Operating Manual

Test Calorimeter for
the Semi-Adiabatic Langavant Method
EN 196-9

(Version 1.12)

Calorimeter test set
for the semi-adiabatic Langavant method
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Importance of this Operating Manual:

Be sure to completely read this Operating Manual, so that you become sufficiently familiar with its contents, before you place this equipment into operation.

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1 Basic information and instructions

1.1 Designations

Designation of the Manufacturer:	Please see the first page of this Operating Manual
Designation of this equipment	Please see the designation plate on the system, which shows the complete parameter data.

1.2 Purpose for which this system has been designed

This Operating Manual contains the information required for operation of the products described here, for the purpose for which they have been designed. This Operating Manual is intended to be used only by technically qualified staff.

"Technically qualified staff" is defined as those persons who – as a result of their training; their experience; the instructions which they have received; as well as their knowledge of the relevant standards, regulations, accident-prevention regulations, and conditions of product operation in the company – have been authorized by the person responsible for the safety of the company facilities to carry out the activities and actions required for operation of the products described below, and who can recognize and prevent any possible dangers arising from such operation (this definition of technically qualified staff).

The User must by all means observe the requirements and limit values, as well as all safety instructions, given in this Operating Manual. Any use of this device not in conformity with these stipulations shall be considered to be in violation of the use for which this system was intended. If this device must be operated under special conditions, or with special modes of operation, then this shall be authorized only after consultation with the Manufacturer, and after obtaining his prior and express approval.

This system serves only for determination of the heat of hydration in fresh mortar. The testing procedure consists of placing a sample of fresh mortar into a calorimeter, and determination of the amount of heat released on the basis of the temperature development that takes place.

Caution	The instructions given in this Operating Manual apply only for the correct application on the system. In order to correctly conduct tests, the User and Operator must observe the specific standards that apply for the testing being conducted.

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This operating manual contains safety instructions that are to be observed in order to exclude any risk of fatalities, injuries, damage to the equipment or improper operation. Safety markings are as follows:

Caution!	This warning refers to dangers that could cause material damage.
Danger	This warning refers to dangers that could cause severe injuries or even fatalities.
Note	Provides practical advice on operation

1.3   Purposes for which this system has NOT been designed

This system has not been designed for the following purposes, and cannot be used under the following conditions:

- The storage of explosive or chemical substances in the calorimeter
- Exceeding the maximum testing temperature of 80°C
- Bending (crimping) the temperature sensors and the temperature cables

Do not take the equipment apart, and do not try to repair or modify it.
Do not cover the calorimeter. There must be sufficient free room around the unit so that the testing can take place in accordance with the relevant standards.

1.4   Guarantee

Our **General Terms of Business** shall apply (*Allgemeine Geschäftsbedingungen*).
The Manufacturer guarantees that this Operating Manual was prepared in conformity with the technical and functional parameters of the product as delivered.
The Manufacturer reserves the right to add supplementary information to this Operating Manual.

The Manufacturer grants the legally stipulated guarantee. This guarantee does not cover wear parts.

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The Manufacturer guarantees trouble-free operation of this device only if the User properly follows the instructions in this Operating Manual, and only if the User employs this device in accordance with its intended use.

The Manufacturer may not be held liable for any damages which arise from employment of this device that is not in accordance with its intended use, or which arise from the User's failure to follow the instructions and stipulations contained in this Operating Manual.
The Manufacturer shall not be obligated to satisfy any claims under this guarantee in the event that the User makes any structural or component modifications to the product, or if the User modifies the product with respect to its functional state, without the express, prior, and written consent of the Manufacturer.
Any violation of the stipulations contained in the above can be punished in a court of law.

1.5   Safety instructions

The operating person must take care not to endanger his or her own health and safety, or the health and safety of other persons. Only those persons may independently operate this system who have received sufficient training in the operation of this system.
If defects or damages to this system occur that impair its operational safety, the system must immediately be taken out of operation. It may be put back into operation only after all sources of danger have been eliminated.

Operate this system only for the use that is described in this Operating Manual. Any use of this system for purposes for which it is not intended will invalidate the guarantee.

This system has been designed and built in accordance with the state of the engineering art and with the accepted rules of good engineering practice. The use of this system, however, can result in danger to life and limb of the Users and third parties, and can cause damage to mechanical-engineering components and other items of property.

If there are any malfunctions or other trouble that could cause dangerous situations to arise in work with this system, these difficulties must be immediately corrected before working with the system.

Warning	The mixing of cement with water causes the release of alkaline substances. In working with concrete, it is essential to take all necessary precautions to prevent dry cement from entering the eyes, mouth, or nose. Use protective clothing to prevent skin contact with wet cement or concrete. If cement or concrete enters the eyes, immediately and carefully wash out the eyes with clean water. Seek medical help without delay. If moist concrete comes into contact with the skin, wash it off immediately.

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Any changes to or modifications of this system (of electrical, mechanical, or any other nature) shall not be allowed unless the Manufacturer has provided his prior, written, and express consent. Any such changes performed without the Manufacturer's consent are prohibited, and the Manufacturer shall accept no claims for damages that result therefrom. Any removal or modification of safety devices on this system shall be considered a violation of EEC safety standards. The Manufacturer cannot accept any liability for damages that result.

1.6   Acceptance of the product and transport
1.6.1 Acceptance of the product

When accepting delivery of the product, first inspect it for its outer, visible condition. If this inspection is satisfactory, the system may be accepted from the freight forwarder (package service, courier, or other forwarding business).
If there are no shortcomings, and if there are no transport damages, then use the bill of delivery to make sure that the consignment is complete, and that all parts have been delivered.
If you assume or suspect transport damage, or if transport damage becomes apparent only after you have accepted the delivery, immediately make an exact report of the conditions and any damage as they exist. Send us this report immediately by fax or e-mail.
Important: Absolutely do not make any changes to the delivered goods.

After we have studied your report, we can make a decision whether we can correct the difficulties by one of the following options:

- Deliver spare parts to you, or
- Send a specialized fitter/installer to your plant, or
- Ask that you return the system to us for repair.

1.6.2 Transport

This system will be delivered in the appropriate cardboard boxes. In order to prevent transport damage, the remaining hollow spaces in the interior of the boxes will be filled with bulk material.
After you have unpacked the system, make a visual inspection to determine whether it was damaged during transport. In cases of doubt, in which you believe the system may have been damaged, do not connect it, and get in touch with your dealer or sales person.

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Caution	Do not allow children to have access to the packing material (plastic, polystyrene, screws, nails, wood, etc.). Make sure that these materials are safely disposed of in accordance with local regulations.
	Before disposing of the packing materials, make sure that no accessories, operating instructions, documents, or spare parts are in the packing materials.

This system must be set up in accordance with the stipulations set forth in the relevant standard.

1.7   Scope of delivery

Standard equipment
1 x   reference calorimeter with temperature senor and connecting cable
1 x   test calorimeter with temperature sensor and connecting cable
1 x   data logger with network cable
                (for connecting a maximum of 4 calorimeters)

Maximum configuration
1 x   reference calorimeter with temperature sensor and connecting cable
up to 7 x   calorimeters with temperature sensor and connecting cable
2 x   data logger with network cable
                (for connecting a maximum of 8 calorimeters)

Accessories:
1 x package mortar containers
1 x   inert mortar container or aluminium cylinder for the reference calorimeter
1 x   applicator rod for the mortar containers
1 CD   Langavant analysis software for calculating the hydration heat

Optional:
Windows PC
Calibration-Set

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2. Commissioning

2.1 Hardware and software requirements

The following hardware and software requirements must be met to operate and install software:

Minimum configuration
- Intel Pentium[1] III or higher,
- Microsoft Windows[2] XP SP3 or later version
- 256 MByte central memory
- CD drive
- One free USB port for each data logger
- 200 MByte of free hard disk space

2.2 Data logger and USB driver

The USB driver has to be installed for acceptable data transfer (from the CD or update from the Internet).

2.3 Connecting devices

Connect the temperature sensors to the recording device. The recording device is connected to free USB ports on the computer.
Be careful with the channel assignment

	Channel
Reference calorimeter	REF
Calorimeter 1	1
Test calorimeter 2 etc.	2 etc.

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3 Characteristics of the equipment delivered

3.1 Test Calorimeter

The Test Calorimeter with No. 1 and following consists of a thermos vessel with a thermally insulating closure and a stable aluminium enclosure that serves as a mount.

External dimensions	Ø (diameter) of 180 mm x 400 mm
Weight (mass)	4.5 kg
Thermos vessel	Ø (diameter) of 100 mm x 240 mm
Interior rubber disk	Ø (diameter) of 95 mm

3.2 Reference calorimeter

The reference calorimeter with No. REF has the same structural features and the same properties as the test calorimeter.

3.3 Mortar container

This container is used to hold the mortar sample that is separated after each test. This container is water-vapour proof, and the cover (lid) is provided with a cylindrical thermometer fitting in its centre.

Dimensions	Ø (diameter) of 84 mm x 162 mm
Volume	approx. 880 cm³
Thermometer fitting	Ø (diameter) of 10 mm x 100 mm

3.4 Temperature recording

Temperature sensor	Pt 100
Length of connection cable	2.5 m
Accuracy class	A, in accordance with DIN 60751
Temperature-recording unit	Desktop model, 140x190x40 mm
	1 … 4 channels

The maximum recording time for the software is 7 days = 168 hours. The test can be stopped at any time.

Note:	For a secure data recording the PC must be connected during the test in standby or in hibernation.

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3.5 Operation of the software

The PC analysis program can run under Windows NT, 2000, XP, 7, 8. It serves for administration, archiving, visualization, and analysis of the data.

The data are read in by the analysis program and are saved in an archive file. The data-management functions ensure that all data are saved in an archive file. The user interface is mouse and keyboard.

We definitely recommend that you familiarise yourself with the software and its operation before the initial test.

The software offers the following recording options:
- Independent individual tests from a maximum of 7 different samples
- Combined measurement of a maximum of 7 of the same samples

The test data, calibration data and the net weights
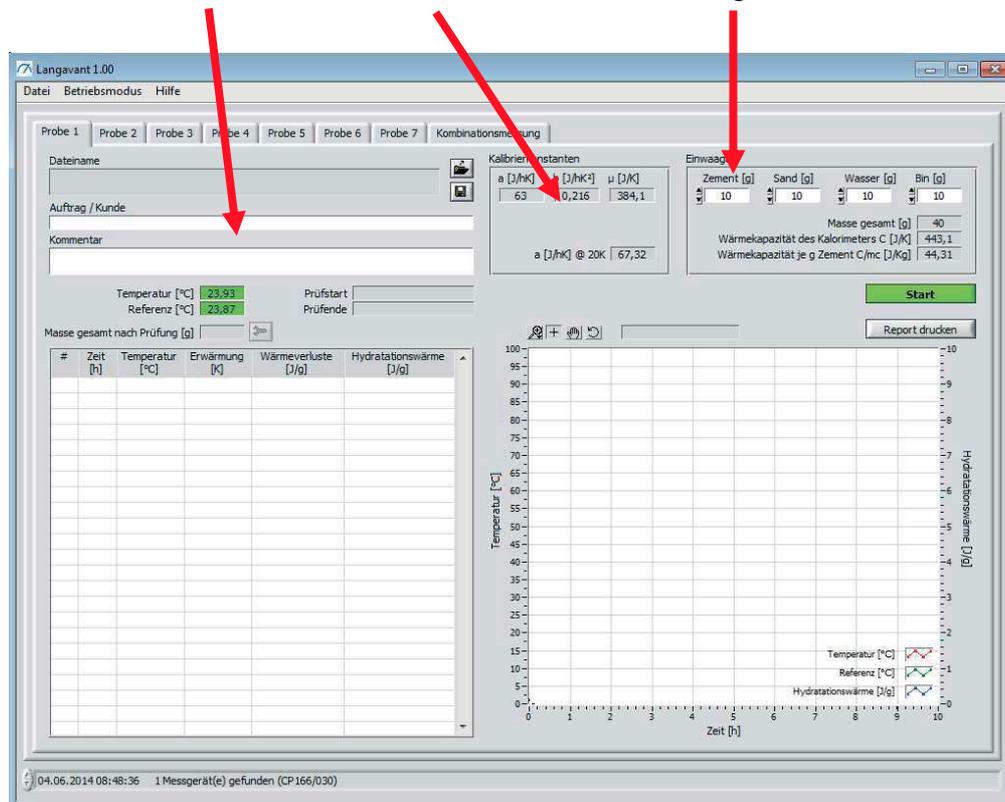
must be checked and entered for the connected calorimeter before each start.

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3.6   Calibration

This system is delivered with test certificates. The measuring equipment used is checked at regular intervals.

As stipulated in the relevant standard, a new calibration must be performed.

- At least every four (4) years, or after every 200 tests
- If the calorimeter or one of its thermal-insulation components is damaged.

3.7   Determination of the heat of hydration

EN 196-9 stipulates that the room temperature of the laboratory must be 20 ± 2°C for mixture of the mortar and for conduct of the testing.
The interval between the calorimeters must be approximately 12 cm.
The speed of air movement in the vicinity of the calorimeter must be less than 0.5 m/s (in other words: **no draughts!**).

Sequence of testing:

- Weighing the amount of the test sample
- Preparation of the equipment
- Start software
- Mixing the sample material and filling it into the mortar container
- Placing the mortar container into the calorimeter and closing it
- Enter test values in the software
- The temperatures are recorded and displayed on the screen
- After completion of the reaction period: Stop recording
- Removing the mortar container and weighing it
- Data is stored and recorded

3.8   Composition, Mixing, Inserting of the mortar

The test sample must have a total mass of 1575 ± 1 g. It must consist of the following mass proportions:

Cement   (360.0 ± 0.5) g
Standard CEN sand   (1080.0 ± 1) g
Deionised water   (180.0 ± 0.5) g

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Recommenda-tion (i) :	Under consideration of the mixing relationship, the mass of the mixture should be slightly more than 1575 g, since residue will always remain in the mixing bowl.

Weigh the empty mortar container, including cover, to a precision of ± 0.5 g.

Fill the thermometer fitting on the cover of the mortar container with oil. The required amount of oil must be determined while the thermometer is inserted.

All equipment and containers for mixing must have been stored in the testing room.

When the mixer is ready for operation, then first fill the sand into the trough, and then fill the cement. Homogenize this mixture for 30 s at slow speed.

Then add the water and continue to mix for 60 s at slow speed. Then mix for 60 s at high speed.

Note (i)	The above-given times for testing are shorter than those given in EN 196-1, in order to prevent heat losses.

Immediately after mixing, weigh 1575 ± 1 g of mortar into the mortar container. Set the cover of the container in place, so that it tightly closes.

Then weigh the filled mortar container to a precision of ± 0.5 g. This will enable determination of any escape of water vapour after the test.

The total mass of the sample can be adjusted subsequently. The individual masses of cement, sand and water follows the proportional change; the mass of the empty can remain unchanged.

After weighing, use the supplied insertion hook to place the mortar container in the centre of the Test Calorimeter. Immediately afterward, set the cover with the thermometer in place, and tightly close the Test Calorimeter.

The time for the mixing and placing the test sample in the unit may not be longer than 6 min.

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4   Software installation

The installation program installs the necessary files for you and creates the associated program group. To do this, start the <setup.exe> program, which then carries out the complete installation.
You still have to install the drivers for the USB data logger (Pico PT-104) before the initial start.

Ensure that the current user has write permissions for the directory with the configuration files used by the program. Assign these permissions manually, if necessary.

This directory may be hidden under certain circumstances. Therefore, activate the option to also show hidden directories in Windows Explorer.

In XP/Vista/Windows 7 you can also install the program in any other directory outside the standard installation directory (e.g. <C:\XYZ\Langavant>). The user must also have write permissions for this directory.

5   Program start
5.1   Entering the serial numbers

The program requires a valid licence at the start. If there is no valid licence available, the Licence Editor (menu option "Hilfe [Help] | "Lizenz" [Licence"]) opens automatically. Let the seller of the software know the computer-specific licence ID that is displayed top right. You will then be given a matching serial number that you enter in the field provided. Then activate the licence that belongs to the serial number using the "Lizenz aktivieren" [Activate licence] key; the validity period for the activated licence will then be displayed for you.

Image 1:   Licence Editor (without licence/with activated licence)

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The following data appears in the status bar as soon as the installation is complete:
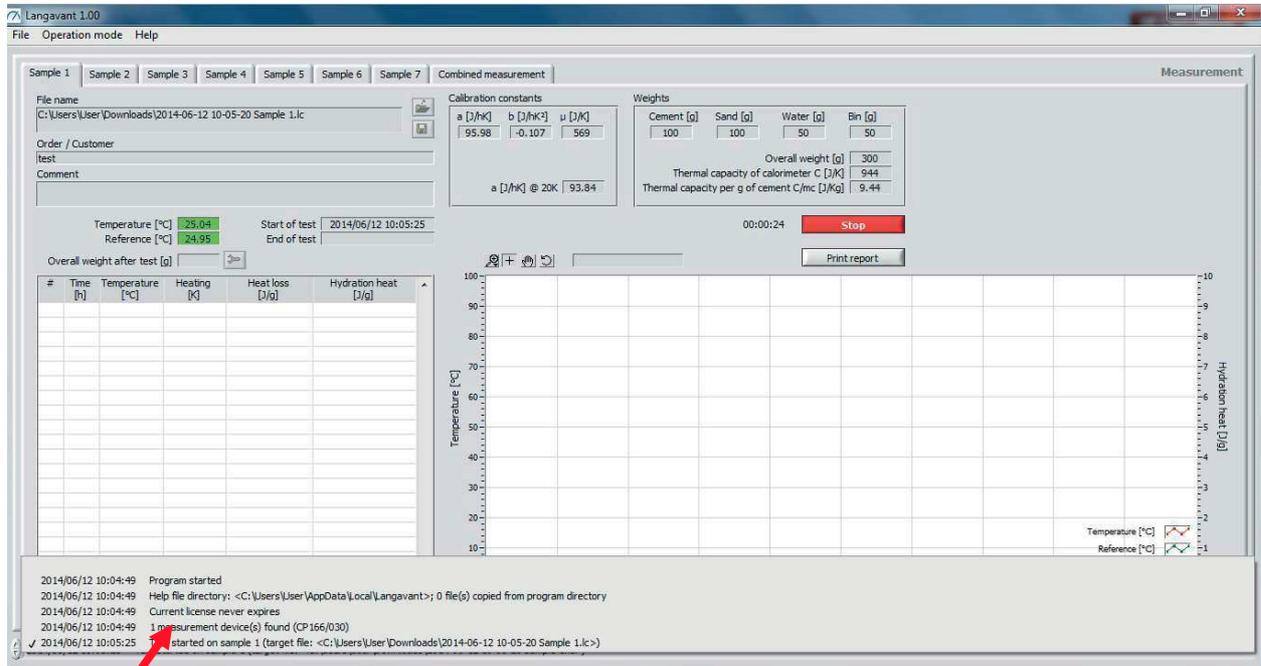
Working directory
Licence assignment
Connected devices
Directory for the saved test data

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5.2 Program interface

The following interface appears at program start:
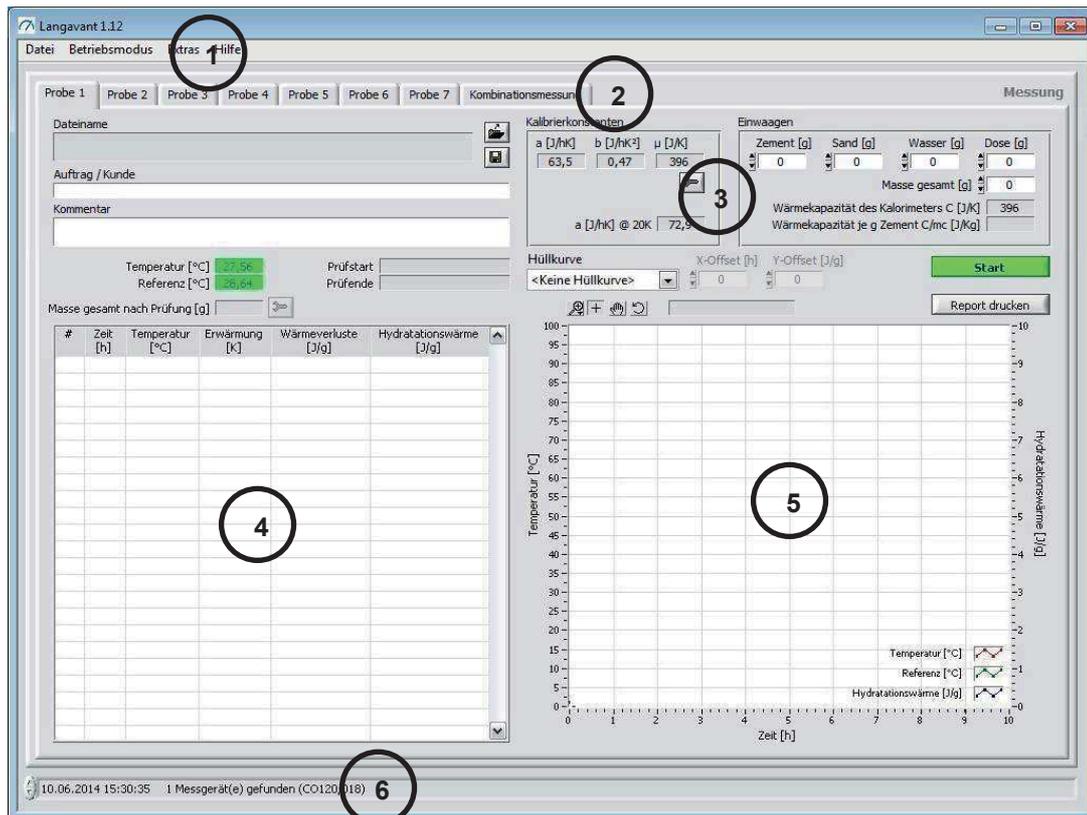
Image 2:   Program start

The interface is divided into the following components:

1. Menu bar
2. Tabs (7 samples + combined measurement)
3. Parameters for setting up a measurement
4. Measured data table
5. Measured data diagram
6. Status bar

The program immediately starts to record and display the current temperatures via the connected measuring devices. If the sensor belonging to the selected sample is switched on, its temperature will be displayed with a green background. Otherwise, the field will be blank and highlighted in red.

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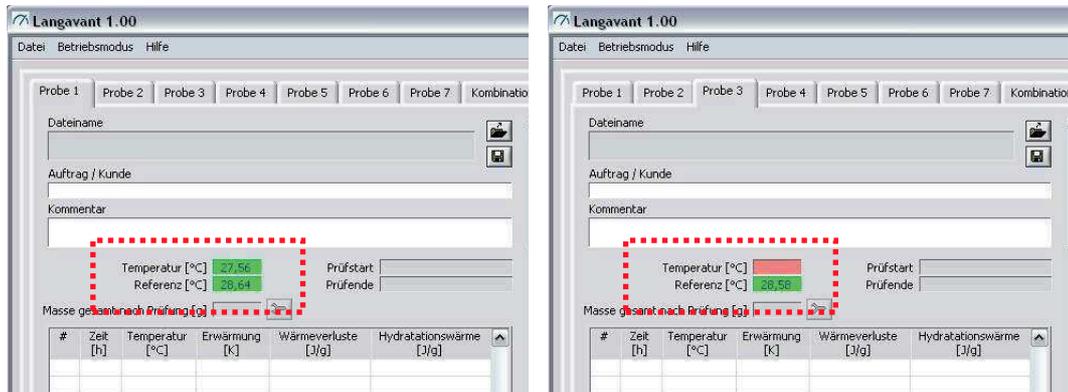
Image 3:   Temperature sensor switched on/switched off

Should no measuring device be connected, the following message appears at program start:

Image 4:   No measuring device connected

In this case, you can only use the program to view and print out measurements that have already been carried out.

5.3   Selecting program language

The menu item "Extras" | "Select language ..." you can select the language used by the program. All available languages are stored in the file<Languages.ini>. Please note that when choosing a new language, the program must be restarted for the change to take effect.

5.4   Test preparation

Before commissioning please check the preset calibration parameters with the actual parameters on the label of the calorimeter. Using the tool icon, you can adjust the parameters for each channel / registration card. Even after the calibration the parameters need to be checked.

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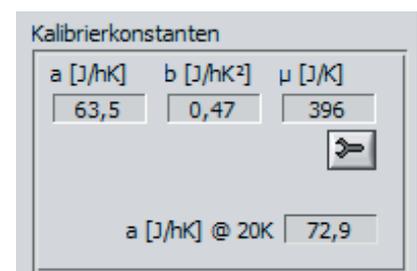
note ⓘ	The review of the parameters is essential for the calculation.

5.4.1 Sample selection

Select the tab of the sample at which you want to start measuring. The tabs work independently of one another, i.e. they can measure several samples simultaneously – even with a time delay.

5.4.2 Sample configuration

Enter the parameters required to carry out the measurement (*: mandatory field):

- **Order/customer:** Order designation and customer name (single line)
- **Comments:** Free comment field (single line)
- **Net weights**
    - **Cement [g] *:** used amount of cement: absolute mixture proportion; Mixture proportion in %, used amount in g or overall mass in g
    - **Sand [g] *:** used amount of sand: absolute mixture proportion; Mixture proportion in %, used amount in g or overall mass in g
    - **Water [g] *:** used amount of water: absolute mixture proportion; Mixture proportion in %, used amount in g or overall mass in g
    - **Bin [g] *:** Weight of the emty bin in g
    - **Total mass [g] *:** sum of each amount of cement, sand, water and bin. When value changes the specified individual amounts of cement, sand and water to be adjusted proportionally

Example 1:
Input of values for a known mixing ratio (here 1 part cement, 4 parts sand, ½ part water). The weight of the empty bin is 50g.

    Cement [g]: 1
    Sand [g]:   4
    Water [g]:   0.5
    Bin [g]:   50

The overall mass is displayed with 55.5 g

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Set the mixture as indicated in the ratio. Fill all in the bin, close the bin and weight the full bin. Enter the overall mass in the field mass, i.e. 550g. Now you get automatically all indivual corrected masses based of the ratio. (In this case 90.91g cement, 363.64g sand and 45.45g water.)

Example 2:
Input of the individual mass which used for the mixture. (here 200g cement, 800g sand, 100g water). The weight of the empty bin is 50g.

The overall mass is displayed with 1150 g

Set the mixture as indicated. Fill all in the bin, close the bin and weight the full bin. Enter the overall mass in the field mass, i.e. 550g. Now you get automatically all indivual corrected masses based of the ratio. (In this case 90.91g cement, 363.64g sand and 45.45g water.)

5.4.3 Loading/saving result data as a template

You can save the complete configuration of a sample in a result file as what is known as a "template" and use it again later.
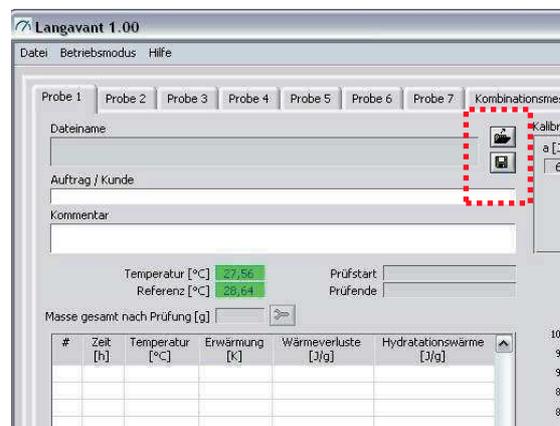
Image 5:   Loading/saving result data as a template

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The "Ergebnisdatei laden" [Load result file] key opens a file dialog, with which you can load an existing result file into the interface and use it as a template. You can store the entire test configuration in a test file using the "Parameter als Vorlage in Ergebnisdatei speichern" [Save parameters as template in the result file] key. However, compared with a normal result file, this file then does not contain any measured values. Langvant suggests "<Date> <Time> Sample template <x> as a file name.
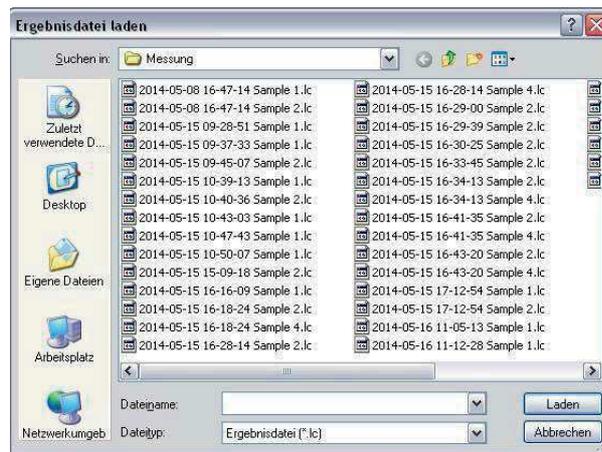
Image 6:   Loading result file
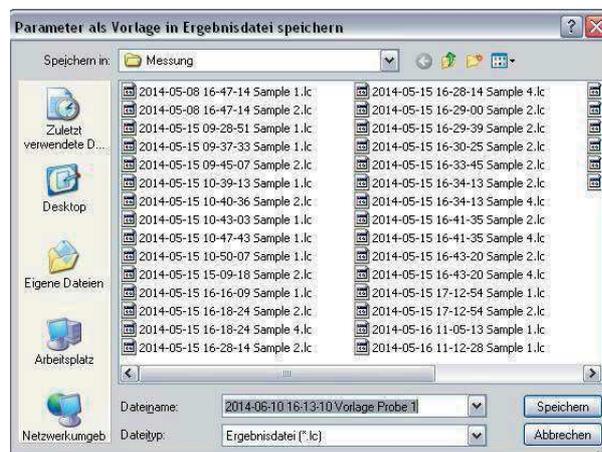
Image 7:   Saving parameters as a template in the result file

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5.5   Carrying out test
5.5.1 Starting test (single measurement)

All samples can be tested independently of one another. The test for a certain sample is started by pressing the "Start" key. First, a parameter check is carried out to ensure that the configuration of the sample is correct and complete. If any errors are identified, a dialog appears with a list of those errors.

Image 8:   Parameter check

You can save the contents of the list field as a text file using the "Als Textdatei auf Desktop speichern" [Save as text file on desktop] key. This text file is always saved under the name "Parameter check sample <x>.txt on the desktop. If this file already exists, it will be over-written.

You must correct the listed errors before you can start a measurement.

If no errors have been identified, a file dialog is displayed in which you can select the target file in which the parameters and measurement data are to be saved. Langavant suggests "<Date> <Time> Sample <x>.lc to you as a file name.
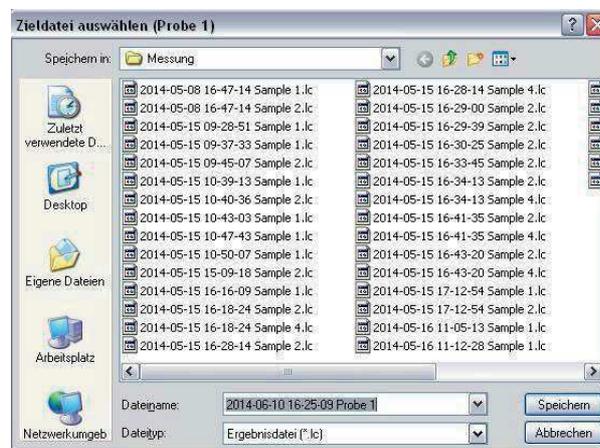
Image 9:   Selecting the target file

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The test of the selected sample starts after "OK" is pressed. The "Start" key changes to a "Stop" key. The test start is entered into the sample configuration, and a clock next to the "Stop" key displays the time that has already elapsed.
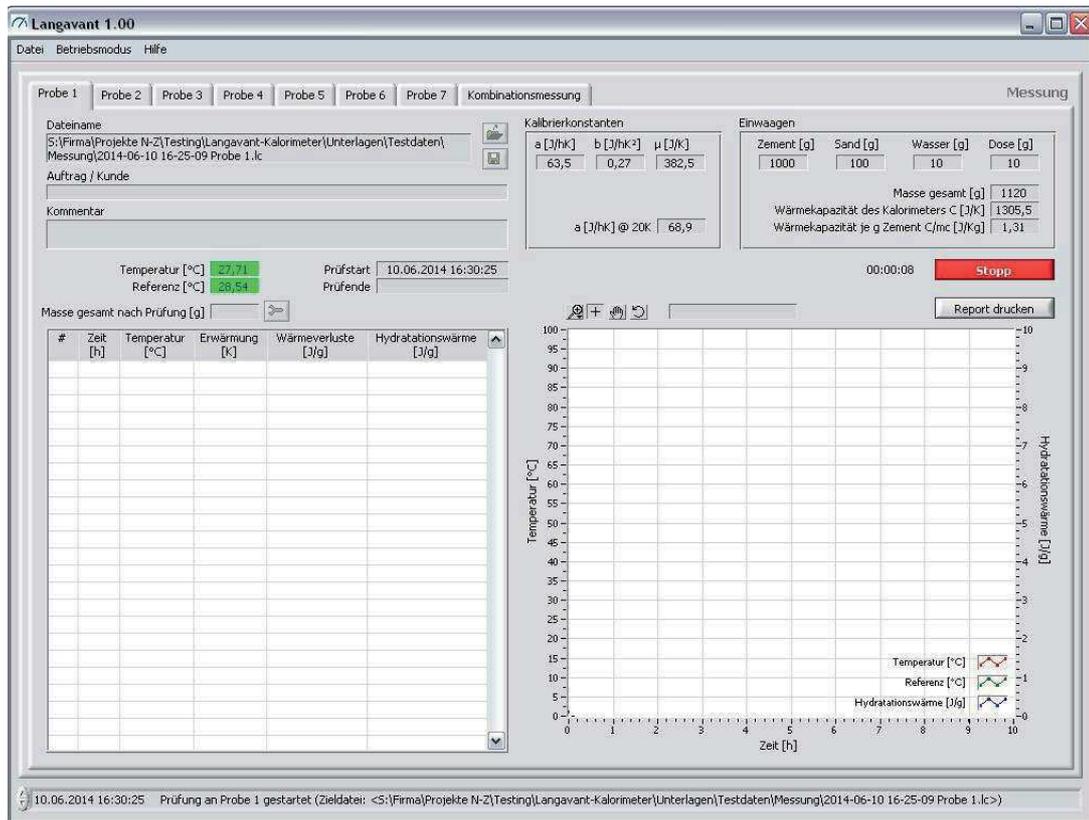
Image 10:   Measurement is running

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5.5.2 Starting test (combined measurement)

With Langavant you can bundle the simultaneous measurement of several samples into what is known as a combined measurement. Configure each individual sample, as described in the chapter and then switch to the "Kombinationsmessung" [combined measurement] tab. Enter the parameters required to carry out the measurement here (*: mandatory field):

- **Order/customer:** order designation and customer name (single line)
- **Comments:** free comment field (single line)
- **Samples involved *:** (key pressed: sample is being used) for samples used for the combination measurement.

The combined measurement is started by pressing the "Start" key on the "Kombinationsmessung" [Combined measurement] tab. First, a parameter check is carried to ensure that the configuration of the sample of the combined measurement AND the configuration of each individual sample involved is correct and complete. If any errors are identified, a dialog appears with a list of these errors.

If no errors have been identified, a file dialog is displayed in which you can select the target file in which the parameters and measurement data are to be saved. Langavant suggests "<Date> <Time>.lcc to you as a file name.
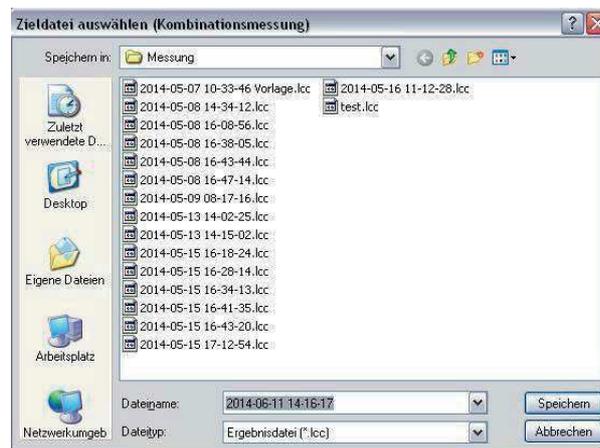
Image 11:   Selecting a target file (combined measurement)

The test starts synchronously on the selected samples after you press "OK". The "Start" key on the "Kombinationsmessung" [Combined measurement] tab and on the tabs of the samples involved changes to a "Stop" key. The test start is entered into the sample configurations, and a clock next to the "Stop" key displays the time that has already elapsed.

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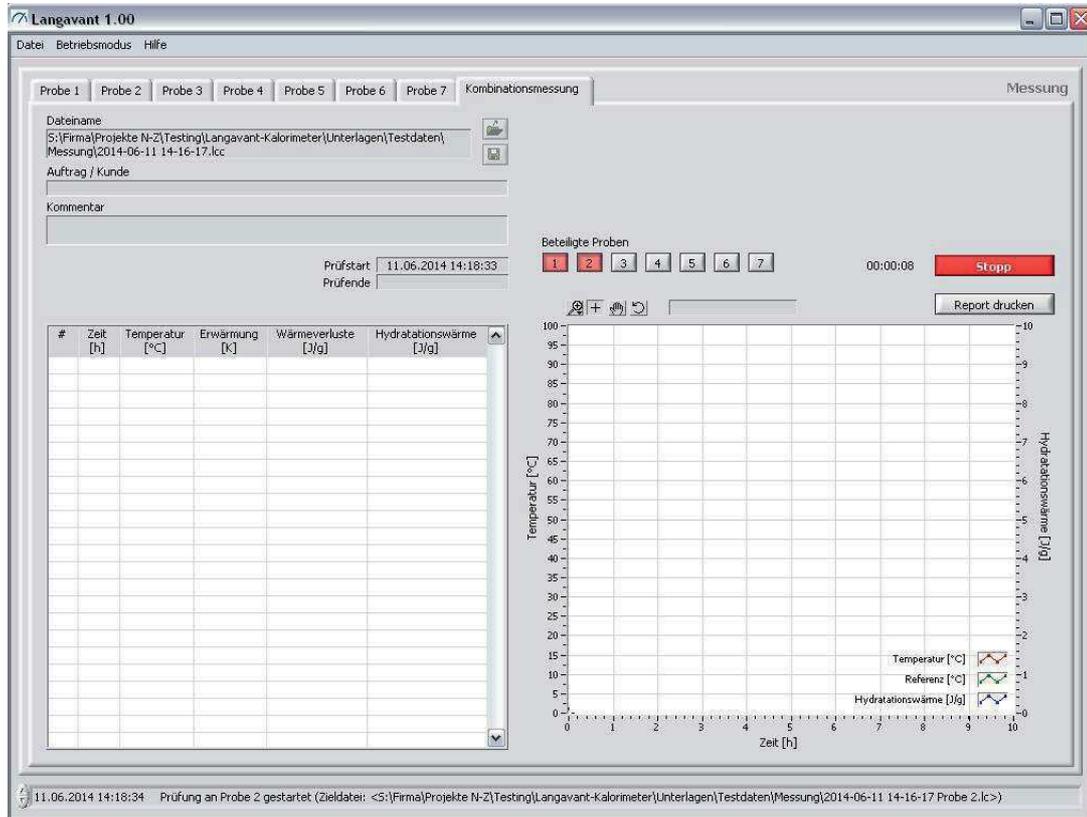
Image 12:   Measurement is running (combined measurement)

5.5.3 Measured values

The measurements are made in a time period that is saved in the configuration file <System.ini>. The identified measured values are displayed as a table and as a diagram.
The diagram has a tool bar. Parts of the diagram can be magnified by using the magnifying glass icon. You can move the diagram with an activated hand icon. If the cursor function ➕ is activated, you can display the co-ordinates for the next data point by clicking the left mouse key.

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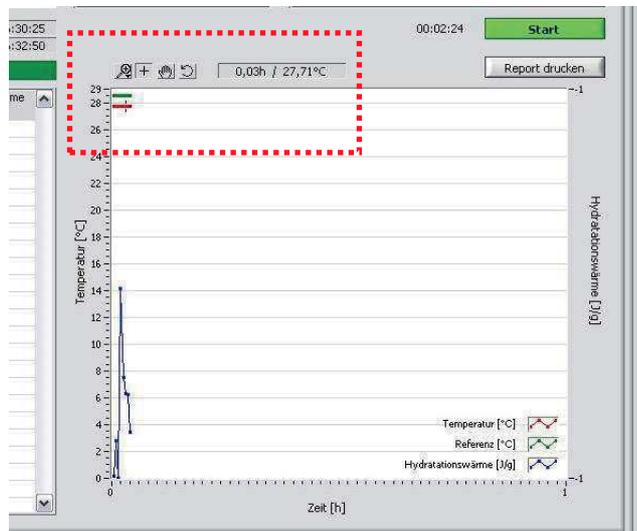
Image 13:   Diagram tool bar and co-ordinates display and envelope

Recreate the original display using ⟳.

Further, via the envelope selection box you can blend an envelope created previously with the envelope editor into the curve and move it horizontally and vertically via the numeric inputs "X-Offset [h]", and "Y-Offset [J/g]".

You are able to print out a report on your desired printer using the "Report drucken" [Print report] key. It encompasses the parameters, the diagram and a measured data table. You can adjust the report individually using the configuration file <Report.ini>.

Image 14:   Report example

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5.5.4 Test end

Testing of a sample ends automatically after the last measured point of the time window saved in the configuration file <System.ini> (normally 168 h). If you want to end testing of the sample early, press the associated "Stop" key. If the sample is part of a combined measurement, the entire combined measurement must be ended.

In both cases, you will be asked to enter the overall mass that the sample still has at the end of the test.
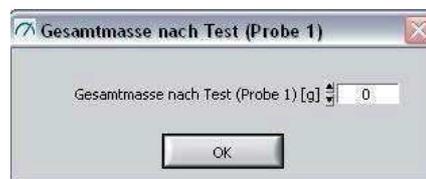
Image 15:   Overall mass after test

The entered mass may not be less than 2 g of the overall mass at the start of the measurement. Only then is the test valid.

The "Stop" key again becomes a "Start" key after the entry is confirmed with the "OK" key, and the end of the test is entered in the test configuration.

Image 16:   Test ended

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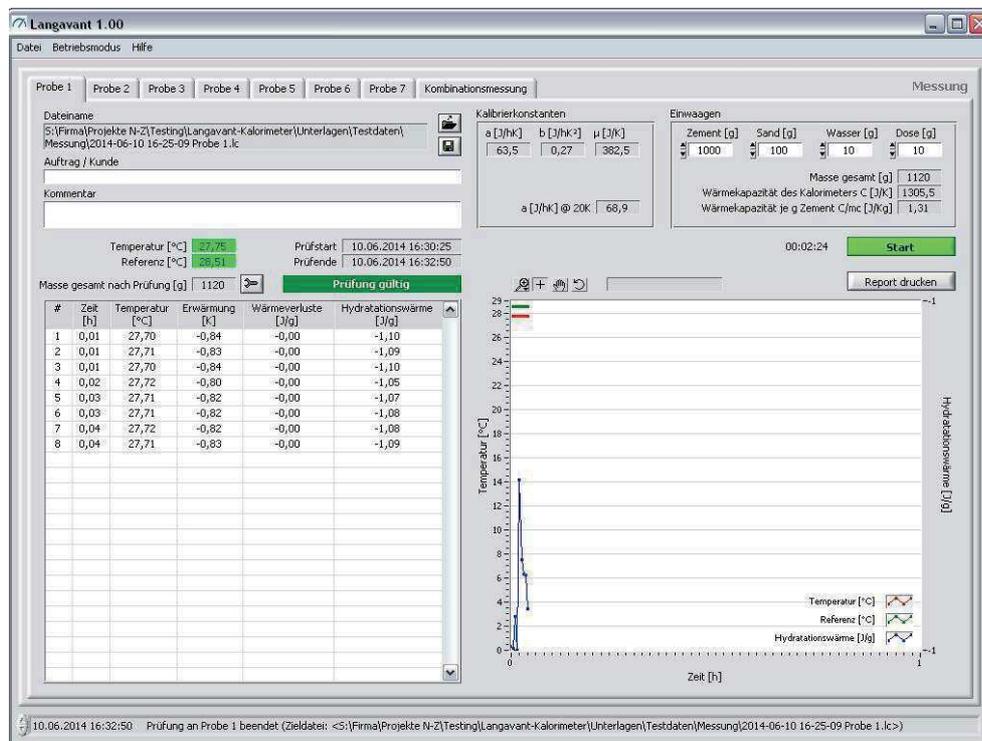
The overall mass after the test is displayed in the parameters, and a text field highlighted green or red below the test end shows whether or not the test is valid.
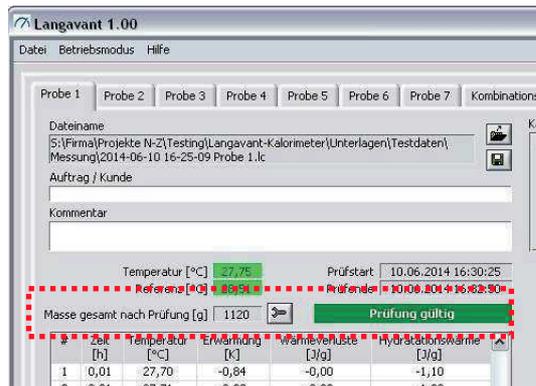
Image 17:   Is the test valid?

If you type in the wrong entry for the final mass, you can subsequently change the value by pressing the ⚒ key. The test result is adjusted dynamically, if required.
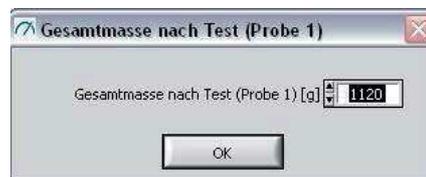
Image 18:   Edit overall mass after test

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5.6 Calibration mode

You can switch between the two modes "Messung" [Measurement] and "Kalibrierung" [Calibration] using the "Betriebsmodus" [Operating mode] menu option. The current operating mode is marked with a checkmark in each case. Switching is only possible, if no measurement or calibration is currently running.

Image 19:   "Kalibierung" [Calibration] operating mode

5.6.1 Sample selection

Select the tab of the sample at which you want to start a calibration. The tabs work independently of one another, i.e. they can measure several samples simultaneously – even with a time delay.

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5.6.2 Sample configuration

Enter the parameters required to carry out the configuration (*: mandatory field):

- **Comments:** free comment field (several lines)
- **Calibration cylinder parameters**
  - o **Resistance [Ohm] *:** resistance of the heating spiral in ohm
  - o **Weight [g] *: weight of the cylinder in g**
  - o **Specific thermal capacity [J/gK]: specific thermal capacity of the** cylinder in J/(g*K) (e.g. 0.896 for aluminium, 0.382 for copper, s. https://de.wikipedia.org/wiki/Spezifische_W%C3%A4rmekapazit%C3%A4t)

5.6.3 Loading/saving calibration file as a template

You can save the complete configuration of a sample in a calibration file as what is known as a a "template" and use it again later.
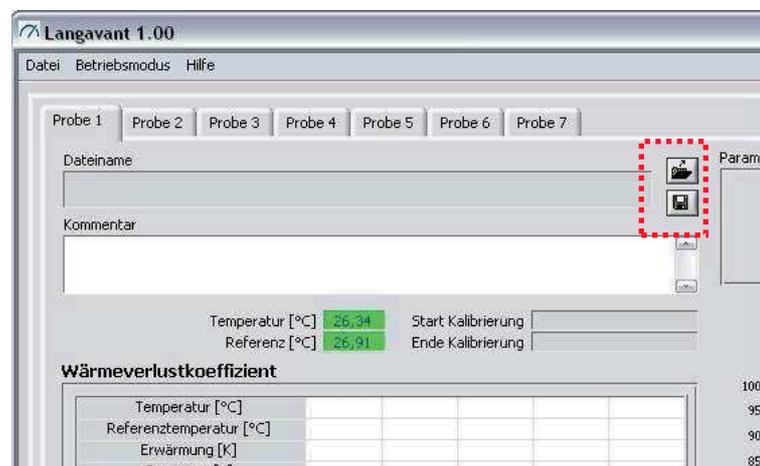
Image 20:   Loading/saving callibration file as a template

The "Kalibrierdatei laden" [Load calibration file] key opens a file dialog, with which you can load an existing calibration file into the interface and use as a template. You can store the entire test configuration in a calibration file using the "Parameter als Vorlage in Kalibrierdatei speichen" [Save parameters as template in the calibration file] key. However, compared with a normal calibration file, this file then does not contain any measured values. Langvant suggests "<Date> <Time> Sample template <x> as a file name to you.

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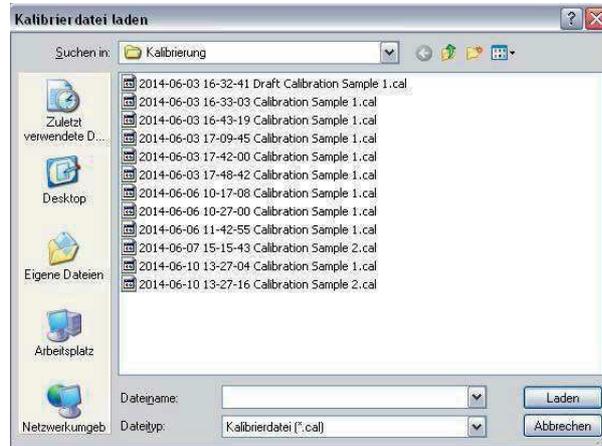
Image 21:   Loading calibration file
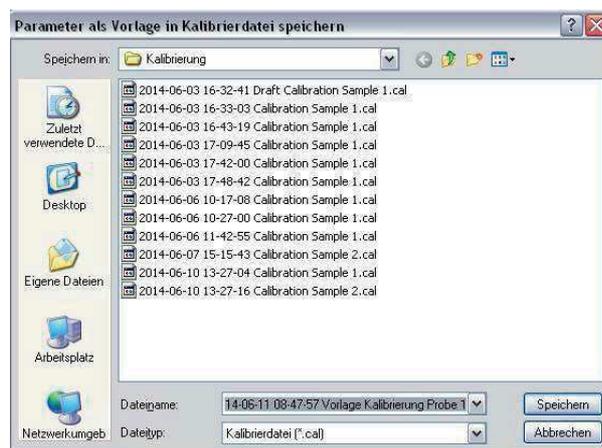
Image 22:   Saving parameters as a template in the calibration file

5.6.4 Starting calibration

All samples can be calibrated independently of one another. The calibration for a certain sample is started by pressing the "Start" key for this sample. First, a parameter check is carried out to ensure that the configuration of the sample is correct and complete. If errors are identified, a dialog appears with a list of these errors.

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Image 23:   Parameter check calibration

You can save the contents of the list field as a text file using the "Als Textdatei auf Desktop speichern" [Save as text file on desktop] key. This text file is always saved on the desktop under the name "Parameter check calibration sample <x>.txt". If this file already exists it will be overwritten.

You must correct the listed fields before you can start a calibration.

If no errors have been identified, a file dialog is displayed in which you can select the target file in which the parameters and measurement data are to be saved. Langavant suggests "<date> <time> calibration sample <x>.cal as a file name to you.
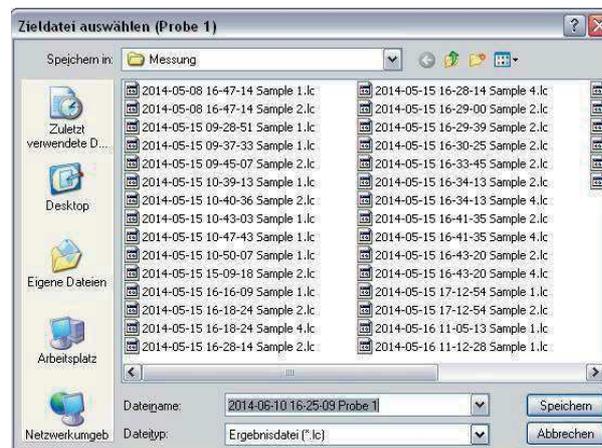
Image 24:   Selecting the target file

Calibration starts on the selected sample after you confirm with "OK". The "Start" key changes to a "Stop" key. The calibration start is entered into the sample configuration, and a clock next to the "Stop" key displays the time that has already elapsed.

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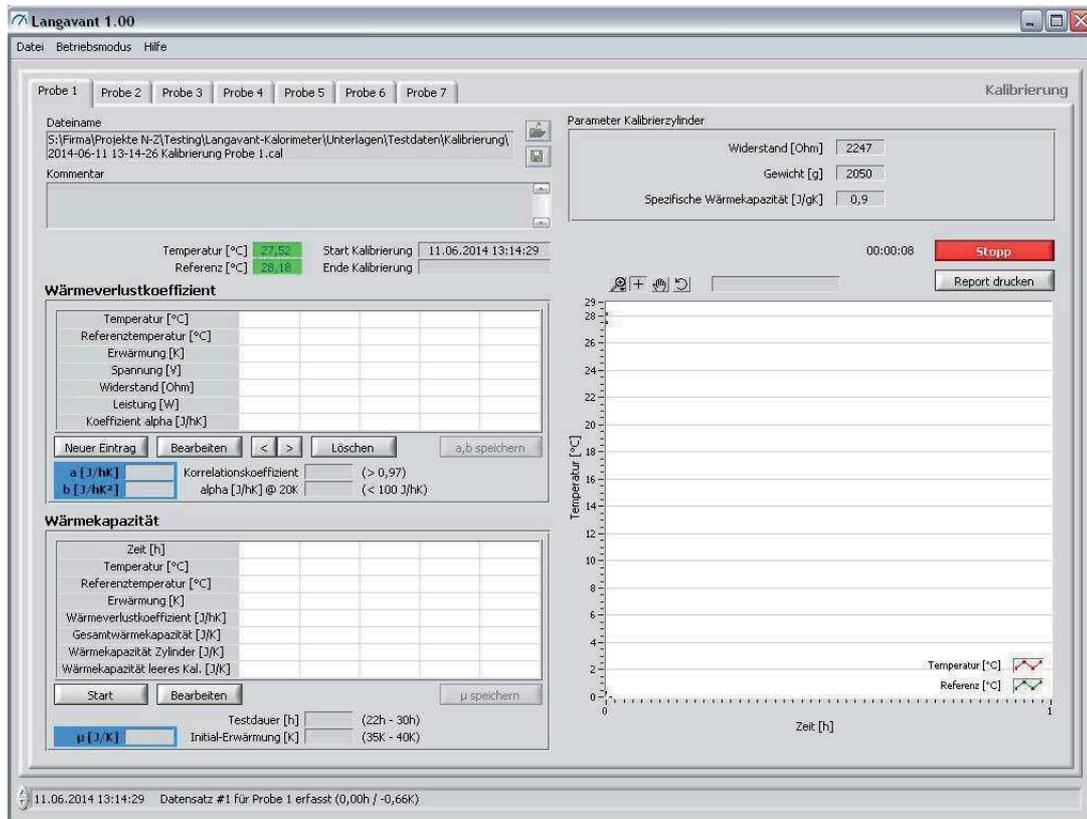
Image 25:   Calibration is running

5.6.5 Measured values

The measurements are made at a time interval that is stored in the configuration file System.ini>. The identified measured values are displayed as a diagram.
The diagram has a tool bar, and operation is similar to the "Measurement operating mode. You can print out a report on the printer you desire with the "Print report key".

5.6.6 Calibrating the heat loss coefficients

Heat loss coefficients are calibrated semi-automatically in accordance with EN 196-9:2003. The calibration cylinder is heated electrically. If the equilibrium state is achieved, you enter the heating voltage used with the "Neuer Eintrag" [New entry] key into the associated table; the cylinder temperature and the reference temperature are recorded automatically.

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Image 26:   Heat loss coefficient data file

The software calculates the associated parameters from these values and enters these in the table.
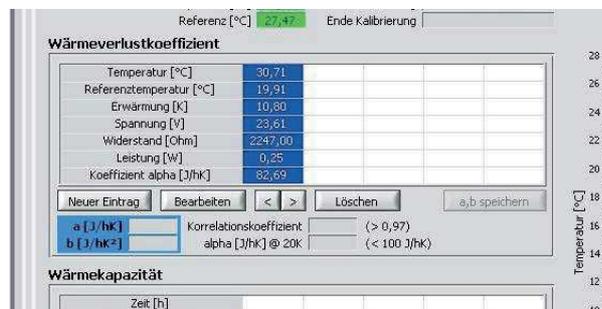
Image 27:   Entered heat loss coefficient data record

Then increase the voltage to calculate the next equilibrium balance until you have calculated a total of five data records. Based on the standard, the temperature rises of these five data records should be 10K, 17K, 24K, 31K and 38K.
After calculating the fifth data record, the software automatically calculates the coefficients a and b and determines whether the calibration is valid by using the correlation coefficients (must be greater than 0.97) and alpha @ 20 k (must be less than 100 J/hK).
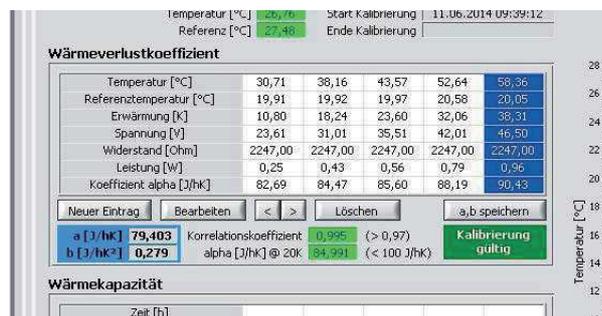
Image 28:   Calculating a and b

Should you have inadvertently made a typing error when entering individual data records, you can subsequently edit the entry by double-clicking the data record (or by highlighting and pressing the "Bearbeiten" [Edit] key. You can remove any data record from the table that has been recorded by mistake by highlighting it and pressing the "Löschen" [Delete] key. If the sequence of data records is changed through subsequent editing, you can move a data record left or right by highlighting it and pressing the "<" oder ">" [or] key.

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You can save the calculated coefficients for the current sample in the <System.ini> using the "a,b,speichern" [Save a,b] key after completing the calibration of the heat loss coefficients. The coefficients already available for the current sample in this file are overwritten after a security question.
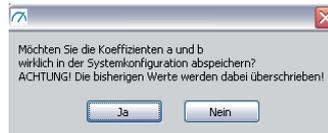
Image 29:   Security question when saving a and b

(Note: you can also enter the determined coefficients a and b and μ of a sample directly in the measuring mode. To do this, press the button ✒, located in the calibration constants, and after confirmation of the warning note enter the values manually in the displayed dialogue.)

5.6.7 Calibrating thermal capacity

Thermal capacity can only be calibrated once the heat loss coefficients have been successfully calibrated.
Thermal capacity is also calibrated semi-automatically in accordance with EN 196-9:2003. Start the calibration with the "Start" key beneath the data table for thermal capacity when you interrupt the power supply to the calibration cylinder. The "Start" key changes to a "Stop" key, and the clock under the "Stop" key shows the time that has elapsed thus far.
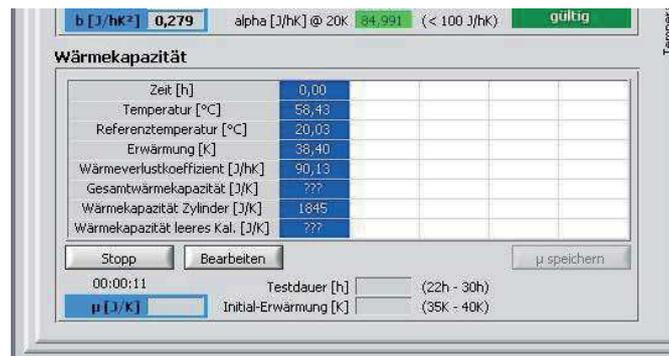
Image 30:   Calibration of thermal capacity is running

The measurements are made in a time period that is stored in the configuration file <System.ini>. The identified measured values are displayed as a table. For mathematical reasons, it is not possible to calculate the overall thermal capacity and thermal capacity of the empty calorimeter for the first data record; the related cells are therefore marked with "???".
Calibration of thermal capacity ends automatically with the recording of the fifth data record after 28 h (can be set in the configuration file <System.ini>. The software then calculates

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the coefficients µ and establishes whether the calibration is valid by using the test period (must be between 22 h and 30 h) and the initial heating up (must be between 35 k and 40 k).
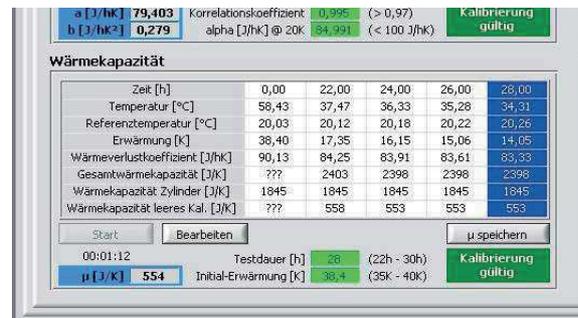
Image 31:   Calibration of thermal capacity ended

If you want to end calibration of thermal capacity prematurely, press the associated "Stop" key. Calibration of the thermal capacity then ends after a security question and can be repeated, if necessary.

The overall calibration also ends automatically with the end of thermal capacity calibration after the fifth data record is recorded.

Should an accidental typing error have been made when entering individual data records, you can subsequently edit the entry by double-clicking the data record (or by highlighting it and pressing the "Bearbeiten" [Edit] key.

Image 32:   Editing thermal capacity data record

Using the "µ speichern" [Save µ] after completing the calibration of the heat loss coefficient, you can save the determined coefficients for the current sample in the <System.ini>. The coefficients already available in this file are overwritten after a security question.

(Note: you can also enter the determined coefficients a and b and µ of a sample directly in the measuring mode. To do this, press the button ⬛, located in the calibration constants, and after confirmation of the warning note enter the values manually in the displayed dialogue.)

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5.7   Envelope editor

Via the menu option "Datei" [File] | "Hüllkurven-Editor" [Envelope editor] you start the envelope editor. With this tool, you can create envelopes for the course of the hydration heat. An envelope always consists of an upper and a lower limit. These envelopes have no effect on the measurement process and serve only to visualise the expected course of the hydration heat.
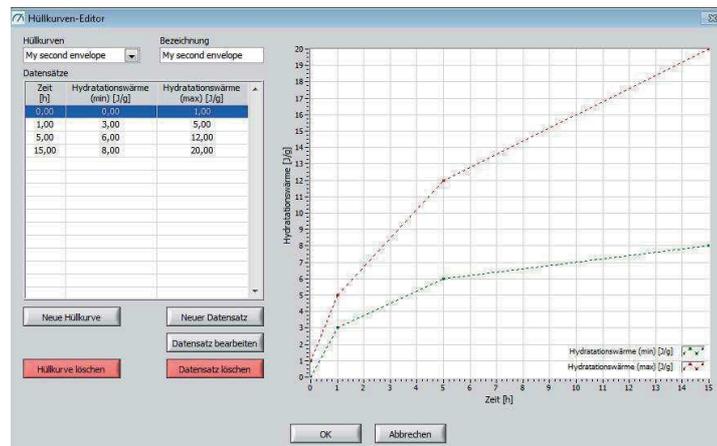
Image 1:   Envelope editor

Using the "Hüllkurven" [envelopes] selection box , you can download and display a pre-created envelope. You can change the name of the current envelope via the "Bezeichnung" [Name] text box.
Double-clicking on a data point (or selecting a data item and pressing "Datensatz bearbeiten" [Edit record]) opens a dialogue to change the record.

Image 2:   Envelope dataset

With "Neuer Datensatz" [New record], you create a new record, which is automatically sorted in the table by ascending time value.
With "Datensatz löschen" [Delete record] you delete the currently selected data set (Note: There will be no security query!).
With "Neue Hüllkurve" [New envelope] you create a new (empty) envelope; the name of a new envelope is automatically "<???>" and can be adjusted using the text field "Name".
With "Hüllkurve löschen" [Delete envelope] the currently loaded envelope is (following a prompt) deleted.

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To leave the envelope editor, either press "OK", to accept all changes made, or "Abbrechen" [Cancel] to discard all changes (following a prompt).

All envelopes are stored in the configuration file <Envelopes.ini>.

6. Maintenance and cleaning

This system requires practically no maintenance.

In case of special maintenance work (such as repairs, exchange of parts, and any other work that is not described in this manual), please get in touch directly with the Manufacturer.

If you use the equipment very frequently, or if it operates in dirty surroundings, it can become necessary to clean the outside of this system. Remove loose dust from the system by using a soft brush, or a vacuum cleaner. If required, use a moist cloth to clean the outside of the system. Normal household cleaning agents are sufficient with moist cloths for this cleaning.

Caution	Do **NOT** try to clean the system with pressurized water, water or other liquid spray, spray water that results in puddles, dripping sponges, or any other unsuitable cleaning methods. If any of these methods are used, the water or other liquid that results can enter the data-recording system (data logger) and lead to permanent damages to the mechanical, electrical, and/or electronic components of the system.
	Before any maintenance work is performed, the data-recording unit (data logger) must be switched off and disconnected from the electrical mains.

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7.   After-sales service and spare parts

A great deal of care has been taken to ensure that this Operating Manual is correct. We cannot, however, guarantee that it is without mistakes or errors, or that all information contained herein will continue to remain valid in the event of technical changes.

7.1   Date of issue of this Operating Manual

Issue no. 7
Sept. 2016

7.2   Copyright

The copyright to this Operating Manual remains with the company

TESTING Bluhm & Feuerherdt GmbH.

This Operating Manual is intended only for the Operator, User, and the User's staff. The information in this Operating Manual may not be:
- Reproduced, or
- Distributed, or
- Provided to any other persons.

Any person acting in violation of the above stipulations may be prosecuted before a court of law.

7.3   Contact for spare parts and technical help

If you have any technical questions, or if you require spare parts, please get directly in touch with the following address:

TESTING Bluhm & Feuerherdt GmbH
Motzener Str. 26b
DE – 12277 Berlin, Germany

Tel. +49 / 30 /710 96 45-0
Fax: +49 / 30 / 710 96 45 98
E-mail: info@testing.de
Internet: www.testing.de

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**EC Declaration of Conformity in accordance with the Machinery Directive
2006/42/EC Appendix II 1.A**

The authorised representative established in the community,

Mr. Feuerherdt

hereby declares that the following product

Manufacturer:	TESTING Bluhm & Feuerherdt GmbH
	Motzener Str. 26b
	12277 Berlin
Product designation:	1.0283
Serial number:	continuous
Serial/Type designation:	Calorimeter test set

complies with all of the relevant provisions of the above named guidelines as well as the additional applied guidelines (following) - including any of the amendments thereto which are in force at the time of the declaration.

The following additional EU Directives have been applied:
Low Voltage Directive 2014/35/EC

The name and address of the person who has been authorised to compile the technical documentation:
Mr. Metge

Location: Berlin
Date: 28/02/2014

_____   _____
(Signature)   (Signature)
Managing Director   Technician