M			Evaluation Certificate
			Number TC8838 revision 10 Project number 3469548 Page 1 of 1
Issued by	NMi Certin B.V.		
In accordance with	 WELMEC 8.8, 2017 "Guide of the Voluntary System of Mo WELMEC 7.2, 2015: Softwar OIML R117-1 Edition 2007 (other than water". OIML R117, 2019: Dynamic water 	on the General odular Evaluati e Guide E) "Dynamic m measuring syst	l and Administrative Aspects of ion of Measuring instruments". neasuring systems for liquids tems for liquids other than
Producer	ABB B.V. Achtseweg Zuid 151A 5651 GW Eindhoven The Netherlands		
Part	An electronic calculating an a part of a dynamic measuring	d indicating system for liq	device intended to be used as uids other than water.
	Producer's mark or name	: ABI	В
	Type designation	: Flov	w-X/C
	Accuracy class	: 0,3	
	Further properties and test res Description TC8838 revision – Documentation folder TC883	ults are descrik 10; 38-5.	bed in the annexes:
Initially issued	3 April 2017		
Remarks	 This revision replaces the pre The documentation folder is 	vious revisions not changed	5;

Issuing Authority

ty NMi Certin B.V. 8 December 2023 Certification Board

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1 General information on the electronic calculating and indicating device

All properties of the electronic calculating and indicating 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 system must be covered by relevant metrological certification that is valid in the country where the instrument is put into use.

One Flow-X/C flow module can be used for one or two meters with dual pulse input per stream.



Flow X/C



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1.1 Essential parts

1.1.1 Hardware-components

Description	Part number	Documentation	Ambient temperature range	
	xx-211-006	8838/0-01, -02	+5 °C / +55 °C	
Digital board	xx-211-007	8838/4-01, -02		
	xx-211-008	8838/6-01, -02	-25 ~C / +55 ~C	
	xx-212-004 xx-212-003	8838/0-03, -04	+5 °C / +55 °C	
Analog board	xx-212-005	8838/4-03, -04		
	xx-212-006	8838/6-03, -04, 8838/9-01	-25 °C / +55 °C	
Power board	xx-213-003	8838/0-05, -06	+5 °C / +55 °C	
	xx-213-004	8838/4-05, -06	-25 °C / +55 °C	
Backplane panel	xx-216-003	8838/0-07, -08	-25 °C / +55 °C	
	xx-218-004	8838/0-09, -10	+5 °C / +55 °C	
Connector panel	xx-218-005	8838/5-01, 8838/4-08	-25 °C / +55 °C	
Display interconnection board	xx-219-004	8838/0-11, -12	+5 °C / +55 °C	
	xx-219-005	8838/4-09, -10	-25 °C / +55 °C	
7" touch screen display drawing	TST070WSBE	8838/4-11, 8838/6-05	-25 °C / +55 °C	

Remark: xx can be any set of characters

1.2 Essential characteristics

- 1.2.1 Environment classes
 - M2 / E2
- 1.2.2 Software specification (refer to WELMEC 7.2)
 - Software type P;
 - Risk Class C;
 - Extension L, T and S while extensions D are not applicable.



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Software part	Software and identifiers		Remarks	
	Software checksum	2F494636		
	acts as software	11143FE8		
	version indication	1AAD4807		
	1.9.0.7041	47E8CD2F		
	2.1.1.9285	712C1E6B		
	2.1.2.10217	0B29E8A2		
	2.1.3.10452	0B29E8A2		
	2.1.4.12541	0B29E8A2	Core calculation,	
Firmware	3.0.0.10988	A9B2B7D9	communication	
	3.1.1.12149	13D0B0C5	engine	
	3.1.3.12952	13D0B0C5	-	
	3.2.0.13638	2555BE9D		
	3.2.1.13738	2555BE9D		
	3.2.3.14630	2555BE9D		
	3.2.4.14771	2555BE9D		
	3.2.6.16452	37B727D5		
	3.2.8.17090	37B727D5		
	1.1.2.7027	Label: Jun 13 2016 18:04:09		
Add-on	2.0.0.8200	Label: Aug 4 2017 15:38:44	Boot loader and	
Programs	2.3.0.11844	Label: Oct 07 2019 16:24:57	programs	
	2.4.0.12900	Label: Apr 14 2020 13:03:41		
	1.1	Release_20160425		
	1.1	Release_20180327		
Operating system	1.1	Release_20190625		
	2.0	3175		
	2.0	3186	Real-time operating system	
	2.0	3423		
	2.0	3753		
	2.0	4121		
	2.0	4616		



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Software part	Software and identif	iers	Remarks
	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	
FPGA	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	
	2.1.0.x	E21B13310	
	2.2.0.x	D5CF6C993	
	2.3.0.x	E48FE7BA4	
	2.3.1.x	E629A5DAF	
Liquid	3.0.0.x	12B497603A	
application	3.0.0.x	1C190AD587	-
	3.1.0.x	11B78C6249	
	3.1.0.x	1D7F5633C8	
	3.1.0.x	30663BE481	
	5.0.0.x	128D4AADEC, 187280E671	

Remarks:

The 'x' in the software version is metrologically not relevant and can 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 Legal software functions
- 1.2.3.1 Monitoring and protection of volume and / or mass impulse input from meters, from analog temperature inputs, from analog pressure, from analog density input and from digital inputs, for instance from HART devices.
- 1.2.3.2 Meter factor curve is available for a maximum of 16 different products. Each meter factor curve is coupled to a product. Selecting a product automatically selects the appertaining meter factor curve.



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1.2.3.3 Registering of volume(s), mass and other measured values and parameters.

For each run and for both forward and reverse flow direction the calculating and indication device supports the following totalizers.

- cumulative accountable indicated (volume or mass depending on the meter type);
- cumulative accountable gross volume;
- cumulative accountable gross standard volume;
- cumulative accountable net standard volume;
- cumulative accountable mass.

1.2.3.4 The calculating and indicating 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 the deviation between the temperature transmitters is larger than a preset value, the following options are available:

- The temperature indications of both transmitters are still used;
- The indication of temperature transmitter A is used;
- The indication of temperature transmitter B is used.
- The deviation is considered as a transmitter failure; depending of the fallback typesetting the calculating and indicating device either shows the last good value or the keypad value or the fallback value.

The checks on that temperature transmitter value (not out of service, not defective, etc.) apply. 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.

1.2.3.5 The calculating and indicating 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 the deviation between the pressure transmitters is larger than a preset value, the following options are available:

- The pressure indications of both transmitters are still used;
- The indication of pressure transmitter A is used;
- The indication of pressure transmitter B is used;
- The deviation is considered as a transmitter failure; depending on the fallback typesetting the calculating and indicating device either shows the last good value or the keypad value or the fallback value.

The checks on that pressure transmitter value (not out of service, not defective, etc.) apply. 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.

- 1.2.3.6 In case no product density temperature transmitter is configured the measured product temperature at the meter is used as the product density temperature. The meter density is assumed to be equal to the measured density.
- 1.2.3.7 In case no product density pressure transmitter is configured the measured product pressure at the meter is used as the product density pressure. The meter density is assumed to be equal to the measured density.
- 1.2.3.8 Option to use pressure and temperature from a smart meter as meter pressure and temperature.

Option to disable totalizers of one meter when two meters are in serial configuration.



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1.2.3.9 The Weights and Measures part of the program that contains the test routines for memory, transmissions and calculation.

1.2.4 Conversions

The Flow X series can perform conversion calculations according to the following methods:

- API Manual of Petroleum Measurements Standards API-2540, Chapter 11.1; 1980 tables (ASTM D1250-80) tables 53A and/or 54A (crude oil), 53B and/or 54B (refined petroleum products), table 54C, table 53D and/or 54D (lube oils);
- API Manual of Petroleum Measurements Standards API MPMS, Chapter 11.1; 2004 tables (ASTM D1250-04) tables 53A and/or 54A (crude oil), 53B and/or 54B (refined petroleum products), table 54C, table 53D and/or 54D (lube oils);
- GPA-27 table 53E and/or 54E (light products);
- API MPMS 11.2.1M and 11.2.2M (pressure correction);
- OIML R22 (Alcohol, ethanol).

1.3 Essential shapes

- 1.3.1 The nameplate should bear at least the following information.
 - the Evaluation certificate number: TC8838;
 - trademark or name of the Producer;
 - part number;
 - serial number;
 - environmental temperature range.
- 1.3.2 Parts of the inscriptions (except for the Evaluation Certificate number and the serial number) may be stated on a separate Data Sheet.
- 1.3.3 For non-interruptible applications, an external uninterruptible power supply must be used.
- 1.3.4 Ethernet cable if connected to the instrument should be less than 10 metres long.

1.4 Conditional characteristics

- 1.4.1 One additional serial RS232 port.
- 1.4.2 2 Ethernet interfaces.
- 1.4.3 External power supply voltage: 24 Vdc +/- 10%. For use in uninterruptible measurement systems the output of this power supply must be undisturbed during input power dips of 10 ms to 0% of the nominal voltage, of 100 ms to 40% of the nominal voltage and of 10 s to 85% of the nominal voltage. This can be achieved by using an uninterruptible power supply.

For information on and the programming of the parameters, see documentation 8838/0-13.



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The below mentioned parameters shall be set to the belonging values and in the secure mode "read only".

Menu	Parameter	Value
Common settings		
Configuration, Overall setup, Common settings	Atmospheric pressure	1)
	Base pressure	1)
	Density of water	1)
	Disable totals if meter is inactive	No
	MID compliance	Enabled
	Calculation out of range alarms	Enabled
Meter ticket	·	
Configuration, Overall	'API 12.2.2 Measurement Tickets' compliance	1)
setup, Meter ticket	API rounding	1)
	Calculation extrapolation allowed	1)
Metrological	·	
Configuration,	Minimum accountable batch size (volume)	1)
Metrological	Minimum accountable batch size (mass)	1)
	Minimum accountable flow rate	1)
	Maximum accountable flow rate	1)
	Minimum accountable temperature	1)
	Maximum accountable temperature	1)
	Minimum accountable pressure	1)
	Maximum accountable pressure	1)
	Equilibrium pressure accountable limit	1)
	Minimum accountable standard density	1)
	Maximum accountable standard density	1)
	Accountable alarm neutralization enabled	1) 3)
	Accountable alarm neutralization quantity	1) 3)
	Accountable alarm neutralization reset quantity	1) 3)



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Menu	Parameter	Value
Products		
Configuration, Products	Name	1)
(for each individual product; max. 16)	Density conversion method	1)
	Standard density override value	1)
	Standard density override unit type	1)
	Densitometer correction factor	1)
	Equilibrium pressure method	1)
	Equilibrium pressure override	1)
	TP15 P100 correlation	1)
	Vapor pressure at 100F	1)
	Equilibrium pressure coefficients A,B,C	1)
	Compressibility F override enabled	1)
	Compressibility F override value	1)
Run setup		l
Configuration, Run, Run	Meter device type	1)
setup	Observed density input type	1)
	Density temperature input type	1)
	Density pressure input type	1)
	Standard density input type	1)
	Single or dual meter temperature transmitter(s)	1)
	Single or dual meter pressure transmitter(s)	1)
Pulse input		
Configuration, Run,	Type of pulse input (single or dual pulse)	1)
Flow meter, Pulse input (if applicable)	Pulse input quantity type	1)
	Dual pulse fidelity level	1)
	Meter active threshold frequency	1)



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Menu	Parameter	Value	
Smart meter			
Configuration, Run,	Smart meter input type	1)	
(if applicable)	Smart meter internal device number	1)	
	Use flow rate or total	1)	
	Pulse is primary	1)	
	Fallback to secondary flow signal	1)	
	Meter active threshold flow rate	1)	
Meter K-factor			
Configuration, Run,	K-factor curve enabled	1)	
Flow meter, Meter K- factor	Curve extrapolation allowed	1)	
(if applicable)	Fwd nominal K-factor	1)	
	Rev nominal K-factor	1)	
	Fwd K-factor curve (max. 12 points)	1)	
	Rev K-factor curve (max. 12 points)	1)	
Meter factor			
Configuration, Run, Flow meter, Meter factor	Type of input value (meter factor or meter error)	1)	
	Meter factor / error curve enabled	1)	
	Curve extrapolation allowed	1)	
for each product (max.	Fwd MF / error	1)	
16 products):	Rev MF / error	1)	
	Fwd meter factor curve (max. 12 points)	1)	
	Rev meter factor / error curve (max. 12 points)	1)	
Data valid input			
Configuration, Run,	Data valid input type	1)	
Flow meter, Data valid input	Data valid digital input module	1)	
	Data valid digital input channel	1)	



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Menu	Parameter	Value
Meter body correction		
Configuration, Run, Flow meter, Meter body correction	Meter body correction enabled	1)
	Body corr reference temperature	1)
(if applicable)	Body corr reference pressure	1)
	Cubical temperature expansion coefficient	1)
	Cubical pressure expansion coefficient	1)
Viscosity correction		
Configuration, Run,	Viscosity correction enabled	1)
Flow meter, Viscosity correction	Viscosity correction type	1)
(if applicable)	Coefficients for the applicable viscosity correction calculation method	1)
Temperature		
Configuration, Run /	Temperature input type	1)
(for each individual	Analog / PT100 input module	1)
temperature transmitter)	Analog / PT100 input channel	1)
	HART internal device number	1)
	HART variable	1)
	HART to analog fallback	1)
	Fallback type	1)
	Fallback value	1)
	Dual transmitter mode	1)
	Dual transmitter deviation limit	1)
	Dual transmitter deviation fallback mode	1)



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Menu	Parameter	Value
Pressure		
Configuration, Run / Station, Pressure (for each individual pressure transmitter)	Pressure input type	1)
	Pressure input units (gauge or absolute)	1)
	Analog input module	1)
	Analog input channel	1)
	HART internal device number	1)
	HART variable	1)
	HART to analog fallback	1)
	Fallback type	1)
	Fallback value	1)
	Dual transmitter mode	1)
	Dual transmitter deviation limit	1)
	Dual transmitter deviation fallback mode	1)
Observed density		
Configuration, Run / Station, Density, Observed density	Observed density input type	1)
	Observed density input unit type	1)
(if applicable)	Analog input module	1)
	Analog input channel	1)
	HART internal device number	1)
	HART variable	1)
	HART to analog fallback	1)
	Fallback type	1)
	Fallback value	1)
	High fail limit	1)
	Low fail limit	1)
	Failure delay	Default: 0 sec.



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Menu	Parameter	Value	
Standard density			
Configuration, Run /	Standard density input type	1)	
Station, Density, Standard density	Standard density input unit type	1)	
	Analog input module	1)	
	Analog input channel	1)	
	HART internal device number	1)	
	HART variable	1)	
	HART to analog fallback	1)	
	Fallback type	1)	
	Fallback value	1)	
	High fail limit	1)	
	Low fail limit	1)	
Densitometer setup			
Configuration, Run /	Densitometer type	1)	
Station, Density, Densitometer setup	Time period input module	1)	
(if applicable; for each individual densitometer)	Time period input number	1)	
,	Time period averaging	Default: disabled	
	Use product density correction factor	1)	
	Densitometer nominal DCF	1)	
Densitometer constants	s		
Configuration, Run / Station, Density, Densitometer constants (if applicable; for each individual densitometer)	Densitometer constants as given on the appertaining calibration certificate (Solartron / Sarasota / UGC / Anton Paar)	1)	



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Menu	Parameter	Value		
BS&W				
Configuration, Run /	BS&W input type	1)		
(if applicable)	Analog input module	1)		
	Analog input channel	1)		
	HART internal device number	1)		
	HART variable	1)		
	HART to analog fallback	1)		
	Fallback type	1)		
	Fallback value	1)		
Viscosity				
Configuration, Run /	Viscosity input type	1)		
(if applicable)	Analog input module	1)		
	Analog input channel	1)		
	HART internal device number	1)		
	HART variable	1)		
	HART to analog fallback	1)		
	Fallback type	1)		
	Fallback value	1)		
Analog inputs		I		
IO, Module,	Input type	1)		
inputs	Averaging method	1)		
(for each individual analog input)	Full scale	1)		
	Zero scale	1)		
	Unit type	1) 2)		
	Unit	1) 2)		
	High fail limit	1)		
	Low fail limit	1)		



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Menu	Parameter	Value
PT100 inputs		
IO, Module,	Input type	1)
inputs	High fail limit	1)
(for each individual PT100 input)	Low fail limit	1)
Pulse input		
IO, Module,	Pulse input A channel	1)
input	Pulse input B channel	1)
	Dual pulse fidelity level	1)
	Fall back to secondary pulse	1)
	Error pulses limit	1)
	Good pulses reset limit	1)
	Error rate limit	1)
	Dual pulse fidelity threshold	1)
Time period inputs		
IO, Module, Configuration, Time period inputs (for each individual time period input)	Time period input channel	1)
Calibration		•
IO, Module, Calibration,	Selected analog input	None
Analog inputs	Freeze all analog and PT100 inputs	Disabled
IO, Module, Calibration,	Selected PT100 input	None
PT100 inputs	Freeze all analog and PT100 inputs	Disabled
Calibration, HART inputs	HART freeze mode	Off
	HART value offsets	Correct values



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Menu	Parameter	Value
Forces		
IO, Module, Force IO, Analog inputs (for each individual analog input)	Force mode	Disabled
IO, Module, Force IO, PT100 inputs (for each individual PT100 input)	Force mode	Disabled
IO, Module, Force IO, Digital IO (for each individual digital IO)	Force mode	Normal
IO, Module, Force IO, Pulse input	Force mode	Disabled
IO, Module, Force IO, Time period inputs (for each individual time period input)	Force mode	Disabled
Communication, HART transmitters (for each individual HART transmitter)	Force mode	Disabled
Communication, flow meter	Force mode	Disabled
Maintenance mode		
Maintenance mode	Maintenance mode	Disabled

- 1) These values should be specified and motivated by the Producer or the owner of the calculating and indicating device. Prior to Weights & Measures verification, a list with the parameters settings and a motivation of these setting should be present at the flow computer location.
- 2) Applicable from firmware revision 5.0.0.x.
- 3) Neutralization

Neutralization enable / disable	If neutralization is enabled, flow range, temperature range, pressure range and standard density range accountable alarms are delayed until a neutralization quantity is reached. If neutralization is enabled, each time an accountable defect appears a neutralization counter (indicated volume or mass depending on meter
	neutralization counter (indicated volume or mass depending on meter quantity type) is started.



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	The accountable totalizers are running, until the counter reaches the neutralization quantity, the accountable alarm is set, and the non- accountable totalizers start running. When there is no more pending defect, the non-accountable totalizers stop running and the accountable totalizers start running again. The neutralization counter is reset after the neutralization reset quantity is reached without any accountable alarm.
Neutralization counter	Setting depends on the minimum measured quantity of the liquid measuring installation.
-	

1.5 Non-essential characteristics

- 1.5.1 Output lines (only for version 2 products).
 - Impulse outputs
 - 4 ... 20 mA output
- 1.5.2 Totalizer information

Additional to the totalizers that are specified in paragraph 1.2.3.3, the following totalizers are available; these totalizers are not intended for use as Weights & Measures data.

For the station:

- cumulative accountable gross volume
- cumulative accountable gross standard volume
- cumulative accountable net standard volume
- cumulative accountable mass

Furthermore, for station, run 1, run 2, run 3 and run 4, and for both forward and reverse flow direction the calculation and indication device supports the following totalizers:

- cumulative non-accountable indicated (volume or mass depending on the meter type; does not apply to station totalizers)
- cumulative non-accountable gross volume
- cumulative non-accountable gross standard volume
- cumulative non-accountable net standard volume
- cumulative non-accountable mass
- cumulative indicated (volume or mass depending on the meter type; does not apply to station totalizers)
- cumulative gross volume
- cumulative gross standard volume
- cumulative net standard volume
- cumulative mass
- cumulative number of impulses (does not apply to station totalizers)
- cumulative number of error impulses (does not apply to station totalizers)
- current [xxx] indicated (volume or mass depending on the meter type; does not apply to station totalizers)
- current [xxx] gross volume
- current [xxx] gross standard volume
- current [xxx] net standard volume
- current [xxx] mass
- current [xxx] number of impulses (does not apply to station totalizers)
- current [xxx] number of error impulses (does not apply to station totalizers)



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- current [xxx] accountable indicated (volume or mass depending on the meter type; does not apply to station totalizers)
- current [xxx] accountable gross volume
- current [xxx] accountable gross standard volume
- current [xxx] accountable net standard volume
- current [xxx] accountable mass
- current [xxx] non-accountable indicated (volume or mass depending on the meter type; does not apply to station totalizers)
- current [xxx] non-accountable gross volume
- current [xxx] non-accountable gross standard volume
- current [xxx] non-accountable net standard volume
- current [xxx] non-accountable mass
- previous [xxx] indicated (volume or mass depending on the meter type; does not apply to station totalizers)
- previous [xxx] gross volume
- previous [xxx] gross standard volume
- previous [xxx] net standard volume
- previous [xxx] mass
- previous [xxx] number of impulses (does not apply to station totalizers)
- previous [xxx] number of error impulses (does not apply to station totalizers)
- previous [xxx] accountable indicated (volume or mass depending on the meter type; does not apply to station totalizers)
- previous [xxx] accountable gross volume
- previous [xxx] accountable gross standard volume
- previous [xxx] accountable net standard volume
- previous [xxx] accountable mass
- previous [xxx] non-accountable indicated (volume or mass depending on the meter type; does not apply to station totalizers)
- previous [xxx] non-accountable gross volume
- previous [xxx] non-accountable gross standard volume
- previous [xxx] non-accountable net standard volume
- previous [xxx] non-accountable mass

With [xxx] either 'batch', 'batch open', 'hour', 'hour open', 'day', 'day open', 'period A', 'period A open', 'period B open'

"Current" totalizers register during the batch or during the applicable time period. At the start of the batch or applicable time period, the respective "current" totalizer values are zero.

"Previous" totalizers show the totals of the previous batch or previous applicable time period. Totalizers indicated with the word "open" show the value of the cumulative totalizers at the start of the batch or applicable time period.

Finally cumulative and current batch open gross volume totalizers per product are available for run 1, run 2, run 3, run 4 and station.



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2 Seals

The Flow-X/C must be locked and sealed. Enabling the tamper switch locks the flow computer. A locked Flow-X/C must be sealed by use of a seal wire through the enabled tampered switch.



If the Flow-X/C is unlocked by disabling the tamper switch and the MID compliance is enabled an alarm is raised.

3 Conditions for conformity assessment

- The electronic calculating and indicating device must be constructed in accordance with this Evaluation Certificate and the appertaining documentation.
- 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 ER8838 issued together with this Evaluation Certificate.