Instructions for

- **Recalibration**
- **Communication via USB interface**

for LR-Cal LTC temperature calibrators

- LR-Cal LTC-FB-9035-45
- LR-Cal LTC-FB-9018-60
- LR-Cal LTC-FB-0200-60
- LR-Cal LTC-FB-0250-60
- LR-Cal LTC-DB-9030-35
- LR-Cal LTC-DB-9050-35
- LR-Cal LTC-DB-0600-35
- LR-Cal LTC-DB-1100-44
- LR-Cal LTC-DB-1200-35

1. Recalibration of LR-Cal LTC temperature calibrators

To recalibrate your LR-Cal LTC temperature calibrator, we recommend sending it to DRUCK & TEMPERATUR Leitenberger GmbH. Please note the return instructions in the operating manual for your calibrator.

If you have the appropriate equipment and the necessary expertise, you can recalibrate your LR-Cal LTC temperature calibrator yourself.

1.1 Requirements

- You understand these instructions, which are available in English language only.
- You have certified reference standards with sufficient measuring accuracy (significantly more accurate than the LR-Cal LTC temperature calibrator).
- You have a room (calibration laboratory) with stable environmental conditions (clean, stable room temperature, normal relative humidity).
- You have expertise in the field of calibration/adjustment of measurement technology.
- You have read and understood the operating instructions for your LR-Cal LTC temperature calibrator in full.
- You are experienced in using your LR-Cal LTC temperature calibrator.

1.2 Preparation

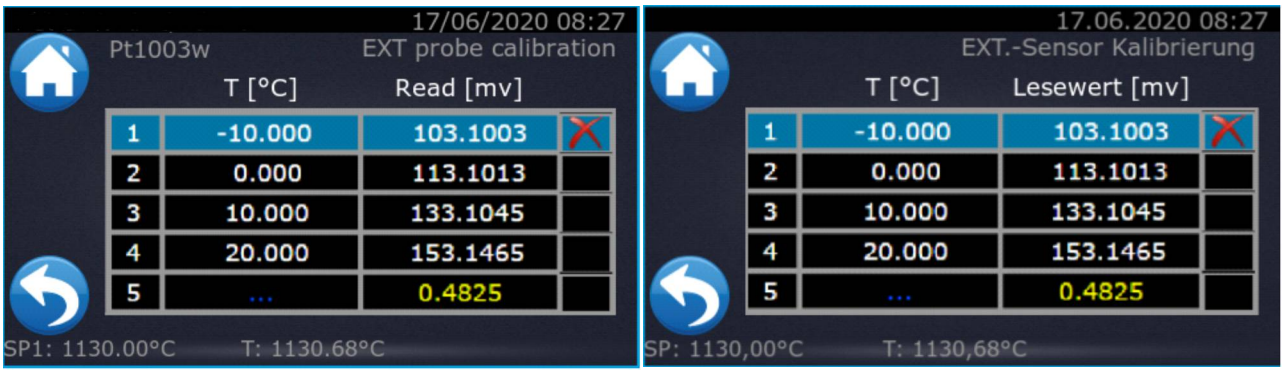
- Refer to chapter 5 and 5.5.3 to see, how to enter the menu screen of your device.
- Select the function „Password“ and enter there the password. Default = **1234**.
- Now the menu item „Calibration“ within the menu items appears.
- Select the menu item „Calibration“ (“Kalibrierung“).
- Select, which sensor you want to recalibrate:
  Devices without option LTC-MP-3I: „INT probe calibration“ only.
  Devices with option **LTC-MP-3I**: in addition „EXT probe calibration“ + „REF probe calibration“.

The buttons on the left side of the screen are used to navigate through the various pages. Tapping on the „Home“ button takes you back to the Main Screen. Using the „backwards“ button takes you back to the Menu Screen.

NOTE: The ANALOG probe is calibrated by tapping the dedicated box on the Main Screen.

• Tap on the button with the sensor channel you want to calibrate.

A new screen opens:



On the top right of the screen, the selected probe is shown (in above example: EXT probe, this means, a probe, connected to the with EXT marked input sockets.
On the top left of the screen, the present sensor type is shown (in above example: Pt 100 3-wire).

The table below (scrollable) shows the 20 calibration points relating to the probe/channel.

1. column: Index (1...20) (note: even for INT sensor, this table shows 20 lines, but you can use the first 5 of them only, for the INT channel.
2. column: Temperature value entered by you (to specify a calibration point).
3. column: Indication of the actual reading of the channel at that point.
4. column: check-mark possibility for deleting a selected calibration point.

The units of measurment in the 3rd. column change based on the type of sensor assigned.

By pressing on the index (first column) it is possible to select a row, in order to enable the delete „cross mark“ (fourth column) which allows you to delete a single point in the table.

The reading in yellow (at the bottom of the screen) represents what the channel returns in real time (updated in real time).

By pressing on the 3 points a pop-up window with a numeric keyboard opens. Here you can insert a new point in the table.

Important note:
The recalibration can only be made with temperature measuring unit is set to °C.
Change previously the measuring unit according the instruments operating manual to °C, if presently set to another unit (°F or K).

1.3 How to recalibrate the internal reference probe / INT channel:

The purpose of recalibration is to correct the error between the indicated temperature and the value of a Master probe.

Note that you need a master (reference) with higher precision than that of the LR-Cal LTC device.

It is possible to perform a complete or partial recalibration of the appliance annually or at the user's choice.

- Insert the master thermometer probe in the calibrator. In case your calibrator is a dry block calibrator, select the most suitable hole of the block insert (see device operating manual!).
- Select the calibration points according to the field of the equipment or the field in which you operate your device normally.
- Set the first calibration point with SET POINT and wait for the appliance is stable.
- Enter the INT probe calibration page - see previous explanations.
- Using the virtual keyboard on the pop-up window: enter the temperature value read by the master probe and confirm with the green button.
- Set the second SET POINT that corresponds to the second calibration point and wait for the appliance is stable.
- Using the virtual keyboard on the pop-up window: enter the temperature value read by the master probe and confirm with the green button.
- Proceed in this way for all the points that you want to recalibrate (up to 5 points for the INT channel).

Any incorrect inputs can be deleted and reinserted. In case you made a mistake on a calibration point, you can redo also only that one.

1.4 How to recalibrate the EXT + REF inputs/channels with a signal generator

- **For devices with option LTC-MP-3I only!**
- **Signal generator required** (e.g. LR-Cal LTC 100)

The calibration of the EXT + REF inputs is performed by adjusting the probe at several points.

The purpose of the recalibration is to correct the error of the EXT and REF inputs. To calibrate this two inputs, it es necessary to have a Pt 100 generator and/or a thermocouples calibrator according to what you want to calibrate.

- Select the type of the EXT or REF input to be recalibrated. See in device operatin manual, how to activate a channel/input.
- Connect the signal generator to the EXT or REF input and let it generate the value of the first calibration point. Respect the polarities and connections indicated in the device operation manual.
- Enter the EXT or REF probe calibration page.
- With the virtual keyboard on the pop-up window enter the temperature value measured with the master in the first line of the table. (Confirmation via green button.)
- Generate the temperature of the second calibration point with the signal generator.
- With the virtual keyboard on the pop-up window enter the temperature value measured with the master. This value corresponds to the second line of the table. (Confirmation via green button.)
- Proceed in this was for all the temperature points that you want to recalibrate (calibration points).

Any incorrect values can be deleted and reinserted.
The above described instructions are valid for the EXT channel as well as for the REF channel.

1.5 How to recalibrate the REF input/channel with a probe connected to the input

- **For devices with option LTC-MP-3I only!**
- **Master (reference) thermometer (probe with indicator) required**

This operation adaptes the value indicated by a probe connected to the REF input, compensating its errors.

To perform the calibration, it is necessary to connect the probe to the REF terminals and to have a Master (reference) thermometer.

- Connect the probe to the REF input respecting the polarity and connection indicated in the calibrators operating manual.
- Insert the master (reference) thermometer in the calibrator. See instructions in the calibrators operating manual.
- Set the SET POINT to the first calibration point and wait until the calibrator is stable.
- Enter the REF probe calibration page.
- With the virtual keyboard on the pop-up window enter the temperature value read with the master (reference) thermometer into the table. (Confirmation via green button.)
- Set the SET POINT to the second calibration point and wait until the calibrator is stable.
- With the virtual keyboard on the pop-up window enter the temperature value read with the master (reference) thermometer into the table. (Confirmation via green button.)
- Proceed in this way for all the points you want to recalibrate.

Any incorrect values can be deleted and reinserted.

2. Communications parameter - Interface protocol

After switching on the calibrator and connecting the USB cable wait the end of the start-up procedure and press the button  to activate serial communication via the USB port.
General characteristics:

Baud Rate: 9600 Parity: No
N. Bit: 8 Bit of stop: 1

The communication runs in half-duplex way which means that is transmission and reception could not be contemporaneously present.
The regulator replies only after receiving command; it never replies itself.
The command and reply are ASCII character string, as detailed forward. The communication program will be able to convert ASCII to decimal to extract numeric values.
The default address is 1.
Baud rate: 2400, 4800, 9600 or 19200 baud, the default value is 9600; the other parameters are standard (fix).

Var	Parameter	Format		Read only
0	Set Point	Float		
1	Ramp ON/OFF	Integer	1=ON | 0=OFF	
2	Set Point 2	Float		
3	Gradient	Float	0...99.99°C/min	
4	Resolution	Integer	0=0.1 | 1=0.01	
5	Proportional Band	Integer	**DO NOT CHANGE** | 0...99%	
6	Integral Time	Integer	**DO NOT CHANGE** | in seconds	
7	Derivative Time	Integer	**DO NOT CHANGE** | in seconds	
8	**only for temperature calibrators LR-Cal LTC with Option LTC-MP-3I:** Channel selection	Integer	1=only internal | 2=INT+EXT | 3=INT+REF | 4=INT+EXT+REF	
9	Title	String	max. 22 characters	
10	Units (°C/°F/K)	Integer	0=°C | 1=°F | 3=K	
13	Access key	Integer	0...99	
14	Baud rate	4800...19200		
15	Adress	Integer	0...99	
16	Serial number	String	max. 22 characters	X
18	Max. set point	Float		
19	Min. set point	Float		
21	Wait On/Off	Integer	0=OFF | 1=ON	
22	Switch ON	Float		X
23	Switch OFF	Float		X
24	Firmware version	String	9 charachters	X
25	**only for temperature calibrators LR-Cal LTC with Option LTC-MP-3I:** EXT sensor type	Integer	0=Pt 100 4-wire | 1= TcN | 2=TcK | 3=TcJ | 4=TcR | 5=TcS 6=Pt 100 3-wire | 7= TcE | 8=Pt 1000 | 9=TcT | 10=TcB	
26	**only for temperature calibrators LR-Cal LTC with Option LTC-MP-3I:** REF sensor type	Integer	0=Pt 100 4-wire | 1= TcN | 2=TcK | 3=TcJ | 4=TcR | 5=TcS 6=Pt 100 3-wire | 7= TcE | 8=Pt 1000 | 9=TcT | 10=TcB	
27	**only for temperature calibrators LR-Cal LTC with Option LTC-MP-3I:** INT sensor type	Integer	0=Pt 100 4-wire	
28	Stability range	Float	0...99.99	
29	Symbol of stability	Integer	0=NO | 1=YES	X
100	Temperature	temperature value of INT sensor		X
105	**only for temperature calibrators LR-Cal LTC with Option LTC-MP-3I:** EXT temperature	temperature value of EXT input		X
106	**only for temperature calibrators LR-Cal LTC with Option LTC-MP-3I:** REF temperature	temperature value of REF input		X

Each command string is ASCII character succession.
First character is **$**; the next must indicate the instrument address (default = **1**) and then followed by the command (4 characters).

Possibilities: **RVAR** = data reading | **WVAR** = data writing

The ultimate part of a string is depending of a type command. The character **<cr>** (CarriageReturn) concludes the sequence.

Table with all variables see previous page.

2.1 Data reading

For reading use the command **RVAR**.

Example 1:
Reading of the Set Point (variable **0**): The command string is **$1RVAR0_<cr>**
where each character means:

$	= beginning of message
1	= instrument address
RVAR	= reading command
0	= variable number to read (see the table on the previous page)
_	= space
<cr>	= CarriageReturn = end of message

The response string is: ***1_110,0** (110,0 is only for example).
The character **<cr>** (CarriageReturn) concludes the message.

Example 2:
Reading of the EXT sensor (only for versions with option **LTC-MP-3I**: (variable 105):
The command string is: **$1RVAR105_<cr>**
The response string is: ***1_123,4** (123,4 is only for example)
The character **<cr>** concludes the message.

The response does not include the measure unity. To read the measurement unity, read variable 10: The command string is: **$1RVAR10_<cr>**
The response string is: ***1_0** if the temperature unity is set to **°C**
The response string is: ***1_1** if the temperature unity is set to **°F**

2.2 Data writing

For writing, use the command **WVAR**.

Writing float variables:

Example 1:
Writing the Set Point to 132,4°C

If the unity of measure of the temperature is already „°C“, it is enouph to write the Set Point variable (see table with the variables).
The command string is: **$1WVAR0_132,4<cr>**
where each character means:

- **$** = beginning of message
- **1** = instrument adress
- **WVAR** = writing command
- **0** = Number of the variable to read (see table with the variables)
- **_** = space
- **132,4** = numerical value of data with character „.“ to separate the decimal part of the number
- **<cr>** = CarriageReturn = end of message

At reception of the command, the calibrator answers with ***1<cr>**. This answer shows the recogintion of the command.

If the unity of measure of the temperature is not „°C“, you first have to write in variable **10** the value **0** (=°C).
The command string is: **$1WVAR10_0<cr>**
At this point the new data is stored. Then you can write the variable 0 for the SetPoint in °C.

Writing integer variables:

Integer variables have two or more states (e.g. for the resolution, the measurement unity, etc.)
It is necessary to assign the value corresponding the required result to the variable.

See the table with the variables, where you can see the possible value for the integer variables.

Example 1:
The variable **1** corresponds to the activation of the ramp function. If you want to set it to ON in order to activate the ramp, you have to assign the value **1** to variable **1**, this sets the ramp to ON. Otherweise, with value 0, you set the ramp to OFF.
The command string is: **$1WVAR1_1<cr>**

Example 2: (only LR-Cal LTC with option **LTC-MP-3I**)
You want to connect a thermocouple type K to the EXT input.
You have to write value **2** (= type K thermocouple) to variable **25** and value **2** (= channel INT+EXT) to variable **8**. (Refer to the table with the variables.)
The command strings are: **$1WVAR25_2<cr>**
$1WVAR8_2<cr>

Example 3: (only LR-Cal LTC with option **LTC-MP-3I**)
You want to connect a Pt 100 (4-wires) to the REF input and a Pt 100 (3-wires) to the EXT input.
You have to write value **6** (= Pt 100 3-wire) to variable **25**, value **0** (= Pt 100 4-wire) to variable **26** and value **4** to variable **8** (to display INT+EXT+REF values).
The command strings are: **$1WVAR25_6<cr>**
$1WVAR26_0<cr>
$1WVAR8_4<cr>

Summary of the most used integer variables ("Var"):

Var	Parameter	Values
1	Ramp ON/OFF	1=ON | 0=OFF
4	Resolution	0=0.1 | 1=0.01
8	**only for temperature calibrators LR-Cal LTC with Option LTC-MP-3I:** Channel selection	1=only internal | 2=INT+EXT | 3=INT+REF | 4=INT+EXT+REF
10	Units (°C/°F/K)	0=°C | 1=°F | 3=K
25	**only for temperature calibrators LR-Cal LTC with Option LTC-MP-3I:** EXT sensor type	0=Pt 100 4-wire | 1= TcN | 2=TcK | 3=TcJ | 4=TcR | 5=TcS 6=Pt 100 3-wire | 7= TcE | 8=Pt 1000 | 9=TcT | 10=TcB
26	**only for temperature calibrators LR-Cal LTC with Option LTC-MP-3I:** REF sensor type	0=Pt 100 4-wire | 1= TcN | 2=TcK | 3=TcJ | 4=TcR | 5=TcS 6=Pt 100 3-wire | 7= TcE | 8=Pt 1000 | 9=TcT | 10=TcB

DRUCK & TEMPERATUR Leitenberger GmbH
Bahnhofstr. 33, 72138 Kirchentellinsfurt, Germany

Tel.: +49-(0)7121-90920-0
E-Mail from inside of Germany: DT-Info@Leitenberger.de
E-Mail from outside of Germany: DT-Export@Leitenberger.de

www.druck-temperatur.de