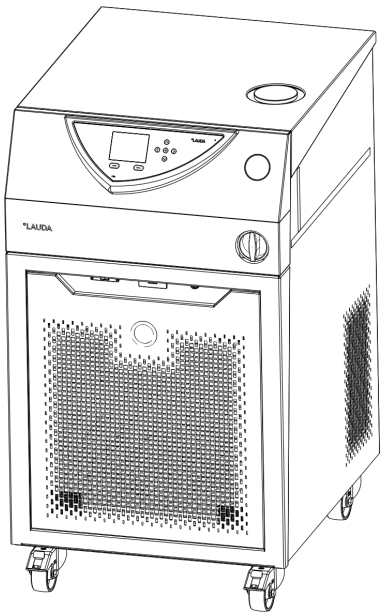
Operation manual

Variocool

VC 1200 (W), VC 2000 (W)

Process thermostat containing natural refrigerant



V1R40

Read this manual prior to performing any task!

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Q4DA-E_13-038, 1, en_US

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1 Safety

1.1 General safety instructions

- The devices can only be operated as intended under the conditions specified in this operating manual. Any other mode of operation is considered to be unintended use and could compromise the protection provided by the device.
- The devices are not designed for use in medical applications in accordance with DIN EN 60601-1 and IEC 601-1!
- This operating manual is part of the device. The information in this operating manual must therefore be kept at hand in the immediate vicinity of the device. Be sure to carefully store this copy of the operating manual.

If this operating manual is lost, contact LAUDA Service. You will find the contact information here Chapter 13.4 “Contact LAUDA ” on page 96.

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

- If relevant, safety fittings are available for the device. This equipment is critical to the safety of the device. Appropriate maintenance activities must be implemented to ensure the device remains in good working order.
  The safety fittings for the device are described in this "Safety" chapter.
- If relevant, various warning symbols are located on the device. These warning symbols must be followed at all times.
  The warning symbols on the device are described in this "Safety" chapter.
- This operating manual contains safety information. These warning symbols must be followed at all times.
- Personnel and the protective equipment worn by personnel are also subject to specific requirements.
  These requirements are described in this "Safety" chapter.

An overview of authorized personnel and protective equipment can be found in Chapter 1.12 “Personnel qualification” on page 11 *and* Chapter 1.13 “Personal protective equipment” on page 11.

Refer to Chapter 1.15 “Structure of warnings” on page 11 *for more information on the general structure of warnings.*

1.2 Obligations of the operator

Observe the national regulations for operating the system in the country in which the system is installed.

In particular, the application of statutory regulations concerning operational safety must be observed.

Note the installation conditions outlined in Chapter 11.1 “General and type-specific data” on page 88.

1.3 Observing additional operating instructions

Interface modules

Additional interface modules can be fitted to the device. Before installing and using interface modules, always read and observe the operating manual accompanying the relevant interface module.

1.4 Limits of the device

1.4.1 Use

Intended use

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

Reasonably foreseeable improper use

Operating the device...

- without heat transfer liquid
- with a flammable heat transfer liquid
- with an unsuitable heat transfer liquid
- for medical applications
- Use in hazardous areas
- Use for controlling the temperature of foodstuffs
- Operation with a glass reactor without gage pressure protection
- in an outdoor installation
- with an open application
- with cables that are faulty, unsuitable or do not conform to standards
- with incorrectly connected hoses
- on a table-like surface
- with incorrectly set pump pressure

Type of power supply

The device is supplied with...

- Electrical energy (each device)

Performance limits, operating values

- See the Technical Data chapter

1.4.2 Application area

The device may only be used in the following areas:

- Production, quality assurance, research and development in an industrial environment
- Use inside buildings
- Within an ambient temperature range of 5 to 40°C
- Maximum relative humidity 80% at temperatures up to 31°C, linearly decreasing to 50% relative humidity at 40°C

- At a maximum altitude of 2,000 m above sea level
- Fluctuations of the mains voltage up to ± 10 % of the nominal voltage
- Surge category II
- Pollution degree 2
- Storage temperature range of 5 to 40°C
- Transport temperature range of -20 to 43°C

1.4.3 Time limits

Service life - The device is designed for 20,000 operating hours.

Maintenance intervals - Chapter 7.2 “Maintenance intervals” on page 72

1.5 EMC requirements

Table 1: Classification in accordance with EMC requirements

Device	Interference immunity	Emissions class	Customer power supply
Variocool	Type 2 in accordance with DIN EN 61326-1	Emissions Class B in accordance with CISPR 11	Only for EU Domestic connection value ≥ 100 A
Variocool	Type 2 in accordance with DIN EN 61326-1	Emissions Class B in accordance with CISPR 11	Rest of the world (outside EU) No limitation

1.6 Software versions

These operating instructions are valid for devices using the following software versions onwards.

Software	valid from version
Command operating system	3.45
Control system	1.35
Analogue IO module	3.24
RS 232/485 module	3.22
Digital IO module	3.14
External temperature module	1.35
Ethernet module	1.23
EtherCAT module	1.06

1.7 Prohibition of modifications to the device

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

1.8 Natural refrigerant

The devices are filled with natural refrigerant.

The cooling units are permanently sealed systems, containing less than 0.15 kg of refrigerant from safety group A3. The natural refrigerants are highly flammable. Due to the low filling weight and sealed design, there are no special installation requirements.
The application area is only classified from a filling weight of over 0.15 kg depending on the installation location and the requirements for using the space.

The refrigerant designation and charge are specified on the type plate and in the ↳ Chapter 11.3 “Refrigerant and filling charge” on page 90.

1.9 Requirements for the heat transfer liquid

- Heat transfer liquids are used to control the temperature. LAUDA heat transfer liquids are recommended for the constant temperature equipment. LAUDA heat transfer liquids have been tested by the company LAUDA DR. R. WOBSER GMBH & CO. KG and approved for this device.
- The heat transfer liquids are suitable for a specific temperature range. This temperature range must correspond with the temperature range of your application.
- Hazards caused by high or low temperatures or fire may arise during operation if the heat transfer liquid exceeds or falls below certain temperatures or if the container ruptures causing a reaction with the heat transfer liquid.
- The safety data sheet of the heat transfer liquid specifies hazards and the corresponding safety measures required for handling the liquid. The safety data sheet of the heat transfer liquid must therefore be observed to ensure proper use of the device.
- If you wish to use your own heat transfer liquids, check to ensure that the fluids are compatible with the materials used.
- The heat transfer liquid must be provided with corrosion protection.

1.10 Materials

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

1.11 Hose requirements

The hoses for the external hydraulic circuit must be resistant to:

- the heat transfer liquid used
- the pressure in the hydraulic circuit
- the high and low working temperatures

1.12 Personnel qualification

Operating personnel

Operating personnel are personnel who have been instructed by qualified personnel on how use the device as intended in line with the information in the operating manual.

1.13 Personal protective equipment

Protective gloves

Protective gloves must be worn for certain tasks. The protective gloves must comply with the standard DIN EN 374. The protective gloves must be chemically resistant.

Protective work clothing

Protective clothing must be worn for certain tasks. This protective clothing must meet the legal requirements for personal protective equipment. The protective clothing should be long-sleeved. Additionally safety shoes are required.

Safety glasses

Safety glasses must be worn for certain tasks. The safety glasses must comply with the standard DIN EN 166. The glasses must be tightly closed and equipped with side plates.

1.14 Product safety label

Hot

A "Hot surface" graphical symbol is affixed to the device. This symbol warns against hot surfaces on the device. These surfaces must not be touched during operation. These surfaces must be allowed to cool to room temperature before they can be touched during other operation phases such as servicing.

1.15 Structure of warnings

Warning signs	Type of danger
	Warning – dangerous electrical voltage.
	Warning – explosive substances.
	Warning – flammable substances.

Warning signs	Type of danger
	Warning – hot surface.
	Warning – slip hazard.
	Warning – toxic substances.
	Warning – danger zone.

Signal word	Meaning
DANGER!	This combination of symbol and signal word indicates an imminently dangerous situation that will result in death or serious injury if it is not avoided.
WARNING!	This combination of symbol and signal word indicates a potentially dangerous situation that can result in death or serious injury if it is not avoided.
CAUTION!	This combination of symbol and signal word indicates a possible dangerous situation that can result in minor injury if it is not avoided.
NOTICE!	This combination of symbol and signal word indicates a potentially dangerous situation that can result in material and environmental damage if it is not avoided.

2 Unpacking

WARNING!
Leaks in the cooling circuit due to transport damage

Fire

- If you notice any damage to the transport packaging, store the device either in a well-ventilated place with no sources of ignition or outdoors. Contact LAUDA Service.

Personnel: ■ Operating personnel

1. Unpack the device.

Keep the original packaging of the device for subsequent transportation.

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

If the device or accessories are damaged contrary to expectations, immediately inform the shipping company so that a damage report can be compiled and the transport damage inspected. Also notify LAUDA Constant Temperature Equipment Service department immediately. You will find the contact information here ↳ Chapter 13.4 “Contact LAUDA ” on page 96.

Table 2: Accessories included as standard

Device type	Designation	Quantity	Catalog number
VC 1200 (W), VC 2000 (W)	Pump connection: Hose nozzle ¾" with union nut ¾"	2	EOA 004
Devices with water cooling	Hose nozzle ½" with screw cap ¾"	2	EOA 001
All devices	Operating manual	1	--

3 Device description

3.1 Device types

The names of the devices consist of the following components.

Component	Description
VC	Variocool
<Number> e.g. 2000	Nominal cooling capacity in watts [W] at 20°C
W	Device with water cooling This indication in the device type denotes water-cooled devices.

- All devices are equipped with a bypass for regulation of the pump pressure.
- All devices are designed as floor-standing units. The devices are equipped with castors with locking brakes.

3.2 Setup of the device

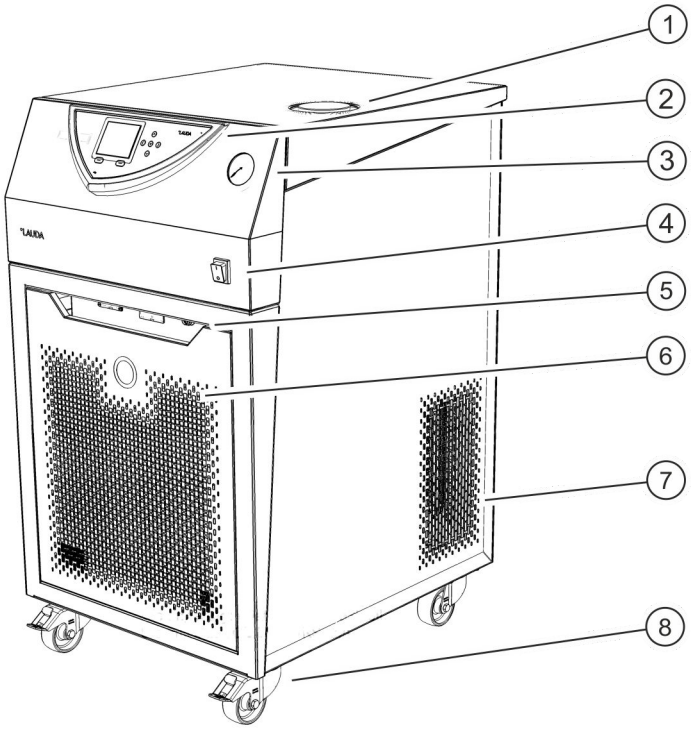


Fig. 1: Front of the VC 2000

1 Filler nozzle with cover
2 Control panel
3 Pressure gauge
4 Mains switch
5 Alarm output and module bays
6 Front panel (ventilation openings only in case of air-cooled devices)
7 Ventilation openings (on both sides)
8 Four castors (front castors with locking brake)

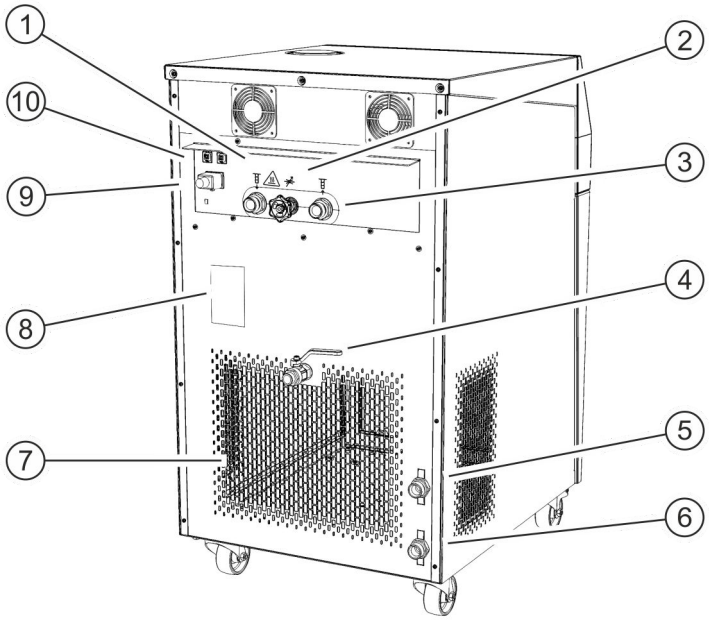


Fig. 2: Back of the VC 2000 W

1 Pump connection, outflow
2 Bypass adjusting wheel
3 Pump connection, outlet
4 Drain tap
5 Connecting sleeve for water cooling outlet (only available for water-cooled devices)
6 Connecting sleeve for water cooling intake (only available for water-cooled devices)
7 Ventilation grid
8 Type plate
9 Power supply
10 Fuses (up to and including VC 2000 (W))

Control panel

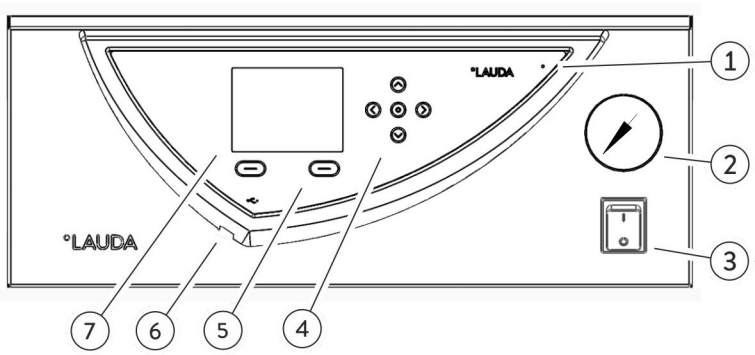


Fig. 3: Control panel

1 Light sensor
2 Pressure gauge
3 Mains switch
4 Entry key and arrow keys
5 Soft keys (left and right)
6 USB interface Type B (on the side of the control panel)
7 TFT display

3.3 Operating elements

3.3.1 Mains switch

VC 2000 (W) or lower

The mains switch can be set to the following positions:

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

3.3.2 Display buttons

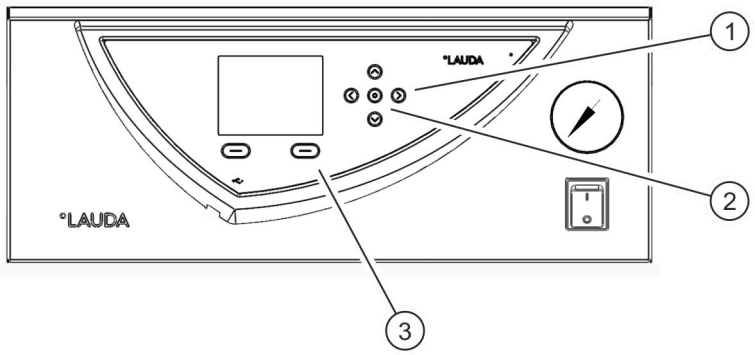


Fig. 4: Display buttons

1 Arrow buttons
2 Enter key
3 Soft keys

Functions in the device display can be controlled by means of the display buttons.

- The up, down, right and left arrow buttons can be used to navigate in the display.
- The Enter button can be used to confirm a selection in the display.
- The soft keys can be used to control the functions indicated on the display for these keys.

3.4 Functional elements

3.4.1 Hydraulic circuit

The hydraulic circuit refers to the circuit that the heat transfer liquid flows through.

Fig. 5: Pressure gauge

The circuit essentially consists of the following components:

- Internal expansion bath with heat transfer liquid
- Submersible pump for conveying the heat transfer liquid to the external consuming unit via the pump connections
- Adjustable bypass with pressure gauge for adjusting the pump pressure to the requirements of the external consuming unit.
- Cooling coil in the bath boiler for cooling the heat transfer liquid
- Heater in the bath boiler for heating the heat transfer liquid

You will find further information on the technical data for the pump in ↳ Chapter 11.4 “Filling volume and characteristics of the pumps” on page 91.

3.4.2 Cooling unit

The cooling unit consists of the following main components:

- Compressor
  The compressor is equipped with a motor protection switch which reacts to the temperature and current consumption of the compressor.
- Condenser
  An air-cooled or water-cooled condenser is used in the cooling unit depending on the device type. The heated air is discharged to the environment in air-cooled condensers. Fresh air is drawn in through the front of the device by means of a fan, heated and then discharged at the back of the device for this purpose. The heat is dissipated via the cooling water circuit in the case of water-cooled condensers.
- Evaporator
  Heat is dissipated via a tube coil evaporator in the internal bath.

You will find technical data on the cooling unit in ↳ Chapter 11.2 “Cooling output” on page 89.

3.4.3 Interfaces

A general overview of the standard interfaces and the optional interface modules of the device can be found in the following sections.

The equipment connected to the low-voltage inputs and low-voltage outputs must have safe separation from dangerous to touch voltages according to DIN EN 61140 such as by the use of double or reinforced insulation according to DIN EN 60730-1 or DIN 60950-1.

The installation of these additional interface modules is described in these operating instructions. Further information regarding wiring and the use of these interface modules is provided in the separate operating instructions for the interface modules. The respective operating instructions must be consulted regarding appropriate use.

USB interface

The devices are equipped with a USB interface (type B) as standard. This interface enables connection to a PC. Software updates are installed on the device via this interface (only for updaters, no process interface).

Alarm output

The devices are equipped with an alarm output as standard equipment. This changeover contact is switched if the device changes to the standby state or if an alarm is triggered. Reverse flow protection can be activated in this way or faults can be registered on a system.

Additional interface modules

Devices can be supplemented with additional interface modules.

- **Analogue module** (catalogue number LRZ 912). Has 2 inputs and 2 outputs on a 6-pin DIN socket. The inputs and outputs can be adjusted independently as 0 – 20 mA, 4 – 20 mA or 0 – 10 V interfaces. For power supply of an external sensor with evaluation electronics, the socket is supplied with 20 V.
- **Pt100- / LiBus module** (catalogue number LRZ 918). An external temperature probe can be connected to the Pt100 interface of the module, which can be used as external control probe. The Command remote control can be used with the constant temperature equipment via the LiBus interface. A solenoid valve for cooling water control or reverse flow protection can, for example be connected.
- **LiBus module** (catalogue number LRZ 920). The Command remote control can be used with the constant temperature equipment via the LiBus connection. It is also possible to connect additional modules (such as the LRZ 918, but without Pt100 interface). A solenoid valve for cooling water control or reverse flow protection can, for example be connected in this way.
- **RS 232/485 module Advanced** (catalogue no. LRZ 926) with connection via 9-pin D-Sub socket. Galvanically separated by an optocoupler. The RS 232 interface can be connected directly with the PC using a straight-through cable.

- **Contact module Advanced** (catalogue number LRZ 927) with plug connector according to NAMUR NE28. This contact module is designed to be identical to the LRZ 928, but with only 1 output and 1 input each on 2 sockets. The coupling socket (catalogue number EQD 047) and the coupling plug (catalogue number EQS 048) are 3-pin connectors.
- **Contact module Advanced** (catalogue number LRZ 928) with connection via 15-pin D-Sub socket. With 3 relay contact outputs (changeover contact, maximum 30 V / 0.2 A) and 3 binary inputs for control via external potential-free contacts.
- **Profibus module Advanced** (order number LRZ 929) with connection via 9-pin D-Sub socket. The Profibus is a bus system with a high signal data transfer rate for the connection of to up to 256 devices.
- **Ethernet module Advanced** (catalogue number LRZ 930). The module provides the customer with the opportunity to monitor and control thermostatic regulation processes that are performed with a LAUDA constant temperature equipment via Ethernet using the LAUDA interface command set.

  Currently, the USB interfaces of the module are not functional.
- **EtherCAT module** (catalogue number LRZ 922) with connection via M8 sockets. **EtherCAT module** (catalogue number LRZ 923) with connection via RJ45 sockets. EtherCAT is an Ethernet-based field bus with master-slave functionality.
- **Profinet module Advanced** (catalogue number LRZ 932) with connections via RJ45 sockets. Profinet is an industrial Ethernet-based communication protocol that enables fast and reliable data transmission between automation components in industrial networks.
- **CAN module Advanced** (catalogue number LRZ 933) with connection via 9-pin D-Sub socket. CAN is a robust, serial bus system for networking control devices in industrial applications that offers a high level of transmission reliability and resistance to interference.

Detailed information for the connection and use of these interfaces can be found in the operating manual of the respective LAUDA interface module.

3.5 Equipment

More powerful pump

For devices with a 230-volt power supply, a more powerful pump can be installed. A higher pump power reduces the cooling capacity by more than 80 W. The height of VC 1200 (W) and VC 2000 (W) devices is increased as a result. A more powerful pump can only be installed at the factory.

Insulation of the cooling water hydraulics

The cooling water hydraulics can be insulated in all water-cooled devices . The insulation is installed at the factory or retrofitted on site by LAUDA Service.

3.6 Type plate

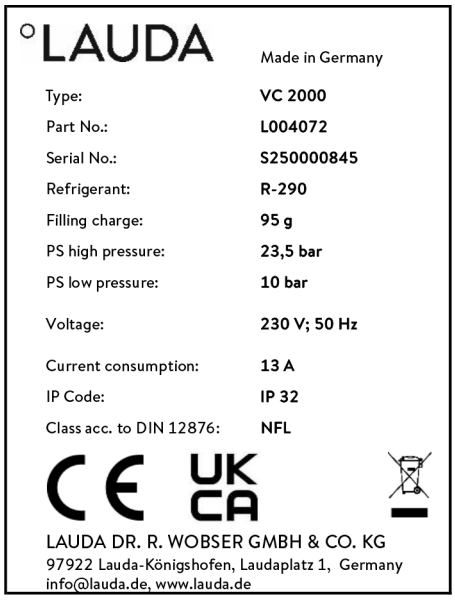


Fig. 6: Type plate (example)

The specifications on the type plate are described in more detail in the following table. Certain specifications depend on the equipment installed.

Specification	Description
Type:	Device type
Part No.:	Catalog number of the device
Serial no.:	Serial number of the device
Refrigerant:	Designation of the refrigerant being used
Filling charge:	Filling charge of the refrigerating machine
PS high pressure:	Maximum permitted working pressure on the refrigerant high-pressure side
PS low pressure:	Maximum permitted working pressure on the refrigerant low-pressure side
Voltage:	Device may only be operated with this distribution voltage and frequency
Current consumption:	Maximum current consumption of the device during operation
IP code:	IP protection level of the device
Class according to DIN 12876:	German standard for electrical laboratory equipment

4 Before starting up

4.1 Install device

Special installation conditions apply to the devices. These installation conditions are specified for the most part in the technical data for the device.

You will find further information on the technical data in
Chapter 11.1 “General and type-specific data” on page 88.

Additional installation conditions are described in the following.

- Irritant vapors may develop, depending on the heat transfer liquid and operating mode used. Always ensure that the vapors are adequately extracted.
- Note the electromagnetic compatibility (EMC) requirements of the device.
- Do not cover the ventilation openings.

You will find further information on the EMC requirements in
Chapter 1.5 “EMC requirements” on page 9.

Personnel: ■ Operating personnel

DANGER!
The function of the drain is disrupted

Electric shock

- Drainage hose must slope downwards all the way into a collecting vessel.

WARNING!
Rolling away or overturning of the device due to incorrect handling

Impact, crushing

- Do not tilt the device.
- Position the device on an even, non-slip surface with a sufficient load carrying capacity.
- Actuate the castor brake when setting up the device.
- Do not place heavy parts on the device.

WARNING!
Danger of overpressure if ambient temperature is too high

Injury, escape of refrigerant, fire

- Note the permissible ambient temperature and storage temperature.

CAUTION!
Escaping heat transfer liquid

Scalding, cold burns

- The temperature and media resistance of the hoses must be suitable for the application.
- Use hoses with a greater compressive strength than the maximum possible pump pressure. For liquids with a density above 1 kg/dm^3, the pump pressure must be converted according to the density.
- Use pressure-resistant external applications or safety valves in the hydraulic circuit.
- When laying the hoses for the application, make sure that the hoses cannot be kinked or crushed.

1. Place the devices on a suitable level surface.

   The devices can be moved. To do this, release the parking brakes on the castors by pushing the lever upward.

2. Lock the castors of the device. Press the lever down with your foot to lock.

4.2 Connecting an application

4.2.1 Temperature control hoses and hose clips

WARNING!
Contact with hot or cold hoses

Hot and cold burns

- Use insulated hoses for temperatures below 0 °C and above 70 °C.

The hoses described below can be used for all heat transfer liquids approved for the devices.

Table 3: Hoses

Type	Device Pump connection	Required accessories (hose nozzle and union nut provided on device as standard)	Maximum working pressure	Clearance width x outer diameter in mm	Temperature range in °C	Catalog number
EPDM hose with fabric reinforcement	VC 1200, VC 2000 (W) G ¾ (15), hose nozzle ¾"	Hose nozzle with union nut EOA 004	10 bar	19 x 27	-40 – 100	RKJ 032

Table 4: Hose clips

Suitable for hose	Clear Ø in mm	Catalog number
RKJ 112, RKJ 031	12 – 22	EZS 013

4.2.2 Connecting an external application

CAUTION!
Escaping heat transfer liquid

Scalding, cold burns

- Use appropriate safety gloves when connecting external application.

CAUTION!
Overflow of heat transfer liquid

Scalding, cold burns

- Do not overfill the device.
  Please note the level display and keep in mind that the heat transfer liquid will increase in volume when heated (for the total volume with application and hoses).

CAUTION!
Risk of heat transfer liquid escaping during operation due to open application

Scalding, cold burns

- Always use hydraulically sealed applications.

CAUTION!
Bursting of the external application due to excessive pressure

Scalding, cold burns

- If the external application is located in a lower position and is sensitive to pressure, also take into account the additional pressure resulting from the difference in height between the application and the device.
- For pressure-sensitive applications (for example, glass apparatus) with a maximum permissible working pressure below the maximum pressure of the pump (see Technical data section), the hoses of the application must be laid in such a way that bending or squeezing is not possible.
- A separate safety valve must be installed in the outflow to protect against operating errors.
- The bypass is used to adjust the pump pressure according to your application.

1. To prevent damage to the consuming unit, open the bypass adjusting wheel on the back of the device to the full extent before switching on. Turn the wheel counterclockwise to do this.
2. Temperature control hoses: Always use the largest possible diameters and shortest possible hoses in the external circuit.

   If the temperature control hose diameter is too narrow, the insufficient flow rate will cause a drop in temperature between the constant temperature equipment and the external consuming unit. In this case, increase or decrease the temperature accordingly.
3. Secure the temperature control hoses using hose clips.

Please note:

- When external consuming units are positioned higher than the device, the external volume may run dry when the pump is switched off and air enters the external fluid circuit, even when the circuits are closed. There is then a danger that the device will overflow.
- If a hose breaks hot liquids may leak out, thus endangering people and materials.

4.3 Cooling water

4.3.1 Cooling water requirements

This section is relevant for:

- Water-cooled devices

The following text is relevant for devices containing less than 150 g of flammable refrigerant (see type plate or technical data).

- Fill quantity per refrigeration circuit < 150 g. According to standard DIN EN 378-1, sealed refrigeration systems below this filling limit are not subject to any special requirements regarding installation location, room volume or access area. Accordingly, no additional security measures are required.

WARNING!
Refrigerant circuit becomes leaky due to corrosion

	Fire
	● Do not use corrosive cooling water.

Requirements

Cooling water is subject to specific purity requirements. A suitable procedure must be employed to purify the cooling water in line with the contamination in the water and maintain the water quality. Unsuitable cooling water may cause the condenser and the entire cooling water circuit to become blocked or damaged, or start to leak. The entire cooling circuit and cooling water circuit may sustain extensive consequential damage as a result.

- Free chlorine consisting of disinfectant, for example, and water containing chloride will cause pitting corrosion in the cooling water circuit.
- Distilled, deionized and demineralized water are unsuitable due to their reactivity and will cause corrosion in the cooling water circuit.
- Sea water is unsuitable due to its corrosive properties and will cause corrosion in the cooling water circuit.
- Iron particles and water containing iron will cause corrosion in the cooling water circuit.
- Hard water is unsuitable for cooling due to the high lime content and will lead to calcification of the cooling water circuit.
- Cooling water containing suspended matter is unsuitable.
- Untreated, unpurified water such as river water or cooling tower water is unsuitable due to its microbiological content (bacteria), which can settle inside the cooling water circuit.

Suitable cooling water quality

Data	Value	Unit
pH value	7.5 – 9.0	---

Data	Value	Unit
Hydrocarbonate [HCO_3^-]	70 – 300	mg/L
Chloride	< 50	mg/L
Sulfate [SO_4^{2-}]	< 70	mg/L
Ratio hydrogen carbonate [HCO_3^-] / sulfate [SO_4^{2-}]	> 1	---
Total water hardness	4.0 – 8.5	°dH
Electrical conductivity	30 – 500	µS/cm
Sulfite (SO_3^{2-})	< 1	mg/L
Free chlorine gas (Cl_2)	< 0.5	mg/L
Nitrate (NO_3^-)	< 100	mg/L
Ammonia (NH_3)	Not permitted	---
Iron (Fe), dissolved	< 0.2	mg/L
Manganese (Mn), dissolved	< 0.05	mg/L
Aluminum (Al), dissolved	< 0.2	mg/L
Free aggressive carbon dioxide (CO_2)	Not permitted	---
Hydrogen sulfide (H_2S)	Not permitted	---
Algae growth	Not permitted	---
Suspended matter	Not permitted	---

4.3.2 Connecting the cooling water

Specification	Value
Maximum cooling water pressure	10 bar
Differential pressure of cooling water Δp	1 – 6 bar VC 1200 W and VC 2000 W
Cooling water temperature	approx. 15°C is recommended, 10 – 30°C permitted (in the upper range with performance limitations)

Please note the following:

- Secure the cooling water hoses to the device using hose clips.
- Secure the water cooling return hose in the outlet area to prevent the hose from jerking suddenly, even when pressure surges occur.
  Secure the water cooling return hose in the outlet area in such a way that hot cooling water cannot spray out.
- Avoid kinking or crushing the hoses.

- We recommend using a leakage water detector with water shut-off function to prevent leakages from causing damage in the cooling water system.
- Ensure that the cooling water fulfills the necessary criteria.
- If the condenser leaks, there is a danger of the refrigerating machine oil and refrigerant from the device's refrigerant circuit mixing with the cooling water. Observe the legal requirements and provisions of the water supply company applicable at the operation site.

4.4 Heat transfer liquids

WARNING!
Use of unsuitable heat transfer liquid

Mutation, poisoning, environmental hazard, equipment damage

- Heat transfer liquids from LAUDA are recommended.
- If you wish to use your own heat transfer liquids, you must check that the fluids are suitable for the materials used. The heat transfer liquid must be provided with corrosion protection. You must also test the suitability of the liquid by performing a test run within the desired temperature range. During the test run, you must also check the low-level protection.
- Select a heat transfer liquid with a temperature range suitable for the application.
- Do not use flammable heat transfer liquids.
- Do not use any heat transfer fluid that is radioactive, toxic or environmentally hazardous.
- Do not use deionized water as a heat transfer liquid.
- Only use heat transfer liquids that are approved for heat transfer systems.
- Use heat transfer fluids with a kinematic viscosity of less than 180 mm^2/s during operation.
- Use heat transfer fluids with a density in the range of 0.75 to 1.8 g/cm^3.

Note:

- The heat transfer liquids each cover a recommended temperature range and must be suitable for the temperature range of your application.
- At the lower limit of the temperature range, the heat transfer liquid becomes more viscous and influences temperature stability, pump power and cooling capacity. The formation of vapours and odours increases in the upper range. Therefore, only use all of the temperature range if required. Particularly with Aqua 90 (water), ice forms which can result in destruction of the device.
- Never use contaminated or degenerated heat transfer liquid.
- Observe the safety data sheet of the heat transfer liquid. You can request the safety data sheets of the heat transfer liquid at any time if required.

Table 5: Approved heat transfer liquids

LAUDA designation	Chemical designation	Temperature range in °C	Viscosity (kin) in mm^2/s (at 20 °C)	Viscosity (kin) in mm^2/s for temperature	Container size Catalogue number		
					5 L	10 L	20 L
Kryo 30	Monoethylene glycol / water mixture	-30 – 90	4	50 at -25 °C	LZB 109	LZB 209	LZB 309
Aqua 90	decalcified water	5 – 90	1	---	LZB 120	LZB 220	LZB 320

Note the following for Kryo 30:

- The water content is reduced during long operating at higher temperatures and the mixture becomes flammable (flash point 119 °C). Check the mixture ratio using a hydrometer.

Heat transfer liquid water

- The alkaline earth ions content (hardness) of the water must be between 0.71 mmol/L and 1.42 mmol/L (equivalent to 4.0 and 8.0 °dH). Harder water results in lime deposits in the device.
- The pH value of the water must be between 6.0 and 8.5.
- Distilled, deionised, demineralised (DM) water or seawater must not be used due to their corrosive properties. Ultra-pure water and distillates are suitable as a medium after addition of 0.1 g soda (Na_2CO_3, sodium carbonate) per litre of water.
- Any chlorine content in the water must be strictly avoided. Do not add any chlorine to the water. Chlorine is contained, for example, in cleaning agents and disinfectants.
- The water must be free of impurities. Water containing iron is unsuitable due to rust formation and untreated river water is unsuitable due to algae formation.
- The addition of ammonia is not permitted.

4.5 Establishing a mains connection

DANGER!
Transport damage

Electric shock

- Closely inspect the device for transport damage prior to starting up.
- Never operate a device that has sustained transport damage!

DANGER!
Contact with voltage conductors due to faulty power supply cable

Electric shock

- The power supply cable must not come into contact with hoses containing heat transfer liquid or other hot parts.

DANGER!
Contact with voltage conductors due to faulty power supply cable

Electric shock

- Always use standard power supply cables such as the one supplied.
- Check the supplied power supply cable for damage prior to use.

WARNING!
Distribution box / multiple socket is unsuitable

Fire

- Only connect the device directly to the socket on the installation side.
- Do not use distribution boxes or multiple sockets.

NOTICE!
Use of impermissible mains voltage or mains frequency

Device damage

- Compare the information on the type plate with the available mains voltage and mains frequency.

Personnel: ■ Operating personnel

Please note the following:

1. Only connect the device to sockets with a protective earth conductor (PE).

Note for electric installation on site:

2. ■ Single-phase devices
   - Single-phase devices must be protected with a 16-ampere circuit breaker fitted during installation.
   - Exception: Devices with 13 ampere UK plugs.

5 Commissioning

5.1 Switching on the device for the first time and filling with liquid

5.1.1 Fill mode

If the filling mode is active, the words "filling mode" appear on a yellow background in the basic window. The device does not heat or does not cool.

The device has a program for convenient filling with heat transfer liquid.

If the fill level of the device is too low, i.e. at level stage 0, the *Fill mode* is started immediately after switching on the device. The fill mode supports the correct filling of the device. The current level stage is displayed under *Start filling* (in the menu *Setup* → *Fill mode*).

An audible signal with long intervals is output from approx. the fourth level stage to warn about any overfilling of the device. If filling continues, the interval of the signal is shortened in the following level stage. You must end the filling at the latest now.

If a continuous tone sounds, the device is overfilled and cannot be started. You must drain some heat transfer liquid from the device to be able to start it again.

To fill an external consumer, press the *Standby* softkey when there is sufficient fill level to start the pump. The heat transfer liquid now pumped into the external consumer can be refilled immediately. If the fill level drops too far, the device automatically goes into the standby state and the pump is switched off. This process is performed until the device and the connected consumer are filled.

The fill mode is completed with *End filling* and the audible notifications are deactivated. The fault messages for low level and high level take effect again.

After ending the filling mode, the device starts the temperature control thermostating, provided the starting state is not set to off. Changing the starting mode can be found in ↳ Chapter 6.12.4 “Specifying the starting mode (Auto start)” on page 58.

5.1.2 Switch on the device and fill it

Personnel:
- Operating personnel

Protective equipment:
- Safety glasses
- Protective work clothing
- Protective gloves

WARNING!
Use of unsuitable heat transfer liquid

Mutation, poisoning, environmental hazard, equipment damage

- Heat transfer liquids from LAUDA are recommended.
- If you wish to use your own heat transfer liquids, you must check that the fluids are suitable for the materials used. The heat transfer liquid must be provided with corrosion protection. You must also test the suitability of the liquid by performing a test run within the desired temperature range. During the test run, you must also check the low-level protection.
- Select a heat transfer liquid with a temperature range suitable for the application.
- Do not use flammable heat transfer liquids.
- Do not use any heat transfer fluid that is radioactive, toxic or environmentally hazardous.
- Do not use deionized water as a heat transfer liquid.
- Only use heat transfer liquids that are approved for heat transfer systems.
- Use heat transfer fluids with a kinematic viscosity of less than 180 mm^2/s during operation.
- Use heat transfer fluids with a density in the range of 0.75 to 1.8 g/cm^3.

WARNING!
Splashing heat transfer liquid

Eye damage

- Always wear suitable safety glasses when working on the device.

CAUTION!
Overflow of heat transfer liquid

Slipping or falling over

- Fill the device only in filling mode. Do not overfill the device.
  Please note the level display and keep in mind that the heat transfer liquid will increase in volume when heated (for the total volume with application and hoses).

CAUTION!
Spraying of heat transfer liquid

Slipping or falling over

- Use a funnel for filling.

CAUTION!
Leaking heat transfer liquid

Slipping or falling over

- Drain tap must be closed.
- Ensure that all hydraulic connections are tight.

1. Close the drain tap. Turn the lever to the left to do this.
2. Switch on the device at the mains switch. A signal tone is emitted.

Press the mains switch to Position [1] *on devices VC 2000 (W) and lower.*

▶ The language selection menu then appears.

Fig. 7: Start screen

Fig. 8: Selecting the menu language

3. The window for selecting the menu language is shown on the display. Use the up and down arrow buttons to select the desired [language]. Press the Enter key to confirm your selection.

For example, select [Deutsch] *to see display entries in German.*

You can change the menu language at any time via the menu.

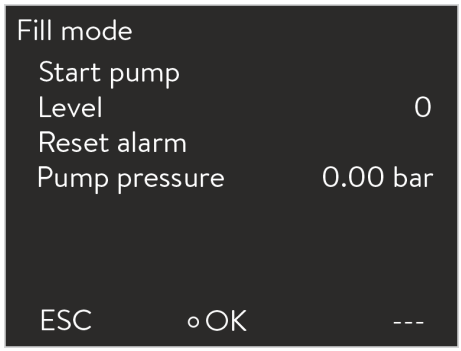


Fig. 9: Fill mode

4. The device detects low or empty level of the heat transfer liquid.
   - ▶ The device automatically starts the fill mode.
5. Pull off the cover of the filler nozzle by lifting it upwards.
6. Fill the device with heat transfer liquid. Observe the display and pay attention to the acoustic signals of the device when doing so.

> *Use a funnel for filling if required.*
>
> *The fill mode can be called again at any time via the menu.*

7. Close the filler nozzle with the cover.
8. End the fill mode by selecting and confirming [End filling].

> *After the fill mode has been ended, the device starts the temperature control unless the starting mode is set to* [off].
>
> *You will find out how to change the starting mode in* ↳ Chapter 6.12.4 “Specifying the starting mode (Auto start)” on page 58.

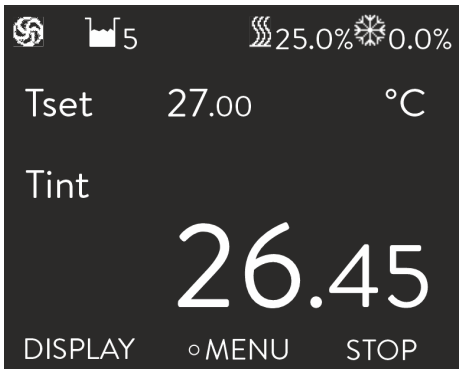


Fig. 10: Home window

9. The Home window appears.

> *You cannot start the device until you end the Fill mode.*

5.2 Setting the pump pressure

The pump pressure can be set for devices with a bypass via a control valve on the back of the device. The pump pressure can therefore be set individually for pressure-sensitive external consuming units.

> *Open the bypass adjusting wheel on the back of the device to the full extent before switching the device on.*

Turn the wheel counterclockwise to do this.

Personnel: ■ Operating personnel

1. To increase the pressure in the consuming unit, turn the bypass adjusting wheel clockwise until the maximum permissible pressure for the external consuming unit is reached.

> *Monitor the pressure indication on the front of the device when doing this.*

5.3 Interfaces

5.3.1 Setting the alarm output

An option is always active in the Alarm output menu. The selected option is marked with a check mark. A fault in the device could be an alarm or an error.

Table 6: Possible options

Signal output	Description
Only alarms	A signal is issued at the alarm output (e.g. for reverse flow protection, pilot lamp)
Alarms and *Stand-by*	A signal is issued at the alarm output and the device switches to standby

Personnel: ■ Operating personnel

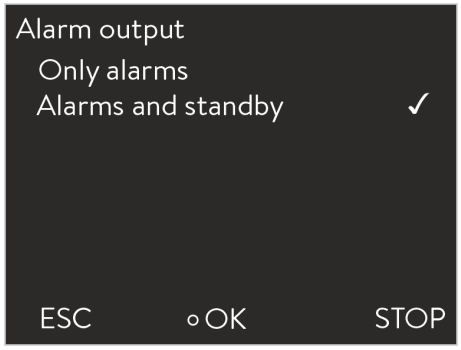


Fig. 11: Configuring the alarm output

1. Switch to the main menu.
2. Select the *Setup* → *Basic setup* → *Alarm output* menu item.
3. The following options are available:
   - With *Only alarms*, a signal is only output at the alarm output in the event of device alarms.
   - With *Alarms and standby*, a signal is also output in Standby.
4. Press the input button to confirm.

5.3.2 Interface alarm output (potential-free contact)

- The contacts may be loaded with a maximum voltage of 30 V direct current (DC) and a maximum current of 0.2 A.

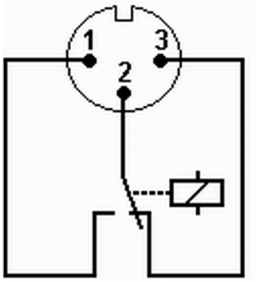


Fig. 12: Flange plug (front) in fault condition

View of the flange plug (front) or into the coupling socket on the soldering side.

Good condition

- Pin 1 and 2 are closed.
- During trouble-free operation, the alarm output is in good state.

Fault condition

- Pin 2 and 3 are closed.
- The alarm output is in fault condition:
  - If the device is switched off,
  - after switching on, if a fault (e.g. low level) is already present,
  - during operation, if a fault occurs, and
  - for each event configured in the *Alarm Output* menu.

You can find information on the settings for the alarm output in ↳ Chapter 5.3.1 “Setting the alarm output” on page 35.

Please note the following:

- The equipment connected to the extra-low voltage inputs and outputs must be reliably isolated from voltages dangerous to the touch in accordance with DIN EN 61140. For example, by double or reinforced insulation according to DIN EN 60730-1 or DIN 60950-1.
- Only use protected connection lines. Connect the protective screen with the connector shell. Cover unused connectors with protective caps.

5.3.3 Installing modules

Optional interface modules can be added to the devices ↳ “Additional interface modules” on page 19. They can be installed in two module bays of different sizes located on the front of the device.

- Right module slot (approx. 51 mm x 27 mm)
- Left module bay (approx. 51 mm x 17 mm) for Pt100/LiBus module

This section is relevant for the following cases, for example:

- You want to use an external temperature probe.
- You want to transfer a signal, such as the actual temperature, from an external consumer to the constant temperature equipment.

- You want to transfer a signal, such as the set temperature, to an external device.
- You want to use the Command remote control.

DANGER!
Contact with live parts

Electric shock

- Disconnect the device from the mains power supply before installing modules.

1. Touch a grounded bare point on the circulation chiller to discharge any possible electrostatic charge.
2. Remove the module from its packaging.
3. Turn off the constant temperature equipment and pull out the mains plug.
4. The module bays are protected with a cover. Loosen the screws for the cover of the corresponding module bay and carefully remove the cover.
5. Carefully remove the bus connection cable from the cover.
6. Insert the bus connection cable into the module – red plug into red socket.

   The plug and the socket are reverse polarity protected.

7. Insert the module into the corresponding bay and fasten it with the two cross-head screws.

5.4 Operating the device using the WebApp or an interface on the control station

The device can also be operated remotely.

WARNING!
Device is started using a remote control

Scalding, slipping, environmental hazard

- Do not switch on the device at the mains switch until all hydraulic connections for the application have been fully established and all measures for safe commissioning have been implemented.

CAUTION!
Two operators make adjustments simultaneously and independently of each other

Scalding, cold burns

- Operate the device from one location only.
- Do not switch on the device at the mains switch until all hydraulic connections for the application have been fully established and all measures for safe commissioning have been implemented.

Basic operation of the device is possible using different interface modules ↳ “Additional interface modules” on page 19.

The device can be operated in more detail using the WebApp LAUDA Command. This app is a software program designed for controlling and monitoring LAUDA constant temperature equipment. The software can operate on a smartphone, tablet or PC, allowing access via the company network. However, the Advanced Ethernet module must be installed in the constant temperature equipment beforehand.

6 Operation

6.1 General safety instructions

WARNING!
Splashing heat transfer liquid

Eye damage

- Always wear suitable safety glasses when working on the device.

WARNING!
Risk of cooling circuit bursting due to excessive gauge pressure

Burns, fire

- Ensure that none of the openings on the fan are blocked, including the front air inlet of the device and the air outlets.

WARNING!
Leaks in the cooling circuit

Burns, fire

- Do not use corrosive heat transfer liquids.

WARNING!
Cooling water circuit is damaged by frost expansion

Fire, device damage, environmental impact

- When decommissioning the device or if there is a risk of freezing, drain the cooling water circuit on the cooling unit. Use compressed air or an industrial vacuum cleaner (waterproof). Blow compressed air through the cooling water circuit.

CAUTION!
Hazard that requires disconnection of the device from the mains power supply.

Scalding, cold burns

- The mains plug must be easy to access. It must be possible to quickly pull the mains plug out of the socket.

The mains plug is the primary mains disconnection device. The mains switch (circuit breaker) only has a safety function.

CAUTION!
Competing settings due to simultaneous operation on the device and via LAUDA.LIVE

Scalding, cold burns

- If the user allows cloud access for write commands, conflicting settings may occur (cloud, operator terminal).

CAUTION!
Competing settings due to simultaneous operation on the device and via LAUDA.LIVE

Scalding, cold burns

- Operate the device from one location only.
- Do not switch on the device at the mains switch until all hydraulic connections for the application have been fully established and all measures for safe commissioning have been implemented.

CAUTION!
Contact with hot/cold surfaces

Hot and cold burns

- Never touch parts that are labeled with the warning symbol "Hot surface".

The following text is relevant for devices containing less than 150 g of flammable refrigerant (see type plate or technical data).

Fill quantity per refrigeration circuit < 150 g. According to standard DIN EN 378-1, sealed refrigeration systems below this filling limit are not subject to any special requirements regarding installation location, room volume or access area. Accordingly, no additional security measures are required.

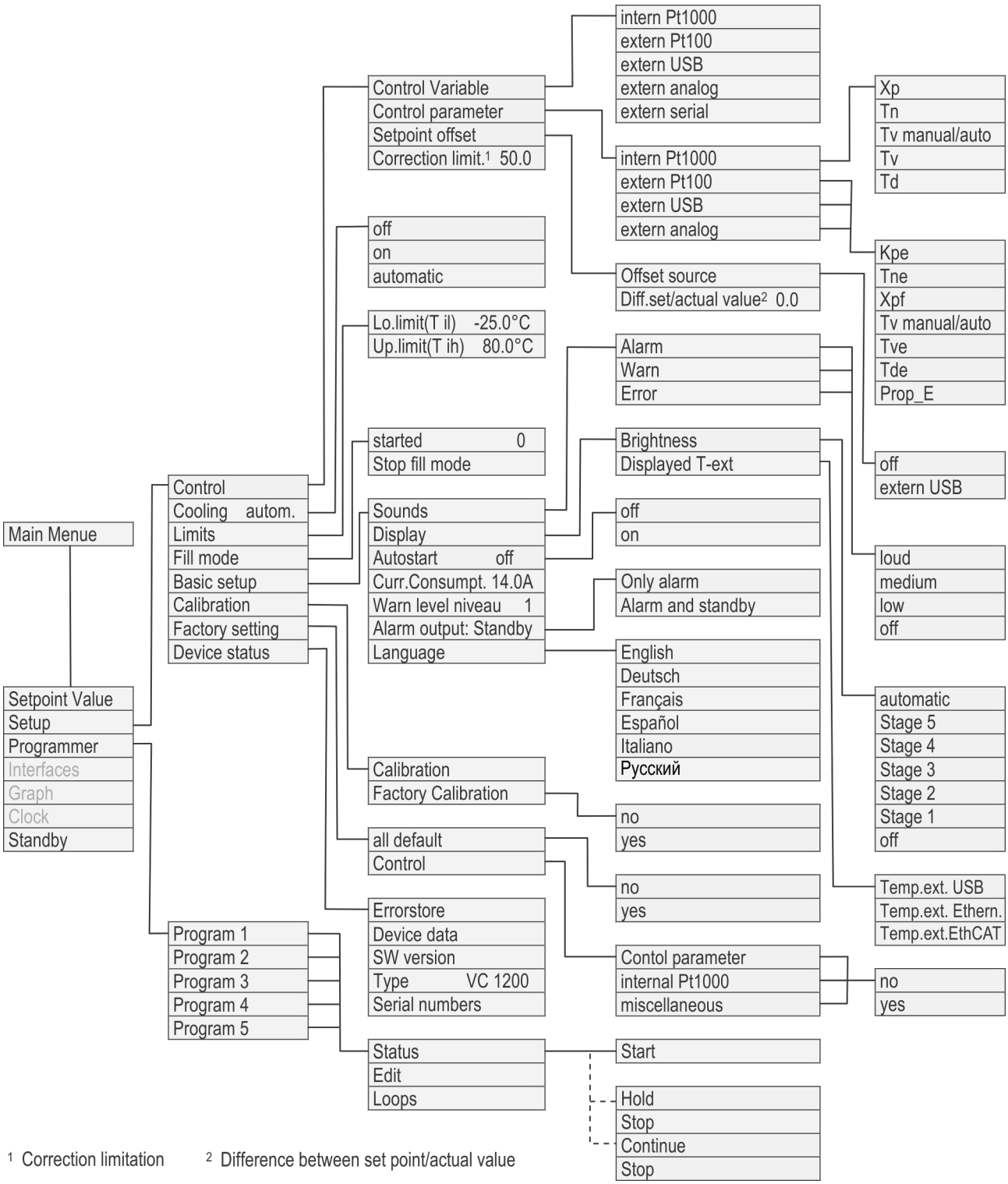
6.2 Operating modes

Two operating modes are supported for the devices.

- During operation, the components of the device are operated.
- In the standby operating mode, all components of the device are switched off. Only the display of the device is supplied with power. For example, this operating mode is suitable for making extensive settings.

6.3 Menu structure overview

Menu structure for Setpoint Value, Setup and Programmer



1 Correction limitation 2 Difference between set point/actual value

Fig. 13: Menu structure part 1

Menu structure for Graph, Clock and Standby

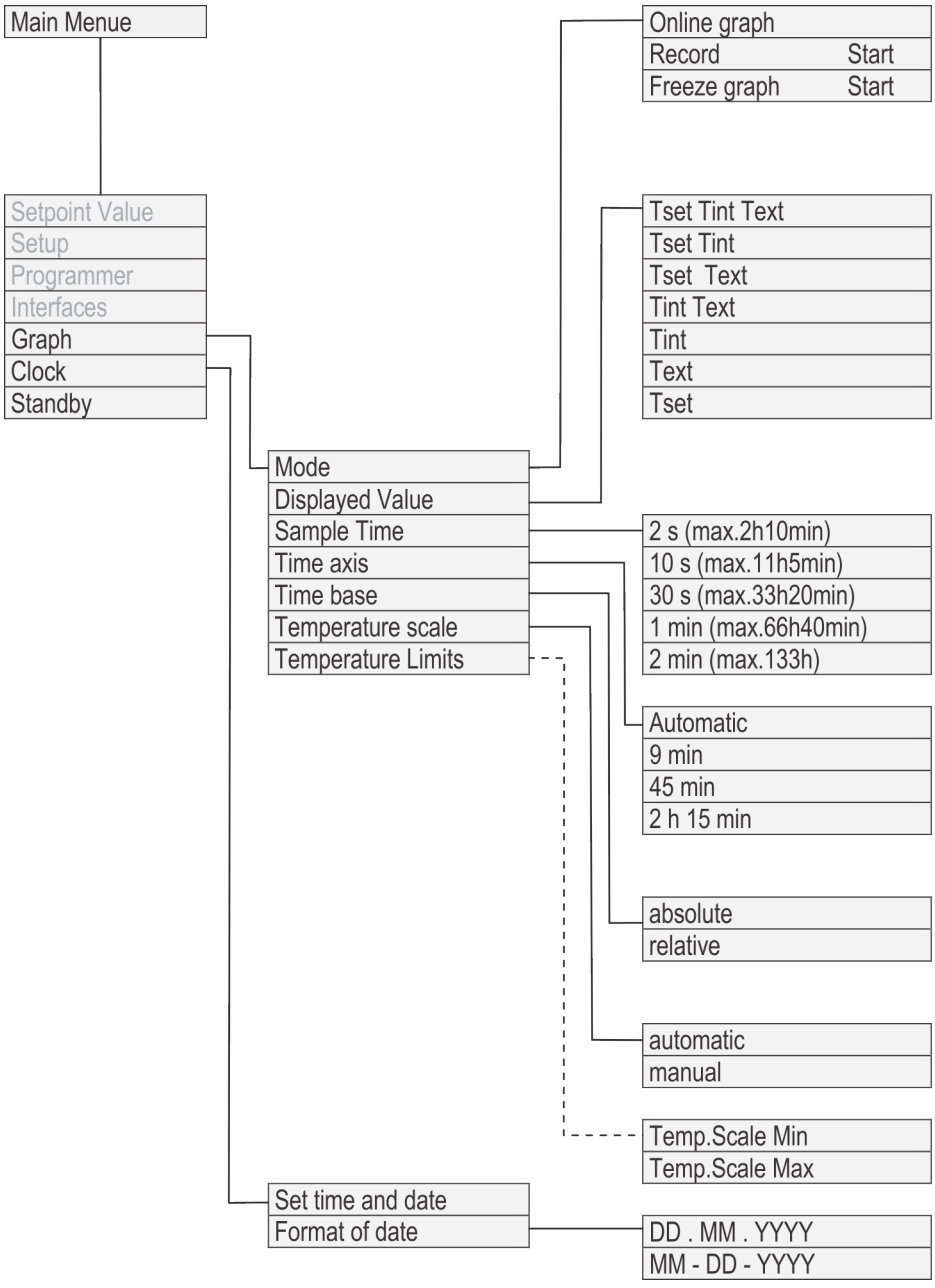


Fig. 14: Menu structure part 2

6.4 Switching on the device

Personnel: ■ Operating personnel

1. Switch on the device at the mains switch.

> *You will find further information about switching on the device in* ↳ Chapter 5.1.2 “Switch on the device and fill it” on page 32.

▶ A signal tone is emitted.

2. The Home window appears.

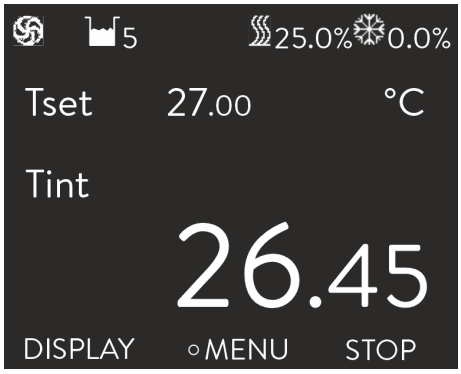


Fig. 15: Home window

> *After the device has been switched on, it is in Standby mode by default (soft key shows* [START]*) unless the starting mode has been set to on. You will find out how to change the starting mode in* ↳ Chapter 6.12.4 “Specifying the starting mode (Auto start)” on page 58.

6.5 The display

6.5.1 Home window

The Home window is displayed after the device has been switched on. The appearance of the Home window is changed by pressing the [DISPLAY] softkey.

During normal operation

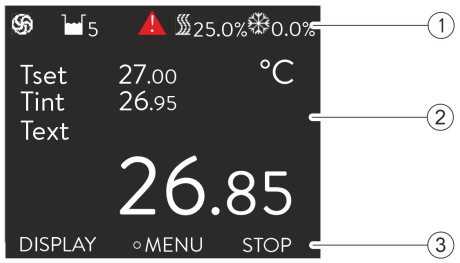


Fig. 16: Home window

1 Overlaid status display
2 Display of the temperatures (device regulates to the control variable external T_{ext})
3 Soft key bar

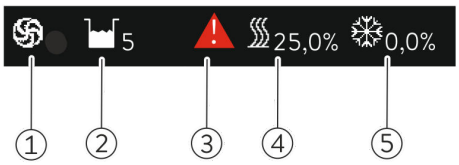


Fig. 17: Status display

1 The pump symbol rotates when the pump is running.
2 Level indication
3 A warning is displayed
4 The heater is active and heats with the displayed percentage of total power.
5 Cooling is active and cools with the displayed percentage of total cooling capacity.

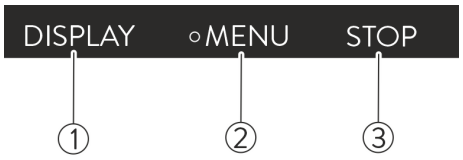


Fig. 18: Soft key bar

1 Left softkey
2 Enter button
3 Right softkey

The functions of the soft keys and the function of the Enter button are shown in this bar.

In the Standby mode

The button assignment [START] is displayed in the soft key bar in Standby mode instead of the button assignment [STOP]

6.5.2 Menu window

Navigating to the main menu

1. You can perform the following steps to bring up the main menu:
   - Press the Enter button in the Home window.
   - If you are in a sub-menu, you can return to the Home window by pressing the left arrow button.

Structure of the main menu

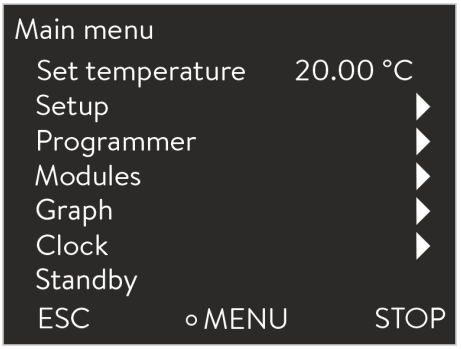


Fig. 19: Main menu

The main menu and the sub-menus consist of menu itemswhich are marked as follows.

Symbol	Description
▶	Indicates that other menu levels (sub-menus) are available.
🔒	The padlock symbolizes a blocked function. These functions cannot be customized.

The currently selected entry is marked.

Structure of sub-menus

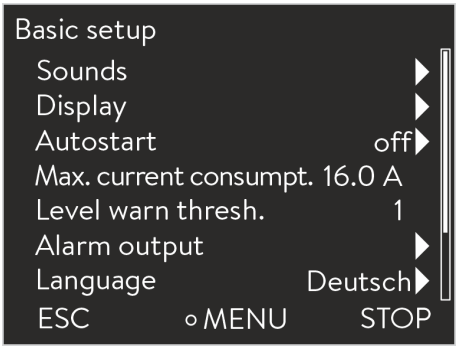


Fig. 20: Sub-menu

The structure of sub-menus basically corresponds to that of the main menu.

Functionality of the soft key bar

The soft key bar is shown at the bottom of the display. The soft keys can be used to select e.g. the following functions:

The [ESC] soft key takes you back to the Home window.

The [STOP] soft key puts the device into Standby mode.

Functionality of the Enter button

The [OK] input button brings up a sub-menu or an entry window.

Navigation in the menus

1. The following options are available:
   - Use the up and down arrow buttons to navigate between the menu items.
   - Press the right arrow button to select a sub-menu.
   - Press the left arrow button to return to a previous menu.
   - The selected menu option is marked.

6.5.3 Entry window

Settings in the display are configured via the entry window. Two varieties of entry windows are available.

Entry window for selecting options

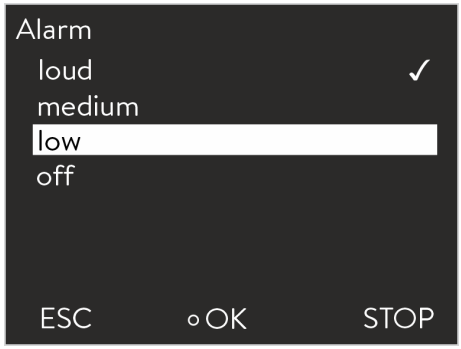


Fig. 21: Selecting options

- The check mark indicates the active function.
- The arrow buttons are used to navigate in the options.
- The selected setting is marked in the process.
- Press the [ESC] soft key to return to the previous display without making any changes.
- Press the [OK] input button to accept the selected setting.

Entry window for manual input

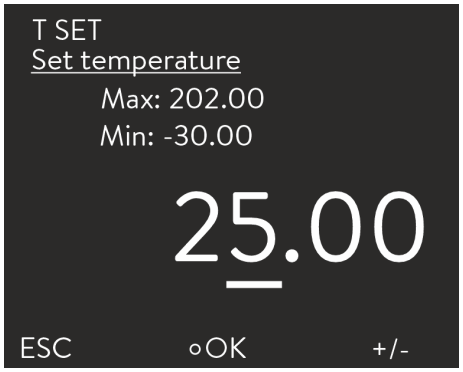


Fig. 22: Entering values

- The value to be entered is displayed in enlarged font. The cursor flashes under the value.
- You can also select individual numeric characters and change them by pressing the left and right arrow button.
- You can change the value with the up and down arrow buttons. If you keep one of the two arrow keys pressed down longer, the change will be accelerated.
- You can change the sign with the [+/-] soft key if the appropriate equipment is installed on your device.
- *Min:* and *Max:* indicate the limits of the entered value.
- Press the [OK] input button to accept the set value.
- Press the [ESC] soft key to return to the previous display without making any changes.

6.5.4 Lock and release operating buttons

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

Lock operating buttons

Personnel: ■ Operating personnel

1. Change to the main menu.
2. Press and hold down the [ENTER] button.
3. Press and hold down the [Down] arrow button within 4 seconds.
4. Hold down both buttons for 4 seconds.
   ▶ In the display the descriptions of the buttons are replaced by [---].
   The entry function is now locked.

The display can be switched between basic window and graphic display.

Release operating buttons

Personnel: ■ Operating personnel

1. Press and hold down the [ENTER] button.
2. Press and hold down the [Up] arrow button within 4 seconds.
3. Hold down both buttons for 4 seconds.
   ▶ In the display the descriptions of the buttons show up again.
   The device can be operated again.

6.6 Define temperature limits

You can use the temperature limits to specify the temperature range of your application, i.e. the temperature range in which temperature control can take place.

Personnel: ■ Operating personnel

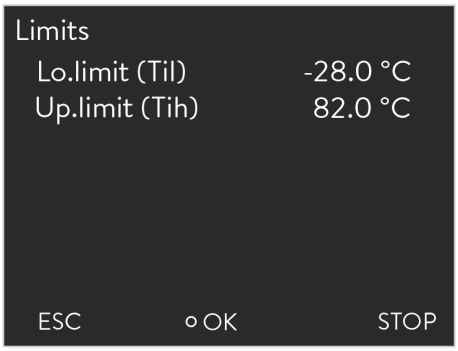


Fig. 23: Selecting the temperature limit

1. Switch to the main menu.
2. Select the menu item *Setup* → *Temp. limits*.
3. Select one of the following options:
   - Select the first entry *Til* to set the lower limit value.
   - Select the second entry *Tih* to set the upper limit value.

Fig. 24: Defining temperature limits

4. Customize the value in the following entry window.

6.7 Specifying the set point

Personnel: ■ Operating personnel

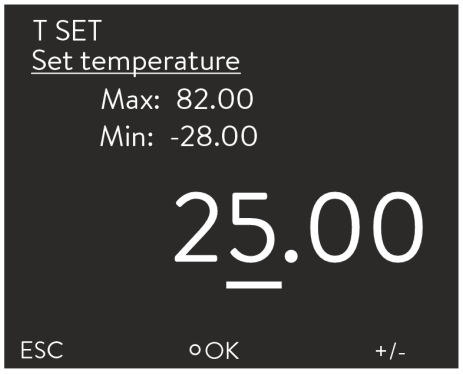


Fig. 25: Specifying the set temperature

1. Switch to the main menu.
2. Select the menu item *Set temperature* in the main menu.
   - ▶ An entry window appears. The cursor flashes under the value. The set temperature can be set to a value within the limits displayed.
3. Customize the set temperature accordingly.
4. Press the input button to confirm.

6.8 Activating and deactivating standby

In standby mode, device components such as the pump are switched off. The display remains active.

Personnel: ■ Operating personnel

Fig. 26: Device in operation

1. Press the [STOP] soft key.
   - ▶ The device is now in Standby mode.
2. Press the [START] soft key to activate the Operation mode.

6.9 SmartCool (cooling)

The cooling unit of the constant temperature equipment is operated in the default [autom.] setting. Depending on the temperature and operating status, the cooling unit is automatically switched on or off. You can also manually switch the cooling unit on or off via the menu.

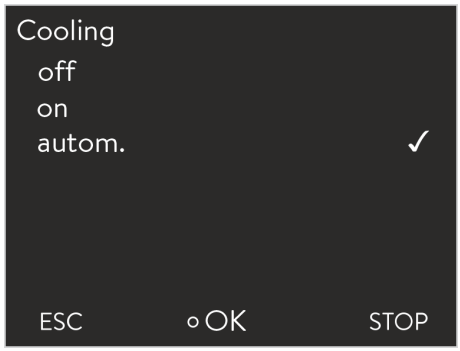


Fig. 27: Setting the cooling

1. Switch to the main menu.
2. Select the menu item *Setup* ➞ *Cooling*.
3. Select one of the following options:
   - With the [autom.] setting, the cooling unit is switched automatically. When cooling capacity is required, the cooling unit switches on.
   - With [off], the cooling unit always remains switched off.
   - With [on], the cooling unit is always switched on, even if no cooling capacity is required.
4. Press the input button to confirm.

6.10 External control

6.10.1 Activating the external control

Personnel: ■ Operating personnel

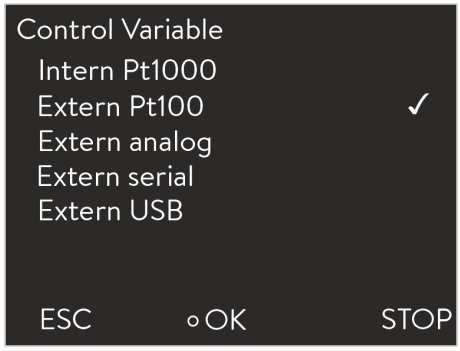


Fig. 28: Activating the external control

1. Select the menu item *Control Variable* ➞ *extern Pt100* in the Control menu.

   This option is only available if a Pt100 module for an external temperature probe has been connected. A Pt100 temperature sensor must be connected to the module.

2. Press the input button to confirm.

6.10.2 Specifying the set point offset

A value can be applied to the temperature specified by the external temperature probe and then processed as a set point. The bath temperature can therefore be set e.g. to -15 °C below the temperature of a reactor which is measured by the external temperature probe.

Navigating to the settings

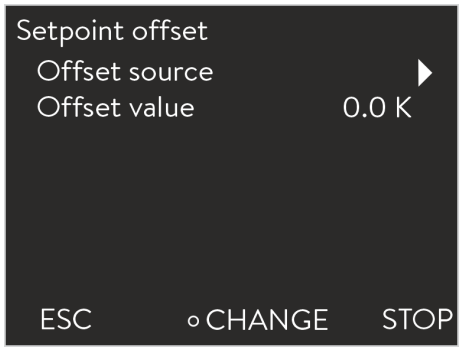


Fig. 29: Set point offset menu

Personnel: ■ Operating personnel

1. Switch to the main menu.
2. Select the *Setup* → *Control* → *Set point offset* menu item.
3. Select one of the following options:
   - *Offset source* allows you to select the source used to measure the offset.
   - *Offset value* allows you to enter the value of the offset.

Selecting the offset source

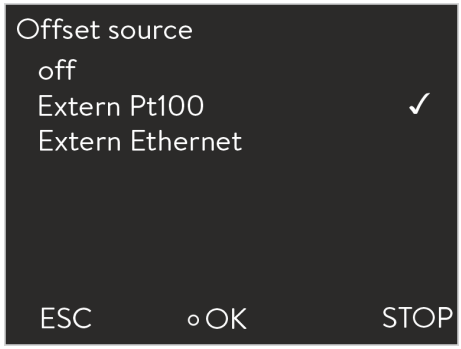


Fig. 30: Selecting the offset source

Personnel: ■ Operating personnel

1. Select the menu item *Offset source* in the set point offset menu.
2. Select one of the following options:
   - You deactivate the set point offset with *off*.
   - You can select the appropriate source with the other menu items. For example, you can specify the set point offset via an external temperature probe with *extern Pt100*.

   Press the left arrow button to return to the previous display without making any changes.
3. Press the input button to confirm.

Specifying the offset

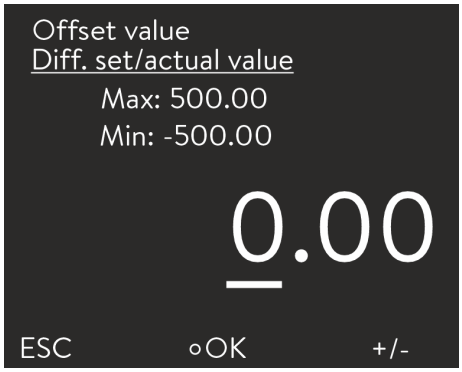


Fig. 31: Specifying the offset value

Personnel: ■ Operating personnel

1. Select the menu item *Offset value* in the set point offset menu.
   ▶ An entry window appears.
2. Adjust the offset value within the displayed limit values.
3. Press the input button to confirm.

6.11 Control

The internal and external control parameters are preset for operation with water as the heat transfer liquid at the factory. It may be necessary to adjust the control parameters on a case-by-case basis, depending on the application. The specific thermal capacity and viscosity of the heat transfer liquid also influence the control action, and the control parameters may need adjusting as a result.

6.11.1 Basics

Explanation of terms

Control value	- Output value of the controller to compensate for the difference of actual value to setpoint (control deviation).
PID controller	- The PID controller operates very precisely and consists of P, I and D parts.
Proportional range Xp	- The proportional range Xp specifies the temperature range in which the proportional part (P part) of the controller is 0 – 100 % of the maximum control value. For example, if the control deviation is 2 K for Xp set to 10 K, the P part is 20 % of the control control deviation. In the case of a control deviation of 10 K and more, the P part is 100 % of the control value.
Reset time Tn	- The reset time is decisive for the integral part (I part) of the control value. It specifies the interval in which an existing control deviation is integrated. The larger Tn is, the slower the control deviation is integrated. Thus, the control is slower. A smaller Tn makes the control more dynamic and finally results in oscillations.
Lead time Tv	- The differential part (D part) of the control value is formed from the lead time Tv. It influences the approach speed of the actual value to the setpoint and counteracts the P and I parts. The larger the lead time Tv is set, the stronger the output signal is damped. As rule of thumb, the following applies: Tv = Tn x 0.75.

Optimising the hydraulic system

An important prerequisite for acceptable control quality is a well designed hydraulic system. Therefore, an as good as possible connection between the application to be temperature-controlled and the constant temperature equipment must be established. This means:

- Only use approved heat transfer liquids: water or water-glycol mixture.
- Use short tubes with large cross section. This reduces the flow resistance. A lot of heat transfer liquid can circulate in a short time, thus the circulation time is short.
- Use bypass of the device to increase the flow rate of the heat transfer liquid.

Other precautions

The viscosity of the heat transfer liquid changes very quickly with the temperature. The liquids have higher viscosity at low temperatures. Therefore, the control quality is generally worse at low temperatures. For this reason, the controller should be set at the lower end of the temperature range to be covered. If the control is stable at low temperatures, then it is generally also stable at high temperatures. On the other hand, if a system is just still stable at high temperatures, it is highly probable it will be unstable at low temperatures, i.e. it oscillates.

If, for example, the operating temperature range of a system is -25 – 80 °C, then the controller setting should take place at -10 – 20 °C.

Indications of incorrect settings

The picture on the left shows optimum setting of the control parameters.

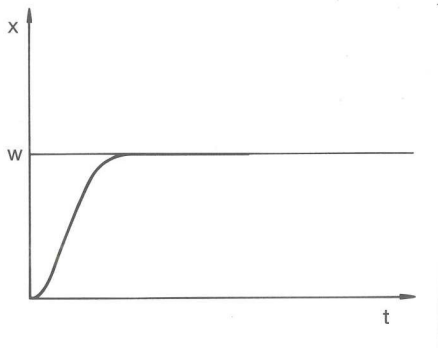
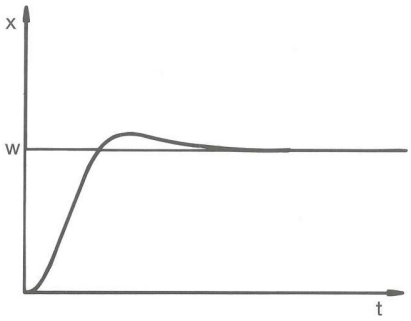
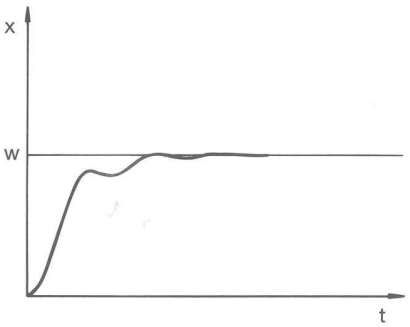


Fig. 32: Optimum setting



If the Xp parameter is selected too large, the actual value reaches the proportional range early and the P part becomes smaller than 100 % of the control value. The approach to the setpoint slows down. Thus, the simultaneously integrating I part has more time to build up its control value portion. If the setpoint is reached, the I part summed too much results in overshooting beyond the setpoint. If the proportional range Xp is reduced, the P part remains at 100 % for longer. Therefore the actual value approaches the setpoint more quickly and the I part has less time to integrate the control difference. The overshooting is reduced.

Fig. 33: Control parameter Xp too large



If the proportional range selected is too small, the P part on the control value is at 100 % for a very long time. This value then reduces more quickly within the proportional range, i.e. the control value reduces rapidly and the approach of the actual value to the setpoint almost comes to a standstill. Due to the I part not becoming effective until now, the actual value approaches the setpoint slowly.

Fig. 34: Control parameter Xp too small

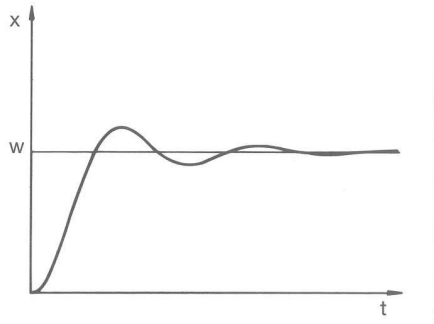


Fig. 35: Control parameters Tn and Tv too small

In this case shown, the I part is set too large (parameter Tn too small). The I part integrates the control deviation until this becomes 0. If this integration runs too quickly, the control value, i.e. the output signal of the controller, is too large. This results in (diminishing) oscillations of the actual value around the setpoint. Parameter Tv should be adjusted again using the formula: Tv = Tn x 0.75.

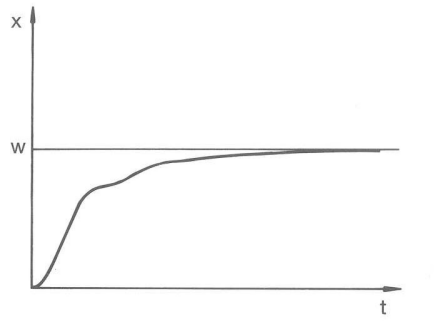


Fig. 36: Control parameters Tn and Tv too large

The actual value increases relatively steeply after specification of the set-point. The proportional range appears to be well-adjusted. The approach to the setpoint becomes significantly slower for diminishing control deviation. The strong reduction of the proportional part (P part) must be compensated for by the integration part (I part). In this case, the I part integrates too slowly. The parameter Tn which specifies the integration interval must be reduced. The lead time (parameter Tv) should also be adjusted using the following formula: Tv = Tn x 0.75.

6.11.2 Opening the control menu

Personnel: ■ Operating personnel

1. Change to the main menu.
2. Select the menu item *Setup* ➞ *Control*.

6.11.3 Overview of internal control parameters

The internal control compares the set temperature with the outflow temperature and calculates the actuating signal, i.e. the measurement used for heating or cooling.

Table 7: The following control parameters can be adapted for internal control:

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

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

The temperature limits Tih and Til also have an effect on the control.

6.11.4 Adapting internal control parameters

Personnel: ■ Operating personnel

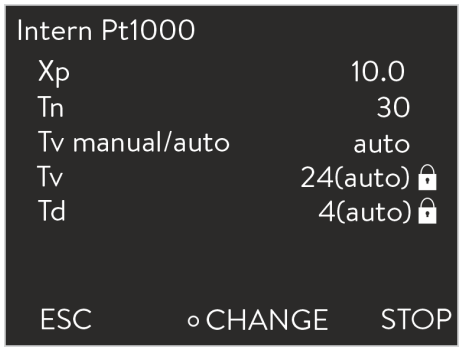


Fig. 37: Internal control parameter menu

1. Select the menu item *Control parameter* → *intern Pt1000* in the Control menu.
2. Select one of the following options:
   - ■ You can select one of the listed control parameters.
   - ■ *Tv manual/auto* allows you to specify whether the control parameters *Tv* and *Td* are set manually or automatically. If the automatic setting is active, the two control parameters are displayed with a padlock and cannot be selected. In this case, they are derived with fixed factors from *Tn*.

Fig. 38: Specifying internal control parameters

3. Press the input button to confirm.
   - ▶ Selection of the menu item *Tv manual/auto* activates manual or automatic adjustment of the parameters depending on the previous setting. An entry window is displayed if the other menu items are selected. The respective value can be adjusted within the displayed limits.
4. Change the value accordingly.
5. Press the input button to confirm.

6.11.5 Overview of external control parameters

- External control consists of a master controller (external controller) and a slave controller (internal controller). The temperature of the consumer to be temperature controlled is also required. In general this is determined with an external “Pt100 sensor”.
- The master controller compares the set temperature with the external temperature (consumer temperature) and, from these temperatures, calculates the set temperature (set_internal) for the slave controller (internal controller).
- The slave controller compares the set temperature (set_internal) with the outflow temperature and calculates the actuating signal, i.e. the measurement used for heating or cooling.

Table 8: The following control parameters can be adapted on the master controller (external controller):

Characteristics	Designation	Unit
Kpe	Amplification factor	-
Tne	Adjustment time	s
Tve	Hold-back time	s
Tde	Attenuation time	s
Prop_E	Proportional range	K

Table 9: The following control parameters can be adapted on the slave controller (internal controller):

Characteristics	Designation	Unit
Xpf	Proportional range	K

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

The temperature limits Tih and Til also have an effect on the control.

Correction limitation

If a temperature jump is specified via set temperature T_{set}, the control may set an outflow temperature which is considerably higher (e.g. 50 K, possible problem with enamel reactors) than the temperature T_{ext} required in the external application. Therefore, there is a correction limitation that specifies the maximum permitted deviation between the temperature at the outflow T_{int} and the temperature in the external consumer T_{ext}.

1. Press the [Enter key] to open the menu.
2. Select the menu items → *Setup* → *Control* → *Correction limit.*.
   - ▶ An entry window opens for the numerical value.
3. Enter the value.
4. Confirm the new value with the [Enter key].
   - ▶ The new value has been accepted.

6.11.6 Adjusting external control parameters

Personnel: ■ Operating personnel

1. Select the menu item *Control Parameter* → *extern Pt100* in the Control menu.
2. Select one of the following options:
   - ■ You can select any of the listed control parameters.
   - ■ With *Tv manual/auto*, you can define whether the control parameters *Tve*, *Tde* and *Prop_E* are set manually or automatically. If the automatic setting is active, both control parameters are displayed with a lock symbol and cannot be selected. *In this case, Tve* and *Tde* are derived with fixed factors from *Tne*.
3. Confirm with the ENTER button.
   - ▶ Selection of the menu item *Tv manual/auto* activates manual or automatic control depending on the previous setting. An input window is displayed when the other menu items are selected.
4. Adjust the value accordingly.
5. Confirm with the ENTER button.

6.12 Basic settings

6.12.1 Calling the basic settings

1. Switch to the main menu.
2. Select the *Setup* → *Basic setup* menu item.

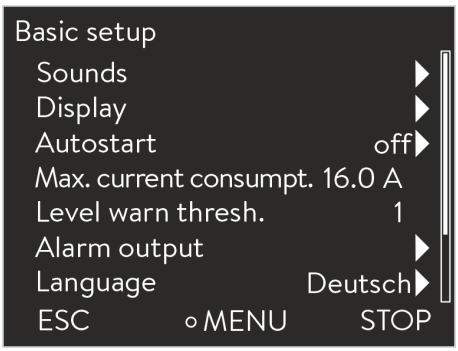


Fig. 39: Basic settings menu

The basic settings are described in the following chapters.

6.12.2 Adjusting the volume of the signal tones

The devices indicate alarms and faults with a two-tone acoustic signal. Warnings are signaled as a continuous tone.

Personnel: ■ Operating personnel

Fig. 40: Adjusting volume

1. Switch to the main menu.
2. Select the *Setup* → *Basic setup* → *Sounds* menu item.
3. Select one of the options depending on which sound you wish to adjust.
4. Select a volume.
5. Press the input button to confirm.

6.12.3 Adjusting the display brightness

The devices are fitted with a sensor that automatically adapts the display brightness to the ambient brightness.

Manual adjustment of the brightness of the display is not absolutely necessary with the "automatic" setting.

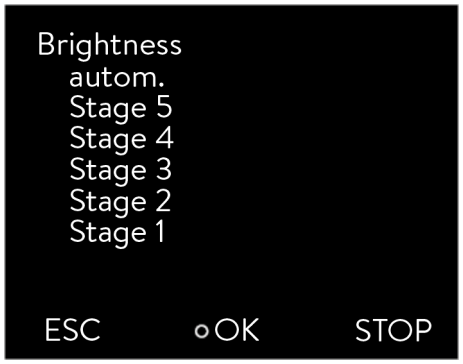


Fig. 41: Adjusting brightness

Personnel: ■ Operating personnel

1. Switch to the main menu.
2. Select the *Settings* → *Basic setting* → *Display* → *Brightness* menu item.
3. The following options are available in the entry window
   - ■ The brightness is adjusted automatically with the default setting *automatic*.
   - ■ You can set the brightness manually with the *Level* options. The brightness intensifies from *Level 1*. The respective brightness immediately becomes visible on the display.
   - ■ You can completely switch off the backlight for the display with *off*.
4. Press the input button to confirm.

6.12.4 Specifying the starting mode (Auto start)

The device will not automatically resume operation after a power failure and restoration of the power supply. You can set the device to switch to Standby mode after restoration of the power supply.

Personnel: ■ Operating personnel

Fig. 42: Selecting auto start setting

1. Switch to the main menu.
2. Select the *Settings* → *Basic setting* → *Auto start* menu item.
3. Select one of the following options
   - ■ The device switches to Standby mode when the power is restored with *off*.
   - ■ The device continues operation (with the settings before the power failure) after power has been restored with *on*.
4. Press the input button to confirm.

6.12.5 Limiting the current consumption

If your mains fuse is less than 16 A, the current consumption can be reduced in steps from 16 A to 8 A. This may impair the control accuracy. Establish whether other consuming units or only your device is connected to the fused circuit.

Personnel: ■ Operating personnel

Fig. 43: Specifying current consumption

1. Switch to the main menu.
2. Select the *Settings* → *Basic setting* → *Current consumption* menu item.
3. Change the current consumption accordingly.
4. Press the input button to confirm.

6.12.6 Configuring the alarm level for the fill level

A warning about low level of the device is usually output on the device starting from the second level stage. However, the alarm level before low level can be configured within a specific range.

Personnel: ■ Operating personnel

Fig. 44: Specifying the Alarm level

1. Switch to the main menu.
2. Select the *Setup* → *Basic setup* → *Level warn stage* menu item.
3. You can select from four stages 0 to 3 for the warning before low level. With *3*, a warning about low level is output from the third level stage. With *0*, no warning at all is output. In this case, the device is switched off and an alarm displayed when low level is reached.
4. Press the input button to confirm.

6.12.7 Selecting the menu language

The menu languages English, German, French, Spanish, and Italian are available for the device display.

Personnel: ■ Operating personnel

1. Switch to the main menu.
2. Select the *Setup* → *Basic setup* → *Language* menu item.
3. Select one of the available languages.
4. Press the input button to confirm.

Fig. 45: Selecting the menu language

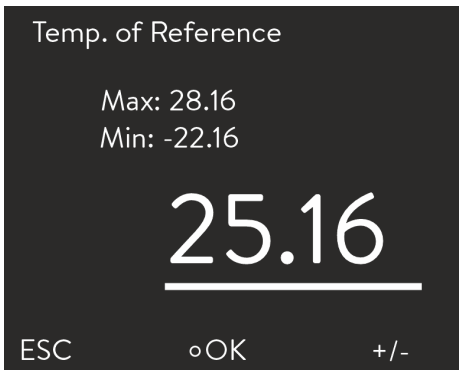
6.13 Entering the offset of the internal actual temperature (calibration)

The factory calibration is overwritten during the adjustment. A reference thermometer with the desired degree of accuracy is required. In other respects, the factory calibration should not be changed.

If a temperature deviation is discovered when checking the constant temperature equipment with a calibrated reference thermometer, the deviation can be corrected.

The sensor of the reference thermometer must be installed in the inlet of the device in accordance with the specifications on the calibration certificate.

Personnel: ■ Operating personnel



1. Switch to the main menu.
2. Select the *Setup* → *Calibration* → *Calibration* menu item.
3. Change the value accordingly. The value displayed on the reference thermometer must be entered.
4. Press the input button to confirm.

Fig. 46: Specifying the offset

6.14 Restoring the factory calibration (internal temperature probe)

An offset specified for the internal temperature measurement can be reset.

Personnel: ■ Operating personnel

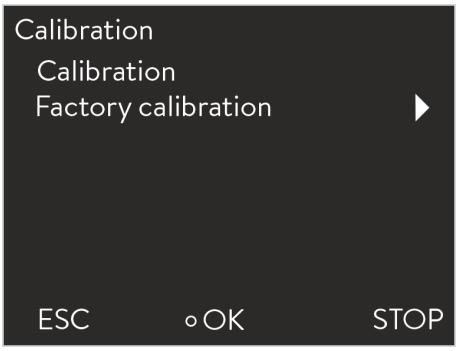


Fig. 47: Factory calibration

1. Switch to the main menu.

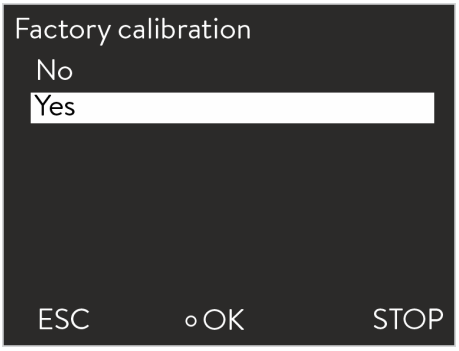


Fig. 48: Restoring the factory calibration

2. Select the *Setup* → *Calibration* → *Factory Calibration* menu item.
3. Select one of the following options:
   - ■ You return to the previous display without making any changes with *no*.
   - ■ The factory calibration is restored with *yes*.

6.15 Restore factory setting

Navigating to the factory setting

Personnel: ■ Operating personnel

1. Switch to the main menu.
2. Select the *Setup* → *Factory setting* menu item.

Restoring individual settings

Personnel: ■ Operating personnel

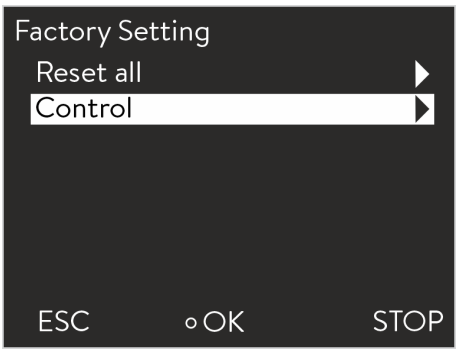


Fig. 49: Selecting the mode

1. Select the *Control* menu item.
   - ▶ This takes you to a list which enables you to reset the parameters individually.

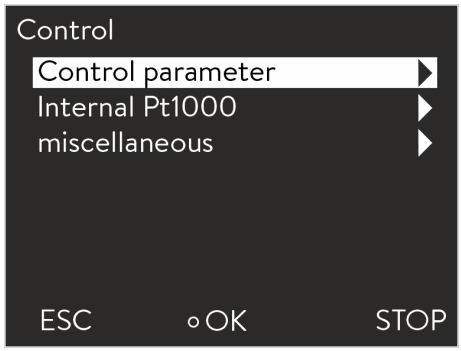


Fig. 50: Resetting the control parameters

2. Select the relevant menu item in the parameter list.
   - You can reset the internal and external control parameters with *Control parameters*.
   - You can reset the settings for the internal sensor with *internal Pt1000*.
   - You can reset the set point and maximum current consumption with *miscellaneous*. The control is also set to internal control.
3. Select one of the following options in the entry window:
   - You return to the previous display without making any changes with *no*.
   - Selecting *yes* resets the selected parameter if you confirm this with the Enter button.

Restoring all settings

Personnel: ■ Operating personnel

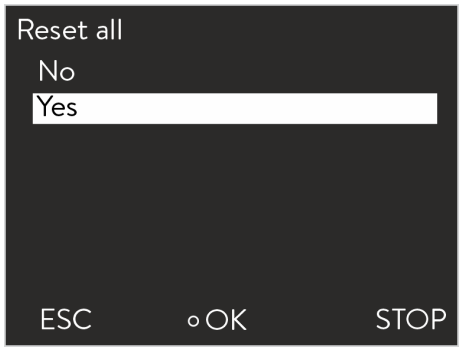


Fig. 51: Reset query

1. Select the *all default* menu item.
2. Select one of the following options:
   - You return to the previous display without making any changes with *no*.
   - The factory settings are restored with *yes* if you confirm this with the Enter button.

6.16 Device status

6.16.1 Viewing the device status

Personnel: ■ Operating personnel

Fig. 52: Device status

1. Switch to the main menu.
2. Select the *Setup* → *Device status* menu item.
   - ▶ You are in the Device status menu.
3. The following options are available:
   - Read out error memory
   - View device data
   - View software version
   - View device type
   - Retrieving serial numbers

6.16.2 Reading the Error store

The devices are provided with an Error store for error analysis. Up to 140 warning, error and alarm messages can be stored here.

1. Select the *Error store* menu item in the Device status menu.

> *The most recent message appears in the first position. The message text is displayed in the footer.*

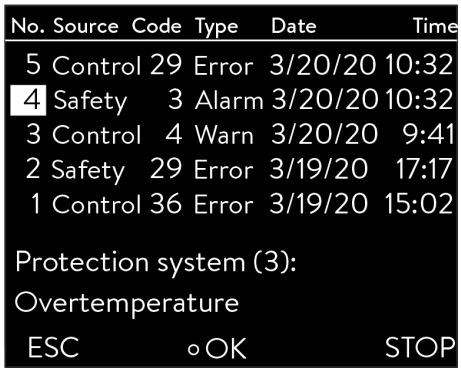


Fig. 53: Error store

2. You can navigate through the list using the up and down arrow keys.

The following information is displayed for each message:

- The relevant module that triggered the message is displayed under *Source*.
- *Code* is the encoded description of the alarm, warning or error.
- *Type* specifies whether it is an alarm, warning or error.
- *Date* and *Time* display the exact time the message was issued.

> *You will find a list of the possible alarms, warnings and errors in* “Procedure in event of alarm” on page 78.

6.16.3 Retrieving device data

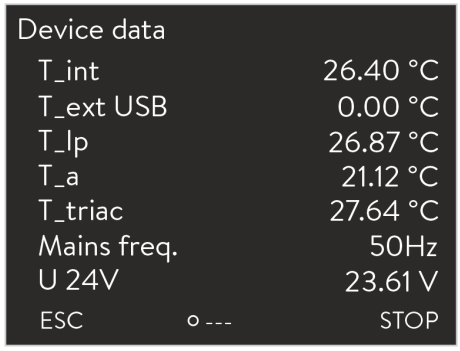


Fig. 54: Device data

1. Select the *Device data* menu item in the Device status menu.
   - ▶ Various current parameters are displayed.

6.16.4 Retrieving the software version

Amongst other things, the respective software versions are needed for service cases.

Personnel: ■ Operating personnel

1. Select the *SW version* menu item in the Device status menu.
   - ▶ The respective software versions are displayed depending on the device type and the connected modules.

6.16.5 Displaying device type

The device type is shown directly at the menu item *Type* in the Device status menu.

6.16.6 Displaying serial numbers

Personnel: ■ Operating personnel

1. Select the *Serial numbers* menu item in the Device status menu.
   ▶ The serial number of the device is displayed. The serial numbers of connected modules are also displayed if they are available.

6.17 Programmer

6.17.1 Program example

The programmer function allows storage of temperature/time programs. The program consists of several temperature/time segments and details about their repetition. Ramps, temperature jumps (time is zero) or temperature-holding phases with identical start and end temperature in the segment are possible. During the start, the current setpoint is stored as the starting value of the first segment.

The total number of freely programmable segments per program is 150.

Up to 5 temperature/time programs can be stored.

Available settings

Setting	Description
No.	Segment number of the program
Tend	End temperature that should be reached
hh	Time in hours (hh) by which the specified temperature should be reached.
mm	Time in minutes (mm) by which the specified temperature should be reached.
Tolerance	The tolerance defines the level of accuracy with which the end temperature should be reached before the next segment will be processed.
S1, S2, S3	The switching state of a contact module (if available) can be programmed here. Contact modules are available as accessory.

The graphic shows an example of reprogramming a setpoint temperature profile.

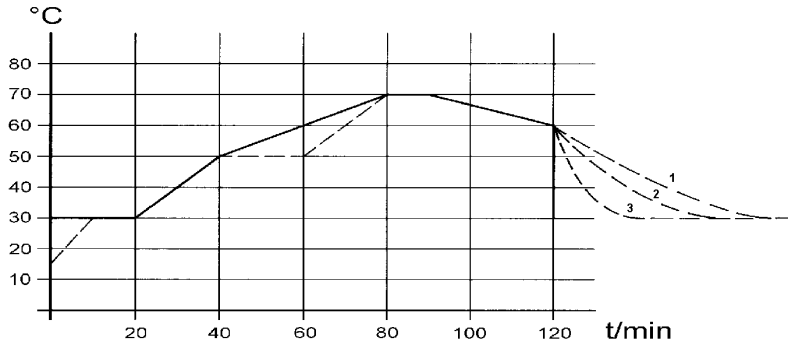


Fig. 55: Program example

The cool-down time in the graph varies depending on the device type, consumer and so on. In example segment No. 2, 50 °C should be reached within 20 minutes.

The original values in the "Before" table provided below are represented by a solid line, while the edited profile of the "After" table is shown by a dashed line.

Table 10: "Before" table

(—)								
No.	Tend	hh	mm	Tol	Pump	S1	S2	S3
Start	30.00	--	--	0.1	---	off	off	off
2	50.00	0	20	0.0	---	off	off	off
3	70.00	0	40	0.0	---	off	off	off
4	70.00	0	10	0.1	---	off	off	off
5	60.00	0	30	0.0	---	off	off	off
6	30.00	0	0	0.0	---	off	off	off

A new segment with the number 3 was entered in the edited table. The time for the segment with number 4 was also changed. The tolerance for the segment with number 5 was adjusted.

Table 11: "After" table

(- - - -, editet)								
No.	Tend	hh	mm	Tol	Pump	S1	S2	S3
Start	30.00	--	--	0.1	---	off	off	off
2	50.00	0	20	0.0	---	off	off	off
3	50.00	0	20	0.1	---	off	off	off
4	70.00	**0**	**20**	0.0	---	off	off	off
5	70.00	0	10	**0.8**	---	off	off	off

(- - - -, editet)								
6	60.00	0	30	0.0	---	off	off	off
7	30.00	0	0	0.0	---	off	off	off

The entered tolerance can have a great influence with external bath control. The graph on the side of the edited profile clarifies the possible overrun of the actual temperature in the bath vessel (solid line) for the setpoint value of the programmer (grey background).

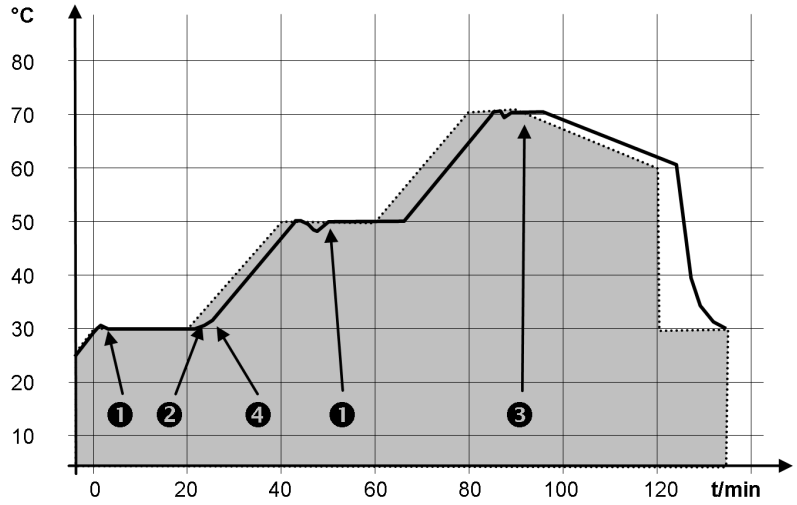


Fig. 56: Program tolerance

Note:

- The tolerance field enables precise adherence to the delay time at a specific temperature. Only once the actual temperature of the tolerance range has been reached (1), will the following segment be processed so that e.g. the ramp of the second segment will not be started until after a delay of 2.
- A tolerance range that has been selected too narrow can also cause undesired delays. The tolerance range should not be too narrow, particularly when external control is used. A larger tolerance was entered in segment 5, so that the desired time of 10 minutes can be adhered to even with transient processes (3).
- Only flat (slow) ramps should be programmed with a tolerance range as needed. Steep ramps that are close to the maximum possible heating or cooling rates of the device may be severely delayed (4) if the tolerance range (here in segment 2) is too narrow.

No time specification is possible in the starting segment (No. 1). The temperature of the first segment is reached as quickly as possible to change to segment 2 after reaching the set tolerance.

6.17.2 Selecting the program

Personnel: ■ Operating personnel

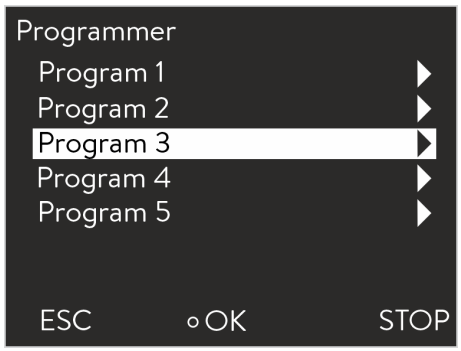


Fig. 57: Selecting the program

1. Switch to the main menu.
2. Select the *Programmer* menu item.
3. Select one of the available programs.

6.17.3 Create and edit programs

Start editing

Please note the following:

- If a segment time > 999:59 h is included, this time must be distributed over several successive segments.

Personnel: ■ Operating personnel

Fig. 58: Editing a program

1. Select the *Edit* menu item for the selected program.
2. You can now edit the segments.

Editing segments

Personnel: ■ Operating personnel

Please note the following:

- No time specification is possible in the starting segment. The temperature of the first segment is reached as quickly as possible, in order to change to segment 2 after reaching the set tolerance.
- If the value "0" is entered in the fields *hh* and *mm*, the set point is applied immediately and the bath temperature ramped up as quickly as possible.

- If a tolerance range which is too small is selected in the *Tolerance* field, it is possible that the program will not be continued as the required tolerance is never reached.
- The default setting for contact modules is *off*. The entry "- -" for contact modules stands for no changes to the previous segment, i.e. if "- -" is set in all fields, the contact position of the starting setting or the setting before the program start is maintained.

1. The following options are available:
   - You can display additional columns of the program with the right and left arrow buttons.
   - You can navigate in the segments of a program with the up and down arrow buttons.
   - You can edit a selected segment by pressing the Enter button. You can customize the value with the up and down arrow buttons. Individual digits can be selected with the right and left arrow buttons. Press the Enter button to confirm your changes.

Add new segment

Personnel: ■ Operating personnel

1. Navigate to the segment under which the new segment should be added.
2. Navigate to the *No.* column in this segment.
3. Press the Enter key.
   ▶ A new segment is created.

No.	Tend	hh	:mm	Tolerance
Start	30.00	---	---	0.1
1	50.00	0	20	0.0
2	50.00	0	20	0.0
3	70.00	0	20	0.1
4	60.00	0	30	0.0
5	30.00	0	0	0.0

ESC ○NEW DELETE

Fig. 59: Selecting program segments

Delete segment

Personnel: ■ Operating personnel

1. Navigate to the segment that you want to delete.
2. Navigate to the *No.* column in this segment.
3. Press the *Delete* soft key.
   ▶ The segment is deleted.

Editing a program currently running

Please note the following:

- No segments can be added or deleted in a currently running program.
- In the running program, changes of the existing temperature values and segment durations are possible. The segment is continued as if the change had been effective since the beginning of the segment.
- If the new segment time is shorter than the elapsed segment time, the program jumps to the next segment.

Personnel: ■ Operating personnel

1. Press the *Prog.x/y* soft key in the soft key bar in the Home window.

> *x represents the currently running program;*
> *y represents the current program loop.*

2. The currently running program opens.
3. You can now edit the segments of the currently running program.

Fig. 60: The currently running program

Completing editing

Personnel: ■ Operating personnel

1. When you have completed the program, you can return to the program overview with the left arrow button.

6.17.4 Defining program loops

Personnel: ■ Operating personnel

1. Select the *Loops* menu item for the selected program.
   - ▶ An entry window appears. The loops can be defined within the displayed limits.

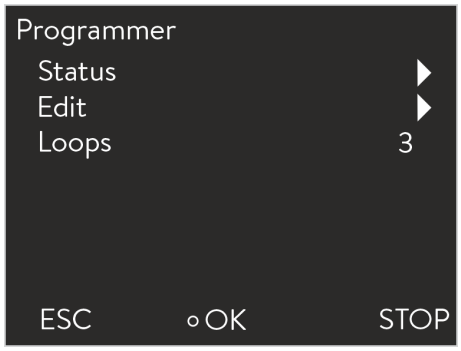


Fig. 61: Setting program loops

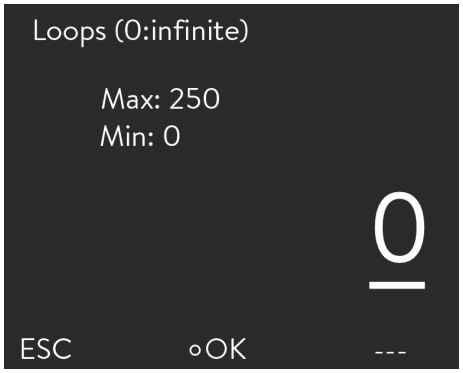


Fig. 62: Setting the number of repetitions

2. Customize the number of program loops as required.

> *Press the left arrow button to enter two or three digit numbers. Another digit is displayed and can be customized.*

> *If "0" is entered, the program is repeated continuously.*

3. Press the input button to confirm.

6.17.5 Starting, interrupting and ending a program

Personnel: ■ Operating personnel

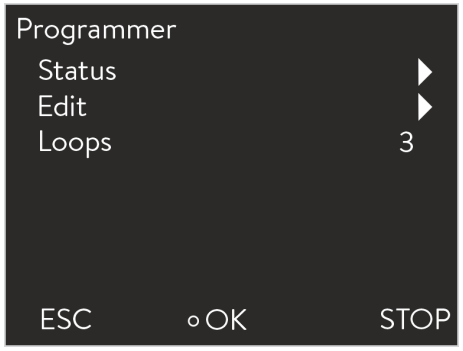


Fig. 63: Programmer menu

1. Select the *Status* menu item for the selected program.
2. The following options are available:
   - Select the option *Start* to start the program.
   - Once the program has started, you can press *Hold* to pause it. A paused program can be continued by pressing *Continue*.
   - Select the option *Stop* to end the program.

7 Maintenance

7.1 General safety instructions

DANGER!
Contact with live or moving parts

Electric shock, impacts, cutting, crushing

- The device must be disconnected from the mains power supply before any kind of maintenance is performed.
- Only skilled personnel are permitted to perform maintenance work.

DANGER!
Contact with live or moving parts

Electric shock

- Before starting any service or repair work, switch off the device and pull out the mains plug.
- Only skilled personnel are permitted to perform service and repair work.

DANGER!
Incorrect handling

Explosion, burns, fire

- Only certified specialists who are trained to handle flammable refrigerants are authorized to perform repair and disposal work.
- In order to avoid the risk of possible ignition due to incorrect maintenance or the installation of incorrect parts, only specialists certified by the manufacturer are authorized to carry out maintenance.
- Any components and parts must be replaced with identical parts.

CAUTION!
Contact with hot or cold device parts, accessories and heat transfer liquid

Scalding, hot or cold burns

- Allow device parts, accessories and heat transfer liquid to reach room temperature before touching.

7.2 Maintenance intervals

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

Interval	Maintenance work
Before switching on the device	Check the power supply cable for damage.
Monthly	Clean the filter screen (cooling water dirt trap) in water-cooled devices.
As required, once a month at the latest	Inspect the external hoses, tubing clips and screw connections for leaks and damage.
After filling for the first time after each transport operation, after changing the heat transfer liquid, once a month at the latest	Check the function of the low-level protection.
As required, every three months at the latest	On air-cooled devices, clean the air-cooled condenser.
Quarterly	Descale the cooling unit or cooling coil (a shorter interval must be selected, depending on the water hardness and operating period).
As required, once every six months at the latest	Check the serviceability of the heat transfer liquid.
As required, once a year at the latest	Check the external condition of the device for damage and stability.
Twenty years	Replacement of safety-relevant electrical and electromechanical components. Including the circuit breaker and power printed circuit board.

7.3 Cleaning the surfaces of the device

Personnel: ■ Operating personnel

1. Clean as follows:
   - ■ Clean the control element using a wet cloth with a drop of washing-up liquid.
   - ■ Clean painted sheet metal parts with a cloth and commercial industrial cleaner.

7.4 Checking the low-level protection

An alarm signal sounds if the liquid level decreases to the extent that the heater is no longer completely covered with liquid. *Low Level* is shown in the display. The components of the device, cooling unit, heater and pump are switched off via the electronics system.

An alarm must sound as soon as the minimum level is reached.

WARNING!
Contact with hot / cold heat transfer liquid

Scalding, cold burns

- Bring the heat transfer liquid to room temperature before draining.

Personnel:
- Operating personnel

Protective equipment:
- Safety glasses
- Protective gloves
- Protective work clothing

The liquid level in the device is shown in the display.

1. Switch on the device. Set the set temperature to room temperature.
2. Lower the liquid level in the device. Drain heat transfer liquid via the drain tap for this purpose.
   - ▶ The display shows that the heat transfer liquid is sinking.

   The device switches off if the liquid level is too low. The message *Low Level* appears in the display.
3. Close the drain tap and top up the heat transfer liquid.
   - ▶ The liquid level in the display rises.
4. Unlock the display with the Enter button.
   - ▶ The device restarts.

7.5 Cleaning the air-cooled condenser

Personnel: ■ Operating personnel

WARNING!
Risk of mechanical damage to refrigerant circuit

Burns, fire

- Use suitable materials/tools to clean the condenser (e.g. soft brush, vacuum cleaner or compressed air).

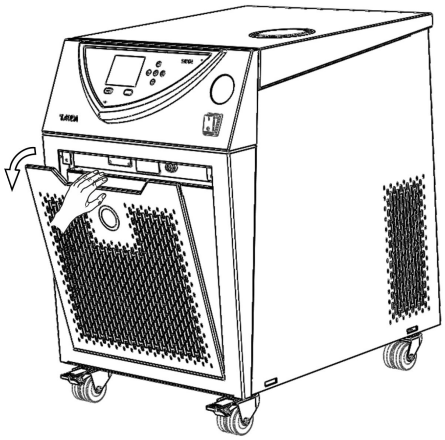


Fig. 64: Removing the front panel

1. Switch off the device.
2. Carefully remove the front panel. Grasp the front panel at the recess, pull it towards you and lift it out of the guide.

   The front panel is held in place by a magnetic catch.

3. Brush off or vacuum the condenser.
4. Install the front panel again with care.

7.6 Cleaning the water filter

This section is relevant for:

■ Water-cooled devices

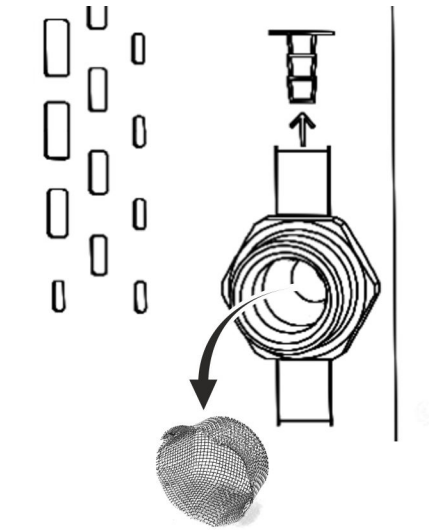


Fig. 65: Removing the water filter

Personnel: ■ Operating personnel

1. Switch off the device at the mains switch.
2. Unscrew the cooling water hose from the threaded connection of the water cooling intake.
3. Carefully remove the water filter from the intake nozzle.

> *Use tweezers to remove/insert the water filter if necessary.*

4. Clean the water filter and then re-insert it in the intake nozzle.
5. Screw the cooling water hose back on the threaded connection of the water cooling intake.

7.7 Descaling the cooling water circuit

This section is relevant for:

- Water-cooled devices

A pump or a funnel is used to fill the device with descaler via the water cooling supply hose. The descaler flows back out through the water cooling return hose and into a container with a sufficient volume (at least 10 liters).

Personnel: ■ Operating personnel

Protective equipment: ■ Safety glasses
■ Protective gloves
■ Protective work clothing

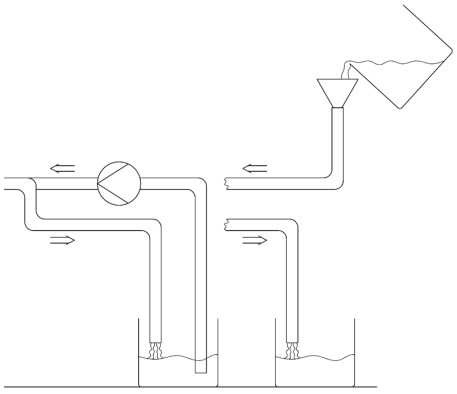


Fig. 66: Descaling

1. Switch off the device at the mains switch.
2. Dissolve the descaler in a bucket of water.

> *LAUDA descaler is required for the descaling process (catalog number LZB 126, 5 kg pack). Read the safety information and instructions on the packaging before using the chemicals.*

3. Unscrew the cooling water hose from the threaded connection of the water cooling intake.
4. Remove and clean the water filter of the device. The water filter is located in the water cooling intake nozzle.

> *You will find more information on cleaning the water filter in* ↳ Chapter 7.6 “Cleaning the water filter” on page 74.

5. Leave the cooling water hose on the outlet on the device. Place the other end of the hose in a large container.

6. Switch the device on and set the set point to 10 °C. After the cooling unit has been started, fill the device with LAUDA descaler via the water cooling supply hose. Use a pump or a funnel.
7. Continuously top up and pump the descaler. Continue this process until the foaming reaction had subsided. This usually takes approx. 20 to 30 minutes.
8. Then drain the condenser.

> *Refer to* Chapter 9.2 “Draining the condenser ” on page 85 *for detailed information on draining the condenser.*

9. Rinse the cooling water circuit of the device thoroughly with clean water.

> *Allow a minimum of 10 liters of water to flow through the system.*

10. Reconnect the device to the cooling water supply.

7.8 Check the heat transfer liquid

WARNING!
Contact with hot/cold heat transfer liquid

Scalding, cold burns

- Bring the heat transfer liquid to room temperature for analysis.

NOTICE!
Wear, contamination, dilution of the heat transfer liquid

Device damage

- The serviceability of the heat transfer liquid must be checked if necessary (e.g. if the operating mode is changed) but at every prescribed maintenance interval at the latest.
  Continued use of the heat transfer liquid is only permitted if the check indicates this.

Wear of the heat transfer liquid

- *Heat transfer liquid is subject to wear, such as cracking or aging (oxidation).*
- *The serviceability of the heat transfer liquid must be checked if necessary (e.g. if the operating mode is changed), at least every six months.*
- *Continued use of the heat transfer liquid is only permitted following successful testing.*

Protective equipment:
- Safety glasses
- Protective gloves
- Protective work clothing

Where applicable, the following points should be considered when testing the heat transfer fluid:

Viscosity	1. Medium becomes tougher due to resinification caused by oxidation, for example.
Water content	2. For water/monoethylene glycol mixtures: The water content decreases during longer periods of operation at higher temperatures and the mixture becomes flammable.
Boiling point	3. Lowered boiling point due to cracking (splitting of C-C chains into hydrocarbons).
Cloudiness	4. Increase in deposits, suspended matter and particles due to thermal reactions and oxidation, for example.
Color	5. Medium turns darker, even black, due to oxidation, for example.
Odor	6. Smells rancid or burnt, for example.
Application	7. General deterioration in thermal performance. Reduction in the achievable temperature stability.

8 Faults

8.1 Alarms, errors and warnings

All alarms, error messages and warnings triggered on the device appear in text form on the display.

Procedure in event of alarm

Alarms affect safety. The components of the device, such as the pump, switch off. The device emits a two-tone acoustic signal. Once the cause of the fault has been eliminated, the alarm can be canceled with the Enter key.

Refer to ↳ Chapter 8.2 “Alarm codes” on page 78 for a list of alarms.

Procedure in event of warning

Warnings do not have a significant effect on safety. The device continues to operate. The device will make a continuous noise for a short period of time. Warnings are issued periodically. Once the cause of the fault has been eliminated, the warning can be canceled with the Enter key.

Refer to ↳ Chapter 8.5 “Warnings - Control system” on page 80, ↳ Chapter 8.6 “Warnings - Safety system” on page 82 and ↳ Chapter 8.7 “Warnings - Smart Cool” on page 83 for a list of warnings.

Procedure in event of error

If an error occurs, the device emits a two-tone acoustic signal.

If this happens, switch off the device at the mains switch. If the error occurs again after switching on the device, make a note of the error code and the corresponding description and contact the LAUDA Service department. You will find the contact information here ↳ Chapter 13.4 “Contact LAUDA ” on page 96.

Errors are displayed with an appropriate description and an error code in the form of a consecutive number.

8.2 Alarm codes

Code	Alarm message	Cause	Possible remedy
02	Low level	Float detects low level in expansion bath.	↳ Chapter 8.3 “Low level alarm” on page 79 If a low level is detected multiple times: Check the device, all connecting parts, and the external consumer for leaks.
03	Overtemperature	Bath temperature is greater than 90°C, temperature cutout has triggered.	↳ Chapter 8.4 “Overtemperature alarm” on page 80
09	T ext missing	Control variable for external actual value Pt100 is not available.	Check the external Pt100 temperature probe. Check the connection cable of the temperature probe.
10	T ext analog	Control variable for external analog actual value is not available.	Check the signal cable to the analog interface. Check the analog signal of the external control.

Code	Alarm message	Cause	Possible remedy
11	T ext missing	Control variable for external serial actual value is not available.	Check the signal cable to the serial interface. Check the temperature specification of the external control.
12	Analog input 1	Analog module: Interruption at input 1.	Check the signal cable to input 1 of the analog interface. Check the analog signal of the external control.
13	Analog input 2	Analog module: Interruption at input 2.	Check the signal cable to input 2 of the analog interface. Check the analog signal of the external control.
15	Contact input	Fault on the digital input/contact.	Check the line between the contact and the external system.
20	T ext missing	Control variable for external Ethernet actual value is not available.	Check the connection of the Ethernet cable. Check the temperature specification of the external control.

8.3 Low level alarm

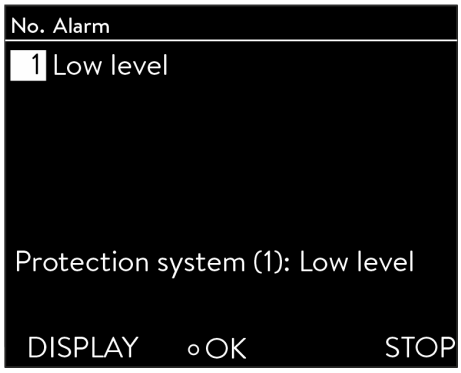


Fig. 67: Low Level Alarm

- An alarm signal sounds if the liquid level falls below the minimum level.
- *Low Level* appears in the display. The components of the device, e.g. the pump, are switched off via the electronics system.

Rectifying a fault

Personnel: ■ Operating personnel

1. Top up the missing heat transfer liquid.
2. Unlock the display with the Enter button.
   ▶ The device restarts.

8.4 Overtemperature alarm

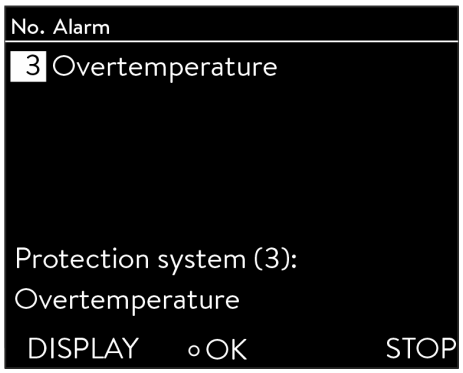


Fig. 68: Overtemperature alarm

If the temperature exceeds 90 °C, *3 overtemperature* alarm is triggered and a two-tone acoustic signal sounds.
The heaters, cooling system and pump are switched off as a result of this alarm.

1. Switch off the device.
2. Allow the device to cool down (> 20 minutes).
3. Switch on the device.
4. Press the *OK* key to acknowledge the alarm.

8.5 Warnings - Control system

All warnings from the control system start with the prefix 0. Two numbers will follow the prefix. These number sequences can be found in the following table.

Code	Warning message	Cause	Possible remedy
001	LiBus receive overf	Overflow at CAN reception	Switch off the device and switch on again after 30 seconds. If the message appears repeatedly, contact LAUDA Service.
002	Watchdog reset	Watchdog reset microcontroller	Switch off the device and switch on again after 30 seconds. If the message appears repeatedly, contact LAUDA Service.
003	T_ih limit active	Lower temperature limit (Til) reached, cooling capacity is reduced.	■ Check the setting for the lower temperature limit (Til). ■ Check the application.
004	T_il limit active	Upper temperature limit (Tih) reached, the heating output is reduced.	■ Check the setting for the upper temperature limit (Tih). ■ Check the application.

Code	Warning message	Cause	Possible remedy
009	Unknown Modul	Unknown accessory or interface module connected.	Check the compatibility, see notes on compatibility in the operating manual accompanying the module.
010	SW Contr. too old	Software control system too old.	Update the device software, please contact LAUDA Service.
...	SW [...] too old	Software [MODULE] too old	Update the device software, please contact LAUDA Service.
029	SW EtherCAT old	EtherCAT module software too old	Update the device software, please contact LAUDA Service.
033	Clock wrong time	Battery supply was/is interrupted. The battery voltage is too low.	■ Insert a new battery into the printed circuit board on the operating unit (lithium battery 3V BR 2032; item no. EZ 291). ■ Then check the clock setting in the device menu.
034	Tset: Prog. is running	The set point was changed while the programmer was active. The set point value must only originate from a single source.	■ Check the set point value. ■ Check the application.
041	Wrong mains voltage	■ Incorrect mains voltage, out of tolerance. ■ Current sensor on power board faulty	■ Check the voltage of the power supply ■ Replace the power board. Contact LAUDA Service.
050	Niveau very low	■ When cooling, the liquid level in the expansion bath may fall due to a decrease in the liquid volume. ■ Leak in the consumer and connecting parts. ■ Leak in the constant temperature equipment	■ If necessary, top up the missing heat transfer liquid. ■ Check the hoses, connections and consumers for leaks. ■ Check the constant temperature equipment for leaks.
051	Niveau high	■ When heating, the liquid level in the expansion bath may rise due to an increase in the liquid volume. ■ Device was filled too much. ■ Reverse flow from the consumer into the device. When external consuming units are positioned higher than the device, the external volume may run dry when the pump is switched off and air enters the external fluid circuit, even when the circuits are closed. There is then a danger that the device will overflow.	■ Allow the device and liquid to cool to room temperature and check the fill level, draining some liquid, if necessary ■ For higher consumers: Check the installation and aerate the external circuit completely, if necessary take measures to prevent reverse flow (reverse flow protection).

8.6 Warnings - Safety system

All warnings from the protection system start with the prefix 1. Two numbers will follow the prefix. These number sequences can be found in the following table.

Code	Warning message	Cause	Possible remedy
101	LiBus receive overf	Overflow at CAN reception	Switch off the device and switch on again after 30 seconds. If the message appears repeatedly, contact LAUDA Service.
102	Watchdog reset	Watchdog reset microcontroller	Switch off the device and switch on again after 30 seconds. If the message appears repeatedly, contact LAUDA Service.
103	Heating not correct	For three-phase devices with more than one heater: ■ Heaters have different current consumptions, deviation greater than 15%. ■ Current sensors on power PCB faulty.	■ Check the wiring. ■ Check the heater.
104	Heat 1 failed	■ Heater 1 faulty. ■ Fuses F1 and F2 on power PCB (3-phase). ■ Triac on power PCB faulty. ■ Wiring fault	■ Check the fuses. ■ Check the wiring. ■ Check the heater and replace, if necessary. Contact LAUDA Service. ■ Replace the power PCB. Contact LAUDA Service.
105	Heat 2 failed	■ Heater 2 faulty. ■ Fuses F3 and F4 on power PCB (3-phase). ■ Triac on power PCB faulty. ■ Wiring fault	■ Check the fuses. ■ Check the wiring. ■ Check the heater and replace, if necessary. Contact LAUDA Service. ■ Replace the power PCB. Contact LAUDA Service.
106	Heat 3 failed	■ Heater 3 faulty. ■ Fuses F5 and F6 on power PCB (3-phase). ■ Triac on power PCB faulty. ■ Wiring fault	■ Check the fuses. ■ Check the wiring. ■ Check the heater and replace, if necessary. Contact LAUDA Service. ■ Replace the power PCB. Contact LAUDA Service.
109	Unknown Modul	Unknown accessory or interface module connected.	Check the compatibility, see notes on compatibility in the operating manual accompanying the module.
110	REGEL: SW Contr. too old	Software control system too old.	Update the device software, please contact LAUDA Service.

Code	Warning message	Cause	Possible remedy
...	[MODUL]: SW [...] too old	Software [MODULE] too old.	Update the device software, please contact LAUDA Service.
129	SW EtherCAT old	EtherCAT module software too old.	Update the device software, please contact LAUDA Service.

8.7 Warnings - Smart Cool

All warnings from the SmartCool start with the prefix 3. Two numbers will follow the prefix. These number sequences can be found in the following table.

Code	Warning message	Cause	Possible remedy
301	LiBus receive overf	Overflow at CAN reception.	Switch off the device and switch on again after 30 seconds. If the message appears repeatedly, contact LAUDA Service.
302	Watchdog reset	Watchdog reset microcontroller	Switch off the device and switch on again after 30 seconds. If the message appears repeatedly, contact LAUDA Service.
304	Pressure Switch activated	**For air-cooled device types:**	
		Condenser is dirty.	Clean the condenser. Chapter 7.5 “Cleaning the air-cooled condenser” on page 74
		Distance to surroundings insufficient.	Check the installation conditions. Observe the minimum distances specified in the technical data.
		Ambient temperature too high.	Check the installation conditions to ensure sufficient heat discharge from the room air. Observe the exhaust air specifications for the devices defined in the technical data.
		Condenser fan faulty	When cooling is active, check the air flow into the condenser in the lower section of the unit front. In the event of a fault, contact LAUDA Service.
		For water-cooled device types:	
		External cooling water supply switched off.	Check the external cooling water supply.
		Filter strainer in the cooling water inlet is dirty.	Check the filter strainer in the cooling water inlet. Chapter 7.6 “Cleaning the water filter” on page 74

Code	Warning message	Cause	Possible remedy
		Pressure difference between cooling water inlet and outlet too low.	Check the pressure difference or cooling water temperature. Refer to the information in the section "Cooling water". Chapter 4.3.2 “Connecting the cooling water” on page 27
		Cooling water temperature too high.	
		Cooling water regulator faulty, no cooling water flow	Contact LAUDA Service.
305	Clean condenser	Temperature in the condenser unit too high.	Clean the condenser. See also the notes relating to warning 304.
306	TO1 out of range (Klixon)	■ Compressor shut down due to overheating. ■ Expansion valve faulty ■ Refrigerant leaking	■ Check whether the compressor switches on in cooling mode. For air-cooled devices: Check the installation conditions. ■ Contact LAUDA Service.
309	Unknown Modul	Unknown accessory or interface module connected.	Check the compatibility, see notes on compatibility in the operating manual accompanying the module.
310	REGEL: SW Contr. too old	Software control system too old.	Update the device software, please contact LAUDA Service.
...	[MODUL]: SW [...] too old	Software [MODULE] too old.	Update the device software, please contact LAUDA Service.
329	SW EtherCAT old	EtherCAT module software too old.	Update the device software, please contact LAUDA Service.
333	Valve sm0 break	■ Expansion valve [Valve Cool] not connected. ■ Expansion valve coil faulty.	■ Check the valve connection on the printed circuit board of the operating unit. ■ Replace the valve coil. Contact LAUDA Service.
334	Output sm0	Valve actuation fault on the printed circuit board of the operating unit.	Replace the operating unit. Contact LAUDA Service.
335	Valve sm1 break	■ Subsequent injection valve [Valve Reinj] not connected. ■ Expansion valve coil faulty.	■ Check the valve connection on the printed circuit board of the operating unit. ■ Replace the valve coil. Contact LAUDA Service.
336	Output sm1	Valve actuation fault on the printed circuit board of the operating unit.	Replace the operating unit. Contact LAUDA Service.
341	sm0 min too small	Adaptation value [SM0 min] of the expansion valve [Valve Cool] is too small.	Increase the value [SM0 min] manually by one increment. Contact LAUDA Service.
344	Chiller missing	Cooling unit does not function.	Check the triggering of the compressor.
349	Preheat unit	Ambient temperature is below 5 °C	

9 Decommissioning

9.1 Drain the device

Personnel: ■ Operating personnel

WARNING!
Possible damage to the evaporator due to cleaning of the hydraulic circuit

Fire

- Use only approved heat transfer liquids.

Also note the following:

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

1. Switch off the device.
2. Let the device and the heat transfer liquid cool down or heat up to room temperature.
3. Position a container with appropriate capacity directly under the drain tap.

Several draining processes are required for devices with high fill capacity.

4. Open the drain tap. Turn the lever to the right for this.

9.2 Draining the condenser

This section is relevant for:

- Water-cooled devices

WARNING!
Cooling water circuit is damaged by frost expansion

Fire, device damage, environmental impact

- When decommissioning the device or if there is a risk of freezing, drain the cooling water circuit on the cooling unit. Use compressed air or an industrial vacuum cleaner (water-proof). Blow compressed air through the cooling water circuit.

Draining the water-cooled condenser

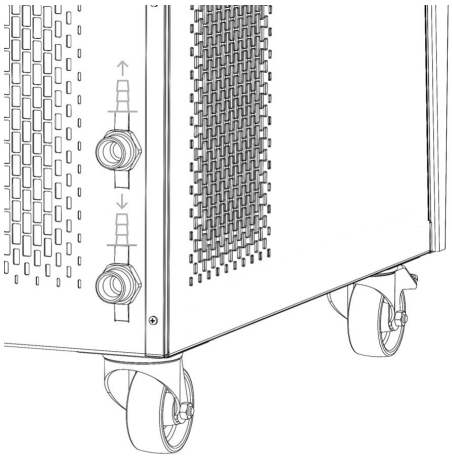


Fig. 69: Cooling water connection socket

To do this, heat up the outflow to about 20 °C. Remove the water hose on the water tap. Set the setpoint to, for example, 10 °C and immediately after the compressor start-up, blow into the water return hose with compressed air. Continue until all water has flowed out of the device. Switch the device off immediately.

10 Disposal

10.1 Disposing of the refrigerant

DANGER!
Uncontrolled leaking of refrigerant

Explosion, burns, fire

- Never dispose of a cooling circuit that is still pressurized.
- Only certified specialists who are trained in the handling of flammable refrigerants are permitted to perform disposal work.

The type and refrigerant charge are printed on the rating label.

Have repair and disposal carried out only by a refrigeration technician.

10.2 Device disposal

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).

10.3 Disposing of packaging

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

11 Technical data

11.1 General and type-specific data

The device sound pressure level is below 70 dB. According to EC Directive 2006/42/EC the sound pressure level of the devices is therefore not specified further.

Table 12: General data

Specification	Value	Unit
IP protection level	IP 32	---
Class division for laboratory equipment according to DIN 12876	NFL (suitable for non-flammable liquids)	---
Protection class for electrical equipment DIN EN 61 140 (VDE 0140-1)	1	---
Display	TFT display, 3.5", 320 x 240 pixels	---
Resolution of indication	±0.01	°C
Setting resolution	±0.01	°C

Table 13: Type-specific data

Device	Working temperature range	Temperature stability	Dimensions (W x D x H)	Weight
Unit	°C	K	mm x mm x mm	kg
VC 1200	-25 – 80	±0.05	450 x 550 x 650	51
VC 1200 W	-25 – 80	±0.05	450 x 550 x 650	50
VC 2000	-25 – 80	±0.05	450 x 550 x 650	51
VC 2000 W	-25 – 80	±0.05	450 x 550 x 650	50

Table 14: VC 1200 and VC 2000 with more powerful pump

Device	Dimensions (W x D x H)	Weight
Unit	mm x mm x mm	kg
VC 1200	450 x 550 x 790	59
VC 1200 W	450 x 550 x 790	58
VC 2000	450 x 550 x 790	59
VC 2000 W	450 x 550 x 790	58

Free space around the device

Table 15: Air-cooled devices

Device	Free space around the device	Exhaust air
	cm (front/back/right/left)	m^3/h
VC 1200	20/20/20/20	650
VC 2000	20/20/20/20	650

Table 16: Water-cooled devices

Device	Free space around the device	Cooling water consumption
	cm (front/back/right/left)	l/min
VC 1200 W	20/20/20/20	1.5
VC 2000 W	20/20/20/20	2.0

Table 17: Cooling water data for VC 1200 W and VC 2000 W

Specification	Value
Maximum cooling water pressure	10 bar
Minimum differential pressure of cooling water Δp	1 bar
Maximum differential pressure of cooling water Δp	6 bar
Recommended cooling water temperature	15°C
Permissible cooling water temperature range	10 – 30°C, in the upper range, the cooling capacity of the device is reduced

11.2 Cooling output

Table 18: Device cooling output

	Unit	VC 1200	VC 1200 W	VC 2000	VC 2000 W
Cooling output at 20 °C	W	1300	1400	2000	2100
10°C	W	1200	1300	1600	1850
0°C	W	1050	1100	1250	1300
-10°C	W	800	850	900	950

	Unit	VC 1200	VC 1200 W	VC 2000	VC 2000 W
-20°C	W	500	530	570	620
-25°C	W	300	340	360	400

Table 19: VC 1200 and VC 2000 with more powerful pump

	Unit	VC 1200	VC 1200 W	VC 2000	VC 2000 W
Cooling output at 20 °C	W	1220	1320	1920	2020
10°C	W	1120	1220	1520	1770
0°C	W	970	1020	1170	1220
-10°C	W	720	770	820	870
-20°C	W	420	450	490	540
-25°C	W	220	260	280	320

The cooling output is measured when the heat transfer liquid reaches a certain temperature. These temperature values are specified above. The ambient temperature for the measurement is 20 °C and ethanol was used as a heat transfer liquid. To measure water-cooled devices, the cooling water temperature is 15 °C and the cooling water differential pressure is 3 bar.

Cooling water connection socket

All water-cooled Variocool devices are equipped with the following cooling water connection:

- ¾" outer connection thread

11.3 Refrigerant and filling charge

Table 20: Refrigerant

	Unit	VC 1200	VC 2000	VC 1200 W	VC 2000 W
Refrigerant	---	R-290	R-290	R-290	R-290
Maximum filling weight	kg	0.095	0.095	0.095	0.095
GWP	---	3	3	3	3

11.4 Filling volume and characteristics of the pumps

Filling volume of the devices

Table 21: Filling volume

Device	Maximum/minimum filling volume	Pump connection	Drain tap
	L	Inches	Inches
VC 1200 (W)	15/8	G ¾, hose nozzle ¾"	G ½"
VC 2000 (W)	15/8	G ¾, hose nozzle ¾"	G ½"

Characteristics of the pumps

The pump characteristics were determined using water.

Table 22: Maximum discharge pressure and maximum flow rate

Alternating current	VC 1200 (W)	VC 2000 (W)
230 V; 50 Hz	0.9 bar; 28 l/min	0.9 bar; 28 l/min

Table 23: Discharge pressure and flow rate for devices with a more powerful pump

Alternating current	VC 1200 (W)	VC 2000 (W)
230 V; 50 Hz	3.2 bar; 37 l/min	3.2 bar; 37 l/min
200 V; 50/60 Hz	3.2 bar; 37 l/min	3.2 bar; 37 l/min
208 – 220 V; 60 Hz	3.2 bar; 37 l/min	3.2 bar; 37 l/min

Characteristics of the pumps

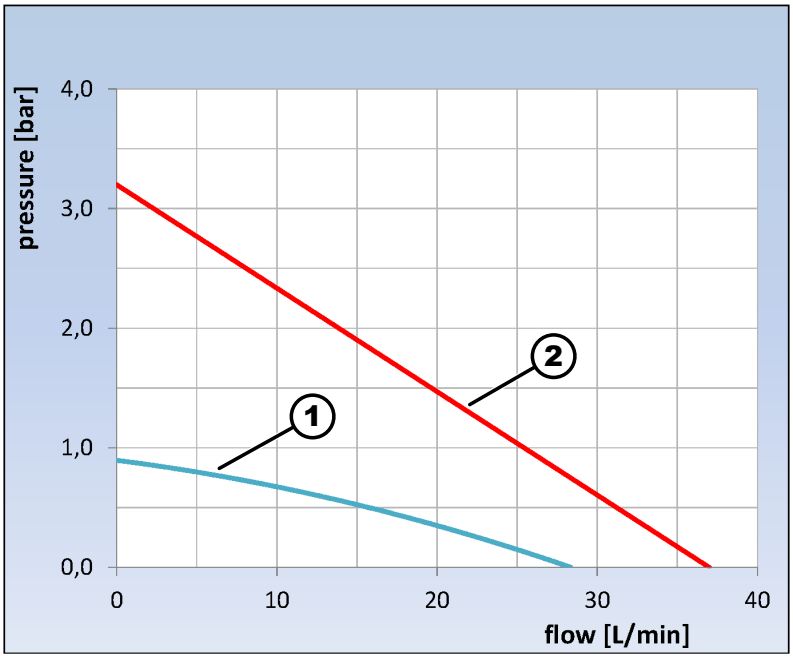


Fig. 70: Characteristics of the pumps

1 Standard pump
2 More powerful pump

11.5 Heating output, power supply and mains fuse

Mains fuse

Mains fuse ↳ “Note for electric installation on site:” on page 30

Table 24: Heating output and current consumption

Power supply		Maximum heating output in kW			
Lower/upper mains voltage	Current consumption in A	VC 1200	VC 1200 W	VC 2000	VC 2000 W
230 V; 50 Hz	12	2.3	2.3	---	---
230 V; 50 Hz	13	---	---	2.3	2.3

Power supply		Maximum heating output in kW			
Lower/upper mains voltage	Current consumption in A	VC 1200	VC 1200 W	VC 2000	VC 2000 W
200 V; 50/60 Hz	13	2.0	2.0	---	2.0
208 – 220 V; 60 Hz	13	---	2.2/2.4	---	---

Table 25: Heating output and current consumption for devices with a more powerful pump

Power supply		Maximum heating output in kW			
Lower/upper mains voltage	Current consumption in A	VC 1200	VC 1200 W	VC 2000	VC 2000 W
230 V; 50 Hz	14	2.6	2.6	2.6	2.6
200 V; 50/60 Hz	14	---	---	2.0	---
208 – 220 V; 60 Hz	14	2.2/2.4	---	2.2/2.4	2.2/2.4

12 Accessories

The following accessories are available for Variocool devices.

Table 26: Large module bay (51 mm x 27 mm)

Accessories	Catalog number
Analog interface module	LRZ 912
RS 232/485-interface module Advanced	LRZ 926
Contact interface module Advanced with one input and one output	LRZ 927
Contact interface module Advanced with three inputs and three outputs	LRZ 928
Profibus interface module Advanced	LRZ 929
Ethernet interface module Advanced	LRZ 930
EtherCAT Interface Module	LRZ 922
Profinet interface module Advanced	LRZ 932
CAN interface module Advanced	LRZ 933

Table 27: Small module bay (51 mm x 17 mm)

Accessories	Catalog number
External Pt100/LiBus module	LRZ 918
LiBus module	LRZ 920
Command remote control (only functional in combination with LRZ 918)	LRT 927

Table 28: Connecting plug

Accessories	Catalog number
External temperature probe with socket and shielded connection cable	ETP 059
Coupling connector, 6-pin for analog inputs/outputs	EQS 057
Connecting plug SUB-D, 9-pin	EQM 042
RS 232 cable (2 m) for PC	EKS 037
RS 232 cable (5 m) for PC	EKS 057
3-pin coupling connector for contact input	EQS 048
3-pin coupling socket for contact output	EQD 047

Table 29: Flow control instrument

Accessories	Catalog number
Flow control instrument G 3/4"	LWZ 118

13 General

13.1 Copyright

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

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

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

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

13.2 Technical changes

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

13.3 Warranty conditions

LAUDA grants a standard warranty of one year.

13.4 Contact LAUDA

Contact the LAUDA Service department in the following cases:

- Troubleshooting
- Technical questions
- Ordering accessories and spare parts

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

Contact information

LAUDA Service

Phone: +49 (0)9343 503-350

Email: service@lauda.de

13.5 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: Variocool **Serial number:** from S250000001

Types: VC1200, VC1200 W, VC2000, VC2000 W
(versions with natural refrigerant)

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 Regulation	(EU) 2023/1230 (valid from 20.01.2027)
Machinery Directive	2006/42/EG (valid until 19.01.2027)
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 III and Annex I Paragraph 1.5.1 in conformity with the Low Voltage Directive 2014/35/EU. The machine or the associated product is subject to the conformity assessment procedure based on internal production control (Module A according to (EU) 2023/1230).

Applied standards (with date of publication):

- EN ISO 12100:2010 (Abl. 08.04.2011)
- EN 61010-1:2010/A1:2019/AC:2019-04 (Abl. 30.11.2020)
- EN IEC 61010-2-010:2020 (Abl. 22.06.2021)
- EN 61326-1:2021
- EN 378-2:2016 (Abl. 09.06.2017)

Authorized representative for the composition of the technical documentation:
Dr. Jürgen Dirscherl, Head of Research & Development

Signed in the name of: LAUDA DR. R. WOBSER GMBH & CO. KG

Lauda-Königshofen, 26.08.2025

Dr. Marc Stricker,
Managing Director (COO)

13.6 Product Returns and Clearance Declaration

Product Returns

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

Return address

LAUDA DR. R. WOBSER GMBH & CO. KG

Laudaplatz 1

97922 Lauda-Königshofen

Deutschland/Germany

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

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

Clearance Declaration

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

Place, date	Name in block letters	Signature

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