

**OIML Member State**  
The Netherlands

Number R117/2007-A-NL1-20.05 revision 1  
Project number 2477337  
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Issuing authority  
Person responsible: NMi Certin B.V.  
M. Boudewijns

Applicant and  
Manufacturer: Sensia  
1000 McClaren Woods Drive  
Coraopolis PA15108, Pennsylvania  
United States of America

Identification of the  
certified type: A **measurement transducer** (ultrasonic sensor and associated electronics).  
Type: Caldon  
Model: LEFM 2xxCi [RN][LT][-R] <sup>[1]</sup>

Characteristics: See page 2 and further

This OIML Certificate is issued under scheme A

This Certificate attests the conformity of the above identified type (represented by the sample(s) identified in the OIML Type Evaluation Report) with the requirements of the following Recommendation of the International Organization of Legal Metrology (OIML):

**R 117-1 (2007)** "Dynamic measuring systems for liquids other than water"

Accuracy class: 0,3

This Certificate relates only to the metrological and technical characteristics of the type of measuring instrument covered by the relevant OIML International Recommendation identified above. This Certificate does not bestow any form of legal international approval.

Important note: Apart from the mention of the Certificate's reference number and the name of the OIML Member State in which the Certificate was issued, partial quotation of the Certificate and of the associated OIML Type Evaluation Report(s) is not permitted, although either may be reproduced in full.

<sup>[1]</sup> xx = 40: 4-path meter; xx = 44: dual 4-path meter; xx = 80: 8-path meter.

[RN] = reducing nozzle variant; [LT] = low temperature variant; [-R] = remote mounted electronics variant.

Issuing Authority

**NMi Certin B.V., OIML Issuing Authority NL1**  
22 July 2020

Certification Board

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This document is issued under the provision that no liability is accepted and that the applicant shall indemnify third-party liability.

The notification of NMi Certin B.V. as Issuing Authority can be verified at [www.oiml.org](http://www.oiml.org)


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The conformity was established by the results of tests and examinations provided in the associated reports:

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- No. CVN-201301-1 dated 11 November 2002 that includes 63 pages;
  - No. CVN-213238 dated 10 July 2003 that includes 75 pages;
  - No. CVN-209924 dated 11 July 2003 that includes 30 pages;
  - No. CPC-501402-2 dated 14 April 2005 that includes 39 pages;
  - No. CPC-501402-3 dated 14 April 2005 that includes 48 pages;
  - No. CPC-507607-3 dated 14 March 2006 that includes 57 pages;
  - No. CPC-609715-02 dated 4 May 2007 that includes 66 pages;
  - No. CPC-708740-1 dated 8 July 2008 that includes 33 pages;
  - No. CPC-807133-1 dated 10 November 2008 that includes 65 pages;
  - No. CPC-9200203-00 dated 24 June 2009 that includes 3 pages;
  - No. CPC-9200620-1 dated 3 December 2009 that includes 9 pages;
  - No. CPC-10200358-1 dated 5 August 2010 that includes 12 pages;
  - No. CPC-10200358-2 dated 14 October 2010 that includes 9 pages;
  - No. NMI-11200549-1 dated 15 July 2011 that includes 8 pages;
  - No. NMI-142000132-02 dated 1 October 2015 that includes 31 pages;
  - No. NMI-2477337-01 dated 12 May 2020 that includes 18 pages.

## Characteristics of the measurement transducer



The LEFM 240Ci [RN][LT][-R] is a four-path ultrasonic meter.

The LEFM 244Ci [RN][LT][-R] is an eight-path ultrasonic meter, it consists of 2 LEFM 240Ci [RN][LT][-R] which are mounted in one spool piece.

The LEFM 280Ci [RN][LT][-R] is an eight-path ultrasonic meter.

Where

[RN] = reducing nozzle variant;

[LT] = low temperature variant;




[-R] = remote mounted electronics variant.



The measurement transducer consists of G3 electronics in combination with either full bore or reduced bore spool piece design.

The full-bore design consists of a cylindrical spool piece with 4 or 8 distinct chord locations for custody transfer metering.

The reduced bore spool piece consists of a nozzle-shaped convergent section, a cylindrical throat piece with 4 or 8 distinct chord locations for custody transfer metering and a divergent section.



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For the LEFM240Ci, LEFM 240CiRN, LEFM244Ci and LEFM 244CiRN use of a flow conditioner is recommended and an upstream straight pipe of at least 10D is required.

For the LEFM 280Ci and the LEFM 280CiRN a flow conditioner is not needed and an upstream straight pipe of at least 5D is required.

For all models the downstream straight pipe shall be at least 3D.

The construction of the measuring instrument is recorded in the Documentation folder no. TC7381-6. In Table 1 the general characteristics of the measuring instrument are presented.

**Table 1 General characteristics**

Measurement sensor design	Full bore sensor and Reduced bore sensor
Transducers	0,5 MHz, 1 MHz or 1,6 MHz
Accuracy class	0.3
Environmental classes	M2 / E2 / H3
Maximum pressure	200 Bar(a)
Maximum Turndown ratio	50:1
Minimum Reynolds number Full Bore meters	4000
Minimum Reynolds number Reduced Bore meters	> 0
Minimum – maximum flow rate	Details in table 2 and 3.
Minimum measured quantity	Details in table 2 and 3.
Ambient temperature range	-40 – +70 °C ; condensing humidity
Product temperature range	-40 – +70 °C (Ci and CiRN versions) -50 – +110 °C (Ci-R and CiRN-R version) -200 – +110 °C (Ci LT-R and CiRN LT-R versions)
Intended for the measurement of	liquid petroleum and related products, liquid food and chemical products in liquid state, with viscosities 0,1 mPa·s to 3000 mPa·s.
Power supply voltage	24V DC ± 6V
Approved Electronics	G3 electronics
Software identification	Details in table 4

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<p>RTD input</p>	<p>The measured temperature is used for:</p> <ul style="list-style-type: none"> <li>• Correction of the thermal expansion of the meter body.</li> <li>• Calculation of the liquid density. This density shall not be used for calculating the delivered mass from the measured volume.</li> <li>• Calculation of the viscosity of the liquid.</li> </ul> <p>Note: The 244Ci and 244CiRN meter can have two Pt-100 elements, one for each 4-path meter.</p>
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**Table 2 Flow characteristics for meter types LEFM 240Ci, LEFM 244Ci and LEFM 280Ci with Full Bore design**

Nominal Size [inches]	DN Size	Bore Diameter [mm]	Minimum Measured Quantity [m <sup>3</sup> ]	Q <sub>min</sub> [m <sup>3</sup> /hr]	Q <sub>max</sub> [m <sup>3</sup> /hr]	V <sub>min</sub> [m/s]	V <sub>max</sub> [m/s]
4	100	80 - 111	0,2	5,2	650	0,2	16,6
6	150	124 - 163	0,5	34	1638	0,2	16,6
8	200	173 - 214	1	123	2195	0,2	16,6
10	250	215 - 267	1	145	3751	0,2	16,6
12	300	257 - 316	2	175	3819	0,2	16,6
14	350	284 - 348	2	70	4656	0,2	16,6
16	400	325 - 399	5	93	4874	0,2	16,6
20	500	407 - 499	5	148	7766	0,2	16,6
24	600	490 - 599	10	406	11328	0,2	16,6

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**Table 3 Flow characteristics for meter types LEFM 240Ci, LEFM244Ci and LEFM 280Ci with Reduced Bore design**

Nominal pipe size [inches]	Nominal throat size [inches]	DN Size	Throat Diameter [mm]	MMQ [m <sup>3</sup> ]	Q <sub>min</sub> [m <sup>3</sup> /hr]	Q <sub>max</sub> [m <sup>3</sup> /hr]	Throat V <sub>min</sub> [m/s]	Throat V <sub>max</sub> [m/s]
6	4	150	74 - 131	0,5	5,2	812	0,2	21
8	5	200	103 - 172	1	9	1444	0,2	21
10	6	250	129 - 214	1	34	1683	0,2	21
12	8	300	154 - 253	2	123	2195	0,2	21
14	9	350	170 - 279	2	111	2988	0,2	21
16	10	400	195 - 320	5	145	3751	0,2	21
20	13	500	244 - 400	5	65	5861	0,2	21
24	15	600	294 - 480	10	93	8440	0,2	21

**Table 4 Software versions, corresponding software revisions and checksums for G3 electronics**

Software version SW000070		Software version SW000082	
Software revision	Checksum	Software revision	Checksum
01.01.01	BD1B34A9	01.01.03	48CDDFA8
01.02.01	E2E72794	01.01.04	106F0E18
01.02.02	022E0647	01.01.05	C92E28DF
		01.01.06	881927E2
		01.01.07	2CF3D2F1
		01.01.08	669F8ED9
		01.01.10	AB14ADF4
		01.01.011	21AB2489
		01.01.012	674D72F2

Software version SW000070 and SW000082 can be used for both 4-path and 8-path meter electronics. The software version is viewable on the display (immediately after power on). Essential parameters are unable to be altered if switch 4 of dipswitch SW1 on the CTC board is in the closed position.

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## Certificate history:

This revision replaces the previous version.

Revision	Date	Description of the modification
Initial	12 May 2020	-
1	22 July 2020	Added missing reference of type evaluation report NMI-2477337-01 to the certificate. Type evaluation report NMI-2477337-01 was issued to give a complete overview of all the test results and examinations done which are used for conformity of this OIML certificate.