Operating instructions MultiTask-MultiLevel calibration station

Multitask level gauging system

MultiLevel calibration system

GUIDANT

Additional documentation for this product:

Designation	**Order No.**
MultiTask operating instructions	MNF19011GE/DOC.-555

History

Revision	**Date**	**Processor**	**Status**	**Description**
Rev. 0.90	September 2019	R. Leferink	Draft	First draft MultiTask-MultiLevel calibration station
Rev. 0.91	September 2019	R. Leferink	Draft	Revision of the MultiTask-MultiLevel calibration station
Rev. 2.00	March 2020	R. Leferink	Release	Final revision to Rev. 2.00
Rev. 2.01	July 2020	R. Leferink	Draft	Added note to local location
Rev. 2.02	June 2021	R. Leferink	Release	Header and footer revised
Rev. 2.03	April 2023	R. Leferink	Release	Note Ethernet interface & FeatureKey Note Power
Rev. 2.04	June 2023	R. Leferink	Release	Note for autom. flow rate limitation for small compartments
Rev. 2.05	April 2024	R. Leferink	Release	Manual back flow lock

Important Note

All explanations and technical information in this documentation have been prepared and compiled by the author with the greatest care. Nevertheless, errors cannot be completely ruled out. ***F. A. Sening GmbH*** is always grateful for the reporting of possible errors.

Table Of Contents

1 General

1.1 Guidance for the Manual

To help you find the information you need in this manual, we have created a few guidelines.

The information in this manual ranges from mandatory protective measures and standardised specifications to concrete steps and advice. For a better differentiation of the context, this information is indicated by corresponding pictograms in front of the text.

They are not only intended to make the information more striking, but also to help you find what you need quickly. For this reason, the pictograms represent the textual content behind them.

The following pictograms are used in this manual:

Danger information
Danger of explosion due to highly flammable gases and liquids.

Malfunction threatens
Actions that damage the device.

§ **Legal information**
Actions that result in legal consequences.

Action required
For example, "*Press the <Enter> key*".

► **Input required**
For example, via numeric or function keys.

Feedback positive
For example, "The main menu now appears".

Feedback negative
For example, "Should an error message now appear...".

Background information
Short tip, e.g. "for more information, see Chapter XX".

Option
Special case.

Function
Description of functions.

NOTE:
Indicates a special **situation**.

CAUTION:
Special attention required.

2 Description of the Calibration Procedure

2.1 General

- Each compartment receives an individual level table, which is created by the calibration. The residual compartment volume and the pipe volume are also determined.
- The more accurate the calibration, the fewer corrections required later when calibrating the vehicle.

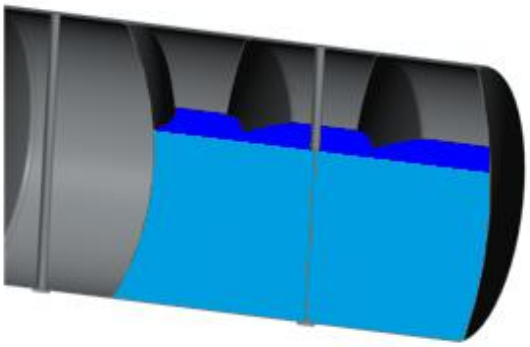


Figure 1: example of a compartment

- The compartments are calibrated using a calibration system. (Figure 2). Only **water** should be used as a medium, as only this can be detected by the calibration unit and therefore a volume determined.

Figure 2: calibration system

- After calibration, the determined values for the pipe volume and residual volume as well as the level table are automatically transferred to the MultiTask. Level table and derivation diagrams are additionally stored locally on the calibration notebook and can optionally also be copied to a connected USB stick.

2.2 Description of the Calibration

- On its delivery valve, the compartment of the TKW that is to be calibrated is connected via an approx. 1m-long 3" hose to the inlet nozzle DN80 of the calibration unit. It is essential to ensure that the connecting hose has a sufficient gradient to the calibration unit.

- The compartment is emptied via the pump P1, while the magnetic inductive flowmeter (FQI/MIF) measures the pumped volume.

- At the same time, the calibration unit receives the corresponding height information from the MultiTask-MultiLevel of the tank vehicle and stores both values internally in a chart.

- After the calibration, the complete level table is automatically transferred to the connected MultiTask via the Ethernet connection. The measured volumes for pipe volume and residual volume are automatically entered in the corresponding compartment setup in the MultiTask!

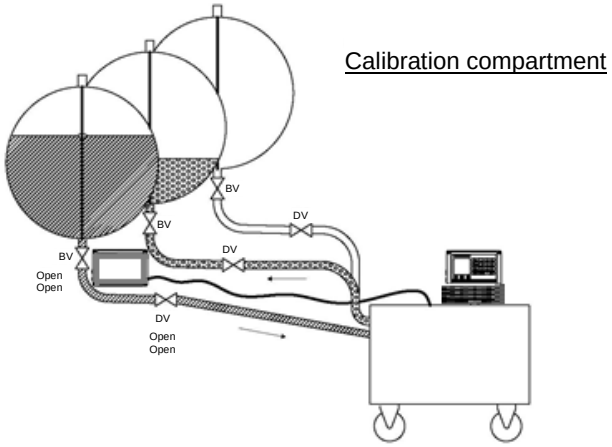
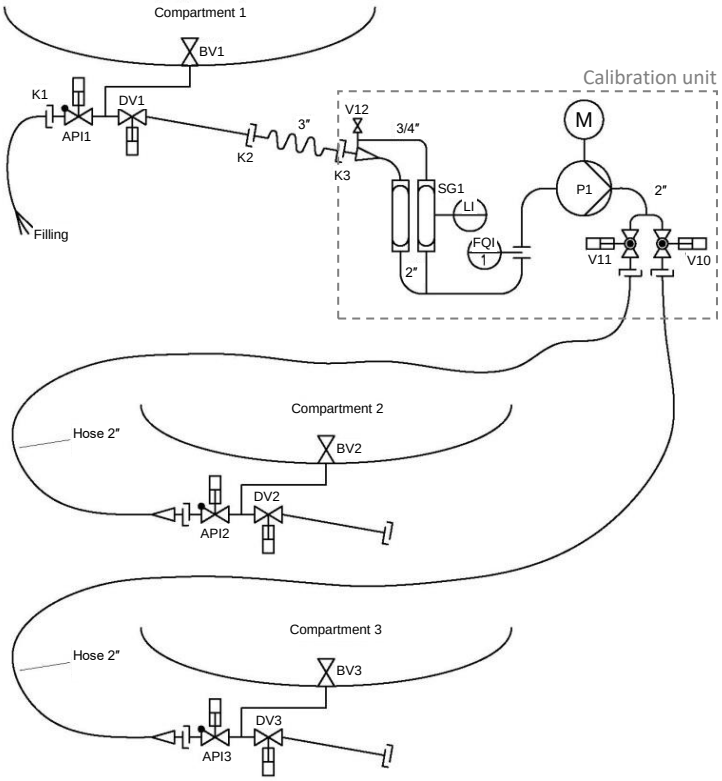


Figure 3: calibration unit connections



Legend:
P1: Impeller pump
API: API coupling
BV: Bottom valve
DV: Through valve
V: Ball valve with actuator
SG1: Inspection glass
FQI: Magnetic inductive flowmeter (MIF)
LI: Level sensor
K: Coupling

Figure 4: flow diagram of the calibration unit

Since the measuring range of the dipstick is limited downwards, the filling quantity below the last measurable level must be determined separately from the calibration unit. This quantity, including pipe volume, is referred to as the "**Rest-Amount**" in the MultiLevel.

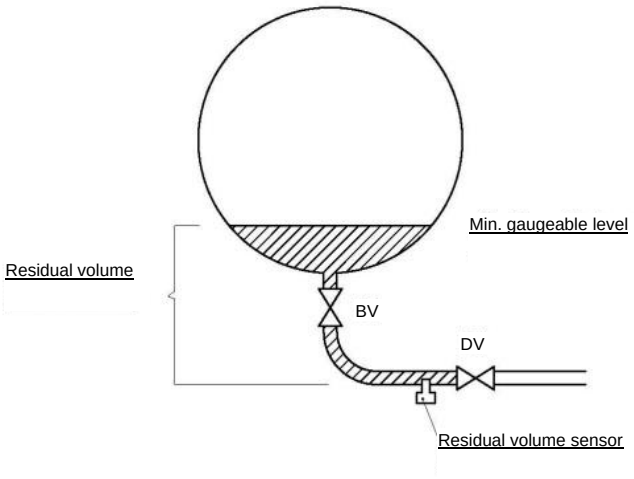


Figure 5: definition of residual volume

Residual volume/Rest-Amount = filling quantity below the last valid dipstick value including pipe volume

In addition, the calibration unit determines the quantity in the pipe, so as, for example, to prevent having to calibrate the entire residual volume when the pipe is replaced. Only the new pipe must be calibrated and the volume difference from the old pipe must be matched with the residual volume.

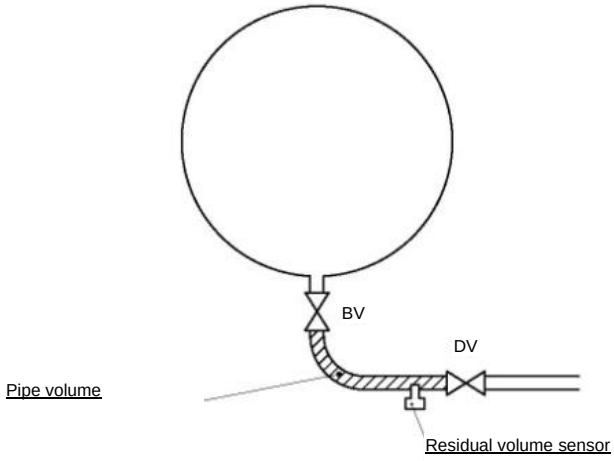


Figure 6: definition of pipe volume

Pipe volume = filling quantity between the bottom valve and the delivery valve.

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

- Hose volume (connection hose between the delivery valve and the calibration unit)
- Pipe volume (connection between the bottom valve and the delivery valve)
- Volume of the compartment (measurable range of the dipstick)
- Residual volume (non-measurable range of dipstick)

3 Preparation of the Calibration

3.1 Commissioning Vehicle

Both the MultiLevel and NoMix applications (if used) must be put into operation before calibration to the extent that the basic functionalities are available. This includes entering all the parameters.

3.2 Mechanical Preparations

In order to successfully calibrate a vehicle, the following points must be taken into account:

1. Jacking up the semi-trailer
   (recommended height at the centre of the outlets min. 600 mm above ground to ensure a drainage with a gradient to the calibration unit)
2. Aligning the jacked-up semi-trailer
   (with the aid of e.g. a digital spirit level on reference surfaces lengthwise and crosswise to 0° ± 0.1°)
3. Required supply voltage of the calibration unit 400V with CEE coupling 16A
4. Required compressed air supply min. 6 bar for the calibration unit
5. 2 x hose DN50 with VK50/MK50, 2.5m to 3m long
6. 2 x adapter VK80 to VK50
7. 1 x discharge adapter with opening function for API couplings for venting the load side
8. If calibrated via the API couplings, 3 x API discharge adapter are required on MK80

3.3 Connection of the calibration unit to the MultiTask

3.3.1 Connection of the Calibration Unit

The hardware connection of the calibration unit to the MultiTask system is carried out using an Ethernet cable. This is plugged into the existing Ethernet socket on the side of the calibration station.

Figure 7: calibration unit Ethernet socket

Optional: Some calibration units also has a plug distributor with integrated USB hub. A USB stick can be connected to the notebook via the USB hub.

Figure 8: USB hub

Caution:
The mentioned plug distributor is an optional accessory. Not all calibration stations are necessarily equipped with a plug distributor. In the case of calibration stations without a plug distributor, the USB stick, if required, must be connected directly to the notebook!

3.3.2 Connection of the MultiTask System

On the MultiTask, an appropriate adapter must be used to connect the Ethernet cable with the external Ethernet port in the MultiTask. The second display of the MultiTask system may already be connected to this connection. As the second display is not required for the calibration procedure, in this case the already connected Ethernet cable must be removed from the connection for the duration of the calibration and replaced by the Ethernet cable connected to the calibration unit!

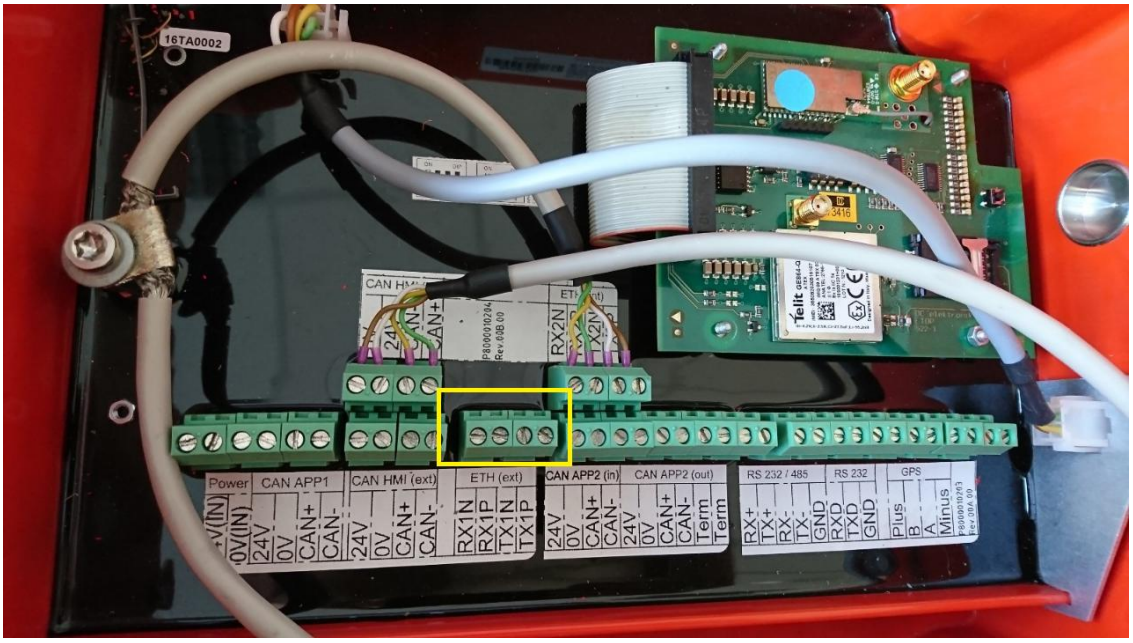


Figure 9: calibration unit Ethernet connection

Caution:
Make sure that the Ethernet interface is activated in the MultiTask setup. Changes to the Ethernet settings are only accepted by the MultiTask after a restart! If the Ethernet interface is not activated in the MultiTask setup, the system cannot be calibrated.

Caution:
The general support of the Ethernet interface depends on the FeatureKey. If there are problems with the Ethernet communication, check whether the Ethernet interface is released via the FeatureKey!

3.4 Calibration Unit Notebook

In addition to the mechanical components mentioned above, the calibration unit also includes a notebook. The notebook is optimised for special use on the calibration unit and is not affected by slight vibrations, humidity and dust.

Figure 10: calibration unit notebook

The notebook is equipped with a touchscreen display, which can be operated either with the finger or with the attached stylus. The stylus is located on the left side of the notebook and is connected to the notebook by means of a spiral cable.

For easier operation, however, it is recommended to use the notebook's touchpad!

CAUTION:
The notebook should only be used for calibration purposes. It is forbidden to install non-system software on the notebook or to start additional programs that are not related to the calibration.

The programs executed on the notebook are monitored internally and evaluated by Guidant when the calibration unit is returned!

CAUTION:
The user must pay for any damage caused by the use of non-system software or by the additional execution of other programs that are not related to the calibration.

3.5 Required Vehicle Parameters Before Calibration

3.5.1 Entry of Compartment-Specific Parameters for Each Compartment

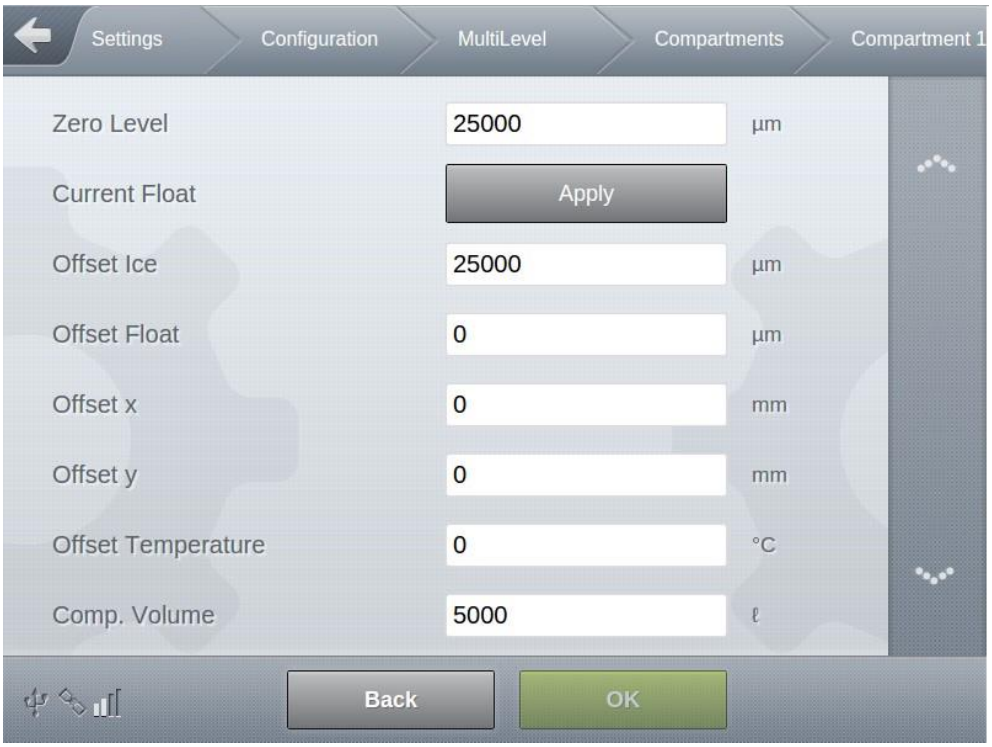


Figure 11: compartment-specific parameters

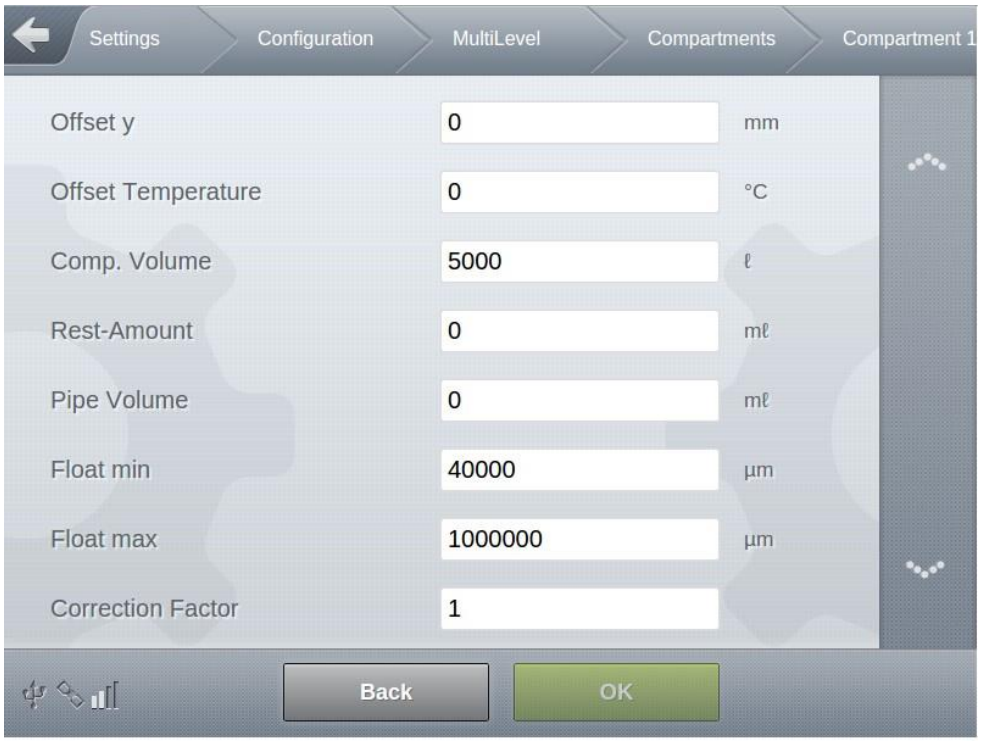


Figure 12: compartment-specific parameters

☞ Menu item for the compartment-specific parameters

✍ Values are partially entered in µm (40 mm = 40000 µm).

1. Input "Offset ice protection": always 25 mm offset ice protection = degree of ice protection.
2. Input "Offset float": from test certificate, offset float = immersion depth float.
3. Input "Zero point dipstick": raw value of the dipstick when the tank is empty, can be determined automatically via the "current float level" button.
4. Make the entries for all other compartments accordingly.
5. Enter "Float min": experience shows that 40 mm is optimal.
6. Enter "Float max": the level to which the compartment is to be filled at the start of calibration. Experience shows approx. 3 to 4 cm under the dome cover. (Check by measuring or test when filling!). The current fill level is displayed on the MultiTask in the setup under "*/Settings/Service/Diagnostics/Level Interface*".
7. All entries are saved only by pressing <OK>!

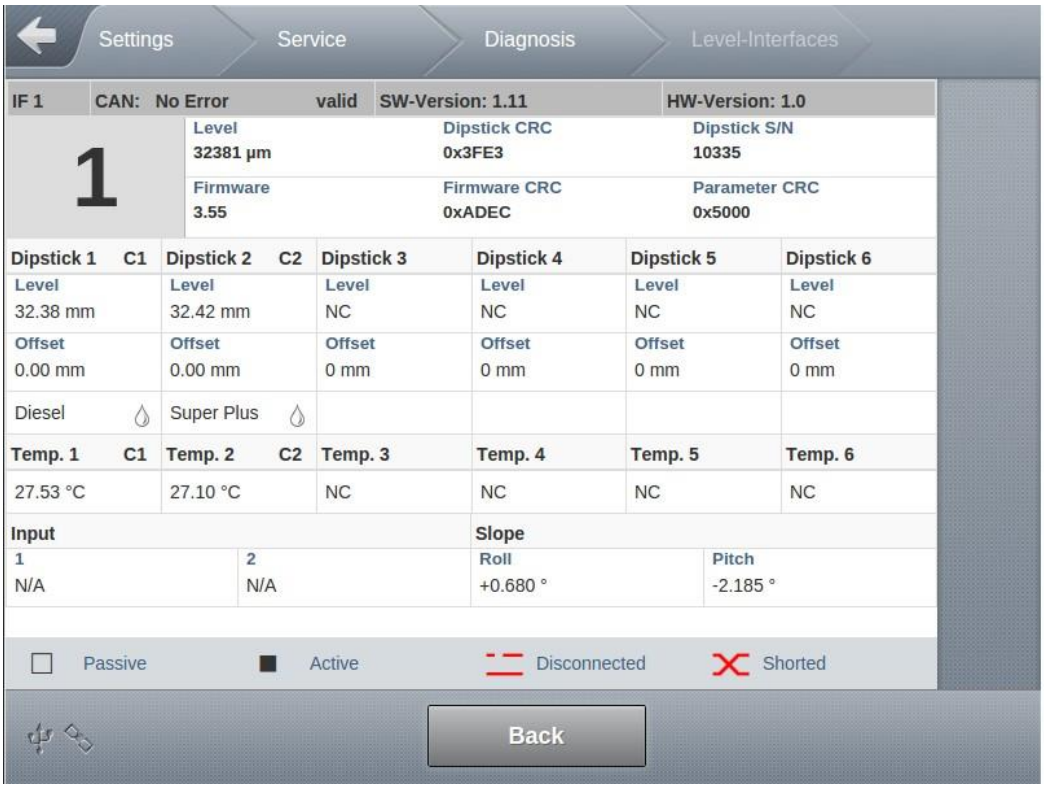


Figure 13: diagnostic level interface

✍ All the compartment information required for the calibration and stored in the MultiTask is automatically transferred from the calibration unit.

CAUTION:
The float must lie on the ice protection when entering the zero point dipstick!!

3.5.2 Entry of Vehicle-Specific Parameters Once Per Vehicle

Figure 14: vehicle tilt settings

☞ Menu item for the truck-specific inclination settings

Check that the vehicle is aligned at 0°. (Longitudinal and transverse tilt)

1. Input "Sensor Offset Pitch": Enter the sensor corrections from the test certificate.
2. Input "Sensor Offset Roll": Enter the sensor corrections from the test certificate.
3. Input "Installation Offset Pitch": the value can be determined automatically using the "Current Inclination" button.
4. Input "Installation Offset Roll": the value can be determined automatically using the "Current Inclination" button.
5. All entries are saved only by pressing <OK>!

3.5.3 Product Preselection in the Loading Plan

Only water should be used for the calibration of the individual tank compartments. In order to assign the correct float immersion depth correction to the medium, the product **"water"** must be assigned to each compartment in the loading plan of the MultiTask.

In the MultiTask, the loading plan can be changed using the following menu items. If the compartments are already filled, the loading plan can be adapted via the item *"/Settings/Service/Loading Plan"*!

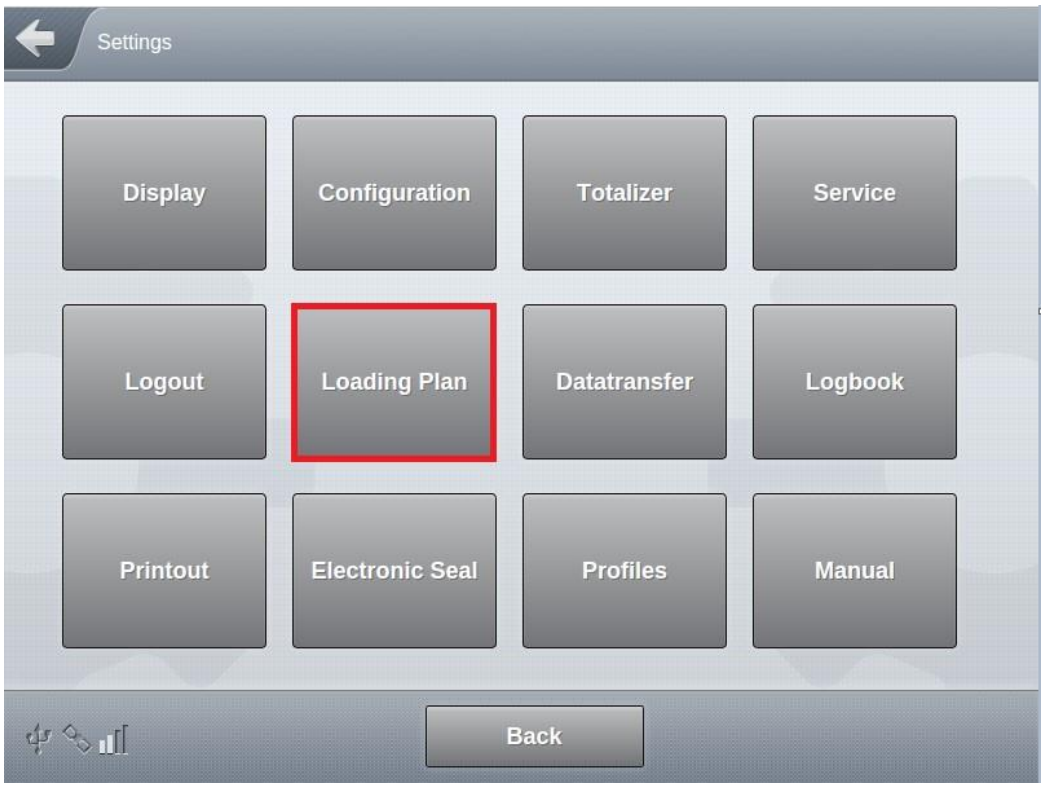


Figure 15: standard loading plan entries

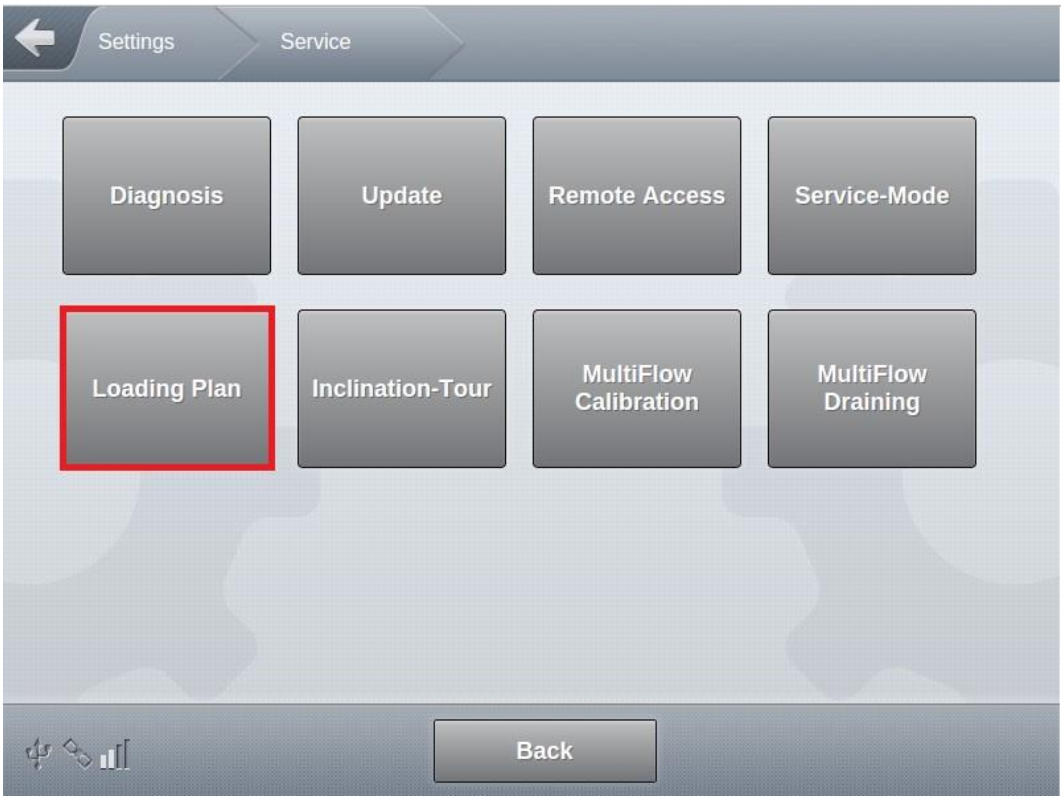


Figure 16: enter the loading plan for filled compartments

3.6 Calibration Software

In addition to the mechanical components mentioned above, the calibration unit also includes a notebook. The "*TechnipFMC - Calibration Station*" program, which is automatically launched on this notebook after switching on, is responsible for communication with the internal USB-IO interface, via which the mechanical components of the calibration unit are controlled, and Ethernet communication with the MultiTask of the vehicle that is to be calibrated. This software is used to read out the settings required for the calibration from the MultiTask, to control the different steps of the calibration and to save the results of the calibration on the notebook, MultiTask and optionally also on a USB stick.

3.6.1 Requirements

Please, note that if the truck or trailer does not have a second display, it is necessary to enable the Ethernet interface in the MultiTask set up. It might be necessary to create a new feature key to activate this interface. Being that the case, please contact Guidant Aftermarket Team so that they can support on that action.

The prerequisite for the successful launch of the calibration software is the correct connection of the required external components:

- USB IO interface
  - This is usually connected to the notebook when the calibration unit is delivered.
- Ethernet connection to the MultiTask
  - The required Ethernet cables in sufficient length are supplied with the calibration unit.

  - The Ethernet cable must be connected to the socket on the calibration unit on one side.
  - The other side of the Ethernet cable must be connected to the external Ethernet port of the MultiTask via an adapter (4-pin end).
- The MultiTask must switch to the calibration mode
  - In order for the calibration software to be able to access the control of the valves and the data of the dipstick and the setup, the connected MultiTask must automatically switch to calibration mode when the program is started.

When starting the notebook or starting the calibration software, all the necessary connections must be made and the system to be calibrated must be supplied with sufficient compressed air.

The MultiTask is automatically switched to calibration mode when the calibration software is started on the notebook of the calibration unit. It is not possible for the MultiTask operator to manually switch to this mode!

To set the calibration unit to an operational state, press the "Start" button after switching on!

Figure 17: front panel - "Start" button

Make sure that the "fault" light on the front of the calibration unit does not light up. If this is the case, press the "Start" button again!

Figure 18: front panel - "Fault" lamp

CAUTION:
To prevent damage to the system, **BEFORE** pressing the "Start" button, it is essential to establish the Ethernet connection to the MultiTask and start the calibration software on the notebook!

3.6.2 Connection Problems

Before starting the program and during operation, the calibration software checks the communication with the internal USB IO interface and the connected MultiTask as well as the presence of sufficient compressed air on the system. If one of these conditions is not met, an appropriate error message is issued.

3.6.2.1 USB Connection to the IO Board

If a communication fault with the USB IO interface is detected, the following message appears on the display of the notebook. In this case, the USB connection from the notebook to the USB interface located in the control cabinet must be checked!

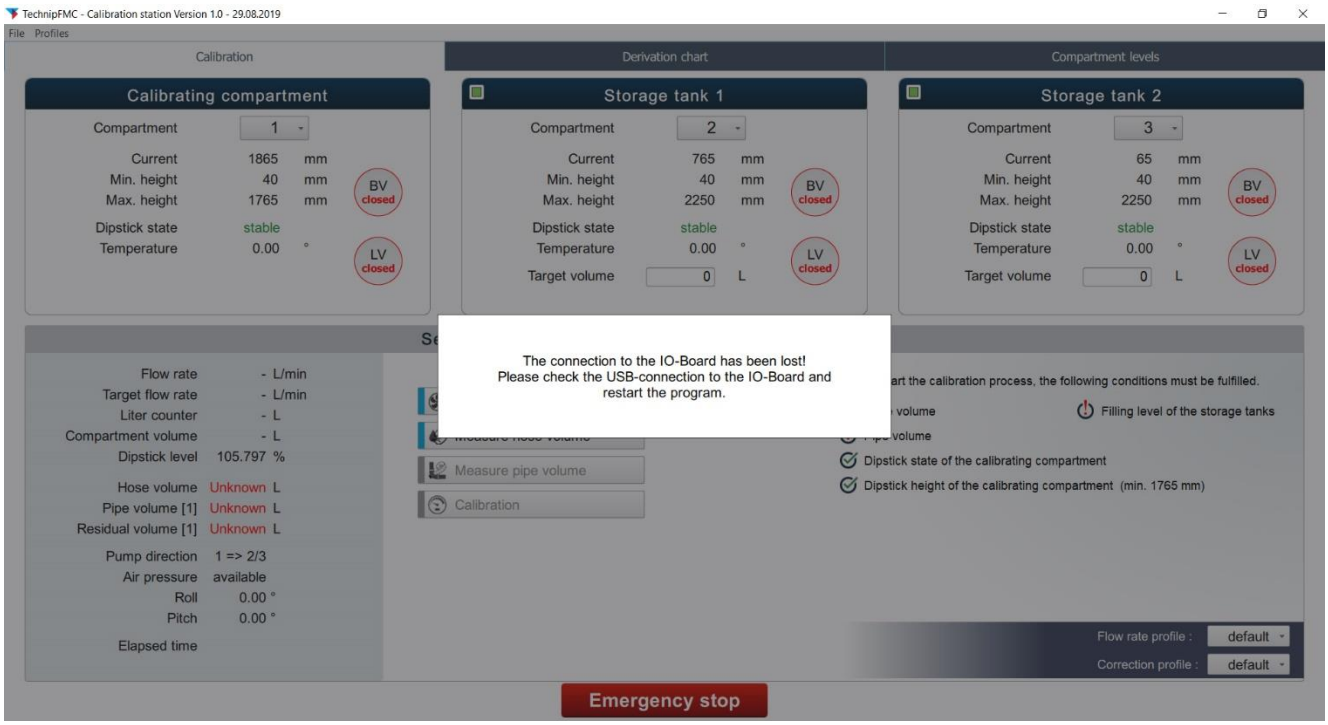


Figure 19: USB connection fault

3.6.2.2 Ethernet Connection to the MultiTask

If a fault in the Ethernet communication with the MultiTask is detected, the following message appears on the display of the notebook. In this case, check the Ethernet connection with the MultiTask. In most cases, there is a connection problem with the Ethernet connection on the MultiTask. The following connections must be checked:

- The 4 wires of the Ethernet interface of the external Ethernet connection in the MultiTask.
- The correct connection between the Ethernet cable and the Ethernet adapter on the Ethernet coupling.
- The Ethernet connector on the Ethernet socket on the control cabinet of the calibration unit is correctly positioned.

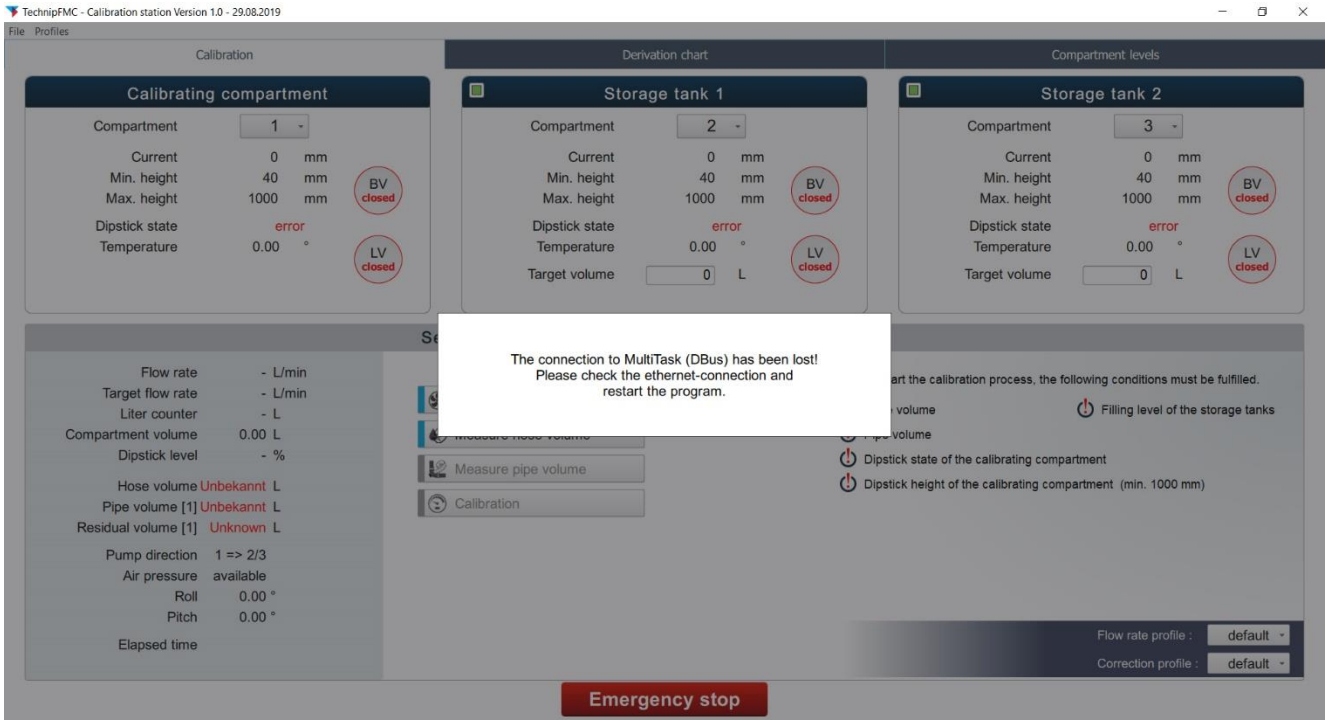


Figure 20: Ethernet connection fault

3.6.2.3 Insufficient Compressed Air

In addition to the communication interfaces, the calibration software also checks the presence of sufficient air pressure on the system. Sufficient air pressure is required so that the calibration software can control the required pneumatic valves during the individual steps of the calibration!

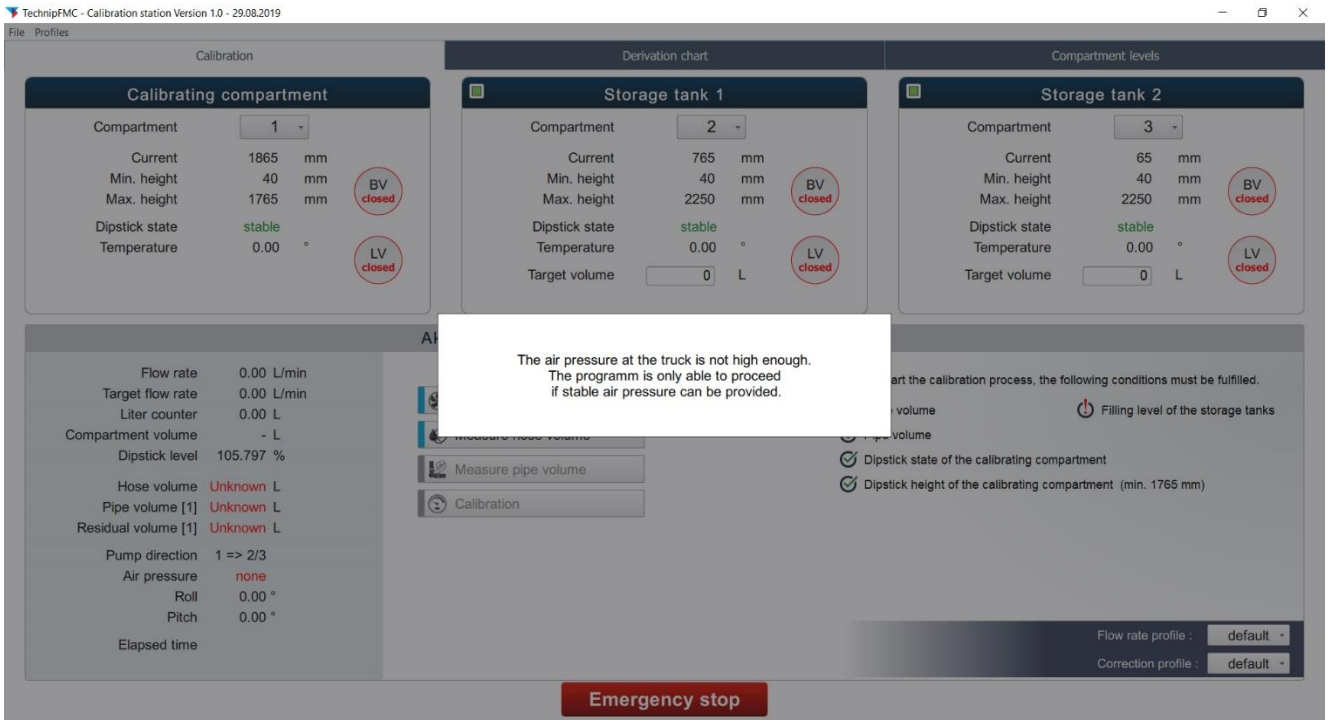


Figure 21: insufficient air pressure

3.6.2.4 MultiTask not in Calibration Mode

When the calibration software is started, the MultiTask automatically switches to calibration mode.

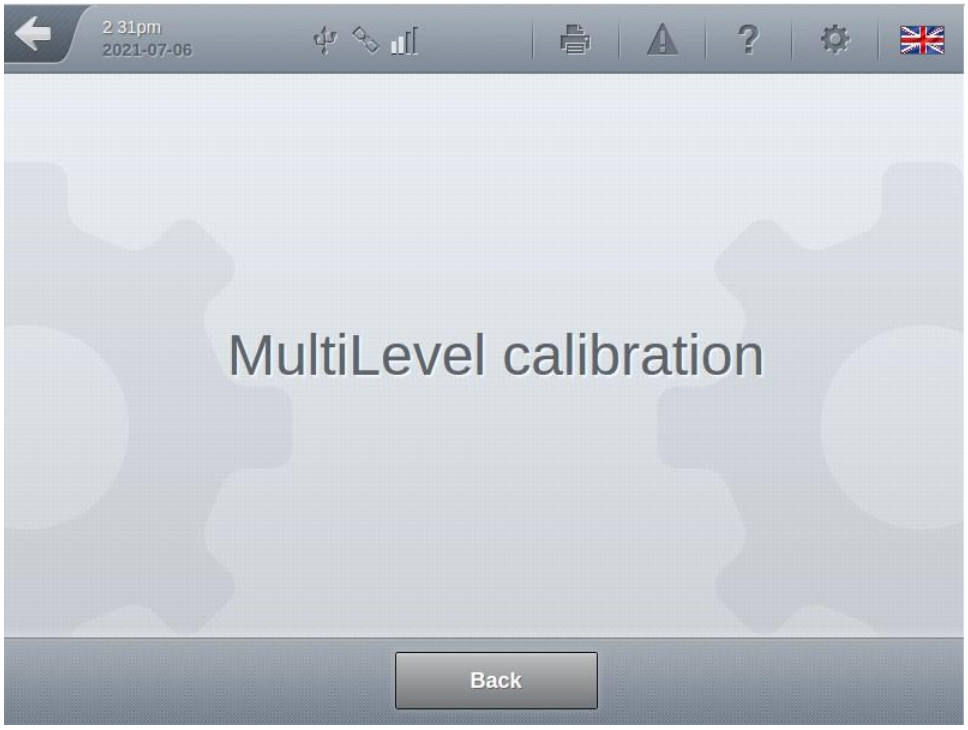


Figure 22: MultiTask calibration mode

If this is not the case, the calibration software displays the following message. Check the Ethernet connection to the MultiTask and contact the Guidant service if necessary!

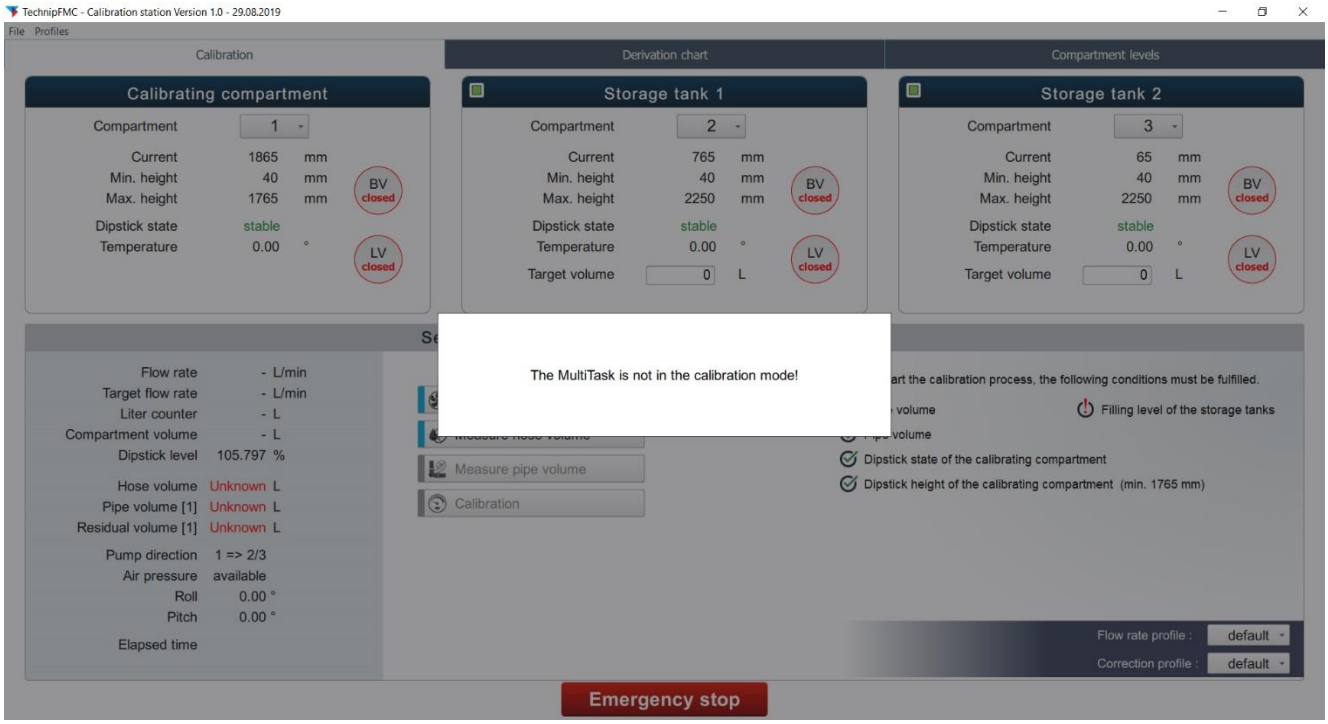


Figure 23: MultiTask not in calibration mode

3.6.3 The Displays

3.6.3.1 Calibration

If all necessary prerequisites are met when the calibration software is started, the calibration display of the software is displayed directly. This is the central display that allows you to control each step of the calibration.

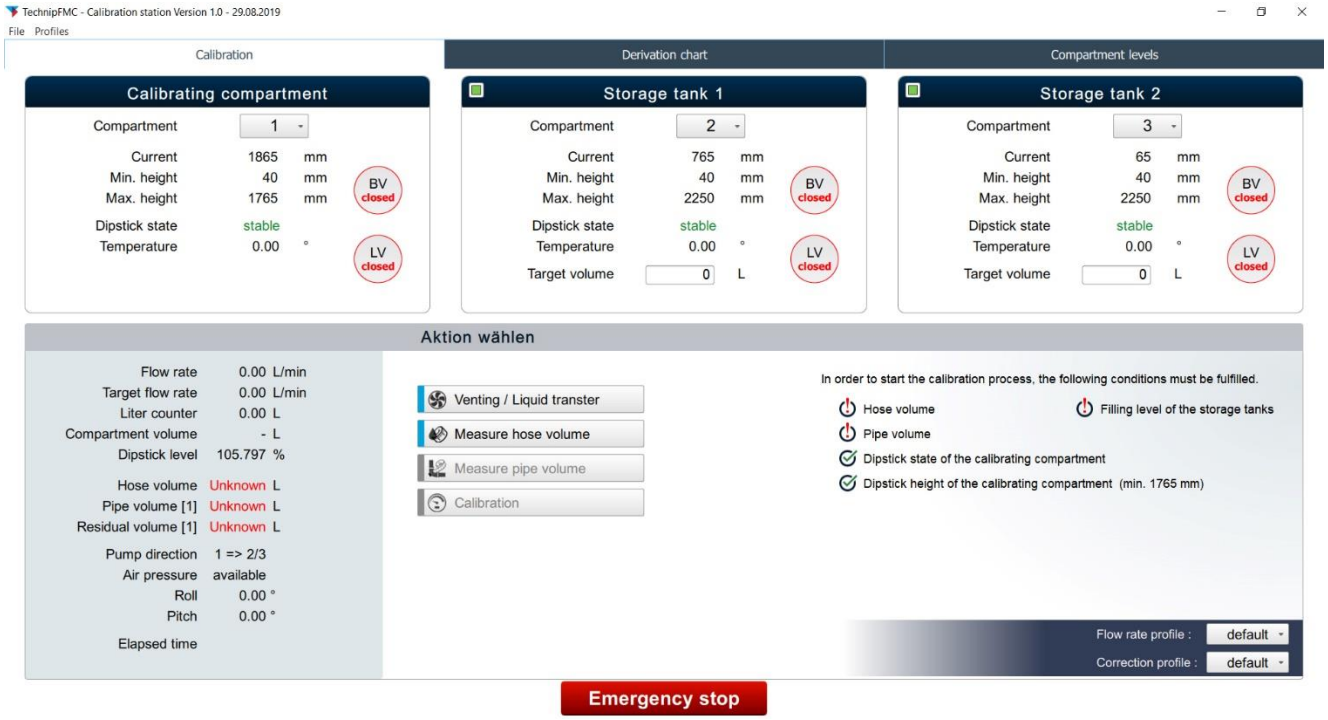


Figure 24: "Calibration" display

3.6.3.2 Derivation Diagram

When a calibration is in progress, this screen shows the current derivation diagram. The diagram is updated at each measurement point. This makes it possible to detect and assess irregularities at an early stage, e.g. due to a pump running too fast!

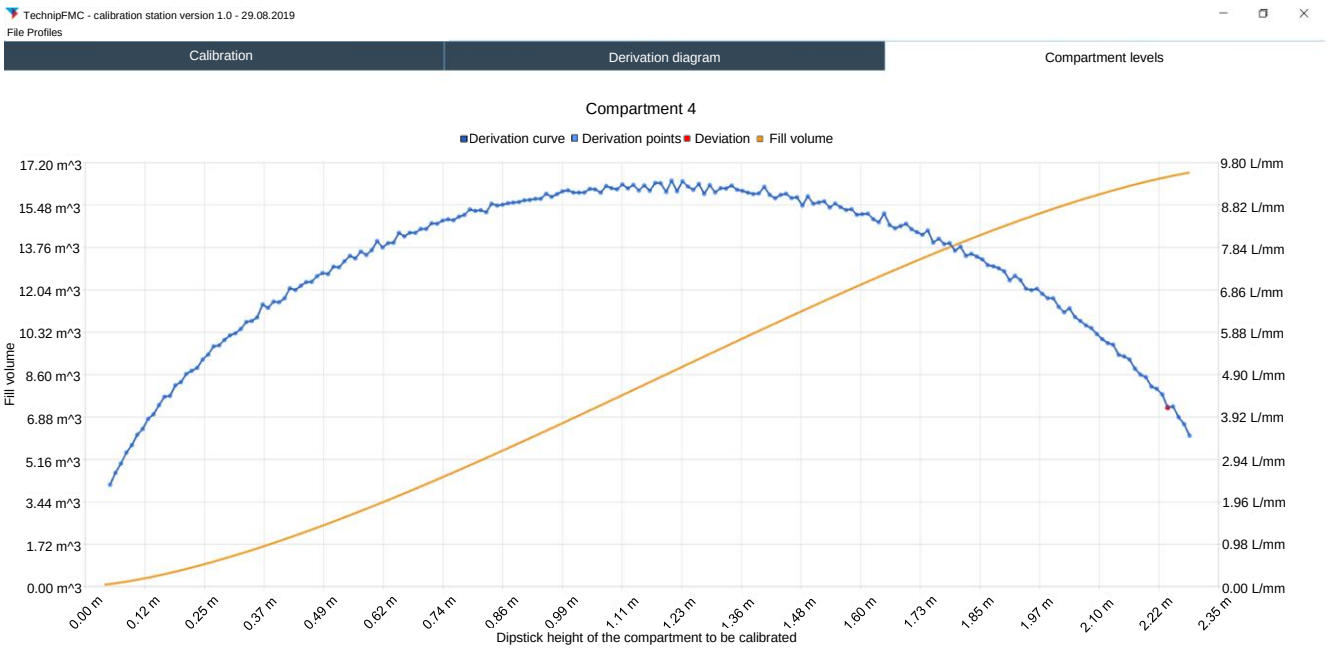


Figure 25: "derivation diagram" display

3.6.3.3 Compartment Levels

Via the display "Compartment levels" it is possible to obtain visuals about the product levels within the compartments configured for calibration!

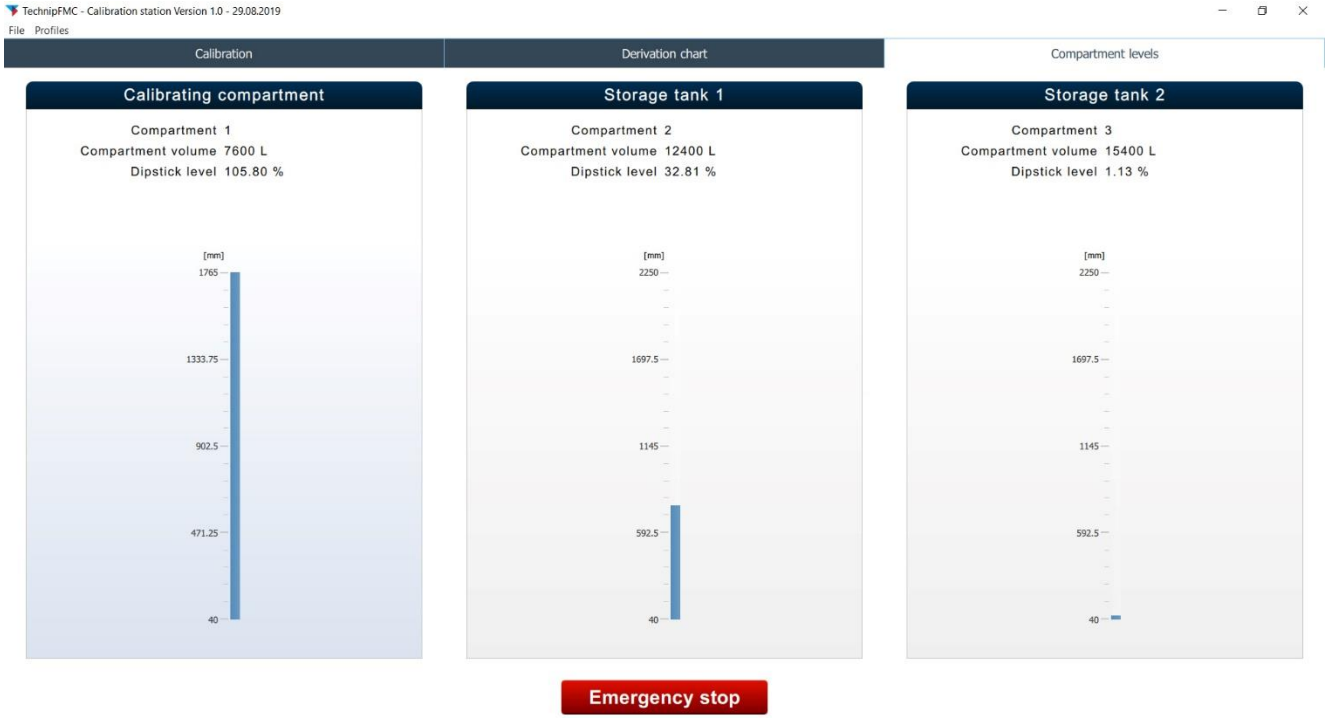


Figure 26: "compartment levels" display

3.6.4 Settings

In the "Settings" area it is possible to make some basic settings on the calibration software!

3.6.4.1 General

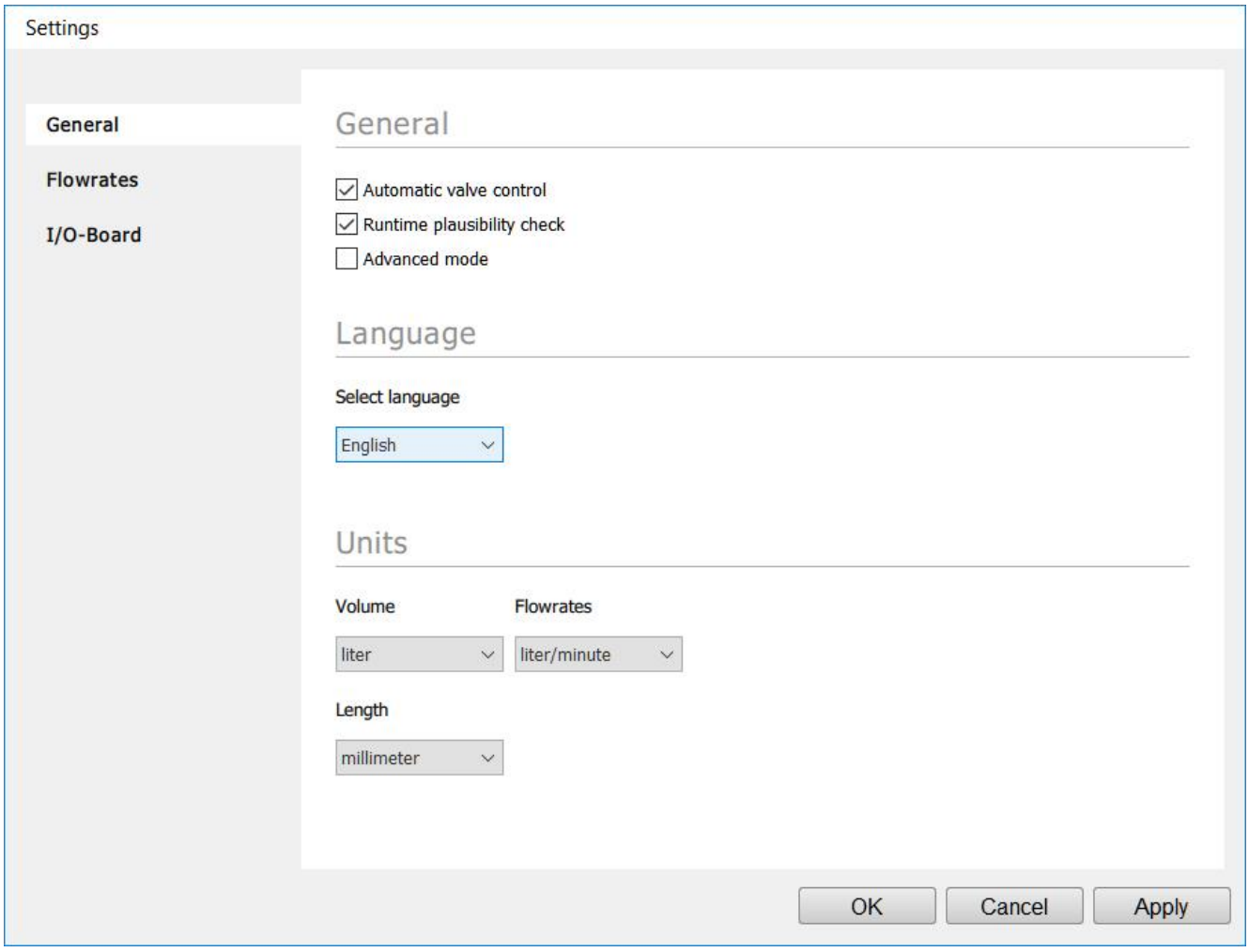


Figure 27: settings - general

- "Automatic valve control"
  - Specifies whether the valves on the vehicle to be calibrated can be controlled automatically by the MultiTask (default) or whether the valves are operated manually in the individual steps.
- "Advanced mode"
  - Activates the advanced mode of the software, in which further system-specific settings can be made. This mode is intended for the maintenance and commissioning of the system, as incorrect operation can cause damage to the calibration unit.
- "Select language"
  - One of the supported operating languages can be selected here.
- "Units"
  - Specification of the units to be used for "volume", "flow rates" and "length".
  - It is recommended that you do not change the settings, as appropriate settings must be coordinated with the connected MultiTask.

Changes to the calibration software settings as well as the individual sequences and events during operation are stored internally and can be traced!

CAUTION:
In the case of automatic valve control via the calibration software, all the associated valves are opened automatically during calibration. If the hoses are not properly connected, the calibration medium may leak out!

3.6.4.2 Flow Rates

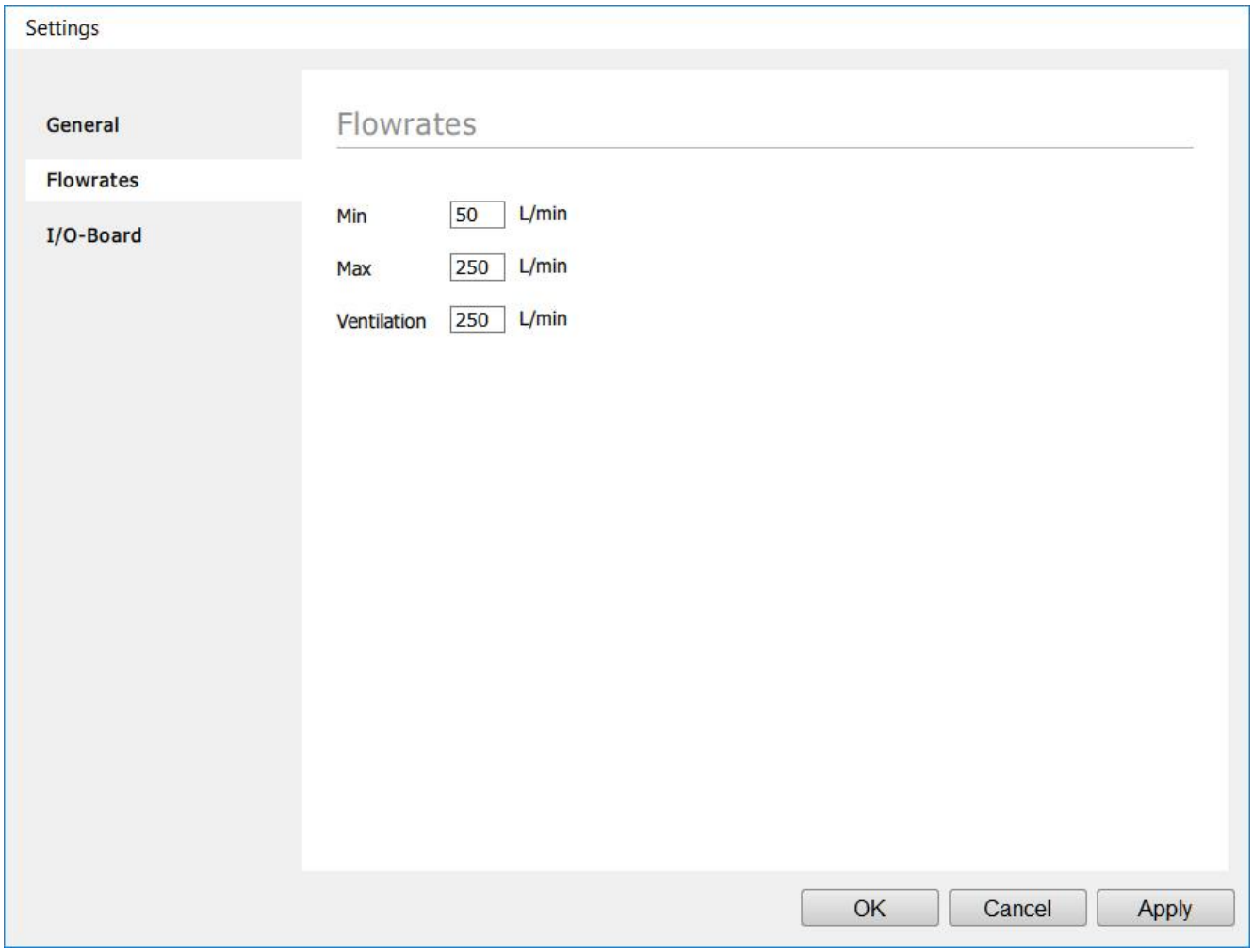


Figure 28: settings – flow rates

The minimum and maximum flow rates can be specified here.

☞ **Default settings:**

Min. flow: 50 ℓ/min
Min. possible flow rate during calibration and when determining the residual volume.

Max. flow: 250 ℓ/min
Max. possible flow rate during calibration and when determining the residual volume.

Ventilation: 250 ℓ/min
Flow rate during ventilation.

3.6.4.3 I/O board

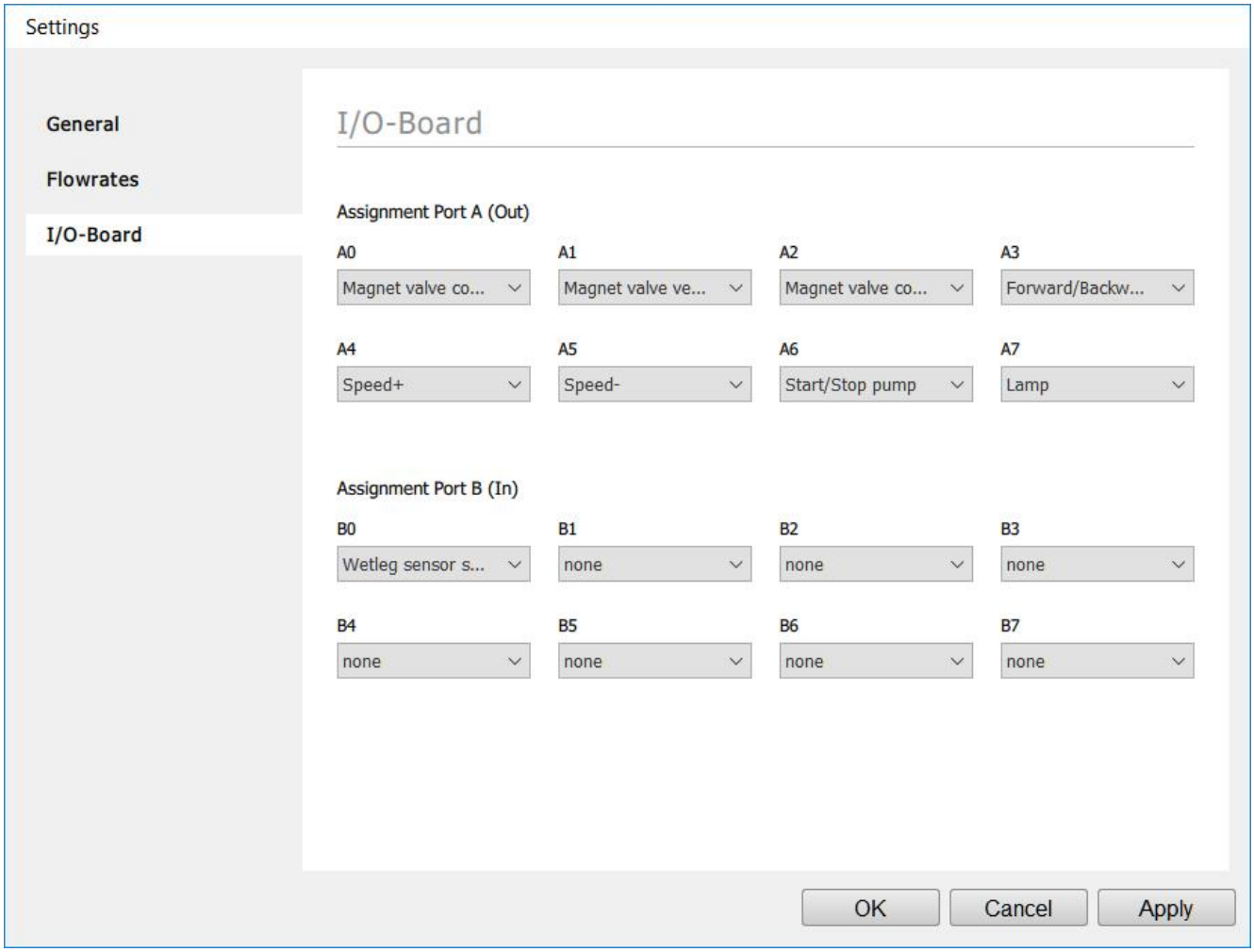


Figure 29: settings - I/O board

Used to assign the inputs and outputs of the USB IO board. These settings are not changed in the normal scenario. The assignment of inputs and outputs is determined by the installation on the calibration unit.

If a defect occurs at an input or output of the USB IO board, the respective function can be transferred to another input or output via this program point. In this case, however, the installation on the calibration unit must also be adapted!

3.6.5 Profiles

3.6.5.1 Flow Rate Profiles

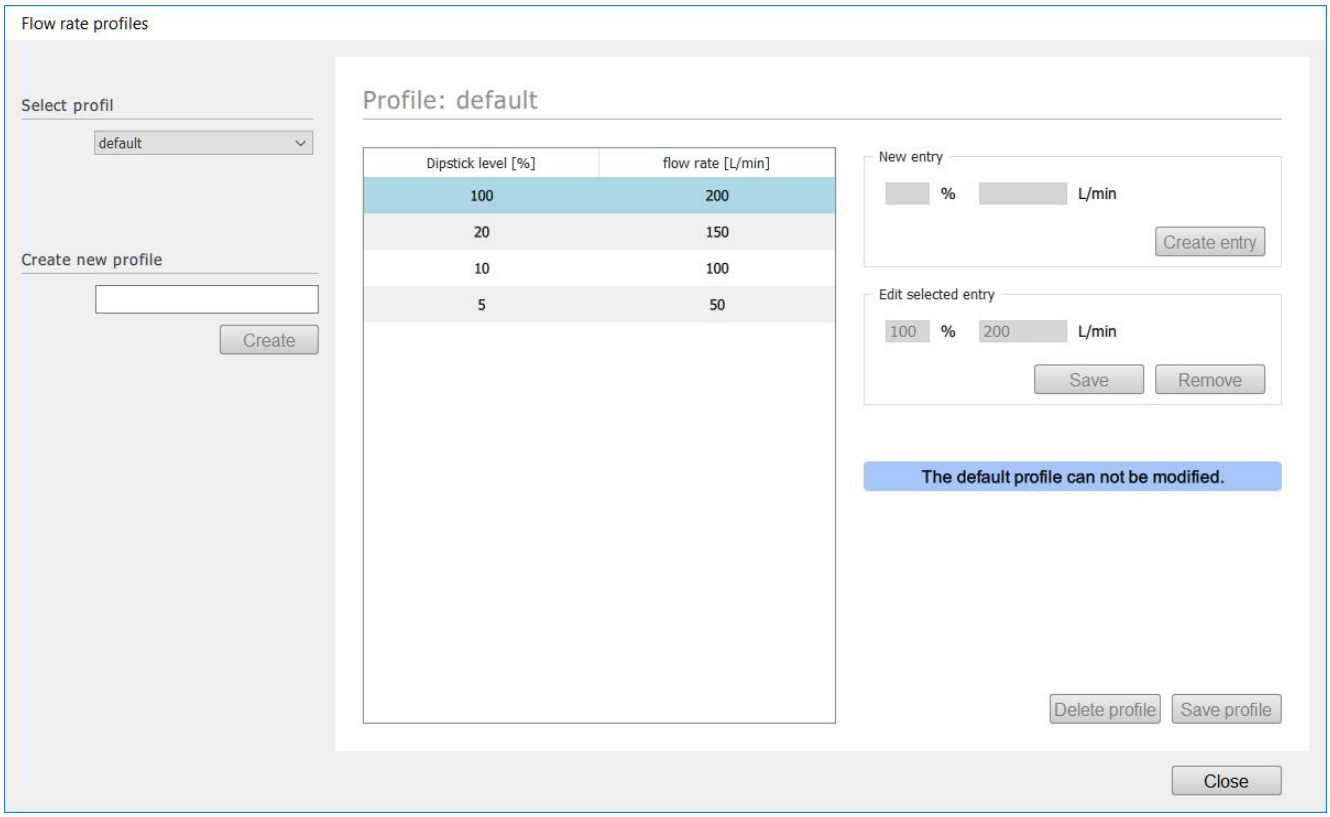


Figure 30: flow rate profiles

In the flow rate profiles area, different profiles can be created and modified, which influence the flow rate depending on the dipstick level of the compartment that is to be calibrated. The different compartment shapes allow different pumping rates, which has a direct influence on the accuracy and duration of the calibration! For this reason, additional flow profiles can be added or existing profiles modified in the calibration software.

- "Profile: <xyz>"
  - Displays the selected profile.
  - Shows the individual switching points (dipstick height <-> flow rate).
- "Select profile"
  - Select from the available profiles.
  - Existing profiles can be modified later.
- "Create new profile"
  - Creates a new profile with any name.
- "Delete profile"
  - The selected profile is deleted from the system.
- "Save profile"
  - A previously created or modified profile is saved.

- "New entry"
  - An additional dipstick level can be added with the appropriate flow rate.
- "Edit selected entry"
  - Modify an existing entry in the selected profile.

A flow profile created here must be explicitly selected in the "Calibration" display so that the corresponding flow profile is also used during calibration!

CAUTION:
For compartments with heights up to 1m, the maximum flow rate is automatically limited to 100L/min!

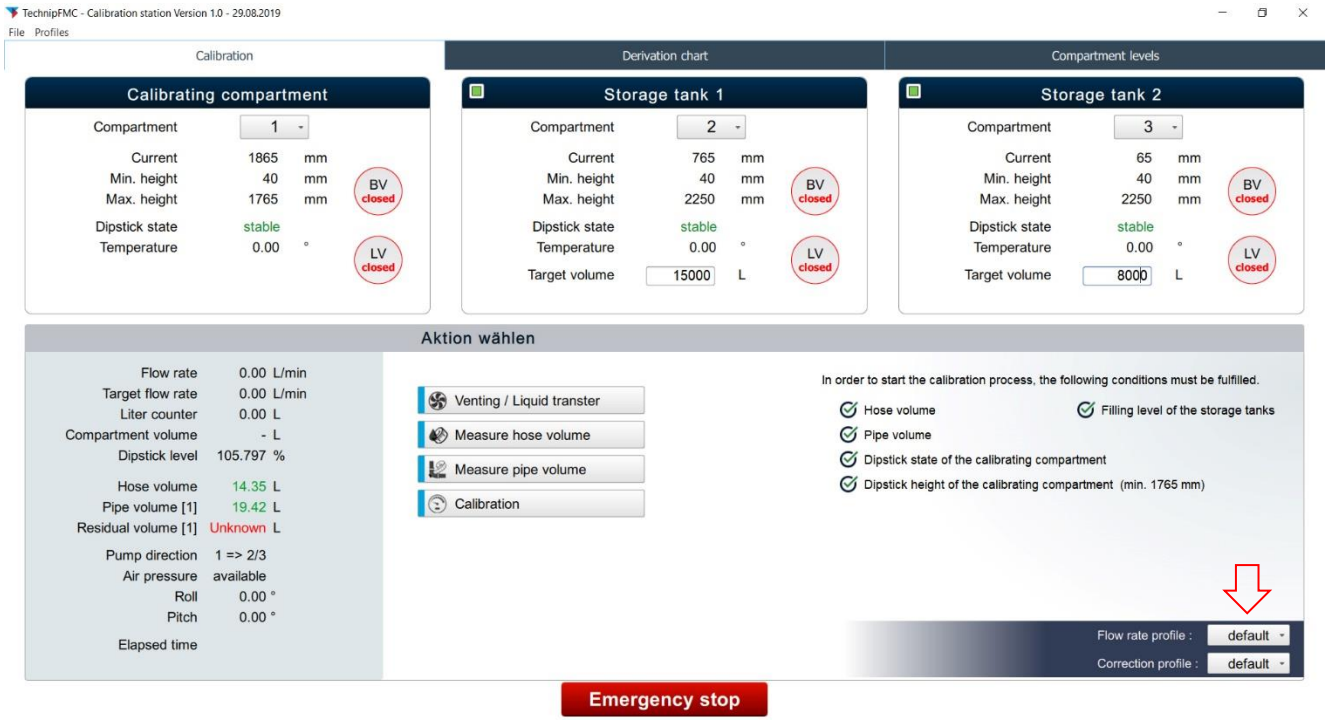


Figure 31: flow rate profile selection

3.6.5.2 Flow Rate Example "box tank"

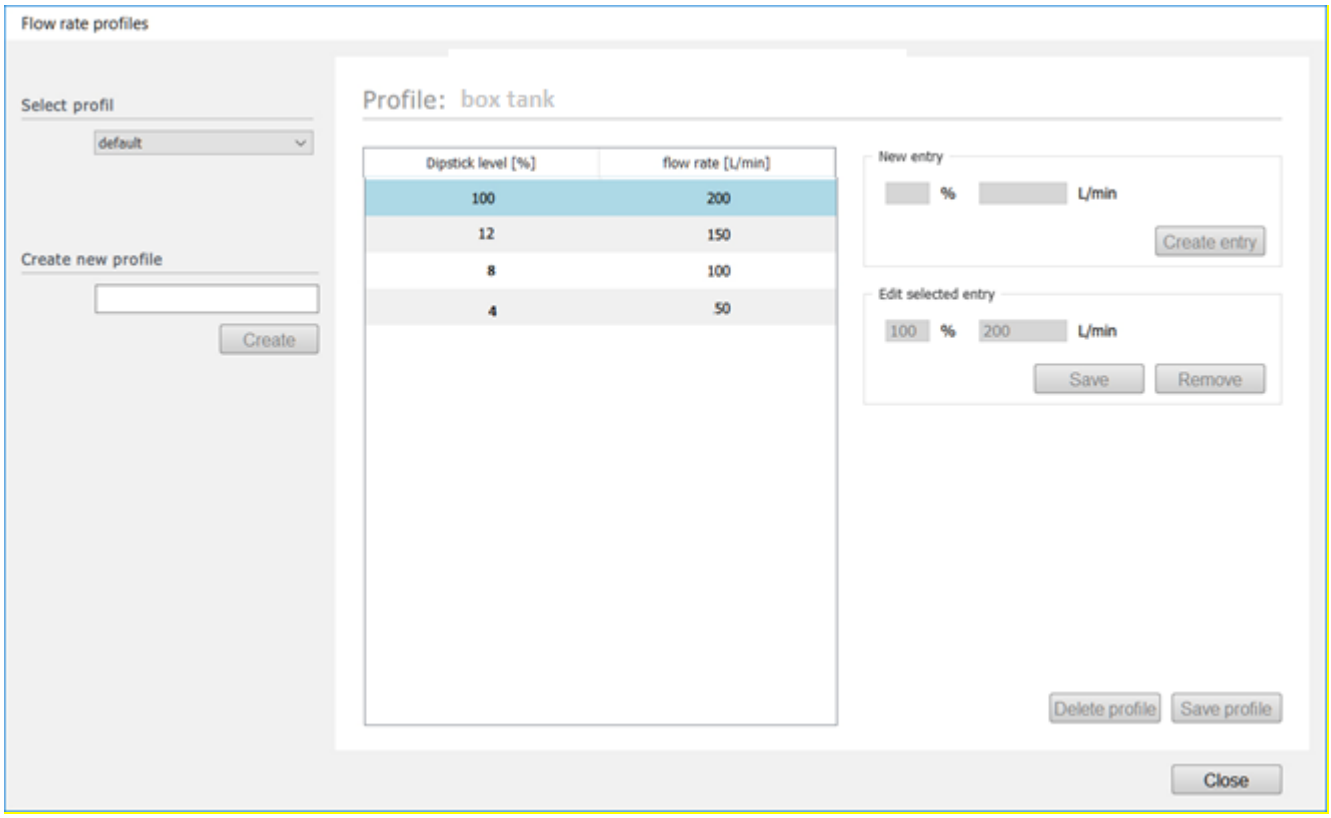


Figure 32: flow rate example of a box tank

Meaning of the profile:

- The calibration unit drains the tank compartment from the fill level 100% to 12% with 200 ℓ/min.
- From the fill level 12% to 8% with 150 ℓ/min.
- From the fill level 8% to 4% with 100 ℓ/min.
- As of 4%, the remainder including the residual drainage is emptied at 50 ℓ/min.

The flow rate can be adjusted to avoid incorrect measurements due to rapid changes in the flow rate (e.g. when starting the calibration) or due to a vortex formation in the tank compartment. The data shown here have proven their worth in standard compartments. The flow rate should be reduced earlier if the tank compartment in the lower area tends to develop a vortex. The majority of the compartment should be calibrated at 200 l/min, as the calibration unit here is particularly smooth and accurate.

CAUTION:
The parameter "Float max" is automatically taken from the MultiLevel and must have been entered correctly in the setup there!

3.6.5.3 Correction Factor Profile

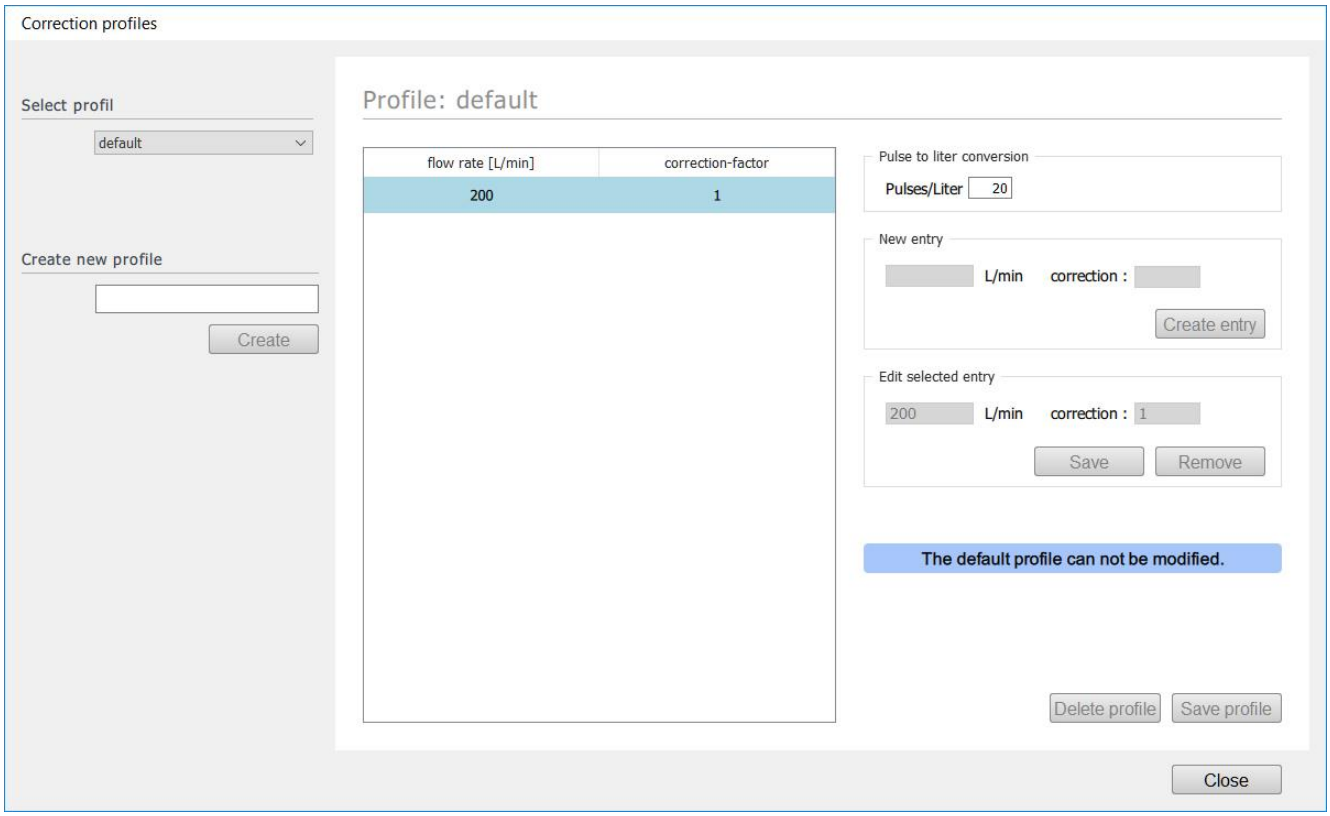


Figure 33: correction factor profile

The default settings should **not** be changed without good reason.

The correction factor profile allows the behaviour of the magnetic inductive flowmeter to be adapted to the flow rate. The correction factors were determined at Sening.

It is possible to readjust the calibration unit by filling a calibration piston with the corresponding flow rates. This is only necessary if deviations are noticeable when calibrating the vehicles.

CAUTION:

The calibration unit must only be operated with water!

3.7 Providing the Measurement Results

When performing a complete calibration, the following measurement results are obtained:

- Hose volume
    - Determined volume is only required by the calibration software.
- Pipe volume
- Residual volume
- Level table
- Derivation diagram

3.7.1 Pipe Volume and Residual Volume

At the end of the calibration, the determined values for the pipe volume and residual volume are automatically entered directly from the calibration software into the respective compartment setup on the MultiTask of the calibrated system. No further user input is necessary!

3.7.2 Level table

If supported by the MultiTask, the created level table is transferred directly to the connected MultiTask.

The level tables can be found locally in the directory *"%APPDATA%\fmc\calibration".* They are stored there in a sub-directory whose name refers to the tank number specified at the beginning of the calibration. This directory can be displayed directly in a separate window under the menu item *"/File/Open folder"*.

If the "Save to USB" option was activated during calibration and a corresponding connected USB stick was selected, the respective level table is stored on the USB stick in the "\calibration" directory. This directory contains a sub-directory, the name of which depends on the tank number specified at the beginning of the calibration.

In addition, the level table is stored on the USB stick under "\MultiTask\LGM". This has the advantage that the USB stick on the MultiTask can be used directly for importing the level tables via USB. To do this, the USB stick must be connected to the MultiTask and the import of the level tables must be initiated via the "Import" button in the *" /Settings/Datatransfer/Level tables"* area!

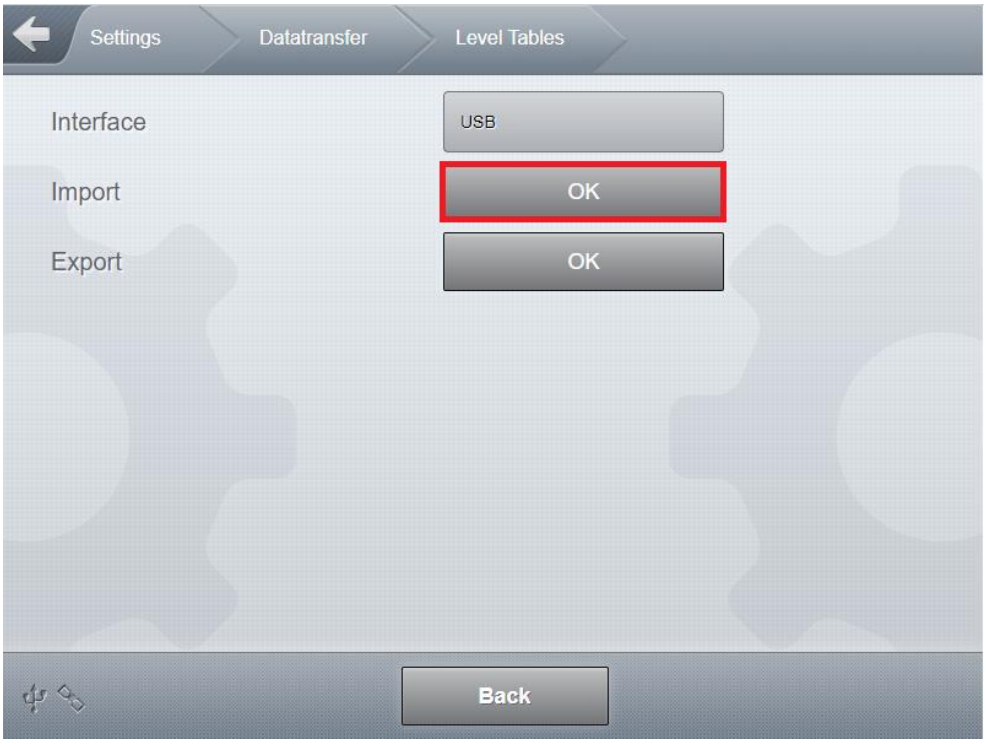


Figure 34: importing level tables via USB

3.7.3 Derivation Diagram

The derivation diagrams can be found locally in the "%APPDATA%\fmc\calibration" directory. They are stored there in a sub-directory whose name refers to the tank number specified at the beginning of the calibration.

If the "Save to USB" option was activated during calibration and a corresponding connected USB stick was selected, the respective derivation diagram is stored on the USB stick in the "\calibration" directory. This directory contains a sub-directory, the name of which depends on the tank number specified at the beginning of the calibration.

4 Performing the Calibration

4.1 Initial State

If all necessary connections are present and functional when the calibration software is started and the MultiTask of the system to be calibrated switches to calibration mode, the calibration software switches directly to the "Calibration" display. This is the starting point of any calibration. The information displayed here indicates:

- Which compartment is to be calibrated
- Which compartment(s) are used as storage containers
- The states of the individual compartments
- Which measurement results have already been determined
- Which flow rate profile to use
- What are the requirements for performing the calibration

Moreover, all necessary steps during calibration are controlled from this display!

4.2 Start a New Calibration

4.2.1 Determining the Participating Compartments

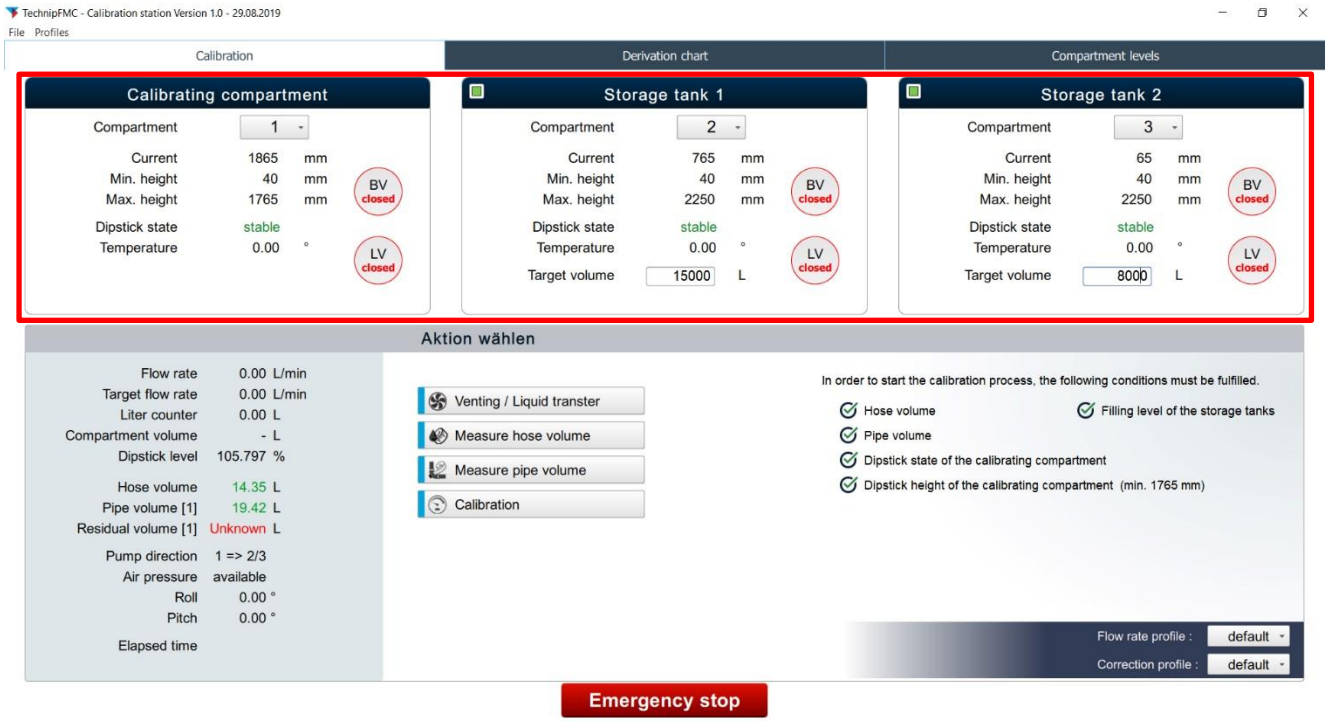


Figure 35: determining the compartments and storage containers

4.2.1.1 "Calibrating compartment"

The following information and input options are available:

- "Compartment"
    - Selects the compartment to be calibrated.
- "Current"
    - Current float level of the compartment to be calibrated.
- "Min. height"
    - The "float min." value set in the MultiTask setup of the compartment to be calibrated.
- "Max. height"
    - The "float max." value set in the MultiTask setup of the compartment to be calibrated.
- "Dipstick state"
    - The status transmitted by the dipstick. To start calibration, the status must be "stable".
- "Temperature"
    - The temperature value measured by the temperature sensor of this compartment.

4.2.1.2 "Storage tank 1" & "Storage tank 2"

The following information and input options are available:

- 1 or 2 storage tanks can be configured; these can be another compartment of the vehicle or an external tank.
- The relevant storage tank can be activated via the checkbox in the upper left corner. This is used to precisely assign the storage tank to be used during the respective calibration steps.
- "Storage tank 1" refers to the "output 1" of the calibration unit; "storage tank 2" to the "output 2" of the calibration unit. The "compartment" defined here must be connected accordingly to the calibration unit.
- "Target volume"
    - Determines the maximum volume that can be pumped into this compartment.
    - When the value is reached, the storage tank is switched over (1 -> 2) or, if there is no second storage tank or it is already full, calibration is stopped to avoid damage to the system being calibrated.
- All other information corresponds to the description of "compartment to be calibrated".

Explanation of the switching behaviour using the example of the specifications from Figure 35:

- The current level of the compartment to be calibrated is "1865 mm" and is thus above "Float max." ("1765 mm").
- The level of compartment 2 (storage container 1) is "765 mm" with a "float max." of "2250 mm". So the compartment is already filled to ~1/3. The target level for this storage container has been additionally set to "15000 L".
- The level of compartment 3 (storage container 2) is "65 mm" with a "float max." of "2250 mm". So the compartment is still almost empty. The target level for this storage container has been additionally set to "8000 L".
- The calibration medium is first pumped from the compartment 1 to be calibrated into the storage tank 1 (compartment 2).
    - If the float in storage tank 1 (compartment 2) reaches the value "Float max." or if the quantity of calibration medium pumped into this storage tank reaches the quantity 15000 L, storage tank 2

is opened and storage tank 1 is closed. From now, the remaining calibration medium is pumped from the compartment to be calibrated into the storage tank 2.

- If the float in storage tank 2 (compartment 3) reaches the value "Float max." or if the quantity of calibration medium pumped into this storage tank reaches the quantity 8000 L, storage tank 2 is also closed and the calibration is interrupted because there is no longer sufficient space to store the remaining calibration medium!

✍ During calibration, the calibration software ensures that the "height max." and "target level" of the respective storage tank are adhered. If one of the values is reached, the calibration software switches to the other storage container or stops the calibration.

✍ The number of selectable compartments is determined by the calibration software directly from the setup of the connected MultiTask!

4.2.2 Measured Values

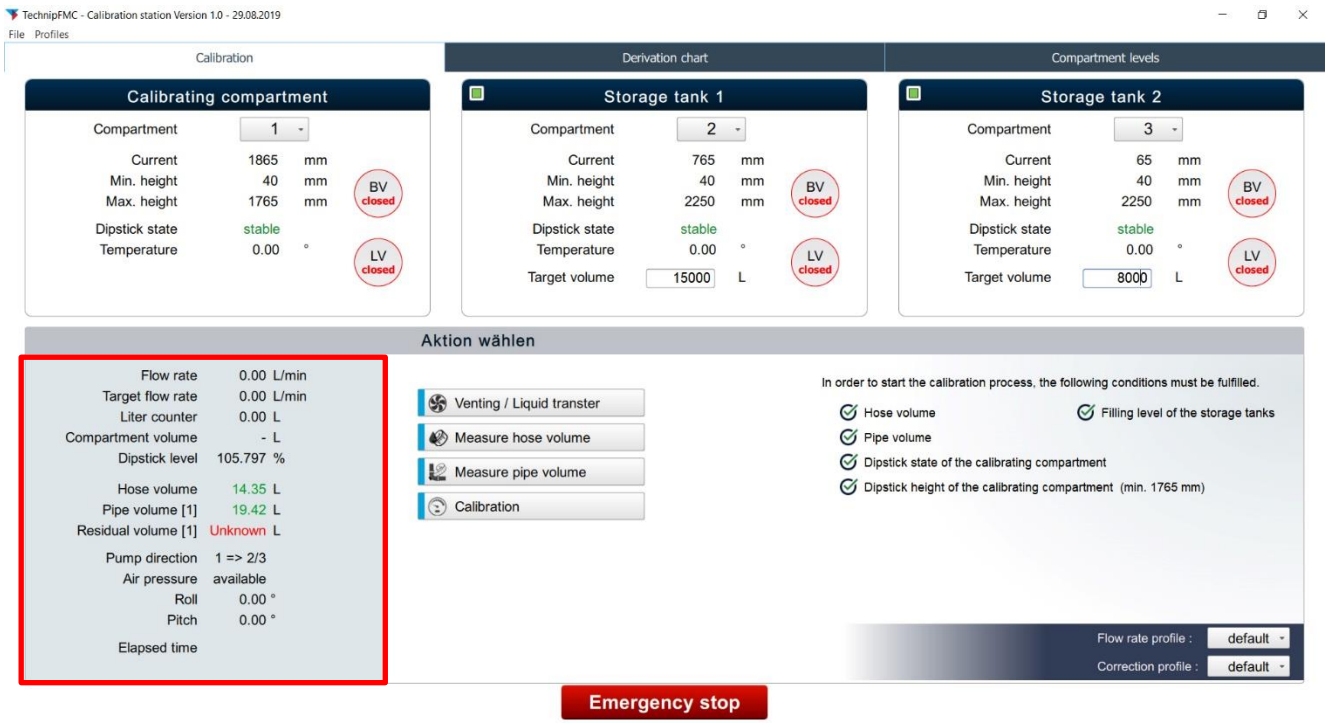


Figure 36: display of the measured values

- "Flow rate"
  - The current measured flow rate of the pump.
- "Target flow rate"
  - The target flow rate of the pump.
- "Litre counter"
  - The number of litres determined by the calibration software.
- "Compartment volume"

  - The "compartment volume" defined in the compartment setup of the MultiTask.
- "Dipstick level"
  - The height of the dipstick currently specified by the dipstick of the compartment to be calibrated in [%] (100% corresponds to "Float max.").
- "Hose volume"
  - The measured hose volume in [L].
- "Pipe volume [x]"
  - The pipe volume measured for compartment <x> in [L].
- "Residual volume [x]"
  - The residual volume measured for compartment <x> in [L].
- "Pump direction"
  - Currently set pump direction.
  - "1 =>2/3" means that at the next calibration step of compartment 1 is pumped into compartments 2/3.
- "Air pressure"
  - Information on whether sufficient pressure has been detected on the system.
- "Roll"
  - The longitudinal inclination value measured by the inclination sensor of the MultiTask.
- "Pitch"
  - The transverse inclination value measured by the inclination sensor of the MultiTask.
- “Elapsed time”
  - The duration so far of the calibration performed.

4.2.3 Calibration Requirements

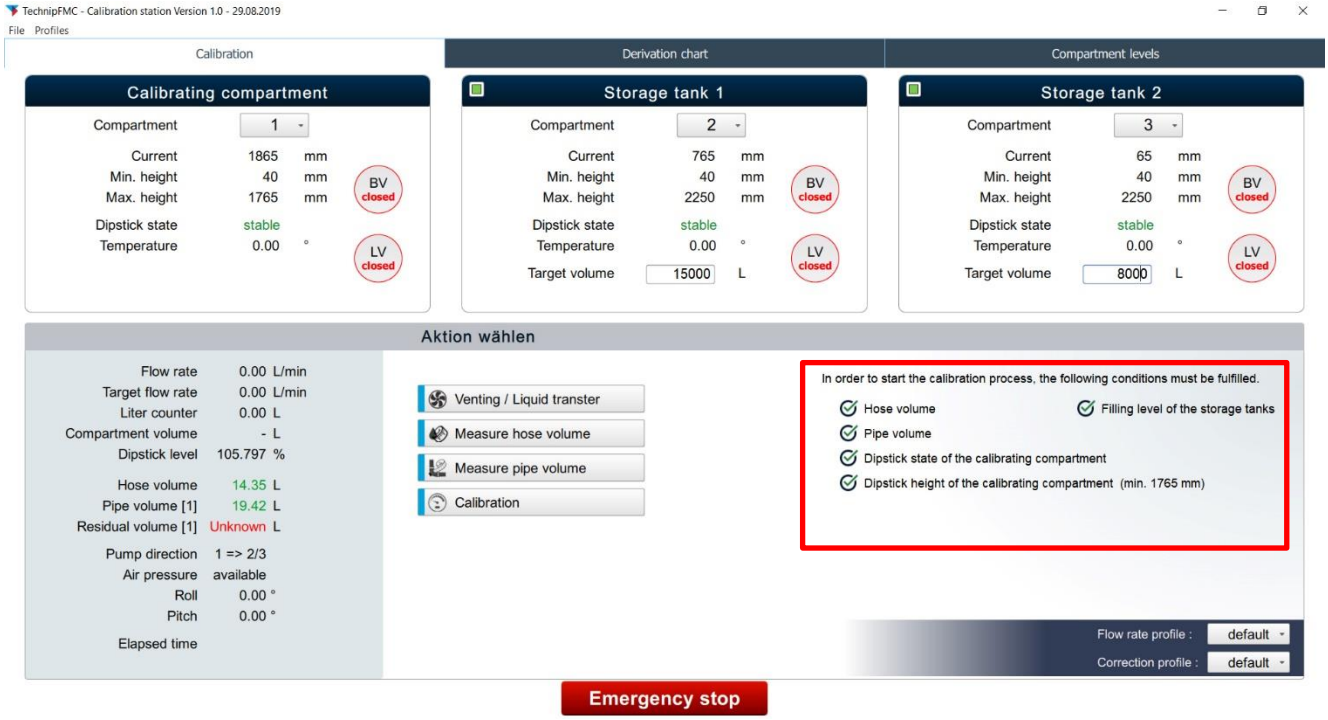


Figure 37: calibration requirements

Provides a checklist of conditions that must be met before the final compartment calibration can be started. The "Calibration" button is activated only when these are fulfilled!

4.2.4 Selecting the Calibration Steps

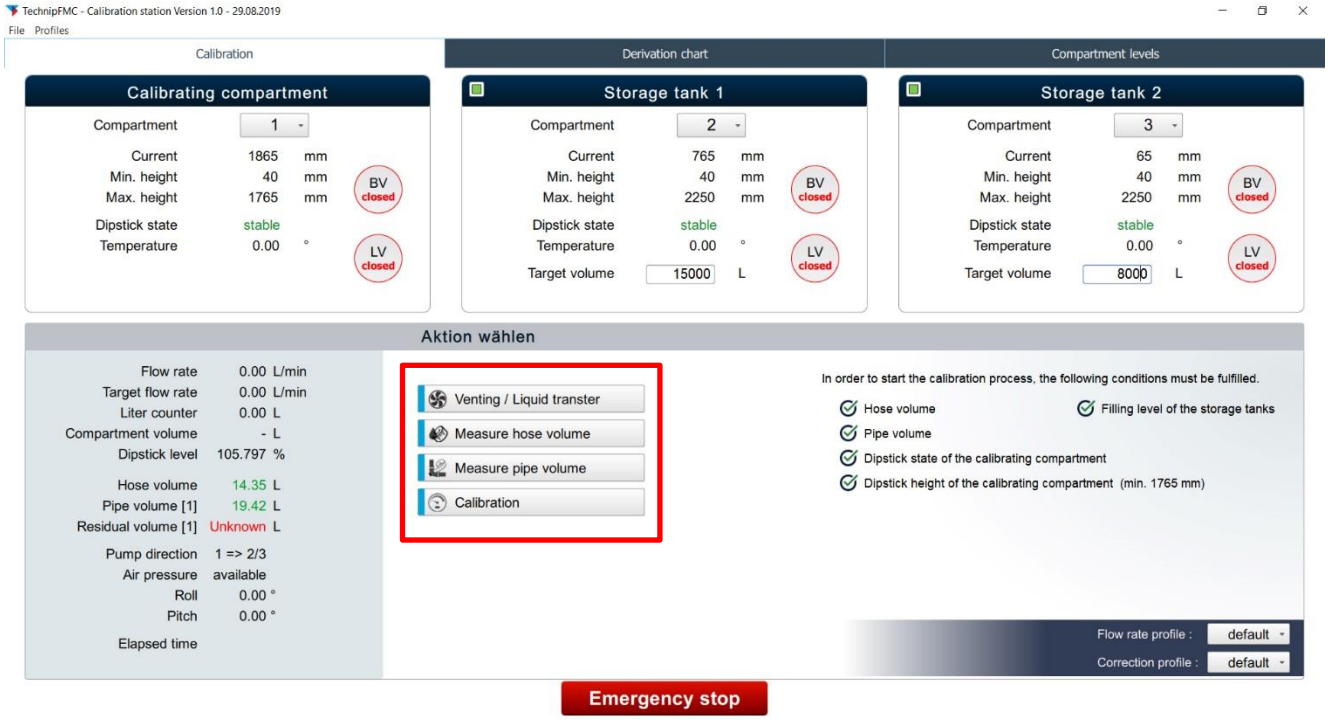


Figure 38: selecting the calibration Steps

These buttons are used to control the calibration. Here, the individual, necessary steps of the calibration can be selected separately.

- "Venting/Liquid transfer"
  - This item is used to vent the system.
  - It is possible to change the pump direction to easily recirculate the calibration medium.
- "Measure hose volume"
  - Determination of the first measured value required for calibration.
  - Basic requirement for the later calibration of the compartment!
- "Measure pipe volume"
  - To measure the pipe volume, the hose volume must first be determined and the hose must be empty.
- "Calibration"
  - This button is not activated until all the prerequisites for a calibration have been met!

4.3 Continue Interrupted Calibration

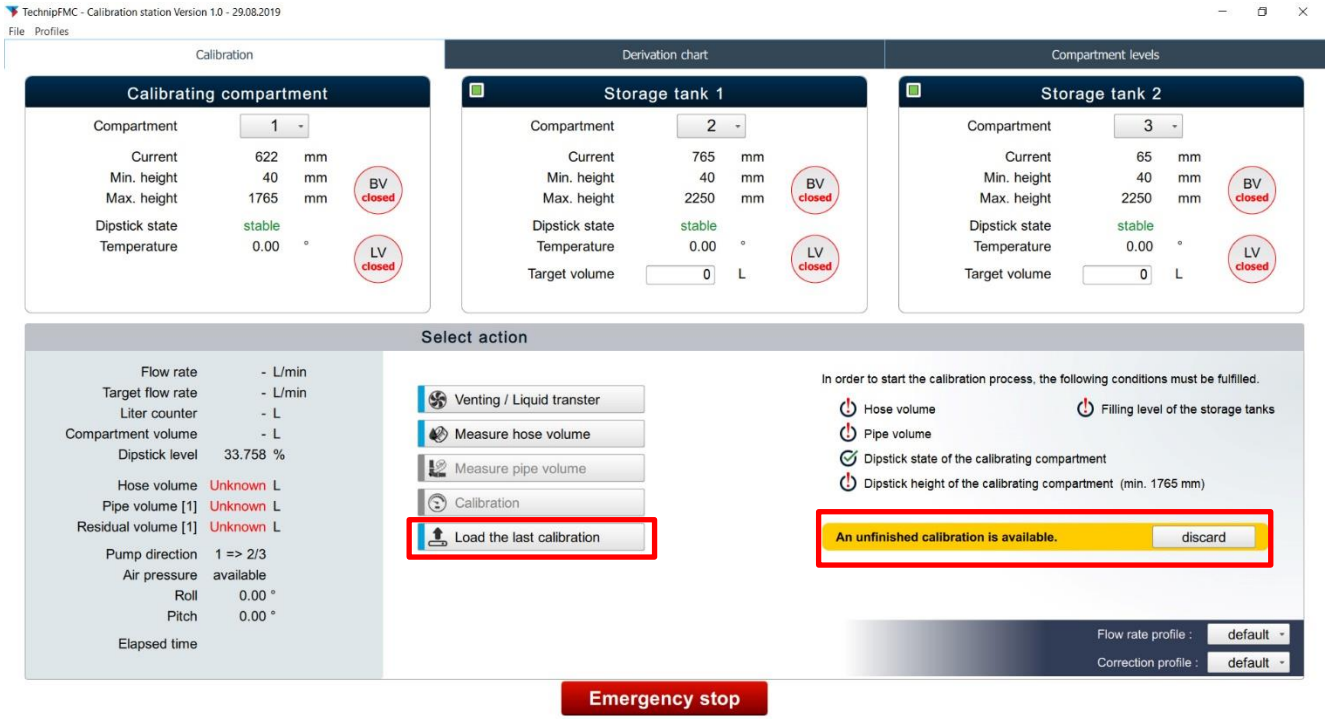


Figure 39: continue interrupted calibration

In addition to starting a new calibration, it is also possible to continue a calibration that has already started but has been interrupted. If the calibration software detects an incomplete calibration, the user is informed of an "unfinished calibration". This can be deleted using the "discard" button. "Load the last calibration" allows the data to be transferred and the user to continue the calibration from the point at which it was previously interrupted!

4.4 Venting the System

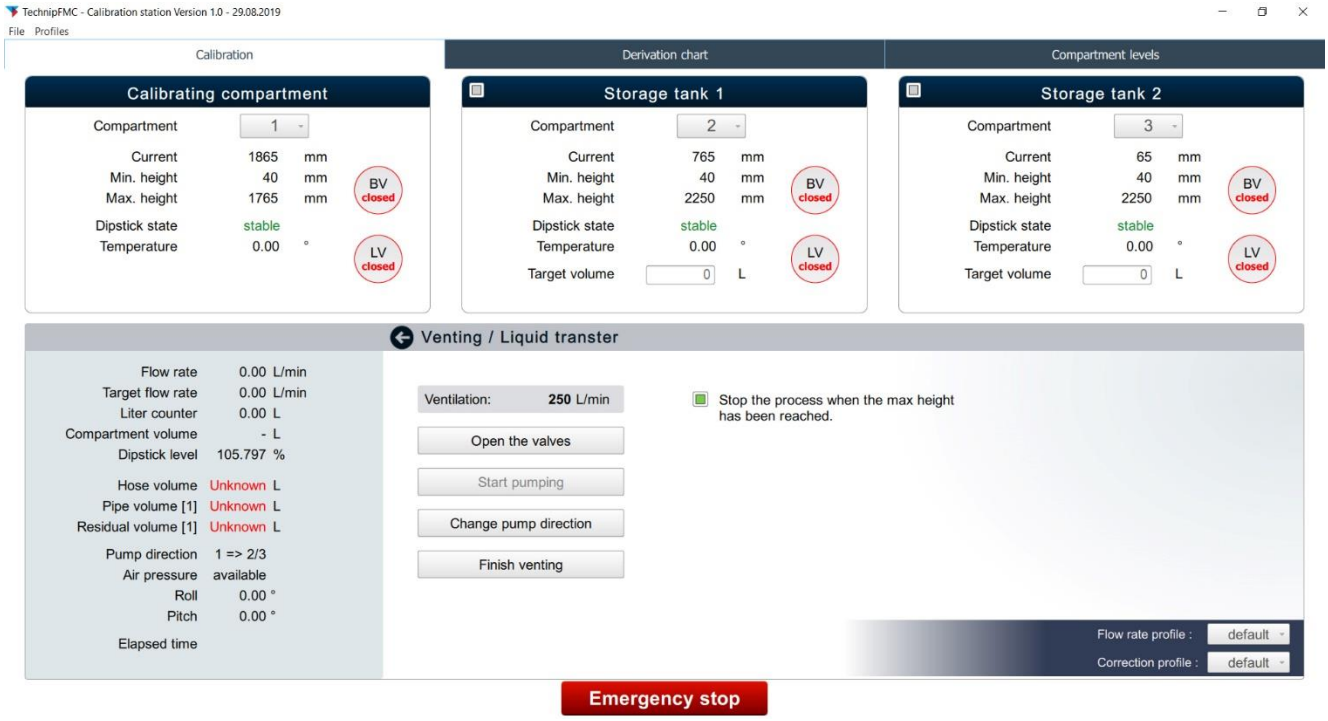


Figure 40: venting

The item "Venting/Liquid transfer" allows the removal of air still in the system. In addition, the calibration medium can be pumped between the configured compartments.

- The flow rate set for the venting is displayed.
- "Open the valves"
    - If the valves are controlled by the MultiTask, all valves required for the venting can be opened using this button.
    - The bottom and line valves (if present) of the compartment to be calibrated and those of the storage containers are opened.
- "Start pumping"
    - Starts the pump only when the wetleg sensor of the calibration unit is wet.
- "Change pump direction"
    - Provides the ability to recirculate the calibration medium in the system without having to replace the hoses.
- "Stop the process when the max. height has been reached"
    - As soon as the level in the compartment into which the calibration medium is pumped reaches the value "Max. height", the calibration software automatically stops the pumping process in order to avoid possible damage to the compartment.
    - In some cases, it is necessary to pump more calibration medium into a compartment than the "Max. height" allows. In this situation, deactivate the checkbox and restart the pump!

CAUTION:
If the automatic shut-off is deactivated at "Max. height", the operator of the calibration software is responsible for the timely shutdown of the pumping process.

☞ The entire pipe system must be vented before starting the measurements. Recommended venting flow rate: **> 250 ℓ/min**

- **CAUTION**:
  If the air is vented at less than **250 ℓ/min**, it cannot be ensured that all the air bubbles have been blown out of the pipe!
- Even higher-lying pipe parts (e.g. API coupling) must be vented!

☞ The calibration unit automatically stops when the correct level of the compartment to be calibrated is reached. The corresponding fill level is transferred from the vehicle to the calibration unit (parameter "Float max." in the corresponding compartment setup).

Recommendation:
After venting, a measurement procedure always follows. To do this, the impeller of the pump should be correctly aligned in order to avoid the slats turning over at the start of the measurement. The pump should therefore run in the correct direction for a short while in the venting mode.

4.5 Measuring the Hose Volume

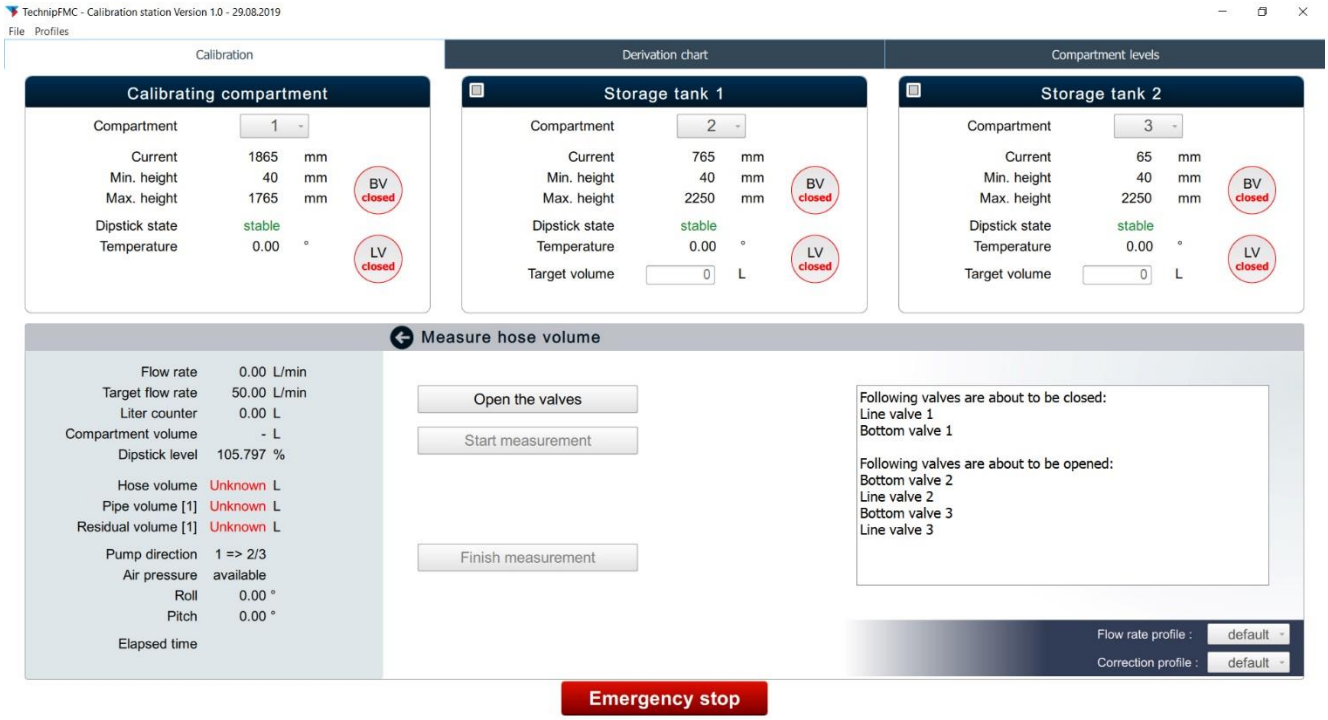
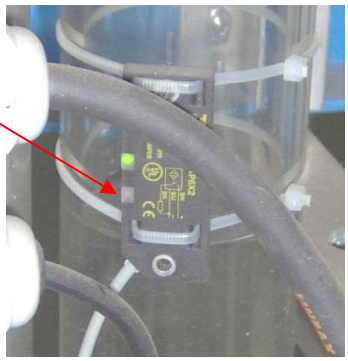


Figure 41: measuring the hose volume

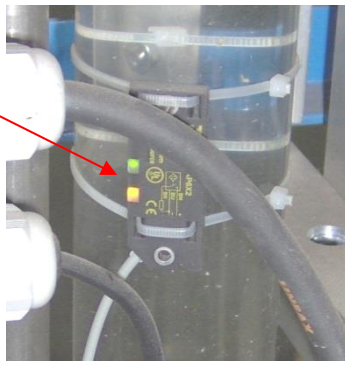
The first necessary measurement is started on the system via the item "Measure hose volume". The volume of the hose to the calibrating compartment is determined!

- "Open the valves"
  - If the valves are controlled by the MultiTask, all the valves required for this measurement can be activated accordingly using this button.
  - The bottom and line valves (if available) of the compartment to be calibrated are closed and the storage tank opened so that the calibration medium can be pumped from the hose into the storage tanks.
  - A description of which valves are activated and how during the process is displayed in the text field. A corresponding instruction is also displayed here if the valves have to be operated manually!
- "Start measurement"
  - When the system is ready (all valves are opened/closed accordingly), the measurement is started using this button.
  - The measurement is automatically terminated as soon as the wetleg sensor of the calibration unit is dry. This is indicated on the display accordingly. If the wetleg sensor becomes wet again due to the subsequent calibration medium, the measurement can be continued.
- "Finish measurement"
  - If the hose volume has been determined, the measurement is accepted via this button and returned to the main display. The measurement result is transferred to the overview of the measurement results.

As soon as the liquid sensor in the inspection glass switches off (**yellow LED goes out**), the pump is automatically stopped.



If further medium flows in, the inspection glass sensor switches back to full
(**yellow LED lights up**).



The measurement must be continued until the sensor no longer activates (yellow LED goes out). As soon as the sensor no longer activates and the associated drip time has elapsed, the measurement of the hose volume can be ended via the "Finish measurement" button and the next step in the calibration procedure can be continued.

CAUTION:
The quantity to be measured should be as large as possible to avoid measuring errors due to a frequent short switching of the pump.

The individual steps of this measurement are partly dependent on each other. For this reason, not all buttons can be selected from the start!

4.6 Measuring the Pipe Volume

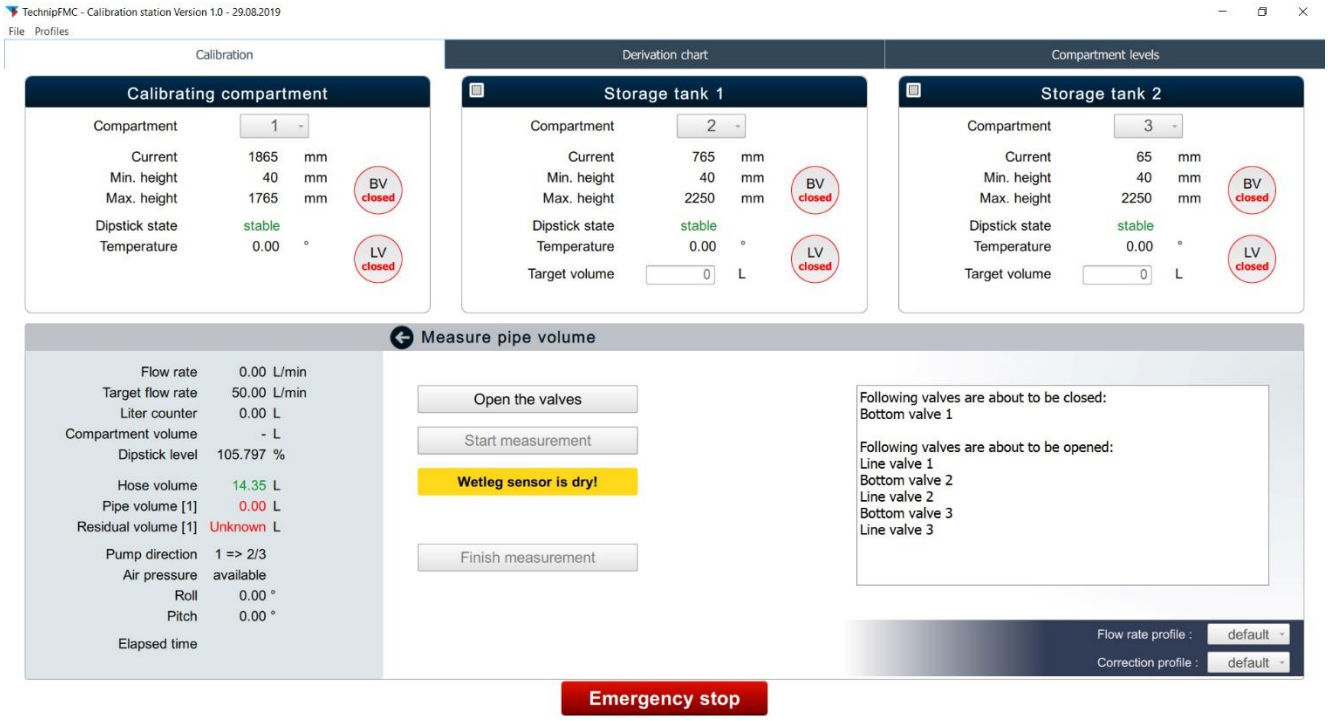


Figure 42: measuring the pipe volume

The second necessary measurement is started on the system via the "Measure pipe volume" item. The volume of the pipe of the compartment to be calibrated is determined!

- "Open the valves"
  - If the valves are controlled by the MultiTask, all the valves required for this measurement can be activated accordingly using this button.
  - Only the line valve of the compartment to be calibrated is opened and the bottom and line valves of the storage tanks are opened so that the calibration medium can be pumped from the pipe into the storage containers.
  - A description of which valves are activated and how during the process is displayed in the text field. A corresponding instruction is also displayed here if the valves have to be operated manually!
- "Start measurement"
  - When the system is ready (all valves are opened/closed accordingly), the measurement is started using this button.
  - The measurement is automatically terminated as soon as the wetleg sensor of the calibration unit is dry. This is indicated on the display accordingly. If the wetleg sensor becomes wet again due to the subsequent calibration medium, the measurement can be continued.
- "Finish measurement"
  - If the pipe volume has been determined, the measurement is accepted via this button and returned to the main display. The measurement result is transferred to the overview of the measurement results.

After opening the line valve, the water flows to the calibration unit. The filling quantity can then be measured.

Wait until the air has completely escaped from the connection hose into the tank compartment before starting the measurement.

The individual steps of this measurement are partly dependent on each other. For this reason, not all buttons can be selected from the start!

4.7 Target Level Specification

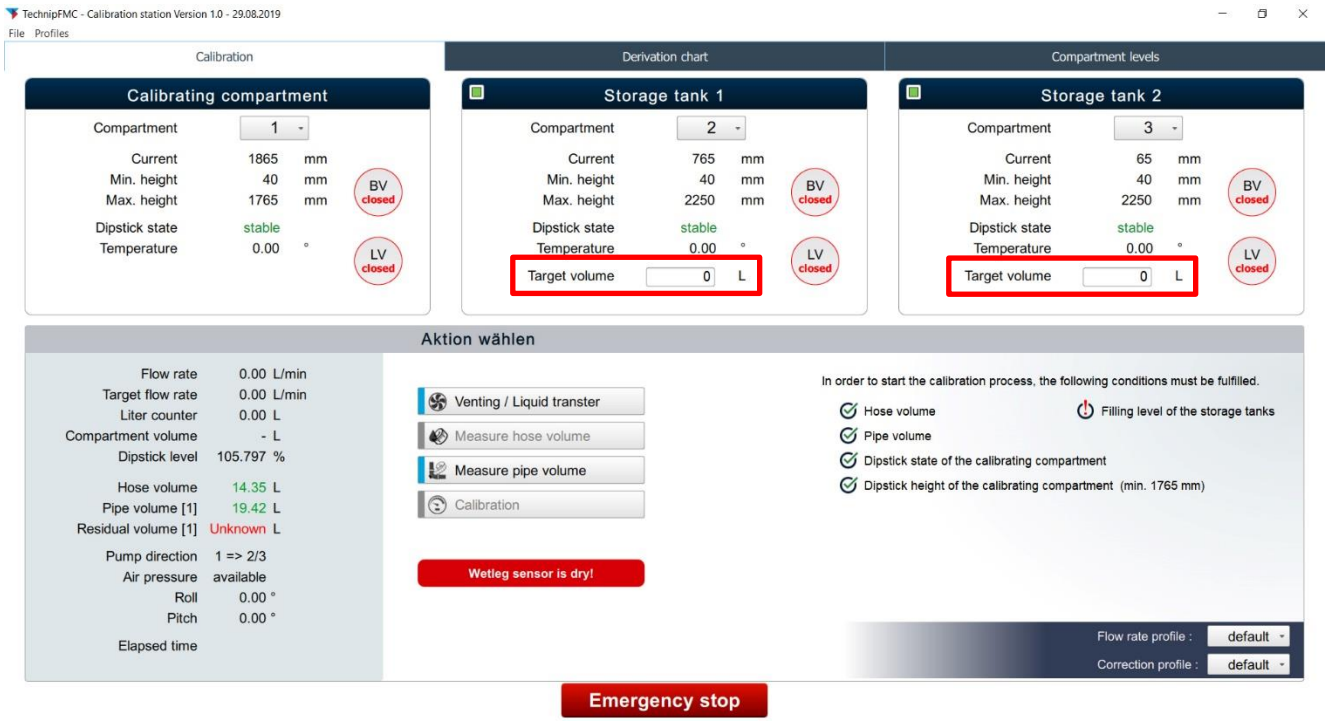


Figure 43: target volumes

Before the actual calibration can be started, the target volume for the activated storage tanks must be entered.

- "Target volume"
  - The maximum volume that can be pumped into this compartment.
  - When the default value is reached, the storage tank is switched over (1 -> 2) or, if there is no second storage tank or it is already full, calibration is stopped to avoid damage to the system being calibrated.

During calibration, the calibration software ensures that the "Max. height" and "Target volume" of the respective storage tank are adhered. If one of the values is reached, the calibration software switches to the other storage tank or stops the calibration.

4.8 Start Calibration

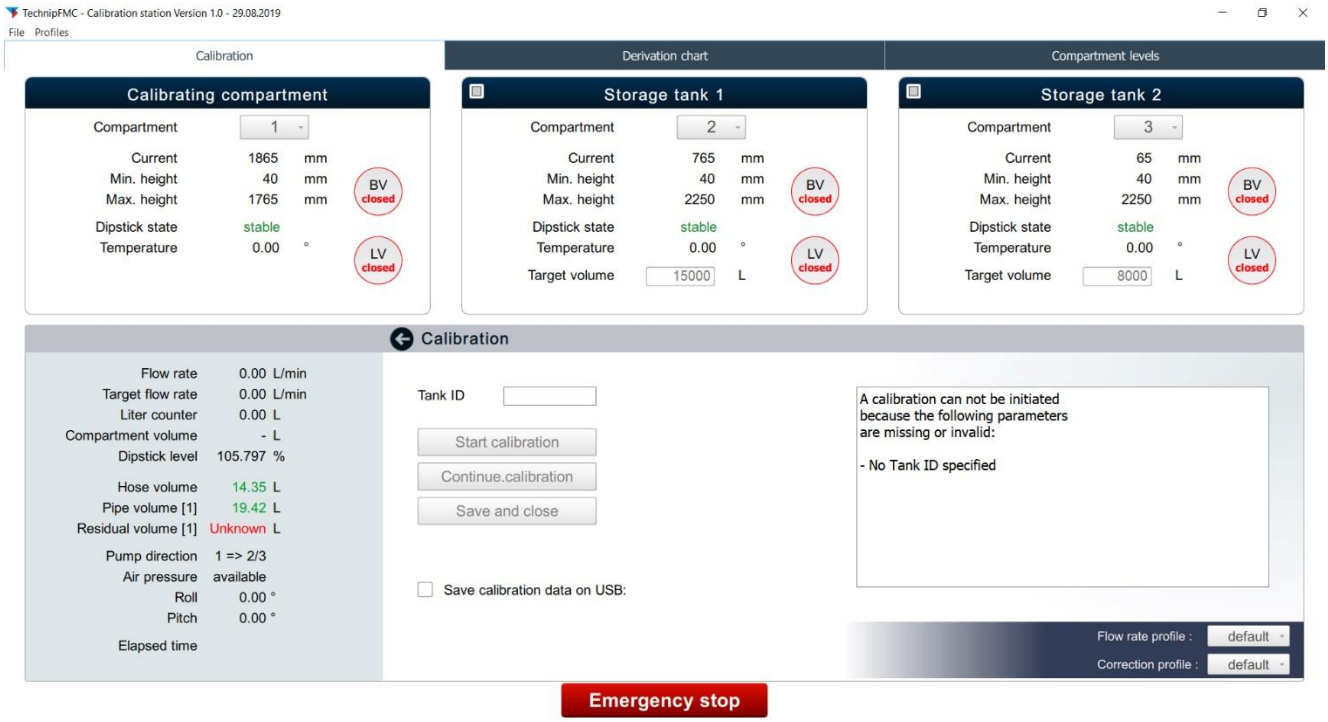


Figure 44: calibration

4.8.1 Venting

Before calibration can be started, the system must be vented again!

In this step, the compartment must be filled to the maximum level. The maximum level is displayed in the "Calibrating compartment" area.

4.8.2 Entering the Tank Number

If all the requirements for calibration are met, the actual calibration of the compartment can be started via the "Calibration" button.

The "tank ID" (tank number) must first be entered here. The tank number is used later for the unique assignment of the level tables and derivation diagrams. These are stored on the system and optionally on a USB stick in a directory with the name specified here!

4.8.3 Calibration

Once the "tank ID" has been entered, the calibration can be started via the "Start calibration" button.

The calibration is automatic. The duration depends on the size of the compartment.

For example: 10000 litres ==> 260 ℓ/min ==> theoretically 38 min.

Practically approx. 45 min. due to the flow reduction at the end of the measurement.

When a calibration is in progress, the "Derivation chart" screen displays the current derivation diagram. The diagram is updated at each measurement point. This makes it possible to detect and assess irregularities at an early stage, e.g. due to a pump running too fast!

All the requirements of the checklist must be met in order to start the calibration. In this case, particular attention should be paid to the sufficiently high level and the settling phase of the dipstick ("dipstick status").

The flow rates used during calibration and their switching times depend on the selected flow rate profile.

To avoid unwanted interruptions during calibration, check the "Target volume" and "Float max." information before starting the calibration. If these are insufficient for receiving the calibration medium from the compartment to be calibrated, the calibration is interrupted prematurely when the specifications are reached!

The calibration software supports the interruption of an ongoing calibration. This interruption can be caused briefly by pausing the calibration or for a longer period of time including switching off the calibration unit.

When continuing an interrupted calibration, the calibration software insists that the level of the compartment to be calibrated is above the last measured value. For this reason, before the interrupted calibration can continue, some calibration medium must be pumped back into the compartment to be calibrated using the "Venting" function. The interrupted calibration can only be continued once this condition has been met!

When pumping back, ensure that sufficient calibration medium is pumped back into the compartment to be calibrated. It is recommended that the quantity is dimensioned so that the flow rate when the calibration is continued is already the same as the flow rate of the pump delivered at the time of the interruption!

An interrupted calibration can be continued. However, any interruption of a calibration represents a fault with a running process and may have negative effects on the measurement result. To achieve the best possible measurement result, an interruption of the current calibration should be avoided!

CAUTION:
200 measured values distributed over the max. fill level (= float MAX) are available. Overfilling (manually) above this level of more than 10 mm is not permitted, as otherwise the last level readings in the lower range cannot be saved during calibration!

4.8.4 Determining the Residual Volume

The transition to the residual volume measurement takes place automatically. The pump stops as soon as the inspection glass sensor drops dry (yellow LED goes out).

The pumping process can then be restarted at any time to measure the residual medium.

Only when the inspection glass sensor shows dry permanently (yellow LED goes out) is the measurement completed.

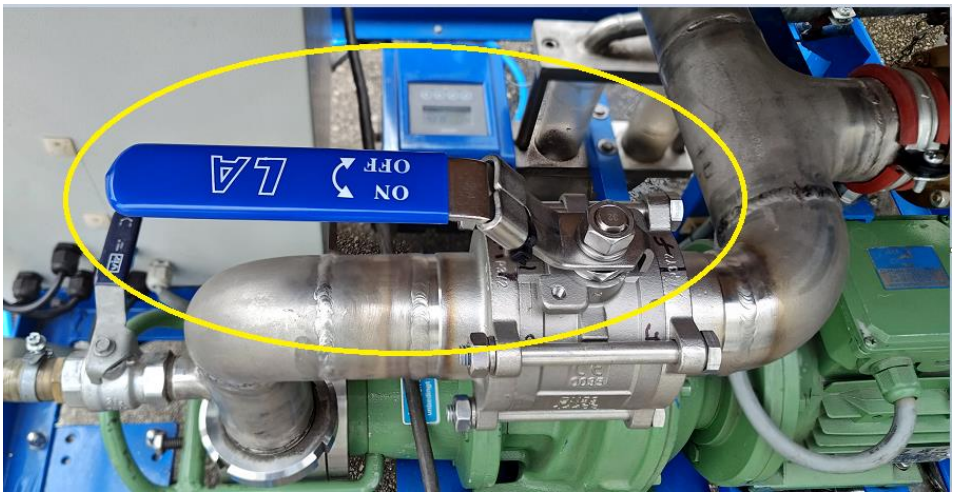


Figure 45: Optional backflow lock – OPEN position

Optional manual backflow lock
Some calibration stations are equipped with an optional backflow lock, to prevent a backflow from the storage tank. Depending on the position of the pump impeller and the structure and filling level of the storage tank, there may be a slight backflow from the storage tank through the impeller pump into the inspection glass during the residual volume determination phase. This may result in the inspection glass

sensor not remaining dry long enough to finish the calibration. In this case, the backflow from the storage tank can be stopped by manually closing the optional backflow lock. If no more water runs out of the connected compartment, the inspection glass sensor remains dry and the calibration can be finished as described below.

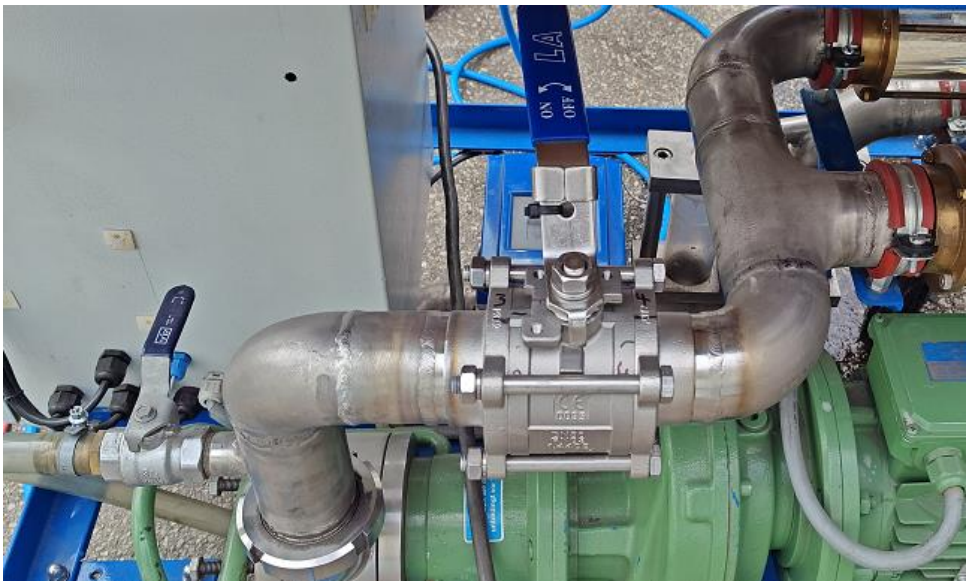


Figure 46: Optional backflow lock – CLOSED position

Note:
If backflow from the storage tank has been prevented by closing the backflow lock, it is essential to ensure that the backflow stop is opened again, after the calibration has been finished! If the backflow lock remains closed, no further measurements or pumping actions are possible with the calibration station.

4.9 Ending the Calibration and Saving the Results

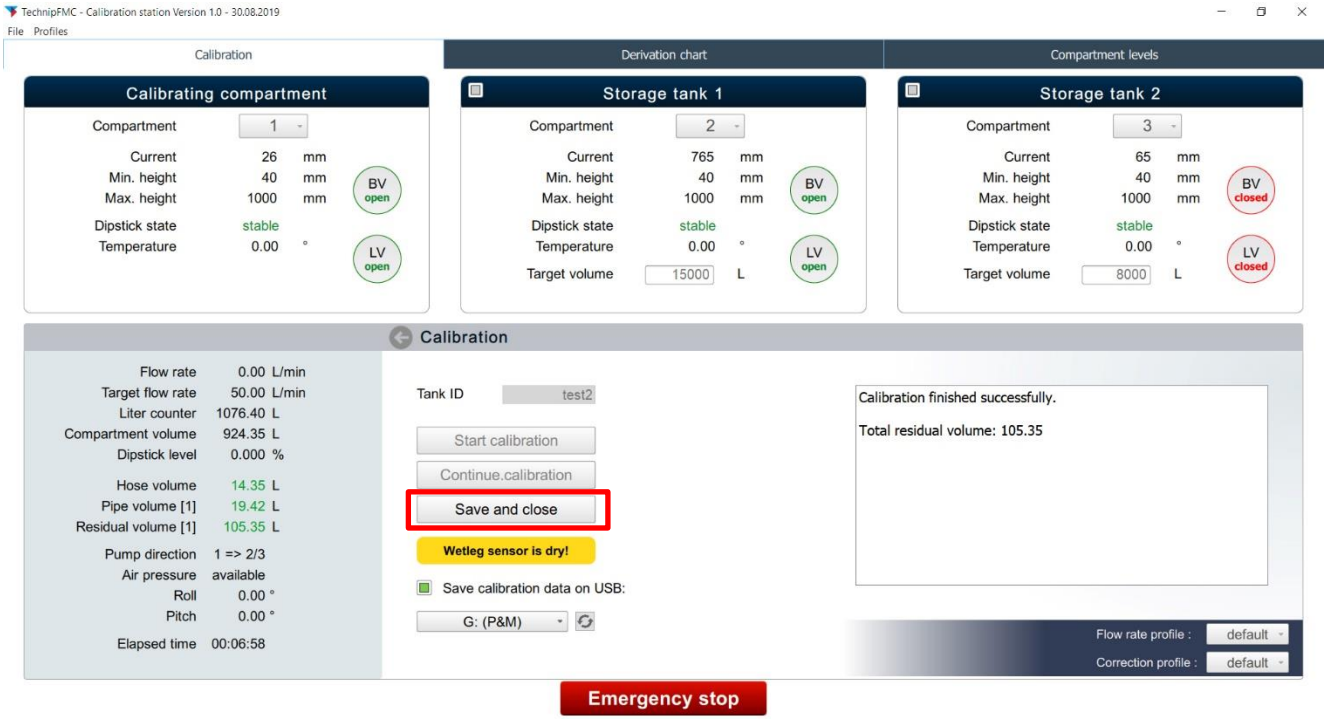


Figure 47: ending the calibration

By pressing the "Save and close" button, the current calibration is ended and the calibration data is saved according to the specifications!

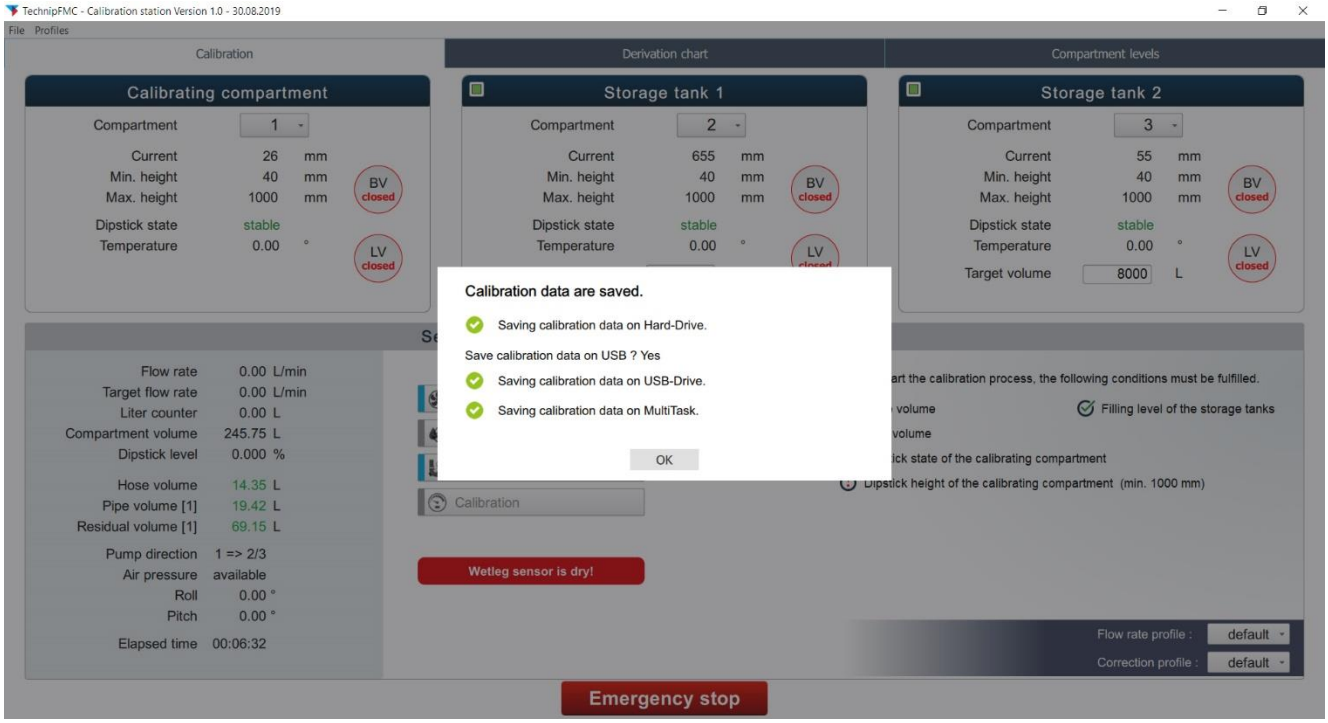


Figure 48: saving the calibration results

The measurement results and level tables are saved immediately after the calibration has been completed:

- The level table and the derivation diagram are stored on the notebook.
- If the MultiTask of the calibrated system supports this, the level table is automatically transferred to the MultiTask.
- If selected, the level table and derivation diagram are stored on the USB stick.

An overview of which storage operations have been performed by the calibration software appears when you exit the calibration mode!

☞ Before starting another calibration, it is recommended to check the correct transfer of pipe volume and residual volume to the compartment setup on the connected MultiTask!

Urgent recommendation:
All measurement results should be copied and stored on a secure corporate directory for each vehicle.
This ensures that all specific tanker data can be imported into the MultiTask over and over again.

5 Evaluation of the Calibration

5.1 General

The approval of the MultiLevel requires that the so-called "derivation" must be calculated for each calibration. This will check that the calibration has been performed correctly and that no irregularities have occurred. The level tables of all the compartments must be evaluated.

The level table consists of pairs of values of fill level and fill volume. From these pairs of values, the derivation is calculated by dividing the volume increments of the table by the corresponding height increments. The result indicates the increase of the individual values from the chart table. This increase also reflects the geometric shape of the compartment.

Height	Volume	Derivation Increase = $\frac{\Delta V}{\Delta H} = \frac{Volume\ difference}{Height\ difference}$
39.5 mm	0.0 litres	-
46.1 mm	14.0 litres	2.1 litres/mm
57.6 mm	39.4 litres	2.2 litres/mm
68.8 mm	65.6 litres	2.3 litres/mm
80.1 mm	94.5 litres	2.5 litres/mm

5.2 Automatically Generated Derivation Diagram

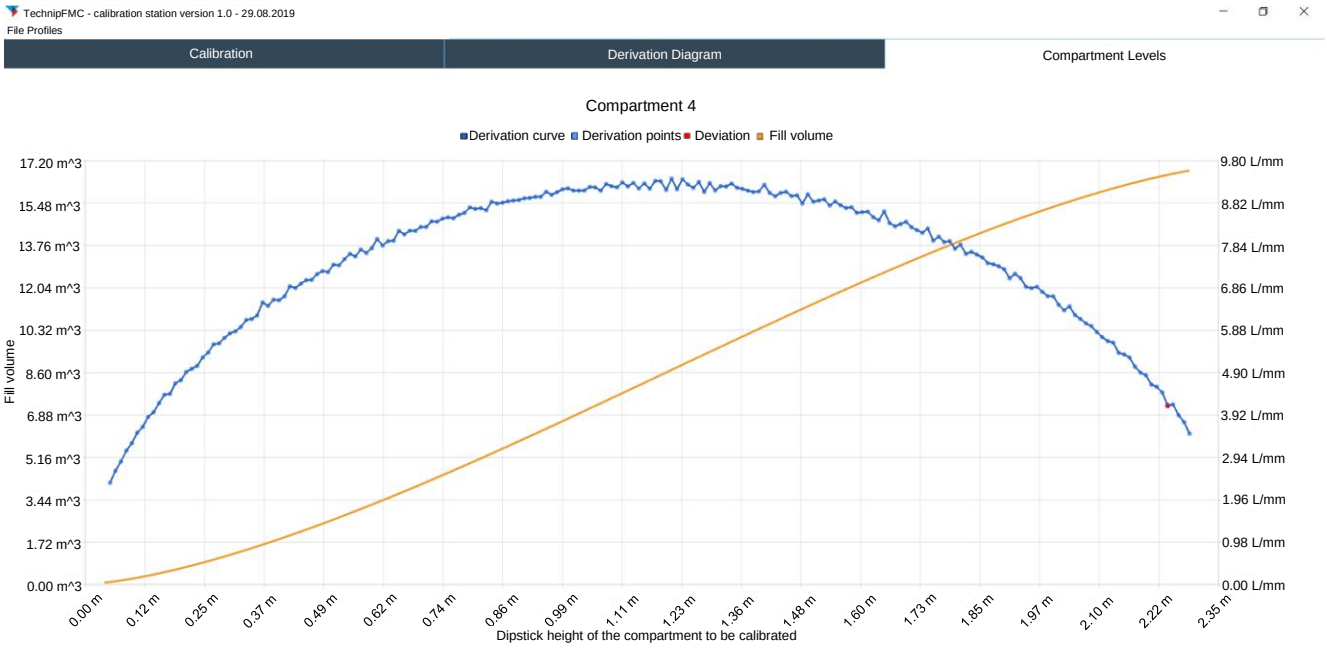


Figure 49: Derivation Diagram

The derivation diagram is already created during the current calibration. This is stored locally on the notebook and, if activated, on the connected USB stick at the end of the calibration.

5.3 Optional: Create the Derivations from the Level tables

A Sening level table (here *COMP01.LGT*) looks like this:

```
999.20061012090840,F769A356
  0.20061011103746.300
  1.20061011103746,FMC,MultiLevel,02.00,,01.00, , 1.1322612
  2,20061011103746,0,
0039463, 00000000,5C2A
0046144, 00014008,31E1
0057559, 00039386,8516
0068811, 00065615,14FE
0080058, 00094505,0BDE
0091427, 00125093,B6D3
0102623, 00156651,EAEB
0113685, 00189066,B140
0124969, 00223254,FBFA
0136123, 00259200.1779
```

The first four lines are not relevant for the calculation.

Fill level in µm column.

Fill volume in µlitre column.

The column for checksum must be deleted for the evaluation.

CAUTION:
The values in the level table are protected by a checksum and must not be changed. If the checksum is incorrect, the level table becomes invalid.

These ***.LGT** charts are easy to import into Excel to calculate the derivations and display them graphically.

Height	Volume	Derivation
39.5 mm	0.0 litres	
46.1 mm	14.0 litres	2.10 L/mm
57.6 mm	39.4 litres	2.22 L/mm
68.8 mm	65.6 litres	2.33 L/mm
80.1 mm	94.5 litres	2.57 L/mm
91.4 mm	125.1 litres	2.69 L/mm
102.6 mm	156.7 litres	2.82 L/mm
113.7 mm	189.1 litres	2.93 L/mm
125.0 mm	223.3 litres	3.03 L/mm
136.1 mm	259.2 litres	3.22 L/mm
147.5 mm	296.9 litres	3.32 L/mm
158.6 mm	334.7 litres	3.39 L/mm

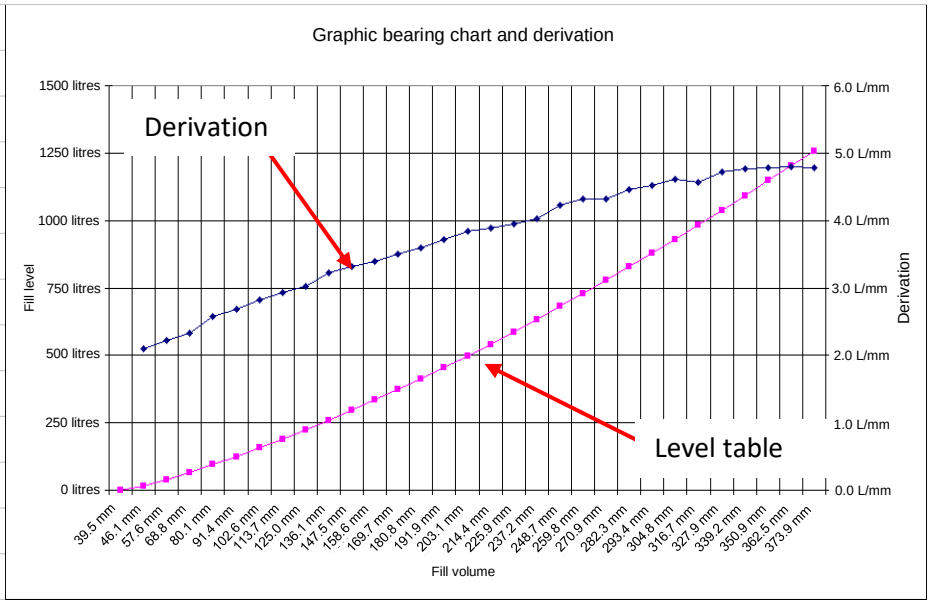


Figure 50: generation of a derivation graphic

5.4 Criterion for the Quality of the Calibration (Requirement for the Derivation)

Vehicles equipped with a level measuring system require approval in Germany. The requirements for such a vehicle, among others things, are set out in this approval.

The measuring compartments and the installation position of the dipsticks must be designed in such a way that the entire system meets the accuracy requirements of the approval. In particular, the inclination correction results in certain geometry requirements that must be met.

It is essential to comply with the accuracy requirement when installing the dipsticks. The dipsticks must be aligned exactly according to the drawing. Deviations can lead to inaccuracies in the inclination correction.

Installation must be carried out in such a way that metrological manipulation is not possible. Seal points must be shown in the approval and in the measuring system letter.

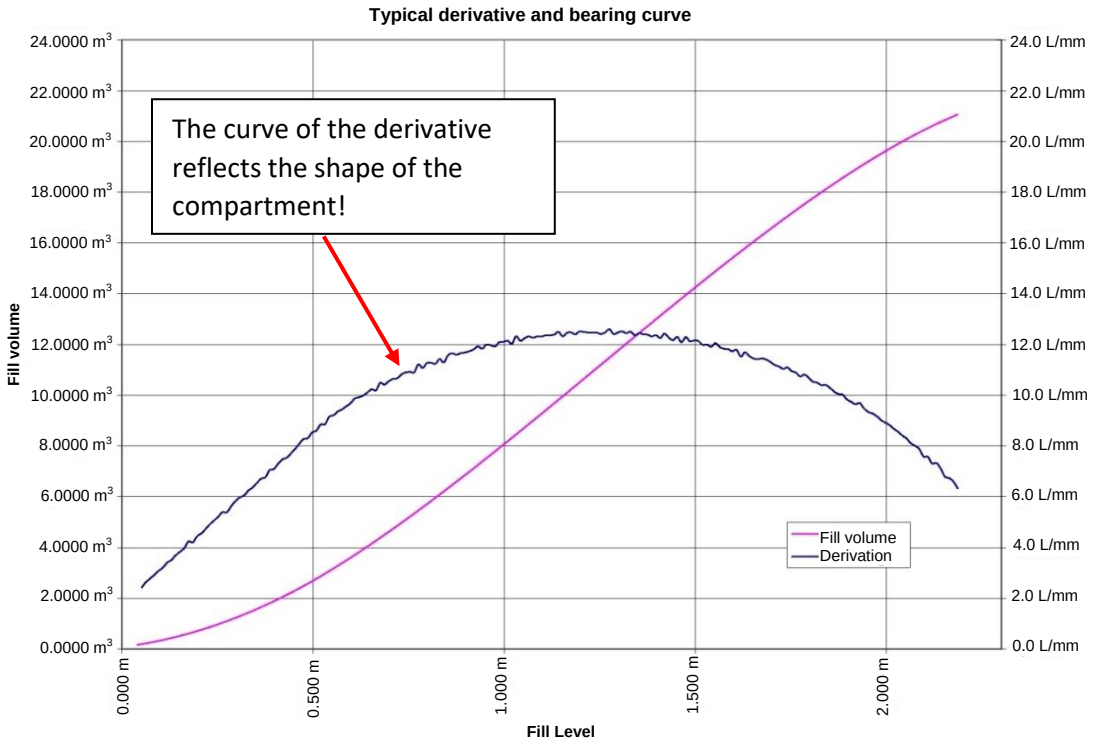


Figure 51: derivation of a good calibration curve

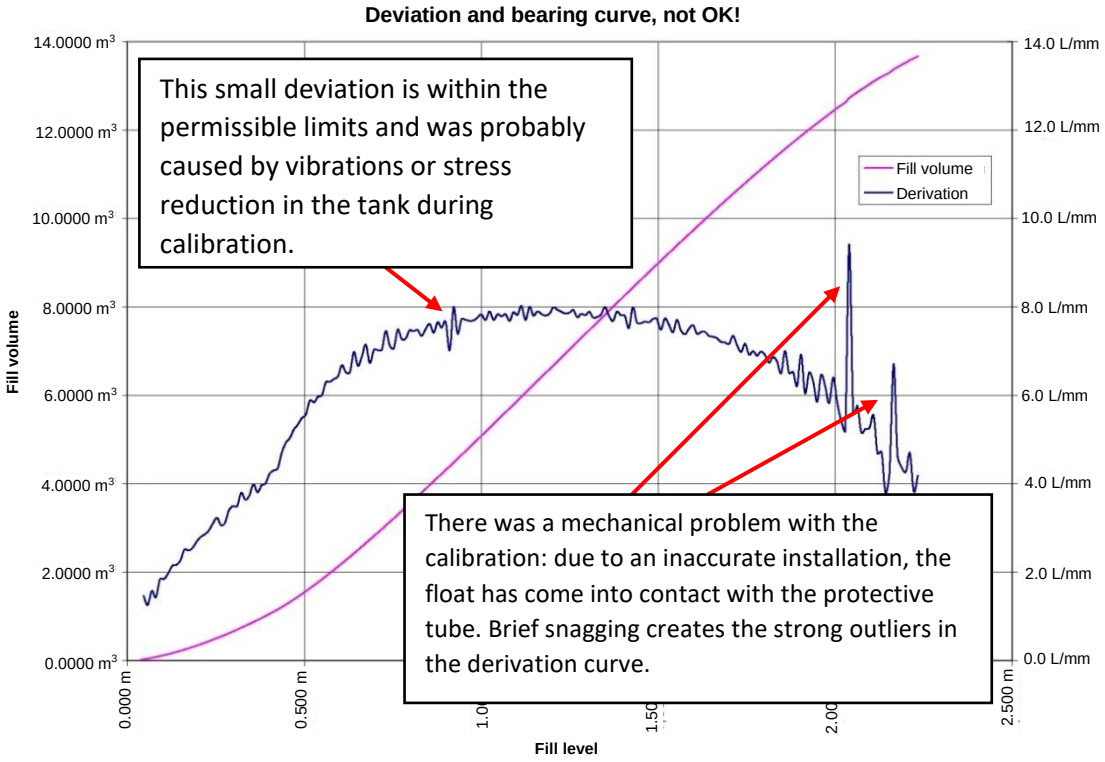


Figure 52: derivation of a bad calibration curve

Depending on the compartment size, the above deviations compared to the assessed ideal line may not exceed the values from the approval.

6 Vehicle Checklist

1. Are all valves, couplings, sensors, electronic components, etc. are assembled correctly, tight and functional?

2. Vehicle power and air supply available?

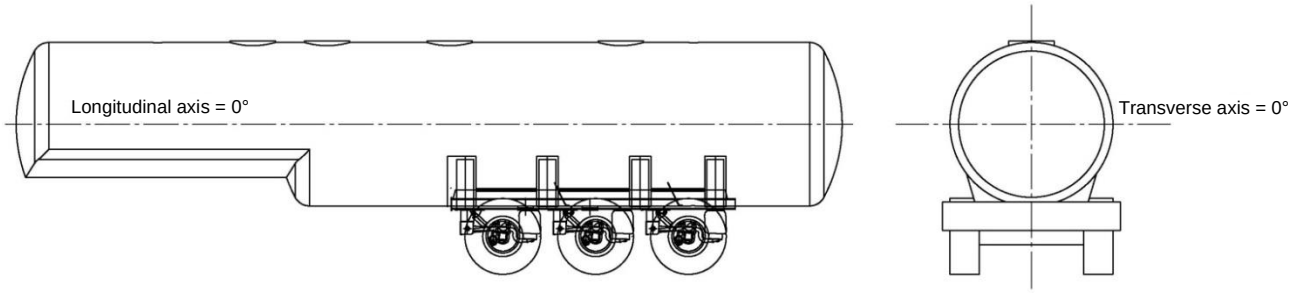
3. Are both the NoMix and MultiLevel applications on the MultiTask properly commissioned?

Are both applications running properly?

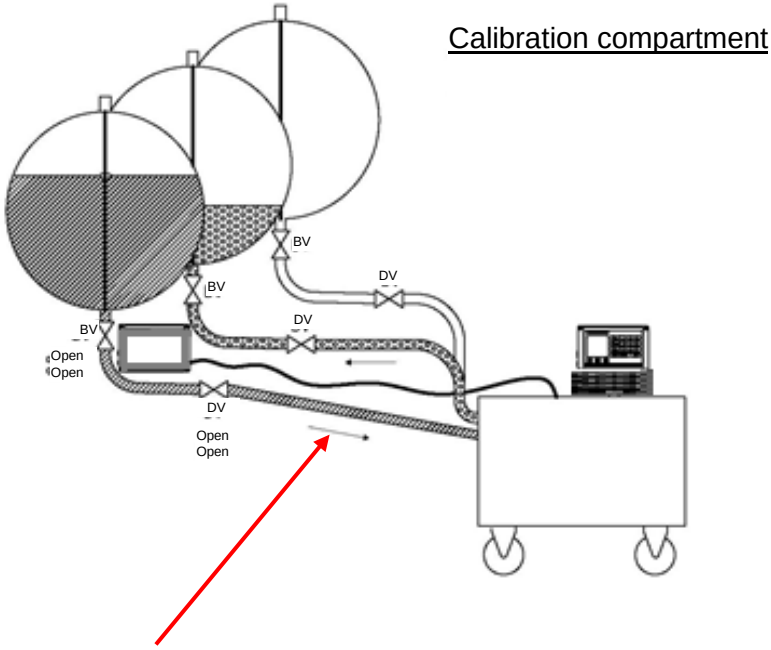
All components of the CAN buses used must be detected.

Error messages, such as *checksum error, level table*, *inclination table*, etc. are OK and must disappear after the parameters have been entered, see below!

4. Is the vehicle securely jacked up and aligned at 0°?



5. Does the hose line to the calibration unit have a sufficient gradient?



CAUTION:
The vehicle must be jacked up to such a height that the hose between the vehicle and the calibration unit runs on a gradient!

If the hose has an insufficient gradient, it is difficult to pump, as the venting does not work optimally.

6. Is the correct compartment number entered?

7. Were the angle corrections applied correctly and the vehicle "reset"?

8. Have all the relevant height parameters been accepted correctly and the height "reset"?

9. Filling the compartments with water:

In what order should the compartments be calibrated?

Is there enough water available for calibration?

Have the right compartments been filled?

CAUTION:
Only 200 measured values distributed over the max. fill level (= float MAX) are available. Overfilling (manually) above this level of more than 10 mm is not permitted, as otherwise the last level readings in the lower range cannot be saved during calibration!

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

11. Is the weight distribution such that a safe level of the vehicle is ensured before and after calibration?

12. Are the cabinet doors or the pneumatic switches locked in such a way that no bottom or line valve is blocked?

13. Is the K-block pulled?

If the valves are to be operated manually, the compressed air switch must still be supplied with air, otherwise MultiTask will generate an error message.

7 Calibration Unit Checklist

14. Is the calibration unit connected to the MultiTask on the vehicle via the Ethernet cable?

15. Is there power and air supply for the calibration unit?

Required: 400 V, min. 6 bar.

16. Are the hose lines connected correctly and all connections tight?

17. Is the calibration unit connected to the compartment that is also being calibrated?

The hose must be connected with a gradient to the compartment that is to be calibrated. If possible, a clear hose should be used.

18. Where should the water be pumped?

Are the associated hoses of the calibration unit connected correctly?

19. Are all the calibration parameters entered correctly?

20. Does the MultiTask switch to the calibration mode when the calibration software is started?

21. Is the optional backflow lock in the OPEN position?

22. If all points are OK, calibration can be started.

8 Operating Instructions

!!! Important!!!

To avoid damage to the system, **BEFORE** pressing the "ON" button, make sure to establish the Ethernet connection to the MultiTask and start the notebook!

9 Address and Contact

Our service department will be happy to support you and can be reached at:

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