W&M Functional Description

Issue/Rev. 2.00 (11/10)
MN F18 005 EN ◄► DOK-480E

Level Gauging System

MultiLevel Calibration

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 Testing	DOK-514E

History

Version	Date	Processed by	Status	Description
Rev. 1.00	Januar 2007	M. Fedde	Release	First edition
Rev. 2.00	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.
- The calibration of the tank chambers is performed with the aid of a calibration unit. (Figure 2).
- After the calibration the obtained data are transferred onto the tank truck via a chip card or via a serial port.

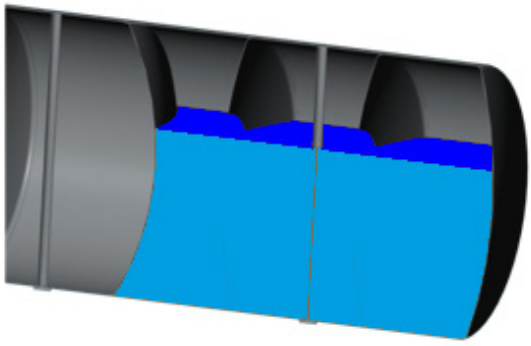


Figure 1: Example a tank chamber

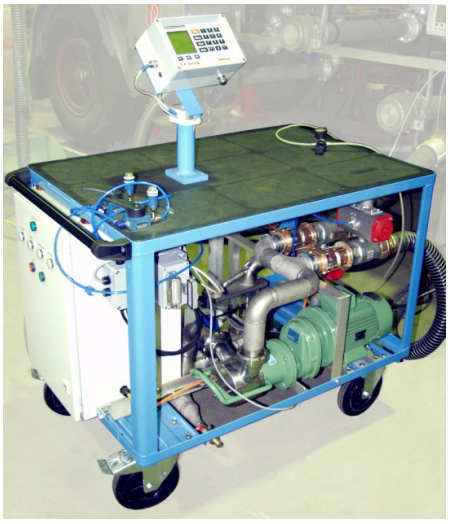


Figure 2: calibration unit

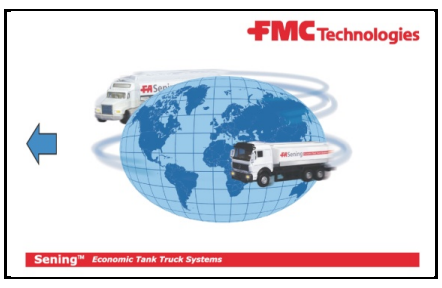


Figure 3: chip card

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 3” hose measuring approx. 1m. When connecting up these components, always make sure that the connecting hose has a sufficient downward slope towards the calibration unit.

- The chamber is emptied via the pump P1, and at the same time the magneto-inductive flow meter (FQI / 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.

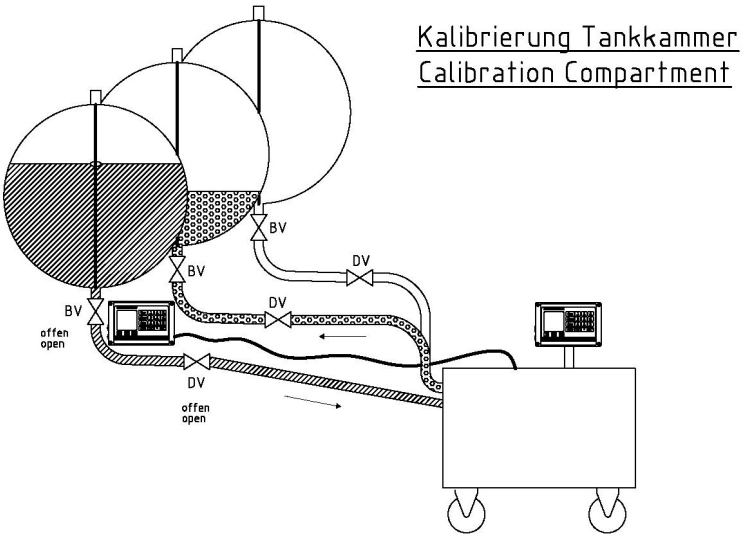
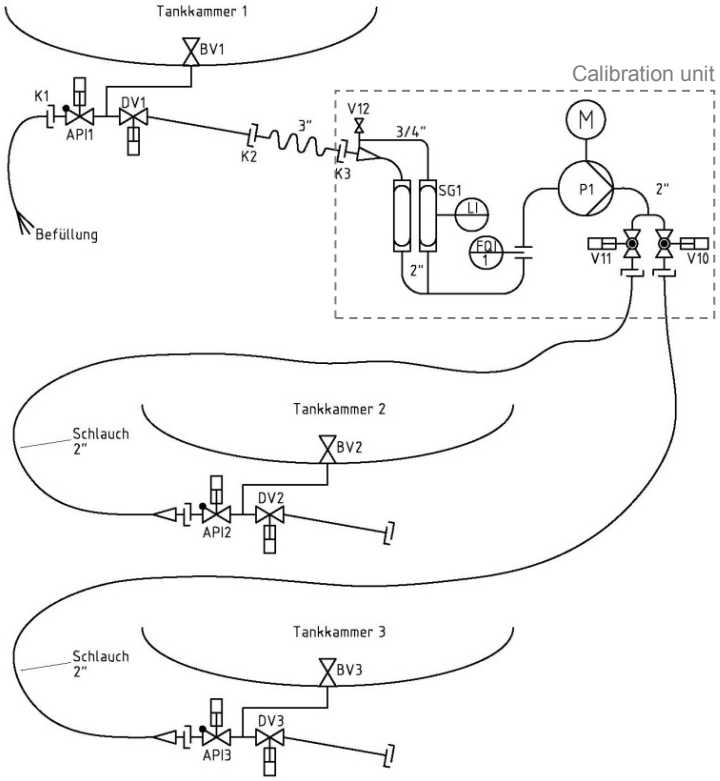


Figure 4: Connecting the calibration unit



Key:

P1:	Impeller pump
API:	API coupling
BV:	Foot valve
DV:	Through valve
V:	Ball valve with actuating drive
SG1:	Sight glass
FQI:	Magneto-inductive flow meter (MID)
LI:	Fill level sensor
K:	Coupling

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.

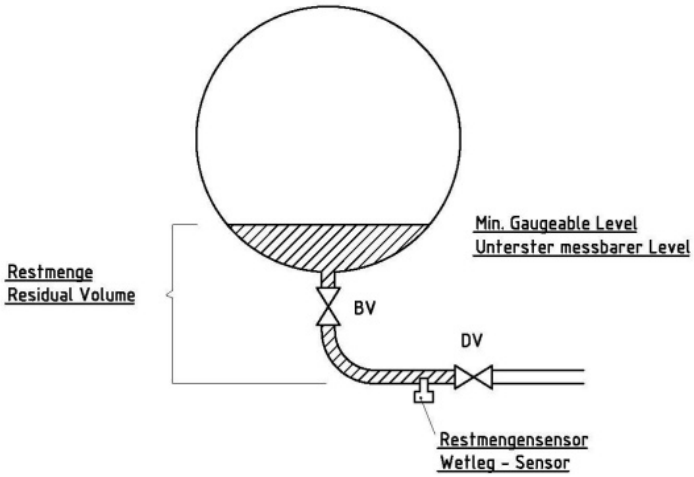


Figure 6: Definition of the residual volume

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.

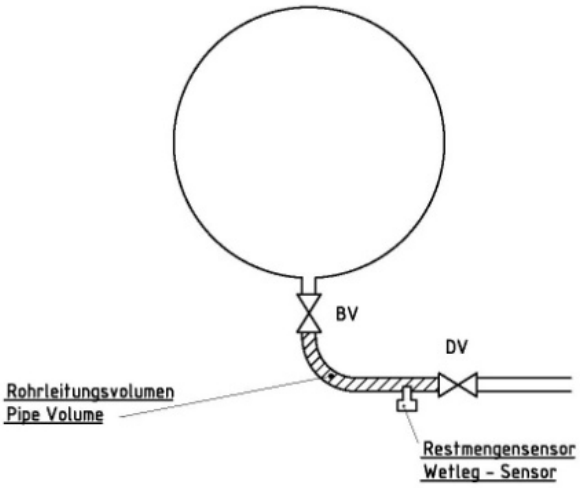


Figure 7: Definition of the pipe volume

Pipe volume = fill quantity between the foot valve and the delivery valve.

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

- Hose volume (connecting hose 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 (amount outside the measuring range of the dipstick)

3 Preparing for calibration

3.1 Commissioning the vehicle

Prior to calibration, both NoMix2000 and MultiLevel must be set up to such an extent to that the basic functions are available. This includes entering all parameters and connecting the chip card reader.

The following documents describe the commissioning procedures for the NoMix2000 (DOK-415) and MultiLevel (DOK-479).

3.2 Mechanical preparations

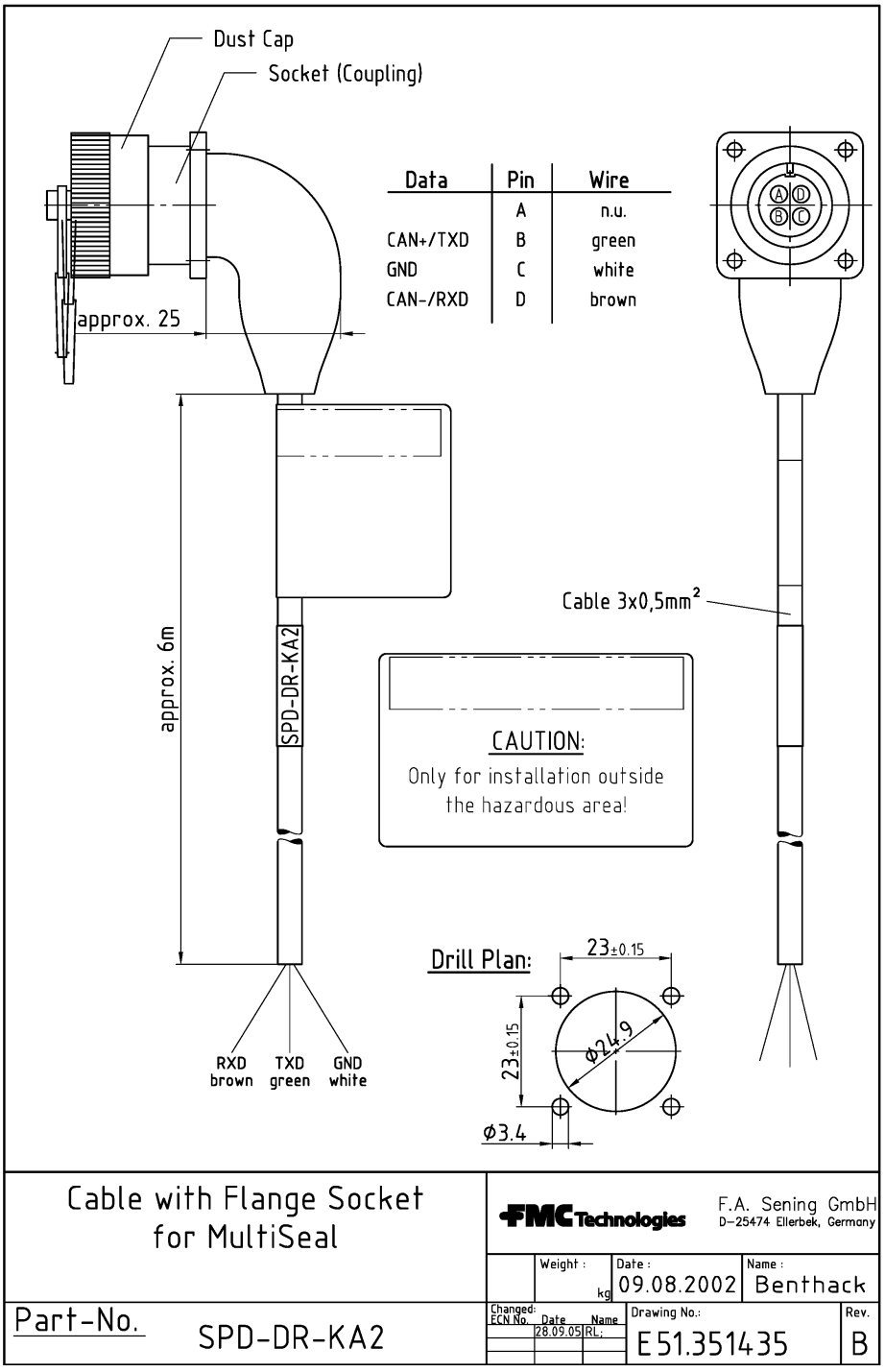
The following points must be taken into consideration in order to calibrate the vehicle successfully:

1. Raise up the semi-trailer
   (recommended height of middle outlet port min. 600 mm above floor level to enable drainage at an incline to the calibration unit)
2. Align the raised semi-trailer
   to 0° ± 0.1° on both longitudinal and transverse reference surfaces, e.g. with the aid of a digital spirit level.
3. Required supply voltage for the calibration unit: 400 V incl. neutral conductor with 16 A CEE connector
4. Required compressed air supply: min. 6 bar for the calibration unit
5. 2 hoses: DN50 with VK50/MK50, 2.5 m to 3 m in length
6. 2 adapters: VK80 to VK50
7. 1 outlet adapter with opening function for API connections to vent the loading side
8. If calibration is performed using the API connections, 3 API to MK80 outlet adapters are required

3.3 Connecting the calibration unit to the CAN bus

3.3.1 Recommended fittings on the vehicle

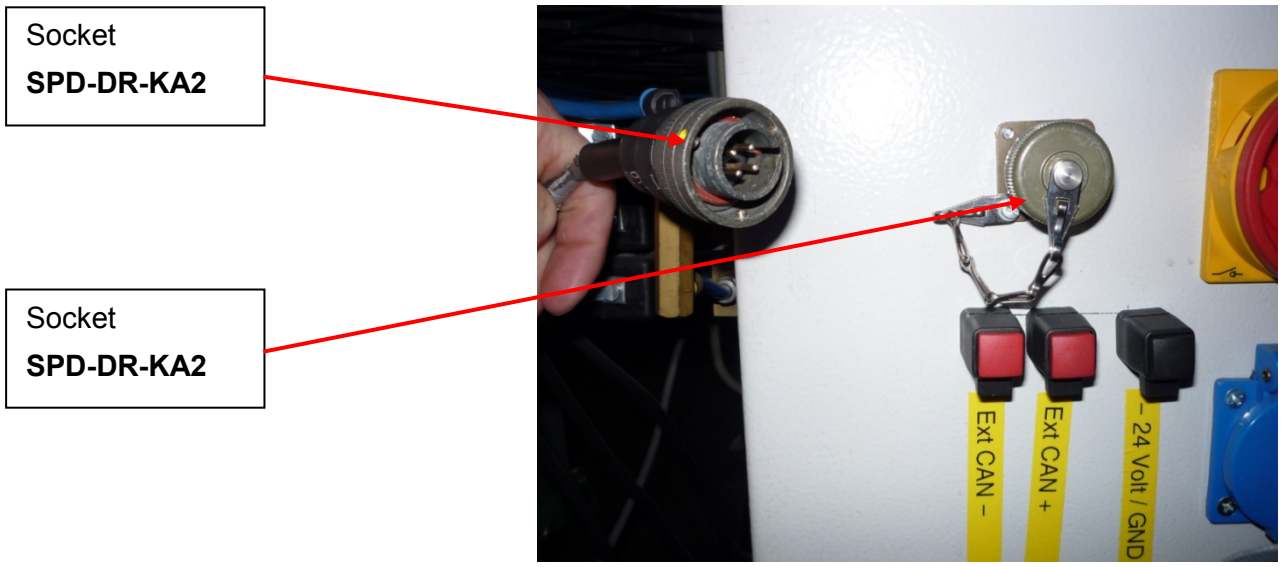
The calibration unit is connected directly to the external CAN bus. FMC Sening recommends using connector socket SPD-DR-KA2 for the connection to the vehicle.



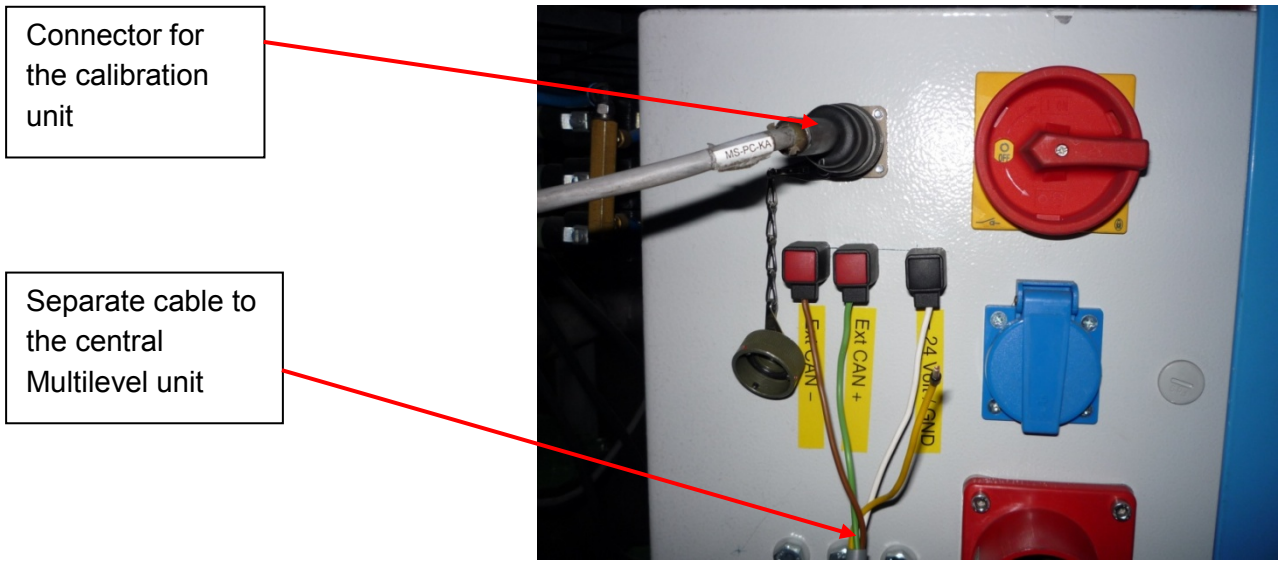
NOTE:
Connection to socket SPD-DR-KA2 may only be made outside of the EX area.

3.3.2 Connecting the calibration unit

If the tank truck has a socket with part number SPD-DR-KA2, connect the calibration unit connector directly to this.



If the tank truck does not have a socket with part number SPD-DR-KA2, connect the calibration unit directly to the external Multilevel CAN bus using a separate cable.



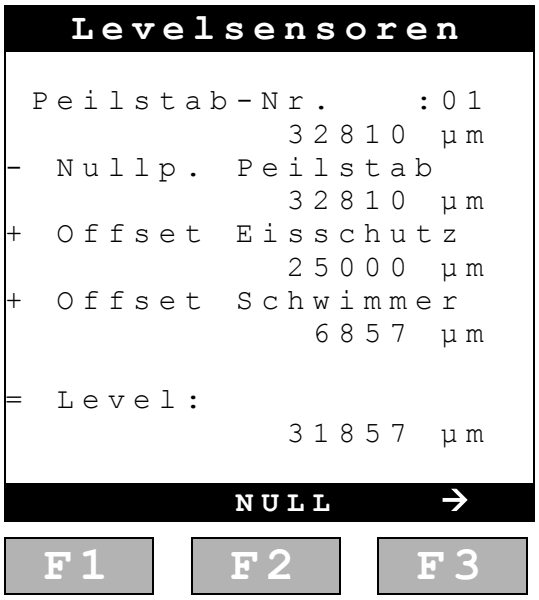
The calibration unit can only communicate with NoMix2000 and MultiLevel if the NoMix2000 node number is set to **"10"** for both of these components. For a standalone Multilevel, this must be set to **"0."**

3.4 Required vehicle parameters prior to calibration

3.4.1 Entering compartment-specific parameters for each compartment

☞ Input display for the compartment-specific parameters.

All values are entered in µm.
(40 mm = 40000 µm)

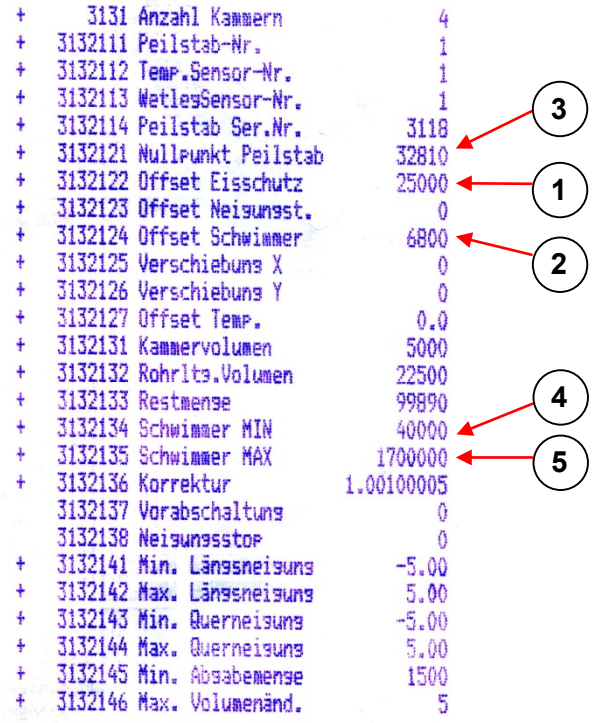


1. Enter the ice-protection offset:
Always 25 mm
Ice-protection offset = high ice protection
(Menu: 3.1.3.2.x.2.2 x = compartment no.)

2. Enter the float offset:
From pre-inspection certificate
Float offset = immersion depth of the float
(Menu: 3.1.3.2.x.2.4 x = compartment no.)

3. Enter the dipstick zero point
Enter the raw value for the dipstick from the diagnostics menu or enter it automatically using the "Zeroing" function.
(Menu: 4.2.1.1)
Press **<F3>** to display the parameters for the next compartment.

4. Float MIN:
From experience, 40 mm is the optimal value. (Same value as used for the parameter entries for the calibration unit:
<*3. Flow rates*> Min height).



5. Float MAX:
   Fill level to which the compartment is to be filled at the start of calibration. From experience, approx. 3 to 4 cm below the manlids. (Determine through measurements or test during filling.) The current fill level is displayed in mm under Filling "F1" on the Multilevel screen if a dip table has not been stored.
   (Menu: 3.1.3.2.x.3.5 x = compartment no.)

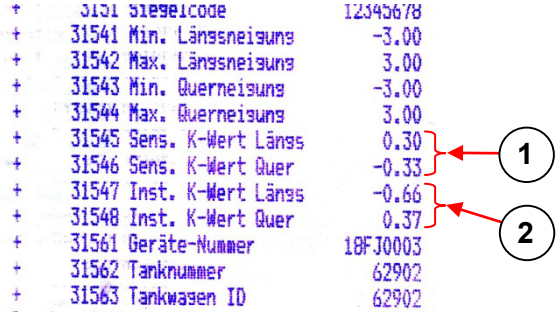
NOTE:
When entering the zero point for the dipstick, the float must be located at the ice protection level !!

3.4.2 Entering vehicle-specific parameters once per vehicle

☞ Input display for the vehicle-specific parameters.

Ensure that the vehicle is leveled to 0°. (Longitudinal and transverse slopes)

1. Enter the sensor corrections from the pre-inspection certificate ***(Menu: 3.1.5.4.5 / 6)***
2. Enter the installation corrections at the vehicle.
   Read the value from the diagnostics menu and enter it so that both slopes display as 0°, or enter the value automatically using the "Zeroing" function: ***(Menu: 4.2.1.3)***



3.4.3 Selecting the product in the loading plan

Only water must be used to calibrate the individual tank compartments. To enter the correct float immersion correction factor for the medium, choose the product **"Water"** for each compartment in the loading plan for a standalone MultiLevel or if NoMix2000 is present.

3.5 Setting up the calibration unit, menu <1. Parameter list>

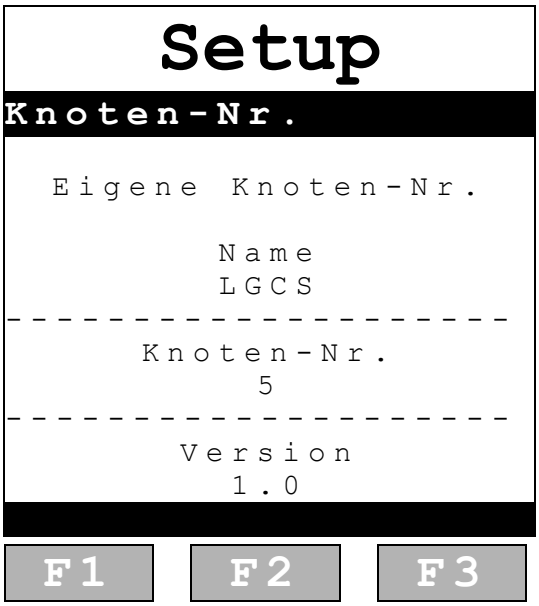
3.5.1 Parameter list: <1. Node no.>

This data is for information only!

Changes are not possible!

NOTE:

Other components must not be assigned node number 5 on the global CAN bus!



3.5.2 Parameter list: <2. C-factors>

The standard settings **must not** be changed.

The C-factors enable the magneto-inductive flow meter behavior to be adjusted to the flow rate. The factors are determined at FMC/Sening.

(The calibration unit can be recalibrated by filling a volume standard using the relevant flow rates. This is required only if deviations are apparent when calibrating the vehicles.)

NOTE:
Only water may be used when operating the calibration unit!

3.5.1 Parameter list: <3. Flow rates>

Standardeinstellungen:

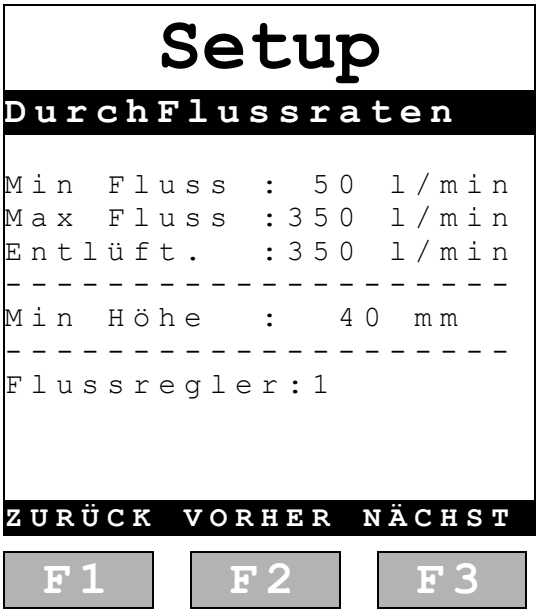
Min. flow : 50 ℓ/min
Flow rate when determining the hose/pipe volumes and residual volume.

Max. flow : 350 m/min
Max. possible flow rate

Venting: 350 ℓ/min
Flow rate when venting

Min. height: 40 mm
Transition to residual volume measurement

Flow regulator: 1 (use the default setting!)



NOTE:
The parameter min. height=40 mm **must** be entered here, otherwise errors will occur when determining the residual volume.
The "Min. height = 40 mm" setting may only be changed in exceptional circumstances following consultation with FMC Sening.

3.5.2 Parameter list: <4. Coffer tank flow rates>

Meaning of the parameters:

- The fill level ranges from 0 mm on the dipstick to the max. float value of 100%.
- The calibration unit empties the tank compartment from a fill level of 100% to 12% at 260 ℓ/min.
- From fill level 12% to 8% at 150 ℓ/min.
- From fill level 8% to float min. (40 mm) at 100 ℓ/min.
- Below float min. (40 mm), the calibration enters residual drainage mode at 50 ℓ/min.

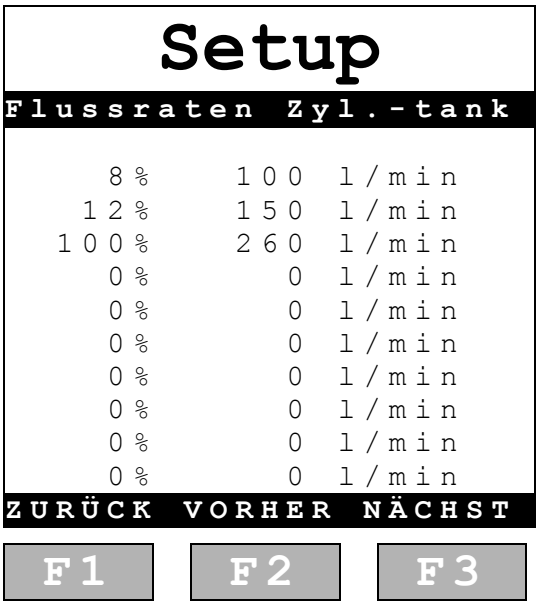
The flow rate can be adjusted to avoid incorrect measurements caused by rapid changes to the flow rate (e.g. when starting the calibration) or by the formation of vortices in the tank compartment. The figures provided here have proved effective for standard compartments. The flow rate should be reduced earlier if the tank compartment is inclined to generate vortices at lower volumes. The majority of the compartment should be calibrated at 260 ℓ/min as the calibration unit operates particularly quietly and accurately at this rate.

NOTE:
The "Float MAX" parameter is transferred from MultiLevel and must be entered there correctly!

3.5.1 Parameter list: <5. Cylinder tank flow rates>

You can also use a second table for the flow rates.

The same applies as for the coffer tank.



3.5.2 Parameter list: <6. Valve control>

☞ The following control types can be selected:

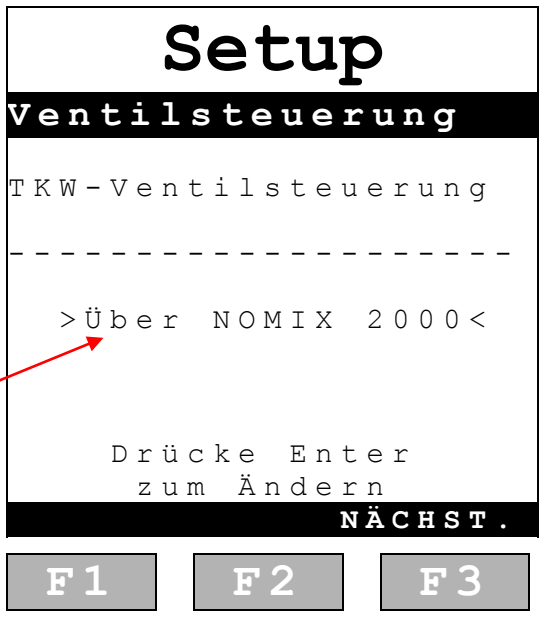
- Via NoMix2000
- Via MultiLevel
- Manual

Additional selection options:

1.) >Via NOMIX 2000<

2.) >Via MultiLevel<

3.) >Manual<



NOTE:
When using valve control via NoMix2000 or MultiLevel, all associated valves are opened automatically during calibration. The calibration medium can leak if the hoses are not connected properly !

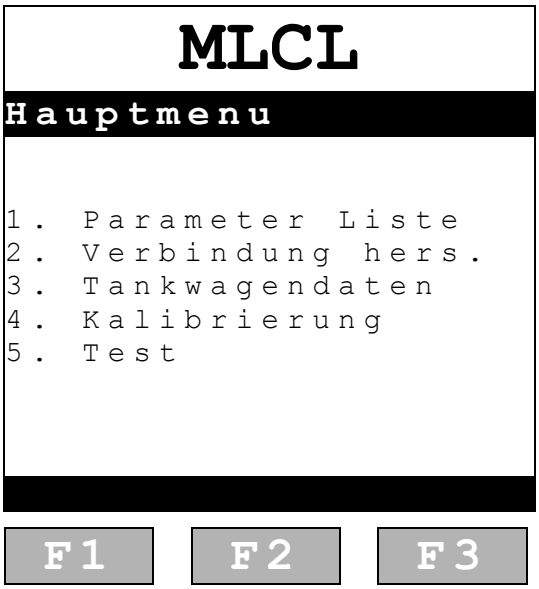
3.5.3 Parameter list: <7. Drip times>

The drip times determine the wait times required for recording the residual volumes in the pipes or compartment accurately. The next calibration step is not triggered until the sensor in the sight glass registers that it is empty and the drip time has elapsed !

Example:
When determining the hose volume between the through valve and the calibration unit, the sight glass sensor must have registered that it is empty and at least 5 seconds must have elapsed before the next function can be called up.

NOTE:
This function is intended to be used for a planned automatic calibration process in the future.

3.6 Setting up the calibration unit, menu <3. Tank truck data>:



3.6.1 Tank truck data: <1. Tank truck data>

☞ **Enter the tank compartment type:**

- <**Coffer**>: Coffer tank flow rates apply
- <**Cylinder**>: Cylinder tank flow rates apply

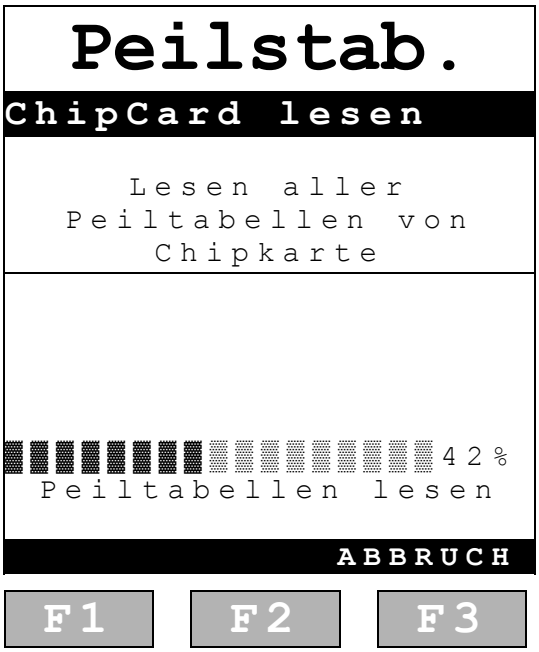
☞ **Enter the chassis number:**

- For information only

NOTE:
When the calibration unit is switched off, the tank truck data resets to the default settings. This means that the flow rates selected will be for the default "coffer tank," even if values for a cylinder tank were selected before switching off the unit.

The <1. Tank truck data> will need to be re-entered after the calibration unit has been switched off !

3.6.2 Tank truck data: <2. Read ChipCard>

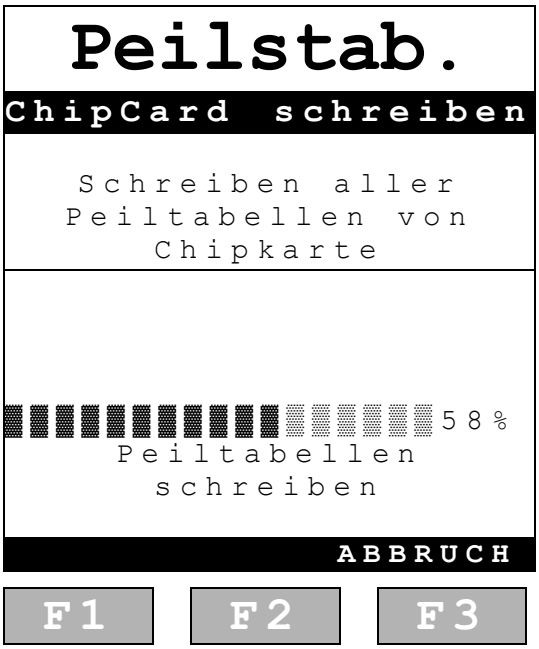


The dip tables can only be imported if a chip card with tables is available. Each chip card always stores 24 dip tables (compartments 1...24). All 24 tables are imported into the calibration unit's memory.

NOTE:
All tables stored in the calibration unit's internal memory are deleted once it is switched off !

NOTE:
If a chip card contains zeros only, calibrations that already exist in the calibration unit are overwritten !

3.6.3 Tank truck data: <3. Write ChipCard>



Dip tables are saved as follows:

1. Calibration unit just switched on: When saving, 24 dip tables are written to the card with zero values.
2. The calibration unit receives complete calibration data for compartment X: Dip table X is written to the chip card; zero values are recorded for the remaining compartments.
3. Compartment X is calibrated, followed by compartment Y without switching off the calibration unit. Both compartments are written to the chip card; zero values are recorded for the remainder.
4. Calibration unit is switched on, compartment X is read from the chip card, compartment Y is then calibrated. Compartments X and Y are written to the chip card; zero values are recorded for the remainder.

NOTE:
All tables stored in the calibration unit's internal memory are deleted once it is switched off. A subsequent save operation would overwrite all tables on the chip card with zero values !

NOTE:
If the calibration unit is switched off when writing data to the chip card, all data will be lost: both in the calibration unit itself and on the chip card.

See recommendations on the following page !

Recommendations:
Following each calibration, the dip table should be saved to a separate chip card and immediately transferred into MultiLevel.

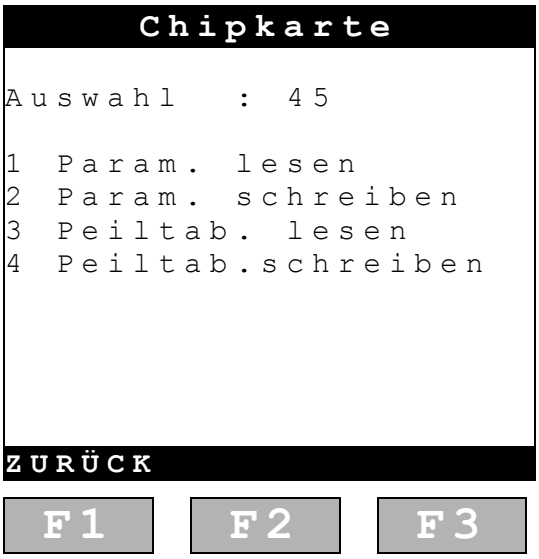
All values saved in the calibration unit are deleted when it is switched off. In this case, the following options are available:

1. Read from a chip card that has previously been written to ==> Continue with calibration, then save the data.
2. Continue the calibration and then save to a different chip card.

This ensures that all calibrations are stored both on the chip card and in Multi-Level.

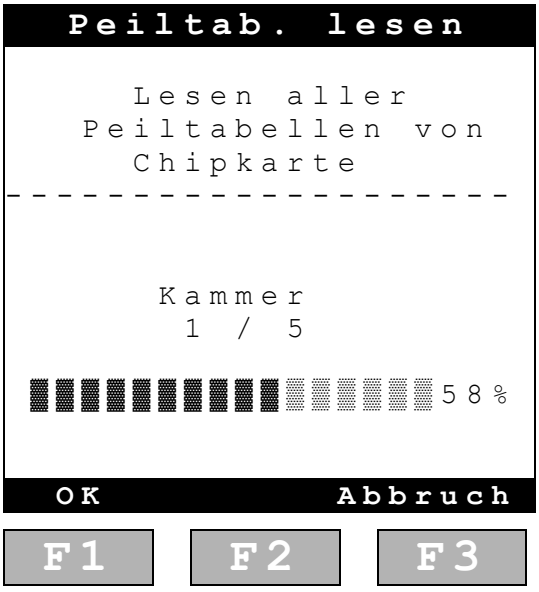
3.6.4 Importing the dip tables from the chip card into MultiLevel

☞ To import a new dip table into MultiLevel, first call up the "**Chip cards**" function in menu **<4>** Service **<5>**. Use function **<3>** to import the dip tables.
(Menu 4.5.3)



Dip tables are imported into MultiLevel as follows:

1. New dip tables are read from the chip card and imported into MultiLevel.
2. Identical dip tables (= identical checksums) are not overwritten.
3. Dip tables with "**zeroes**" are not transferred. An existing dip table is not overwritten with "**zeroes**."



NOTE:
If you select "Write dip table" by accident and confirm the write operation, the chip card will be overwritten. This deletes the calibration data currently stored on the chip card.

4 Conducting the calibration

Step 1:

Check that all parameters have been entered correctly!

A.) Section 3.5 / page 16: Calibration unit parameters OK?

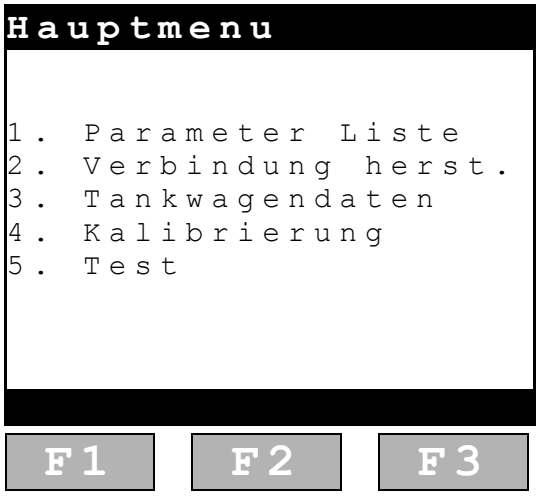
B.) Section 3.6 / page 21: Vehicle parameters OK?

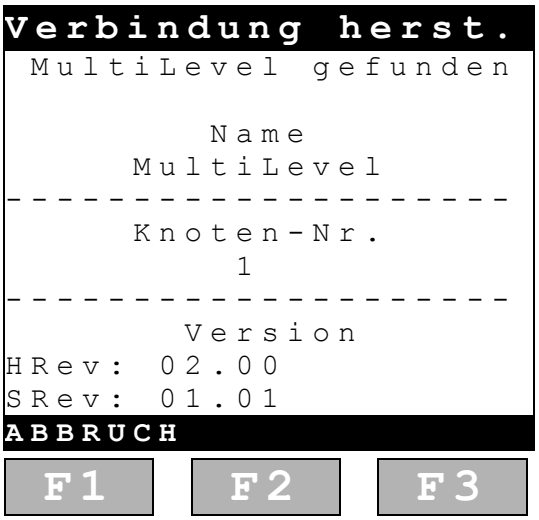
Step 2:

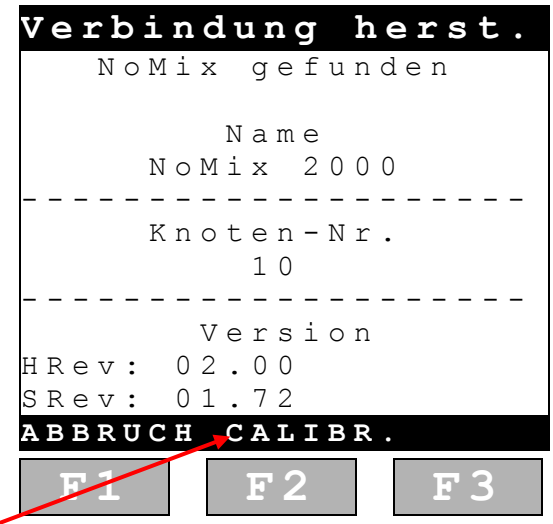
<2. Establish connection>

The connection must always be established prior to calibration because the calibration process checks whether the connection between the components has been created. Data pertaining to the current calibration is also exchanged between MultiLevel and the calibration unit.

IMPORTANT: When establishing the connection, the "Float max." parameter is transferred to the calibration unit. As a result, the calibration unit automatically limits the fill level when filling the compartment to be calibrated during fluid transfer.





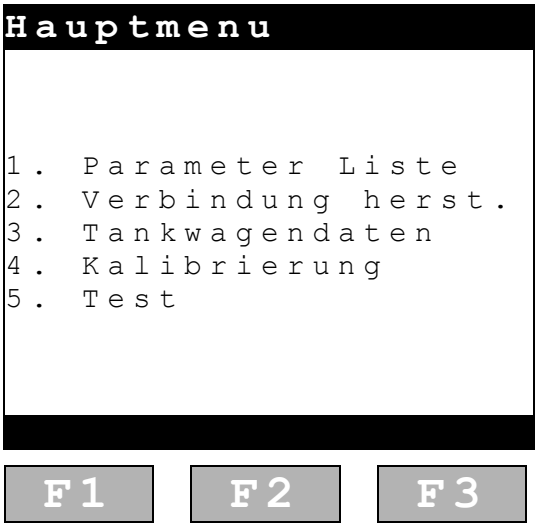


Once the connection has been established and all data has been transferred, **"CALIBR." appears above the F2 - key** and can be used to proceed to the next step.

Step 3:

<4. Calibration>

☞ Select <**4. Calibration**> to start the calibration run !



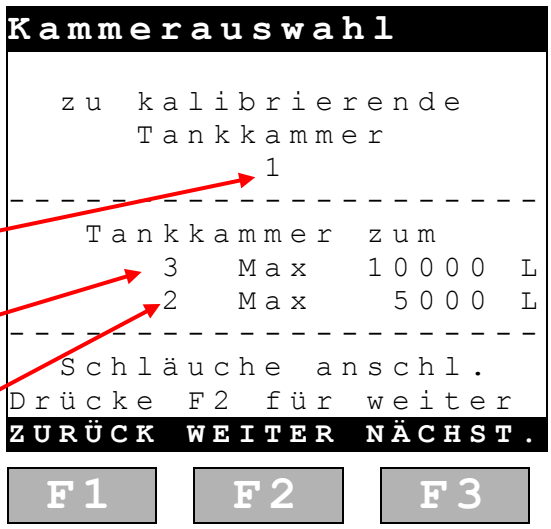
Step 4:

Start the calibration run

- A.) Specify the compartment to be calibrated
- B.) Specify how much water is to be pumped into which compartments.

The settings shown here mean:

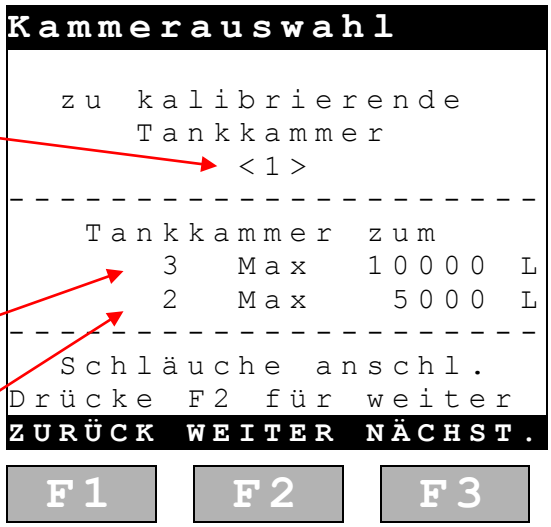
1. Compartment **1** is being calibrated
2. Compartment **3** will first be filled with 10000 l using delivery nozzle **1**.
3. Compartment **2** will then be filled with 5000 l water using delivery nozzle 2.



Note:
The total volume of both amounts must be larger than the volume of the tank compartment to be calibrated. In this case, the calibration unit stops after 15000 l, even if the compartment to be calibrated is not yet empty.

Operating instructions for the editor:

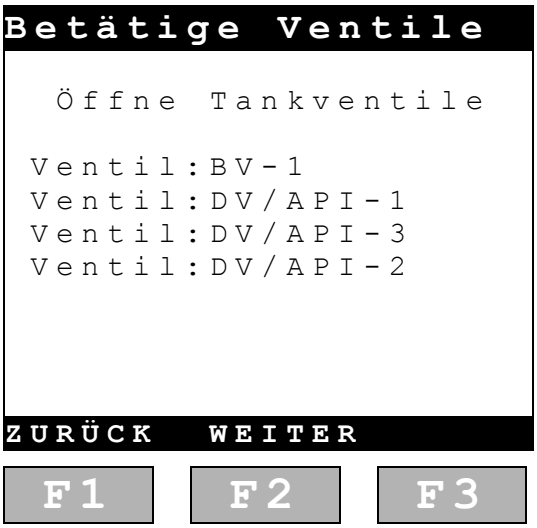
- *No fields are active on the basic screen. Activated fields are indicated by <...>.*
- *Use **F3 <Next>** to move to the field that you wish to change.*
- ***F2** switches to <**Change**> mode; the cursor becomes active in the entry fields.*
- *Use **F2 <Change>** or the number pad to enter or change the values.*
- *Use <**Enter**> to confirm the value. The next field becomes active.*
- *Once no more fields are active with <...>, use **F2 <Continue>** to carry out the next calibration step.*



Step 5:

Open the valves

- The valves open automatically if they are controlled via NoMix2000 or MultiLevel.
- If manual control is selected, the valves must be opened manually at this point.
- In both cases, a screen appears showing which valves need to be opened or the valves that have been opened automatically.



The calibration unit always opens its own valves automatically.

*When using automatic valve control, the system opens **ALL** valves for the two compartments on the tank truck into which water is to be pumped. The amount issued is regulated by the ball valves in the calibration unit.*

Step 6:

Vent the system

☞ The entire pipe system must be vented of air before measurement commences. Recommended flow rate for venting: **>260 ℓ/min**

(For the associated parameters, see section 3.5.1, page 17)

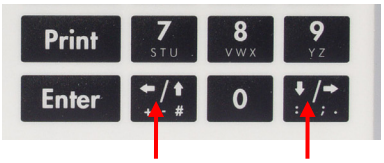
NOTE:
If venting is carried out below **260 ℓ/min**, it cannot be guaranteed that all air pockets will be conveyed out of the pipes !

Pipe sections located higher up (e.g. API connection) must also be vented !

☞ The calibration unit stops automatically once the correct fill level has been achieved in the compartment to be calibrated. The relevant fill height is transferred to the calibration unit from the vehicle (parameter "Float MAX").

☞ Press **<F3> "STOP"** to switch off the pump. You can then use **<F2> "CONTINUE"** to select the next step or restart the pump using **<F3> "START."**

☞ Change in the rotational direction of the pump is only possible if the pump is switched off. The rotational direction is displayed in line 3:

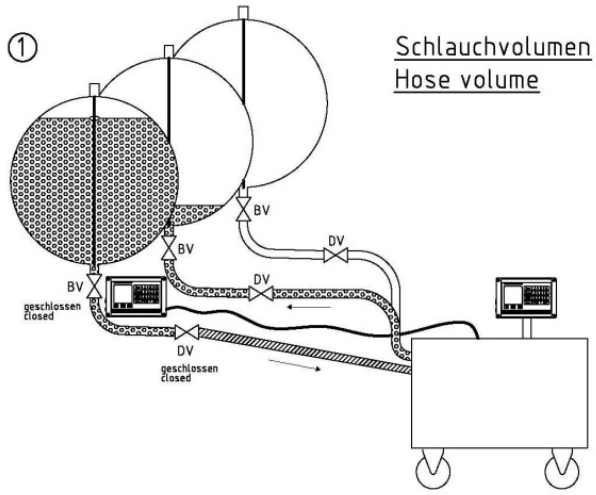


- With: **-->** or **<--**

Recommendation:
A measuring process is always carried out after venting. For this, the pump impeller must be correctly aligned to prevent the blades turning when the measurement starts. While still in venting mode, the pump should therefore run briefly in the correct direction.

Step 7:

Measuring the hose volume




```
Schlauchvolumen

 Schließe Tankventile

  Ventil: DV/API-1
  Ventil: BV-1
----------------------

   Öffne Tankventile




ZURÜCK   WEITER
```

F1 F2 F3

☞ Once the valves have been opened, you must choose **<F2>** "**CONTINUE**" to select the next step.

☞ Then choose **<F3>** "**START**" to start the measurement process for determining the hose volume.

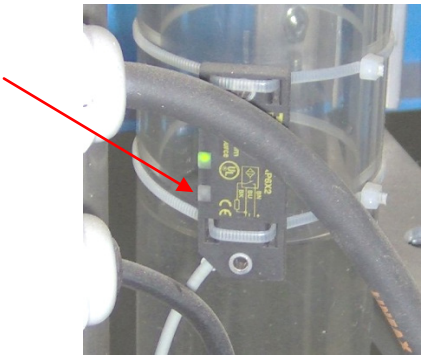
```
Schlauchvolumen

 Lagerb. <-- Kalib.
----------------------
 Aktueller DurchFluss
          50 l/min
   Schlauchvolumen
         3.3 Liter
----------------------

 Drücke F3 für Start
 Drücke F2 für Weiter

ZURÜCK   WEITER   START
```

F1 F2 F3

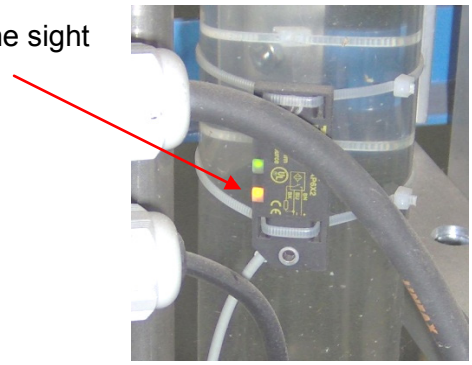
```
Schlauchvolumen

 Lagerb. <-- Kalib.
----------------------
 Aktueller DurchFluss
           0 l/min
   Schlauchvolumen
         6.3 Liter
----------------------

 Drücke F3 für Start
 Drücke F2 für Weiter

ZURÜCK   WEITER   START
```

F1 F2 F3

As soon as the liquid sensor in the sight glass is deactivated
(**yellow LED extinguishes**) , the pump stops automatically.



If the medium subsequently continues to flow, the sight glass once again registers as full
(**yellow LED illuminates**).



Use **<F3>** "**START**" to start the pump as often as required until the sensor is no longer triggered. (Yellow LED remains extinguished.) As soon as the sensor is no longer active and the associated drip time has elapsed, use **<F2>** "**CONTINUE**" to select the next step in the calibration process.

NOTE:
The volume to be measured should be as large as possible to prevent measuring errors caused by repeated brief activations of the pump.

Step 8:

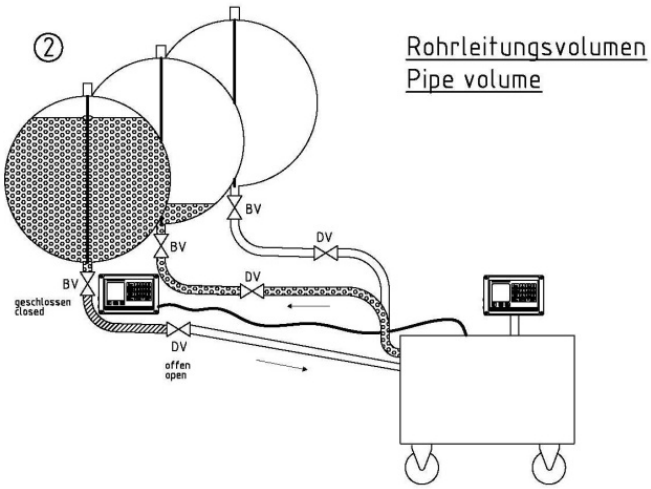
Measure the pipe volume

☞ Once the delivery valve has been opened, you must choose **<F2>** "**CONTINUE**" to select the next step.

☞ Then choose **<F3>** "**START**" to start the measurement process for determining the pipe volume. Before starting the measurement, wait until the air has escaped from the connection hose into the tank compartment.

```
Rohrleitungsvolumen

Schließe Tankventile

 Ventil: BV-1
--------------------

   Öffne Tankventile

 Ventil: DV/API-1


ZURÜCK  WEITER  START
```

F1 F2 F3




```
Rohrleitungsvolumen

 Lagerb. <-- Kalib.
----------------------
 Aktueller DurchFluss
           0 l/min
 Schlauchvolumen
        26.3 Liter
----------------------

 Drücke F3 für Start
 Drücke F2 für Weiter


ZURÜCK  WEITER  START
```

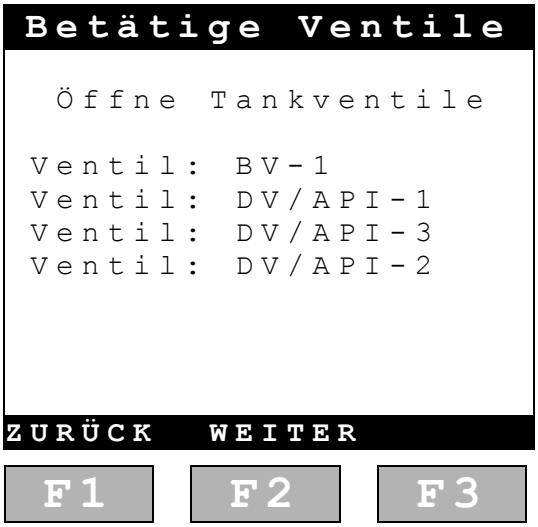
F1 F2 F3

☞ Once the through valve has been opened, the water flows into the calibration unit. The fill level can then be measured.

Step 9:

Open the valves

☞ Carried out manually or automatically, depending on the settings. See step 5 !



Step 10:

Vent the system

☞ See step 6 !

✍ In this step, the compartment must always be filled to the maximum possible fill level. The maximum fill level is taken from the MultiLevel parameter list.

☞ Use **<F2> "Continue**" to select the next step in the calibration process.

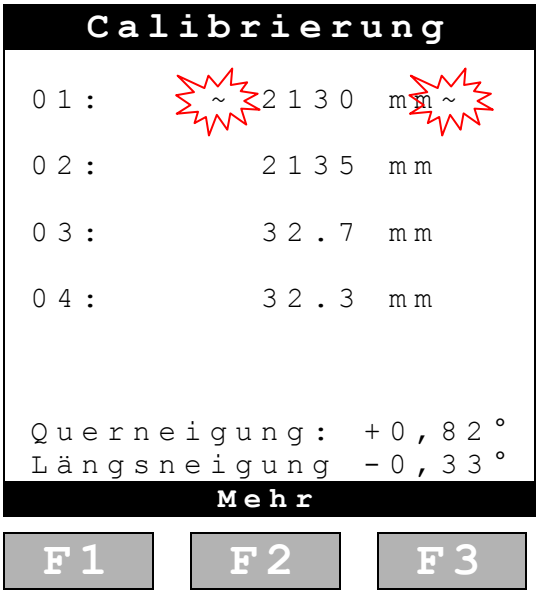
NOTE:
200 measurement values are available that are distributed over the max fill level (= float MAX). The compartment may not be overfilled (manually) by more than 10 mm above this level, otherwise it is not possible to save the last fill level measurement values for the lower range during calibration !

Step 11:

Calibrate the tank compartment

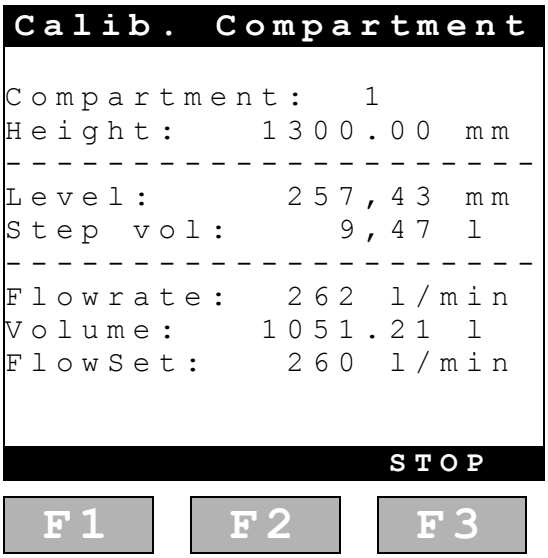
☞ Use **<F3>** "**START**" to start the actual calibration of the compartment. Ensure that the **"~"** for the tank compartment to be calibrated has disappeared in the MultiLevel display. (Float has settled.)

- Calibration proceeds automatically. The time required depends on the size of the compartment.
- For example:
  10000 liters ==> 260 ℓ/min ==> 38 min in theory
- In practice, this lasts around 45 min owing to the reduction in flow rate at the end of the measurement.



Key to the display:

- Float MAX (from MultiLevel parameter)
- Current fill level
- Volume measured since the measurementvalue was last saved.
- Current flow rate
- Total volume currently being measured
- Target flow rate (see parameter 4 or 5 "Flow rates")



NOTE:
To prevent measuring errors, avoid interrupting the calibration at all costs !

Step 12:

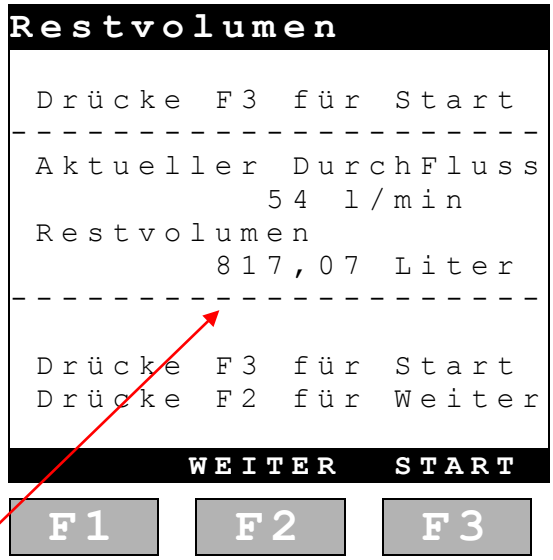
Determine the residual volume

☞ The calibration unit automatically switches over to residual volume measurement. The pump stops as soon as the sight glass sensor is dry (yellow LED extinguishes).

☞ It can be switched back on again at any time using **<F3> "Start"** to measure any residual medium that has accumulated.

☞ The measurement is only complete once the sight glass sensor is permanently dry (yellow LED extinguished).

Wrong: This shows the total volume and not just the residual volume !!



Step 13:

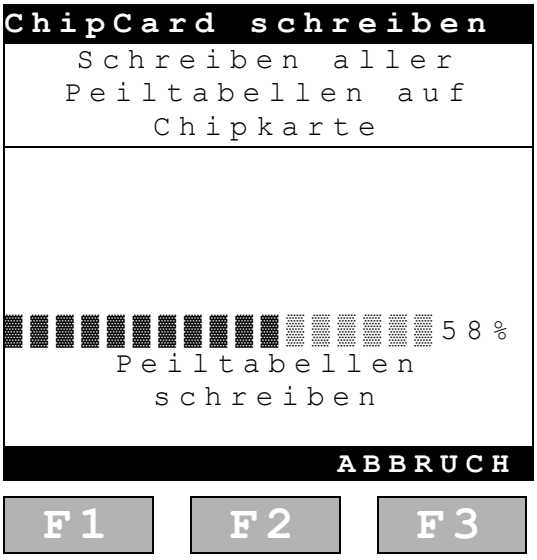
Close the valves

☞ Carried out manually or automatically, depending on the settings. See step 5. !

Step 14:

Save the values to the chip card

- Once the calibration is complete, the data needs to be written to the chip card.
- **Detailed instructions**:
  See 3.6.3 / page 23



Strong recommendation:
Once calibration is complete, you should save the dip table to a separate chip card and transfer it directly to MultiLevel.
This is the only way to ensure that all calibration data is safe and is not deleted from the calibration unit following a loss of power, for example !

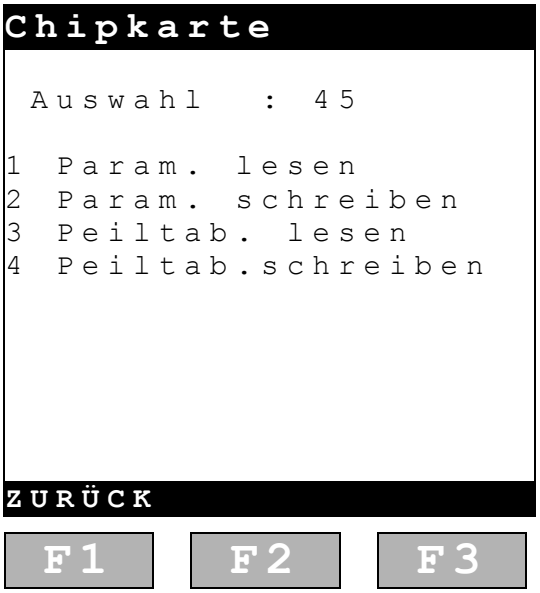
Step 15:

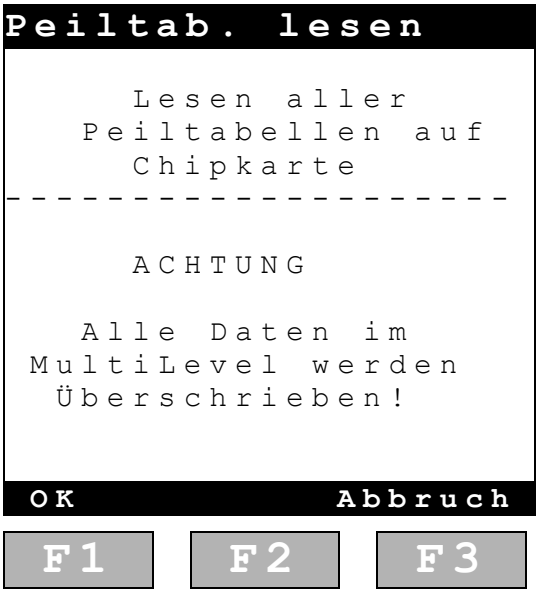
Import the values into MultiLevel from the chip card

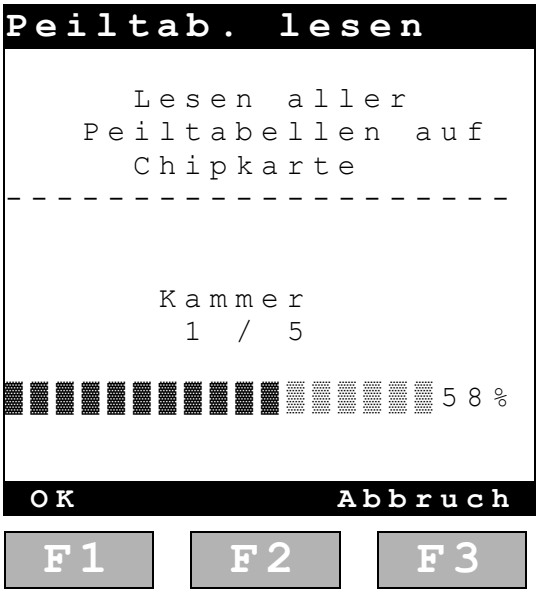
☞ To import an new dip table into MultiLevel, first call up the "**Chip cards**" function in menu **<4>** Service **<5>**.

☞ Use function **<3>** to import the dip tables.

🔗 Detailed instructions:
See section 3.6.2 / page 22.







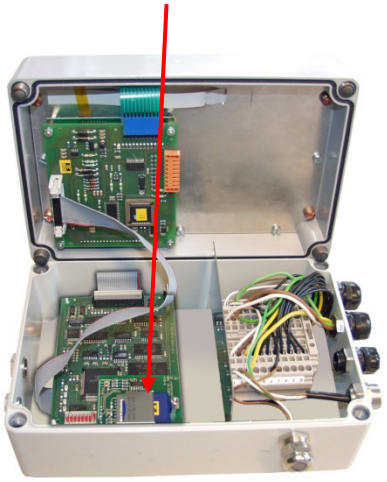
NOTE:
If you select "Write dip table" by accident and confirm the write operation, the chip card will be overwritten and the current calibration is deleted from the chip card.

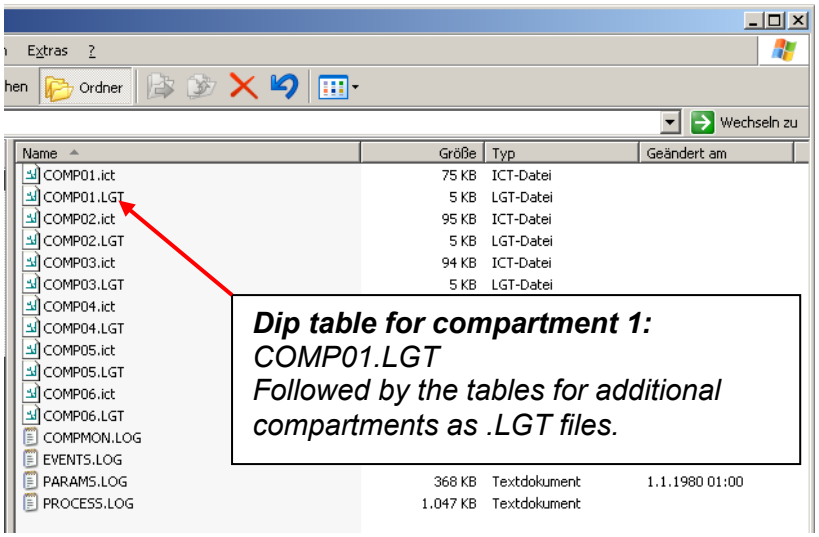
Step 16:

Copy and save all calibration data to the PC

Data located on the multimedia card must always be copied to a secure storage location once vehicle calibration is complete.

Multimedia card





To save the data to a PC, the multimedia card must be removed and placed in a card reader. The multimedia card contains all dip tables as ***.LGT** files, all slope tables as ***.ICT** files and all logbooks as ***.LOG** files.

Example:

Slope table for compartment 1: *COMP01.ict*

Dip table for compartment 1: *COMP01.lgt*

Parameter list: *PARAMS.log*

Strong recommendation:
Each multimedia card should be copied and saved by vehicle in a secure company file directory.
This ensures that all data specific to an individual tank truck can be re-imported into MultiLevel at any time.

5 Evaluating the calibration

5.1 General

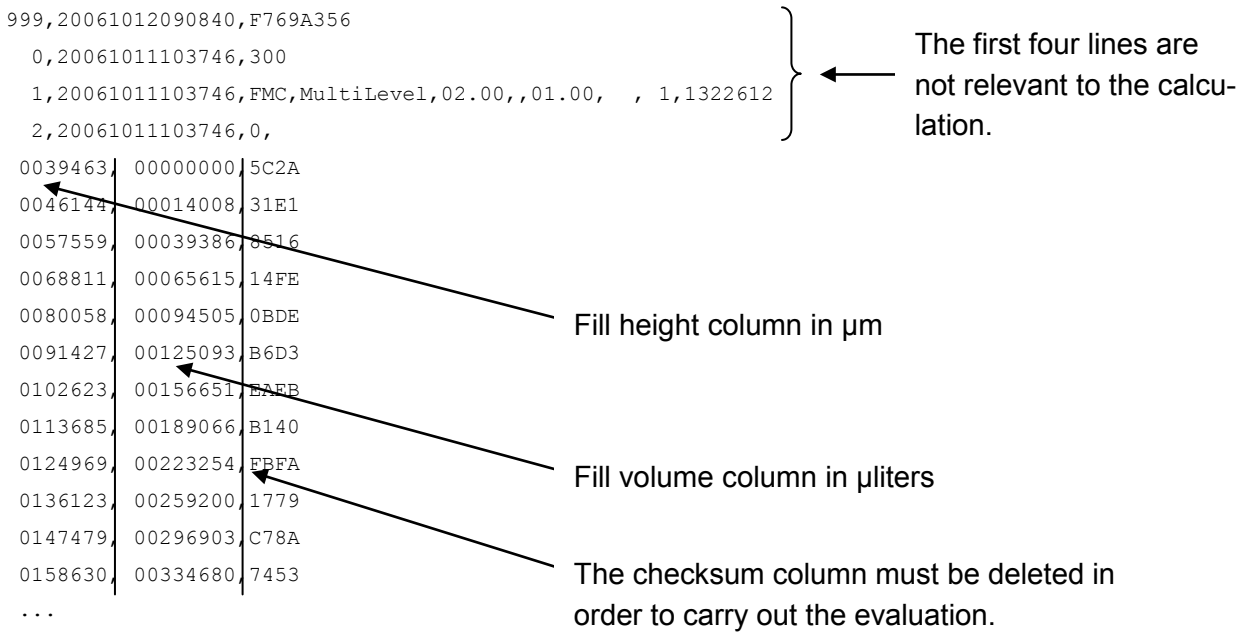
The MultiLevel approval specifies that a "derivation" needs to be carried out for each calibration. This is used to check whether the calibration was performed correctly and that no irregularities occurred. The dip tables are evaluated for all compartments.

The dip tables are made up of pairs of values for the fill level and fill volume. The derivation is calculated from these pairs of values by dividing the volume increments in the table by the associated height increments. The result shows the increase in individual values from the dip table. This increase also reflects the geometric form of the compartment.

Height	Volume	Derivation Increase = $\frac{\Delta V}{\Delta H} = \frac{Volume\ \ differenz}{Height\ \ differenz}$
39,5 mm	0,0 liters	-
46,1 mm	14,0 liters	2,1 liters/mm
57,6 mm	39,4 liters	2,2 liters /mm
68,8 mm	65,6 liters	2,3 liters /mm
80,1 mm	94,5 liters	2,5 liters /mm

5.2 Generating the derivations from the dip tables

The following shows an example of a Sening dip table (here *COMP01.LGT*):



NOTE:
The values in the dip table are protected by a checksum and must not be changed. An incorrect checksum renders the dip table invalid.

The ***.LGT** tables can easily be imported into Excel in order to calculate the derivations and display them graphically.

Höhe	Volumen	Ableitung
39,5 mm	0,0 Liter	
46,1 mm	14,0 Liter	2,10 L/mm
57,6 mm	39,4 Liter	2,22 L/mm
68,8 mm	65,6 Liter	2,33 L/mm
80,1 mm	94,5 Liter	2,57 L/mm
91,4 mm	125,1 Liter	2,69 L/mm
102,6 mm	156,7 Liter	2,82 L/mm
113,7 mm	189,1 Liter	2,93 L/mm
125,0 mm	223,3 Liter	3,03 L/mm
136,1 mm	259,2 Liter	3,22 L/mm
147,5 mm	296,9 Liter	3,32 L/mm
158,6 mm	334,7 Liter	3,39 L/mm

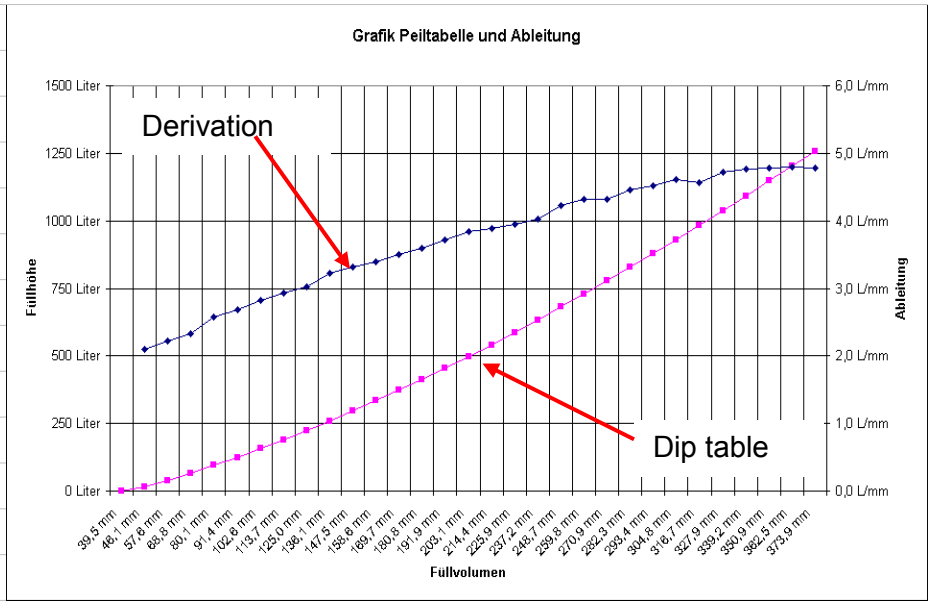


Figure 8: Generating a derivation graphic

5.3 Calibration quality criteria (requirements of the derivation)

- Vehicles fitted with a fill level measuring system require approval in Germany. The requirements on this type of vehicle are set out in the approval document and other regulations.
- The measuring compartments and the installation location of the dipsticks must be designed to ensure that the entire system meets the level of accuracy required for the approval. The slope correction in **particular** gives rise to certain geometrical requirements that must be met.
- The accuracy requirements must be met when installing the dipsticks. The dipsticks must be fitted exactly in line with the drawings. Deviations can cause the slope correction to be inaccurate.
- The method of installation must prevent metrological manipulations. Seal points must be indicated in the approval document and on the measuring system certificate.

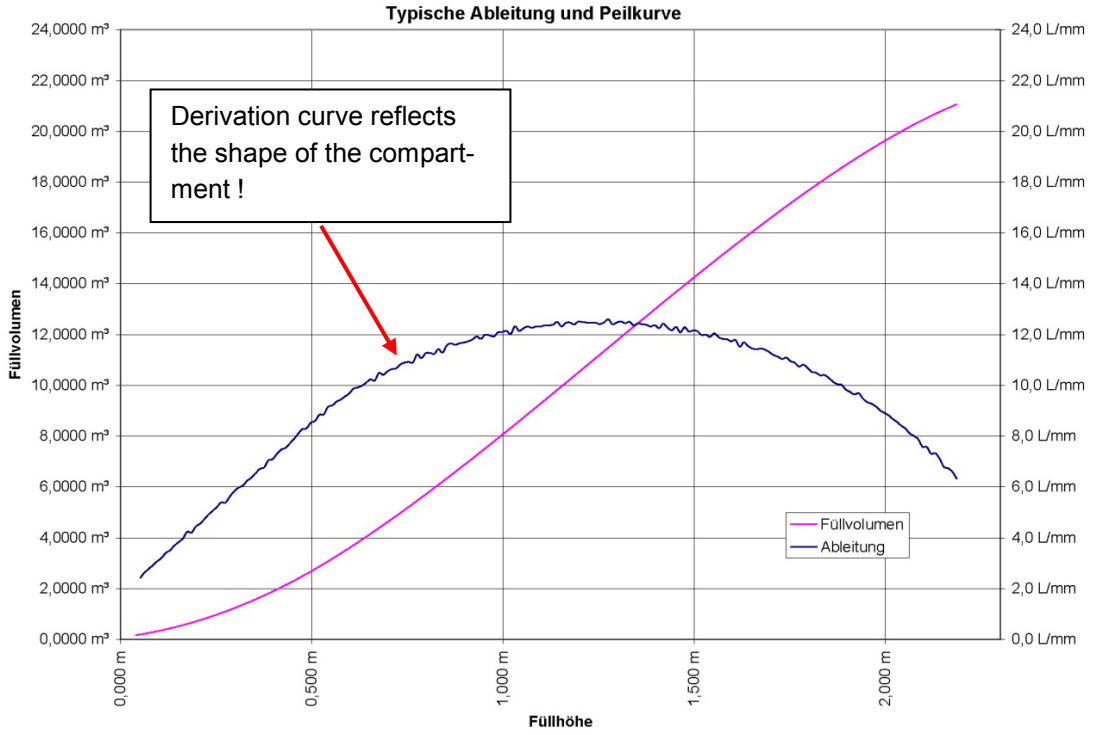


Figure 9: Derivation of a good discharge curve

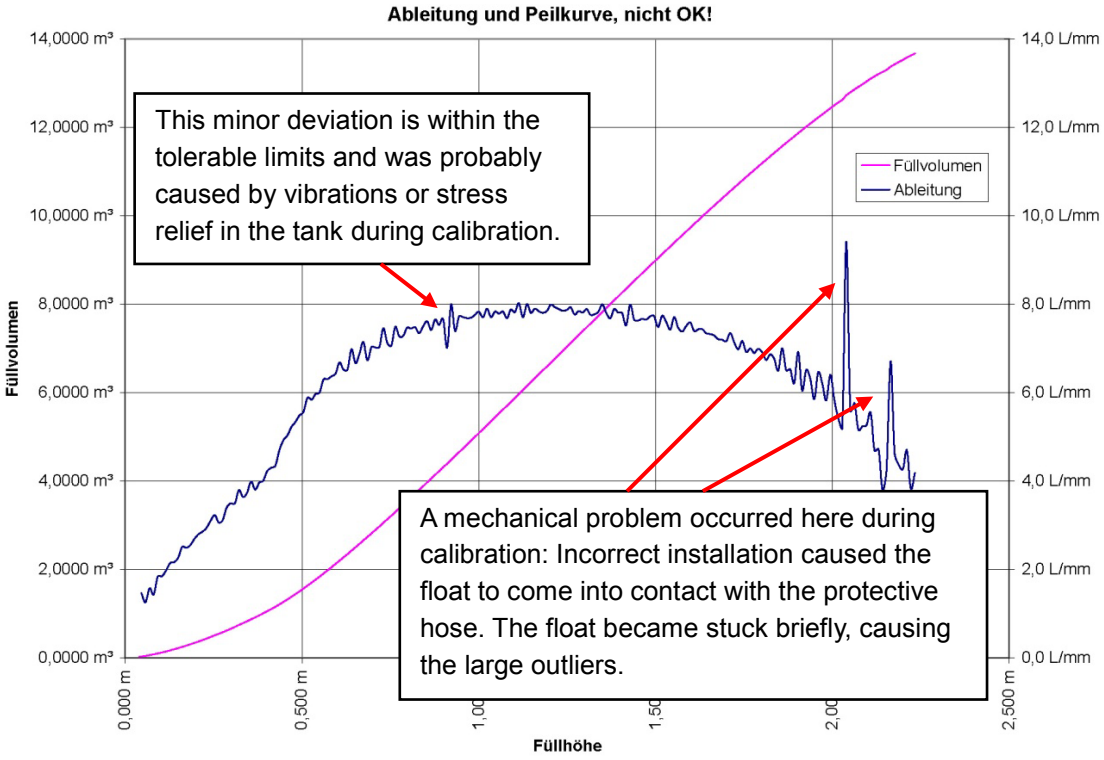


Figure 10: Derivation of a poor discharge curve

When compared with the imaginary ideal line, the above-mentioned deviations may not exceed the values from the approval permit, taking into account the size of the compartment.

6 Truck checklist

- **Are all valves, couplings, sensors, electronic components, etc, correctly installed, leak proof, and functional?**

- **Is a power and air supply present for the vehicle?**

- **Have both NoMix2000 and MultiLevel been commissioned correctly?**

  Do both systems start without problems?

  All components from the internal and external CAN bus must be recognized.

  Error messages such as *Checksum error for dip table*, *slope table*, ... are OK but must disappear once the parameters have been entered. See below !

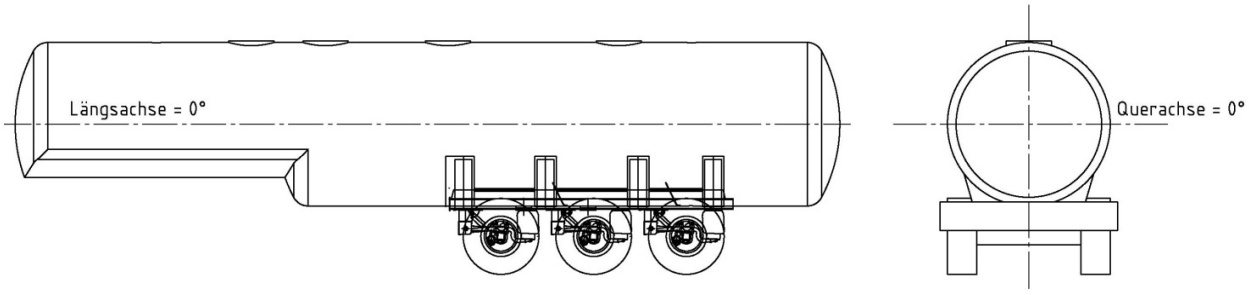
  EMIS must be switched off during calibration !!

- **Is NoMix2000 set to CAN bus node 10?**

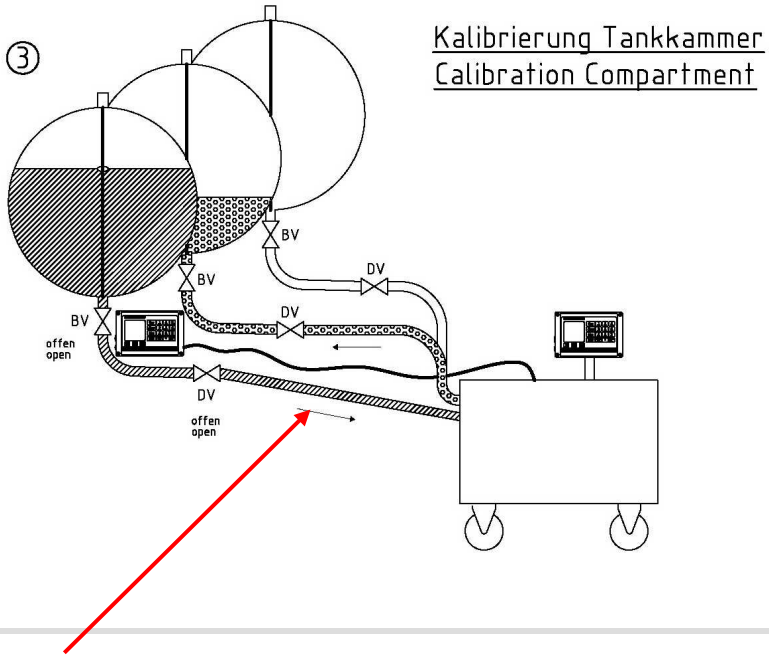
  Parameters for MultiLevel and NoMix2000

  (Required for calibration unit only - software 1.0 of March 2006)

- **Has the vehicle been raised securely and leveled to 0°?**



➢ Is the hose to the calibration unit at a large enough gradient?

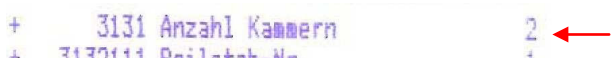


NOTE:

The vehicle must be raised high enough to enable the hose between the vehicle and the calibration unit to run at a downward gradient !!

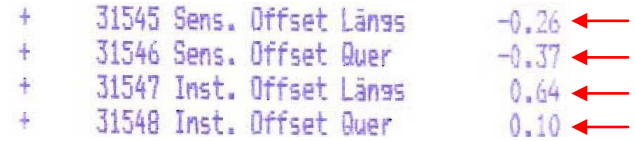
It is difficult to pump out hoses that do not run at a gradient because the venting does not function optimally.

➢ Has the correct number of compartments been entered?



NOTE: These are example values only !!

➢ Have the angle corrections been entered and has the vehicle been "zeroed"?

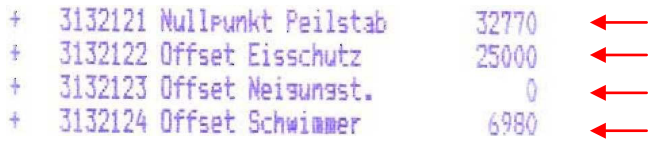


Still to be renamed as "Sens. correction"!

As in MultiLevel !

NOTE: These are example values only !!

➢ Have all relevant height parameters been entered correctly and has the height been "zeroed"?



NOTE: These are example values only !!

➢ Filling the compartments with water:

In what sequence do the compartments need to be calibrated?

Is sufficient water available for calibration?

Have the correct compartments been filled?

NOTE:
Only 200 measurement values are available and these are distributed over the max fill level (= float MAX). The compartment may not be over-filled (manually) by more than 10 mm above this level, otherwise it is not possible to save the last fill level measurement values for the lower range during calibration!

➢ Are the selected storage compartments large enough to hold the water from the compartment to be calibrated?

➢ Is the weight distributed in a way that ensures the vehicle remains stable both before and after calibration?

➢ Are the cabinet covers or the pneumatic switches locked in a way that prevents the foot valve or through valve from becoming blocked?

➢ Has the control block been removed?

Has the pneumatic switch - if present - of NoMix2000 been pressurized?

The pneumatic switch must also be supplied with air if the valves are to be operated manually, otherwise the NoMix2000 will generate an error message.

7 Checklist for calibration unit

- **Is the calibration unit connected to the vehicle via the CAN bus?**
- **Is a power and air supply present for the calibration unit?**

  Required: 400 V incl. neutral conductor, min. 6 bar
- **Have the hoses been connected properly and are all connections leak proof?**
- **Is the calibration unit connected to the compartment that is to be calibrated?**

  The hose must be connected to the compartment to be calibrated at an incline. Use a clear hose if possible.
- **Where is the water to be pumped?**

  Are the hoses to the calibration unit connected properly?
- **Have all calibration parameters been entered correctly?**
- **Has a connection been established between MultiLevel and the calibration unit?**
- **Calibration may begin if all the above items are OK.**

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

F. A. Sening GmbH

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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@fmcti.com	
Internet:	www.fmctechnologies.com/seningttp	

Annex A. Certificates and Drawings

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
……

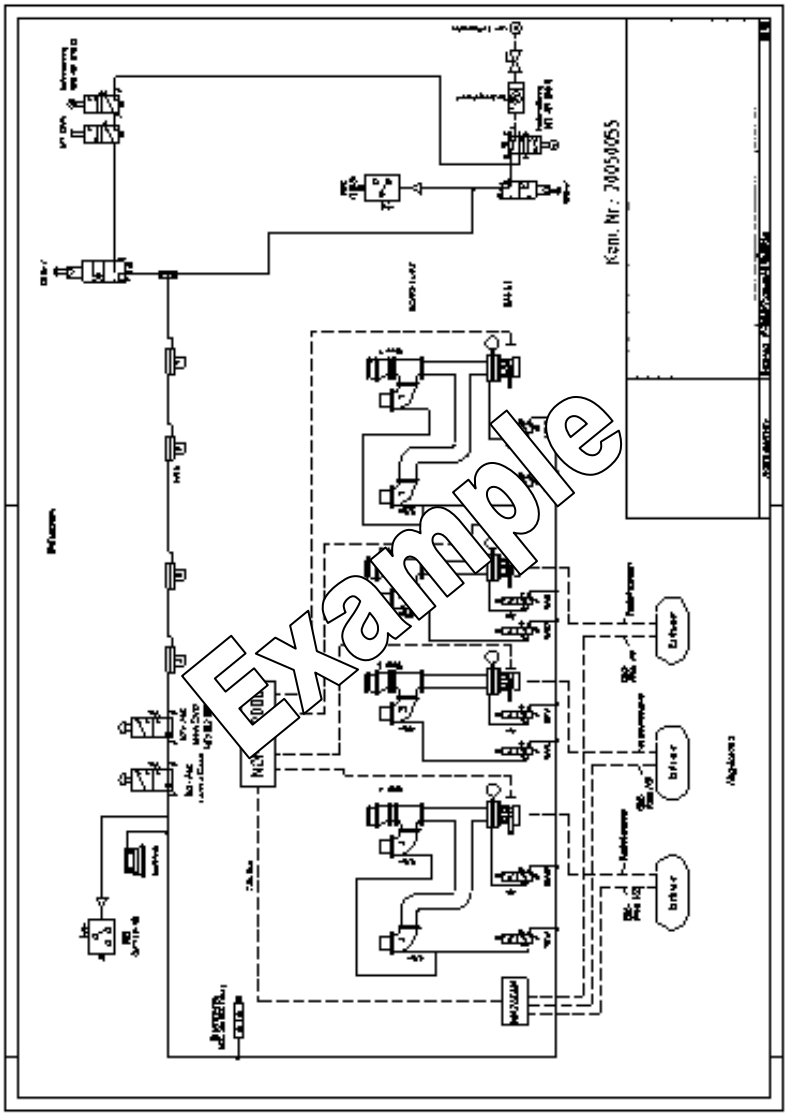
Measuring system certificate no.: Page 1 of 3

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

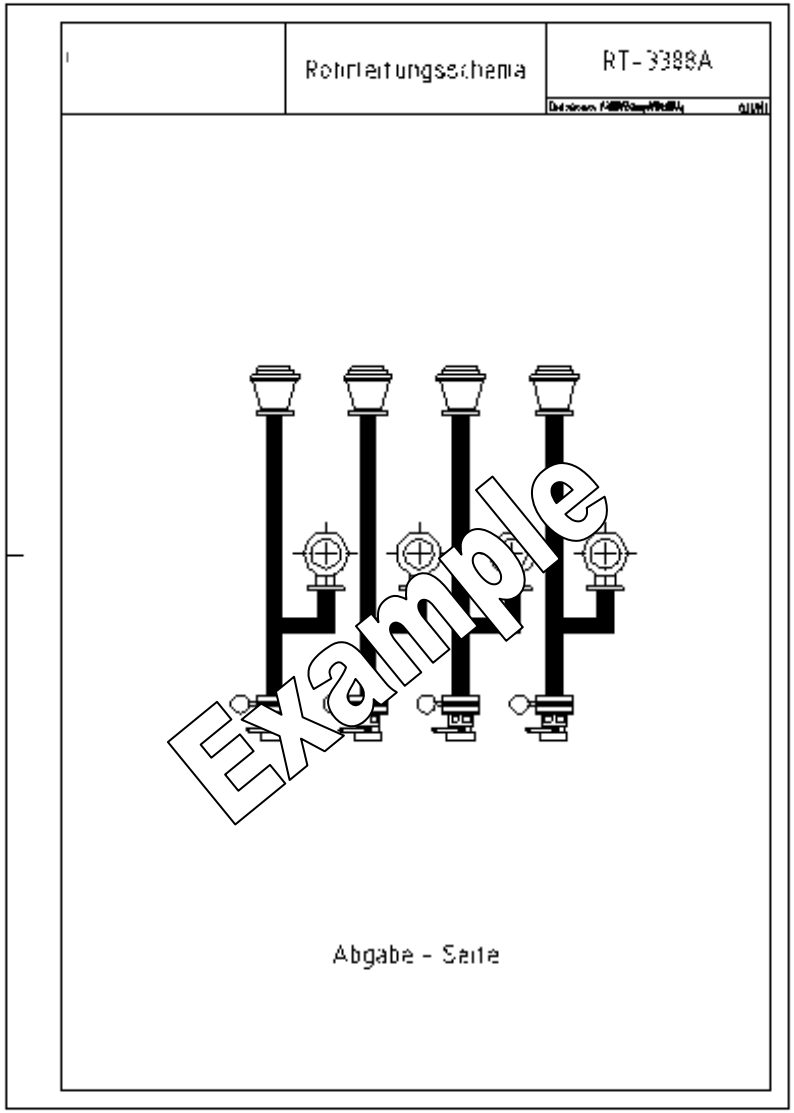
Year	Gauging office / tester	Year	Gauging office / tester

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

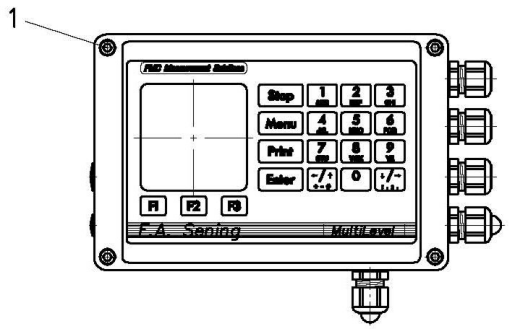
-Supplementary sheet-

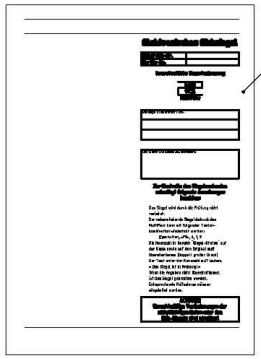
Change (CH) or damaged seal (DS)	Index (A-F)	Electronic seal number	Software CRC	Verification parameter CRC	Date / checked by	Repairer	Gauging office reference no.

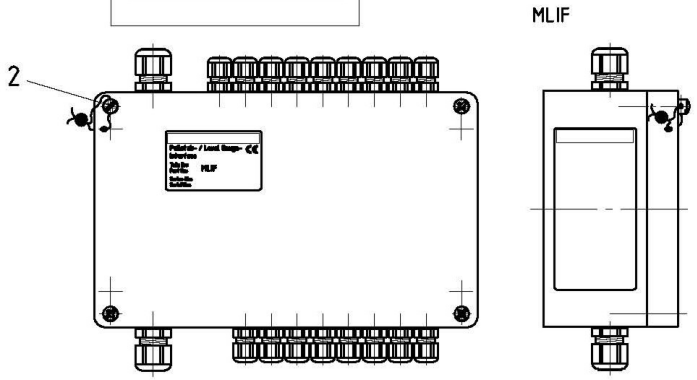
Measuring system certificate no.: ……..

Supplementary sheet no. 1

Stamp schedule



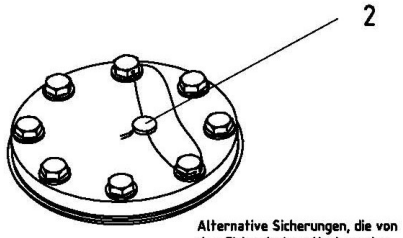




Peilstab Unteneinbau: MLDSB0-xxxx ×)

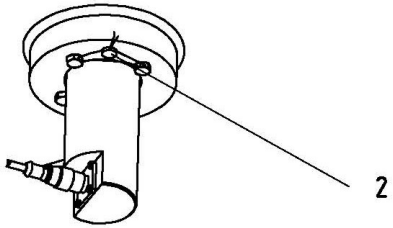
×) xxxx: Peilstablänge in mm

Peilstabführung oben



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

Sondenkopf unten

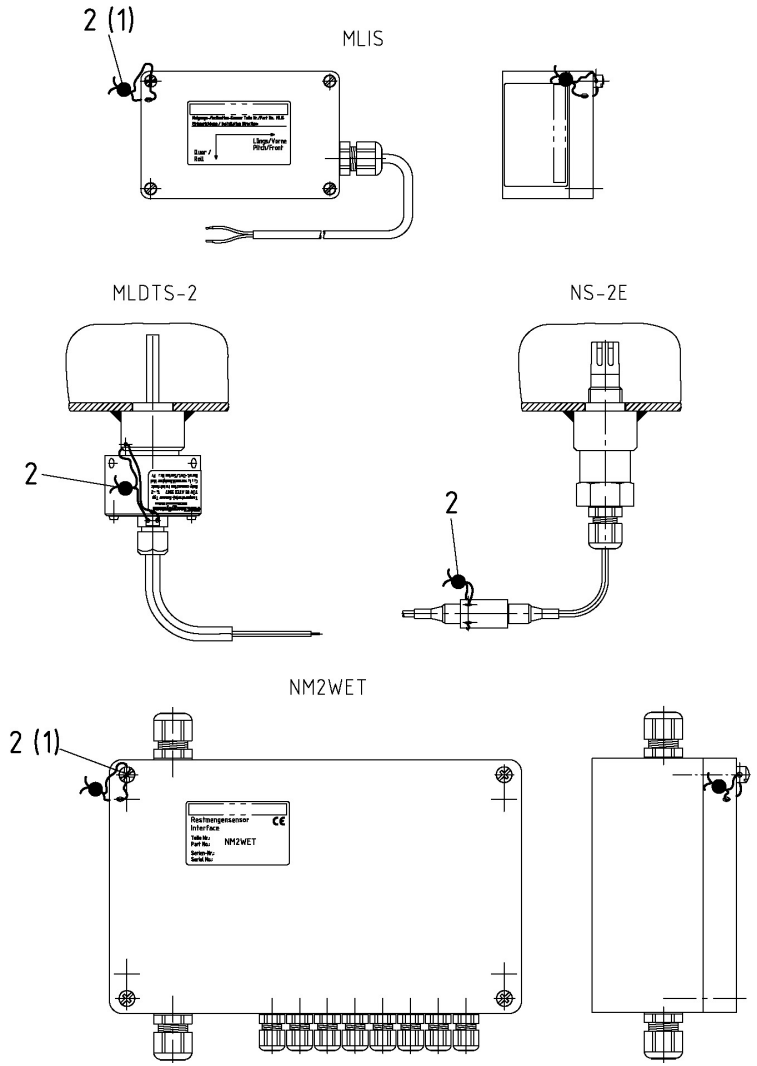


Falls Zusatzflansche verwendet werden, müssen auch diese verblombt werden.

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 xxxx =	Seal with sealing wire Dipstick length in mm
3	DOK-482E	Seal document

(1)

Measuring system certificate no.: ……

Supplementary sheet no. 3

FMC Technologies

Electronic Level Gauging System
MultiLevel
Seal Receipt

Rev. 1.00 JS / jp / Date: 04.01.2010 / MN F18 007 US / DOK-482E

```
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          *
```

Electronic Seal

as
appendix to measurement
system documentation

The seal was produced by:

Signature and identification of official:

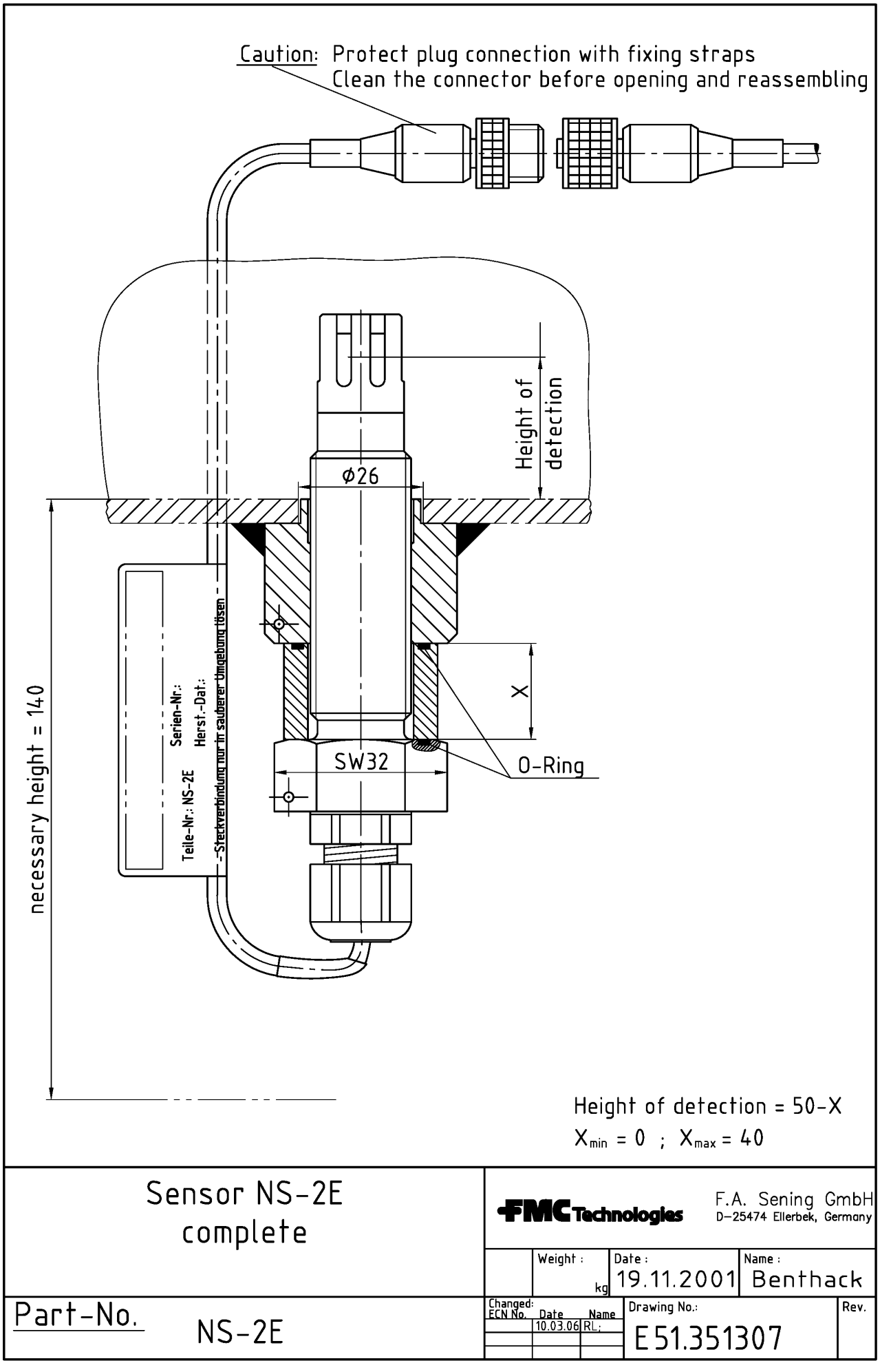
It is essential to observe the following instructions when checking the seal status:

- 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



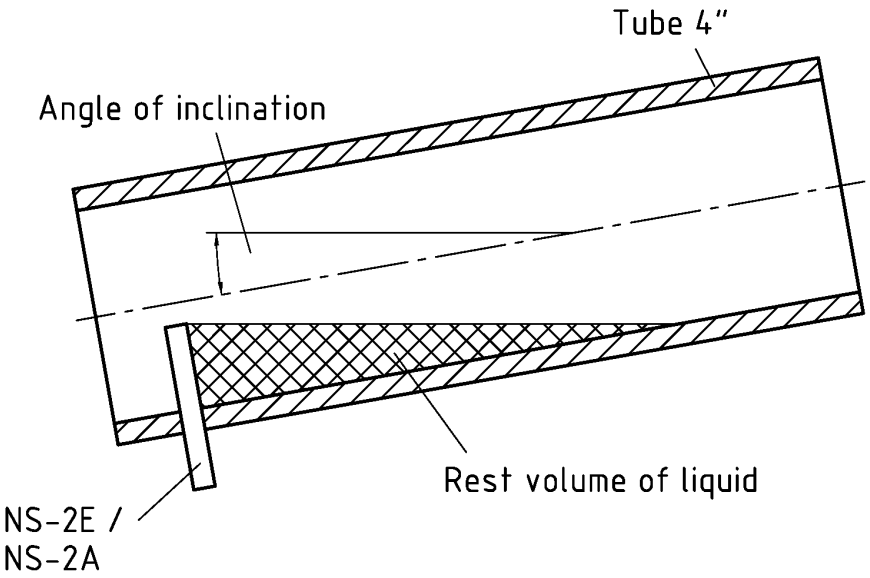


Figure: Rest volume of liquid behind the NS-2E / NS-2A

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

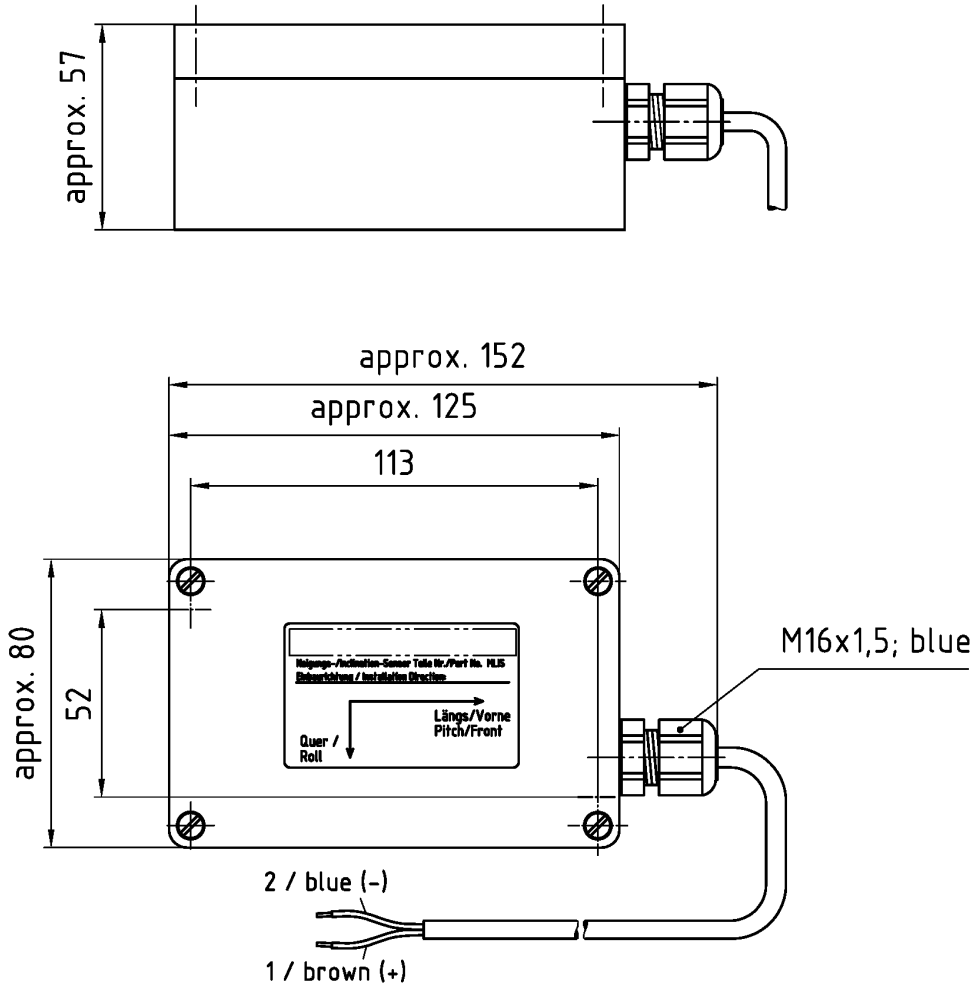
DOK-415E; DOK-416E
"Schutzvermerk nach DIN 34 beachten"

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

FMC Technologies
F.A. Sening GmbH
D-25474 Ellerbek, Germany

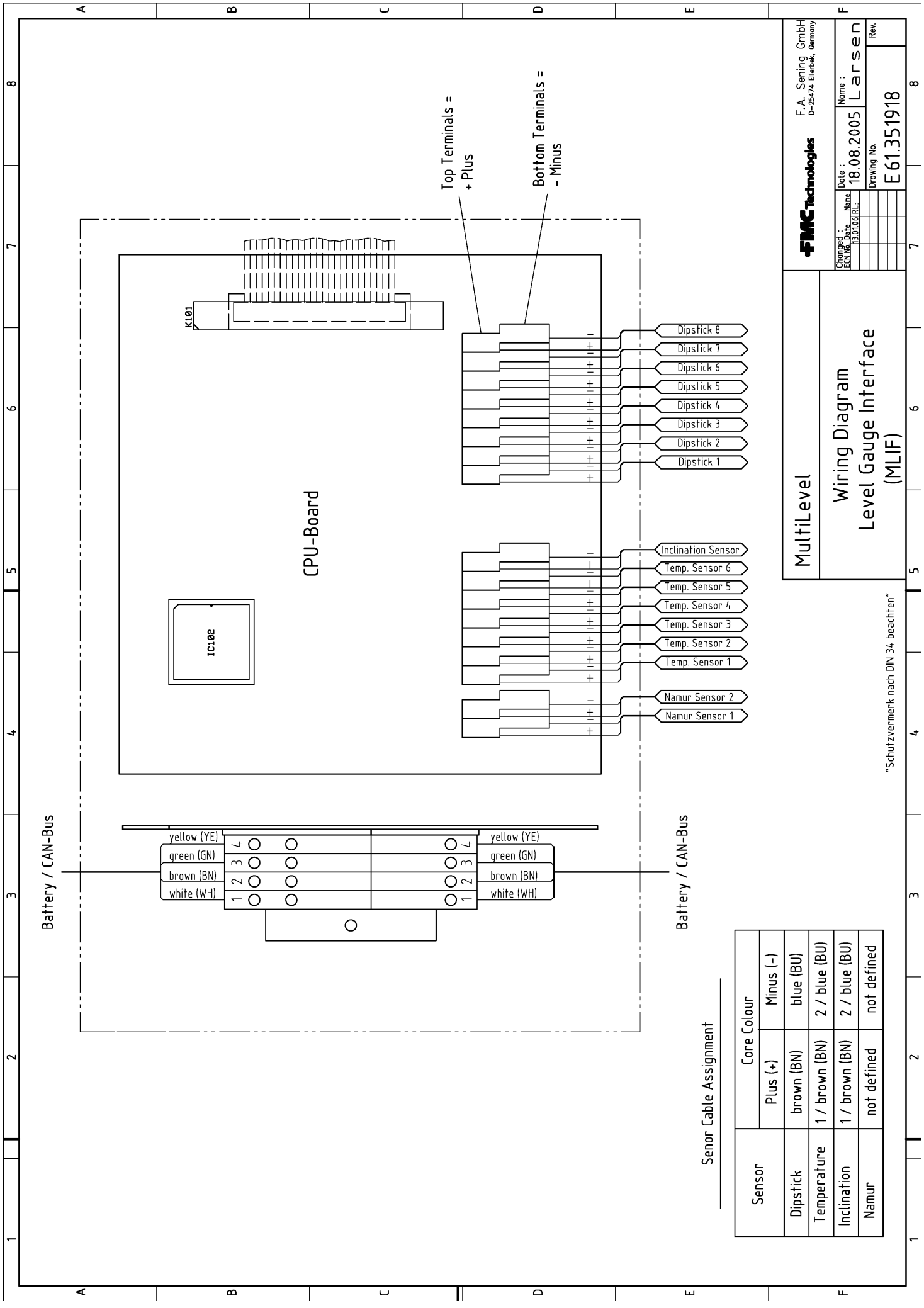
Changed : ECN No.	Date	Name
	31.08.00	MK.:

Date : 15.01.1997
Name : Kracht
Drawing No. E51.350839
Rev.



"Schutzvermerk nach DIN ISO 16016 beachten"

Inclination sensor	FMC Technologies F.A. Sening GmbH D-25474 Ellerbek, Germany		
	Weight : kg	Date : 25.07.2005	Name : Larsen
Part-No. MLIS	Changed: ECN No. / Date / Name	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

Contact information is subject to change. For the most current contact information, visit our website at www.fmctechnologies.com/measurementsolutions and click on the "Contact Us" link in the left-hand column.

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Printed in Germany MN F18 005 US / DOK-480E Issue/Rev. 2.00 (November 2010)