

Issued by

NMi Certin B.V.

In accordance with

- WELMEC 8.8, 2017 "General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments under the MID".
- OIML R117-1 Edition 2007 (E) "Dynamic measuring systems for liquids other than water".
- OIML R81 Edition 1998 (E) "Dynamic measuring devices and systems for cryogenic liquids"

Producer

Endress+Hauser Flowtec AG  
Kägenstrasse 7  
CH-4153 Reinach  
Switzerland

Measuring instrument

A **measurement device** (Coriolis), intended to be used as a part of a measuring instrument.

Producer's mark or name : Endress+Hauser Flowtec AG

Type designation : LNGmass DNxx<sup>[1]</sup>

Accuracy class : 1.5 and 2.5

Destined for the measurement of : Cryogenic liquids (e.g. LNG) with a density between 300 and 1100 kg/m<sup>3</sup>.

- Further properties and test results are described in the annexes:
- Description TC8502 revision 5;
  - Documentation folder TC8502-1.

Remarks

- This revision replaces the previous revisions;
- The documentation folder is not changed.
- The LNGmass sensor is approved for measuring mass only.
- The LNGmass sensor is approved for measuring and compensating of the boil-off gas (BOG) in the vapour return line.

**[1]** With xx denoting the size of the meter (diameter of the in- and outlet in mm).

Issuing Authority

**NMi Certin B.V., Notified Body number 0122**  
17 June 2022

Certification Board

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## 1 General information on the measurement device

All properties of the measurement device, whether mentioned or not, shall not be in 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 instrument must be covered by relevant metrological certification that is valid in the country where the instrument is put into use.



Example of the measurement device

### 1.1 Essential parts

For the photograph and technical drawings of the complete measurement transducer see documentation number 8502/0-01 and 8502/0-02.

Description	Documentation	Remarks
Measurement sensor technical drawings	8502/0-02	The measurement sensor consists of a housing in which the two parallel measuring tubes are mounted. The measurement tubes are set into a vibrating motion by a drive coil, which is controlled by means of an alternating current generated by the measurement transducer. Two measuring coils are also mounted on the measurement tubes, which generate signals representative of the frequency of the measurement tubes. The frequency of the measurement tubes is representative for the density of the liquid. The time shift between the two signals is representative of the mass flow rate.

Description	Documentation	Remarks
Measurement transducer	8502/0-04 8502/0-05 8502/0-06 8502/0-07	The electronic module in the measurement transducer consists of an amplifier board and a connection board. The amplifier board drives the sensor and processes the measuring values. The connection or IO board is a simple connection board with some user interface functions. See documentation number 8502/0-04 up to and including 8502/0-07.

## 1.2 Essential characteristics

### 1.2.1 Measurement sensor

- Maximum pressure : 100 bar(g)
- Maximum viscosity : 2 mPa·s

#### LNGmass sensor

	DN08	DN15	DN25
- Qmax [kg/min]	30	100	300
- Qmin [kg/min]	1,5	5	15
- MMQ sensor [kg]	2	5	20

- The LNGmass is only approved for measuring mass.

### 1.2.2 Temperature range liquid: -200 °C / +55 °C

### 1.2.3 Temperature range ambient: -40 °C / +55 °C

### 1.2.4 Environment classes: M3 / E2 / H3; condensing humidity

### 1.2.5 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.

### 1.2.6 Outputs

The measurement device is capable of indicating several quantities.

For Weights and Measures / custody transfer purposes the following quantities is approved:

- Mass

The output is available as:

- Modbus RS485 serial communication.

### 1.2.7 Vapour recovery meter

LNGmass can be used as the measuring device in the main cryogenic liquid system or can also be used in the vapor return line, in order to measure and compensate for the mass of gas returned from the receiving tank.

## 1.2.8 Parameter settings

The legally relevant settings, which cannot be altered anymore after putting the device into Custody Transfer Mode (see documentation number 8502/0-03), are as follows:

Parameter	Register	Data type	Legally relevant settings
Device information			
Serial number	7003	String	Corresponding to the device.
Software version	7277	String	See paragraph 1.2.9.
CRC 32 checksum	20386	String	
Measured values and units			
Mass flow	2007	Float	Metrical units (example kg/min)
Mass flow unit	2101	Integer	
Mass unit	2102	Integer	One of the totalizer values shall be used for custody transfer and have the unit g, kg or t.
Totalizer value 1	2610	Float	
Totalizer value 1 unit	2602	Integer	
Totalizer value 2	2810	Float	
Totalizer value 2 unit	2802	Integer	
Totalizer value 3	3012	Float	
Totalizer value 3 unit	3002	Integer	
Low flow cut-off			
Assign process variable	5101	Integer	1 = Mass flow (Default)
On value	5138	Float	“Low-flow cut-off” features shall not be set at flow rates higher than 20 % of the application-defined minimum flow rate.
Off value	5104	Float	
Pressure shock suppression	5140	Float	
Partial filled pipe detection			
Assign process variable	5106	Integer	The parameters should be such that product densities outside the expected range (especially low density) are detected and generate an alarm.
Low value	5110	Float	
High value	5112	Float	
Response time	5108	Float	
Maximum damping	2414	Float	
Measurement mode and sensor adjustment			
Select medium	2442	Integer	0 = Liquid
Installation direction	5501	Integer	In accordance with calibration data 0 = Flow in arrow direction 1 = Flow against arrow direction
Mass flow offset	5521	Float	The parameters shall be set without any favour of any party.
Mass flow factor	5519	Float	

Parameter	Register	Data type	Legally relevant settings
Calibration parameters			
Nominal diameter	2048	String	In accordance with sensor size.
Calibration factor	7513	Float	In accordance with calibration data.
Zero point	7527	Float	
C0	7501	Float	
C1	7503	Float	
C2	7505	Float	
C3	7507	Float	
C4	7509	Float	
C5	7511	Float	
Correct operation (mainly actual diagnostic)			
Alarm delay	6808	Float	0 seconds
Actual diagnostics	2732	Integer	-
Timestamp	2719	String	-
Previous diagnostics	2734	Integer	-
Timestamp	2068	String	-
Operating time from restart	2624	String	-
Operating time	2631	String	-

- All parameter settings may be read out and displayed:
  - by the electronic calculating/indicating device connected to the LNGmass, or
  - for example via a computer temporarily connected to the LNGmass;
- The software version and belonging checksum of the LNGmass shall be displayed on the electronic calculating/indicating device by manual command.  
If this is technically not possible, the software version and checksum shall be inscribed on the LNGmass meter body.

## 1.2.9 Software specification (refer to WELMEC guide 7.2)

- Software type P;
- Risk Class C;
- Extensions T, while extensions L, D and S are not applicable.

The following software versions are approved:

Version	CRC32 checksum	Remarks
V1.03.01	0xF41E4DB9	Dated 14 May 2014
V1.03.02	0x54AE3887	Dated 1 July 2016
V1.03.03	0x87DFCB30	Dated 30 October 2017

## 1.3 Essential shapes

### 1.3.1 Inscriptions

On the nameplate of the measurement device, clearly visible, at least the following is inscribed:

- This Evaluation Certificate number: TC8502;
- The sensor designation (type);
- Manufacturers name and/or trademark;
- Serial number and year of manufacture.

### 1.3.2 EMI protection measures

- Grounding of the measurement device;
- Metal cable plugs for the measurement transducer;
- Shielded cables shall be used and grounding of the shielding.

## 1.4 Conditional parts

### 1.4.1 Power supply

- Voltage : 230 VAC
- Frequency : 50 ... 60 Hz

### 1.4.2 AC/DC converter

- Voltage input : 100 ... 230 VAC
- Frequency input : 50 ... 60 Hz
- Voltage output : 20 ... 30 VDC
- Power failure bypass : > 20 ms

The power unit shall be tested to ensure it meets safety requirements (e.g. PELV, SELV class 2) and must be connected to the Ex i barrier, see paragraph 1.4.3.

### 1.4.3 Ex i barrier

The Ex i barrier ensures the necessary galvanic isolation and the necessary energy limitation for intrinsic safety in the hazardous area.

- Voltage input : 20 ... 30 VDC
- Voltage output : 14 VDC

See documentation number 8502/0-08 and 8502/0-09.

### 1.4.4 EEPROM

The HistoROM S-DAT is a small EEPROM mounted in the sensor interface between sensor neck and electronic containing all sensor data as well as all data of the measuring point. So in case of electronic defect all data will be kept after electronic change.

## 1.5 Non-essential shapes

- The appearance of the data plate.

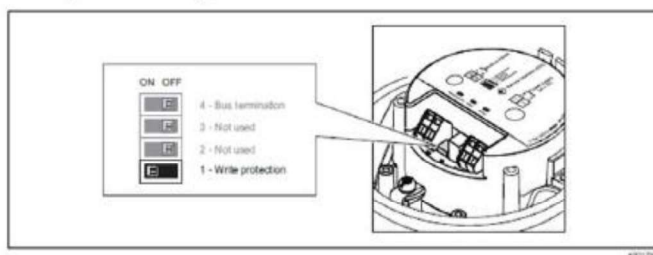
## 2 Seals

After setting the measurement device in Custody Transfer mode, the housing of the measurement transducer is sealed against unauthorised opening. See documentation number 8502/0-03 or see pictures below.

The sealing of LNGmass is a 2-step process.

- 1) Activation of custody transfer mode:

After calibration and configuration of the LNGmass the Custody Transfer Mode is activated by switching on the "Write protection" via a DIP switch inside the electronics housing.



**Figure 1 Activation of custody transfer mode**

- 2) External cover of housing is sealed against opening.

2. Externally the cover of the electronics housing and the housing itself are secured by a bracket. The threaded pin has a hole to receive a wire. A grommet in the housing allows slinging a wire with an anti-tamper seal (c.g. lead seal) through, as demonstrated in the pictures:



**Figure 2 External cover sealed against opening**

### 3 Conditions for conformity assessment

- Verification procedure
  - Before putting into use the measurement sensor has to be calibrated on the product it is going to measure or on a product with similar properties (density and viscosity) 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.
  - When installed in the complete measuring system:
    - The parameters as stated in paragraph 1.2.8 should be set as stated in the table and should be possible to read out with the electronic calculating/indicating device (flow computer) connected to the measurement device.
    - The error caused by the zero-offset of the meter, related to the minimum flow rate, shall not exceed the value specified in R117-1, Table 2, line C. This should be verified when installed in the complete measuring system.
    - Checking facilities shall be designed and manufactured such that they can verify the presence of the measuring device, its correct operation, and the correctness of the data transmission. This should be verified when installed in the complete measuring system by a cable unplug test. Herewith the electronic calculating/indicating device (flow computer) should give an alarm and stop the measurement when a cable is unplugged.
- 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 ER8502 revision 5 issued together with this Evaluation Certificate.