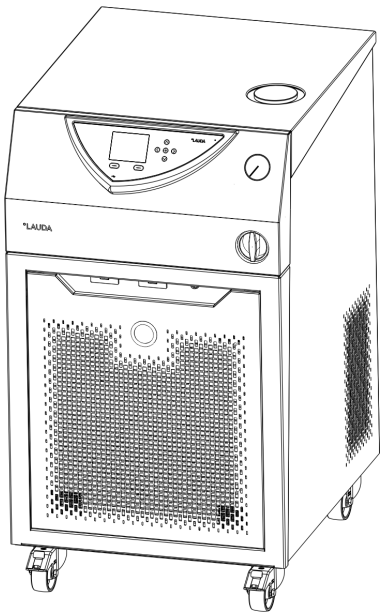
Operation manual

Variocool

VC 1200 (W), VC 2000 (W), VC 5000 (W), VC 10000 (W)

Process thermostat containing natural refrigerant



V3R24

Read this manual prior to performing any task!

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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 108.

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 12.

Refer to Chapter 1.15 “Structure of the warnings” on page 12 *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 100.

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

The following are considered cases of reasonably foreseeable misuse:

- Operating the device without heat transfer liquid
- Operating the device with an unsuitable heat transfer liquid
- Operating the device with a flammable heat transfer liquid
- Connecting hoses incorrectly
- Operation with faulty or unsuitable hoses
- Setting an incorrect pump pressure
- Operating the device in medical applications
- Use in hazardous areas
- to control the temperature of foodstuffs
- with a glass reactor without gage pressure protection
- Connection to a non-closed hydraulic circuit
- Outdoor installation
- Operating the device with power supply cables that are faulty, unsuitable or do not conform to standards

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
- Maximum storage and transport temperature of 43°C

1.4.3 Time limits

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

Maintenance intervals -

1.5 EMC requirements

Table 1: Classification in accordance with EMC requirements

Devices	Immunity requirements	Emissions class	Customer power supply	
			Countries within the EU	Countries outside of the EU
VC 1200 (W), VC 2000 (W), VC 5000 (W),	Table 2 (industrial) in accordance with EN 61326-1	Emissions Class B in accordance with CISPR 11	Domestic connection value ≥ 100 A	No limitations
VC 10000 (W) [1]	Table 2 (industrial) in accordance with EN 61326-1	Emissions Class B in accordance with CISPR 11	Domestic connection value ≥ 100 A	No limitations

[1] This device is a Class A product. This product may cause radio interference in a domestic environment.

Instructions for Class A digital device, USA

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

Instructions for Class A digital device, Canada

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

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

1.6 Software versions

This operating manual is valid for devices with the following software versions or higher.

Software	Valid from version
Operating system Command	3.45
Control system	1.74
Cooling (natural refrigerant)	2.08
Analog IO module	3.31
RS 232/485 module	3.34
Digital IO module	3.17
External temperature module	1.45
Ethernet module	1.27
EtherCAT module	1.14

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 of safety group A3. These natural refrigerants have higher flammability.

The refrigerant designation and charge are specified on the type plate and in the chapter "Technical Data".

1.9 Heat transfer liquid requirements

- 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 to the temperature range of your application.
- The safety data sheet of the heat transfer liquid specifies potential 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 that the fluids are suitable for the materials used.
- The heat transfer liquid must be provided with corrosion protection.

- You must also check the suitability of the heat transfer liquid by performing a test run within the desired temperature range.
- During the test run, you must also check that the low-level protection is functioning correctly.

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

- temperature,
- pressure and
- media resistance of the hoses must be suitable for the respective application.

Refer to the "Hoses" chapter for information on recommended hoses.

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.

Refrigeration specialist

Refrigeration specialists are specially trained and certified for the specialist field in which they are active and know all the applicable standards and regulations. The certification includes the expertise required to avoid emissions, recover fluorinated greenhouse gases and safely handle refrigeration equipment of the relevant type and size.

Refrigeration specialists are able to carry out work on refrigeration systems and independently recognize and avoid possible dangers based on their professional training and experience.

A certificate relating to (EU) No. 2024/573 and (EU) No. 2015/2067 must be available.

Specialized personnel

Certain activities on the device must be performed by specialized personnel. Specialized personnel are people whose professional education, knowledge, and experience as well as knowledge of relevant standards qualify them to assess the function and risks associated with the device and its use.

1.13 Personal protective equipment



Protective gloves

Protective gloves must be worn for certain tasks. The protective gloves must comply with standard DIN EN ISO 374-1. 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. Protective clothing with long sleeves must be worn. 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.

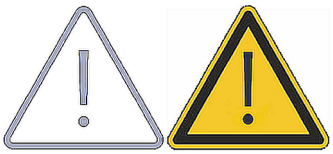
1.14 Product safety label

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.

Danger zone



A "Danger zone" graphic symbol is affixed to the device. This symbol warns of a possible danger zone on the device, which may pose an impending or imminent danger to the life and health of personnel.



A "flammable substances" graphic symbol is affixed to the device. This symbol warns of a possible danger zone on the device, which may pose an impending or imminent danger to the health of personnel.

1.15 Structure of the warnings

Warning signs	Type of danger
	Warning – dangerous electrical voltage.

Warning signs	Type of danger
	Warning – explosive substances.
	Warning – flammable substances.
	Warning – hot surface.
	Warning – slip hazard.
	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.

NOTICE!
Origin of the hazard

	Possible consequences of the hazard
	• Measure 1 • Measure...

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.

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 G¾"	2	EOA 004
Devices with water cooling	Hose nozzle ½" with union nut G¾"	2	EOA 001
All devices	Operating manual	1	Q4DA-E_13-038

Table 3: Accessories included as standard

Device type	Designation	Quantity	Catalog number
VC 5000 (W)	Pump connection: Hose nozzle ¾" with union nut G¾"	2	EOA 004
VC 10000 (W)	Pump connection: Hose nozzle 1" with union nut G1¼"	2	EOA 003
Devices with water cooling	Hose nozzle ½" with union nut G¾"	2	EOA 001
All devices	Operating manual	1	Q4DT-E_13-026

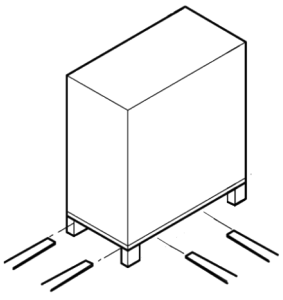


Fig. 1: Transporting with an industrial vehicle

Check the device and accessories for completeness and any 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 the LAUDA Service department immediately. You will find the contact information here Chapter 13.4 “Contact LAUDA ” on page 108.

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

Unpacking information, illustrated using the example of a VC 5000

Personnel: ■ Operating personnel

Unpack the device according to the following instructions.

1. Fig. 1: Cut and remove the plastic straps ①.
2. Remove the wooden cover ② from the packaging.

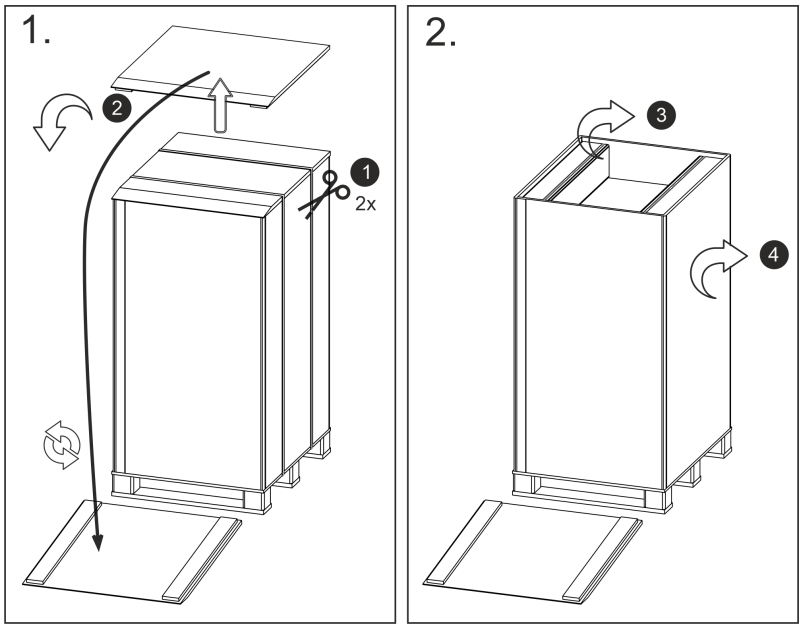


Fig. 2: Graphic of unpacking instructions for VC 5000

3. Fig. 2: Remove the two spacer blocks ③ from the box. Remove the box ④.
4. Fig. 3: The operating manual is lying on the device ⑤. You will need this.

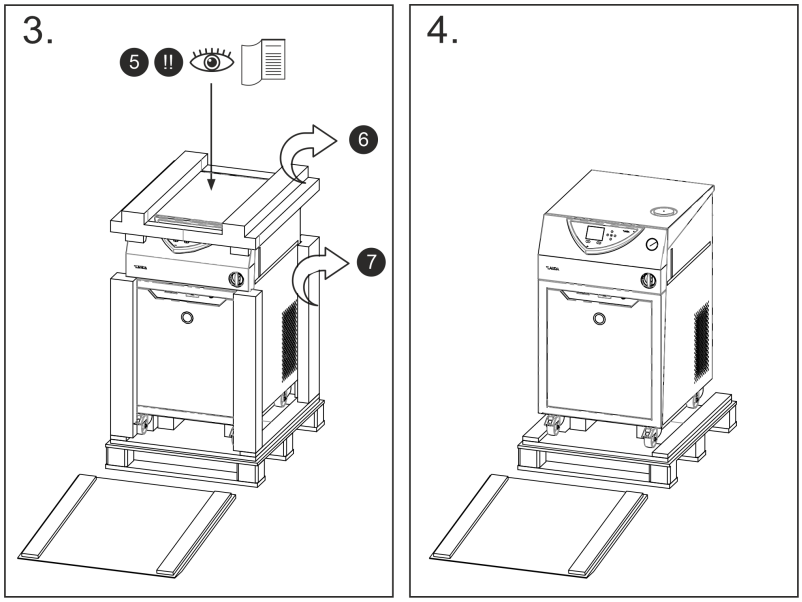


Fig. 3: Graphic of unpacking instructions for VC 5000

5. Remove the foam material ⑥ from the device and the corners ⑦.

6. Fig. 4: The device has been unpacked.

> *To ensure your safety, you will need three persons to carry out the next step.*

7. Fig. 5: Carefully tip the device slightly to one side ⑧. Remove the foam material ⑨ on which the device was previously resting. Tip the device to the other side, and do the same.

   ▶ The device is standing on its castors.

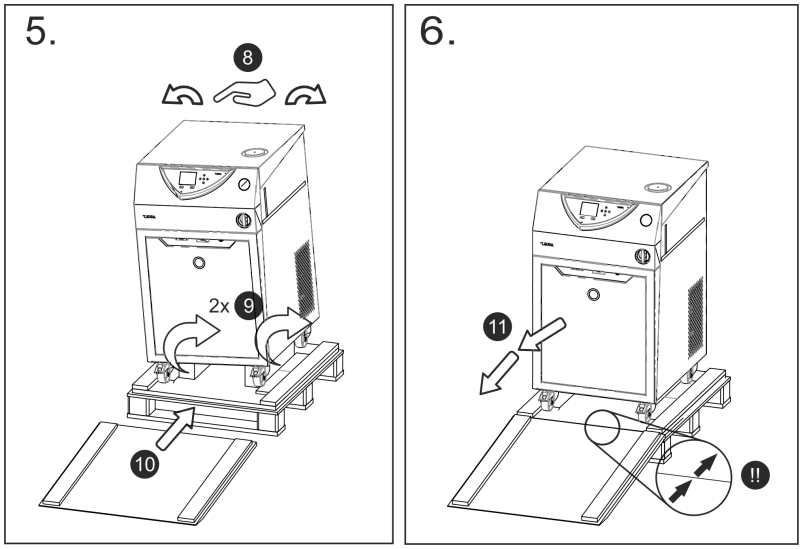


Fig. 4: Graphic of unpacking instructions for VC 5000

8. Fig. 5: The wooden cover now becomes a ramp. The slanted sides of the ramp should face away from the device, towards the ground. The guide rails are visible. Place the ramp ⑩ on the recess on the pallet. Open the castor brakes on the device.

9. Fig. 6: The ramp should be installed close to the pallet. Two persons should stand with their feet to the right and left of the ramp's guide rails to prevent them from slipping. Carefully push the device, front first ⑪, down from the transport pallet.

10. Read the operating manual for information about starting up the device.

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 Setting up the device

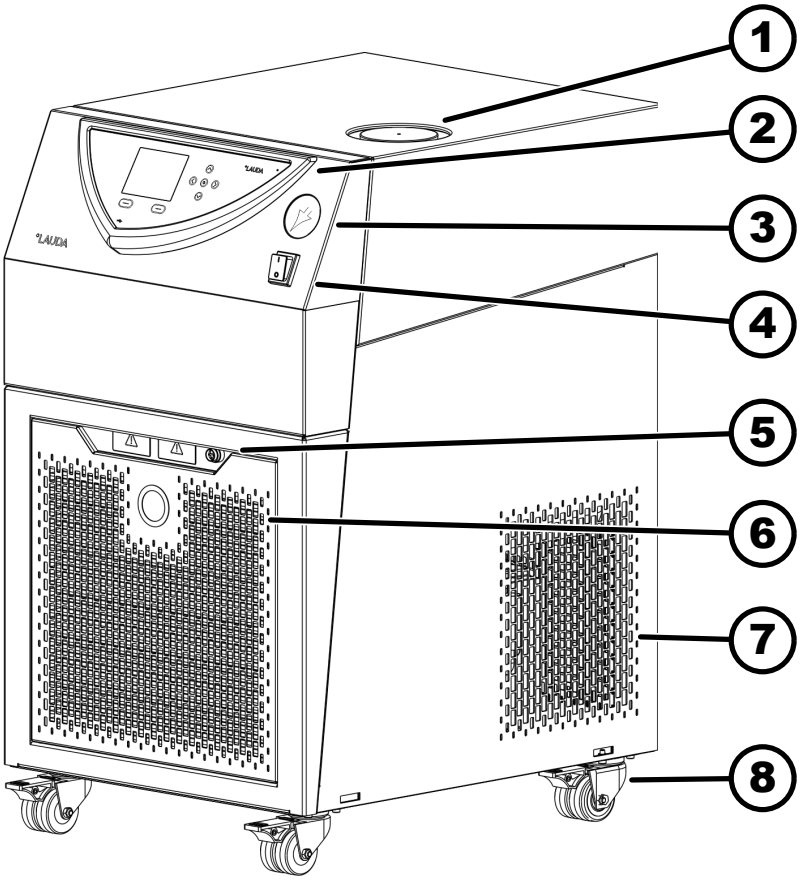


Fig. 5: Front of the VC 2000

1 Filler nozzle with cover
2 Control panel
3 Pressure gage
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 (with locking brake)

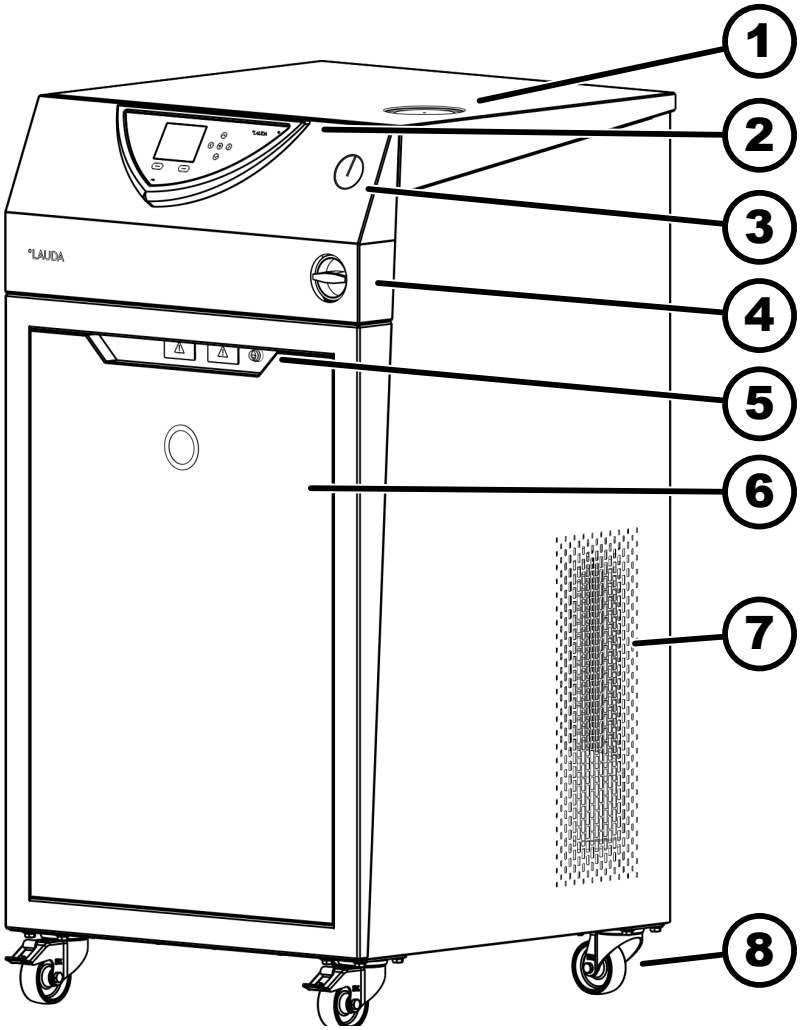


Fig. 6: Front of the VC 10000 W

1 Filler nozzle with cover
2 Control panel
3 Pressure gage
4 Mains switch (note: the arrangement of the mains switch depends on the design)
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 (with locking brake)

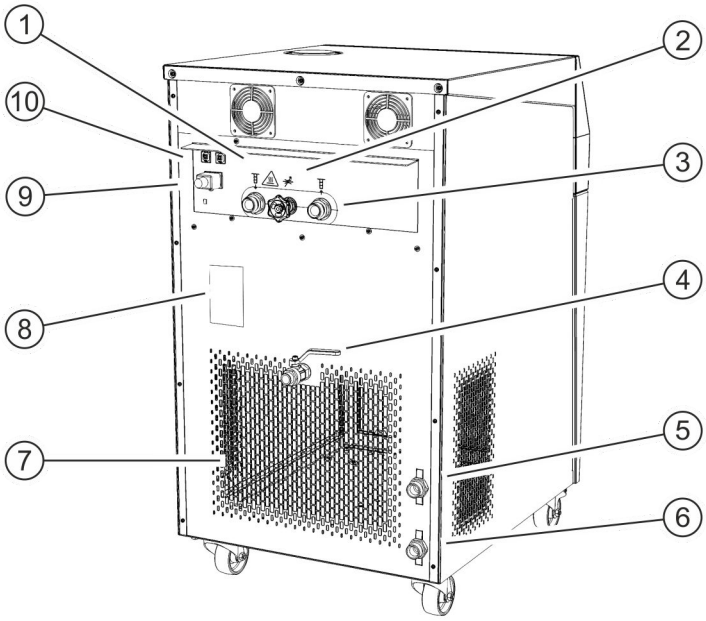


Fig. 7: Back of the VC 2000 W

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

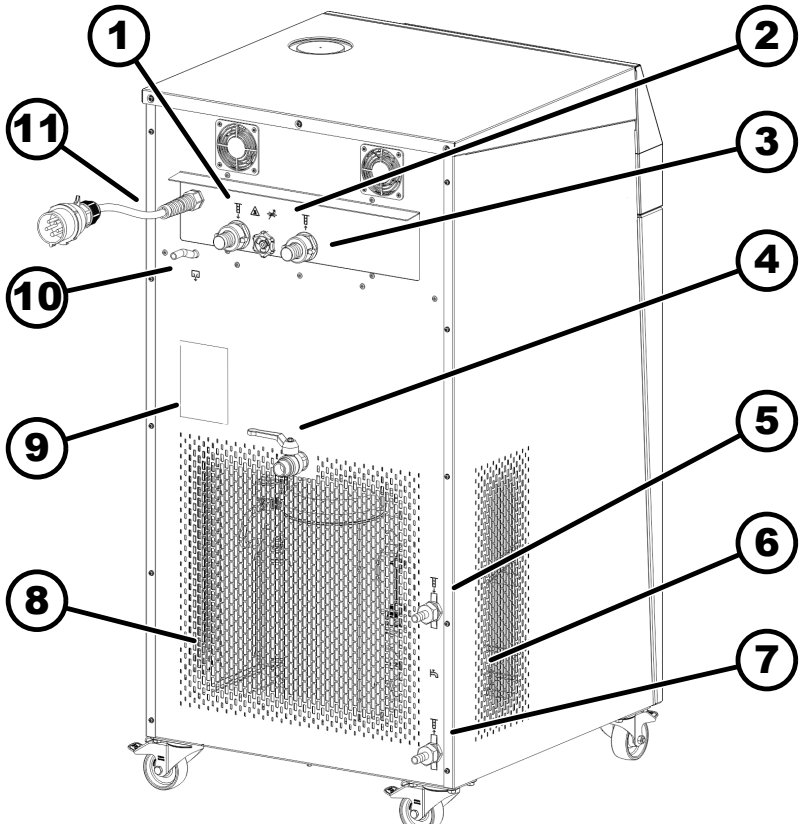


Fig. 8: Back of the VC 10000 W

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 Gas warning sensor (build into the device)
7 Connecting sleeve for water cooling intake (only available for water-cooled devices)
8 Ventilation grid
9 Type plate
10 Overflow pipe
11 Power supply

Control panel

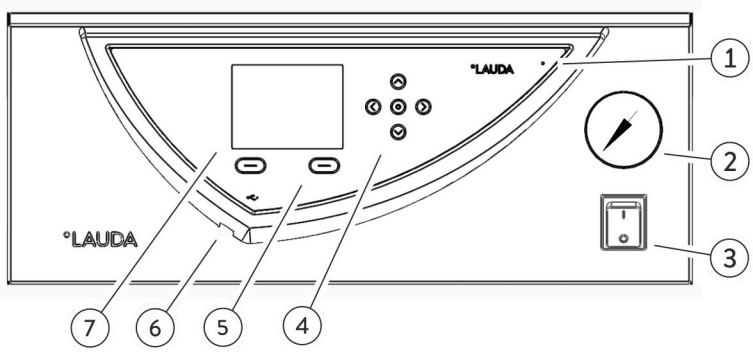


Fig. 9: Control panel

1 Light sensor
2 Pressure gage
3 Mains switch for VC 1200 (W), VC 2000 (W)
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

Restriction to FAT32 formatting on USB sticks

When using a USB stick in a USB socket host (type A) on the constant temperature equipment (e.g. for the software update) or the interface module, it must be formatted with FAT32. USB sticks (> 32 gigabytes) are generally factory-formatted with exFAT and therefore do not work with the constant temperature equipment. Use a USB stick with max. 32 gigabytes so that formatting is possible.

3.3 Operating elements

3.3.1 Mains switch

VC 1200 (W), VC 2000 (W)

The mains switch can be set to the following positions:

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

VC 5000 (W), VC 10000 (W)

The mains switch can be turned to the following positions:

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

3.3.2 Display buttons

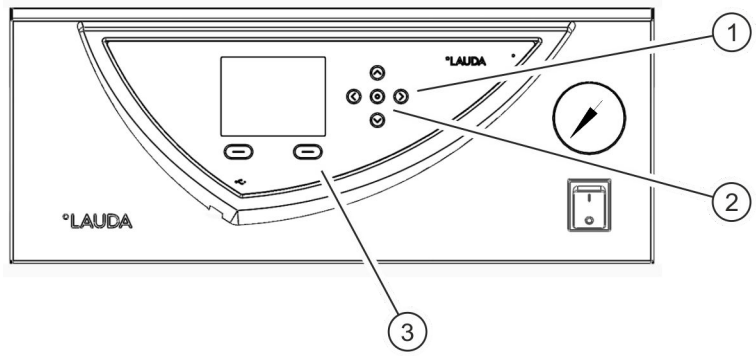


Fig. 10: Display buttons

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



Fig. 11: Pressure gauge

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

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 104.

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 capacity” on page 102.

3.4.3 Gas warning sensor: Operation and protection

This section applies to devices with more than 150 g of flammable refrigerant.

Due to the increased flammability of the refrigerants, the unit is equipped with a gas warning sensor.

- *The device only switches on when the gas warning sensor does not detect a dangerous refrigerant concentration.*
- *The LED of the gas warning sensor flashes green quickly during initialization.*
- *The LED of the gas warning sensor flashes green slowly when a gas concentration is not detected.*
- *The LED is visible through the ventilation slots.*

Gas concentration and protection

Integrated safety measures consist of gas detection followed by corresponding responses:

- 1. Warning message:
  - Operation of the constant temperature equipment can continue;
  - Warning message on the display for initiating troubleshooting and repairs;
  - Recommendation: Activating or increasing customer aeration to avoid shutdown of the constant temperature equipment.
- 2. Automatic shutdown:
  - The device is switched off on all poles via an external circuit;
  - Recommendation: Increase in the customer’s aeration rate to prevent the gas volume from exceeding 25% of the LFL at the installation site;
  - Recommendation: Activation of acoustic and visual warning signals.

Function of the gas warning sensor

If the gas warning sensor measures a gas concentration between 10% and 25% of the Lower Flammability Limit (LFL), a warning (Warning 042 "Gas detected") is stored in the error memory and shown on the display.
The LED of the gas warning sensor flashes red.

The gas warning sensor triggers an automatic shutdown, if the threshold of 25% of the Lower Flammability Limit (LFL) is exceeded. There is no separate error message for an automatic shutdown — the device switches off immediately. The LED of the gas warning sensor is lit red.

If the gas warning sensor triggers, a specialist trained in handling flammable refrigerants must identify and rectify the cause. Only then can the constant temperature equipment be recommissioned.

Table 4: Gas concentration and response

Refrigerants	Warning at gas concentration	Automatic shutdown at
R-290	between 10 % and 25 % of the Lower Flammability Limit	above 25 % of the Lower Flammability Limit

Apart from operating the internal gas warning sensor, the customer can define and implement other equivalent measures after conducting their own risk assessment.

3.4.4 Interfaces

The following sections contain a general overview of all standard interfaces on the device as well as optional interface modules.

Equipment connected to the low-voltage inputs and low-voltage outputs must be safely insulated against dangerous contact voltages as per DIN EN 61140, for example, using double or reinforced insulation as per DIN EN 60730-1 or DIN 60950-1.

The installation of these additional interface modules is described elsewhere in this manual. Refer to the separate operating manual accompanying the interface modules for further information on wiring and operating these modules. The respective operating manual must be observed in order to use the module as intended.

USB interface

The devices are equipped with a USB socket device (type B) as standard. This interface enables connection to a PC. Software updates can be installed on the device via this interface (for updates only, not a process interface).

Restriction to FAT32 formatting on USB sticks

When using a USB stick in a USB socket host (type A) on the constant temperature equipment (e.g. for the software update) or the interface module, it must be formatted with FAT32. USB sticks (> 32 gigabytes) are generally factory-formatted with exFAT and therefore do not work with the constant temperature equipment. Use a USB stick with max. 32 gigabytes so that formatting is possible.

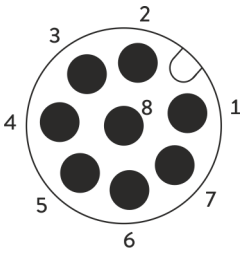
Alarm output

The devices are equipped with an alarm output as standard. This change-over contact is switched if the device changes to standby mode or an alarm is triggered. This enables reverse flow protection to be activated or faults are reported on a control station.

Safety interface

The safety interface is installed only on devices containing more than 150 g of flammable refrigerant.

The build-in connector is labeled `Safety`.



- PIN 1/2: Output. The device can be switched off externally via Pin 1 and Pin 2 using a normally closed contact. (To do this, the jumper (PIN 1/2) must be removed from the short-circuit jack.
  Contact closed ➜ Device can be operated
  Contact open ➜ Device is switched off
- PIN 3/4: Output, potential-free contact, gas sensor pre-alarm status. The gas sensor's pre-alarm status can be read out. Warning message appears on the device display; the device continues to operate.
  Contact closed ➜ Pre-alarm not triggered
  Contact open ➜ Pre-alarm triggered or device turned off, or the 3-minute wait time upon startup has not yet elapsed.
- PIN 5/6: Not used
- PIN 7/8: Output, potential-free contact, status of the main contactor; contact closed when the main contactor is closed; device is in operation.
  During the automatic shutdown, the device is disconnected from the power supply and the potential-free contact (PIN 7/8) of the safety interface opens.
  The device status (On/Off) can be read out via PIN 7 and PIN 8.

If the safety interface is not used, the short-circuit jack (with a jumper between PIN 1 and PIN 2) must be plugged into the safety interface! Otherwise, the device will not start.
This corresponds to the factory default setting.

Turning off the device:

- Manually at the main switch
- Open the PIN 1/2 contact
- Gas detection sensor in case of refrigerant leak (PIN 7/8)

Additional interface modules

Depending on the design, the devices are equipped with one small and one large interface module bay or with two large interface module bays. Modules LRZ 918 and LRZ 920 are suitable for small module bays and can only be used on correspondingly designed devices. On devices with two large module bays, use module LRZ 925 accordingly.

Additional interface modules can be installed in the devices.

- **Analog module** (order no. LRZ 912). Has 2 inputs and 2 outputs on 6-pin DIN socket. The inputs and outputs can be configured as a 0 – 20 mA, 4 – 20 mA or 0 – 10 V interface independently of one another. A power supply of 20 V applied to the socket supplies power to an external sensor with an electronic evaluation unit.
- **LiBus module** (cat. no. LRZ 920 no cover). The Command remote control can be used with the constant temperature equipment via the LiBus connection. Additional modules can also be connected (such as the LRZ 918 but without a Pt100 interface). A solenoid valve for regulating the cooling water, or a reverse flow protection device can subsequently be connected.
- **Pt100-/LiBus module** (LRZ 925 large cover; cat. no. LRZ 918 small cover). An external temperature probe can be connected to the module's Pt100 interface and used as an external control probe. The Command remote control can be used with the constant temperature equipment via the LiBus interface. A solenoid valve for regulating the cooling water, or a reverse flow protection device can subsequently be connected.
- **RS 232/485 module Advanced** (cat. no. LRZ 926) with connection via a 9-pin D-sub socket. Galvanically isolated by an optocoupler. The RS 232 interface can be connected directly to the PC using a 1:1 contacted cable.
- **Contact module Advanced** (cat. no. LRZ 927) is available with a connector according to NAMUR NE28. This contact module is identical to LRZ 928 but only has two sockets, each with one output and one input. The coupling socket (cat. no. EQD 047) and the coupling connector (cat. no. EQS 048) have a 3-pin design.
- **Contact module Advanced** (cat. no. LRZ 928) with connection via a 15-pin D-sub socket. With three relay contact outputs (changeover contacts, maximum 30 V/0.2 A) and three binary inputs for control via external potential-free contacts.
- **Profibus module Advanced** (cat. no. LRZ 929) with connection via a 9-pin D-sub socket. Profibus is a bus system with high signal transmission rates for connecting up to 256 devices.
- **Ethernet module Advanced** (cat. no. LRZ 930). This module offers the customer the opportunity to control and monitor their temperature processes, performed with a LAUDA constant temperature equipment, via Ethernet by means of a LAUDA interface command set.

  The module's USB interfaces currently do not work.
- **EtherCAT module** (cat. no. LRZ 922) with M8 connection sockets. **EtherCAT module** (order no. LRZ 923) with connection via RJ45 sockets. EtherCAT is an Ethernet-based fieldbus with master/slave functionality.
- **Profinet module Advanced** (cat. no. LRZ 932) with connection via RJ45 sockets. Profinet is an industrial Ethernet-based communication protocol that enables fast, reliable data transmission between automation components in industrial networks.
- **CAN module Advanced** (cat. no. LRZ 933) with connection via a 9-pin D-sub socket. CAN is a robust, serial bus system for networking control units in industrial applications that offers a high degree of transmission reliability and resistance to interference.

- **OPC UA module Advanced** (order no. LRZ 934) with 8-pin RJ45 socket. The OPC UA server enables secure, standardized communication as well as easy integration of the LAUDA constant temperature equipment into higher-level systems such as MES or SCADA.
- **Modbus TCP/IP module Advanced** (cat. no. LRZ 935) with 8-pin RJ45 socket. Modbus allows established, efficient network communication as well as simple integration of LAUDA constant temperature equipment into existing automation systems.

Refer to the operating manual accompanying the relevant LAUDA interface module for further information on connecting and using these interfaces.

3.5 Equipment

More powerful pump

A more powerful pump is available for the VC 1200 (W) and VC 2000 (W) devices.
A higher pump power reduces the cooling capacity by more than 80 watts and 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.

A more powerfull pump is available for the VC 5000 (W) and VC 10000 (W) devices.
A higher pump power reduces the cooling capacity by more than 200 watts.
A more powerful pump can only be installed at the factory.

3.6 Type plate

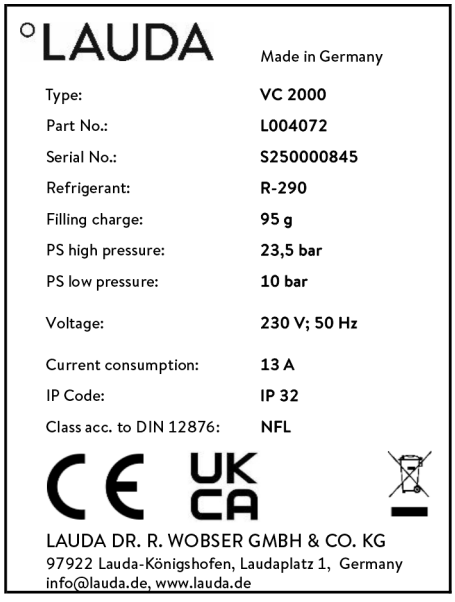


Fig. 12: Type plate (example)

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:	Refrigerant filling charge
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 100.

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 5: 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 (W), VC 2000 (W), VC 5000 (W) G ¾ (15), hose nozzle ¾"	Hose nozzle with union nut EOA 004	10 bar	19 x 27	-40 – 100	RKJ 032
EPDM hose with fabric reinforcement	VC 10000 (W) G 1¼ (20), hose nozzle 1"	Hose nozzle with union nut EOA 003	10 bar	25 x 34	-40 – 100	RKJ 033

Table 6: Hose clips

Suitable for hose	Clear Ø in mm	Catalog number
RKJ 112, RKJ 031	12 – 22	EZS 013
RKJ 032, RKJ 033	25 – 40	EZS 016

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

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	---
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	---

Data	Value	Unit
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

Warning is relevant for devices containing less than 150 g of flammable refrigerant.



WARNING!
Cooling water circuit leaking due to corrosion

Fire

- Do not use corrosive cooling water.

Warning is relevant for devices containing more than 150 g of flammable refrigerant.

NOTICE!
Cooling water circuit leaking due to corrosion

Device damage

- Do not use corrosive cooling water.

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

Fire, 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 liquids 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.
- Only ever use non-flammable heat transfer liquids.
- Do not use any heat transfer liquids that are 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.
- Do not use heat transfer liquids with a kinematic viscosity above 75 mm^2/s during regular operation.
- Use heat transfer liquids with a density in the range of 0.95 to 1.2 g/cm^3.

Please note the following:

- The heat transfer liquids each cover a recommended temperature range and must correspond to the temperature range associated with their application.
- The heat transfer liquid becomes more viscous at the lower limit of the temperature range and impairs temperature stability, pump power and cooling capacity. The formation of vapors and odors increases in the upper range. Therefore, only fully utilize the temperature range when absolutely necessary. In particular, ice forms with Aqua 90 (water), which can lead to the destruction of the device.

- Never use contaminated or degenerated heat transfer liquids.
- Observe the safety data sheets for the various heat transfer liquids. If required, you can download the safety data sheets from our homepage (https://www.lauda.de).
  Open the LAUDA homepage, select your language and tap *Services* → *Download center*.
  In the Download center, choose the [Safety data sheet] option in the [Document type] drop-down list.
  A list of safety data sheets in PDF format in different languages is displayed.
  Tap the relevant safety data sheet.
  The download starts and the PDF file is downloaded.

Table 7: Approved heat transfer liquids

LAUDA designation	Chemical characterization	Temperature range in °C	Viscosity (kin) in mm²/s at (at 20 °C)	Viscosity (kin) in mm²/s at temperature
Kryo 30	Water-monoethylene glycol mixture	-30 – 90	4	50 at -25 °C
Kryo 15	Water-monoethylene glycol mixture	-20 – 90	2.6	17.6 at -20 °C
Kryo 10	Water-propylene glycol mixture	-10 – 90	4.3	14 at -10 °C
Aqua 90	Decalcified water	5 – 90	1	---

When using Kryo 30, Kryo 15 and Kryo 10:

- The water content decreases during longer periods of operation at higher temperatures, and the mixture becomes flammable. Check the mixing ratio using a hydrometer, for example.
  The flash point of the glycol used in the heat transfer liquid:
  - Monoethylene glycol (Kryo 30, Kryo 15): 119 °C
  - Propylene glycol (Kryo 10): 104 °C

Table 8: Heat transfer liquid part numbers

Designation	Container size Part number			
	5 L	10 L	20 L	200 L
Kryo 30	LZB 109	LZB 209	LZB 309	LZB 809
Kryo 15	LZB 133	LZB 233	LZB 333	LZB 833
Kryo 10	LZB 132	LZB 232	LZB 332	LZB 832
Aqua 90	LZB 120	LZB 220	LZB 320	---

Heat transfer liquid, water

- The proportion of alkaline earth ions in the water must be between 0.71 mmol/L and 1.42 mmol/L (equivalent of 4.0 and 8.0 °dH). Harder water leaves limescale deposits in the device.
- The pH value of the water must be between 6.0 and 8.5.
- Due to their corrosive properties, distilled, deionized, fully desalinated (FD) water, or ocean water cannot be used. High-purity water and distillates are suitable as a medium after 0.1 g of soda (Na_2CO_3, sodium carbonate) is added for every liter of water.
- Avoid chlorine content in the water at all costs. Do not add chlorine to the water. Cleaning agents and disinfectants, for example, contain chlorine.
- The water must be free of impurities. Water with iron content is unsuitable due to rust formation and untreated river water is unsuitable due to algae growth.
- The addition of ammonia is not permitted.

4.5 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.

Note for electric installation on site:

3. ■ Three-phase devices
   - Three-phase devices must be fused according to their current draw. The required value will be found on the type plate. In each case, select the next higher value. Using an excessively high fuse rating is not permissible.

Pump with three-phase motor

Personnel: ■ Specialized personnel

The pump on device types VC 5000 (W) and VC 10000 (W) is powered by a three-phase motor. Observe the direction of rotation of the power supply. If the pressure gauge does not show an increase in pressure, two phases must be swapped to reverse the rotational direction of the three-phase connection!

This work must always be carried out by a qualified electrician!

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 70.

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

Fire, 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 liquids 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.
- Only ever use non-flammable heat transfer liquids.
- Do not use any heat transfer liquids that are 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.
- Do not use heat transfer liquids with a kinematic viscosity above 75 mm^2/s during regular operation.
- Use heat transfer liquids with a density in the range of 0.95 to 1.2 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.

This note (Info) applies to devices with more than 150 g of flammable refrigerant (VC 5000 (W) and VC 10000 (W)).

After switch on, the device requires up to 3 minutes to become ready for operation. During this time, the gas warning sensor is initialized and it is checked that there is no gas present in the device.

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.*

Turn the mains switch to Position [1] *on devices VC 5000 (W) and higher.*

▶ The language selection menu then appears.



Fig. 13: Start screen



Fig. 14: 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.

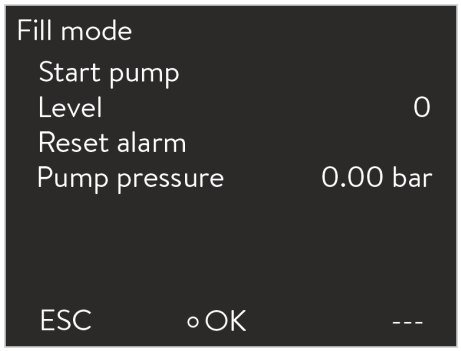


Fig. 15: Fill mode

4. The device detects a low or empty level of the heat transfer liquid.
   - ▶ The device automatically starts 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 fill mode has ended, the device starts the temperature control, unless starting mode is set to* [off].
>
> *You can find out how to change starting mode in* ↳ Chapter 6.12.4 “Specifying the starting mode (Auto start)” on page 70.

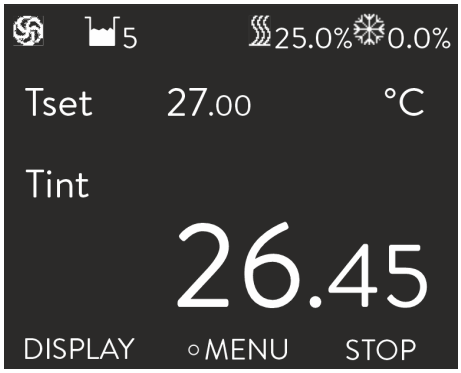


Fig. 16: Home window

9. The Home window appears.

> *You cannot start the device until you end 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 9: 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

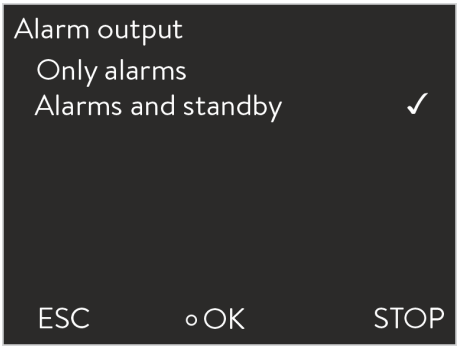


Fig. 17: Configuring the alarm output

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 Alarm output interface (floating contact)



Fig. 18: Alarm output symbol

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

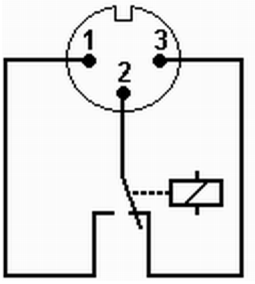


Fig. 19: Built-in connector in the fault condition

View of the built-in connector (front)

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.

Accessories: Coupling socket cat. no. EQD 047 (NAMUR NE28)

You can find information on the settings for the alarm output in ↳ Chapter 5.3.1 “Setting the alarm output” on page 44.

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 .

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

- You want to use an external temperature probe.
- You wish to transfer a signal, such as the actual temperature, from an external consumer to the constant temperature equipment.
- You wish to transfer a signal, such as the set temperature, to an external device.
- You wish to use the Command remote control.

DANGER!
Contact with live parts

Electric shock

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

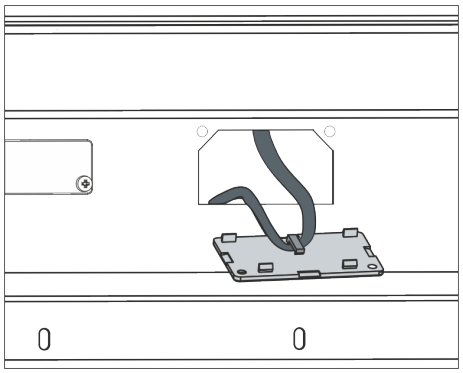


Fig. 20: Cable hooked onto the cover

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 on the cover of the corresponding module bay, and carefully remove the cover.

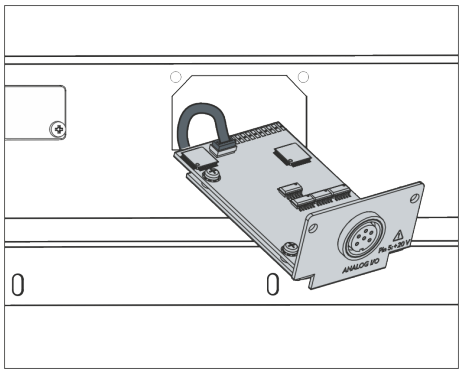


Fig. 21: The plug is in the socket

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 .

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

The following warnings apply to all devices.

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!
Damage to the evaporator due to icing

Burns, Fire

- Only use the heat transfer liquids within the approved temperature range.



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.



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".

CAUTION!
Unauthorized control

Scalding, cold burns

- Always operate the process interface in a protected intranet (firewall).

The following safety instructions and warnings apply to devices with less than 150 g of flammable refrigerant (see nameplate or technical data).

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

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.

The following safety instructions and warnings apply to devices with more than 150 g of flammable refrigerant (see nameplate or technical data).

According to DIN EN 378-1, the refrigeration system is a "sealed refrigeration system". All parts carrying refrigerant are tightly installed by welding, brazing or similar permanent joints. Service connections are fitted with caps. The refrigeration system also has a tested leakage rate of less than 3 g per year at a minimum of one quarter of the maximum permissible pressure.

The integral gas warning sensor triggers an automatic shutdown if a predefined threshold corresponding to 25% of the Lower Flammability Limit (LFL) is exceeded.
If the gas warning sensor triggers, a specialist trained in handling flammable refrigerants must identify and rectify the cause. Only then can the system be recommissioned.

With consideration for the category of the access area in buildings, each circuit may contain a maximum of 1 kg of flammable refrigerant according to DIN EN 378-1. This applies to basements in monitored access areas (such as laboratories, offices or business premises, premises for general manufacturing and work purposes). For ground floors and upper floors, the maximum filling quantity in the monitored access area is 2.5 kg.

It is the operator's responsibility to use the interfaces provided on the device according to any risk assessments conducted (e.g. evacuation of the room, shutdown of ignition sources in the room).
The device can only detect the presence of an explosive atmosphere when switched on.

DANGER!
Formation of a flammable atmosphere

Explosion, burns, fire

- Avoid ignition sources in the immediate vicinity.
- The maintenance and calibration periods specified by the manufacturer for the gas warning sensor must always be observed. The gas warning sensor must be replaced at the end of its service life, see chapter "Maintenance". However, local regulations may stipulate the need for earlier periodic testing and/or calibration.
- If the gas warning sensor triggers, a specialist trained in handling flammable refrigerants must identify and rectify the cause. Only then can the system be recommissioned.
- Ensure that the minimum room size requirements are met, see chapter Technical Data. If the room size does not meet the minimum requirements, additional measures must be implemented. For example, installation in the machinery room or outdoors.

WARNING!
Risk of cooling circuit bursting due to corrosion

Burns, fire

- Do not use corrosive heat transfer liquids.

WARNING!
Penetration of flammable refrigerant into the hydraulic circuit

Burns, Fire

- Do not use corrosive heat transfer liquids.
- Only use the heat transfer liquids within the approved temperature range.

WARNING!
Penetration of flammable refrigerant into the hydraulic circuit

Burns, Fire

- The overflow pipe of the hydraulic circuit may not be closed.
- If a hose is connected to the overflow pipe, it must be routed with a continuous downward slope into an open vessel or drain.



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

Scalding, cold burns

- The mains switch must be easy to access.



NOTICE!
Cooling water circuit is damaged by frost expansion

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.

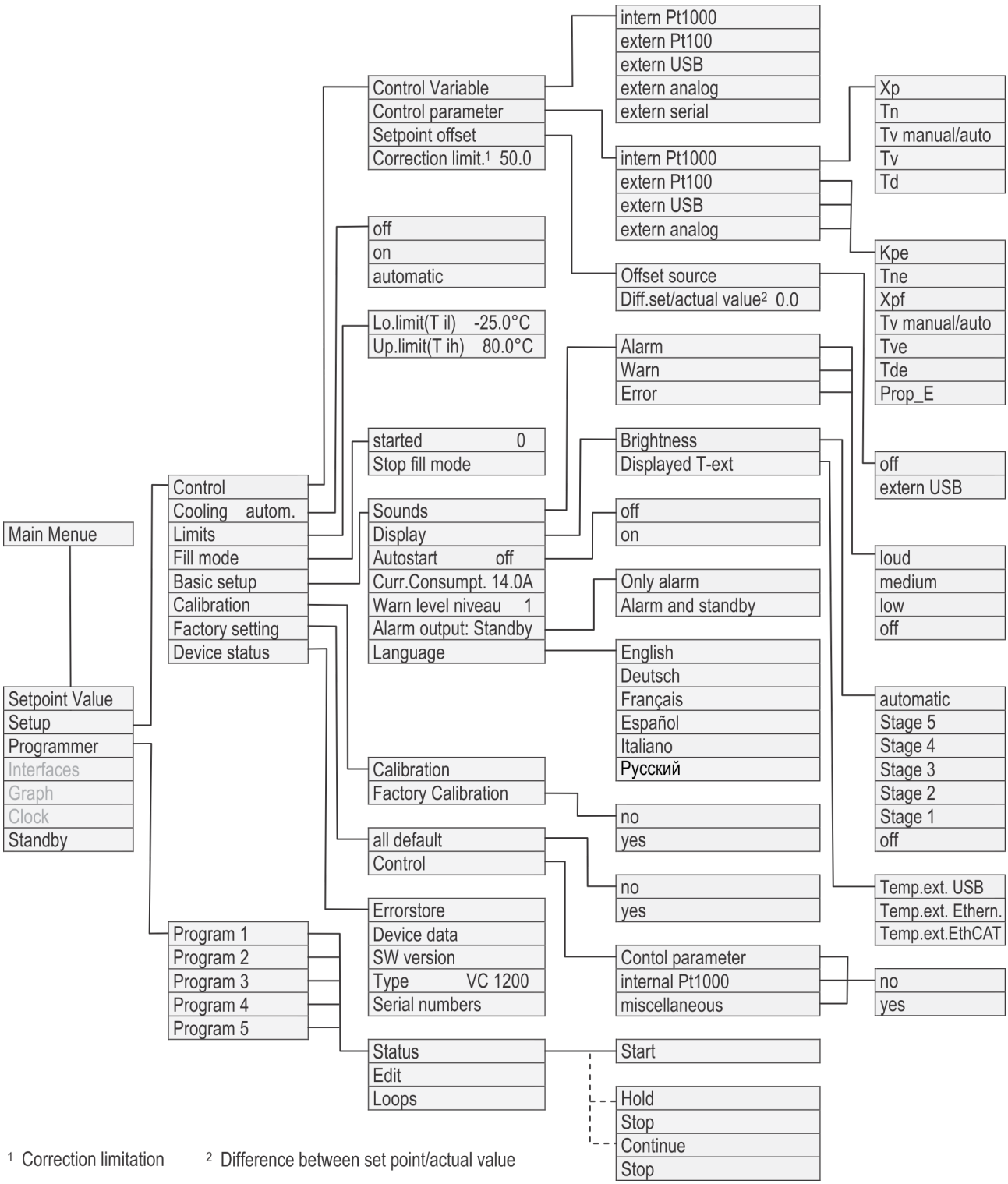
6.2 Operating modes

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. 22: Menu structure part 1

Menu structure for Graph, Clock and Standby

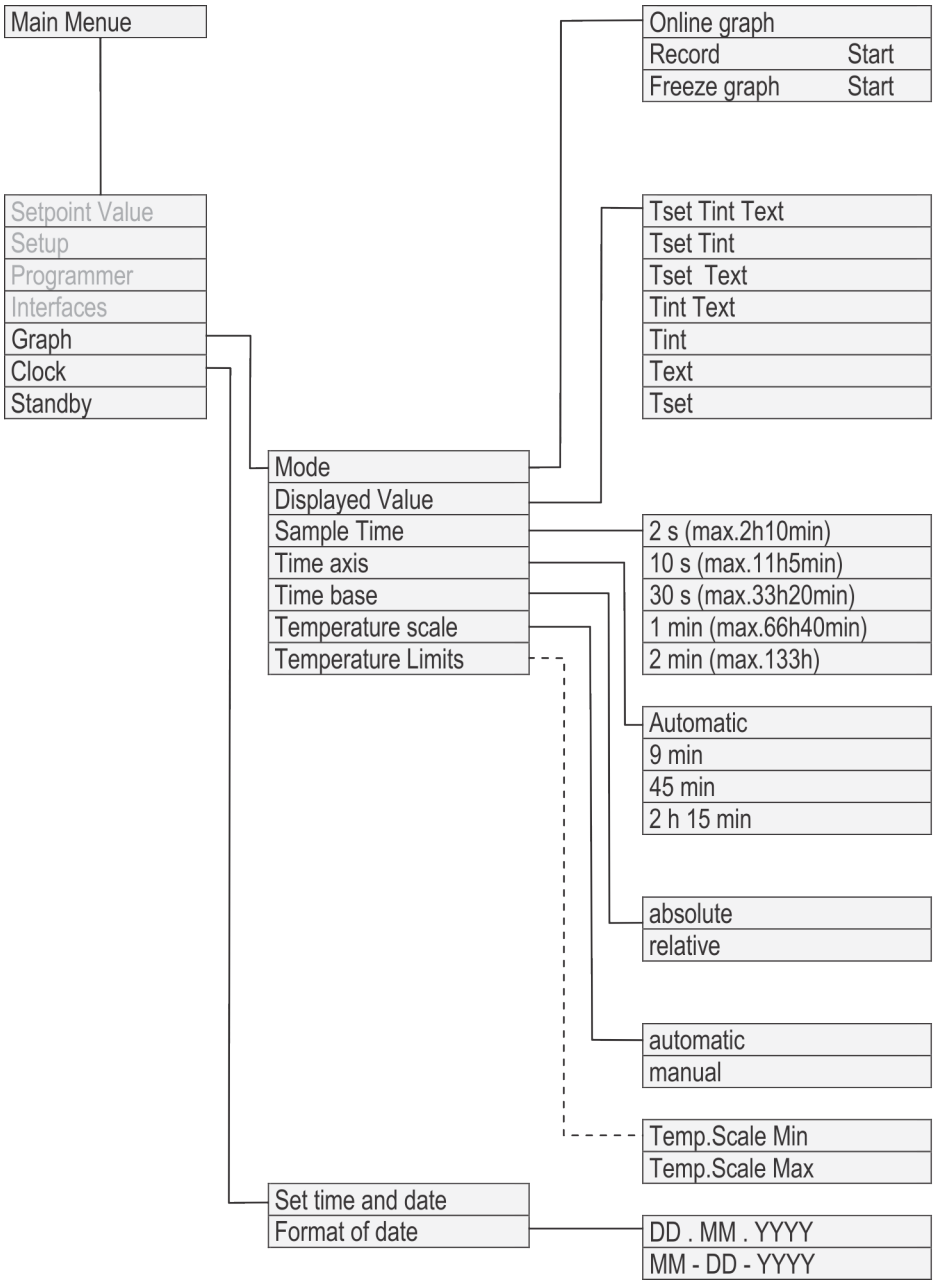


Fig. 23: Menu structure part 2

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 41.

▶ A signal tone is emitted.

2. The Home window appears.

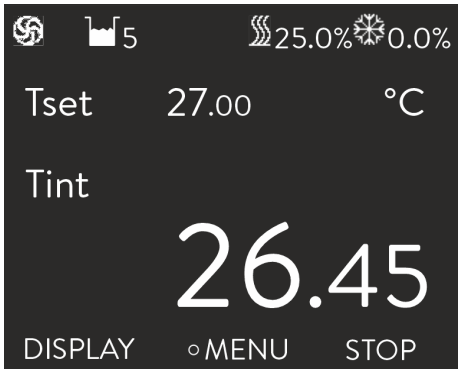


Fig. 24: Home window

> *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 70.

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

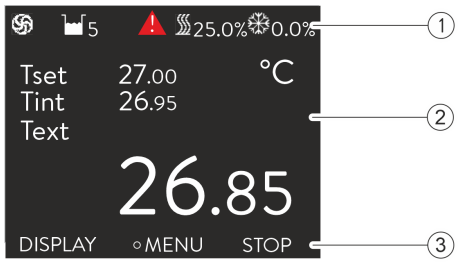


Fig. 25: Home window

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

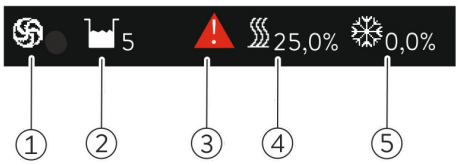


Fig. 26: Status display

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.

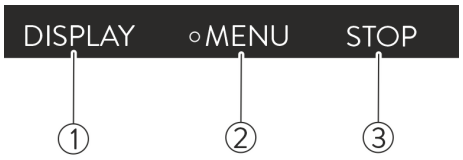


Fig. 27: Soft key bar

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

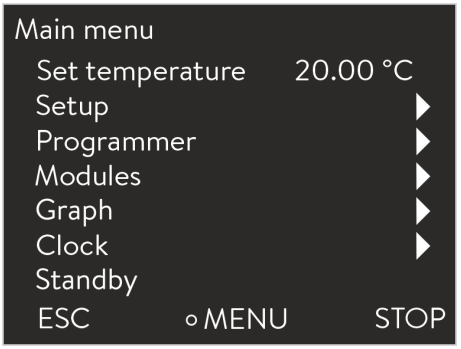


Fig. 28: Main menu

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

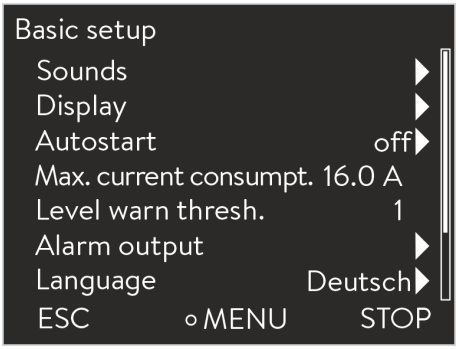


Fig. 29: Sub-menu

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

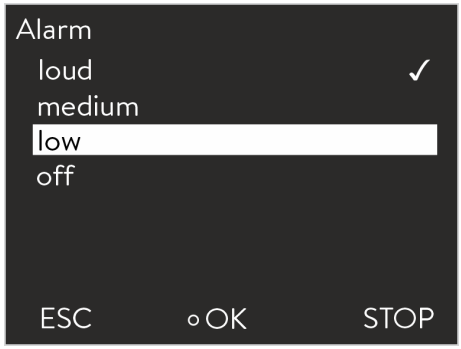


Fig. 30: Selecting options

- 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

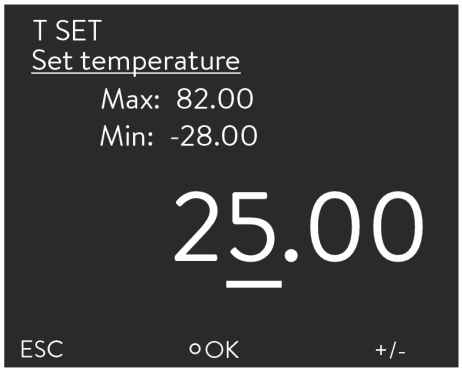


Fig. 31: Entering values

- 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

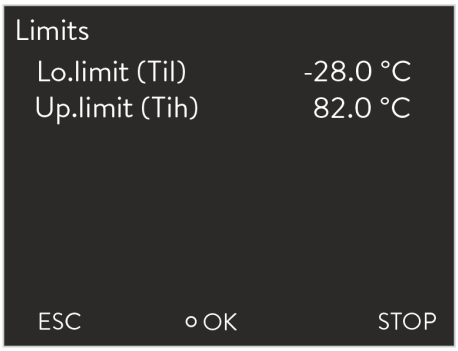


Fig. 32: Selecting the temperature limit

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. 33: Defining temperature limits

4. Customize the value in the following entry window.

6.7 Specifying the set point

Personnel: ■ Operating personnel

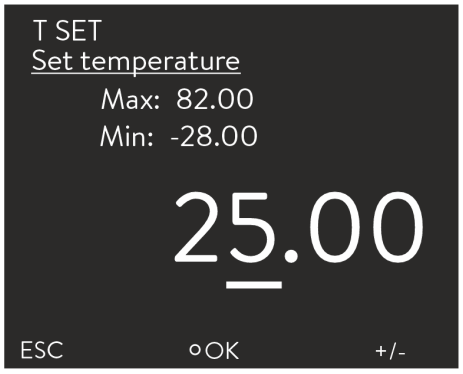


Fig. 34: Specifying the set temperature

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. 35: 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.

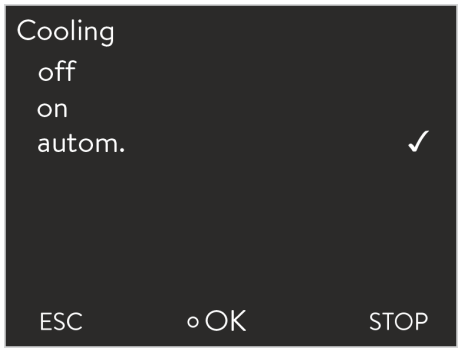


Fig. 36: Setting the cooling

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

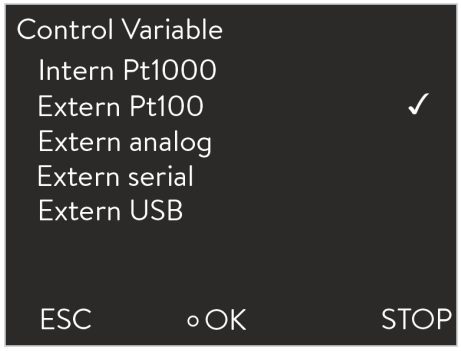


Fig. 37: Activating the external control

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

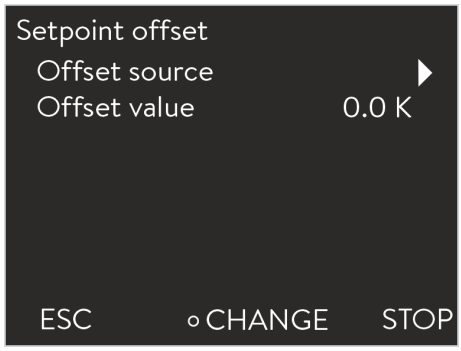


Fig. 38: Set point offset menu

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

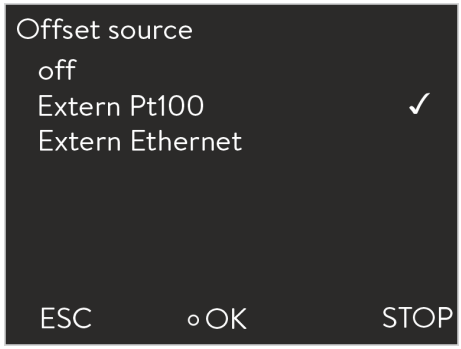


Fig. 39: Selecting the offset source

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

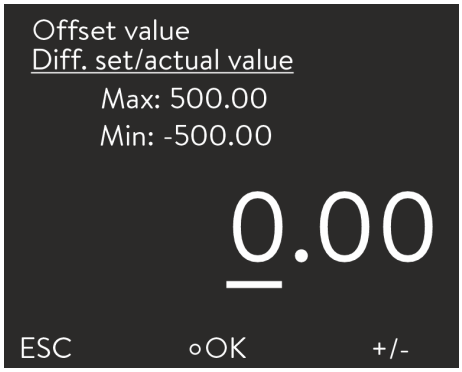


Fig. 40: Specifying the offset value

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.

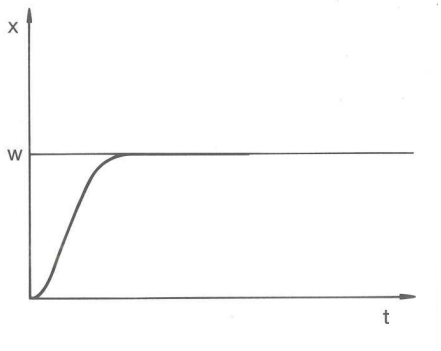
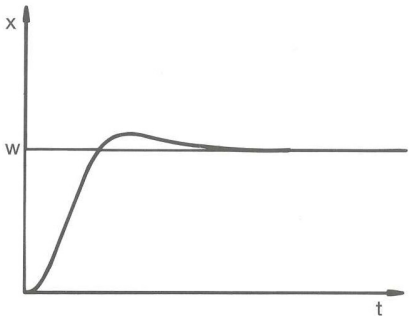
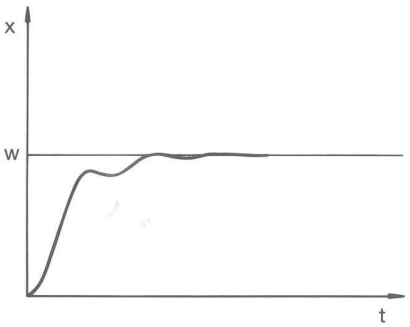


Fig. 41: Optimum setting



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. 42: 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. 43: Control parameter Xp too small

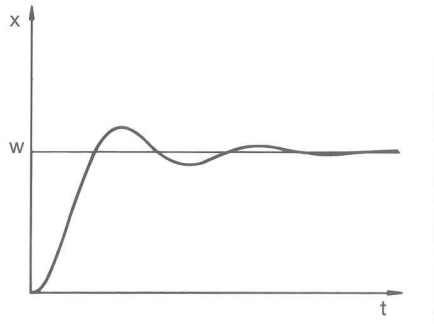


Fig. 44: Control parameters Tn and Tv too small

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.

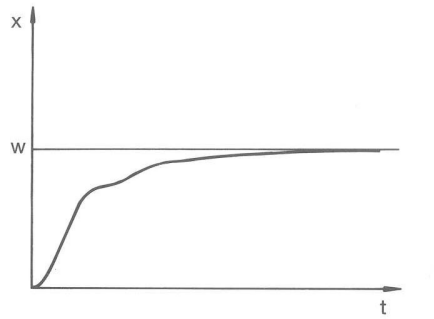


Fig. 45: Control parameters Tn and Tv too large

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 10: 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

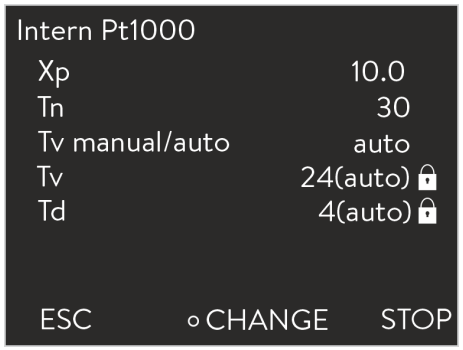


Fig. 46: Internal control parameter menu

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. 47: 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 application 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 (application 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 11: 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 12: 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.

Furthermore, the following parameters can influence the external control:

- *Temperature limits: Til and Tih*
- *Controller output limit: Heating power and cooling power*
- *Correction limitation*

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 pump connection pressure side T_{int} and the temperature at the external application 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

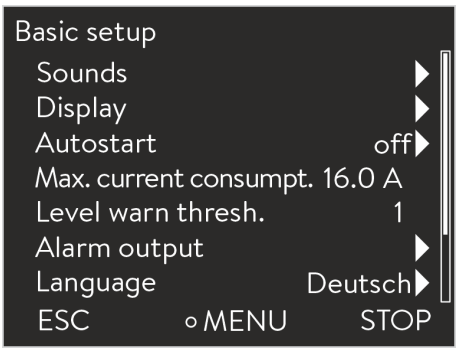


Fig. 48: Basic settings menu

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

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. 49: 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.

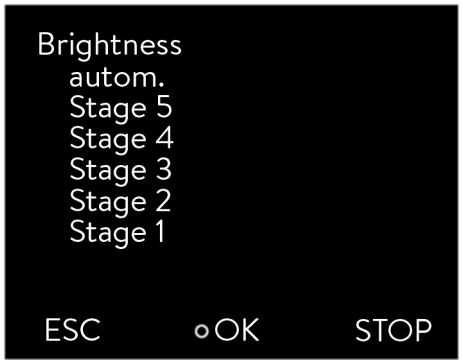


Fig. 50: Adjusting brightness

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. 51: 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. 52: 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. 53: 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.



Fig. 54: Selecting the menu language

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.

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

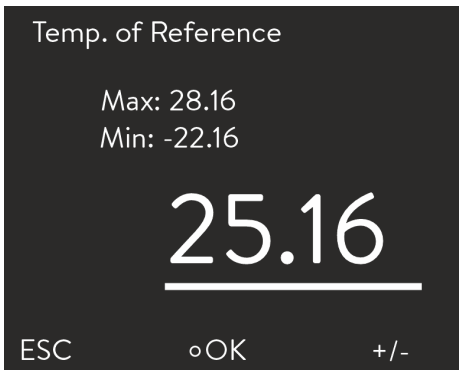


Fig. 55: Specifying the offset

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.

6.14 Restoring the factory calibration (internal temperature probe)

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

Personnel: ■ Operating personnel

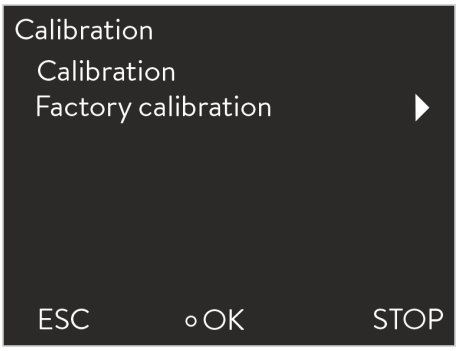


Fig. 56: Factory calibration

1. Switch to the main menu.

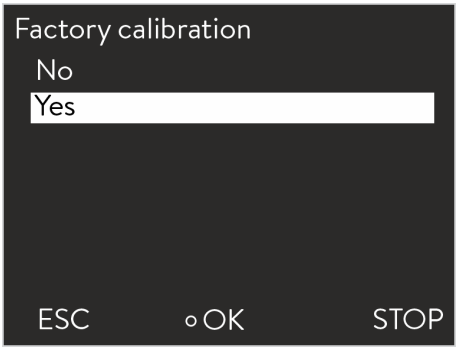


Fig. 57: Restoring the factory calibration

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

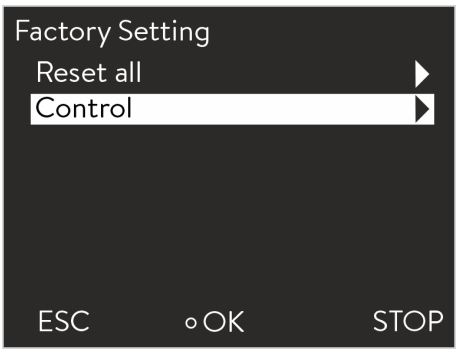


Fig. 58: Selecting the mode

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

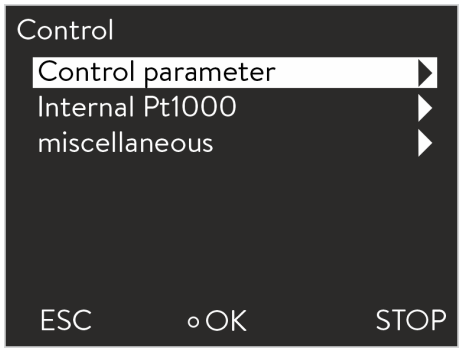


Fig. 59: Resetting the control parameters

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

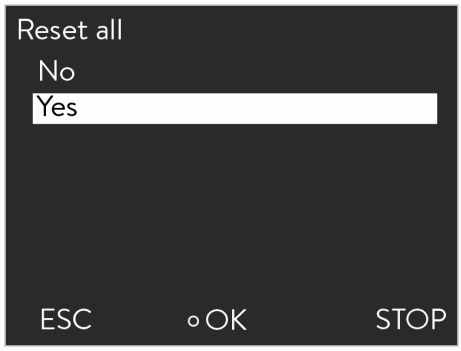


Fig. 60: Reset query

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. 61: 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.*

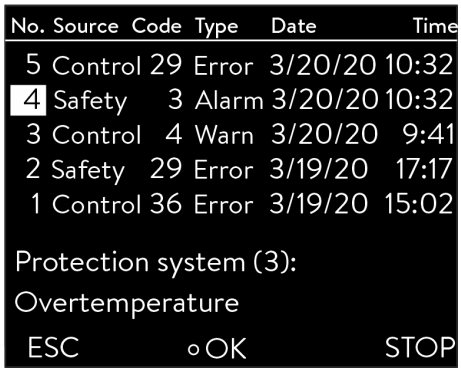


Fig. 62: Error store

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 90.

6.16.3 Retrieving device data

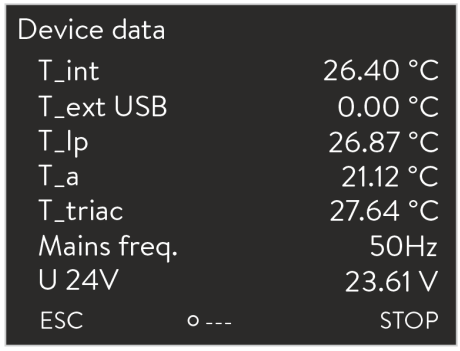


Fig. 63: Device data

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.

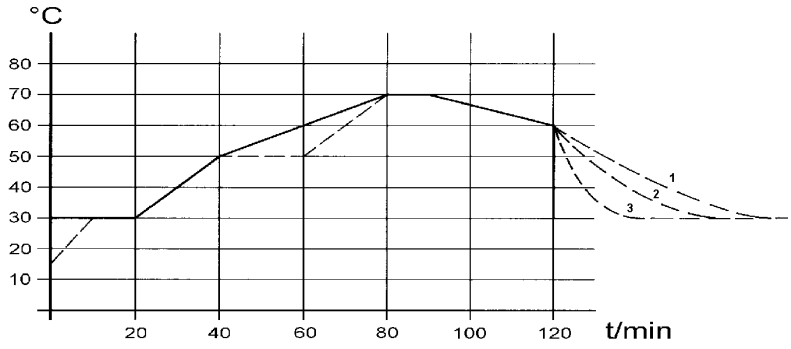


Fig. 64: Program example

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 13: "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 14: "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).

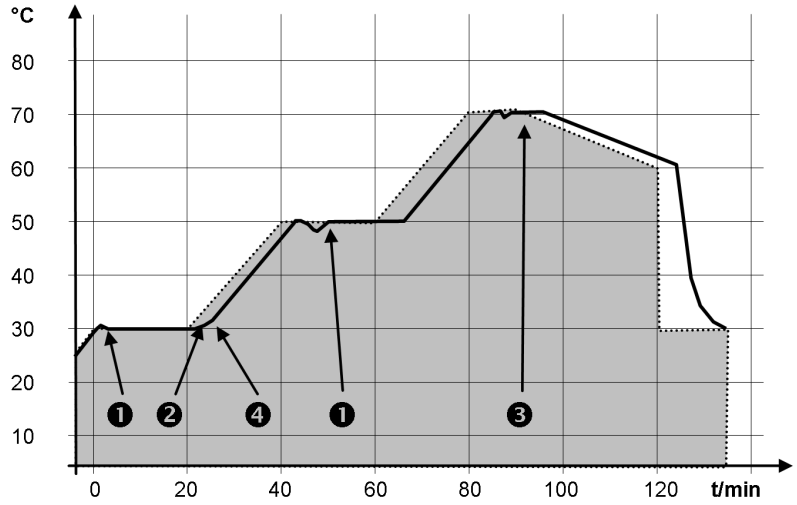


Fig. 65: Program tolerance

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

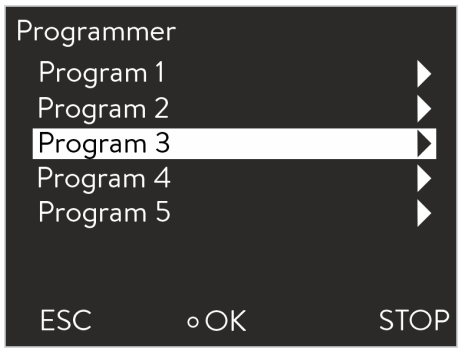


Fig. 66: Selecting the program

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. 67: 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. 68: 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. 69: 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.

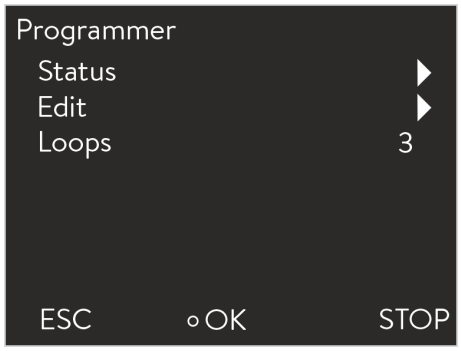


Fig. 70: Setting program loops

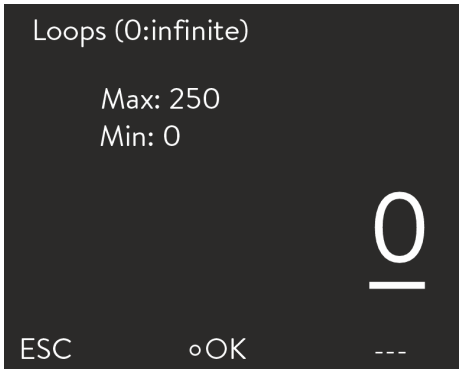


Fig. 71: Setting the number of repetitions

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

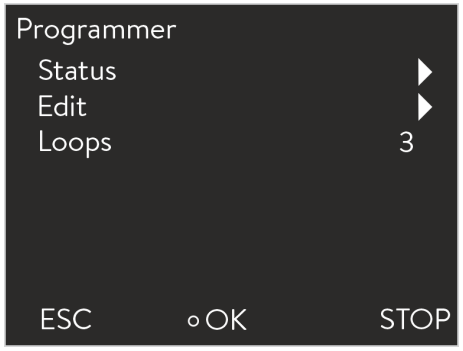


Fig. 72: Programmer menu

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 cord for damage
Monthly	Clean the screen insert (cooling water dirt trap) in water-cooled devices.
As required, once a month at the latest	(Visually) 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	Clean the air-cooled condenser.
Quarterly	Descale the cooling water circuit and the 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 that the heat transfer liquid is suitable for use.
As required, once a year at the latest	Check the external condition of the device for damage and stability.
Recommended every five years	Check the gas warning sensor for correct function; contact ↳ LAUDA Service for this.
After ten years at the latest	Replace the gas warning sensor once its service life has ended; contact ↳ LAUDA Service for this.
Every twenty years	Replacement of safety-related electrical and electromechanical components by the LAUDA service, including the circuit breaker and power printed circuit board.

7.3 Cleaning the surfaces of the device

Personnel: ■ Operating personnel

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.

CAUTION!
Contact with hot or 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).

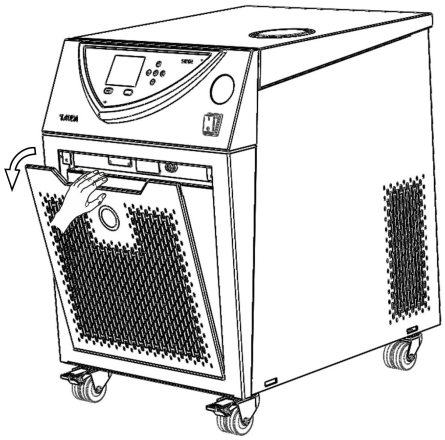


Fig. 73: Removing the front panel

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 Clean the screen insert

This section is relevant for:

■ Water-cooled devices

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.

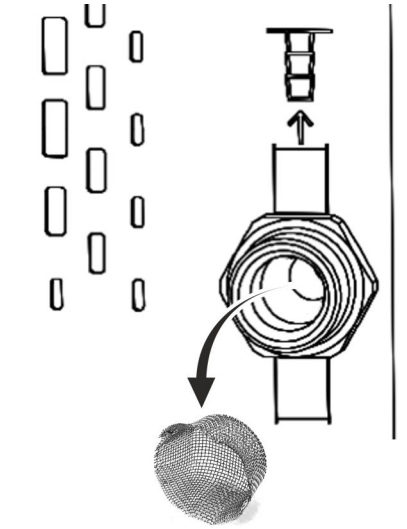


Fig. 74: Remove the screen insert

3. Carefully remove the screen insert from the threaded connection.

> *Use tweezers to remove/install the screen insert if necessary.*

4. Clean the screen insert and then re-insert it into the intake nozzle.
5. Screw the cooling water hose back on at 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

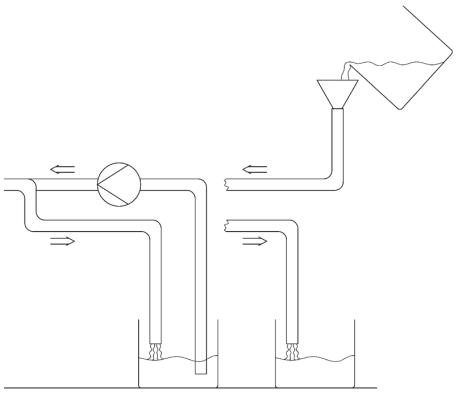


Fig. 75: Descaling

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 “Clean the screen insert” on page 86.

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 linktarget [VerflüssigerEntleerenVC] doesn't exist but @y.link.required='true' 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

CAUTION!
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.*

Personnel:
- Operating personnel

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

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

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 of 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 90 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 92, ↳ Chapter 8.6 “Warnings – Safety system” on page 94 and ↳ Chapter 8.7 “Warnings – Smart Cool” on page 94 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 108.

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 91 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 92
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

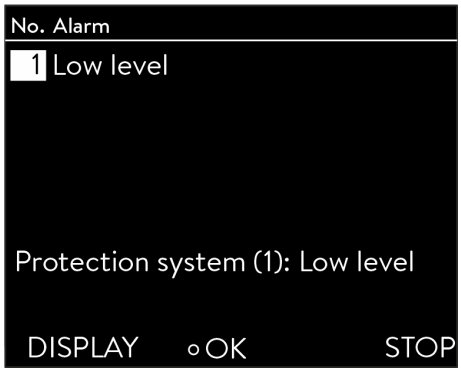


Fig. 76: Low Level Alarm

- 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

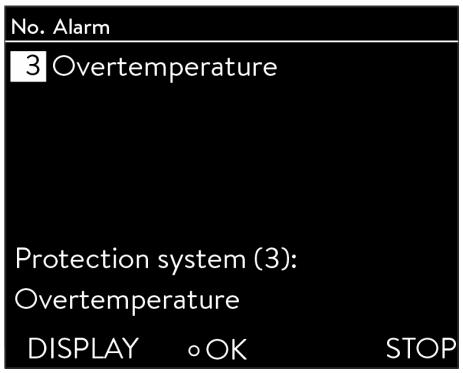


Fig. 77: Overtemperature alarm

If the temperature exceeds 90 °C, *3 overtemperature* alarm is triggered and an audible 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 further numbers follow the prefix. These number sequences can be found in the following table.

Code	Warning message	Cause	Possible remedy
001	LiBus buffer overflow	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 output is reduced.	■ Check the setting for the lower temperature limit (Til). ■ Check the application.
004	T_il limit active	Upper temperature limit (Tih) reached, heating output is reduced.	■ Check the setting for the upper temperature limit (Tih). ■ Check the application.

Code	Warning message	Cause	Possible remedy
009	Unknown module	Unknown accessory or interface module connected.	Check the compatibility, see notes on compatibility in the operating manual accompanying the module.
010	CONTROL: SW Update reqd.	Software control system too old.	Update the device software, please contact LAUDA Service.
...	[MODULE] SW Update reqd.	Software [MODULE] too old	Update the device software, please contact LAUDA Service.
029	EtherCAT: SW Update reqd.	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.	Contact LAUDA Service.
034	T_set: 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	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 consuming units 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 consuming unit into the device. When external consuming units are positioned higher than the device, the external volume may run dry if 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 down 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 safety system start with the prefix 1. Two further numbers follow the prefix. These number sequences can be found in the following table.

Code	Warning message	Cause	Possible remedy
101	LiBus buffer overflow	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	■ Heating defective.	Contact LAUDA Service.
104	Heat 1 failed	■ Heater 1 faulty.	Contact LAUDA Service.
105	Heat 2 failed	■ Heater 2 faulty.	Contact LAUDA Service.
106	Heat 3 failed	■ Heater 3 faulty.	Contact LAUDA Service.
109	Unknown module	Unknown accessory or interface module connected.	Check the compatibility, see notes on compatibility in the operating manual accompanying the module.
110	CONTROL: SW Update reqd.	Software control system too old.	Update the device software, please contact LAUDA Service.
...	[MODULE]: SW Update reqd.	Software [MODULE] too old.	Update the device software, please contact LAUDA Service.
129	EtherCAT: SW Update reqd.	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 further numbers follow the prefix. These number sequences can be found in the following table.

Code	Warning message	Cause	Possible remedy
301	LiBus buffer overflow	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:**	

Code	Warning message	Cause	Possible remedy
		Condenser is dirty.	Clean the condenser. ↳ Chapter 7.5 “Cleaning the air-cooled condenser” on page 86
		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 “Clean the screen insert” on page 86
		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 35
		Cooling water temperature too high.	
		Cooling water regulator faulty, no cooling water flow	Contact LAUDA Service.
305	Cleaning the 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 module	Unknown accessory or interface module connected.	Check the compatibility, see notes on compatibility in the operating manual accompanying the module.
310	CONTROL: SW Update reqd.	Software control system too old.	Update the device software, please contact LAUDA Service.
...	[MODULE]: SW Update reqd.	Software [MODULE] too old.	Update the device software, please contact LAUDA Service.
329	EtherCAT: SW Update reqd.	EtherCAT module software too old.	Update the device software, please contact LAUDA Service.

Code	Warning message	Cause	Possible remedy
333	Valve sm0 break	■ Expansion valve [Valve Cool] not connected. ■ Expansion valve coil faulty.	Contact LAUDA Service.
334	Output sm0	Valve actuation fault on the printed circuit board of the operating unit.	Contact LAUDA Service.
335	Valve sm1 break	■ Subsequent injection valve [Valve Reinj] not connected. ■ Expansion valve coil faulty.	Contact LAUDA Service.
336	Output sm1	Valve actuation fault on the printed circuit board of the operating unit.	Contact LAUDA Service.
341	sm0 min too small	Adaptation value [SM0 min] of the expansion valve [Valve Cool] is too small.	Contact LAUDA Service.
344	Cooling unit	Cooling unit does not function.	■ Switch on the cooling unit in the software menu (automatic cooling). ■ If the device does not cool in spite of the menu change, contact LAUDA Service.
349	Preheat unit	Ambient temperature is below 5°C	
352	Fan speed wrong	Fan motor or fan control defective.	Check the warning entry in the error store, see ↳ Chapter 6.16.2 “Reading the Error store” on page 74. Note the detail code that may be displayed in the text message. Contact LAUDA Service.
353	Evaporator frozen	■ When using a water-monoethylene glycol mixture (Kryo 30, Kryo 15, Kryo 10) as heat transfer liquid: Insufficient antifreeze concentration ■ Hydraulic circuit blocked, e.g., by closed valves, a pinched hose, or contamination. ■ Hose diameter too small. ■ Hose lengths too long.	■ Check whether the temperature range of the heat transfer liquid matches the temperature range of your application. Check the antifreeze protection of the heat transfer liquid, for example, using a hydrometer. ■ Check for blockages in the hydraulic circuit and resolve the cause. ■ Use hoses with a larger diameter or open the bypass. ■ Shorten the hoses between the device and the application.
354	Inverter Communication Error	Communication problem between the cooling system and the inverter.	Contact LAUDA Service.
355	Inverter fault	The inverter is issuing an internal fault message.	Check the warning entry in the error store, see ↳ Chapter 6.16.2 “Reading the Error store” on page 74. Note the detail code displayed in the text message. Contact LAUDA Service.

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 cooling water circuit

This section is relevant for:

- Water-cooled devices

To prevent the heat exchanger in the devices from being damaged by freezing water, the cooling water circuit must be completely drained. Only then may the device be transported or stored in temperatures below freezing point.

Personnel: ■ Operating personnel

This warning applies to units with less than 150 g of flammable refrigerant.

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.

This warning applies to units with more than 150 g of flammable refrigerant.

NOTICE!
Cooling water circuit is damaged by frost expansion

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.

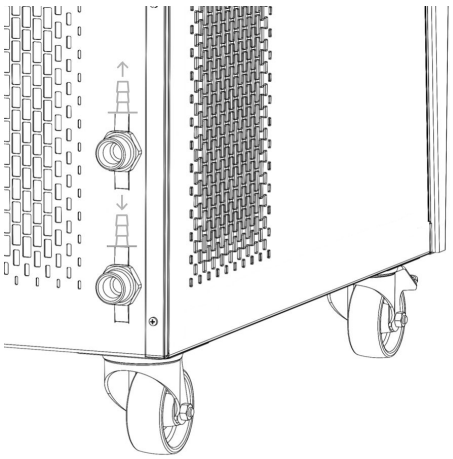


Fig. 78: Cooling water connections

1. Control the temperature of the device to 20°C.
2. Switch off the device.
3. Close the cooling water intake.
4. At the device, unscrew the cooling water hose at the cooling water intake (lower connection of the cooling water connections).
5. A screen insert is installed in the water cooling threaded connection. Carefully remove the screen insert from the intake nozzle.

   You will find more information on removing the screen insert in Chapter 7.6 “Clean the screen insert” on page 86.

6. Leave the cooling water hose screwed onto the cooling water outlet on the device. Place the other end of the hose in a drain or a large container.
7. Switch the device on and set the set point on the device to 5°C (“Cooling” mode).
8. Blow compressed air into the water intake immediately after starting the compressor. Give several blasts of compressed air. Continue blowing compressed air through the device until all the cooling water has flowed out of the device.
9. Switch off the device immediately.
10. Clean the device's screen insert. Then place it back in the intake nozzle.

    ▶ The cooling water circuit has been drained.

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.

Personnel: ■ Refrigeration specialist

1. 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 15: 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	---
Display resolution	±0.01	°C
Setting resolution	±0.01	°C

Table 16: 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
VC 5000	-25 – 80	±0.05	550 x 650 x 970	98
VC 5000 W	-25 – 80	±0.05	550 x 650 x 970	94
VC 10000	-25 – 80	±0.1	650 x 670 x 1250	147
VC 10000 W	-25 – 80	±0.1	650 x 670 x 1250	140

Table 17: 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 18: 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
VC 5000	50/50/20/20	2500
VC 10000	50/50/20/20	5500

Table 19: 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

Device	Free space around the device	Cooling water consumption
VC 2000 W	20/20/20/20	2.0
VC 5000 W	20/20/20/20	5.0
VC 10000 W	20/20/20/20	16.0

Table 20: Cooling water data for VC 1200 W, VC 2000 W, VC 5000 W and VC 10000 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
Permissible cooling water temperature range	10 – 30°C, in the upper range, the cooling capacity of the device is reduced

11.2 Cooling capacity

Table 21: Cooling capacity of the devices VC 1200 and VC 2000

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

Table 22: VC 1200 and VC 2000 with more powerful pump

	Unit	VC 1200	VC 1200 W	VC 2000	VC 2000 W
Cooling capacity 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	280	280	320

For devices with a more powerful pump, the cooling capacity is lower due to the higher heat input.

Table 23: Cooling capacity of the devices VC 5000 and VC 10000

	Unit	VC 5000	VC 5000 W	VC 10000	VC 10000 W
Cooling capacity at 20 °C	W	5300	5600	10000	10500
10 °C	W	3900	4300	7800	8300
0 °C	W	2800	2900	5900	6200
-10 °C	W	1850	1850	4300	4500
-20 °C	W	1000	1000	2900	3000
-25 °C	W	600	600	2300	2300

Table 24: VC 5000 and VC 10000 with more powerful pump

	Unit	VC 5000	VC 5000 W	VC 10000	VC 10000 W
Cooling capacity at 20 °C	W	5000	5300	9700	10200
10 °C	W	3600	4000	7500	8000
0 °C	W	2500	2600	5600	5900
-10 °C	W	1550	1550	4000	4200
-20 °C	W	700	700	2600	2700
-25 °C	W	300	300	2000	2000

For devices with a more powerful pump, the cooling capacity is lower due to the higher heat input.

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 25: Refrigerant

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

Table 26: Refrigerant

	Unit	VC 5000	VC 5000 W	VC 10000	VC 10000 W
Refrigerant	---	R-290	R-290	R-290	R-290
Maximum filling charge	kg	0.35	0.36	0.55	0.57
GWP	---	3	3	3	3

11.4 Filling volume and characteristics of the pumps

Filling volume of the devices

Table 27: Filling volume

Device	Minimum/maximum filling volume	Pump connection	Drain tap
	L	inches	inches
VC 1200 (W)	8/15	G ¾, hose size ¾"	G ½"
VC 2000 (W)	8/15	G ¾, hose size ¾"	G ½"
VC 5000 (W)	20/33	G ¾, hose size ¾"	G ½"
VC 10000 (W)	58/70	G 1¼, hose size 1"	G ¾"

The pump characteristics were determined using water.

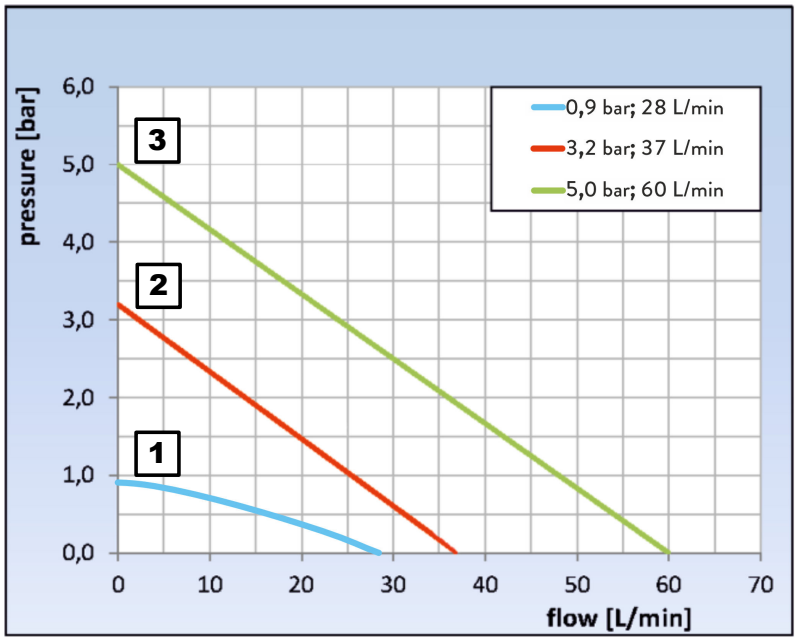


Fig. 79: Pump characteristics

1 VC 1200 (W), VC 2000 (W)
2 VC 1200 (W) und VC 2000 (W) with more powerful pump, VC 5000 (W), VC 10000 (W)
3 VC 5000 (W) und VC 10000 (W) with more powerful pump

11.5 Heating output and current consumption

Mains fuse

Mains fuse ↳ “Please note the following:” on page 39

Table 28: Heating output and current consumption

Power supply		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

Table 29: Heating output and current consumption for devices with a more powerful pump

Power supply	VC 1200	VC 1200 W	VC 2000	VC 2000 W	Unit
230 V; 50 Hz					---
Heating output	2.6	2.6	2.6	2.6	kW

Power supply	VC 1200	VC 1200 W	VC 2000	VC 2000 W	Unit
Current consumption	14	14	14	14	A
200 V; 50/60 Hz					---
Heating output	2.0	2.0	2.0	2.0	kW
Current consumption	13	13	14	13	A
208 – 220 V; 60 Hz					---
minimum / maximum heating output	2.2 / 2.4	2.2 / 2.4	2.2 / 2.4	2.2 / 2.4	kW
Current consumption	14	13	14	14	A

Table 30: Heating output and current consumption

		Heating output in kW			
Three-phase power supply	Current consumption in A	VC 5000	VC 5000 W	VC 10000	VC 10000 W
400 V; 3/N/PE~50 Hz	16	4.5	4.5	7.5	7.5

12 Accessories

The following accessories are available for Variocool devices.

Table 31: Large module bay (51 mm x 27 mm)

Accessories	Catalog number
Analog interface module	LRZ 912
External Pt100/LiBus module	LRZ 925
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
OPC UA interface module Advanced	LRZ 934
Modbus TCP/IP module Advanced	LRZ 935
Command remote control (only functional in combination with LRZ 925)	LRT 927

Table 32: 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 33: Flow control instrument

Accessories	For device	Catalog number
Flow control instrument G 3/4"	VC 1200 (W), VC 2000 (W), VC 5000 (W)	LWZ 118
Flow control instrument G 1 1/4"	VC 10000 (W)	LWZ 119

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 and certificates

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 S260000001

Types: VC1200, VC1200 W, VC2000, VC2000 W
(versions with refrigerants with safety class A3 in accordance with ISO 817)

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
PPWR Regulation	(EU) 2025/40

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, 18.08.2026

Nina Kössel,
Director Quality and Environmental Management

Q5WA-QA13-064-EN-02

°FAHRENHEIT. °CELSIUS. °LAUDA.

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 S2600000001

Types: VC 5000, VC 5000 W, VC 10000, VC 10000 W
(versions with refrigerants with safety class A3 in accordance with ISO 817)

comply with all relevant provisions of the following EC directives and regulations due to their design and construction in the version marketed by us:

Machinery Regulation	(EU) 2023/1230 (valid from 20.01.2027)
Machinery Directive	2006/42/EU (valid until 19.01.2027)
Pressure Equipment Directive	2014/68/EC Module A2
EMC Directive	2014/30/EC
RoHS Directive	2011/65/EC in conjunction with (EC) 2015/863
PPWR Regulation	(EU) 2025/40

The protection objectives of the Machinery Regultation (or Directive) with regard to electrical safety are complied with in accordance with Annex III (or Annex I) paragraph 1.5.1 with conformity to the Low Voltage Directive 2014/35/EU. The machine or the associated product is subject to the conformity assessment procedure the basis of an internal production control (Module A according to (EU) 2023/1230).

Notified body according to the Pressure Equipment Directive:
BUREAU VERITAS SERVICES SAS
Address: 4, Place des Saisons, 92400 COURBEVOIE, France
Number of the notified body: 0062
Certificate: CE-0062-PED-A2-LDA 001-25-DE-rev-a
List of components of the assemblies: See appendix.

Standards applied (date of publication in the Official Journal of the European Union is given in brackets if applicable):

- EN ISO 12100:2010 (exp. 08.04.2011)
- EN 61010-1:2010/A1:2019/AC:2019-04 (exp. 30.11.2020)
- EN 61326-1:2021
- EN 61326-3-1:2017
- EN IEC 61010-2-010:2020 (exp. 22.06.2021)
- EN 378-2:2016 (exp. 09.06.2017)

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

Signed for and on behalf of: LAUDA DR. R. WOBSER GMBH & CO. KG

Lauda-Königshofen, 17.08.2026

Nina Kössel,
Director Quality and Environmental Management

Annex to the EC Declaration of Conformity in accordance with the Pressure Equipment Directive 2014/68/EU:
List of components of the assembly.

Heat transfer circuit :
Art. 4 para. 3

Cooling water circuit:
Art. 4 para. 3

Refrigeration circuit HD:

Designation of component (pressure equipment)	Manufacturer	Fluid group	PS [bar]	Volume [l] / DN	Category	Evaluation procedure	TS min. [°C]
Material/type		Condition					TS max. [°C]
Pressure switch	Johnson Controls	Fluid group 1	23,5	-	Cat. VI	Module B+D	-53
P 100		Gas					135

Refrigeration circuit ND:

Designation of component (pressure equipment)	Manufacturer	Fluid group	PS [bar]	Volume [l] / DN	Category	Evaluation procedure	TS min. [°C]
Material/type		Condition					TS max. [°C]
Compressor	Panasonic/ BSonyo	Fluid group 1	14	4.5	Cat. II	Module A2	-30
7CB083		Gas					55
Compressor	Tecumseh	Fluid group 1	14	6.16	Cat. II	Module A2	-35
FH4522U		Gas					46
Heat Exchanger	LAUDA	Fluid group 1	14	2.0	Cat. I	Module A	-50
Cooper		Gas					125
Heat Exchanger	LAUDA	Fluid group 1	14	3.4	Cat. I	Module A	-50
Cooper		Gas					125

CERTIFICADO ◆ 인증서 ◆ CERTIFICATO ◆ 認証書 ◆ CERTIFICATE ◆ 认证证书 ◆ ZERTIFIKAT

CERTIFICATE

No. U8 019054 0028 Rev. 00

Holder of Certificate: **LAUDA DR. R. WOBSER GMBH & CO. KG**
Laudaplatz 1
97922 Lauda-Königshofen
GERMANY

Certification Mark:

Product: **Cooling apparatus for laboratory**

Cooling unit

This product was voluntarily tested to the relevant safety requirements referenced on this certificate. It can be marked with the certification mark above. The mark must not be altered in any way. This product certification system operated by TÜV SÜD America Inc. most closely resembles system 3 as defined in ISO/IEC 17067. Certification is based on the TÜV SÜD "Testing, Certification, Validation and Verification Regulations (TCVVR)". TÜV SÜD America Inc. is an OSHA recognized NRTL for USA and a Standards Council of Canada ISO/IEC 17065 accredited Certification body for Canada.

Test report no.: 713386259-1

Date, 2026-07-15

Siemon

(Thorsten Siemon)

TÜV SÜD America, Inc. • 401 Edgewater Place Suite #500 • Wakefield • MA 01880 • USA

ZERTIFIKAT ◆ 认证证书 ◆ CERTIFICATE ◆ 認証書 ◆ CERTIFICATO ◆ 인증서 ◆ CERTIFICADO

CERTIFICATE

No. U8 019054 0028 Rev. 00

Model(s):	VC 1200, VC 1200 W, VC 2000, VC 2000 W
Brand Name:	**LAUDA**
Tested according to:	UL 61010-1:2012/R:2024-11 UL 61010-2-010:2019/R:2023-09 CSA C22.2 No. 61010-2-010:2019 CSA C22.2 No. 61010-1:2012/U4:2024-11 CSA C22.2 No. 61010-2-011:2019
Also evaluated to the following standards:	UL 61010-2-011:2021/R:2025-01

Parameters:

Rated voltage:	208-220 V
Rated frequency:	60 Hz
Rated current:	14 A (VC 1200) 13 A (VC 1200 W) 14 A (VC 2000, VC 2000 W)
Protection class:	I
Ambient temperature:	5-40 °C
Humidity:	80% at temperatures up to 31°C, decreasing linearly up to 50% relative humidity at 40°C
Altitude:	up to 2000 m
Pollution degree:	2
Overvoltage category:	II
Refrigerant:	R-290
Filling charge:	95 g
PS high pressure:	23.5 bar
PS low pressure:	10 bar

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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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