

Issued by NMI Certin B.V.

In accordance with

- WELMEC 8.8, 2017: Guide on the General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments
- OIML R117-1, 2007: Dynamic measuring systems for liquids other than water

Producer

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Part

An **electronic calculating and indicating device** (flow computer) intended to be used as a part of a liquid measuring installation.

Producer mark or name : Endress+Hauser Process Solutions AG
Type designation : Bunker Metering Computer; or
Off-Loading Flow Computer

Accuracy class : 0.3

Further properties and test results are described in the annexes:

- Description TC8396 revision 28.
- Documentation folder TC8396-3.

Initially issued

7 June 2013

Remark

This revision replaces the previous versions, except for its documentation folder.

Issuing Authority

NMI Certin B.V.
26 February 2026

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 instrument must be covered by relevant metrological certification that is valid in the country where the instrument is put into use.



Display panel

Controller (as an example)

Example of the electronic calculating and indicating device

The main components (controller, display panel, printer) can be placed in one or more housings. See documentation 8396/1-01 and 8396/9-01 for housing examples.

The Modbus booster RS-485 can optionally be placed in the house for signal boost. See documentation no 8396/16-01 for technical specification of the Modbus booster.

The Bunker Metering Computer can also be referred to as Off-Loading Flow Computer.

1.1 Essential parts

1.1.1 Hardware components

Controller (the picture is an example)



The controller consists of the following modules, mounted in a steel enclosure:

| Description | Make and type |
|---|--|
| industrial Programmable Logic Controller (PLC) | Allen Bradley 1769-L24ER-QBFC1B or Allen Bradley 1769-L27ERM-QBFC1B |
| power supply | Allen Bradley 1606XLS120E or PULS SL5 for 100-240VAC to 24 VDC conversion |
| power redundancy unit (optional) | Allen Bradley 1606XLSRED or PULS YR2.DIODE |
| serial interface | Allen Bradley 1769-ASCII |
| converter between RS232C and Ethernet | Moxa Nport 5110 or 5150 |
| Modbus RTU interface | Allen Bradley 1769-SM2 |
| analogue input module | Allen Bradley 1769-IF4I |
| Remote Access Modem with integrated Ethernet switch (optional) | ICP-DAS NS205 5 Port UTP-100, or MDH834, or Allen Bradley / Rockwell 1783-US5T |
| Boost or amplify RS485 signals over longer distances to overcome limitations of standard signals. | Moxa TCC-120 RS-485 converters / repeaters |

Display panel make Allen-Bradley Type: 1200P (Cat: 6181P-12TSXP Ser: E) or display panel make Bernecker + Rainer Type: Panel PC 2100 (5AP1120.1214-xxx) or a similar type.
Printer make OKI, type ML280 Matrix POS (Point of Sale) or a similar printer, for instance GEBE GPT-4352-(60) or GPT-4344 or Epson TM-T88V.

1.2 Essential characteristics

1.2.1 Temperature range ambient:

- -10 °C ... +55 °C

1.2.2 Environment classes: M3 / E2

1.2.3 Correction device

Applicable from version 1.08.00 onwards:

Virtual Offset Correction

Based on two or three defined points, the BMC flow computer will correct the measurements by taking into account the offset in zero flow rate caused by measuring a different product, different in viscosity and density, than used for the setting of the zero-flow rate. The defined points shall cover the operating range. The settings are stored behind seal.

Only interpolation of the virtual offset is allowed. If a product falls outside the defined range, a new point must be defined. This requires breaking of the seal.

An alarm occurs, if the flow computer has to extrapolate between set limits to determine the virtual offset.

1.2.4 Bunker Metering Computer (BMC) controller functionality:

Count flow meter mass pulses.

Convert 4-20mA signals into digital values (pressure(s) and/or temperature(s)).

Convert 4-20mA signals into digital values (Valve(s) position guarding).

Convert Digital IO signal into digital values (Valve(s) position guarding).

Standard volume conversion (@15°C) according to method ASTM D1250:80 table 54B with pressure correction according to API MPMS Ch11.2.1M. Present since software version: 91.01.01-CH1 or 1.06.00.

Receive (Modbus) RS485 flow meter(s) information/diagnostics.

Transfer all digital information to (Modbus) RS485 slave (Optional in case of RSG40 or RSG45 Paperless recorder).

The Batch Function enables the operator only to reset a "resettable totalizer". The system measures and counts/totalizes continuously (without interruption). The operator can decide when he resets due to Delivery or Loading end or before starting a new operation.

Print Ticket (Decisive Presentation of measured Mass) on RS-232C

Remark: in certain applications, a ticket can be printed when the flow is not zero. A text on that ticket shows that it is not for trade and / or customs.

Transfer digital information (TCP/IP) to Display Panel.

Digital Outputs for Alarms and Warnings as galvanically isolated relays switch.

Zero flow Verification

An automatic function for verifying the zero offset allows to verify the connected measurement sensor (meter) without breaking the seals of meter and Bunker Metering Computer. The Bunker Metering Computer gives the zero flow as t/h and compares the median value of the zero flow verification cycles with the pre-set tolerance.

Basic functions controlled by the Display Panel

Display warning(s) on power-, communication-failure(s) and process values being above the HiHi or below the LoLo configured process values (outside 4-20mA assigned ranges or if a signal is not available (broken cable) and (optional) if valve position(s) (digital guard(s)) have changed during a batch.

From version 1.08.00 onwards, the BMC flow computer has the following functionality added:

- Flow signal surveillance
The BMC can check if unexpected variations in the flow signal have occurred. If this feature is enabled, an alarm is risen if a disturbance of the flow signal is detected. The settings are protected behind a seal.
- Auto adaptive setting for the discrimination between measurements without air and measurements with air
The setting for discriminating between measurement with air and measurements without air is based on the setting of two limits, which are stored behind a seal. Based on the measured viscosity, the BMC interpolates between these set limits to determine the point where the BMC flags that air is entrained in the liquid.

1.2.5 Weights & Measures parameters.

The manufacturer or user should specify and explain the settings and / or values of these parameters.

A so called "Signature ID" is part of the function block of the custody transfer calculations.

This "Legally Relevant Part" has its own versioning and version number and is part of the controller application.

This ID changes when any modification to the calculation algorithms is applied. This happens automatically in the controller. The custody transfer relevant parameters (used in the calculations) are monitored by the audit trail and can only be changed when the hardware sealing switch inside the control cabinet is set to "unsealed". In addition, it is also monitored by the audit trail if the control cabinet's door is opened.

K-Factor of flow meter(s).

Digital inputs for valve position(s).

Range of 4-20mA inputs for temperature sensors and pressure sensors.

Selection between presentation of either mass in vacuum or mass in air or both.

Factor for conversion from mass in vacuum to mass in air.

Standard Density low/high limit warning, adjustable by customer.

The limit for both low/high density is 0-2000 kg/m³, but the setting should match the used volume conversion method.

Added Gross Observed Volume (GOV) indication, based on operator entered reference density or dynamically determined density and process Pressure and process Temperature.

With the operator entered reference density the Gross Observed Volume [m³] = Mass [T] / (API Reference Density [kg/m³] * Flow weighted average VCF / 1000).

With the dynamically determined density the Gross Observed Volume [m³] = Mass [T] / dynamically determined density.

When indicative, the indication of the GOV should be presented as non-Weights & Measures approved.

When Custody Transfer relevant, the indication of the GOV shall be as shown below in bullet "Screen with mass custody transfer metering results".



Description

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Added Reference Density calculation from flowing density (for instance a Promass mass flow meter) and Pressure and Temperature.
 When indicative, the Reference Density indication should be presented as non-Weights & Measures approved.

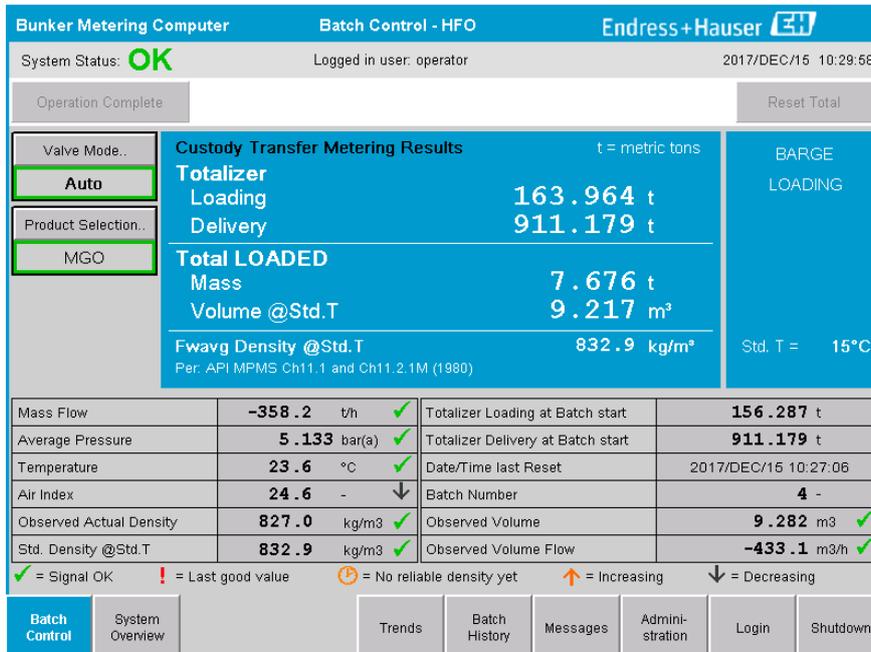
When Custody Transfer relevant, the Reference Density indication shall be as shown below in bullet "Screen with mass custody transfer metering results".

Remark: The Bunker Metering Computer will not calculate the reference density. This fixed reference density as input by the operator must be known by that operator, for example because it is a laboratory determined density.

Screen with mass custody transfer metering results.

| Bunker Metering Computer | | Batch Control - HFO | | Endress+Hauser | |
|---|---|--------------------------|-----------------------------------|----------------------|----------------|
| System Status: OK | | Logged in user: operator | | 2017/DEC/15 10:37:18 | |
| Operation Complete | | | Reset Total | | |
| Valve Mode.. | Custody Transfer Metering Results t = metric tons | | | | BARGE LOADING |
| Auto | Totalizer | | | | |
| | Loading | 199.293 t | | | |
| | Delivery | 911.179 t | | | |
| | Total LOADED | | | | |
| | Mass | 2.845 t | | | |
| | | | | Std. T = | 15°C |
| Mass Flow | -352.6 t/h | ✓ | Totalizer Loading at Batch start | 196.458 t | |
| Average Pressure | 5.133 bar(a) | ✓ | Totalizer Delivery at Batch start | 911.179 t | |
| Temperature | 23.6 °C | ✓ | Date/Time last Reset | 2017/DEC/15 10:35:35 | |
| Air Index | 24.6 - | ↓ | Batch Number | 4 - | |
| Observed Actual Density | 827.0 kg/m3 | ✓ | Observed Volume | 3.428 m3 ✓ | |
| Std. Density @Std.T | 832.9 kg/m3 | ✓ | Observed Volume Flow | -426.3 m3/h ✓ | |
| ✓ = Signal OK ! = Last good value ⚠ = No reliable density yet ↑ = Increasing ↓ = Decreasing | | | | | |
| Batch Control | System Overview | Trends | Batch History | Messages | Administration |
| | | | | Login | Shutdown |

Screen with mass and volume custody transfer metering results.



The screenshot displays the 'Custody Transfer Metering Results' for a 'BARGE LOADING' operation. The system status is 'OK' and the user is 'operator'. The interface shows various parameters and their values:

| Custody Transfer Metering Results | | t = metric tons |
|---|--|-------------------------|
| Totalizer Loading | | 163.964 t |
| Totalizer Delivery | | 911.179 t |
| Total LOADED Mass | | 7.676 t |
| Volume @Std.T | | 9.217 m ³ |
| Fwavg Density @Std.T | | 832.9 kg/m ³ |
| Per: API MPMS Ch11.1 and Ch11.2.1M (1980) | | Std. T = 15°C |

| | | | | |
|-------------------------|-------------------------|---|-----------------------------------|----------------------------|
| Mass Flow | -358.2 t/h | ✓ | Totalizer Loading at Batch start | 156.287 t |
| Average Pressure | 5.133 bar(a) | ✓ | Totalizer Delivery at Batch start | 911.179 t |
| Temperature | 23.6 °C | ✓ | Date/Time last Reset | 2017/DEC/15 10:27:06 |
| Air Index | 24.6 - | ↓ | Batch Number | 4 - |
| Observed Actual Density | 827.0 kg/m ³ | ✓ | Observed Volume | 9.282 m ³ ✓ |
| Std. Density @Std.T | 832.9 kg/m ³ | ✓ | Observed Volume Flow | -433.1 m ³ /h ✓ |

Legend: ✓ = Signal OK, ! = Last good value, ⚠ = No reliable density yet, ↑ = Increasing, ↓ = Decreasing

1.2.6 The following software packages are installed on the Operating Panel:

Factory Talk View (Site Edition Version 6.10.00).

- It can be verified during startup of system

HashCalc (Version 2.02.00337).¹

- HashCalc (Version 2.02.00337), it can be verified on active HashCalc application. Click on icon (top left) and select "About HashCalc..."

Panda USB Vaccine (Version 1.0.1.4) or the Windows Patch KB967715.²

- It can be verified under "Add or Remove Programs" in Windows Control Panel. Activate "Show updates".

Endress+Hauser Bunker Metering Computer Operating Panel application:

Software Version can be verified on "Administration" page of application:

- 1.01.02; 1.01.03; 1.01.04
- 1.03.00; 1.03.01; 1.03.02
- 1.04.00; 1.04.01; 1.04.02; 1.04.03; 1.04.04; 1.04.51; 1.04.52; 1.04.53
- 1.05.00; 1.05.01; 1.05.02; 1.05.03; 1.05.04
- 1.06.00
- 1.07.00; 1.07.02; 1.07.03;
- 1.08.00; 1.08.01
- 1.09.00; 1.09.01
- 5.00.00; 5.01.00
- 91.01.01-CH1
- 91.02.00-CH1

¹ Only for application versions < 1.05.00.

² Windows XP only.

- 1.10.00; 1.10.01
- 5.02.01
- 5.03.00
- 5.03.01

Hash code to be calculated after start-up and commissioning.

1.2.7 Antivirus software packages optionally installed

The version number of the software package is non-essential. See also chapter 1.2.12.

SuperAntiSpyware Anti Spyware software.³

Microsoft Security Essentials (part of Windows XP).³

Microsoft Windows Defender (part of Windows 7).⁴

1.2.8 The following software packages are installed on the Controller:

Bunker Metering Computer Controller Application (PLC program):

Versions:

- 1.01.06; 1.01.07; 1.01.08
- 1.03.00; 1.03.01; 1.03.02
- 1.04.00; 1.04.01; 1.04.02; 1.04.03; 1.04.04; 1.04.51; 1.04.52; 1.04.53
- 1.05.00; 1.05.01; 1.05.02; 1.05.03; 1.05.04
- 1.06.00
- 1.07.00; 1.07.02; 1.07.03; 1.07.04
- 1.08.00; 1.08.01; 1.08.03; 1.08.04
- 1.09.00; 1.09.01
- 5.00.00; 5.01.00
- 91.01.01-CH1
- 91.02.00-CH1
- 1.10.00; 1.10.01
- 95.02.01
- 5.02.01
- 5.03.00
- 95.03.00
- 95.03.01

Legally Relevant Part:

Versions:

- 1.01.03, 1.01.04 or 1.01.05
- 1.03.00; 1.03.01; 1.03.02
- 1.04.00; 1.04.01; 1.04.02; 1.04.03; 1.04.04; 1.04.51; 1.04.52
- 1.05.00; 1.05.01; 1.05.02; 1.05.03; 1.05.04
- 1.06.00
- 1.07.00; 1.07.02; 1.07.03; 1.07.04; 1.08.00; 1.08.01; 1.08.03; 1.08.04
- 1.09.00; 1.09.01
- 5.00.00; 5.01.00
- 91.01.01-CH1
- 91.02.00-CH1
- 1.10.00; 1.10.01
- 95.02.01
- 5.02.01

³ Windows XP only.

⁴ Windows 7 only.

- 5.03.00

The signature ID of the block is calculated automatically after start-up and commissioning.

The resulting HASH code can be inscribed on the nameplate, or on another plate that fulfils the same demands as for the nameplate (inscription must be durable; it must be impossible to remove to plate without damaging it or the plate must be sealed).

NOTE: Added function for improved system performance with MGO. Present since Software version: 1.05.02 (also applicable for operation panel software).

1.2.9 The Controller software fulfils the parts P, L and T of the WELMEC guide 7.2, issue 5, while the parts U, S and D are not applicable.

1.2.10 The Display Panel software fulfils the parts U and T of the WELMEC guide 7.2, issue 5, while the parts P, L, S and D are not applicable.

When the Gross Observed Volume (GOV) is shown next to the legally relevant indication it shall be clearly marked that the GOV is not legally relevant.

1.2.11 Users (for information only)

The system will be setup with the following user accounts:

Bunkering System operator

This is the standard user account to be used and has limited access.

System administrator

Administrative account in case of necessary updates. Login information for this account shall not be known to the user of the instrument.

NOTE: Updates will only be installed/applied if they fix a problem that has impacted the Bunker Metering Computer Display Panel otherwise the software will be left as it is.

1.2.12 Security (for information only)

The Bunkering Display Panel is set up to run only the E+H Bunkering Application Display Panel application. The normal (default) user (i.e. the Operator) can only operate the Bunkering Program, this to prevent the operator(s) from inadvertently (or deliberately) changing anything that could change the metrological result(s) on the Bunkering Controller.

This is achieved by ensuring that the windows system does not allow the Operator access to the other programs on the Display Panel and disabling the standard Windows keyboard shortcuts (like CTRL+ALT+DEL). The access to metrological parameters is there for granted only to the Representative of an authorized entity by changing the user level of the Bunkering Application program to the highest level and thus gaining access to the Application Program configuration page.

Using the Administrative account, the system administrator can access the Computer System, for instance if a critical bug in the Windows system would need to be corrected. Because the Computer connections and cables (protective interfaces) are only accessible by breaking the seal(s) from the cover plate and or Controller housing this means that after an update a representative of an authorized entity needs to reseal the Display Panel' cover plate(s) and housing; of course after it has been verified (HashCalc) that the E+H Bunkering Application Display Panel Application has remained unchanged.

The Bunker Metering Computer's Program is setup to have (at least) 3 user levels:

Standard operator

The standard operator can use the system to perform the day to day normal operation (Start and Stop batches and print tickets.)

Supervisor

The Supervisor can do all that the Standard operator can do but also change Hi and Lo limit settings as well as other (Non-Authorized entity) parameters.

Representative of an authorized entity

The representative of an authorized entity, can perform all the above mentioned and verify/set the Process parameters that could influence the measured quantity of the Bunkering Metering System.

Due to the fact that the system is not accessible from outside (also no internet connection) a contamination with any virus or malware is impossible so Antivirus tools are not mandatory on the panel pc.

The manufacturer makes sure and proofs that the system is "clean" right before the sealing by a representative of an authorized entity. This is ensured through the production process so that the system is delivered "clean". Also, after updating or reinstallation of the system software using original images from the manufacturer it is ensured that the system is "clean". An additional test before sealing is not needed but if requested this could be either done with installed Antivirus software or by running a scan from a dedicated tool (e.g. boot from an USB stick with updated Antivirus software).

Informative remark:

The manufacturer's production process includes an Antivirus scan and is included into their quality system.

- 1.2.13 After installation and commissioning (Sealing by an authorized entity) the system has no links to the internet, so no remote connection is available, only a dedicated link to the Controller so contamination with any virus is impossible. (And other protective interfaces through which it is not possible to change files on the Bunker Metering Computer's Display Panel.
Inside the Controller box is a switch set to either Locked (Custody transfer mode is on) or Unlocked (Custody transfer mode is off) hooked up to a digital input of the Controller. (Only accessible after breaking the seal of the Controller.)
- 1.2.14 The Controller has the following functions:
- Power supply.
 - Communication with the Operating Panel (CRCs and packet checksums) using a dedicated TCP/IP cable.
 - Communication with a ticket printer (OKI ML280 or GEBE GPT-4352-(60) or GPT-4344) for the decisive presentation, using an RS-232C cable (odd parity).
 - Frequency input(s) from flow meter(s).
 - Data input from flow meter(s) using Modbus (RS485, Even parity) connection(s).
 - Communication with optional paperless recorder(s) using a Modbus (RS485, Even parity) connection.
 - 4-20mA input signals from Temperature Transmitter(s).
 - 4-20mA input signals from Pressure Transmitter(s).
 - 4-20mA signals to and/or from Pressure Control valve(s).
 - Various digital input connection(s) using dedicated connections.
 - A Control valve will go to manual mode if a broken wire error to the pressure sensor is detected and will return to auto mode after the error is solved.
- 1.2.15 The Display Panel has the following functions:
- Power supply.
 - Communication with the controller using a dedicated TCP/IP cable.

- 1.2.16 Inscription containing the hash code that was detected during legal verification.
- 1.2.17 EMC measures
The shields of the cables that are connected to the I/O Box shall be electrically connected to the metal of the controller box.

1.3 Non-essential characteristics

- 1.3.1 Passive Circuit breakers in the AC output line.
- 1.3.2 Modbus-TCP Gateway; Anybus X-gateway - EtherNet/IP-Slave-Ethernet Modbus-TCP Slave type: AB7632-F or ABC4011
- 1.3.3 Modbus-RTU Gateway; Anybus X-gateway - EtherNet/IP-Slave Modbus-RTU Slave type AB7839-F

2 Seals

The following items are sealed:

- Sealing of communication cables

- The (protective interface) cables are terminated behind a sealed plate or strip.

- The controller-Box will be sealed by using a steel strip with a hole for sealing protruding through the lid (Positioned on either the edge where the 'locks' are or on one of the corners depending on location the controller-Box will be mounted).

- Sealing of the inscription that contains the hash code that was detected during legal verification.

3 Conditions for conformity assessment

- 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 ER8396 revision 28 issued together with this Evaluation Certificate.