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| Issued by | NMi Certin B.V. |
| In accordance with | − WELMEC guide 8.8 "General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments under the MID"<br>− OIML R81 Edition 1998(E) "dynamic measuring devices and systems for cryogenic liquids"<br>− OIML R117-1 Edition 2007(E) "Dynamic measuring systems for liquids other than water".<br>− OIML R137-1 Edition 2012(E) "Gas meters". |
| Producer | Emerson Process Management Flow B.V.<br>Neonstraat 1<br>6718 WX Ede<br>The Netherlands |
| Measuring instrument | A **flow transmitter** (calculating/indicating device for Micro Motion Inc. Coriolis meters), intended to be used as a part of a measuring instrument. |

| | | |
|---|---|---|
| Producer's mark or name | : | Micro Motion Inc. |
| Designation | : | 5700*1(2, 3 or 5)A***ZZ*<br>with additional feature code OL or OG |
| Software versions | : | See paragraph 1.2.5 |
| Accuracy classes | : | 0.3; 0.5; 1.0; 1.5; 2.5 |
| Environment classes | : | M3 / E3 / H3 |
| Temperature range ambient | : | -25 °C … +55 °C |
| | | -40 °C … +55 °C In case the measurement results can be read and / or recorded with a connected approved instrument. |
| Power supply voltage | : | See paragraph 1.2.3 |

Further properties and test results are described in the annexes:
− Description TC8519 revision 6;
− Documentation folder TC8519-1.

| | |
|---|---|
| Remark | This revision replaces the previous versions.<br>The documentation folder is not changed. |
| Issuing Authority | **NMi Certin B.V.**<br>21 November 2017 |

C. Oosterman
Head Certification Board

INSPECTION
RvA I 122

## 1 General information on the flow transmitter

Properties of this flow transmitter, 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 guide 8.8.

The complete measuring instrument must be covered by an EC type-examination Certificate or an EU-type examination certificate.

The Evaluation certificate is valid for the flow transmitter 5700 variants as described below, and can be used in combination with MID approved Coriolis measurement sensors, for instance type F sensors and type CMF sensors, manufactured by Micro Motion Inc., that are described in and covered by respectively the Evaluation certificates TC7050, TC7056 and TC8064.

The flow transmitter is intended for control of a Coriolis sensor and processing of its Custody Transfer output signals into:
- mass flow rate, mass total and  mass inventory;
- actual density, actual volume flow rate, actual volume total and actual volume inventory.
- density at defined reference temperature, volume flow rate at defined reference temperature, volume total at defined reference temperature and volume inventory at defined reference temperature;
- net mass flow rate, net mass total, net mass inventory, net volume flow rate, net volume total, net volume inventory, and concentration
  - Note 1:
  - Net means at defined reference temperature and 100% concentration.
  - Note 2:
  - The Micro Motion Inc. meters are calibrated in such a way to represent the mass in vacuo (and not the weight or mass in air or apparent mass) and density in vacuo (and not density in air or apparent density). Mass and/or density can be presented in vacuo (default setting) or in air. When mass and/or density are/is to be presented in air the Mass meter factor and/or the Density meter factor must be used:

| | |
|---|---|
| Mass Flow Rate Meter Factor | 1,00000 |
| Density Meter Factor | 1,00000 |

  The meter factor depends on the actual fluid density and/or ambient air density and is always <1; therefore these meter factors are application specific.
  It shall be made clear on the device when the measurement is presented in air.

Depending on the type, the flow transmitter is equipped with or without a display. It can be considered as an electronic calculating / indicating device or an electronic calculating device.

The Model 5700 can be used in the following configurations.
- Config. 1 = Model type 5700I: Integral mount of the Core processor and 5700 transmitter with the sensor.
- Config. 2 and 3 = Model type 5700R: Remote Core Processor and 5700 transmitter.
- Config. 4 = Model type 5700C: Core processor integrated with remote 5700 transmitter.

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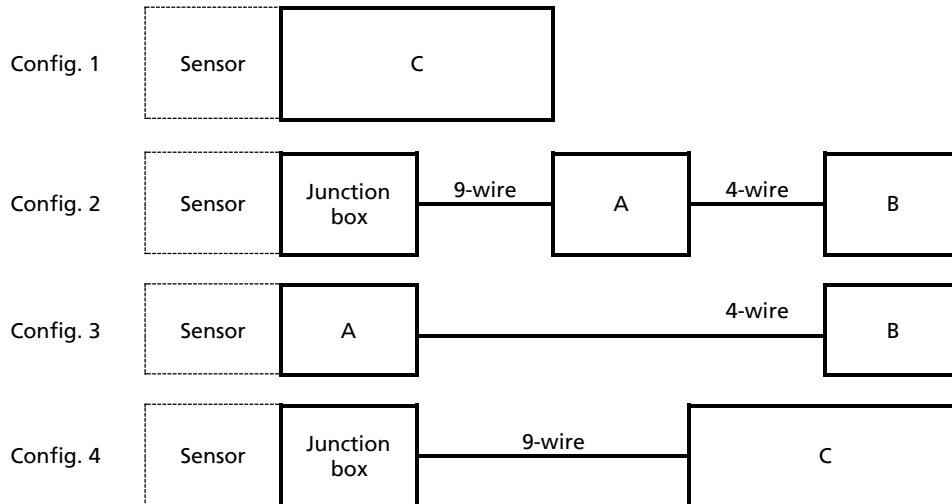
A is the Remote Core-Processor MVD700 or MVD800, known from TC7057.
B is the transmitter.
C is the transmitter with integral Core-Processor.

All measurement calculations of Process Variables are performed in the 5700; the Core Processor only supplies raw signal measurements and basic sensor diagnostics.



| Remote mount version (Config. 2, config. 3 and config. 4) | Sensor mount version (Config. 1) |

One of the functions is LD-optimisation, which is described in detail in the document number 7057/26-01 belonging to Evaluation Certificate TC7057.

Remark:
Smart Meter Verification (on-line) can be used in Custody Transfer mode, as it has no influence on the measurement accuracy.

## 1.1 Essential Parts

The boards included in the Calculating / Indicating device:

| Part | Reference | Documentation |
|------|-----------|---------------|
| Core processor board (config. 1 & 4) | EB-20025291 | 8519/0-01, -02 |
| Core processor pass thru board (config. 2 & 3) | EB-20025294 | 8519/0-03, -04 |
| Config. I/O board | EB-20025303 | 8519/0-05, -06 |
| Analog board | EB-20025300 | 8519/0-07, -08 |
| Display board | EB-20029907 | 8519/0-09, -10 |
| Power board | EB-20025312 | 8519/0-11, -12 |
| Backplane | EB-20025288 | 8519/0-13, -14 |
| 4 – wire terminal board (config. 2 & 3) | EB-20025315 | 8519/0-15, -16 |
| 9 - wire terminal board (config. 4) | EB-20025318 | 8519/0-17, -18 |
| Connector board | EB-20025323 | 8519/0-19, -20 |

**The Core-Processor**
Communication to the Core Processor is initially established using RS-485 Modbus RTU mode, 38400 baud, no parity, and one stop bit. Once the revision is validated as supported, the protocol is switched to a proprietary burst protocol which transfers basic, raw sensor information and diagnostics from the Core Processor to the 5700 to be used in Sensor Calculations. All packets contain a CRC value for the data in that packet and also a packet sequence number. The Core Processor may be remotely mounted or integral to the 5700, the interface is the same in each case.
All measurement calculations of Process Variables are performed in the 5700; the Core Processor only supplies raw signal measurements and basic sensor diagnostics.

The 5700 transmitter can be changed with another 5700 transmitter.
- This is under the condition that the Weights and Measures parameters from the old 5700 are transferred to the new 5700 and with 5700C (Config. 4) or 5700I (Config.1), the new transmitter is zero-ed via the auto-zero function.
- Exchanging the 5700 transmitter requires breaking of the seal of the connected transmitter.

For changing the remote MVD800ECP or MVD700CP (Config. 2 and 3), see Evaluation Certificate TC7057.

## 1.2 Essential characteristics

1.2.1 Totals / inventories
Only actual mass total/inventory, actual volume total/inventory or standard/net (API/Concentration Measurement) volume total/inventory can be used to measure a custody transfer transaction.
These totalisers / inventories can be read from the transmitter via the display (if configured as such), via pulse output (double channel, phase shifted) or via digital communication (Modbus) on an approved indicating device or calculating and indicating device.

1.2.1.1 Conversion of measured volumes to volumes at reference conditions using:
- Methods 53A, 54A, 53B, 54B, 54C, 53D and 54D (reference temperature 15 °C) as specified in API Manual of Petroleum Measurements Standards, Chapter 11, Physical Properties Data, Section 1 (also known as ASTM D1250-07).

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With a reference of 20 °C the calculations give the same results as with methods 59A, 60A, 59B, 60B, 60C, 59D and 60D.
- Methods 53E, 54E, 59E and 60E as specifies in API Manual of Petroleum Measurements Standards, Chapter 11, Physical Properties Data, Section 2, part 4 (also known as GPA Technical Publication TP-27).

Remark: this conversion method is not approved for transmitter software version 1.20 / Weights & measures version 1.0!

1.2.1.2 Concentration Measurement uses manually configured tables which are stored behind seal, e.g. they cannot be modified when the device is in Custody Transfer Secure Mode. Concentration Measurement requires an approved external temperature probe; it is not allowed to use the temperature probe of the connected sensor.
Concentration Measurement feature can be used for density and volume at a defined reference temperature for any liquid for which a traceable database or norm/standard is available. This Evaluation Certificate covers
- FAME calculations, using the formula:
Density at 15 °C = density at actual temperature + 0,723 * (product temperature -15 °C).
- Methyl-Ester calculations, using the formula:
Density at 15 °C = density at actual temperature + 0,71962 * (product temperature -15 °C).
- The Concentration Measurement feature is used for measuring alcohol, alcohol percentage and alcohol at 20°C (100% alcohol), based on OIML R22. This Evaluation Certificate covers alcohol percentages from 50% up to and including 100%.
Remark: For using the Concentration Measurement feature on alcohol, it is always (independent of temperature) necessary to determine the FT and DT values of the individual sensor.
Remarks:
- Before putting into use, when a flow transmitter 5700 is using the Concentration Measurement feature, the correctness of the configured table must be verified, in order to be sure that the conversion does not exceed the limits as defined for the calculations.

1.2.1.3 Batch function
A batch can be 1 or 2 stages (valves) and can also control a pump. Up to 6 presets can be configured for use. The batch can be configured to batch by an amount (for example in mass; kg) or by percent (for example 80% from target). It has the capability to predict when to close valves to prevent an overshoot of the target. After the batch is reset, the Batch Count number is incremented. Note: Batch Count is a different parameter and is maintained separately from the BOL number used in non-batch printer function (see 1.2.14).
Batch count is configurable only when the device is not secured.

1.2.2 Input signals
- 4 … 20 mA temperature from an external device;
- 4 … 20 mA pressure from an external device;
- Modbus from the remote Core Processor;
- HART BELL 202 over the current output for reading digitally the pressure and/or temperature. The Hart signals are superimposed on the DC-current of the output.
  - The user can configure the number of decimal places for each process variable. Temperature has a default of 2 decimal places, all other variables 4, with a maximum of 5 places of precision.

**1.2.3 Power supply voltage**
- 100 … 240 VAC (tested with good results at 85 VAC and at 265 VAC)

or
- 21 … 90 VDC (tested with good results at 18 VDC and at 100 VDC).

For uninterruptible applications an uninterruptible power supply is mandatory.

**1.2.4 Software specifications (see the WELMEC 7.2 "Software Guide"):**
Chapter P;
Risk Class C;
Extensions T, I-2 and I-5 apply.

Chapter U and the extensions L, S, D, I1, I3, I4 and I6 do not apply.

**1.2.5 Software versions**

| Firmware | Software version | Checksum |
|---|---|---|
| Transmitter Software (Weights & Measures)[1] | 1.20 (1.0) | 2DF0D8E9 |
| | 1.30 (1.1) | ADE631BB |
| | 1.85 (2.0) ETO28130 | 0EA71B41 |
| | 2.00 (2.0) | 2F52132D |
| Internal Core Software | 4.02 | 8D61C368 |
| | 4.14 | 40860C63 |
| | 4.20 | 2983A9BE |
| | 4.40 | B280233F |
| | 4.42 | D7BA0841 |
| PIC Firmware | 8.0 | 0000DE9C |
| LCD PIC Firmware **\*)** | 3.0 | 000081D5 (1.20) 00007442 (1.30 & 1.85) |

**\*)** Between brackets the Transmitter Software is mentioned which belongs to the stated checksum

The software versions of the remote Core Processor (MVD700 or MVD800) are mentioned in Evaluation Certificate TC7057.

**1.2.6 Minimum measured quantity**
The minimum measured quantity is not smaller than the largest of the following values:
- The minimum measured quantity of the connected sensor;
- n times the unit of indication of the 5700, where is n is given in the table below:

| Accuracy Class | 0,3 | 0,5 | 1,0 | 1,5 | 2,5 |
|---|---|---|---|---|---|
| n | 500 | 200 | 100 | 100 | 50 |

**1.2.7 Custody Transfer parameters**
The Custody Transfer parameters and the mandatory settings are given in paragraph 1.4 of this Description.

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[1] The transmitter Software and the Weights & Measures software form a matched set. Please note that the Weights & Measures software does not have a checksum and means W&M is licensed.

1.2.8    Security mode:
- The 5700 transmitter must have a license installed that enables custody transfer, and the switch on the LOI must be placed into the secure state. See the following picture for the location of the switch.

security switch



- The remote Core Processor contains no parameters that affect legally relevant functionality. Therefore, it requires no special locking or sealing mechanism.
- Software passwords are not needed and are not incorporated.
- The wiring compartment must be sealed to prevent tampering with the wiring or access to the USB service port (SP). See the example in chapter 2 of this description.
  The display cover must be sealed.
  See the example in chapter 2 of this description.
- When in the secure mode, the host is limited to read commands only. All configuration and calibration data can be read via digital communication while in a secured mode. The LOI may be additionally protected by password security, which requires the user to enter a 4 digit alphanumeric password to change configuration. The user always has read access to configuration menus. If the user forgets the password, that password must be reset using digital communications. When in secure mode, the operator has only read access.

1.2.9    Non Volatile Memory Data Integrity
Data integrity of the NVM is preserved by keeping two exact copies of NVM parameters and each copy a computed CRC of the data. The 5700 updates the CRC as data is changed in the NVM. At power up the 5700 checks the NVM integrity by comparing calculating a CRC value over the data and comparing it to the stored value. If the CRCs do not match with the stored values an Electronics Failed alert is activated. During runtime, the 5700 completes a CRC validation of NVM every 5 minutes. If CRCs do not match, an Electronics Failed alert is activated.

1.2.10    Parameters that are protected in the secure mode
When in secure mode all output and calibration configuration data is locked (no write privileges).

1.2.11    Process Variable Approval
Process variables that are approved for MID functionality will be marked on the LOI using the following method. Legal for Trade and the name of the process variable will alternately be displayed on the menu bar at the top of the process variable screen. Variables that are approved for display must be entered by the user when the 5700 is not in secured state. This is accomplished by navigating the LOI menus Configuration -> Weights & Measures ->

Approve Variables. The appropriate variables can then be selected. This can also be done using digital communications.

1.2.12 Rollover
- Setting NTEP
  Not allowed to be used.
- Setting OIML
  Totals and inventories always roll-over. A rollover count is incremented for each total/inventory whenever they roll-over. This is different from previous products where there was no running count, only a rollover flag. If the rollover count for a given total/inventory is greater than 0, a rollover indication is shown on the corresponding process variable screen. The roll-over indication is stored in non-volatile memory.

1.2.13 The 5700 has 7 Totalizers and 7 Inventories, each is independent and configurable. In addition to Process Variable Assignment, behavior with respect to flow direction can be configured. The Process Variables available for configuration depends on what licenses are installed. For details on configuration refer to Configuration Manual, Micro Motion Model 5700 Transmitter. Configuration of the Totalizers and Inventories is not allowed when the 5700 is in Custody Transfer secured mode.

1.2.14 Printer function and printout of the delivery via RS485 port using the Epson protocol. The applied printers are EPSON TM-T88V (thermal printer), a EPSON TMU-295 (slip printer) or any other printer using the EPSON protocol all with paper-out detection and feedback warning.
Notes: The RS485 port can be configured for:
- Modbus output OR (via channel E with connected RS485/RS232 converter with RTS);
- Printer output.

## 1.3 Essential shapes

1.3.1 Inscriptions
- At least the inscription "TC8519" is placed on the model.
- Identification of the measurement sensor.
- Close to the display of the 5700 or that of the connected flow computer: the minimum measured quantity.

1.3.2 Status
In case an electronic calculator/indicating device is connected to the 5700 the status is sent to the connected device in one or more of the following ways:
- The status is sent directly to the flow computer using the Modbus connection.
- The status output results in interrupting one of the pulse-channels, thus enabling the flow computer to detect a pulse failure and consequently generate an alarm.
- The status results in a saturated mA output (< 3,6 mA or >21 mA) thus enabling the flow computer to detect failure and consequently generate an alarm.

1.3.3 Sealing.
See chapter 2 of this description.

## 1.4 Conditional characteristics

1.4.1 Parameter settings; all settings are protected by the security switch.
- Totalizer reset (if allowed)
- Meter zero calibration
- The settings of the following parameters must be explained before putting into use of the instrument, either by the user or the manufacturer.
  - Configuration / Flow / damping, direction

- Configuration / Flow / mass / flow units, low flow cutoff, decimals on display, meter factor
- Configuration / Flow / volume / flow type, flow units, low flow cutoff, decimals on display, meter factor
- Configuration / Flow / density / units, decimals on display, damping, cut off, meter factor
- Configuration / Flow / temperature / units, decimals on display, damping, external temperature
- Configuration / Flow / pressure / units, flow factor, density factor, calibration pressure
- Configuration / Totalizers/Inventory / mass, volume, source, direction, response time
- Configuration / Totalizer reset / on/of

1.4.2    The indication unit can be set to tons or kg or grams, respectively m3 or litres.

1.4.3    Double impulse, phased shifted, frequency output signal, for the transmission of mass- or volume information.

1.4.4    Current output(s) for density

1.4.5    Modbus RS485 output of the various parameters (for example mass total) to an approved indicating device (flow computer).

1.4.6    Low flow cut off settings.
The low flow cut off for mass flow and the low flow cut off for volume flow shall not be more than one fifth of the minimum flow rate of the connected sensor.

1.4.7    Damping settings
- Flow: maximum damping time is 1,6 s.
- Density: maximum damping time is 1,6 s.
- Temperature: maximum damping time is 4,8 s.

1.4.8    Last measured value fault time out settings
- The maximum value for "Last measured value fault time out setting" for mA and for pulses (one setting) is 2 s.

1.4.9    The 5700 is equipped with meter factors for density and volume. These factors can be used to adjust the density and volume in case density and/or volume are outside the allowed limits but still are within a band of two times the allowed limits. Using the factors applies a linear shift in the measurement.


**1.5    Conditional shapes**

- Printed Ticket (if applicable)
  - See the Evaluation/Parts certificate of the applied flow computer if the printer is connected to the flow computer.
  - In case a printer is connected to the 5700, at least the following information is printed:
    - Unique information, identifying the delivery.
    - Delivered mass and/or volume under metering conditions.
    - Identification of the delivered product.
    - A message indicating if alarms have occurred during the delivery.
      Optionally the following information can be printed:
    - Delivered volume under reference conditions, In this case it is mandatory to print the reference conditions.
    - When the printer is to be used in road vehicle applications and is being powered directly by the on board road vehicle battery, a suitable power conditioner is required to comply with the road vehicle battery disturbance requirements.

## 2    Seals

- After setting the 5700 in Custody Transfer mode, the access to the wiring is sealed to avoid unauthorised changing of the wiring. The display window is sealed against opening for protection of the Weights & Measures switch setting.
See the example below.
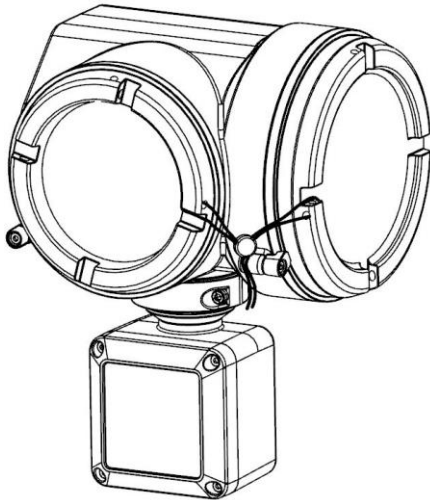


- The transmitter is sealed against removal from the measurement sensor. This is done either by physically sealing the transmitter to the measurement sensor or by mentioning the measurement sensor's serial number on the type plate of the transmitter.
- In case of configuration Config. 2 and Config. 4: The 9-wire connection between measurement sensor (junction box) and Core Processor resp. transmitter is sealed at both ends against opening.

## 3    Conditions for Conformity Assessment

- Other parties may use this Evaluation Certificate only with the written permission of Emerson Process Management Flow B.V., Neonstraat 1, 6718 WX Ede, the Netherlands.
- Cabling has to be in accordance with manufacturer installation instructions.

## 4    Reports

An overview of performed tests is given in the test reports:
- NMi-14200115-01;
- NMi-14200115-02;
- NMi-14200115-03;
- NMi-15200770-01;
- NMi-14200115-06.