TYPE APPROVAL CERTIFICATE

N. ELE379616CS

This is to certify that the product below is found to be in compliance with the applicable requirements of the RINA type approval system.

Description	**Coriolis flowmeter**
Type	**Proline Promass E / F 100**
Applicant	**Endress + Hauser Italia S.p.A.** **Via Fratelli Di Dio, 7** **20063 Cernusco s/N (MI)** **Italy**
Manufacturer	**Endress + Hauser Flowtec AG** **Kaegenstrasse, 7** **CH-4153 Reinach BL1** **Switzerland**
Testing Standard	**Rules for the Classification of Ships - Part C - Machinery, Systems and Fire protection - Ch.3, Sect.6, Tab.1.**

Issued in **Genova, March 1st, 2017**

This certificate is valid until **March 1st, 2022**

RINA Services S.p.A.

Valerio Bonanni

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Application:

- Measuring principle operates independently of physical fluid properties such as viscosity or density
- Highest measurement performance for liquids and gases under varying, demanding process conditions

Measuring Principle:

The measuring principle is based on the controlled generation of Coriolis forces. These forces are always present in a system when both translational and rotational movements are superimposed. The amplitude of the Coriolis force depends on the moving mass Δm, its velocity v in the system and thus on the mass flow. Instead of a constant rotational velocity ω, the sensor uses oscillation. In the sensor, two parallel measuring tubes containing flowing fluid oscillate in antiphase, acting like a tuning fork. The Coriolis forces produced at the measuring tubes cause a phase shift in the tube oscillations. The phase difference increases with increasing mass flow. Electrodynamic sensors register the tube oscillations at the inlet and outlet. System balance is ensured by the antiphase oscillation of the two measuring tubes.

Measuring system:

The device consists of a transmitter, and a sensor.

Transmitter: Promass 100
Sensor: Promass F: Flange nominal diameter range DN 8 to 250 mm (3/8" to 10")
Sensor: Promass E: Flange nominal diameter range DN 8 to 80 mm (3/8" to 3")

Device architecture:

Possibilities for integrating measuring devices into a system

Control system (e.g. PLC)
EtherNet/IP
PROFIBUS DP
Modbus RS485
4-20 mA HART, pulse/frequency/switch output
Modbus RS485(*)
Non-hazardous area
Non-hazardous area and Zone 2/Div. 2
Intrinsically safe area and Zone 1/Div. 1

(*) *Safety barrier to be Type Approved model*

Software Versions:

EtherNet/IP	Sw. 1.02.xx
Modbus	Sw. 1.03.xx
HART	Sw. 1.01.xx

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Input

Direct measured variable: • Mass flow • Density • Temperature

Calculated measured variables: • Volume flow • Corrected volume flow • Reference density

Sensor **F**
Measuring range for liquids: DN 8 to 250 mm 0 to 2200000 kg / h
Measuring range for gases:
To calculate the real gas measuring range, Endress + Hauser Applicator sizing tool must be used.
To estimate the gas measuring range, use the formula mentioned into the datasheet as per "Calculation example for gas".

Sensor **E**
Measuring range for liquids: DN 8 to 80 mm 0 to 180000 kg / h
Measuring range for gases:
To calculate the real gas measuring range, Endress + Hauser Applicator sizing tool must be used.
To estimate the gas measuring range, use the formula mentioned into the datasheet as per "Calculation example for gas".

Output

- **Current output:** 4-20 mA HART (active)

Maximum output values: DC 24 V (no flow) • 22.5 mA

Load: 0 to 700 Ω

Assignable measured variables: • Mass flow • Volume flow • Corrected volume flow • Density
• Reference density •Temperature

- **Pulse/frequency/switch output**

Function: can be set to pulse, frequency or switch output

Version: passive , open collector

Maximum input values: • DC 30 V, • 25mA

- **Pulse output**
Pulse width: adjustable 0,05 to 2000 ms
Max pulse rate: 10000 impulse /s
Pulse value: adjustable
Assignable measured variables: • Mass flow • Volume flow • Corrected volume flow

- **Frequency output**
Output frequency: adjustable 0 to 10000 Hz
Pulse / pause ratio: 1:1
Assigned measured variables: • Mass flow • Volume flow • Corrected volume flow • Density
• Reference density • Temperature

- **Switch output**
Switching behavior: Binary, conductive or not conductive
Switching delay- adjustable: 0 to 100 s
Number of switching cycles: unlimited
Assignable functions: • Off, • On, • Diagnostic behavior
• Limit value: - Mass flow, - Volume flow, - Corrected volume flow, - Density
- Reference density, - Temperature, - Totalizer 1-3
• Flow direction monitoring
• Status: – Partially filled pipe detection , – Low flow cut off

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PROFIBUS DP
Power supply: 24Vdc
Signal encoding: NRZ code
Data transfer: 9.6 kBaud … 12 MBaud

Modbus RS 485
Power supply: 24Vdc
Physical interface: in accordance with EIA /TIA- 485-A standard
Terminating resistor: • For device version used in non-hazardous areas or Zone 2/Div. 2: integrated and can be activated via DIP switches on the transmitter electronics module

EtherNet/ IP
Power supply: 24Vdc
Standard: in accordance with IEEE 802.3

- **Signal on alarm:** Depending on the interface , failure information is displayed as follows

***Current output**: 4-20 mA*
Failure mode Selectable (as per NAMUR recommendation NE 43):
• Minimum value: 3.6 mA , • Maximum value: 22 mA, • Defined value: 3.59 to 22.5 mA, • Actual value, • Last valid value

HART
Device diagnostics: Device condition can be read out via HART Command 48

Pulse/Frequency/Switch output

Pulse output:	Failure mode Choose from:	• Actual value, • No pulses
Frequency output:	Failure mode Choose from:	• Actual value, • Defined value: 0 to 12 500 Hz, • 0 Hz
Switch output:	Failure mode Choose from:	• Current status, • Open, • Closed

PROFIBUS DP
Status and alarm messages: Diagnostics in accordance with PROFIBUS PA Profile 3.02

Modbus RS485
Failure mode Choose from: • NaN value instead of current value, Last valid value

EtherNet/IP
Device diagnostics: Device condition can be read out in Input Assembly

Local display
Plain text display: With information on cause and remedial measures
Backlight: Red backlighting indicates a device error

Light emitting diodes (LED)
Status information Status indicated by various light emitting diodes
The following information is displayed depending on the device version:
• Supply voltage active
• Data transmission active
• Device alarm/error has occurred
• EtherNet/IP network available
• EtherNet/IP connection established

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Galvanic isolation:

The following connections are galvanically isolated from each other:
• Outputs
• Power supply

Maximum measured error o.r. = of reading; 1 g/cm³ = 1 kg/l; T = medium temperature

Base accuracy
Mass flow and volume flow (liquids)
±0.05 % o.r. (PremiumCal, for mass flow)
±0.10 %
Mass flow (gases)
±0.35 % o.r.

Accuracy of outputs (o.r. = of reading; o.f.s. = of full scale value)

The output accuracy must be factored into the measured error if analog outputs are used, but can be ignored for fieldbus outputs (e.g. Modbus RS485, EtherNet/IP).
Current output: Accuracy Max. ±0.05 % o.f.s. or ±5 µA
Pulse/frequency output: Accuracy Max. ±50 ppm.

Repeatability o.r. = of reading; 1 g/cm3 = 1 kg/l; T = medium temperature
Base repeatability

Mass flow and volume flow (liquids)

±0.025 % o.r. (PremiumCal, for mass flow)
±0.05 % o.r.

Mass flow (gases)
±0.25 % o.r.
Density (liquids)
±0.00025 g/cm3
Temperature
±0.25 °C ± 0.0025 · T °C (±0.45 °F±0.0015 · (T–32) °F)

Degree of protection
Transmitter and sensor : • As standard: IP66/67

Process:

Medium temperature range
Sensor **F** : –50 to +150 °C
Sensor **E** : –50 to +140 °C

Density 0 to 5 000 kg/m3 (0 to 312 lb/cf)

Promass E100 Specification

Brief Operating Instructions: doc.code KA01115D
Operating Instructions: BA01167D (HART), BA01248D (PROFIBUS DP) , BA01056D (ModbusRS485), BA01064D (EtherNet/IP)

Promass F100 Specification

Brief Operating Instructions: doc.code KA01116D
Operating Instructions: BA01168D (HART), BA01249D (PROFIBUS DP) , BA01057D (ModbusRS485), BA01065D (EtherNet/IP)

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Test Reports:
Paconsult reports n. 14-5875 – Climatic / Vibrations (18/05/2014)
n. 14-5891b – Salt mist (07/01/2015)
MessTechnikNordGmbH reports: n. 07295.183.14 V1.1 - EMC (02/09/2014)
Endress + Hauser Standard calibration reports: eg. 3014798881, 3014799152, 3008798574, 3023422321
Sira Certificates: n. 51G24572labA (18/10/2011), R26637A/00 (04/ 2012), R28599A/00 (01/2013)

EC-Type Examination

Equipment and protective systems intended for use in potentially explosive atmospheres – Directive 94/9/EC

Equipment:	**Mass Flow Measuring System Proline Promass A/E/F/G/H/I/P/S/O/X 100 and Cubemass C100**
Certification Authority:	**DEKRA Certification B.V. (The Netherlands)**
EC- type Examination Certificate:	**DEKRA 12ATEX0148 Issue number : 4**

Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 60079-0:2012 + A11	**General requirements**
EN 60079-11:2012	**protection by intrinsic safety "I"**
EN 60079-26:2007	**with equipment protection level (EPL) Ga**
EN 60079-31:2014	**dust ignition protection by enclosure "t"**

The marking of the equipment shall include the following:

II (1) G [Ex ia Ga] IIC
II 2 G Ex ia IIC T6…T1Gb or Ex ia IIB T6… T1 Gb
II 1/2 Ex Ia IICT6…T1Ga/Gb or Ex ia IIB T6…T1 Ga/Gb
II 2 D Ex tb IIIC Txx °C Db

General remarks
Installation and use to be in accordance with the manufacturer instructions.

For each equipment, before delivery on board, accuracy test Certificate to be provided, based on accredited calibration rigs that are traced to ISO 17025.