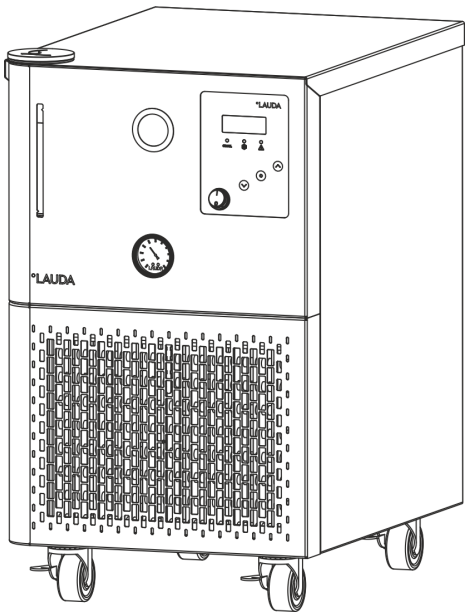
Operation manual

Microcool

MC 350, MC 600, MC 1200, MC 2000

Circulation chiller containing natural refrigerant



V1R25

Read this manual prior to performing any task!

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Translation of the original operation manual
Q4DA-E_13-039, 1, en_US

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1 Safety

1.1 General safety instructions

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

If this operating manual is lost, contact LAUDA Service Constant Temperature Equipment. You can find the contact information here Chapter 12.3 “Contact LAUDA” on page 60.

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

- If relevant, safety fittings are available for the device. This equipment is critical to the safety of the device. Appropriate maintenance activities must be implemented to ensure the device remains in good working order.
  The safety equipment for the device is described in this "Safety" chapter.
- If relevant, various warning symbols are located on the device. These symbols must be observed without fail.
  The warning symbols on the device are described in this "Safety" chapter.
- This operating manual contains safety information. This information must be followed at all times.
- Personnel and the protective equipment worn by personnel are also subject to specific requirements.
  These requirements are described in this "Safety" chapter.

An overview of authorized personnel and protective equipment can be found in Chapter 1.10 “Personnel qualification” on page 9 *and* Chapter 1.11 “Personal protective equipment” on page 9.

Refer to the "Structure of warnings" chapter for more information about the general structure of warnings.

1.2 Obligations of the operator

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

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

1.3 Limits of the device

1.3.1 Use

Intended use

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

Reasonably foreseeable improper use

The following are considered cases of reasonably foreseeable misuse:

- Operating the device without heat transfer liquid
- Operating the device with a flammable heat transfer liquid
- Operating the device with an unsuitable heat transfer liquid
- for medical applications
- Use in hazardous areas
- Use for controlling the temperature of foodstuffs
- Outdoor installation
- Connecting a non-closed hydraulic circuit
- Operating the device with power cables that are faulty, unsuitable or do not conform to standards
- Installing the device on a table-like surface (only permitted for MC 350)
- Operating under medical conditions in accordance with DIN EN 60601-1 or IEC 601-2

Type of power supply

The device is supplied with...

- Electrical energy (each device)

Performance limits, operating values

- See the Technical Data chapter

1.3.2 Environmental specifications

The device may only be used in the following areas:

- Production, quality assurance, research and development in an industrial environment
- Internal areas, not suitable for outdoor installation
- Height up to 2,000 m
- Ambient temperature of 5 to 40°C
- Maximum relative humidity 80% at temperatures up to 31°C, linearly decreasing to 50% relative humidity at 40°C
- Surge category II
- Sporadic electric surges that occur in the mains power supply
- Pollution degree 2
- Maximum storage and transport temperature of 43°C
- IP protection level IP 32

1.3.3 Time limits

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

1.4 EMC requirements

Table 1: Classification in accordance with EMC requirements

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

Instructions for Class A digital device, USA

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

Instructions for Class A digital device, Canada

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

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

1.5 Prohibition of modifications to the device

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

1.6 Natural refrigerant

The devices are filled with natural refrigerant.

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

The refrigerant designation and charge are specified on the type plate and in the ↳ Chapter 11.3 “Refrigerant and filling charge” on page 58.

1.7 Heat transfer liquid requirements

- Heat transfer liquids are used to control the temperature. LAUDA heat transfer liquids are recommended for the constant temperature equipment. LAUDA heat transfer liquids have been tested by the company LAUDA DR. R. WOBSER GMBH & CO. KG and approved for this device.
- The heat transfer liquids are suitable for a specific temperature range. This temperature range must correspond to the temperature range of your application.
- The safety data sheet of the heat transfer liquid specifies potential hazards and the corresponding safety measures required for handling the liquid. The safety data sheet of the heat transfer liquid must therefore be observed to ensure proper use of the device.
- If you wish to use your own heat transfer liquids, check that the fluids are suitable for the materials used.
- The heat transfer liquid must be provided with corrosion protection.
- You must also check the suitability of the heat transfer liquid by performing a test run within the desired temperature range.
- During the test run, you must also check that the low-level protection is functioning correctly.

1.8 Materials

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

1.9 Hose requirements

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

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

1.10 Personnel qualification

Operating personnel

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

1.11 Personal protective equipment

Protective gloves

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

Protective work clothing
Protective clothing must be worn for certain tasks. This protective clothing must meet the legal requirements for personal protective equipment. Protective clothing with long sleeves must be worn. Additionally safety shoes are required.

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

1.12 Structure of the warnings

Warning signs	Type of danger
	Warning – dangerous electrical voltage.
	Warning – flammable substances.
	Warning – hot surface.
	Warning – extreme cold.
	Warning – slip hazard.
	Warning – danger zone.

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

!	NOTICE! Origin of the hazard
	Possible consequences of the hazard
	• Measure 1 • Measure...

2 Unpacking

WARNING!
Leaks in the cooling circuit due to transport damage

Fire

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

Personnel: ■ Operating personnel

1. Unpack the device.

   Keep the original packaging of the device for subsequent transportation.

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

   If the device or accessories are damaged contrary to expectations, immediately inform the shipping company so that a damage report can be compiled and the transport damage inspected. Also notify LAUDA Constant Temperature Equipment Service department immediately. You will find the contact information here ↳ Chapter 12.3 “Contact LAUDA” on page 60.

Table 2: Accessories included as standard

Device type	Designation	Quantity	Catalog number
MC 600, MC 1200, MC 2000	Hose nozzle ¾" with union nut ¾"	2	EOA 004
All devices	Operating manual	1	Q4DA-E_13-039

3 Device description

3.1 Device types

The names of the devices consist of the following components.

Component	Description
MC	Microcool
<Number>, e.g. 600	Indication of the cooling capacity in watts

Available device types

Device type	Description
MC 350	Air-cooled table-top device with a cooling capacity of 350 watts
MC 600	Air-cooled floor-standing device with a cooling capacity of 600 watts The pump pressure can be set via a bypass adjusting wheel.
MC 1200	Air-cooled floor-standing device with a cooling capacity of 1200 watts The pump pressure can be set via a bypass adjusting wheel.
MC 2000	Air-cooled floor-standing device with a cooling capacity of 2000 watts The pump pressure can be set via a bypass adjusting wheel.

3.2 Structure of the circulation chiller

Note: The illustrations partly show devices in different casing versions. This does not affect the operation.

Front of the MC 350

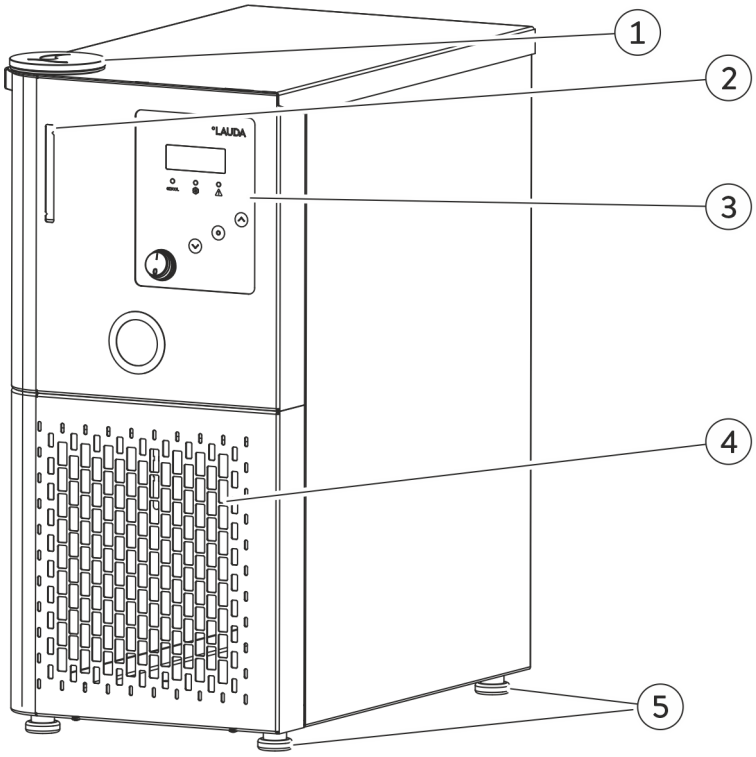


Fig. 1: Overview of the front

1 Filler nozzle with cover
2 Level indication
3 Operating unit
4 Front panel with ventilation openings
5 Four feet

Rear of the MC 350

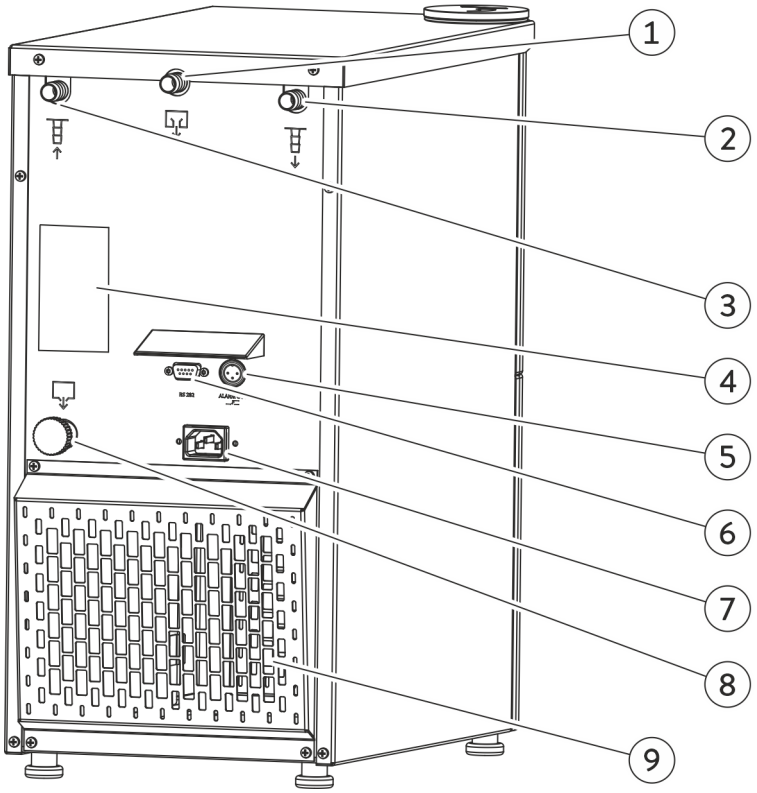


Fig. 2: Overview of the back

1 Overflow connection
2 Pump connection, flow
3 Pump connection, outlet
4 Type plate
5 Alarm output
6 RS 232 interface
7 Power supply
8 Drain screw
9 Ventilation openings

Front of the MC 600, MC 1200, MC 2000

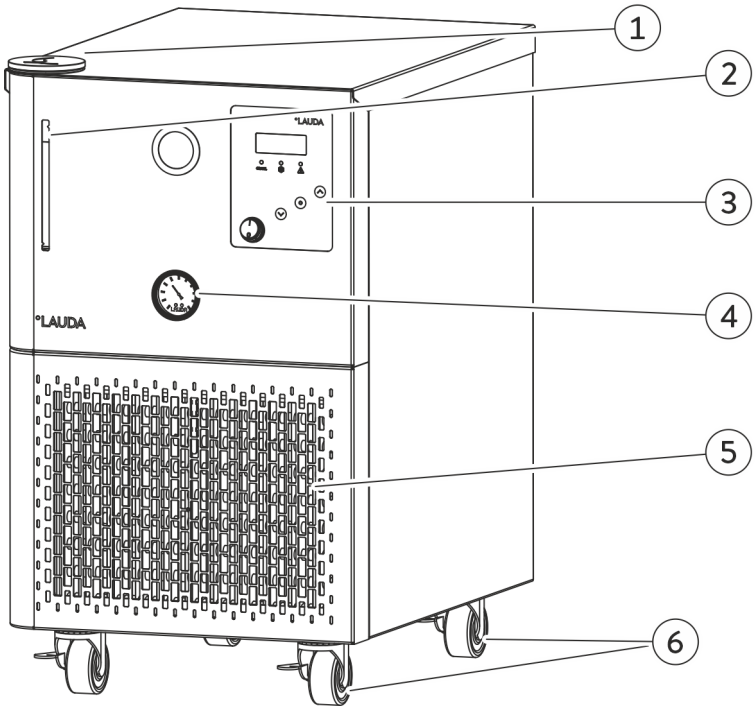


Fig. 3: Overview of the front

1 Filler nozzle with cover
2 Level indication
3 Operating unit
4 Pressure gauge
5 Front panel with ventilation openings
6 Four casters with locking brake

Back of the MC 600, MC 1200, MC 2000

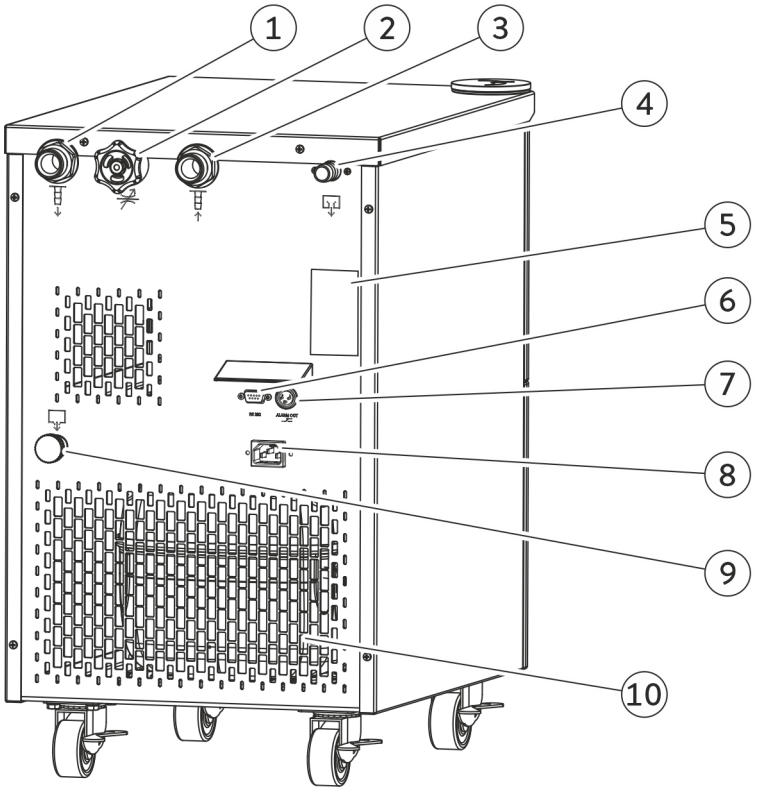
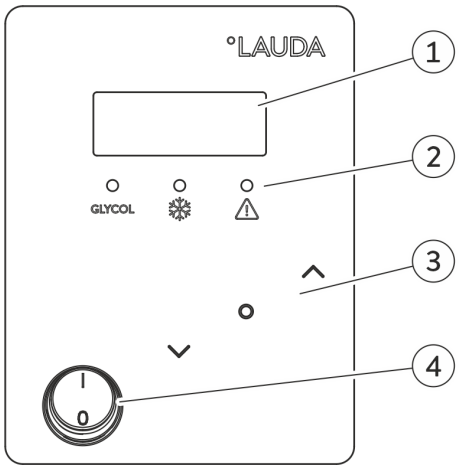


Fig. 4: Overview of the back

1 Pump connection, flow
2 Bypass control knob (from MC 600 onwards)
3 Pump connection, outlet
4 Overflow connection
5 Type plate
6 RS 232 interface
7 Alarm output
8 Power supply
9 Drain screw
10 Ventilation openings

Operating unit



1 Display
2 LEDs
3 Display buttons
4 Mains switch

Fig. 5: Operating unit

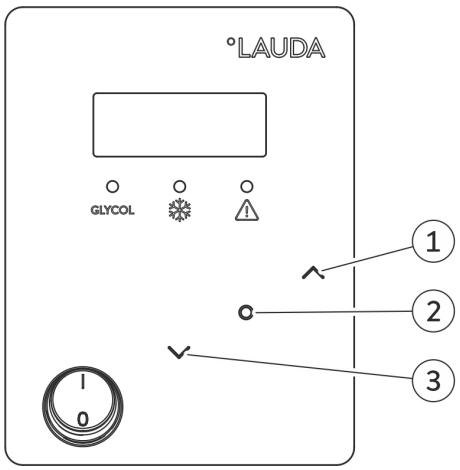
3.3 Operating elements

3.3.1 Mains switch

The mains switch can be set to the following positions:

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

3.3.2 Display buttons



1 Up arrow button
2 Enter key
3 Down arrow button

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

- The Enter button can be used to confirm a selection in the display.
- The up and down arrow buttons can be used to navigate in the display.

Fig. 6: Display buttons

3.4 Functional elements

3.4.1 LEDs for function display

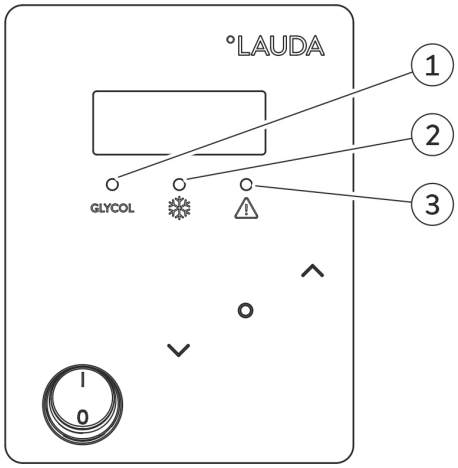


Fig. 7: LEDs

1 yellow LED
2 Blue cooling LED
3 Red error LED

Each device has three LEDs with the following functions:

- The yellow LED is lit if Kryo 30 is required as a heat transfer liquid.
- The blue cooling LED indicates whether the cooling unit is active.
- The red error LED is lit if the device has an error.

3.4.2 Hydraulic circuit

Hydraulic circuit

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

The circuit essentially consists of the following components:

- Internal storage tank with heat transfer liquid
- Pump for conveying the heat transfer liquid to the external consuming unit via the pump connections
- From MC 600 on, the devices are equipped with an adjustable bypass to adjust the pump pressure to the requirements of the external consuming unit.

Pump

The devices are equipped with a magnetically coupled pressure pump.

You will find further information on the technical data of the pump and the pump characteristics in ↳ Chapter 11.4 “Hydraulic circuit” on page 59.

3.4.3 Pressure gage

Fig. 8: Pressure gage

The device types with a bypass are equipped with a pressure gage for reading the set pump pressure. The pump pressure is regulated via the bypass adjusting wheel. The bypass adjusting wheel is located on the back of the device.

3.4.4 Level indication

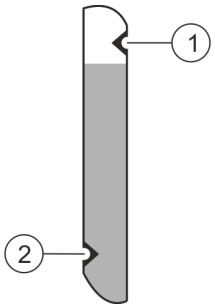


Fig. 9: Level indication

The fill level of the heat transfer liquid in the circuit can be read via the level indication.

- The maximum liquid level of the device is indicated via the top arrow.
- The minimum liquid level of the device is indicated via the bottom arrow.

1 Maximum level
2 Minimum level

3.4.5 Cooling unit

The cooling unit consists of the following main components:

- Compressor
  A fully hermetically encapsulated compressor is used in the cooling unit. The compressor is equipped with a thermal cutout which reacts to the temperature and current consumption of the compressor.
- Condenser
  The condensation heat is discharged to the environment in the case of air-cooled condensers. Fresh air is drawn in through the front of the device by means of a fan, heated and then discharged at the back of the device for this purpose.
- Evaporator
  Heat is dissipated from the bath by means of a tube coil evaporator in the case of an internal bath.

You will find technical data on the cooling unit in Chapter 11.2 “Cooling unit” on page 58.

3.4.6 Interfaces

Please note the following:

- The equipment connected to the extra-low voltage inputs and outputs must be reliably isolated from voltages dangerous to the touch in accordance with DIN EN 61140. For example, by double or reinforced insulation according to DIN EN 60730-1 or DIN 60950-1.

RS 232 interface

You can use the RS 232 interface to control certain device functions, such as set temperature, on a PC. This allows individual programs to be developed to control the device.

You will find further information on the connection and configuration in Chapter 6.8.3 “Cable test and interface test of RS 232” on page 43 *and* Chapter 6.8.1 “Configuring the RS 232 interface” on page 42.

Alarm output

Change-over contact which is switched in the event of a fault in the device. Faults can therefore be reported e.g. to a system.

The fault situations in which a signal is output via the interface can be set via the display.

3.5 Type plate

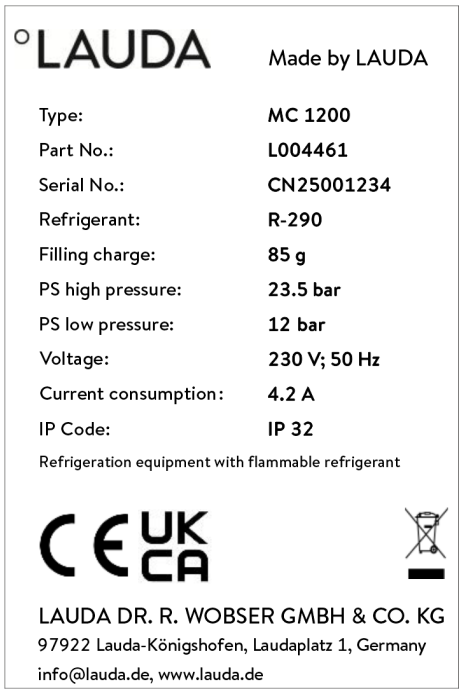


Fig. 10: Type plate, example

The specifications on the type plate are described in more detail in the following table. Certain specifications depend on the installed device options. These specifications are marked with a corresponding addendum.

Specification	Description
Type:	Device type
Part No.:	Catalog number of the device
Serial No.:	Serial number of the device
Refrigerant:	Designation of the refrigerant used in the refrigerating machine
Filling charge:	Refrigerant filling charge
PS high pressure:	Maximum permitted working pressure on the refrigerant high-pressure side
PS low pressure:	Maximum permitted working pressure on the refrigerant low-pressure side
Voltage:	Device may only be operated with this distribution voltage and frequency
Current consumption:	Maximum current consumption of the device during operation
IP Code:	IP protection level of the device

4 Before starting up

4.1 Install device

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

You will find further information on the technical data in
↳ Chapter 11.1 “General data” on page 57.

Additional installation conditions are described in the following.

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

You will find further information on the EMC requirements in
↳ Chapter 1.4 “EMC requirements” on page 8.

WARNING!
Danger of the device rolling away or overturning

Impact, crushing

- Do not tilt the device!
- Position the device on an even, non-slip surface with a sufficient load carrying capacity!
- Do not position the device close to table edges.
- Actuate the caster brake when setting up the device!
- Do not place heavy parts on the device!

WARNING!
Danger of overpressure from high ambient temperature

Injury, escape of refrigerant, fire

- Observe the permitted ambient and storage temperatures.

1. Place the device in a suitable location in the room.
   - Place table-top devices on a suitable table. To do so, carry the device with your hands holding the bottom of the device.
   - Place floor-standing devices on a suitable level surface.

   Floor-standing devices can be moved. To do so, release the parking brakes on the casters by pushing the [Off] *lever downwards.*

   You can position several devices next to each other.
2. Lock the casters in the case of floor-standing devices. To lock, press the [On] lever downwards.

4.2 External application

4.2.1 Hoses

WARNING!
Contact with cold hoses

Cold burns

- Use insulated hoses for temperatures below 0 °C.

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

You will find further information on the pump connections of the individual devices in Chapter 11.4 “Hydraulic circuit” on page 59.

Approved hoses, adapters and hose clips

Table 3: Hoses, non-insulated

Type	Hose nozzle	Maximum permissible pressure	Clear Ø in mm	Outer diameter in mm	Temperature range in °C	Catalog number
EPDM hose	10 mm	Devices with a maximum pump pressure of < 1 bar	9	11	10 – 90	RKJ 111
EPDM hose	½" (13 mm)	Devices with a maximum pump pressure of < 1 bar	12	14	10 – 90	RKJ 112
Rubber hose with fabric reinforcement	½" (13 mm)	up to 10 bar	13 (½")	19	-40 – 100	RKJ 031
Rubber hose with fabric reinforcement	¾" (19 mm)	up to 10 bar	19 (¾")	27	-40 – 100	RKJ 032

Table 4: Hoses, insulated at the factory

Type	Pump connections	Application area	Clear Ø in mm	Insulation thickness in mm	Temperature range in °C	Catalog number
EPDM hose, insulated	Hose nozzle 13 mm, M16 x 1	Devices with a maximum pump pressure of < 1 bar	12	9	-35 – 90	LZS 021

Table 5: Insulating hoses for subsequent insulation, length 1 m

Insulation catalog number	Temperature range in °C	Clear Ø in mm	Wall thickness in mm	Suitable for hose
RKJ 058	-50 – 105	19	17.5	RKJ 112
RKJ 024	-50 – 110	16	8	RKJ 112

Insulation catalog number	Temperature range in °C	Clear Ø in mm	Wall thickness in mm	Suitable for hose
RKJ 009	-50 – 110	23	8.5	RKJ 031
RKJ 013	-50 – 110	29	8.5	RKJ 032

Table 6: Adapter, suitable for MC 600, MC 1200 and MC 2000

Designation	Description	Catalog number
Hose fitting	¾" Union nut, ½" hose nozzle	LWZ 016
Hose fitting	¾" union nut, 10 mm hose nozzle	LWZ 040

Table 7: Hose clips

Material	Ø from to in mm	Catalog number
Stainless steel	10 – 16	EZS 012
Stainless steel	12 – 22	EZS 013
Stainless steel	20 – 32	EZS 015

4.2.2 Connecting an application

WARNING!
Risk of heat transfer liquid leaking

Scalding, cold burns

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

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

Scalding, cold burns

- Always use hydraulically sealed applications.

WARNING!
Bursting of the external application due to excessive pressure

Scalding, cold burns

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

WARNING!
Use of unsuitable heat transfer liquid

Fire, mutation, poisoning, environmental hazard, equipment damage

- Heat transfer liquids from LAUDA are recommended.
- If you wish to use your own heat transfer liquids, you must check that the liquids are suitable for the materials used. The heat transfer liquid must be provided with corrosion protection. You must also test the suitability of the liquid by performing a test run within the desired temperature range. During the test run, you must also check the low-level protection.
- Select a heat transfer liquid with a temperature range suitable for the application.
- Use non-flammable heat transfer liquids.
- Do not use any heat transfer liquids that are radioactive, toxic or environmentally hazardous.
- Do not use deionized water as a heat transfer liquid.
- Only use heat transfer liquids that are approved for heat transfer systems.
- Use heat transfer liquids with a kinematic viscosity of less than 75 mm^2/s during operation.
- Use heat transfer fluids with a density in the range of 0.95 to 1.2 g/cm^3.

Please note the following:

- Temperature control hoses: Always use the largest possible diameters and shortest possible hoses in the external circuit.
  If the diameter of the temperature control hose is too small, the temperature will drop between the device and the external application due to the low flow rate. In this case, increase or decrease the temperature accordingly.
- Secure the temperature control hoses using hose clips.
- If the external application is positioned higher than the device, the external volume may run idle when the pump is switched off and air enters the external fluid circuit, even when the circuits are closed. There is then a danger that the constant temperature equipment will overflow.
- If a hose breaks, cold liquid may leak out, thereby endangering people and materials.

5 Commissioning

5.1 LAUDA heat transfer liquids

Please note the following:

- The heat transfer liquids each cover a recommended temperature range and must be suitable for the temperature range associated with their application.
- The heat transfer liquid becomes more viscous in the lower limit of the temperature range and affects temperature stability as well as the pump power and cooling capacity. The formation of vapors and odors increases in the upper range. Therefore, only fully utilize the temperature range when absolutely necessary. In particular, ice forms with Aqua 90 (water), which can lead to the destruction of the device.
- Never use contaminated or degenerated heat transfer liquids.
- You can request a copy of the safety data sheets for the heat transfer liquid at any time, if necessary.

Table 8: Approved heat transfer liquids

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

Please note the following with regard to Kryo 30:

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

Heat transfer liquid, water

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

5.2 Establishing a mains connection

DANGER!
Transport damage

Electric shock

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

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

Electric shock

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

WARNING!
Distribution box / multiple socket is unsuitable

Fire

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

NOTICE!
Use of impermissible mains voltage or mains frequency

Device damage

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

Personnel: ■ Operating personnel

Please note:

1. The mains plug disconnects the device from the power supply. The mains plug must be easy to identify and access.
2. Only connect the device to a socket with a protective earth conductor (PE).

Note for electric installation on site:

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

   Exception: Devices with 13 ampere UK plugs.

5.3 Switching on the device and filling with heat transfer liquid

Fill mode

The device is provided with a software program (from and including software version 1.46) that supports the operator when filling the constant temperature equipment. If the fill level is too low, Fill mode is activated immediately after the device is switched on. *FILL* is shown in the display and the level indication is illuminated. The pump and the cooling unit are not started.

DANGER!
Formation of condensation (after transport)

Electric shock

- After transporting the device, wait for at least 24 hours, before putting it into operation to allow the device to adapt to the temperature at the installation location.

WARNING!
Splashing heat transfer liquid

Eye damage

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

CAUTION!
Overflow of heat transfer liquid

Slipping or falling over

- Do not overfill the device.

CAUTION!
Risk of heat transfer liquid escaping

Slipping or falling over

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

Personnel:
- Operating personnel

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

You have already connected the external application as described in chapters ↳ Chapter 4.2.1 “Hoses” on page 24 and ↳ Chapter 4.2.2 “Connecting an application” on page 26.

Please refer to Chapter ↳ Chapter 5.4 “Setting the pump pressure” on page 33 *when using pressure-sensitive consuming units.*

1. Close the drain screw. Turn the screw clockwise as far as it will go.
2. Turn the bypass control knob counterclockwise to the fully open position.
3. Attach a suitable hose to the overflow connection on the device.

The permissible hose diameter for the overflow must be complied with. More detailed information on the suitable hose diameter can be found in the technical data ↳ Chapter 11.4 “Hydraulic circuit” on page 59.

4. Place the end of this hose into a suitable canister to collect the overflowing heat transfer liquid.

In a closed thermostatic circuit with an application in a higher position, if the pump is at a standstill and air enters the thermostatic circuit (e.g. due to an incompletely closed or defective vent valve), the application can run idle. Adjust the size of the overflow container to this, if possible.

Fill level sufficient

5. Switch on the device at the mains switch.
   - ▶ A signal tone is emitted. The software version is shown in the display. The actual temperature is then shown in the display.

     The constant temperature equipment starts operation, the pump is started.

     Depending on the set temperature, the cooling unit is started after 2 minutes at the earliest. The blue LED is lit if the cooling unit is active.

Fill level too low (low level)

6. Switch on the device at the mains switch.
   - ▶ A signal tone is emitted. The software version is shown in the display. *FILL* is then shown in the display. The pump and the cooling unit are not started if the level is low.

     Fill the device with heat transfer liquid.
7. Carefully pull the cover on the filler nozzle upwards, do not twist it.
8. Carefully pour heat transfer liquid into the filler nozzle. Monitor the level indication. Fill the device to the maximum fill level.

Use a funnel for filling if required.

The fill level of the heat transfer liquid may not exceed the maximum marking of the level indication.

9. Press the **Enter key** when the maximum or a sufficient fill level is reached.

   ▶ The pump starts. The actual temperature is shown on the display. The fill level in the constant temperature equipment falls as the application is filled.

Fill level falls

10. Fill the constant temperature equipment. If, however, the fill level drops too far, the constant temperature equipment automatically switches to FILL mode. The pump and the cooling unit are switched off. Continue filling until trouble-free operation is possible. Monitor the level indication.

11. Carefully press the cover in the filler nozzle.

5.4 Setting the pump pressure

The pump pressure can be adjusted via a control valve on the rear of the device in devices with a bypass. Therefore, the pump pressure can be set individually when using a pressure-sensitive application.

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

Turn the adjusting wheel counterclockwise to open.

Personnel: ■ Operating personnel

1. To increase the pressure in the application, turn the bypass control knob clockwise until the desired pressure (< than the permissible pressure) for the application is reached.

   While doing so, monitor the display in the pressure gage.

6 Operation

6.1 General warning and safety instructions

WARNING!
Leaks in the cooling circuit

Burns, fire

- Do not use corrosive heat transfer liquids.

WARNING!
An uncontrolled refrigerant circuit or pump transfers heat into the bath

Burns

- Do not use flammable heat transfer liquids.
- For temperature-sensitive applications with a permissible operating temperature under the boiling point of the heat transfer liquid, an additional temperature limiting device is required.

WARNING!
Operating errors, technical defect

Fire

- Disconnect the mains plug to safely disconnect from the mains power.

WARNING!
Unauthorized control

Scalding, cold burns, fire

- Only operate the process interface at a protected process control station. Secure physical access to the constant temperature equipment or serial cable against authorized access.

CAUTION!
Danger due to inaccessible mains switch

Scalding, cold burns

- Make sure that the mains plug is always easily accessible. It must be possible to quickly pull the mains plug out of the socket.

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

CAUTION!
Restrictions during operation or setup

Ergonomic impairment

- Position the LAUDA thermostat on a table, pedestal or the floor so that all operating elements (connections, interfaces, display, keyboard) are easy to use.
- Devices with four castors are only suitable for positioning on the ground so that they are prevented from falling from an elevated height.

The following text is relevant for devices containing less than 150 g of flammable refrigerant (see type plate or technical data).
According to standard DIN EN 378-1, permanently sealed refrigeration systems below this filling limit are not subject to any special requirements regarding installation location, room volume or access area. Accordingly, no additional security measures are required.

6.2 Switching on the device

Personnel: ■ Operating personnel

1. Switch on the device at the mains switch.
   ▶ A signal tone is emitted. The software version is shown in the display. The actual temperature is then shown in the display.

   The constant temperature equipment starts operation, the pump is started.

   Depending on the set temperature, the cooling unit is started after 2 minutes at the earliest. The blue LED is lit if the cooling unit is active.
2. Heat transfer liquid may have to be topped up, depending on the size of the application. Monitor the level indication.

Refer to ↳ Chapter 5.3 “Switching on the device and filling with heat transfer liquid” on page 31 *for detailed information on topping up the heat transfer liquid.*

6.3 Basic display and menu items

1. Press the Enter key to go to the menu items from the basic display, i.e. the actual temperature.

The menu item or the input window is exited if you do not press a key for more than 4 seconds.

2. Use the arrow keys to scroll from menu item to menu item.
3. Press the Enter key at the selected menu item.
   ▶ The display flashes.

4. Use the arrow keys to change the value or setting.
5. Immediately accept the changed value or setting by pressing the Enter key.

Changed values or settings are automatically applied and the menu item or input window is exited if you do not press a key for more than 4 seconds.

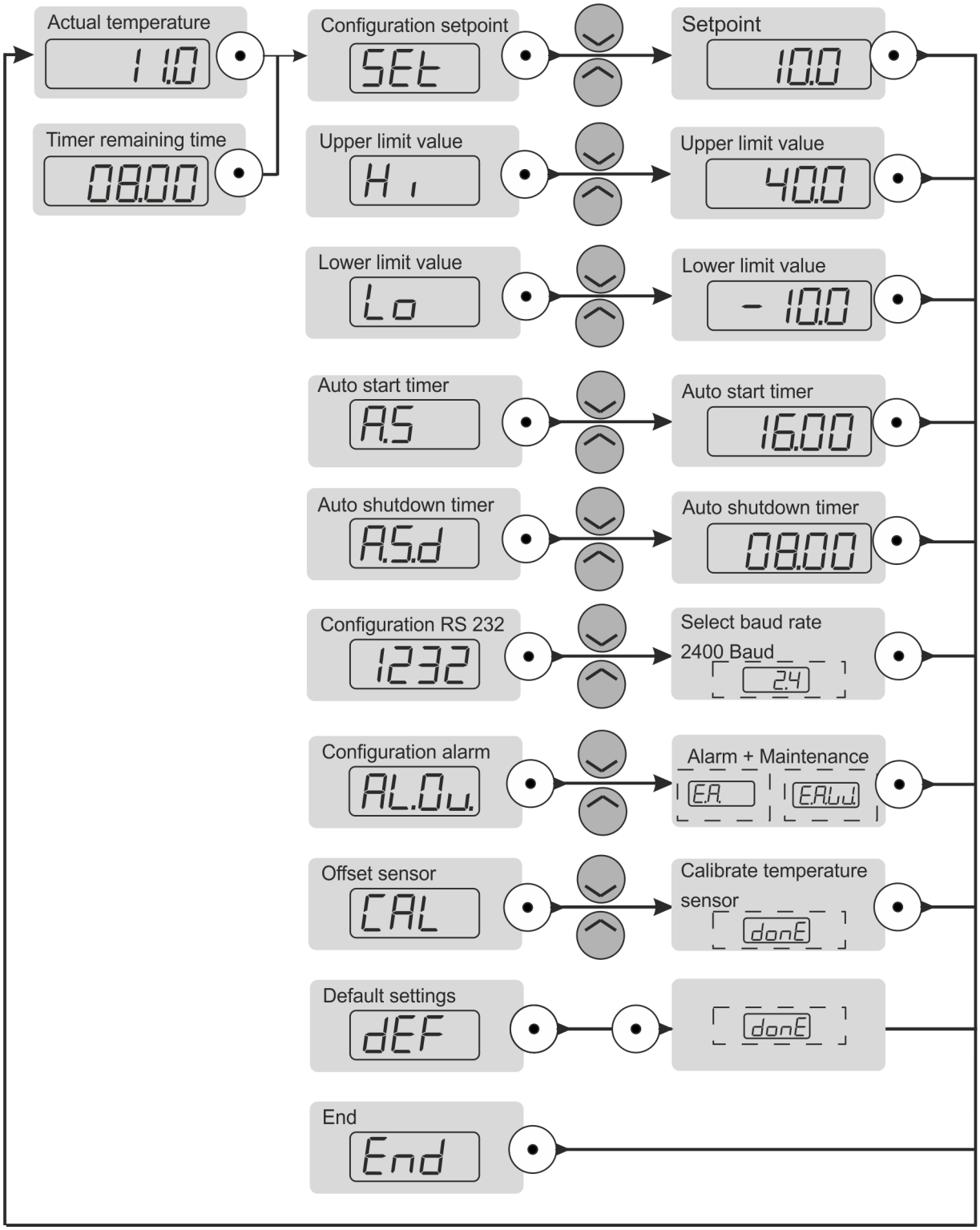

Actual temperature
11.0
Timer remaining time
08.00
Configuration setpoint
SEt
Setpoint
10.0
Upper limit value
H i
Upper limit value
40.0
Lower limit value
Lo
Lower limit value
- 10.0
Auto start timer
A.S
Auto start timer
16.00
Auto shutdown timer
A.S.d
Auto shutdown timer
08.00
Configuration RS 232
1232
Select baud rate
2400 Baud
2.4
Configuration alarm
AL.Ou.
Alarm + Maintenance
E.A.
E.A.u.d.
Offset sensor
CAL
Calibrate temperature sensor
donE
Default settings
dEF
donE
End
End

Fig. 11: Menu

6.4 Indications in the display

Basic display

Fig. 12: Basic display

The basic display is the indication in the display which is shown unless other operations such as configuring settings are performed. The actual temperature of the device in °C is shown in the basic display.

Menu

The Enter key can be used to call the menu of the device with possible settings.

You will find more information on the structure of the menu and how to navigate in the menu in ↳ Chapter 6.3 “Basic display and menu items” on page 35.

Editing display

The display flashes if a menu item has been selected in the display. The setting can now be made. The entered value is accepted by confirming the setting.

6.5 Setting the temperature set point

Relationship between the temperature set point and the temperature limits

You set a temperature set point for the temperature control. This value specifies the temperature to which the heat transfer liquid is cooled. The upper and lower temperature limits of the device have default values of 45.0 °C and 5.0 °C respectively. The temperature limits define the temperature range of your application, i.e. the temperature range in which temperature control can take place. A warning is issued by the device outside the temperature limits. This range ensures that no unnecessary warnings are issued during transient processes of the temperature control. The defaults can be subsequently restricted depending on the heat transfer liquid.

Do not set the temperature set point lower than 5 °C when operating the device with Aqua 90. Also use the lower temperature limit value *Lo* ↳ “Lower temperature limit value” on page 39 and set it to 3 °C so that a warning is output at lower temperatures.

The yellow LED on the device is lit at a temperature set point or an actual temperature of less than 5 °C. It warns of incorrect use of the heat transfer liquid and the resulting damage to the device.

If the device is operated at liquid temperatures below 5 °C, Kryo 30 (glycol/water) must be used as the heat transfer liquid for the device

Personnel: ■ Operating personnel

1. Select the menu item for specifying the temperature set point.

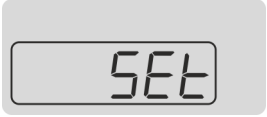


Fig. 13: Set point entry

2. Specify the set point value.

The value cannot be accepted if the set point entered is outside the set temperature limits. The editing mode is active. An acoustic signal is also emitted. You can enter the set point again.

3. Press the input button to confirm.

6.6 Restricting the temperature limits

You must limit the temperature limit value range for safety reasons. These two values depend on the heat transfer liquid used. The default settings 45.0 °C and 5.0 °C are stored in the device and cannot be changed.

Appropriate temperature limit values are:

Aqua 90 - Set the range to the values 42 °C and 3 °C.

Kryo 30 (water/glycol) - Set the range to the values 42 °C and -12 °C.

Adjusting the temperature limit values automatically limits the adjustable set point range to 2 °C below the upper temperature limit and 2 °C above the lower temperature limit.

Upper temperature limit value

Personnel: ■ Operating personnel

Fig. 14: Upper limit

1. Select the menu item for the upper temperature limit value.
2. Press the input button to confirm.
3. Specify the upper limit.

The maximum value for the upper limit is 45 °C.

4. Press the input button to confirm.

Lower temperature limit value

Personnel: ■ Operating personnel

Fig. 15: Lo. limit

1. Select the menu item for the lower temperature limit value.
2. Press the input button to confirm.
3. Specify the lower limit.

The minimum value for the lower limit is 5 °C when using Aqua 90 and -15 °C when using Kryo 30.

4. Press the input button to confirm.

6.7 Configuring the clock timer

The integrated clock timer can be used to switch the device on and off automatically. The clock timer can be viewed and configured during normal operation of the device.

Special features of the clock timer

- The clock timer is configured by a number of hours and minutes in the format hh.mm. The first two digits represent the number of hours, the last two represent the number of minutes. The clock timer can be set to a maximum of 99 hours and 59 minutes.
- The clock timer is only active as long as the device is switched on. If the device is switched off via the mains switch during the runtime of the clock timer, the clock timer is reset.

Functions of the clock timer

- If the clock timer is active, the current actual temperature is indicated by a flashing dot in the display.
- If the clock timer is called via the corresponding menu item, the remaining time period, e.g. *05.30*, flashes on the display.
  If the clock timer is not active, *00.00* flashes on the display.
- If the time period of the auto shutdown function has elapsed, the device is not switched off completely, but switched to standby. Standby means that all components of the device are switched off, and only the device display is still supplied with power.

Functions for automatic switch-on - Auto start

- If auto start of the clock timer has been configured, the device switches to standby, and auto start becomes active immediately. If auto shutdown is active, auto start only becomes active after the auto shutdown has elapsed.
- If auto start is active, the remaining time period until the automatic start is shown in the display. An acoustic signal is also emitted during the entire last minute before the device is started.

Configuring auto shutdown

Fig. 16: Auto shutdown

1. Select the menu item for specifying auto shutdown.
2. Press the input button to confirm.
3. Specifies the time period from which the device is to be switched to standby.

Wait approx. 4 seconds if you do not wish to accept the specified value. The display will automatically return to the basic display.

4. Press the input button to confirm.

> *The value must be confirmed within 4 seconds of the last entry. Otherwise, the display will return to the basic display.*

▶ The device is switched to standby after the entered time period. This is shown in the display as follows.

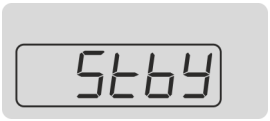


Fig. 17: Standby

5. You can now configure auto start before auto shutdown elapses, in order to switch the device on again after a certain time. Otherwise, you can start the device manually by pressing the Enter key.

Configuring auto start

Fig. 18: Auto start

1. Select the menu item for specifying auto start.
2. Press the input button to confirm.
3. Specifies the time period after which the device is to be switched on again.

> *If auto shutdown has not been configured for the device, the device is switched directly to standby when you confirm.*

> *Wait approx. 4 seconds if you do not wish to accept the specified value. The display will automatically return to the basic display.*

4. Press the input button to confirm.

> *The value must be confirmed within 4 seconds of the last entry. Otherwise, the display will return to the basic display.*

Viewing and editing the remaining time period

1. Select the menu item for auto shutdown or auto start.
2. Press the input button to confirm.

▶ The remaining time period is displayed.

3. The following options are available:

- Wait approx. 4 seconds if you only wish to display the remaining time period. The basic display is shown again.
- Set the time period accordingly to edit the remaining time period. Press the input button to confirm.

Resetting

1. Select the menu item for auto shutdown or auto start.
2. Enter 00.00.

3. Press the input button to confirm.

The value must be confirmed within 4 seconds of the last entry. Otherwise, the display will return to the basic display.

Switching on again manually

If the device was switched to standby via auto shutdown and auto start has not been configured, the device can be switched on again manually.

1. Press the Enter key to switch the device back on.

This function is only available if auto start is not active.

6.8 RS 232 interface

6.8.1 Configuring the RS 232 interface

The baud rate for the RS 232 interface can be configured via the display.

Personnel: ■ Operating personnel

Fig. 19: RS 232 interface

1. Select the menu item for configuration of the RS 232 interface.
2. Select the desired baud rate.

   The following baud rates can be selected:

   - *2.4*
   - *4.8*
   - *9.6*
   - *19.2*

The hundreds and thousands digits are not shown in the display.

3. Press the input button to confirm.

Your entry is automatically accepted after approx. 4 seconds.

6.8.2 Protocol

Protocol RS 232

Please note the following:

- The interface works with 1 stop bit, without a parity bit and with 8 data bits.
- Transmission speed alternately: 2400, 4800, 9600 (factory setting) or 19200 bauds.
- The RS 232 interface can be operated with or without hardware handshake (RTS/CTS).
- The command from the computer must be made with a CR, CRLF, or LFCR.

- The response from the thermostat is always made with a CRLF.
- After each command sent to the thermostat, it is necessary to wait for the reply before sending another command. This ensures that the sequencing of inquiries and answers is clear.

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

Example

Table 9: Example for set value transfer from 30.5 °C to the thermostat.

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

6.8.3 Cable test and interface test of RS 232

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

Please note the following:

- With hardware handshake: When connecting a thermostat to the PC, use a 1:1 and not a null modem cable. The RS 232 interface can be connected directly to the PC using a 1:1 contacted cable.
- Without hardware handshake: Set the corresponding operation mode on the PC. Use protected connection lines. Connect the protective screen with the connector shell. The lines are galvanically separated from the rest of the electronics. Do not connect unassigned pins.
- It is easy to check the RS 232 interface when it is connected to a PC with a Microsoft Windows operating system.

  For Windows® 3.11 with the "Terminal" program.

  For Windows® 95/98/NT/XP with the "HyperTerminal" program.

"HyperTerminal" is no longer included in the operating system from Windows Vista, Windows 7, and Windows 8 onwards.

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

6.8.4 Read commands

The interface module recognizes the following read commands, which you can use to retrieve operating data of the constant temperature equipment.

Please note the following:

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

Table 10: Temperature

ID	Function	Unit, resolution	Command
2	Temperature set point	[°C]	IN_SP_00
3	Bath temperature (outflow temperature)	[°C], 0.01°C	IN_PV_00
27	Limitation of outflow temperature TiH (upper limit) Hi	[°C]	IN_SP_04
29	Limitation of outflow temperature TiL (lower limit) Lo	[°C]	IN_SP_05

Table 11: Status

ID	Function	Unit	Command
107	Device type (Example answer: "MC")	[–]	TYPE
130	Device status: 0 = OK / -1 = Fault	[–]	STATUS
131	Fault diagnosis; a 7-digit answer in the format XXXXXXX is output, whereby each digit X contains fault information (0 = no fault / 1 = fault). The following information is defined for the seven places of the answer format: ■ First character = error ■ Second character = alarm ■ Third character = warning ■ Fourth character = overtemperature ■ Fifth character = low level ■ Sixth character = higher level (alarm setting) ■ Seventh character = external control value missing	[–]	STAT

Table 12: SW version

ID	Function	Unit	Command
108	Control system	[–]	VERSION_R
109	Protection system	[–]	VERSION_S
114	RS 232/485 interface module or Profibus / Profinet (interface module must be present)	[–]	VERSION_V

6.8.5 Write commands

A write error is a command from the control station to the constant temperature equipment.

Please note the following:

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

Table 13: Temperature

ID	Function	Unit	Command
1	Temperature set point	[°C]	OUT_SP_00_XXX.XX
26	Limitation of outflow temperature TiH (upper limit)	[°C]	OUT_SP_04_XXX
28	Limitation of outflow temperature TiH (lower limit)	[°C]	OUT_SP_05_XXX

Table 14: Status

ID	Function	Unit	Command
74	Switch the device on/off (standby)	[–]	START/STOP

Table 15: Acceptable data formats

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

6.9 Alarm output

6.9.1 Configuring the alarm output

The default setting is that an electrical signal is output via the alarm output of the device in the event of an alarm or error. However, you can also configure the system so that a signal is additionally output in the case of a warning.

Personnel: ■ Operating personnel

1. Select the menu item for configuring the alarm output.

Fig. 20: Alarm output

Fig. 21: Error and alarm option

2. Select the following option to output an electrical signal for alarms and errors.

Fig. 22: Option with additional warning

3. Select the following option to output an additional electrical signal for warnings.

Wait approx. 4 seconds if you do not wish to accept the specified value. The display will automatically return to the basic display.

4. Press the input button to confirm.

The value must be confirmed within 4 seconds of the last entry. Otherwise, the display will return to the basic display.

6.9.2 Interface alarm output (potential-free contact)

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

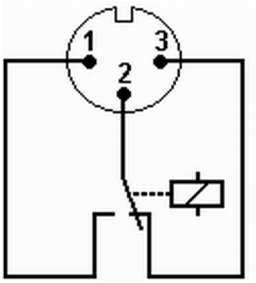


Fig. 23: Flange plug (front) in fault condition

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

Good condition

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

Fault condition

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

You can find information on the settings for the alarm output in
Chapter 6.9.1 “Configuring the alarm output” on page 45.

Please note the following:

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

6.10 Enter the offset for the temperature probe

The factory calibration is overwritten during the adjustment.

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

A calibrated reference thermometer (e.g. from the LAUDA DigiCal series) with the desired degree of accuracy is required. In other respects, the factory calibration should not be changed.

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

Personnel: ■ Operating personnel

Fig. 24: Adjusting the temperature sensor

1. Select the menu item for the adjustment.
2. Enter the temperature value read off the reference thermometer into the device.
3. Then press and hold the Enter key for about 3 seconds.
   ▶ *donE* appears in the display. The new value has been accepted.

6.11 Restore factory setting

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

- The range of the temperature limit values is reset to 45 °C and 5 °C.
- The timers are reset to *00.00*.
- The signal output is reset to *alarms and errors* at the alarm output.
- The baud rate is reset to *9600 baud*.

Fig. 25: Factory setting

Personnel: ■ Operating personnel

1. Select the menu item for restoring the factory setting.
2. (Briefly) press the input button to confirm.
3. Press and hold down the Enter key for about 3 seconds.
   ▶ *donE* appears in the display. The factory setting has been restored.

7 Maintenance

7.1 Warnings for maintenance

DANGER!
Contact with live or moving parts

Electric shock, impacts, cutting, crushing

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

WARNING!
Contact with cold heat transfer liquid

Cold burns

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

Please also note the following:

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

7.2 Maintenance intervals

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

Interval	Maintenance work
Before switching on the device	Check the power cord for damage
As required, once a month at the latest	(Visually) check the external hoses for material fatigue and leaks
	Check that the hose clips and screw connections are fitted correctly and securely
As required, every three months at the latest	Clean the condenser
As required, once every six months at the latest	Check that the heat transfer liquid is suitable for use

Interval	Maintenance work
As required, once a year at the latest	Check the external condition of the device for damage and stability.
Every twenty years	Replace safety-related electrical and electromechanical components. This includes the circuit breaker.

7.3 Cleaning the device

DANGER!
Risk of moisture/cleaning agent penetrating into the device

Electric shock

- Use a slightly damp cloth to clean the device.

Personnel: ■ Operating personnel

1. Only use water and detergent to clean the control panel. Do not use acetone or solvent
   ▶ as these substances will permanently damage the plastic surfaces.

7.4 Cleaning the air-cooled condenser

WARNING!
Risk of mechanical damage to refrigerant circuit

Burns, fire

- Do not damage the cooling circuit.
- Use suitable materials/tools to clean the condenser (e.g. soft brush, vacuum cleaner or compressed air).
  To do this, remove the detachable cover plate from the front of the device.

CAUTION!
Contact with sharp slats on the condenser

Cutting injuries

- Wear protective gloves.

Personnel: ■ Operating personnel

1. Switch off the device.
2. Remove the front panel by grasping the bottom with both hands and pulling the grille forward. Remove the front panel slowly and carefully to avoid damage.
3. Brush off or vacuum the condenser.
4. Install the front panel again with care.

7.5 Check the heat transfer liquid

WARNING!
Contact with hot/cold heat transfer liquid

Scalding, cold burns

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

Wear of the heat transfer liquid

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

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

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

Water content	1. For water/monoethylene mixtures and water/propylene mixtures: The water content decreases during longer periods of operation at higher temperatures and the mixture becomes flammable.
Cloudiness	2. The water becomes opaque or cloudy due to micro-organisms, suspended matter and deposits.
Discoloration	3. The liquid turns yellow, green or brown due to algae growth and bacterial decomposition processes
Odor	4. The liquid emits a moldy musty odor due to bacteria and fungal growth.
Application	5. General deterioration in thermal performance. Reduction in the achievable temperature stability. Clogging of hoses.

8 Faults

8.1 Warnings regarding troubleshooting, fault elimination and repair

DANGER!
Contact with live or moving parts

Electric shock

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

DANGER!
Incorrect handling

Explosion, burns, fire

- Only certified specialists who are trained to handle flammable refrigerants are authorized to perform repair and disposal work.
- Any components and parts must be replaced with identical parts.

8.2 Alarms, errors and warnings

All alarms, error messages and warnings triggered on the device appear on the display as a 7-segment text.

Procedure in event of alarm

Once the cause of the fault has been eliminated, the alarm can be canceled with the Enter key.

A list of alarms can be found in ↳ Chapter 8.3 “Overview of alarms” on page 53.

Procedure in event of warning

Once the cause of the fault has been eliminated, the warning can be canceled with the Enter key.

A list of warnings can be found in ↳ Chapter 8.4 “Overview of warnings” on page 54.

Procedure in event of error

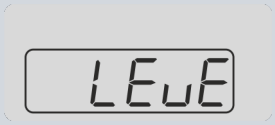
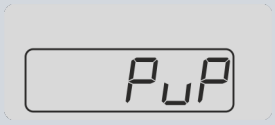
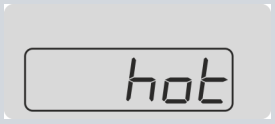
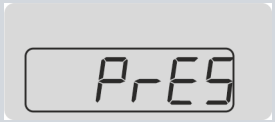
If an error occurs, the device emits a two-tone acoustic signal. In addition, the red LED on the device is lit.

If this happens, switch off the device at the mains switch. If the error occurs again after switching on the device, make a note of the error code and contact the LAUDA Constant Temperature Equipment Service department. You will find the contact information in ↳ Chapter 12.3 “Contact LAUDA” on page 60.

Errors are symbolized with an E and a consecutive three-digit number.

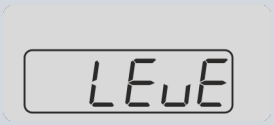
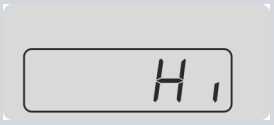
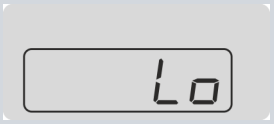
8.3 Overview of alarms

Alarms affect safety. The components of the device, such as the pump, switch off. The device emits a two-tone acoustic signal. In addition, the red LED on the device is lit.

Output in the display	Description	Possible remedy
	In the case of a low-level alarm, the level of the heat transfer liquid is below the minimum limit. Warnings are output before the alarm is output. The alarm is triggered after approx. 5 minutes.	– If necessary, top up the heat transfer liquid until it is above the minimum limit. – Check hoses, connections and applications for leaks. – Check the constant temperature equipment for leaks.
	The pump is clogged. The pump protective motor switch has triggered.	– Check the application and viscosity of the heat transfer liquid. – Foreign body in the circuit.
	The temperature of the electronics is higher than 75°C.	Check the installation requirements. Adhere to the ambient temperature in the technical data.
	Pressure switch in the schema cooling circuit has triggered.	
	– Condenser is contaminated	Clean the condenser. See the "Air-cooled condenser" chapter in the operating manual.
	– Insufficient distance to surroundings	Check the installation requirements. Adhere to the minimum distances in the technical data.
	– Ambient temperature too high	Check the installation requirements. Adhere to the ambient temperature in the technical data.
	– Condenser ventilator fan defective	When active cooling is in operation, check the air flow at the condenser. Replace the ventilator fan if necessary.

8.4 Overview of warnings

Warnings do not have a significant effect on safety. The device continues to operate. The device will make a continuous noise for a short period of time. Warnings are issued periodically. You will therefore be reminded of an active fault.

Indication in the display	Description
	In the case of a low-level warning, the level of the heat transfer liquid is below the minimum limit. Where required, the fault which caused this low level must be remedied to clear the warning. The heat transfer liquid must also be topped up. If this warning is ignored, a low level alarm is issued after approx. 5 minutes and the components of the device, such as the pump, are switched off.
	This warning means that the upper temperature limit has been exceeded. The device fault must be remedied to clear this warning.
	This warning means that the lower temperature limit has been exceeded. The device fault must be remedied to clear this warning.

8.5 Error messages

The following is a description of the error messages of the modules.

Error	Description
ERR_2	Wrong entry (e.g. buffer overflow).
ERR_3	Wrong command
ERR_5	Syntax error in value
ERR_6	Impermissible value
ERR_32	The upper temperature limit is lower than or equal to the lower temperature limit.

9 Decommissioning

9.1 Draining the device

Personnel: ■ Operating personnel

WARNING!
Contact with cold heat transfer liquid

Cold burns

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

Please also note the following:

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

1. Switch off the device.
2. Allow the device and heat transfer liquid to cool or warm up to room temperature.
3. Place a container with an appropriate capacity directly under the drain screw.

The heat transfer liquid flows out of the device immediately after the drain screw is opened.

4. Open the drain screw. To do so, turn it counterclockwise.
5. Let the heat transfer liquid flow out.
6. Turn the drain screw back in clockwise.

10 Disposal

10.1 Disposing of the refrigerant

DANGER!
Uncontrolled leaking of refrigerant

Explosion, burns, fire

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

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

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

10.2 Device disposal

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

10.3 Disposing of packaging

Disposal of the packaging must be carried out in accordance with EC Directive 94/62/EC.

11 Technical data

11.1 General data

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

Table 16: General data

Specification	Value	Unit
Installation and use	Indoors	---
Use up to a maximum height above sea level of	2,000	m
Air humidity	Maximum relative humidity 80% at temperatures up to 31 °C, linearly decreasing until 50% relative humidity at 40 °C	%
IP code according to EN 60529	IP 32	---
Pollution degree	2	---
Clearance (front and back)	40	cm
Surge	Surge category II and transient surges according to category II	---
Protection class for electrical equipment DIN EN 61 140 (VDE 0140-1)	1	---
Class division according to DIN 12876	NFL (suitable for non-flammable liquids)	---
Display	7-segment, LED	---
Display resolution	0.1	°C
Setting resolution	0.1	°C
Temperature stability	±0.5	K
Ambient temperature range	5 – 40	°C
Storage temperature range	5 – 40	°C
Transportation temperature range	-20 – 60	°C

Table 17: Working temperature range

	Working temperature range	Dimensions (W x D x H)	Weight
Device/unit	°C	mm x mm x mm	kg
MC 350	-10 – 40	240 x 400 x 500	31.0
MC 600	-10 – 40	350 x 480 x 595	48.0
MC 1200	-10 – 40	450 x 550 x 650	58.0
MC 2000	-10 – 40	450 x 550 x 650	60.5

11.2 Cooling unit

Table 18: Cooling capacity

	Unit	MC 350	MC 600	MC 1200	MC 2000
Cooling capacity (at 20°C)	W	350	600	1200	2000
Cooling capacity (at 10°C)	W	270	500	1050	1700
Cooling capacity (at 0°C)	W	200	370	750	1250
Cooling capacity (at -10°C)	W	120	200	400	700

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

11.3 Refrigerant and filling charge

Table 19: Refrigerant and filling charge

	Unit	MC 350	MC 600	MC 1200	MC 2000
Refrigerant	---	R-290	R-290	R-290	R-290
Maximum filling weight	g	41	65	85	93
$GWP_{(100a)}$*	---	3	3	3	3

Global Warming Potential (GWP), CO_2 comparison = 1.0

** Time frame 100 years - according to IPCC IV*

11.4 Hydraulic circuit

Table 20: Hydraulic circuit

	Unit	MC 350	MC 600	MC 1200	MC 2000
Filling volume	L	4 – 7	4 – 8	7 – 14	7 – 14
Maximum flow rate (water 20°C)	L/min	16	35	35	35
Maximum discharge pressure (water 20°C)	bar	0.35	1.30	1.30	1.30
Pump connection	inches	Hose nozzle ½"	G ¾, hose nozzle ¾"	G ¾, hose nozzle ¾"	G ¾, hose nozzle ¾"
Drain tap (connection)	inches	G ½"	G ½"	G ½"	G ½"
Overflow connection	inches / mm	Hose nozzle ½" (10)	Hose nozzle 16 mm	Hose nozzle 16 mm	Hose nozzle 16 mm

11.5 Voltage-dependent data

Table 21: Current consumption

Voltage variants	MC 350	MC 600	MC 1200	MC 2000
Unit	A	A	A	A
230 V; 50 Hz	---	3.2	4.2	5.1
220 V; 60 Hz / 230 V; 50 Hz	1.7	---	---	---
220 V; 60 Hz	---	3.7	---	---
115 V; 60 Hz	3.7	7.2	9.6	12.9
100 V; 50/60 Hz	3.7	---	---	---

12 General

12.1 Copyright

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

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

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

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

12.2 Technical changes

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

12.3 Contact LAUDA

Contact the LAUDA Service department in the following cases:

- Troubleshooting
- Technical questions
- Ordering accessories and spare parts

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

Contact information

LAUDA Service

Phone: +49 (0)9343 503-350

Email: service@lauda.de

12.4 Declaration of Conformity

EC DECLARATION OF CONFORMITY

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

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

Product Line: Microcool **Serial number:** from S250000001

Types: MC 350, MC 600, MC 1200, MC 2000
(versions with natural refrigerant)

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

Machinery Regulation	(EU) 2023/1230 (valid from 20.01.2027)
Machinery Directive	2006/42/EG (valid until 19.01.2027)
EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU in connection with (EU) 2015/863

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

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

Applied standards (with date of publication):

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

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

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

Lauda-Königshofen, 02.10.2025

Dr. Marc Stricker,
Managing Director (COO)

12.5 Product Returns and Clearance Declaration

Product Returns

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

Return address

LAUDA DR. R. WOBSER GMBH & CO. KG

Laudaplatz 1

97922 Lauda-Königshofen

Deutschland/Germany

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

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

Clearance Declaration

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

Place, date	Name in block letters	Signature

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