EC type-examination Certificate

Number **T10020** revision 11
Project number SO16201099

Issued by	NMi Certin B.V., designated and notified by the Netherlands to perform tasks with respect to conformity modules mentioned in article 9 of Directive 2004/22/EC, after having established that the Measuring instrument meets the applicable requirements of Directive 2004/22/EC, to:
Manufacturer	Emerson Process Management Flow B.V. Neonstraat 1 6718 WX Ede The Netherlands
Measuring instrument	A **Coriolis Gas Meter**

Brand	:	Micro Motion
Type	:	CMFxxxy (see paragraph 1.2 for the meaning of xxxy), CNG050 and DS600, with MVD electronics (see paragraph 1.1 for details)
Destined for the measurement of	:	fuel gases, with an actual density of 4 kg/m^3 and higher, and supercritical ethylene with a density up to 450 kg/m^3
Minimum – Maximum flowrate (Q_{min} - Q_{max})	:	see paragraph 1.2 of the description
Accuracy class	:	Class 1,0
Environment classes	:	M3 / E3
Temperature range gas	:	-40 °C / +150 °C for CMF200/300/350/400/HC2/HC3/HC4/DS600; -10 °C / +50 °C for CMF025/050/100; -25 °C / +55 °C for CNG050.
Ambient temperature range	:	-40 °C / +55 °C

Further properties are described in the annexes:
– Description T10020 revision 11;
– Documentation folder T10020-10.

Valid until	8 May 2017
Remarks	This revision replaces the previous versions, including the documentation folder.
Issuing Authority	**NMi Certin B.V., Notified Body number 0122** 8 April 2016

C. Oosterman
Head Certification Board

NMi Certin B.V.
Hugo de Grootplein 1
3314 EG Dordrecht
The Netherlands
T +31 78 6332332
certin@nmi.nl
www.nmi.nl

INSPECTION
RvA I 122

1 General information about the gas meter

Properties of the gas meter, whether mentioned or not, shall not be in conflict with the legislation.

This EC type-examination certificate confirms that the involved equipment complies with the applicable essential requirements of the European directive 2004/22/EC (MID).

Beside the measurement of mass the coriolis meter is capable of measuring volume as well. However, only the measurement of mass is part of this EC type-examination Certificate.

1.1 Essential parts

Measurement sensor
Essentially, the measurement sensor consists of a housing in which two parallel measuring tubes are mounted. On the measurement tubes three coils are mounted: one drive-coil and two pick-off coils.

The drive coil is controlled by an external device and sets the measurement tubes in a vibrating motion. The pick-off coils generate signals representative for the frequency of motion of the measurement tubes.
The resonant frequency depends, among other things, on the density of the gas in the measurement tubes.
The time difference between the signals from both pick-off coils depends on the mass flow of the gas through the measurement tubes.
Processing of the measurement signals is performed by the same external device that controls the drive coil.

The different sensors are described in the documentation no. 10020/0-02, 10020/0-04, 10020/2-02 and 10020/8-01. The CMF400 sensor is produced including the changes mentioned in documentation no. 10020/0-05.

In- and outputs
The measurement sensor is equipped with several in- and outputs:
- Drive current input, for setting the measurement tubes in a vibrating motion
- 2 Pick-off outputs, generating sinusoidal millivolt signals
- One 3-wire Pt-100 output, for the measurement of the tube temperature

1.1.1 Core processor, model 700 or 800
The output of the sensor is processed by a core processor, model 700 or 800, as described in the Evaluation Certificate no. TC7057.
When a flow transmitter 5700 with integral core processor is used the core processors 700 or 800 are not applied.

1.1.2 Flow transmitter, model 1700 or 2700
A flow transmitter, model 1700 or 2700, is connected to the core processor. The flow transmitter is described in the Evaluation Certificate no. TC7057, but with the following aspects:
- markings as described in paragraph 1.3.2;
- only the indication of mass via the 'Total' and 'Inventory' registers is used for custody transfer purposes;
- indication as described in paragraph 1.5.1;
- settings as described in paragraph 1.5.2.

1.1.3 Flow transmitter, model 3500 or 3700
A flow transmitter, model 3500 or 3700, is connected to the core processor. The flow transmitter is described in the Evaluation Certificate no. TC7057, but with the following aspects:
- markings as described in paragraph 1.3.2;
- only the indication of mass via the 'Total' and 'Inventory' registers is used for custody transfer purposes;
- indication as described in paragraph 1.5.1;
- settings as described in paragraph 1.5.2.

1.1.4 Flow transmitter, model 5700
The flowtransmitter 5700 has two options. Either it uses an integral core processor, in which case it is connected directly to a flow sensor, or it is connected to a core processor, in which case it is not equipped with an integral core processor.
The flow transmitter is described in the Evaluation Certificate no. TC8519, but with the following aspects:
- markings as described in paragraph 1.3.2;
- only the indication of mass via the 'Total' and 'Inventory' registers is used for custody transfer purposes;
- indication as described in paragraph 1.5.1;
- settings as described in paragraph 1.5.2.

1.1.5 Pressure transducer, model 3051S (optional, see paragraph 1.2.3. when applicable)
A pressure transducer, model 3051S, can be connected to the flow transmitter. The pressure transducer is described in Parts Certificate no. TC7457.

1.1.6 Indicating device, model FloBoss S600 or S600+ (optional)
An indicating device, model FloBoss S600 or S600+, can be connected to the flow transmitter for the use of logging and printing. The indicating device is described in Parts Certificate no. TC8219, but with the following aspects:
- - a marking near the display stating "not legally relevant indication".

Remark:
When a flow transmitter 1700, 2700, 3500, 3700 or 5700 is equipped with an indication a flow computer is optional.

1.2 Essential characteristics

1.2.1 Flow characteristics
The meter has the following flow characteristics:

Model	Q_{max} [kg/h]	Q_t	Q_{min} [kg/h]	diameter in/outlet [mm]	maximum p_{max} [bar]		minimum actual density [kg/m³]
					A/M/L/S (y)	B/C/E/H/P/Y (y)	
CMF025 y)	19 x actual density [kg/m³]	≤ 1/5 Q_{max}	3	6	103	190	4
CMF050 y)	60 x actual density [kg/m³]		15	12	103	185	5
CMF100 y)	175 x actual density [kg/m³]		60	25	100	170	6,9
CMF200 y)	425 x actual density [kg/m³]		200	50	108	190	9,5
CMF300 y)	1.175 x actual density [kg/m³]		500	80	119	185	8,6
CMF350 M/L/H/P	1.940 x actual density [kg/m³]		1236	90	102	155	12,7
CMF350 A/B/C/E	1.940 x actual density [kg/m³]		2472	90	102	155	25,5
CMF400 y)	3.150 x actual density [kg/m³]		9.000	100	103	197*)	57,2
DS600 S	3.300 x actual density [kg/m³]		6.500	150	43	N/A	39,4
CNG050	4620		115	12	345		-
CMFHC2 y)	3.571 x actual density [kg/m³]		6.182	200	102	206	34,7
CMFHC3 y)	5.904 x actual density [kg/m³]		12.364	200	102	206	41,9
CMFHC4 y)	9.244 x actual density [kg/m³]		18.545	250	102	206	40,2

Remarks:
- *) with the exception to the value as indicated in the table the maximum pmax value of the CMF400P is 205 bar.
- y) Indicates the type of material the meter is build of.
- The Qmax is limited to a maximum speed of the flow in the sensor. The stated formula reflects the calculation of the value for Qmax based on the maximum speed, while using the actual density.
- If the meter is used in a specific density range, the minimum density is used to calculate the value for Qmax.
- Turn down ratio (Qmax to Qmin) □ 20:1.
- All sensors can be used bi-directional.

1.2.2 Volume indication at base conditions
For pure gases or gases with a (known) fixed composition mass can be converted to a volume at base conditions using a fixed density at base conditions. The applied fixed density and the base conditions are stated on the nameplate or close to the indicator, for example Nm^3 @ xx°C and yy bar(a) with zzzz kg/m^3.

1.2.3 Pressure correction, Temperature correction and Density correction

1.2.3.1 Pressure correction

A) 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 1/5 of the Maximum Permissible Error (MPE) for that application.

B) When the sensor is calibrated at another average pressure then the average pressure in the final application (e.g. water calibration at low pressure), the corresponding pressure effect due to the pressure difference has to be considered. When the pressure effect is more than 1/5 of the MPE, then a pressure correction is required, either static (configured in electronics) or dynamic (pressure transmitter).

C) The pressure coefficient values for the different sensors and the pressure values at which the correction has to take place for the different accuracy classes are mentioned in the documentation no. 10020/11-01.

1.2.3.2 Temperature correction

In the flow transmitter (see Evaluation Certificates TC7057 and TC8519) a temperature correction is applied depending on the connected sensor type, according to document no. 10020/11-02.

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.

The temperature dependency on mass flow is called mass Flow Temperature coefficient FT (in % per 100 °C).

1.2.3.3 Gas density based correction for velocity of sound influences

In the flow transmitter a gas density based correction can be applied depending on the connected sensor type, according to document no. 10020/11-03.

The velocity of sound influences the mass output of the Coriolis meters that have high operating frequencies and/or large tube diameters. Correction to the mass output takes place automatically by default, based on the measured density and the configured gas density compensation coefficients in the electronics.

1.3 Essential shapes

1.3.1 Nameplate sensor

The nameplate of the sensor is bearing at least, good legible, the following information:

- CE marking and the supplementary metrological marking;
- the type-examination mark no. T10020;
- name or trade mark of the manufacturer;
- sensor type;
- serial number and year of manufacture;
- accuracy class;
- Q_{max}, Q_t and Q_{min};
- temperature range of the sensor;
- density range and/or pressure range;
- indication of the flow direction;
- information concerning possible bi-directional use.

An example of the markings is shown in document no. 10020/4-07.

1.3.2 Nameplate flow transmitter
The nameplate of the flow transmitter is bearing at least, good legible, the following information:
- the type-examination mark no. T10020;
- name or trademark of the manufacturer;
- transmitter type;
- transmitter serial number;
- sensor type;
- sensor serial number;
- year of manufacture;
- ambient temperature range;
- the remark "Only the mass indication 'Total' is used for custody transfer." or "Only the mass indication 'Total / Inventory' is used for custody transfer."

An example of the markings is shown in document no. 10020/4-08.

1.3.3 Nameplate indicating device
The nameplate of the indicating device is according to the Parts Certificate no. TC8219.

1.3.4 Nameplate Pressure transducer
The nameplate of the pressure transducer is according to the Parts Certificate no. TC7457.

1.3.5 Sealing
See chapter 2.

1.4 Conditional parts

1.4.1 Housing
The gas meter has a housing, which has sufficient tensile strength.

1.4.2 Transmission
The transmission between the sensor and the flow transmitter is described in the Evaluation Certificates TC7057 and TC8519.

1.4.3 Outputs
The characteristics of frequency and/or current outputs is presented on the display.

1.4.4 Outputs for an external flow computer
An external flow computer can be connected to the flow transmitter, as indicated in the applicable Evaluation Certificates no. TC7057 or TC8519. In that case the flow computer is connected to the transmitter module, using the available outputs of the transmitter module. The flow computer has to be approved via an EC-type examination Certificate.

1.4.5 Uninterruptible Power Supply (UPS)
The gas meter is connected to the mains via an emergency power supply device, which is sufficient to guarantee safeguarding of all measuring functions for a period of at least three days

1.5 Conditional characteristics

1.5.1 Register

The measured quantity of gas is presented by the flow transmitter and/or indicating device in such a way, that the following conditions are fulfilled:

- the number of digits equals at least the quantity corresponding with 8.000 hours at the maximum flow rate;
- the least significant digit shall not exceed the quantity of gas passed during one hour at Q_{min}.

In documentation no. 10020/9-02 the method for programming of the flow transmitter is described.

1.5.2 Settings

The following items as stated in the applicable Evaluation Certificate no. TC7057 or TC8519, are programmed in the flow transmitter:

- security mode settings;
- low flow cut off settings;
- damping settings;
- slug flow settings;
- last measured value fault time out settings.

2 Seals

2.1 Sensor

The sensor is not provided with seals.

2.2 Flow transmitter

The flow transmitter is sealed according to the applicable Evaluation Certificate TC7057 or TC8519.

2.3 Indicating device

The indicating device is sealed according to the Parts Certificate no. TC8219.

2.4 Pressure transducer

The pressure transducer is sealed according to the Parts Certificate no. TC7457.

3 Conditions for conformity assessment

- Verification procedure

  For the initial verification the NMi procedure C-SP-HW-280 can be applied with the title 'Procedure C-SP-HW-280 for the MID conformity assessment for the Micro Motion Flow meter when used for custody transfer in gas applications (annex MI-002) and liquid applications (annex MI-005)'.

  The initial verification can be based on:

  - a water calibration, which includes:
    - a zero mass flow setting at the water calibration facility
    - a mass flow test
  - In the field:
    - a zero mass flow setting, if needed
    - a zero mass flow verification

  Note: a zero mass flow verification can also be used for subsequent verifications.

  If the measurement sensor is used bi-directional, the verification in one direction is sufficient.

  This procedure is justified because of the fact that tests have proven that the mass accuracy on water is representative for mass accuracy on gases.