OIML Certificate

OIML Member State
The Netherlands

Number R117/2007-A-NL1-20.05 revision 2
Project number 2393688

Issuing authority Person responsible:	NMi Certin B.V. M.Ph.D. Schmidt
Applicant	Sensia 1000 McClaren Woods Drive Coraopolis PA15108 United States of America
Identification of the certified type	A **measurement transducer** (ultrasonic sensor and associated electronics). Brand: Caldon Type: LEFM 2xxCi [RN][LT][-R]; LEFM / SVM 289Ci [RN][LT][-R][1]
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.

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[1] xx = 40: 4-path meter; xx = 44: dual 4-path meter; xx = 80: 8-path meter; xx=88: dual 8-path meter; xx=89: 8-path meter with 8 additional verification paths.
[RN] = reducing nozzle variant; [LT] = low temperature variant; [-R] = remote mounted electronics variant.

Issuing Authority **NMi Certin B.V., OIML Issuing Authority NL1**
4 October 2021

Certification Board

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

Report number	Issue date	Number of pages
CVN-201301-1	11 November 2002	63
CVN-213238	10 July 2003	75
CVN-209924	11 July 2003	30
CPC-501402-2	14 April 2005	39
CPC-501402-3	14 April 2005	48
CPC-507607-3	14 March 2006	57
CPC-609715-02	4 May 2007	66
CPC-708740-1	8 July 2008	33
CPC-807133-1	10 November 2008	65
CPC-9200203-00	24 June 2009	3
CPC-9200620-1	3 December 2009	9
CPC-10200358-1	5 August 2010	12
CPC-10200358-2	14 October 2010	9
NMi-11200549-1	15 July 2011	8
NMi-142000132-02	1 October 2015	31
NMi-2477337-01	12 May 2020	18
NMi-2393688-01	1 October 2021	52

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.

The LEFM 288Ci (RN][LT][-R] is a dual eight path ultrasonic meter (two meters in one body).

The LEFM / SVM 289Ci [RN][LT][-R] is an ultrasonic meter with eight primary paths and an additional eight (secondary) paths that are used for verification purposes (SVM capability). For this variant, an MXR daughter board is stacked on top of the MXR board in the G3 electronics.

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.

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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.

For the LEFM24xCi flow meters, use of a flow conditioner is recommended and an upstream straight pipe of at least 10D is required.
For the LEFM /SVM 28xCi flow meters, 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. TC7381-7.
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

RTD input	The measured temperature is used for: • Correction of the thermal expansion of the meter body. • Calculation of the liquid density. This density shall not be used for calculating the delivered mass from the measured volume. • Calculation of the viscosity of the liquid. Note: The 244Ci and 244CiRN meter can have two Pt-100 elements, one for each 4-path meter.

Table 2 Flow characteristics for all meter types with Full Bore design

Nominal Size [inches]	DN Size	Bore Diameter [mm]	Minimum Measured Quantity [m³]	Q_{min} [m³/hr]	Q_{max} [m³/hr]	V_{min} [m/s]	V_{max} [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

Table 3 Flow characteristics for all meter types with Reduced Bore design

Nominal pipe size [inches]	Nominal throat size [inches]	DN Size	Throat Diameter [mm]	MMQ [m³]	Q_{min} [m³/hr]	Q_{max} [m³/hr]	Throat V_{min} [m/s]	Throat V_{max} [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

Nominal pipe size [inches]	Nominal throat size [inches]	DN Size	Throat Diameter [mm]	MMQ [m³]	Q_{min} [m³/hr]	Q_{max} [m³/hr]	Throat V_{min} [m/s]	Throat V_{max} [m/s]
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 revision	Checksum	Software revision	Checksum	Software revision	Checksum
Software version SW000070					
01.01.01	BD1B34A9	01.02.01	E2E72794	01.02.02	022E0647
Software version SW000082					
01.01.03	48CDDFA8	01.01.07	2CF3D2F1	01.01.012	674D72F2
01.01.04	106F0E18	01.01.08	669F8ED9		
01.01.05	C92E28DF	01.01.10	AB14ADF4		
01.01.06	881927E2	01.01.011	21AB2489		
Software version SW000128–SVM					
01.01.01	EC02626B				

Software versions SW000070, SW000082 can be used for both 4-path and 8-path meter electronics. Software version SW000128–SVM can only be used for meters with SVM capabilities. 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.

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.
2	4 October 2021	Addition of the LEFM / SVM 289Ci meter with 8 paths for verification purposes (SVM capability).