°LAUDA

Operation manual

LOOP

L 100, L 250

Thermo-electric circulation thermostat

°FAHRENHEIT. °CELSIUS. °LAUDA.

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Table of contents

1   Safety

1.1   Safety information

■ The devices can only be operated as intended under the conditions specified in this operating manual. Any other mode of operation is considered to be an unintended use and could compromise the protection warranted by the device.

■ The devices are not designed for use in medical applications in accordance with DIN EN 60601-1 and IEC 601-1!

■ This operating manual is part of the device. The information in this operating manual must therefore be kept at hand in the immediate vicinity of the device. Be sure to carefully store this copy of the operating manual for future reference.

> *If you lose the operating manual, you can download a new one from our LAUDA homepage.*

When operating the device, there is a risk of injury from high and low temperatures, fire and the presence of electrical energy. These risks posed by the device have been mitigated in the design to the extent possible in keeping with the applicable norms. The remaining risk can be reduced using one of the following measures:

■ Use suitable hoses (temperature range and pressure). If a hose breaks hot liquids may leak out, thus endangering people and materials.

■ Appropriate maintenance activities must be implemented to ensure the device remains in good working order.

■ Various warning symbols are located on the device. These symbols must be observed without fail.

■ This operating manual contains safety information. This information must be followed at all times.

■ Personnel and the protective equipment worn by personnel are also subject to specific requirements.

> *Refer to ⮫ Chapter 1.10 "Structure of warnings" on page 7 for more information on the general structure of safety notices.*

1.2   Intended use

As intended

This device may only be used for the temperature control and circulation of non-flammable heat transfer liquid through a closed circuit.

Unintended

The following are considered examples of unintended use:

■ Use in potentially explosive areas

■ Use for controlling the temperature of foodstuffs.

1.3   Foreseeable misuse

Misuse of the device must always be prevented.

The following are considered cases of foreseeable misuse:

■ Operating the device without heat transfer liquid
■ Operating the device with an incorrect, flammable heat transfer liquid
■ Incorrect connection of hoses.

1.4 EMC requirements

Table 1: Classification in accordance with EMC requirements

Device	Immunity requirements	Emissions class	Customer power supply
LOOP	Table 2 (Industrial) in accordance with EN 61326-1	Emissions Class B in accordance with CISPR 11	Worldwide No limitation

Instructions for Class A digital device, USA

"This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC (Federal Communication Commission) Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense."

Instructions for Class A digital device, Canada

"This Class A digital apparatus complies with Canadian ICES-003" (ICES = Interference Causing Equipment Standards).

« Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada ».

1.5 Prohibition of modifications to the device

Any technical modification of the device by the user is prohibited. Any damage resulting from unauthorized modification is not covered by customer service or the product warranty. Service work may only be performed by the LAUDA Service department or a service partner authorized by LAUDA.

1.6 Materials

All parts that come into contact with heat transfer liquid are manufactured from high-quality materials adapted to withstand the operating temperature. Stainless steel, copper, silicone (hoses) and premium-quality heat-resistant plastics are used.

1.7 Heat transfer liquid

■ The device is designed exclusively for non-combustible heat transfer liquids according to class I as per DIN 12876-1.
■ The use of heat transfer liquids poses a risk of injury from high and low temperatures if certain upper or lower temperature thresholds are exceeded or the external application is broken and a reaction is initiated with the heat transfer liquid.
All possible risks in handling the heat transfer liquid are specified in the safety data sheet for the liquid together with corresponding safety measures. The safety datasheet must therefore be observed in order to use the device as intended.

1.8 Application area

The device may only be used in the following areas.

■ Production, quality assurance, research and development in an industrial environment
■ Use inside buildings
■ Height up to 2,000 m
■ Ambient temperature of 5 to 40 °C
■ Maximum relative humidity 80 % at temperatures up to 31 °C, linearly decreasing until 50 % relative humidity at 40 °C
■ Fluctuations of the mains voltage up to +/-10 % of the nominal voltage
■ Transient electrical surge up to the values of the surge category II
■ Sporadic electric surges, that occur in the mains power supply
■ Pollution degree 2

1.9 Personnel qualification

Before operating the device, the operating personnel must read the operating manual. The operator must have understood the operating manual.

1.10 Structure of warnings

Dangerous

■ A warning of "dangerous" indicates an **immediately dangerous** situation.
■ If this warning is not observed, then **death** or **severe, irreversible injury** could occur.

⚠	DANGER! Type and source
	Consequences of not following instructions
	● Measure 1 ● Measure...

Warning

- A warning of "warning" indicates a **possibly dangerous** situation.
- If this warning is not observed, then **death** or **severe, irreversible injury** could occur.

⚠️	WARNING! Type and source
	Consequences of not following instructions
	● Measure 1 ● Measure...

Caution

- A warning of "caution" indicates a **possibly dangerous** situation.
- If this warning is not observed, then **minor, reversible injury** could occur.

⚠️	CAUTION! Type and source
	Consequences of not following instructions
	● Measure 1 ● Measure...

Notice

A "notice" warns that dangers to property or the environment may exist.

❗	NOTICE! Type and source
	Consequences of not following instructions
	● Measure 1 ● Measure...

2 Unpacking

<table>
<tr><td>⚠️</td><td>DANGER!
Transport damage</td></tr>
</table>

Electric shock
● Closely inspect the device for transport damage prior to commissioning! ● Never operate a device that has sustained transport damage!

■ Hold on under the device to lift and carry it.

1. Unpack the device.

> ℹ️ *Keep the original packaging of your constant temperature equipment for subsequent transportation.*

2. Check the device and accessories for completeness and transport damage immediately after delivery.

> ℹ️ *If the device or accessories are damaged contrary to expectations, immediately inform the shipping company so that a damage report can be compiled and the transport damage inspected. Also notify LAUDA Service Temperature control devices immediately. You will find the contact information here* ⮑ Chapter 8.4 "Contact LAUDA" on page 37.

Table 2: Standard accessories for all devices

Device type	Designation	Quantity	Cat. No.
All devices	Operating manual	1	Q4WA-E_13-001
All devices	Hose nozzle (CPC in-line socket type PMC 2204)	2	EOA 077
All devices	Power cable	1	- - -

3 Structure and operating buttons

3.1 Setup of the device
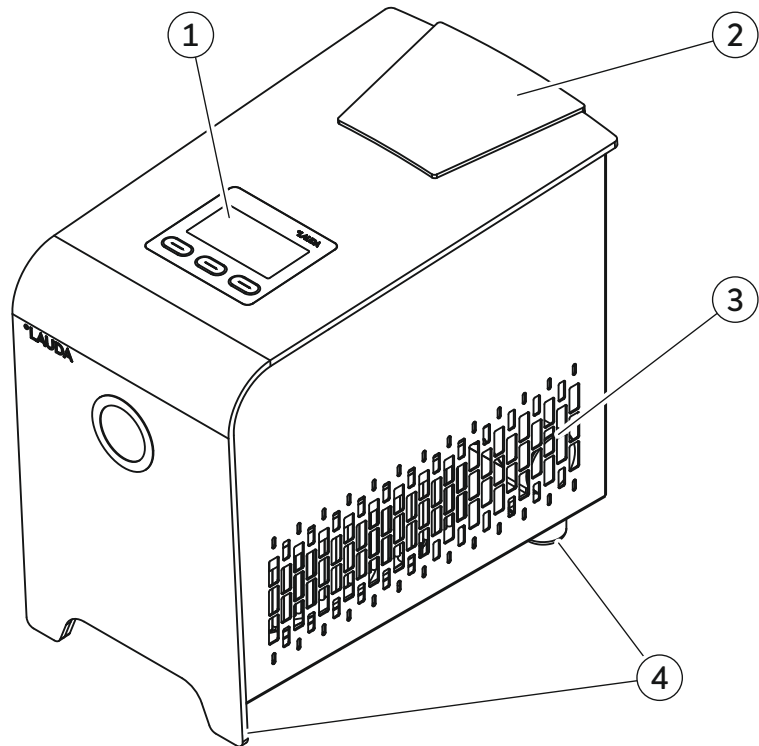
Fig. 1: Front side LOOP

1   Controller with temperature display and control buttons (soft buttons)
2   Cover over the tank lid
3   Ventilation openings
4   4 feet
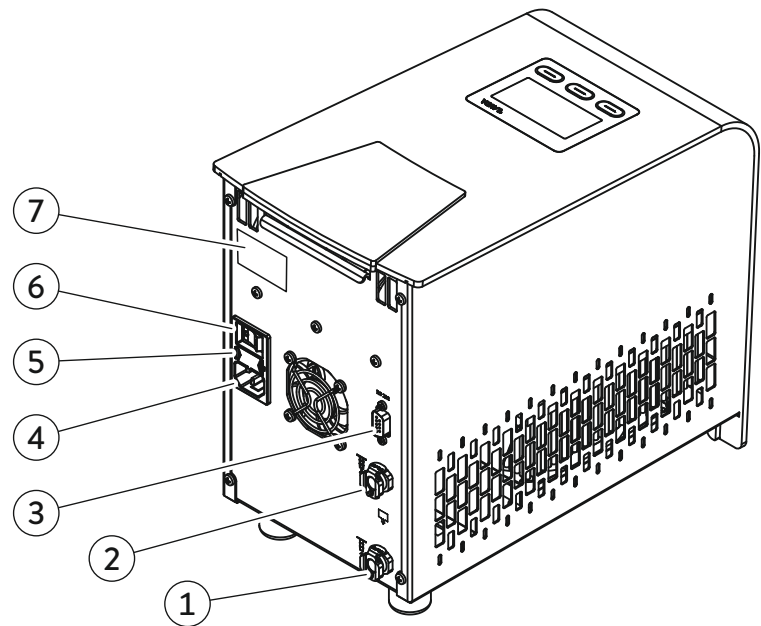
Fig. 2: Rear LOOP L 100

1   Pump connection IN inlet (back from consumer)
2   Pump connection OUT outflow (to consumer)
3   RS 232 interface (socket)
4   Device panel plug
5   Box for 2 safety fuses
6   Mains switch
7   Rating label
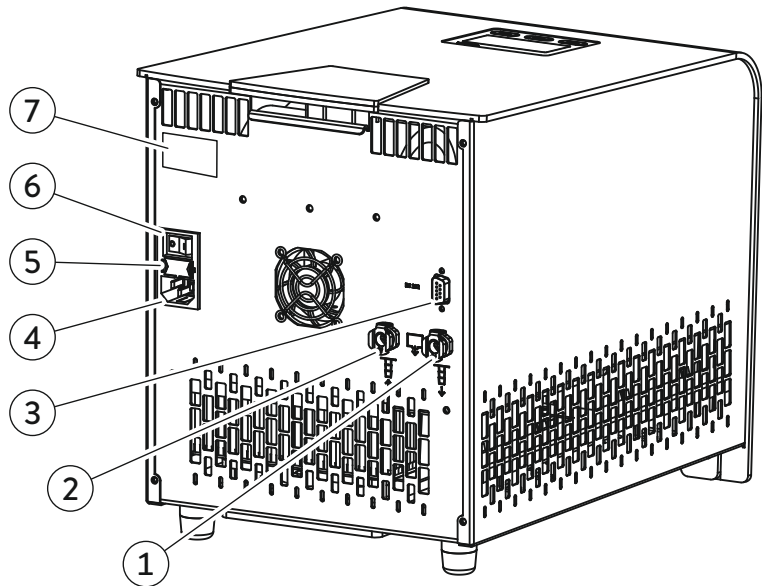
Fig. 3: Rear LOOP L 250

1   Pump connection OUT outflow (to consumer)
2   Pump connection IN inlet (back from consumer)
3   RS 232 interface (socket)
4   Device panel plug
5   Box for 2 safety fuses
6   Mains switch
7   Rating label

Fig. 4: Tank with filler nozzle and cover

Fig. 5: Hose nozzle EOA 077
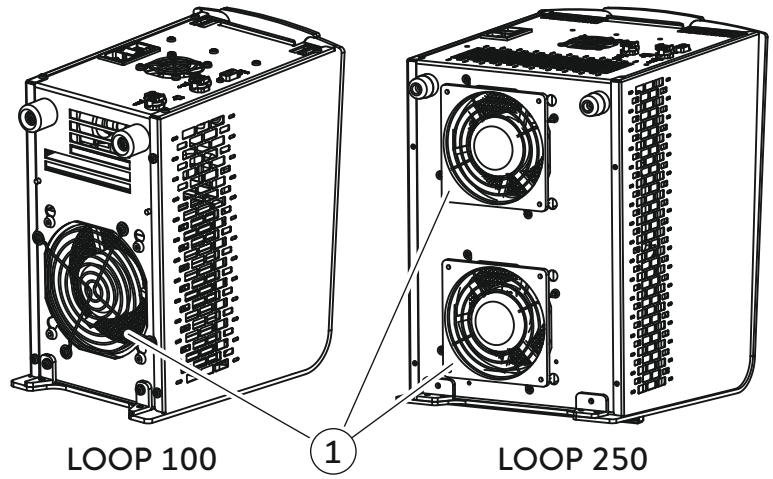
Fig. 6: Ventilator fan (1) on the underside

ℹ️ *The device sucks up fresh air from below!*

3.2 Mains switch

The mains switch can be set to the following positions:

- Position [I] switches the device on.
- Position [O] switches the device off.

3.3   Operating buttons
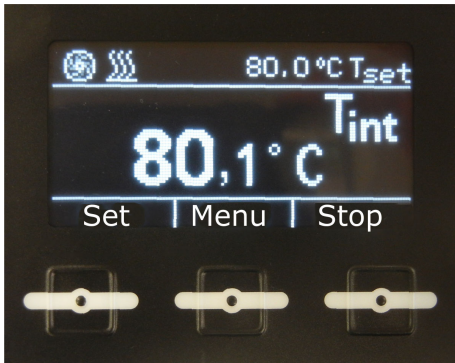
Fig. 7: Operating buttons in the home screen

The three operating buttons can be used to control the functions of the device.

- Use the [Set] button to configure the set temperature.
- Use the [Menu] button to pull up the menu, in order to configure settings.
- Use the[Stop] or [Start] button to switch the device to standby or operation mode.
  The device supports two operating modes.
  - In Standby operation mode, the device's pump and temperature control unit are turned off. Power is supplied to the display on the device. This operating mode is suitable for adjusting settings, for example.
  - In Operation mode, the components of the device are activated.
- Use the [Display] button to switch back and forth between the home screen and the display window for warnings (only possible if a warning has been generated by the device).
- Use the [Down] and [Up] arrow buttons
  - to navigate through the menu and/or
  - change set values.
- Use the [OK] input button to confirm the selection in the display.
- Use the[ESC] menu item to navigate one window back in the menu.
- If no entry is made in the home screen for 10 seconds, the operating button configuration will fade out and the temperature display will be magnified in the display. If you press on any one of the operating buttons, they will darken again.
- If no entry is made in the menu for 30 seconds, then the display will return to the home screen.

3.4   Overtemperature cutout and overtemperature

An overtemperature cutout with an electric self-retaining mechanism is installed in the device. In the event of overtemperature, (> 90 °C ±3 °C) the overtemperature cutout permanently switches off the device. For safety reasons, the device does **not** restart automatically.
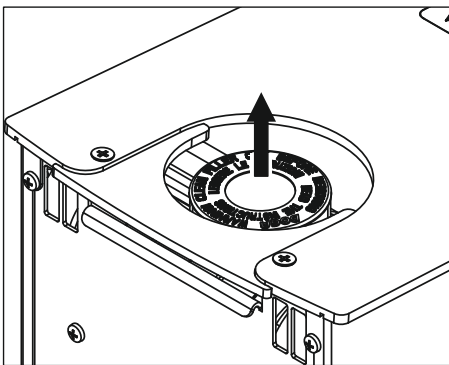
1.   Switch off the device at the mains switch.

2.   Eliminate the cause of the error.

3.   Wait approx. 5 minutes to allow the device to cool off.

4.   Switch the mains switch back to position [1].

   ▶   The device starts.

3.5   RS 232 interface

You can use the RS 232 interface to control certain device functions, such as set temperature, via a control station/PC. You can develop and use your own programs to control the device.

4 Commissioning

4.1 Set up and connect the hoses

⚠️	**WARNING!** Danger of device falling or overturning
	Crushing, impacts
	● Do not tilt the device. ● Position the device on an even, non-slip surface with a sufficient load carrying capacity. ● Do not position the device close to table edges.

Take the following information into account:

- Hold on under the device to lift and carry it.
- Set device on a level surface.
- Be careful not to cover the ventilation openings, including the ones under the device.
- Use a hose clip or cable tie to secure the hose nozzle and hose against slippage!
- The pump connections on the device are self-closing. This ensures that liquid does not flow out of the device.
- The included hose nozzles do not close.

Connect the hose to the device
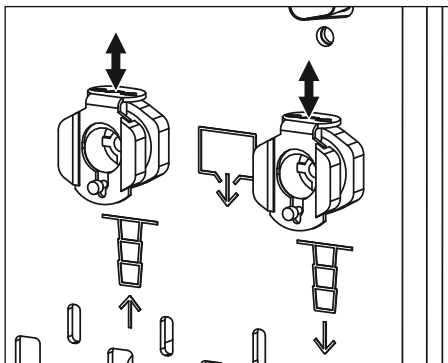
Fig. 8: Pump connection

1. Plug the hose nozzle into the pump connection.

   ▶ Spring tension locks the locking plate in the up position. A clicking noise indicates that the hose nozzle is securely locked in the connection.

If the hose nozzle cannot be plugged into the pump connection, then the locking plate on the pump connection is already locked. Unlock the locking plate by pressing down as shown in the pump connection illustration.

Remove hose from the device

1. Unlock the locking plate by pressing down as shown in the pump connection illustration.

2. Pull the nipple out of the pump connection.

   ▶ Liquid will immediately flow out of the hose.

4.2   LAUDA heat transfer liquid

Note the following instructions:

■ The heat transfer liquids each cover a recommended temperature range and must be suitable for the temperature range associated with their application.

■ Never use contaminated or degenerated heat transfer liquids.

■ You can request a copy of the safety data sheets for the heat transfer liquid at any time, if necessary.

Table 3: Approved heat transfer liquids

LAUDA designation	Chemical name	Temperature range in °C	Viscosity (kin) in mm^2/s at (at 20 °C)	Viscosity (kin) in mm^2/s at temperature	Container size Cat. No.		
					5 L	10 L	20 L
Aqua 90	Decalcified water	5 – 90	1	—	LZB 120	LZB 220	LZB 320
Kryo 30	Monoethylene glycol/water mixture	-30 – 90	4	50 at -25 °C	LZB 109	LZB 209	LZB 309

Heat transfer liquid Kryo 30

■ The water content decreases during longer periods of operation at higher temperatures and the mixture becomes combustible (flash point 119 °C). Check the mixing ratio using a hydrometer.

Heat transfer liquid, water

■ The proportion of alkaline earth ions in the water must be between 0.71 mmol/L and 1.42 mmol/L (equivalent of 4.0 and 8.0 °dH). Harder water leaves limescale deposits in the device.

■ The pH value of the water must be between 6.0 and 8.5.

■ Due to their corrosive properties, distilled, deionized, fully desalinated (FD) water, or ocean water cannot be used. High-purity water and distillates are suitable as a medium after 0.1 g of soda (Na_2CO_3, sodium carbonate) is added for every liter of water.

■ Avoid chlorine content in the water at all costs. Do not add chlorine to the water. Cleaning agents and disinfectants, for example, contain chlorine.

■ The water must be free of impurities. Water with iron content is unsuitable due to rust formation and untreated river water is unsuitable due to algae growth.

■ The addition of ammonia is not permitted.

4.3 Filling with heat transfer liquid and draining

⚠️	**WARNING!** Overflow of heat transfer liquid
	Electric shock
	● Do not overfill the device. Monitor the liquid level in the tank.

⚠️	**WARNING!** Spraying of heat transfer liquid
	Electric shock
	● Avoid spraying heat transfer liquid.

⚠️	**CAUTION!** Risk of heat transfer liquid escaping due to the use of unsuitable hoses
	Scalding, cold burns
	● The temperature and media resistance of the hoses must be suitable for the application.

❗	**NOTICE!** Use of unsuitable heat transfer liquids
	Device damage
	● In accordance with the descriptions of the LAUDA heat transfer liquids in this operating manual, only the heat transfer liquids of water and water/glycol are approved. ● The heat transfer liquid must be chosen based on the temperature range of its application.

Note the following instructions:

■ The device is designed exclusively for non-flammable heat transfer liquids.

■ LAUDA is not liable for damages resulting from the use of unsuitable heat transfer liquids.

■ Only connect pressure-sealed consumers to the device.

■ Once the consumer is connected, the liquid level in the tank will sink as the consumer is filled. Top up the heat transfer liquid!

■ When consumers are higher up, the external volume can run empty when there is a standing pump and intrusion of air into the thermostatic circuit, even in a closed circuit. This will cause the tank in the device to overflow!
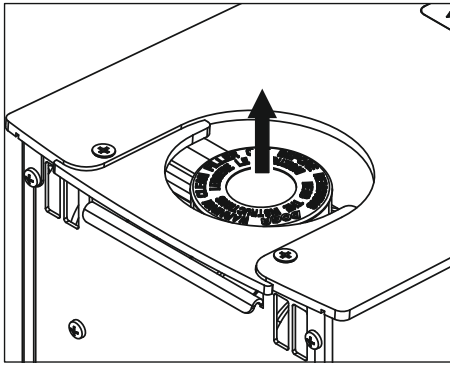
■ The tank is ventilated through the tank lid. Once the device is filled, do not tip it and never set it upside down!

■ Empty the device before transporting it.

Filling the tank

Fig. 9: Tank lid

1. Slide and remove the cover over the filler nozzle towards the back of the device.

2. Open the tank lid by turning it in a counterclockwise direction.

3. Fill the tank with heat transfer liquid. Use a standard spray bottle or a funnel to fill it.

4. Put the tank lid on and close it by turning it in a clockwise direction.

5. Slide in the cover over the filler nozzle.

Empty the tank

⚠	**WARNING!** **Contact with hot or cold heat transfer liquid**
	Scalding, cold burns
	● Bring the heat transfer liquid to room temperature before draining.

Take the following information into account:

■ Empty the device when decommissioning it or if there is danger of frost!

The pump connections on the device are self-closing. This ensures that liquid does not flow out of the device.

1. The device is switched off.

2. In order to empty the device, stick the hose nozzle into a pump connection and hold the end of the hose over a suitable container.

   ▶ Liquid will immediately flow out of the device.

   The tank and the hydraulic line in the device will empty out partially.

3. Plug the hose nozzle into the other pump connection.

   ▶ The tank and the hydraulic lines in the device will empty out completely.

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4.4 Establishing a mains connection

	NOTICE! Use of impermissible mains voltage or mains frequency
!	
	Device damage
	● Compare the type plate with the available mains voltage and mains frequency.

Take the following information into account:

- Only use the supplied power cable for the power supply.
- The mains plug disconnects the device from the power supply. The mains plug must be easy to identify and access.
- Only connect the device to sockets with a protective earth conductor (PE).
- The devices must be secured with a 16 A circuit breaker during installation.
  Exception: Devices with 13 A UK plugs.

5 Operation

5.1 General safety instructions

⚠	**CAUTION!** **Risk of heat transfer liquid escaping during operation due to open consuming unit**
	Scalding, cold burns
	● Always use hydraulically sealed consuming units.

⚠	**CAUTION!** **Risk of heat transfer liquid escaping due to the use of unsuitable hoses**
	Scalding, cold burns
	● The temperature and media resistance of the hoses must be suitable for the application.

⚠	**CAUTION!** **Overheating exceeding the maximum temperature of the application**
	Scalding, burning
	● In cases of error, temperatures of up to 125 °C may occur on the heat sink in the device. Do not touch the heat sink.

❗	**NOTICE!** **Overheating of the pump**
	Device damage
	● Never operate the device without heat transfer liquid.

5.2 LOOP menu structure

Menu

Setpoint Value
Setup
Stop / Start
Esc

Control
Limits
Basic setup
Calibration
Factory Setting
Device Status
Esc

Control parameter
Esc

Xp
Tn
Tv/Td man/auto
Tv
Td
Esc

Lower limit (Til)
Upper limit (Tih)
Esc

°C
°F

Baud rate
Esc

2400
4800
9600
19200

Temperature unit
Serial interface
Sounds
Brightness
Autostart   on
Fan limit   100%
Language
Esc

loud
medium
low
off

Stage 5
Stage 4
Stage 3
Stage 2
Stage 1

off
on

intern Pt1000
Esc

English
Deutsch
Français
Español
Italiano

all default
Control parameter
internal Pt1000
miscellaneous
Esc

no
yes

Offset
2-Punkt lower
2-Punkt upper
Factory calibration
Esc

Power
Current
Voltage
Esc

Errorstore
Line   LOOP
Type   L 100
SW version
Serial numbers
Device data
Esc

no
yes

Actuating variable
Max. Heat
Max. Cool
Esc

Temperatures
Pump
Actuating variable
Operating hours
Esc

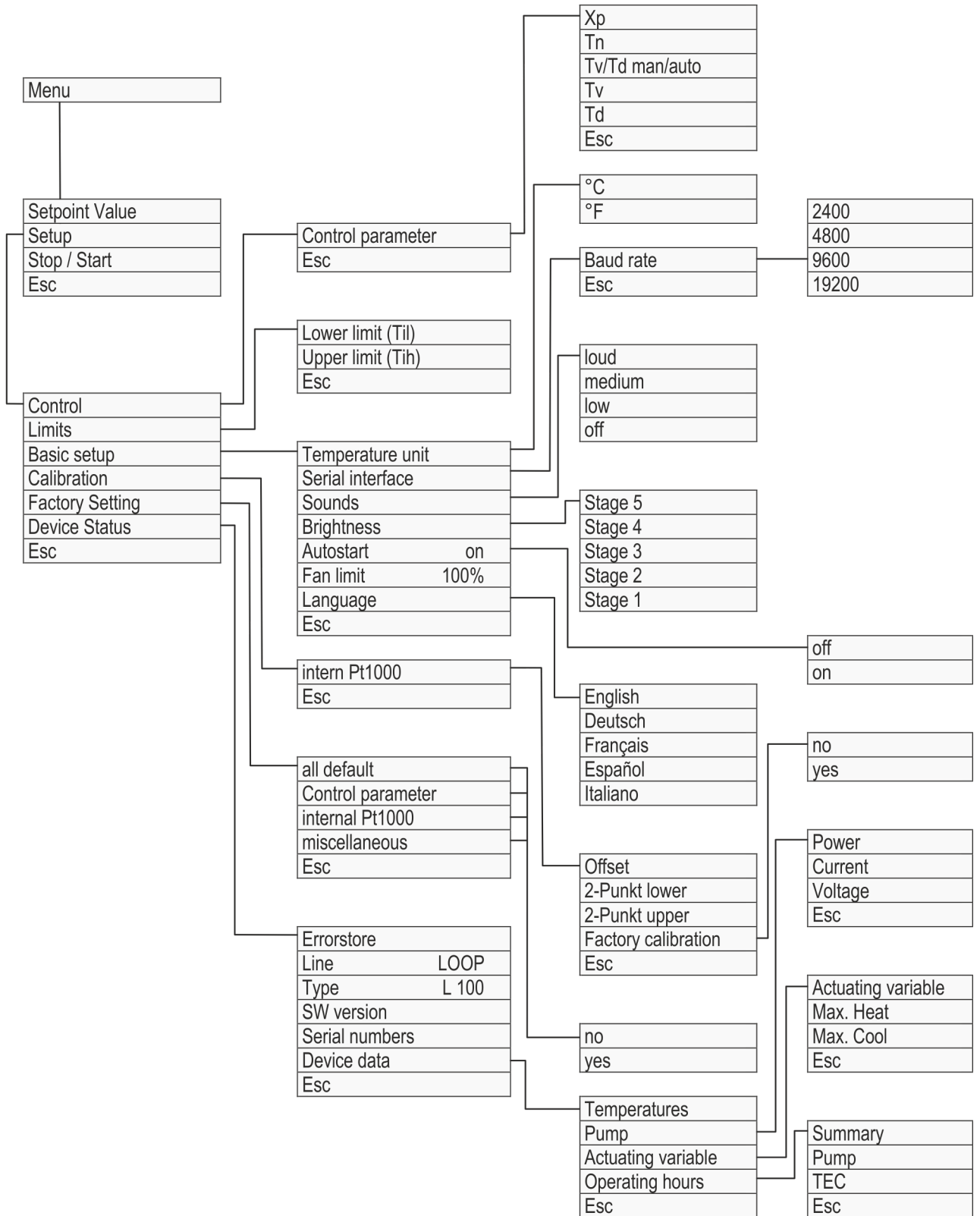| Summary |
| --- |
| Pump |
| TEC |
| Esc |

Fig. 10: Menu structure

5.3 Set the set temperature T_{set}

The set temperature T_{set} is the temperature that the constant temperature equipment should reach and then maintain.

T_{int} is the outflow temperature of the device.

In a well-controlled system, the outflow temperature is the same as the set temperature.

1. Select the [Set] operating button or the *Menu* ➞ *Set temperature* menu item.
2. Enter a new set temperature.
3. Press [OK] to confirm the new value.
   ▶ The new set temperature has been accepted.

5.4 Lock and release operating buttons

The operating buttons can be locked in order to protect the device when using a process control system or against unauthorized access.

Lock the operating button

1. Press any operating button on the display in order to make the button set appear.
2. Press and hold down the [Menu] button.
   ▶ Button set switches from [Menu] to [OK].
3. Press and hold down the [Down] arrow button within 4 seconds.
4. Hold down both buttons for 4 seconds.
   ▶ In the display the descriptions of the buttons are replaced by [---].
   The entry function is now locked.

Release operating buttons

1. Press and hold down the middle entry button.
2. Press and hold down the right entry button[---] for 4 seconds.
3. Hold down both buttons for 4 seconds.
   ▶ In the display the descriptions of the buttons show up again.
   The device can be operated again.

5.5 Set temperature limit values Til and Tih

These menu items are used to set temperature limit values Til and Tih. The temperature limit values limit the entry range for the set temperature. A warning is issued if the temperature Tint is outside the temperature limit range. The two temperature limit vales reflect the temperature limits of the application.

> ⓘ *The working temperature range of the heat transfer liquid must be greater than the range of the temperature limit values.*

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1. Select the *Menu* ➜ *Setup* ➜ *Limits* ➜ *Lower limit (Til)* menu item.

2. Enter the temperature limit value.

3. Press [OK] to confirm the new value.

5.6   Edit basic settings

This chapter explains the basic settings.

■ Set temperature unit: Degrees Celsius or degrees Fahrenheit.
■ Set the baud rate of the serial interface.
■ Set the sound volume of the signal tone; loud, medium, quiet, and off.
■ Reduce or increase the display brightness.
■ Autostart: Setting [off] or [on]
  ● Sometimes it is desirable for the device to resume operation after a power failure. However, you can introduce a manual activation step for safety reasons.
■ The maximum rotation speed of the ventilator in the device is limited between 70 and 140 %.
  With the[Fan Limit] at 100 %, under normal conditions (ambient temperature 20 °C) the specified cooling capacity is reached.
  ● If a higher cooling capacity is required or if higher ambient temperatures are present, the maximum ventilation fan rotation speed can be increased. This does, however, increase the noise issued by the device.
  ● Reducing the maximum ventilation fan rotation speed can cut down on the operating noise of the device. This does, however, reduce the cooling capacity of the device.
  ● Increase the maximum ventilator fan rotation speed when the device is operating in a warmer environment.
  ● If the device has reached the control range, the ventilator fan rotation speed will automatically be reduced, regardless of the setting [Fan Limit].
  ● If the device heats up, the rotation speed of the ventilator fan will be automatically reduced, regardless of the setting [Fan Limit].
■ The menu languages English, German, French, Spanish, and Italian are available for the device.

1. Select the *Menu* ➜ *Setup* ➜ *Basic setup* menu item.

2. Select the menu item for the value that you want to change.

3. Press [OK] to confirm.

4. Change the new value with the arrow buttons.

5. Press [OK] to confirm.

  ▶ The setting is changed.

5.7   Change the calibration of the temperature probe

> *A calibrated reference thermometer with the desired level of accuracy is necessary. Otherwise you should not change the calibration.*

If a temperature deviation is discovered during inspection of the device with a reference thermometer, the offset value (that's the additive part of the characteristic line) of the internal measurement chain can be adjusted or a 2-point calibration carried out with the menu item *Calibration*.

The reference thermometer must, in accordance with the requirements of the calibration certificate, be incorporated into the outflow of the device.

Offset

1. Select the *Menu → Setup → Calibration → intern Pt1000 → Offset* menu item.

2. Enter the temperature value read off the reference thermometer into the device.

> ℹ️ *You can change the displayed temperature value in the device within the range of ±3 K.*

3. Press [OK] to confirm the new value.

    ▶ The new value has been accepted.

2-point calibration

1. Set a low set temperature T_{set} in the device (for example 10 °C).

2. Wait until the displayed bath temperature T_{int} matches the set temperature T_{set}.

3. Select the *Menu → Setup → Calibration → intern Pt1000 → 2-Punkt lower* menu item.

4. Enter the temperature value read off the reference thermometer into the device.

> ℹ️ *You can change the displayed temperature value in the device within the range of ±3 K.*

5. Press [OK] to confirm the new value.

    ▶ The lower value has been accepted.

6. Set a high set temperature T_{set} in the device (for example 60 °C).

7. Wait until the displayed bath temperature T_{int} matches the set temperature T_{set}.

8. Select the *Menu → Setup → Calibration → intern Pt1000 → 2-Punkt upper* menu item.

9. Enter the temperature value read off the reference thermometer into the device.

10. Press [OK] to confirm the new value.

    ▶ The upper value has been accepted. 2-point calibration has been completed.

Restore factory calibration

Use this menu item to restore the calibration configured at the factory.

1. Select the *Menu → Setup → Calibration → intern Pt1000 → Factory calibration → Yes* menu item.

    ▶ This deletes the customer's calibration and restores the calibration as it was configured in the factory.

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5.8 Restore factory setting

Use this menu item to restore the factory settings in the device.

- With *All default* the control parameters, internal Pt1000, and other parameters are reset to factory settings.
- With *Control parameter* only the control parameters are reset to the factory setting.
- With *internal Pt1000* only the calibration of the internal temperature probe is reset to the factory calibration.
- With *Miscellaneous* all other parameters are reset to the factory settings. This includes:
    - The range of the temperature limit values is reset to 81 °C and 3 °C.
    - The baud rate is reset to *9600 bauds*.
    - Operating button locking is deactivated.
    - The temperature control unit is reset to *°C*.
    - The sound volume of the signal tone is reset to *Loud*.
    - The display brightness is reset to *Level 5*.

1. Select the *Menu* ➜ *Setup* ➜ *Factory setting* menu item.
2. Select the menu item for the parameter that you want to reset.
3. Press [OK] to confirm.
4. Select the [Yes] menu item.
5. Press [OK] to confirm.

    ▶ The factory setting stored in the device is restored.

5.9 Viewing the device status

In the "Device status" menu item, you can have the different current technical data of your device displayed. It isn't possible to set or change values.

You can have the following data displayed:

- Error memory
- The product line
- The device type
- The software version
- The serial number
- The device data with
    - Temperatures in the device
    - Pump data
    - Actuating signal for the heating and cooling
    - The operating hours.

1. Select the *Menu* ➜ *Setup* ➜ *Device status* menu item.
2. Select the menu item for the parameter that you want to view.
3. Press [OK] to confirm.

5.10 Control

5.10.1 Control basics

Definition

A brief explanation of terms

Actuating signal	-	Initial value of the controller to compensate for the difference between the actual value and target value (control deviation).
PID controller	-	The PID controller operates with extreme speed and precision and consists of a P, I and D-component.
Proportional range Xp	-	The proportional range Xp indicates the temperature range within which the proportional component (P-component) of the controller represents 0 — 100 % of the maximum actuating signal. If, for example, the preset Xp is 10 K and the control deviation is 2 K, the P-component is 20 % of the actuating signal. If the control deviation is 10 K or more, the P-component is 100 % of the actuating signal.
Adjustment time Tn	-	The adjustment time is crucial for the I-component of the actuating signal. It specifies the interval at which an existing control deviation is integrated. The higher the Tn, the slower the control deviation is integrated and the more sluggish the control becomes. A small Tn makes the control more dynamic and eventually results in vibrations.
Hold-back time Tv	-	The D-component of the actuating signal is formed from the hold-back time Tv. It influences the speed with which the actual value approaches the target value and counteracts the P-component and I-component. The greater the preset hold-back time Tv, the more intensively the output signal is attenuated. Rule of thumb: Tv = Tn x 0.75.
Attenuation time Td	-	Attenuation time of the D-component. Rule of thumb: Td = Tv x 0.15.

Effects of viscosity on the heat transfer liquid

A control that is stable at low temperatures will usually be stable at high temperatures. Conversely, if a system is just about stable at high temperatures, it will most probably be unstable at lower temperatures, i.e. vibrate.

Influence of control parameters on the control action

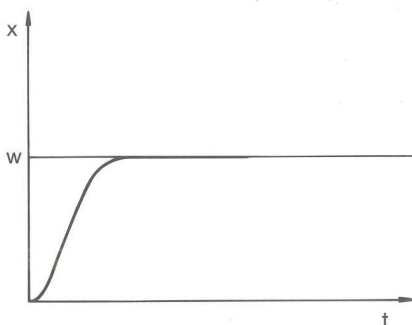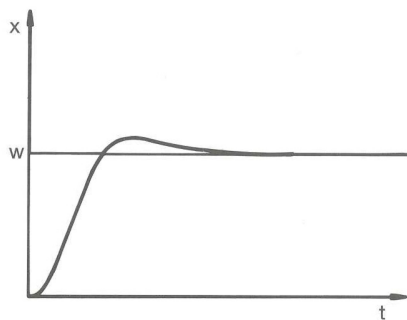
Fig. 11: Ideal setting

Fig. 12: Control parameter Xp too large

If the Xp parameter selected is too large, the actual value will reach the proportional range early and the P-component will be less than 100 % of the actuating signal. It takes longer to reach the target value and as a result, the simultaneously integrated I-component has more time to establish its actuating signal component. Once the target value is reached, the excessive addition of the I-component causes the value to overshoot the target value. If proportional range Xp is reduced, the P-component remains at 100 % for longer. Consequently, the actual value approaches the target value more quickly and the I-component has less time to integrate the system deviation. The overshoot is reduced.
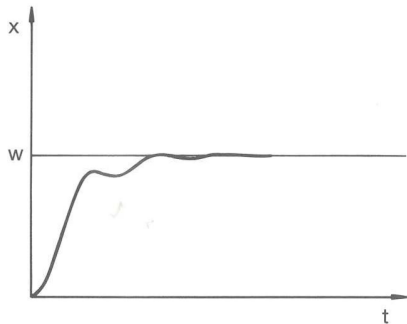

Fig. 13: Control parameter Xp too small

If the proportional range selected is too small, the P-component of the actuating signal remains at 100 % for a long time. This value decreases even faster within the proportional range, i.e. the actuating signal decreases rapidly and the progress of the actual value towards the target value comes almost to a complete stop. The I-component, which only becomes effective now, causes the actual value to move slowly towards the target value.
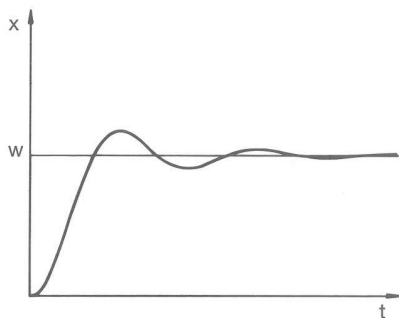

Fig. 14: Control parameters Tn and Tv too small

In the case shown here, the preset I component is too large (parameter Tn too small, Tn must be increased). The I-component integrates the control deviation until it becomes 0. If integration proceeds too rapidly, the actuating signal, i.e. the output signal of the controller, is too large. As a result, the actual value fluctuates (fading) around the target value. The hold-back time (parameter Tv) should be adapted using the formula: Tv = Tn x 0.75.
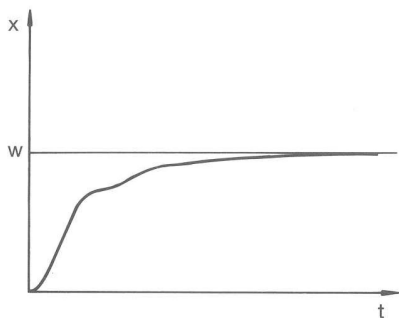
Fig. 15: Control parameters Tn and Tv too large

The actual value increases relatively sharply towards the specified target value. The proportional area settings seem to be correct. If the control deviation becomes smaller, the actual value approaches the target value much more slowly. The integration component (I-component) must compensate for the drastic reduction of the proportional component (P-component). In this case, the I component is integrated too slowly. The parameter Tn, which specifies the integration interval, must therefore be reduced. The hold-back time (parameter Tv) should be adapted using the formula: Tv = Tn x 0.75.

5.10.2 Overview of control parameters

The internal control compares the set temperature T_{set} with the bath temperature T_{int} and calculates the actuating signal, i.e. the measurement used for heating or cooling.

Designation	Abbreviation	Unit
Proportional range	Xp	K
Adjustment time	Tn	s
Hold-back time	Tv	s
Attenuation time	Td	s

> *If Tv manual/auto is set to auto, Tv and Td cannot be modified. In this case, they are derived with fixed factors of Tn.*

The following parameters may also influence the control:

- Temperature limits: Til and Tih

5.10.3 Editing control parameters

The [Tv man/auto] menu item allows you to define whether the control parameters [Tv] and [Td] are adapted manually or configured automatically. If the automatic setting is enabled, both control parameters are marked with the letter "a" and a lock symbol and cannot be selected. In this case, [Tv] and [Td] are derived with fixed factors of [Tn].

1. Press the desired operating button.

2. Select the *Menu → Setup → Control → Control parameter* menu items.

3. Select the control parameter that you want to change.

   ▶ An input window appears. A value can be entered within the limit values displayed.

4. Press [OK] to confirm the entry.

5.11 RS 232 interface

5.11.1 Cable and test of the RS 232 interface

	Computer				Thermostat		
Signal	9-pin sub-D socket		25-pin sub-D socket		9-pin sub-D socket		Signal
	With hardware handshake	Without hardware handshake	With hardware handshake	Without hardware handshake	With hardware handshake	Without hardware handshake	
RxD	2	2	3	3	2	2	TxD
TxD	3	3	2	2	3	3	RxD
DTR	4		20		4		DSR
Signal ground	5	5	7	7	5	5	Signal ground
DSR	6		6		6		DTR
RTS	7		4		7		CTS
CTS	8		5		8		RTS

Take the following information into account:

- With hardware handshake: When connecting a thermostat to the PC, use a 1:1 and not a null modem cable. The RS 232 interface can be connected directly to the PC using a 1:1 contacted cable.

- Without hardware handshake: Set the corresponding operation mode on the PC. Use protected connection lines. Connect the protective screen with the connector shell. The lines are galvanically separated from the rest of the electronics. Do not connect unassigned pins.

- It is easy to check the RS 232 interface when it is connected to a PC with a Microsoft Windows operating system.
  For Windows® 3.11 with the program "Terminal".
  For Windows® 95/98/NT/XP with the program "HyperTerminal".

For operating systems Windows Vista, Windows 7, and Windows 8 "HyperTerminal" is no longer part of the operating system.

- Terminal programs are available on the Internet as freeware. These programs offer features similar to "HyperTerminal" (for example PuTTY). Search query "serial port terminal program".

5.11.2 Protocol RS 232

Take the following information into account:

- Connection to SUB-D socket 9-pin
- The interface works with 1 stop bit, without a parity bit and with 8 data bits.
- Transmission speed alternately: 2400, 4800, 9600 (factory setting) or 19200 bauds.
- The RS 232 interface can be operated with AND without hardware handshake (RTS/CTS). In order to do so, Pin 4 (DSR) and Pin 6 (DTR) and Pin 7 (CTS) and Pin 8 (RTS) must be connected with a bridge.

- The command from the computer must be made with a CR, CRLF, or LFCR.
  CR = Carriage Return (Hex: 0D); LF = Line Feed (Hex: 0A)
- The response from the thermostat is always made with a CRLF.
- After each command sent to the thermostat, it is necessary to wait for the reply before sending another command. This ensures that the sequencing of inquiries and answers is clear.

Table 4: Example for set value transfer from 30.5 °C to the thermostat.

Computer	Thermostat
"OUT_SP_00_30.5"CRLF	
	"OK"CRLF

5.11.3 Write commands

Write commands are data specifications from the PC to the thermostat.

Command	Description
OUT_SP_00_XXX.XX	Desired value transfer with maximum 3 places in front of the decimal point and a maximum of 2 places after.
OUT_SP_04_XXX	Write [Hi] Outflow temperature limit upper value
OUT_SP_05_XXX	Write [Lo] Outflow temperature limit lower value
OUT_PAR_00_XX.X	Configuration of the control parameter Xp
OUT_PAR_01_XXX	Configuration of the control parameter Tn (5 – 180 s; 181 = Off)
OUT_PAR_02_XXX	Configuration of the control parameter Tv
OUT_PAR_03_XX.X	Configuration of the control parameter Td
OUT_MODE_00_X	Keyboard master: 0 = free / 1 = blocked (corresponds to: "KEY")
START	Turns the device on (from standby).
STOP	Switches the device to standby (switches the pump and Peltier elements off).

Take the following information into account:

- " " (blank space) can also be used for "_".
- Response from thermostat will be "OK" or, if there is an error, "ERR_X".

Table 5: Acceptable data formats

-XXX.XX	-XXX.X	-XXX.	-XXX	XXX.XX	XXX.X	XXX.	XXX
-XX.XX	-XX.X	-XX.	-XX	XX.XX	XX.X	XX.	XX
-X.XX	-X.X	-X.	-X	X.XX	X.X	X.	X
-.XX	-.X	.XX	.X				

5.11.4   Read commands

Read commands are data demands from the PC to the thermostat.

Command	Description
IN_PV_00	Query outflow temperature
IN_SP_00	Query set temperature
IN_SP_04	Query of outflow temperature limit Hi
IN_SP_05	Query of outflow temperature limit Lo
IN_PAR_00	Query of the control parameter Xp
IN_PAR_01	Query of the control parameter Tn (181 = OFF)
IN_PAR_02	Query of the control parameter Tv
IN_PAR_03	Query of the control parameter Td
IN_MODE_00	Keyboard master: 0 = free / 1 = blocked
IN_MODE_02	Standby: 0 = device ON / 1 = device OFF
TYPE	Query of the device type (answer = "BC_LOOP")
VERSION_R	Query of the software version
STATUS	Query device status 0 = OK, -1 = fault
STAT	Query of fault diagnosis response: XXXXXX; X = 0 no fault, X = 1 fault
	1st Character = error
	2nd Character = not assigned, always 0
	3rd Character = not assigned, always 0
	4th Character = not assigned, always 0
	5th Character = not assigned, always 0
	6th Character = not assigned, always 0

Take the following information into account:

- " " (blank space) can also be used for "_".
- If not otherwise specified in the command, the response will always be given in fixed point format "XXX.XX" or for negative values "-XXX.XX" or "ERR_X".

5.11.5   Error messages

The following is a description of the error messages of the RS 232 interface.

Error	Description
ERR_2	Wrong entry (for example, buffer overflow)
ERR_3	Wrong command

Error	Description
ERR_5	Syntax error in value
ERR_6	Impermissible value
ERR_32	The upper temperature limit is lower than or equal to the lower temperature limit.

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6 Maintenance

6.1 General safety instructions

⚠️	**DANGER!** Contact with live or moving parts
	Electric shock, impacts, cutting, crushing
	• The device must be disconnected from the mains power supply before any kind of maintenance is performed. • Only skilled personnel are permitted to perform repairs.

⚠️	**WARNING!** Risk of cleaning agent entering the device
	Electric shock
	• Only use a slightly damp cloth for cleaning.

⚠️	**WARNING!** Contact with hot or cold heat transfer liquid
	Scalding, cold burns
	• Bring the heat transfer liquid to room temperature before draining.

Take the following information into account:

- Before conducting maintenance work, ensure that the device has been decontaminated after coming into contact with hazardous materials.

6.2 Maintenance intervals

The maintenance intervals described in the following table must be observed. The following compulsory maintenance tasks must be performed before operating the device for prolonged periods.

Interval	Maintenance work
Monthly	Check the seal tightness of hoses and tubing clips
	Inspect the hoses for material fatigue
Six monthly	Check the heat transfer liquid

6.3 Check the heat transfer liquid

Contaminated heat transfer liquid must be replaced. Continued use of the heat transfer liquid is only permitted following successful testing.

The heat transfer liquid must be tested as outlined in DIN 51529.

6.4 Cleaning the device

> **⚠ WARNING!**
> **Risk of cleaning agent entering the device**
>
> Electric shock
>
> - Only use a slightly damp cloth to clean the device.

Note the following instructions:

- Only use water and detergent to clean the device. Do not use acetone or solvent as these substances will permanently damage the plastic surfaces.
- Ensure that the device is decontaminated after coming into contact with hazardous materials.
- It is forbidden to use decontaminants or cleaning agents that may react with parts of the device or materials contained in those parts and potentially pose a **hazard**.
- If you are unsure whether decontaminants or cleaning agents are compatible with parts of the device or the materials contained in those parts, please contact LAUDA Service Temperature control devices.

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7   Technical data

The information has been conveyed in accordance with DIN 12876.

Specification	Unit	LOOP 100	LOOP 250
Working temperature range	°C	4 – 80	
Temperature stability	K	±0.1	
Ambient temperature range	°C	5 – 40	
Storage temperature	°C	5 – 40	
Power supply	- - -	100 – 240 VAC; 50/60 Hz	
Power consumption	kW	0.2	0.4
Heating output at ambient temperature 20 °C			
- T_{Water} = 20 °C	kW	0.2	0.4
Cooling capacity at ambient temperature 20 °C			
- T_{Water} = 20 °C	kW	0.12*	0.25*
- T_{Water} = 10 °C	kW	0.06*	0.13*
Pump type	- - -	Delivery pump	
- Discharge pressure	bar	0.8	
- Flow rate	L/min	2.6	
- Tank content	L	0.3	
Hose connections	- - -	Quick connections ¼ " Hose nozzle/CPC in-line socket type PMC 2204 (EOA 077)	
Display	- - -	OLED	
- Resolution	Pixels	128 x 64	
- Size	mm	61.4 x 30.7	
- Setting resolution	°C	0.1	
- Resolution of indication	°C	0.1	
Data entry	- - -	Using three buttons (soft buttons)	
Electric interface	- - -	RS 232 interface	
Class division according to DIN 12 876-1 for labor devices			
- Class designation	- - -	I	
- Identification code	- - -	NFL (non-flammable liquids)	
Protection level (IP code) according to IEC 60529	- - -	IP 21	

Specification	Unit	LOOP 100	LOOP 250
Protection level according to DIN EN 61140	- - -	I	
Safety fuse	- - -	2 pieces SP 5x20 F 250V 6.3A H (EES 074)	
Device dimensions			
- Width	mm	175	261
- Depth	mm	301	368
- Height	mm	266	312
Weight	kg	6.9	11.9
Noise level (1m)	dB(A)	57*	57*

*Measured at 100 % setting [Fan Limit] ⮎ Chapter 5.6 "Edit basic settings" on page 23

8 General

8.1 Copyright

This manual is protected by copyright and only meant for internal use by purchasers.

The relinquishment of this manual to third parties, copying in any way whatsoever – even in the form of excerpts – and the utilization and/or conveyance of its content are not allowed, except for internal purposes, without written approval from the manufacturer.

Violation of this may obligate the violator to the payment of damages. Other claims reserved.

We point out that the designations and brand names of the respective companies used in the manual are generally subject to trademark, brand and patent protection.

8.2 Technical changes

The manufacturer reserves the right to make technical modifications to the device.

8.3 Warranty conditions

LAUDA grants a standard warranty of one year on all devices.

8.4 Contact LAUDA

Contact the LAUDA Service department in the following cases:

- Troubleshooting
- Technical questions
- Ordering accessories and spare parts

Please contact our sales department for questions relating to your specific application.

Contact information

LAUDA Service

Phone: +49 (0)9343 503-350

Fax: +49 (0)9343 503-283

Email: service@lauda.de

8.5 Declaration of Conformity

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EC DECLARATION OF CONFORMITY

Manufacturer: LAUDA DR. R. WOBSER GMBH & CO. KG
                    Laudaplatz 1, 97922 Lauda‑Königshofen, Germany

We hereby declare under our sole responsibility that the machines described below

Product Line: LOOP   **Serial number:**   from S210000001

Types: LOOP L 100, LOOP L 250

comply with all relevant provisions of the EC Directives listed below due to their design and type of construction in the version brought on the market by us:

Machinery Directive	2006/42/EC
EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU In connection with (EU) 2015/863

The protective objectives of the Machinery Directive with regard to electrical safety are complied with in accordance with Annex I Paragraph 1.5.1 in conformity with the Low Voltage Directive 2014/35/EU.

Applied standards:

- EN 12100:2011 (ISO 12100:2010)
- EN 61326‑1:2013 (IEC 61326‑1:2012)
- EN 61010‑1:2011 (IEC 61010‑1:2010 + Cor. :2011)
- IEC 61010‑2‑012:2016

Authorized representative for the composition of the technical documentation:

Dr. Jürgen Dirscherl, Director Research & Development

Lauda‑Königshofen, 29.09.2021

Dr. Alexander Dinger, Head of Quality Management

Document number: Q5WA‑QA13‑013‑EN   Version 04

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8.6   Product Returns and Clearance Declaration

Product Returns

Would you like to return a LAUDA product you have purchased to LAUDA? For the return of goods, e.g. for repair or due to a complaint, you will need the approval of LAUDA in the form of a *Return Material Authorization (RMA)* or *processing number*. You can obtain the RMA number from our customer service department at *+49 (0) 9343 503 350* or by email service@lauda.de.

Return address

LAUDA DR. R. WOBSER GMBH & CO. KG

Laudaplatz 1

97922 Lauda-Königshofen

Deutschland/Germany

Clearly label your shipment with the RMA number. Please also enclose this fully completed declaration.

RMA number	Product serial number
Customer/operator	Contact name
Contact email	Contact telephone
Zip code	Place
Street & house number	
Additional explanations	

Clearance Declaration

The customer/operator hereby confirms that the product returned under the above-mentioned RMA number has been carefully emptied and cleaned, that any connections have been sealed to the farthest possible extent, and that there are no explosive, flammable, environmentally hazardous, biohazardous, toxic, radioactive or other hazardous substances in or on the product.

Place, date	Name in block letters	Signature

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