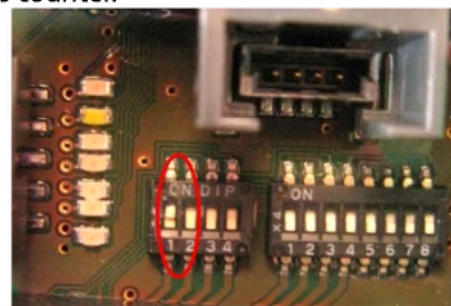
The Custody Transfer parameters and the mandatory settings are mentioned in Annex 1.

For securing the Weights and Measures parameters:

- Go to menu Operation - Custody transfer - choose the locking status: defined parameter (locks W & Measures parameters) or all parameter (locks W&M and non-legally relevant parameters). if locked, a parameter cannot be modified by whatever means (via the menu systems or via remote control)
- Go to menu Setup – Advanced setup – Cust.trans. act.
- Login with authorized user login and password and complete all other settings (date and time)
- Turn off the power to the flow transmitter.
- Set dipswitch number 2 to ON.
- Turn the power on and after restart the lock symbol (🔒) is shown on the display and the bottom row shows the Weights and Measures counter.



Security disabled



Security enabled (parameters protected)

[1] ICUMSA = International Commission for Uniform Methods of Sugar Analysis.

**Note:**

For software versions before 01.05.00, the power down step in the procedure has to be skipped. If not skipped, the procedure is aborted and not completed.

An alternative method is to set dipswitch number 1 to ON; this secures all parameters against changing. The lock symbol (🔒) is shown on the display.

- 1.2.10 The flow transmitter may only be used in combination with an approved flow computer<sup>[1]</sup> if the transmitter is going to be used at temperatures below -10 °C. The transmitter operates normally below this temperature, only the display is unreadable at temperatures below -20 °C.

### 1.3 Essential shapes

1.3.1 Inscriptions of the Promass z00

- At least the inscription "10822" is placed on the housing(s) of the Promass z00
- Identification of the measurement sensor
- Serial number
- In case of a remote version: the serial number of the measurement sensor is inscribed on the Promass 500 and/or the serial number of the Promass 500 is inscribed on the measurement sensor.

See documentation number 10822/8-11 for an example of the markings.

1.3.2 Housing variants

- Promass 300  
The transmitter is mounted on top of the measurement sensor. Optionally equipped with a remote display.
- Promass 500  
The transmitter is mounted remotely of the measurement sensor. There are two possibilities:
  - Analog version where the amplifier board is mounted inside the transmitter. The cable between sensor and transmitter carries analogue signals.
  - Digital version where the amplifier board is mounted on top of the measurement sensor. The cable between transmitter and amplifier board carries digital (Modbus) communication.

1.3.3 Flow transmitter with two amplifier boards

If the flow transmitter is connected to a Promass Q sensor, sizes DN150, DN200 and DN250, there are two identical amplifier boards present working in a master – slave set-up. A dedicated connection board is used for the internal interconnection of the master and slave amplifiers.

Notes:

- The use of a master and slave amplifier is only possible with software version 01.06.00 or higher.
- This configuration is not possible for the Promass 500 digital.
- An extended (higher) neck is used to accommodate the two amplifiers and the connection board. See documentation number 10822/13-04.

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[1] The flow computer must have an Evaluation or Parts Certificate issued by a recognised Notified Body under Annex MI-005 (MID 2004/22/EC) or Annex VII (MID 2014/32/EU) or directly mentioned in relevant metrological certification of the complete measuring system.



#### 1.3.4 Status of the device

In case an electronic calculator/indicating device is connected to the Promass z00, the Promass' status is sent to the connected device in one of the following ways:

- The Promass' status output is connected directly to the flow computer
- The Promass' status output interrupts one of the pulse-channels, thus enabling the flow computer to detect a pulse failure and consequently generate an alarm. If necessary, an extra electrical board is added to prevent this action short-circuiting the Promass z00.
- The current output is set to failure current (minimum or maximum value is possible), thus enabling the flow computer to detect the failure.
- The Promass' pulse output is set to maximum pulse rate for one channel and to no pulses for the other pulse channel. This will trigger the pulse security checking of the connected electronic calculator/ indicating device.
- The Promass' status information is available via Modbus.  
In all cases the status of the device must be configured so, that the alarm conditions "Failure" and "Empty Pipe" are sent to the connected device.

1.3.5 Cabling, all cables shall be shielded, and the shielding shall be connected on both sides.

### 1.4 Conditional parts

#### 1.4.1 Keyboard

The keyboard consists of three keys of which their function depends on the menu and selected item. The keyboard is part of the LCD display. If the display is not present, the keyboard is also not present.

#### 1.4.2 Housing

Inside the housing of the Promass, the essential and the conditional parts are mounted. Access can be obtained through sealable lids.

See documentation numbers 10822/0-01 and 10822/2-01 ... 10822/2-04 for the assembly of the parts inside the housing.

- Compact, explosion proof, directly mounted on the measurement sensor.  
Optionally the display is mounted in a separate housing. The communication with the display is via Modbus, maximum cable length is 300 m.
- Remote  
The remote versions are connected to the sensor by means of a cable with a maximum length of 300 m depending on the version.

### 1.5 Conditional shapes

- Blinding of Promass display  
If an electronic calculator/indicating device (flow computer) is connected to the Promass z00, the display (when present) of the Promass z00 may be blinded. The display is still present and functioning, only it is not possible to read the display.

## 2 Seals

The following seals are applied:

After setting the security switch in the secured position and verification that the lock symbol (🔒) is shown on the display, all lids are sealed against opening. See documentation number 10822/8-12.

### **3 Conditions for conformity assessment**

- Verify the parameters settings mentioned in Annex 1 for correct settings and where applicable if the setting is in accordance with the calibration data.
- Other parties may use this Evaluation Certificate only with the written permission of the producer.

### **4 Reports**

An overview of the performed tests is given in Evaluation Report ER10822 revision 15 issued together with this Evaluation Certificate.

## A1. Mandatory parameter settings:

General settings for all parameters (where applicable):

Mass unit: t, kg, or g  
 Mass flow unit: Metrical (for example kg/min)  
 Volume unit: m<sup>3</sup>; dm<sup>3</sup>; cm<sup>3</sup>; L or ml  
 Volume flow unit: Metrical (for example m<sup>3</sup>/h)  
 Density unit: Metrical (for example kg/m<sup>3</sup>)  
 Temperature unit: °C or K  
 Pressure unit: Metrical unit  
 Simulation modes: Shall be disabled

Menu	Sub Menu	Sub sub menu	Parameter	Value	
-			Display Language	Local language (preferred); English	
Operation			Locking Status	CT act.; CT act.-def.par.	
			Custody transfer lock	Defined parameter or all parameter	
Setup	Curr.output <sup>(1)</sup>		Medium selection	Liquid	
			Assign current output	Density	
			0/4 mA value	See note (2)	
	Double pulse output <sup>(1)</sup>			20 mA value	
				Signal mode	Passive or active
				Assign pulse output	Mass flow, volume flow or corrected volume flow
				Value per pulse	See note (3)
				Pulse width	See note (4)
	Relay <sup>(1)</sup>			Phase shift	See note (4)
				Diagnostic behaviour	Alarm, see note (5)
	PFS output <sup>(1)</sup>			Operating mode	Switch, see note (5)
				Diagnostic behaviour	Alarm, see note (5)
				operating mode	Pulse
				Assign pulse output	Mass flow / Volume flow / corrected volume flow
				Value per pulse	See note (6)
				Pulse wide	See note (4)

Menu	Sub Menu	Sub sub menu	Parameter	Value	
Setup	PFS Output		failure mode		
			operating mode	Frequency	
			Assign pulse output	Mass flow / Volume flow / corrected volume flow	
			Min / Max frequency value		
			Value at min / max frequency		
			failure mode		
	Current input <sup>(1)</sup>		Assign	Either temperature or pressure input	
			0/4 mA value	Shall match current settings of the external device.	
			20 mA value		
	Status input <sup>(1)</sup>		Assign status input	Reset totaliser 3	
	Low flow cut off		Assign variable	Mass flow or volume flow	
			On value	See note (7)	
			Off value	See note (8)	
	Partial pipe det		Assign variable	Density	
			Low value	See note (9)	
			High value		
	Advanced setup	Totaliser n	Operation mode	See note (10)	
			Failure mode	Actual value	
	Expert	System	Diagnostic handling	Alarm delay	0
		Sensor	Process parameter	Flow damping	In accordance with the calibration data.
Density damping					
Temp. damping					
	Sensor adjustment	Install direct.	Correct installation direction shall be selected.		

Menu	Sub Menu	Sub sub menu	Parameter	Value
Expert	Sensor	Process variable adjustment	Mass flow offset	See note (11)
			Mass flow factor	See note (12)
			Volume flow offset	See note (11)
			Volume flow factor	See note (12)
			Density offset	See note (13)
			Density factor	See note (13)
		External compensation <sup>(1)</sup>	Pressure correction	Current input / External value (shall match to external device)
			Temperature correction	Current input / External value (shall match to external device)
		Calibration	Cal.factor	According to calibration data
			Nominal diameter	Correct size
			C0 ... C5	According to calibration data.

Notes to the mandatory parameter settings:

- (1) If the I/O is available and used as custody transfer relevant I/O.
- (2) The settings in the flow computer shall match the settings in the flow transmitter.
- (3) The settings shall be such that the maximum pulse frequency of 1000 Hz is not exceeded.
- (4) The value shall be such that the pulses can still be processed by the connected flow computer.
- (5) When used for the status of the device.
- (6) The setting shall be such that the pulse frequency lies in the range of 2 ... 10 000 Hz.
- (7) Value at which the low flow cut off is enabled (pulse output stopped)
- (8) Value at which the low flow cut off is disabled (pulsed started). Is given as a percentage in respect of the On value.  

$$\text{actual value} = \text{On value} \times (1 + \text{Off value}/100).$$
 If the actual flow rate is higher than 20% of the minimum flow rate of the (complete) measuring system, pulses must be generated by the flow transmitter.
- (9) Values shall be explained during conformity assessment
- (10) At least one of the totalisers must be in accordance with the calibration data.
- (11) If the mass or volume flow offset is not zero, the value shall be explained during the conformity assessment for the impact on the measurement performance. These parameters are not intended for a correction of the zero-flow rate.
- (12) If the mass/volume flow factor is not 1 the actual value shall be explained during the conformity assessment for the impact on the measurement performance.
- (13) If the density offset and density factor are not 0 resp. 1, the actual value shall be explained during the conformity assessment.