W&M Functional Description

Issue/Rev. 1.01 (04/10)
MN F18 003 EN ◄► DOK-514

Level Gauging System

# Calibration Testing


FMC Technologies

Further documentation for this product:

| Name | Order no. |
|---|---|
| NoMix 2000 Installation | DOK-415E |
| MultiLevel Installation and Service Instructions | DOK-479E |
| MultiLevel Leporello Driver Operation Instructions | DOK-518E |
| MultiLevel Calibration Instructions | DOK-480E |

## History

| Version | Date | Processed by | Status | Description |
|---|---|---|---|---|
| Vers. 1.00 | January 2007 | M. Fedde | Release | First edition |
| Rev. 1.01 | April 2010 | / Oel / JS / jp / | Release | Restructuring |

## Important note

All of the explanations and technical information in this document have been written and compiled with the greatest of care by the author. It is, of course, possible that mistakes could still remain. ***F. A. Sening GmbH*** is always grateful to receive any information about possible improvements.

# Contents

# 1 General

## 1.1 Visual aids used in this manual

We have incorporated a number of visual aids into this manual in order to make it easier for readers to find the information they are looking for.

- Pictograms

  The information presented in this manual ranges from mandatory safety measures and standardized requirements to detailed work steps and recommendations. In order to provide a clear distinction between these different types of information in the context, corresponding pictograms are used as identifiers on the left-hand side of the text.
  As well as drawing the reader's attention to important information, they also help to locate the required information more quickly. For this reason the pictograms are designed to reflect the content of the text which they represent.

  The following pictograms are used in this manual:


**Danger warning**. Here: Risk of explosion due to highly flammable gases and liquids.

**Risk of system malfunction**. Actions which could damage the device.

§ **Legal notices**. Actions which have legal consequences.

**Work step**. Description of a specific activity, e.g. "*Press the <Enter> key*".

**Input** required, e.g. via numerical keys or function keys

**Positive response**, e.g. "*The main menu is now displayed*".

**Negative response**, e.g. "*If an error message now appears, ....*"

**Background information**, brief hint - e.g. "More information can be found in section XX"

**Optional equipment, special case**

**Function** / description of operation

**NOTE:** provides additional information about a particular situation.

**CAUTION:** special attention required.

- The index at the end of the document can be used to locate topics more easily.

# 2 Preparations for verification

Calibration is performed by the tank truck builder and is not part of the initial verification or re-verification. The following description is provided for information purposes only and will help to improve understanding of the process.

## 2.1 General

- Every tank chamber receives an individual dip table which is prepared through calibration (measurement of volume). The residual volume in the chamber and the volume of the pipe are determined at the same time.
- The closer to specification the installation of the dipstick is performed and the tank is constructed, the fewer corrections are required subsequently during verification of the vehicle.

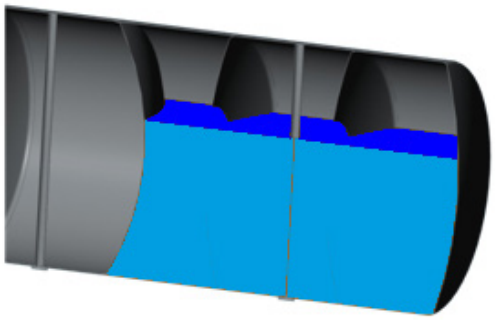


Figure 1: Example of a tank chamber

- The calibration of the tank chambers is performed with the aid of a calibration system. (Figure 2).
- The only medium which can be used is **water**, as this is the only medium which can be measured by the calibration unit and therefore used to determine the volume.

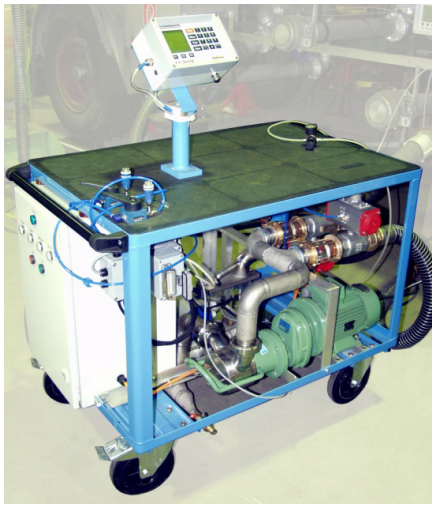


Figure 2: Calibration system

- After the calibration the obtained data are transferred onto the tank truck via a chip card or via a serial port.


Figure 3: Chip card

## 2.2 Description of the calibration process

- The chamber which is to be calibrated is connected to the calibration unit via the outlet port of the tank truck at the inlet port DN80 using a length of tube measuring approx. 1m. When connecting up these components, always make sure that the connecting tube has a sufficient downward slope towards the calibration unit.

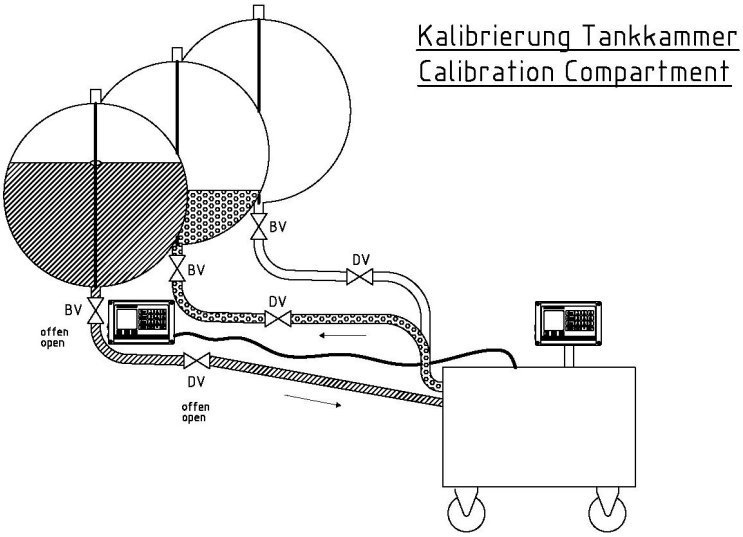



**Figure 4: Connection of the calibration unit**

- The chamber is emptied via the pump P1, and at the same time the magneto-inductive flow meter (MID) measures the volume which is pumped through.

- At the same time the calibration unit receives the corresponding level information from the MultiLevel unit of the tank truck and saves both values internally in a dip table.

- After the calibration the complete dip table is transmitted to the MultiLevel unit.

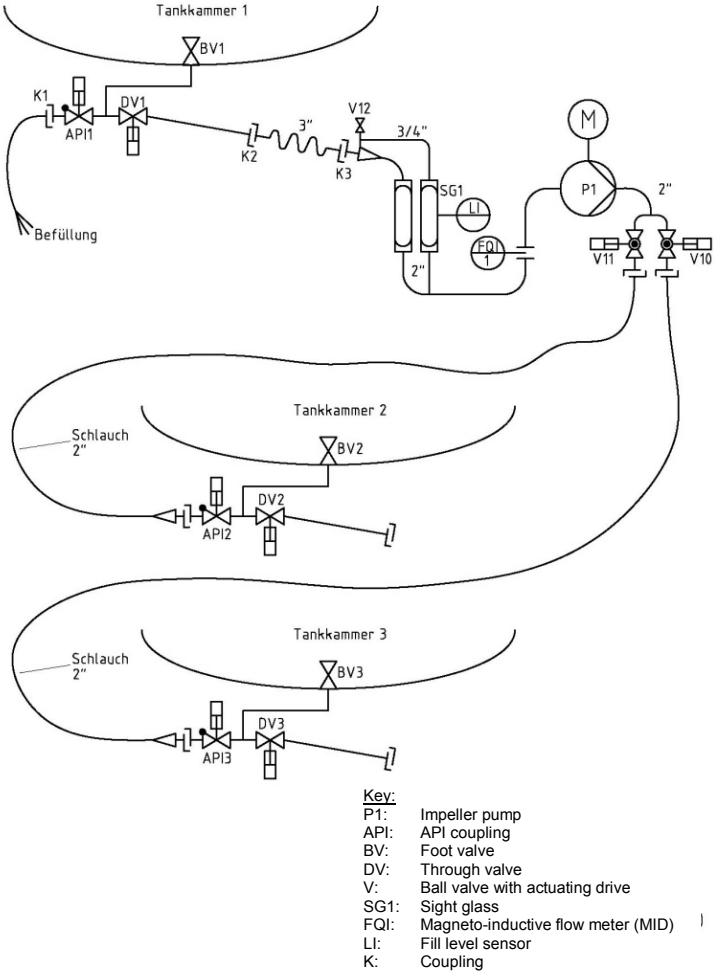



**Figure 5: Calibration unit flow chart**

As the measuring range of the dipstick has a bottom limit, the fill quantity below the last measurable fill level needs to be determined separately by the calibration unit. This amount is referred to as the "**residual volume**" in the MultiLevel unit.

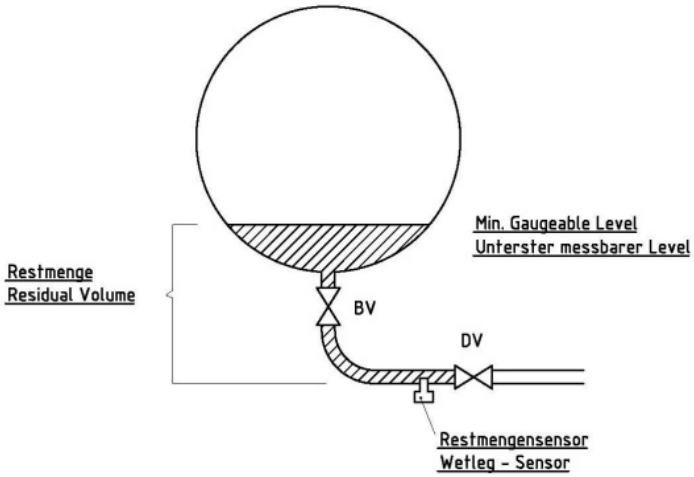



**Figure 6: Definition of the residual volume**

***Residual volume*** = fill level below the last valid dipstick measurement including the volume in the pipe

In addition, the calibration unit also determines the quantity in the pipe so that e.g. it is not necessary to measure the volume of the entire residual volume if the pipe is replaced. In this case only the volume of the new pipe needs to be measured, and the difference in volume to the old pipe is then balanced with the residual volume.

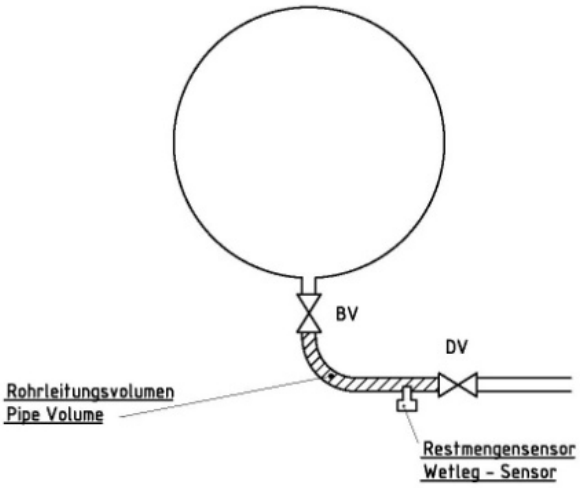



**Figure 7: Definition of the pipe volume**

***Pipe volume*** = fill quantity between the foot valve and the delivery valve (through valve or API coupling).

During a calibration the following partial volumes are determined by the calibration unit with interim venting of the system.

- Tube volume (connecting tube between the delivery valve and the calibration unit)
- Pipe volume (connection between the foot valve and the delivery valve)
- Volume in the tank chamber (volume within the measuring range of the dipstick)

Residual volume in the tank chamber (amount outside the measuring range of the dipstick)

## 2.3 Re-calibration

**When is it necessary to calibrate the tank?**

- For initial operation when a new tank is built.
- After mechanical changes to a chamber - for example:
  - panel beating a chamber,
  - installation of new chamber walls.

# 3 Inputting parameters prior to verification / sealing

The following parameters must be entered prior to sealing / verification.

## 3.1 Chamber-specific inclination limits

```
+   3132141  Min. longitudinal gradient-5.00
+   3132142  Max. longitudinal gradient 5.00
+   3132143  Min. transverse gradient  -5.00
+   3132144  Max. transverse gradient   5.00
```

Factory settings

Value in angular degrees → **[ ° ]**

### 3.1.1 Chamber-specific longitudinal gradient

Example setting for a chamber with the foot valve positioned at the front:

**Min. longitudinal gradient = - 5.00°** (max. measurable value of the vehicle)

- Adjustment of the minimum longitudinal gradient. If the minimum value is not attained the delivery will not be verified if the wetleg sensor falls dry.

  (vehicle inclined ("front down") **==>**
  adjustment normally suitable for a rear chamber)

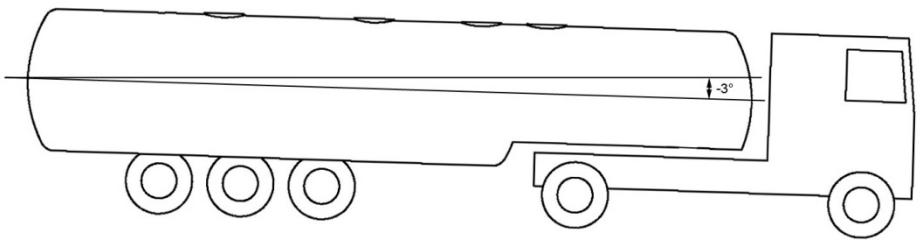



**Figure 8: tank truck negatively inclined (value: - 5.0°) in the longitudinal direction**

Value in angular degrees → **[ ° ]**

**Max. longitudinal gradient = + 5.00°**

- Adjustment of the maximum longitudinal gradient. If the maximum value is exceeded the delivery will not be verified if the wetleg sensor falls dry.

  (vehicle inclined ("front up") **==>**
  adjustment normally suitable for a front chamber)

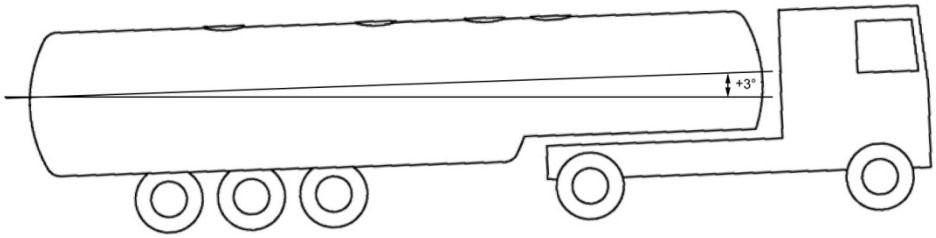



**Figure 9: tank truck positively inclined (value: + 5.0°) in the longitudinal direction**

Value in angular degrees → **[ ° ]**

### 3.1.2 Chamber-specific transverse gradient

Example setting for a chamber with the foot valve positioned at the left:

**Note:**
With a transverse gradient the foot valve is usually positioned in the middle. As a consequence, even at high transverse gradients hardly any residual volumes remain in the chamber. We therefore recommended entering the max. angle range of the vehicle as the setting: Min. transverse gradient = -5.00°, max. transverse gradient = +5.00°

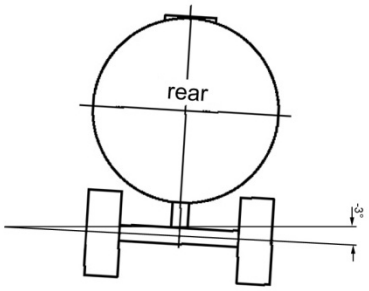



**Figure 10: Tank truck negatively inclined in the transverse direction (value: -3.0°).**

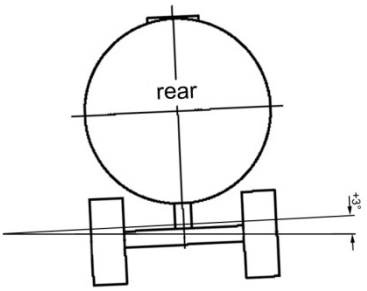



**Figure 11: Tank truck positively inclined in the transverse direction (value: +3.0°)**

## 3.2 Minimum delivery amounts

| | | | |
|---|---|---|---|
| + | 3132145 | Min. delivery amount | 1500 |

The minimum delivery amount depends on the size and design of the chamber and should correspond to a change in height of at least 150mm at the largest cross-section of the tank. In theory, this corresponds to around 10% of the chamber volume. Without special tests an amount of 20% of the chamber volume has proved to be successful.

Value in → **[liters]**

## 3.3 Vehicle-specific inclination limits

Here, the limits defined in the homologation process (i.e. the limits up to which the error limits can be satisfied) are used as the factory settings (verified delivery). Greater inclination during delivery will lead to a violation of the error limits (non-verified delivery).

```
+     31541 Min. longitudinal gradient-5.00
+     31542 Max. longitudinal gradient 5.00
+     31543 Min. transverse gradient  -5.00
+     31544 Max. transverse gradient   5.00
```

Value in angular degrees → **[ ° ]**
Definition of directions: See section 3.1.

- **General information about the inclination limits**

  - The purpose of the parameters for the chamber-specific inclination limits is to ensure that ***no residual volumes*** are left in the chamber or in the pipe if the inclination of the vehicle is disadvantageous. For this purpose limits are entered for *every* chamber; if these limits are exceeded then *no* verified delivery takes place.

  - Independently of the chamber-specific limits, inclination limits are also defined for the *overall* vehicle. These limits are set slightly wider and are intended to prevent error limits from being exceeded if the inclination of the overall vehicle becomes too much. This applies particularly to higher fill volumes. At lower fill volumes the chamber-specific inclination limits come into play more.

The diagram below is an example which shows the effects of the inclination limits on the delivery.

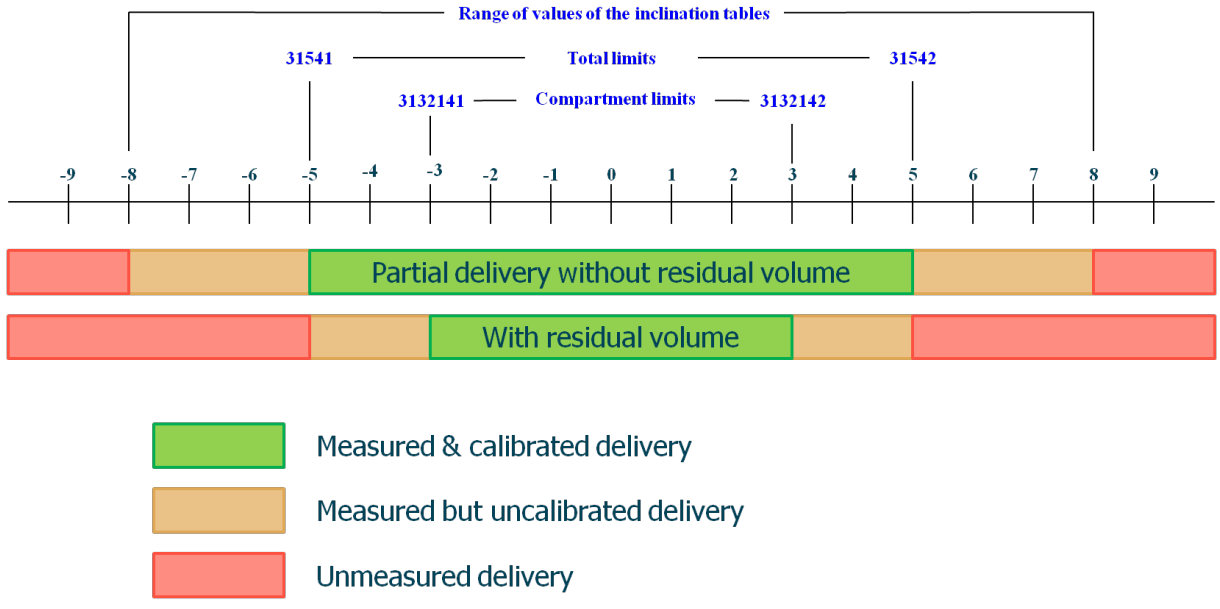



**Figure 12: Inclination limits**

## 3.4 Correction

```
+   3132136  Correction              1.00100005
```

The correction value can be used to compensate for a minor linear deviation which has arisen during the calibration of the chamber. As a general rule, the correction value should be defined by cross-checking with a volume standard during or before the verification. The corresponding procedure should be agreed with the inspection authority. The correction value only influences the dip table - but not the residual volume.

The value for the residual volume should be adapted chamber-specifically:
( Menu: **3.1.3.2.x.3.6** x = chamber no. ).

## 3.5 Max. change in volume (chamber monitoring)

This is used to define the maximum permissible change in volume in a tank chamber which is not involved in the delivery.

```
+   3132146  Max. change in volume          5
```

Value in → **[liters]**

Use of a camera monitoring system may be required in the homologation/approval or may be requested by the operator of the measuring system.

**Additional requirements**
Monitoring of non-active measuring chambers.

In order to prevent malfunctions and manipulations, the fill volume in measuring chambers which are not involved in a delivery must not change significantly during a delivery. In the event of a change in the fill volume of non-active measuring chambers, delivery is interrupted and an alarm is issued.
This additional requirement does not apply to tanks which only have one measuring chamber.

Chamber monitoring is activated via the following parameter.

```
+     3135  Chamber monitoring
                          BV at start & end
```

← Example settings

For information about the settings refer to the MultiLevel DOK-479 handbook

# 4 Checklist for preparation of the verification

## 1. Have all of the required parameters been entered in the system? (Check a printout of the parameters.)

## 2. Are all pre-inspection certificates or factory certificates present?

| | |
|---|---|
| MultiLevel central unit incl. TMU: | MLMAINDISP2 |
| Dipstick interface: | MLIF |
| Wetleg sensor interface: | NM2WET2 |
| Inclination sensor: | MLIS |
| Temperature sensors: | MLDTS-2 |
| Dipsticks: | MLDSBO-xxxx<br>(xxxx: length of the dipsticks) |
| Float: | 251596 (allocation to dipstick?) |

## 3. Are the volume measurement curves OK? (1. derivative)

Please contact Sening Service if anything is unclear.

## 4. Does it look as though the approval requirements will be satisfied?

This should be confirmed with tests in advance.

## 5. Can any of the documents be prepared already?

For example: Preparation of the measuring system certificate with all tank truck data, seal plan present, seal printout Sening DOK-477 present, ...

## 6. Are the sealing points prepared and already fitted with sealing screws? It may be possible to prepare the sealing wires already.

This list is not claimed to be complete. Subject to the rulings of the applicable bodies of rules and the design homologation/type approval.

# 5 Initial verification

For the components which are relevant from a metrological point of view, only genuine parts which are supplied by the manufacturer with a factory certificate (or pre-inspection certificate) must be used. The initial verification must be performed in accordance with the relevant national design homologation/type approval and in accordance with these instructions. All test equipment which is used must offer the required accuracy and must be connected to the national measurement standard where possible. The testing of the test equipment must be documented.

## 5.1 Test of appearance and workmanship

The test of appearance and workmanship for the measuring system covers both the measuring container and the fill level measuring system. It includes the testing of the following points:

**For the measuring container:**

1. Presence of any external damage.
2. Compliance with the definitions in the design homologation/type approval.

**For the fill level measuring system:**

1. Completeness of the required pre-inspection certificates or factory certificates.
2. Identification of the installed components.
3. Compliance of the software version used and the software signature with the design homologation/type approval.
4. Presence of the dip tables and inclination correction values for the measuring chambers.
5. Correct entry of the parameters which are under seal protection (e.g. float correction values, product data etc.)
6. Operational readiness of the measuring system.
7. Presence of the measuring system certificate in accordance with the regulations.

## 5.2 Testing a measuring chamber with a volume standard

All of the measuring chambers of the measuring container should be checked individually by emptying them step-by-step. In addition to the requirements which stem from the homologation/approval, special attention must be paid to the following points:

- The fill quantities of the individual chambers should be coordinated in such a way that:
  1. The available test liquid is sufficient for all chambers *without* the need to refill.
  2. The quantity of test liquid is subsequently still enough to be able to perform the inclination tests. (Refer to section 5.3)
  3. The vehicle always remains stable on the chassis stands and has a safe loading status.
- Prior to the first measurement it is important to make sure that the pipe has been bled (on the filling side as well). Otherwise there is a risk that air bubbles could lead to differences during draining of the residual volume.
- After successful verification, all of the sealing points should be sealed in accordance with the homologation/approval. These should already have been prepared by the tank truck outfitter.
- Check that enough paper is present for the printouts of the list of parameters and the sealing certificate.
- The measuring system certificate should already be prepared so that only the last entries need to be made during and after the verification.

### 5.2.1 Procedure for volumetric testing (example):

- Reliable load volume of the tank chamber: 12,200 liters
- Smallest measured amount of the tank chamber = 1/5 of the permissible load volume: 2,440 liters
- Nominal volume of the volume standard which is used: 2,000 liters
- Error limit: ± 0.3% ± 7.32 liters

## Step 1:

The tank chamber is filled with the permissible load volume (12,200 liters).

## Step 2:

Delivery of e.g. 2,000-liter steps into a volume standard of the same size positioned underneath the delivery port until the residual content of the chamber is 200 liters.

## Step 3:

Collection of the data "Delivered quantity (MultiLevel) / volume standard display" in a table.

Example:

| Lfd. Nr. | Fill level measuring system display | Volume standard display | Measuring discrepancy for current measurement | | Measuring discrepancy for the smallest measured amount (from the sum of individual measurements) | | |
|---|---|---|---|---|---|---|---|
| | | | Absolute | Relative | Measurements used | Absolute | Relative |
| | Liters | Liters | Liters | % | | Liters | % |
| 1 | 2000 | 2002,4 | - 2,4 | - 0,12 | | | |
| 2 | 2001 | 2000,2 | + 0,8 | + 0,04 | | | |
| 3 | 2003 | 2000,1 | + 2,9 | + 0,14 | 1+2+3 | + 1,3 | + 0,02 |
| 4 | 2004 | 2002,0 | +2,0 | + 0,10 | 2+3+4 | + 5,7 | + 0,09 |
| 5 | 1997 | 2003,7 | - 6,7 | - 0,34 | 3+4+5 | - 1,8 | - 0,03 |
| 6 | 1996 | 1998,5 | - 2,5 | - 0,13 | 4+5+6 | - 7,2 | - 0,12 |
| ∑ / 6 | **2000,167** | **2001,150** | | | | | |

**Note**: The determined measuring deviation of the individual measurement no. 5 is - 0.34% in the example, but the error limit for the smallest measured amount of ± 0.3% (initial verification) is still satisfied.

From this value the correction value for the tank chamber is then calculated.
(Menu**: 3.1.3.2.x.3.6** **x** = chamber no.).

### *3132136 - correction

A fixed correction factor **( = K-factor)** can be set here if a linear discrepancy between the display on the MultiLevel and the volume standard is observed during the measurements in the volume standards.

**K** only acts on the volume according to the dipstick table - but not on the correction volume of the inclination table and not on the residual volume!

$$K_{New} = \frac{V_{Target} \times K_{Old}}{V_{Actual}}$$

$V_{Target}$ = Volume in the volume standard
$V_{Actual}$ = MultiLevel display
$K_{Old}$ = K-factor used for the calculation of $V_{Actual}$.

Examples from the table:

$$K_{New} = \frac{\sum Liters \text{ Volume standard / 6} \times K_{Old}}{\sum Liters \text{ Measuring system/ 6}} = \frac{2001.150 \times 1.0}{2000{,}167} = \underline{1.0004916}$$

**CAUTION**:
Allow for the compensation, i.e. only compare $V_T$ or $V_0$

## Step 4:

The residual volume (here: 200 liters) is the quantity of product which cannot be measured by the dipstick. It is determined during the calibration and transferred as a parameter to the Multi-Level when the dip table is read in. The correction factor of the dip table does not affect the residual volume.

## Step 5:

Afterwards allow this quantity to drain into a suitable underground volume standard with a capacity of 200 liters. Now read off the display on the ***MultiLevel*** and on the ***volume standard***. The new residual volume is then calculated as follows:

New residual volume = (*Old residual volume*) + { (*Volume standard*) - (*MultiLevel display*) }

**Example**:
Residual volume = 150 l + { 200 l – 205 l } = 145 l → Enter 145,000 ml in **3.1.3.2.x.3.3**.

( Menu**: 3.1.3.2.x.3.3** **x** = chamber no. )

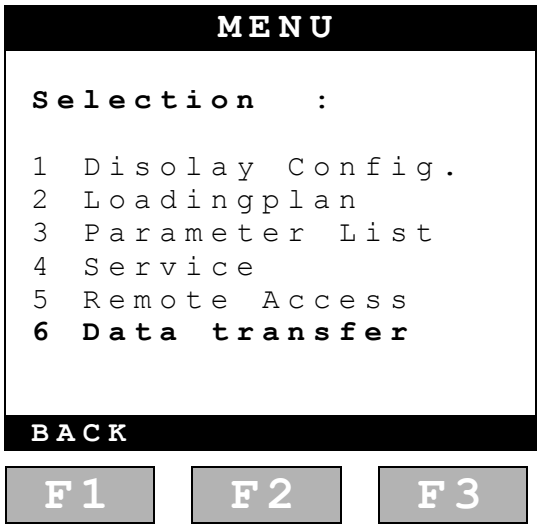
### *3132133 - residual volume

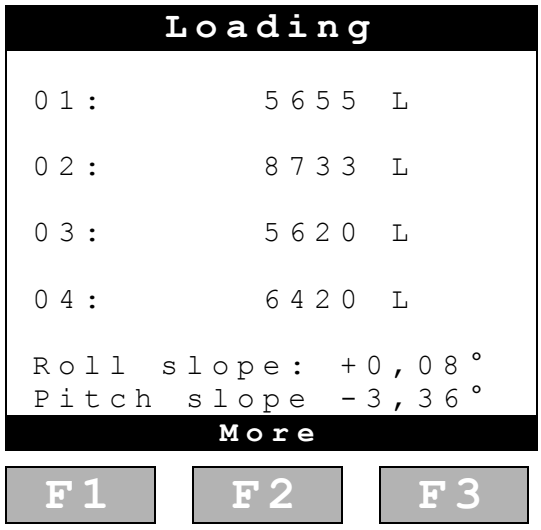
Entry of the complete residual volume which cannot be measured by the dipstick (**incl. pipe volume)**. This parameter is automatically entered when the data are transferred from the calibration system to the MultiLevel. As a general rule, no manual changes are required.

Value in → **[ ml ] = 1/1000 l**

## 5.3 Inclination tests

- The inclination correction is checked for each chamber at fill levels of around 15-30 % and 70-90 % of the nominal volume of the relevant chamber. To do this, the vehicle should already be laden at the start of the measurement in such a way that both fill levels can be set up in turn in all of the measuring chambers. This will make it easier to complete the inclination tests.
- The current fill level of each measuring chamber can be displayed in the MultiLevel menu **<2>**:

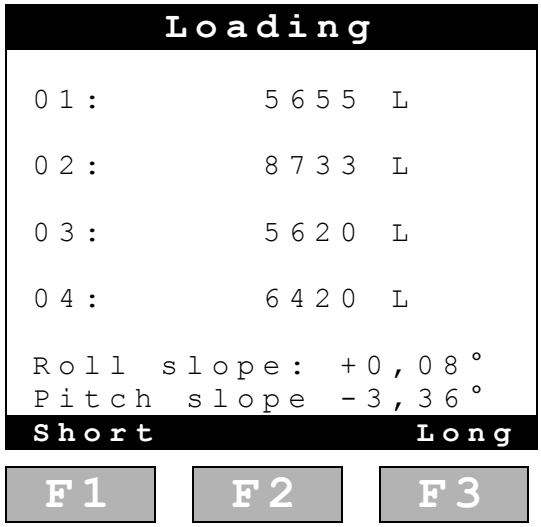



☞ Press the **<PRINT>** key to print out the current fill level.

Pressing
**<F1>** afterwards generates a short printout,
**<F3>** a long printout.

(See also: 5.3.2 / page 24)



### 5.3.1 Procedure for testing the inclination correction (example):

- Chamber volume 12,200 liters each
- Smallest measured amount (1/5 of the permissible chamber volume): 2,440 liters per chamber
- Error limits for inclination test (± 0.3% of the smallest measured amount): ± 7.32 liters

## Step 1:

For a reference printout the vehicle is positioned on a level surface with partially loaded tank chambers **(e.g. K1 30% / K2 70% / K3 70%)**.

(longitudinal and transverse inclination in the area smaller than **0°** ± 0.1°)

## Step 2:

After a waiting time of approx. **5** minutes the fill levels of all chambers are printed out. Then the tank is moved into the following positions in turn.

## Step 3:

- Through **+ 5°** ±0.1° in a transverse direction
  (inclination of the tank towards the ***top right*** (seen in the direction of travel))
- afterwards print out the fill level (see 5.3.2 / page 24)
- Through **- 5°** ±0.1° in a transverse direction
  (inclination of the tank towards the ***top left*** (seen in the direction of travel))
- afterwards print out the fill level (see 5.3.2 / page 24)

## Step 4:

The change in volume per tank chamber in relation to the reference printout must remain within the permissible error limits.

## Step 5:

- Through **+ 5°** ±0.1° in a longitudinal direction
  (inclination of the tank towards the ***top at the front*** (seen in the direction of travel))
- afterwards print out the fill level (see 5.3.2 / page 24)
- Through **- 5°** ±0.1° in a longitudinal direction
  (inclination of the tank towards the ***top at the rear*** (seen in the direction of travel))
- afterwards print out the fill level (see 5.3.2 / page 24)

## Step 6:

The same procedure is performed with changed fill volumes and by transferring the contents of the chambers **(e.g. K1 70% / K2 30% / K3 30% )**.

## Step 7:

Repeated alignment of the tank in a horizontal position and recording of the reference measured values.

## Step 8:

Repeating of the tilting processes - up at the front, up at the back, up at the right and up at the left - and recording of the measured values.

## Step 9:

If a displayed value does not remain within the error limits, this should be compensated for with a parameter representing an X-Y dipstick shift for each tank chamber; this should then be checked by carrying out the tilting tests again.

```
+ 3132125  X shift                    0
+ 3132126  Y shift                    0
```

**X shift:**

- Positive: Shift towards → Front
- Negative: Shift towards → Rear

**Y shift:**

- Positive: Shift towards → Right (seen in the direction of travel)
- Negative: Shift towards → Left (seen in the direction of travel)

Values in → **[ mm ]**

This error occurs if the dipstick is *not* installed accurately enough in the vertical volumetric mid-point. This error can be corrected to a certain degree through an XY shift. The vehicle is left in its position, and the vertical volumetric mid-point is shifted by inputting the X-Y parameters. After these offset values have been entered the new volume is calculated and shown on the main display. If the error is then within the permitted error limits the other inclination values should be verified.

### Evaluation:

The volume displays in the normal position and in each of the four tilted positions (with two different fill levels in each case) must not exceed **± 0.3 %** of the smallest measured amount for any of the measuring chambers (refer to the previous example).

### 5.3.2 The following printouts can be generated

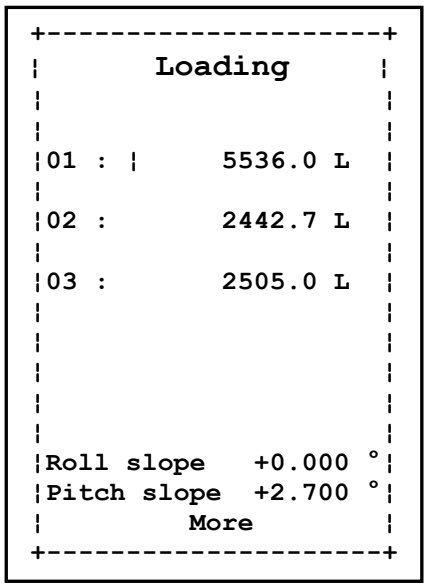



Figure 13: Short variant

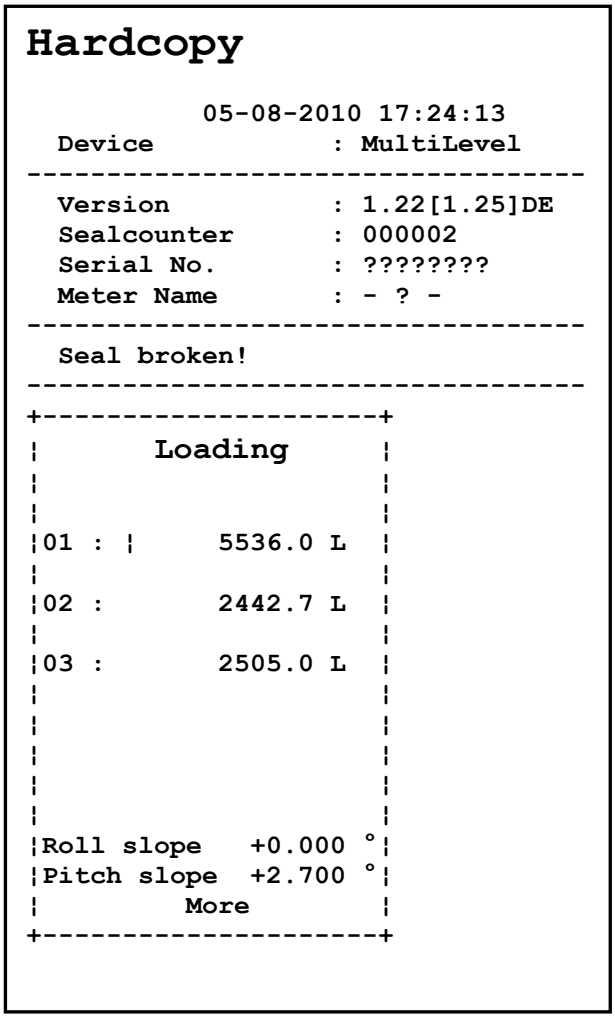



Figure 14: Long variant

# 6 Re-verification

## 6.1 Test of appearance and workmanship (every 2 years)

The test of appearance and workmanship for the measuring system covers both the measuring container and the fill level measuring system. It includes the testing of the following points:

**For the measuring container:**

1. Presence of external damage (if there is good cause to suspect that a measuring chamber is damaged it should be cleaned by the operator (on demand) in such a way that the chamber can be safely inspected from the inside). In this case the chamber needs to be recalibrated and verified.
2. Compliance with the definitions in the design homologation/type approval

**For the fill level measuring system:**

1. Compliance of the parameters and/or signature(s) which are under seal protection with those at the time of initial verification
2. Compliance of the software version used and the software signature with the design homologation/type approval.
3. Presence of the measuring system certificate
4. Identification of the installed components
5. Presence of mechanical damage to the fill level measuring sensors
6. Presence of the measuring system sign and operating instructions

## 6.2 Test of appearance and workmanship (every 4 years)

1. Same as under point 6.1.
2. Plus random testing of the chamber volumes against a standard volume and examination of inclination deviations.

# 7 Replacement and testing

## 7.1 Replacement of the dipstick

**Procedure:**

1. Remove the dipstick.
2. Clean the mounting flange on the tank truck and replace the O-ring.
3. Transfer the float (caution - for correct installation position see 7.2.1 / page 29)
4. Install a new dipstick (see 7.1.1 / page 27)
5. Grease the threaded connection piece on the dipstick and make the electrical connections.
6. Unseal the MultiLevel => dip switch **8**
7. Restart the MultiLevel.
8. Select menu **4.2.1.1** and
   press **<F3>** to select the chosen dipstick number; then press **<F2>** to reset it to "**zero**"
   (see also section: 7.7.4 "Setting the zero point for the dipstick" / page 35 )
9. Restart the MultiLevel.
10. Seal the MultiLevel with
    Menu: **4.1.4 "Setting the seals"**
    Dip switch **8** in the "**OFF**" position.
11. Enter the new dipstick in the measuring system certificate.

**Note**:
The dipstick is calibrated at the factory. It is not necessary to perform metrological checks on the measuring system after a replacement.

### 7.1.1 Installation instructions Sensor head

Assembly opening for inserting the dipstick
(use e.g. a screwdriver to aid assembly)

**CAUTION**:
Recommended gap between protective tube ➔ cover: <5 mm
Otherwise there is a risk that the protective tube might jump out of the guide.

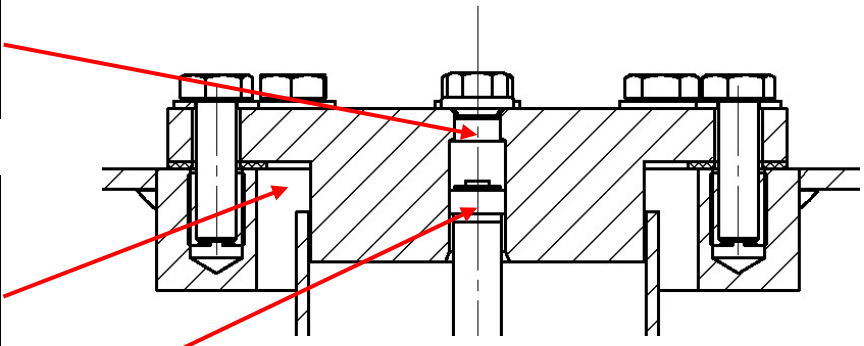


Figure 15: Installation of the sensor head (part 1)

**CAUTION**:
Min. insertion depth: 10mm ➔ otherwise there is a risk of the dipstick jumping out of the guide.
Max. insertion depth: 25mm ➔ otherwise there is a risk of the dipstick being bent

Alignment of the float: lettering always points towards the sensor head.

**IMPORTANT**:
It is not permitted to shorten the ice protection.

Securely tighten the cable connection; the contacts should be lightly coated with acid-free grease (e.g. terminal grease).

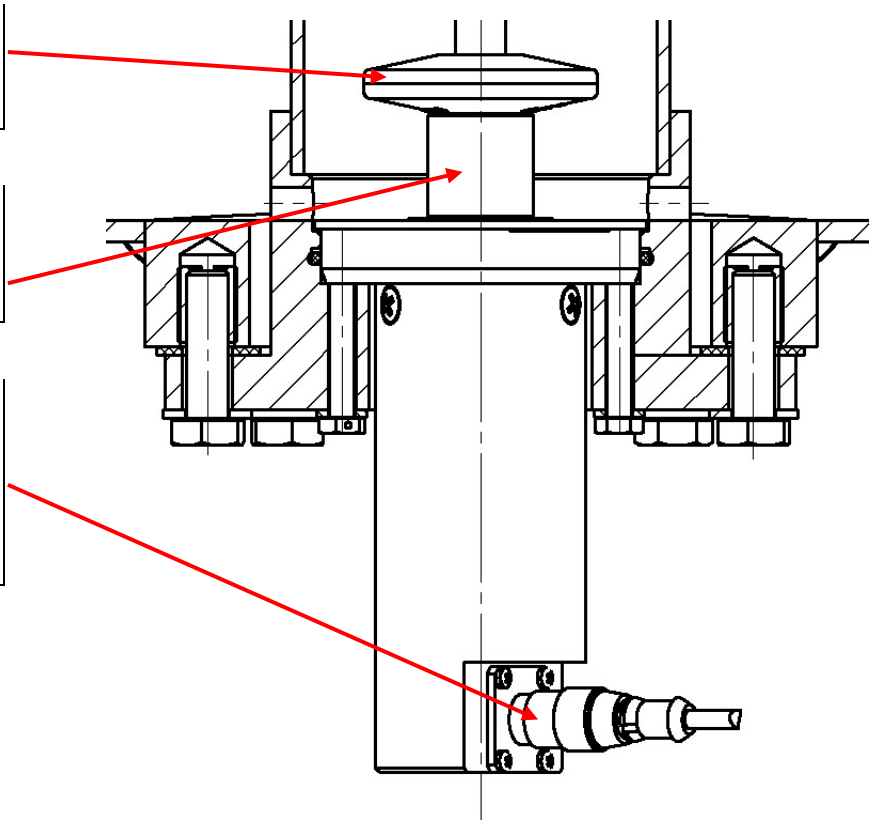


**Figure 16: Installation of the sensor head (part 2)**

## 7.2 Replacement of the float

**Procedure:**

1. Remove the dipstick.
2. Clean the mounting flange on the tank truck and replace the O-ring.
3. Insert a new float (caution - for correct installation position see 7.2.1 / page 29)
4. Install the dipstick, grease the threaded connection piece on the dipstick and make the electrical connections.
5. Unseal the MultiLevel => dip switch **8**
6. Restart the MultiLevel.
7. Menu: **3.1.3.2.x.2.4** **x** = chamber no.
   Enter the "**Float offset**" from the pre-inspection certificate
   (**Float offset** = immersion depth of the float)
8. Restart the MultiLevel.
9. Seal the MultiLevel with
   Menu: **4.1.4 "Setting the seals"**
   Dip switch **8** in the "**OFF**" position.
10. Enter the new float in the measuring system certificate.

**Note**:
The float has been tested and calibrated at the factory. It is not necessary to perform metrological checks on the tank chambers after replacement.

### 7.2.1 Float

For measurements of mineral oil based products a float made of POM (polyoxymethylene) mixed with graphite is used.

- The float is resistant to all low viscosity mineral oils and alcohols / RME biodiesel.
- Fluid can easily run off the upper side
- Small spacer lugs are provided in the guidance area of the dipstick tube which prevent adhesion to the dipstick tube.

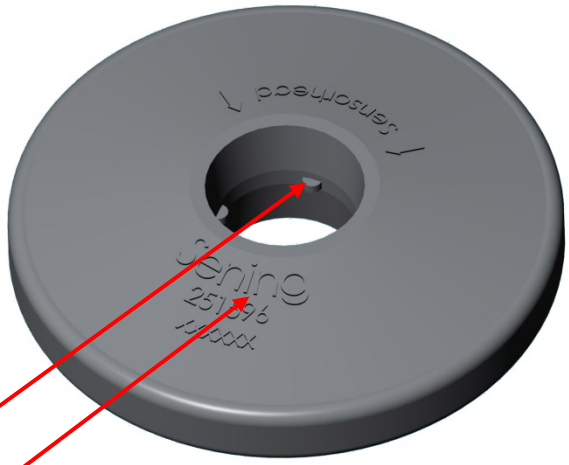



Figure 17: Float

**CAUTION:**
**The lettering on the float must always face towards the sensor head.**

### 7.2.2 Plug connection

- The dipstick is equipped with an M12 plug connection.

Figure 18: Dipstick plug connection

**CAUTION:**
**In order to ensure that the plug connection is leak-tight, only use the cable sockets specified by F.A. Sening.**

## 7.3 Replacement of the inclination sensor

**Procedure:**

1. Alignment of the semi-trailer with the aid of
   e.g. a digital spirit level to longitudinal and transverse reference surfaces to **0° ± 0.1°.**
2. Replace the inclination sensor.
3. Unseal the MultiLevel => dip switch **8**
4. Restart the MultiLevel.
5. Menu: **3.1.5.4**. **5.**+**6.**
   Input of the sensor corrections from the pre-inspection certificate.
6. Menu: **4.2.1.3**
   Calculation of the installation corrections on the vehicle.
7. Pressing **<F2>** (the "**Zero**" key) has the effect of automatically entering the installation K-values, as a result of which **0°** appears in both directions.
8. Seal the MultiLevel with
   Menu: **4.1.4 "Setting the seals"**
   Dip switch **8** in the "**OFF**" position.
9. Enter the new inclination sensor in the measuring system certificate.

### 7.3.1 MLIS inclination sensor

Part no.: **MLIS**
Drawing no.: E31.351979 / P.55
Wiring diagram no.: E61.351918/ P.56


**Figure 19: MLIS inclination sensor**

- The MLIS inclination sensor is part of the MultiLevel dipstick system on tank trucks. It is used to measure the inclination in a longitudinal direction and in a transverse direction.
- It is connected to the dipstick MLIF interface.-.
- All components are installed in a housing which has a weather-proof seal.

**Note**:
It is not necessary to check the inclination correction again after replacing the inclination sensor.

**Installation:**

- The inclination sensor must be securely mounted on a sturdy cross beam; after installation it must be fixed in place and not able to move. It must not be possible for the alignment of the sensor to be altered by external forces acting on it.
- The inclination sensor must be mounted in the tank truck with the correct alignment. The lettering on the sensor should be noted.
- Enter the new inclination sensor in the measuring system certificate.

Also refer to the following section: 7.7.3 "Zeroing the inclination sensor" / page 34

## 7.4 Calculation of the new K-factor

**Procedure:**

1. Changes can only be made at the unsealed MultiLevel.
2. Unseal the MultiLevel => dip switch **8**
3. Menu **3.1.3.2.x.3.6** – correction **x** = chamber no.
4. A fixed correction value (= **K-factor**) can be set here if a linear discrepancy between the display on the MultiLevel and the volume standard is observed during the measurements in the volume standards.
5. **K** only acts on the volume according to the dipstick table - but not on the correction volume of the inclination table and not on the residual volume.
6. Seal the MultiLevel with
   Menu: **4.1.4 "Setting the seals"**
   Dip switch **8** in the "**OFF**" position.

$$K_{neu} = \frac{V_{soll} \times K_{alt}}{V_{ist}}$$

$V_{soll}$ = volume in the volume standard
$V_{ist}$ = MultiLevel display
$K_{alt}$ = K-factor used for the calculation of VActual

## 7.5 Testing the temperature sensors

- The temperature sensors should be checked during a delivery of product by determining the average temperature of the delivered product for a quantity of at least 1,000 liters and comparing this value to the average temperature calculated by the system. Alternatively, the temperature can also be measured in a temperature measuring pocket positioned next to the temperature sensor and compared directly. The discrepancy must not exceed ± 0.5 °C. The test of the temperature sensor is performed at the same time as the test of the error curve of the corresponding measuring chamber.

**Note**:
The temperature sensor is calibrated at the factory. It is not necessary to perform metrological checks on the system after replacement.

- In the event of replacement the new temperature sensor should be entered in the measuring system certificate.

## 7.6 Wetleg sensor - NS-2E

Part no.: **NS-2E**
Drawing no.: E51.351307 / P.53
Adjustment no.: E51.350839 / P.54

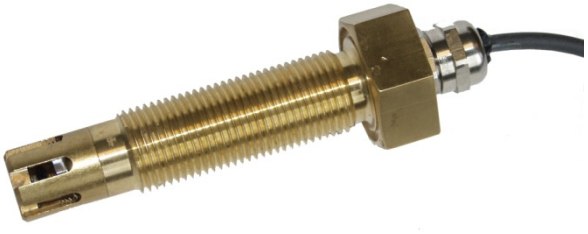


**Figure 20: Wetleg sensor - NS-2E**

- The wetleg sensors should be mounted with the aid of the weld-in connections at the lowest points in the pipes which still form part of the relevant chambers.
- This lowest point is located on the underside of the pipe ahead of the flange of the through valve (seen looking from the foot valve) or in the filling coupling.
- The wetleg sensors should always be installed from underneath in a vertical position.
- The wetleg sensors are electrically connected to the terminals of the wetleg sensor interface.
- The height (level) at which the wetleg sensors NS-2E respond can be adjusted if necessary with the aid of different intermediate bushes. In order to increase the height (level) at which the sensor responds, the bush should be shortened on a lathe, or it can be omitted altogether. (Refer to drawing no. **51.350839** / page 54 for more information about adjustment of the wetleg sensor.)

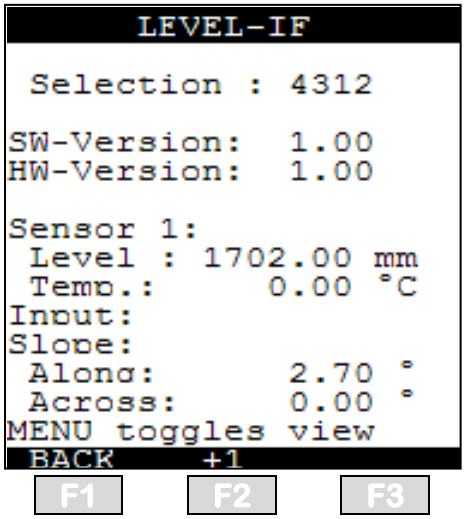
**Note**:
The wetleg sensor is calibrated at the factory. It is not necessary to perform metrological checks on the system after replacement.

Also refer to the following section:
7.7.2 "Wetleg sensors are checked in the menu 4314:" / page 34

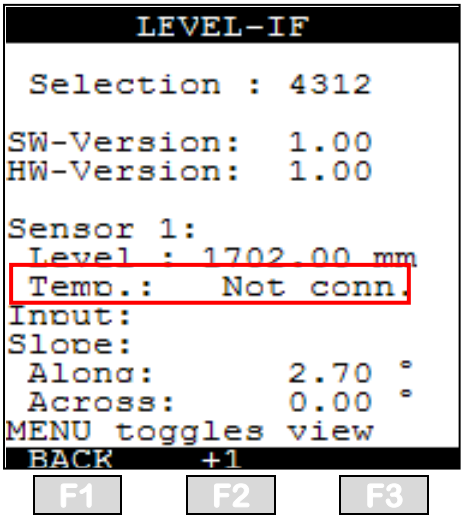
## 7.7 Checking the sensors

### 7.7.1 Sensors on the dipstick interface are checked in menu 4312:

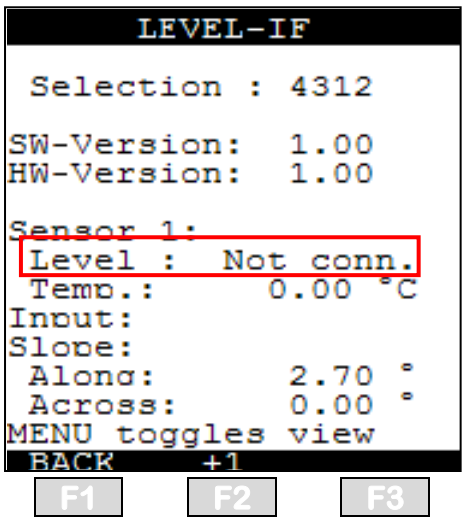
- All temperature sensors should return a valid value.
- All dipsticks should return a valid value.
- The inclination sensor should return valid values.
- When the fifth wheel plate is lifted the longitudinal inclination should increase; when it is lowered the inclination should decrease.



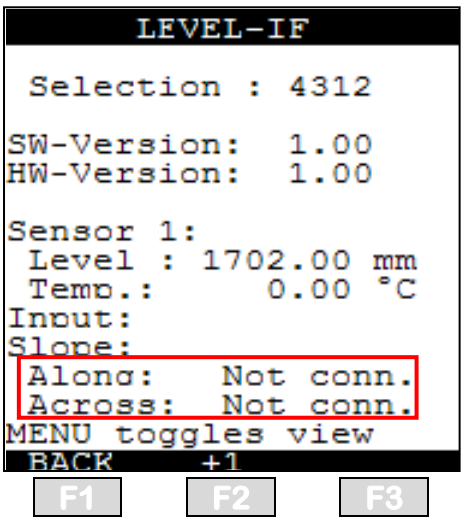

All sensors OK




Temp. sensor fault




Dipstick fault




Inclination sensor fault

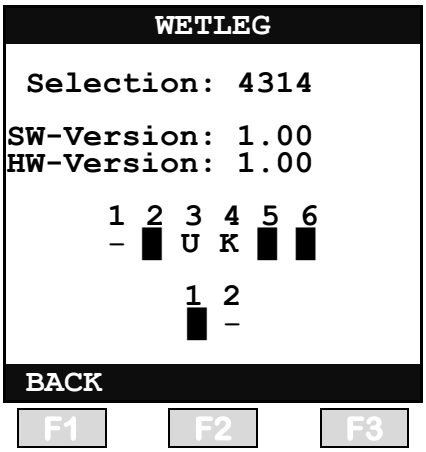
### 7.7.2 Wetleg sensors are checked in the menu 4314:

Sensors should be wet or dry.

**In the event of a fault:**

- Check the connection at the interface
- Check the polarity of the connections
- Check the plug connection

☞ Also refer to the following section:
7.6 "Wetleg sensor - NS-2E" / page 32



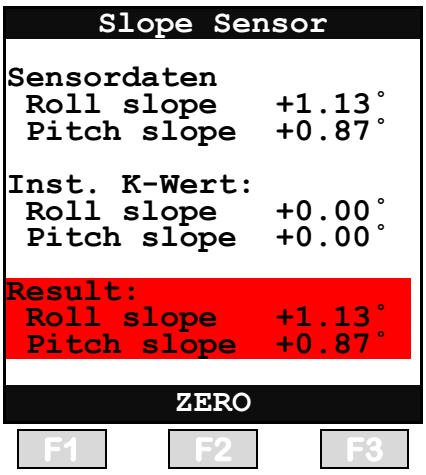

### 7.7.3 Zeroing the inclination sensor

☞ Move the tank truck into reference position

- ▶ Longitudinal & transverse direction = 0°

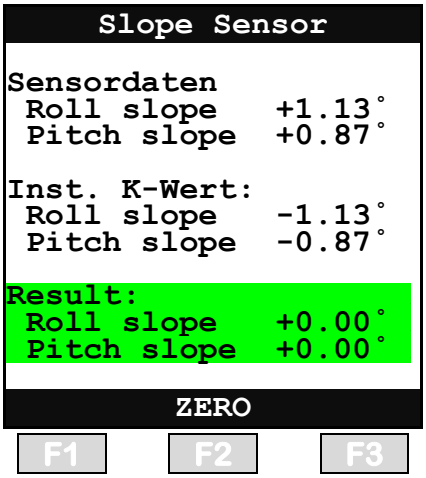
☞ Call up menu **4213**:

- ▶ Sensor data are corrected by K-values
- ▶ The result is generally not equal to 0, as the installation of the sensor is not exactly aligned with the tank truck.




- ▶ Press the **<F2>** key to zero
- ▶ The installation K-values are adjusted to produce a result of 0°

☞ Also refer to the following section:
7.3 "Replacement of the inclination sensor" / page 30



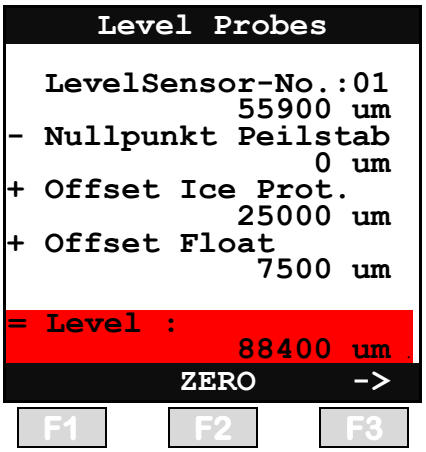
## 7.7.4 Setting the zero point for the dipstick

**Requirement:**

- All chambers are empty

☞ Call up menu **4211**

▶ The level should be
(ice protection offset + float offset)

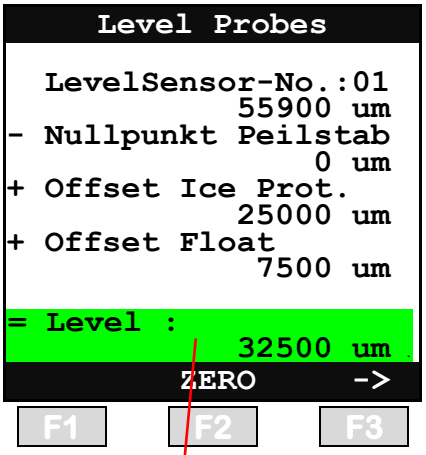


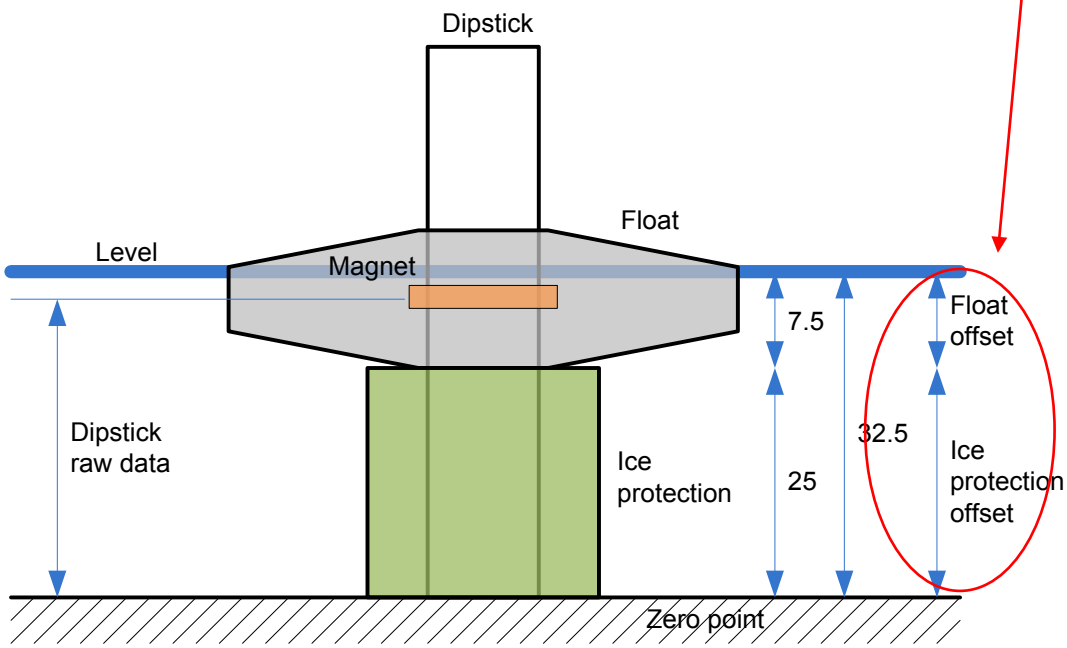

☞ Also refer to the following section:
7.1 "Replacement of the dipstick" / page 27
7.2 "Replacement of the float" / page 28

☞ Press the **<F2>** key to zero

▶ The "Dipstick zero point" is set so that the result is correct.

☞ Press **<F3>** to move to the next chamber and repeat the process



## 7.8 Installation of new software

- Prior to any software upgrade, it is vital that the setup of the tank truck is written down or printed out, so that when the system is started up again with the new software all of the vehicle-specific parameters can be selected again during setup.

> **Note**:
> If new software is installed it is not necessary to perform metrological checks on the measuring system.

- The EPROM (this contains the software) is located in the main unit on the main CPU board.
- This has a 32-pin "PLCC" housing (rectangular housing with one cut-off corner) and carries a sticker showing the software version number (e.g. 1.32). The circuit board also has one cut-off corner on its base. A special, commercially available "PLCC removal tool" is required for removal of the EPROM from the base in order to ensure that the EPROM is not damaged. In the process, the two claws of the removal tool must be inserted in the two cut-outs on the EPROM base. Then the two arms of the removal tool are pressed together. This has the effect of lifting the EPROM out of the base.
- Before inserting the new EPROM, check its connecting pins for damage ("*bent connecting pins*"?).
- The new EPROM is then inserted into the base and pressed into the base using the fingers until it noticeably engages. Take care to ensure that the EPROM goes in straight.

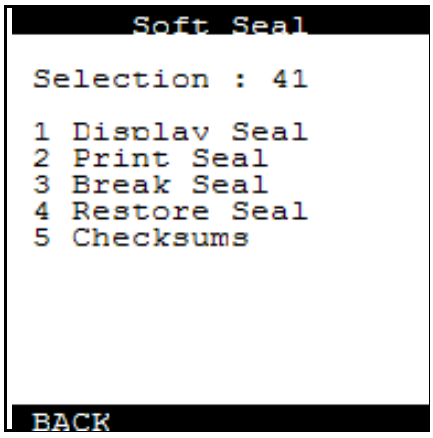
**The cut-off corner on the EPROM must line up with the cut-off corner on the base.**

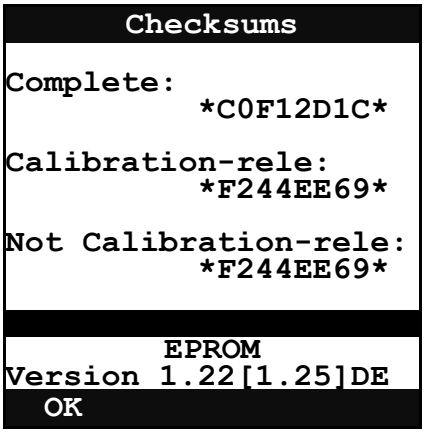
- After replacing the EPROM on the main CPU board, the entire SETUP MENU must be set up/checked again.

## 7.9 Checking the SW version

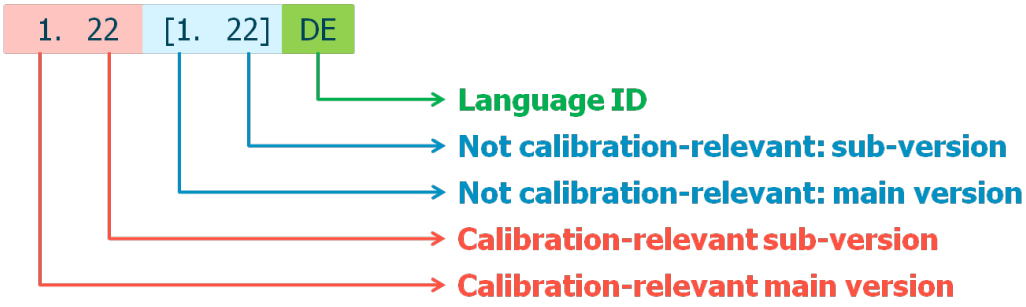
You can call up the menu **415** "Checksums" to check and display the software version. The EPROM version is displayed in the lower line.

**Example display on the MultiLevel:**




### 7.9.1 Version designation



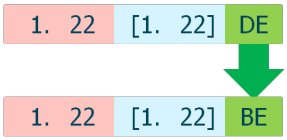

### 7.9.2 Update logbook

- Saves update procedures in the verification-relevant area.
- Currently allows 100 entries.
- Once the logbook is full no further updates are saved in the verification-relevant area.
- Can be reset if the seal is broken.

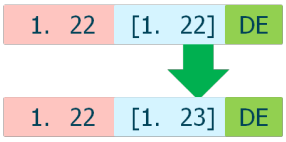
**Update-Report**

```
17.10.2008 14:48:45 - 07.11.2008 19:38:22
  Device           : MultiLevel
-----------------------------------------
  Version          : 1.22[1.22]DE
  Seal count       : 000003
  Serial No.       : 18AB1234
  Meter Name       : 1234ABCD
-----------------------------------------
  Seal broken!
-----------------------------------------
  Rest attempts    : 95
-----------------------------------------
17.10.08 14:48 + 098BB138          Eggers
19.10.08 12:32 - FFFFFFFF           Meier
20.10.08 15:12 + 098AB37F         Schmidt
05.11.08 09:17 + A35FBD97          Müller
07.11.08 19:38 - FFFFFFFF          Eggers
```

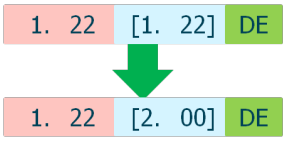
### 7.9.3 Update, logbook entry, seal breakage



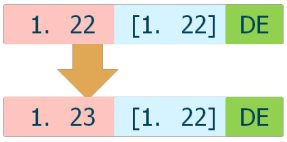

Change of language:
- No logbook entry
- No seal breakage



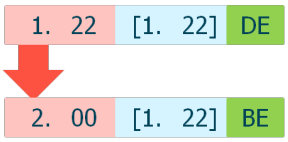

Change of sub-version:
- No logbook entry
- No seal breakage



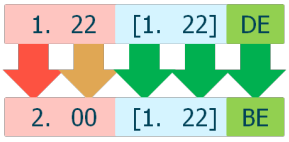

Change of main version:
- No logbook entry
- No seal breakage




Change of sub-version:
- Logbook entry
- No seal breakage




Change of main version:
- Logbook entry
- Seal breakage



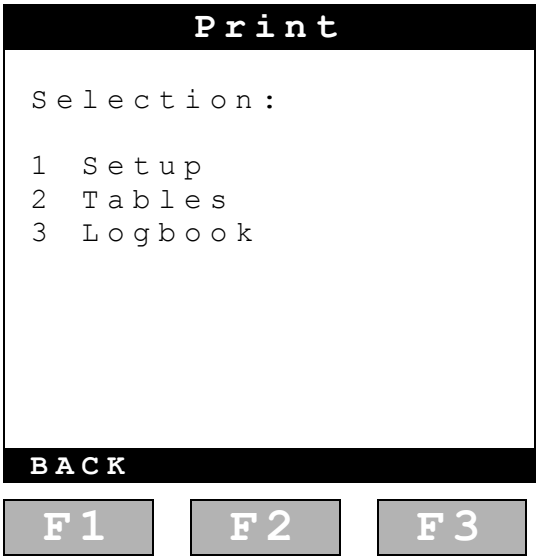

Summary

## 7.10 Printing out parameters which are under seal protection

From the Main MENU / Start screen you can press the **<Print>** function key to go to the Print MENU.

### Print MENU

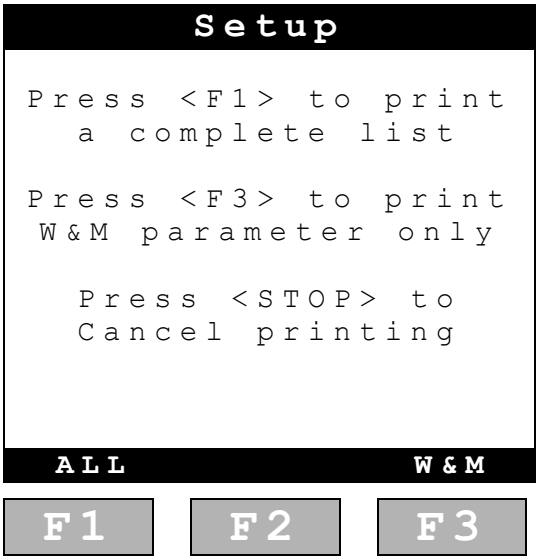
☞ Press the **<Setup>** key to access the print MENU setup




### Print MENU setup

☞ The verification-relevant parameters can be printed out by pressing **<F3>**.

☞ Pressing **<STOP>** takes you back to the higher level print MENU.




☍ Also refer to Annex A: „Parameters which are under seal protection" / page 43

# 8 Address and contact information

**Important note**

All of the explanations and technical information in this document have been written and compiled with the greatest of care by the author. It is, of course, possible that mistakes could still remain. We are always grateful to receive any information about possible improvements.

Our service department will be happy to assist and can be contacted as follows:

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**Measurement Solutions**

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D-25474 Ellerbek

| | | |
|---|---|---|
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| Fax: | +49 (0) 4101 304 - 152 | (Service) |
| Fax: | +49 (0) 4101 304 - 133 | (Sales) |
| Fax: | +49 (0) 4101 304 - 255 | (Order processing) |
| E-Mail: | info.ellerbek@intl.fmcti.com | |
| Internet: | www.fmctechnologies.com/measurementsolutions | |

# Annex A. Parameters which are under seal protection

```
Parameter
          11.03.2010 12:52:20
  Device           : MultiLevel
****************************************
* Version          : 1.22[1.22]EN       *
* No. of seals     : 000037             *
* Ser.no.          : ????????           *
* Tank number      : - ? -              *
****************************************
* Seal OK!                              *
****************************************
* Parameter CRC    : 9F9F               *
****************************************
Local CAN bus
----------------------------------------
+      3112 Qty. dipstick interface      1
+      3114 Qty. Wetleg IF               1
Global CAN bus
----------------------------------------
Chambers
----------------------------------------
+      3131 Qty. chambers                3
+   3132111 Dipstick no.                 1
+   3132112 Temp. sensor no.             1
+   3132113 Wetleg sensor no.            1
+   3132114 Dipstick ser.no.          3000
+   3132121 Zero point dipstick          0
+   3132122 Offset ice protection    25000
+   3132123 Offset inclination table     0
+   3132124 Offset float                 0
+   3132125 Shift X                      0
+   3132126 Shift Y                      0
+   3132127 Offset temp.               0.0
+   3132131 Chamber volume            5000
+   3132132 Pipe volume                  0
+   3132133 Residual volume              0
+   3132134 Float MIN                40000
+   3132135 Float MAX              1000000
+   3132136 Correction          1.00000000
+     3132141 Min.longit.gradient      -
3.00
+   3132142 Max.longit.gradient       3.00
+     3132143 Min.transv.gradient      -
3.00
+   3132144 Max.transv.gradient       3.00
+   3132145 Min. delivery amount      5000
+   3132146 Max. volume change
100
+   3132211 Dipstick no.                 2
+   3132212 Temp. sensor no.             2
+   3132213 Wetleg sensor no.            2
+   3132214 Dipstick ser.no.          3000
+   3132221 Zero point dipstick          0
+   3132222 Offset ice protection    25000
+   3132223 Offset inclination table     0
+   3132224 Offset float                 0
```

```
MultiLevel  ????????  11.03.10 12:52  -02-
----------------------------------------
+   3132225 Shift X                      0
+   3132226 Shift Y                      0
+   3132227 Offset temp.               0.0
+   3132231 Chamber volume            5000
+   3132232 Pipe volume                  0
+   3132233 Residual volume              0
+   3132234 Float MIN                40000
+   3132235 Float MAX              1000000
+   3132236 Correction          1.00000000
+     3132241 Min.longit.gradient    -3.00
+   3132242 Max.longit.gradient       3.00
+     3132243 Min.transv.gradient    -3.00
+   3132244 Max.transv.gradient       3.00
+   3132245 Min. delivery amount      5000
+   3132246 Max. volume change         100
+   3132311 Dipstick no.                 3
+   3132312 Temp. sensor no.             3
+   3132313 Wetleg sensor no.            3
+   3132314 Dipstick ser.no.          3000
+   3132321 Zero point dipstick          0
+   3132322 Offset ice protection    25000
+   3132323 Offset inclination table     0
+   3132324 Offset float                 0
+   3132325 Shift X                      0
+   3132326 Shift Y                      0
+   3132327 Offset temp.               0.0
+   3132331 Chamber volume            5000
+   3132332 Pipe volume                  0
+   3132333 Residual volume              0
+   3132334 Float MIN                40000
+   3132335 Float MAX              1000000
+   3132336 Correction          1.00000000
+   3132341 Min.longit.gradient      -3.00
+   3132342 Max.longit.gradient       3.00
+   3132343 Min.transv.gradient      -3.00
+   3132344 Max.transv.gradient       3.00
+   3132345 Min. delivery amount      5000
+   3132346 Max. volume change         100
Chamber monitoring
----------------------------------------
+     31352 On delivery                OFF
Control options
----------------------------------------
Verification restrictions
----------------------------------------
+      3151 Seal code             12345678
+     31541 Min.longit.gradient      -5.00
+     31542 Max.longit.gradient       5.00
+     31543 Min.transv.gradient      -5.00
+     31544 Max.transv.gradient       5.00
+     31545 Sens. K-value longit.     0.00
+     31546 Sens. K-value transverse  0.00
+     31547 Inst. K-value longit.     0.00
+     31548 Inst. K-value transverse  0.00
+     31551 Minimal layout
                        101,103,500,503,504
+     31552 Decimal separator        Comma
+     31561 Device number            - ? -
+     31562 Tank number              - ? -
+     31563 Tank truck ID            - ? -
Printer settings.
```

```
----------------------------------------
Wetleg IF
----------------------------------------
+      3341 ON time                    5
+      3342 OFF time                   5
Page layout
----------------------------------------
Product definition
----------------------------------------
+    351111 Product name       Fuel oil EL
+     35112 Product type    Liquid product
+     35113 PTB code                  1
+    351171 Compensation              YES
+    351172 Comp. temperature         15
+    351173 Comp. method              54B
+    351174 Mean density           846.0
+     35119 Float correction          700
+    351211 Product name            Diesel
+     35122 Product type    Liquid product
+     35123 PTB code                  2
+    351271 Compensation              YES
+    351272 Comp. temperature         15
+    351273 Comp. method              54B
+    351274 Mean density           836.0
+     35129 Float correction          750
+    351311 Product name   Normal unleaded
+     35132 Product type    Liquid product
+     35133 PTB code                  3
+    351371 Compensation              YES
+    351372 Comp. temperature         15
+    351373 Comp. method              54B
+    351374 Mean density           741.0
+     35139 Float correction         1800
+    351411 Product name    Super unleaded
+     35142 Product type    Liquid product
+     35143 PTB code                  5
+    351471 Compensation              YES
+    351472 Comp. temperature         15
+    351473 Comp. method              54B
+    351474 Mean density           749.0
+     35149 Float correction         1700
+    351511 Product name      Super leaded
+     35152 Product type    Liquid product
+     35153 PTB code                  4
+    351571 Compensation              YES
```

```
MultiLevel  ????????  11.03.10 12:54  -04-
----------------------------------------
+    351572 Comp. temperature         15
+    351573 Comp. method              54B
+    351574 Mean density           749.0
+     35159 Float correction         1700
+    351611 Product name   Super Plus (98)
+     35162 Product type    Liquid product
+     35163 PTB code                  6
+    351671 Compensation              YES
+    351672 Comp. temperature         15
+    351673 Comp. method              54B
+    351674 Mean density           753.0
+     35169 Float correction         1600
+    351711 Product name         Petroleum
+     35172 Product type    Liquid product
+     35173 PTB code                  7
+    351771 Compensation              YES
+    351772 Comp. temperature         15
+    351773 Comp. method              54B
+    351774 Mean density           807.0
+     35179 Float correction         1000
+    351811 Product name          Jet fuel
+     35182 Product type    Liquid product
+     35183 PTB code                  8
+    351871 Compensation              YES
+    351872 Comp. temperature         15
+    351873 Comp. method              54B
+    351874 Mean density           801.0
+     35189 Float correction         1050
+    351911 Product name    Biodiesel(RME)
+     35192 Product type    Liquid product
+     35193 PTB code                  9
+    351971 Compensation              YES
+    351972 Comp. temperature         15
+    351973 Comp. method              54B
+    351974 Mean density           831.0
+     35199 Float correction          800
Driver list
----------------------------------------
```

# Annex B. Measuring system certificate

## MEASURING SYSTEM CERTIFICATE

For a fill level measuring device with float
as volumetric measuring system with electronic
depth measuring device with measuring container

☐ Motor vehicle
☐ Trailer
☐ Semi-trailer

---

Measuring system manufacturer:

Measuring container no.: ……
Approval: ……
Product compartments: ……
Capacity of the chambers (max.): ……

Operator:
……
……
……

---

Measuring system certificate no.: ……
Issued on: ……

(Stamp of the verification authority) (Signature)

(A) Fill level measuring device

☐ Approval: ……
☐ Dipstick interface no.: ……
☐ Controller no.: ……
☐ Inclination sensor no.: ……

| Chamber | Dipstick no. | Float no. | Temperature sensor no. |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |

(B) ☐ Pump Type: ……

$Q_{max}$ …… (l/min) $P_{max}$ …… (bar)

(C) ☐ Dry hose - Qty: ….
Nominal size DN (mm): ……

(D) ☐ Wet hose - Qty: ….
Nominal size DN (mm): ……
Length L (m): ……

(E) ☐ Printing equipment
Printer serial no.: ……

(F) ☐ Other important installations
……
……

Provided official stamps are intact and no changes are made to the measuring container, the measuring container is validated until:

| Year | Gauging office / tester | Year | Gauging office / tester |
|---|---|---|---|
| | | | |
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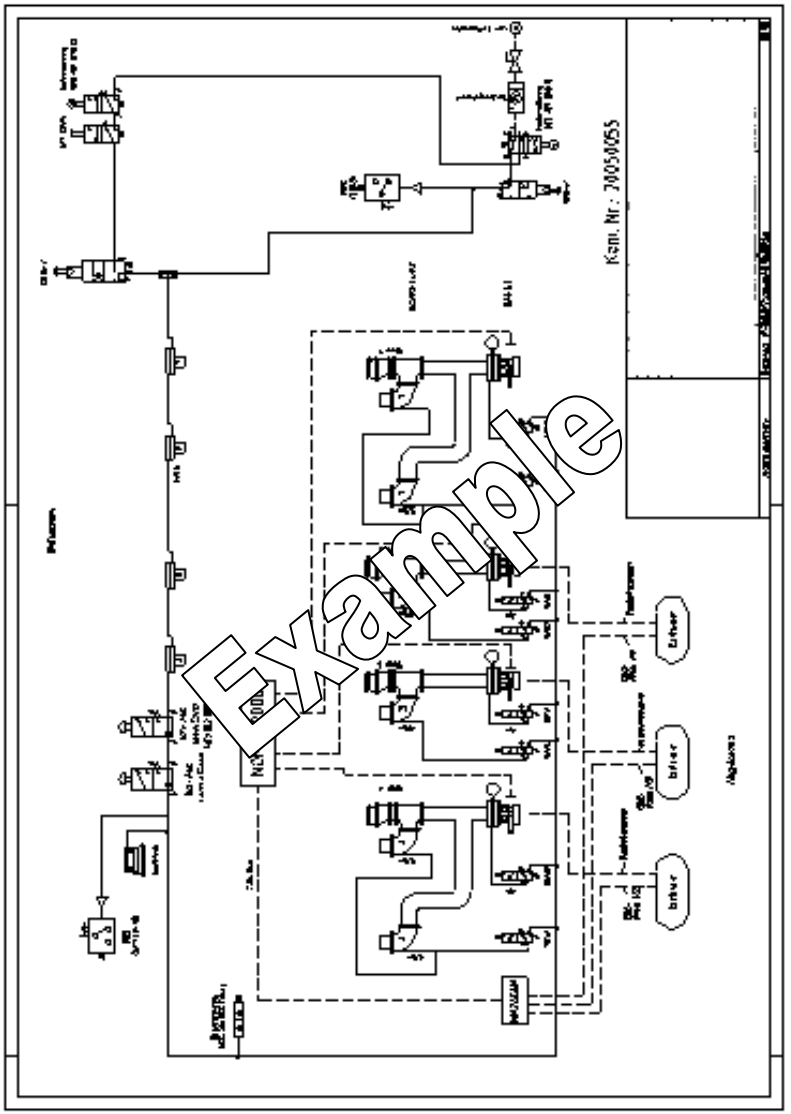
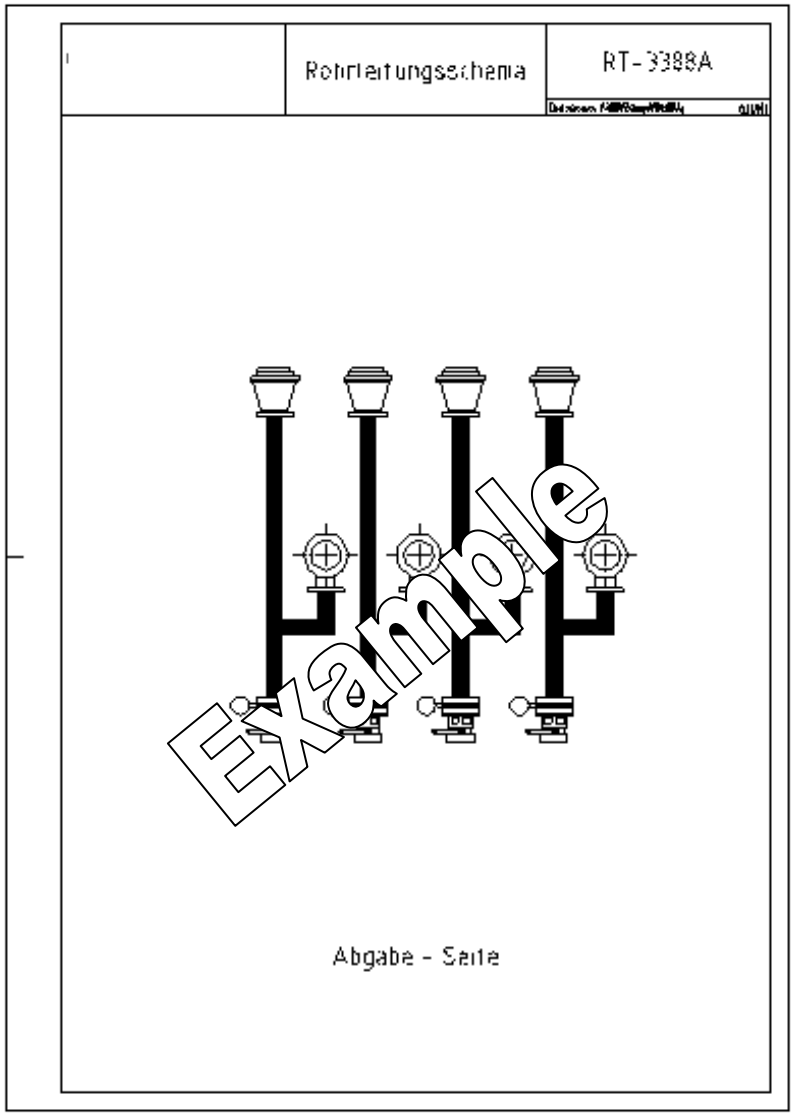
**Important**:
The measuring system certificate and the parameter printout are part of the measuring system. They must be carried with the vehicle. Unauthorized breaking of the seals and non-approved/non-authorized changes are prohibited and punishable by law.
Repair reports must be enclosed with the measuring system certificate until they have been officially confirmed.

**Function diagram (example)**
showing the metrologically important control lines



## Pipe diagram (example)




## Stamp schedule:

| Applied verification marks | Quantity |
|---|---|
| Volumetric measuring system with display: (MLMAINDSIP) | Units |
| Dipstick interface (MLIF): | Units |
| Wetleg sensor interface (NM2WET): | Units |
| Inclination sensor (MLIS): | Units |
| Temperature sensors (MLDTS -2): | Units |
| Wetleg sensors (NM -2E): | Units |
| Dip sensors (MLDSBO -xxxx): | Units |
| Printing equipment: | Units |
| Measuring system sign / wiring diagram: | Units |

Changes confirmed by the verification authority / replacement of damaged safety seals in accordance with the repair report

**-Supplementary sheet-**

| Change (CH) or damaged seal (DS) | Index (A-F) | Electronic seal number | Software CRC | Verification parameter CRC | Date / checked by | Repairer | Gauging office reference no. |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
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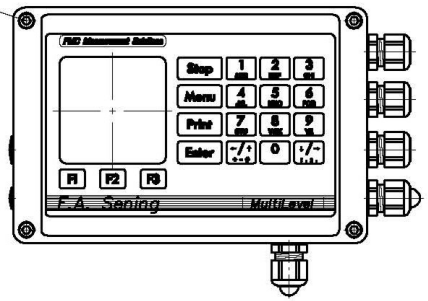
Measuring system certificate no.: ……..

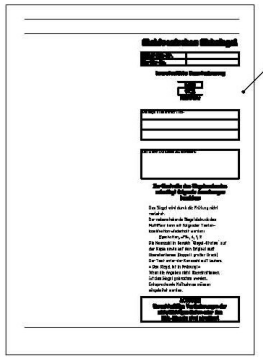
Supplementary sheet no. 1

# Stamp schedule

1



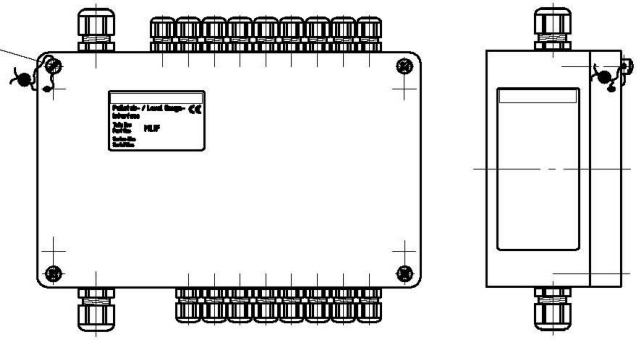

MLMAINDISP



3 Elektronisches Eich-Siegel (DOK-386) im Meßanlagenbrief prüfen!

MLIF

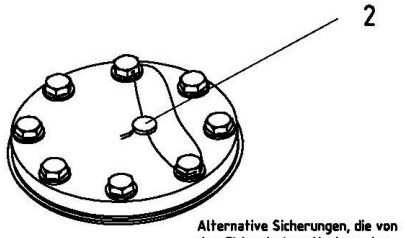
2



Peilstab Unteneinbau: MLDSB0-xxxx ×)

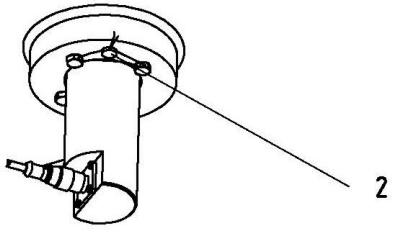
×) xxxx: Peilstablänge in mm

Peilstabführung oben




Alternative Sicherungen, die von dem Eichamt akzeptiert werden, sind möglich.

Sondenkopf unten

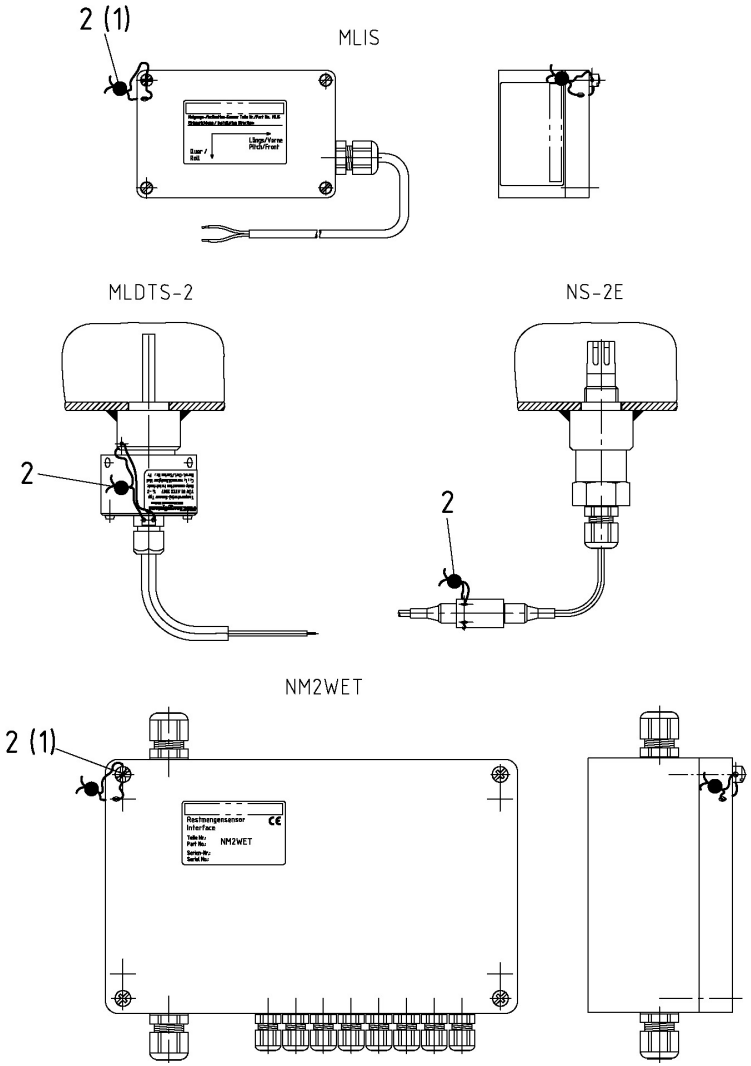



Falls Zusatzflansche verwendet werden, müssen auch diese verblombt werden.

Measuring system certificate no: .....

Supplementary sheet no. 2

# Stamp schedule




Key

| Type | Part number | Description |
|---|---|---|
| 1 alternatively type 2 | MLMAINDISP | Seal as bolt adhesive |
| 1 alternatively type 2 | MLIF | Seal as bolt adhesive |
| 1 alternatively type 2 | NM2WET | Seal as bolt adhesive |
| 2 alternatively type 1 | MLIS | Seal with sealing wire |
| 2 | MLDTS-2 | Seal with sealing wire |
| 2 | NS-2E | Seal with sealing wire |
| 2 | MLDSBO-xxxx<br>xxxx = | Seal with sealing wire<br>Dipstick length in mm |
| 3 | DOK-482E | Seal document |

(1)

# Electronic Seal

as
appendix to measurement
system documentation

```
SEAL REPORT
          14-01-2010 15:47:41
  Device            : MultiLevel
*****************************************
* Version           : 1.22[1.22]DE      *
* Sealcounter       : 000037            *
* Serial No.        : ????????          *
* Meter Name        : - ? -             *
*****************************************
* Seal OK!                              *
*****************************************

General Info:
* Seal date         : 14-01-2010 15:37:14 *
* Sealed by         : JENS              *
* LRP Software CRC  : F244EE69          *
* NRP Software CRC  : F244EE69          *
* Parameter CRC     : 9F9F              *

Serial number of level sensors:
* Sensor 01         : 00003000          *
* Sensor 02         : 00003000          *
* Sensor 03         : 00003000          *

Checksums of level tables:
* Compartment 01    : E58BDCEE          *
* Compartment 02    : A0E820D3          *
* Compartment 03    : ED8D186D          *

Clecksums of slope tables:
* Compartment 01    : 96418FE7          *
* Compartment 02    : 85F667E1          *
* Compartment 03    : F3BD9A0C          *
```

| The seal was produced by: |
|---|
| |
| |

| Signature and identification of official: |
|---|
| |

**It is essential to observe the following instructions when checking the seal status:**

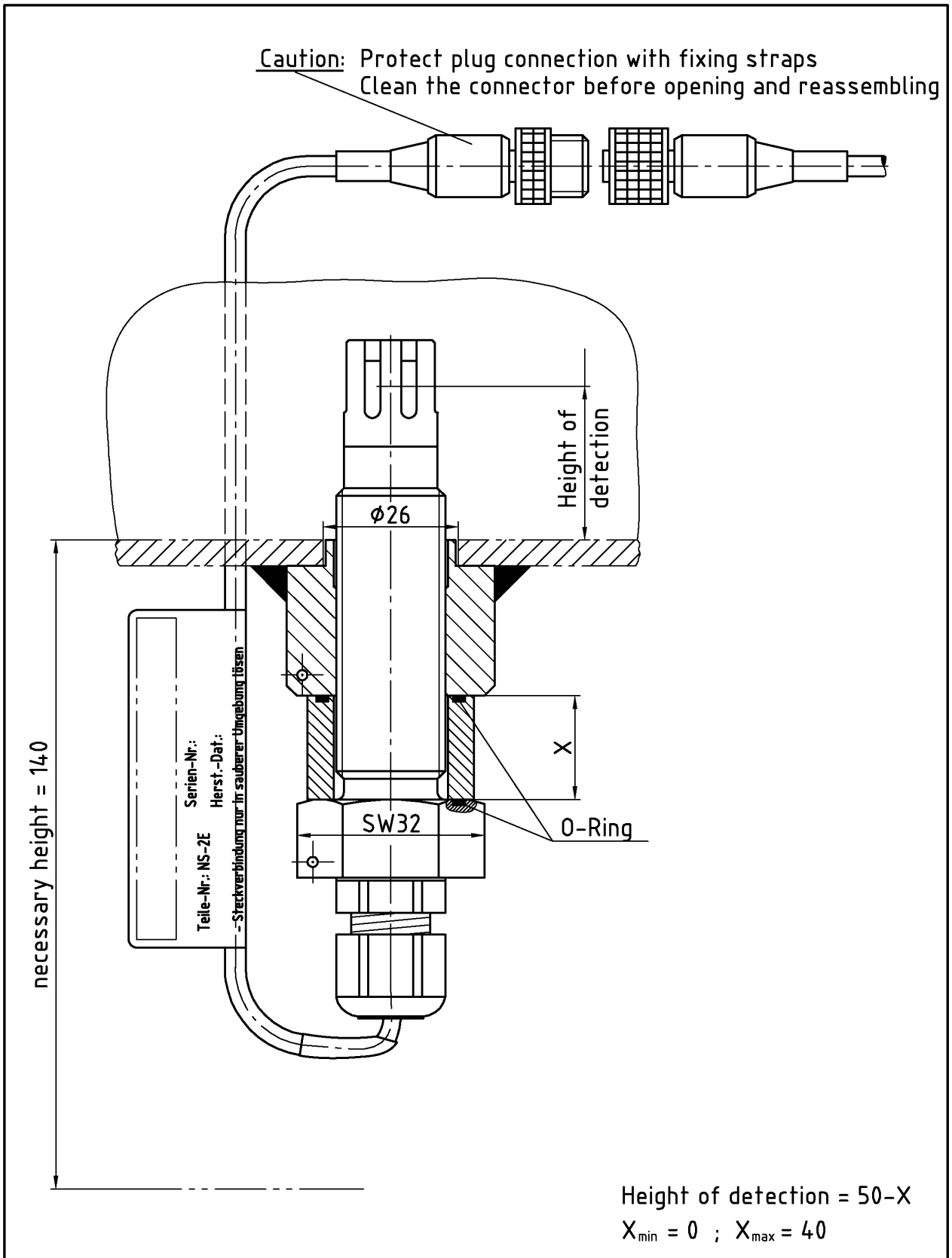
- The seal is not violated by the inspection.
- The seal impression opposite for the Multiflow can be repeated with the following key combination:

  *Switch On* *<**F1**> (Seal Status)*
  *<**F1**> (Print)*
- The code number in the 'Seal status' area on the copy and on the original must match (double-sized printing).
- The text under the code number must read: `*The seal is approved!*`
- If the details do not match, the seal has been broken. Appropriate action must be initiated.

**IMPORTANT:**

**Illegal modification of the sealed data is a punishable offence!**

## E51.351307 - Sensor NS-2E, complete




| | | | |
|---|---|---|---|
| Sensor NS-2E complete | FMC EnergySystems FMC Measurement Solutions | F.A. Sening GmbH D-25474 Ellerbek, Germany | |
| | Weight : kg | Date : 19.11.2001 | Name : Benthack |
| Part-No. NS-2E | Changed : 04.02.03 NB; 12.11.04 JA.; 10.03.06 RL; | Drawing No.: E51.351307 | Rev. |

DOK-415E;DOK-416E
"Schutzvermerk nach DIN 34 beachten"

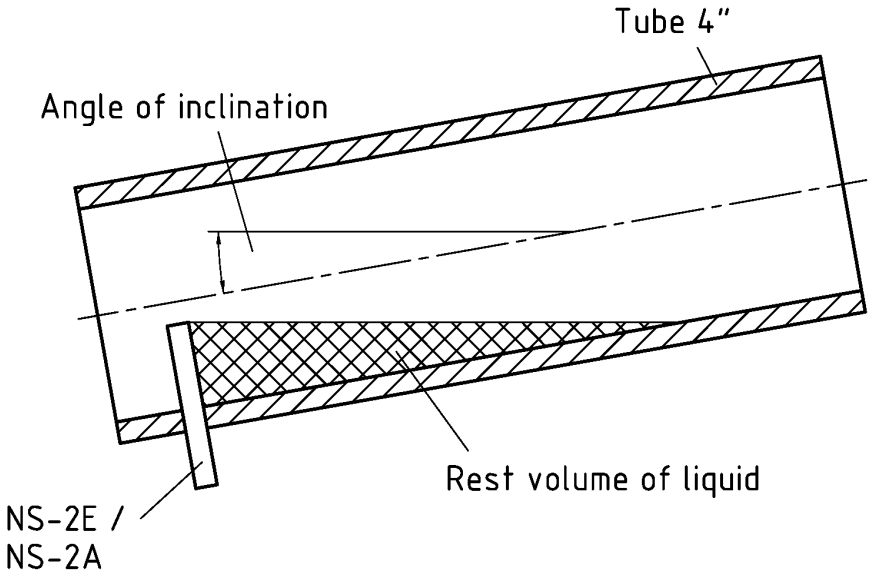



Figure: Rest volume of liquid behind the NS-2E / NS-2A

| Hight of operation in [mm] | Inclination angle of the tube [Grade] 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 20 | 0.5 | 0.3 | 0.2 | 0.1 | 0.1 |
| 30 | 1.4 | 0.7 | 0.5 | 0.4 | 0.3 |
| 40 | 2.8 | 1.4 | 0.9 | 0.7 | 0.6 |
| 50 | 4.8 | 2.4 | 1.6 | 1.2 | 1.0 |

Rest volume of liquid behind the NS-2E / NS-2A in [Liter]

Table: Calculated rest volume of liquid

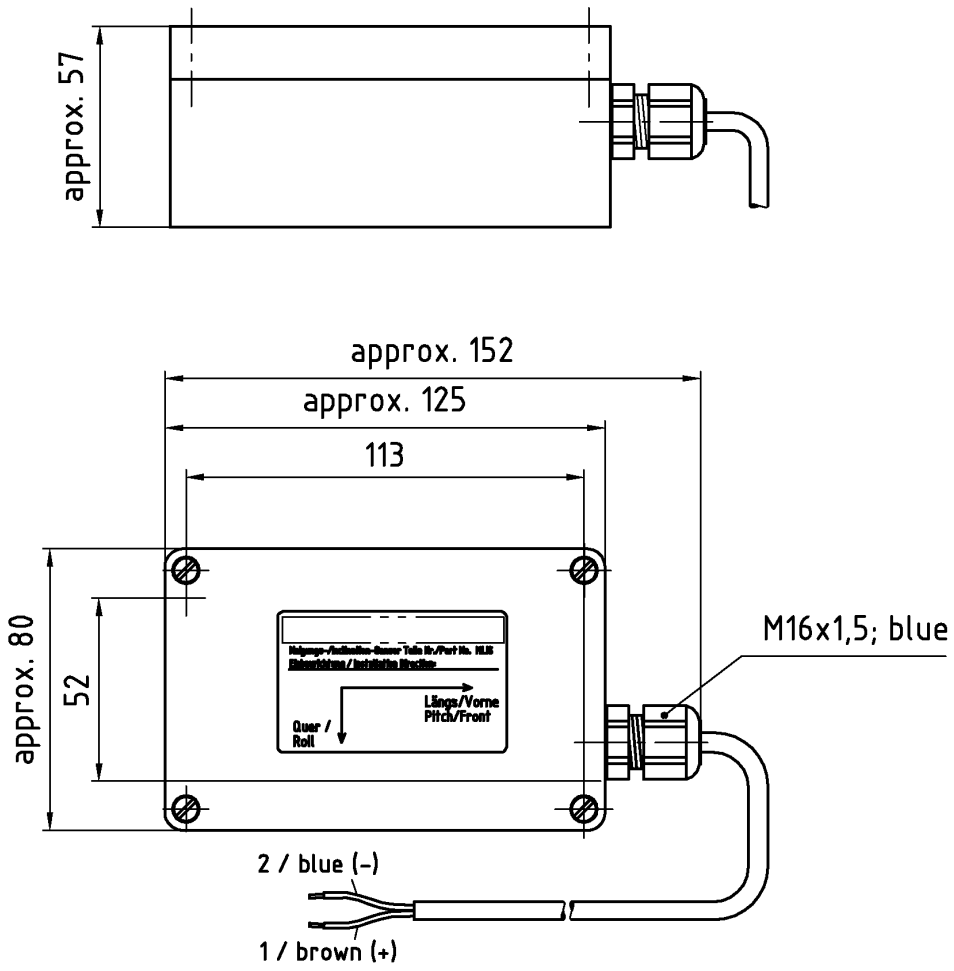
DOK-415E; DOK-416E
"Schutzvermerk nach DIN 34 beachten"

Rest volume
behind the NS-2E / NS-2A

FMC EnergySystems
FMC Measurement Solutions
F.A. Sening GmbH
Ellerbek, Germany

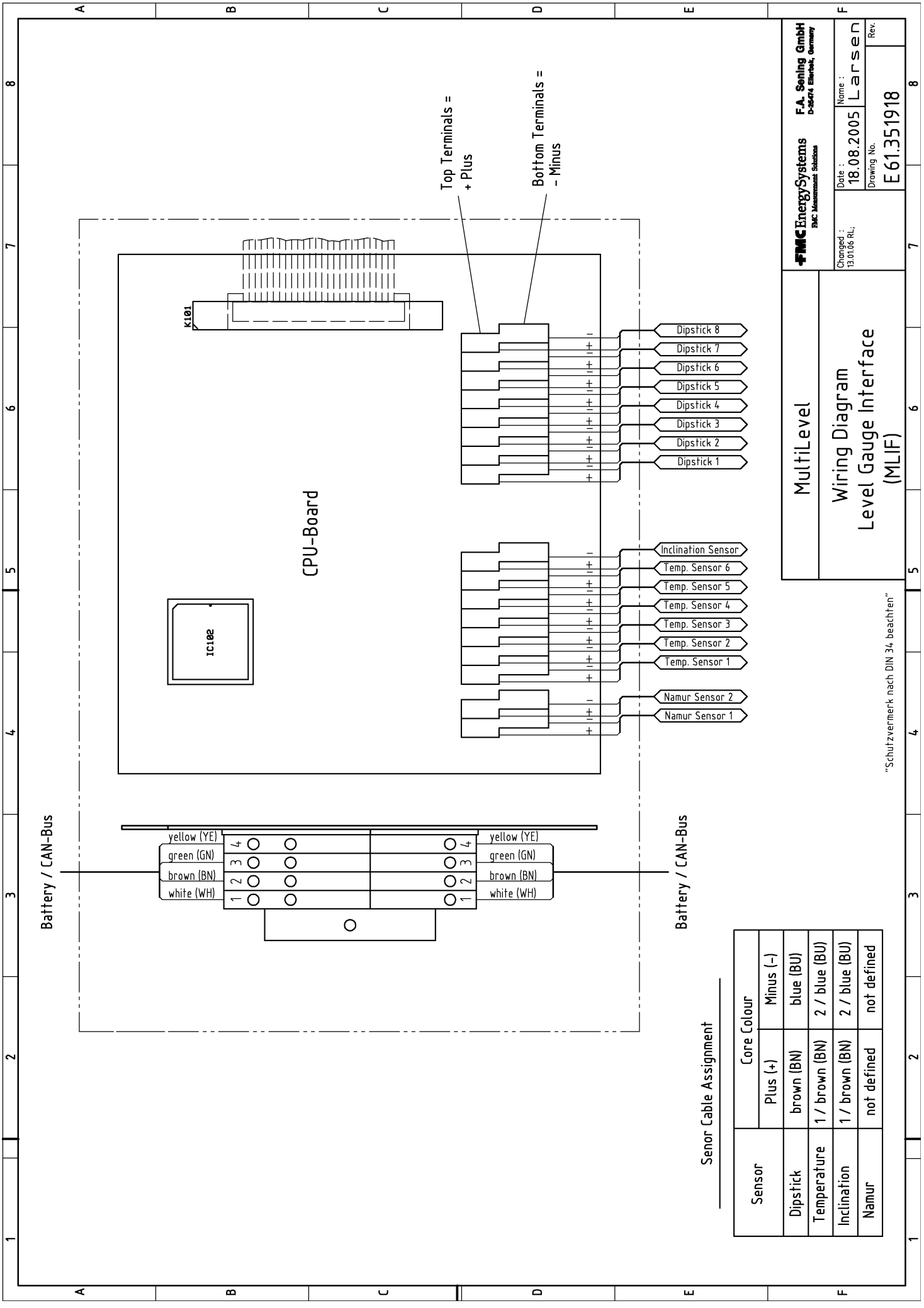
| Geänd. am : | Datum : | Name : |
|---|---|---|
| 31.08.00 MK.; | 02.06.1997 | M. Kracht |

Zeichnungs–Nr. E51.350839 | Rev.




"Schutzvermerk nach DIN ISO 16016 beachten"

| | | | |
|---|---|---|---|
| Inclination sensor | FMC Technologies | F.A. Sening GmbH<br>D-25474 Ellerbek, Germany | |
| | Weight : kg | Date : 25.07.2005 | Name : Larsen |
| Part-No. MLIS | Changed : | Drawing No.: E51.351979 | Rev. |




Senor Cable Assignment

| Sensor | Core Colour | |
|---|---|---|
| | Plus (+) | Minus (–) |
| Dipstick | brown (BN) | blue (BU) |
| Temperature | 1 / brown (BN) | 2 / blue (BU) |
| Inclination | 1 / brown (BN) | 2 / blue (BU) |
| Namur | not defined | not defined |

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