The right temperature worldwide

LAUDA

Operating instructions

Variocool
VC 600, VC 1200 (W), VC 2000 (W), VC 3000 (W), VC 5000 (W), VC 7000 (W), VC 10000 (W)
Circulation chiller

CE

Read the operating manual before starting all work!

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Translation of the original operating instructions
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1 Safety

1.1 General safety instructions

- The devices must only be operated for the intended purpose under the conditions stated in this operating manual. Any other operating mode is considered to be non-intended use and can impair the protection provided by the device.
- The operating manual is a constituent part of the device. The information in this operating manual must therefore be available in the immediate vicinity of the device. Also take care to keep this copy of the operating manual.

If you lose this operating manual, contact the LAUDA Constant Temperature Equipment service department. The contact details can be found in ↳ Chapter 13.4 “Contact LAUDA” on page 100.

Use of the device results in hazards from high and low temperatures and from the use of electrical energy. The hazards arising from the device have been eliminated as far as possible by the design in accordance with the applicable standards. Residual hazards are reduced using any of the following measures:

- If relevant, there are safety fittings for the device. These devices are essential for the safety of the device. Their functionality must be ensured by carrying out the appropriate maintenance activities.

  The safety fittings of the device are described in this "Safety" chapter.
- If relevant, there are warning symbols on the device. These symbols must always be observed.

  The warning symbols on the device are described in this “Safety” chapter.
- There are safety instructions in this operating manual. These instructions must always be observed.
- There are additional specific requirements for the staff and for the personal protective equipment.

  These requirements are described in this "Safety" chapter.

An overview of the authorised personnel and the protective equipment can be found in ↳ Chapter 1.10 ‘Personnel qualification’ on page 10 *and* ↳ Chapter 1.11 ‘Personal protective equipment’ on page 10.

Further information about the general structure of safety instructions can be found in ↳ Chapter 1.13 ‘Structure of the safety instructions’ on page 11.

1.2 Take note of additional operating instructions

Interface modules

The device can be equipped with additional interface modules. Installation and use of interface modules requires that the respective operating instructions of the interface module are read and adhered to.

1.3 Intended use

Intended use

The present device is exclusively permitted to be used for tempering and delivering non-combustible heat transfer liquids in a closed circuit.

Non-intended use

The following applications are considered to be not-intended:

- medical applications
- in potentially explosive areas
- for tempering foodstuffs
- with a glass reactor without overpressure protection

1.4 Foreseeable misuse

Misuse of the device must always be prevented.

Among other things, the following uses are considered to be foreseeable misuse:

- Operation of the device without heat transfer liquid
- Incorrect connection of hoses
- Setting the device up on a tabletop surface
- Setting an incorrect pump pressure

1.5 No modifications may be made to the device

Any technical modifications to the device are prohibited. Service work is only permitted to be carried out by the LAUDA Constant Temperature Equipment service department or one of the service partners authorised by LAUDA.

1.6 Requirements regarding the heat transfer liquid

- The device is exclusively designed for non-flammable heat transfer liquids in Class I according to DIN 12876-1.
- Heat transfer liquids are used for temperature control. Only LAUDA heat transfer liquids are approved for use in the device. LAUDA temperature control liquids are tested and approved by LAUDA DR. R. WOBSER GMBH & CO. KG

- In each case, the heat transfer liquids cover a specific temperature range. This temperature range must match the temperature range of your application.
- The use of heat transfer liquids can cause hazards arising from high and low temperatures, and fire, if certain temperature thresholds are exceeded or if the temperature falls below the threshold value, or if the container breaks and there is a reaction with the heat transfer liquid.
- The safety data sheet specifies the hazards and appropriate safety measures for handling the heat transfer liquid. The safety data sheet of the heat transfer liquid must therefore be consulted for the intended use of the device.

1.7 Materials

All parts coming into contact with the heat transfer liquid are made of high quality materials suitable for the operating temperature. High quality stainless steel and temperature-resistant plastics are used.

1.8 Requirements regarding the hoses

Only LAUDA hoses must be used for the external hydraulic circuit. LAUDA hoses are hoses approved by LAUDA DR.
R. WOBSER GMBH & CO. KG. Particular attention must be paid to the permissible temperature range and the maximum permissible pressure when selecting suitable hoses for the application.

1.9 Application area

The device is exclusively permitted to be used in the following areas.

- Commercial area
- Indoor use
  Outdoor installation is also possible with appropriate options.
- At altitudes of up to 2,000 m
- Ambient temperatures from 5 to 40 °C
- Maximum relative air humidity 80 % for temperatures up to 31 °C, decreasing linearly to 50 % relative air humidity at 40 °C
- Mains voltage fluctuations up to +/- 10 % of the rated voltage
- Transient surge voltages up to the values of overvoltage category II
- Temporary surge voltages that occur in the mains power supply
- Contamination level 2
- IP protection class IP 32

1.10 Personnel qualification

Operating personnel
Operating personnel are personnel who have been instructed by specialist personnel about the intended use of the device according to the operating manual.

Specialist
Specific activities on the device must be carried out by technical staff. Technical staff is personnel that can evaluate functions and risks of the device and the application based on their training, skills and experience.

1.11 Personal protective equipment

Protective clothing
Protective clothing is required for certain activities. This protective clothing must comply with the legal requirements for personal protective equipment. Protective clothing should have long sleeves. Safety footwear is additionally required.

Protective gloves
CE protective gloves are required for certain activities. These protective gloves must comply with the legal requirements for personal protective equipment of the European Union.

Protective goggles
Protective goggles are required for certain activities. These protective goggles must comply with the legal requirements for personal protective equipment of the European Union.

1.12 Warning symbols on the device

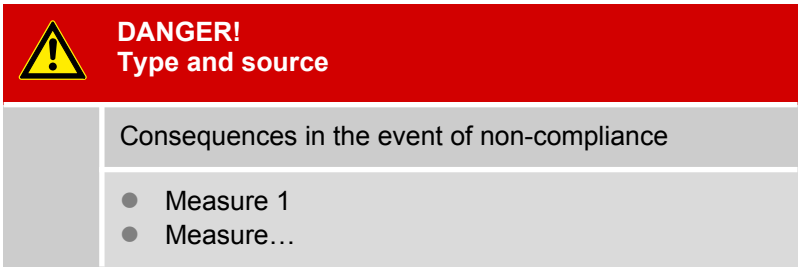
Hot

The "Hot surfaces" warning symbol is attached to the devices. This notice warns about hot surfaces of the device. These surfaces must not be touched during operation. To be able to touch these surfaces during other life cycles such as during maintenance, they must be cooled down to room temperature.

1.13 Structure of the safety instructions

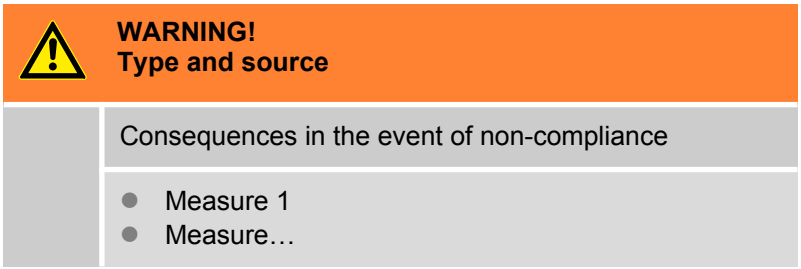
Danger

- A safety instruction of the type "Danger" indicates an **imminently hazardous** situation.
- This will result in **death** or **severe, irreversible injuries** if the safety instruction is disregarded.



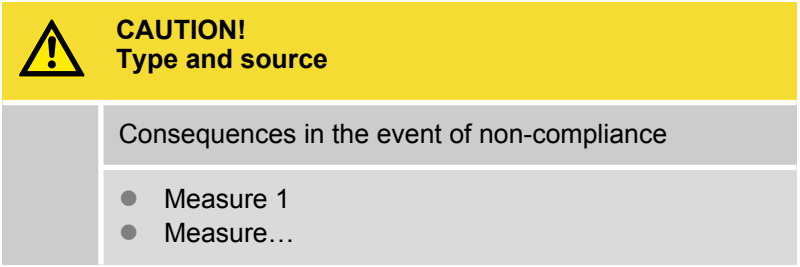
Warning

- A safety instruction of the type "Warning" indicates a **potentially hazardous** situation.
- This can result in **death** or **severe, irreversible injuries** if the safety instruction is disregarded.



Caution

- A safety instruction of the type "Caution" indicates a **potentially hazardous** situation.
- This can result in **minor, reversible injuries** if the safety instruction is disregarded.



Notice

A "notice" warns about possible property or environmental damage.

!	**NOTICE!** **Type and source**
	Consequences in the event of non-compliance
	• Measure 1 • Measure…

2 Unpacking

DANGER!
Transport damage

Electric shock

- Inspect the device for transport damage before commissioning.
- Never put the device into operation if you have discovered any transport damage.

Personnel: ■ Operating personnel

1. Unpack the device.

Keep the original packaging of your device for later transport.

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

If there is unexpected damage to the device or accessories, inform the carrier immediately so that a damage report is produced and a check of the transport damage can be made. Also inform LAUDA Constant Temperature Equipment Service immediately. Contact details can be found in Chapter 13.4 “Contact LAUDA” on page 100.

Accessories included as standard

Device type	Description	Quantity	Catalogue number
VC 600	Olive	2	HKO 026
VC 600	Union nut M16 x 1 for olive 13 mm, installed	2	HKM 032
VC 600	Sealing plug, installed	2	HKN 065
VC 1200 (W) to VC 5000 (W)	¾" olive with ¾" union nut	2	EOA 004
VC 7000 (W) and VC 10000 (W)	1" olive with 1¼" union nut	2	EOA 003
Devices with water cooling	½" olive with ¾" union nut	2	EOA 001
All devices	Operating instructions	1	--

3 Design and function

3.1 Device types

The type designation of the devices is composed of the following integral parts.

Element	Description
VC	Variocool
<number>, e.g. 5000	Specification of the cooling capacity in watts [W] at 20 °C
W	Device with water cooling This specification in the device type is optional. It identifies water-cooled devices.

- All devices are intended as floor-standing units. The devices have castors with locking brakes.
- Starting with VC 1200 (W), the devices are equipped with a bypass for regulation of the pump pressure.
- The devices can optionally be fitted with a heater for heating heat transfer liquids.

3.2 Design of the device

Fig. 1: Front

1 Filler nozzle with cover
2 Control panel
3 Pressure gauge (starting with VC 1200 (W))
4 Mains switch
5 Alarm output (interface 12N)
6 Front panel (removable without tools) with ventilation openings
7 Ventilation openings (on both sides)
8 Four castors (front castors with locking brakes)

Fig. 2: Rear VC 5000 W

1 Pump connection, inlet
2 Bypass adjusting wheel (starting with VC 1200 (W))
3 Pump connection, outlet
4 Drain tap
5 Water cooling outlet (only for water-cooled devices)
6 Water cooling inlet (only for water-cooled devices)
7 Ventilation grid
8 Type plate
9 Mains cable
10 Fuses (up to and including VC 3000 (W))

Control panel

Fig. 3: Control panel

1 Light sensor
2 TFT display
3 ENTER button and arrow buttons
4 Softkeys (left and right)
5 Mains switch
6 USB interface Type B (on the side of the control panel)

3.3 Operating elements

3.3.1 Mains power switch

VC 600 to VC 3000 (W)

The mains power switch can be toggled between the following positions:

- In position [I], the device is switched on.
- In position [O], the device is switched off.

VC 5000 (W) and higher

The mains power switch can be turned to the following positions:

- In position [I], the device is switched on.
- In position [O], the device is switched off.

3.3.2 Screen buttons

Fig. 4: Screen buttons

1 Arrow buttons
2 ENTER button
3 Soft keys

Functions on the screen of the device can be controlled using the screen buttons.

- The UP, DOWN, RIGHT and LEFT arrow buttons can be used to navigate in the screen.
- A selection in the screen can be confirmed with the ENTER button.
- You can control can buttons functions shown in the display with the soft keys.

3.4 Function elements

3.4.1 Hydraulic circuit

The hydraulic circuit designates the circuit through which the heat transfer liquid flows.

The circuit basically consists of the following components:

- Internal expansion bath with heat transfer liquid
- Immersion pump for conveying the heat transfer liquid to the external consumer via the pump connections
- Starting with VC 1200 (W), the devices are equipped with an adjustable bypass to be able to adjust the pump pressure to the requirements of the external consumer.
- Optional heater for heating the heat transfer liquid

Detailed information about the technical data of the pump can be found in Chapter 11.3 ‘Standard and optional pumps’ on page 90.

3.4.2 Manometer

Fig. 5: Manometer

The device types with bypass have a manometer for reading the pump pressure which can be regulated via the bypass of the machines.

The bypass is available for device types starting with model VC 1200 (W).

3.4.3 Refrigeration unit

The refrigeration unit includes the following components:

- Compressor
  A reciprocating compressor is used in the refrigeration unit. The compressor is equipped with a motor circuit breaker which trips on the compressor temperature and compressor current consumption.
- Condenser
  Depending on the device type, an air-cooled or water-cooled condenser is used in the refrigeration unit. For air-cooled condensers, the heated air is discharged to the environment. The fresh air is sucked in through the front of the device using a fan, heated and discharged on the rear of the device. In water-cooled condensers, the heat is dissipated via the cooling water circuit.
- Evaporator
  In the internal bath, heat is discharged with a pipe coil evaporator.

Technical information for the refrigeration unit can be found in Chapter 11.2 ‘Refrigeration unit’ on page 89.

3.4.4 Interfaces

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

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

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

USB interface

The devices are equipped with a USB interface (type B) as standard. This enables, for example, connection to a PC and operation using the LAUDA Wintherm Plus control software.

Alarm output

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

Additional interface modules

Devices can be supplemented with additional interface modules.

- The **analogue module** (catalogue number LRZ 912) has 2 inputs and 2 outputs on a 6-pin DIN socket. The inputs and outputs can be adjusted independently as 0 — 20 mA, 4 — 20 mA or 0 — 10 V interfaces. For power supply of an external sensor with evaluation electronics, the socket is supplied with 20 V.
- The **RS232/485 interface module** (catalogue number LRZ 913) is designed as a 9-pin SUB-D socket. Galvanically separated by an optocoupler. The RS232 interface can be connected directly to the PC using a straight-through cable. The LAUDA command set makes the module compatible with the product lines ECO, Variocool, Proline, Proline Kryomat, PRO, Integral XT and Integral T.
- The **contact module** (catalogue number LRZ 914) is designed as a connector according to NAMUR NE28. This contact module is designed to be identical to the LRZ 915, but with only 1 output and 1 input each on 2 DIN sockets. The coupling socket (catalogue number EQD 047) and the coupling plug (catalogue number EQS 048) are 3-pin connectors.
- The **contact** (catalogue number LRZ 915) is designed as a 15-pin SUB-D socket. With 3 relay contact outputs (changeover contact, maximum 30 V / 0.2 A) and 3 binary inputs for control via external potential-free contacts.
- The **RS232/RS485 interface module** (catalogue number LRZ 916) is designed as a 9-pin SUB-D socket.

- **Profibus module** (order number LRZ 917). The Profibus is a bus system with a high signal data transfer rate for the connection of to up to 256 devices and is mainly used in the chemical industry.
- **Pt100- / LiBus module** (catalogue number LRZ 918). An external temperature probe can be connected to the Pt100 interface of the module. The Command remote control can be used with the thermostatic circulator via the LiBus interface. A solenoid valve for cooling water control, reverse flow protection or a flow through cooler can, for example be connected in this way.
- **LiBus module** (catalogue number LRZ 920). The Command remote control can be used with the thermostatic circulator via the LiBus connection. It is also possible to connect additional modules (such as the LRZ 918, but without Pt100 interface). A solenoid valve for cooling water control, reverse flow protection or a flow through cooler cooler can, for example be connected in this way.
- **USB-Ethernet module** (catalogue number LRZ 921). The module provides the customer with the opportunity to monitor and control thermostatic regulation processes that are performed with a LAUDA thermostatic circulator via Ethernet (referred to as process interface) using the LAUDA interface command set.

  An additional function of the module is remote maintenance of the LAUDA constant temperature equipment via Ethernet.
- **EtherCAT module** (catalogue number LRZ 922) with connection via M8 sockets. **EtherCAT module** (catalogue number LRZ 923) with connection via RJ45 sockets. EtherCAT is an Ethernet-based field bus with master-slave functionality.

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

3.5 Options

The options installed in the device can be seen on a sticker underneath the type plate.

Heater

A heater can be installed in all devices if required. The maximum work temperature range is increased to 80 °C. This option is only available ex factory.

More powerful pump

Stronger pumps are installed in devices from the VC 1200 (W) upwards. Depending on the pump power, this option reduces the cooling capacity by more than 200 W. It also results in greater device installation height for the VC 1200 (W) and VC 2000 (W) devices. This option is only possible ex factory.

Outdoor installation

The device may only be installed in open air if it is protected from weather influences (provide shelter or enclosure). Outdoor installation is possible as an option for the VC 5000, VC 7000 and VC 10000 devices. This option is only possible ex factory.

Extension of the technical data:

- The ambient temperature range is extended to -20 – 40 °C.

Operation outdoors for outdoor temperature below 5 °C:

- Outdoor installation is configured, the following warning is shown: **349 Preheat device for XX min**.
  The display shows this warning after the device is switched on. It indicates the remaining pre-heating time required before the compressor can be started. The compressor is preheated using its own heater. The other components (pump and heater) are started immediately when the device is switched from standby to operation.
- Outdoor installation is **not** configured, the following warning is shown: **349 Preheat device!**
  The display shows this warning for 10 seconds after switching on the device. It is possible to start the device afterwards.

Increased wear or damage to the compressor may result if the compressor is not preheated!

Sound insulation

Sound insulation is possible as an option for theVC 5000 (W), VC 7000 (W) and VC 10000 (W) devices. This option is only possible ex factory.

Insulation of the cooling water hydraulic system

Insulation of the cooling water hydraulic system is available as an option for the VC 1200 W to VC 10000 W devices. This option is available ex factory and can also later be installed on site by the LAUDA Constant Temperature Equipment service department.

3.6 Rating plate

Fig. 6: Rating plate with heater option

The rating plate specifications are explained in detail in the following table. Certain specifications are dependent on installed device options. These specifications are supplemented accordingly. For example, if the heater option is used, "optional heater" is appended after the specification. Whether the device is equipped with any additional options is indicated with a note directly underneath the rating plate. For example, an "Option heater included" label (see adjacent picture) is located underneath the rating plate for the heater option. If this label is not present, the respective specification without supplement is applicable for the device.

Specification	Description
Type	Device type
Catalogue No.	Catalogue number of the device
Serial No.	Serial number of the device
Refrigerant I	Refrigerant that is used in the refrigeration unit of the device
Filling charge I	Fill quantity of the refrigerant
PS high pressure I	maximum permitted operating pressure on the refrigerant high pressure side (compression, liquefaction)
PS low pressure I	maximum permitted operating pressure on the refrigerant low pressure side (expansion, evaporation)
Power consumption	Power consumption of the device
Power consumption with optional heater	Power consumption of the device; only applicable for devices with optional heater
Protection class	IP protection class of the device
Fuse	Fuse used in the device
Fuse optional heater	fuse used in the device; only applicable for devices with optional heater
Class according to DIN 12876-1	Device class according to DIN 12876-1

3.7 Serial number

The serial number of a LAUDA device has the following structure:

- LAUDA catalogue number
- Year of manufacture
  The year is indicated with two digits.
- Sequential number of the device in the year of manufacture.
  The sequential number is a four-digit number.

This information is displayed in the format <catalogue number>-<year of manufacture>-<sequential number>.

An example for Variocool devices: LWG183-13-0130.

4 Before starting up

4.1 EMC classification

Approval of the devices according to EMC classification

Countries	EMC class
Europe	Class B This classification has been made according to the EMC standard DIN EN 61326-1 (corresponds to VDE 0843-20-1).
USA	Class A This classification has been made according to the FCC (Federal Communications Commission) regulations, Section 15.
Canada	Class A This classification has been made according to the ICES-003 (Interference Causing Equipment Standards) and NMB-003 regulations.

Instructions for devices, Europe

EMC classification of the devices:

- Class A: Operation only on mains power supplies without connected residential areas.
- Class B: Operation on mains power supplies with connected residential areas.

In the case of unfavourable mains conditions, disruptive voltage fluctuations can occur.

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 ».

4.2 Placement

Very specific placement conditions are applicable to the devices. These placement conditions are mainly specified in the technical data for the device.

Further information about the technical data can be found at ↳ Chapter 11.1 ‘General data’ on page 87.

Additional placement conditions are described below.

- Toxic vapours can be produced, depending on the heat transfer liquid used and the operating mode. Ensure adequate extraction of the vapours.
- Observe the requirements of the device for electromagnetic compatibility (EMC).
- Do not cover the ventilation openings.

Further information about EMC requirements can be found at ↳ Chapter 4.1 ‘EMC classification’ on page 24.

Operation outdoors at outdoor temperatures below 5 °C

A warning is displayed on the screen indicating the duration of the preheating time for the compressor and whether the compressor needs preheating. Increased wear or damage to the compressor may result if the compressor is not preheated! Further information can be found at ↳ ‘Outdoor installation’ on page 21.

Personnel: ■ Operating personnel

WARNING!
Rolling or toppling of the device from incorrect handling

Impact, crushing

- Do not tilt the machine.
- Place the device on a level, skid-free surface with sufficient load bearing capacity.
- Engage the reel brake when setting up the device.
- Do not place any heavy parts on the machine.

1. Place the devices on a suitable base.

The devices can be moved. Release the locking brakes of the castors for this by pushing the lever upwards.

2. Lock the castors on the device. Push the lever downwards to lock them.
3. Attach the "Hot surface" warning sticker in a clearly visible position for applications above 70°C.

4.3 External consumer

4.3.1 Thermostatic hoses and hose clips

CAUTION!
Discharge of heat transfer liquid during operation caused by use of unsuitable tubes

Scalding, frostbite

- Use tubes with temperature resistance that is appropriate for the operating temperature range of the device.
- Use tubes with a temperature resistance of at least 100 °C for the heater option.

CAUTION!
Contact with hot or cold tubes

Burns, frostbite

- Use insulated tubes for temperatures below 0 °C or above 70 °C.

The hoses specified below can be used for all heat transfer liquids that are approved for the devices.

Hoses

Type	Device Pump connection	Accessories required (nipple and screw cap are provided on the device as standard)	Maximum working pressure	Clear width x outer diameter in mm	Temperature range in °C	Catalogue number
EPDM hose, insulated	VC 600 M16 x 1 (10), nipple 13 mm	Nipple HKO 026, screw cap HKM 032	< 1 bar	12 x 30	-35 — 90	LZS 021
EPDM hose, not insulated	VC 600 M16 x 1 (10), nipple 13 mm	Nipple HKO 026, screw cap HKM 032	< 1 bar	9 x 11	10 — 90	RKJ 111
EPDM hose, not insulated	VC 600 M16 x 1 (10), nipple 13 mm	Nipple HKO 026, screw cap HKM 032	< 1 bar	12 x 16	10 — 90	RKJ 112
EPDM hose with textile reinforcement	VC 600 M16 x 1 (10), nipple 13 mm	Nipple HKO 026, screw cap HKM 032	10 bar	13 x 19	-40 — 100	RKJ 031
EPDM hose with textile reinforcement	VC 1200 to VC 5000 (W) G ¾ (15), nipple ¾"	Nipple with screw cap EOA 004	10 bar	19 x 27	-40 — 100	RKJ 032
EPDM hose with textile reinforcement	VC 7000 to VC 10000 (W) G 1¼ (20), nipple 1"	Nipple with screw cap EOA 003	10 bar	25 x 34	-40 — 100	RKJ 033

Hose clips

Suitable for hose	Clear width Ø in mm	Catalogue number
RKJ 111	8 — 16	EZS 012
RKJ 112, RKJ 031	12 — 22	EZS 013
RKJ 032, RKJ 033	25 — 40	EZS 016

4.3.2 Connecting external consumer

CAUTION!
Discharge of heat transfer liquid during operation caused by open consumer

Electric shock, scalding, frostbite

- Only use hydraulically closed consumers.

CAUTION!
Bursting of the external hydraulic circuit due to overpressure

Impact, cutting, scalding, frostbite

- Lay tubes so that they do not kink.

Note the following:

- Temperature control tubes: Always use the largest possible diameters and shortest possible tube lengths in the external circuit.
  If the temperature control tube diameter is too small, a temperature drop between device and external consumer occurs due to flow rate too low. In this case, increase or lower the temperature accordingly.
- Secure the temperature control tubes with hose clamps.
- If the external consumer is at a higher level than the device, emptying of the external volume can occur if the pump is stopped and there is ingress of air in the external liquid circuit even for closed circuits. In this case, there is the risk of the device overflowing.
- In the event of tube rupture, hot liquid can escape and become a danger for persons and material.

4.4 Cooling water

4.4.1 Requirements for the cooling water

This section is relevant for the following:

- For water-cooled devices

NOTICE!
Schema cooling circuit starts leaking due to corrosion

Device damage

- Do not use corrosive cooling water.

Requirements

There are specific requirements concerning the purity of the cooling water. A suitable process for treating and maintaining the water must be applied to handle the specific impurities in the cooling water. The condenser and the entire cooling water circuit can get blocked, damaged and can leak due to unsuitable cooling water. Extensive consequential damage to the entire cooling circuit and cooling water circuit may occur. The cooling water quality is dependent on the local conditions.

- Free chlorine, e.g. from disinfectants and water containing chloride results in pitting corrosion in the cooling water circuit.
- Distilled, deionised or demineralised water is not suitable due to its corrosive properties and results in corrosion in the cooling water circuit.
- Seawater is not suitable due to its corrosive properties and will result in corrosion in the cooling water circuit.
- Water containing iron and iron particles in the water lead to corrosion in the cooling water circuit.
- Hard water is not suitable for cooling due to the high lime content resulting in calcification in the cooling water circuit.
- Cooling water with suspended matter is not suitable.
- Untreated, non-purified water, for example river or cooling tower water, is not suitable due to its microbiological content (bacteria) that may settle in the cooling water circuit.

Suitable cooling water quality

Data	Value	Unit
pH value	7.5 — 9.0	
Sulphates [SO_4^{2-}]	< 70	mg/l
Hydrogen carbonate [HCO_3^-] / Sulphates [SO_4^{2-}]	> 1.0	
Water hardness (alkaline earth ions content)	0.71 — 1.52	mmol/l
Hydrogen carbonate [HCO_3^-]	70 — 300	mg/l
Conductivity	10 — 500	µs/cm
Chlorides (Cl^-)	< 50	mg/l
Sulphite (SO_3^{2-})	< 1	mg/l
Free chlorine gas (Cl_2)	< 1	mg/l
Nitrates (NO_3^-)	< 100	mg/l
Ammonia (NH_3)	< 2	mg/l
Iron (Fe), in solution	< 0.2	mg/l
Manganese (Mn), in solution	< 0.1	mg/l
Aluminium (Al), in solution	< 0.2	mg/l
Free, aggressive carbonic acid (CO_2)	< 5	mg/l

Data	Value	Unit
Hydrogen sulphide (H_2S)	< 0.05	mg/l
Algae growth	not permitted	
Suspended matter	not permitted	

4.4.2 Connecting cooling water

Description	Value
Maximum cooling water pressure	10 bar
Differential pressure cooling water △p	1 — 6 bar VC 1200 W and VC 2000 W 3 — 6 bar VC 3000 W and greater
Cooling water temperature	Approx. 15 °C recommended, 10 — 30 °C permitted (with performance restrictions)

Note the following:

- Fix the cooling water hoses in place using hose clips.
- Fix the return hose of the water cooling in the drain area to prevent uncontrolled slipping off of the hoses even in the event of pressure surges.
  Fix the return hose of the water cooling in the drain area so that spraying out of hot cooling water is not possible.
- Prevent kinking or crushing of the hoses.
- We recommend using a leak detector with water shut-off to prevent damage due to cooling water system leaks.
- Ensure that the cooling water meets the required criteria.
- In the case of leaks in the condenser, there is the danger that refrigerating machine oil and refrigerant from the refrigerant circuit of the device can get into the cooling water. Comply with all applicable legal provisions and the requirements of the water supply companies at the operating site.

4.5 Interfaces

4.5.1 Alarm output 12N

Available functions

Function	Description
Alarm output	--
Alarm and standby	for on-site return flow protection

- maximum 30 V DC; 0.2 A

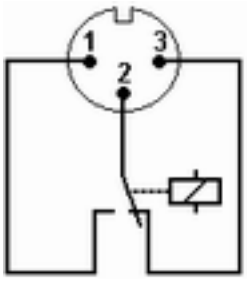


Fig. 7: Flange connector (front) in idle state

1 Normally open contact
2 Centre
3 Normally closed contact

Front view of the flange connector or of the coupling socket on the solder side

Idle state

- The alarm output is in resting state:
  - When the device is switched off,
  - after switching on if a fault is already evident at that time (e.g. level too low)
  - and during normal operations when a fault occurs.
- Pins 1 and 2 are open.
- Pins 3 and 2 are closed.

GO state

- The alarm output is in a sound state when no faults occur.
- Pins 1 and 2 are closed.
- Pins 3 and 2 are open.

Information on the settings for the alarm output can be found in ↳ Chapter 6.12.7 ‘Configuring alarm output’ on page 60.

Note the following:

- The equipment connected to the low voltage inputs and low voltage outputs must have be safely separated from dangerous voltages according to DIN EN 61140. For example, using double or reinforced insulation according to DIN EN 60730-1 or DIN 60950-1.
- Only use shielded connection cables. Connect shield to connector case. Cover unused plug connections with protective caps.

4.5.2 Installing the driver for the standard USB interface

A special USB driver must be installed on your PC to be able the USB interface of the thermostatic circulator to respond. The LAUDA company makes the USB Virtual COM Port driver available for download at http://www.lauda.de. Supported operating systems are Windows XP SP3, Windows Vista, Windows 7 and Windows 8 (each with 32 bit and 64 bit).

Personnel: ■ Specialist

1. Execute the driver set-up (exe file) for the USB interface on your PC.
   ► An installation wizard is displayed on your PC.
2. Follow the instructions of the wizard on your PC.
   ► The USB driver is installed on your PC.

4.5.3 Connecting device to a PC

Before connecting the device to a PC, the appropriate USB driver must be installed on the PC.
↳ Chapter 4.5.2 ‘Installing the driver for the standard USB interface’ on page 32

If the device is connected to the PC via the USB interface, a free COM port is automatically assigned to the device. The PC uniquely identifies the device using the internal serial number and always assigns the same COM port to this device. If additional devices are connected to the PC via USB interfaces, other free COM ports are assigned to these devices.

Establishing the connection

1. The device and the PC are switched on.
2. Connect the device and the PC using a USB cable.

   The USB cable is not included in the scope of delivery.

   ► Windows XP: The hardware search help function opens on your PC.
3. Follow the instructions of the wizard on your PC.
   ► The software for the new device is installed.

   Windows Vista, Windows 7, Windows 8: The software for the new device is installed in the background.

COM port

The device can be addressed as a COM port using conventional communication programs (e.g. Hyperterminal or Putty). Other settings such as baud rate are not necessary.

The COM port assignment for connected devices can be checked in Windows *Device Manager* under *Ports (COM & LPT)*.

4.5.4 Installing modules

Devices can be optionally supplemented with additional interface modules. These can be installed in two different size module slots on the front of the device.

- Right module slot (approx. 51 mm x 27 mm) for RS232 / RS485 module / analogue module / contact modules / Profibus module
- Left module slot (approx. 51 mm x 17 mm) for Pt100 / LiBus module

This section is relevant for the following sample cases:

- You would like to use an external temperature sensor.
- You would like to transmit a signal such as the actual temperature from an external consumer to the circulation chiller.
- You would like to transmit a signal such as the setpoint temperature to an external device.
- You would like to use the Command remote control unit.

DANGER!
Contact with live parts

Electric shock

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

1. Touch the grounded, bare metal stainless steel rear side of the circulation chiller to discharge any electrostatic charge.
2. Remove the module from the packaging.
3. Switch off the circulation chiller and unplug the mains plug.
4. The module slots are protected with a cover. Release the screws on the cover for the appropriate module slot and carefully remove the cover.
5. Carefully detach the bus connection cable from the cover.
6. Attach the bus connection cable - red plug to red socket.

   The plug and the socket have a reverse-polarity-proof design.

7. Insert the module into the appropriate slot and fasten it using the two Philips screws.

5 Commissioning

5.1 LAUDA heat transfer liquids

Note the following:

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

Approved heat transfer liquids

LAUDA designation	Chemical designation	Temperature range in °C	Viscosity (kin) in mm²/s (at 20°C)	Viscosity (kin) in mm²/s for temperature	Container size Catalogue number		
					5 l	10 l	20 l
Kryo 30	Monoethylene glycol / water	-30 — 90	4	50 at -25 °C	LZB 109	LZB 209	LZB 309
Aqua 90	decalcified water	5 — 90	1	---	LZB 120	LZB 220	LZB 320

Note the following for Kryo 30:

- The water content is reduced during long operating at higher temperatures and the mixture becomes flammable (flash point 128°C). Check the mixture ratio using a hydrometer.

Heat transfer liquid water

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

- The water must be free of impurities. Water containing iron is unsuitable due to rust formation and untreated river water is unsuitable due to algae formation.
- The addition of ammonia is not permitted.

5.2 Establishing power supply

Personnel: ■ Operating personnel

NOTICE!
Use of unauthorised mains voltage or mains frequency

Machine damage

- Compare the rating plate with available mains voltage and mains frequency.

Also note the following:

- Only connect the device to an earthed (PE) power socket.

Pump with three-phase motor

Personnel: ■ Specialist

The pump of the device types VC 5000 (W), VC 7000 (W) and VC 10000 (W) is driven by a three-phase motor. The direction of rotation of the power supply must be considered. The direction of rotation of the three-phase connection must be reversed by swapping 2 phases if the pressure gauge shows no pressure build-up!

This should only be performed by an electrician!

5.3 Switching on device for the first time and filling with water

5.3.1 Fill mode

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 operating mode 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 fill mode, the device starts the temperature control provided the start operating mode is not set to off. Changing the start operating mode can be found in ↳ Chapter 6.12.4 ‘Specifying starting mode (Autostart)’ on page 58.

5.3.2 Switching on and filling device

Personnel:
- Operating personnel

Protective equipment:
- Protective goggles
- Protective clothing
- Protective gloves

DANGER!
Use of incorrect heat transfer liquid

Fire

- Select a heat transfer liquid with a temperature range 20 K above the temperature range of the application.

WARNING!
Overflow of heat transfer liquid

Electric shock

- Ensure that the device is not overfilled. Note the level indicator and the thermal volume expansion of the heat transfer liquid.

WARNING!
Spraying of heat transfer liquid

Electric shock

- Avoid spraying heat transfer liquid. Use a funnel for filling.

1. Close the drain tap. Turn the lever to the left for this.
2. Switch on the device using the mains power switch.

For VC 600 to VC 3000 (W), push the mains switch to Position [1].

For VC 5000 (W) and higher, turn the mains switch to Position [1].

▶ A signal tone sounds.

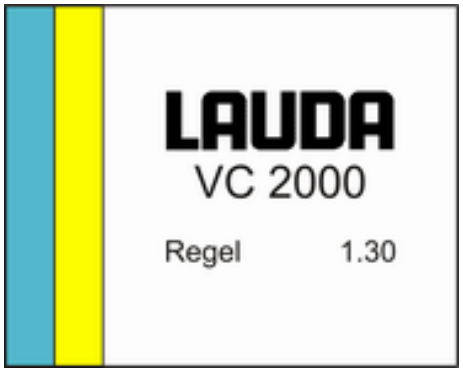


Fig. 8: Start screen

3. The type designation and version numbers of the software available as standard in the device are shown in the display for approx. 5 seconds. If device options are configured, these are also displayed.

> *You can retrieve the version numbers of the software available in the device at any time using the menu.*

Fig. 9: Menu language

4. The window for selection of the menu language is displayed on the screen. Select the required menu language using the UP and DOWN arrow buttons. Confirm your selection with the OK button.

> *For example, select* [Deutsch] *to see display entries in the German language.*
>
> *The selection option for the menu language is only shown when the programme is first started.*

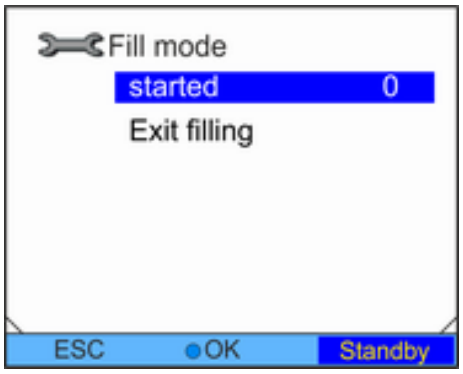


Fig. 10: Fill mode

5. The device detects when the heat transfer liquid level is low or zero.
   - ► The device automatically starts the filling mode.
6. Pull up the cover of the filler nozzle.
7. Fill the device with heat transfer liquid. In doing so, monitor the display on the screen and the audible signal of the device.

> *If necessary, use a funnel for filling.*
>
> *The filling mode can be invoked again at any time using the menu.*

8. Close the filler neck with the cover.
9. End the filling mode by selecting and confirming [End filling].

> *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 starting mode (Autostart)’ on page 58.

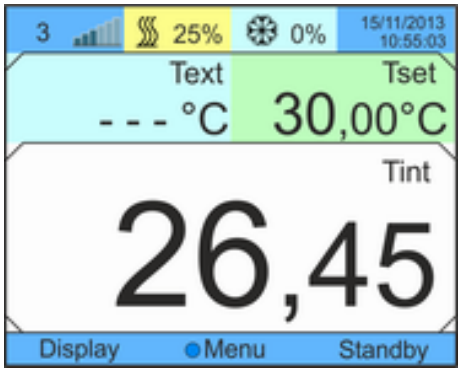


Fig. 11: Basic window

10. The basic window is displayed.

Operation outdoors at outdoor temperatures below 5 °C

A warning is displayed on the screen indicating the duration of the preheating time for the compressor and whether the compressor needs preheating. Increased wear or damage to the compressor may result if the compressor is not preheated! Further information can be found at ↳ 'Outdoor installation' on page 21.

5.4 Setting pump pressure

For devices with bypass (starting from VC 1200 (W)), the pump pressure can be set using a control valve on the rear side of the device. Individual setting of the pump pressure is possible with this when using pressure-sensitive external consumers.

Personnel: ■ Operating personnel

CAUTION!
Bursting of the external consumer

Scalding, frostbite, impact, cutting

- A bypass regulator is provided to set the pump pressure (starting from VC 1200).
- For consumers with a maximum permissible operating pressure below the maximum pressure of the pump, use a safety valve for protection. This safety valve must be installed in the flow of the device.

1. To reduce the pump pressure, turn the bypass adjustment wheel anticlockwise until the maximum permitted pressure for the external consumer is reached.

Monitor the display on the manometer for this.

2. To increase the pump pressure, turn the bypass adjustment wheel clockwise until the required pressure for the external consumer is reached.

6 Operation

6.1 General safety instructions

⚠	**CAUTION!** **Overheating beyond maximum operation temperature in the event of a fault**
	Burns, scalding
	● In the event of a fault, temperatures can reach up to 100 °C with the heater option.

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 screen 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

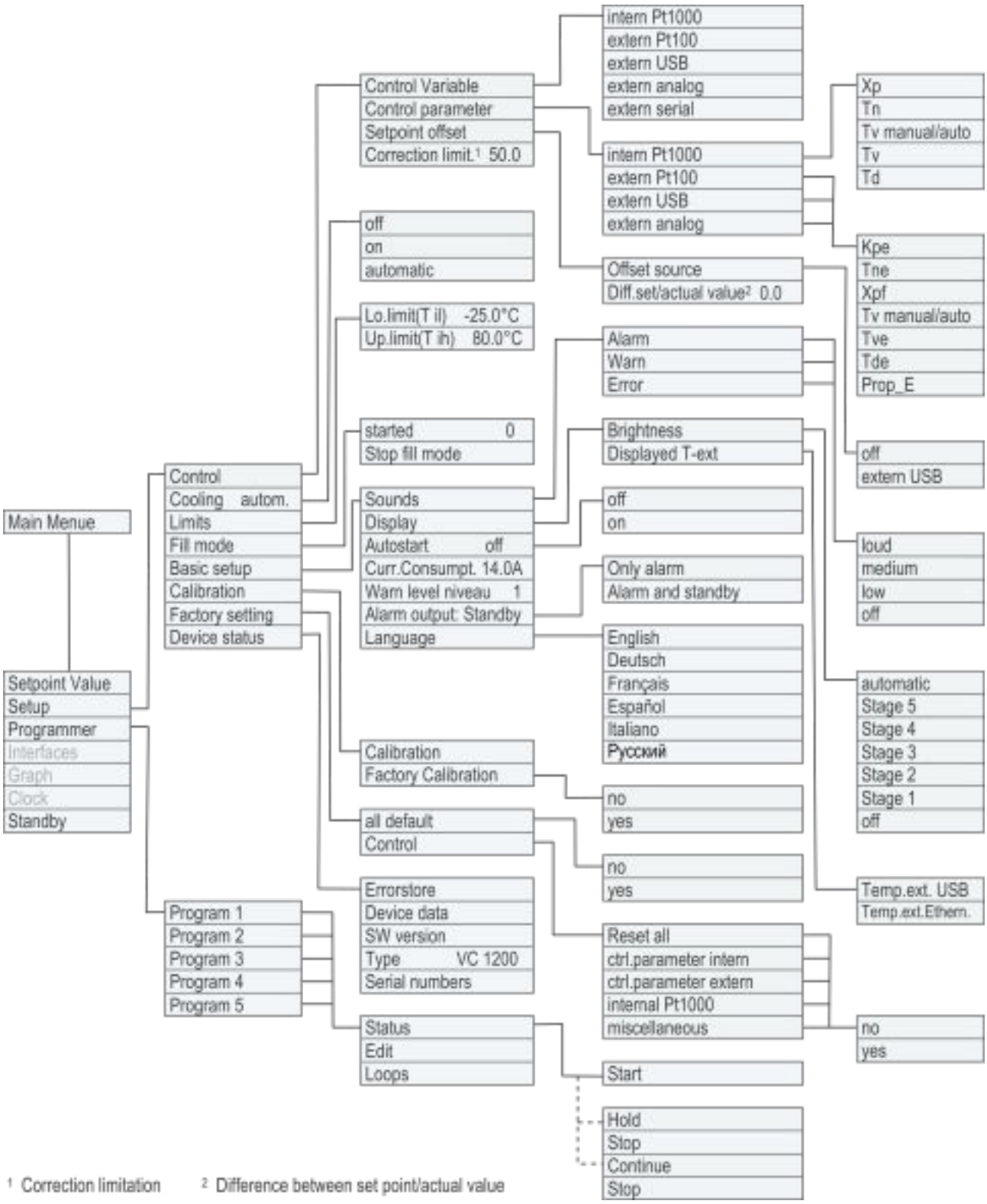


Fig. 12: Menu structure part 1

Menu structure for Graph, Clock and Standby

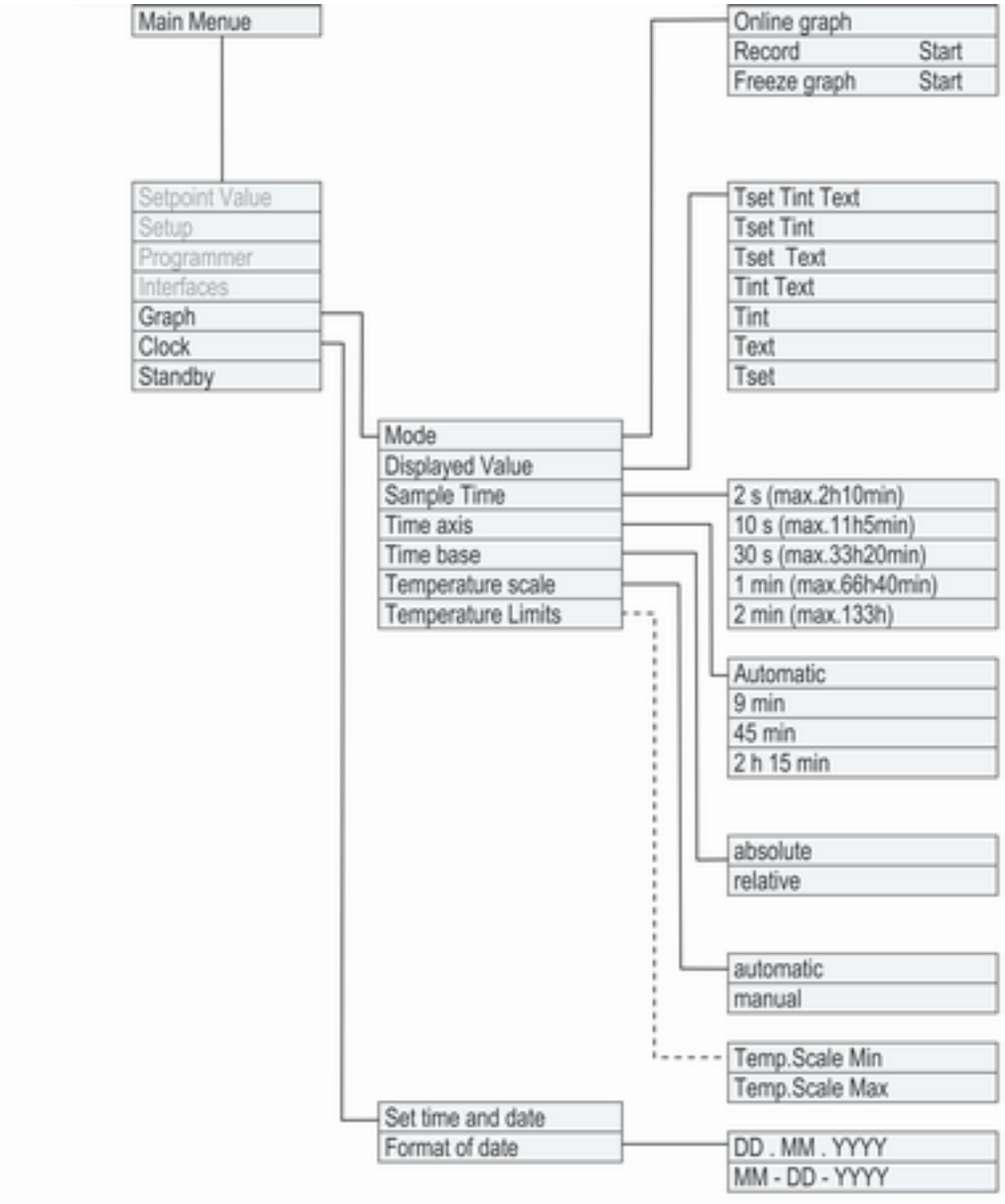


Fig. 13: Menu structure part 2

6.4 Switching on the device

Personnel: ■ Operating personnel

1. Switch on the device using the mains power switch.
   ▶ A signal tone sounds.
2. The basic window is displayed.

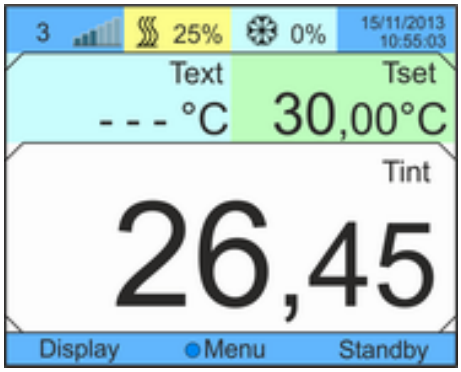


Fig. 14: Basic window

After switching on, the device defaults to the standby operating mode if the start operating mode is not set to on. Changing the start operating mode can be found in ↳ Chapter 6.12.4 ‘Specifying starting mode (Autostart)’ on page 58.

6.5 Screen displays

6.5.1 Basic window

The basic window is displayed after switching on the device. The basic window contains different components depending on the operating mode.

During normal operation

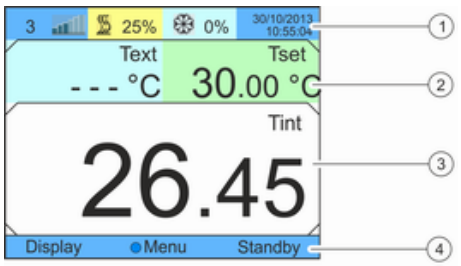


Fig. 15: Basic window structure

1 Expanded status display
2 Status display
3 Internal actual temperature Tint (depending on set control variable, the external actual temperature Text is also displayed here)
4 Softkey bar

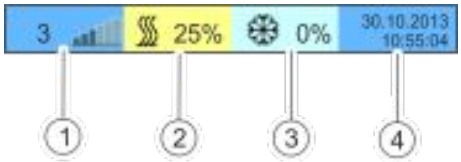
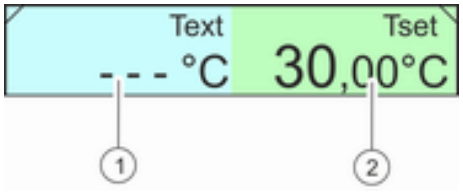


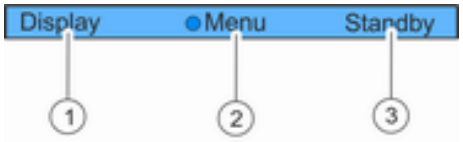
Fig. 16: Expanded status display

1 Level indicator
2 Heater is active and heats with the displayed percentage of total power. This display is only available if the device is equipped with the optional heater.
3 Cooling is active and cools with displayed percentage of total cooling capacity.
4 Display of date and time



1 External actual temperature Text (depending on set control variable, the internal actual temperature Tint is also displayed here)
2 Setpoint value Tset

Fig. 17: Status display

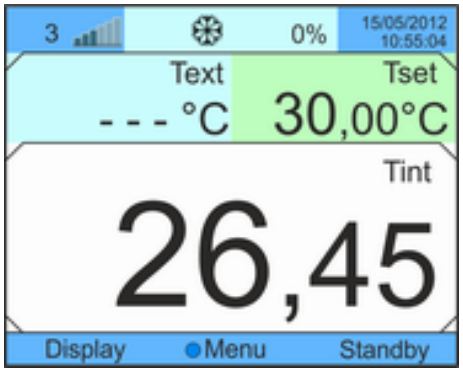


1 Softkey button, left
2 Menu button
3 Softkey button, right

The functions of the softkeys and the function of the Menu button are shown in this bar.

Fig. 18: Softkey bar

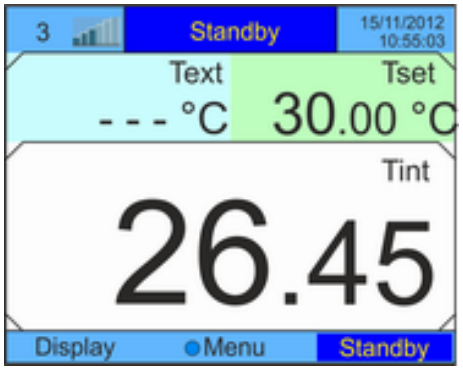
During normal operation - devices without optional heater



Unlike devices with optional heater, there is no field with heat output information available in the expanded status display.

Fig. 19: Basic window without optional heater

In the operating mode Standby



During standby operation, the expanded status bar shows *Standby* instead of the status of the components. The *Standby* area also has a dark blue background in the softkey bar.

Fig. 20: Basic window in Standby

6.5.2 Menu window

Navigating to the main menu

1. You can perform the following steps to reach the main menu:
   - Press the ENTER button in the basic window.
   - If you are in a submenu, you can return to the main menu with the left arrow button.

Main menu structure

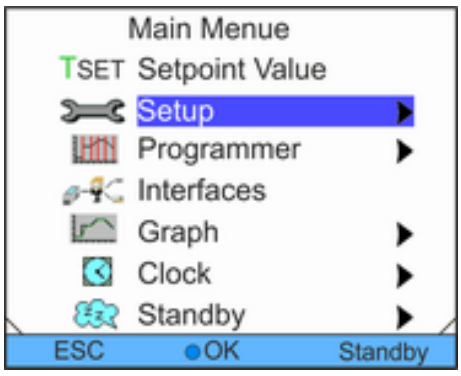


Fig. 21: Main menu

The main menu and also the submenus consist of menu items which are marked as follows.

Symbol	Description
▶	Indicates that other menu levels (submenus) are available.
🔒	The padlock symbolises a blocked function. These functions cannot be adjusted.

The currently selected entry is highlighted with colour.

Structure of submenus

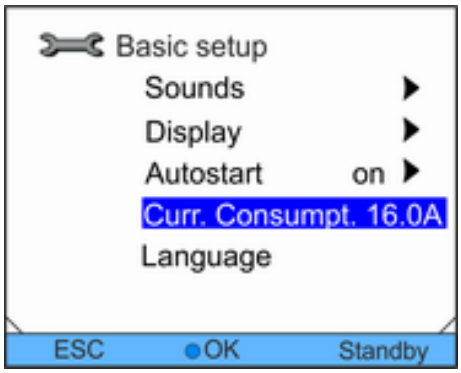


Fig. 22: Submenu

The structure of submenus basically corresponds to that of the main menu.

Softkey bar functionality

The softkey bar is shown in the lower display area. For example, the following functions can be selected using the softkeys:

The [ESC] softkey takes you back to the basic window.

The [Standby] softkey puts the device in the standby state.

Functions of the Enter key

The [OK] enter button leads to a submenu or to an input window.

Navigation in the menus

1. You have the following options:
   - Use the UP and DOWN arrow buttons to navigate between the menu items.
   - Press the RIGHT arrow button to select a submenu.
   - Press the LEFT arrow button to return to a previous menu.
   - The selected menu entry is highlighted in colour.

6.5.3 Input window

The input window is used for configuration of settings on the screen. Two versions of input windows are provided.

Input window for selecting options

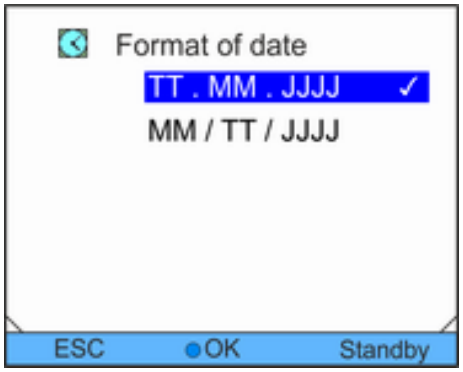


Fig. 23: Selecting option

- The tick mark indicates the active function.
- Navigation in the options is performed using the arrow buttons.
- In doing so, the selected setting is highlighted in colour.
- Using the softkey button [ESC], you return to the previous display without making any changes.
- The selected setting is accepted by pressing the [OK] enter button.

Input window for manual input

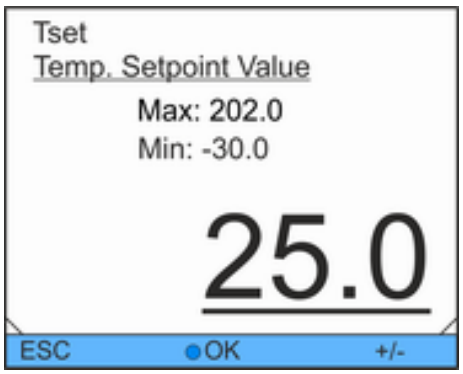


Fig. 24: Inputting values

- The value to be entered is shown in large characters. The cursor under the value flashes.
- Individual digits can also be selected and changed by pressing the RIGHT and LEFT arrow buttons.
- The value can be changed using the UP and DOWN arrow buttons. The change is accelerated if one of the two arrow buttons is pressed for a longer period.
- The [+/-] softkeys can be used to change the sign when your device is appropriately equipped.
- *Min:* and *Max:* can be used to enter the limits for the value specification.
- The value chosen is accepted by pressing the [OK] enter button.
- The [ESC] softkey brings you back to the previous screen without making any changes.

6.6 Specifying temperature limit values

The temperature limits define the temperature range of your application, i.e. in which range temperature control can take place.

Personnel: ■ Operating personnel

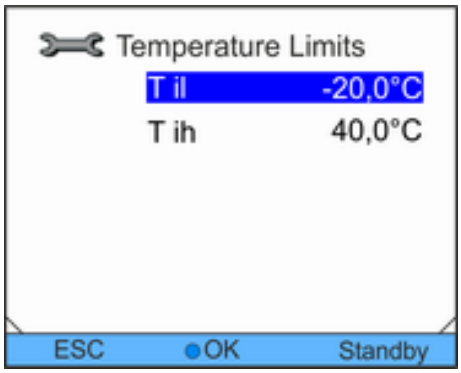


Fig. 25: Selecting temperature limit value

1. Change 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.

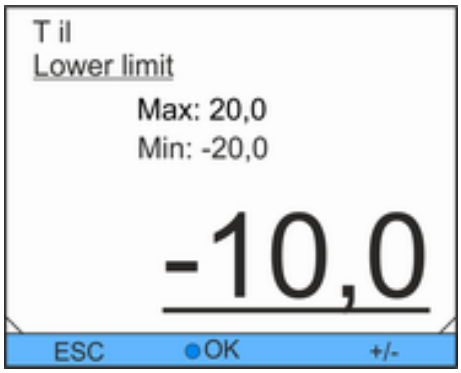


Fig. 26: Defining temperature limit value

4. Adjust the value in the following input window.

6.7 Specifying the set point

Personnel: ■ Operating personnel

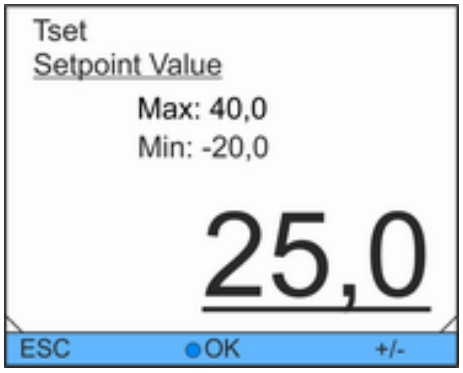


Fig. 27: Specifying the set temperature

1. Change to the main menu.
2. Select the *Set temperature* item in the main menu.
   - ► An input window is displayed. The cursor under the value flashes. The set temperature can be adjusted within the displayed limit values.
3. Adjust the set temperature accordingly.
4. Confirm with the OK button.

6.8 Activating and deactivating standby

During standby operation, the components of the device such as the pump are switched off. The display remains active.

Personnel: ■ Operating personnel

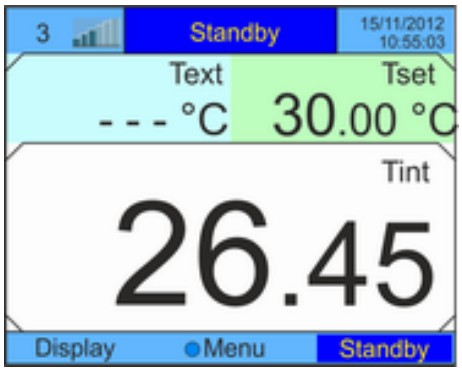


Fig. 28: Basic window in Standby

1. Press the [Standby] softkey button.
   - ► The device is in the standby operating mode. The *Standby* entry in the softkey bar is highlighted. This operating mode is also shown in the expanded status display.
2. Press the *Standby* softkey button to activate the Operation operating mode.

6.9 SmartCool (cooling)

The cooling unit of the constant temperature equipment is [automatically] operated, using the standard settings. During this process, the cooling unit is automatically switched on or off, depending on temperature and operating status. The cooling unit can also be permanently switched on or off by using the manual functions.

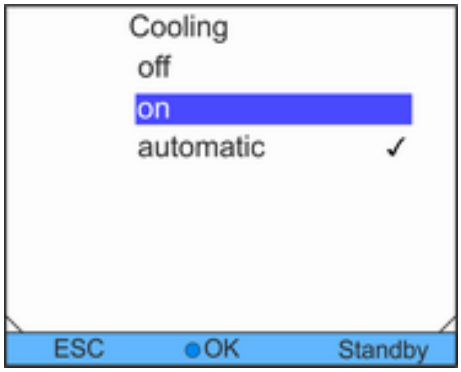


Fig. 29: Configuring cooling

1. Change to the main menu.
2. Select the menu item *Settings* → *Cooling*.
3. Select one of the following options:
   - The cooling unit is automatically controlled when [Automatic] mode is selected. The cooling unit switches on when cooling capacity is required.
   - The cooling unit always remains switched off when [Off] is ticked.
   - The cooling unit always remains on when [On] is ticked, also when no cooling capacity is required.
4. Confirm with the OK button.

> *The cooling unit on devices without heating might show prolonged standstill periods (several minutes) in* [Automatic] *mode.*

Cooling of a device without heating and in [Automatic]mode

The cooling unit automatically switches off if the consumption load is low and if load falls below the set point is by 2 K. The cooling unit only switches back on when the set point is exceeded by 2 K due to heat transfer from the pump and electricity consumers.

This 2-point control system always keeps the outflow temperature within ±2 K around the set point. A smaller control range causes the cooling unit to switch on and off more frequently, which has negative effects on the lifespan of the refrigeration compressor.

On devices with the optional heating installed, the cooling unit only switches off in [Automatic] mode when cooling capacity is no longer needed.

6.10 External control

6.10.1 Activating external control

Personnel: ■ Operating personnel

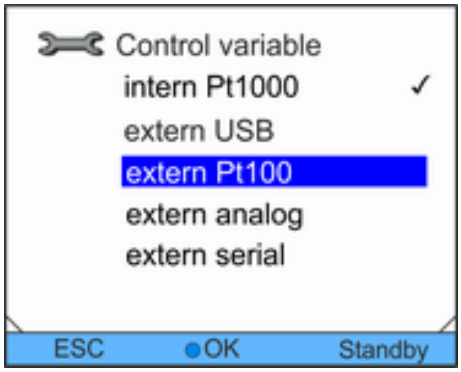


Fig. 30: Activating external control

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 sensor has been connected. A Pt100 temperature sensor must be connected to the module.*

2. Confirm with the OK button.

6.10.2 Defining setpoint offset

It is possible to apply a value to the temperature that is predefined by the external temperature sensor and then process it as a set-point. For example, the bath temperature can be 15 °C below the temperature of a reactor that the external temperature sensor measures.

Navigating to the settings

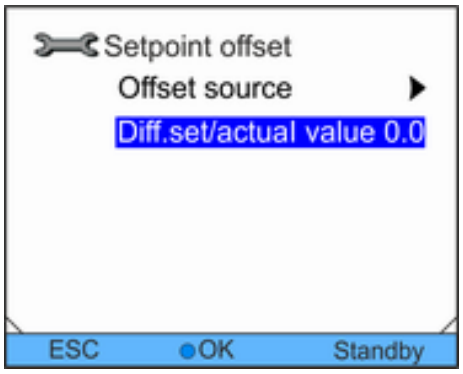


Fig. 31: Setpoint offset menu

Personnel: ■ Operating personnel

1. Change to the main menu.
2. Select the menu item *Setup* → *Control* → *Setpoint offset*.
3. Select one of the following options:
   - With *Offset source*, you can specify which source to use to measure the offset.
   - With *Diff. set/actual value*, you can specify the offset.

Specifying offset source

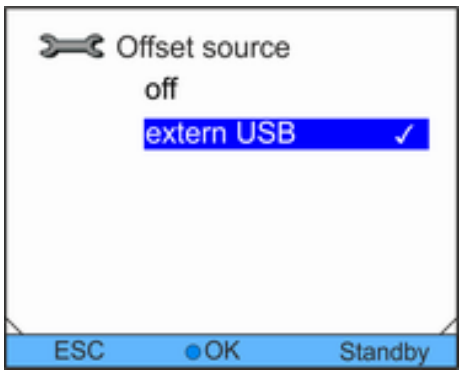


Fig. 32: Adjusting setpoint offset

Personnel: ■ Operating personnel

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

   The LEFT arrow button takes you to the previous display without changes.
3. Confirm with the OK button.

Specifying offset

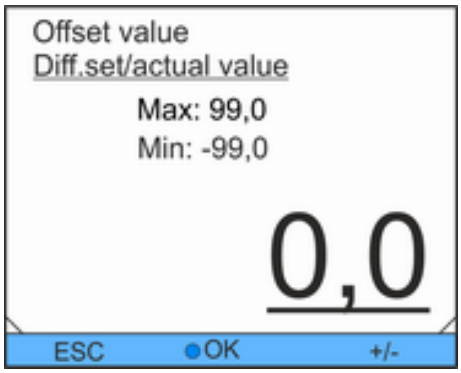


Fig. 33: Specifying offset

Personnel: ■ Operating personnel

1. Select the menu item *Diff. set/actual value* in the Setpoint offset menu.
   ▶ An input window is displayed.
2. Adjust the offset value within the displayed limit values.
3. Confirm with the OK button.

6.11 Control

The internal and external control parameters are preset at the factory for operation as circulation chiller (with water as heat transfer liquid). Depending on the application, adjustments of the control parameters can be necessary from case to case. The thermal capacity and the viscosity of the heat transfer liquid also influence the control behaviour and may require adjustment of the control parameters.

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 value. 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 value 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 hydraulics

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

- Only use approved heat transfer liquids: water or water-glycol.
- 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 strongly 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.

For example, if the operating temperature range of a system is -20 ... 80 °C, the controller setting should be made for approx. -10 ... 20 °C.

Information about possible incorrect settings

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

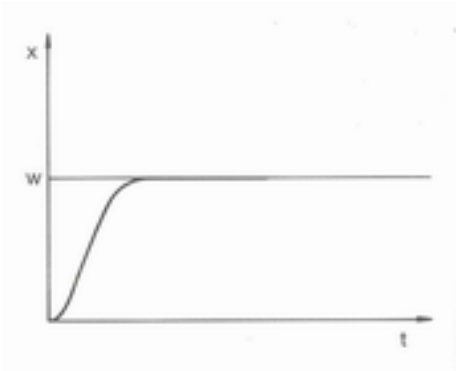


Fig. 34: Optimum setting

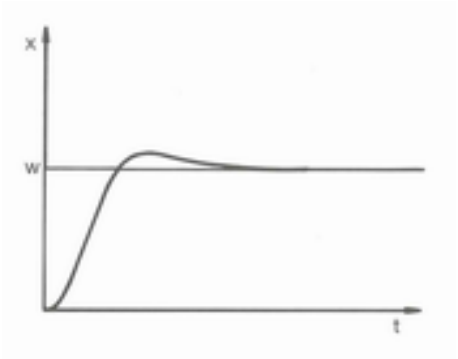


Fig. 35: Control parameter Xp too large

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 set-point. If the proportional range Xp is reduced, the P part remains at 100 % 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.

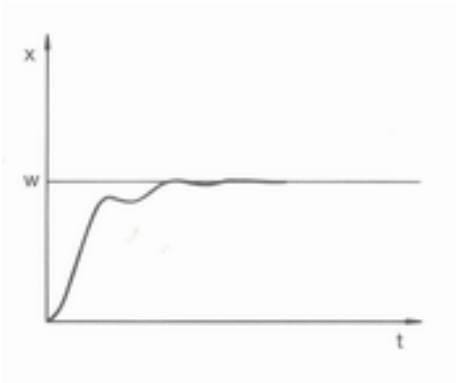


Fig. 36: Control parameter Xp too small

If the proportional range is selected 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 set-point slowly.

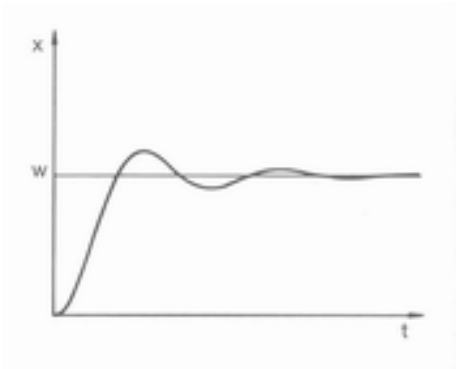


Fig. 37: Control parameters Tn and Tv too small

In this case shown in the graph, 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.

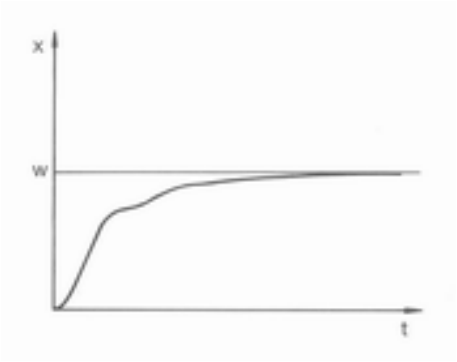


Fig. 38: Control parameters Tn and Tv too large

The actual value increases relatively steeply after specification of the setpoint. 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 Calling 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 setpoint temperature with the outflow temperature and calculates the actuating signal, i.e. the amount to be heated or cooled.

The following control parameters can be adjusted for internal control:

Parameter	Description	Unit
Xp	Proportional range	K
Tn	Reset time	s
Tv	Lead time	s
Td	Damping time	s

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

The temperature limits Tih and Til also influence the control.

6.11.4 Adjusting internal control parameters

Personnel: ■ Operating personnel

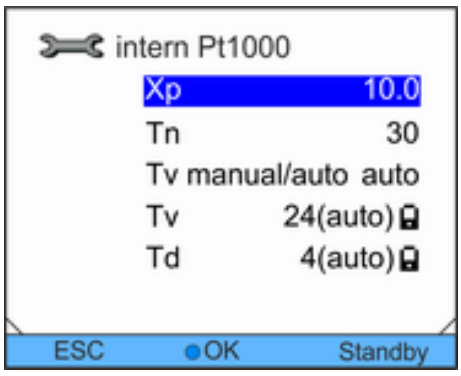


Fig. 39: Internal control parameter menu

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

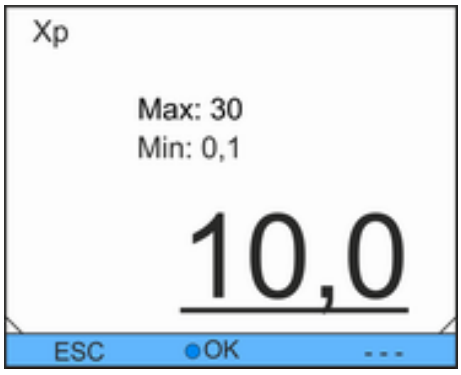


Fig. 40: Specifying internal control parameters

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

6.11.5 Overview of external control parameters

- ■ The external control consists of a master controller (external controller) and a slave controller (internal controller). The temperature of the consumer to be temperature-controlled is also required. In general, this is determined with an external "Pt100 sensor".
- ■ The master controller compares the setpoint temperature with the external temperature (consumer temperature) and uses this information to calculate the set temperature (setpoint_internal) for the slave controller (internal controller).
- ■ The slave controller compares the set temperature (setpoint_internal) with the outflow temperature and calculates the actuating signal, i.e. the demand for heating or cooling.

The following control parameters can be adjusted for the master controller (external controller):

Parameter	Description	Unit
Kpe	Gain	-
Tne	Reset time	s
Tve	Lead time	s
Tde	Damping time	s
Prop_E	Proportional range	K

The following control parameters can be adjusted for the slave controller (internal controller):

Parameter	Description	Unit
Xpf	Proportional range	K

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

The temperature limits Tih and Til also influence the control.

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 padlock 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 Invoking basic settings

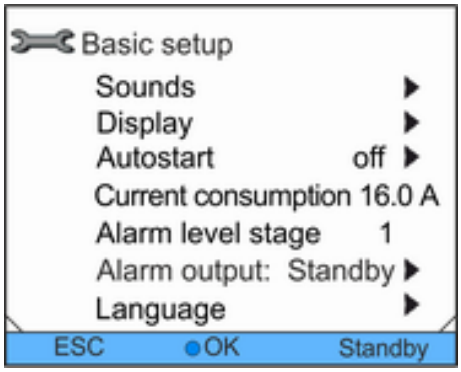


Fig. 41: Basic setup menu

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

The basic settings are described in the following chapters.

6.12.2 Setting volume of the sounds

The devices signal alarms and faults as two-tone sounds. Warnings are signalled as a continuous tone.

Personnel: ■ Operating personnel

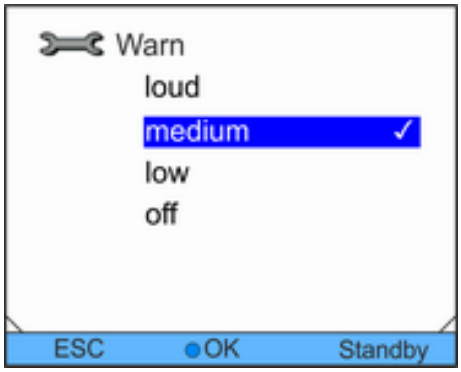


Fig. 42: Setting volume

1. Change to the main menu.
2. Select the menu item *Setup* → *Basic setup* → *Sounds*.
3. Select one of the options depending on which sound you want to adjust.
4. Select a volume level.
5. Confirm with the OK button.

6.12.3 Setting display brightness

The devices have a sensor which automatically adjusts the display brightness according to the ambient light level.

Adjustments to this setting are usually not necessary.

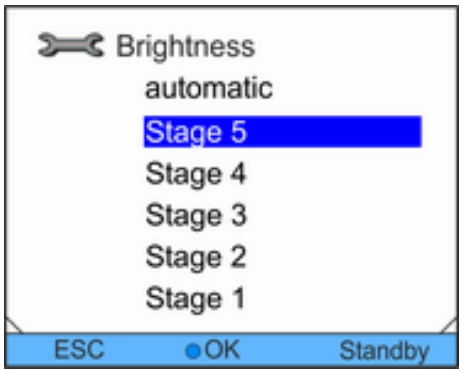


Fig. 43: Setting brightness

Personnel: ■ Operating personnel

1. Change to the main menu.
2. Select the menu item *Setup* → *Basic setup* → *Display* → *Brightness*.
3. The following options are available in the input window:
   - The brightness is adjusted automatically with the *automatic* default setting.
   - The brightness can be set manually using the *Stage* entries.
     The brightness is increased from *Stage 1*. The corresponding brightness becomes visible on the display.
   - The backlighting for the display can be completely switched off using *off*.
4. Confirm with the OK button.

6.12.4 Specifying starting mode (Autostart)

It is generally required that the device starts operating again after a mains power failure. A manual activation step can be inserted, e.g. for safety reasons.

Personnel: ■ Operating personnel

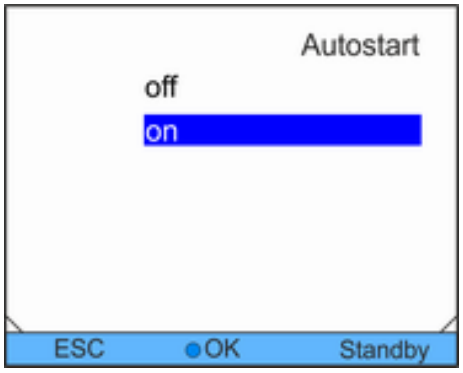


Fig. 44: Specifying Autostart

1. Change to the main menu.
2. Select the menu item *Setup* → *Basic setup* → *Autostart*.
3. Select one of the following options:
   - With *off*, the device is in the standby operating mode after a mains power failure.
   - Normal operation is continued directly after a power failure using *on*.
4. Confirm with the OK button.

6.12.5 Limiting current consumption

If your line fuse is below 16 A, the current consumption can be reduced in steps from 16 A to 8 A. In the case of the optional heater, the output of the heater is reduced accordingly. Take account here whether other consumers are still connected to the same fused circuit or whether your device is the only consumer.

Personnel: ■ Operating personnel

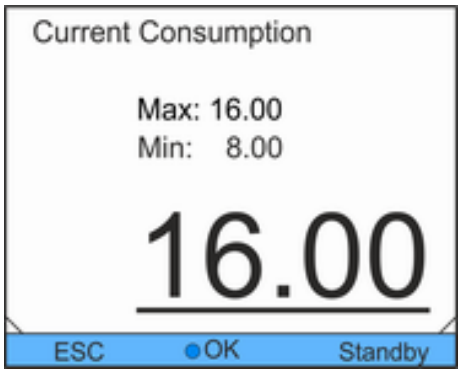


Fig. 45: Specifying current consumption

1. Change to the main menu.
2. Select the menu item *Setup* → *Basic setup* → *Curr. Consumpt.*
3. Adjust the current consumption accordingly.
4. Confirm with the OK button.

6.12.6 Configuring alarm level for 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. 46: Specifying level alarm level

1. Change to the main menu.
2. Select the menu item *Setup* → *Basic setup* → *Warn level niveau*.
3. You can select from four stages 0 to 3 for the warning before "low level". With *3*, a warning about too low fill level is output as early as from the third level stage. With *0*, no warning at all is output. In this case, the device is switched off and an alarm is displayed if low level is reached.
4. Confirm with the OK button.

6.12.7 Configuring alarm output

Appropriate configuration must be performed if standby of the device as well as alarms should be output at the alarm output. Return flow protection for the device can be activated with this.

Personnel: ■ Operating personnel

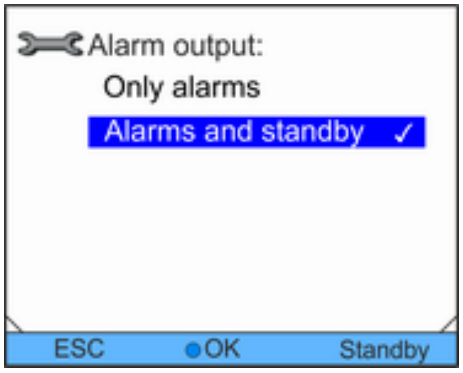


Fig. 47: Configuring alarm output

1. Change to the main menu.
2. Select the menu item *Setup* → *Basic setup* → *Alarm output.*
3. You have the following options:
   - With *Only alarms*, a signal is only output at the alarm output in the event of alarms of the device.
   - With *Alarms and standby*, a signal is also output during standby.
4. Confirm with the OK button.

6.12.8 Selecting menu language

The menu languages of German, English, French, Spanish, Italian and Russian are available in the devices.

Personnel: ■ Operating personnel

Fig. 48: Selecting menu language

1. Change to the main menu.
2. Select the menu item *Setup* → *Basic setup* → *Language*.
3. Select any of the available languages.
4. Confirm with the OK button.

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

The factory calibration is overwritten during the adjustment. This requires a reference thermometer with the required level of accuracy. The factory calibration should otherwise not be changed.

A temperature deviation can be corrected if inspection of the thermostatic circulator with a calibrated reference thermometer shows such a deviation.

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

Personnel: ■ Operating personnel

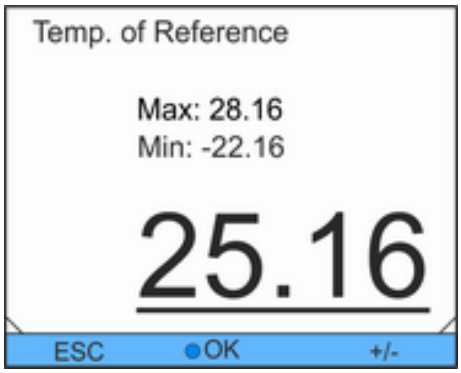


Fig. 49: Specifying offset

1. Change to the main menu.
2. Select the menu item *Setup* → *Calibration* → *Calibration*.
3. Adjust the value accordingly. The value displayed on the reference thermometer must be entered.
4. Confirm with the OK button.

6.14 Restoring factory calibration (internal temperature sensor)

Any offset specified for the internal temperature measurement can be restored to the factory setting.

Personnel: ■ Operating personnel

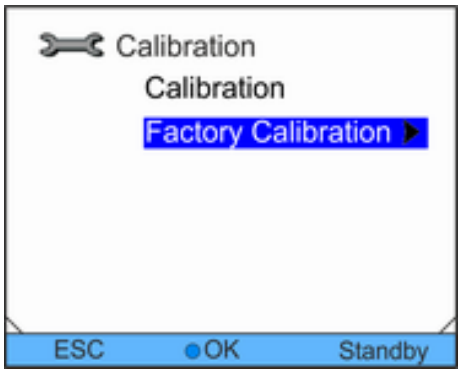


Fig. 50: Factory calibration setting

1. Change to the main menu.

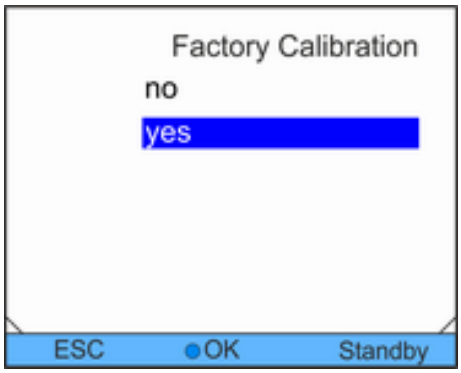


Fig. 51: Restoring factory calibration

2. Select the menu item *Setup* → *Calibration* → *Factory Calibration*.
3. Select one of the following options:
   - Selecting *no* returns to the previous display without making any changes.
   - Selecting *yes* restores the factory calibration.

6.15 Restoring factory settings

Navigating to the factory settings

Personnel: ■ Operating personnel

1. Change to the main menu.
2. Select the menu item *Setup* → *Factory settings*.

Restoring individual settings

Personnel: ■ Operating personnel

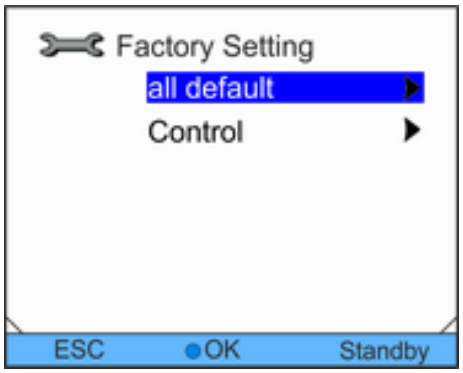


Fig. 52: Selecting mode

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

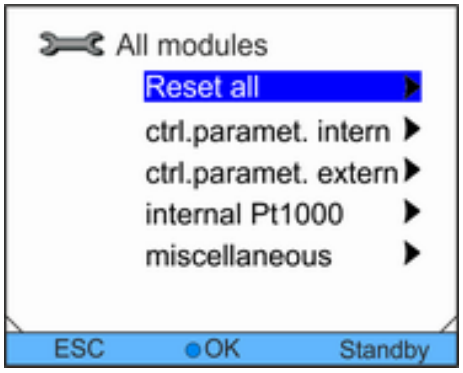


Fig. 53: Resetting control parameters

2. Select the appropriate menu item in the parameter list.
   - The internal control parameters can be reset using *ctrl.parameter intern*.
   - The external control parameters can be reset using *ctrl.parameter extern*.
   - The settings for the internal sensor can be reset with *intern Pt1000*.
   - Setpoint and maximum current consumption can be reset with *miscellaneous*. The control is also set to internal control.
3. Select one of the following options in the input window:
   - Selecting *no* returns to the previous display without making any changes.
   - Selecting *yes* resets the selected parameter if you confirm this with the OK button.

Restoring all settings

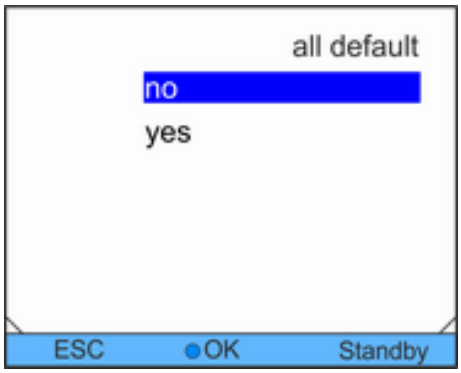


Fig. 54: Reset confirmation

Personnel: ■ Operating personnel

1. Select the menu item *Reset all*.
2. Select one of the following options:
   - Selecting *no* returns to the previous display without making any changes.
   - Selecting *yes* restores the factory settings if you confirm this with the OK button.

6.16 Device status

6.16.1 Retrieving device status

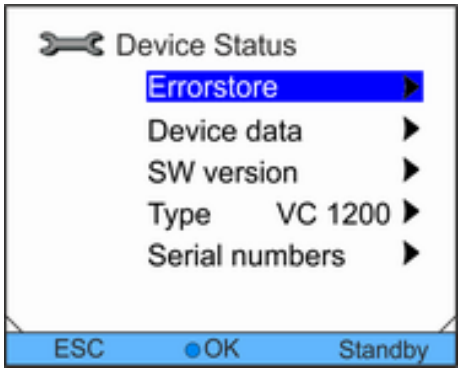


Fig. 55: Device status

Personnel: ■ Operating personnel

1. Change to the main menu.
2. Select the menu item *Setup → Device status*.
   - ▶ The Device Status menu is displayed.
3. You have the following options:
   - Read Errorstore
   - Retrieving device data
   - Request software version
   - Request device type
   - Request serial numbers

6.16.2 Read Errorstore

The devices have an Errorstore for error analysis. Up to 140 warning, error and alarm messages can be stored in the Errorstore.

1. Select the menu item *Errorstore* in the Device Status menu.

The latest message is in the first position. The message text is displayed in the footer.

Fig. 56: Errorstore

2. You can navigate through the list using the UP and DOWN arrow buttons.

The following information is displayed for each message:

- The relevant module which causes the message is displayed under *Source*.
- *Code* is the coded alarm, warning or error description.
- *Type* specifies alarm, warning or error.
- The exact time of the message is displayed with *Date* and *Time*

A list of the possible alarms, warnings and errors can be found in ‘Procedure in the event of alarms’ on page 78.

6.16.3 Retrieving device data

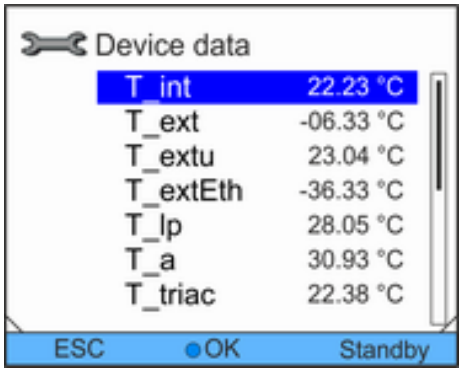


Fig. 57: Device data

1. Select the menu item *Device data* in the Device Status menu.

► Various parameters are displayed.

6.16.4 Retrieving software version

Among other things, the relevant software versions are needed for service cases.

Personnel: ■ Operating personnel

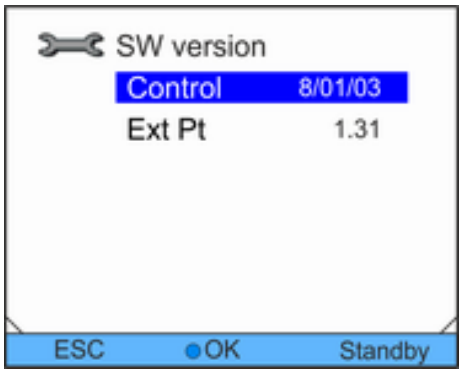


Fig. 58: Software version

1. Select the menu item *SW version* in the Device Status menu.

► The corresponding software versions are displayed depending on device type and 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

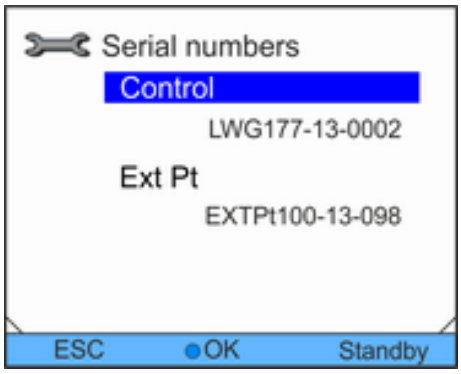


Fig. 59: Serial numbers

1. Select the menu item *Serial numbers* 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 Programme example

The programmer function allows storage of temperature/time programmes. 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 programme is 150.

Up to 5 temperature/time programmes can be stored.

Possible settings

Setting	Description
No.	Segment number of the program
Tend	End temperature to be reached
hh	Time in hours (hh) in which the specified temperature should be reached.
mm	Time in minutes (mm) in which the specified temperature should be reached

Setting	Description
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	Switching contacts of the contact module (if available) can be programmed here. Contact modules are available as accessories.

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

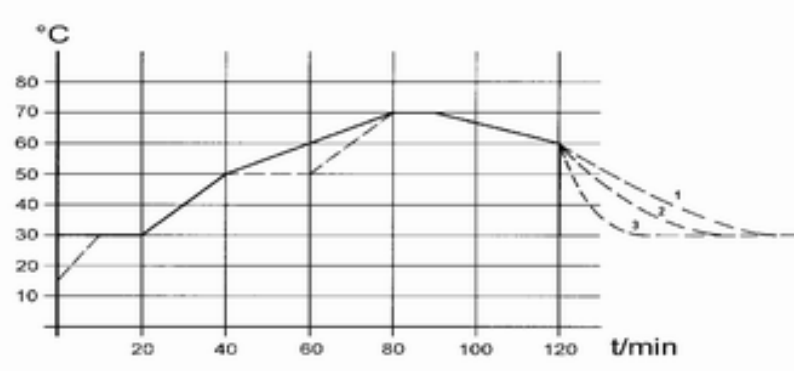


Fig. 60: Program example

The cool-down time in the graph varies according to the device type, consumer etc. The sample segment No. 2 is aimed at reaching 50 °C within 20 minutes.

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

"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.

"After" table

(- - - -, edited)								
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
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).

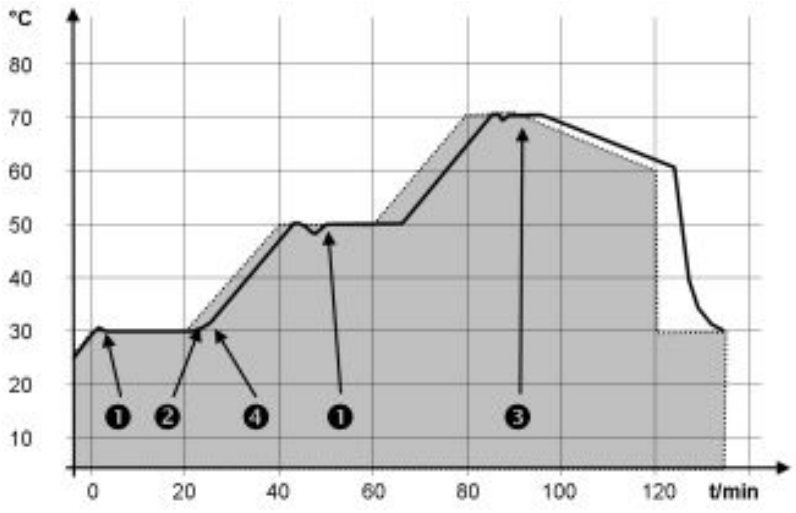


Fig. 61: Program tolerance

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 a program

Personnel: ■ Operating personnel

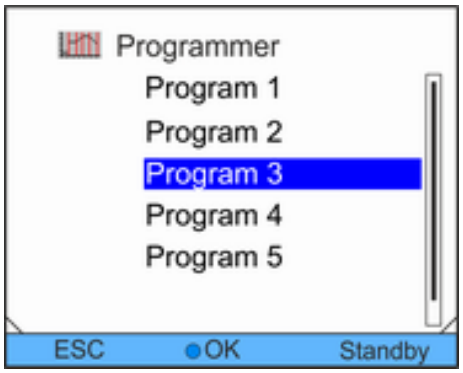


Fig. 62: Selecting a program

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

6.17.3 Creating and editing programs

Starting editing

Note the following:

- If a segment time of >999 h: 59 min is intended, this time must be distributed among several successive segments.

Personnel: ■ Operating personnel

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

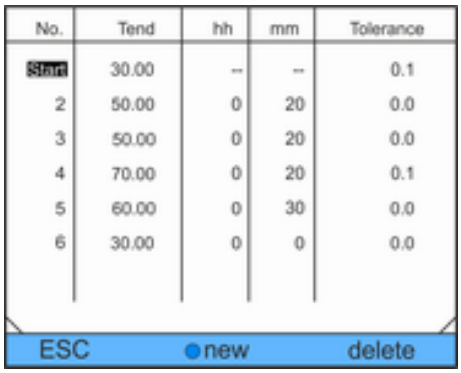


Fig. 63: Editing program

Editing segments

Personnel: ■ Operating personnel

Note the following:

- No time specification is possible in the starting segment. The temperature of the first segment is reached as quickly as possible to change to segment 2 after reaching the set tolerance.
- If the value "0" is entered in the fields *hh* and *mm*, the setpoint is applied immediately and the bath temperature reached as quickly as possible.
- If a tolerance range that is too small has been selected in the *Tolerance* field, the program may 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 in all fields, the contact position of the starting setting or the setting before the program start is maintained.

1. You have the following options:
   - You can display additional columns of the program using the RIGHT and LEFT arrow buttons.
   - You can navigate in the segments of a program using the UP and DOWN arrow buttons.
   - You can edit a selected segment by pressing ENTER. You can adjust the value using the UP and DOWN arrow buttons. Individual digits can be selected with the RIGHT and LEFT arrow buttons. Confirm your changes with the ENTER button.

Inserting a new segment

Personnel: ■ Operating personnel

1. Navigate to the segment below which the new segment should be inserted.
2. Navigate to the No. column in this segment.
3. Press ENTER.
   ► A new segment is created.

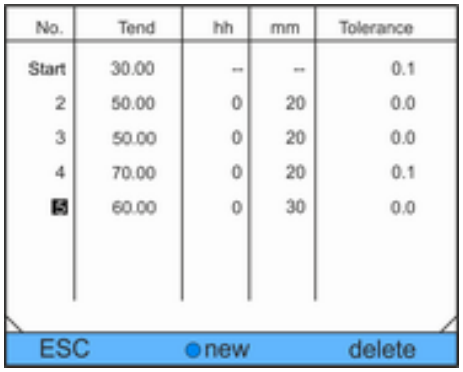


Fig. 64: Selecting program segments

Deleting a segment

Personnel: ■ Operating personnel

1. Navigate to the segment you want to delete.
2. Navigate to the No. column in this segment.
3. Press the *Delete* softkey button.
   ► The segment is deleted.

Editing a currently running program

Note the following:

- No segments can be added or deleted in a running program.
- Modifications of the existing temperature values and segment times are possible in a running program. The segment is continued as if the change had been valid since the segment was started.
- If the new segment time is shorter than the already elapsed segment time, the program jumps to the next segment.

Personnel: ■ Operating personnel

1. In the basic window, press the *Prog.x/y* softkey in the softkey bar.

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

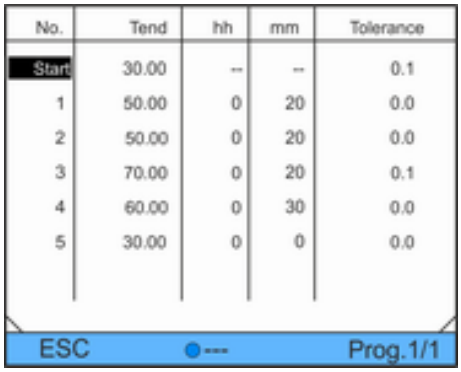


Fig. 65: running program

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

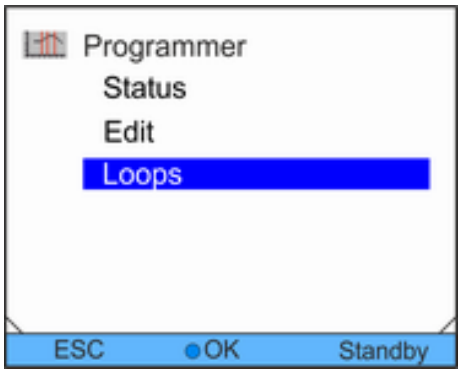


Fig. 66: Setting program loops

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

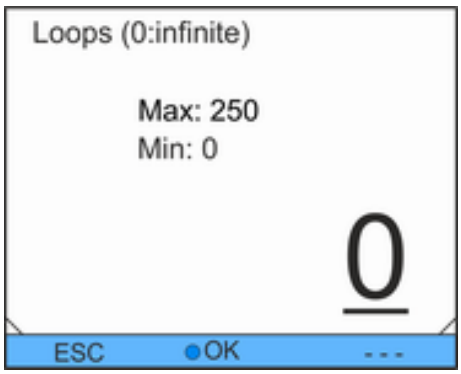


Fig. 67: Defining program loops

2. Adjust the number of loops accordingly.

Press the LEFT arrow button to enter two or three digit numbers. Another digit is displayed and can be adjusted.

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

3. Confirm with the OK button.

6.17.5 Starting, interrupting and ending a program

Personnel: ■ Operating personnel

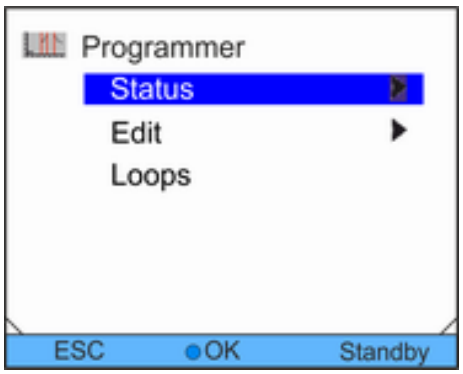


Fig. 68: Setting program status

1. Select the *Status* menu item for the selected program.

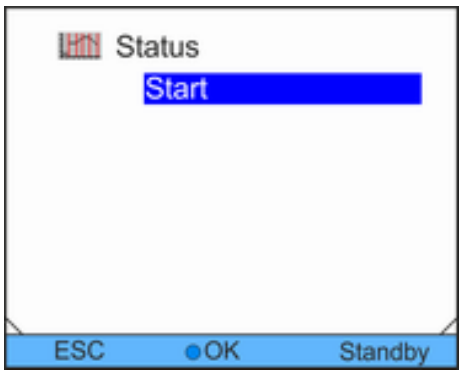


Fig. 69: Specifying program status

2. You have the following options:

- Select the *Start* option to start the program.
- If the program is started, it can be interrupted using *Pause*. An interrupted program can be continued using *Continue*.
- Select the *Stop* option to end the program.

7 Maintenance

7.1 General safety instructions

DANGER!
Contact with live or moving parts

Electric shock, impact, cutting, crushing

- The device must be disconnected from the mains power supply before any maintenance work.
- Repairs must only be carried out by specialists.

DANGER!
Heat transfer liquid drips onto the electronics

Short circuit

- The device must be disconnected from the mains power supply before any maintenance work.

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

Burns, scalding, frostbite

- Ensure device parts, accessories and heat transfer liquid are at room temperature before touching them.

NOTICE!
Contact with rotating part

Severed parts of the body

- Repairs must only be performed by specialist personnel.

Also note the following:

- Before all maintenance work, you should ensure that decontamination of the device has been performed if it came into contact with hazardous materials.

7.2 Maintenance intervals

The maintenance intervals described in the following table must be complied with. The following maintenance work is mandatory before every longer unsupervised operation.

Interval	Maintenance work
monthly	Inspection of the drain tap by visual inspection from the outside
	Inspection of the external tubes for material fatigue
	Cleaning of the condenser (only for air-cooled devices)
	Cleaning of the water filter (only for water-cooled devices)
quarterly	Decalcification of the cooling water circuit (a shorter interval must be selected depending on water hardness and operating time) (only for water-cooled devices)
half-yearly	Inspection of the heat transfer liquid

7.3 Cleaning device

Personnel: ■ Operating personnel

WARNING!
Ingress of cleaning agents in the device

Electric shock

- Use a moist cloth for cleaning.

Also note the following:

- Only clean the control panel with water and detergent. Do not use acetone or solvents. The consequence would be permanent damage of the plastic surfaces.

7.4 Cleaning air-cooled condenser

Personnel: ■ Operating personnel

1. Switch off the device.
2. Remove the front panel carefully. Pull the panel to the front by gripping the recess and lift the panel out of the guide for this.

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

3. Brush off or vacuum the condenser.
4. Replace the front cover carefully.

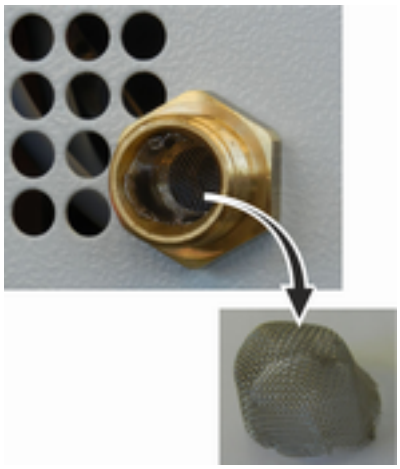
Fig. 70: Remove the front panel

7.5 Cleaning water filter

This section is relevant for the following:

■ For water-cooled devices

Personnel: ■ Operating personnel



1. Switch off the device using the mains power switch.
2. Unscrew the cooling water hose at the inlet of the water cooling unit from the threaded connection neck.
3. Carefully remove the water filter from the inlet connection spigot.

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

4. Clean the water filter and then put it back into the inlet connection spigot.
5. Screw the cooling water hose at the inlet of the water cooling unit back again.

Fig. 71: Removing water filter

7.6 Decalcifying cooling water circuit

This section is relevant for the following:

■ For water-cooled devices

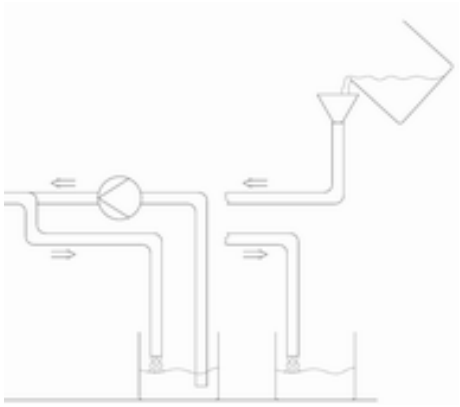


Fig. 72: Decalcification

The decalcifying agent is fed to the device through the water cooling inlet hose using a pump or a funnel. The decalcifying agent flows back through the return flow hose of the water cooling unit and should be directed into a container with sufficient storage capacity (at least 10 litres).

Personnel: ■ Operating personnel

1. Switch off the device using the mains power switch.
2. Dissolve the decalcifying agent in a bucket of water.

   Decalcification requires LAUDA decalcifying agent (catalogue number LZB 126, 5 kg packaging). Read the safety instructions and the instructions for use on the packaging for handling the chemical.

3. Unscrew the cooling water hose at the inlet of the water cooling unit from the threaded connection neck.
4. Remove and clean the water filter of the device. The water filter is located in the inlet spigot of the water cooling unit.

   Further information for cleaning the water filter can be found in ↳ Chapter 7.5 ‘Cleaning water filter’ on page 75.

5. Leave the hose for the cooling water return flow screwed to the device. Insert the other end of the hose into a large container.
6. Switch on the device and adjust the setpoint to 10 °C. After starting the cooling unit, fill the device through the inlet hose of the water cooling unit with LAUDA decalcifying agent. Use a funnel or a pump.
7. Continuously fill in decalcifying agent or pump it around. Continue this process until the foaming reaction goes down. This is usually the case after approx. 20 to 30 minutes.
8. Drain the condenser afterwards.

   Further information about draining the condenser can be found in ↳ Chapter 9.2 ‘Draining condenser ’ on page 84.

9. Thoroughly flush the cooling water circuit with clean water.

   Allow at least 10 litres of water to flow through the device.

10. Reconnect the device to the cooling water supply.

7.7 Checking heat transfer liquid

Contaminated or diluted heat transfer liquid must be replaced. Further use of the heat transfer liquid is only permitted with appropriate test results.

The heat transfer liquid must be checked according to DIN 51529.

8 Faults

8.1 Alarms, errors and warnings

Any alarms, error signals and warnings triggered on the device are shown as plain text on the screen.

Procedure in the event of alarms

Alarms are relevant for safety. The components of the device such as the pump switch off. A two-tone signal is output by the device. Alarms can be cancelled with the ENTER button after rectification of the cause of the fault.

You can find a list of alarms in ↳ Chapter 8.2 ‘Alarm codes’ on page 78.

Procedure in the event of warnings

Warnings are not relevant for safety. The device continues running. A continuous tone is output for a short time by the device. Warnings are output periodically. Warnings can be cancelled with the ENTER button after rectification of the cause of the fault.

A list of warnings can be found in ↳ Chapter 8.5 ‘Warnings - control system’ on page 80 and ↳ Chapter 8.6 ‘Warnings – safety system’ on page 81.

Procedure in the event of errors

A two-tone signal is output if any error occurs.

In the case of an error, switch off the device at the mains power switch. If the error occurs again after restarting the device, note the error code and the associated description and contact LAUDA Constant Temperature Equipment service. Contact details can be found in .

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

8.2 Alarm codes

Code	English output	Description
02	Low level	Low level detected by float switch
03	Overtemperature	Bath / outlet temperature higher than Tmax
09	T ext Pt100	External Pt100 actual value is not present
10	T ext analogue	External analogue actual value is not present
11	T ext serial	External serial actual value is not present
12	Input Analogue 1	Analogue module: Current input 1, interruption.
13	Input Analogue 2	Analogue module: Current input 2, interruption.
14	T ext serial	No signal for actual value via the USB interface

Code	English output	Description
15	Digital Input	Fault at the digital input / switch contact
20	T ext Ethernet	No signal for actual value via the Ethernet module

8.3 Low Level alarm

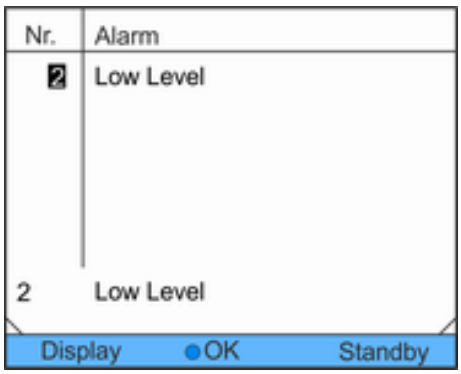


Fig. 73: Alarm Low Level

- If the liquid level falls below the minimum level, an alarm sounds.
- *Low Level* is shown on the screen. The device components such as the pump are switched off by the electronics.

Rectifying fault

Personnel: ■ Operating personnel

1. Refill lacking heat transfer liquid.
2. Unlock the display with the OK button.
   ▶ The device restarts.

8.4 Overtemperature alarm

This alarm can only occur for devices with heater.

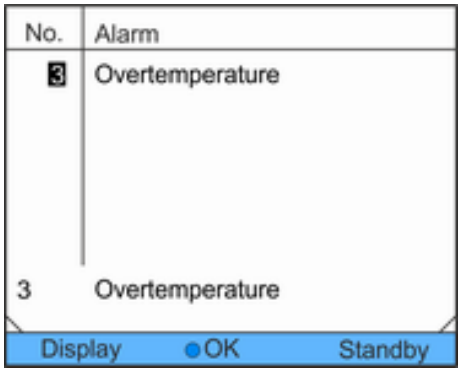


Fig. 74: Overtemperature alarm

- The message *3 Overtemperature* is shown on the screen if the temperature monitor trips.
- The electronics switch off the components of the device.
- The device outputs a two-tone signal.

Restarting device

1. Eliminate the cause of the error.
2. After cooling down, lock the display using the *OK* button.
   ► The device restarts.

8.5 Warnings - control system

All warnings of the control system start with the prefix 0. The prefix is followed by two additional digits. These digits are listed in the following table.

Code	English output	Description
001	CAN receive overflow	Overflow during CAN reception
002	Watchdog reset	Watchdog reset
003	T_il limit active	til-limit active
004	T_ih limit active	tih-limit active
005	Corrupt parameter	Inadmissible internal parameter
006	Corrupt programme	Inadmissible programmer data
007	Invalid parameter	Inadmissible parameter in memory
008	CAN system	Problem during internal data exchange
009	Unknown module	Unknown module connected
010	SW Control too old	Software version of control system too old
011	SW Safety too old	Software version of safety system too old
012	SW Command too old	Software version of remote control unit Command too old
013	SW Cool too old	Software version of cooling module too old
014	SW Analogue too old	Software version of analogue module too old
015	SW Serial too old	Software version of serial interface (RS232) too old
016	SW Contact old	Software version of contact module too old
017	SW Valve 0 old	Software version of solenoid valve 0 too old
018	SW Valve 1 old	Software version of solenoid valve 1 too old
019	SW Valve 2 old	Software version of solenoid valve 2 too old
020	SW Valve 3 old	Software version of solenoid valve 3 too old
021	SW Valve 4 old	Software version of solenoid valve 4 too old
022	SW Pump 0 old	Software version of pump 0 too old
023	SW Pump 1 old	Software version of pump 1 too old

Code	English output	Description
024	SW Pump 2 old	Software version of pump 2 too old
025	SW Pump 3 old	Software version of pump 3 too old
026	SW HTC old	Software version of high temperature cooler too old
027	SW Ext. Pt100 old	Software version of external Pt100 too old
028	SW Ethernet old	Software version of Ethernet too old
029	SW EtherCAT old	Software version of EtherCAT too old
033	Clock wrong time	Internal clock defective; battery power supply was/is interrupted (insert new battery)
034	Tset: Prog. is running	Setpoint was changed while the programmer is running.
041	Wrong mains voltage	Incorrect mains voltage setting
042	No VC type	Device type not configured
043	No VC voltage	Mains voltage not configured
050	Level very low	Level too low, top-up heat transfer liquid
051	Level high	Level too high (fill level of the heat transfer liquid too high, risk of bath overflow)
055	CAN buff. overflow	Buffer overflow for CAN reception

8.6 Warnings – safety system

All warnings of the safety system start with the prefix 1. The prefix is followed by two other digits. These digits are listed in the following table.

Code	English output	Description
101	CAN receive overflow	Overflow during CAN reception
102	Watchdog Reset	Watchdog reset
103	Heating not correct	Heaters have different outputs
104	Heat 1 failed	Heater 1 defective
105	Heat 2 failed	Heater 2 defective
106	Heat 3 failed	Heater 3 defective
107	Invalid Parameter	Inadmissible parameter in memory
108	CAN system	Problem during internal data exchange
109	Unknown Modul	Unknown module connected
110	SW Control too old	Software version of control system too old

Code	English output	Description
111	SW Safety too old	Software version of safety system too old
112	SW Command too old	Software version of command remote control unit too old
113	SW Cool too old	Software version of cooling module too old
114	SW Analog too old	Software version of analogue module too old
115	SW Serial too old	Software version of serial interface (RS232) too old
116	SW Contact too old	Software version of contact module too old
117	SW Valve 0 old	Software version of solenoid valve 0 too old
118	SW Valve 1 old	Software version of solenoid valve 1 too old
119	SW Valve 2 old	Software version of solenoid valve 2 too old
120	SW Valve 3 old	Software version of solenoid valve 3 too old
121	SW Valve 4 old	Software version of solenoid valve 4 too old
122	SW Pump 0 old	Software version of pump 0 too old
123	SW Pump 1 old	Software version of pump 1 too old
124	SW Pump 2 old	Software version of pump 2 too old
125	SW Pump 3 old	Software version of pump 3 too old
126	SW HTC old	Software version of high temperature cooler too old
127	SW Ext. Pt100 old	Software version of external Pt100 too old
128	SW Ethernet old	Software version of Ethernet too old
129	SW EtherCAT old	Software version of EtherCAT too old
155	CAN buff. overflow	Buffer overflow for CAN reception

8.7 Warnings – SmartCool

All warnings of the SmartCool system start with the prefix 3. The prefix is followed by two additional digits. These digits are listed in the following table.

Code	English output	Description
301	CAN receive overflow	Overflow during CAN reception
302	Watchdog reset	Watchdog reset
303	Missing SM adaptation	Adaptation run not performed
304	Pressure switch activated	Pressure switch in schema cooling circuit was triggered
305	Clean condenser	Clean the condenser

Code	English output	Description
306	TO1 out of range (Klixon)	Injection temperature outside value range
307	Invalid parameter	Inadmissible parameter in memory
308	CAN system	Problem during internal data exchange
309	Unknown module	Unknown module connected
310	SW Control too old	Software version of control system too old
311	SW Safety too old	Software version of safety system too old
312	SW Command too old	Software version of command remote control unit too old
313	SW Cool too old	Software version of cooling module too old
314	SW Analogue too old	Software version of analogue module too old
315	SW Serial too old	Software version of serial interface (RS232) too old
316	SW Contact old	Software version of contact module too old
317	SW Valve 0 old	Software version of solenoid valve 0 too old
318	SW Valve 1 old	Software version of solenoid valve 1 too old
319	SW Valve 2 old	Software version of solenoid valve 2 too old
320	SW Valve 3 old	Software version of solenoid valve 3 too old
321	SW Valve 4 old	Software version of solenoid valve 4 too old
322	SW Pump 0 old	Software version of pump 0 too old
323	SW Pump 1 old	Software version of pump 1 too old
324	SW Pump 2 old	Software version of pump 2 too old
325	SW Pump 3 old	Software version of pump 3 too old
326	SW HTC old	Software version of high temperature cooler too old
327	SW Ext. Pt100 old	Software version of external Pt100 too old
328	SW Ethernet old	Software version of Ethernet module too old
329	SW EtherCAT old	Software version of EtherCAT too old
341	sm0 min too small	Starting value of injection valve too low
344	chiller missing	Refrigerant unit does not run
345	Valve not closed	Valve of the cooling circuit does not close
347	Configure EEV0	Contact LAUDA Service
348	Configure EEV1	Contact LAUDA Service
349	Preheat unit	A warning concerning possible damage to the cooling system is sent when the device is operated below 5 °C. The cooling system must be preheated to prevent damage. This is automatically performed when outside installation is activated.
355	CAN buff. overflow	Buffer overflow for CAN reception

9 Decommissioning

9.1 Draining device

Personnel: ■ Operating personnel

WARNING!
Contact with hot or cold heat transfer liquid

Scalding, frostbite

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

Also note the following:

- Observe the regulations for disposal of the 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 condenser

This section is relevant for the following:

- For water-cooled devices

Fig. 75: Cooling water connection

Personnel: ■ Operating personnel

1. Temper the device to approx. 20 °C. Switch off the device.
2. Unscrew the cooling water hose at the inlet of the water cooling unit from the threaded connection neck.
3. A water filter is located in the inlet connecting spigot of the water cooling unit. Carefully remove the water filter from the inlet connection spigot.

   Further information for removing the water filter can be found in ↳ Chapter 7.5 ‘Cleaning water filter’ on page 75.
4. Clean the water filter of the device. Then reinsert it into the inlet connection spigot.
5. Leave the cooling water hose for the return flow screwed to the device. Insert the other end of the hose into a drain or a large container.
6. Switch on the device and set the setpoint on the device to 10 °C.
7. After starting the compressor, immediately blow compressed air into the water inlet. Continue to blow compressed air through the device until all the cooling water has flowed out of the device.
8. Switch off the device.

10 Disposal

10.1 Disposing of refrigerant

The refrigerant must be disposed of in accordance with EC Directive 303/2008/EC in combination with 842/2006/EC.

CAUTION!
Uncontrolled escape of refrigerant

Impact, cutting

- Do not dispose of any pressurised refrigerant circuit.
- Disposal must be performed by specialist personnel.

Refrigerant	$GWP_{(100a)}$
R-404A	3922

Global Warming Potential (GWP) time horizon 100 years - according to IPCC IV (2007). Comparison: CO_2 = 1.0.

Type and fill quantity of the refrigerant can be seen on the rating plate.

10.2 Device disposal

The following applies in member states of the EU: The device must be disposed of according to EU Directive 2012/19/EC.

10.3 Disposing of packaging

The following applies in member states of the EU: The packaging must be disposed of according to EC Directive 94/62/EC.

11 Technical Data

11.1 General data

The device sound pressure level of the devices is below 70 dB. In accordance with EC Directive 2006/42/EC, the sound pressure level of the devices is therefore not specified further.

Common to all devices

Data	Value	Unit
Placement	Indoor areas	--
Height above sea level	maximum 2,000	m
Humidity	maximum relative humidity 80 % at 31 °C to 40 °C, decreasing linearly to 50 %	--
Ambient temperature range	5 ... 40	°C
IP protection class	IP 32	--
Contamination level	2	--
Clearance (on all sides)	500	mm
Overvoltage	Overvoltage category II, transient surge voltages according to category II	--
Protection class for electrical equipment (DIN EN 61140)	1	--
Protection class for laboratory equipment (DIN 12876-1)	I/NFL	--
Display	TFT display, 3.5", 320 x 240 pixels	--
Display resolution	±0.01	°C
Adjustment resolution	±0.01	°C
Storage temperature range	5 ... 40	°C
Transport temperature range	-20 ... 43	°C

Device-specific

	Operating temperature range	Operating temperature range with optional heater	Temperature stability	Dimensions (W x D x H)	Weight
	°C	°C	K	mm	kg
VC 600	-20 ... 40	-20 ... 80	±0.05	350 x 480 x 595	39
VC 1200	-20 ... 40	-20 ... 80	±0.05	450 x 550 x 650	54
VC 1200 W	-20 ... 40	-20 ... 80	±0.05	450 x 550 x 650	51
VC 2000	-20 ... 40	-20 ... 80	±0.05	450 x 550 x 650	57
VC 2000 W	-20 ... 40	-20 ... 80	±0.05	450 x 550 x 650	54
VC 3000	-20 ... 40	-20 ... 80	±0.05	550 x 650 x 970	93
VC 3000 W	-20 ... 40	-20 ... 80	±0.05	550 x 650 x 970	89
VC 5000	-20 ... 40	-20 ... 80	±0.05	550 x 650 x 970	98
VC 5000 W	-20 ... 40	-20 ... 80	±0.05	550 x 650 x 970	94
VC 7000	-20 ... 40	-20 ... 80	±0.1	650 x 670 x 1250	138
VC 7000 W	-20 ... 40	-20 ... 80	±0.1	650 x 670 x 1250	131
VC 10000	-20 ... 40	-20 ... 80	±0.1	650 x 670 x 1250	147
VC 10000 W	-20 ... 40	-20 ... 80	±0.1	650 x 670 x 1250	140

The case height is 140 mm higher for the VC 1200 (W) and VC 2000 (W) devices with the optional pump.

	Clearance around the device	Exhaust air (air-cooled devices)
	(front/back/right/left) in cm	m³/h
VC 600	20/20/20/20	350
VC 1200	20/20/20/20	650
VC 1200 W	20/20/0/0	---
VC 2000	20/20/20/20	650
VC 2000 W	20/20/0/0	---
VC 3000	50/50/20/20	1300
VC 3000 W	20/20/0/0	---
VC 5000	50/50/20/20	2500
VC 5000 W	20/20/0/0	---
VC 7000	50/50/20/20	4500

	Clearance around the device	Exhaust air (air-cooled devices)
VC 7000 W	20/20/0/0	---
VC 10000	50/50/20/20	4500
VC 10000 W	20/20/0/0	---

Power consumption - VC 600

Alternating current	VC 600	Unit
230 V; 50 Hz	0.7	kW
220 V; 60 Hz	0.7	kW
115 V; 60 Hz	0.8	kW
100 V; 50/60 Hz	0.7	kW

Power consumption - VC 1200 (W) to VC 3000 (W)

Alternating current	VC 1200 (W)	VC 2000 (W)	VC 3000 (W)	Unit
230 V; 50 Hz	1.1	1.6	1.8	kW
200 V; 50/60 Hz	1.3	2.0	2.2	kW
208-220 V; 60 Hz	1.4	2.2	2.3	kW

Power consumption - VC 5000 (W) to VC 10000 (W)

Three-phase current	VC 5000 (W)	VC 7000 (W)	VC 10000 (W)	Unit
400 V; 3/N/PE~50 Hz	3.3	4.3	5.4	kW
208-220 V; 3/PE~60 Hz	3.6	4.6	5.9	kW
200 V; 3/PE~50/60 Hz	3.5	4.5	5.7	kW

11.2 Refrigeration unit

Refrigerant

All Variocool circulation chillers are filled with the R404A refrigerant.

Cooling water connection

All water-cooled Variocool circulation chillers have the following cooling water connection:

- Thread G ¾" and olive ½"

Cooling capacity

	Cooling capacity (20 °C)	Cooling capacity (10 °C)	Cooling capacity (0 °C)	Cooling capacity (-10 °C)	Cooling capacity (-20 °C)
	kW	kW	kW	kW	kW
VC 600	0.60	0.50	0.36	0.21	0.08
VC 1200 (W)	1.20	1.00	0.70	0.40	0.18
VC 2000 (W)	2.00	1.50	1.06	0.68	0.38
VC 3000 (W)	3.00	2.40	1.68	1.03	0.60
VC 5000 (W)	5.00	3.90	2.75	1.70	1.00
VC 7000 (W)	7.00	5.30	3.70	2.40	1.30
VC 10000 (W)	10.00	7.60	5.30	3.50	2.00

The cooling capacity is measured for a specified temperature of the heat transfer liquid. These temperature values are shown in brackets. The ambient temperature for the measurement is 20 °C; ethanol was used as heat transfer liquid. The cooling water temperature is 15 °C and the cooling water differential pressure is 3 bar for the measurement of water-cooled devices.

11.3 Standard and optional pumps

The pump characteristics were determined using water as heat transfer liquid.

The hydraulic circuit

	Maximum/minimum filling volume	Maximum flow pressure	Maximum flow rate	Pump connection	Drain tap
	L	bar	L/min		
VC 600	8/4	0.9	28	M 16 x 1 (10), olive 13 mm	G ½"
VC 1200 (W)	15/8	0.9	28	G ¾ (15), olive ¾"	G ½"
VC 2000 (W)	15/8	0.9	28	G ¾ (15), olive ¾"	G ½"
VC 3000 (W)	33/20	3.2	37	G ¾ (15), olive ¾"	G ½"

	Maximum/min-imum filling volume	Maximum flow pressure	Maximum flow rate	Pump connec-tion	Drain tap
VC 5000 (W)	33/20	3.2	37	G ¾ (15), olive ¾"	G ½"
VC 7000 (W)	64/48	3.2	37	G 1¼ (20), olive 1"	G ¾"
VC 10000 (W)	64/48	3.2	37	G 1¼ (20), olive 1"	G ¾"

Characteristic curves of the standard pumps

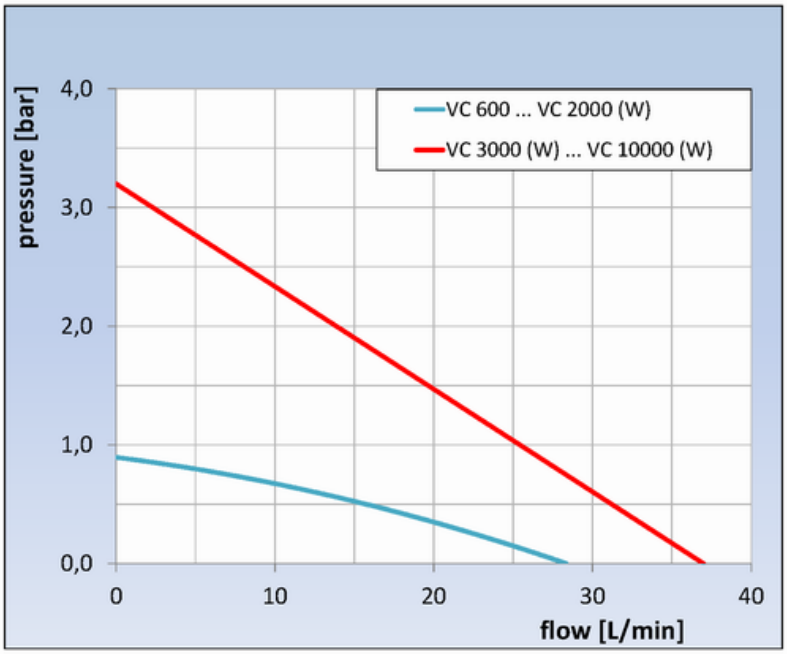


Fig. 76: Characteristic curves of the standard pumps

Pump characteristics for different mains power supply

Pump 0.9 bar; 28 litres per minute

Alternating current	VC 600
230 V; 50 Hz	LWG 175
115 V; 60 Hz	LWG 276
220 V; 60 Hz	LWG 475
100 V; 50/60 Hz*	LWG 675

* Pump characteristics for 100 V; 50 Hz:
0.7 bar; 25 litres per minute

Alternating current	VC 1200 (W) and VC 2000 (W)
230 V; 50 Hz	LWG 176, 177, 182, 183
200 V; 50/60 Hz*	LWG 576, 577, 582, 583
208-220 V; 60 Hz	LWG 876, 877, 882, 883

* Pump characteristics for 200 V; 60 Hz:
1.2 bar; 28 litres per minute

Pump 3.2 bar; 37 litres per minute

Alternating current	VC 3000 (W)
230 V; 50 Hz	LWG 178, 184
200 V; 50/60 Hz	LWG 578, 584
208-220 V; 60 Hz	LWG 878, 884

Three-phase current	VC 5000 (W), VC 7000 (W) and VC 10000 (W)
400 V; 3/N/PE~50 Hz	LWG 279, 285, 280, 286, 281, 287
208-220 V; 3/PE~60 Hz	LWG 379, 385, 380, 386, 381, 387
200 V; 3/PE~50/60 Hz	LWG 479, 485, 480, 486, 481, 487

Characteristic curves of the optional pumps

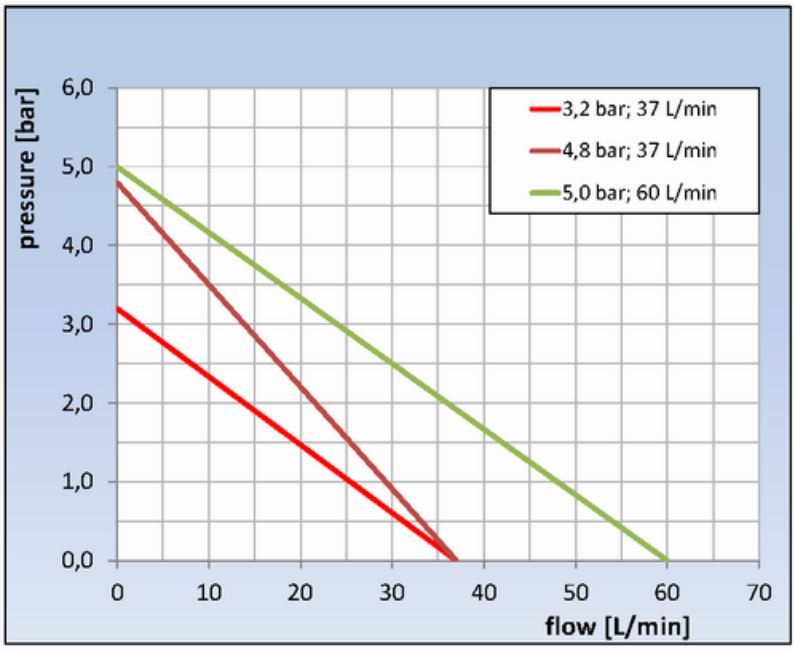


Fig. 77: Characteristic curves of the optional pumps

Option: Pump 3.2 bar; 37 litres per minute

Alternating current	VC 1200 (W)	VC 2000 (W)
230 V; 50 Hz	LWZ 1100	LWZ 1101
200 V; 50/60 Hz	LWZ 5100	LWZ 5101
208-220 V; 60 Hz	LWZ 8100	LWZ 8101

Option: Pump 4.8 bar; 37 litres per minute

Alternating current	VC 1200 (W)	VC 2000 (W)	VC 3000 (W)
230 V; 50 Hz	LWZ 1103	LWZ 1104	LWZ 1102
208-220 V; 60 Hz	LWZ 2103	LWZ 2104	LWZ 2102
200 V; 50/60 Hz	LWZ 5103	LWZ 5104	LWZ 5102

Three-phase current	VC 5000 (W)	VC 7000 (W)	VC 10000 (W)
400 V; 3/N/PE~50 Hz	LWZ 2105	LWZ 2105	LWZ 2105
208-220 V; 3/PE~60 Hz	LWZ 3105	LWZ 3105	LWZ 3105
200 V; 3/PE~50/60 Hz	LWZ 4105	LWZ 4105	LWZ 4105

Option: Pump 5 bar; 60 litres per minute

Three-phase current	VC 5000 (W)	VC 7000 (W)	VC 10000 (W)
400 V; 3/N/PE~50 Hz	LWZ 2106	LWZ 2106	LWZ 2106
208-220 V; 3/PE~60 Hz	LWZ 3106	LWZ 3106	LWZ 3106
200 V; 3/PE~50/60 Hz*	LWZ 4106	LWZ 4106	LWZ 4106

* Pump characteristics for 200 V; 3/PE~50 Hz:
4.3 bar; 60 litres per minute

11.4 Optional heater

Heat output and power consumption

Alternating current	VC 600	Unit
230 V; 50 Hz		
Heat output	1.5	kW
Power consumption with heater	2.2	kW
Catalogue number	LWZ 1095	
220 V; 60 Hz		
Heat output	1.35	kW
Power consumption with heater	2.0	kW
Catalogue number	LWZ 2095	
115 V; 60 Hz		
Heat output	1.15	kW
Power consumption with heater	1.3	kW
Catalogue number	LWZ 4095	
100 V; 50/60 Hz		
Heat output	1.0	kW
Power consumption with heater	1.1	kW
Catalogue number	LWZ 6095	

Heat output and power consumption

Alternating current	VC 1200 (W)	VC 2000 (W)	VC 3000 (W)	Unit
230 V; 50 Hz				
Heat output	1.5	1.5	1.5	kW
Power consumption with heater	2.6	2.6	2.6	kW
Catalogue number	LWZ 1095	LWZ 1095	LWZ 1095	
200 V; 50/60 Hz				
Heat output	1.1	1.1	1.1	kW
Power consumption with heater	2.3	2.3	2.6	kW
Catalogue number	LWZ 5095	LWZ 5095	LWZ 5095	
208-220 V; 60 Hz				
Heat output	1.2 — 1.35	1.2 — 1.35	1.2 — 1.35	kW
Power consumption with heater	2.4	2.5	2.8	kW
Catalogue number	LWZ 8095	LWZ 8095	LWZ 8095	

Heat output and power consumption

Three-phase current	VC 5000 (W)	VC 7000 (W)	VC 10000 (W)	Unit
400 V; 3/N/PE~50 Hz				
Heat output	4.5	4.5	7.5	kW
Power consumption with heater	7.8	8.8	11.1	kW
Catalogue number	LWZ 2096	LWZ 2096	LWZ 2097	
208-220 V; 3/PE~60 Hz				
Heat output	3.65 — 4.1	3.65 — 4.1	6.1 — 6.9	kW
Power consumption with heater	4.5	5.7	7.7	kW
Catalogue number	LWZ 3096	LWZ 3096	LWZ 3097	
200 V; 3/PE~50/60 Hz				
Heat output	3.4	3.4	5.7	kW
Power consumption with heater	4.3	5.4	7.6	kW
Catalogue number	LWZ 4096	LWZ 4096	LWZ 4097	

Stronger heating

Alternating current	VC 1200 (W)	VC 2000 (W)	Unit
230 V; 50 Hz			
Heat output	2.25	2.25	kW
Catalogue number	LWZ 1107	LWZ 1107	
200 V; 50/60 Hz			
Heat output	1.7	1.7	kW
Catalogue number	LWZ 5107	LWZ 5107	
208-220 V; 60 Hz			
Heat output	1.8 — 2.1	1.8 — 2.1	kW
Catalogue number	LWZ 8107	LWZ 8107	

11.5 Options, voltage-independent

Option	VC 5000	VC 5000 W	VC 7000 VC 10000	VC 7000 W VC 10000 W
Sound insulation	LWZ 126	LWZ 127	LWZ 128	LWZ 135
Outdoor installation	LWZ 922	---	LWZ 923	---

Option	VC 1200 W VC 2000 W	VC 3000 W VC 5000 W VC 7000 W VC 10000 W
Insulation of the cooling water hydraulic system	LWZ 070-2	LWZ 070-3

11.6 Line fuse

Alternating current	VC 600
230 V; 50 Hz	T6 A
with optional heater	T10 A
220 V; 60 Hz	T6 A
with optional heater	T10 A
115 V; 60 Hz	T10 A
with optional heater	T16 A
100 V; 50/60 Hz	T10 A
with optional heater	T16 A

Alternating current	VC 1200 (W)	VC 2000 (W)	VC 3000 (W)
230 V; 50 Hz	T10 A	T16 A	T16 A
with optional heater	T16 A	T16 A	T16 A
200 V; 50/60 Hz	T16 A	T16 A	T16 A
with optional heater	T16 A	T16 A	T16 A
208-220 V; 60 Hz	T16 A	T16 A	T16 A
with optional heater	T16 A	T16 A	T16 A

Three-phase current	VC 5000 (W)	VC 7000 (W)	VC 10000 (W)
400 V; 3/N/PE~50 Hz	T16 A	T16 A	T16 A
with optional heater	T16 A	T16 A	T16 A
208-220 V; 3/PE~60 Hz	T16 A	T20 A	T25 A
with optional heater	T16 A	T20 A	T25 A
200 V; 3/PE~50/60 Hz	T16 A	T20 A	T25 A
with optional heater	T16 A	T20 A	T25 A

11.7 Catalogue numbers

Alternating current	VC 600
230 V; 50 Hz	LWG 175
220 V; 60 Hz	LWG 275
115 V; 60 Hz	LWG 475
100 V; 50/60 Hz	LWG 675

Alternating current	VC 1200	VC 1200 W	VC 2000	VC 2000 W	VC 3000	VC 3000 W
230 V; 50 Hz	LWG 176	LWG 182	LWG 177	LWG 183	LWG 178	LWG 184
200 V; 50/60 Hz	LWG 576	LWG 582	LWG 577	LWG 583	LWG 578	LWG 584
208-220 V; 60 Hz	LWG 876	LWG 882	LWG 877	LWG 883	LWG 878	LWG 884

Three-phase current	VC 5000	VC 5000 W	VC 7000	VC 7000 W	VC 10000	VC 10000 W
400 V; 3/N/PE~50 Hz	LWG 279	LWG 285	LWG 280	LWG 286	LWG 281	LWG 287
208-220 V; 3/PE~60 Hz	LWG 379	LWG 385	LWG 380	LWG 386	LWG 381	LWG 387
200 V; 3/PE~50/60 Hz	LWG 479	LWG 485	LWG 480	LWG 486	LWG 481	LWG 487

12 Accessories

The following accessories are available for all devices.

Top module slot (57 mm x 27 mm)

Accessories	Catalogue number
Analogue module	LRZ 912
RS232/485 interface module	LRZ 913
Contact module with 1 input and 1 output	LRZ 914
Contact module with 3 inputs and 3 outputs	LRZ 915
Profibus module	LRZ 917

Bottom module slot (51 mm x 17 mm)

Accessories	Catalogue number
External Pt100/LiBus module	LRZ 918
Command remote control unit (only functional in combination with LRZ 918)	LRT 914

Connector

Accessories	Catalogue number
External temperature sensor with connector and shielded connection cable	ETP 059
Coupling connector, 6-pin for analogue inputs / outputs	EQS 057
Connector SUB-D 9-pin	EQM 042
RS232 cable (2 m) for PC	EKS 037
RS232 cable (5 m) for PC	EKS 057
Coupling connector, 3-pin for contact input	EQS 048
Coupling socket, 3-pin for contact output	EQD 047

Flow rate monitor

Accessories	for device	Catalogue number
Flow rate monitor G 3/4"	VC 600	LWZ 129
Flow rate monitor G 3/4"	VC 1200 (W) ... 5000 (W)	LWZ 118
Flow rate monitor G 1 1/4"	VC 7000 (W) ... 10000 (W)	LWZ 119

13 General

13.1 Copyright

This manual is protected by copyright and is exclusively intended for the purchaser for internal use.

The transfer of this manual to third parties, reproductions of any type and form, whether in whole or in part, and the dissemination and/or communication of the contents are not authorised without the written permission of the manufacturer.

Infringements will result in legal action for damages. We reserve the right to assert further claims.

13.2 Technical changes

Technical details of the device subject to change.

13.3 Warranty conditions

LAUDA provides a warranty of one year on equipment as standard.

13.4 Contact LAUDA

Contact LAUDA Service Constant temperature equipment in the following cases:

- For device errors
- For technical questions concerning the device
- To order replacement parts

Contact our Sales Department for application-specific questions.

Contact information

LAUDA Service Constant temperature equipment

Phone: +49 (0)9343 503 350

Fax: +49 (0)9343 503 283

Email: service@lauda.de

13.5 EU conformity

The device complies with the basic occupational health and safety requirements of the Directives listed below.

- Machinery Directive 2006/42/EC
- EMC Directive 2014/30/EU

LAUDA DR. R. WOBSER GMBH & CO. KG - Pfarrstrasse 41/43 - 97922 Lauda-Königshofen - Germany

VC 600, VC 1200 and VC 1200 W:

The device does not fall under the Pressure Equipment Directive 2014/68/EU, as the device is classified in accordance with Article 3.3. The requirements from the above-mentioned directives are thus sufficiently met for the pressure-related hazards of the device.

VC 2000 to VC 10000 W:

The device falls into Category 1 of the Pressure Equipment Directive 2014/68/EU. The requirements from the above-mentioned directives are thus sufficiently met for the pressure-related hazards of the device.

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BESTÄTIGUNG / CONFIRMATION / CONFIRMATION

An / To / A:
LAUDA Dr. R. Wobser • LAUDA Service Center • Fax: +49 (0) 9343 - 503-222

Von / From / De :

Firma / Company / Entreprise: _____

Straße / Street / Rue: _____

Ort / City / Ville: _____

Tel.: _____

Fax: _____

Betreiber / Responsible person / Personne responsable: _____

Hiermit bestätigen wir, daß nachfolgend aufgeführtes LAUDA-Gerät (Daten vom Typenschild):
We herewith confirm that the following LAUDA-equipment (see label):
Par la présente nous confirmons que l'appareil LAUDA (voir plaque signalétique):

Typ / Type / Type :	**Serien-Nr. / Serial no. / No. de série:**

mit folgendem Medium betrieben wurde
was used with the below mentioned media
a été utilisé avec le liquide suivant

_____

_____

_____

_____

Darüber hinaus bestätigen wir, daß das oben aufgeführte Gerät sorgfältig gereinigt wurde, die Anschlüsse verschlossen sind, und sich weder giftige, aggressive, radioaktive noch andere gefährliche Medien in dem Gerät befinden.

Additionally we confirm that the above mentioned equipment has been cleaned, that all connectors are closed and that there are no poisonous, aggressive, radioactive or other dangerous media inside the equipment.

D'autre part, nous confirmons que l'appareil mentionné ci-dessus a été nettoyé correctement, que les tubulures sont fermées et qu'il n'y a aucun produit toxique, agressif, radioactif ou autre produit nocif ou dangeureux dans la cuve.

Stempel **Seal / Cachet.**	**Datum** **Date / Date**	**Betreiber** **Responsible person / Personne responsable**

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