Operating Manual

LR-*Cal* FLUID 100-N
LR-*Cal* FLUID 100-45

Portable temperature calibration bath

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1. Safety instructions

1.1 Used symbols

WARNING!
Hot surface or part.

CAUTION!
Indicates a potentially dangerous situation, that can result in injuries or damage to equipment, personnel or environment, if not avoided.

DANGER!
Identifies hazards caused by electric power. Should the safety instructions not be observed, there is a risk of serious or fatal injury.

This instrument must not be disposed of in domestic waste. The disposal is carried out by return to the manufacturer of by the corresponding municipal authorities (see directive 2002/96/EC).

1.2 Warning

CAUTION!
Hazardous voltage are present in this electrical equipment during operation. Non-observance of the safety instructions can result in severe personal injury or property damage.
Only qualified personnel should work on or around this equipment after becomming familar with all warnings, safety notices and maintenance procedures contained herein. Only qualified personnel or our personnel should work on this equipment for maintenance operation.
The successful and safe operation of this equipment is dependent on proper handling, operation and maintenance.
Do not use the instrument for any application other than calibration of temperature any other use of the instrument may cause hazards to the user.
Use the instrument only in normal environmental conditions.

Where not specified, the numbers in parentheses in this manual refer to the drawings on page 9 and 18.

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WARNING!
Due to the fact that the temperature calibrator is a portable instrument, it is very important to ensure that the socket has been earthen correctly when connecting it to the electricity supply.
Carry out the mainentance and any repair operation only with the equipment at ambient temperature and disconnected from the electric power.

During the use of the temperature calibrator, the upper protection grid may overheat.
Do not touch the probe to calibrate when it is in the fluid reservoir.

Never change the configuration parameters (3. Function Menu Level).
Do not operate the instrument in an excessively wet, oily, dusty or dirty environment.
Do not connect any voltage to the input bushes (4), (5), (15).
Remove the cover before switching on and do not put it back until the liquid has reached ambient temperature and the temperature calibrator is turned off.

With silicon oil 47V5 verwenden absolutely do never
exceed the maximum temperature of +130°!

This equipment adopt the following devices to protect operation from hazard:
• Protection fuse (3).
• Thermal fuse to protect the container in case of over-temperature.
• Ground conductor.

Follow this instructions:
• Never put anything on the top of the temperature calibrator.
• Never put fuel objects (liquids) near the calibrator.
• If the temeprature calibration bath is operating at high pressure, a fume hood should be used
  to remove any vapours given off by the hot bath fluid.
• Never put any type of liquids unless water-glycol (50%) or silicon oil inside the reservoir.
• Use common sense any time.

After any use at high temperature, bring the Set Point to room temperature letting the temperature calibrator go till it's cold.

⚠️

After any extended use at a temperature below zero:

- **Bring the Set Point to about 95...100°C letting the temperature calibrator work till the water inside the oil has completely evaporated.**
Using the temperature calibrator at a temperature below zero for a long time with high environmental humidity needs it takes a long time to evaporate the whole water inside the oil (mor than one hour could be necessary).
Air humidity when the oil has a low temperature condenses on oil surface in the shape of ice crystals.
At 95...100°C the formation of foam means that the water inside the oil has evaporated.

2. Technical data

2.1 Purpose and summary of instructions

This manual contains the use and maintenance instructions valid for the following equipment:
Portable Temperature Calibration Bath **LR-*Cal* FLUID 100-N** and **LR-*Cal* FLUID 100-45**.

The instructions reported in this manual, for the above mentioned equipment, are those relevant to:
• Start-up preparation
• Operation description
• Using the equipment
• Re-calibration procedure
• Preventive maintenance
• Typcial faults and their remedies

Users must observe all the usual safety rules out in this manual for own security and to avoid equipment failure.

Order-Code model **LR-*Cal* FLUID 100-N**:   FLUID100-N   (without measuring inputs)
Order-Code model **LR-*Cal* FLUID 100-N-2I**:   FLUID100-N-2I   (with 2 measuring inputs)

Order-Code model **LR-*Cal* FLUID 100-45**:   FLUID100-45   (without measuring inputs)
Order-Code model **LR-*Cal* FLUID 100-45-2I**: FLUID100-45-2I   (with 2 measuring inputs)

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2.2 Name of the product

Portable temperature calibration bath **LR-Cal** **FLUID 100** resp. **LR-Cal** **FLUID 100-N**, including standard accessories as per chapter 2.9.

2.3 Technical data

Environmental temperature range:		+5°C...+45°C
Environmental humidity range:		10...80% r.h.
Operative temperature range:		
	model **LR-Cal** **FLUID 100-N**	-18°C...+150°C
	model **LR-Cal** **FLUID 100-45**	-30°C...+150°C
Stability:	at -10°C	±0.03°C
	at +121°C	±0.02°C
Display resolution:		0.01° / 0.1° switcheable
Measuring accuracy (at 100°C):		±0.15°C (**LR-Cal** **FLUID 100-45**: ±0,015°C)
Internal reference sensor:		Pt 100 class A DIN 43760
Version **-2I** with 2 measuring inputs:		Pt 100 and thermocouples type K, J, T, N, E, S and R
Temperature unit:		°C, °F, K, switcheable
Interface:		RS232
Reservoir depth:		185 mm (usable: 150 mm)
Usable liquids:		Silikon oil, gycol-water mixtures
Ramp function:		Min. 0.1°C / min.
Max. ascent rate:		4°C / min. (-10°C...+100°C)
Max. descent rate:		6°C / min. (+125°C...+30°C)
		1,5°C / min. (+30°C...-12°C)
Thermostat switch test:		12 Vcc
Supply:		230 VAC ±10% at 50/60 Hz
		(optional: 115 VAC ±10%)
Power:		300 VA
Fuse:		2.5 A type F (3.0 A for supply version 115 VAC)
Dimension:		160 x 330 x height 370 mm
Weight:		10 kg (approx. 17 kg incl. packing)

• Structure in flanged iron plate with handle
• Microprocessor operated temperature regulator
• Switch test
• Internal oven in stainless steel
• Electronic control components thermally insulated
• Forced air cooling system
• Socket with main cable and protection fuses
• Electromagentic compatibility: Emission EN50081-2 and Immunity EN50082-2

NOTE:
All stated values are based on:
• **Ambient temperature +20°C**
• **Supply 230 VAC ±10%**
• **Silicon oil type 47V5**
• **Pt 100 with 6 mm diameter**
Valid for one year, then recertification recommended.

Controller Data:

Display   2 lines (3.2 x 5.5), with back light
Microprocessor: 80C522 (80C51 family, CMOS)
Memory: 8K SRAM (ultra-low-power SRAM, crystal, power-fail control and battery
A/D converter: 24 bit
E2PROM-memory, serial communication RS232 insulated.

2.4 Intended use

The portable temperature calibrator **LR-Cal** **FLUID 100-N** and **LR-Cal** **FLUID 100-45** is usable for following applications:
• Check and calibrate temperature sensors, in the laboratory or in the field, in conformity to
  ISO 9000 standards.
• Check and calibrate thermostats with LED indication when electric contact closes.
• Thermal tests on materials
The temperature calibrator has been designed to reduce the EMC effect in accordance with the harmonised regulation for residential, commercial, light industry and heavy industry.
NOTE: With optional PC software AQ2sp the temperature calibrator can carry out:
• Complete control of the calibrator from PC
• Manual or automatic calibration of one or more probes (test items)
• Cyclic life or stress test on temperature sensors
• Test of thermostats to check the opening and closing of the switch
• Filling and printing of the results optained, guaranteeing that the ISO 9000 standars are
  observed.

2.5 Quantity

1 piece

2.6 Manufacturer

DRUCK & TEMPERATUR Leitenberger GmbH, Bahnhofstr. 33, D-72138 Kirchentellinsfurt, Germany. www.LR-Cal.net

2.7 Correspondent data sheet:

„FLUID 100"

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2.8 Drawing

Schnitt A - A

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Electrical drawing

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2.9 Scope of standard delivery

1 bottle silikon oil 47V10 at model **LR-*Cal* FLUID 100-N**
1 bottel silikon oil 47V10 at modell **LR-*Cal* FLUID 100-45**
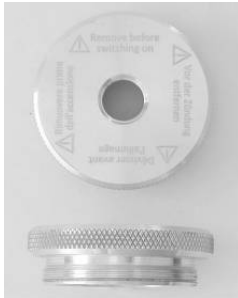
Cover for transport and emptying

Accessories for transport and emptying

Cover with holes for two probes

Holders for probes (optimized for glass thermometer)

Electrical power cable
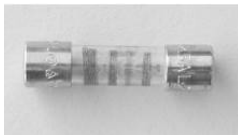
Spare fuse

only **-2I** version: Clamps for probes

Cables for thermostat- / switch-test

Soft bag

Operating manual

Test certificate (accuracy, stability, final check)

2.10 Optional Accessories
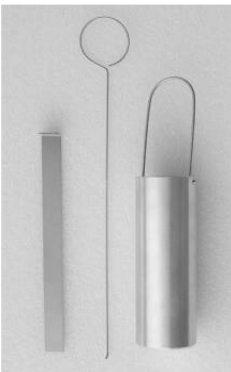
Order-Code: **FLUID-INS-9** or **FLUID-INS-0**
Kit to convert to metal dry block calibrator

Order-Code: **FLUID100-ER**
Extension tube to increase insertion depth of the reservoir to 230 mm

Order-Code: **599.0.000.0003.0**
PC software AQ2sp incl. RS232 interface cable

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3. Calibration media

CAUTION
The temperature calibrator has been configured in the factory with the parameters that optimize the performance of the equipment. Modification of these parameters (3. Menu Function Level) can cause malfunctioning or breakage of the equipment with consequent risk of damage to objects or injury to persons.

Before filling the reservoir, be aware of fundamental facts regarding the liquids that can be used!

3.1 Liquids
The **LR-Cal** FLUID 100-N and **LR-Cal** FLUID 100-45 temperature calibrator is suitable in a field from temperature from -18 up to 150° resp. -30 to 150°C; different liquids can be put into the bath but not many can work on the entire calibrator field.
Before using the temperature calibrator check the temperature field of the liquid to be used and always remain under the safety limits. The upper temperature limit is conditioned by vaporisation, smokiness, flammability and chemical deterioration of the liquid. The inferior temperature limit is conditioned by freezing of the liquid.
The principal features of a liquid for constant-temperature baths are: the temperature field, viscosity, specific heat, thermal conductivity, the thermal expansion, the dielectric resistivity, life span, safety, etc.

3.1.1 Recommended temperature field
The recommended temperature field of the principal liquids which can be used with the temperature calibrator are shown below. It depends principally on the equipment in which it is used. Normally the temperature field of a liquid is greater than the one shown below, but out of these values fome features of the liquid can jeopardise functioning inside the calibrator.

• Wasser-Glycol-Mixture (50%):	recommended for operation range -30...+60°C
Smokiness increases considerably above 70°C!
• Silikon oil type 47V5:	recommended for operation range -20...+125°C
Steam triggers combustion in the presence of a naked flame above 136°C!
• Silikon oil type 47V10:	recommended for operation range -15...+140°C
Smokiness increases considerable above +130°C!
• Silikon oil type 47V20:	recommended for operation range +20...+140°C
Smokiness increases considerable above +130°C!

Straight water is not recommended because of the presence of limestone causes blockage of the agitation.

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3.1.2 Viscosity

Viscosity is the property of fluids that indicates it's resistance to mixing and it depends on the type of fluid and temperature.

The more viscous the fluid, the more difficult the mixing of the fluid and consequently the distribution of a uniform temperature inside the bath.

Liquids with a viscosity higher than 20 centistokes (cts) do not allow a good performance of the bath, therefore they should be avoided in the **LR-Cal FLUID 100-N** and **LR-Cal FLUID 100-45**. Oil viscosity is established at room temperature.

	The value for water (at 20°C) is	1 cst.
Viscosity at room temperature	silicone oil 47V5	5 cst
	silicone oil 47V10	10 cst
	water-glycol-mix 50%	5 cst

Remember that viscosity, especially in oils, varies considerably when the temperature changes: this is the reason that characterises the use of oil in a well-defined field: normally the oil becomes more viscous when the temperature drops, creating problems in mixing and uniform distribution of the temperature.

3.1.3 Thermal expansion

Thermal expansion indicates how liquid volume changes with variation of the temperature. It is an important factor especially regarding oils, which increase in volume with increase of temperature. Read the filling instructions and do not fill over the values indicated because thermal expansion could cause the liquid to escape from the bath.

Silicone oils increase by about 10% with respect to their initial volume with a temperature increase of 100°C.

3.1.4 Life span

The life span that you can expect depends on many conditions: evaporation, chemical deterioration, gelling, etc.

The life span of an oil becomes shorter becauer the higher the temperature the greater oxidation of the oil in contact with air.

To increase the life span:

• Use the most suitable oil at high temperature for the shortest time possible

• Place the appropriate cover with holes on the bath to allow passage of the probes, in order to limit contact between the hot oil and air.

For example: continous use at 125°C, in open bath conditions, of 47V5 silicone oil cause deterioration in a few tens of hours; with the deterioration of its conditions the viscosity increases considerably; at temperature below zero the 47V5 silicone oil becomes doughy and mixing in the bath is impossible.

3.1.5 Bath filling

Fill the temperature calibrator with the suitable fluid depending on the field of calibration. The liquid we recommend is 47V5 silicone oil (resp. 47V10). Fill the bath with about 43-43 cl of oil. Do not exceed the recommended quantity, as the thermal expansion at high temperatures could cause the liquid to escape from the upper opening.

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Using 47V5, bath performances are optimal in the field from -20° to 120°C, but with a fumes suction device it can be used up to 125°C, limiting the running time to the highest values in order to increase the life span, while at a low temperature the viscosity, even if high, allows good functioning of the temperature calibrator, adjusting the magnetic stirrer to maximum speed.

If the liquid is often used at high temperatures, we suggest to use the appropriate cover with holes that allow passage of the probes and place it on the bath.

Before replacing the liquid in the calibrator with a different one, it is recommended to clean the container with absorbent paper in order to prevent mixtures of different liquids that worsen the operating conditions and, most of all, cause the liquid to leak due to incompatibility of the maximum temperature.

3.1.6 Stirrer adjustment

The rotational speed of the magnetic stirrer can be adjusted using knob (6). The speed increases with a clockwise movement. Adjustment is based on the vortex produced in the liquid: an ideal vortext should be about 2 cm high. The rotational speed should be raised, at low temperatures, when high viscosity silicone oil is used. At high temperatures reduce the rotational speed in order to prevent having vortexes that are too high causing the liquid to escape.

Switch the temperature calibrator off, if the rotation is blocked, adjust the speed controller (6) to maximum and switch on the calibrator again. If it still does not work, perform the maintenance indicated in chapter 6.

3.1.7 Positioning of the probes

In order to get the best performances in the calibration, observe the following recommendations:

• Verify that the probe is inserted for about 140 mm, avoiding touchting the bottom.

• As for the calibration by means of comparison with a reference sample, it is necessary to position the two probes, respectively the sample one and the probe to be calibrated, at the same lavel and as close as possible.

• To get the best accuracy and stability, put over the bath the protections disc with holes to allow the passage of the probes (see image below).

• The protection disc reduces the formation of moisture condensation in the silicone oil at low temperatures.

• Do not insert the probes in the center of the tank interfere with stirring.

• Always verify the operating range of the probes a thermostats before calibration: only insert them i liquid if the calibration range is compatible with tl temperatures set on the temperature calibrator. For example: inserting a probe with a range 0...50 a liquid at a temperature higher than 120°C could determine the breakage of the probe's sensitive e

• Avoid placing too many probes at the same time, because the agitation of the liquid is disturbed resulting in large calibration errors.

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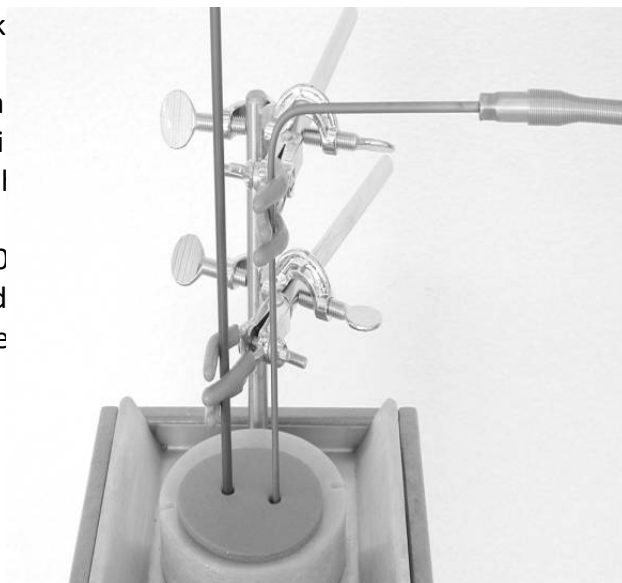
3.1.8 Recommendations

• Do not close the container when the temperature is very high. Wait for the temperature of the liquid to reach room temperature and then turn off and close using appropriate cap and cover.

• Avoid transporting the **LR-Cal FLUID 100-N** and **LR-Cal FLUID 100-45** temperature calibrator without having emptyed and closed it beforehand, following the previous instructions.

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4. Installation and Operation

4.1 Installation

4.1.1 Removal of packaging
The temperature calibrator is equipped with suitable packaging for transport and traditional shipping systems. Any damage caused during transport must be notified immediately to the transporters and claim must be made.

4.1.2 Positioning the temperature calibrator
Position the temperature calibrator on a safe and clean place.

The temperature calibrator is suitable for operating at high temperatures with the consequent danger of fire. Keep it away from any type of inflammable materials and never put any type of liquid inside (except the liquid reservoir).

To avoid any smell in the room it is better to switch on the temperature calibrator outside the room or to use a fume hood to remove any vapours given off by hot bath fluid.

4.1.3 Power supply
The temperature calibrator runs on a voltage of 230 VAC (115 VAC on request), single-phase, 50/60 Hz. A 2.5 meter long cable 3 x 1 mm² is supplied with the instrument.
Make sure that the plant is earthen correctly before switching on the temperature calibrator.

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5. Operating the calibrator

5.1 Elements of the front panel
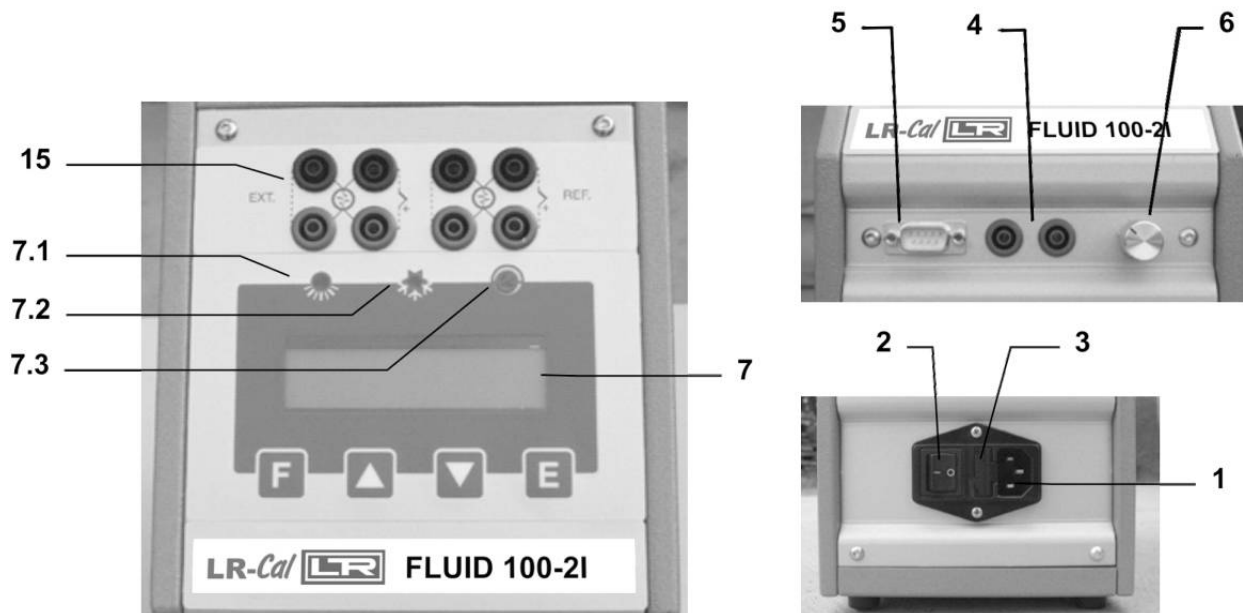
(1)   Supply socket
(2)   Main switch
(3)   Protection fuses
(4)   Switch test plugs
(5)   RS232 interface
(6)   Mixer speed control
(7)   Display
(7.1)   LED „heating"
(7.2)   LED „cooling"
(7.3)   LED „switch test"

(15)   Sockets for external probes (version **-2I** only, with two measuring inputs)

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5.2 Description of the instrument
The **LR-Cal FLUID 100-N** and **LR-Cal FLUID 100-45** temperature calibrator consists of an aluminium block with one hole into which the sensors to be calibrated are inserted. The capacity of the fluid tank is 500 cm³.
The Peltier defices and an electronic microcontroller checks and regulates the temperature. Liquid stirring is ensured by a magnetic system. A grid, to prevent the inserted probes from stopping its operation protects the stirrer. A speed adjustment system is supplied, to ensure the best homogeneous condition, according to the type of used fluid.
A fan, mounted in the bottom side, generates a constant air flow that reduces the temperature of the case.

5.2.1 Thermoregulator
The thermo regulator (7) is a PID microprocessor which can be set from -12 to +125°C (resp. +140°C). The first display line shows the measured value while the second display line displays the input Set Point value.
Fur further specifications and methods of use, see chapter 9 concerning the thermoregulator.

5.2.2 Main switch
The main switch (2) is found on the front of the instrument. It is fitted with a socket for the voltage calble, a main switch and one fuse (2.5 A for model at 230 VAC).
Note: use only fuses F. 5 x 20 mm. All the electrical part is found below the main switch.

5.2.3 Carrying handle
The temperature calibrator is fitted with a carrying handle.

5.2.4 Liquid container
The capacity of the container is about 500 cm³.
Follow the instructions of chapter 3.1.5 to fill the container with the suitable calibration liquid. The magnetic stirrer inside the container makes the temperature of the liquid homogeneous in order to have the best performance. A metallic grid protects the magnetic stirrer.

5.2.5 Internal reference probe
The temperature sensor used for the reading and thermoregulation is a Pt 100 resistance thermometer. The probe is inserted directly into the aluminium container.

5.3 Operation

⚠ The temperature calibrator can only be used correctly if the user has a good knowledge of its basics.

Before starting with the calibration, follow the installation procedures.

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You have three options to calibrate test items in the means of comparison of values:

Calibration with comparison with internal reference sensor

Make reference to the temperature value of the display (7).
It is opportune to refer the value to the supplied test report, to compensate the error of the display.
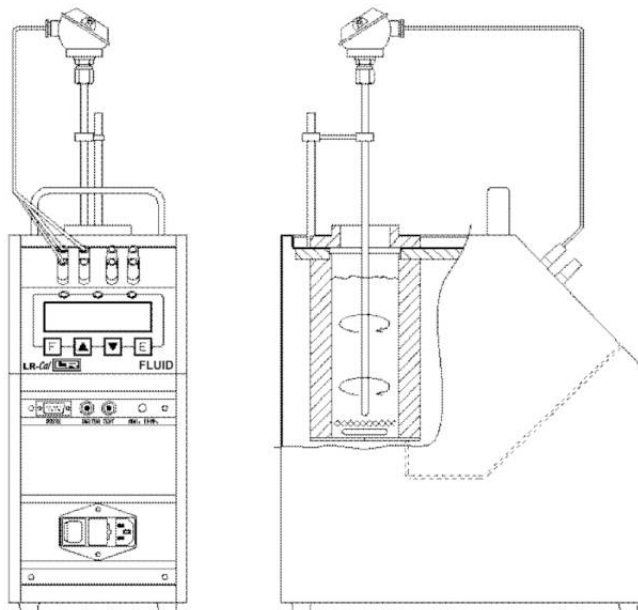
Calibration with comparison with external reference sensor, reading on calibrator's display
(**-2I** versions only)

Make reference to the temperature value of the external standard instrument inserted to the container and connected directly to the temperature calibrator. Temperature is read on the 2. line of the display. When possible, put the sensitive elements of the probes near and at the same dept.

Calibration with comparison with external reference sensor, reading on display of an external instrument

Make reference to the temperature value of the external standard instrument inserted in the container and connected to an external instrument.
When possible, put the sensitive elements of the probes near and at the same dept.

Externes Gerät
External Instrument

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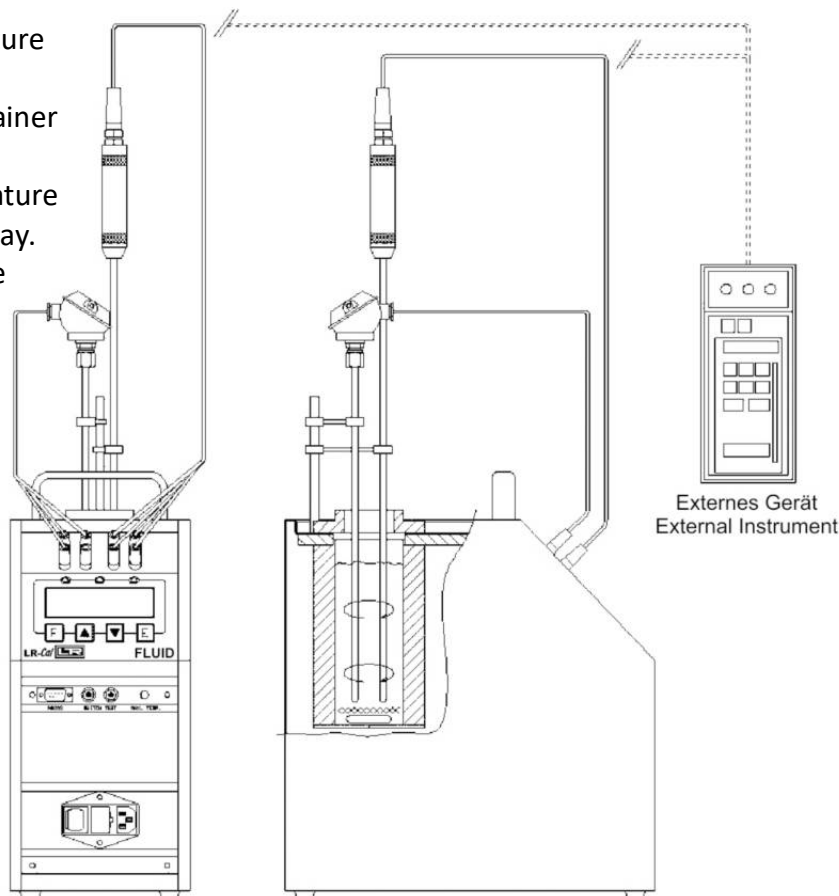
Before any calibrations, follow the instructions in chapter 3, and:

• Start the calibration only at ambient temperature. Thermal shock can break the sensitive element of the probe and cause harm to operator.

• Put the probe to check into the bath. Refer to chapter 3.1.7.

• Switch on the temperature calibrator with the main switch (2) and wait for the end of the auto-test (self-test) procedure.

• Set the required temperature value on the display:
  - Press the „arrow-up"-key to increment the Set Point value
  - Press the „arrow-down"-key to decrement the Set Point value
  - Press the „E"-key to confirm the input value.

• It is advisable to wait for the stabilisation of the oven before starting any calibration.

• Adjust the stirrer with the knob (6) for the best performance. The fluid must be mixed well for good temperature uniformity and fast controller response. Set the knob (6) in middle position to start.

• The display shows the temperature of the calibrator and the Set Point. When the temperature is reached and it is stable, the display shows the symbol „÷".

• For different calibration point, regulate the Set Point to the new temperature and wait for the stabilisation ("÷").

• The temperature indicated on the display must not be considered as a reference temperature, but only as a general indication of the temperature inside the bath. We suggest to insert a precision reference thermometer (e.g. **LR-Cal LRT 750**) or, at **-2I** versiones, without own display (e.g. **LR-Cal LRT F**).

  At **-2I** versions, the complete measuring chain (calibrators display plus reference thermometer **LR-Cal LRT F** can be certified.

To modify the regulation parameter or to set the ramp, see the instructions in chapter 9.

Cooling: To reduce the oven's temperature, change the Set Point and wait for the natural cooling.

CAUTION!
At the end of the calibration, do not remove the probe if it is still at high temperature.
Always allow the temperature calibrator to cool down with the probe still inserted in order to avoid a thermal shock to the probe itself and harm to operator or things.

Before transporting the calibrator make sure, that the temperature of the liquid is close to the ambient temperature and the closing-cap is well tightened.

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5.4 Use of the functions

5.4.1 Reading external probes - only -2I versions

You can connect up to two external temperature probes to the temperature calibrator (only -2I versions) and show their values on the temperature calibrator's display (2nd. line):

• Thermocouples types J, K, R, S, N or E (with automatic compensation of the terminal clamp temperature)
• Resistance thermometers (2-, 3- or 4-wire)

For connecting, follow this instructions:

• Connect the wires of the external temperature probe(s) to the bushes (15) as shown on images (Fig. 6):

 (A) Thermocouples: make a bridge between bushes „1" and „3". Connect sensor to bushes „2" and „4" and pay attention for right polarisation (plus to 4, minus to 2).
 (B) Pt 100 (4-wire): connect the 4 wires of the sensor to the bushes as shown in image „(B)".
 (C) Pt 100 (3-wire): make a bridge between bushes „3" and „4" and connect the 3 wires of the sensor to bushes „1", „2" and „3", see picture „(C)".
 (D) Pt 100 (2-wire): make bridges between bushes „1" and „2" as well as „3" and „4" and connect the 2 wires of the sensor to bushes „2" and 4", see picture „(D)".

• Press the „F"-key ans select menu item „SENSOR". Then select the used input „EXT" or „REF" or „EXT+REF" (both inputs together). Confirm with „E"-key.

• Press „arrow-up"-key and „F"-key together, to reach the 2nd. menu level. Press „F"-key until menu item „EXT SENSOR TYPE" and „REF SENSOR TYPE" is indicated. Select used sensor type with arrow keys. Confirm with „E"-key.

Fig. 6

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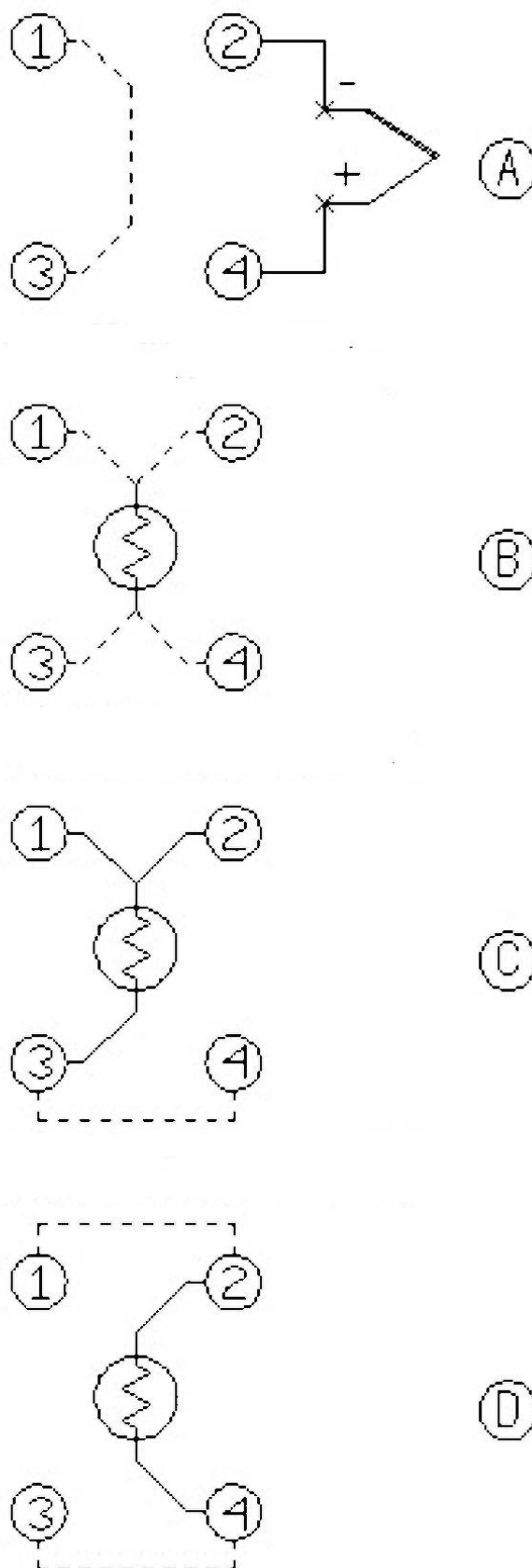
NOTE:
The temperature calibrator always uses the internal reference sensor to regulate it's temperature.

Possible Error Messages:
• EXT SENSOR FAIL   Wrong connection or configuration of the probe connected to „EXT".
• REF SENSOR FAIL   Wrong connection or configuration of the probe connected to „REF".
• SENSORS FAIL   Wrong connection or configuration of both probes.

CAUTION: Never connect voltage >5 V to the measuring inputs (15)!

5.4.2 Switch test
You can test the operating point of thermostats using the „SWITCH TEST" function:
• Put the sensor of the thermostat into the calibrator (dry block or fluid bath) avoiding touching
  the button. Follow the instructions in chapter 3.1.7.
• Connect the terminals of the thermostat to the socket (4).
• Switch on the temperature calibrator.
• Set the test temperature upper to the operating temperature of the thermostat.
  The LED (7.3) will light on when the thermostat electric contact works.
• The instrument stores the switch test value. Follow the instructions and the flow chart in
  chapter 10.1, up to „SW ON" - „SW OFF" to display the stored values.
• Press both arrow-keays together at the same time to reset the values of „SW ON" and „SW OFF"
• See chapter 10.1 for generation of a ramp.

CAUTION: Never connect voltage >5V to the switch-test input (4)!

5.4.3 Serial communication RS232

For PC control, use the serial communication RS232 (5)
interface, see Fig. 7.
With the RS232 interface, you can read and/or change the
operative parameters, for example: set point, external probe,
slope rate, etc.
Refer to the communication protocol instructions in
chapter 10.2.
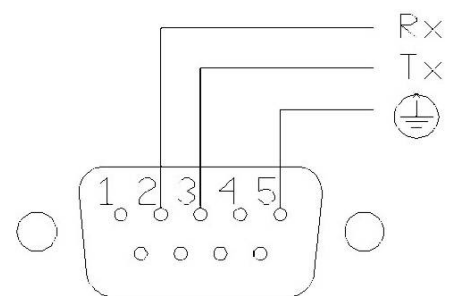
Fig.7   RS232 front view

CAUTION: The external PC must be conform to the IEC950 standard.
NOTE: The used RS232 cable must have pin 2 and pin 3 crossed.

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6. Maintenance

6.1 Periodical Maintenance
• Check once a month the level of the liquid inside the fluid container.
• Check once a month the liquid and change if it is exhausted.
• To have the instrument always efficient, it is opportune to recalibrate it periodically. The
  frequency of recalibration depends on the use of the instrument, however we suggest to
  recalibrate the temperature calibrator once a year.
  To recalibrate the temperature calibrator it is necessary to have a high precision standard
  reference thermometer and simulator and follow the instructions of chapter 10.
• Check once a year the calibration date.

6.2 Continous Maintenance
• At 20...30°C the fluid level should be about 30 mm under the top edge of the container.
  If the liquid level is too low, fill up the level with the same liquid (ref. chapter 3).
• If the liquid is dirty, thick or exhausted at ambient temperature, it is advisable to change it.
  To change the liquid, proceed with the emptying, cleaning and filling again.

Emptying of the liquid from the container of the temperature calibrator:
To remove completely the liquid from the temperature calibrator, reduce the temperature to a
value which is close to the ambient temperature. Remove the transport cap (see picture below)
from the transport cover, replace it with the emptying cover and then empty the tube. Overturn
the temperature calibrator by making the liquid leak. Collect it inside a container having adequate
dimensions resp. volume.

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Cleaning of the tank (container):

To take off the protection grid, it is necessary to unscrew the insulating ring nut (A). Remove the spring (B) and then hook the grid with a wire (C). Under the grid, there is the stir bar for mixing the fluid (D). Clean the well with a paper towels before mounting and filling again.
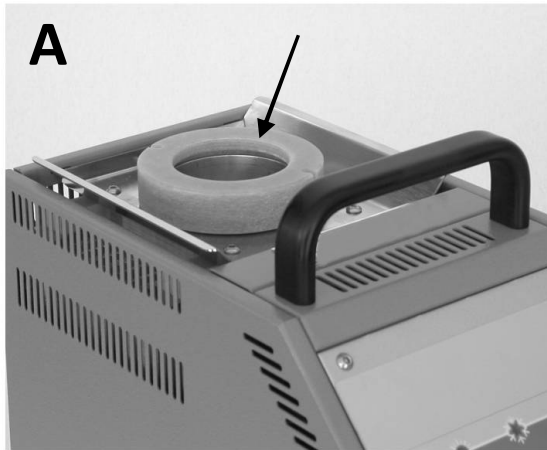
Filling of the container / tank:

Follow the instructions in chapter 3.1.5.

⚠️ **IMPORTANT!**
For retrieval of the exhausted liquid, use petrol tank in plastics.
Do not disperse in the surrounding.
The excesses, the refusals and the containers must be wasted according to the disposition laws of your country.

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7. Typical faults

Fault: The calibrator does not work when the power cable is connected and the main switch is turned on.
Cause: • The fuse (3) is cut off. Replace the fuse.
                • The power cable is cut off. Replace the power cable with a similar one.
                • The main switch is faulty. Contact the manufacturer for a repair.

Fault: The fuse (3) is triggered when the power cable is connected and the main switch is turned on.
Cause: • There is a short circuit on the supply card. Contact the manufacturer for a repair.
                • The main switch is faulty. Contact the manufacuturer for a repair.

Fault: The control panel is working properly, but the temperature does not increase.
Cause: • The thermo regulator is not generating a signal. Contact the manufacturer for a repair.
                • The supply card is faulty. Contact the manufacturer for a repair.

Fault: The first line of the display shows a different temperature from the one measured in the well.
Cause: • The thermal element is faulty. Contact the manufacturer for a repair.
                • The thermal regulator is faulty. Contact the manufacturer for a repair.

Fault: The liquid is not mixed. Differences of temperature inside the bath.
Cause: • Magnetic stirring off. Turn off the calibrator, then turn on again and adjust the speed control (6).
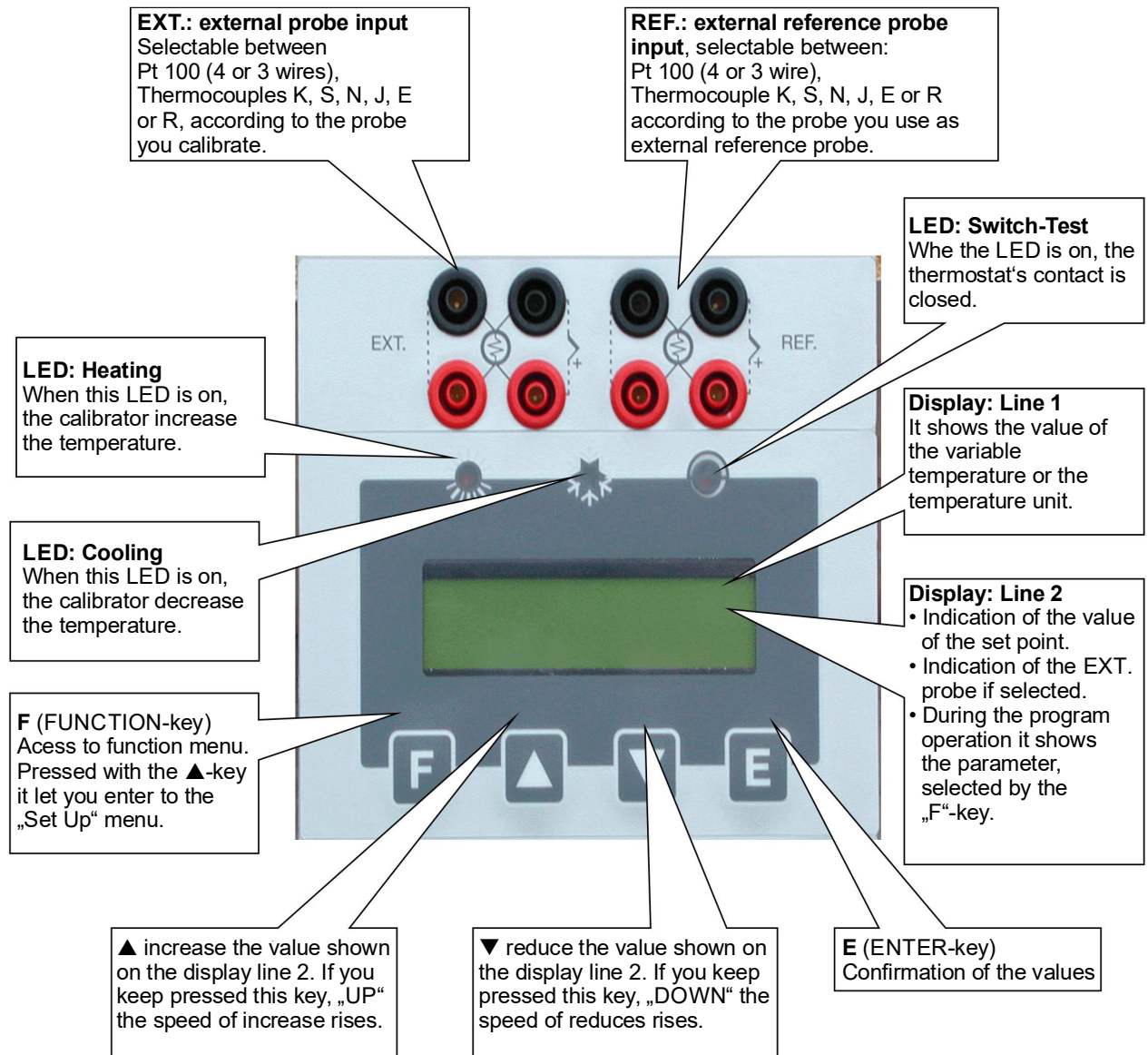   • The liquid is exhaust because of too long use at high temperature. Clean the well and the stirr
                  bar if dirty, change the liquid.

Fault: The display shows MEMORY FAIL
Cause: • RAM error caused by electrical noise. Thermo regulator needs replacement. Contact the
                  manufacturer for a repair.

Fault: The display shows „internal sensor fail".
Cause: • The internal reference probe is faulty. Contact the manufacturer for a repair.

Fault: The temperature does not stop at the value of the Set Point.
                • The supply card is faulty (TRIAC cut off). Contact the manufacturer for a repair.

Fault: The temperature dos not decrease to the Set Point as quickly as it should.
Cause: • The supply card is faulty. Contact the manufacturer for a repair.
                • The cooling fan is faulty. Contact the manufacturer for a repair.

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8. Description of the front panel

EXT.: external probe input
Selectable between
Pt 100 (4 or 3 wires),
Thermocouples K, S, N, J, E
or R, according to the probe
you calibrate.

REF.: external reference probe input, selectable between:
Pt 100 (4 or 3 wire),
Thermocouple K, S, N, J, E or R
according to the probe you use as
external reference probe.

LED: Switch-Test
Whe the LED is on, the
thermostat's contact is
closed.

LED: Heating
When this LED is on,
the calibrator increase
the temperature.

Display: Line 1
It shows the value of
the variable
temperature or the
temperature unit.

LED: Cooling
When this LED is on,
the calibrator decrease
the temperature.

Display: Line 2
• Indication of the value
  of the set point.
• Indication of the EXT.
  probe if selected.
• During the program
  operation it shows
  the parameter,
  selected by the
  „F"-key.

F (FUNCTION-key)
Acess to function menu.
Pressed with the ▲-key
it let you enter to the
„Set Up" menu.

▲ increase the value shown
on the display line 2. If you
keep pressed this key, „UP"
the speed of increase rises.

▼ reduce the value shown on
the display line 2. If you keep
pressed this key, „DOWN" the
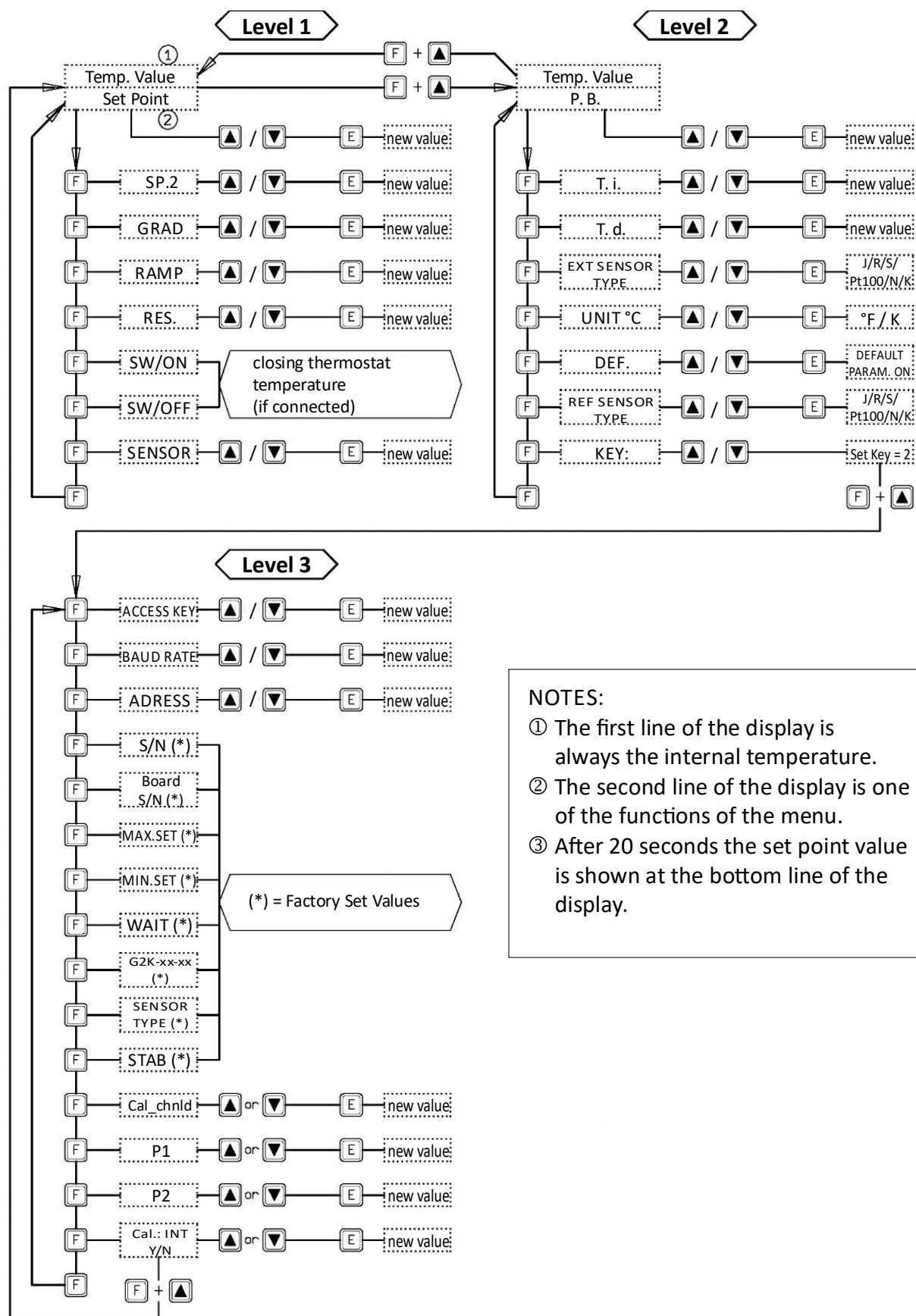speed of reduces rises.

E (ENTER-key)
Confirmation of the values

NOTE:
The picture shows the **-2I** version of the **LR-Cal** temperature calibrator, with 2 configurable measuring inputs.

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9. Description of the Function Menu Levels

⟨ **Level 1** ⟩   ⟨ **Level 2** ⟩

① Temp. Value / Set Point ② — F + ▲ → / F + ▲ → Temp. Value P. B.

▲ / ▼ — E — new value

F — SP.2 — ▲ / ▼ — E — new value   F — T. i. — ▲ / ▼ — E — new value

F — GRAD — ▲ / ▼ — E — new value   F — T. d. — ▲ / ▼ — E — new value

F — RAMP — ▲ / ▼ — E — new value   F — EXT SENSOR TYPE — ▲ / ▼ — E — J/R/S/ Pt100/N/K

F — RES. — ▲ / ▼ — E — new value   F — UNIT °C — ▲ / ▼ — E — °F / K

F — SW/ON — ⎰ closing thermostat   F — DEF. — ▲ / ▼ — E — DEFAULT PARAM. ON.
F — SW/OFF — ⎱ temperature (if connected)   F — REF SENSOR TYPE — ▲ / ▼ — E — J/R/S/ Pt100/N/K

F — SENSOR — ▲ / ▼ — E — new value   F — KEY: — ▲ / ▼ — Set Key = 2

F   F   F + ▲

⟨ **Level 3** ⟩

F — ACCESS KEY — ▲ / ▼ — E — new value

F — BAUD RATE — ▲ / ▼ — E — new value

F — ADRESS — ▲ / ▼ — E — new value

F — S/N (*)

F — Board S/N (*)

F — MAX.SET (*)

F — MIN.SET (*)   ⟨ (*) = Factory Set Values ⟩

F — WAIT (*)

F — G2K-xx-xx (*)

F — SENSOR TYPE (*)

F — STAB (*)

F — Cal_chnld — ▲ or ▼ — E — new value

F — P1 — ▲ or ▼ — E — new value

F — P2 — ▲ or ▼ — E — new value

F — Cal.: INT Y/N — ▲ or ▼ — E — new value

F   F + ▲

NOTES:
① The first line of the display is always the internal temperature.
② The second line of the display is one of the functions of the menu.
③ After 20 seconds the set point value is shown at the bottom line of the display.

The **LR-*Cal*** temperature calibrator has three function menu levels (see previous page):
• Level 1: Functions for the continuous usage
• Level 2: More specific functions and for the regulation of the calibrator
• Level 3: Typical functions for each calibrator instrument

9.1 Functions of the 1. Function Menu Level

This functions are to be selected by pressing the „F"-key and to be confirmed by the „E"-key.

• SP
Set Point: temperature set which the temperature calibrator has to reach following the technical specifications.

• SP2
Set Point 2: temperature set which the temperature calibrator reaches with the set gradient and the ongoing launched ramp procedure.

• GRAD
Gradient (from 0.1 °C/1 min): set point variation speed during the changes from one temperature value to the SP2 temperature value. The set gradient must be negative for descent ramps.
NOTE: gradient values to be set must be lower than the ones stated in the technical data (max. cooling time, max. heating time) for this temperature calibrator model.

• RAMP
Ramp procedure enabling (ON) or disabling (OFF): Select „ON" by the arrow-keys and confirm the choice by pressing the „E"-key. The temperature calibrator will reach the set SP2 temperature with the set gradient, starting from the same temperature as the one with which the ramp has been confirmed. The starting temperature does not depend on the SP Set Point temperature.
If a negative ramp is set and the gradient is left positive and/or the SP2 temperature value is higher than the current temperature, the start of the ramp will not be accepted, an alarm will begin to run.
When the ramp is „ON", the display shows „Ramp:..." followed by the Set Point value on the second line of the display. The Set Point value will reach the speed related to the set gradient.
When the calibrator temperature reaches the SP2 set temperature, the calibrator will produce an alarm and the ramp procedure will be automatically set „OFF"; the SP2 value will be considered as the new Set Point and the calibrator will be steadily set at that temperature.
During the ramp process, the derivative parameter will not be considered.

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Ramp procedure effective example:

Let's say, that the set temperature is the ambient one and that it is necessary to reach 400°C with a gradient of 2°C/min.

• Press „F"-key, set „SP2" to „400°C" using the arrow-keys. Press „E"-key to confirm the choice.

• Press „F"-key, set „GRAD" to „2°C/min" using the arrow-keys. Press „E"-key to confirm.

• Press „F"-key, set „RAMP" to „ON" using the arrow-keys. Press „E"-key to confirm.

After pressing the „E"-key for confirming the ramp start, the calibrator will acsend with the set slope. Of course, there will be some oscillations at the beginning since the ramp slope will not be suitable but they will stop in a short time and then the calibrator temperature will follow the ramp's set point one.

• **RES**

Display reading resolution (0.1/0.01): the values admitted are „0.1" and „0.01" and they can be selected by the arrow-keys.

• **SW/ON**

Thermostat Switch ON: it displays the temperature at which the thermostat's contact, connected to the „SWITCH TEST" bushes, is closed.

• **SW/OFF**

Thermostat Switch OFF: it displays the temperature at which the thermostat's contact, connected to the „SWITCH TEST" bushes, is open.

The value is reset each time the power supply fails or by pressing both arrow-keys at the same time. The value is updated every time that the thermostat's contact closing is detected.

• **SENSOR** - only for **-2I** versions with measuring inputs

This parameter allows at **-2I** versions of the **LR-*Cal*** temperature calibrators (with 2 measuring inputs for external reference and one test item or for two test items) the reading of connected sensors.

OFF: no input is enabled to read the sensor's value.

EXT: the 4 bushes of the input „EXT" are enabled to read the sensor connected to them, whose value is indicated at the 2nd. line of the display

REF: the 4 bushes of the input „REF" are enabled to read the sensor connected to them, whose value is indicated at the 2nd. line of the display. (except model **LR-*Cal*** **BK40-M-2I**)

EXT+REF: the 8 bushes of the 2 inputs „EXT" and „REF" are enabled to read the sensors connected to them, whos values are indicated at the 2nd. line of the display. (except model **LR-*Cal*** **BK40-M-2I**).

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9.2 Functions of the 2. Function Menu Level

This functions can be selected by pressing the „F"-key together with the „arrow-up"-key at the same time. Once the 2. Function Menu Level is intered, these functions can be selected only by pressing the „F"-key. In order to go back to the first level, press the „F"-key and the „arrow-up"-key at the same time or wait for about 20 seconds.

• P.B.
Value of the Proportional Band expesed in percentage of the value of the end temperature of this temperature calibrator. Proportional band means per cent of range within which there is the variation of the modulation of the heating element power.

• T.I.
Integral time value expressed in seconds. The integrating action cancels the error between the chosen set point and the temperature reached only ba the proportional action. Integral time means the length of time necessary to the integrative action to double up the proportional action.

• T.D.
Derivative time expressed in seconds. When there is a step variation of temperatures, the derivative action induces a greater initial adjustment, so that the calibrator will have a greater power than it usual has due to the proportional and integral action only. Since the error keeps existing, the derivative action reduces the impact giving the integrative action the task of reducing the error.

• EXT SENSOR TYPE - only for **-2I** versions with 2 inputs
This parameter allows selecting the kind of sensor read by the dipslay and connected to the four „EXT" terminals:
N, K, J, R, S   = thermocouples types N, K, J, R resp. S
Pt3W   = resistance thermometer Pt 100 3-wire
Pt   = resistance thermometer Pt 100 4-wire

• UNIT
Temperature measuring unit:
°C   = degrees Celsius
°F   = degrees Fahrenheit
K   = Kelvin

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• DEF.
Default Parameters: this function allows choosing to set the thermoregulator with the P.B., T.i., T.d. parameters either as a default or as a customisable adjustment. By selecting the „OFF" parameter and confirming by the „E"-key, it is possible to modify the adjustment parameters, which will keep operational even if the calibrator is turned off. By selecting the „ON" parameter (followed by the confirmation by pressing the „E"-key) the default parameters will be turned on again.

• REF SENSOR TYPE - only for **-2I** versions with 2 measuring inputs
This parameter allows selecting the kind of sensor read by the dipslay and connected to the four „REF" terminals:

N, K, J, R, S   = thermocouples types N, K, J, R resp. S
Pt3W   = resistance thermometer Pt 100 3-wire
Pt   = resistance thermometer Pt 100 4-wire

• KEY:
This the key (password) for accessing the 3. Function Menu Level. Using the arrow-keys it is possible to set the number, recorded in the „ACCESS KEY" parameter at the third level, and by pressing the „F"-key and the „arrow-up"-key at the same time (it is not necessary to confirm the choice by pressing the „E"-key), it is possible to enter the 3. Function Menu Level. The acceptable values are from 1 to 99, the default value set by the manufacturer is „2".

9.3 Functions of the 3. Function Menu Level

Functions, that can be selected by pressing the „F"-key and the „arrow-up"-key at the same time when the „KEY" parameter is reached at the 2. Function Menu Level and when the set value corresponds to the recorded one. Once the 3. Function Menu Level is entered, these functions can be selected only by pressing the „F"-key. In order to come back to the first level, press the „F"-key and the „arrow-up"-key at the same time or wait for about 20 seconds.

• ACCESS KEY
Password for entering the 3. Function Menu Level: numerical value from 1 to 99 that enables passing to the 3. Function Menu Level. The default value is „2".

• BAUD RATE
Data transmission speed to PC. Values are from 300 to 19200, default value is „9600".

• ADRESS
Communication adress: the value of this parameter is necessary to communicate from the PC to many **LR-Cal** temperature calibrators. The admitted values are from 1 to 32 and once the value is set by using the arrow-keys, it is necessary to confirm the choice by pressing the „E"-key.

• S/N
Equipment serial number. It is set by the manufacturer and cannot be changed by the user.

• Board S/N
Mainboard serial number. It is set by the manufacturer and cannot be changed by the user.

• MAX. SET.
Maximum value to be set as the Set Point. It is set by the manufacturer and cannot be changed.

• MIN.SET.
Minimum value to be set as the Set Point. It is set by the manufacturer and cannot be changed.

• WAIT
Initial waiting procedure (0/1):
0 = After switching on and after initial self-test procedure, the calibrator immediately run to last set point value chosen before turning off.
1 = After switching on and after initial self-test procedure, the calibrator waits for input. During waiting, the 2nd. display line flashes. It is necessary to press any key in order to move the calibrator from the waiting position and to choose the desired parameter or value.

• G2K-xx-xx
Internal firmware release number.

• SENSOR TYPE
It indicates the type of the main (internal) sensor designed to adjust the temperature.

• STAB
It indicates the swinging value of the temperature, which has been set to see on the display the symbol of the calibrator steadiness „÷". The symbol light on when the temperature is stable for over 6 minutes.

• Cal_chnl
Recalibration of the temperature calibrator: chooses the channel to be calibrated. It can assume three values: INT, EXT, REF. Press the arrow-keays to select and press „E"-key to confirm.
NOTE: values „EXT" and „REF" are valid only for **-2I** versions of temperature calibrators.

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• P1

First calibration point. Press arrow-keys to set the value read with a precision reference thermoemter and press „E"-key to accept.

• P2

Second calibration point. Press arrow-keys to set the value read with a precision reference thermometer and press „E"-key to accept.

• CAL: INT (Y/N)

This writing can have three different configurations:

CAL: INT (Y/N)   if Cal_chnl is set to INT (see above)

CAL: EXT (Y/N)   if Cal_chnl is set to EXT (see above)

CAL: REF (Y/N)   if Cal_chnl is set to REF (see above)

Choose Y (yes) or N (no) with the arrow-keys and confirm by pressing the „E"-key.

Of course, a calibration of measuring inputs „EXT" and „REF" is only possible at **-2I** versions.

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10. Recalibration of the LR-Cal temperature calibrator

CAUTION: This section is applicable for authorised personnel only. Personnel must be able to operate the calibrator and must be familiar with the menu item selection etc. Deep knowledge about calibration of temperature instruments is necessary.
The temperature calibrator can have a complete or partial re-calibration yearly or when chosen by the user. Calibration can be carried out using the optional CALIBRA ED200 software or directly on the keyboard of the temperature calibrator.

The calibration of the internal probe is done by adjusting the internal probe at two points of the range, using a precision reference thermometer, such as model **LR-Cal** **LRT 750**.

Only for **-2I** versions of the **LR-Cal** temperature calibrators with 2 measuring inputs:
The calibration of the „EXT" and „REF" inputs is done by adjusting the inputs of the controller at two points of the range using a mV/ohm generator, such as model **LR-Cal** **LTC 100**.

A calibration of the calibrator is only possible if the calibrator is set to °C as temperature unit.

10.1 Calibration of the internal probe:
The purpose of recalibration is to correct the error between the temperature indicated and the value of a precision reference thermometer.
To calibrate the interal probe of the temperature calibrator, it is necessary to have a standard thermometer with precision greater than that of the temperature calibrator, and then to follow the instructions:
• Insert the probe of the precision reference thermometer in the temperature bath or in the most suitable hole of the dry block.
• Choose two calibration points depending on the calibrator's range or the field where you wish to carry out calibrations.
• Set the first calibration point and wait for the calibrator to be stable (see symbol ÷).
• Enter the 3. Function Menu Level and select „Cal_chnl=INT". Press „E"-key to confirm.
• Press „F"-key to select „P1", press the arrow-keys to set the value read with the precision reference thermometer and press „E"-key to confirm. Confirmation is indicated by the symbol „*" which appears on the display after about 5 seconds.
• Return to the 1. Function Menu Level and set the second set point. Then wait for the calibrator to be stable (indicated by „÷" on the display).
• Enter the 3. Function Menu level and select „P2", press the arrow-keys to set the value read with the precision reference thermometer and press „E"-key to confirm. Confirmation is indicated by the symbol „*" which appears on the display after about 5 seconds.
• Select „CAL: INT", set „Y" (yes) and confirm by pressing the „E"-key. The calibration begins. The procedure takes a few seconds, at the end of which there is a audible signal „beep".

• Enter the 3. Function Menu Level and select „P2". Use the arrow-keys to enter the temperature value, indicated by the pecision reference thermometer and press „E"-key to confirm. Your input is confirmed by symbol „*" on the display, appearing after about 5 seconds.

• Select „CAL: INT", set the parameter to „Y" (yes) and confirm with „E"-key.
The internal calibration procedure is now running for a couple of seconds. When this procedure is finished, the temperature calibrator gives an audible „beep".

10.2 Calibration of the „EXT" and „REF" inputs with a signal calibrator - only for **-2I** versions
The purpose of the re-calibration is to correct the „EXT" and „REF" inputs error together.
To calibrate the two inputs, it is necessary to have a Pt100 calibrator and/or a thermocouples calibrator depending on what is to be calibrated, e.g. **LR-Cal LTC 100**.
Calibration of the „EXT" input automatically reproduces the same calibration on the „REF" input:

• On the 2. Function Menu Level, select the type of „EXT" input to calibrate (Pt100, Tc K, Tc J, Tc N, TcR, Tc S) following the instructions in the manual. Press „E"-key to confirm.

• Enter the 3. Function Menu Level and press the arrow-keys to set „Cal_chnl"= EXT. Press „E"-key to accept.

• Choose two calibration points depending on the appliance range or the field where one wishes to carry out calibration. (For example 0 and 450°C for PT100; 200 and 800°C for thermocouples).

• Connect the signal generator to the „EXT" input, generating the first calibration value. See the instructions for the connection.

• Select „P1" and press arrow-keys to set the first value (for example 0°C). Press „E"-Key to confirm. Confirmation is indicated by the symbol „*" which appears on the display after about 5 seconds.

• Generate the second calibration value with the signal generator. See the instructions for the connections.

• Select „P2" and press arrow-keys to set the second value (for example 450°C). Press „E"-key to confirm. Confirmation is indicated by the symbol „*" which appears on the display after about 5 seconds.

• Select „CAL: EXT", set to „yes" and confirm pressing „E"- Key. The procedure takes a few seconds. At the end there is a Beep.

10.3 Calibration of the „REF" input with a reference probe connected - only for -2I versions
This operation adapts the value indicated by the „REF" input to the value indicated by the reference probe connected to it, compensating its errors.
To carry out the calibration it is necessary to connect the probe to the „REF" terminals and to have a precision reference thermometer, e.g. model **LR-Cal LRT 750**.

• Connect the probe to the „REF" input following the instructions in the manual.

• Insert the probe in a suitable hole or in the bath of the temperature calibrator.

• Insert the precision reference thermometer in a suitable hole or in the bath of the temperature calibrator.

• Set the first calibration point and wait for the appliance to be stable (wait for symbol „÷").

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- Enter the 3. Function Menu Level (see instructions) and select „Cal_chnl"= REF. Press „E"-key to confirm.
- Select „P1" and press arrow-keys to set the value read with the precision reference thermometer. Press „E"-key to confirm. Confirmation is indicated by the symbol „*" which appears on the display after about 5 seconds.
- Return to the 1. Function Menu Level and set the second set point. Then wait for the calibrator to be stable (wait for symbol „÷").
- Enter the 3. Function Menu Level, select „P2" and press the arrow-keysto set the value read with the precision reference thermometer. Press „E"-key to confirm. Confirmation is indicated by the symbol „*" which appears on the display after about 5 seconds.
- Select „CAL: REF", set „Y" (yes) and confirm pressing the „E"-key. The calibration begins. The procedure takes a few seconds. At the end there is a Beep.

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11. Communication protocol RS232/C

This chapter is needed only, if you like to communicate with the temperature calibrator with your OWN software. This instructions are intended to be used by software engineers only.

General characteristics: Baud Rate: 9600   Parity: No
                          Data bits: 8   Stop bits: 1

The communication runs in half duplex way which means that the transmission and reception of data cannot be contemporeneously present. The regulator of the calibrator replies only after receibing a command, it never replies itself. The command and reply are ASCII character strings, as detailed forward. The communication program will be able to convert ASCII to decimal to extract numeric values. The default adress is 1. Baud rate: 2400, 4800, 9600 and 1200 baud, the default value is 9600; the other parameters are standard and cannot be changed.

Variables			Read / Write	Type
0	Set point		read / write	float
1	Ramp ON/OFF		read / write	integer
2	Set point 2		read / write	float
3	Gradient		read / write	float
4	Resolution		read / write	integer
5	Prop. Band		read / write	float
6	Integral time		read / write	float
7	Derivative time		read / write	float
8	Sensor input selection	1 = internal probe 2 = internal probe + EXTernal probe 3 = internal probe + REFerence probe 4 = internal probe + EXT + REF probe	read / write	integer
9	Title		read / write	float
10	Units	0 = °C 1 = °F 2 = K	read / write	integer
13	Access key		read / write	float
14	Baud rate		read	float
15	Adress		read / write	float
16	Serial number		read	float
18	Max. set point		read	float
19	Min. set point		read	float
21	Wait ON/OFF		read	float
22	Switch on temperature		read	float
23	Switch off temperature		read	float
24	Version		read	float
25	EXTernal sensor type	0 = Pt 100 (4-wire) 1 = thermocouple type N 2 = thermocouple type K 3 = thermocouple type J 4 = thermocouple type R 5 = thermocouple type S 6 = Pt 100 (3-wire) 7 = thermocouple type E	read / write	integer
26	REFerence sensor type		read / write	integer
28	Stability range		read	float
29	Symbol of steadiness		read	float
100	Temperature (internal sensor)		read	float
105	Temperature (EXTernal sensor)		read	float
106	Temperature (REFerence sensor)		read	float

Each command string is an ASCII character succession. First is $ character, the next must indicate the instrument adress (default = 1) and than follows the commanc (4 characters):

Possibility: RVAR (data reading)
WVAR (data writing)

The ultimate part of the string depends on type of command. The character CR (carriage return) concludes the sequence.

Data reading

Example no. 1 (Reading of the set point / variable no. 0):
The command string is: **$1RVAR0_<cr>**

$	= beginning of message
1	= instrument adress
RVAR	= read variable
0	= number of variable to read
_	= space
<cr>	= end of message (carriage return)

The responding string is: ***1_110,0** (if 110,0 is the temperature in this example).
The character <cr> concludes the message.

Example no. 2 (reading of the EXTernal sensor / variable no. 105):
(Note: the type of sensor must be specified first, in variable no. 25).
The command string is: **$1RVAR105_<cr>**
The responding string is: ***1_123,4** (if 123,4 is the temperature in this example).
The character <cr> concludes the message.

The response does not include the temperature unit. To read the temperature unit, use the variable 10. Command string is **$1RVAR10_<cr>**.
The response string is ***1_0** if the temperature unit is °C,
the response string is ***1_1** if the temperature unit is °F.

Data writing (FLOAT variables)

For writing, the command WVAR is to be used.

Example no. 1 (writing of the set point to 132,5°C); if the temperature unit is already °C, it is enouph to write the SET POINT.
The command string ist: **$1WVAR0_132,4<cr>**

$	= beginning of message
1	= instrument adress
WVAR	= write variable
0	= number of variable to write
_	= space
<cr>	= end of message (carriage return)

At receipt of the command, the answer of the instrument is ***1<cr>**
This string confirms the command.

If the temperature unit is not °C, but e.g. °F, you first should write the variable no. 10 (units) to the required value, see table of variables.

Data writing (INTEGER variables)

Above is shown how to write into variables of type „float". The variables number 1, 4, 8, 10, 25 and 26 have two or more states (for example, the resolution by tenth or hundredth of °C) and to activate them, it is necessary to assign to the variable number the number corresponding to that one which should be set according to the table indicated below:

Variable No.: **1**   Ramp   **0** = OFF   **1** = ON
Variable No.: **4**   Resolution   **0** = 0.1°C   **1** = 0.01°C
Variable No.: **8**   Sensor input selection   **1** = INT   **2** = INT+EXT
     3 = INT+REF   **4** = INT+EXT+REF

Variable No.: **10**   Unit (of temperature)   **0** = °C   **1** = °F   **2** = K
Variable No. **25** and Variable No. **26**:
     Ext. / Ref. Sensor type   **0** = Pt 100 (4)   **1** = Tc N   **2** = Tc K
     3 = Tc J   **4** = Tc R   **5** = Tc S
     6 = Pt 100 (3)   **7** = Tc E

Example no. 1: the variable no. 1 corresponds to the activation of the ramp function. If you want to set it ON in order to activate the ramp function, you should assign the value 0, otherwise the value 1 to the variable no. 1.
The command string is: **$1WVAR1_0<cr>** (activates the ramp function)

Example no. 2: the variable no. 8 corresponds to the activation of the sensor reading which can be connected to the bushes of the external inputs. If you want to read a thermocouple type K, connected to the „Ref.Input", you should set the variable no. 26 to the number, corresponding to the sensor type which you want to read (in this example: 2 - for Tc type K) and then set the variable no. 8 to 3 (INT+REF).
The command strings are: **$1WVAR26_0<cr>** and **$1WVAR8_3<cr>**

Do likewise for other variables.

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12. Instructions for optional Accessories

12.1 Instructions for Metal Dry Block Insert Kit

Conversion kit for LR-Cal FLUID 100-N without holes for self-drilling: FLUID-INS-0
Conversion kit for LR-Cal FLUID 100-N with 9 holes: FLUID-INS-9
Conversion kit for LR-Cal FLUID 100-45 with 8 holes: FLUID-100-45-INS
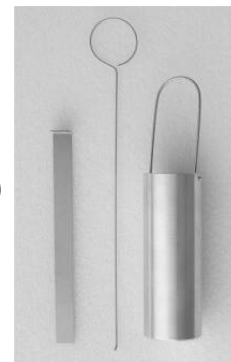
For the replacement of the liquid with the metal insert, proceed as provided for in chapter 8, following the dismantling instructions until the extraction of the Teflon shaft that shakes the liquid. Extract the shaft using the specific tool (supplied) and thus accurately clean the tank with blotting paper prior to inserting the insert.

Subsequently follow the standard instructions for use, reducing the agitatir's rotary speed to the minimum (knob 6).
To recover the use with liquid, proceed in a reverse manner.

The span of time needed to reach the reserved Set Point considerably increase whereas the metal insert is used. The following table shows some sample values. The times are detected when the temperature calibrator has activated the stability symbol „÷" on the display.

TEST	with Liquid	with Metal insert
Minimum temperature	-12°C	-12°C
Descent time +20 to -10°C	30 min.	47 min.
Ascent time -12 to +110°C	34 min.	45 min.
Ascent time +20 to +121°C	38 min.	44 min.
Ascent time 110 to 125°C	30 min.	42 min.
Descent time 121 to +20°C	30 min.	37 min.

12.2 Instructions for the Extension Tube for increasing the insertion depth

Order-Code: **FLUID100-ER**

With this optional accessory the useable insertion depth of the reservoir is increased.

Usefull diameter:	60 mm
Usefull depth:	230 mm
Max. temperature:	+180°C
Min. temperature:	-9°C (at 20°C ambient temp.)

Temperature uniformity with liquid „Silicone Oil 47V5":
Range at 20°C ambient temperature: -9...+130°C
Horizontal uniformity (at 50 mm from the bottom): ±0,10°C
Vertical uniformity: ±0,10°C (over the depth of 150 mm from the bottom) resp. ±0,15°C at <0°C.

Optimal place for probes: about 1.5 cm from edges, about 3 cm from bottom.

Mounting Instructions:
• Unscrew the green ring nut and screw strongly the aluminium tube. Be sure that the O-ring should be compressed.
• Set on the foam insulation tube.
• Screw in the green ring nut again.
• Fill the liquid up to 5 cm from the edge of the green ring nut in order to reach the max. of 180°C, verify the leakages of liquid from the bute. In case of leakage screw on again the tube.
• At the end of the calibration, set up the ambient temperature at the temperature calibrator and wait for cooling down nearly to ambient temperature before emting the liquid.

Further supplied: spare O-ring.

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13. Declaration of Conformity

DRUCK & TEMPERATUR Leitenberger GmbH, Bahnhofstr. 33, D-72138 Kirchentellinsfurt, GERMANY, declares that the

• Portable temperature calibrator - temperature calibration bath
   LR-Cal FLUID 100-N   **LR-Cal FLUID 100-45**
   LR-Cal FLUID 100-N-2I   **LR-Cal FLUID 100-45-2I**

is conform with the requirements of the following European directive:

• Low voltage directive 2006/95/CE ammended by 93/68/EEC
• EMC directive 2004/108/CE89/336/EEC

and that it has been designed in accordance with the following harmonised regulations:

• EN 61000-6-350081-1   Emission
• EN 61000-6-250082-1   Immunity
• EN 61010-1/6 1010-2-0106101-1   Safety requirements for electrical equipment

The conformity with the above mentioned requirements is certified by affixing the CE mark on the product.

DRUCK & TEMPERATUR Leitenberger GmbH
Kirchentellinsfurt (Germany), März 2020

(Gernot Coulon)
Managing Director

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LR-Cal LR

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