LAUDA

Operating instructions

PROLINE heating thermostat

Thermostats with PowerAdapt system

Heating thermostats	P 5 C
Calibration thermostat	PJ 12 C, PJL 12 C
Clear view thermostats	PV 15 C, PVL 15 C, PV 24 C, PVL 24 C, PV36 C
Bridge thermostats	PB C, PBD C

Read the instructions before starting all work!

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Q4DA-E_13-009-DE-01
Translation of the original operating instructions
English / Release 08/2024 B
replaces release A
21.8.2024

Valid from:
Software of Operating system (Command) version 3.45
Software of Control system (Master) version 2.13
Software of Protection Safety system (Master) version 2.07
Software of Analogue IO module interface version 3.14
Software of Serial IO -module version 3.22
Software of contact Digital IOI/0 module version 3.14
Software of Solenoid valve version 3.06
Software of Ethernet module version 1.23
Software of EtherCAT module version 1.06

Prefixed safety notes

Before operating the equipment, please read carefully all the instructions and safety notes in Section 1. If you have any questions, please phone us!

Follow the instructions on setting up, operation etc. This is the only way to avoid incorrect operation of the equipment and to ensure full warranty protection.

- Transport the equipment with care!
- Equipment and its internal parts can be damaged:
  - by dropping,
  - by shock.
- Equipment must only be operated by technically qualified personnel!
- Never operate the equipment without the heat transfer liquid!
- Do not start up the equipment if:
  - it is damaged or leaking,
  - cable (not only supply cable) is damaged.
- Switch off the equipment and pull out the mains plug:
  - for servicing or repair,
  - moving the equipment!
- Drain the bath before moving the equipment!
- Do not carry out any technical changes on the device! (⇨ 6).
- Have the equipment serviced or repaired by properly qualified personnel only!

The Operating Instructions include additional safety notes, which are identified by a triangle with an exclamation mark. Carefully read the instructions and follow them accurately! Disregarding the instructions may have serious consequences, such as damage to the equipment, damage to property or injury to personnel!

We reserve the right to make technical alterations!

Content

Explanation of signs :

Caution: This sign is used where there may be injury to personnel if a recommendation is not followed accurately or is disregarded.

Note: Here special attention is drawn to some aspect. May include reference to danger.

Reference: Refers to other information in different sections.

1 Safety information

1.1 General safety information

A laboratory thermostat heats and circulates liquids according to specified parameters. This involves hazards due to high temperatures, fire and general hazards due to the application of electrical energy.

The user is largely protected by the application of relevant standards.
Further hazard sources may arise due to the type of tempering medium, e.g. by exceeding or undercutting certain temperature thresholds or by the breakage of the container and reaction with the heat transfer liquid.
It is not possible to consider all eventualities. They remain largely subject to the judgment and responsibility of the operator.
The equipment may only be used as prescribed and as described in these operating instructions. This includes operation by instructed specialist personnel.

The equipment is not rated for use under medical conditions according to DIN EN 60601-1 or IEC 601-1.

Classification according with EMC requirements			
Device	Immunity requirements	Emissions class	Customer power supply
Heating thermostats Proline	Table 2 (industrial) in accordance with DIN EN 61326-1	Emissions class B in accordance with CISPR 11	Worldwide No limitation

Instructions for Class A digital devices, 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."
"This device complies with Part 15 of the FCC (Federal Communication Commission) Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation."

Instructions for Class A digital devices, Canada:

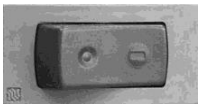
"This Class A digital apparatus complies with Canadian ICES-003" (ICES = Interference Causing Equipment Standards).
« Cet appareil numérique de la Classe A est conforme à la norme NMB-003 du Canada ».

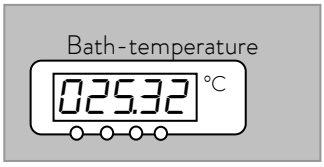
1.2 Other safety information

- Only connect equipment to PE grounded mains sockets.
- At higher operating temperatures, parts of the bath cover can reach surface temperatures exceeding 70 °C. Be careful when touching it → Risk of burning!
- Use suitable hoses (⇨ 6.4).
- Secure hose against slippage with the aid of hose clips. Avoid kinks in the hoses.
- Check hoses from time to time for any possible material fatigue.
- Thermal medium hoses and other hot parts must not come into contact with the mains cable.
- With the use of thermostats as circulating thermostats hot liquid can be emitted when the hose breaks, presenting a hazard to persons and material.
- If no external load is connected, the pump outflow must be closed (use screw plugs) and the bypass valve must be set to "internal" (⇨ 4.3).
- Take into account the thermal expansion of the heat transfer oils with increasing bath temperature.
- Irritant vapors may develop, depending on the heat transfer liquid and operating mode used. Always ensure that the vapors are adequately extracted. Use the bath cover.
- When changing the heat transfer liquid from water to a thermal transfer medium for temperatures above 100 °C, carefully remove all water residues, including from the hoses and loads. **When doing this, also open the screw plugs (HKN 065) (⇨ 3) of the pump outputs and inputs and blow compressed air through all the pump outputs and inputs.** With higher temperature there is the risk of burning due to delay in boiling!
- Withdraw the mains plug before cleaning, maintenance or moving the thermostat.
- Repairs in the control section must only be carried out by specialist personnel.
- Figures of temperature constancy and display accuracy apply under normal conditions according to DIN 12876. Electromagnetic high frequency fields may in special cases lead to unfavourable values. Safety is not impaired.
- The following action may start the thermostat unintentionally from the standby mode:
  Previously activated timer mode (⇨ 7.12),
  "Start" command via interfaces (⇨ 8).

2 Brief operating instructions

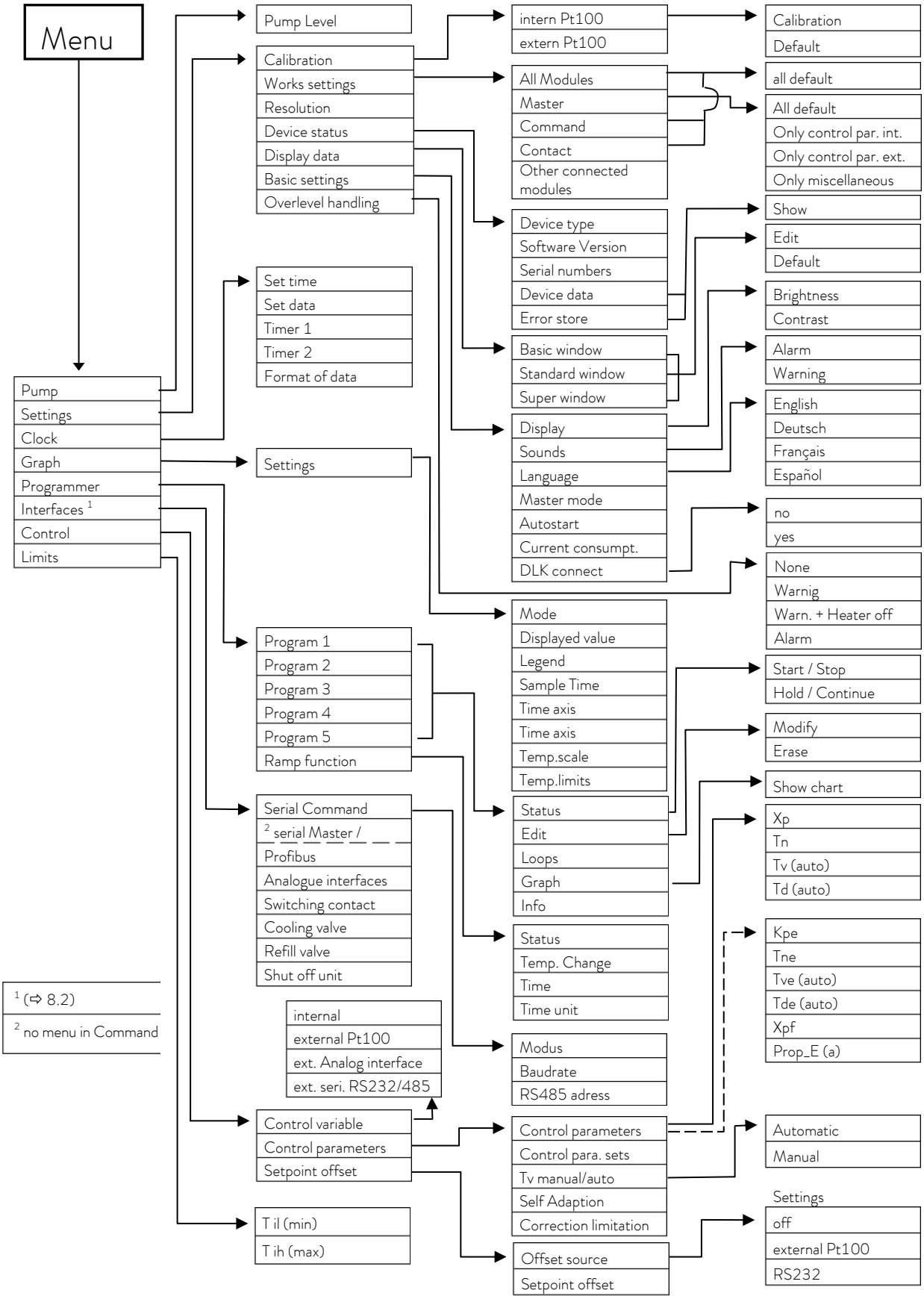
These brief instructions shall give you the possibility to operate the unit quickly. For safe operation of the unit, it is absolutely necessary to read carefully all the instructions and safety notes!

1. Assemble unit and add items as appropriate (⇨ 6.1).
   Take care of the hose tubing connections (⇨ 6.4 and 6.5).
2. Fill the unit with corresponding heat transfer liquid (⇨ 6.4). The units are designed for operation with non-flammable and flammable liquids to DIN EN 61010-2-010.
   → Take care of the level of the heat transfer liquid! (⇨ 6.3).
3. Compare the information on the rating label with the supply details.
4. Connect the unit only to a socket with a protective earth (PE) connection.
5. Check whether the main fuse-switch at the back 
   is in the "On = –" position.
6. Switch the unit on with the switch  at the front.
7. With  set the overtemperature cut-off point to a value clearly above room temperature (⇨ 7.14.1).
8. Now you see the current bath temperature
   in the display, e.g.:

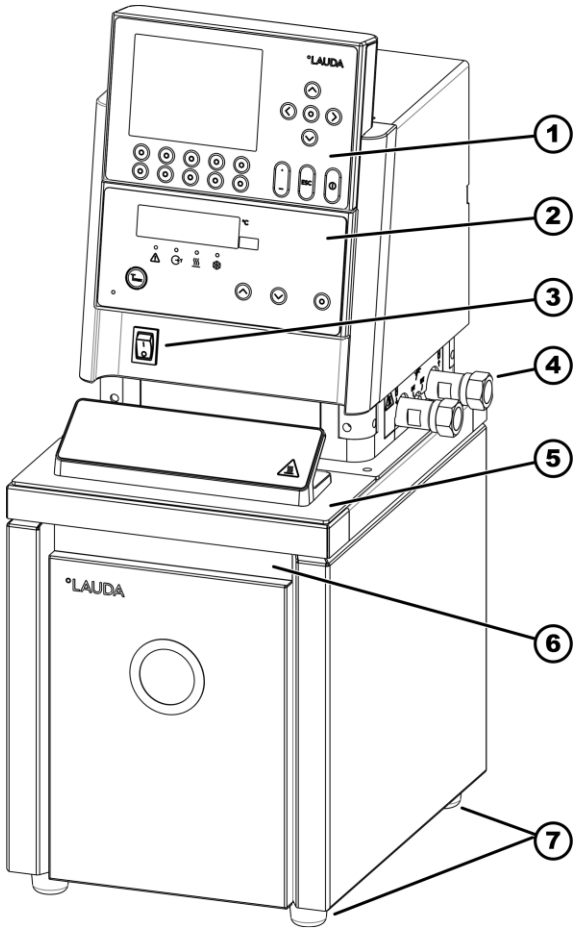


If instead, a warning or error message is displayed, then refer to Section 7.13.3.

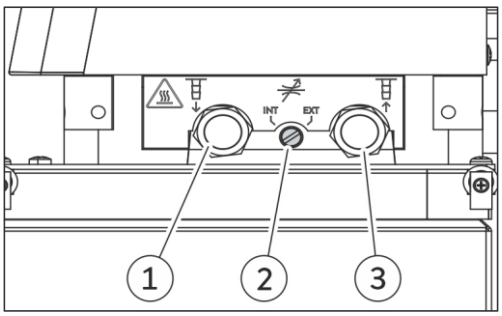
Menu structure: Command remote control



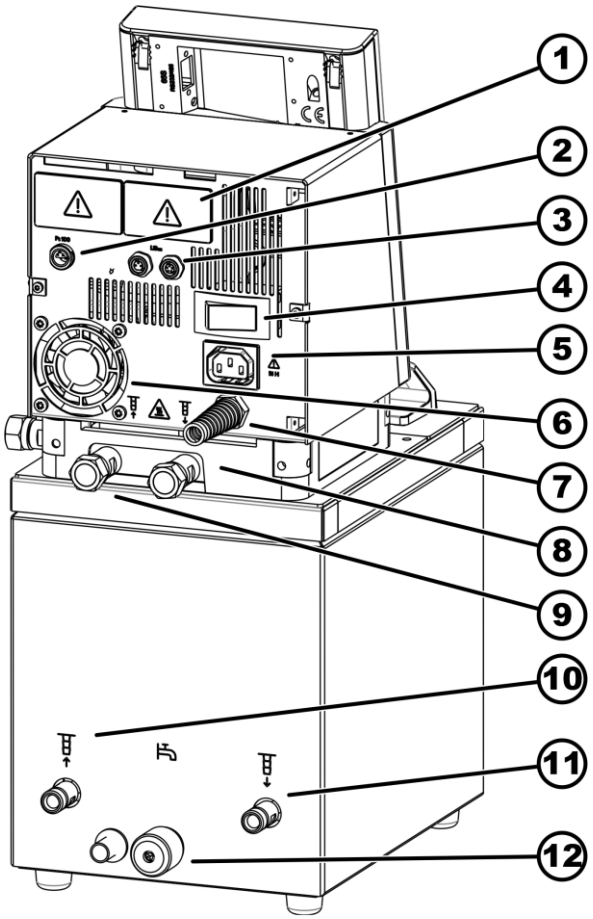
3 Controls and functional elements



1 Command remote control (see page 16)
2 Master control panel (see page 16)
3 Mains switch
4 Pump connection at side and bypass-valve (see illustration below)
5 Bath cover
6 Recessed grip
7 4 Feet



1 Side pump connection:
Pumpe outflow, pressure output
(closed off with screw plug)
2 Bypass valve
(in “external” position)
3 Side pump connection:
Suction nozzle (return to bath)
(closed off with screw plug)



1 Cover for the two module slots

2 Connection socket for the external Pt100 temperature probe

3 Connection socket (CAN 1 and 2) for bus suitable for unit and to which the refrigerating lower section and Command remote control are connected.

4 Main fuse-switch

5 Connection socket for through-flow cooler DLK (accessary)

6 Air intake to electronic head.

7 Mains supply head

8 Rear pump connection:
Suction nozzle (return to bath)

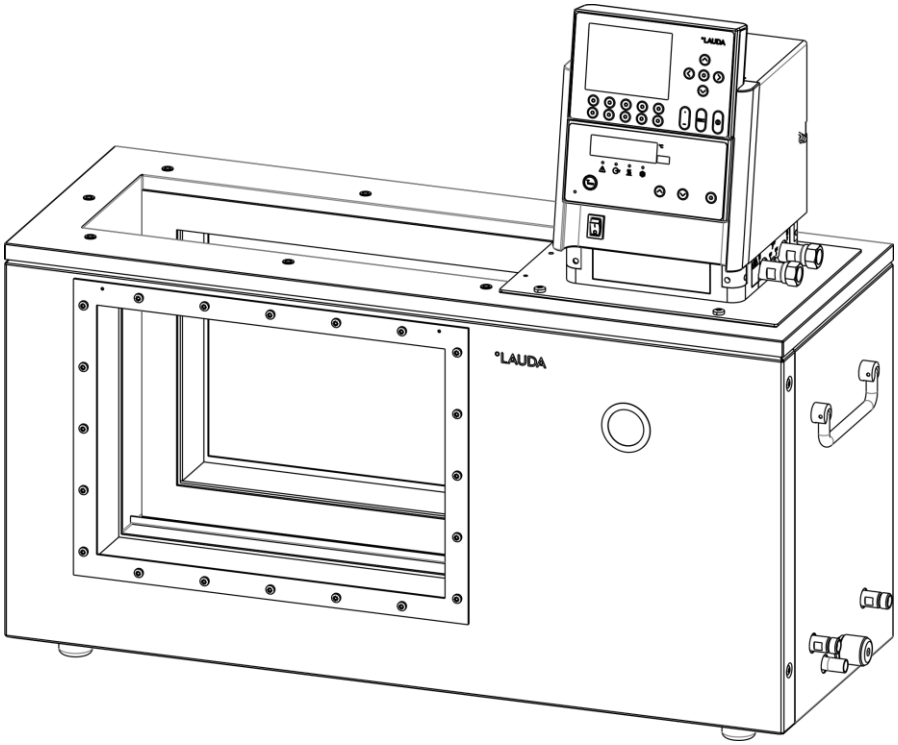
9 Pumpe outflow (pressure output)

10 Cooling coil: Cooling water inlet connection

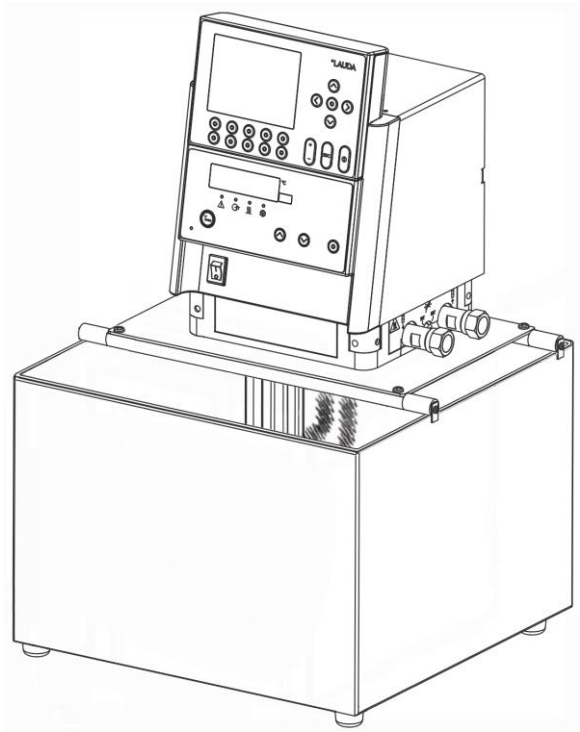
11 Cooling coil: Cooling water outlet connection

12 Drain nozzle with drain cock

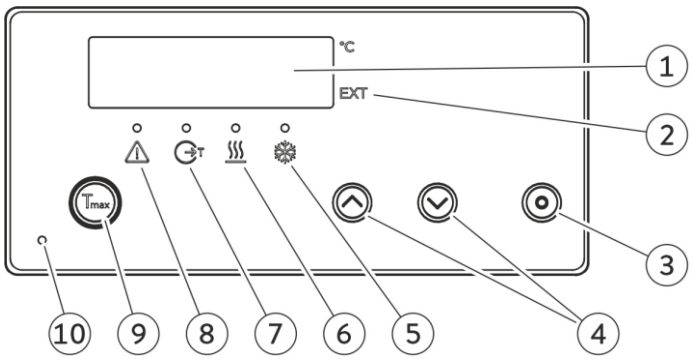
Clear view thermostat PVL 24



Bridge thermostat PB C

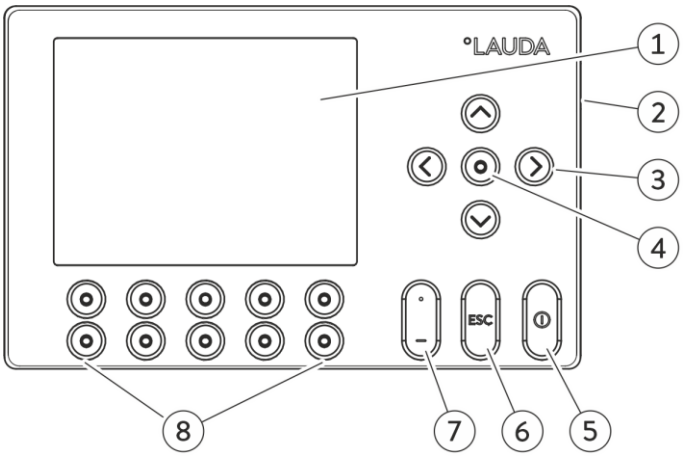


Control element: “Master”



1 Display
2 EXT: The temperature of an external source is displayed (EXT is lit green).
3 : Enter key
4 , : Select keys
5 : Heater active (yellow LED lit)
6 : Cooler active (blue LED is lit)
7 : Bath controlled by external temperature source (green LED lits)
8 : Error signal (red LED blinking)
9 : Overtemperature set point to check or set Tmax
10 Mains ON (green LED is lit)

Control element: Command remote control



1 Graphical display
2 RS 232/485 socket (hidden on the back)
3 / , / : Select keys
4 : Enter key
5 : Standby key, brings the thermostat into the idle mode. (Heater and pump are switched off, yellow LED lits).
6 : Escape key, to quit a window without any changes
7 : Decimal point or “-”symbol
8 : 5 Softkey duo-keys, their associated functions are shown in the display

4 Device description

4.1 Environmental conditions

The operation of the thermostats is only allowed under the following conditions as specified in DIN EN 61010-2-010:2003 and DIN EN 61010-1:2001:

- Indoor use only.
- Elevation up to 2000 m above sea level.
- Foundation must be dense, even, non-slippery and non-flammable.
- Ambient temperatures range (⇨ 11).
  Use only within this range for an undisturbed operation.
- Mains supply voltage fluctuations (⇨ 11).
- Relative humidity (⇨ 11).
- Transient over voltage according to Installation Categories (Over voltage Categories) II.
- Pollution degree: 2.

4.2 Device types

The type designation of the Proline heating thermostats always begins with P for Proline. The meaning of the following letters is: V for clear-view thermostats respectively VL with insulation for an extended temperature range, J for calibration thermostats respectively JL with insulation for an extended temperature range. The following numbers are equal to the bath volume in liters.
The models PB for min. 200 mm bath depths and PBD for min. 320 mm bath depths can be used as bridge thermostats.

Examples: P 5 C is a Bath thermostat with 5-liter bath and Command remote control.
PVL 15 is a clear view thermostat with 15-liter bath and operating temperature up to -60 °C (with LAUDA add-on cooler).
PJ 12 C is a calibration thermostat with 12-liter bath and Command remote control.
PBD C is a bridge thermostat with big immersion depth and Command remote control.

4.3 Varioflex pump

All units are fitted with a Varioflex pump with an 8-stage variable drive. The pump power can therefore be optimally matched to the relevant task: High pump pressure when, for example, long hoses pass to external loads or circulation is to be provided for a large bath. Low pressure when the heat input into the bath must be low.

With heating thermostat P 5 C the Varioflex pump enables as a pressure/suction pump, the very effective supply of pressure-sensitive glass reactors which have a minimum permissible pressure rating.
The thermostats PJ 12 with extreme bath depth and the bridge thermostats PBD are equipped with a very effective pressure pump as all clear view thermostats (PV 15, PVL 15, PV 24, PVL 24, PV 36).
Furthermore, open vessels can be operated when a constant level controller (accessory LCZ 0660) is used (except PV/PVL).

At the right-hand side and at the back of the unit outflow and inflow nozzles are fitted for external loads. This means that up to two external loads can be directly connected without a distributor. Connections which are not required must be closed off with the supplied caps and union nuts.
A bypass valve can subdivide the total volume flow variably between the bath (internally) and the connected load (externally). Consequently, no "pump short circuit" is needed. If no load is connected to the pump connector, the bypass valve must be set to the “internal” position for the best bath circulation.

In the heating range the Varioflex pump operates up to viscosity values of 150 mm^2/s. In the closed-loop control mode 50 mm^2/s should not be exceeded. The temperature control is the best with 30 mm^2/s and lower viscosity.

With small bath thermostats power level 3 to 6 is practicable.

For operation as a circulating thermostat with an external load, a higher power level is practicable to maintain the temperature difference low, among other things also with higher temperatures in conjunction with oils as heat transfer liquids.

The pump connections on the unit are fitted with M16 x 1 threads.

Pump characteristics (⇨ Section 11).

The pump outflows of the Varioflex pump can be closed off without any impairment to the pump. Here, the "internal" setting of the bypass controller is recommended.

4.4 Materials

All parts being exposed to with the heat transfer liquid are made of high quality material appropriate to the operating temperature. Non-rusting stainless steel and high quality temperature-resistant, primarily solvent-resistant plastics are used.

4.5 Temperature display, control and safety circuit

In the Master Version, the units are equipped with a 5-character green LED display, which is used for the display of the measurements and settings, as well as the operating status. The entry of setpoints and other settings occurs under menu guidance via four keys.

The extra features of the Command Version include a removable console with a backlit graphical display. The entry of the setpoint and other settings occurs under menu guidance via situation-dependent cursor keys and soft keys.

A Pt100 temperature probe acquires the outflow temperature in the bath. A high-resolution A/D converter processes the measurement. Further measurement conditioning occurs using a special control algorithm for controlling the heater actuator, which has a low reactive effect on the mains.

An external Pt100 can be connected via a socket (10S) for the acquisition of an external temperature. This value can be displayed and, if required, used as the controlled variable with external control (Master) switched on. In this way the system controls the external measurement and not the outflow temperature (⇨ 7.7.4).

The safety system conforms to DIN EN 61010-2-010. The SelfCheck Assistant monitors about 50 unit parameters, A dual-channel system is used in which two microcontrollers monitor one another. Along with the bath temperature measurement and control probes, there are also two safety temperature probes (Pt100) for the safety circuit for the overtemperature cut-off and for monitoring the bath temperature probe.
The overtemperature cut-off point is displayed on pressing the key  on the Master. Changing the overtemperature cut-off point: (⇨ 7.2) (Switching on) on page 27.

The bath level is acquired by the SelfCheck Assistant in 8 stages. A permanent display is provided only with the Command remote control. If the minimum level is undercut, the pump and heater are switched off. The reaction of the thermostat in case of overfill can be set to simply display a warning, to display a warning and switch off the heater or to switch off the unit completely with pump and heater.

When the level is too low, with overtemperature, or with other alarms the SelfCheck Assistant switches the heater off on all poles. The pump is also switched off.
This switch-off under fault conditions is retained, i.e. after the fault is rectified, the fault must be reset (released) on the Master operating panel with the key.

Other unit functions are described in the appropriate sections and in Section 7. (Starting up).

4.6 Programmer and ramp function

Master Version:

No programmer provided.

Command remote control:

The units are equipped with a programmer function, which enables five temperature/ time programs to be saved. Each program consists of a number of temperature/ time segments. These also include details of how often the program is to be executed. Up to 150 segments can be distributed amongst the five programs.
With the ramp function, a rate of change can be directly entered in °C per unit time. (⇨ 7.10).

4.7 Interfaces

Master Version:

The Master unit is equipped with the following sockets at the back of the control head:

- For the connection of an external Pt100 temperature sensor (10S).
- Two sockets (70S) for the connection of components via the LAUDA equipment bus (cooling section, Command remote control, external solenoid valve, etc.).

Command remote control:

The Command remote control is equipped as standard with the following sockets:

- For the connection of an external Pt100 temperature probe (10S).
- Two sockets (70S) for the connection of components via the LAUDA equipment bus (cooling section, Command remote control, external solenoid valve, etc.)
- One RS 232/485 interface (65S) at the back of the Command remote control.

4.8 Interface modules (accessories)

The Master and Command can be supplemented with further interface modules, which are simply inserted into two module slots (see Section 3) at the back of the control head.
The following modules are currently available:

1. **RS 232/485 Interface Module** (Order No. LRZ 913) with 9-pole SUB-D socket. Electrically isolated through optocouplers. Command set largely compatible with the ECO, Ecoline, Integral XT and Integral T Series. The RS 232 interface can be directly connected to the PC with a cable wired 1:1 straight through (Order No. EKS 037).
   Further details can be found in section 8.3.

2. **Analog Module** (Order No. LRZ 912) with two inputs and two outputs on 6-pole DIN socket. The inputs and outputs can be set independently as 4 – 20 mA, 0 – 20 mA or 0 – 10 V interface.
   Further details can be found in section 8.4.

3. **Contact Module** (Order No. LRZ 915) on 15-pole SUB-D socket. With three relay contact outputs (change-over, max. 30 V/0.2 A) and three binary inputs for control via external voltage-free contacts. Plug 15-pole, Order No. EQM 030 and plug case Order No. EQG 017.
   Further details can be found in section 8.5.1.

4. **Contact Module** (Order No. LRZ 914) with connector to NAMUR NE28. Functionality as LRZ 915, but only one output and one input on each of two DIN sockets. Coupling socket 3-pole, LAUDA Order No. EQD 047 and coupling plug 3-pole, LAUDA Order No. EQS 048.
   Further details can be found in section 8.5.2.

5. **Profibus Module** (Order No. LRZ 917).
   Further details can be found in the operating instructions Q4DA-E_13-014.

6. **Pt100/LiBus Module** (LAUDA catalogue no. LRZ 918)
   External Pt100: For the connection of an external temperature sensor.
   LiBus: For the connection of the Command remote control unit from the Proline equipment line and other accessories, such as a solenoid valve for cooling water control or a reverse-flow protection device.

4.9 Heater rating and power consumption from the mains

The Proline Low-Temperature Thermostats have an extraordinarily high heater rating of 3.5 kW maximum. If your mains fuse is rated below 16 A, the current consumption can be reduced in steps from 16 A to 10 A (⇨ 7.7.5). The maximum heater rating of 3.5 kW is reduced accordingly.

5 Unpacking

Keep your original packing of your thermostat for later transport.

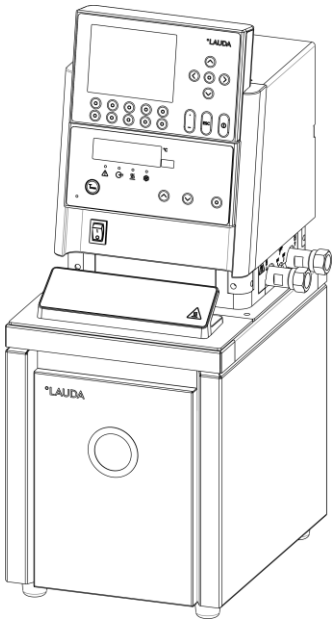
After unpacking, firstly check the device and accessories for any damage in transit. If, contrary to expectations, there is visible damage to the unit, the carrier must be immediately informed, so that an investigation can be made.
Please also inform the LAUDA Service (Contact ⇨ 9.4).

Standard Accessories:

Catalogue number	Quantity	Designation	
Q4DA-E_13-009	1x	Operating instructions	for all heating thermostats
LRT 927	1	Command remote control	for all heating thermostats
HDQ 107	1 x	Bath cover	for Proline P 5
HDR 028	1 x	Bath cover	for calibration thermostat PJ(L) 12
HKO 026 (UD 413)	2 x	Hose olive ∅ 13mm	for all heating thermostats
HKM 032	4 x	Union nuts for olives ∅ 13 mm (M16 x 1)	already adapted for heating thermostats
HKN 065	4 x	Screw plugs (for M16 x 1)	already adapted for heating thermostats
HKO 009 (UD 415)	2 x	Tubing nipple ∅ 11mm	for cooling coil of heating thermostats
HKM 045 (UD 415)	2 x	Union nuts for olives ∅ 11 mm (M14 x 1.5)	for cooling coil of heating thermostats
EZB 260	1 x	Warning label "Hot Surface“ 	for all heating thermostats

6 Preparation

6.1 Assembly and sitting



– Site the unit on a flat surface

– The unit must not be put into operation if its temperature during storage or transport has dropped below the dew point.
Wait for about one hour.

– Do not cover the ventilation openings at the back of the control head.

– When used as a bath thermostat put the bypass valve in “internal” position (without “external load”) (⇨ 3).

With the transparent thermostat, the condensation of humidity can be prevented at minus temperatures. A thread is cut into the bath bridge. A plug-in nipple can be screwed in here. The nipple is used to connect nitrogen or dry air. Only a small volume flow of gas is required.

Operation with external loads
(Circulating thermostat) continue at (⇨ 6.5).

– Check whether the pump connectors at the side and back are fitted with sealing caps (⇨ Section 3) or that hoses are fitted for external loads.

– With bath temperatures over 70 °C the supplied self-adhesive label should be applied on the bath at an easily visible point.

– Do not carry out technical changes on the device!

– The unit can safely operate up to an ambient temperature of 40 °C.

6.2 Expanding the working temperature range with external cooling

Operation with internal cooling coil

- A different cooling source, for example tap water, can be connected as standard to the cooling coil.
- Tubing with 10 mm inner diameter must be used.
- The lowest operating temperature of the thermostat without external consumer can be reduced to a value of 5 °C above the temperature of the cooling liquid.
- In combination with the cooling liquid valve LCZ 9662 (controlled by Proline by means of LiBus) as optional accessory the cooling water will only be opened if cooling is required.

Operation of the LCZ 9662 coolant valve with drinking water

The LCZ 9662 cooling liquid valve is approved for Proline heating thermostats up to a bath temperature of 155 °C if they are operated on a drinking water line with an unpressurized outlet into the waste water system. Safe operation of the coolant valve with water on a Proline thermostat above 100 °C is possible here because the coolant can flow out of the thermostat's cooling coil and does not have to be completely evaporated first.

If the cooling liquid valve opens and cooling water enters the cooling coil at a bath temperature of over 100 °C, a brief burst of steam occurs, which is why the free hose end of the cooling coil must be fixed at the outlet.

The cooling capacity of the cooling coil depends on the bath temperature of the thermostat and the temperature of the cooling water.

If oil is used as the heat transfer liquid instead of water, a slightly lower cooling capacity at the same bath temperature can be assumed. However, if higher bath temperatures (up to 155 °C) are used, the cooling capacity increases further due to the higher temperature gradient between the heat transfer liquid and the cooling water.

Operation of the cooling liquid valve LCZ 9662 on a central cooling water system

The LCZ 9662 cooling liquid valve is approved for Proline heating thermostats up to a bath temperature of 100 °C when operated on a central cooling water system.

In practice, the operating pressures in a central cooling water system vary greatly and the return lines are not depressurized. This means that the cooling coil does not run empty when the cooling liquid valve is closed. The temperature control process is therefore massively impaired at temperatures above the boiling point of the cooling water due to the high heat extraction when the cooling water evaporates in the cooling coil. Furthermore, the effect of possible steam blasts on the central cooling water circuit and consumers connected to it cannot be estimated.

When operating Proline heating thermostats above 100 °C to 300 °C, we recommend the LAUDA high-temperature cooler HTC, order number LCZ 9663.

Operation with high-temperature cooler

- For bath temperatures above 155 °C it is not allowed to cool with water together with the simple cooling coil (water vapor → risk of explosion).
- Especially for the Proline there is a controlled high temperature cooler for fast and time saving cooling with bath temperatures up to 300 °C (accessory LCZ 9663). Due to its special construction it is possible to cool with water without the risk of producing dangerous water vapor.
- The high temperature cooler **shall not be connected to the cooling coil connections**. It must be connected to the external pump connections.

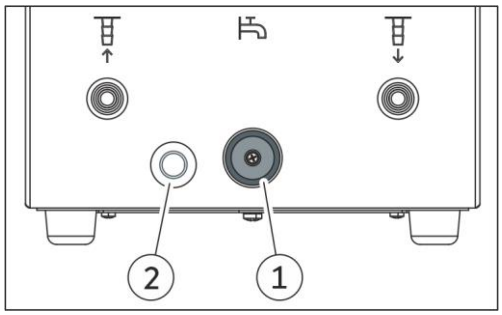
6.3 Filling and draining

Filling

- Close the drain cock!
- Carefully remove all residues of the previous heat transfer liquid (blow dry and remove screw plugs!).
- Maximum filling level is up to 10 mm below the top edge of the bath. Overfilling leads to the display of the warning LJ 103 (⇨ Section 7.14.4).
- Best operation is with a level 20 – 80 mm below the top edge of the bath.
- Low-level cut-off occurs at about 95 mm (at P 12 C approx. 215 mm) below the top edge of the bath.

- The units are designed for use with non-flammable and flammable liquids to DIN EN 61010-2-010. Flammable heat transfer liquids (⇨ Section 6.4) may only be used below the flash point.
- When using thermal transfer oils note that they expand on heating (approx. 10 % per 100 K).
- With enclosed external loads, the overall expansion takes place in the bath.
- Ensure that with the connection of an external load, the liquid level does not drop impermissibly due to filling the load. Top up with heat transfer liquid if necessary.
- Set the upper and lower temperature limits (⇨ 7.8.3) in accordance with the limits of the heat transfer liquid in use.

Draining



- Switch off the thermostat, withdraw the mains plug!
- Let out the heat transfer liquid through the drain cock; fit a hose when doing this.
- The drain cock is placed on the back of the heating thermostats.

1 Drain cock
2 Drain Nozzle

Completely drain the bath, external consumers, accessories and hose connections and flush or clean them (e.g. with new heat transfer liquid).

- Follow the regulations for the disposal of used heat transfer liquid.

Do not drain heat transfer liquid when it is hot or at bath temperatures below 0 °C!

6.4 Heat transfer liquids and hoses

Approved heat transfer liquids

LAUDA designation	Temperature range	Chemical designation	Viscosity (kin)	Viscosity (kin) at temperature	Flash point	Packing drum Order number		
	from °C to °C		mm^2/s at 20 °C	mm^2/s	°C	5 L	10 L	20 L
Aqua 90 ①	5 – 90	Decalcified water	1	--	--	LZB 120	LZB 220	LZB 320
Kryo 30 ②	-30 – 90	Monoethylene glycol/water mixture	4	50 at -25 °C	--	LZB 109	LZB 209	LZB 309
Kryo 20	-20 – 170	Silicone oil	11	28 at -20 °C	170	LZB 116	LZB 216	LZB 316
Therm 160	60 – 160	Poly-alkyleneglycol	141	28 at 60 °C	260	LZB 106	LZB 206	LZB 306
Therm 180	0 – 180	Silicone oil	23	36 at 0 °C	250	LZB 114	LZB 214	LZB 314
Therm 250	50 – 250	Silicone oil	158	25 at 70 °C	300	LZB 122	LZB 222	LZB 322

① At higher temperatures vaporization losses occur. In this case use a bath cover.
Only use distilled water or fully demineralized high purity water after adding 0.1 g of soda (Na2CO3 sodium carbonate) per liter of water. Otherwise, there is the risk of corrosion!

② Water content falls with longer operation at high temperatures. The mixture becomes flammable (flash point 119 °C). Check the mixture ratio with a hydrometer.

– With the selection of the heat transfer liquid it should be noted that impairment of the properties is to be expected at the lower limit of the temperature range due to increasing viscosity. Therefore, only make maximum use of temperature ranges when essential.

– Application ranges of heat transfer liquids and hoses are general figures, which may be restricted by the operating temperature range of the units.

With silicone rubber, silicone oils lead to substantial swelling. Never use silicone oil with silicone hoses!

Observe the safety data sheets for the various heat transfer liquids. If required, you can download the safety data sheets from our homepage.

Open the LAUDA homepage, tap ⇨ Services ⇨ Download center.
In the Download center, chose the [Safety data sheet] option in the [Document type] drop-down list.
A list of safety data sheets in PDF format in different languages is displayed.
Tap the relevant safety data sheet.
The download starts and the PDF file is downloaded.

Hoses

Approved elastomer hoses

Hose type	Internal width Ø mm	Temperature range °C	Field of application	Catalogue number
EPDM hose uninsulated	9	10 – 90	For all LAUDA heat transfer liquids except mineral oils	RKJ 111
EPDM hose uninsulated	12	10 – 90	For all LAUDA heat transfer liquids except mineral oils	RKJ 112
EPDM hose insulated	12 External Ø approx. 30 mm	-35 – 90	For all LAUDA heat transfer liquids except mineral oils	LZS 021
Silicone hose uninsulated	11	10 – 100	Water, Glycol/water mixture	RKJ 059
Silicone hose insulated	11 External Ø approx. 30 mm	-60 – 100	Water, Glycol/water mixture	LZS 007
	– EPDM hose is not suitable for mineral oils! – With silicone rubber, silicone oils lead to substantial swelling → never use silicone oil with silicone hoses! – Secure hoses against slippage with hose clips.			

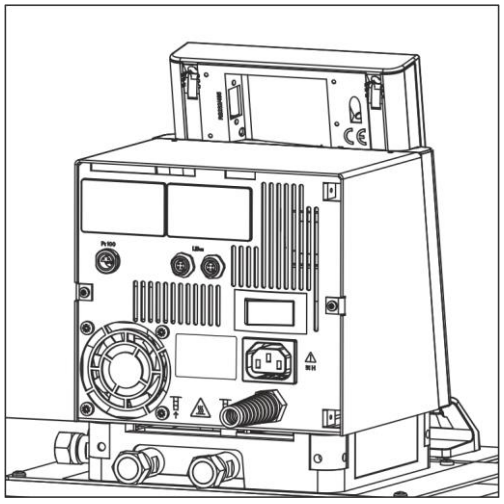
Approved metal hoses in non-rusting stainless steel with union nut M16 x 1, internal width 10 mm

Type	Length (cm)	Temperature range °C	Field of application	Catalogue number
MC 50	50	10 – 400	With simple insulation, for all LAUDA heat transfer liquids	LZM 040
MC 100	100	10 – 400		LZM 041
MC 150	150	10 – 400		LZM 042
MC 200	200	10 – 400		LZM 043
MK 50	50	-90 – 150	With foam insulation for refrigeration range, for all LAUDA heat transfer liquids	LZM 052
MK 100	100	-90 – 150		LZM 053
MK 150	150	-90 – 150		LZM 054
MK 200	200	-90 – 150		LZM 055

6.5 Connecting external loads

Operation as circulating thermostat

Bursting of the external consumer due to overpressure
Scalding, frostbite, cutting
• Use a pressure relief device on pressure-sensitive consumers (e.g. glass reactors).



– When used as circulation thermostat, care for shortest hose connections with largest inner diameter as possible. This gives the best flow.
– Push hose with 11 – 12 mm internal width onto hose olive or connect metal hoses (⇨ 6.4) to pump connectors.
– Pump connectors at side:
Inlet and outflow → see labeling housing.
– Pump connectors at back
Inlet and outflow → see labeling housing.
– Set bypass valve to “external”.

☞
– If cross-sectional area of tube is too low → temperature gradient between bath and external load due to low flow rate.
– Always ensure the largest possible passages in the external circuit!
– If external control is to be used, provide a Pt100 probe in the external load (⇨ Section 7.7.2 and 7.7.4).
– When tightening the union nuts on the pump nipple AF 19, use a wrench AF 14 to counter the tightening torque (see figure).

– With loads at a higher position and with stationary pump and ingress of air into the thermostatic circuit, the external volume can drain away, even with closed circuits → Risk of thermostat overflowing!
– Secure hoses against slippage with hose clips!
– Unused pump connectors must be closed off.

7 Starting up

7.1 Mains connection

Compare the rating on the nameplate (back of control head) with the mains voltage.

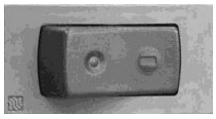
- Connect unit only to sockets with a protective earth conductor (PE).
- No liability is accepted for incorrect mains connections!
- Ensure that pump connectors without external loads are closed off.
- Ensure that the unit is filled according to Section 6.3.

Note for electric installation on site:

The devices must be protected with a 16 ampere circuit breaker fitted during installation.

Exception: Devices with 13 ampere UK plugs.

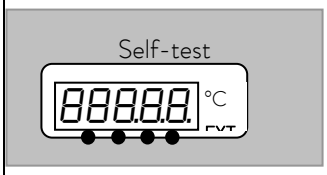
7.2 Switching on



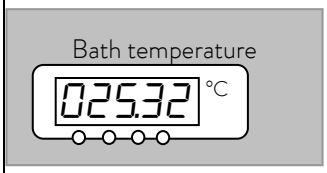
Check whether the main fuse switch at the back is in the 'On = –' position.

Switch on the mains switch :

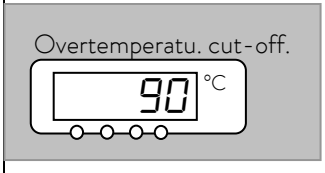
- The green LED for 'Mains ON' is lit,
- an acoustic signal is emitted for about 1 s.



- The unit starts its self-test. All display segments and symbols appear for about 1 second.



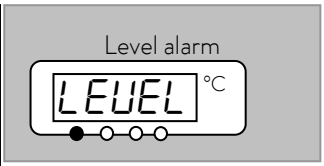
- The momentary bath temperature is displayed,
- the pump starts provided 'Standby' or 'Manual start' (⇨ Section 7.8.2) has not been programmed,
- all values are accepted which were active before switch-off.



Check or set overtemperature cut-off point:

- The switching point is shown in the LED display on pressing the key  .
- Change overtemperature cut-off (⇨ Section 7.14.1) Overtemperature protection and checking on page 80.

- If necessary, top up heat transfer liquid which has been pumped out by filling the external load.



– Display for LEVEL (low level) appears when the bath has too little liquid.

– Red LED ☼ above the fault triangle ⚠ flashes.

– Find cause of fault and, where necessary, top up missing heat transfer liquid (⇨ Section 6.4).

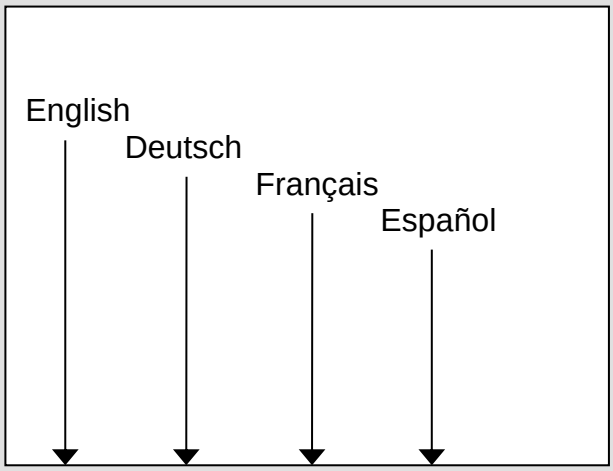
– Press the Enter key.

– Also press the key if unit has been switched off in the fault state.

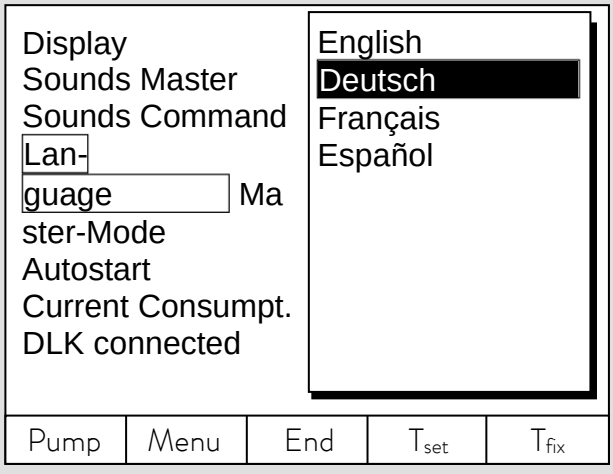
– No release is possible on Command remote control!

Command

Language



– If the Command remote control is being switched on for the first time, the illustrated window appears automatically, enabling you to select the dialog language with the appropriate soft key.



– The dialog language also can be changed later via → Settings → Basic settings → Language.

– Mark the required language with ⊙ or ⊙.

– Confirm the selection with ⊙.

7.3 Switching off / standby

Switching off: Set mains switch to position 0.

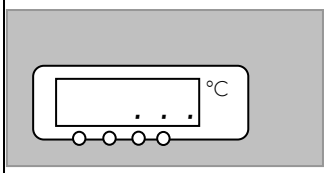
Standby operation: Use the key  on the Command remote control. The pump and heater are switched off.
The operating display remains active, so that the device status is visible and adjustments can be made.

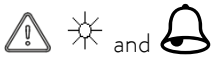
The timer continues to run. Stop as required with Pause (⇨ 7.12).

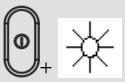
7.4 Key functions

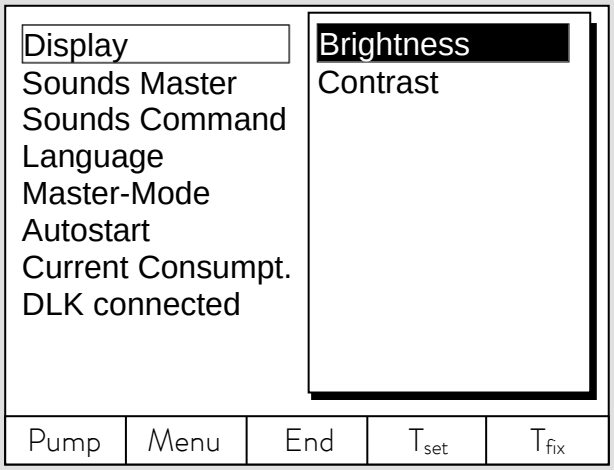
Your Proline Thermostat is easy to operate.

7.4.1 General key functions and pilot lamps

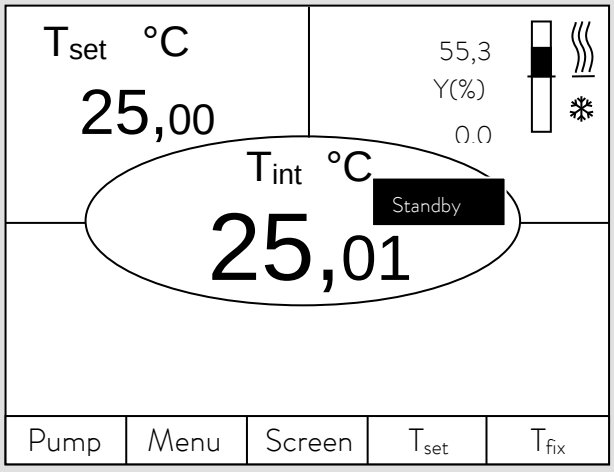
Master	
	Enter key: – From the actual-value display at the main menu level, – activates input, display flashes, – saves input, display ceases to flash and menu point is left, – press for approx. 3 s: Exit function and returns to bath temperature display.
 or 	– Paging with keys is possible within the relevant level, or setting of numerical values Speeds up entry by moving the counting position to the left: a) Keys are pressed and held down **or** b) One of the two keys is pressed and held down, followed immediately by brief pressing of the other key. Moves counting position to the right: – Switching one **place to the right** occurs by briefly (1 s) releasing the key, followed by another pressing of the key.
	Useful additional information: – Two dots in the Master display indicate that a submenu follows. – Three dots in the display indicate that a submenu for a module (interface...) or a component (thermostat, Command remote control ....) follows. Module/component-specific possible settings are only displayed when the hardware is connected.

	– **The following always applies**: After termination of the relevant settings, they are accepted automatically after approx. 4 s **or** – the setting is accepted immediately with the Enter key.
	– Fault signal: Flashing red Alarm LED and acoustic signal. – An acoustic signal can only sound when it has not been intentionally deactivated! (⇨ 7.8.6)
	– The bath control occurs via the external temperature probe when the green LED is lit.
	– Heating is active when the yellow LED is lit.
	– Cooling is active. When the setpoint temperature is lowered, it makes take up to one minute before the blue LED is lit.
EXT	– The temperature of the external probe is displayed.

Command	
	– Enter key ("Confirm selection") and go back one level.
End	– Soft key function to confirm a selection or input and to return to the main display window.
	– Escape key to quit a window without changes and to go back one level.
	– Cursor keys for Up, Down, Left and Right.
	– Standby activation (pump and heater are deactivated when the yellow LED is lit). However, the Timer goes on! See safety information on (⇨ 7.7.3).
	Duo key: – Top: Decimal-point key. – Bottom: Key for arithmetical sign.
	– Soft keys: 5 duo-keys which each have the function shown in display above them. Soft-key entries are shown framed in the operating instructions. Example: You would like to change the setpoint temperature, then press the duo-key under T_{set}.



Screen



Brightness Contrast

The brightness and contrast can be set on the Command remote control:

- The works setting can be changed via → Settings → Basic settings → Display → Brightness or → Contrast.
- The brightness of the LCD illumination can be selected from 8 steps or switched off completely.
- The contrast can be set in 8 steps.

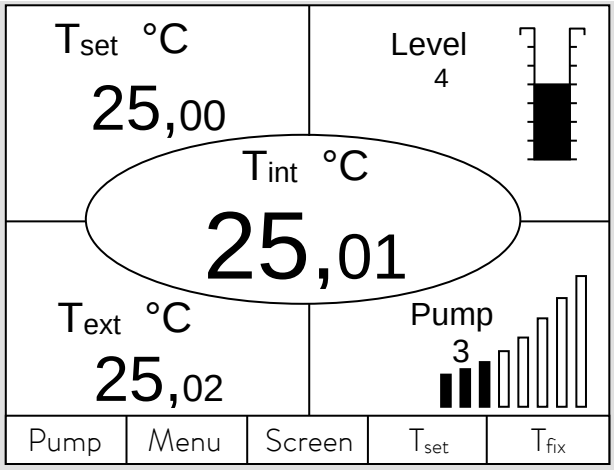
There are four different screen displays available. The screen is switched over with the soft key Screen:

1. **Basic window** with the three most important items of information:

- T_{int}, current bath temperature,
- T_{set}, setpoint of the bath or external temperature,
- Information: Heating / cooling. Here, heating is taking place at 55.3 % and 0.0 % cooling.

Soft keys:

- Pump: Set pump level.
- Menu: Set unit parameters.
- Screen: Changes between basic, normal, super and graphics recorder windows.
- T_{set}: Changes setpoint temperature.
- T_{fix}: Calling and setting of saved setpoints.



2. **Standard window** with five important items of information:

– T_{int}, current bath temperature,

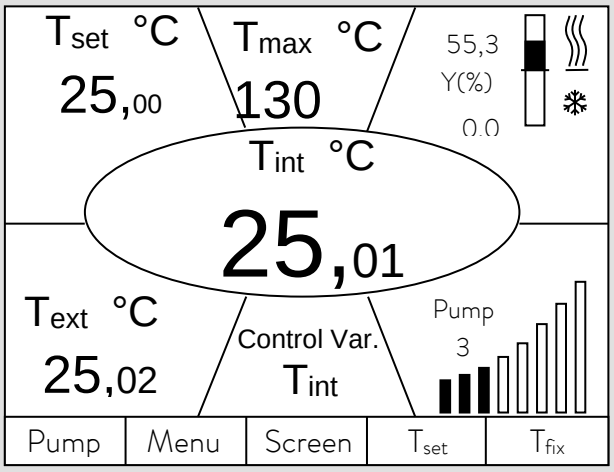
– T_{set}, setpoint,

– T_{ext}, current temperature on external probe (if connected),

– Level of heat transfer liquid in cm above the minimum level,

– Pump level of the Varioflex Pump.

Soft keys as above.



3. **Super window** with seven items of information:

– T_{int}, current bath temperature,

– T_{set}, setpoint,

– T_{ext}, current temperature on external probe (if connected).

– Overtemperature cut-off point T_{max}.

– Pump level of the Varioflex Pump.

– Control variable to T_{int} or $T_{ext.}$

– Information Heating / Cooling.

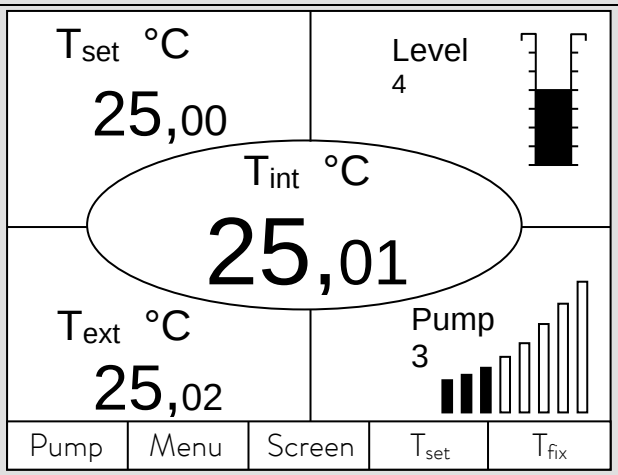
Soft keys as above.

4. **Graphical measurement display**

– All temperature values can be shown graphically against time (⇨ 7.9).

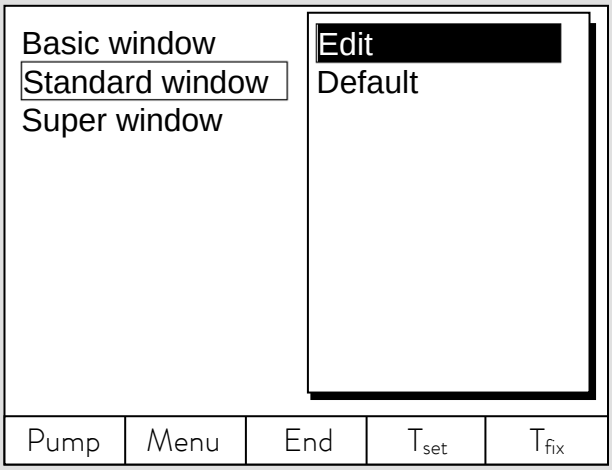
7.4.2 Changing window information

Command	Display data

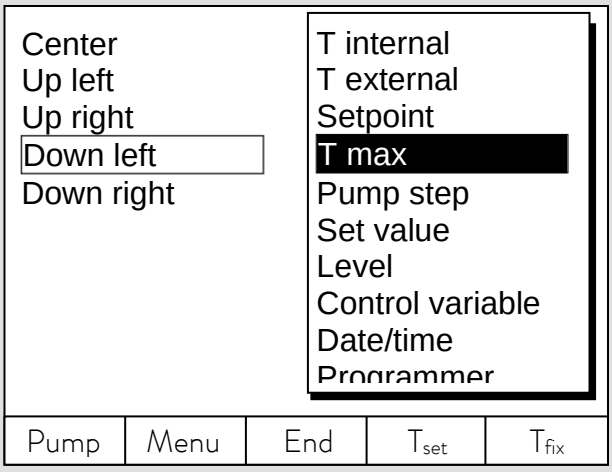


You can adapt the information displayed by your Command remote control to your requirements. For example, if you have not connected any temperature probe, you can exchange it in the standard setting of the normal window for the maximum temperature T_{max} (safety cut-off).

This is how it is done:



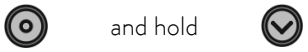
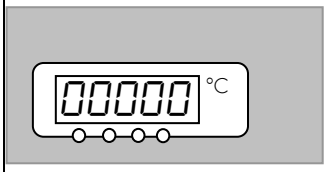
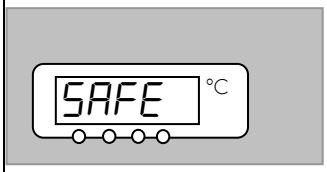
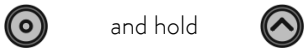
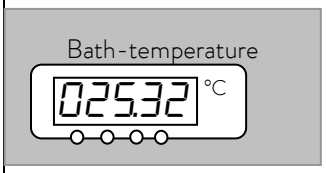
– Open the unit parameter menu via the soft key Menu.
– With ⊙ and ⊙ change from Settings → Display Data → Standard window → Edit.

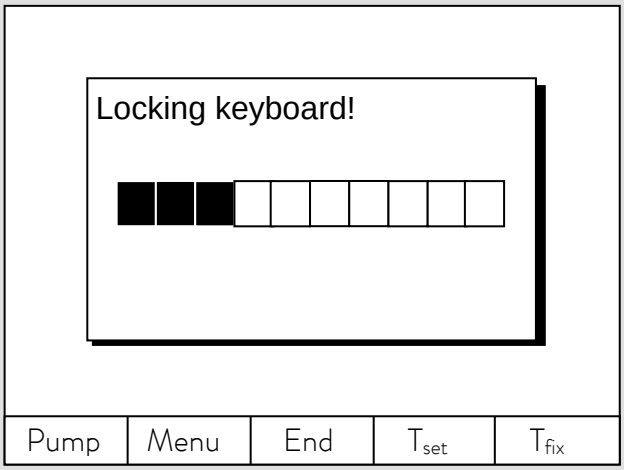
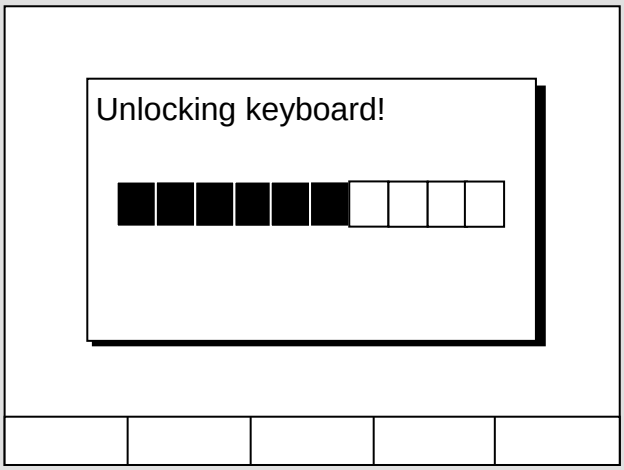


– ⊙ or ⊙ take you to the illustrated window.
– ⊙ and ⊙ mark T max as illustrated.
– Confirm selection with ⊙ or End,
– or quit the window with ESC without any changes being made.

7.4.3 Locking the keyboard

The keyboards of the Master and the Command remote control can be locked independently of one another. This is especially advantageous when the thermostat is positioned in another room and the Command remote control is used as a remote control device. Then the Master keyboard can be locked to prevent unintentional adjustment.

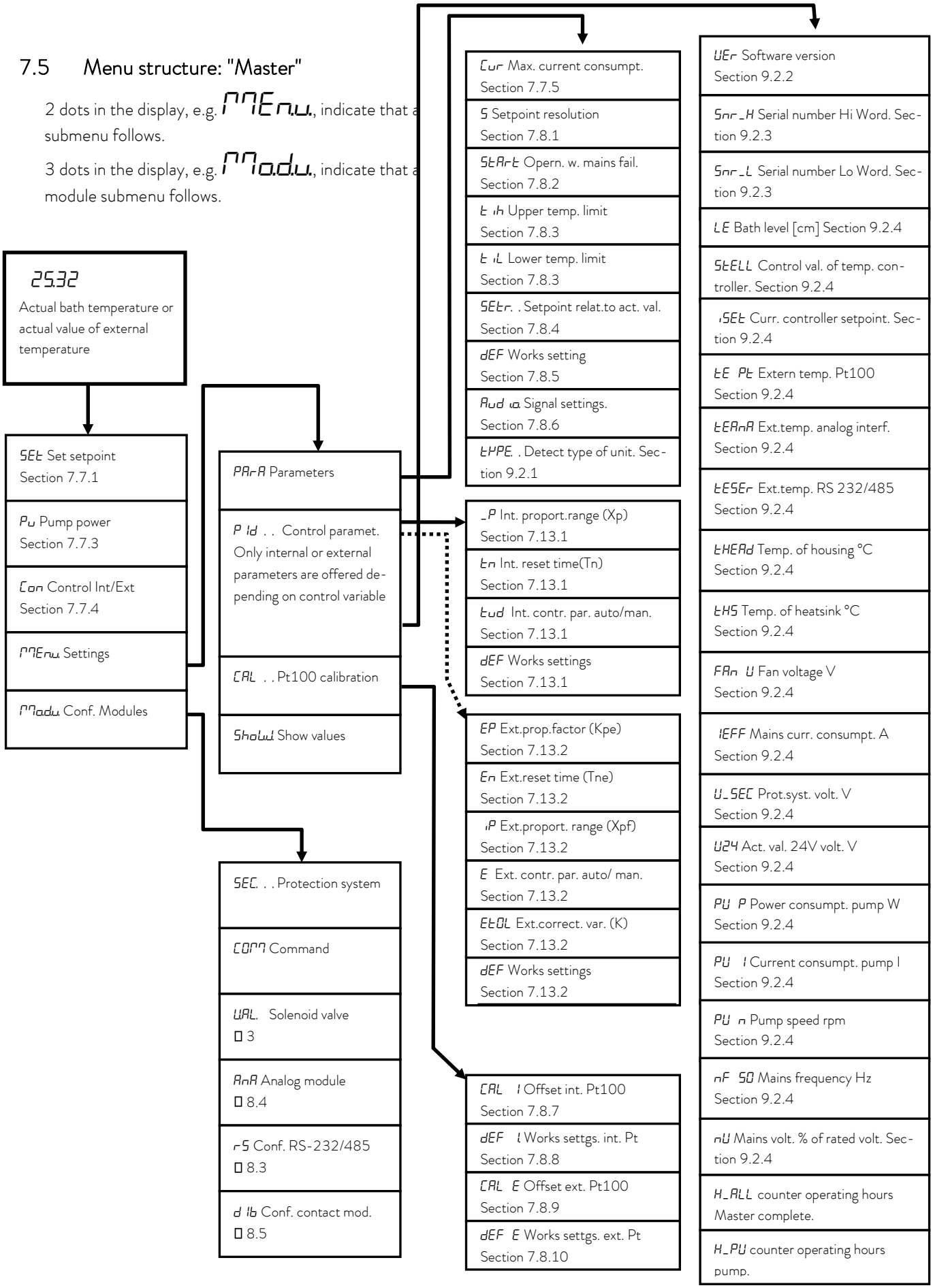
Master	SAFE
	Lock:
 and hold pressed simul-taneously for 3 s	– SEt appears for 3 seconds, – then the segments of the first right-hand 0 are formed,
	– hold both keys pressed until this display is completely visible.
	– SAFE flashes briefly and the display returns to the actual temperature. – The Master keyboard is now locked. – The SAFE display signals the locked state when any Master key is pressed.
	Unlocking:
 and hold pressed simul-taneously for 3 s	– For three seconds, then SAFE appears. – Then the segments of the left-hand 0 are formed.
 Bath-temperature	– The actual bath temperature appears again when all the 0s have been formed.

Command	
	**Locking:** – Press and then and hold pressed simultaneously for 3 s. – The locking window appears. – Hold both keys pressed until the progress bar is completely filled. – Then the display skips back to the previously set Screen mode. – The soft-key boxes are now blank, indicating that the keyboard is locked. – On pressing any Master key the display appears: Keyboard locked.
	**Unlocking:** – Press and then and hold pressed simultaneously for 3 s. – The unlocking window appears. – Hold both keys pressed until the progress bar is completely filled. Then the display skips back to the previously set Screen mode.

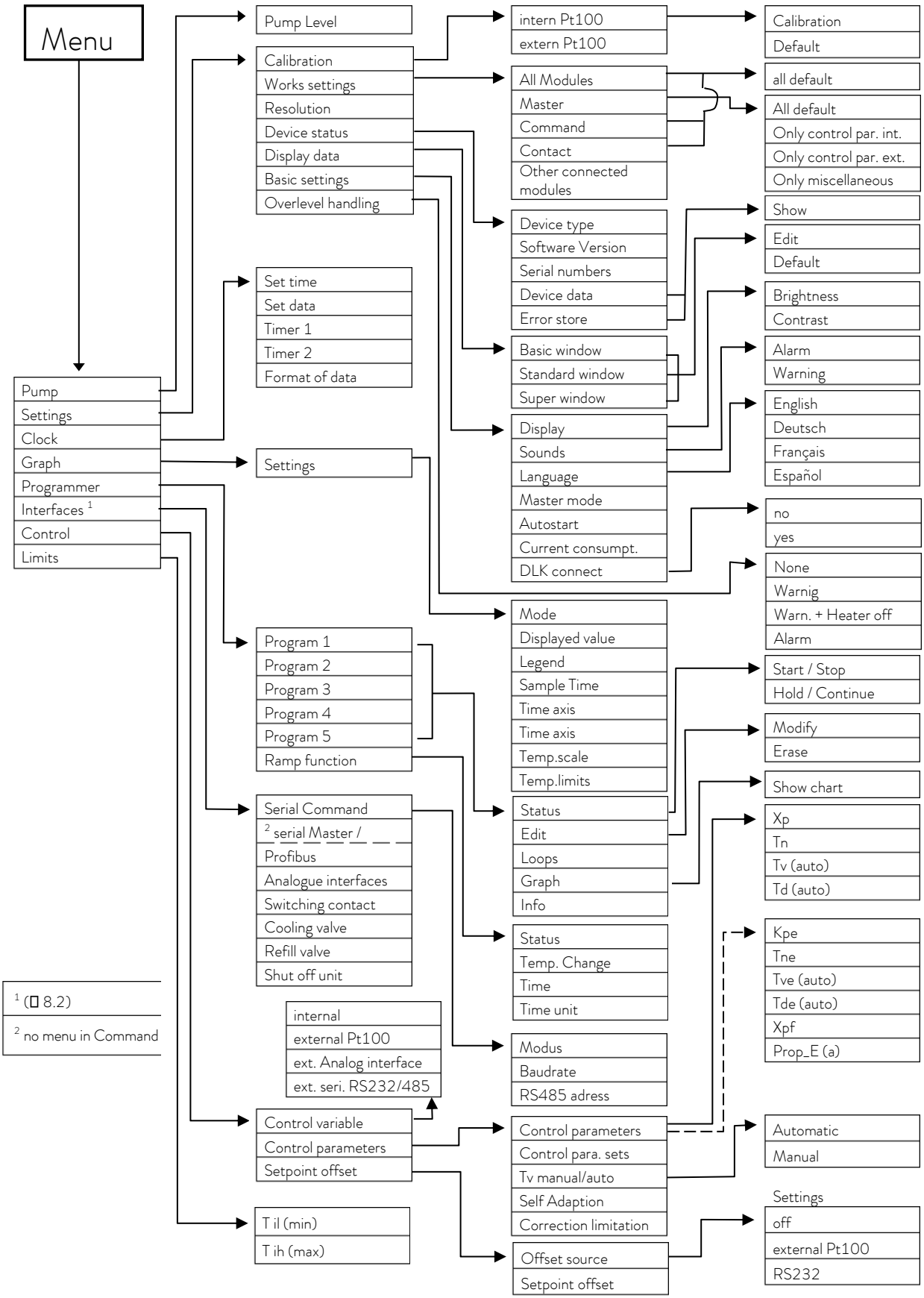
7.5 Menu structure: "Master"

2 dots in the display, e.g. MEnu., indicate that a submenu follows.

3 dots in the display, e.g. Modu., indicate that a module submenu follows.



7.6 Menu structure: Command remote control



7.7 Important settings

7.7.1 Temperature setpoint setting

The setpoint is the temperature which the thermostat should reach and maintain constant.

Master (main level)	SEt
	– Press key until SEt (Setpoint) appears.
	– Press, display flashes.
or	– Enter the setpoint with the two keys (⇨ Section 7.4.1 General key functions and pilot lamps).
Wait 4 seconds or	– Display flashes 4 s → new value is automatically accepted, **or** value is accepted immediately with Enter key.
	– For safety reasons the setpoint can only be set up to 2 °C above upper limit of the operating temperature range for the relevant device type.
	– In the following cases the manual setpoint entry is blocked: Setpoint is taken from the analog module, from the programmer in the Command remote control or via the serial interface.

Command	T_{set} or T_{fix}
	– or the soft key T_{set} opens the setpoint window.
	– 123.45 is the setpoint which is still active. The upper and lower limit temperatures are displayed (device-specific values).

Enter new setpoint:

123,45

Min: -40,00°C Max:202,00°C

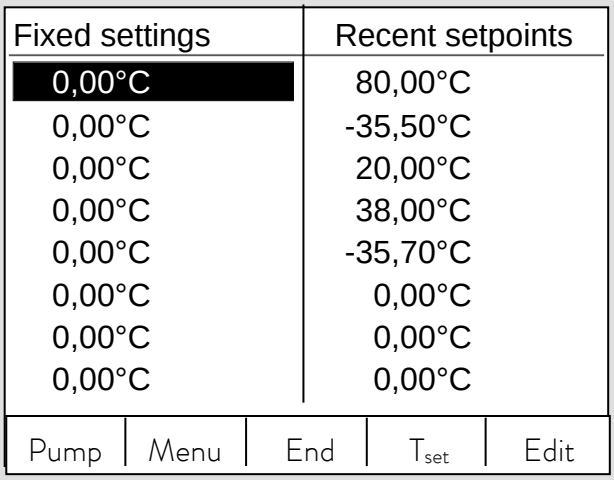
1	2	3	4	5
6	7	8	9	0

There are three different possible entry methods:

1. Change the value with the or keys. First you vary the 1/10 °C values. If you hold the key pressed longer, then full degrees change.
2. Enter the complete number with the numerical duo keys and the key for the negative sign and decimal point.
3. Using or , move the flashing cursor line to the decimal place which you would like to change and then change it with or .

– Confirm the value with ◎ or quit the window with ESC without having made any changes.

Two other ways of entering the setpoint:

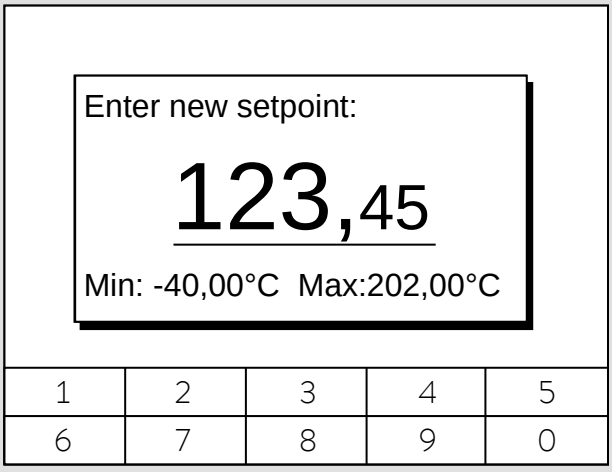


– With the soft key ◎ T_{fix} open the window shown on the left.

– The setpoints which you last entered are shown in the right-hand column. In the illustrated screen the last setpoint was 80.0 °C.

– To accept an earlier setpoint, enter the right-hand column with ▷ and select the desired value with ▽, then accept it with ESC or cancel with ◎.

– In the left-hand column setpoint temperatures, which are to be used frequently, can be defined as "fixed settings".



– Select desired position with the cursor keys ▽ (black background).

– With the soft key ◎ Edit open the window shown on the left.

– Enter fixed temperature setpoint as described above and accept into the list with ◎ or cancel with ESC.

– Select and accept values from the list of fixed settings as described above for the "Recent set-points".

7.7.2 Displaying the actual external temperature

With all Proline Thermostats an external temperature probe can be connected, which for example.....

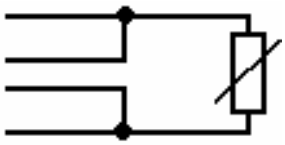
1. ... can be used as an independent temperature measurement channel.
2. ... can be used as the controlled variable for the bath temperature in applications with a noticeable temperature gradient (between the internal bath temperature and an external load). The setup is described in Section 7.7.4. With the function described in the following, you only change over the display!

– External actual temperatures can also be read in by interface modules (⇨ 8).

Connection of the external Pt100 to the Lemo socket 10S 

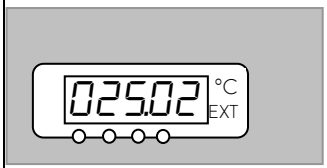
This interface is a Lemo socket in size 1S.

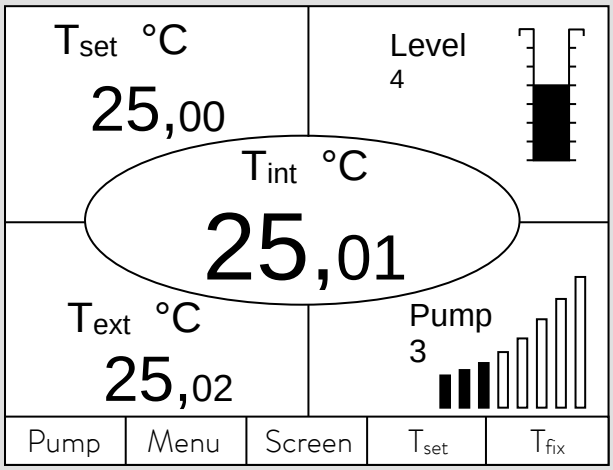
Contact on socket 10S			
1	+	I	Current circuit
2	+	U	Voltage circuit
3	-	U	Voltage circuit
4	-	I	Current circuit



Pt100
DIN EN 60751

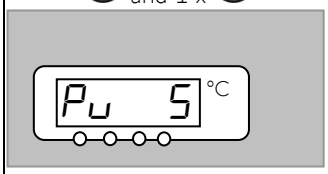
– Plug: 4-pole Lemosa for Pt100 connection (Order No. EQS 022).
– Use screened connecting leads. Connect screen to plug case.

Master	EXT
or	– Switches to the actual-value display of the external temperature probe (or to the actual value received from an interface module (⇨ 7.7.4)).
	– EXT is lit in green next to the row of figures. – If no external Pt100 probe is connected, ----- is displayed.

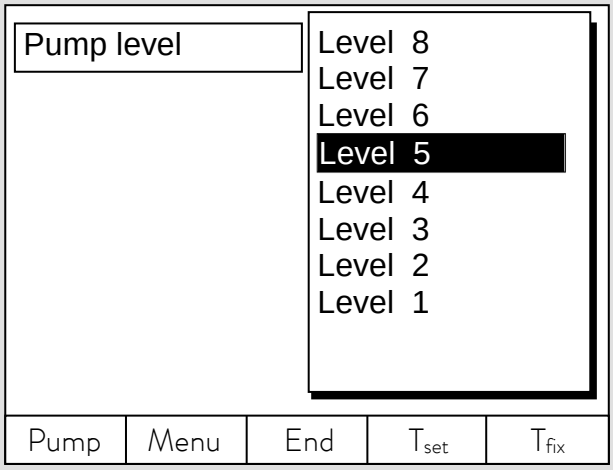
Command	T_{ext}
	– Provided an external temperature probe is connected, its value is displayed in the lower left part of the standard and super windows (applies to the works setting for the window partitioning). – External actual temperatures can also be read in via interface modules. (⇨ 8).

7.7.3 Setting pump power or standby

With the Proline Varioflex pump, 8 pump levels are available with which the bath circulation, flow rate and pressure, the noise generated and the mechanical heat input can be optimized. This is particularly advantageous with coolers. With smaller coolers (e.g. P8) without an external load, Power Level 3 to 4 is practicable and sufficient.

Master	Pu
and 1 x 	– Call pump power levels display Pu. – The current pump level is displayed (here 5).
 or  	– The pump levels display flashes. – Select pump level (pump speed = pump power): 1 to 8 for pump operation. Pump responds immediately! – 0 activates the standby function (pump and heater are deactivated).
Wait 4 seconds or 	– Display flashes 4 s → new value is automatically accepted, **or** – value is immediately accepted with Enter key.

Command	Pump level



– Open the device parameter menu via the soft key Menu.
– Change from Pump → Pump level using .
– With or you enter the illustrated window. Level 5 is active.
– Select another pump level with or and confirm with or End,
– or quit the window with without making any changes.

Standby activation

– Standby activation
(Pump and heater are deactivated when the green LED in the lower part of the key is lit).

Please exercise caution when thermostat is in standby mode.
The following settings/ actions may start the thermostat unintentionally from the standby mode:

– A previously activated timer mode (⇨ 7.12), because a started time continues to run.
– "Start" command via interfaces (⇨ 8).

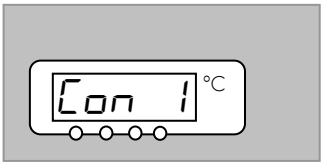
7.7.4 Activating external control

An external temperature probe can be connected to the Proline Thermostats. How this is done is explained in Section 7.7.2. If the set point temperature is to be controlled using this sensor instead of the internal sensor, the setting can be made here.

Furthermore, control can also occur based on the signal from the analog or serial module (⇨ 4.8).

Master	Con

and 2 x



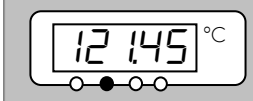
Call the source selection for the control Con.

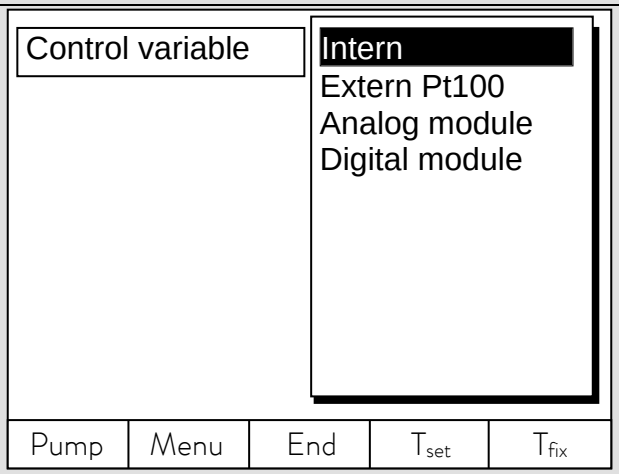
– The momentary setting for the source is displayed,
– here 1 for internal, because control takes place using the temperature signal from the internal temperature probe.

– The source display flashes.

Change temperature probe source:

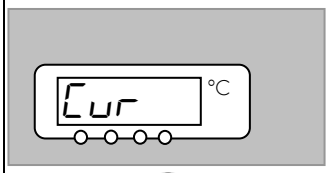
– 1 for the internal probe,

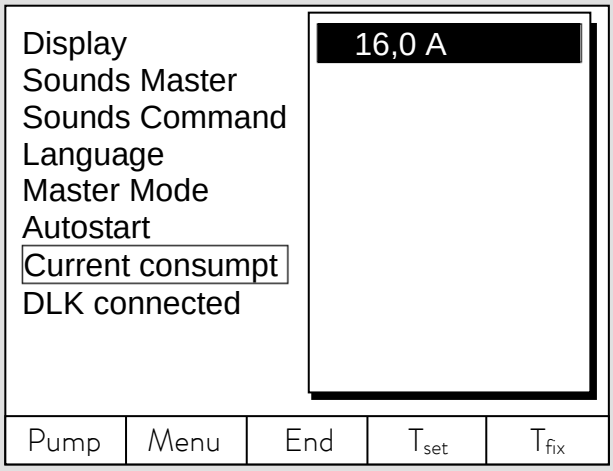
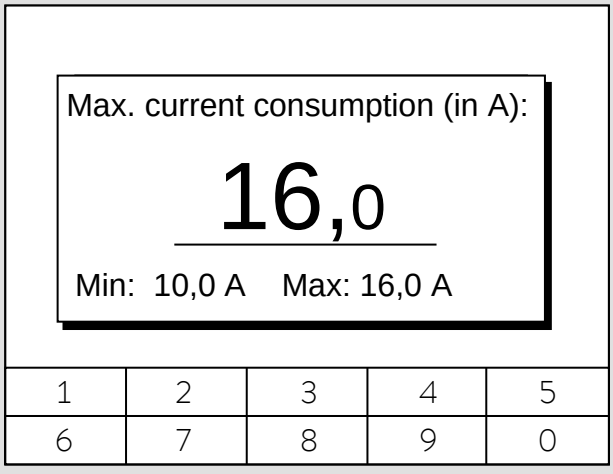
or	– EP only when an external probe is connected, – EA only when an analog module is connected and configured, – ES only when a serial module is connected and is continuously receiving actual values from a PC.
Wait 4 seconds **or** 	– Display flashes 4 s → new value is automatically accepted, **or** – value is immediately accepted with Enter key.
	– If EP EA or ES has been selected, then the green T LED indicates that the control has regulated to the external temperature signal.

Command	Control variable
	– Open the device parameter menu with the soft key Menu. – With the cursor keys, change further to: → Control → Control variable. – Intern is currently active. – Select other control variables (only displayed when present) with or and confirm with or End, – or quit the window with ESC without making any changes.

7.7.5 Current consumption from the mains

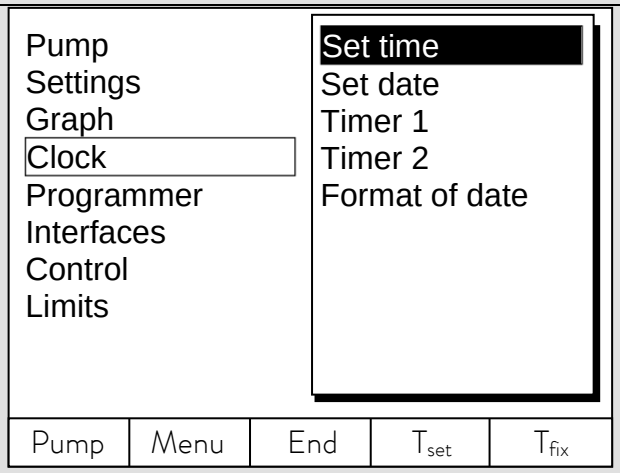
If your mains fuse is rated below 16 A, the current consumption can be reduced in steps from 16 A to 10 A using this function. Of course the maximum heating power of 3.5 kW is then also reduced accordingly. Take into account whether other loads are still connected to the fused circuit or whether your Proline Thermostat is the only load.

Master	Cur
3 x to MEnu to PArA	– Call current consumption Cur.
	– The present setting is displayed.
	– The current consumption is shown flashing: e.g. 16.0 A.
or	– Set the required maximum current consumption (in A).
wait 4 seconds or	– Display flashes 4 s → new value is automatically accepted, or
	– value is immediately accepted with the Enter key.

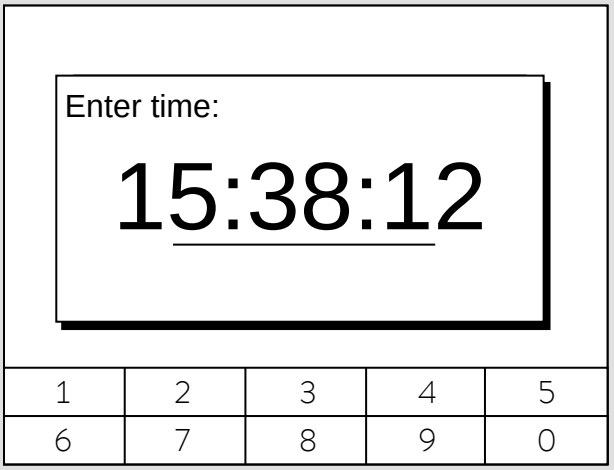
Command	Current consumption
	– Open the device parameter menu via the soft key Menu. – With the cursor keys change further to: → Settings → Basic settings → Current consumpt.. – 16,0 A is presently active.
	– Open the settings window with . – Change the current with cursor or soft keys and accept with or End, – or quit the window with ESC without making changes.

7.7.6 Setting the date and time

Command — Clock | Time | Date



- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: → Clock → Set time.
- or to Set date.

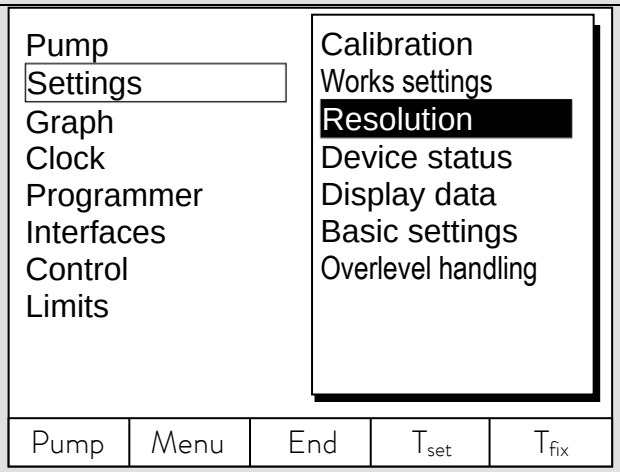


- Open the settings window with ◎.
- Change the time with cursor or soft keys and accept with ◎,
- or quit the window with ESC without making changes.
- The date is set just the same with Set date.
- The date format (Day Month Year or Month Day Year) can be set under Format of date.

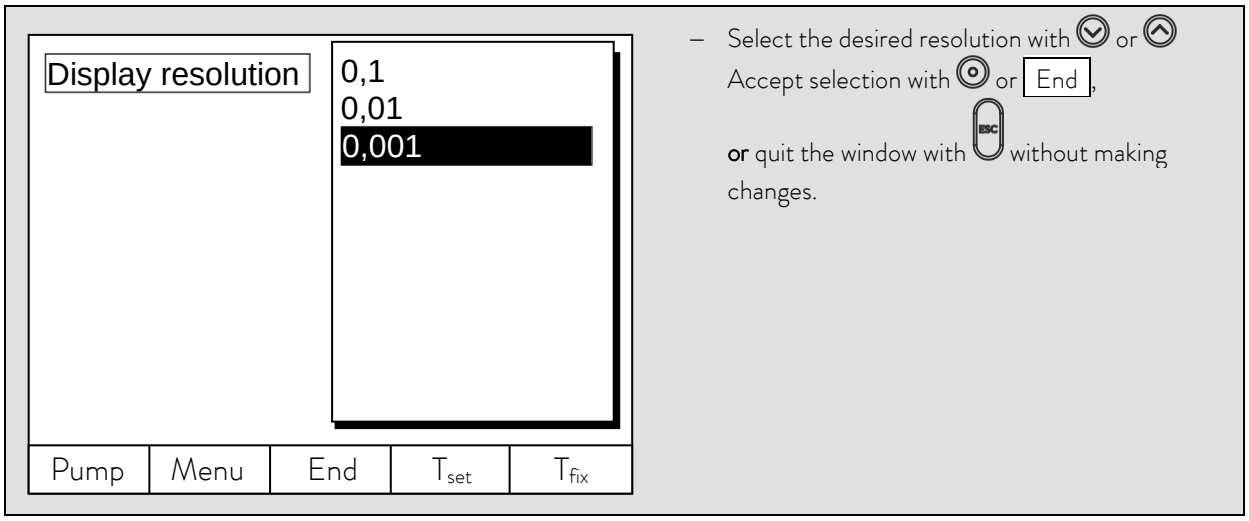
7.7.7 Display resolution setting

The Command version allows for different resolutions of the displayed temperature.

Command — Resolution



- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: → Settings → Display resolution.



7.8 Special settings

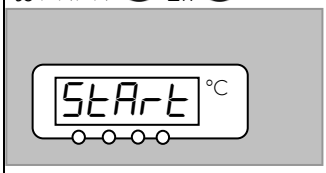
7.8.1 Setpoint resolution

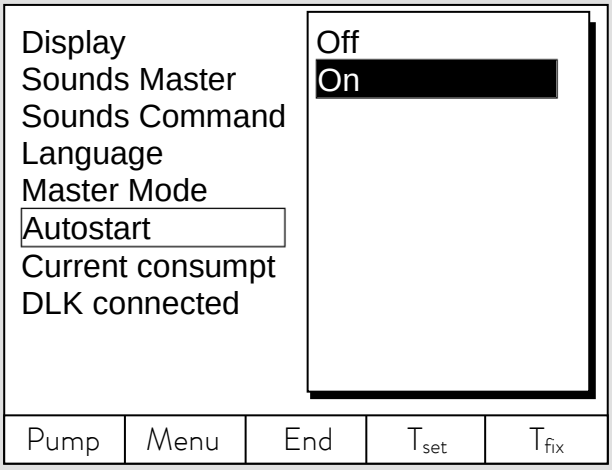
This function enables the resolution of the setpoint T_{set} to be increased from the standard value of 0.1 °C to 0.01 °C (only Master).

Master	S
3x to MEnu to PArA 1x	– Call setpoint resolution S .
S 0.1 °C	– The current setting is displayed (here 0.1 for the works setting of 0.1 °C).
	– The resolution display 0.1 flashes.
or	– 0.1 for 0.1 °C. – 0.01 for 0.01 °C.
Wait 4 seconds or	– Display flashes 4 s → new value is automatically accepted, or
	– value is immediately accepted with the Enter key.

7.8.2 Defining the type of start mode

Usually it is desirable that the thermostat carries on operating again after an interruption in the voltage supply. However, if for safety reasons you do not wish this, you can insert an intervening manual activation step.

Master	StArt
3x to MEnu to PArA 2x	– Call the start option StArt .
	– The start mode can be changed here.
or	– The display Auto or MAn flashes. – Auto, when operation is be restored automatically again after an interruption. – MAn, when the standby mode is to be activated after a mains interruption.
Wait 4 seconds or	– Display flashes 4 s → new value is automatically accepted, **or** – value is immediately accepted with the Enter key.
☞	– When the mains voltage is restored after an interruption, standby is activated in the MAn mode and StArt is displayed. You can quit the standby mode with .

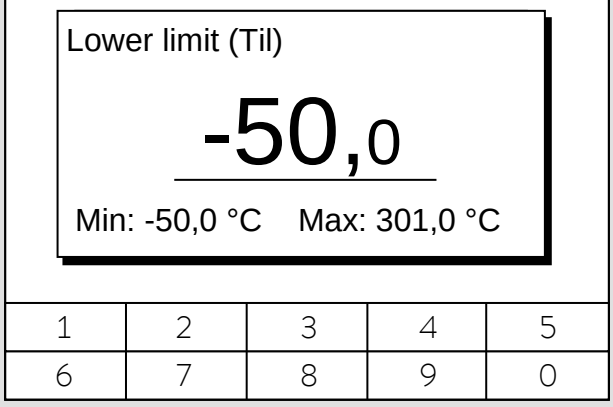
Command	Autostart
	– Open the device parameter menu via the soft key Menu . – With the cursor keys continue to: → Settings → Basic settings → Autostart . – On is currently active. – If the standby mode is to be activated after a mains interruption, select "Off" with or . – Accept the change with or End , – or quit the window with ESC without making changes.
☞	– When the mains voltage has been restored after an interruption, you can quit the standby mode with .

7.8.3 Defining temperature limits

With this function it is possible to define a minimum and a maximum temperature in which the thermostat controls. By reaching the temperature limits, a warning appears. In this way setpoint input can be prevented which may damage the heat transfer liquid or the apparatus. For example, if water is used as the heat transfer liquid, 95 °C would be practicable as the maximum temperature and 5 °C as the minimum temperature.

Master	t ih and t iL .
3x to MEnu to PArA 3x	– Call the start option t ih (maximum temperature), or with 4x t iL (minimum temperature).
t ih °C	– The maximum temperature can be changed here.
t iL °C	– The minimum temperature can be changed here.
or	– The maximum temperature (minimum temperature) is displayed flashing. – Set the required limit temperature.
Wait 4 seconds or	– Display flashes 4 seconds → new value is automatically accepted, **or** – value is immediately accepted with the Enter key.

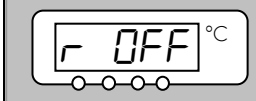
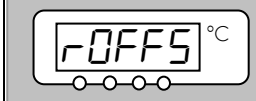
Command	Limits
Pump Settings Graph Clock Programmer Interfaces Control Limits Til (min) -50,0 °C Tih (max) 302,0 °C Pump | Menu | End | T_{set} | T_{fix}	– Open the device parameter menu via the soft key Menu. – With the cursor keys continue to: Limits. – The minimum and maximum temperatures are displayed. – T il (min) is currently active. – Select the limit to be changed with or and confirm with .



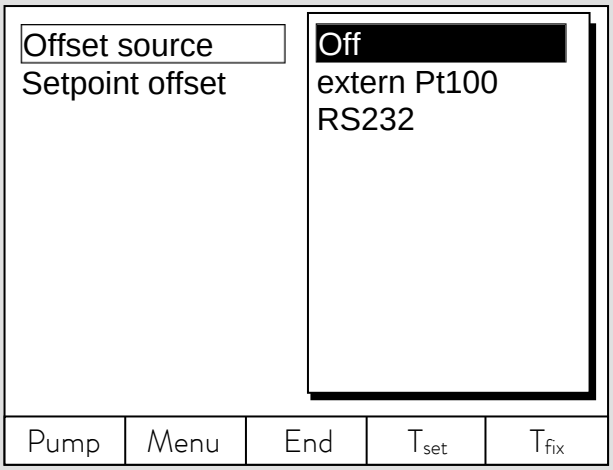
– Enter the desired limit temperature.
– Accept the change with ⊙,
– or quit the window with ESC without making changes.

7.8.4 Setpoint offset operating mode

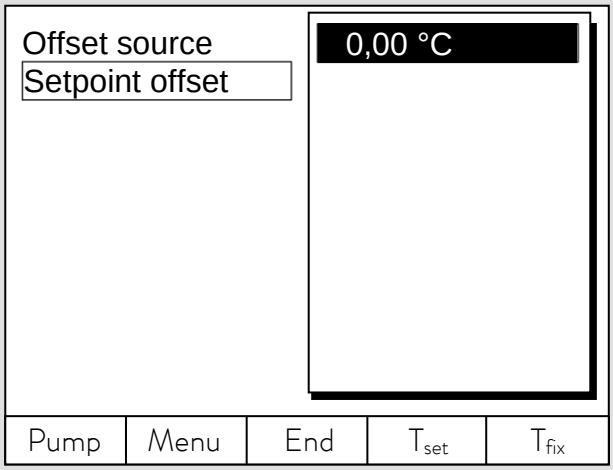
With this function it is possible to apply an offset value to the temperature provided by the external temperature probe or a module and then to use it as the setpoint. The bath temperature can, for example, be operated at -25 °C below the temperature of a reactor, which is being measured by the external temperature probe.

Master	SEtr. .
⊙ 3x ⌄ to mENu ⊙ to PArA ⊙ 5x ⌄	– SEtr. . in the following submenu the relative setpoint (Set) and the source of the actual value can be entered.
	– Continue with ⊙.
	– The offset operating mode is currently deactivated. – To activate it press ⊙ and with ⌄ change to EP (external Pt100), EA (external via analog module) or ES (external via serial module).
Wait 4 seconds or ⊙	– Display flashes 4 s → new value is automatically accepted, **or** – value is immediately accepted with the Enter key.
	– Continue with ⌄. The left-hand window is displayed. – To activate the relative offset input press ⊙ and change the value with ⌄ or ⌃.
Wait 4 seconds or ⊙	– Display flashes 4 s → new value is automatically accepted, **or** – value is immediately accepted with the Enter key.

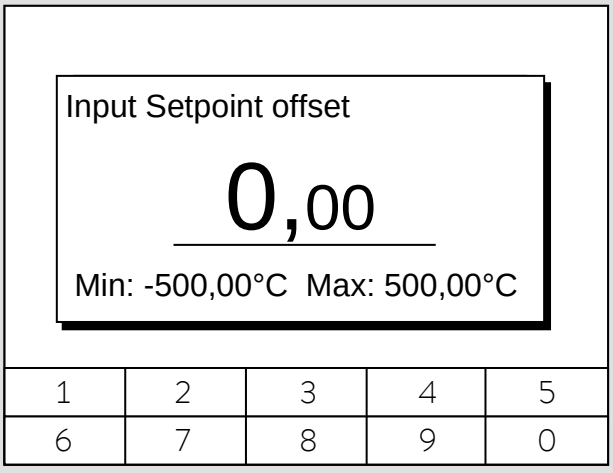
Command	Offset source and Setpoint offset



- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: → Control → Setpoint offset → Offset source.
- Off indicates that the setpoint offset is currently deactivated.
- Select the setpoint source with or and confirm with .
- Interfaces (e.g. RS 232) are only displayed if a valid setpoint has already been transmitted.

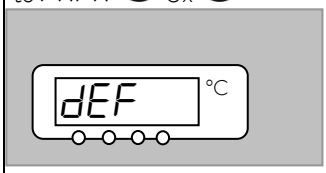


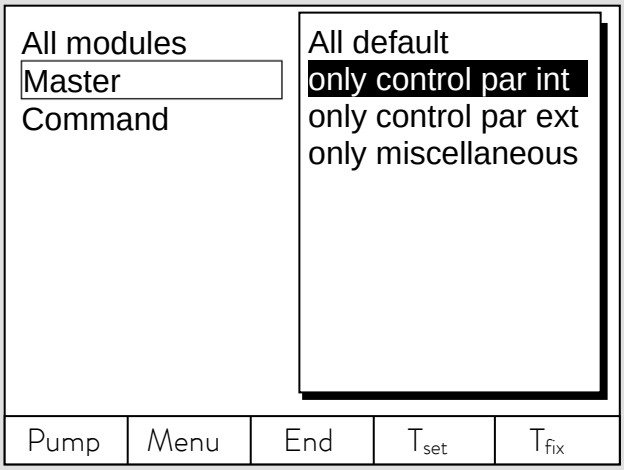
- With the cursor keys continue to: → Setpoint offset.
- The standard value is 0.00°C.

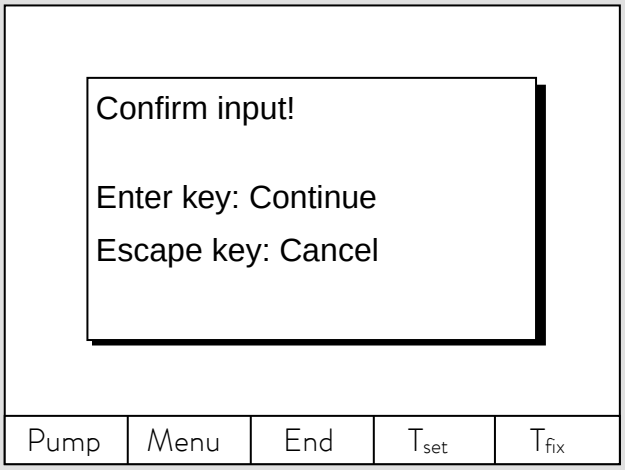


- Open the left-hand window with .
- Enter the desired temperature.
- Accept the change with ,
- or quit the window with ESC without making changes.

7.8.5 Restoring works settings

Master	dEF
	If you would like to restore all the works settings except the control parameters PId and the probe calibrations CAL,
3x to mEnu to PArA 3x	– call the works settings dEF.
	– dEF is displayed.
3 seconds long	– Press longer than 3 seconds. – The changeover is acknowledged with donE. – Proceed to the next menu until End appears.
or	– Press this key.

Command	Works setting
	– Open the device parameter menu via the soft key Menu. – With the cursor keys continue to: → Settings → Works settings. – The window shown opposite appears. – Master and then only control para int is shown as a possible choice. There are however various possibilities, which can be selected with or – Under All modules Master, Command and all connected modules are reset to the works setting with All default.



- Under Master you have the choice between:
  - All default, then all Master settings are reset,
  - only control para int for the internal control parameters,
  - only control para ext similar for external,
  - only miscellaneous which resets set-point, pump level, max. current consumption, control to internal and autostart to "Auto".
- Under Command all command settings are reset with All default.
- Confirm selection with ◎.
- Confirm the control dialog shown on the left with ◎ or cancel with ESC.
- Return to measurement window with End or ESC.

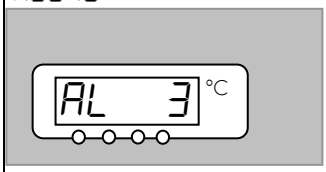
7.8.6 Setting the volume of the acoustic signals

The LAUDA Proline Thermostats signal alarms as a dual-tone acoustic signal and warnings as a continuous tone.

Master — Aud io

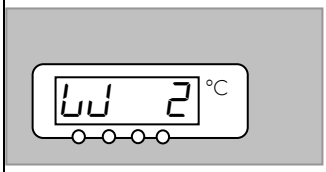
3x ⌄ to mEnu ◎ to PArA 7x ⌄ to Aud io

– Call the volume setting Aud io (⇨ 7.5).



– ◎ takes you to the alarm volume,

the currently set volume, here 3, is displayed or ...



– ... ◎ and 1x ⌄ takes you to the warning tone volume.

– The currently set volume, here 2, is displayed.

◎

⌃ or ⌄

– The volume display flashes.

– Select volume:

0 = off to 3 = loud.

– You hear the alarm or warning tones at the selected volume.

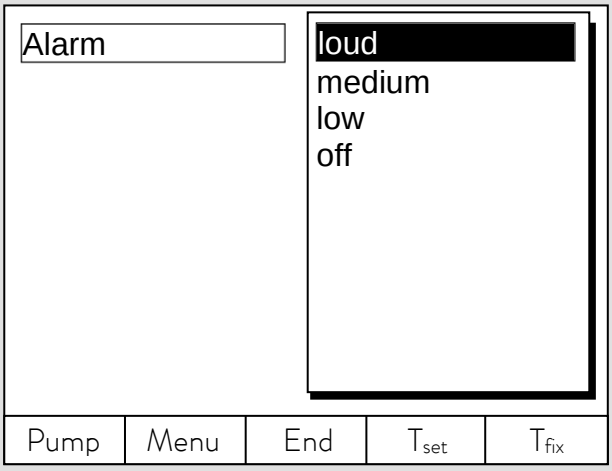
Wait 4 seconds or

◎

– Display flashes 4 s → new value is automatically accepted, or

– value is immediately accepted with the Enter key.

Command — Sounds



– Open the device parameter menu via the soft key ◎ Menu.

– With the cursor keys continue to:
→ Settings → Basic settings → Sounds.

– Select either Alarm or Warning.

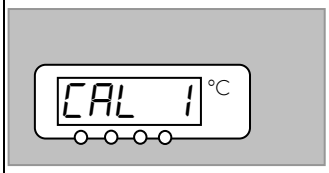
– Example on left: Alarm is set to loud.

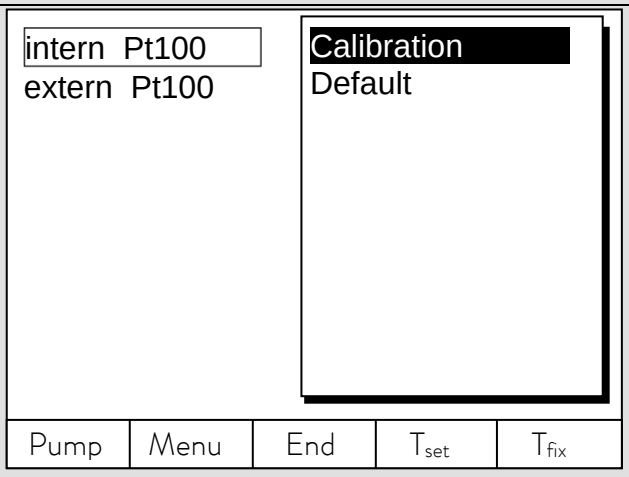
– Select the desired volume with ⌃ oder ⌄.

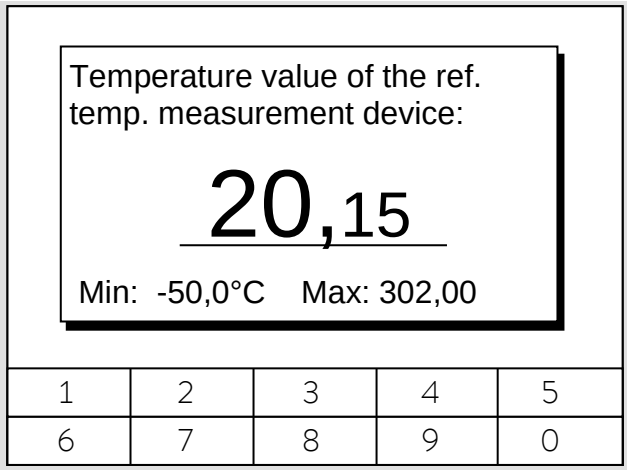
– Accept selection with ◎ or End or quit the window with ESC without making changes.

7.8.7 Entering the offset of the internal temperature probe

If, during checking with a calibrated reference thermometer probe, a deviation is found, then the offset (i.e. the additive part of the characteristic) of the internal measuring chain can be adjusted with the following function. The reference thermometer must be dipped into the bath according to the details on the calibration certificate.

Master	CAL 1
3x to MEnu 2x to CAL ..	– Call the offset adjustment of the internal temperature probe CAL ..
	– CAL 1 is displayed.
3 sec	– The actual value of the bath temperature is displayed flashing.
or	– Set the value which you have read from the calibrated reference measurement device (with glass thermometers consider the correction where applicable!).
	– The entered value is accepted and donE is displayed.

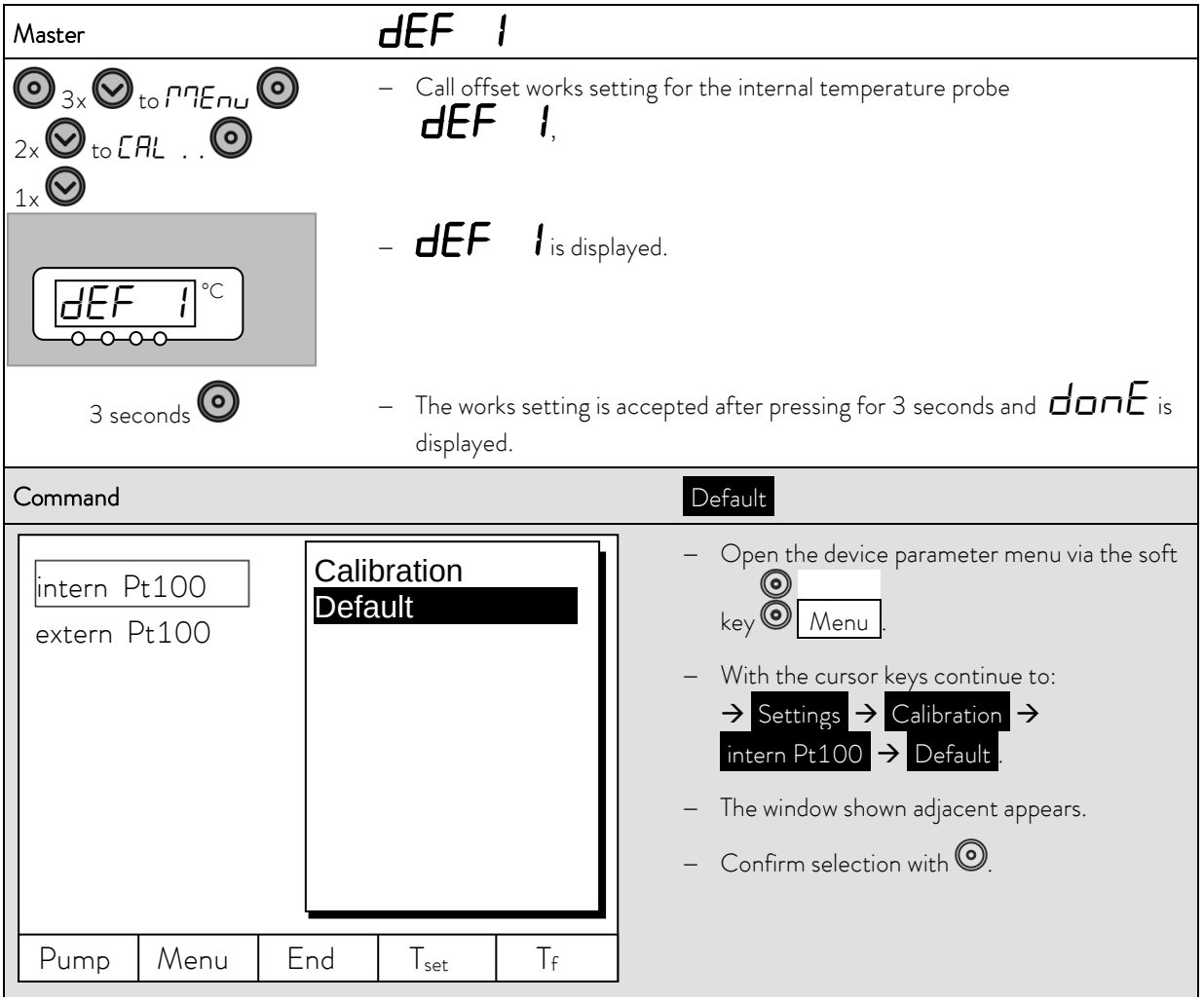
Command	Calibration
	– Open the device parameter menu via the soft key ESC Menu. – With the cursor keys continue to: → Settings → Calibration → intern Pt100 → Calibration. – The window shown on the left appears. – Confirm selection with ◎.

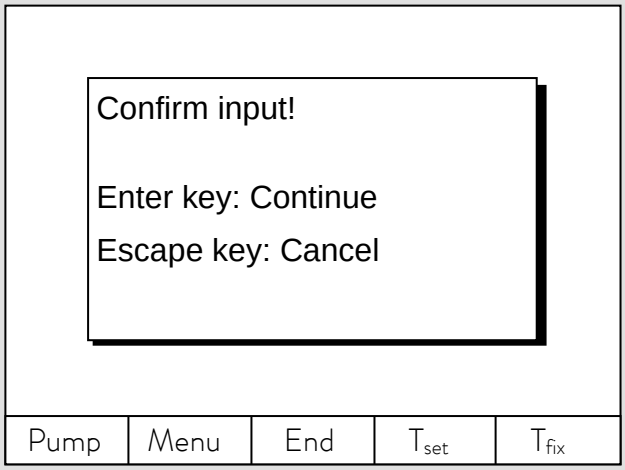


– The temperature measurement device shows the true temperature value (with glass thermometers consider the correction where applicable!).
– Change the display in the adjacent window to the true value with cursor or soft keys and accept with or End,
– or quit the window with without making changes.

7.8.8 Restoring the works setting of the internal temperature-probe offset

If the offset has been misadjusted unintentionally, the works setting can be restored with this function.





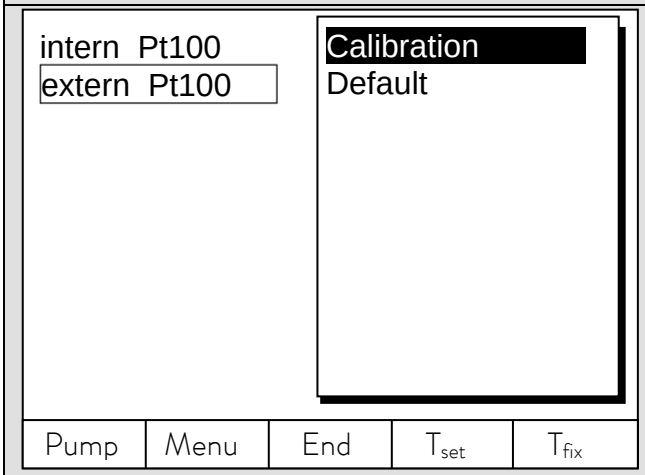
– Confirm the control dialog on the right with ◎ or cancel with ESC.

– Return to the measurement window with End or ESC.

7.8.9 Entering the offset of the external temperature probe

If a deviation is found during the check using a calibrated reference thermometer probe, then the offset (the additive part of the characteristic) of the external measurement chain can be adjusted with the following function. The reference thermometer must be dipped nearly by the external temperature probe into the consumer bath according to the details on the calibration certificate.

Master	CAL E
◎ 3x ▽ to MENU ◎ 2x ▽ to CAL . . ◎ 2x ▽	– Call the offset adjustment for the external temperatures probe CAL E . – Continue as described in (⇨ 7.8.7) for the internal temperature probe.
Command	**Calibration**



– Open the device parameter menu via the soft key ◎ ◎ Menu.

– With the cursor keys continue to: → Settings → Calibration → extern Pt100 → Calibration.

– The adjacent window appears.

– Confirm selection with ◎.

– Continue as described in (⇨ 7.8.7) for the internal temperature probe.

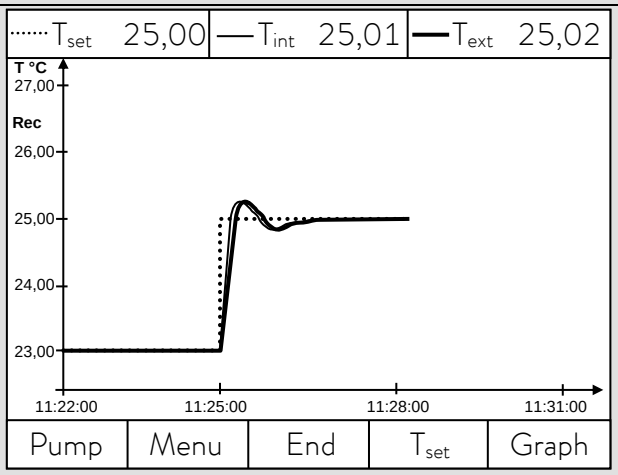
7.8.10 Restoring the works setting of the external temperature-probe offset

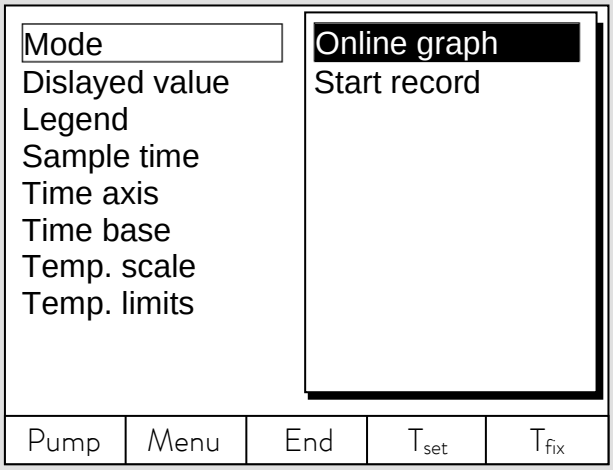
If the offset has been misadjusted unintentionally, the works setting can be restored with this function.

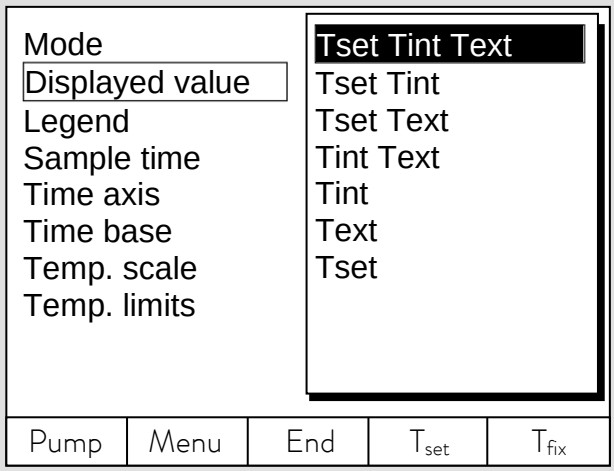
Master	dEF E
3x to MEnu 2x to CAL . . 3x	– Call the offset works setting for the external temperature probe dEF E. – Continue as described in (⇨ 7.8.8) for the internal temperature probe.
Command	**Default**
intern Pt100 extern Pt100 Calibration Default Pump | Menu | End | T_{set} | T_{fix}	– Open the device parameter menu via the soft key Menu. – With the cursor keys continue to: → Settings → Calibration → extern Pt100 → Default. – The adjacent window appears. – Confirm selection with . – Continue as described in (⇨ 7.8.8) for the internal temperature probe.

7.9 Graphical display of temperature measurements

Command	Screen and Graph







– Press the soft key Screen a number of times as required until the graph recorder window appears.

– With the soft key Graph you enter the menu for the configuration of the graph recorder.

Mode defines,

– whether the recording is to run continuously as **Online graph**,

– or whether it is to be started with **Start record** and later terminated with **Stop record**. When this start/ stop mode is active, **Rec** flashes at the top left of the display.

Displayed value defines,

– which of the measurements **T_{int}**, **T_{set}** and/ or **T_{ext}** is to be graphically displayed. In the menu all combinations are offered.

Legend defines,

– whether the axis label is to be **invisible** or **visible**.

Sample time defines with which time interval the measurements are recorded. 5 possibilities are offered:

– From **2s (max. 1h:45min)** up to **2min (max. 105h)**.

Time axis defines over which time range the measurements are to be displayed.

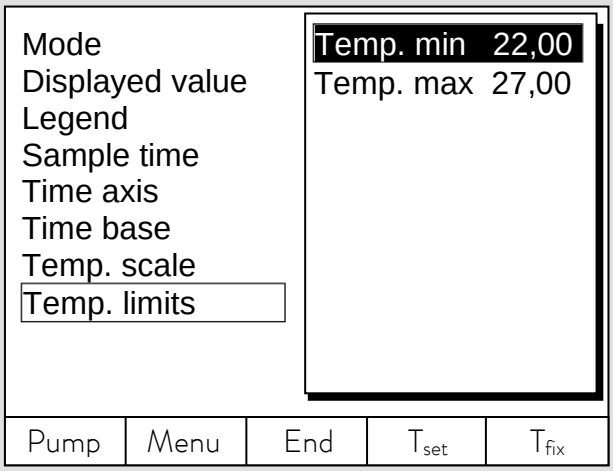
– With **Automatic** the program finds the optimum display,

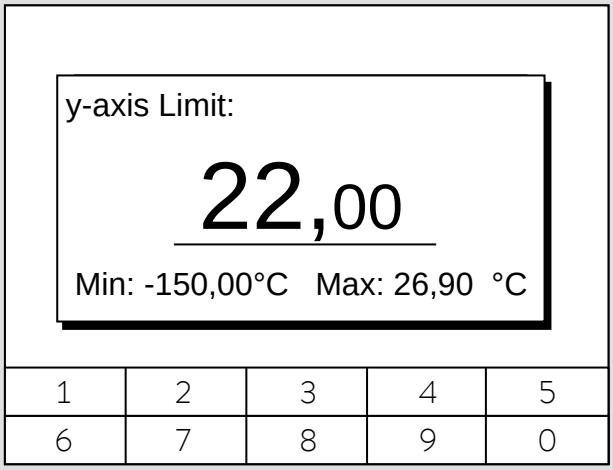
– from **9min** up to **144h**.

Time base defines whether scaling is to be carried out.

– With **Relative** the start occurs at 00:00:00.

– With **Absolute** the current time is displayed.





Temp. scale defines how the scaling is to be carried out:

– Automatic, by the program, or
– Manual in that you yourself define the limits with the next menu point.

The min. and max. values for the graphical display are manually entered with Temp. limits.

– Temp. min 22.00°C is the momentary minimum value.
– Temp. max 27.00°C is the momentary maximum value.
– The highlighted value can in each case be changed with ◎. Enter the desired new value in the changes window in the usual way.
– When setting the minimum value, the largest permissible value (here 26.90 °C, since the maximum value is 27 °C) is stated.
– When setting the maximum value, it is conversely the minimum value which is entered.
– However, if a value is entered which exceeds the other corresponding limit, then this warning is issued:
  Warning: Value not in input range.

7.10 Programmer (PGM)

Almost any temperature/time profile can be created with the programmer. A desired bath temperature can be approached as quickly as possible or via a defined ramp. Furthermore, the pump level and the behavior of the switching outputs can be defined. Five temperature/time programs are provided for free programming. Each program consists of a number of temperature/time segments. Also included are details of how often the program is to be executed (loops). The sum of all segments of all programs may be up to a maximum of 150.

Typical segments are:

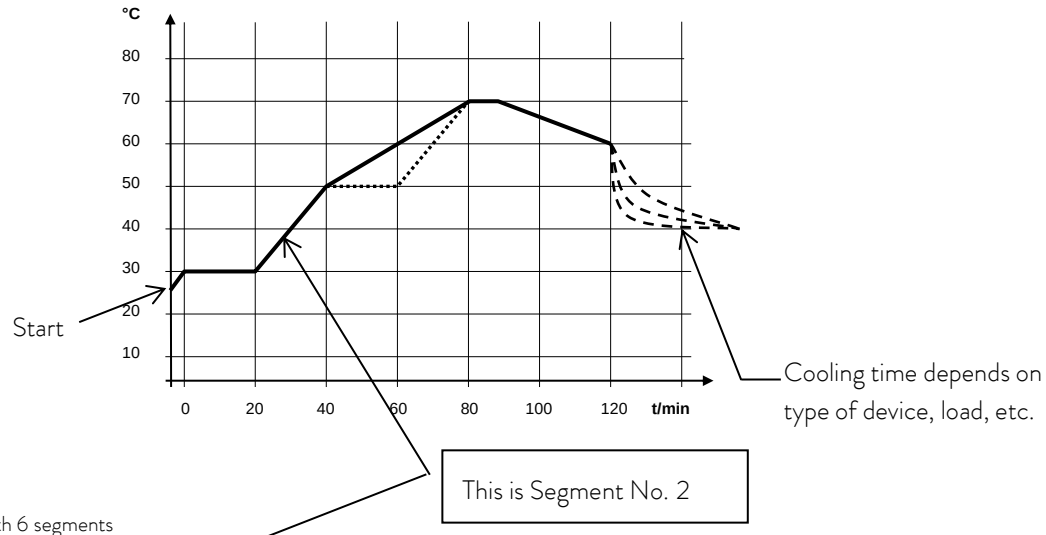
Ramp: If a time is specified, then the segment is a ramp which is described by the target temperature, i.e. the temperature at the end of the segment, and the duration from the start to the end of the segment.

Step: Without any specified time the final temperature is approached as quickly as possible.

Temperature hold phase: No temperature change (i.e. the temperatures at the start and end of a segment are the same).

The programmer can be controlled or changed via the RS 232 interface, the timer or switching contacts.

7.10.1 Program example



Real program example with 6 segments

No.	T end °C	Time	Tolerance
Start	30,00°C	-------	0,00°C
1	30,00°C	00:20	0,10°C
2	50,00°C	00:20	0,00°C
3	70,00°C	00:40	0,00°C
4	70,00°C	00:10	0,10°C
5	60,00°C	00:30	0,00°C
6	30,00°C	00:00	0,00°C

Pump	Menu	End	Insert	Delete

Nr.	Pump	Out 1	Out 2	Out 3
Start	-------	-------	-------	-------
1	2	-------	-------	-------
2	3	-------	-------	-------
3	4	-------	-------	-------
4	2	-------	-------	-------
5	2	-------	-------	-------
6	2	-------	-------	-------

Pump	Menu	End	Insert	Delete

Each program begins with the segment "Start". It defines at which temperature Segment 1 is to continue the program. It is not possible to specify a time for the Start segment. Without the Start segment, Segment 1 would be different depending on the bath temperature at the start of the program.

For heating thermostats the start temperature must be set above the actual bath temperature during program start together with a sufficient tolerance to allow reaching the set temperature without cooling (especially if no additional cooling is available). Testing and watching the process with "Graphical Display" (⇨ 7.9).

Edited program example (see dashed curve in the graph on previous page)

No.	T end °C	Time	Tolerance
Start	30,00°C	-------	0,00°C
1	30,00°C	00:20	0,10°C
2	50,00°C	00:20	**0,00**°C ③
3①	**50,00**°C①	**00:20**②	0,10°C ③
4	70,00°C	**00:20**②	0,00°C
5	70,00°C	00:10	**0,80**°C ③
6	60,00°C	00:30	0,00°C
7	60,00°C	00:00	0,00°C
Pump	Menu	End	Insert	Delete

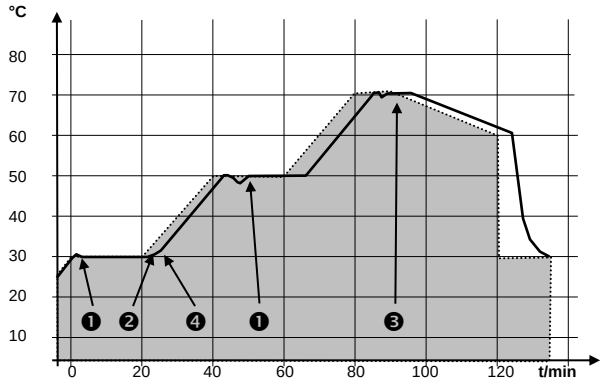
No.	Pump	Out 1	Out 2	Out 3
Start	-------	-------	-------	-------
1	2	-------	-------	-------
2	2	-------	-------	-------
3	2	-------	-------	-------
4	2	-------	-------	-------
5	2	-------	-------	-------
6	2	-------	-------	-------
7	2	-------	-------	-------
Pump	Menu	End	Insert	Delete

① Insert new segment (⇨ Section 7.10.4)

② ③ Change segment time or tolerance (⇨ Section 7.10.4)

The field tolerance (refer to the above program table and the graph below):

- It facilitates exact conformance to the dwell time at a specified temperature. Segment 1 is not processed until the bath temperature is within the tolerance range ❶, so that the ramp (Segment 2) starts delayed at ❷.
- A tolerance range which is too tight can however also cause undesired delays. **In particular with external control** the range should not be chosen too tightly. In Segment 5 a larger tolerance has been entered, so that the desired time of ten minutes is maintained even with settling action ❸.
- Only flat (slow) ramps should be programmed where necessary with a tolerance range. Steep ramps which lie close to the maximum possible heating or cooling rates of the thermostat may be severely delayed by a tolerance range that is too tight (here in Segment 2) ❹.



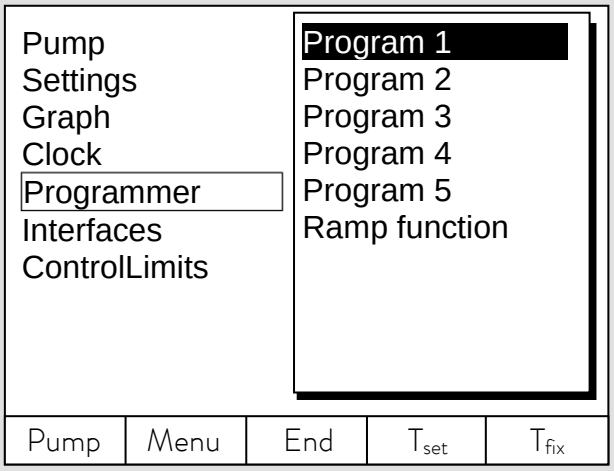
Example for the influence of the Tolerance field input in case of external bath temperature control:

The setpoint temperature of the programmer is shown in grey.
The actual temperature in the external bath container is represented as a continuous line.

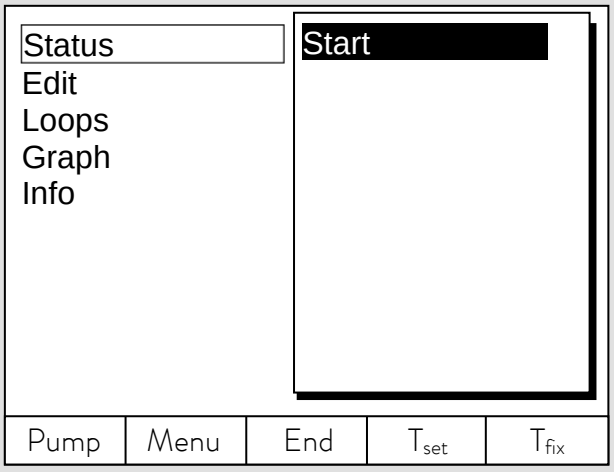
7.10.2 Selecting and starting the program (Start, Hold, Stop)

Here you will learn how to select and start a program that has already been created. If no program has been created see creating or modifying a program (Edit) (⇨ Section 7.10.4).

Command	Programmer Program 1



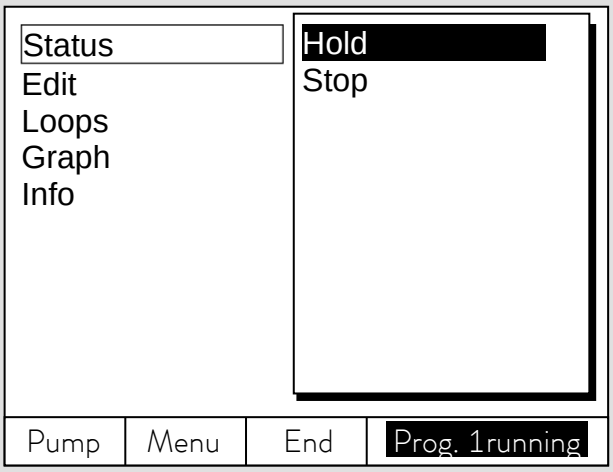
– Open the device parameter menu via the soft key Menu.
– With the cursor keys continue to: ▯ Programmer ▯ Program 1.
– Confirm with the key.



– The submenu Status appears.
– Using the Status menu, the selected program can be:
  1. started Start,
  2. paused Hold,
  3. continued Continue or
  4. terminated Stop.

In addition, the standby key stops the programmer! (Pause operation).
After the standby is deactivated, the programmer goes on!

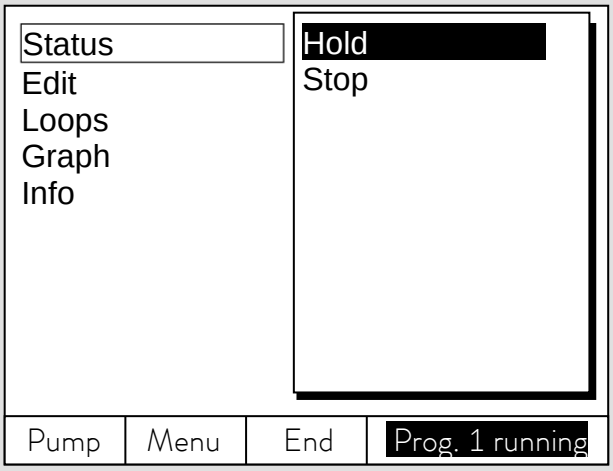
Commands, which depending on the situation cannot be executed, are not displayed.
Continue therefore only appears, when Hold has been activated.



– Once the start has been confirmed with , Prog. 1 running appears at the bottom.

7.10.3 Interrupting, continuing or terminating the program (Hold, Continue, Stop)

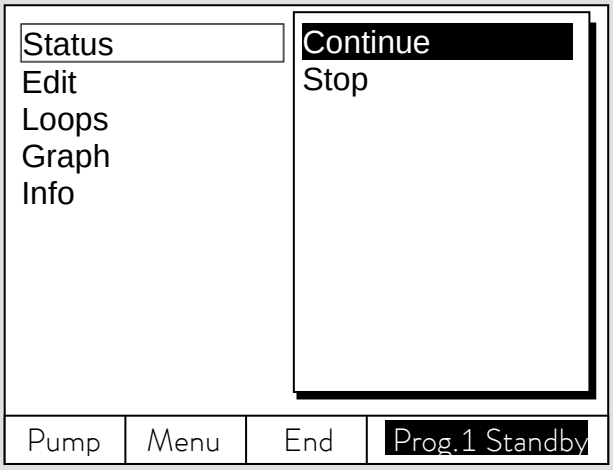
Command — Programmer | Program 1 | Status



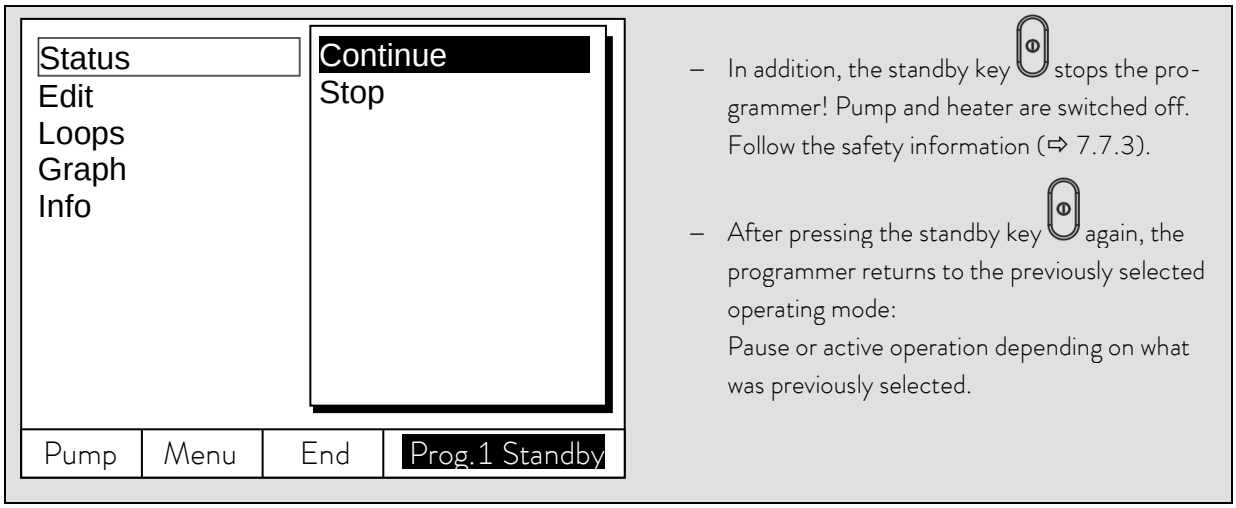
– After a program has been started by pressing the key, the command options Hold or Stop are shown.

– Here, with the aid of the keys or and the running program can be paused with Hold or terminated with Stop.

– Once the program has been terminated, the device runs with the last setpoint setting.



– Continuation of a program paused with Hold occurs using Continue which is obtained with .



– In addition, the standby key stops the programmer! Pump and heater are switched off. Follow the safety information (⇨ 7.7.3).

– After pressing the standby key again, the programmer returns to the previously selected operating mode:
Pause or active operation depending on what was previously selected.

7.10.4 Creating or modifying a program (Edit)

Here, there are the following functions:

- Entry of a program.
- Display of the program data of a saved program and modification of the segment data.
- Insertion or appending of a new segment.
- Deletion of a segment.

– In addition, when a program has just been executed, new segments can be inserted and existing ones modified, even the currently active segment. Furthermore, all segments, except the currently active one, can be deleted at any time.

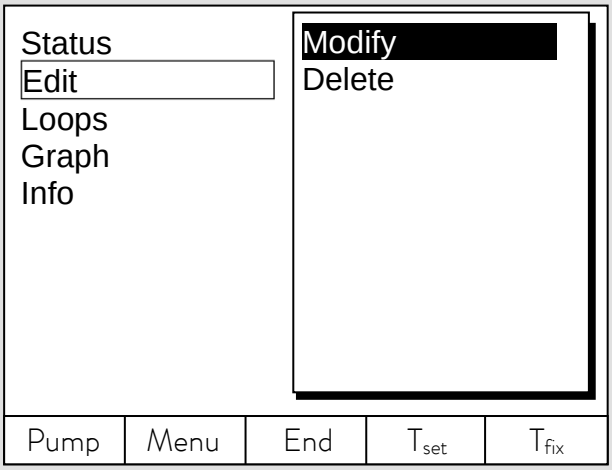
– Modifications to the currently running segment are possible. The segment then continues as though the modification had been applicable since the start of the segment.

However: If the new segment time is shorter than the segment time that has already run, then the program skips to the next segment.

– If a segment time >999h:59min is required, then this time period must be shared over a number of consecutive segments.

Entering a program: Program example (⇨ 7.10.1).

Command | Programmer | Program1 | Edit | Modify



- In the Edit menu one can Modify or Delete a program.
- Press the ⊙ key.
- Continue to Modify with the key ◎.
- There is the possibility of modifying single segments, i.e. segments can be entered as new, changed and also deleted.

No.	T end °C	Time [h:m]	Tolerance
Start	30,00°C	-------	3,00°C
1	30,00°C	00:30	3,00°C

Pump | Menu | End | Insert | Delete

- In the "Start" line enter in the field "T end °C" the temperature at which the sequence is to start (default value is 30 °C). A time entry is not possible in the "Start" segment, because the thermostat immediately executes Segment 1 on reaching the start temperature.
- Delete single segments (rows) with Delete.
- For thermostats without cooling ability, the setpoint temperature must be obtainable, i.e. above the bath temperature displayed at the time of the program start!

- Using the cursor keys move the black background to the field which you would like to change. It can be edited by pressing the key ◎ (see following pages).
- The soft key ◎ Insert inserts in the marked line a new segment which has a default value taken from the previous segment with the exception of the tolerance field. The tolerance is always specified as 0.00. All following segment lines will be moved one line downwards.
- In the above window Segment 1 was created in this way.
- Continue with ⊙ to the fields ☐ "Time" ☐ "Tolerance". See program example in (⇨ 7.10.1).
- If there is no entry in the "Time" field, the bath temperature is approached as quickly as possible. With a time entry the final temperature is obtained exactly after the time expires (ramp).
- The entry in the field "Tolerance" field defines how accurately the final temperature is to be obtained before the next segment is processed. In case there is no additional cooling, you should select a more generous tolerance limit. Check and observe the transient effect using the “graphic display” (⇨ Section 7.9).

If the tolerance range has been selected too small, it may be that the program does not continue, because the required tolerance is never achieved.
External temperature control: Especially with ramps, a too close tolerance range can cause undesired delays in the start phase of the ramp.

No.	Pump	Out 1	Out 2	Out 3
Start	-------	-------	-------	-------
1	4	-------	-------	-------

Pump	Menu	End	Insert	Delete

End of segment temperature:

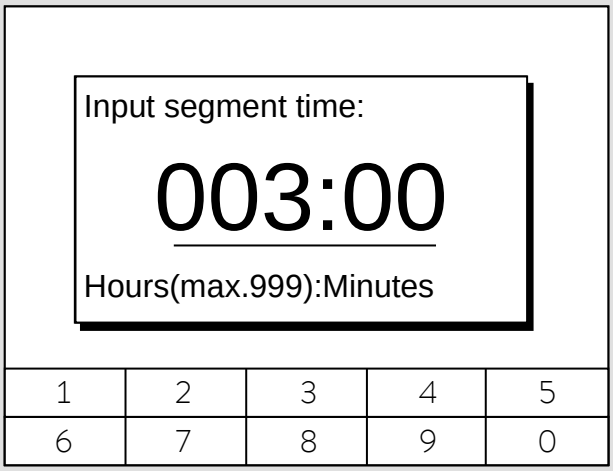
25,00

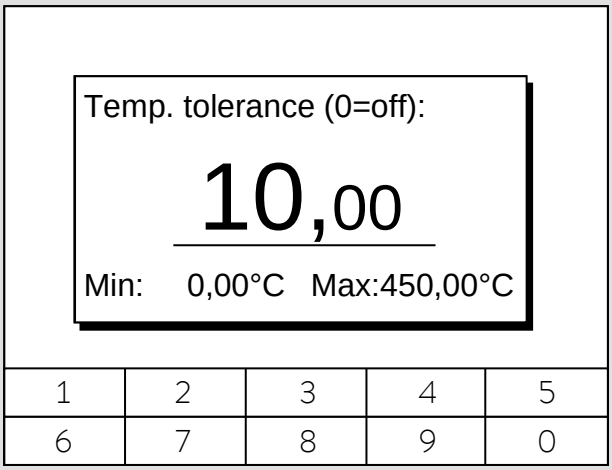
Min: -150,00°C Max:450,00°C

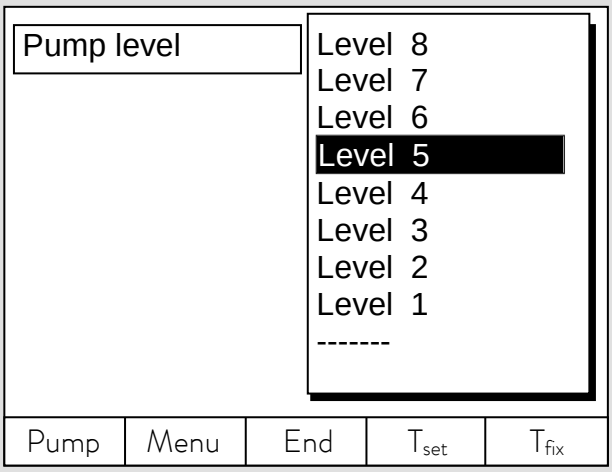
1	2	3	4	5
6	7	8	9	0

- Then continue with ⊙ to the pump and signal output setting.
- The right-hand part of the entry table appears as shown on the left.
- Here, in the "Pump" field, the pump level and, in the fields "Out 1" to "Out 3", the contact outputs of the contact mode (accessory) can be programmed. With the setting "-------" the starting value is retained which was either set before the program start or was defined by a previous segment in the running program. Further details are given on the following pages.

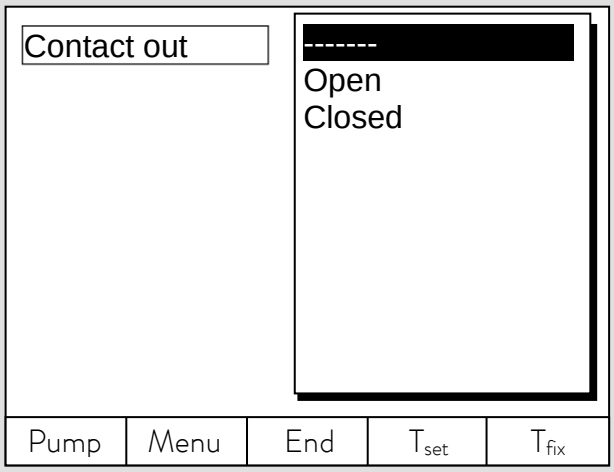
- A new segment is produced by moving the cell with the black background to a blank line with the cursor keys and then pressing the soft key ⊙ Insert. The values of the cell located above it are automatically copied.
- If the field in the column T end °C has a black background, the entry mode "End of segment temperature" is obtained by pressing the ⊙ key. Depending on the setting, that is the temperature, which the thermostat is to achieve on the internal or external temperature probe.
- Enter the value, confirm with the ⊙ key and continue to the "Time" entry field with ⊙.







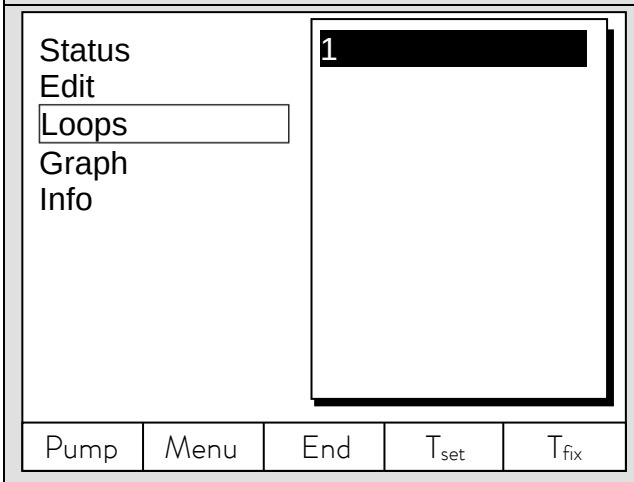
- If the field in the column Time has a black background, the entry mode for the "Segment time" time setting is obtained by pressing the key.
- If 0 is entered into the field "Time", ------ appears. Then the final temperature is approached as quickly as possible. With a time entry the final temperature is obtained exactly after the time expires (ramp).
- Enter the segment time and confirm with the key.
- Continue to the "Tolerance" entry field with .
- If the field in the column "Tolerance" has a black background, the entry mode for the "Temperature tolerance" is obtained by pressing the key. It defines how accurately the end of segment temperature is to be obtained before the next segment is processed.
  A tolerance which is selected too small can stop the next segment from being started according to plan.
- Set the temperature tolerance and confirm with .
- Continue with to the entry field "Pump".
- If the field in the column "Pump" has a black background, the entry mode for the Pump level is obtained by pressing the key .
- With or select Pump Level 1 – 8 or ------ and confirm with .
  ------ stands for "no change to previous segment", i.e. when ------ is present in all fields, the pump level always retains the start setting or the setting before the program start.
- Continue with to the field "Out 1", "Out 2" or "Out 3".



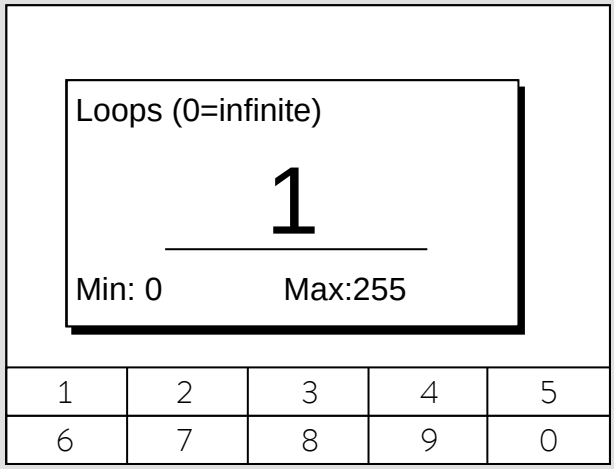
- The contact outputs of the contact module (if present, special accessory) are programmed here.
- If the field in the column "Out 1" has a black background, the entry mode for the Contact output is obtained by pressing the ◎ key.
- With ⊙ or ⊙ select ------ -, Open or Closed and confirm with ◎. ------- stands for no change with respect to the previous segment, i.e. if ------- is present in all fields, the contact setting of the start setting or that from the program start is retained.
- If applicable, continue with ⊙ to "Out 2" and "Out 3".
- Programming is terminated with ESC or End.

7.10.5 Defining the number of program loops (Loops)

Command: Programmer | Program 1 | Loops



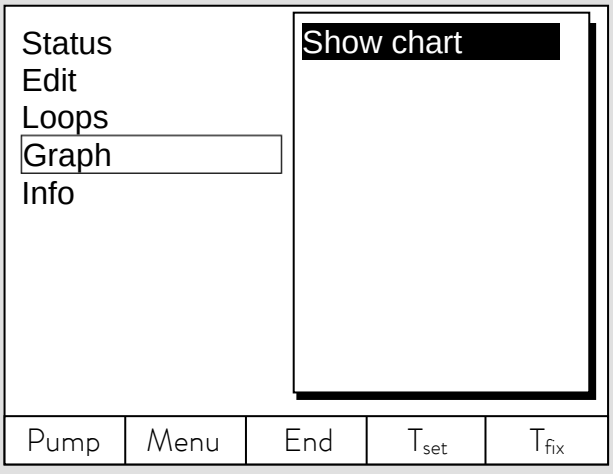
- If required, programs can be looped many times.
- With ⌄ and › access the menu **Loops**.
- Select the number of desired program loops.



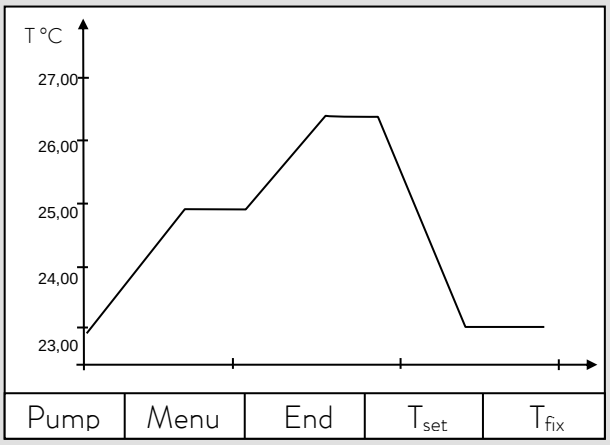
- Press the ◎ key, set the required number. Entering 0 causes the program to repeat continuously.
- Confirm the entry with the ◎ key and return to the display.
- You can quit the Edit mode with ESC or End.

7.10.6 Viewing the program sequence as a graph (Graph)

Command: Programmer | Programm 1 | Graph



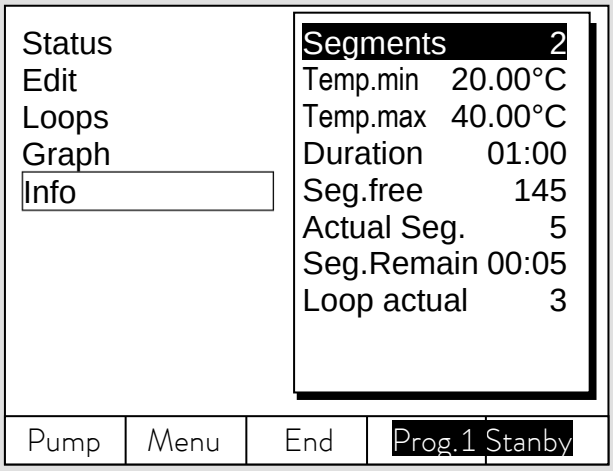
- ⌄ takes you to the submenu **Graph**.
- Press the › key □ **Show chart** and ◎.
- The program sequence is shown.



– The display of the programmed temperature curve can be quit with ESC or End.

7.10.7 Obtaining information on a program (Info)

Command: Programmer | Program1 | Info



– Continue with ⊙ to Info.

Here, all information is displayed about the entered program sequence.

– Number of segments.
– Minimum temperature in °C.
– Maximum temperature in °C.
– Program duration in hh:mm (without the time, which is necessary to process step changes in temperature).
– Number of free segments.
– Segment, which is at present (currently) being processed.
– Residual time of the current segment, in hours and minutes.
– Current pass; in the example the third of all passes is running.

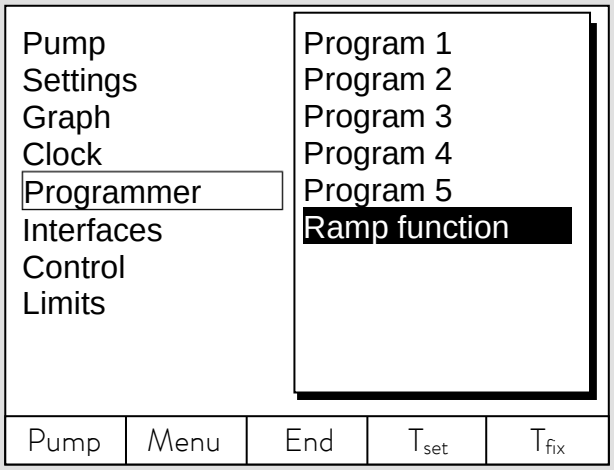
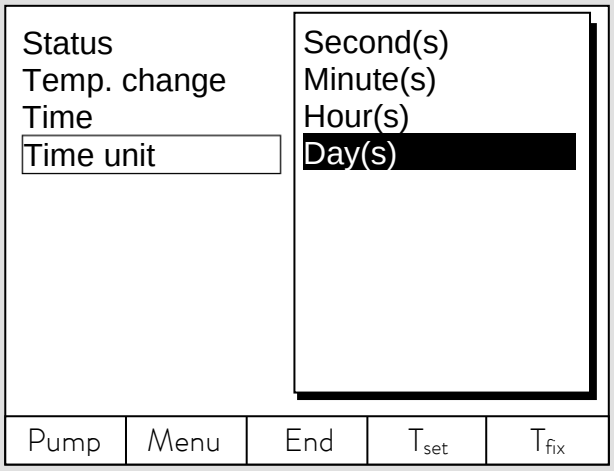
The last three points are only displayed when a program runs.

– Quit the window with ESC or End.

7.11 Ramp function

With the ramp function temperature changes over any time period can be conveniently entered. This is especially advantageous with very low temperature changes (e.g. 0.1 °C per day).
Example: From the current outflow temperature (e.g. 242.4 °C), 200 °C of cooling is to occur over 5 days. Then the temperature change is entered as 200 °C and the time as 5 days.

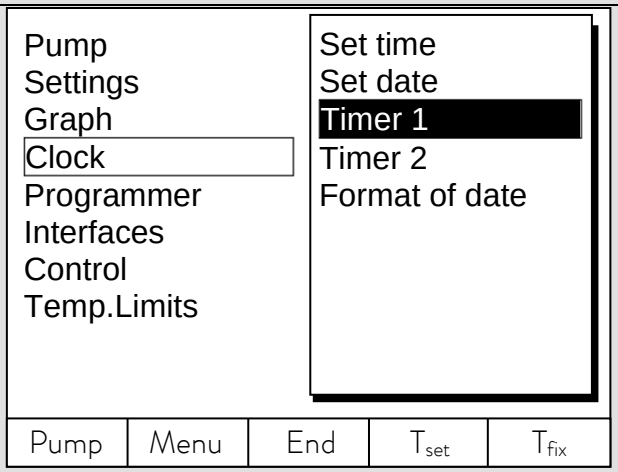
> The ramp function is executed until it is manually terminated or until the temperature limits T_{il} (min) or T_{ih} (max) described in Section 7.8.3 are attained.

Command	Ramp function
	– Open the device parameter menu via the soft key Menu. – With the cursor keys continue to: Õ Programmer Õ Ramp function. – Confirm with the key.
	– Enter a positive or negative temperature value with Temp. change. – With Time enter a figure (without time unit). – With Time unit choose between Second(s) up to Day(s). – Under Status the ramp is started → Start or stopped → Stop. – When the ramp function is being executed, Ramp active appears in the window bar. – Without manual switch-off the ramp terminates at the latest at T_{il} (min) or T_{ih} (max).

7.12 Timer function

Using the timer function, the thermostat can carry out an action at a certain time or after a certain waiting period. The actions are: Switching on the thermostat, entering the standby mode or one of the five programs in the programmer.

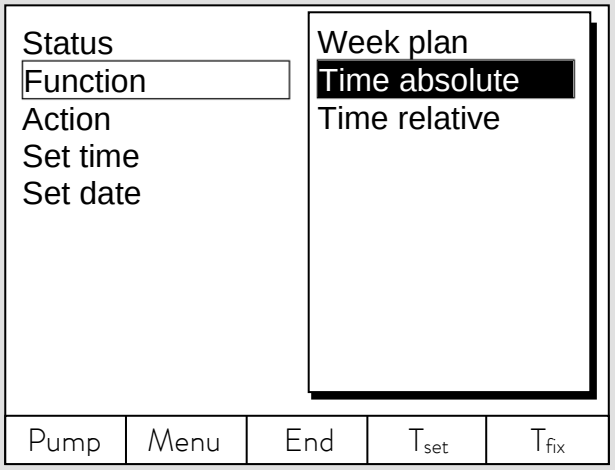
Command | Timer 1 | Timer 2



- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: → Clock → Timer 1,
- or to Timer 2,
- with the menu Status the selected timer is switched off or on.

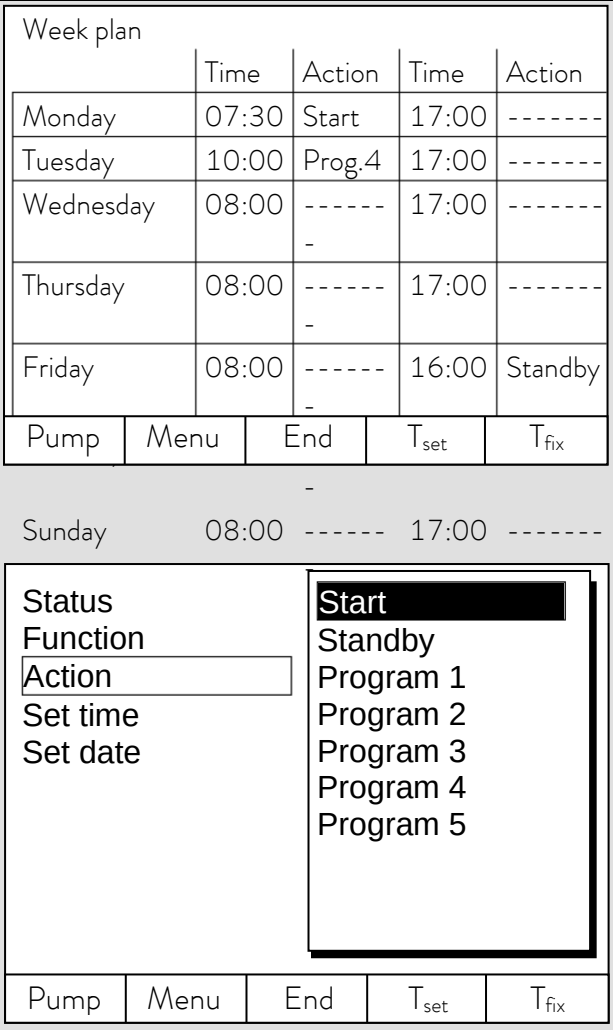
The standby key does not stop the timer!

Please exercise caution when thermostat is in standby mode! The thermostat is not switched off safely.
A previously activated timer mode could unintentionally start the thermostat again from the standby mode!



The menu Function is used to define **when** an action is executed:

- Similar to an electronic mains timer, Week plan enables two switching events to be carried out each day. The cycle is repeated after 7 days.
- Time absolute defines a time and a date on which a once-only action (switching event) occurs. The time point is set with Set time and with Set date.
- Time relative defines a waiting period after which a once-only action occurs. With Set time up to 99h:59min can be entered. (Set date is masked out with this function selection).
- If the Week plan is activated, in this window only Status, Function and Week plan are displayed.



– Week plan → Arrange takes you to the window shown on the left.

– Using the cursor keys, select the field, which is to be filled in.

– Open the input dialog of the field with : Select a time in the time fields and an action in the action field.

– In the example on the right, the thermostat is started on Monday at 7:30h, Program 4 is executed at 10:00h on Tuesday and the standby mode is switched in on Friday at 16:00h. Fields displaying ------ are passive.

Confirm each field selection with or quit with ESC without making changes.

The menu Action is used to define **what** is to be carried out:

– Start activates the thermostat from the standby mode.

– Standby activates the standby mode (refrigerating unit, heater and pump are switched off).

– Program X all actions of this program defined in the programmer are processed.

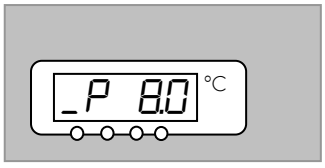
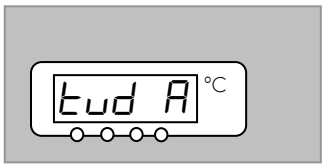
7.13 Control parameters

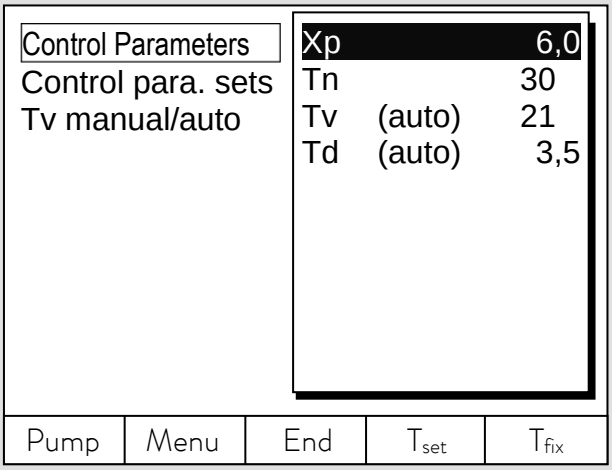
The control parameters are optimized ex-works for operation as a bath thermostat (with water as the heat transfer liquid) with internal control. The parameters are also preset for the operation of external containers with external control. Sometimes however, the operation of external containers requires adaptation. In addition, the thermal capacity and viscosity of the heat transfer liquid sometimes require adaptation.

- The intelligent menu guidance with the Master and Command detects whether you have set the device (as described in Section 7.7.4), to internal or external control and only displays the relevant dialog boxes in each case.
- Your Proline Thermostat automatically optimizes some control parameters. This automatic mechanism should only be deactivated and manually optimized in exceptional cases.

7.13.1 Internal control variable (integral measurement probe)

Only read further here, if you have no external temperature probe connected (and activated according to Section 7.7.4 as control variable).

Master	PId ..
3x to MEnu 1x to PId ..	– As shown in the menu structure (⇨ 7.6), the parameters for the internal control variable can be set. – Select the parameter with or and confirm with . The set value is displayed. Adapt it with or and confirm with . – Example: Proportional range is 8.0 K.
	– Proportional range _P = Xp in Kelvin. – Reset time tn = Tn in seconds. – Derivative time (Auto/Man) tv = Tv in seconds. The thermostat logic system only permits values with Tn > Tv!
	– Damping time (Auto/Man) td = Td in seconds. – Tv, Td changeover to auto/ man tvd A =Auto or MA = Manual. The works setting is Automatic. Only experienced control technicians should change these two parameters!

Command	Control Parameters
	– Open the device parameter menu via the soft key Menu. – With the cursor keys continue to: → Control → Control Parameters → Control Parameters. – The adjacent window appears. – Change parameters marked with (auto) where necessary to manual input with Tv manual/auto. – Select the parameters to be changed with and confirm with . – Then in the following settings window, change the value and confirm with .

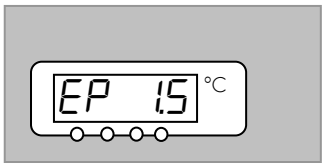
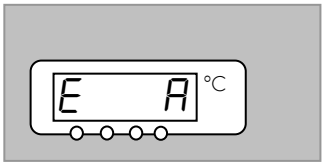
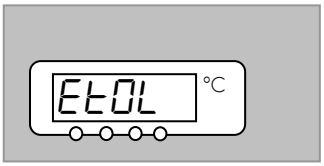
Proven settings for control parameters and pump (Internal control)

Device type	Heat transfer liquid	Xp _P	Tn tn	Tv tu	Td td	Pump level
P 8	Water	4.0	50	35	6	4
P 8	Water	4.0	30	---	---	4
P 8	Water-Glycol	4.0	30	---	---	4

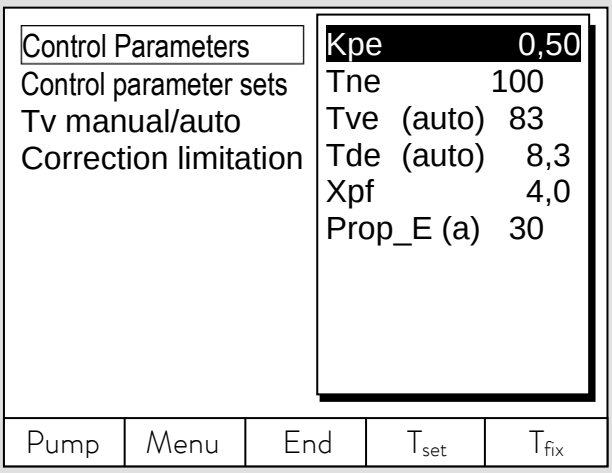
7.13.2 External control variable (External measurement probe)

You only need to read further here if you have connected an external temperature probe or the actual temperature is read in from a module (and you have activated it as control variable according to (⇨ Section 7.7.4)).

Only modify the control parameters if you have knowledge of control techniques.
The control system for external actual values is implemented for improvement of the control behavior as a two-stage cascade controller. A "master controller" determines the "internal setpoint", from the temperature setpoint and the external temperature, passed to the slave controller. The control value of the slave controller controls the heating.
When a setpoint step change is specified, it may be that the optimum control would set a bath temperature, which might significantly exceed the temperature desired on the external vessel. There is a correction limitation, which specifies the maximum permissible deviation between the temperature on the external load and the bath temperature.

Master	PId..
3x to MEnu 1x to PId..	– As shown in the menu structure (⇨ 7.6), the parameters for the external control variable can now be set. – Select the parameter with or and confirm with . The set value is displayed. Adapt it with or confirm with . – Example: Proportional factor of the master controller Kpe = 1.5.
	Parameters **Ma**ster controller (PIDT$_1$-controller): – Ma proportional factor: EP = Kpe as factor. – Ma proportional range: Eb = Prop_E in Kelvin. – Ma reset time: En = Tne in seconds. – Ma derivative time (auto/ man) Eu = Tve in seconds. The thermostat logic system only permits values with Tne > Tve! – Ma damping time (auto/ man) Ed = Tde in seconds.
	Parameter **Sl**ave controller (P-controller): – Sl proportional range: iP = Xpf in Kelvin.
	– Tve, Tde, Prop_E changeover to Auto/ Man E A = Automatic or Mn = Manual. Works setting is Automatic. These three parameters should only be modified by experienced control technicians! Hold pressed for 3s, then make changes.
	– Correction limitation EtOL . See introduction (⇨ 7.13.2).

Command	Control Parameters



- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: → Control → Control Parameters → Control Parameters.
- The adjacent window appears.
  Parameter endings:
  e = Master controller, f = Slave controller.
- Where applicable change parameters marked with (auto) to manual input with Tv manual/auto.
- Select the parameters to be changed with ↓ and confirm with ◎.
- Then change the value in the following settings window and confirm with ◎.
- Correction limitation see introduction (⇨ 7.13.2).

7.13.2.1 Proven settings for control parameters and pump (external control):

External consumer					Master controller (External controller)					Slave controller (Internal controller)	
Device type	Heat transfer liquid	Field of application	Volume [L]	Hose length [m]	**Kpe** EP	**Tne** En	**Tve** Eu	**Tde** Ed	**Prop_E** Eb	**Xpf** iP	Pump level
P 8	Water	Double wall glass vessel	2.5	2x1	2.0	80	60	5.0	30	4.0	5
P 8	Water	Double wall glass vessel	2.5	2x1	2.0	150	130	5.0	30	3.0	5
P 8	Water	Double wall stainless steel vessel with water	0.7	2x1	0.5	70	50	5.0	30	3.0	5

7.13.2.2 Steps for setting the control parameters for external control

1. Activate external control (⇨ 7.7.4).
2. Setting the slave controller:

2.1. Set parameters to auto; Xpf see table (⇨ 7.13.2.1) (empirical value) in dependence upon:

- Check for thermostat type and change when necessary (P....) (⇨ 9.2.1).
- Choose heat transfer liquid with low viscosity and high thermal capacity.
  Ranking: Water, ethanol, water-glycol, oil, Fluorinert®,

– set pump level as high as possible,

– make bath circulation strong and fast,

– choose hose length as short as possible, i.e. 2 x 1m,

– choose hose cross section as large as possible, i.e. ½ inch,

– throughput through the external load as large as possible.

2.2. Xpf Setting:

– when oscillating with short period occur (i.e. 30 s) ➔ Xpf lower, otherwise higher,

– in case of bad thermal coupling and large thermal mass ➔ high (i.e. 2 — 5, or even higher),

– in case of good thermal coupling and small thermal mass ➔ small (i.e. 0.2 — 0.7),

– when rapid temperature response is required simple internal control should be preferred. Otherwise select very small Xpf (0.05 — 0.1).

3. Setting the master controller ($PIDT_1$-controller):

– Start with setting Auto and proceed with Manual only when necessary.

3.1. Kpe setting:

– Start with empirical values from table (⇨ 7.13.2.1).

– In case of oscillations (with large period, i.e.10 min) ➔ Kpe higher, otherwise lower.

3.2. – Tne/ Tve/ Tde setting:

– Start with empirical values from table (⇨ 7.13.2.2) and with high numbers (Tne = 70 s — 200 s; Tve = 50 s — 150 s),

– with lower numbers ➔ faster approach, otherwise slower approach with lower oscillations,

– Tve: to reduce overshot ➔ Tve higher, otherwise lower,

– Tde (damping for Tve): in general approximately 10 % of Tve.

4. Correction limitation (or outflow temperature limitation) (⇨ 7.13.2) and temperature limits (Til/ Tih) (⇨ 7.8.3)

– make settings in accordance with the boundary conditions. Examples:

Heat transfer liquid	Correction limitation	Til	Tih
Water	depending on the external vessel size and the heat transfer liquid	2 °C	95 °C
Ethanol		Minimum	40 °C

Tool to watch the time behavior:

- Graph mode of the Command remote control,

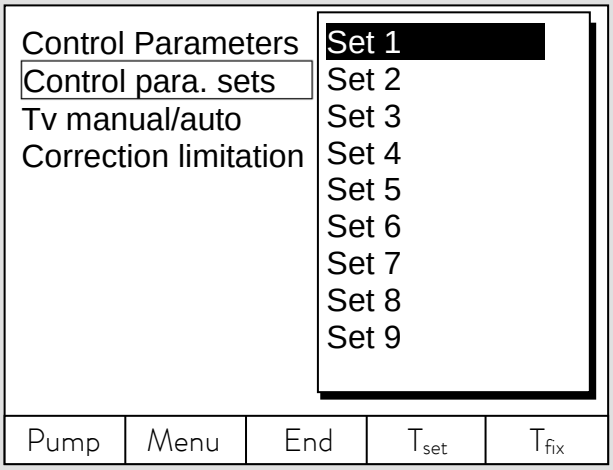
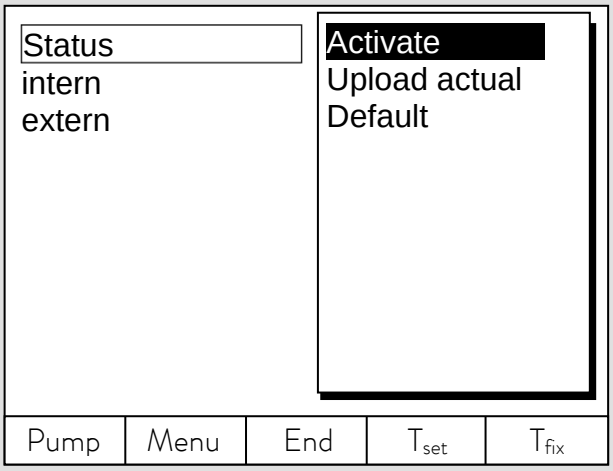
7.13.3 Internal and external control parameter sets

If a thermostat is used for a number of applications, which always leads to a change of the control parameters, these control parameters (up to 9 sets) can be saved in the thermostat and activated again as required.

Also saving is useful for finding the best control parameters; in this way external management of the control parameters can be avoided.

There are 9 sets (each for internal and external sets of control parameters) saved at the factory.
In this menu the control parameters cannot be edited, they are only displayed.

- With Activate the currently valid control parameters are used.
- With Upload actual the actual ones are read in and saved (for later reuse).
- With Default the set of control parameters saved at the works is loaded again (in this case the control parameters set by the customer are lost).

Command	Control parameter sets
	– Open the device parameter menu via the soft key Menu. – With the cursor keys continue to: → Control → Control Parameters → Control para. sets. – The adjacent window appears. Set 1 to Set 9. – Select the desired set with and confirm with .
	– In the setting window (see left) the selected set is listed under intern or extern in the display. – Under Status the previously selected set: is activated, is read in and the set, who was saved at the factory, is restored.

Editing the control parameter sets

The change in the control parameters is explained in Section 7.13.1 / 7.13.2 (internal / external). Once the value has been changed and confirmed, the set number, e.g. Set 3 and Upload actual, the new value is accepted into the control parameter set to be changed (Set 3) via the command Control parameter sets.

7.14 Alarms, Warnings and Errors

The SelfCheck Assistant of your Proline Thermostat monitors more than 50 device parameters and triggers alarms, warnings or errors as appropriate.
All warnings and alarms are shown on the Command remote control in plain text. Errors are shown in plain text on the Command remote control in an error list.

Alarms: Alarms are safety relevant. Pump and heater unit will be shut off.

Warnings: Warnings normally are not safety relevant. The thermostat continues to operate.

Errors: When an error occurs, switch of the device. If the error is always present after switching on the device, please inform the LAUDA Service (⇨ 9.4).

Find cause of alarm or warning and rectify where necessary. Then press on the Master keyboard in order to remove the alarm message. Warning messages can be removed either on the Master keyboard with or on the Command board with .
Warnings may be ignored by pressing or on the Master keyboard or by activating the Screen Softkey on the Command remote control. Otherwise warnings will be repeated periodically.

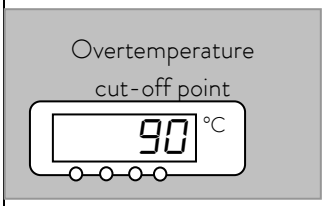
7.14.1 Overtemperature protection and checking

The units are designed for operation with non-flammable and flammable liquids to DIN EN 61010-2-010.

Setting the overtemperature cut-off: Recommended setting: 5 °C above desired bath temperature.

Caution! The overtemperature switch point T_{max} is being controlled by a system that works independent of the internal bath control. The setpoint setting can be limited independently to T_{max} with the functions T_{ih} and T_{il} (⇨ 7.8.3).

– The cut-off point is displayed in the LED display on pressing the key .



Changing the overtemperature cut-off point:

– For safety, and to guard against unintentional adjustment, the key must be held pressed during all the following entries. Now, briefly press . The display flashes and the overtemperature cut-off can be set with the keys or .

– Quit the change mode by pressing again or automatically after 5 seconds, while you keep Tmax pressed.

– This somewhat complicated procedure is intended to prevent unintentional adjustment.

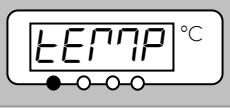
– Set the overtemperature switch-off point Tmax below the flash point of the heat transfer liquid (⇨ 6.4).

– The setting range is restricted to 5 °C above the upper limit of the working temperature range (Tih ⇨ 7.8.3).

– If the bath temperature rises above the overtemperature cut-off:

1. Alarm sounds as dual-tone signal.
2. tEMP for overtemperature appears in the display.
3. Red LED above the fault triangle flashes.
   → Heater switches off on both poles,
   → Pump is switched off electronically.

Overtemperature alarm



– Rectify cause of fault.

– Wait until the bath temperature has cooled below the cut-off point or set the cut-off point higher than the bath temperature. When tEMP is shown in the display:

– Unlock with the key.

– Unlocking is not possible on the Command remote control!

– Before longer periods of unsupervised operation, the **overtemperature protection should be checked. To do this:**

– Slowly lower T_{max}, as described above.
  → Cut-off at the bath temperature should occur.

– Step 1 – 2 (see above) must follow.

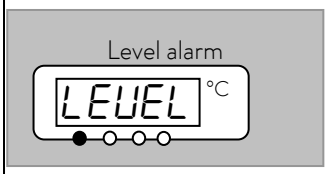
– Set the overtemperature cut-off higher than the bath temperature again and wait until tEMP appears in the display.

– Unlock with the key.

– Unlocking is not possible on the Command remote control!

Command	Overtemperature alarm!
	– Overtemperature alarm! is shown in the display and signifies that unlocking is only possible on the Master control panel.

7.14.2 Low-level alarm and low-level checking



If the liquid level falls so far that the heating element is no longer completely covered with liquid, an alarm is initiated:

1. The alarm sounds as a dual-tone signal.
2. Display for LEVEL (low level) is shown when the bath contains too little liquid.
3. Red LED above the fault triangle flashes.
   → Heater switches off on both poles,
   → Varioflex pump is switched off.

– Find the cause of the fault and, where necessary, top up for missing heat transfer liquid (⇨ 6.3 and 6.4).
– Press the Enter key.
– Also press this key if the unit has been switched off in the fault state.

– **Checking the safety system at regular intervals** by lowering the bath level. To do this, push hose onto pump connector and pump heat transfer liquid into a suitable vessel.
– Step 1 – 2 must follow.

– With this test the bath temperature must not be below 0 °C or above max. 50 °C, otherwise there is a risk of burning!
– If irregularities arise during the checking of the safety devices, switch off the unit immediately and pull out the mains plug!
– Have the equipment checked by LAUDA Service.

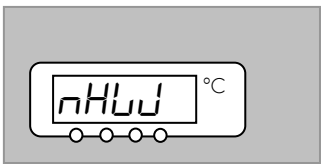
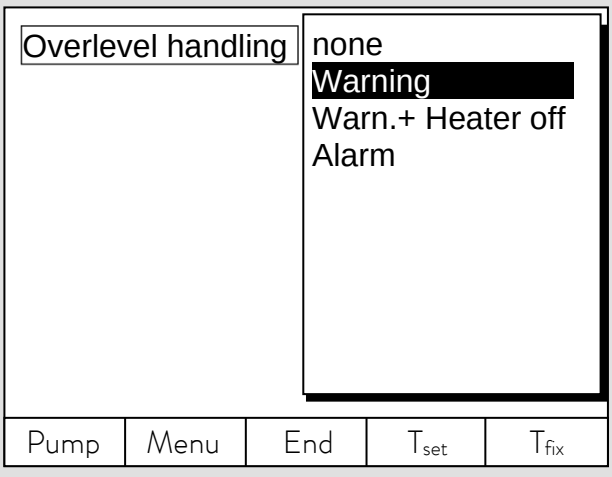
Command	Low-level alarm!

– Low-level alarm is shown in the display and signifies that unlocking is only possible on the Master control panel.

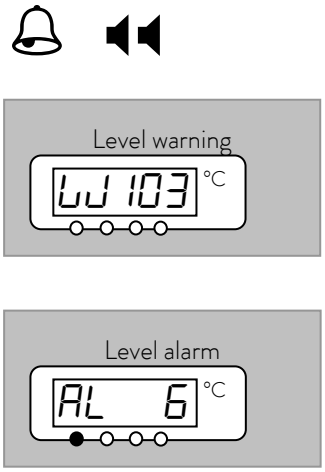
7.14.3 High-level settings

Different reactions can be chosen when the level sensor detects the height of the heat transfer liquid level. Depending on the setup, heat transfer liquid or operation conditions, one of the following settings may be suitable:

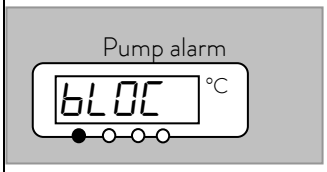
Setting	Master set-tings	Command set-tings	Reaction and application recommendation
No warning	nHnon	none	Select only when no safety sensitive application. I.e. water as heat transfer liquid.
Warning	nHUJ	Warning	Acoustic and optical warning as long as the level goes down. This is the factory setting.
Warning and heater off	nHUJH	Warning + heater off	*Warning* and additional *heater off* as long as the level goes down. Recommended for flammable heat transfer liquids with much higher flash point and temperatures above 100 °C.
Alarm	nHALA	Alarm	*Alarm* switches off the pump and the heater until the alarm is removed by pressing on the Master keyboard. Recommended for external loads and flammable liquids.

Master	nHUJ
4 x to Modu. to SEC. . . 2x	– Choose the menu for the high level reaction. – The factory setting is nHUJ. That is a warning.
	– Press to enter the setup mode. The current setting flashes. – Choose a setting from the above list.
Command	Overlevel handling
	– Open the device parameter menu via the soft key Menu. – With the cursor keys continue to: → Settings → Overlevel handling. – The shown window appears. – Select the preferred parameter with and confirm with . See introduction for details.

7.14.4 High-level warning or alarm

3 Sec.	– Acoustic warning signal sounds for 3 seconds when the liquid level rises so far that the uppermost switching point of the level sensor has been reached.
	Or in case the warning function as described in (⇨ 7.14.3) was chosen: – The acoustic signal with dual-tone sounds. – Warning WJArn 103 (high level) appears when the bath contains too much liquid. – The WJArn flashes by turns with the numeral. In case the alarm function as described in 7.14.3 was chosen: – The acoustic signal with dual-tone sounds. – Red LED ☼ above the fault triangle ⚠ flashes. → Heater switches off on both poles, → Pump unit is switched off electronically. – Find the cause of the fault. Possible causes may be: 1. Volume expansion on heating. 2. Feed to an external vessel may be interrupted so that only return suction is possible. 3. Heat transfer liquid taking up moisture.
	– At Alarm: Press Enter key. Warnings disappear automatically when the cause is gone. – Also; press this key if the unit has been switched off in the fault state. Warnings disappear automatically when the cause is gone.
Command	High-level warning/ alarm
	– The display shows Warning. To release press Enter key Security 3 Level too high or Alarm AL 6: Level too high is shown in the display and signifies that unlocking is only possible on the Master control panel.

7.14.5 Pump-motor supervision: Overload or blockage



The SelfCheck Assistant monitors the Varioflex Pump:

1. Alarm sounds as dual-tone signal for pump-motor overload or blockage.
2. Display of bLOC signals blockage.
3. Red LED above the fault triangle flashes.
   → Heater switches off on both poles,
   → Pump unit is switched off electronically.

– Find the cause of the fault. Perhaps the viscosity of the heat transfer liquid is too high or the pump is blocked.

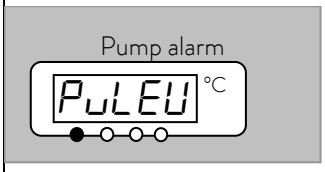
– Press the Enter key.

– Also press this key if the unit has been switched off in the fault state.

Command	Pump-motor alarm!

– Pump-motor alarm is shown in the display and signifies that unlocking is only possible on the Master control panel.

7.14.6 Pump-motor supervision: Dry running



The SelfCheck Assistant monitors the Varioflex pump:

1. Alarm sounds as dual-tone signal when the pump runs without liquid. This can only occur when the float level measurement has failed.
2. The display of PuLEU signals that the SelfCheck Assistant has detected a pump low level.
3. Red LED above the fault triangle flashes.
   → Heater switches off on both poles,
   → Pump unit is switched off electronically.

The cause of the failure of the level measurement with the floatation sensor must be found and rectified. Perhaps foreign bodies in the bath block it.

– Press the Enter key.

– Also press this key if the unit has been switched off in the fault state.

Command	Alarm! Low level (pump)

– Alarm! Low level (pump) is shown in the display and signifies that unlocking is only possible on the Master control panel.

7.14.7 Fault list “Alarms and Warnings”

Alarms

Message	Meaning
PuLEU	Pump too fast (low level)
LEUEL	Low level alarm in the level sensor
tEMP	Overtemperature (t > tmax)
bLOC	Pump blocked (no rotation)
CFA IL	Command connection interrupt
AL 1	Temperature signal of external Pt100 missing
AL 2	Temperature signal of analogue input missing
AL 3	Temperature signal of serial port missing
AL 4	Analogue module: Current input 1 interrupted
AL 5	Analogue module: Current input 2 interrupted
AL 6	Protection system: High bath level
AL 7	Error digital input (from V 1.30 on)
AL 8	Refill fail

Warnings from “Master-Display”

Message	Meaning
uu 1	Overflow of CAN receipt
uu 2	Watchdog-Reset
uu 3	til-limitation active
uu 4	tih-limitation active
uu 5	Heatsink temperature
uu 11	Software version of protection system too old
uu 12	Software version of operating system too old
uu 14	Software version of analogue Interface too old
uu 15	Software version of RS 232 too old
uu 16	Software version of contact I/0 module too old
uu 17	Software version of Valve 0 too old
uu 18	Software version of Valve 1 too old
uu 19	Software version of Valve 2 too old
uu 20	Software version of Valve 3 too old
uu 21	Software version of Pump 0 too old
uu 22	Software version of Pump 1 too old
uu 23	Software version of Pump 2 too old
uu 24	Software version of Pump 3 too old

Warnings from “Safety system”

Message	Meaning
uu 101	Overflow of CAN receipt
uu 102	Watchdog-Reset
uu 103	Close to bath overflow
uu 104	Bath level is approaching switch off level or is out of optional range
uu 105	Heater 1 break
uu 106	Heater 2 break
uu 107	Heater 3 break
uu 110	Software version of control system too old
uu 112	Software version of operating system too old
uu 114	Software version of analogue interface too old
uu 115	Software version of RS 232 too old
uu 116	Software version of contact I/0 module too old
uu 117	Software version of Valve 0 too old
uu 118	Software version of Valve 1 too old
uu 119	Software version of Valve 2 too old
uu 120	Software version of Valve 3 too old
uu 121	Software version of Pump 0 too old
uu 122	Software version of Pump 1 too old
uu 123	Software version of Pump 2 too old
uu 124	Software version of Pump 3 too old

Warnings from "Command-Display"

Message	Meaning
bJ201	Overflow of CAN receipt
bJ202	Watchdog-Reset
bJ203	RTC Voltage drop recognised: Battery failure
bJ210	Software version of control system too old
bJ211	Software version of protection system too old
bJ214	Software version of analogue interface too old
bJ215	Software version of RS 232 too old
bJ216	Software version of contact I/O too old
bJ217	Software version of Valve 0 too old
bJ218	Software version of Valve 1 too old
bJ219	Software version of Valve 2 too old
bJ220	Software version of Valve 3 too old
bJ221	Software version of Pump 0 too old
bJ222	Software version of Pump 1 too old
bJ223	Software version of Pump 2 too old
bJ224	Software version of Pump 3 too old

Warnings from "Cooling system"

Message	Meaning
bJ301	Overflow of CAN receipt
bJ302	Watchdog-Reset
bJ303	sm.stell_min still not determined ➔ Adaption run necessary
bJ304	Pressure switch 1 operated
bJ305	Condenser dirty (➔ cleaning)
bJ310	Software version of control system too old
bJ311	Software version of protection system too old
bJ312	Software version of operation system too old
bJ314	Software version of analogue interface too old
bJ315	Software version of RS 232 too old
bJ316	Software version of contact I/O too old

Warnings from "Analogue-Module"

Message	Meaning
bJ401	Overflow of CAN receipt
bJ402	Watchdog-Reset
bJ410	Software version of control system too old
bJ411	Software version of protection system too old
bJ412	Software version of operation system too old
bJ413	Software version of refrigeration system too old
bJ415	Software version of RS 232 too old
bJ416	Software version of contact I/O too old
bJ417	Software version of Valve 0 too old
bJ418	Software version of Valve 1 too old
bJ419	Software version of Valve 2 too old

Warnings from "RS 232/485-Module"

Message	Meaning
bJ501	Overflow of CAN receipt
bJ502	Watchdog-Reset
bJ510	Software version of control system too old
bJ511	Software version of protection system too old
bJ512	Software version of operation system too old
bJ413	Software version of refrigeration system too old
bJ514	Software version of analogue interface too old
bJ516	Software version of contact I/O too old
bJ517	Software version of Valve 0 too old
bJ518	Software version of Valve 1 too old
bJ519	Software version of Valve 2 too old

bJ420	Software version of Valve 3 too old
bJ421	Software version of Pump 0 too old
bJ422	Software version of Pump 1 too old
bJ423	Software version of Pump 2 too old
bJ424	Software version of Pump 3 too old

bJ520	Software version of Valve 3 too old
bJ521	Software version of Pump 0 too old
bJ522	Software version of Pump 1 too old
bJ523	Software version of Pump 2 too old
bJ524	Software version of Pump 3 too old

Warnings from "Contact I/O-Module"

Message	Meaning
bJ601	Overflow of CAN receipt
bJ602	Watchdog-Reset
bJ610	Software version of control system too old
bJ611	Software version of protection system too old
bJ612	Software version of operation system too old
bJ613	Software version of refrigeration system too old
bJ614	Software version of analogue interface too old
bJ615	Software version of RS 232 too old
bJ617	Software version of Valve 0 too old
bJ618	Software version of Valve 1 too old
bJ619	Software version of Valve 2 too old
bJ620	Software version of Valve 3 too old
bJ621	Software version of Pump 0 too old
bJ622	Software version of Pump 1 too old
bJ623	Software version of Pump 2 too old
bJ624	Software version of Pump 3 too old

Warnings from "Solenoid valve" (Code 7, 8, 9XX)

Message	Meaning
bJ701	Overflow of CAN receipt
bJ702	Watchdog-Reset
bJ710	Software version of control system too old
bJ711	Software version of protection system too old
bJ712	Software version of operation system too old
bJ713	Software version of refrigeration system too old
bJ714	Software version of analogue interface too old
bJ715	Software version of RS 232 too old
bJ716	Software version of contact I/O too old
bJ721	Software version of Pump 0 too old
bJ722	Software version of Pump 1 too old
bJ723	Software version of Pump 2 too old
bJ724	Software version of Pump 3 too old

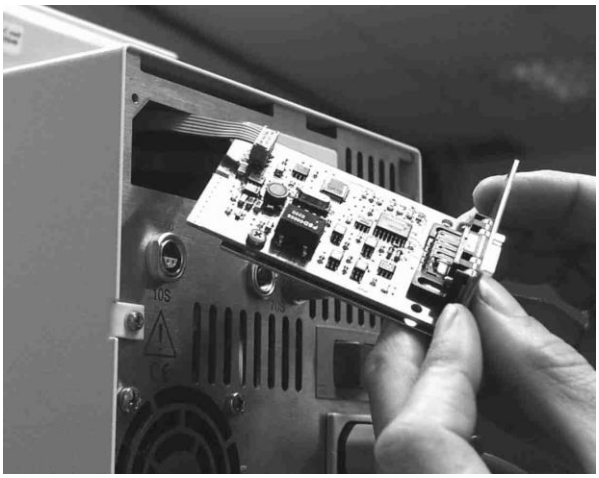
8 Interface modules

8.1 Installing modules

The master and command can be supplemented with further interface modules which are simply inserted at the back of the control head into two module slots.

- Touch the earthed bath cover of the Proline thermostat to discharge any electrostatic charge.
- Remove the module from its packaging.
- Switch off the thermostat and pull out the mains plug.
- Insert a screwdriver into the lower recess of the module cavity and prise up the plastic cover. The cover can then be pulled off downwards.

- Pull out the plug of the bus connecting cable from the plastic cover.

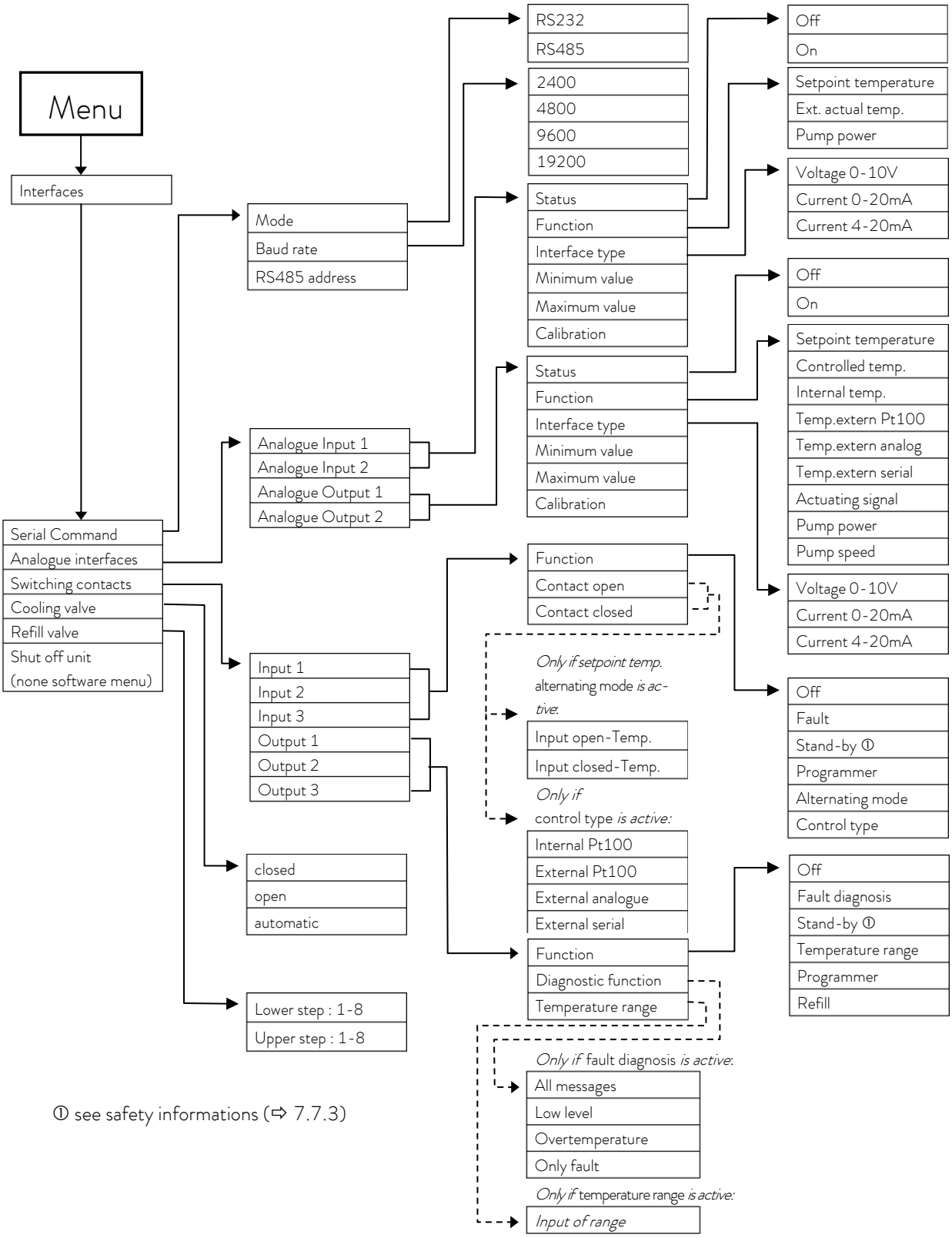


- Plug on the bus connecting cable (red plug onto red socket).
- Insert the module and secure with the two cross-head screws.
- Connect the mains plug again and switch on the thermostat.

☞ The plugs are protected against reverse polarity. The plugs have a ridge, which slides into a groove in the socket.

8.2 Menu structure for all modules

All existing menu points are illustrated. However, the Command remote control masks out menu points, which cannot be executed. Further information can be found in the following sections.



① see safety informations (⇨ 7.7.3)

8.3 RS 232/485 Serial interface

RS 232/485 interface module (catalogue no. LRZ 913) with 9-pole SUB-D socket. Electrically isolated by opto-coupler. With the LAUDA instruction set essentially compatible to the ECO, Ecoline, Integral XT and Integral T Series. The RS 232 interface can be connected directly to the PC with a 1:1 through-contact cable (catalogue no. EKS 037).

8.3.1 Connecting cables and interface test RS 232

Computer					Thermostat		
Signal	9-pin sub-D-socket		25-pin sub-D-socket		9-pin sub-D-socket		Signal
	①	②	①	②	①	②	
R x D	2	2	3	3	2	2	T x D
T x D	3	3	2	2	3	3	R x D
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

① with hardware handshake: For connecting a thermostat to the PC use 1:1 cable and not a null-modem cable!

② without hardware handshake: the computer / PC must be set to the operating mode “without hardware handshake”.

- Use screened connecting cable.
- Connect screen to connector case.
- The connections are galvanically isolated from the rest of the electronics.
- Any pins not in use must not be connected!

When a PC is connected up the RS 232 interface can easily be **tested** using the Microsoft Windows operating system.

On Windows® 3.11 with the “Terminal” program, on Windows® 95/ 98/ NT/ XP with the “Hyper Terminal” program.

"HyperTerminal" is no longer included in later Windows operating systems.

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

8.3.2 Protocol RS 232

- The interface operates with 1 stop bit, no parity bit and 8 data bits.
- Transfer rate either: 2400, 4800, 9600 (factory setting) or 19200 baud as selected.
- The RS 232 interface can be operated with or without hardware handshake, (RTS/CTS).
- The command from the computer must be terminated with CR, CRLF, or LFCR.
- The response of the thermostat is always terminated with 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.

CR = Carriage Return (Hex: 0D)
LF = Line Feed (Hex: 0A)

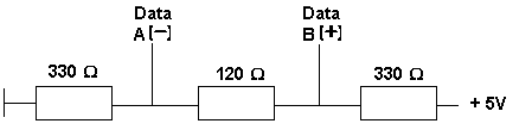
Example: Transfer of setpoint 30,5 °C to the thermostat

Computer	Thermostat
„OUT_SP_00_30.5“CRLF	⇨
⇦	„OK“CRLF

8.3.3 Connecting cable RS 485

Thermostat	
9-pin sub-D-socket	
Pin	Data
1	Data A (-)
5	SG (Signal Ground) optional
6	Data B (+)

- Use screened connecting cables.
- Connect screen to connector case.
- The connections are galvanically isolated from the rest of the electronics.
- Any pins not in use must not be connected!!



An RS 485 bus always requires bus termination in the form of a termination network which ensures a defined rest status in the high-resistance phases of bus operation. The bus termination is as follows:

This termination network is usually incorporated on the PC plug-in card (RS 485).

8.3.4 Protocol RS 485

- The interface operates with 1 stop bit, no parity bit and 8 data bits.
- Transfer rate either: 2400, 4800, 9600 (Factory setting) or 19200 baud as selected.
- The RS 485 commands are always preceded by the device address. There is provision for 127 addresses. The address must always have 3 digits. (A000_...to A127_...).
- The command from the computer must be terminated with CR.
- The response of the thermostat is always terminated with CR.

CR = Carriage Return (Hex: 0D)

Example: Transfer of setpoint 30.5 °C to the thermostat with address 15.

Computer	Thermostat
„A015_OUT_SP_00_30.5“CR	⇨
⇦	„A015_OK“CR

8.3.5 Write commands (Data commands to the thermostat)

Command	Explanation
OUT_PV_05_XXX.XX	External temperature given via interface
OUT_SP_00_XXX.XX	Set value transfer with max. 3 places before the decimal point and max. 2 places after it
OUT_SP_01_XXX	Pump power level 1 to 8
OUT_SP_02_XXX	Operation mode cooling (0 = OFF / 1 = ON / 2 = AUTOMATIC)
OUT_SP_04_XXX.X	TiH outflow temperature limit, high limit
OUT_SP_05_XXX.X	TiL outflow temperature limit, low limit
OUT_PAR_00_XX.X	Setting of control parameter Xp
OUT_PAR_01_XXX	Setting of control parameter Tn (5 — 180 s; 181 = Off)
OUT_PAR_02_XXX	Setting of control parameter Tv
OUT_PAR_03_XX.X	Setting of control parameter Td
OUT_PAR_04_X.XX	Setting of control parameter KpE
OUT_PAR_05_XXX	Setting of control parameter TnE (5 — 979 s; 980 = Off)
OUT_PAR_06_XXX	Setting of control parameter TvE (0 = Off).

Command	Explanation
OUT_PAR_07_XX.X	Setting of control parameter TdE
OUT_PAR_09_XXX.X	Setting of the correction limitation
OUT_PAR_10_XX.X	Setting of control parameter XpF
OUT_PAR_14_XXX.X	Setting of the setpoint offset
OUT_PAR_15_XXX	Setting of control parameter PropE
OUT_MODE_00_X	Keyboard Master: 0 = free / 1 = locked (corresponds to “KEY”)
OUT_MODE_01_X	Control: 0 = internal / 1 = external Pt100 / 2 = external Analogue / 3 = external Serial
OUT_MODE_03_X	Keyboard Command Remote Control: 0 = free / 1 = locked
OUT_MODE_04_X	Setpoint offset source: 0 = normal / 1 = external Pt / 2 = external analog / 3 = external serial
START	Switches the device on (from Standby). See safety information (⇨ 7.7.3).
STOP	Switches the device into Standby (pump, heater off)
RMP_SELECT_X	Selection of the programme (1 — 5) to which the further instructions apply. When the unit is switched on, programme 5 is selected automatically.
RMP_START	Start the programmer
RMP_PAUSE	Hold (pause) the programmer
RMP_CONT	Restart the programmer after pause
RMP_STOP	Terminate the programmer
RMP_RESET	Delete the programmer (all Segments)
RMP_OUT_00_XXX.XX_XXXXX_XXX.XX_X	Set a programme segment (temperature and time, tolerance and pump level). A segment is added and appropriate values are applied to it.
RMP_OUT_02_XXX	Number of times the programme runs: 0 = unlimited / 1 — 250.

- For “_“ use also “ ” (blank character).
- Response from thermostat “OK“ or in case of error ”ERR_X“ (RS 485 interface e.g. “A015_OK” or in case of error ”A015_ERR_X”.).

Permitted 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				

8.3.6 Read commands (Data requested from the thermostat)

Command	Explanation
IN_PV_00	Read bath temperature (outflow temperature)
IN_PV_01	Indication of the controlled temperature (internal/external Pt/external Analogue/external Serial)
IN_PV_03	Read external temperature TE (Pt100)
IN_PV_04	Read external temperature TE (Analogue input)
IN_PV_05	Read current bath level
IN_PV_10	Read bath temperature (outflow temperature) in 0.001 °C
IN_PV_13	Read external temperature TE (Pt100) in 0.001 °C
IN_SP_00	Read temperature setpoint
IN_SP_01	Read current pump power level
IN_SP_02	Read cooling operation mode (0 = OFF / 1 = ON / 2 = AUTOMATIC)
IN_SP_03	Read current overtemperature switch-off point
IN_SP_04	Read current outflow temperature limit TiH
IN_SP_05	Read current outflow temperature limit TiL
IN_PAR_00	Read control parameter Xp
IN_PAR_01	Read control parameter Tn (181 = OFF)
IN_PAR_02	Read control parameterTv
IN_PAR_03	Read control parameter Td
IN_PAR_04	Read control parameter KpE
IN_PAR_05	Read control parameter TnE (980 = OFF)
IN_PAR_06	Read control parameter TvE (0 = OFF)
IN_PAR_07	Read control parameter TdE
IN_PAR_09	Read value of correction limitation
IN_PAR_10	Read control parameter XpF
IN_PAR_14	Read setpoint offset
IN_PAR_15	Read control parameter PropE
IN_DI_01	State of contact input 1: 0 = open/ 1 = closed
IN_DI_02	State of contact input 2: 0 = open/ 1 = closed
IN_DI_03	State of contact input 3: 0 = open/ 1 = closed
IN_DO_01	State of Contact output 1: 0 = make-contact open/ 1 = make-contact closed
IN_DO_02	State of Contact output 2: 0 = make-contact open/ 1 = make-contact closed
IN_DO_03	State of Contact output 3: 0 = make-contact open/ 1 = make-contact closed

Command	Explanation
IN_MODE_00	Keyboard Master: 0 = free / 1 = locked
IN_MODE_01	Control: 0 = int. / 1 = ext. Pt100 / 2 = ext. Analogue / 3 = ext. Serial
IN_MODE_02	Standby operation: 0 = Device ON / 1 = Device OFF
IN_MODE_03	Keyboard Command Remote Control: 0 = free / 1 = locked
IN_MODE_04	Setpoint offset source: 0 = normal/ 1 = ext. Pt/ 2 = ext. analogue/ 3 = ext. serial
TYPE	Read device type (response e.g. "P 8")
VERSION_R	Read software type of control system
VERSION_S	Read software type of protection system
VERSION_B	Read software type of Command
VERSION_T	Read software type of cooling system
VERSION_A	Read software type of analogue module
VERSION_V	Read software type of RS 232/485 module
VERSION_D	Read software type of digital module
VERSION_M_0	Read software type of solenoid valve (cooling water)
VERSION_M_1	Read software type of solenoid valve (automatic refilling)
VERSION_M_3	Read software type of solenoid valve (shut-off valve 1)
VERSION_M_4	Read software type of solenoid valve (shut-off valve 2)
VERSION_M_5	Read software type of high temperature cooler
STATUS	Read equipment status 0 = OK, -1 = error
STAT	Read error diagnosis response: XXXXXXX → X = 0 no error, X = 1 error 1. char = fault 2. char = alarm 3. char = warning 4. char = over temperature 5. char = low bath level 6. char = high bath level (at adjustment alarm) 7. char = no external control variable
RMP_IN_00_XXX	Read a programme segment XXX (response: e. g. 030.00_010.00_005.00_001.00 → set point temperature 30.00 °C, time = 10 min, tolerance = 5.00 K, pump level = 1)
RMP_IN_01	Read the current segment number
RMP_IN_02	Read the set number of programme runs
RMP_IN_03	Read the current programme run
RMP_IN_04	Read which program further commands refer
RMP_IN_05	Read which programme is currently running (0 = none)

Command	Explanation
LOG_IN_00_XXXX	Read measuring point XXXX from data logger (Reply: e. g. 020.00_021.23_030.50 → set point temperature = 20.00 °C, bath temperature = 21.23 °C, external temperature = 30.5 °C)
LOG_IN_01	Read all measuring points from data logger As a difference to the command “LOG_IN_00”, a tabulator is used here as separator instead of ‚_’ . The measuring points are separated by CR and LF. The end is marked by CR LF CR LF.
LOG_IN_02	Read starting time of the data logger (Reply: e.g. 20_14_12_20 → day 20, 14:12:20 o’clock)
LOG_IN_03	Read acquisition interval from the data logger (Reply in seconds)

- For ”_“ use also ” ” (blank character) is also admissible.
- The equipment response is always in the fixed decimal format ”XXX.XX“ or for negative values “-XXX.XX” or ” ERR_X“. (RS 485 interface e.g. ”A015_ XXX.XX” or ”A015_-XXX.XX” or ”A015_ERR_X”).

8.3.7 Error messages

Message	Explanation
ERR_2	Wrong input (e.g. buffer overflow)
ERR_3	Wrong command
ERR_5	Syntax error in value
ERR_6	Illegal value
ERR_8	Module resp. value not available
ERR_30	Programmer, all segments occupied
ERR_31	Set point not possible, analogue set point input ON
ERR_32	TiH ≤ TiL
ERR_33	external sensor missing
ERR_34	Analogue value not available
ERR_35	Automatic is selected
ERR_36	No set point input possible. Programmer is running or is pausing.
ERR_37	No start from programmer possible, analogue setpoint input is switched on.

8.3.8 Driver software for LABVIEW®

An individual, easy-to-use control and automation software for operating the PROLINE device can be programmed with the aid of the National Instruments program development tool LABVIEW® (http://sine.ni.com/apps/we/nioc.vp?cid=1381&lang=US).
In order to make program operation possible on the RS 232/485 interface, LAUDA provides drivers specially designed for LABVIEW® which can be downloaded free of charge under**https://www.lauda.de/en/**.

8.4 Analogue module

The analogue module (order no. LRZ 912) has 2 inputs and 2 outputs which are brought out on a 6-pole socket to Namur Recommendation (NE28). The inputs and outputs can be set independently as 4 – 20 mA, 0 – 20 mA or 0 – 10V interface. Various functions can be selected for the inputs and outputs. Accordingly, the signal on the input is interpreted differently and different information is output via the output connection.
In addition the interfaces can be scaled freely according to the set function.
For measuring transducer is 20 V DC available.

The following values can be specified via the inputs:

- setpoint temperature with function: Fn tS or Set temperature,
- external actual temperature with function: Fn tE or ext. actual temperature,
- Pump power with function: Fn PP or Pump power.

The following values can be specified via the outputs:

- Setpoint temperature with function: Master: Fn tS or Command: Set temperature,
- The temperature source with which active control occurs: Fn tC Controlled temp.,
- Actual temperature (bath temperature): Fn t1 or Internal Temp.,
- External actual temperature from Pt100: FntEP or Temp.external Pt100,
- External actual temperature from analogue input: FntEA or Temp.external analogue,
- External actual temperature from the serial interface: FntES or Temp.external serial,
- Actuating signal: Fn H or Actuating signal,
- Pump power: Fn PP or Pump power,
- Pump speed: FntEn or Pump speed.

In addition the interfaces can be scaled freely with L 0.0 / H 100.0 in % or minimal value / maximal value according to the set function.

For example: 4 mA corresponds to 0 °C and 20 mA corresponds to 100 °C.

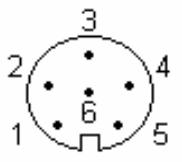
– Accuracy of the inputs and outputs after calibration better than 0.1% F.S.

– Inputs, current	Input resistance < 100 Ohm
– Inputs, voltage	Input resistance > 50 kOhm
– Outputs, current	Burden < 400 Ohm
– Outputs, voltage	Load > 10 kOhm

Connection of the analogue inputs and outputs

A 6-pole round connector with screw locking and contact arrangement according to DIN EN 60130-9 or IEC 130-9 is needed.
A suitable coupling plug can be obtained under order no. EQS 057.

View of the socket (front) or solder side of plug: socket 74S (from May 2010 on)



Pin 1	Output 1	Pin 4	Input 1
Pin 2	Output 2	**Pin 5**	**+20 V (max. 0.1 A)**
Pin 3	0V reference potential	Pin 6	Input 2

Use shielded lines. Connect shielding with connector housing!

8.5 Contact module

8.5.1 Contact module LRZ 915 with three inputs and three outputs

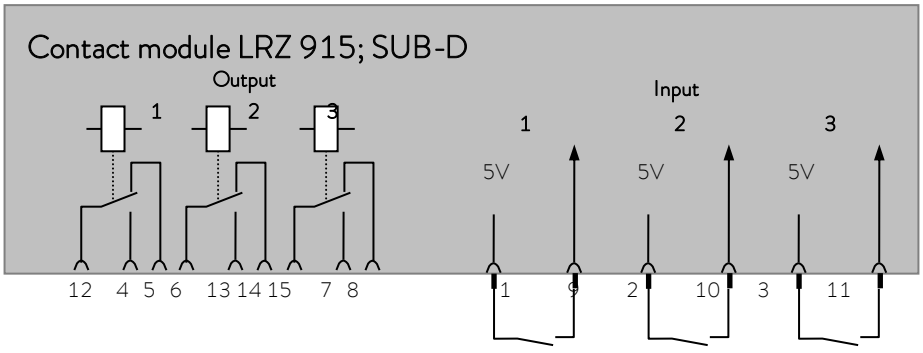
Contact module Cat. No. LRZ 915) on 15 pole SUB-D socket. With three relay contact outputs (changeover, max. 30 V/0.2 A) and three binary inputs for control via external voltage-free contacts.

The following functions are made available by the inputs:

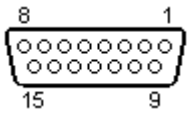
- Set fault with function: Master: F ALA or Command: Fault.
- Set Stand-by with function: F StB or Stand by, see safety instruction (⇨ 7.7.3).
- Control programmer (input 1 activates programmer 1, input 2 activates programmer 2 etc. At the first "close" the programmer gets starting; "open" removes it in "pause". The next "close" initiate "continue") with function: F Prg or Programmer.
  Control alternating mode (the switching state contact "open" or "closed" allot to two different setpoint temperatures): F t2C or alternating mode.
- Controller mode (the switching state input "open" or "closed" can allotted to two different control temperature sources. E. g. internal ↔ external control): F Con or type of control.

The following functions are made available by the outputs:

- Signal various fault states: F diA or fault diagnosis.
- Signalling standby: F StB or Standby.
- Providing status of the window discriminators (inside ↔ outside): F tol or temperature range.
- Providing the programmer status: F Prg or Programmer.
- Signalling refill of heat transfer liquid: F FIL or Refill.



Contact inputs and outputs

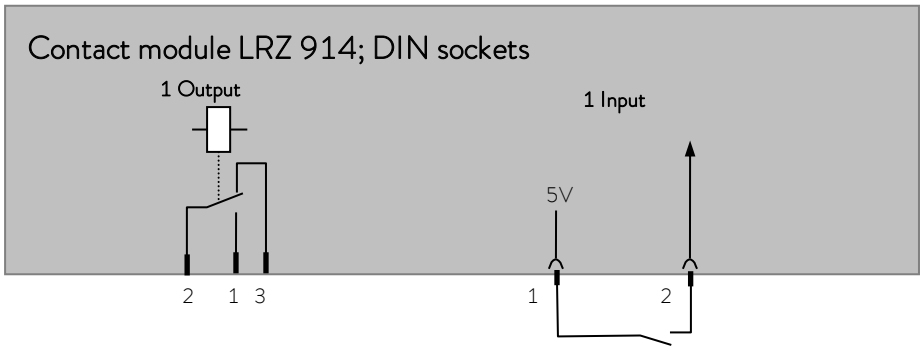


– View of the socket from the plug side or of the plug on the solder side.

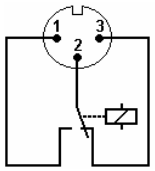
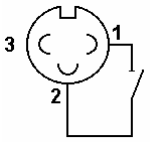
– A suitable 15-pole Sub-D plug can be obtained together with a suitable housing:
  Catalogue no. EQM 030 and plug housing catalogue no. EQG 017.

8.5.2 Namur-Contact module LRZ 914 with only one input and one output

Contact module (Cat. no. LRZ 914) with connector to NAMUR NE28. Functionality as LRZ 915, but only one output and one input on each of two sockets.



Contact inputs and outputs:

Output	Input
– View on flange plug (Front) or solder side coupler socket. – Max. 30 V; 0.2 A Coupler socket Cat. No. EQD 047	– View on flange plug (Front) or solder side coupler socket – Signal approx. 5 V, 10 mA. Do not use pin 3! Coupling plug Cat. No. EQS 048
 1 = normaly open (make) 2 = common 3 = normaly closed (break) 	

– Use shielded lines. Connect shielding with connector housing. Cover unused plug connections with protecting caps!

9 Maintenance

9.1 Cleaning

Withdraw the equipment mains plug before cleaning!

Cleaning can be carried out with water to which a few drops of surfactant (washing-up liquid) have been added and using a damp cloth.

No water must enter the control section!

Carry out appropriate decontamination if hazardous material is spilt on or in the equipment.

The cleaning or decontamination method is determined by the user's specialist knowledge respectively the corresponding data sheets. In case of doubt contact the manufacturer of the hazardous material.

9.2 Device status

The thermostat can be conveniently checked with the Command remote control. Some values can however also be interrogated in the Master version.

9.2.1 Interrogating the device type

→ MEnu. → PArA. → tYPE. (⇨ 7.5)

→ Settings → Device status → Device type.

The unit type for heating thermostats is being preset ex works. Please avoid to modify it!

9.2.2 Software Version

→ MEnu. → ShoU → UEr (⇨ 7.5)

Here, only the version of the control system in the Master is displayed.

→ Settings → Device status → Software version.

With the Command remote control the versions of the control system (Control), safety system (Safety), Command remote control (Command) and, where applicable, other connected modules are displayed.

9.2.3 Serial numbers

→ MEnu. → ShoU → Snr H und Snr L (⇨ 7.5)

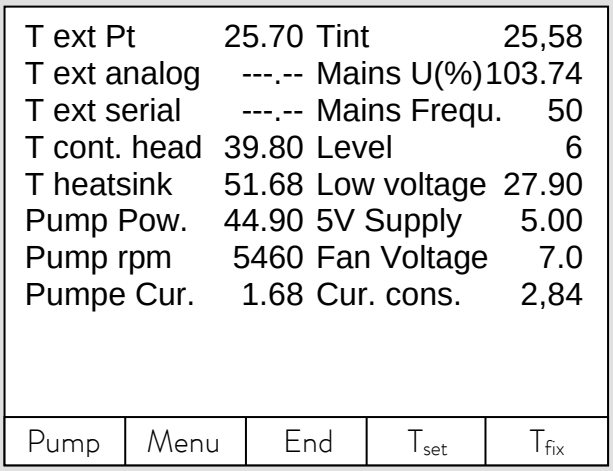
Under Snr H the first five places of the ten-character serial number of the Master device are displayed. Under Snr L the last five places are shown.

→ Settings → Device status → Serial numbers.

With the Command remote control the serial number of the Master (Master), Command remote control (Command) and other connected modules are displayed.

9.2.4 Device data

Master	→ mEnu → Show (⇨ Section 7.5)
	– Various device datas are displayed.
Command	Device data



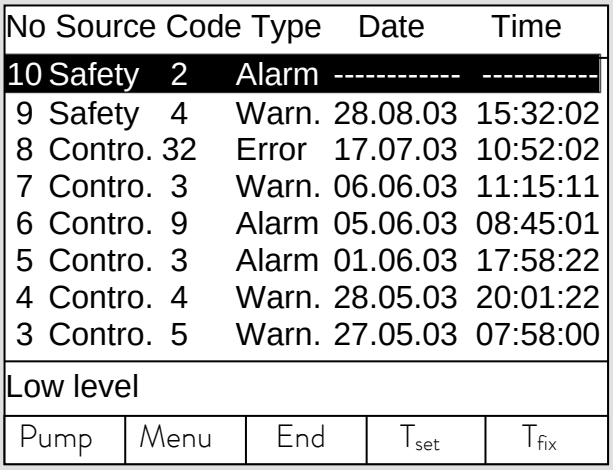
→ Settings → Device status → Device data → Display.

- Text shows various actual temperatures in °C from ext. Pt100 and the modules.
- T cont. head and T heatsink are temperatures of electronics in the Master in °C.
- Pump power in Watts, pump speed in rpm, pump current in ampere.
- T_{int} indicates the current internal bath temperature in °C.
- Mains voltage in % of nominal and mains frequency in hertz.
- Level indicates the liquid level in the internal bath.
- Low Voltage of power transformer, of the 5 V supply and fan voltage in volt.
- Cur. cons.: Mains current consumption in ampere.

9.2.5 Fault memory

For the analysis and localization of faults the Command version includes a fault memory in which up to 45 fault and alarm messages are saved.

Command	Errorstore



→ Settings → Device status → Error-store → Display.

- The last message is at the top.
- Each message line can be marked with the cursor keys. The message appears in plain text in the footer.
- Under “Source”, the CAN node is displayed which signaled the fault.
- Code is the number, which in the Master is shown in the display until the cause has been rectified.
- Type: Alarm, Warning or Fault (Error).

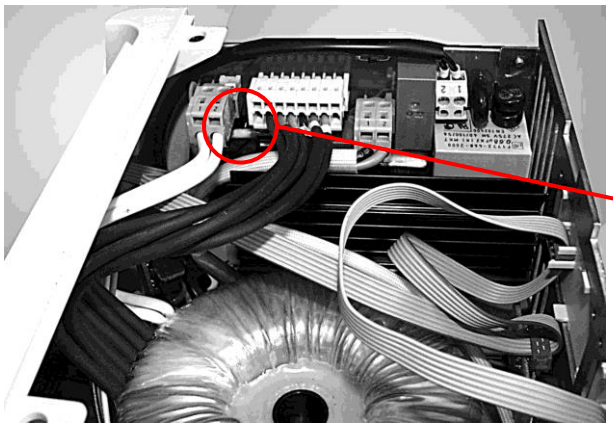
9.3 Servicing, repair and disposal information

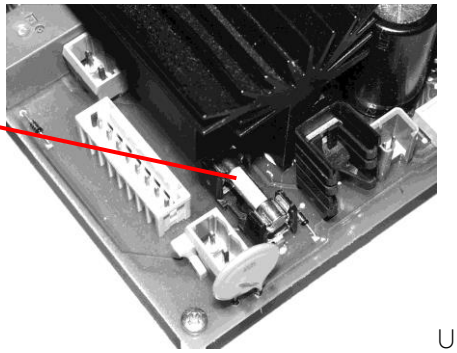
- Withdraw the mains plug before all service and repair work!
- Only specialists must carry out repairs in the control section!
- Keep to service intervals (⇨ 9.3.2). If servicing does not occur at the stated intervals, then the manufacturer can no longer guarantee the safe operation of the thermostatic circulator.

9.3.1 Servicing

LAUDA Thermostats largely require no service. If the heat transfer liquid becomes contaminated, it should be replaced (⇨ 6.3).

- At the back of the Proline head a main fuse switch  is located which interrupts the mains connection when an overload occurs. It is then in the "o" position and can be set in the "–" position again.
- If the fuse trips again, the cause must be located by Service.
- Additionally, a safety fuse, which protects the low voltages, is situated on the mains board. If a fuse fails (→ mains lamp does not light) only replace with a fuse with the specified data (1 x T (= slow-blow) 10 A, size 5 x 20 → fhe Fuse is located in the unit as shown below).





UL 533

9.3.2 Servicing intervals

System part	Mandatory for initial operation and before any longer unsupervised operation, then with recommended frequency	Comment
Complete device		
External condition of device	Monthly	
Heat transfer liquid		
Analysis of heat transfer liquid	Half-yearly (and as required)	(⇨ 9.3.3)
Bath vessel with drain tap		
Sealing	Daily	External visual inspection
External hoses		
Material fatigue	Monthly	External visual inspection
Electronics		
Over temperature protection	Quarterly	(⇨ 7.14.1)
Low level protection	Quarterly	(⇨ 7.14.2)
High-level protection	Quarterly	(⇨ 7.14.4)

Bring the device parts and accessories to room temperature before touching them.

9.3.3 Testing the heat transfer liquid

Bring the heat transfer liquid to room temperature before touching it.

If the heat transfer liquid becomes contaminated or degenerated, it should be renewed.

The heat transfer liquid is to be checked for its usability as required, but at least every six months. Further use of the tempering liquid is only permissible if the inspection indicates this.

The test of the heat transfer liquid takes place according to DIN 51529; ("Testing and assessment of used heat carrier media"). Source: VDI 3033; DIN 51529.

9.3.4 Repair information

If you need to send in a unit for repair, it is essential to first contact the **LAUDA Service** (⇨ 9.4).
If the equipment does have to be returned to the factory, it may only be necessary to dismantle the control head from the bath vessel and return the control head.

– When sending in the unit, ensure that it is carefully and properly packed. LAUDA cannot be held liable for any damage caused by improper packing.

9.3.5 Disposal information

The following applies for EU member states: The device must be disposed of according to Directive 2012/19/EU (WEEE Waste of Electrical and Electronic Equipment).

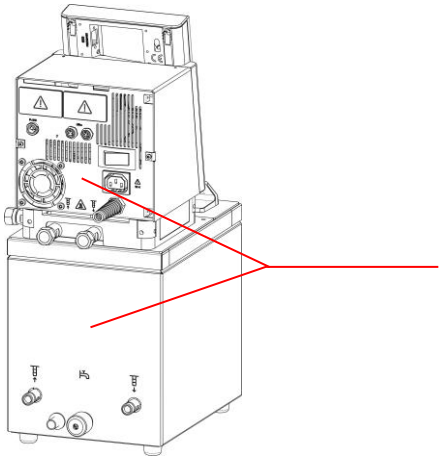
The disposal is regulated by EC Directive 2002/96/EC.

9.3.6 Disposal of the packaging

The following applies for EU member states: The disposal of the packaging must proceed according to the EC Directive 94/62/EC.

9.4 Service, ordering replacement parts and rating label

When ordering spares please state the serial number (rating label). This avoids queries and supply of incorrect items.



Contact the LAUDA Service in the following cases:

- In the event of faults on the device
- For technical questions about the device
- For spare part orders

Contact our Sales Department for application-specific questions.

LAUDA Service
Telephone: +49 (0)9343 503-350 (English and German)
E-mail service@lauda.de

We are available any time for your queries and suggestions!

LAUDA DR. R. WOBSER GMBH & CO. KG
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Germany
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Internet https://www.lauda.de

10 Accessories

Description	Application	Catalogue No.
RS 232/485 Interface modules	Digital Communication, (⇨ 8.3)	LRZ 913
Analogue module	Current and voltage interface (⇨ 8.3.1)	LRZ 912
RS 232 Cable (2 m)	Thermostat-PC Sub-D (9 pin. 9 pin).	EKS 037
RS 232 Cable (5 m)	Thermostat-PC Sub-D (9 pin. 9 pin).	EKS 057
Relays module with 3 input and 3 output channels	Import and export of thermostat signals (⇨ 8.5.1)	LRZ 915
Relays module with 1 input and 1 output channel.	NAMUR NE28 functionality (⇨ 8.5.2)	LRZ 914
T-piece adapter cable for the LAUDA internal bus (LiBus) ①.	For the connection of further LiBus components (with heating thermostats two LiBus connections are not occupied and one with cooling thermostats).	EKS 073
Extension for LiBus 5 m.	For LiBus components, but especially for remote operation with the Command remote control.	EKS 068
Extension for LiBus 25 m.		EKS 069
LAUDA DLK 10 Through-flow Cooler 230 V; 50/60 Hz, 250 W at 20 °C.	Extends the application temperature range of the Proline heating thermostats to -15 — 150 °C.	LFD 010
LAUDA DLK 25 Through-flow Cooler 230 V; 50Hz, 330 W at 20 °C.	Extends the application temperature range of the Proline heating thermostats to -30 — 150 °C.	LFD 108
Connection cable Proline to DLK 10 and DLK 25.	For the electrical connection between heating thermostat and through-flow cooler.	UK 263
LAUDA DLK 45 Through-flow Cooler, 230 V; 60 Hz, control via LiBus, 1100 W at 20 °C.	Extends the application temperature range of the Proline heating thermostats to -40 — 150 °C. Control via LiBus.	LFD 111
Cooling liquid valve with LiBus control.	For lowering the application temperature range with Proline thermostats to 15 °C	LCZ 9662
Automatic filling device with LiBus control.	Evaporating heat transfer liquid is automatically topped up.	LCZ 9661
Reverse flow protection with LiBus control (Shut down valve).	Prevents the return of heat transfer liquid into the bath from external containers located above the bath.	LCZ 9673
Controlled high temperature cooler HTC, controlled via LiBus	For the rapid cooling of high bath temperatures using water cooling.	LCZ 9663
Level controller without reverse-flow protection, mechanical control.	Keeps the liquid level in an open external bath at a constant level.	LCZ 0660

Description	Application	Catalogue No.
Raising platform 300 mm x 200 mm for P 18 C, RP 1840/1845 C.	For lowering and lifting out objects for P 18 C, RP 1840/1845 C.	LCZ 0664
Raising platform 300 mm x 350 mm for P 26 C, RP 3530 C.	For lowering and lifting out objects for P 26 C, RP 3530 C (depth 250 mm).	LCZ 0665
Rising platform for P 40 C	For lowering and lifting out objects adjustable platform for heating thermostat P 40	LCZ 0714
Application frame for 56 tubes, diam. 10-13 mm, 80 mm ID②.	2 frames fit in each of P 18 C, RP 1840 C and RP 1845 C; 4 frames fit in P 26 C.	UG 070
Application frame for 33 tubes, diam. 14-18 mm, 80 mm ID②.	2 frames fit in each of P 18 C, RP 1840 C and RP 1845 C; 4 frames fit in P 26 C.	UG 071
Application frame for 33 tubes, diam. 14-18 mm, 110 mm ID②.	2 frames fit in each of P 18 C, RP 1840 C and RP 1845 C; 4 frames fit in P 26 C.	UG 072
Application frame for 14 tubes, diam. 24-30 mm, 110 mm ID②.	2 frames fit in each of P 18 C, RP 1840 C and RP 1845 C; 4 frames fit in P 26 C.	UG 073
Application frame for 20 tubes, diam. 14-18 mm 80mm ID②.	1 frame fits in P 8 C, (P 12 C), RP 845 C, RP 855 C, RP 870 C, RP 890 C.	UG 076
Application frame for 20 tubes, diam. 14-18 mm 110 mm ID②.	1 frame fits in P 8 C, (P 12 C), RP 845 C, RP 855 C, RP 870 C, RP 890 C.	UG 077
Gable cover for beer forcing test, 0.3 litre bottles	For RP 3530 C and P 26 C.	LCZ 011
Gable cover for beer forcing test, 0.5 litre bottles	For RP 3530 C and P 26 C.	LCZ 058
Displacement body for 8 litre baths	The heating and cooling rates are reduced due to the bath volume being reduced to approx. 4 litres.	LCZ 0667
Wall bracket for Command remote control.	For mounting the console securely on the wall or on a laboratory stand.	LCZ 0659
Bath cover for calibration thermostats type PJ	Round cover for PJ 12, PJ 12 C, PJL 12, PJL 12 C.	HDR 028

① LiBus = LAUDA internal BUS (based on CAN)

② ID = Immersion depth for test tubes

We will inform you about other accessories on request (⇨ 9.4). Also, refer to our special and accessory broachers.

11 Technical data and diagrams

The figures have been determined according to DIN 12876

		Heating thermostat
		P 5 C
Working temp. range (WT) ①	°C	35 – 300
WT with water cooling	°C	20 – 300
Operating temperature range ②	°C	-30 – 300
Setting resolution	°C	Master: 0.1 / 0.01; Command: 0.01
Display resolution	°C	Master: 0.01 Command: 0.1 / 0.01 / 0.001
Accuracy of indication		±0.2 K can be calibrated additively (→ Section 1.2 last point)
Temperature stability	K	±0.01
Pump type / number of power levels		Pressure/ suction pump, 8 power levels
Discharge pressure maximum	bar	0.7 at Pump Power Level 8
Intake suction maximum	bar	0.4 at Pump Power Level 8
Flow rate maximum (pressure)	L/min	25 at Pump Power Level 8
Flow rate maximum (suction)	L/min	23 at Pump Power Level 8
Hose connections	mm	M16 x 1 / 13
Bath volume from – to	L	3.5 – 5.5
Bath opening B x L	mm	150 x 150
Bath depth	mm	200
Usable bath depth	mm	180
Height to top of bath	mm	254
Overall dims. W x D	mm	200 x 260
Height	mm	454 ③
Weight	kg	12
Heater power / power consumption		
230 V; 50/60 Hz	kW	3.5 / 3.6
115 V; 60 Hz	kW	1.8 / 1.8
200 V; 50/60 Hz	kW	2.8 / 2.9
100 V; 50/60 Hz	kW	1.4 / 1.4
208-220 V; 60 Hz	kW	3.5 / 3.6

① on pump output step 1. ② with external cooling. ③ put-on Command Remote Control: 56 mm higher.

Table 2		Clear view thermostats				
		PV 15 C	PV 24 C	PV 36 C	PVL 15 C	PVL 24 C
Working temp. range (WT) ①	°C	30 – 230	30 – 230	30 – 230	30 – 100	30 – 100
WT with water cooling	°C	20 – 230	20 – 230	20 – 230	20 – 100	20 – 100
Operating temperture range ②	°C	0 – 230	0 – 230	0 – 230	-60 – 100	-60 – 100
Setting resolution	°C	Master: 0,1 / 0,01; Command: 0,01				
Display resolution	°C	Master: 0,01 Command: 0,1 / 0,01 / 0,001				
Absolute accuracy	K	±0.2 can be calibrated additively (⇨ 1.2)				
Temperature stability	K	±0.01				
Pump type / number of power levels		Pressure pump, 8 power levels				
Discharge pressure max.	bar	0,8 at Pump Power Level 8				
Flow rate max. (pressure)	L/min	25 at Pump Power Level 8				
Hose connections	mm	M16 x 1 / 13				
Bath volume from – to	L	11 – 15	19 – 24	28 – 36	11 – 15	19 – 24
Bath opening B x L	mm	230 x 135	405 x 135	585 x 135	230 x 135	405 x 135
Bath depth	mm	320				
Usable bath depth	mm	285				
Size of glass panel W x H	mm	149 x 230	326 x 230	506 x 230	149 x 230	326 x 230
Height to top of bath	mm	390				
Overall dims. W x D	mm	506 x 282	740 x 282	1040 x 282	506 x 282	740 x 282
Height	mm	590 ③				
Weight	kg	26	36	44	28	39
Heater power / power consumption						
230 V; 50/60 Hz	kW	3.5 / 3.6				
115 V; 60 Hz	kW	1.8 / 1.8	---	---	1.8 / 1.8	1.8 / 1.8
200 V; 50/60 Hz	kW	---	2.8 / 2.9	2.8 / 2.9	---	---
100 V; 50/60 Hz	kW	1.4 / 1.4	---	---	1.4 / 1.4	1.4 / 1.4
208-220 V; 60 Hz	kW	---	3.5 / 3.6	3.5 / 3.6	---	---

① on pump output step 1. ② with external cooling. ③ put-on Command Remote Control: 56 mm higher.

Table 3		Bridge thermostats		Calibration thermostats	
		PB C	PBD C	PJ 12 C	PJL 12 C
Working temp. range (WT) ①	°C	30 – 300	30 – 300	30 – 300	30 – 200
WT with water cooling	°C	20 – 300	20 – 300	20 – 300	20 – 200
Operating temperture range ②	°C	-30 – 300	-30 – 300	0 – 300	-40 – 200
Setting resolution	°C	Master: 0,1 / 0,01; Command: 0,01			
Display resolution	°C	Master: 0,01 Command: 0,1 / 0,01 / 0,001			
Absolute accuracy	K	±0.2 can be calibrated additively (⇨ 1.2)			
Temperature stability	K	±0.01			
Pump type / number of power levels		Pressure/ suction pump, 8 power levels	Pressure pump, 8 power levels	Pressure pump, 8 power levels	
Discharge pressure max.	bar	0.7	1.1	0,8	
Intake suction max.	bar	0.4	--	--	
Flow rate max. (pressure)	L/min	25	32	25	
Flow rate max. (suction)	L/min	23	--	--	
Hose connections	mm	M16 x 1 / 13			
Bath volume from – to	L	to approx. 80	to approx. 80	8.5 – 13.5	8.5 – 13.5
Bath opening B x L	mm	--	--	120 ∅	120 ∅
Bath depth	mm	200 min	320 min	320	320
Usable bath depth	mm	Telescopic rod can be extended between 310 and 550 mm		300	
Size of glass panel W x H	mm	---	---	---	
Height to top of bath	mm	---	---	374	
Overall dims. W x D	mm	185 x 185	185 x 185	220 x 360	
Height	mm	400 ③	520 ③	574 ③	
Weight	kg	8	8	17	
Heater power / power consumption					
230 V; 50/60 Hz	kW	3.5 / 3.6			
115 V; 60 Hz	kW	1.8 / 1.8	1.8 / 1.8	1.8 / 1.8	1.8 / 1.8
200 V; 50/60 Hz	kW	---	---	2.8 / 2.9	2.8 / 2.9
100 V; 50/60 Hz	kW	1.4 / 1.4	1.4 / 1.4	1.4 / 1.4	1.4 / 1.4
208-220 V; 60 Hz	kW	---	---	3.5 / 3.6	3.5 / 3.6

① on pump output step 1. ② with external cooling. ③ put-on Command Remote Control: 56 mm higher.

Data applicable to all Proline heating thermostats		
Ambient temperature range	°C	5 – 40
Relative humidity		maximum relative humidity 80 % for temperatures up to 31 °C, decreasing linearly to 50 % relative humidity at 40 °C
Storage temperature range	°C	-20 – 50
Safety equipment		Class III to DIN 12876-1; FL suitable for flammable and non-flammable liquids
Class of protection for electrical operating equipment		Protection class I according to DIN EN 61140 (VDE 0140-1)
Class of protection		IP 21

Mains connection data

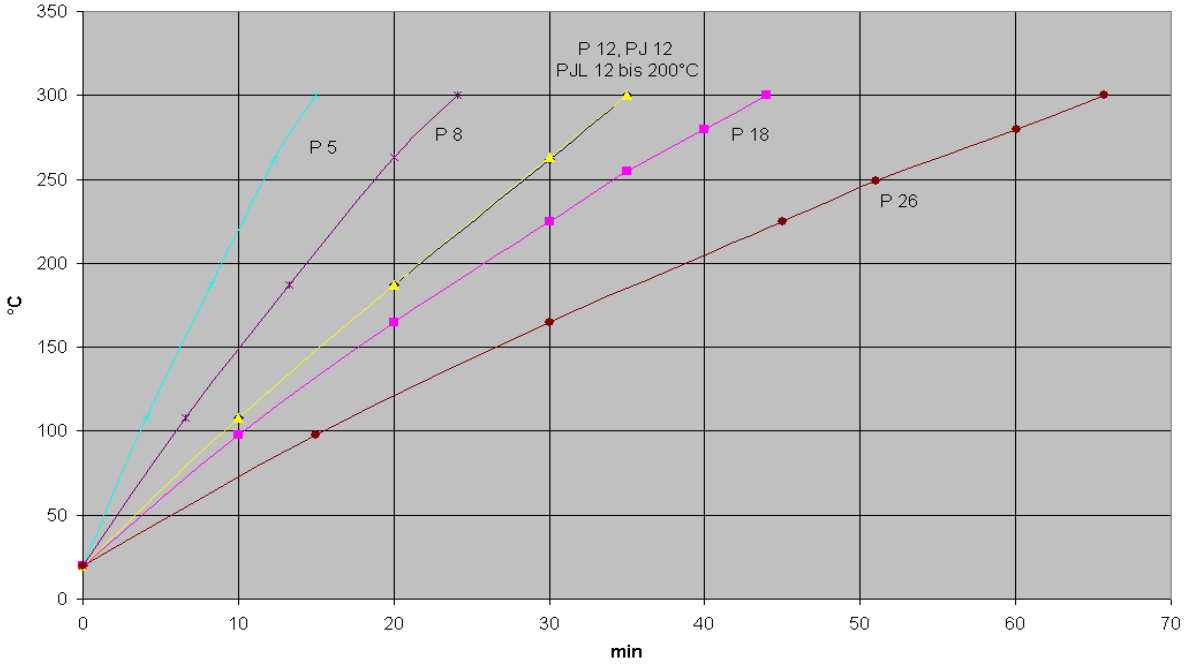
	P 5 C	PV 15 C	PV 24 C	PV 36 C
230 V ±10 %; 50/60 Hz	X	X	X	X
115 V ±10 %; 60 Hz	X	X	-----	-----
200 V ±10 %; 50/60 Hz	X	-----	X	X
100 V ±10 %; 50/60 Hz	X	X	-----	-----
208-220 V ±10 %; 60 Hz	X	-----	X	X

2	PVL 15 C	PVL 24 C	PB C	PBD C	PJ 12 C	PJL 12 C
230 V ±10 %; 50/60 Hz	X	X	X	X	X	X
115 V ±10 %; 60 Hz	X	X	X	X	X	X
200 V ±10 %; 50/60 Hz	-----	-----	-----	-----	X	X
100 V ±10 %; 50/60 Hz	X	X	X	X	X	X
208-220 V ±10 %; 60 Hz	-----	-----	-----	-----	X	X

Technical modifications reserved.

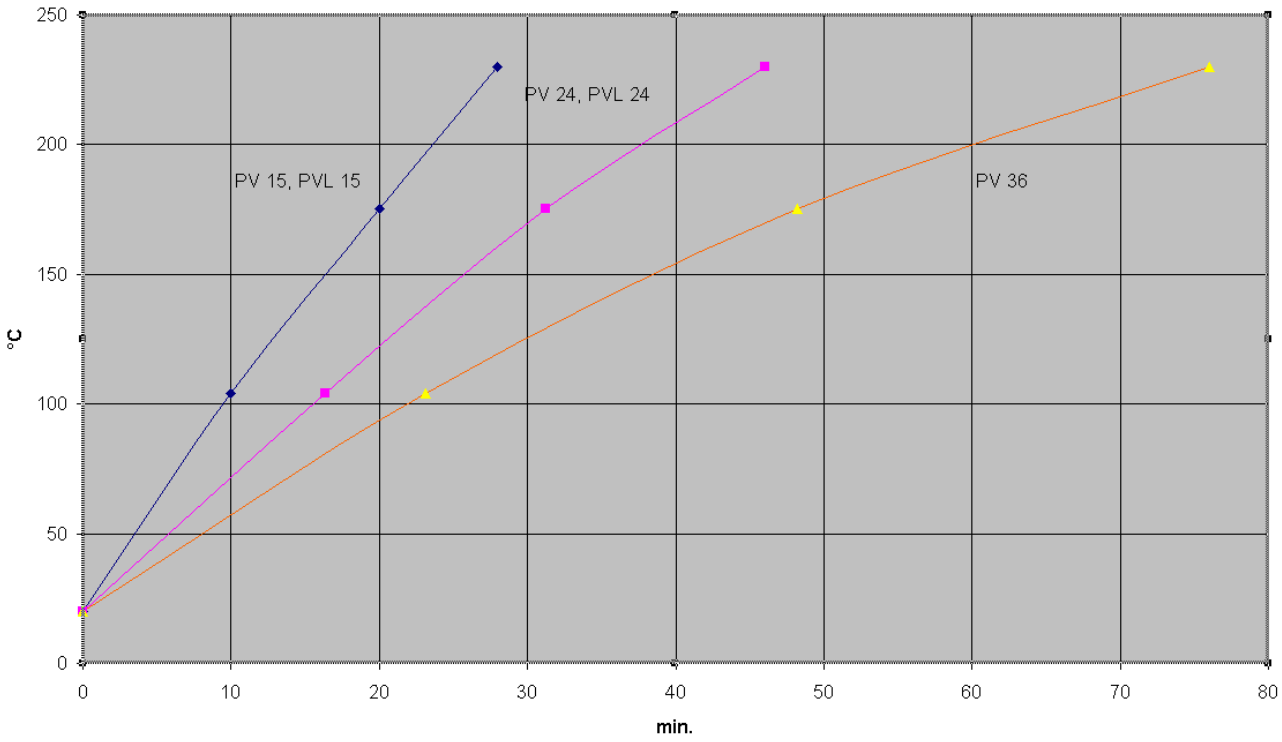
Heating curve for P 5 C, PJ 12, PJL 12 (PJL 12 up to 200 °C)

measured with Ultra 300, bath covered



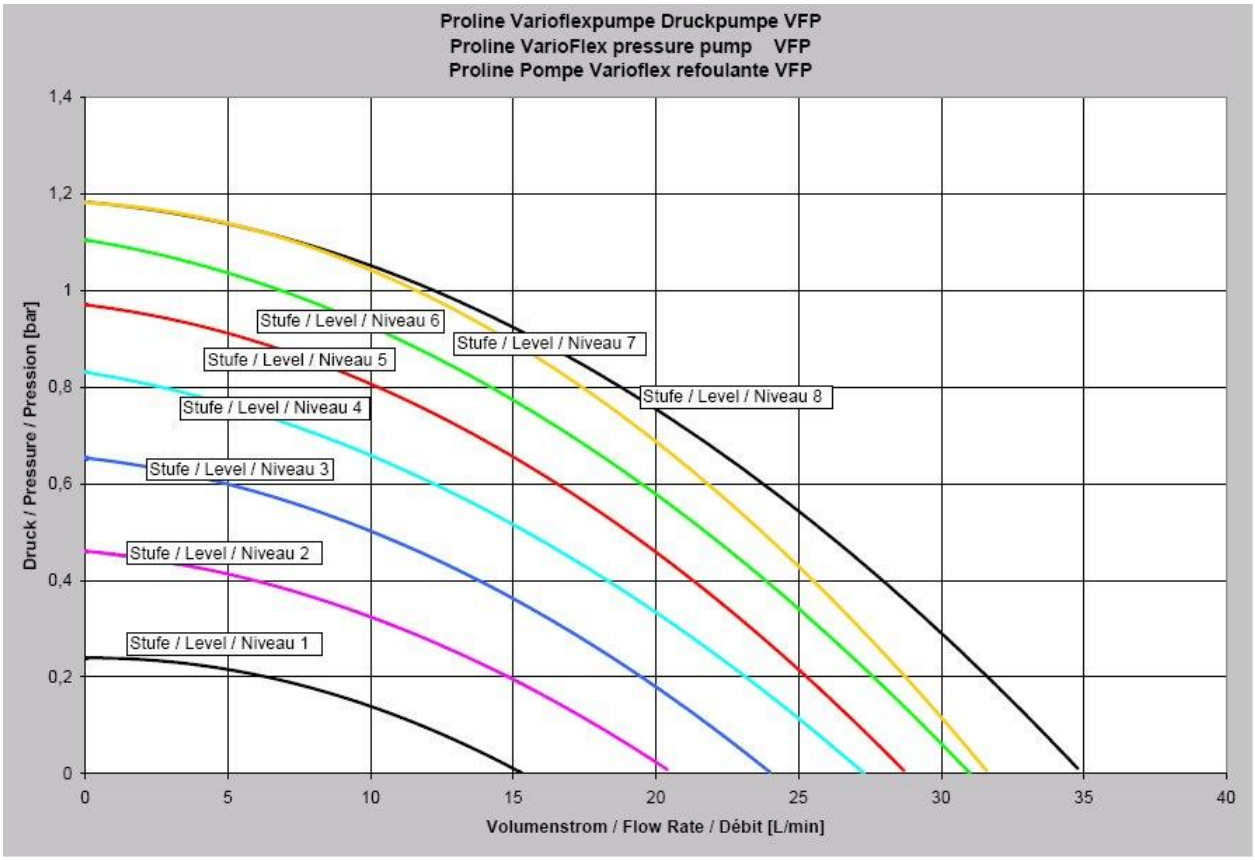
Heating curve for PV 15, PV 24, PV 36, PVL 15, PVL 24 (PVL 15 and PVL 24 up to 100 °C)

measured with Ultra 230, bath covered



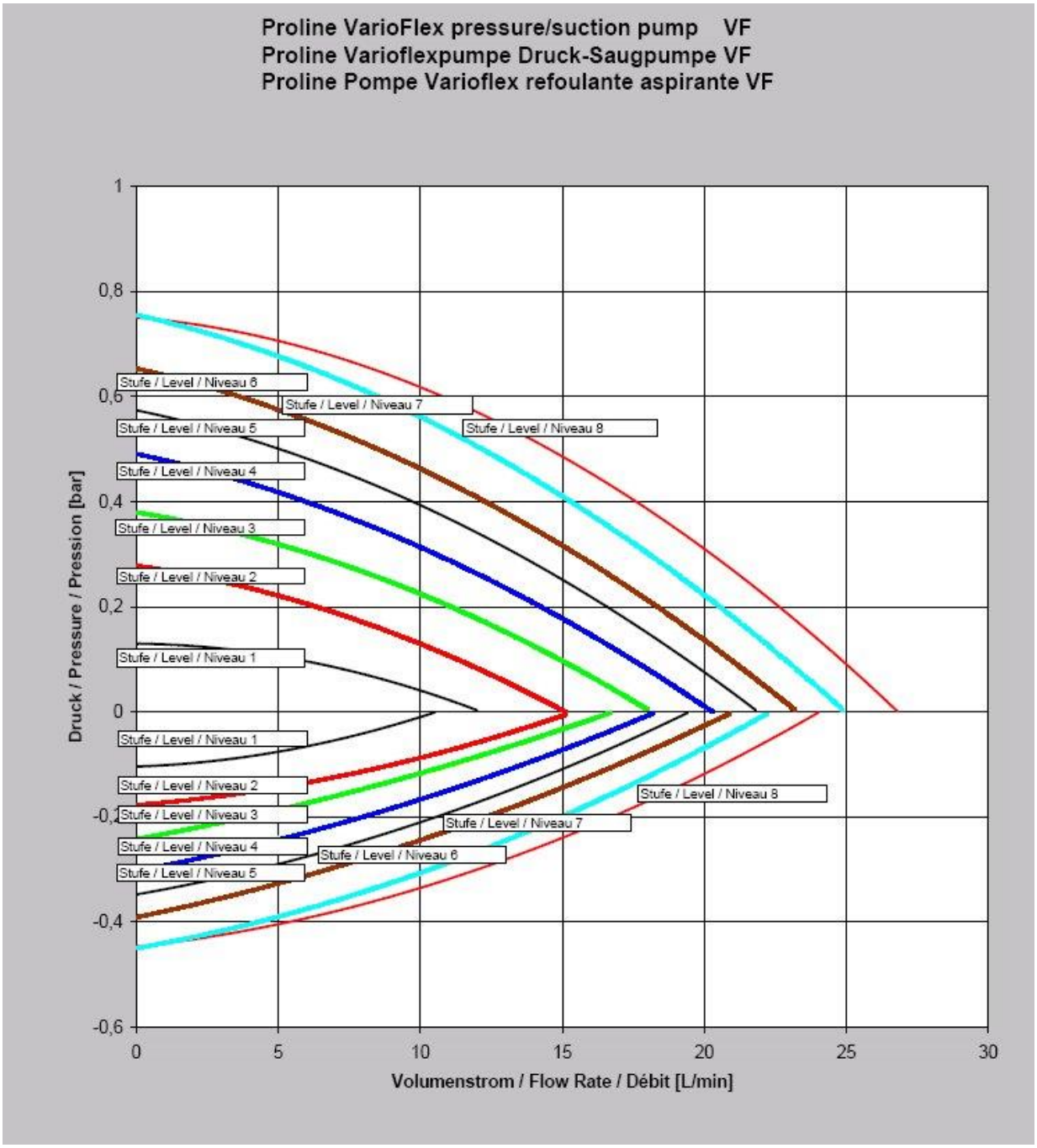
Pump characteristics

measured with water



Pump characteristics

measured with water



12 Declaration of Conformity

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: Proline **Serial number:** from S210000001

Types: P 5, PJ 12, PJL 12, PB, PBD, PV 15, PV 24, PV 36, PVL 15, PVL 24

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 equipment is not covered by the Pressure Equipment Directive 2014/68/EU, as the maximum classification of the equipment is Category 1 and it is covered by the Machinery Directive.

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)
- EN 61010-2-010:2015 (IEC 61010-2-010:2014)

Authorized representative for the composition of the technical documentation:

Dr. Jürgen Dirscherl, Director Research & Development

Lauda-Königshofen, 23.09.2021

A. Dinger

Dr. Alexander Dinger, Head of Quality Management

Document number: Q5WA-QA13-022-EN Version 04

°FAHRENHEIT. °CELSIUS. °LAUDA.

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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

Manufacturer
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