EU-type examination certificate

Number **T11449** revision 13
Project number 3469548

Issued by	NMi Certin B.V., designated and notified by the Netherlands to perform tasks with respect to conformity assessment procedures mentioned in article 17 of Directive 2014/32/EU, after having established that the Measuring instrument meets the applicable requirements of Directive 2014/32/EU, to:
Manufacturer	Endress+Hauser SICK GmbH+Co. KG Bergener Ring 27 01458 Ottendorf-Okrilla Germany
Measuring instrument	An **electronic gas-volume conversion device (EVCD),** intended to be used for gas volume conversion as a sub-assembly (according to article 4 of the MID) of a gas meter.

Type	:	Flow-X/C
Conversion principle	:	PTZ
Manufacturer's mark or name	:	E+H
Ambient temperature range	:	see § 1.1 of the description
Designed for	:	non-condensing humidity
Environment classes	:	M2 / E2

The intended location for the instrument is "closed".

Further properties are described in the annexes:
- Description T11449 revision 13;
- Documentation folder number T11449-8.

Valid until	24 December 2028
Initially issued	24 December 2018
Remark	This revision replaces the previous versions, including its documentation folder.

Issuing Authority

NMi Certin B.V., Notified Body number 0122
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Certification Board

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Description

1 General information about the electronic gas-volume conversion device

All properties of the EVCD, whether mentioned or not, shall not be in conflict with the legislation.

One Flow-X/C calculating and indicating device can be used for one or two meters per stream.

Flow X/C

1.1 Essential parts

The electronic gas volume conversion device is composed of the following parts:

Part	Part number	Documentation	Ambient temperature range
Digital board	xx-211-006	11449/0-01; -02	+5 °C / +55 °C
	xx-211-007	11449/3-01; -02	-25 °C / +55 °C
	xx-211-008	11449/6-01; 11449/11-01	
Analog board	xx-212-004 xx-212-003	11449/0-03; -04	+5 °C / +55 °C
	xx-212-005	11449/3-03; -04	-25 °C / +55 °C
	xx-212-006	11449/6-03; -04, 11449/9-01	
Power board	xx-213-003	11449/0-05; -06	+5 °C / +55 °C
	xx-213-004	11449/3-05; -06	-25 °C / +55 °C
Backplane panel	xx-216-003	11449/0-07; -08	-25 °C / +55 °C
Connector panel	xx-218-004	11449/0-09; -10	+5 °C / +55 °C
	xx-218-005	11449/4-01; 11449/3-08	-25 °C / +55 °C
Display interconnection board	xx-219-004	11449/0-11; -12	+5 °C / +55 °C
	xx-219-005	11449/3-09; -10	-25 °C / +55 °C
7" touch screen display drawing	TST070WSBE	11449/4-02; 5-01	-25 °C / +55 °C
	xx Can be any set of characters.		

1.2 Essential characteristics

1.2.1 Calculation of volumetric and / or mass flow totals from volume impulses and / or mass impulses and / or serial data (RS232, RS485 or Ethernet).
The calculation and indication of cumulative gross volume, base volume and / or mass, for station and each run, and for both forward and reverse streams, are under legal control.
The correction of the meter errors is under legal control.

1.2.2 Software specification (refer to WELMEC 7.2):

- Software type P;
- Risk Class C;
- Extensions L, T, S and I2;
  while extension O and D are not applicable or exclueded

Software part	Software and checksum		Remarks
Firmware [1]	2.1.2	6CDF1740	Core calculation, reporting and communication engine
	2.1.3.x	F1A5B851	
	3.1.1.x	C1F045E3	
	3.1.2.x	C1F045E3	
	3.2.0.x	1FFCB2B5	
	3.2.1.x	1FFCB2B5	
	3.2.3.x	1FFCB2B5	
	3.2.6.x	C609AB2B	
	3.2.8.x	C609AB2B	
	3.3.x.yyyyy	69D96585	

Software part	Software and checksum		Remarks
Add-on Programs	1.1.1.6855	Label: Apr 20, 2016 11:02:11	Boot loader and other auxiliary programs
	2.0.0.8200	Label: Aug 4, 2017 15:38:44	
	2.3.0.11844	Label: Oct 7, 2019 16:24:57	
	2.4.0.12900	Label: Apr 14, 2020 13:03:41	

Software part	Software and checksum		Remarks
Gas application [1]	3.2.1.x	FFEA98FEB	-
	3.2.2.x	FFEA98FEB	
	4.0.0.x	E33FB1F61	
	4.0.0.x 3runs	215D6456A8	
	103.1.0.x	110AA27372 (standard) 110AA27372 (2plex) 2CF3FDF3AE (4runs)	

Software part	Software and checksum		Remarks
Operating system	1.1	Release_20160425	Real-time operating system
	1.1	Release_20180327	
	1.1	Release_20190625	
	2.0	3175	
	2.0	3186	
	2.0	3423	
	2.0	3753	
	2.0	4121	
	2.0	4616	
	2.0	4707	
	2.0	4768	
	2.0	4823	

Software part	Software and checksum		Remarks
FPGA	0879.914A. E820.BBF1	20D4.7372.2349.0DFB	-
	0879.914A. E820.BBF1	6B1A.43BD.C7C8.F1D5	
	0000.0000. 9367.6641	0000.0000.707E.0117	
	0000.0000. 4486.EE18	0000.0000.5AF4.9B91	
	0000.0000. 4486.EE18	0000.0000.354A.32F1	
	0000.0000. 2244.331C	0000.0000.00E4.231B	
	0000.0000. 2244.331C	0000.0000.8F26.C78C	
	0000.0000. 2244.331C	0000.0000.BE45.0762	
	0000.0000. 2244.331C	0000.0000.38D2.DDE6	

Remarks:
[1] Where ‘x’ and if applicable ‘y’ is related to metrologically non relevant part of the software and could be any number.
Label and Release number act as checksum.
The software version number and appertaining information can be inspected on the local display by selecting display 'Metrological', 'Software version'.

1.2.3 Conversion

The conversion is performed according to the following formula as stated below:

$$V_b = V \times \frac{p_{abs}}{p_b} \times \frac{273{,}15 + t_b}{273{,}15 + t} \times \frac{Z_b}{Z}$$

Symbol	Represented quantity	Unity
V_b	volume at base conditions	m^3
V	volume at measurement conditions	m^3
p_{abs}	absolute pressure at measurement conditions	bar
p_b	absolute pressure at base conditions	bar
T	gas temperature at measurement conditions	°C
t_b	temperature at base conditions	°C
Z_b	compression factor at base conditions	-
Z	compression factor at measurement conditions	-

1.2.4 Compression

The compression factor Z_b/Z can be programmed in the EVCD as a fixed value or it can be calculated on the basis of the following algorithms:

- SGERG91 (ISO12213-3) (mol%CO_2, mol%H_2, H_s and d) ;
- AGA8 (ISO12213-2) (complete gas analyses).
- AGA NX-19 1962 (mol%N_2, mol%CO_2 and specific gravity d);
- AGA NX-19 MOD – BR.KORR.3H (PTB G9 correction for higher calorific gases).

  The calculation of compressibility factor Z using NX-19 MOD + PTB G9 correction (BR.KORR.3H) compression method is valid for the following boundary conditions:
  - P_{abs} = 0 to 80 Bar;
  - T = 0 to 30 °C;
  - d = 0,554 to 0,691;
  - H_s = 39,8 to 46,2 MJ/m^3;
  - Mol%N_2 = 0 to 7 %;
  - Mol%CO_2 = 0 to 2,5 %.

  Beyond the above stated boundary conditions, the NX-19 MOD + PTB G9 correction (BR.KORR.3H) compression method results in higher uncertainties.

A Compressibility calculation out of range' alarm is generated by the Flow X/C in case if values beyond above stated limits are used, except for when heating values lower than 39,8 MJ/m^3 are used. For heating values lower than 39,8 MJ/m^3 the compressibility is calculated according to NX-19 MOD without the PTB G9 correction.

From 28 February 2023 onwards, for the fixed value, conformity with the essential requirements of directive 2014/32/EU is not demonstrated and instruments with this part may no longer be placed on the market.

1.2.5 Gas Composition

A gas composition can be read from an optional gas chromatograph or Calorific Value Determining Device (CVDD) or can be manually input.
In case the communication to the gas chromatograph or CVDD fails, the last good composition before failure or a manually input override composition is used. The electronic gas-volume conversion device can be connected to two gas chromatographs or CVDD's. In

case of a failure in one chromatograph or CVDD, the composition and the values issued from the other chromatograph or CVDD are used.

Composition setup is described in documentation no. 11449/0-13 and can be configured on display Configuration -> Run / Station -> Gas properties -> Gas composition.

1.2.6 Presentation of legal data
The legal data is presented via a special menu by pressing the arrows keys on the front panel.
The menu structure, keyboard, display and (alarm) indicators are described in Chapter 'User interfaces' and 'Metrological settings' of the documentation no. 11449/0-14 and 11449/0-15.

1.2.7 Accountable alarms
The EVCD has to be programmed such that accountable alarms will be generated if extreme values are measured by the EVCD or if a defect is detected. Accountable alarms cause the registration of the volume at base conditions to be stopped.

Additionally, to the registration in the main totalizer, if there's no accountable alarm the volume at measurement conditions will be registered in the accountable totalizer, while during the alarm the volume at measurement conditions will be registered in the non-accountable totalizer.

An accountable alarm is raised if a remote transmitter is frozen.

The alarm indication can be acknowledged using the "Acknowledge" button on the alarms display. However, it is not possible to clear an alarm as long as the cause of the alarm is still present.

1.2.8 The validity of serial communication is always checked by determining and comparing the CRC of received messages and in some cases additionally by checking if the received value is between valid limits.

The validity of Modbus messages is checked by comparing the received checksum with the calculated checksum of received bytes.

Modbus ASCII mode and RTU mode use different methods to determine the checksum.
Modbus ASCII uses LRC (Longitudinal Redundancy Check) to generate the checksum.
Modbus RTU uses CRC (Cyclic Redundancy Check) to generate the checksum.
The checksum of HART messages is the result of the XOR function of all bytes in the message.

During the alarm the volume at measurement conditions will (besides the main totalizer) also be registered in the alarm totalizer.

The alarm indication can be reset by using the keyboard or the configuration software ("reset alarm" button). However, it is not possible to clear an alarm as long as the cause of the alarm is still present.

1.3 Essential shapes

1.3.1 Markings

The nameplate is bearing at least, good legible, the following information:
- CE marking including the supplementary metrological marking (M + last 2 digits of the year in which the instrument has been put into use);
- Notified Body identification number, following the supplementary metrological marking;
- EU-type examination certificate no. T11449;
- manufacturer's name, registered trade name or registered trade mark;
- manufacturer's postal address;
- serial number of the meter and year of manufacture.

The following information is mentioned on the nameplate or on the display:
- ambient temperature range;
- the gas temperature range;
- the gas pressure range;
- the base pressure; (if applicable)
- the base temperature;
- the compression algorithm; (if applicable)
- the gas properties; (if applicable)
- the parameters for gas meter error correction curve. (if applicable)

The following information is mentioned on the display and/or on the transducer nameplate:
- upper and lower limits of the transducers.

The following information is mentioned on the nameplate or in the manual:
- mechanical environment class;
- electromagnetic environment class.

Remarks:
The nameplate must be clearly visible without removing the covers.
An example of the name plate is given in documentation number 11449/13-01.

This electronic calculating and indicating device was previously placed on the market under the name "SICK".

1.3.2 Sealing: see chapter 2.

1.4 Conditional parts

1.4.1 Housing
The EVCD has a synthetic housing, which has sufficient tensile strength.
Metrological important parts only are accessible after breaking one or more seals.

1.4.2 LCD board
This board is used for the presentation of legal data and (accountable) alarms.
See documentation no. 11449/0-13 and 11449/0-14 for an example of the LCD-board.

1.4.3 External Power supply
The EVCD can be supplied by an external 24 V DC uninterruptible power supply.

1.4.4 Serial communication
The EVCD is equipped with a serial communication port. Use of the serial communication may not influence the working of the EVCD. In the normal situation (also see paragraph 1.5.2) the essential parameters needed for the conversion cannot be changed via the communication ports.

1.4.5 Temperature transducer
Any temperature transducer may be used provided the following conditions are met:
- There is a respective Parts Certificate issued under WELMEC 8.8 by a Notified Body that acts under module B of the Directive 2014/32/EU for ANNEX IV (MI-002);
- The output signal is according to the HART-protocol, it uses a standard 4-20 mA signal or the sensor is a Pt100.
- The temperature range is according to the appertaining Parts certificate; however, the temperature t must not exceed -30 °C ≤ t ≤ +80 °C.
- The temperature range must be within the working range of the algorithm used for correcting the deviation from the ideal gas law.
  The electronic gas-volume conversion device may be equipped with an application that allows connection of two temperature transmitters per stream, for calculating and presenting the average value of the two measured temperature values.
  In case one of the temperature transmitters fails, the calculated average temperature value is replaced by the measured temperature value of the good temperature transmitter.
  One of the transmitters can be manually taken out of service for calibration purposes. In that case, the measured temperature of the other transmitter is used.
  If the deviation is larger than the preset deviation limit value, the flow computer can be configured to use either the value from transmitter 1, the value from transmitter 2, or the average value. Of course, the checks on the selected transmitter value(s) (not out of service, not defective, etc.) apply. Alternatively, the flow computer can be configured to regard a transmitter deviation alarm as a transmitter failure, upon which the configured transmitter fallback mode (last good value, fallback value or override value) will be used.

1.4.6 Pressure transducer
Any pressure transducer may be used provided the following conditions are met:
- There is a respective Parts Certificate issued under WELMEC 8.8 by a Notified Body that acts under module B of the Directive 2014/32/EU for ANNEX IV (MI-002);
- The output signal must be according to a standard 4-20 mA signal or HART protocol.
- The pressure range is according to the appertaining Parts certificate; apart from that the following restrictions are valid.
- The maximum pressure does not exceed 120 bar.

- The pressure range must be within the working range of the algorithm used for correcting the deviation from the ideal gas law. On top of that the Flow-X optionally also raises an accountable alarm if the pressure drops below a configurable minimum accountable pressure PTmin.
  Note: if a gauge pressure transducer is used the constant value for the atmospheric pressure is stated on the main menu – MID page.

A gauge pressure transducer may be used if its minimum operating absolute pressure is equal to or greater than 21 bar. The electronic gas-volume conversion device may be equipped with an application that allows connection of two pressure transmitters per stream, for calculating and presenting the average value of the two measured pressure values.
In case one of the pressure transmitters fails, the calculated average pressure value is replaced by the measured pressure value of the good pressure transmitter.
One of the transmitters can be manually taken out of service for calibration purposes. In that case, the measured pressure of the other transmitter is used.
If the deviation is larger than the preset deviation limit value, the flow computer can be configured to use either the value from transmitter 1, the value from transmitter 2, or the average value. Of course, the checks on the selected transmitter value(s) (not out of service, not defective, etc.) apply. Alternatively, the flow computer can be configured to regard a transmitter deviation alarm as a transmitter failure, upon which the configured transmitter fallback mode (last good value, fallback value or override value) will be used.

1.4.7 Use of a gas chromatograph or Calorific Value Determining Device (optionally)
Any gas chromatograph or CVDD may be used provided the following conditions are met:
- There is a respective Parts Certificate issued under WELMEC 8.8 by a Notified Body that acts under module B of the Directive 2014/32/EU for ANNEX IV (MI-002);
- The communication between the EVCD and the gas chromatograph or CVDD takes place through an RS232, RS485 or Ethernet interface; when the connection between the EVCD and gas chromatograph or CVDD is broken or when the gas chromatograph or CVDD is defective an accountable alarm is raised.

1.5 Conditional characteristics

1.5.1 Impulse input
The maximum frequency is not higher than 5 kHz for dual impulse and 10 kHz for single impulse.

1.5.2 Ethernet interfaces
When an ethernet cable is connected to the device it should be less than 10 meters long.

1.5.3 Programming
Change of metrological parameters is protected by a programming switch, password or key identification.
An exception is the unconverted and converted main totalizers, which only can be changed after the programming switch is set in the “on” position.

If the programming switch is set in the “off” position, parameters declared as protected can be changed after password or key-identification.

In the normal situation the programming switch always has to be set in the “off” position.

See paragraph 'Operations' of documentation no. 11449/0-14 for a full description of the programming and data protection.

1.6 Non-essential characteristics

1.6.1 Alarm outputs

1.6.2 A customer switch

2 Seals

The following items are sealed:
- the nameplate with the housing; *)
- the housing is sealed by sealing the tamper switch on the back plane;
- the programming switch and the terminals of the pressure- and temperature transmitter.

*) Removal without destroying the nameplate shall not be possible; otherwise, the nameplate shall be sealed to the housing.

If the Flow-X/C is unlocked by disabling the tamper switch and the MID compliance is enabled an alarm is raised.
To ensure the presence of the correct temperature transmitters and pressure transmitters the serial numbers can be shown in the display. Change of that numbers are only possible after breaking the seal of the Tamper Switch.