

Issued by	NMi Certin B.V.
In accordance with	<ul style="list-style-type: none">– WELMEC 8.8:2017 "General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments under the MID".– OIML R117-1:2007 "Dynamic measuring systems for liquids other than water".– OIML R117:2019 "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 4153 Reinach Switzerland
Part	<p>A measurement sensor (Coriolis sensor) intended to be used as a part of a measuring instrument.</p> <p>Producer's mark or name : Endress+Hauser Flowtec AG</p> <p>Type designation : Promass 84 y DNx^[1]; Promass y z00 DNx^[1]</p> <p>Accuracy class : See chapter 1.2 of the description</p> <p>Destined for the measurement of : See chapter 1.2 of the description</p> <p>Further properties and test results are described in the annexes: – Description TC7149 revision 21; – Documentation folder TC7149-8.</p>
Initially issued	26 April 2007
Remarks	<ul style="list-style-type: none">– This revision replaces the previous revisions.– The documentation folder is not changed.– The measurement sensor is approved for measuring mass. Some versions are also approved for measuring density and volume. See chapter 1.2 of the description for details.

[1] With y denoting the mechanical variant and x denoting the size of the meter (diameter of the in- and outlet in mm) z denoting the type of transmitter.

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1 General information about the measurement sensor

Properties of this measurement sensor, 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 8.8:2017.

The complete measuring system 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 sensors, as described in chapter 1.2 of the description and may only be used in combination with the electronics/indication mentioned in chapter 1.1 under "Calculating and indicating device".

1.1 Essential parts

1.1.1 Measurement sensor

Essentially, the measurement sensor consists of a housing in which the one, two or four parallel measuring tubes (depends on sensor type, see chapter 1.3) are mounted. The measurement tube(s) is (are) set into a vibrating motion by a drive coil, which is controlled by means of an alternating current generated by the calculating/indicating device. Also mounted on the measurement tube(s) are two or four measuring coils, which generate signals representative of the frequency of the measurement tube(s). The frequency is representative for the density of the liquid. The time shift between the two signals is representative of the mass flow rate. By knowing the mass flow rate and the density, the volume flow rate can be calculated.

1.1.2 Sensor variants

The measurement sensor can be built in seven mechanical variants:

- Promass A, with a single curved tube. See documentation number 7149-A-1.
- Promass F with two curved tubes. See documentation numbers 7149-F/M-1 and 7149-F-2.
- Promass O with two curved tubes. See documentation number 7149-O-1.
- Promass Q with two or four curved tubes. See documentation numbers 7149-Q-1 and 7149-Q-2.
- Promass E, with two curved tubes. See documentation number 7149-E-1.
- Promass M, with two straight tubes. See documentation number 7149-F/M-1.
- Promass X, with four curved tubes. See documentation number 7149-X-1.

Examples of the various meter models are given below:



Promass F



Promass O



Promass X



Promass E



Promass Q, with two tubes



Promass Q, with four tubes



Promass M



Promass A

1.1.3

Calculating and indicating device

- Promass 84, see Evaluation Certificate TC7151
 The Promass 84 transmitter is intended for all measurement sensors mentioned in chapter 1.2 except for Promass Q.
- Promass z00, see Evaluation Certificate TC10822
 The Promass z00 transmitter is intended for all measurement sensors mentioned in chapter 1.2, except for Promass E, Promass A and Promass M.
- The Promass Q sizes DN150, DN200 and DN250 cannot be used in combination with the Promass 500 digital flow transmitter.

- 1.1.4 Powered by battery of a vehicle
 Environmental class E3 is approved for
- Promass 84 without DC-DC convertor
 - Promass z00 in combination with DC-DC convertor type Orion-TR 24 / 24 – 5A by Victron Orion. This installation is an interruptible system and shall be always used in combination with a MID approved flow computer which is also certified for class E3.

1.2 Essential characteristics

1.2.1 Measurement application^[1]

Sensor Type	Promass Transmitter		Oil and oil products, chemicals, and potable liquids	Liquefied gases under pressure $\geq -10^{\circ}\text{C}$ (i.a. LPG, LCO ₂ ^[2])	Liquefied gases below -10°C (i.a. cryogenic liquids, LNG, LCO ₂)
	84	z00			
	Accuracy class			0.3; 0.5	1.0
Promass F	+	+	M D V	M D V	M
Promass O	+	+	M D V	M D V	M
Promass X	+	+	M D V	M D V	M
Promass Q	-	+	M D V	M D V	M
Promass E	+	-	M D V	M D V ^[3]	-
Promass A	+	-	M D V	-	-
Promass M	+	-	M	-	-

The measurement sensor has the following characteristics:

1.2.1.1 Promass F sensors

Meter size	DN8	DN15	DN25	DN40	DN50	
Qmin [kg/min] Acc. Class 1.0; 1.5 & 2.5	0,75	2,5	7,5	18,75	29,15	
Qmin [kg/min] Acc. Class 0.3 & 0.5	1,5	5	15	37,5	58,3	
Qmax [kg/min]	30	100	300	700	1000	
MMQ [kg]	2	5	20	20	20	

^[2] Indicates approved measurements: **M** for Mass, **D** for Density and **V** for Volume.

^[3] Liquefied CO₂ (LCO₂) is approved for mass only.

^[8] Basic measurement is volume.

Meter size	DN80	DN100	DN150	DN250		
Qmin [t/h] Acc. Class 1.0; 1.5 & 2.5	4,5	7	16	45		
Qmin [t/h] Acc. Class 0.3 & 0.5	9	14	32	90		
Qmax [t/h]	180	270	720	2200		
MMQ [kg]	200	200	500	1000		

1.2.1.2 Promass O sensors

Meter size	DN80	DN100	DN150	DN250		
Qmin [t/h] Acc. Class 1.0; 1.5 & 2.5	4,5	7	16	45		
Qmin [t/h] Acc. Class 0.3 & 0.5	9	14	32	90		
Qmax [t/h]	180	270	720	2200		
MMQ [kg]	200	200	500	1000		

1.2.1.3 Promass X sensors

Meter size	DN350					
Qmin [t/h] Acc. Class 1.0; 1.5 & 2.5	68,5					
Qmin [t/h] Acc. Class 0.3 & 0.5	137					
Qmax [t/h]	3500					
MMQ [kg]	1000					

1.2.1.4 Promass Q sensors

Meter size	DN25	DN50	DN80	DN100	DN150	DN200
Qmin [t/h] Acc. Class 1.0; 1.5 & 2.5	0,225	1	3	7	8	12
Qmin [t/h] Acc. Class 0.3 & 0.5	0,45	2	6	14	16	24
Qmax [t/h]	20	80	200	400	850	1500
MMQ [kg]	10	20	100	200	200	200

Meter size	DN250					
Qmin [t/h] Acc. Class 1.0; 1.5 & 2.5	25					
Qmin [t/h] Acc. Class 0.3 & 0.5	50					
Qmax [t/h]	2400					
MMQ [kg]	500					

1.2.1.5 **Promass E sensors**, accuracy class 0.3 and 0.5

Meter size	DN8	DN15	DN25	DN40		
Qmin [kg/min]	3,3	10,8	30	75		
Qmax [kg/min]	36	130	330	600		
MMQ [kg]	2	5	20	50		

1.2.1.6 **Promass E sensors**, accuracy class 1.0

Meter size	DN8	DN15	DN25	DN40		
Qmin [L/min]	0,8	2,4	3	6		
Qmax [L/min]	36	130	320	600		
MMQ [L]	2	5	20	20		

1.2.1.7 **Promass A sensors**

Meter size	DN2	DN4				
Qmin [kg/min]	0,1	0,4				
Qmax [kg/min]	2	8				
MMQ [kg]	0,05	0,2				

1.2.1.8 **Promass M sensors**

Meter size	DN8	DN15	DN25	DN40	DN50	DN80
Qmin [kg/min]	1,5	5	15	37,5	50	150
Qmax [kg/min]	30	100	300	700	1000	3000
MMQ [kg]	2	5	20	50	50	200

1.2.1.9 Further characteristics:

- In case of volume measurement: the minimum and maximum volume flow rate is equal to the mass flow rate divided by the liquid density. The MMQ on volume is equal to the MMQ on mass divided by the liquid density.

- In case of mass measurement for the Promass E on liquefied gases: the minimum and maximum mass flow rate is equal to the volume flow rate multiplied with the liquid density. The MMQ on mass is equal to the MMQ on volume multiplied with the liquid density.

1.2.2 Bi-directional flow

All sensors can be used to measure flow in forward and reverse directions. See also the conditions as stated in chapter 3.

1.2.3 Product range (density and/or viscosity)

- Product density:
 - Between 300 kg/m³ and 1400 kg/m³ for mass measurement.
 - Between 400 kg/m³ and 1400 kg/m³ for volume and density measurement.
- Maximum viscosity 1000 mPa·s.

1.2.4 Maximum operating pressure

- Promass O: 258 bar(g)
- All other types: 100 bar(g)

1.2.5 Temperature range liquid

The temperature range for the liquid is given in the table below. If the cell is grey, that type of measurement is not approved for legal use.

Product temperature range in °C						
Accuracy class		0,3	0,5	1,0	1,5	2,5
Promass type	Measurement					
F	Mass	-10 ... +200			-200 ... +90	
	Density & Volume	-10 ... +90				
O	Mass	-10 ... +200			-40 ... +90 ⁽¹⁾	
	Density & Volume	-10 ... +90				
X	Mass	-10 ... +180			-50 ... +90	
	Density & Volume	-10 ... +90				
Q	Mass	-10 ... +200			-200 ... +90	
	Density & Volume	-10 ... +200				
E	Mass	-10 ... +90				
	Density & Volume	-10 ... +90				
A	Mass	-10 ... +90				
	Density & Volume	-10 ... +90				
M	Mass	-10 ... +90				
	Density & Volume					

Notes:

- (1) Product temperature range for measuring liquefied CO₂ (LCO₂).

- 1.2.6 Temperature range ambient: -40 °C ... +55 °C
- 1.2.7 Environment classes:
- M3 / E3 / H3 when using the Promass 84 flow transmitter
- M3 / E2 + E3 / H3 when using the Promass z00 flow transmitter
- 1.2.8 Power supply
The measurement sensor is powered via the transmitter. See the applicable Evaluation Certificate of the calculating and indicating device mentioned in chapter 1.1.3.
- 1.2.9 Pressure correction
- Depending on the sensor characteristics, a dynamic pressure correction by means of pressure transmitter is required when the pressure variation in the final application has an effect of more than the significant fault for that application.
- When the sensor is calibrated at another average pressure than the average pressure in the final application, the corresponding pressure effect due to the pressure difference has to be considered.
When the pressure effect is more than the significant fault, then a static pressure correction (configured in electronics) is required.
- The pressure correction values are mentioned in documentation number 7149 - Press -6.
- 1.2.10 Temperature correction
In the flow transmitter a temperature correction is applied depending on the connected sensor type.

Temperature correction for the sensor behaviour due to process temperature variations takes automatically place by default, based on the integral temperature sensor and the configured temperature coefficients in the electronics.
- 1.2.11 Outputs
The calculating and indicating device is capable of indicating and/or transmitting several quantities. Use for Weights and Measures related purposes is allowed for the following quantities:
- Mass

and/or for the Promass F, Promass O, Promass Q, Promass X, Promass A and Promass E sensors
- Volume
- Density

The output(s) that can be used for legally relevant data are given in the applicable Evaluation Certificate of the calculating and indicating device mentioned in chapter 1.1.3. The calibration requirements are given in chapter 1.2.1.
- 1.2.12 Parameter settings
The mandatory parameter settings are given in the applicable Evaluation Certificate of the calculating and indicating device mentioned in chapter 1.1.3
- 1.2.13 Vapour return meter
The Promass F, X and Q versions can also be used in the vapour return line as a vapour return meter, to measure and compensate for the mass of gas (boil-off gas) returned from the receiving tank. This application of the measurement sensor is only allowed for liquefied gases under pressure (accuracy class 1.0) and for cryogenic products (accuracy classes 1.5 and 2.5).
- 1.3 Essential shapes**
- 1.3.1 Inscriptions
On the measurement sensor, clearly visible, at least the following is inscribed:
- Evaluation Certificate number TC7149.

- Name or trademark of the producer.
- Type designation.
- Serial number and year of manufacture.

1.4 Conditional characteristics

1.4.1 Alarm handling

Alarm handling is performed by the calculating and indicating device. See the applicable Evaluation Certificate of the calculating and indicating device mentioned in chapter 1.1.3.

2 Seals

- The inscriptions are fixed to the measurement sensor, for example on a nameplate.
- The connection box of the measurement sensor, only present in case of a Promass 500 transmitter, is sealed against opening.

3 Conditions for conformity assessment

- Other parties may use this Evaluation Certificate only with the written permission of the producer.
- If the measurement sensor is applied in a measuring instrument:
 - If the measurement sensor is used bi-directional, the verification in one direction is sufficient.
- Verification procedure
 - Before putting into use the measurement sensor has to be calibrated on the product it is going to measure at operating temperature and pressure (if possible). This calibration can be performed on site or at a test place. In the latter case the relevant parameter settings have to be registered and checked at the initial verification on site. If a measurement sensor is intended to be used with multiple liquids without adjustments, the sensor has to be calibrated on all applicable liquids with identical parameter settings, while the accuracy requirements are met for all products.
 - **Alternative verification procedure CPC-EH-01** for putting certain types of Promass sensors into use based on a water calibration only:

Important note: this alternative procedure is only valid for the following sensors:

- Liquids in accuracy class 0.3 and 0.5:
 - ♦ Promass F and Promass O, sizes DN80, DN100, DN150, DN250
 - ♦ Promass Q, sizes DN25, DN50, DN80, DN100, DN150, DN200, DN250
 - ♦ Promass X, size DN350
- Liquids in accuracy class 1.0:
 - ♦ Promass F, sizes DN8, DN15, DN25, DN40; DN50, DN80, DN100, DN150, DN250
 - ♦ Promass O, sizes DN80, DN100, DN150, DN250
 - ♦ Promass Q, sizes DN25, DN50, DN80, DN100, DN150, DN200, DN250
 - ♦ Promass X, size DN350
- Liquids in accuracy classes 1.5 and 2.5 (Cryogenic products, LNG and liquid CO₂):
 - ♦ Promass F, sizes DN8, DN15, DN25, DN40; DN50, DN80, DN100, DN150, DN250
 - ♦ Promass O, sizes DN80, DN100, DN150 and DN250 for liquid CO₂ only.
 - ♦ Promass Q, sizes DN25, DN50, DN80, DN100, DN150, DN200, DN250
 - ♦ Promass X, size DN350 for liquid CO₂ only.

Alternative verification procedure for mass measurement (all liquids which comply with the fluid properties as mentioned in chapters 1.2.3 and 1.2.5):

The Promass sensor can be calibrated on water only, according to procedure CPC-EH-01. This procedure is justified because of the fact that tests have proven that the mass accuracy on water is transferable to mass accuracy on other liquids. If the measurement sensor is also used to measure the density and/or the volume, a standard density calibration is sufficient.

See procedure number CPC-EH-01, §3.1. This procedure is justified because tests have proven that the standard density calibration is representative for other liquids.

During the calibration on water the Weights and Measures parameters regarding the measurement performance must be laid down. Correct settings shall be verified during the conformity assessment modules D, F or G.

4 Reports

An overview of the performed tests is given in Evaluation Report ER7149 revision 21 issued together with this Evaluation Certificate.