LR-Cal **LR**
Temperature calibration
micro baths LR-Cal LTC-FB-...

MANUAL

Rel.20260124

Operating manual

LR-Cal **LTC-FB-9035-45** (-35...+120°C)
LR-Cal **LTC-FB-9018-60** (-18...+140°C)
LR-Cal **LTC-FB-0200-60** (amb.temp...+200°C)
LR-Cal **LTC-FB-0250-60** (amb.temp...+250°C)

Portable temperature calibration micro baths

1. Safety instructions

1.1 Symbols used

WARNING!
Hot surfaces or hot parts

WARNING!
Indicates a potentially hazardous situation that could result in minor or slight injury, property damage, or environmental damage if not avoided.

WARNING!
Risk of electric shock.

Electrical and electronic devices marked with the adjacent symbol must not be disposed of with household waste. In accordance with EU Regulation 2002/96/EC, European users of electrical and electronic devices must dispose of them at appropriate collection points or through their suppliers. Illegal disposal is prohibited and will result in fines.

1.2 Warning

WARNING!
During operation, high voltages are present inside the device. Failure to observe the safety instructions may result in damage to persons or property.
Only qualified personnel who have read and understood this operating manual may work on and with the temperature calibrator. Repair work may only be carried out by the manufacturer or by qualified personnel.

The successful and safe operation of this device depends on its precise handling, operation, use, and maintenance.

Unless otherwise specified, numbers in parentheses refer to operating or reading elements of the calibrator; see the drawing on page 51 and Chapter 5.

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WARNING!
Especially considering that this temperature calibrator can also be used on site as a portable device, ALWAYS ensure that it is properly grounded when connecting it to the power supply.
Maintenance and repair work may only be carried out on the temperature calibrator when it is switched off and the block or calibration bath has cooled down to ambienttemperature.

The upper silver-colored ventilation grille can become very hot. Never touch inserted sensors when the temperature calibrator is in operation.

Never attempt to change the factory-set PID controller basic parameters.
Never use the temperature calibrator in excessively humid, dirty, dusty, or oily environments.
Never connect a voltage to the electrical measurement inputs (devices with option **LTC-MP-3I**) and thermostat test sockets.
Remove any covers/lids before turning on the temperature calibrator. These must remain removed until the calibrator has reached room temperature.

If you are using version LR-Cal LTC-FB-9018-60 with silicone oil 47V5, you must never exceed a maximum temperature of +130°C!

This temperature calibrator has the following safety features:
• Protective fuse (power supply)
• Safety temperature switch (protection against excessive temperatures)
• Grounding

Always follow these instructions:
• Never place anything on top of the temperature calibrator.
• Do not store liquids near the temperature calibrator.
• Use a fume hood when using high temperatures.
• Never fill with any liquid other than a water-glycol mixture (50%) or silicone oils.

After each use at high temperatures, set the set point (target temperature) to room temperature and allow the temperature calibrator to cool down or heat up to this temperature.

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LR-Cal **LR** Temperature calibration
micro baths LR-Cal LTC-FB-...

MANUAL

⚠️

Device versions LR-Cal LTC-FB-9035-45 + LR-Cal LTC-FB-9018-60:

If the temperature calibrator has been operating at a temperature below 0°C for a long period of time:

- **Set the set point to 95...100°C and allow the temperature calibrator to heat up until the water in the silicone oil has evaporated again.
  If you have operated the calibrator at sub-zero temperatures in conditions of high relative humidity, this process may take longer than an hour.
  Condensation in the silicone oil can be recognized by the ice crystals that have formed.
  If steam formation is visible during this process, this is a sign that the evaporation process was successful.**

- **Then set the set point to a temperature approximately equal to the room temperature and wait until the temperature calibrator has approximately reached this temperature. Only now can you switch off the device.**

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2. Technical data + description

Specification LR-Cal	LTC-FB-9035-45	LTC-FB-9018-60	LTC-FB-0200-60	LTC-FB-0250-60
Temperature range:	-35...+120°C	-18...+140°C	amb. ...+200°C	amb. ...+250°C
Display:	Touch screen (color)			
Display accuracy:	±0.15°C *		±0.2°C *	
Units of measure:	°C / °F / K			
Display resolution:	0.1° / 0.01° / 0.001°			
Mean heating time: (incl. stabilization)	approx. 40 min from amb. to 120°C	approx. 50 min from amb. to 140°C	approx. 30 min. from amb. to 200°C	
Mean cooling time: (incl. stabilization)	approx. 100 min from 120°C to amb.	approx. 50 min from 140°C to amb.	approx. 75 min from 200°C to 50°C	
Stability:	±0.02°C at 0°C **		±0.03°C at full temperatur range **	
Axial uniformity:	±0.05°C		±0.01°C at 140°C	
Radial uniformity:	±0.02°C at 0°C ***	±0.07°C at 140°C ***	±0.06°C at 140°C ***	
Hole diameter:	45 mm	60 mm		
Hole depth:	170 mm			
Insert material:	anticorodal			
Switch test, voltage:	On/Off - 4.5 VDC			
Adjustable ramp function:	from 0.1°C /1°C			
PC interface:	USB type B			
Automatic calibration:	on 5 temperature points			
External probes:	Option: order code **LTC-MP-3I** together with instrument			
Operation voltage:	230 VAC (optional 115 VAC) 50/60 Hz			
Electric power:	350 VA	300 VA	500 VA	
Dimensions:	160 x 360 x 350 mm			
Weight incl. std. equipm.	11.0 kg		8.3 kg	

All values have been measured at ambient temperature of +20°C and with a sensor with diameter 6 mm.

The achievement of stabilization is confirmed by a displayed root symbol √ and an audial beep

* Temperature deviation between display and reference probe.

** Max. temperature difference at stable temperature over 30 min.

*** Measured from the button up to 40 mm

Features:
- Aluminum frame with pull-out carrying handle
- Temperature control with PID microcontroller
  Microprocessor: 32-bit, 216 MHz ARTM cortex-M7; A/D converter: 24-bit
  E2PROM memory + flash memory
  Color touchscreen: TFT 480 x 272 RGB colors
- Aluminum inner container for the calibration fluid
- Safety thermostat (surface thermostat)
- Testing of thermostats (working or alarm thresholds, trigger temperatures)
- Forced air cooling system
- Thermally insulated electronic control components
- Upper protection of the calibration bath and liquid collection tray
- Power supply with power cord and protective fuse
- Electromagnetic compatibility: Emission EN 50081-1, Immunity EN 50082-2

Notes:
The technical data was determined at a supply voltage of 230 VAC ±10%.

The certified data (factory calibration certificate) are valid for 1 year from the date of issue. After this period, the calibrator must be recalibrated.

The stability time was measured over a period of 6 minutes if the stability values remain within ±0.03°C.

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LR-Cal **LR** Temperature calibration
micro baths LR-Cal LTC-FB-...

MANUAL

2.1 Intended use

The LR-Cal LTC-FB portable temperature calibrator is designed for the following applications:
• Testing and calibrating temperature measuring devices in the laboratory and in the field in
  accordance with ISO 9000.
• Testing and calibrating thermostats with visual indication when the contact is closed.
• Thermal material testing
The temperature calibrator has been designed to minimize the EMC effect in accordance with the
harmonized regulations for residential, commercial, light, and heavy industry.
NOTE: The range of applications is expanded with the optional AQ2Sp2 PC software as follows:
• Control of the calibrator via PC software via the USB (Type B) connection
• Manual or automated calibration of one or more test objects
• Cyclic tests or stress tests of temperature sensors
• Testing of thermostats with regard to opening and closing of the switching contact
• Output, saving, and printing of the recorded values in compliance with ISO 9000 standards.

2.2 Manufacturer

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Germany. E-Mail: *dt-export@leitenberger.de* • *www.druck-temperatur.de*

2.3 Versions (temperature working ranges)

Version:	Order-Code:	Temperature range:
LR-Cal LTC-FB-9035-45	LTC-FB-9035-45	-35...+120°C
LR-Cal LTC-FB-9018-60	LTC-FB-9018-60	-18...+140°C
LR-Cal LTC-FB-0200-60	LTC-FB-0200-60	Ambient ...+200°C
LR-Cal LTC-FB-0250-60	LTC-FB-0250-60	Ambient ...+250°C

2.4 Temperature generation

In the LR-Cal LTC-FB-9035-45 and LR-Cal LTC-FB-9018-60 versions, the temperature is generated by
powerful Peltier elements.

The LR-Cal LTC-FB-0200-60 and LR-Cal LTC-FB-0250-60 versions feature heating resistors (made of
steel) that can generate temperatures of up to 250°C with an output of 400 W at 230 VAC.
NOTE:
Please remember that generating very high temperatures very frequently reduces the service life
of the heating resistors. Generate very high temperatures for as short a time as possible to
increase the service life.

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2.5 Ventilation

The internal fan and ventilation grilles on the bottom allow air to circulate for cooling and heat dissipation inside the calibrator.
IMPORTANT: Do not block the ventilation openings with objects. All bottom and rear openings must be kept clear for air to pass through.
Airflow is necessary for the calibrator to function properly. It allows for better temperature control and lowers the temperature of the calibration bath during cooling.

2.6 Calibration bath container and stirring system

The calibration bath (aluminum container) has a capacity of approximately 500 cm³. Follow the instructions in Chapter 3 to fill the container with the calibration fluid and reach the temperature range at the desired power.
A magnetic mixer inside the bath homogenizes the liquid. This improves the control conditions. There is a stirrer protection grid at the bottom of the container.
Avoid calibrations if the calibration fluid is not stirred properly.

2.7 Internal reference temperature sensor

A Pt 100 resistance thermometer, which is permanently installed in the calibration bath, is used to regulate the temperature. The calibration data is stored in the memory of the calibrator's microprocessor.

2.8 Safety thermostat

The calibrator is equipped with a safety thermostat (10) for overtemperature, which intervenes in the event of a malfunction in the heating resistors or Peltier elements.
If the safety thermostat is triggered, wait until the calibrator has reached a temperature close to the ambient temperature. This should allow the safety thermostat to release the calibrator's function again. If not, disconnect the calibrator from the power supply, correct any faults, and then switch the calibrator back on. For more information on the safety thermostat, see chapter 9.
The trigger temperature of the safety thermostat depends on the calibrator version.

2.9 Carrying handle

The calibrator is equipped with a retractable transport handle, so the handle does not "get in the way" during operation.

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2.10 Scope of standard delivery

for versionen LR-Cal **LTC-FB-9035-45** + LR-Cal **LTC-FB-9018-60**:
  1 bottle silicone oil (500 cm³) 47V10, Code: LTC-FB-SO-010
for version LR-Cal **LTC-FB-0200-60**:
  1 bottle silicone oil (500 cm³) 47V20, Code: LTC-FB-SO-020
for version LR-Cal **LTC-FB-0250-60**:
  1 bottle silicone oil (500 cm³) 47V100, Code: LTC-FB-SO-100

Container lid for transport and emptying

Accessories for transport and emptying
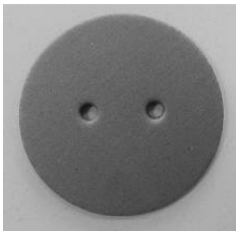
Container lid with 2 openings for test specimens

Retention system for test specimens (optimized for glass thermometers)

Power supply connection cable
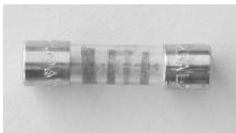
Spare fuse

Only with option **LTC-MP-3I** ordered:
Plugs and cables for the three measurement inputs

Cables for thermostat/temperature switch tests

Carrying bag with shoulder strap

- Operating manual

- Test report (measurement accuracy, control stability, final inspection)

2.11 Options

• LTC-MP-3I   Device version with 3 configurable measurement inputs, including 2 inputs for resistance thermometers/thermocouples and 1 input for analog signals 4...20 mA or 0...10 V

• LTC-MP-115V   Device design for 115 VAC (50/60 Hz) power supply

2.12 Accessories

• LTC-FB-INSERT   Calibration bath insert including sealing lid for quick replacement of the calibration fluid (without emptying and cleaning)
See chapter 13.1

• LTC-FB-COOL   Only for LR-Cal LTC-FB-0200-60 + LR-Cal LTC-FB-0250-60:
Cooling coil to reduce cooling time, requires fresh water connection.
See section 13.4.

• LTC-AQ2SP2   PC software LR-Cal Aq2Sp2

• LTC-FB-DB-...   Various metal block inserts for "converting" the device to a metal block calibrator
See chapter 13.2

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3. Calibration media

⚠️ **WARNING**
The temperature calibrator controller has been factory configured with optimal parameters. Any changes to these parameters by the customer (Chapter 5.5.3) may cause malfunctions or even injury to persons and damage to equipment, and will also void the warranty/guarantee.

Before filling the calibration bath, please observe the following general instructions!

3.1 Liquids

The temperature calibrator is designed for the following temperature range:
• LR-Cal LTC-FB-9035-45: -35...+120°C   • LR-Cal LTC-FB-0200-60: ambient temp. to +200°C
• LR-Cal LTC-FB-9018-60: -18...+140°C   • LR-Cal LTC-FB-0250-60: ambient temp. to +250°C
Various liquids can be filled into the tank of the calibration bath, but not all of them are suitable for the above-mentioned temperature ranges.
Before filling in a liquid, you must check whether this liquid is suitable for the desired temperature range, especially with regard to safety limits (smoke development, flash point). The upper temperature limit of a liquid is determined by its evaporation rate, smoke development, flammability, and chemical decay, while the lower temperature limit is determined by the freezing point of the liquid.
The basic properties of a filling liquid for calibration baths with the highest possible temperature uniformity are the temperature range, viscosity, specific heat, thermal conductivity, thermal expansion, electrical conductivity, service life, and safety.

3.1.1 Recommended operating temperature ranges
The liquids (calibration media) recommended for these temperature calibrators are listed in the table below. From a purely chemical point of view, the liquids may be suitable for larger temperature ranges, but excessive viscosity impairs the magnetic mixer and thus the temperature uniformity in the calibration bath.

• Water-glycol mixture (50%):   recommended for area of use -40...+90°C
                                      Smoke may develop at temperatures above +70°C!
• Silicone oil type 47V5:   recommended for area of use -40...+130°C
                                      Ignition is possible at temperatures above +136°C!
• Silicone oil type 47V10:   recommended for area of use -30...+150°C
                                      Ignition is possible at temperatures above +160°C!
• Silicone oil type 47V20:   recommended for area of use -20...+200°C
                                      Ignition is possible at temperatures above +230°C!
• Silicone oil type 47V50:   recommended for area of use +30...+200°C
                                      Ignition is possible at temperatures above +280°C!
• Silicone oil type 47V100 + 47V150: recommended for area of use +50...+200°C
                                      Ignition is possible at temperatures above +300°C!

Pure water is unsuitable because limescale deposits can impair or destroy the magnetic mixer.

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3.1.2 Viscosity

Viscosity is a property of a liquid that provides information about the resistance it offers to the magnetic mixer, which is important for temperature uniformity. The higher the resistance, the poorer the temperature uniformity.

Fluids with a viscosity above 20 cst (centistokes) do not allow for good performance of the calibration bath and should therefore be avoided. The viscosity of a fluid is defined at room temperature. For water (at 20°C), it's 1 cst.

Viscosity at room temperature Water-glycol mixture and silicone oil 47V5: 5 cst.
Silicone oil 47V10: 10 cst.   Silicone oil 47V20: 20 cst.
Silicone oil 47V50: 50 cst.   Silicone oil 47V100: 100 cst.
Silicone oil 47V150 (S1050): 150 cst.

Please note that viscosity - especially of oils - changes significantly under the influence of temperature. It is therefore necessary to use different calibration fluids in the temperature calibrator depending on the desired temperature range.

Normally, viscosity decreases at higher temperatures and increases at lower temperatures—the latter can cause problems with temperature uniformity. See also chapter 13.1—Calibration bath insert for quick fluid change.

3.1.3 Thermal expansion

The thermal expansion of a calibration fluid defines the change in volume as a function of changing temperatures. This is particularly important for oils, which expand significantly when heated. Therefore, never fill the temperature calibrator above the marked maximum level, otherwise liquid may escape from the calibration bath ("overflow") when heated. Silicone oils expand by approx. 10% per 100°C increase in temperature.

3.1.4 Service life

The service life (possible period of use) of a calibration fluid is reduced by contamination, chemical degradation, gelation, etc. At higher temperatures in particular, oxidation occurs due to the influence of air (oxygen).

To increase the service life of the calibration fluid
• use the most suitable fluid at high temperatures for as short a time as possible
• put on the supplied lid with the two holes to minimize contact between
   hot oil and ambient air.

Example: when silicone oil 47V5 is used at 125°C and in an "open" calibration bath, the viscosity increases with increasing chemical degradation within a period of several tens of hours.

At temperatures below freezing, silicone oil 47V5 increasingly takes on a dough-like consistency.

3.1.5 Filling the reservoir

Fill the temperature calibrator with a suitable calibration fluid (e.g., the one supplied). Fill with approx. 42-43 cl of oil. Avoid filling with a larger quantity, as thermal expansion may cause it to overflow when the temperature rises.

The silicone oils ensure ideal performance of the calibration bath in the specified temperature ranges. A fume extraction system can be used to increase the operating range, but such high temperatures should only be reached for as short a time as necessary (to increase the service life of the oil).

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Even at lower temperatures, silicone oil 47V5—despite its higher viscosity—still allows the magnetic mixer rod to rotate smoothly, ensuring sufficient temperature uniformity in the bath. Before replacing the liquid in the bath with another liquid, clean the reservoir with absorbent paper to prevent the two liquids from mixing. Mixing affects the operating conditions and changes the possible maximum temperature to a dangerous—because undefined—value. Highly recommended accessory: Order-Code **LTC-FB-INSERT** (replaceable calibration bath container, see Chapter 13.1)!

3.1.6 Adjusting the stirring rod
The rotation speed of the magnetic mixer rod can be adjusted using the adjustment knob (6). Turn clockwise to increase the rotation speed and counterclockwise to decrease it. The speed should be set so that the vortex/whirl created by the rotating mixer reaches a height of approx. 2 cm.
At low temperatures, when the silicone oil used has a higher viscosity, the rotation speed should be increased. At higher temperatures, when the silicone oil used has a lower viscosity, the rotation speed should be reduced (so that an excessive vortex/whirl does not cause liquid to escape from the reservoir).

Switch off the temperature calibrator immediately if the magnetic mixer rod becomes blocked. Set the mixer to maximum speed using button (6) and switch the temperature calibrator back on. If the magnetic mixer rod still does not move, the calibrator requires maintenance or repair. See chapters 8 and 9.

3.1.7 Positioning the test specimens in the calibration bath
Observe the following guidelines to achieve maximum performance:

• Immerse the test specimen approximately 140 to 150 mm without it touching the bottom.

• For calibrations using comparative measurement, both probes must be inserted as evenly and as close together as possible (same immersion depth, smallest possible distance).

• For optimum accuracy and stability, use the supplied cover with the two holes wherever the dimensions of your test specimens and, if applicable, reference sensors (see figure). This protective cover reduces the formation of condensation in the silicone oil.

• Always check the permissible temperature range of your test specimens; the temperature in the calibration bath must be within the permissible temperature range for the test specimen**.**
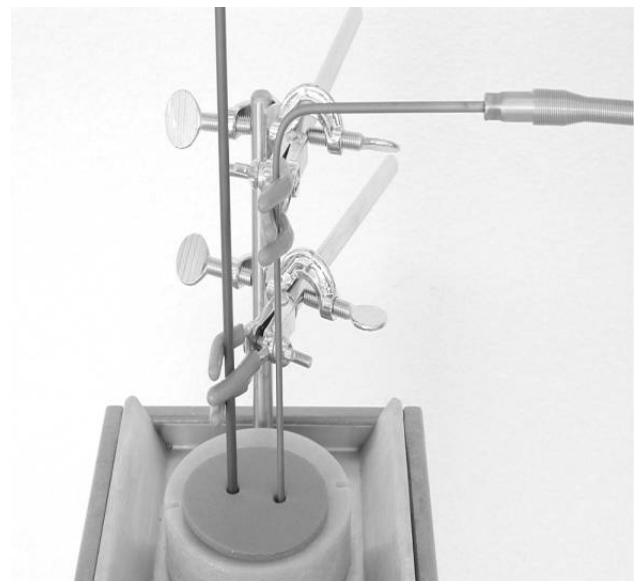
- Do not place the test specimens exactly in the center of the calibration opening, as this can interfere with the stirring process.
- If you hang too many test specimens at the same time, this will reduce the measurement accuracy due to the behavior of the liquid.

3.1.8 Recommendations

- If the temperature is very high, do not close the reservoir. Wait until the liquid has reached approximately room temperature. Only then switch off the temperature calibrator and close the reservoir with the transport lid supplied.
- Never transport the temperature calibrator with a filled and unclosed reservoir.

Connection for drain hose

Closing lid

Test specimen holder

Test specimen

Do NOT center test pieces!

Protective guard over magnetic mixer rod

Internal reference sensor

Motor (magnetic mixer)

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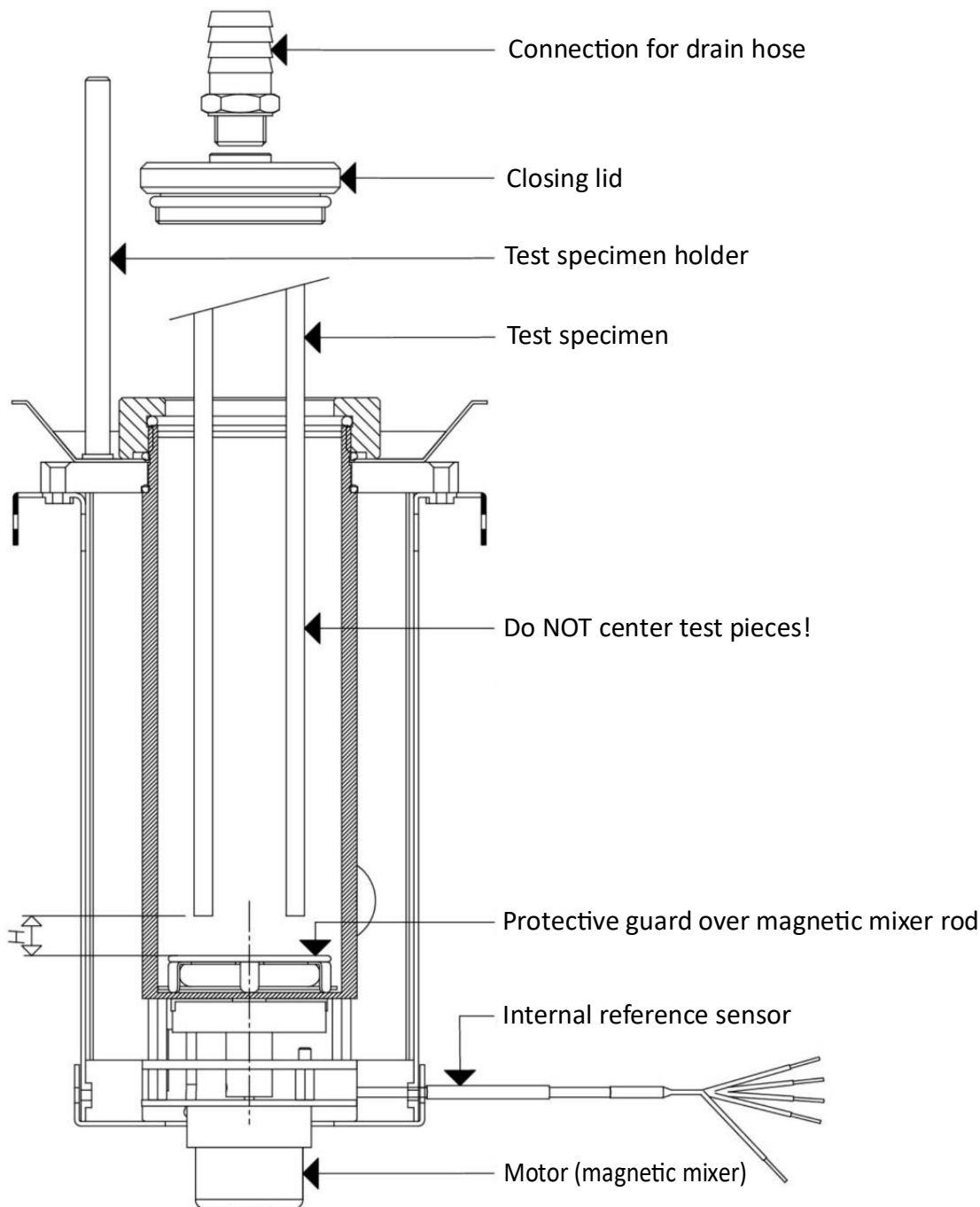
4. Installation of the temperature calibrator

4.1 Installation

4.1.1 Removing the packaging
The temperature calibrator was delivered in transport packaging suitable for standard shipping.
We recommend that you keep this packaging (e.g., for returns/recalibrations).
If external damage to the transport packaging is visible upon delivery, contact the transport company with a complaint.

4.1.2 Setting up the temperature calibrator
Place the temperature calibrator on a level, stable, and clean surface for operation.

The temperature calibrator can generate high temperatures. There is a risk of burns and fire. Keep the temperature calibrator away from highly flammable materials. No liquid may be poured into the holes in metal block inserts (accessories, see Chapter 13.2).

To prevent smoke build-up in rooms, the use of an extraction system (or outdoor operation) is recommended.

4.1.3 Power supply for the temperature calibrator
Ensure that your mains voltage matches the value specified on the type plate on the bottom of the housing (underside). The temperature calibrator is designed for a mains voltage of 230 VAC (50/60 Hz) (optionally with option **LTC-MP-115V**: 115 VAC). A connection cable approx. 2.5 meters long (3 x 1 mm²) is included in the scope of delivery.
Before switching on the temperature calibrator, you must ensure that it is correctly earthed.

If you have the calibrator without the LTC-MP-115V option, it is designed for 230 VAC and the connection cable has a Schuko plug. Do NOT use an adapter to avoid losing the correct grounding!

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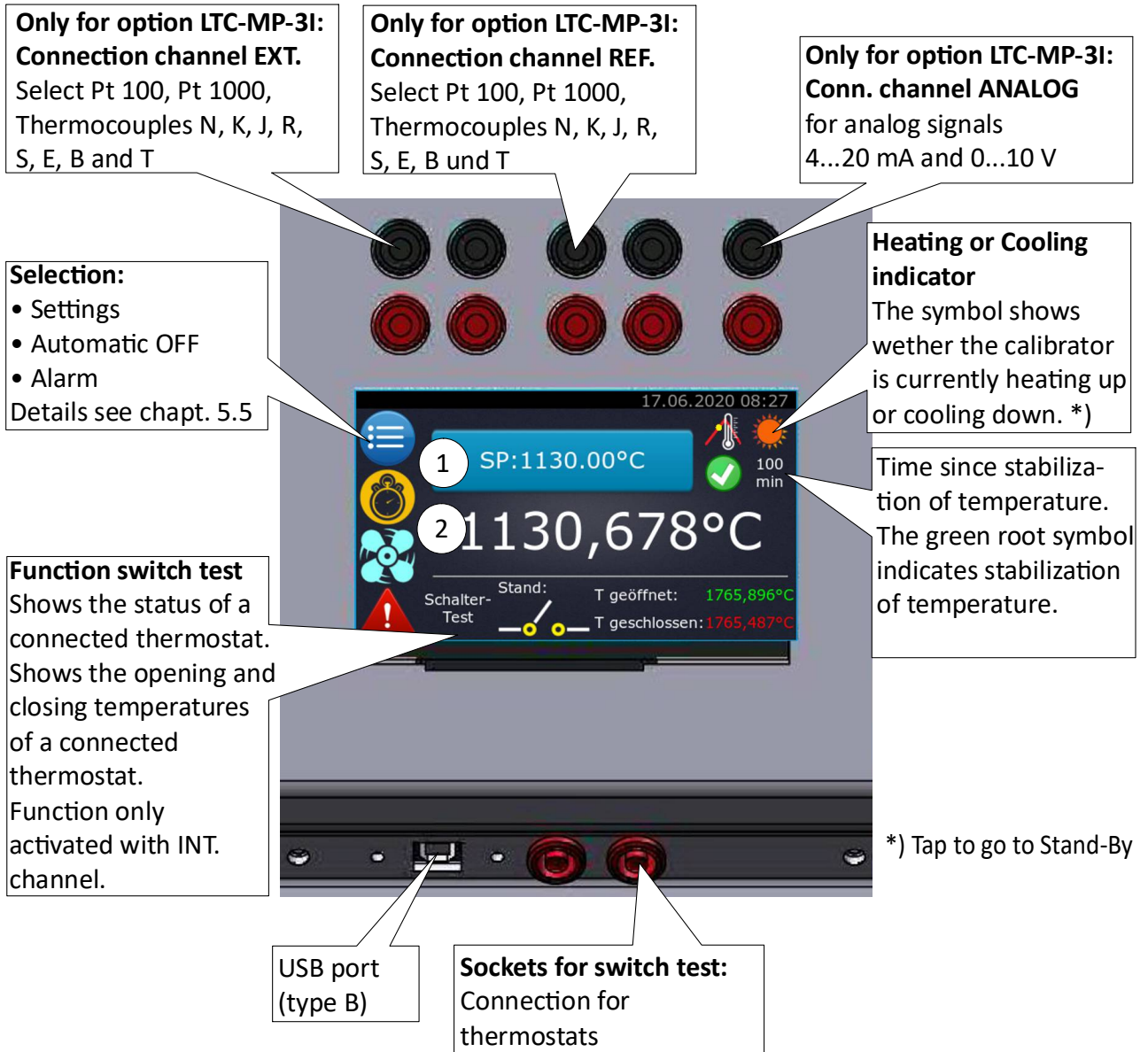# 5. Description of controls and displays

5.1 Front of the device

(1) = Socket for power
supply cable

(2) = Main switch

(3) = Safety fuse

(4) = Sockets for
switch tests
(thermostat tests)

(5) = USB Type B interface

(6) = Mixer speed control
The lower the temperature,
the faster and the higher
the temperature, the
slower the magnetic
mixer should rotate

(7) = Touchscreen
Line 1: Set point temperature
Line 2: Temp. of internal sensor
Line 3: Switch test displays
With option **LTC-MP-3I**,
the display of the values
at the measurement inputs
can be set here instead.

(7.1) = "Heating" symbol

(7.2) = "Cooling" symbol

(7.3) = "Stability reached" display: white
root symbol in a green circle

(7.4) = "Ramp function" active display
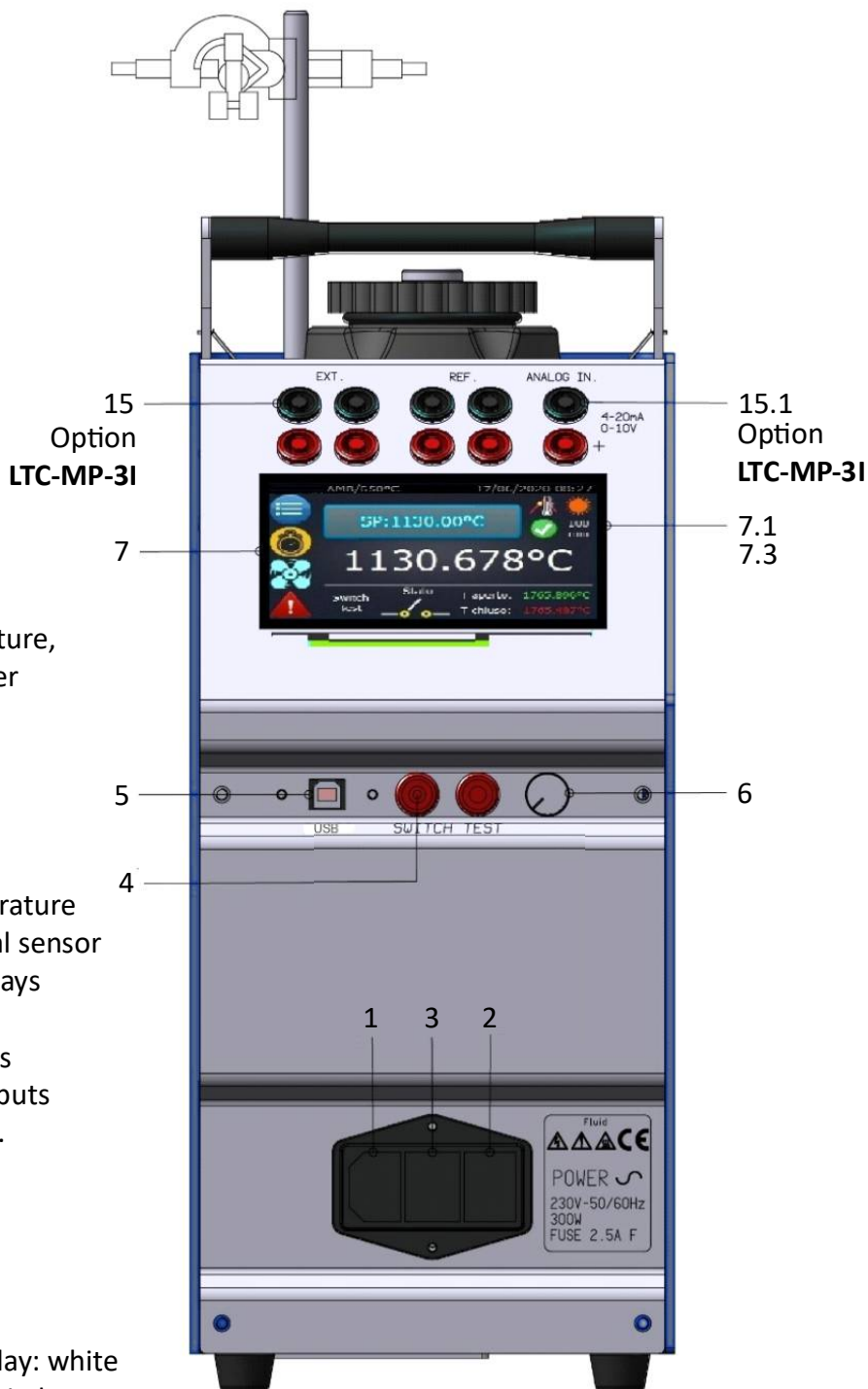
Only with option LTC-MP-3I:
(15) = Sockets for measurement inputs (resistance thermometers/thermocouples)
(15.1) = Sockets for analog signal 4...20 mA or 0...10 V

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Option
LTC-MP-3I

15.1
Option
LTC-MP-3I

7

7.1
7.3

5

4

6

1   3   2

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MANUAL

5.2 Overview of the touchscreen

Only for option LTC-MP-3I: Connection channel EXT. Select Pt 100, Pt 1000, Thermocouples N, K, J, R, S, E, B and T

Only for option LTC-MP-3I: Connection channel REF. Select Pt 100, Pt 1000, Thermocouples N, K, J, R, S, E, B und T

Only for option LTC-MP-3I: Conn. channel ANALOG for analog signals 4...20 mA and 0...10 V

Heating or Cooling indicator The symbol shows wether the calibrator is currently heating up or cooling down. *)

Selection:
• Settings
• Automatic OFF
• Alarm
Details see chapt. 5.5

Time since stabilization of temperature. The green root symbol indicates stabilization of temperature.

Function switch test Shows the status of a connected thermostat. Shows the opening and closing temperatures of a connected thermostat. Function only activated with INT. channel.

17.06.2020 08:27

SP:1130.00°C

1130,678°C

Stand:
Schalter-Test
T geöffnet: 1765,896°C
T geschlossen: 1765,487°C

100 min

*) Tap to go to Stand-By

USB port (type B)

Sockets for switch test: Connection for thermostats

① **Display line 1 (blue):** Displays the set point. Tap to adjust.

② **Display line 2:** Displays the temperature of the INT channel. If multiple channels are activated, this line shows the active channel. Tap to select a channel.

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5.2.1 Description of symbols and buttons

✓	Enabling or disabling a feature
◉	Selecting an option, e.g., from a drop-down list
▬	Input field - opens a pop-up window with a virtual keyboard
🏠	Icon HOME - Display returns to the main screen
↩	Icon BACK - any changes made will NOT be saved (cancel)
✓	Icon CONFIRM - all entries/changes made will be accepted

Buttons on the main page:

☰	Menu button - Call up various calibrator settings
⏱	"Automatic shutdown" button—opens a pop-up window with a virtual keyboard for entering a time. after which the calibrator should go into standby mode once temperature stability has been reached
⚠	"Alarm" button - opens a pop-up window with an error code in the event of a fault
SP:1130.00°C	"Set Point" button - for changing the setpoint temperature. There are two different possible actions: If the ramp or switch test function is active, the switch test window opens. Otherwise, a pop-up window opens. Window with virtual numeric keypad for entering a new value. When the calibrator is in standby mode is located, the font changes between red and white when entered.

Icons auf der Hauptseite:

🌡	Indicates whether the calibrator is in standard mode or whether the ramp or switch test function is active.
☀ ❄	Shows whether the calibrator is currently heating (sun) or cooling (snow). Tap to switch to standby mode.
✓ 100 min	Indicates that the temperature in the calibrator is stable and displays the time since stability was achieved.

Switch Test — State

Swtich test
Displays the current status of a thermostat (test object) connected to the sockets (4), as well as the switching temperatures.

5.3 Main switch of the temperature calibrator

The main switch (2) is located on the front of the device. It is an assembly that also includes the socket for the power supply cable and the protective fuse.

Only 5 x 20 mm fuses may be used, namely:
- Version for 230 VAC: 2,5 A - T
- Version for 115 VAC: 5 A - F   (Option **LTC-MP-115V**)

⚠ **The temperature calibrator may only be operated by personnel who have read and understood these instructions in full.**
The instructions for commissioning must be observed.

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5.4 Main screen

The main screen displays:
• Title bar (device version and limit values at top left, date and time at top right)
• On the left: List of buttons
• On the right: Measured values, etc.
• Some windows have a footer showing the current set point and measured value of the internal
  reference sensor

Title ➤

List of buttons ➤

Main part of display
contains switch test, or,
with option **LTC-MP-3I**, also
data from measuring inputs

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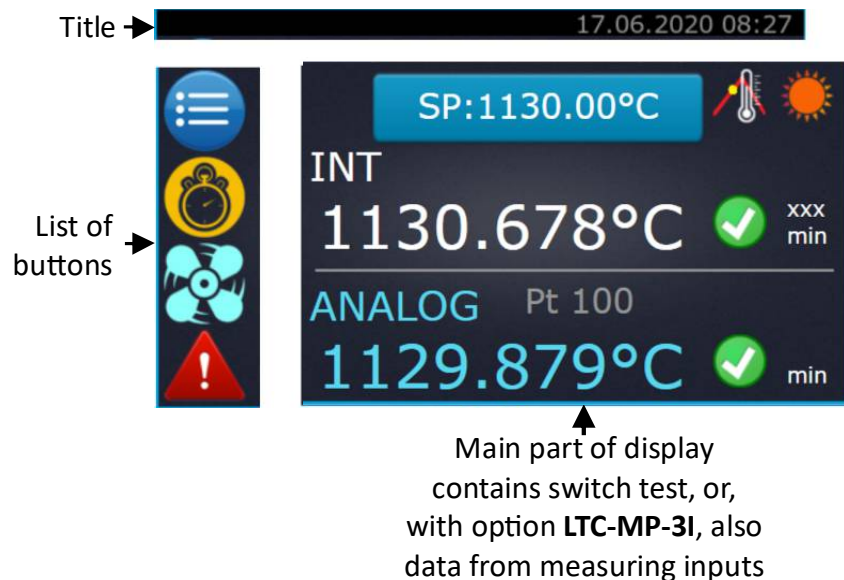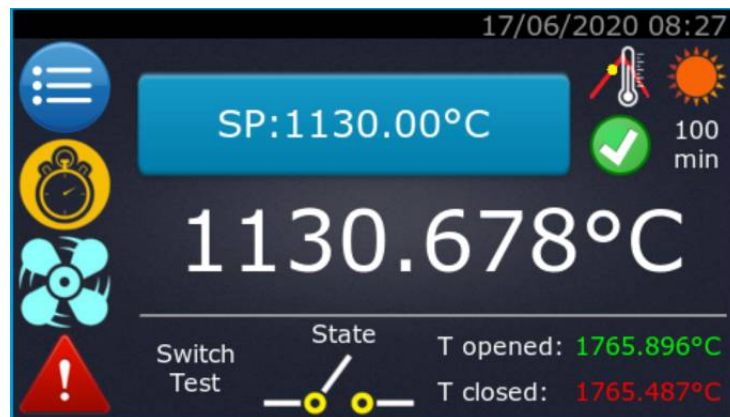
5.4.1 Main screen functions

5.4.1.1 All device versions

Without activating a channel (only devices with option **LTC-MP-3I**), the main screen displays the measured value of the internal reference sensor. By adjusting the calibrator settings (menu screen), the temperature unit and display resolution can be varied.
When the target temperature is stable, a white root symbol on a green circle is displayed, next to it the time in minutes since the calibrator has been maintaining a stable temperature.

Main screen without activated channels

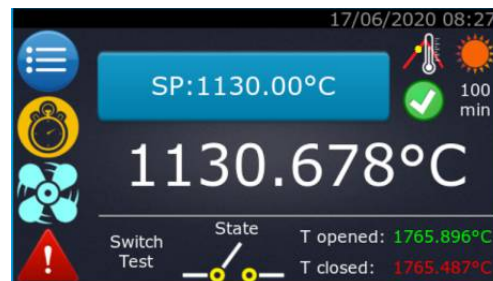Information about the switch test function is displayed at the bottom of the screen if this function is active. If the switch test function is active, you will find information here about the current switching status of a connected thermostat and the last measured switching temperatures. See chapter 7.1.

5.4.1.2 Device version with option **LTC-MP-3I** (three measurement inputs)

If more than one channel is activated, the main page displays the measured values of the internal reference sensor and the measured values of the activated channels.

Each channel has its own display color:
• ANALOG: blue
• EXT: green
• REF: yellow

Main screen with 1 activated channel

The currently measured temperatures are displayed. When the setpoint temperature is stable, a white root symbol on a green circle is displayed, along with the time in minutes since the calibrator has been maintaining a stable temperature.

The selected type of external sensor is displayed above the temperature values (only for EXT and REF channels). Tapping on such an EXT or REF value opens a pop-up window "Probe selection", while tapping on ANALOG opens the "Signal type" pop-up window -
here you can set whether the ANALOG channel should measure current or voltage and the option of a 2-point conversion of the current or voltage signal into temperature.

Main screen with 2 activated channels

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5.4.2 Areas in the main window that open functions when tapped

	CLOCK	see point 7 in chapter 5.5.3
	SUN SNOW	Button „Standby": Sets the calibrator to standby mode manually. Heating or cooling process is canceled.
SP:1130.00°C	SP	Opens window for entering temperature set point
	ALARM	If the calibrator displays an error status, tapping this button will display the error code.

	Font color: **white**	Opens a window showing the current temperatures of the two cold junction compensators.
1130,678°C		

Only at devices with option **LTC-MP-3I**:

	Font color:	
1230.987°C	**green**	Opens window for channel EXT, to specify the sensor type
1340.678°C	**yellow**	Opens window for channel REF, to specify the sensor type
1129.879°C	**blue**	Opens window for ANALOG channel to select current or voltage and set parameters for conversion to temperature

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5.5 Menu screen

The menu screen displays:
- Title bar
  (top left: device version and limit values; top right: date and time)
- On the left: button(s)
- On the right: scrollable menu entries, accessed by tapping
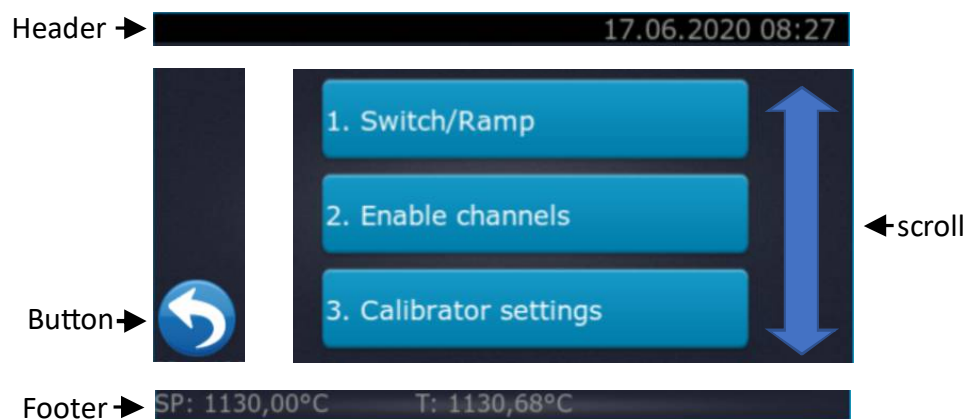
5.5.1 Pop-Up window

The pop-up windows are used to interact with the user.
There are three options:
- View: Display of data, without the option to make changes, i.e., no confirmation button
- Set: Display of data, with the option to make changes, with a confirmation button
- Enter: Virtual keyboard (numeric or alphanumeric) for entering data
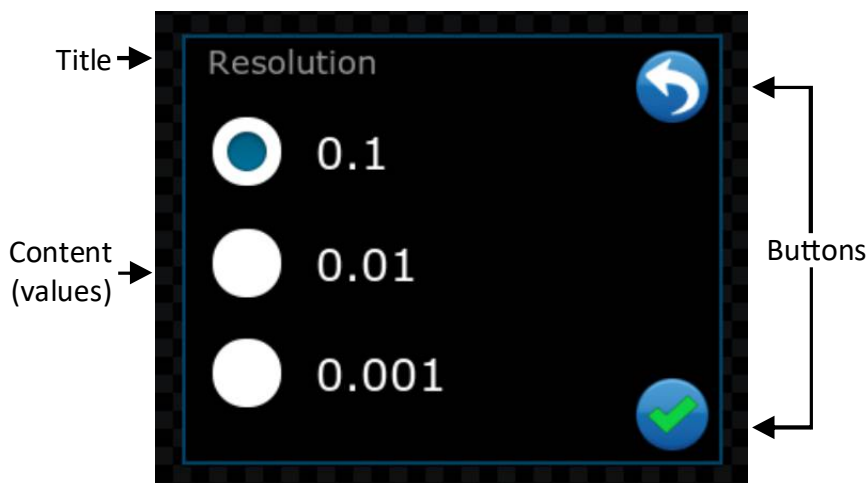
Example of a pop-up window

5.5.2 Menu screen functions

Tap the menu button to display the menu screen.

There are several menu items that can be accessed by scrolling; see the next page.

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5.5.3 Menu items

1. Switch/Ramp:

Function:	Description:
Switch test	Opens window "Switch test and ramp" to view/edit both functions. See chapter 7.1
Ramp	Opens windows regarding the ramps, can be increasing/decrasing. See chapter 7.2

2. Channel enablement *(only at devices with option LTC-MP-3I):*

Function:	Description:
EXT or REF channel	Activation of the EXT and/or REF channels for sensors connected to sockets (15). When a channel is activated, tapping on the green EXT value or the yellow REF value on the main page displays a window. Here you can select the type of sensor connected to the selected channel. See chapter 6.1.2
ANALOG channel	Activation of the ANALOG channel for sensors connected to sockets (15.1). When activated, tapping on the blue ANALOG value displays a window. Here you can enter the current or voltage input as well as parameters for conversion to temperature. See chapter 6.1.2

3. Calibrator Setup

Function:	Description:
Language selection	Opens window to select user language
Info Calibrator	Opens widow with information about the calibrator
Touch calibration	Opens window to calibrate the touch screen. See chapter 8.2
Setting date + time	Opens window to enter/change date + time
Serial communication	Opens window with serial communications parameter. See chapter 11
Ethernet	DEACTIVATED

4. Parameter Setup

Function:		Description:
Unit of measurement		Opens window to select temperature unit (°C/°F/K)
Resolution		Opens window to select display resolution (1, 2 or 3 digits after decimal point)
Hidden Function:	*Only make changes here if you know exactly what you are doing. Any changes to the parameters will immediately void your warranty.*	**Description: (Password must be entered to get access)**
Wait On/Off		Opens window to change standby settings: After which time the calibrator changes to standby or standard mode
PID parameter		Opens window to see/edit PID parameter settings:
		Proportional band: — expressed as % of full scale value. Bereich innerhalb des Messbereichs, innerhalb dessen die Leistungsregelung erfolgt.
		Integral time: — expressed in seconds. The integrative effect reduces the error between the setpoint value and the the temperature achieved solely by the proportional effect to zero. The integral time is the time required for the integrative effect to double the proportional effect.
		Derivative Time: — expressed in seconds. In the event of a sudden temperature change, the derivative effect causes a stronger initial control effect, so that the calibrator achieves higher performance than would be the case with the proportional and integral effects alone. If the error persists, the derivative effect reduces its effect and leaves it to the integrative effect to reduce the error.
Calibration		Access to the 3rd menu level, to recalibrate channels INT, EXT and REF. See chapter 10

5. Password

Function:	Description:
Password	User password. Access to hidden functions within the Parameter Setup menu. Default password: **1234**

7. Auto Power OFF

Function:	Description:
Auto Power OFF	The indication of the temperature(s) are continuously updated until the target temperature is stable. After that, the set waiting time is observed, then the calibrator enters the standby mode. The last measured values are saved and are available to the user until the next cycle. To activate this function, set the automatic shutdown by tapping the corresponding box and enter the time to wait until the calibrator has reached temperature stability. This function can also be accessed by tapping the yellow clock icon on main screen.

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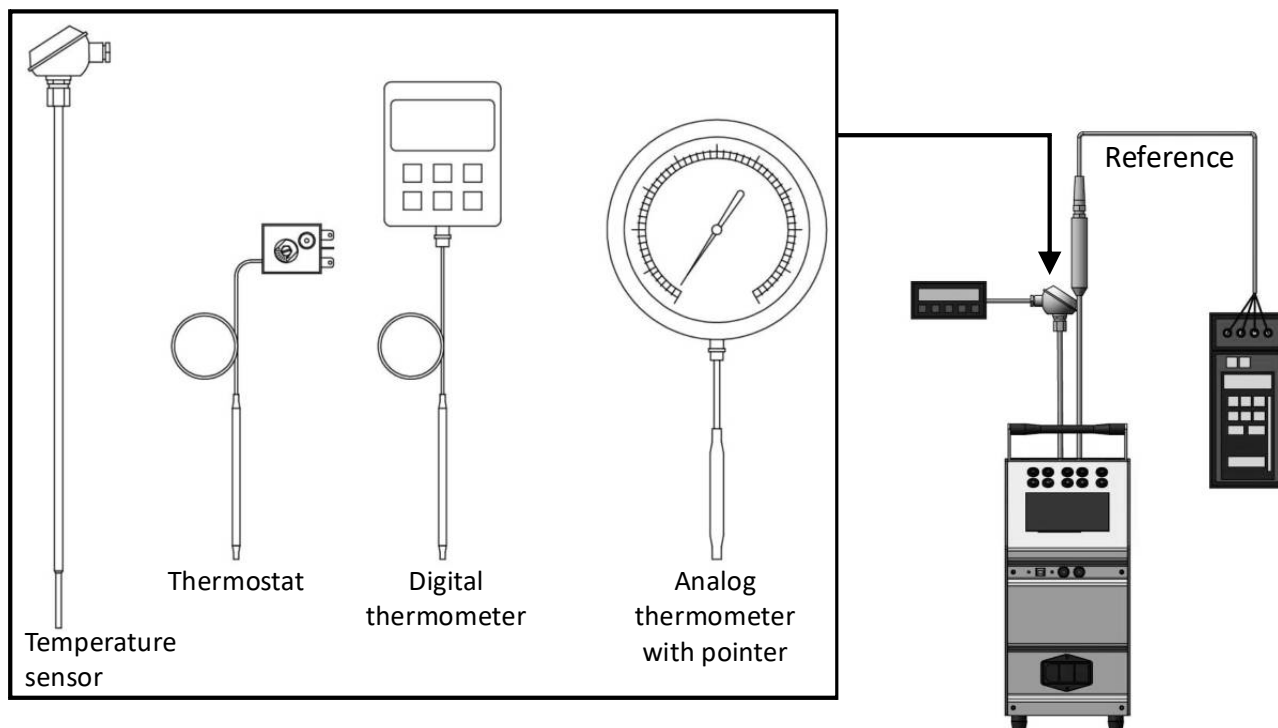
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6. Operation

• For a description of the controls and displays, see Chapter 5.
• For suitable calibration fluids and filling, see Chapter 3.

6.1 Applications of the temperature calibrator

The LR-Cal LTC-FB calibrators are designed for testing and calibrating
• Resistance thermometers and sensors
• Thermocouples and sensors
• Thermostats; temperature switches
• Digital thermometers
• Laboratory and glass thermometers
with temperature measuring ranges that match your calibrator version.

Temperature sensor | Thermostat | Digital thermometer | Analog thermometer with pointer | Reference

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**6.1.1 Calibrations with calibrator versions WITHOUT the LTC-MP-3I option:**

Comparative calibrations with these calibrator versions can be performed using two different methods:
a) Calibration with the calibrator's internal reference sensor (7) as the reference standard
b) Calibration with an external reference thermometer (sensor and display) as the reference standard

The main page only displays information related to the internal reference sensor:
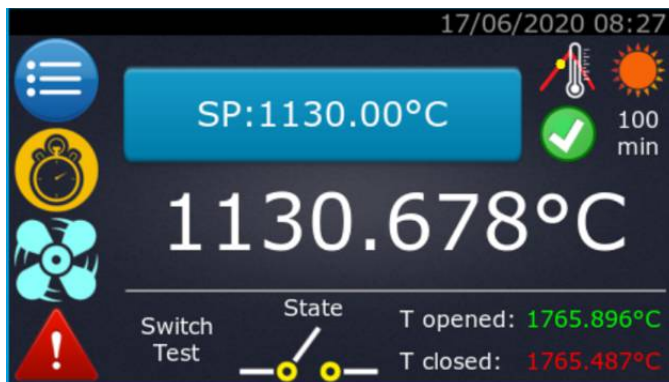
If you tap on the second display line (white on black) showing the internally measured reference temperature, a pop-up window labeled "Cold Spot Compensation" will open on some versions of the LR-Cal LTC-FB calibrator, displaying the values.
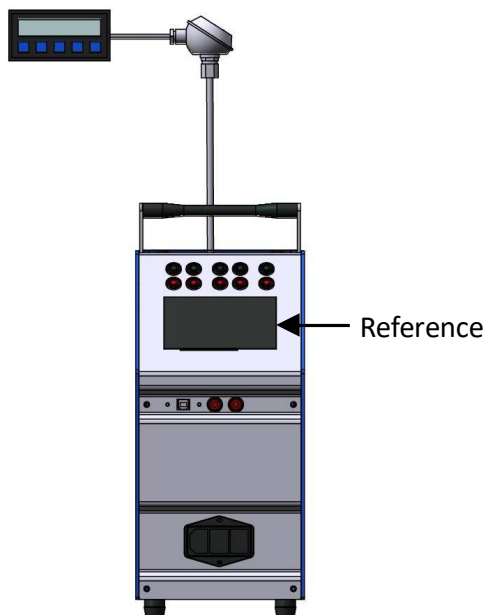
Reference

The test item is compared with the calibrator display as a reference.
The reference value is shown in the second display line (white on black).
It may need to be corrected in accordance with the information in the certificate.
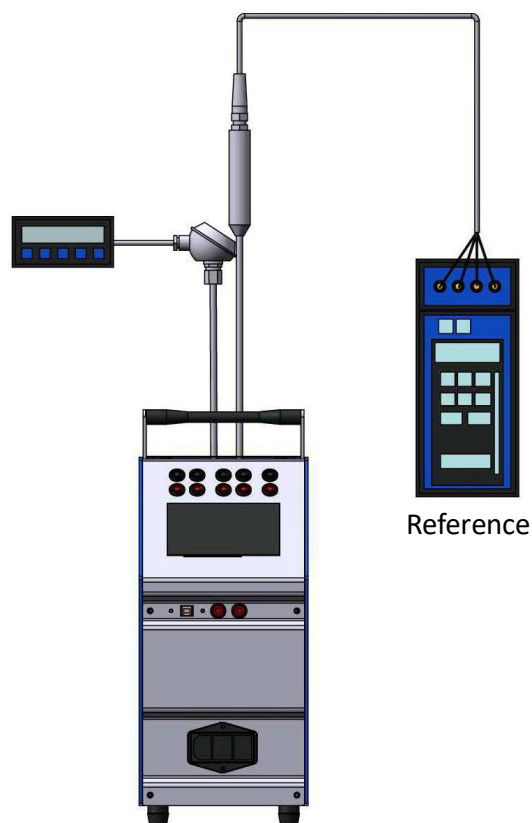
Reference

The test item is compared with an external reference.
The calibrator acts purely as a temperature source.
The sensors of the test object and the reference must be inserted into the calibration bath.
The reference value is read on the display of the external reference.

6.1.2 Calibrations with calibrator versions WITH LTC-MP-3I option:

6.1.2.1 Calibration with EXT and REF inputs

If your calibrator is equipped with the **LTC-MP-3I** option (three measurement inputs) and you have external reference sensors (e.g., LR-Cal LRT-F), the "EXT" and "REF" channels can be activated to perform calibration using one of the following methods.

a) Calibration with the calibrator's internal reference sensor (7) as the reference
b) Calibration with external reference sensor (e.g., LR-Cal LRT-F) connected to the "REF" measurement input of the calibrator
c) Calibration with external reference thermometer (sensor and display) as reference
See next page.

If more than one channel is activated on the calibrator with option **LTC-MP-3I**, the main page displays the values of the internal reference sensor and the values of an external reference sensor (yellow), as well as the values of a test object (green).
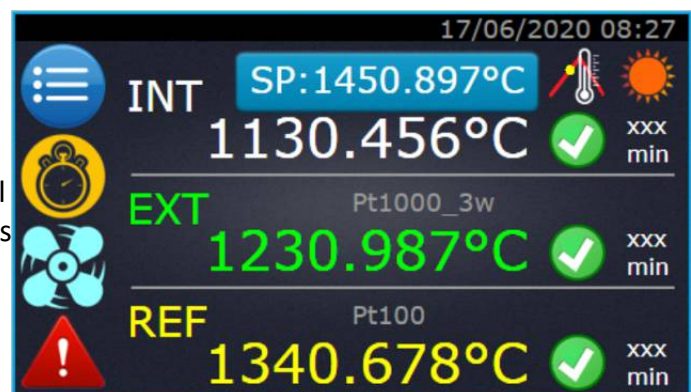

Use the REF channel (yellow on black background) **for the external reference sensor and the EXT channel** (green on black background) **for a test object.**

To activate the channels on calibrators with option **LTC-MP-3I**, proceed as follows:
• Tap the menu button on the main page.
• Tap the "2. Activate channels" button; a pop-up window will appear.
• Here you can now activate a maximum of two channels, whose values will then be shown on the display.

When you tap on the green EXT value or the yellow REF value, a window appears where you can determine the type of sensor connected. This window is two "screens" high. The first page lists 11 standard sensor types, while the second page lists customer-specific sensors.
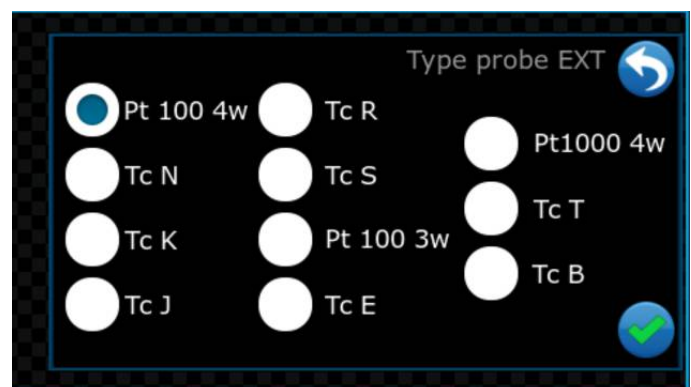
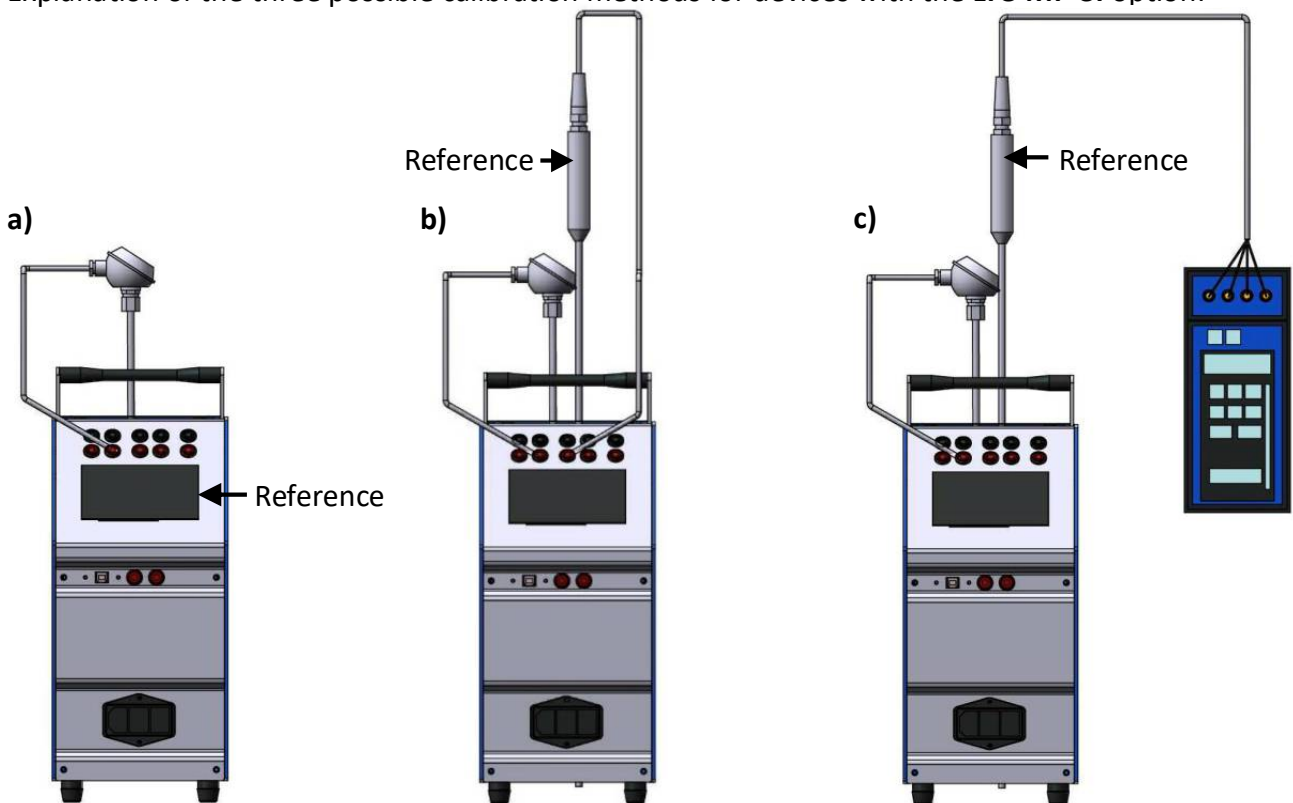Connection of sensors to the EXT and REF measurement inputs (15) see section 6.1.2.2.

The use of the EXT and REF channels is described below.

Please always connect an external reference probe (e.g. LR-Cal LRT-F) to the REF connection.

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Explanation of the three possible calibration methods for devices with the **LTC-MP-3I** option:

a)   b)   c)

Reference →   ← Reference

← Reference

a) Calibration with internal reference sensor (7) of the calibrator as reference

• Connect the test object to the EXT measurement input.

• Insert the test object into the calibration bath.

• Compare the values displayed for INT (internal reference, white) and EXT (test object, green).

b) Calibration with external reference sensor as reference

• Connect the external reference probe to the measurement input REF.

• Connect the test object to the measurement input EXT.

• Place the test object and external reference in the calibration bath.

• Compare the values displayed at REF (external reference, yellow) and EXT (test object, green).

c) Calibration with external reference thermometer (sensor and display) as reference

• Connect the test object to the EXT measurement input.

• Insert the test object and the sensor of the reference thermometer into the calibration bath.

• Compare the values displayed at EXT (test object, green) and on the display of the reference thermometer.

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6.1.2.2 Connecting external RTD or TC sensors to EXT and REF inputs

When the measurement input channels are activated on calibrators with the
LTC-MP-3I option, the values of externally connected sensors can be read.
The following sensors can be connected:

Connection: thermocouples:

• Thermocouples (TC) types J, K, R, S, N, E, T, and with automatic
  cold junction compensation.

• Resistance temperature detectors (RTD) Pt 100 (2-, 3-, and 4-wire) + Pt 1000.

Tap the green EXT or yellow REF channel. Here
you can then select the sensor type.

Connection: Pt 100 4-wire

Connect the sensor terminals to the sockets (15)
as shown opposite:

• Thermocouples to pins 2 and 4, bridge between pins 1 and 3.

• Pt 100 4-wire to pins 1, 2, 3, and 4.

Connection: Pt 100 3-wire:

• Pt 100 3-wire to pins 1, 2, and 3, bridge between pins 3 and 4.

• Pt 100 2-wire to pins 2 and 4, bridge between pins 1 and 2
  and bridge between pins 3 and 4.

Use cables that are as short as possible for the bridges.
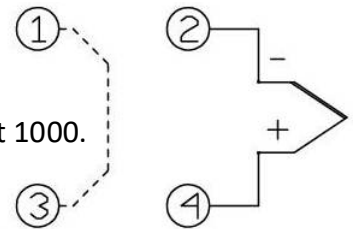
If the connection or configuration is incorrect,
"0.0°" will be shown on the display.

Connection: Pt 100 2-wire

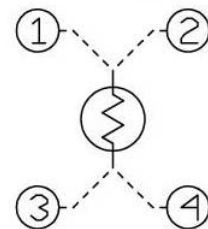⚠ **Never connect voltages greater than 5 V
to the input sockets (15).**

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6.1.2.3 Calibrations with calibrator versions **WITH LTC-MP-3I** option with ANALOG input:

For calibrator versions with the **LTC-MP-3I** option, the analog measurement input (channel) can also be activated.

When the ANALOG channel is activated, the main screen displays the measured value of the internal reference sensor and the ANALOG input.

To activate the ANALOG channel on devices with the **LTC-MP-3I** option, proceed as follows:
• Tap the menu button on the main page.
• Tap the "2. Activate channels" button.
• Select "Analog."

When the ANALOG channel is activated, it is possible to read current or voltage signals and convert them to temperature.

When you select ANALOG, a window opens in which you can specify whether current (mA) or voltage (V) is to be measured. You can also set the conversion to temperature via two points.
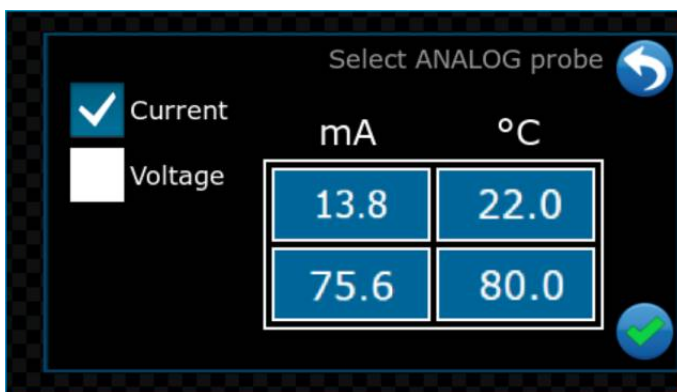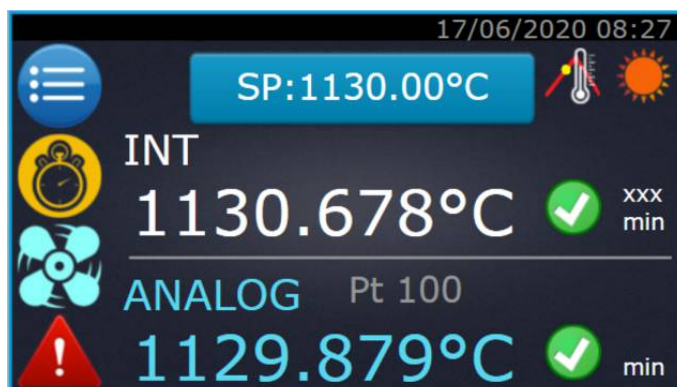
Explanation of the two possible calibration methods for devices with the **LTC-MP-3I** option with the ANALOG input activated:

a) Calibration with the calibrator's internal reference sensor (7) as the reference.
b) Calibration with an external reference sensor (e.g., LR-Cal LRT-F) connected to the calibrator's "REF" measurement input.

See next page.

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LR-Cal **LR** Temperature calibration
micro baths LR-Cal LTC-FB-...

MANUAL

Explanation of the 2 possible calibration methods with ANALOG input, only with option **LTC-MP-3I**:
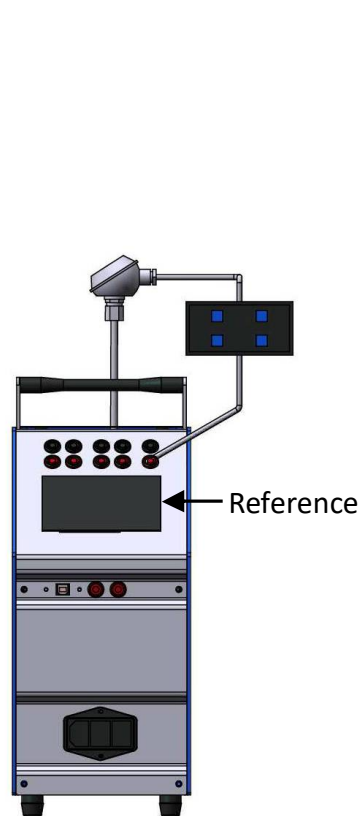
Calibration with internal reference sensor (7) of the calibrator as reference

- Connect the test object to the ANALOG measurement input.

- Insert the test object into the calibration bath.

- Compare the values displayed for INT (internal reference, white) and ANALOG (unit under test, blue).
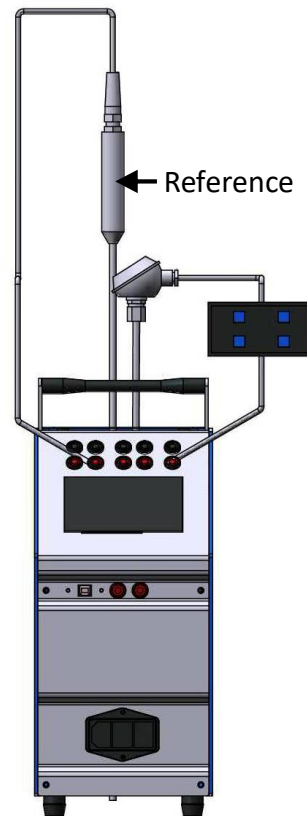
Calibration with external reference sensor as reference

- Connect the external reference to the REF measurement input.

- Connect the test object to the ANALOG measurement input.

- Place the test object and external reference in the calibration bath.

- Compare the values displayed at REF (external reference, yellow) and ANALOG (test object, blue).

6.1.2.4 Connecting sensors to the ANALOG input, only with option **LTC-MP-3I**

When the ANALOG measurement input channel is activated on calibrators with option **LTC-MP-3I**, sensors with a linear output signal of 4...20 mA or 0...10 V can be connected.
Sensors.

To activate the ANALOG channel, tap the menu button on the main screen. Then select "2. Activate channels". The main screen now displays the values of the internal reference sensor INT and the values of the selected channels.

Tap on the ANALOG value displayed in blue. A window will open in which you can select "Current" (mA) or voltage (V). Conversion to temperature can also be performed after entering two corresponding values.

Connect the sensor with analog output signal to the sockets (15.1):

**Power supply
6...32 VDC**

Test object 4...20 mA

Red (+VDC)

Black
(sign. mA)

Black

Red
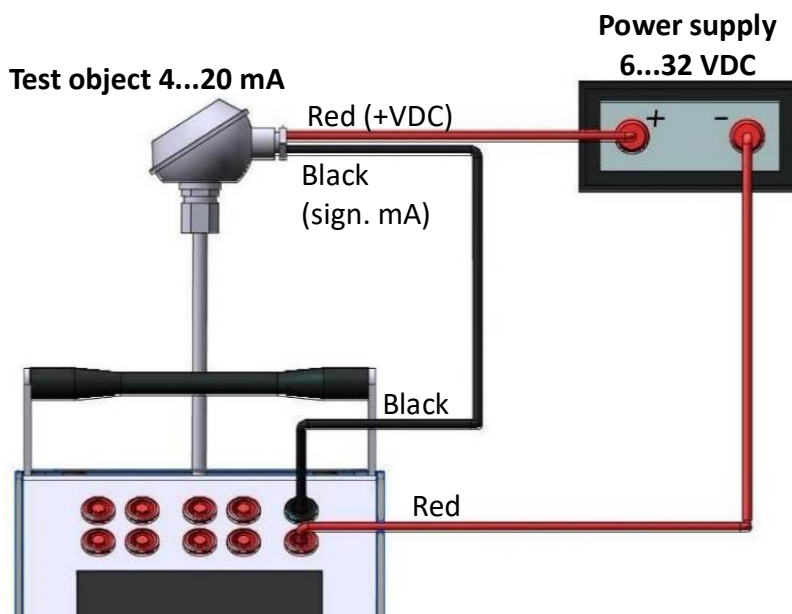
Example: Connection of a probe with current output signal

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6.2 Calibration of test specimens

Follow these recommendations for all calibration methods:

• Ensure that the calibrator is at room temperature. Inserting probes when the calibrator is too hot can damage them, cause drift, or endanger the operator.

• Insert the probes into the calibration bath. Refer to section 3.1.7.

• Switch on the calibrator at the main switch (2) and wait for the self-test to finish.

• Set the temperature value at which you want to calibrate as the set point.
  Tap the blue SP (set point) button and set the desired value in the pop-up window that appears.
  Tap the white check mark in the green circle to confirm.

• Wait until the calibrator has reached the target temperature and stabilized.

• Stability (temperature fluctuations max. ±0.5°C over 10 minutes) is indicated by a root symbol, next to which is displayed how many minutes the calibrator has already been maintaining the target temperature at a stable level.

• Adjust the stirrer (6) so that a constant stirring speed is achieved.
  Avoid stirring too vigorously to prevent liquid from escaping from the container. The calibration fluid must be well mixed to achieve good temperature uniformity and a fast response from the calibrator's temperature controller. First set the rotary knob (6) to the middle position.

• If you want to calibrate at additional temperature points, set the next target temperature value and wait until the new temperature has stabilized.
  The target temperature display and the internal reference sensor display may change at different speeds. This is due to the different sensor types and different positions in the container.

• The temperature displayed by the internal reference sensor is shown with the accuracy specified in the data sheet and certificate. If higher accuracy is required, an external reference must be used - here, the position of the test specimen and reference in the container is also more similar and therefore more comparable.

• For setting ramps, see section 7.2.

⚠ **DO NOT remove the probes inserted into the container if the calibrator is still at particularly low or high temperatures: risk of temperature shock and burns or frostbite to the operator.**

6.3 After completion of the calibration work

CAUTION: Risk of burns or frostbite
Before switching off the calibrator, it must be at a temperature very close to the ambient temperature. Set a target temperature value as the set point that corresponds approximately to the room temperature and wait until the calibrator has reached this temperature.
Please note the information on page 5!

Only then switch off the calibrator at the main switch (2) and disconnect the power supply cable. Close the container with the lid provided.

Only when the calibrator has reached room temperature may you close the calibration bath with the supplied sealing lid. **Note the information on page 5!**

6.4 Communication via the computer interface

The calibrator can be connected to a PC via the USB (type B) port (5). Special commands can be used to read or change parameters such as the set point, external channels on devices with the **LTC-MP-3I** option, ramp function, etc.
For communication parameters, see Chapter 11.
After switching on the calibrator and performing the self-test, tap the button
to activate the interface.

The connected PC must comply with the IEC 950 safety standard.

We recommend the Windows® PC software LR-Cal Aq2Sp2, available as an accessory.
Order-Code **LTC-AQ2SP2**.

7. Special functions

The following pages describe special functions of the temperature calibrator:

• Testing and adjusting temperature switches/thermostats

• Ramp function

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7.1 Switch test - Checking thermostats

You can check the switching temperatures and the switching status of thermostats.

• Insert the thermostat sensor into the calibration bath.
• Connect the thermostat to the connection sockets (4).
• Switch on the calibrator and wait for the self-test to complete.
• Tap the menu button in the main window and then select the
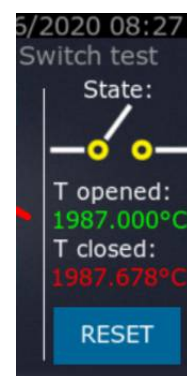 entry "1. Switches/Ramps" in the selection window.

The main screen displays information about the
connected thermostat at the bottom (unless

devices with the **LTC-MP-3I** option display the values of connected sensors there
– in this case, the "Ramps" page can be displayed on the screen.

For configuration of the ramp function, see chapter 7.2.

⚠ **Never connect a voltage higher than 5 V to the sockets (4).**

7.2 Ramps - Ramps for rising and falling temperatures

• Tap the menu button on the main screen and then select "1. Switches/Ramps" from the
  selection window.

A window opens where you can configure
all ramp settings on the left side.
On the right side of the window, switch
test information is displayed, see Chapter 7.

Notes on ramps:
When the ramp function is activated, the calibrator reaches a preset temperature with the desired
gradient G, starting at the temperature at which the ramp was confirmed.

When the ramp is active, the ramp symbol appears on the display, followed by the
setpoint, which moves at the speed specified by the set gradient G.
If the ramp is deactivated, the ramp symbol disappears from the display.

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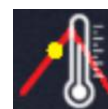
The ramp can be single or continuous:

• Single ramp:
When the calibrator temperature reaches the set temperature SP2, the
ramp function is automatically deactivated. The value reached is adopted as the new setpoint
and the calibrator stabilizes at this temperature.

• Continuous ramp:
The blue T button switches to SP1 (to be set). The internal temperature of the calibrator
fluctuates between the two values SP1 and SP2.

Functions adjustable by the operator:
• G (Gradient):
Specifies the number of steps after which the setpoint temperature changes (increases with
a positive value and decreases with a negative value).
• T / SP1:
For a single ramp, the internal temperature is specified.
For a continuous ramp, it switches to SP1 – this corresponds to the temperature that the
calibrator reaches after reaching T / SP2 (Set Point 2).

Ramp ON: Switch on of ramp function

Continue: Changement of ramp mode (single/continuously)

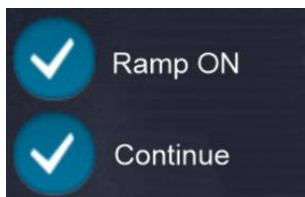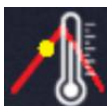This symbol shows, that the ramp function is active.

Example of use for a single ramp:

• Suppose the calibrator is currently at room temperature and you want to increase the
temperature to 150°C with a gradient of 2°C/min:

• Call up the "1. Switches/Ramps" menu.

• The "Continuous" function must NOT be activated.

• Set the temperature value SP2 to 150°C.

• Set the gradient G to 2°C/min.

• Tap the "Ramp ON" button. The ramp function is now active.

The controlled temperature of the calibrator now rises at the specified rate. In the first section of
the ramp, there are fluctuations (which do not correspond to the ramp rate), but after a short
time, the temperature in the calibrator follows the ramp.

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Example of use for a continuous ramp:

• Suppose the calibrator is currently at room temperature and you want to fluctuate the temperature between 50°C and 150°C with a gradient of 2°C/min.

• Call up the "1. Switches/Ramps" menu.

• Activate the "Continuous" function. The blue T button changes to SP1.

• Set the temperature value SP1 to 50°C.

• Set the temperature value SP2 to 150°C.

• Set the gradient G to 2°C/min.

• Tap the "Ramp ON" button. The ramp function will now start.

The calibrator will now continuously move the temperature between 50°C and 150°C with the set gradient until you deactivate the ramp function again.

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8. Maintenance

Continuous:
Check the level of the calibration fluid in the container.
Check the condition of the calibration fluid: clean the container and replace the calibration fluid if it starts to decompose. If the touchscreen does not respond correctly to inputs, it can be recalibrated; see chapter 8.2. Check the power cord and replace it if damaged. Keep dust away from the calibrator. Prevent the fans from sucking in dirt from the floor. Otherwise, the ventilation may become clogged. Check for cleanliness. The heat sink can be cleaned from above with a compressed air gun. If necessary, replace the protective fuses - see chapter 5.3.

Annually:
To ensure the efficiency of the calibrator, the device should be recalibrated annually - or at longer intervals if used infrequently. Contact *DT-Export@Leitenberger.de* to request recalibration at a time of your choosing. We can also manage your measuring equipment and remind you in good time when recertification is due. Recalibration by the customer is also possible at their own responsibility. See chapter 10.

Ice and condensation form when used at temperatures below 0°C. After each use below 0°C, the calibrator must be heated to 70-80°C so that any water contained in the oil can evaporate. Allow the calibrator to cool to ambient temperature before switching it off. See page 5.

In general, the calibrator does not require any special maintenance. For any repairs, please contact *DT-Export@Leitenberger.de*. See also chapter 9.

8.1 Cleaning

Always keep the calibrator clean to ensure proper functioning. Before cleaning, the calibrator must be at room temperature and disconnected from the power supply.

• Clean the outer surfaces with a damp cloth.
The electrical connections must NOT come into contact with moisture. Do NOT use aggressive cleaning agents or solvents. Do NOT use sharp or hard objects.

• Cleaning the calibration bath and changing the calibration fluid: Screw the lid with the hose nozzle and drain hose piece onto the container. Lift the calibrator and hold it so that the fluid drains out.
Recommended accessory:
Calibration bath insert
Order-Code: **LTC-FB-INSERT**, see chapter 13.1

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Cleaning the reservoir:

Unscrew the insulating ring nut (A). Remove the spring (B). Remove the protective grid of the magnetic mixer rod using a wire (C). Lift out the magnetic mixer rod (D).
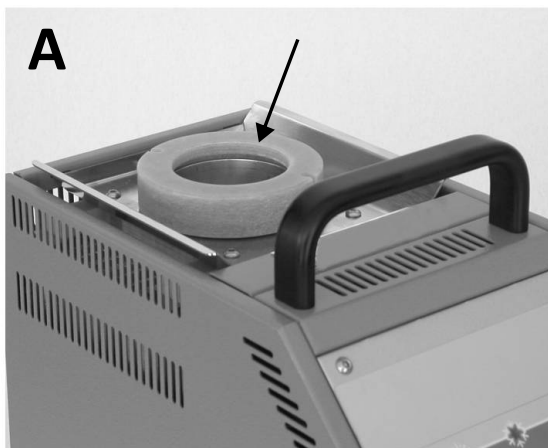
Clean the reservoir and the magnetic mixer rod with a lint-free absorbent paper or cloth.

Filling the reservoir:

Follow the instructions in chapter 3.1.5.

⚠️ **IMPORTANT!**

The old fluid must be disposed of properly in accordance with the environmental regulations applicable to you. This must be done in such a way that the environment is not endangered and people are not contaminated. We recommend using sealable plastic containers for storage and disposal.

8.2 Recalibrating the touchscreen

If the touchscreen does not respond to
inputs (taps) as expected, it can be
recalibrated. Tap the menu icon to open the
menu screen. Then select the "Touchscreen
calibration" menu item under "3. Calibrator
settings."

Tapping the "Start" button opens
the window for recalibrating the
touchscreen. This window can also be displayed automatically immediately after switching on the
temperature calibrator if the calibrator does not find a valid touchscreen calibration file in its
memory.

To calibrate the touchscreen, follow the instructions displayed, which require you to tap three
different yellow dots on the screen precisely. This calibrates the touchscreen. Finally, tap the
confirmation button. If you miss the yellow dots significantly when tapping, the changes cannot be
applied.

If performed correctly, a message will indicate that the calibration has been successfully
completed. After a few seconds, the next screen will be displayed.

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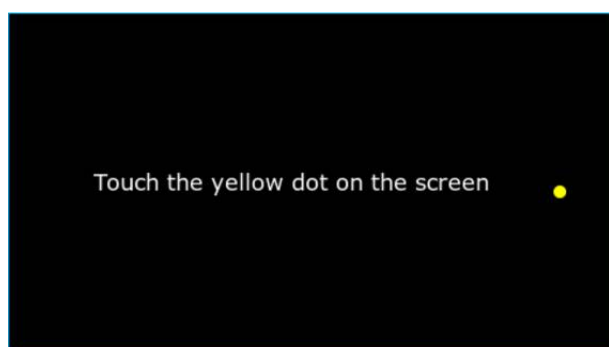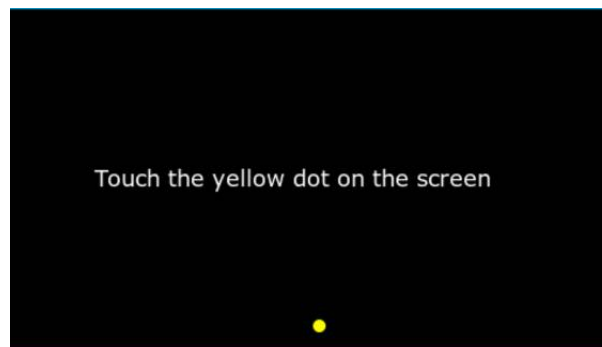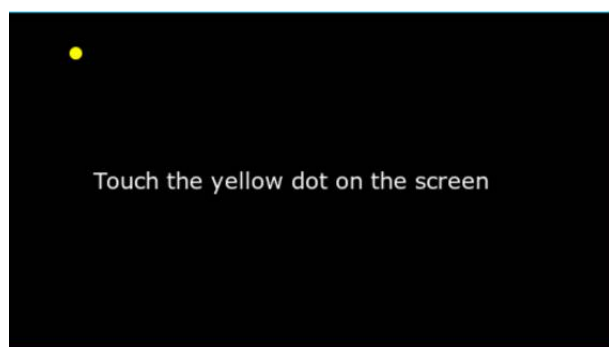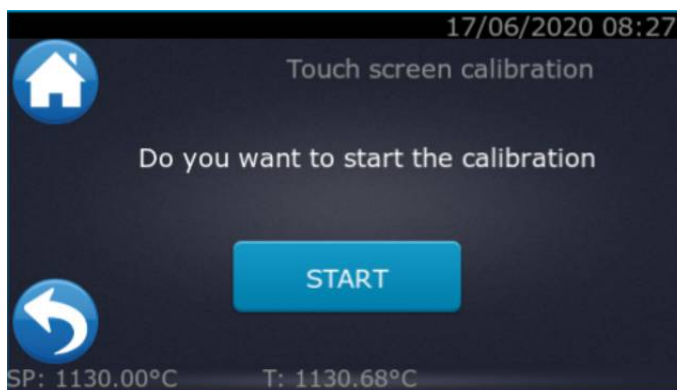
9. Possible malfunctions and how to fix them

You can try to fix the following errors yourself:

• Although the calibrator is connected to a power source and the device is switched on, it is not working : Replace the fuse (3), see section 5.3, or replace the power cable. If the error persists, please contact us: *DT-Export@Leitenberger.de*.

• The calibration fluid is not being stirred. No temperature uniformity in the calibration bath: Switch the calibrator off and on again, adjust the stirring speed on the controller (6).
If this does not help, remove the calibration fluid, remove the protective grid and check whether the magnetic mixer rod can move freely – clean thoroughly, see section 8.1.

For all other errors, please contact us by email at *DT-Export@Leitenberger.de*, for example in the following cases:
• The fuse (3) trips as soon as the power supply cable is connected and the main switch is activated.
• The control system is working properly, but the temperature in the calibrator does not increase or decrease.
• The temperature displayed in the temperature calibrator deviates from the temperature measured in the calibration bath - more than specified in the technical data.
• The temperature change does not stop when the setpoint is reached.
• The heating or cooling capacity of the calibrator does not correspond to the specifications in the technical data.
• A constant temperature is shown on the display and the red alarm symbol is displayed.
• The cooling fan of the temperature calibrator is not working.
• The calibrator does not stabilize after reaching the setpoint temperature.

In these cases, switch off the temperature calibrator immediately and allow it to cool down to room temperature. Then empty the calibration bath container and clean it according to the instructions in chapter 8.1. Contact us (*DT-Export@Leitenberger.de*) to arrange a repair appointment and send us the device, well packaged (in the original packaging if possible). Please enclose our completed "Return Declaration" form.

Return form:

https://www.druck-temperatur.de/images/pdf/
formular-ruecksendeerklaerung-EN.pdf

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10. Recalibration of the temperature calibrator

If you have the appropriate training and the necessary calibration standards, you can recalibrate the device yourself instead of sending it to us for recalibration (see Chapter 12.1). Instructions for this are available for download below.

If in doubt, we always recommend sending the temperature calibrator to us for recalibration, see chapter 12.1. On request, we can also take care of device management for you and remind you in good time when recalibration is required.

11. Communication protocol of the computer interface

If you would like to program your own software for communicating with the temperature calibrator instead of using the LR-Cal Aq2Sp2 PC software (item no. **LTC-AQ2SP2**) that we offer, a communication protocol is available for this purpose.

The instructions for recalibration and the communication protocol are available for download only:

https://www.druck-temperatur.de/images/pdf/anleitungen/LTC-INSTRUCTIONS-Recalibration-Communication_protocol.pdf

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12. Returns and disposal

12.1 Returns

⚠️ **WARNING!**
Please note the following when shipping the device:
All devices delivered to DRUCK & TEMPERATUR Leitenberger GmbH must be free of hazardous substances (acids, alkalis, solutions, etc.).

Use the original packaging or suitable transport packaging to return the device.

To avoid damage:
1. Wrap the device in antistatic plastic film.
2. Place the device in the packaging with the insulation material. Insulate evenly on all sides of the transport packaging.
3. If possible, include a bag of desiccant in the packaging.
4. Mark the shipment as transport of a highly sensitive measuring device.

Please fill out our "Return Declaration" form and enclose it with your return shipment to us::
https://www.druck-temperatur.de/images/pdf/formular-ruecksendeerklaerung-EN.pdf

12.2 Disposal
Improper disposal can pose a risk to the environment.
Dispose of device components and packaging materials in an environmentally friendly manner in accordance with country-specific waste treatment and disposal regulations.

🗑️ Please note that the device must not be disposed of with household waste.
Disposal must be carried out by returning it to the retailer or through the appropriate municipal authorities (see EU Directive 2002/96/EU).

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13. Instructions for optional accessories

Below you will find instructions for optional accessories:

• Order-Code **LTC-FB-INSERT** chapter 13.1 Calibration bath insert - faster and easier replacement of calibration fluid

• Order-Code **LTC-FB-DB-...** chapter 13.2 Dry metal block inserts „Conversion" to dry block temperature calibrator

• Order-Code **LTC-FB-LONG** chapter 13.3 Extension tube - increasing the immersion depth

• Order-Code **LTC-FB-COOL** chapter 13.4 Cooling coil - reduction of cooling time

13.1 Calibration bath insert (quick change of calibration fluid)

Order-Code: **LTC-FB-INSERT**

The LTC-FB-INSERT calibration bath insert allows the calibration fluid to be removed from the calibrator or replaced with another silicone oil without having to turn the calibrator upside down to drain the calibration fluid currently in use or to suck out the fluid. The calibration fluid is contained in a special removable insert, so that it can be replaced with a metal block insert or another calibration bath insert containing a different calibration fluid. The process is very simple: remove the current insert and insert another one. This is a much faster and easier process when, for example, a silicone oil suitable for low temperatures needs to be replaced with a silicone oil suitable for high temperatures. Your calibration processes are made much easier, and waste, spillage, or leakage of calibration fluid is avoided.
We recommend using at least TWO of these LTC-FB-INSERT calibration bath inserts.

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(1)
Unscrew the lid.

(2)
Fill with calibration fluid
to a level 3 cm
below the upper edge.

(3)
Screw the lid
completely shut and
insert the insert into
the calibrator.

(4)
Once the insert is in place,
unscrew the cap and
proceed with calibration.

(5)
If a change of
calibration fluid
becomes necessary, pull
the insert out by hand.

(6)
Drain the calibration fluid,
clean the insert with paper
towels, and fill with the
desired calibration fluid.

**CAUTION:
Only change the insert when the calibration fluid is at ambient temperature!
Risk of burns or frostbite.**

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13.2 Metal block inserts (conversion to metal dry block calibrator)

Order-Code: **LTC-FB-DB-...**

Various metal block inserts are available for the different calibrator variants: without holes (for drilling yourself), with 7 or 9 holes.
To convert the temperature calibrator, it must be completely emptied and the reservoir cleaned.

The magnetic mixer rod must be removed using the auxiliary tool (see illustration below), and the reservoir must be completely cleaned and dried with absorbent paper or cloth. Then insert the metal block into the opening of the reservoir.

When operating with the metal block inserted, the control (6) for the magnetic mixer must be set to the lowest possible level. To convert back to a calibration bath, proceed in reverse order.
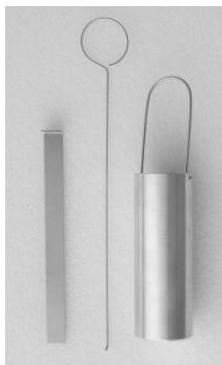
Please note the changed temperature working ranges, uniformity, and stability of the controlled temperatures:

LR-Cal	LTC-FB-9035-45	LTC-FB-9018-60	LTC-FB-0200-60	LTC-FB-0250-60
Dimension:	Ø 44,5 mm x 170 mm	Ø 59,5 mm x 170 mm	Ø 59,5 mm x 170 mm	Ø 59,5 mm x 170 mm
Range *:	-10...+140°C	-10...+120°C	ambient...+200°C	ambient...+250°C
Stability:	±0.04°C	±0.04°C	±0.04°C	±0.04°C
Radial temperature uniformity:	±0.03 at 0°C ±0.05 at 80°C	±0.03 at 0°C ±0.05 at 80°C	±0.05 at 80°C	±0,05 at 80°C

* = Temperature working range

Please note that when used as a metal block temperature calibrator, the heating and cooling times are longer than those specified in the technical data for the portable temperature calibration bath!

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13.3 Extension tube (Increase in immersion depth)

Order-Code: **LTC-FB-LONG**
(NOT suitable for version LR-Cal LTC-FB-9035-45!)
This accessory LTC-FB-LONG is an extension tube for increasing
the immersion depth of the calibration bath for test specimens with
particularly long probes or submersible elements.

Usable diameter:	60 mm
Usable depth:	230 mm
Maximal temperature:	for LR-Cal LTC-FB-9035-45 + LR-Cal LTC-FB-9018-60: +130°C
	for LR-Cal LTC-FB-0200-60 + LR-Cal LTC-FB-0250-60: +180°C
Minimal temperature:	for LR-Cal LTC-FB-9035-45 + LR-Cal LTC-FB-9018-60: -9°C

LR-Cal LTC-FB-9035-45 + LR-Cal LTC-FB-9018-60 with silicone oil 47V10 (Code **LTC-FB-SO-010**):
Radial uniformity: ±0.15°C, measured 50 mm above the base
Axial uniformity: ±0.15°C (±0.2°C at <0°C), measured 150 mm above the base

LR-Cal LTC-FB-0200-60 + LR-Cal LTC-FB-0250-60 with silicone oil 47V20 (Code **LTC-FB-SO-020**):
Radial uniformity: ±0.2°C, measured 50 mm above the base
Axial uniformity: ±0.1°C, measured 150 mm above the base

Operating instructions:

The sensors must be positioned as close as possible to the center of the calibration bath container
and approximately 3 cm from the bottom.
Avoid positioning sensors at the edge of the calibration bath container, as this reduces
temperature uniformity due to poorer mixing. Maintain a distance of at least 1.5 cm from the edge
of the container.

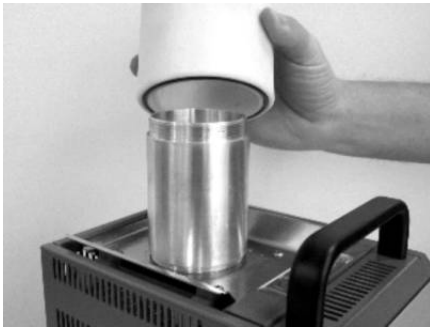### Installation of the extension tube:
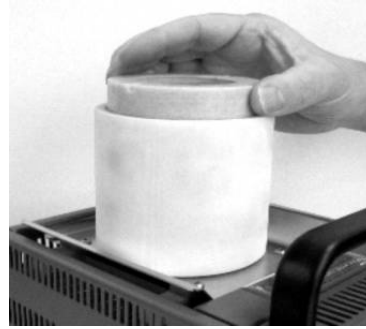

(1)
Unscrew the upper ring nut.

(2)
Screw in the extension tube, making
sure that the O-rings are correctly
positioned.

(3) Insert the insulating pipe.

(4) Screw the upper ring nut back on.

Ensure that the O-rings are positioned correctly, as this is the only way to guarantee that the extension tube is leak-proof. Fill the calibration fluid to approx. 5 cm below the rim of the tube and top up if necessary. Ensure that no fluid is leaking from under the tube; if necessary, screw the extension tube back on tightly.
When you have finished using the extension tube, the calibration fluid must be at approximately room temperature before removal.

Emptying:
To empty the container, including the extension tube, ensure
that the temperature of the calibrator is approximately the same as the
ambient temperature. Then screw the supplied cap onto the green
ring and pour out the liquid.

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LR-Cal **LR** Temperature calibration
micro baths LR-Cal LTC-FB-...

MANUAL

13.4 Cooling coil (accelerated temperature reduction)

Order-Code: **LTC-FB-COOL**

Only suitable for versions LR-Cal LTC-FB-0200-60 + LR-Cal LTC-FB-0250-60.
NOT suitable for versions LR-Cal LTC-FB-9035-45 + LR-Cal LTC-FB-9018-60.

The cooling coil is designed to increase the cooling speed; it can also be used to lower the temperature range of the calibrator (temperatures below ambient temperature).

Pipe diameter:	10 mm
Pipe length:	300 mm
Maximal temperature:	200°C (Attention at version LR-Cal LTC-FB-0250-60!)
Requirement:	Cold water supply
	(requires connection to your cold water supply)

The minimum operating temperature depends on the calibration fluid and the temperature of the water from your cold water supply.

Example: Water temperature of your cold water connection = 15°C,
Used calibration liquid = silicone oil 47V5 (200C5)
Temperature range start = 20°C (even at higher ambient temperatures)

Instructions for use:
• Set a low temperature as the set point on the temperature calibrator, for example +20°C, and make sure that the valve on the cooling coil is closed.
• Connect your cold water supply to the inlet of the cooling coil (= side with valve).
• Connect the outlet of the hose to a plastic hose to drain the hot water.
• Open the valve carefully. Adjust it so that the calibration fluid is cooled evenly.
• Make sure that there are no leaks.
• Only now you should insert the cooling coil into the calibration tank bath.

⚠️ **WARNING:**
Only use silicone tubing for high-temperature applications.
WARNING:
Leave the hose outlet open. Close the valve at the end of the process.

CAUTION:
There is a risk of burns when working with high temperatures.

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Appendix A: Declaration of conformity

The manufacturer DRUCK & TEMPERATUR Leitenberger GmbH, Bahnhofstr. 33,
72138 Kirchentellinsfurt, GERMANY, certifies that the system

• Portable temperature calibrator - temperature calibration micro bath
   LR-Cal LTC-FB-9035-56   LR-Cal LTC-FB-9018-60
   LR-Cal LTC-FB-0200-60   LR-Cal LTC-FB-0250-60
complies with the requirements of the following European directives:

• Low Voltage Directive 2014/35/EU
• EMC Directive 2014/35/EU

Conformity is confirmed by affixing the CE marking to the product.

DRUCK & TEMPERATUR Leitenberger GmbH
Kirchentellinsfurt, January, 2026

(Gernot Coulon)
General Manager / C.E.O.

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Appendix B: Drawing LR-Cal LTC-FB
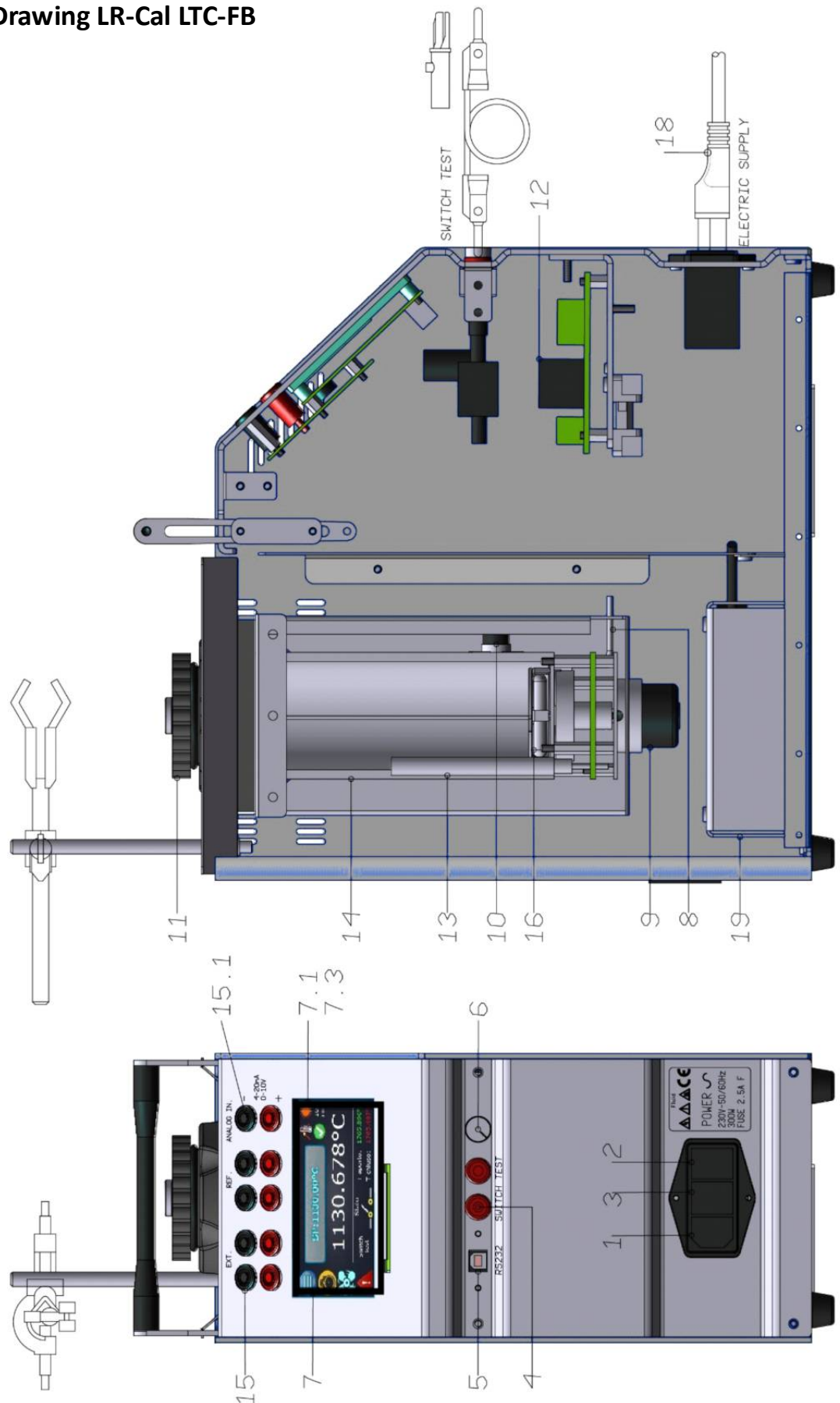
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LR-*Cal* LR

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