EU-type examination certificate

Number **T10548** revision 17
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
D-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	:	E+H Flow-X/M, E+H Flow-X/P, E+H Flow-X/S, E+H Flow-X/R and E+H Flow-X/K.
Manufacturer's mark or name	:	E+H
Conversion principle	:	PTZ
Ambient temperature range	:	–25 °C / +55 °C
Designed for	:	non-condensing humidity
Environment classes	:	M2 / E2

The intended location for the instrument is open.

Further properties are described in the annexes:
- Description T10548 revision 17;
- Documentation folder T10548-11.

Valid until

28 February 2033

Initially issued

28 February 2013

Remark

This revision replaces the previous versions including its documentation folder.

Issuing Authority

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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.

1.1 Essential parts

Remark: The documentation numbers in the following tables refer to board pictures only. This is because all parts should be considered as OEM parts. On request, the OEM manufacturer submits the requested information (for instance principal electrical schematic drawings, board component placement drawings, bills of materials).

The electronic gas volume conversion devices are previously known as SICK Flow-X/M, SICK Flow-X/P, SICK Flow-X/S, SICK Flow-X/R and SICK Flow-X/K.

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

1.1.1 E+H Flow-X/M

Part	Part number	Document	Ambient temperature range
Analog board	6557-0700-1310	10548/0-01	+5 °C / +55 °C
	xx-212-003 xx-212-004	10548/3-01; 10548/5-01	
	xx-212-005	10548/6-01; 10548/6-02	-25 °C / +55 °C
	xx-212-006	10548/8-01; 10548/8-02, 10548/12-01	
Digital board	6557-0700-1210 6557-0700-1211	10548/0-02	+5 °C / +55 °C
	xx-211-006	10548/3-03; 10548/5-02	
	xx-211-007	10548/6-03; 10548/6-04	-25 °C / +55 °C
	xx-211-008	10548/8-03; 10548/14-01	
Display board	6557-0700-65056	10548/3-05; 10548/5-03	+5 °C / +55 °C
	xx-214-003	10548/3-07; 10548/5-04	
	xx-214-004	10548/6-05; 10548/6-06	-25 °C / +55 °C
Power board	6557-0800-8204	10548/0-04	+5 °C / +55 °C
	xx-213-003	10548/3-09; 10548/5-05	
	xx-213-004	10548/6-07; 10548/6-08	-25 °C / +55 °C
SD Card Adapter board (optional)	6557-1500-0000	10548/2-01	+5 °C / +55 °C
	6557-1500-0001	10548/2-02	

Remark: In the part number x can represent any character.
The Flow X/M with Part Number starting with '6557-' may contain a normal SD card or the SD Card Adapter board with micro-SD card.

1.1.2 E+H Flow-X/P

Part	Part number	Document	Ambient temperature range
GUI module Touch screen controller	6557-0700-1410	10548/0-05	+5 °C / +55 °C
Power board	xx-213-003	10548/3-09; 10548/5-05	+5 °C / +55 °C
	xx-213-004	10548/6-07; 10548/6-08	-25 °C / +55 °C
Flow-X Type 2: GUI module Touch screen controller	xx-221-006	10548/3-03; 10548/5-02	+5 °C / +55 °C
'Digital Board' (instead of 'Flow X/P type 2: GUI board')*)	xx-211-006	10548/6-16; 10548/6-17	+5 °C / +55 °C
	xx-211-007	10548/6-03; 10548/6-04	-25 °C / +55 °C
	xx-211-008	10548/8-03; 10548/14-01	
Backplane PCB	6557-0800-2905	10548/0-06	+5 °C / +55 °C
	xx-215-003	10548/3-11; 10548/5-06	-25 °C / +55 °C
Display interconnection board	xx-219-004	10548/3-13; 10548/5-07	+5 °C / +55 °C
	xx-219-005	10548/6-09; 10548/6-10	-25 °C / +55 °C
7" touch screen display drawing	TST070WSBE	10548/6-13; 10548/7-01	-25 °C / +55 °C
Connector panel	6557-0800-2804	10548/0-07	+5 °C / +55 °C
	xx-217-004	10548/3-15; 10548/5-08	
	xx-217-005	10548/6-11; 10548/6-12	-25 °C / +55 °C
SD Card Adapter board (optional)	6557-1500-0000	10548/2-01	+5 °C / +55 °C
	6557-1500-0001	10548/2-02	

The Flow X/P with Part Number starting with '6557-' may contain a normal SD card or the SD Card Adapter board with micro-SD card.
*) E+H Flow-X/P may contain a GUI board or a digital board.

1.1.3 E+H Flow-X/S

Part	Part number	Document	Ambient temperature range
Back plane	6557-0800-4902	10548/0-08	+5 °C / +55 °C
	xx-225-001	10548/8-05; 10548/8-06	-25 °C / +55 °C

Remark: In the part number, x can be any character.
The E+H Flow-X/S enclosure contains one E+H Flow-X/M module.

1.1.4 E+H Flow-X/R

Part	Part number	Document	Ambient temperature range
Back plane	6557-0800-8401	10548/1-01	+5 °C / +55 °C

The E+H Flow-X/R enclosure may contain up to eight E+H Flow-X/M modules.

1.1.5 E+H Flow-X/K

Part	Part number	Document	Ambient temperature range
Back plane	xx-226-000	10548/8-07; 10548/8-08	+5 °C / +55 °C
	xx-226-001	10548/8-09; 10548/8-10	-25 °C / +55 °C

The E+H Flow-X/K enclosure contains one E+H Flow-X/M module.
Remark: In the part number, x can be any character.

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.

1.2.2 Software specification (refer to WELMEC 7.2):

- Software type P;
- Risk Class C;
- Extension L, T, S and I2;
  while extensions O and D are not applicable or excluded.

Software part	Software version	Software checksum	Remarks
Firmware [1]	33be526d		Core calculation, reporting and communication engine
	C9F932F8		
	1.7.6	8F315499	
	2.1.2	6CDF1740	
	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 version	Software checksum	Remarks
Add-on Programs	1.0.0.1169		Boot loader and other auxiliary programs
	1.0.0.1170		
	1.1.2.7027		
	2.0.0.8200		
	2.3.0.11844 Label: Oct 07 2019 16:24:57		
	2.4.0.12900 Label: Apr 14 2020 13:03:41		

Software part	Software version	Software checksum	Remarks
FPGA	1357-22-1-2009		Field-Programmable Gate Array for X/M
	1422-21-2-2012		
	1350-29-10-2009		
	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	

Software part	Software version	Software checksum	Remarks
Operating system	16.53 (First release) 10.70		Real-time operating system
	14.74		
	19.81		
	20.82		
	21.83		
	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 version	Software checksum	Remarks
Gas application [1]	1.2.3.0	93D121AC0	-
	1.4.3	ECDD94451	
	1.5.2	E6816CFE5	
	1.5.3	E6816CFE5	
	3.0.0	FFDD7F84A	
	3.1.0.x	FEE0F6A8D	
	3.2.1.x	FFEA98FEB	
	3.2.2.x	FFEA98FEB	
	4.0.0.x	E33FB1F61	
	4.0.0.x 3runs	215D6456A8	

Software part	Software version	Software checksum	Remarks
	103.1.0.x	110AA27372 (standard) 110AA27372 (2plex) 2CF3FDF3AE (4runs)	

Remark:
[1] Where 'x' and if applicable 'y' is related to metrologically non relevant part of the software and could be any number.

The software version can be read on the display by selecting 'Metrological', 'Software version' or 'Metrological/version' on the local display.

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 Zb/Z can be programmed in the EVCD as a fixed value or it can be calculated on the basis of the following algorithms:
- SGERG 91 (ISO12213-3) (mol%CO_2, mol%H_2, H_s and d);
- AGA8 (ISO12213-2) (complete gas analyses);
- AGA NX-19 1962 (mol%N2, mol%CO2 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:

- Pabs = 0 to 80 Bar;
- T = 0 to 30 °C;
- d = 0,554 to 0,691;
- Hs = 39,8 to 46,2 MJ/m^3;
- Mol%N2 = 0 to 7 %;
- Mol%CO2 = 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 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 2 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 document no. 10548/9-16 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. 10548/6-14 and 10548/6-15.

1.2.7 Accountable alarm

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 forced or 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. T10548;
- 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:
- the 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 10548/10-01 and 10548/17-01.

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. 10548/6-14 and 10548/6-15 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 $\leq$ t $\leq$ +80 °C.
- The temperature range must be within the working range of the algorithm used for correcting the deviation from the ideal gas law.

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.
- 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 Pmin.
  Note: if a gauge pressure transducer is used the constant value for the atmospheric pressure is stated on the main menu – MID page.

1.4.7 Gas chromatograph or Calorific Value Determining Device (optionally)
Any gas chromatograph or CVDD may be used provided the following conditions are met:
- For the gas chromatograph or CVDD a part certificate has been issued by a Notified

Body responsible for type examination;
- 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. 10548/6-15 for a full description of the programming and data protection.

1.6 Non-essential parts

1.6.1 Alarm outputs

1.6.2 A customer switch

2 Seals

The following items are sealed:
- The nameplate with the housing; *****)

- Each E+H Flow-X/M flow module must be locked by operating the tampering switch (push button) and the tampering switch must be sealed if the access to the tamper switch is not protected by a sealed bar;

- All enclosures have the option of locking the flow computer with a seal by an authorized body, to prevent access to the tamper switch of the individual modules (see above). In a E+H Flow-X/P (Panel) and a E+H Flow-X/R, one bar is used to seal all installed modules with one seal;

Remark: If the tamper switch is unlocked while MID compliance is enabled an alarm is raised.

An example of the sealing is presented in the document no. 10548/10-03.

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