



## Type approval certificate

Number **T8911** revision 3  
Project number 2491609  
Page 1 of 1

Issued by NMI Certin B.V.

In accordance with The "Metrologiewet" (Stb. 2006, 137) and the "Regeling nationaal autonoom regelde meetinstrumenten"

Manufacturer Endress+Hauser Yamanashi Co., Ltd.  
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Fuefuki-shi Yamanashi 406-0846  
Japan

Measuring instrument An **automatic level gauge**  
Manufacturer's mark or name : Endress+Hauser Yamanashi Co., Ltd.  
Type designation : NMS8x

Further properties are described in the annexes:  
– Description T8911 revision 3;  
– Documentation folder T8911-3.

Remarks – This revision replaces the previous revisions;  
– The documentation folder replaces the previous documentation folder.

Issuing Authority **The Designated Body, NMI Certin B.V.**  
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## Description

Number **T8911** revision 3

Project number 2491609

Page 1 of 7

### 1 General information about the level gauge

Properties of the level gauge, whether mentioned or not, shall not conflict with the legislation.

#### 1.1 Essential parts

See document number 8911/0-02 for assembly drawing of the level gauge housing.

##### 1.1.1 Electronic parts

The level gauge is composed of the following parts:

Part	Documentation	Remarks
Display/Keyboard	8911/0-03, 0-04, 0-05, 3-01, 3-02, 3-03	-
Frontplane	8911/0-06, 0-07	-
IOM-Analog AEXd	8911/0-08, 0-09, 0-10, 2-01	-
IOM-Analog AEXi	8911/0-11, 0-12, 0-13, 2-02	-
IOM-Digital	8911/0-14, 0-15, 0-16	-
IOM-Modbus	8911/0-17, 0-18, 0-19	-
IOM-V1/WM550	8911/0-20, 0-21, 0-22, 3-04, 3-05, 3-06	-
Main Board (CPU)	8911/0-23, 0-24, 0-23	-
Power supply HV AC	8911/0-26, 0-27, 0-28	HV = High voltage
Power supply LV AC	8911/3-07, 3-08, 3-09	LV = Low voltage
Power supply LV DC	8911/3-10, 3-11, 3-12	LV = Low voltage
Magnetic Rotary Encoder	8911/0-29, 0-30, 0-31	-
HALL	8911/0-32, 0-33, 0-32	-
Sensor module (SMS)	8911/0-35, 0-36, 0-37	-

##### 1.1.2 Sensor

Part	Documentation	Remarks
Sensor	8911/0-38	
Wiredrum	8911/0-39, 3-13	
Displacer	8911/0-40	

##### 1.1.3 Remote indications (optional)

The following remote indications can be used optionally:

- NRF81, as described in the Test Certificate TC8909.
- Tankvision, as described in the Test Certificate TC7445.
- Tankvision Professional, as described in the Test Certificate TC8732.



Description

Number **T8911** revision 3  
Project number 2491609  
Page 2 of 7

1.2 Essential characteristics

- 1.2.1 Maximum measuring range
  - 40 metre
- 1.2.2 Temperature range ambient
  - -40 °C / +70 °C
- 1.2.3 Electromagnetic environment class
  - E2
- 1.2.4 Power supply
  - The level gauge can be powered by one of these options:
    - AC high voltage (HV), in the range of 100 ... 240V AC (-15% / +10%) @ 50/60Hz.
    - AC low voltage (LV), with 65 V AC (-20% / +15%) @ 50/60Hz.
    - DC low voltage (LV), in the range of 24 ... 55 V DC (-20% / +15%) @ 50/60Hz.
- 1.2.5 Indication
  - Scale interval of the indication, in m or mm, shall not be greater than 1 mm.
  - Level indication information and gauge status (level balance, etc.).
  - Indication of status messages, error messages and alarm messages.
  - Indication of the device locking status.
- 1.2.6 Density range
  - For each displacer type the density range shall be determined using the following "Additional information in order to be able to determine the influence of alternating product density".

Additional information to determine the influence of alternating product density

As the buoyancy of the displacer placed in liquid is a function of the density of the liquid ( $\rho$ ) and the balance volume ( $V_B$ ) of the displacer, for a given displacer and a set reference density ( $\rho_{ref}$ ), a limited density range ( $\rho_{min}$ ;  $\rho_{max}$ ) applies. This density range depends on the given reference density, and therefore has to be calculated for this reference density as follows:

1. Resulting weight of the displacer during balance, at reference condition:

$$m_{res} = m_{Disp} - \rho_{ref} * V_B$$

Balance volume may also be expressed as:

$$V_B = A_{Disp} * h_{ref} \Leftrightarrow h_{ref} = \frac{V_B * 4}{\pi * d_{Disp}^2}$$

Balance volume and reference density are adjustable parameters. The immersion depth ( $h_{ref}$ ) of the displacer during balance can be calculated by the above stated formula using the displacers' cross-section ( $A_{Disp}$ ) of the cylindrical part of the displacer.



Description

Number **T8911** revision 3  
Project number 2491609  
Page 3 of 7

Additional information to determine the influence of alternating product density

2. Density range at a given reference density:

For each density the resulting weight of the displacer is equal since the algorithm calculates it out of the given parameters. So the minimum and maximum density may be calculated as follows:

$$\rho_{ref} * A_{Disp} * h_{ref} = (\rho_{ref} + \Delta\rho) * A_{Disp} * (h_{ref} \pm 1mm)$$

From this formula the minimum and maximum density can be determined as:

$$\rho_{min} = \frac{h_{ref}}{(h_{ref} + 1mm)} * \rho_{ref}$$

$$\rho_{max} = \frac{h_{ref}}{(h_{ref} - 1mm)} * \rho_{ref}$$

Symbol	Description
$m_{res}$	Resulting weight of the displacer when balanced in liquid [g]
$m_{Disp}$	Weight of displacer in air [g]
$V_B$	Balance volume (volume of displacer which is submerged in the liquid), stated on the displacers' label. [mL]
$A_{Disp}$	Cross-sectional area of displacer [mm²]
$d_{Disp}$	Diameter of the cylindrical part of displacer
$\rho_{ref}$	Reference density, or density the user considers as reference (set value of the device, parameter "Upper density") [kg/m³]
$\rho_{min}$	Minimum allowed density [kg/m³]
$\rho_{max}$	Maximum allowed density [kg/m³]
$h_{ref}$	Immersion depth of displacer [mm]



## Description

Number **T8911** revision 3  
Project number 2491609  
Page 4 of 7

### Additional information to determine the influence of alternating product density

#### 3. Balance volume of displacers:

The stated balance volume ( $V_B$ ) on the displacer's label can be used to determine the density range as stated above. To increase the density range the following minimum balance volumes ( $V_{Bmin}$ ) can be used alternatively. Using the listed  $h_{ref}$  values below the allowable density range can be calculated.

Displacer type	Balance volume $V_B$	$V_B$ immersion depth $h_{ref}$	Minimum balance volume $V_{Bmin}$	$V_{Bmin}$ immersion depth $h_{ref}$
50 mm SS / Al	70,7 mL	34,9 mm	35 mL	17,4 mm
50 mm PTFE	59,0 mL	30,0 mm	25 mL	12,5 mm
50 mm Alloy C	70,7 mL	34,9 mm	35 mL	17,4 mm
70 mm SS / Al	52,8 mL	13,7 mm	28 mL	7,2 mm
110 mm SS / Al	36,3 mL	3,8 mm	27 mL	2,8 mm

#### 1.2.7 Software specification (refer to WELMEC 7.2):

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

Software version	Checksum	Remarks
01.02.00	0x477A	-
01.02.01	0xB028	-
01.03.03	0x940B	-
01.04.01	0x8cc8	-

Software version and belonging checksum can be viewed by the display as stated in paragraph 1.5.1.

#### 1.2.8 Data communication

The level gauge is capable of indicating several quantities. Use for Weights and Measures related purposes is allowed for the following quantities:

- Level.

The following input(s) can be used for legally relevant data:

- 4...20 mA analog input;
- HART superimposed;
- Digital input.



## Description

Number **T8911** revision 3

Project number 2491609

Page 5 of 7

The following output(s) can be used for legally relevant data:

- Display;
- 4...20 mA analog output;
- HART superimposed;
- Digital output;
- 2-wire serial communication.

The following transmission protocols can be used for legally relevant data:

- Modbus protocol;
- V1 protocol;
- WM550 protocol.

### 1.3 Essential shapes

#### 1.3.1 Markings

The main nameplate is bearing at least, good legible, the following information:

- Type approval certificate number T8911;
- Name or trade mark of the manufacturer;
- Serial number and year of manufacture;
- The text: "Only read when "Level Bal." is displayed" or "Niveau uitsluitend aflezen tijdens aanduiding "Level Bal."";
- Identification of the measuring tank the level gauge is mounted upon;
- The reference height (in mm);
- The text "Het nulpunt van de vloeistofhoogtemeter ligt .... mm beneden het referentiepunt." (meaning: "The zero-point of the liquid level gauge is .... mm below the reference point.");
- The text "Vloeistof" for the nature and characteristics of the liquid product to be measured.

### 1.4 Conditional parts

#### 1.4.1 Housing

The material of the housing of the level gauge is aluminium or stainless steel.

### 1.5 Conditional characteristics

#### 1.5.1 Programming

When the Weights & Measures switch is set to "W&M sealed" W&M parameters cannot be changed.

Below an overview is given of the parameters that are important from a legal point of view, with the correct setting:

Parameter	Value	Remarks
<b>Operation</b>		
Gauge command	verification	Gauge Operation Command to choose the measurement mode of the Device.
<b>Setup</b>		



## Description

Number **T8911** revision 3  
Project number 2491609  
Page 6 of 7

Parameter	Value	Remarks
Units preset	mm or m	Used to select one of a preset unit settings.
Upper density	verification	Density of the upper layer of the liquid in the tank.
Process Condition	calm surface	Select tank liquid condition.
Empty	verification	Distance from reference point to zero position (tank bottom or datum plate).
Tank reference height	verification	Defines the distance from the dipping reference point to the zero position (tank bottom or datum plate).
Set level	verification	If the level measured by the device does not match the actual level obtained by a manual dip, enter the correct level into this parameter.
High stop level	verification	Position of the displacer high stop as measured from defined zero position (tank bottom or datum plate).
Low stop level	verification	Position of the displacer low stop as measured from defined zero position (tank bottom or datum plate).
<b>Setup-&gt;Advanced Setup-&gt;Sensor config-&gt;Displacer</b>		
Displacer type	verification	Chooses the type of displacer used.
Displacer weight	verification	Set the weight of the displacer in air ( $m_D$ ). Indicated on the displacer's label in grams.
Displacer volume	verification	Displacer volume ( $V_D$ ). Indicated on the displacer's label in millilitre.
Displacer balance volume	verification	Defines the balance volume of the displacer as the lower part of displacer immersed in liquid ( $V_B$ or $V_{Bmin}$ ). Units in millilitres (usually 50% displacer volume) and is indicated on the displacer's label.
<b>Setup-&gt;Advanced Setup-&gt;Sensor config-&gt;Wiredrum</b>		
Drum circumference	verification	Sets the circumference of the wire drum. Indicated on wiredrum's label.
Wire weight	verification	Defines the weight of the measuring wire in g/10m. Indicated on wiredrum's label.
<b>Setup-&gt;Advanced Setup-&gt;Display</b>		
Value 1 display	tank level	Select the measured value that is shown on the local display.
<b>Setup-&gt;Advanced Setup-&gt;System units</b>		
Distance unit	mm or m	Select the unit for distance. This selection does not affect the measurement and calculation accuracy of the device.
<b>Diagnostics-&gt;Device info</b>		
Firmware version	See § 1.2.7	Shows the device firmware version installed.
Firmware CRC	See § 1.2.7	Shows the checksum of the firmware version.



Description

Number **T8911** revision 3  
Project number 2491609  
Page 7 of 7

Parameter	Value	Remarks
W&M config CRC	information	Shows the checksum of all W&M parameter. This value can differ from the calibration report. For more information chapter 3.

1.5.2 Error messages  
On the indication or indications a message is presented if the measured value is not legal and/or a technical problem occurs.

2 Seals

- The following seals are applied:
- The Weights and Measures key switch. A seal or sealing sticker has to be place over the switch after system is configured and sealed and switch is closed;
  - The data plate is fixed to the level gauge and secured against removal by seal or it will be destroyed when removed;
  - The housing is sealed against opening.

For an example of the sealing see document number 8911/3-14.

3 Conditions for conformity assessment

- The level gauge shall be constructed in conformity with the description and documentation folder that belong to this Type approval certificate;
- The seals shall be applied as described in chapter 2.
- The calibration of the level gauge can be done in a test lab. The result of this investigation is a calibration report, which states the results and the settings of all parameters of the level gauge (as a result of this investigation, some parameters may have to be changed in respect of the original factory settings to adapt to the local conditions during commissioning). For the measurement accuracy the following parameter mentioned in paragraph 1.5.1 shall be verified according to the calibration report:
  - Drum circumference.

4 Reports

- An overview of performed tests is given in the reports:
- NMI-16200591-03;
  - NMI-16200591-04;
  - NMI-2491609-03;
  - NMI-2491609-04.

A report can be a test report, an evaluation report, a type evaluation report and/or a pattern evaluation report.

