The right temperature worldwide

LAUDA

Operating instructions

Microcool

MC 250, MC 600, MC 1200, MC 1200 W

Circulation chiller

CE

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Translation of the original operating instructions
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1 Safety

1.1 General safety instructions

- The equipment must only be operated for the intended use under the conditions stated in this operating manual. Any other type of operation is considered to be not-intended use and can impair the protection provided by the device.
- The operating manual is part of the device. The information in this operating manual must therefore be available in close vicinity to the device. Also store this copy of the operating manual carefully.

If you lose this operating manual, contact the LAUDA Constant Temperature Equipment service. The contact details can be found in *Chapter 12.3 'LAUDA contact' on page 63*.

Use of the device results in hazards from high or low temperatures, fire and from the use of electrical energy. The hazards of the device must be eliminated as much as possible by the design in accordance with the appropriate standards. Residual hazards are reduced using any of the following measures:

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

  The safety devices 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 chapter “Safety”.
- There are safety instructions in this operating manual. These instructions must always be observed.
- There are additional specific requirements for the personnel 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 1.9 'Personnel qualification' on page 8* and *Chapter 1.10 'Personal protective equipment' on page 9*.

Further information about the general structure of safety instructions can be found in *Chapter 1.11 'Structure of safety instructions' on page 9*.

1.2 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

1.3 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
- Placement of the device on a tabletop surface, only permitted for MC 600 and MC 1200 (W)
- Setting an incorrect pump pressure

1.4 Modifications to the device

Any technical modifications to the machine are prohibited. Service works may be carried out only by the LAUDA Constant Temperature Devices service or one of the service partners authorized by LAUDA.

1.5 Heat transfer liquid

- The device is exclusively designed for nonflammable heat transfer liquids in Class I according to DIN 12876-1.
- Heat transfer liquids are used for the temperature control. Only LAUDA heat transfer liquids are approved for the device. LAUDA heat transfer liquids are heat transfer liquids that have been tested and approved by the company 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 from high or low temperatures and fire if certain temperature thresholds are exceeded or undercut or if the container breaks and there is a reaction with the heat transfer liquid .

  The heat transfer liquid safety data sheet specifies all possible hazards and appropriate safety measures for handling the liquid. The safety data sheet must therefore be consulted for the intended use of the device.

1.6 Materials

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

1.7 Hoses

Only LAUDA hoses are permitted to be used for the external hydraulics circuit. LAUDA hoses are hoses that are approved by LAUDA DR. R. WOBSER GMBH & CO. KG. When selecting suitable hoses for the application, the permissible temperature range and the maximum permissible pressure must be particularly observed.

1.8 Application area

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

- Commercial area
- Indoor use, no outdoor installation
- Ambient temperatures from 5 to 40 °C

1.9 Personnel qualification

Operating personnel
Operating personnel are employees that have been instructed by technical staff in the intended use of the device according to the operating manual.

1.10 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.

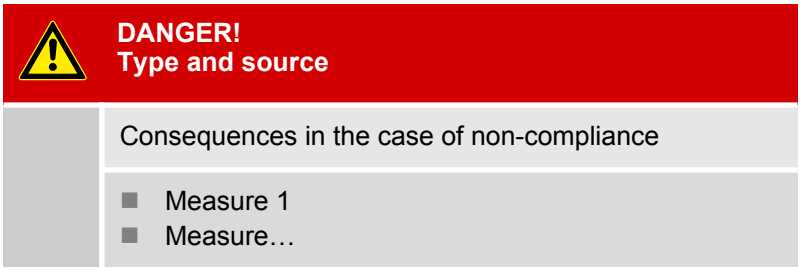
Protective gloves
CE protective gloves are required for certain activities. These protective gloves must comply with the legal requirements for personal protective equipment of the European Union.

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.

1.11 Structure of safety instructions

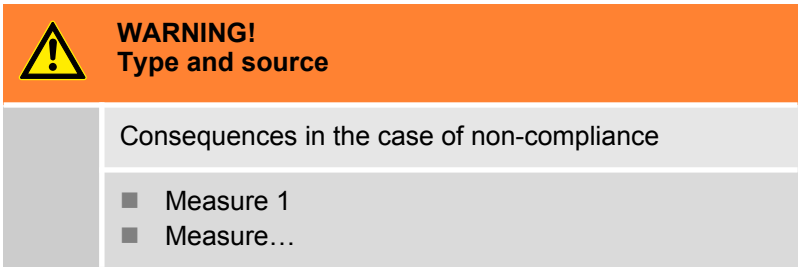
Danger

- A safety instruction of the type "Danger" indicates an **immediately hazardous** situation.
- This results 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.

CAUTION!
Type and source

Consequences in the case of non-compliance

- Measure 1
- Measure…

Notice

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

NOTICE!
Type and source

Consequences in the case 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 the 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 12.3 'LAUDA contact' on page 63.*

Accessories included as standard

Device type	Designation	Quantity	Catalogue number
MC 600, MC 1200 (W)	¾" olive with ¾" union nut	2	EOA 004
All equipment	Operating manual	1	--

3 Design and function

3.1 Device types

The type designation of the equipment is composed of the following elements.

Element	Description
MC	Microcool
<number>, e.g. 600	Specification of the cooling capacity in watts
W	Device with water cooling This specification in the device type is optional. It identifies water-cooled equipment.

Available device types

Device type	Description
MC 250	Air-cooled tabletop device with a cooling capacity of 250 watts
MC 600	Air-cooled floor-standing device with a cooling capacity of 600 watts. The pump pressure can be adjusted using a bypass adjustment wheel.
MC 1200	Air-cooled floor-standing device with a cooling capacity of 1200 watts. The pump pressure can be adjusted using a bypass adjustment wheel.
MC 1200 W	Water-cooled floor-standing device with a cooling capacity of 1200 watts. The pump pressure can be adjusted using a bypass adjustment wheel.

Rear side MC 250

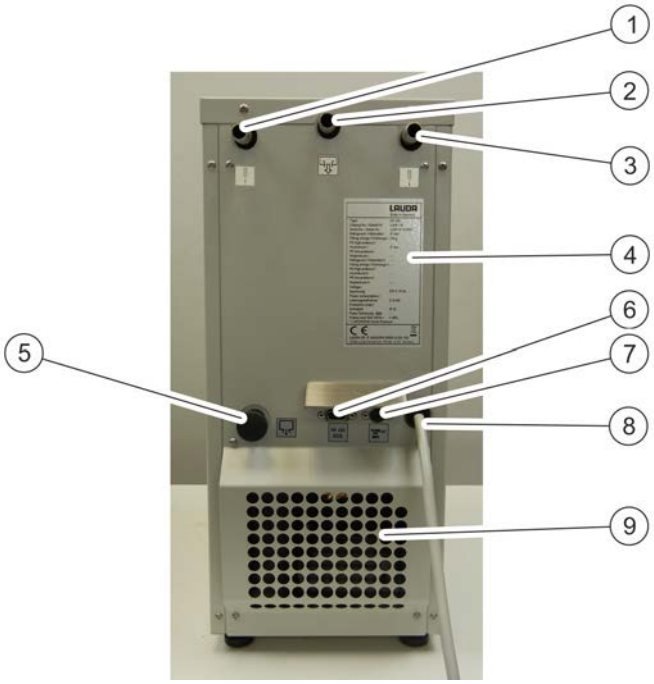


Fig. 2: Overview of the rear side

1 Pump connection, outlet
2 Overflow connection
3 Pump connection, return
4 Rating plate
5 Drain plug
6 RS232 interface
7 Alarm output
8 Mains cable
9 Ventilation openings

3.2 Design of the circulation chiller

Front side MC 250

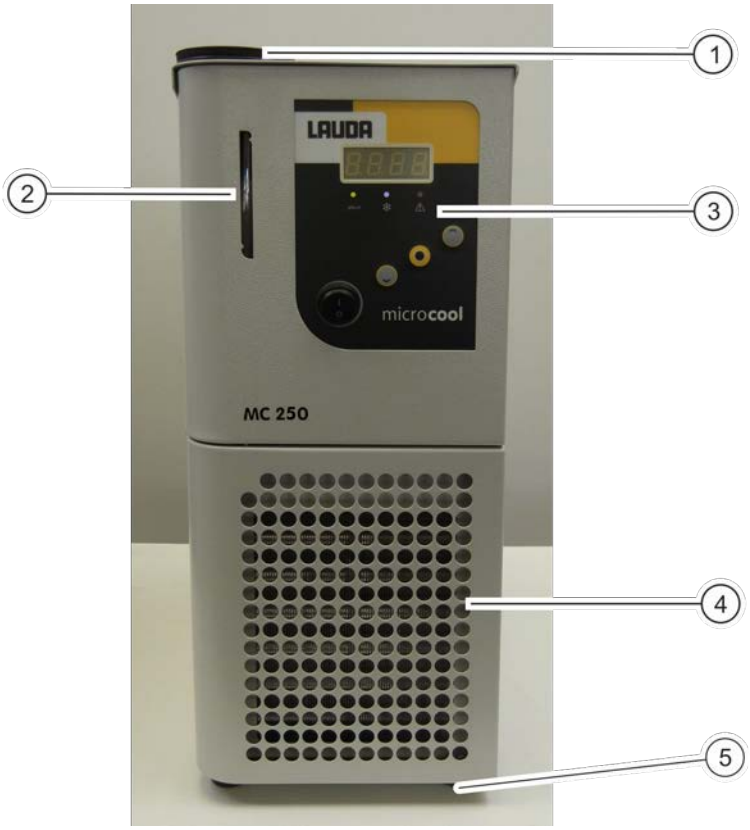


Fig. 1: Overview of the front side

1 Filler nozzle with cover
2 Level indicator
3 Control panel
4 Front panel with ventilation openings
5 Four support feet

Front side MC 600, MC 1200 (W)

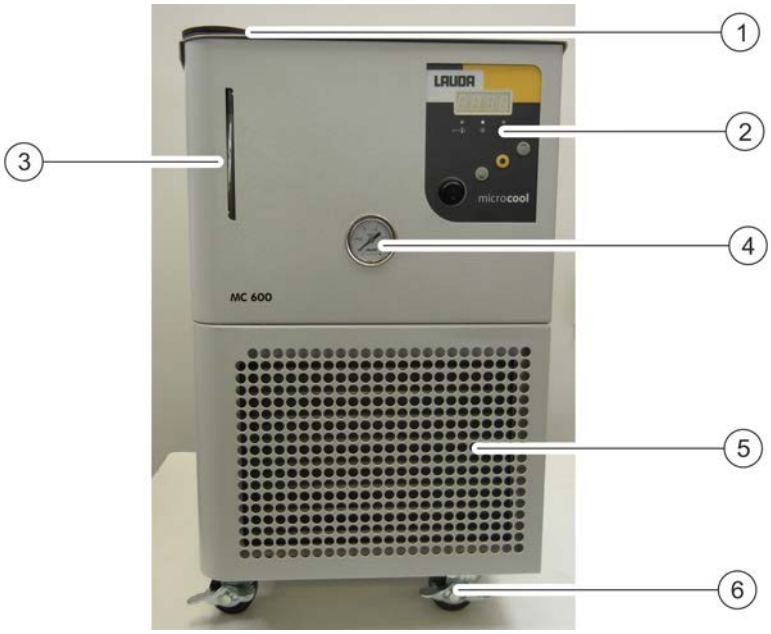


Fig. 3: Overview of the front side

1 Filler nozzle with cover
2 Control panel
3 Level indicator
4 Manometer
5 Front panel with ventilation openings
6 Four castors with locking brakes

Rear side MC 600, MC 1200 (W)

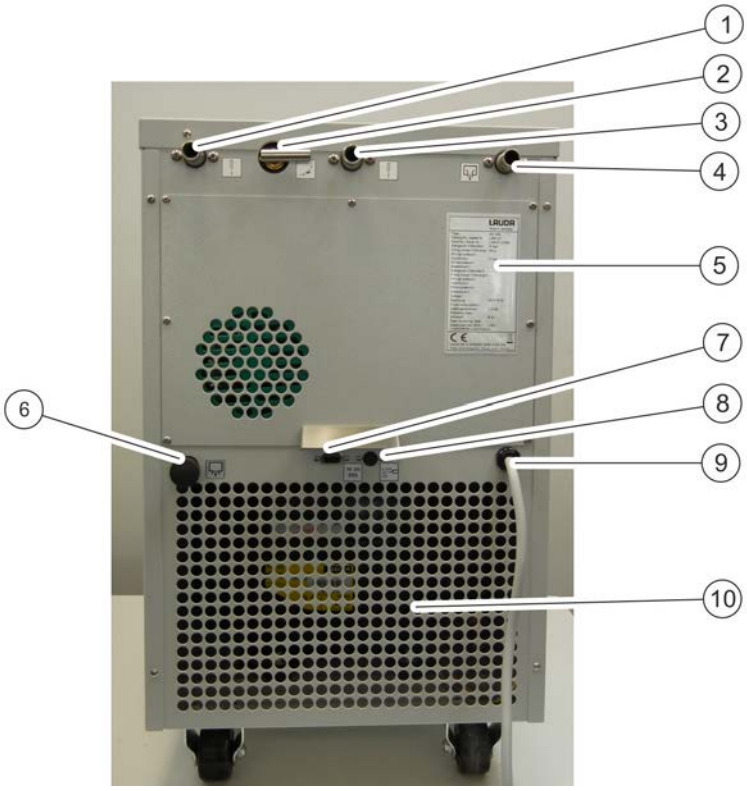


Fig. 4: Overview of the rear side

1 Pump connection, outlet
2 Bypass adjustment wheel
3 Pump connection, return
4 Overflow connection
5 Rating plate
6 Drain plug
7 RS232 interface
8 Alarm output
9 Mains cable
10 Ventilation openings

Control panel

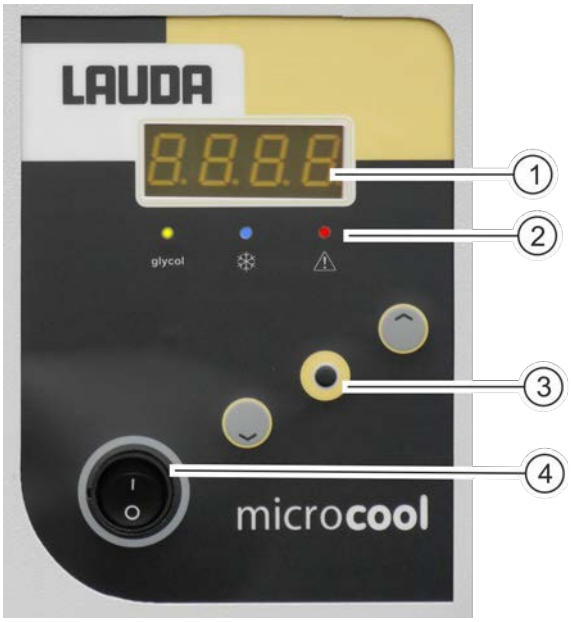


Fig. 5: Control panel

1 Display
2 LEDs
3 Display buttons
4 Mains power switch

3.3 Controls

3.3.1 Mains power switch

The mains power switch can be put in the following positions:

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

3.3.2 Display buttons

Fig. 6: Display buttons

1 UP arrow button
2 ENTER button
3 DOWN arrow button

Functions in the display of the device can be controlled using the display buttons.

- A selection in the display can be confirmed with the ENTER button.
- The UP and DOWN arrow buttons can be used to navigate in the display.

3.4 Function elements

3.4.1 LEDs for function display

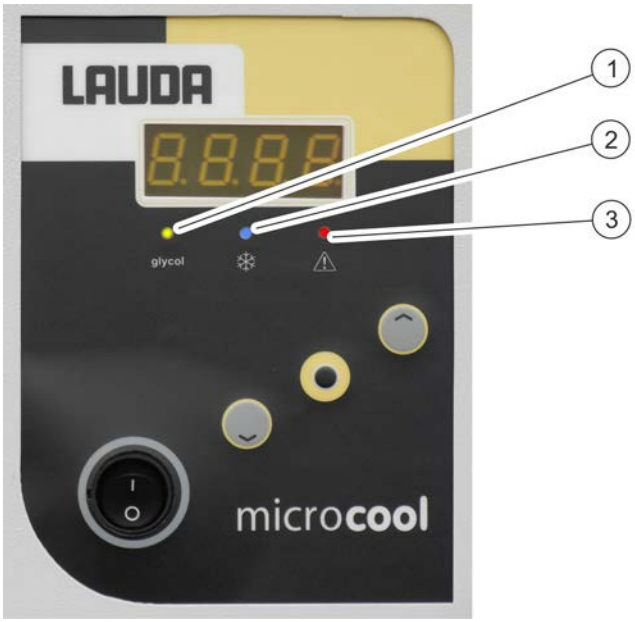


Fig. 7: LEDs

1 Yellow LED
2 Blue refrigeration LED
3 Red error LED

Each device has three LEDs with the following functions:

- The yellow glycol LED lights if Kryo 30 is necessary as heat transfer liquid.
- The blue refrigeration LED indicates whether the refrigeration unit is active.
- The red error LED lights in the event of device faults.

3.4.2 Hydraulic circuit

Hydraulic circuit

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

The circuit basically consists of the following components:

- internal storage bath with heat transfer liquid
- pump for conveying the heat transfer liquid into the external consumer via the pump connections
- Starting with MC 600, devices are equipped with an adjustable bypass to be able to adapt the pump pressure to the requirements of the external consumer.

Pump

The devices are equipped with a magnetically coupled pressure pump.

Further information about the technical data of the pump and the pump characteristic curve can be found *Table on page 62*.

3.4.3 Manometer

Fig. 8: Manometer

The device types with bypass have a manometer for reading the set pump pressure. The pump pressure is regulated using the bypass adjustment wheel on the rear side.

3.4.4 Level indicator

The fill level of the heat transfer liquid in the circuit can be read using the level indicator.

- The top arrow indicates the maximum liquid level of the machine.
- The bottom arrow indicates the minimum liquid level of the machine.

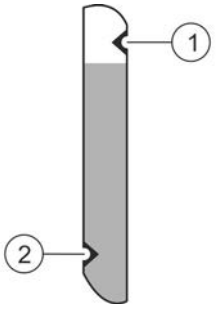


Fig. 9: Level indicator

1 Maximum level
2 Minimum level

3.4.5 Refrigeration unit

The refrigeration unit includes the following components:

- Compressor
  A hermetically sealed compressor is used in the refrigeration unit. The compressor is equipped with overload protection 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. In air-cooled condensers, the condensation heat 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 condensation heat is discharged via cooling water.
- Evaporator
  In the internal bath, heat is discharged using a pipe coil evaporator.

Technical information for the refrigeration unit can be found in ↬ *on page 61*.

3.4.6 Interfaces

Note the following:

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

RS232 interface

Specific functions of the device such as the setpoint temperature can be controlled with the RS232 interface using a PC. Thus, custom programs for controlling the device can be developed.

Further information about the connection and configuration can be found in ↬ *Chapter 6.7.1 'Configuring RS232 interface' on page 44*.

Alarm output

Changeover contact which switches in the event of a device fault. For example, faults can be registered on a system.

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

3.5 Rating plate

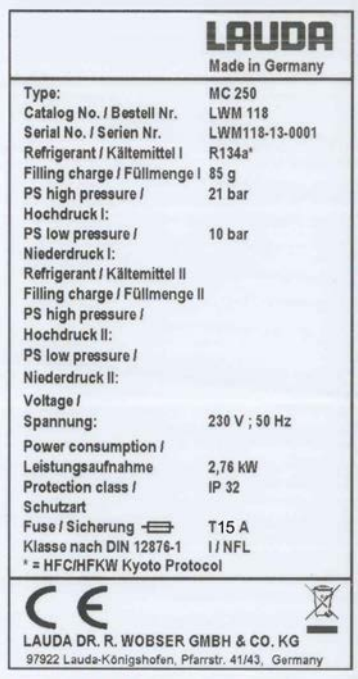


Fig. 10: Rating plate

The rating plate information is explained in detail in the following table. Certain information is dependent on installed device options. This information is noted with an appropriate suffix.

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 compressor 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 (compressor, condenser)
PS low pressure I	maximum permitted operating pressure on the refrigerant low pressure side (expansion, evaporation)
Voltage	Device must only be connected to this voltage and frequency
Power consumption	Power consumption of the device during operation
Protection class	IP protection class of the device
Fuse	Fuse used in the device
Class according to DIN 12876-1	German standard for electrical laboratory equipment

3.6 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 Microcool devices: LWM118-13-0130.

4 Before commissioning

4.1 EMC classification

Approval of the equipment according to EMC classification

Countries	EMC Class
Europe	Class A 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 machines, Europe

EMC classification of the equipment:

- 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 Device Placement

Very specific placement conditions are applicable for the equipment. These placement conditions are specified in the technical data of the device for the most part.

Further information about the technical data can be found in *Chapter 11.1 'General data' on page 60*.

Additional placement conditions are described below.

- Toxic vapours can be produced depending on the heat transfer liquid used and type of operation. Ensure sufficient 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 in *Chapter 4.1 'EMC classification' on page 23*.

WARNING!
Rolling away, falling over of the device

Impact, crushing

- Do not tilt the device.
- Place the device on a level, non-slip surface with sufficient load bearing capacity.
- Engage the castor brake when setting up the device.
- Do not place any heavy parts on the device.

1. Place the device at a suitable location in the room.

- Place tabletop devices on a suitable table. Support the device for this by reaching under the device.
- Place floor-standing devices on a suitable base.

Floor-standing devices can be moved. Release the locking brakes of the castors for this by pressing the [Off] lever downwards.

Several devices can be positioned next to each other.

2. Lock the castors of the device for floor-standing devices. Press the [On] lever downwards to lock.

4.3 External consumer

4.3.1 Hoses

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

Frostbite

- Use hoses with temperature resistance that is appropriate for the operating temperature range of the device.

CAUTION!
Contact with cold hoses

Frostbite

- Use insulated hoses for temperatures below 0 °C.

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

Further information about the pump connections of the individual devices can be found in *Chapter 11.3 'Hydraulic circuit' on page 62*.

Approved hoses, adapters and hose clamps

Hoses, not insulated

Type	Olive	Application area	Internal Ø in mm	External diameter in mm	Temperature range in °C	Catalogue number
EPDM hose	10 mm	Devices with maximum pump pressure of < 1 bar	9	11	-35 ... 90	RKJ 111
EPDM hose	½" (13 mm)	Devices with maximum pump pressure of < 1 bar	12	14	-35 ... 90	RKJ 112
Rubber hose with fabric reinforcement	½" (13 mm)	no restrictions	13 (½")	19	-40 ... 100	RKJ 031
Rubber hose with fabric reinforcement	¾" (19 mm)	no restrictions	19 (¾")	27	-40 ... 100	RKJ 032

Hoses, insulated at the factory

Type	Pump connections	Application area	Internal Ø in mm	External diameter in mm	Temperature range in °C	Catalogue number
EPDM hose, insulated	Olive 13 mm, M16 x 1	Devices with maximum pump pressure of < 1 bar	12	23	-35 ... 90	LZS 021

Insulated hoses for subsequent insulation, length 1 m

Insulation catalogue number	Max. temperature in °C	Internal Ø in mm	External diameter in mm	Suitable for hose
RKJ 058	105	19	54	RKJ 112
RKJ 024	125	16	36	RKJ 112
RKJ 009	105	23	43	RKJ 031
RKJ 013	125	29	50	RKJ 032

Adapters, suitable for MC 600 and MC 1200 (W)

Designation	Description	Catalogue number
Olive	¾" union nut, ½ " olive	LWZ 016
Olive	¾" union nut, 10 mm olive	LWZ 040

Hose clamps

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

4.3.2 Connecting external consumer

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

Electric shock, frostbite

- Only use closed consumers.

CAUTION!
Bursting of the external hydraulic circuit due to overpressure

Impact, cutting, frostbite

- Lay hoses so that they do not kink.

Note the following:

- Temperature control hoses: Always use the largest possible diameters and shortest possible hose lengths in the external liquid circuit.
  If the temperature control hose 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 hoses 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, you risk device overflow.
- In the event of hose rupture, cold liquid can escape and become a danger for persons and material.

4.4 Cooling water

4.4.1 Cooling water requirements

This section is relevant for the following:

- For water-cooled devices

General requirements

There are specific requirements for the cooling water concerning its purity. In accordance with the cooling water requirements, a suitable process for treatment and maintenance of the water must be used. The condenser and the complete cooling water circuit can be clogged, damaged and leak due to unsuitable cooling water. Extensive consequential damage to the complete refrigerant circuit can 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 results in corrosion in the cooling water circuit.
- Water containing iron and iron particles in the water result in rust formation in the cooling water circuit.
- Hard water is not suitable for cooling due to the high lime content and results in calcification in the cooling water circuit.
- Cooling water with suspended matter is not suitable.
- Untreated, not purified water, e.g. river or cooling tower water is not suitable due to its microbiological content (bacteria) which can 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), dissolved	< 0.2	mg/l
Manganese (Mn), dissolved	< 0.1	mg/l
Aluminium (Al), dissolved	< 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

This section is relevant for the following:

- For water-cooled devices

Specification	Value
Maximum cooling water pressure	6 bar
Differential pressure cooling water △p	1 ... 6 bar
Cooling water temperature	approx. 15 °C recommended 10 ... 30 °C permissible (with performance limitations)

Note the following:

- Fix the cooling water hoses in place with hose clamps.
- Fix the supply hose of the water cooling in place in the sink area to prevent uncontrolled sliding, also in the event of pressure surges.
  Fix the supply hose of the water cooling in place in the sink area so that spraying out of hot cooling water is not possible.
- Prevent kinking or squeezing 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 refrigerator 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 RS232 interface

4.5.1 Cable and interface test RS232

Computer					Thermostat		
Signal	9-pin Sub-D female connector		25-pin Sub-D female connector		9-pin Sub-D female connector		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

Note the following:

- With hardware handshake: Use a straight-through and not a null modem cable for connecting a thermostat to the PC. The RS232 interface can be connected directly to the PC using a straight-through cable.
- Without hardware handshake: Set the corresponding operating mode on the PC. Use shielded connection cables. Connect shield to connector case. The cables must be galvanically isolated from the rest of the electronics. Do not connect unassigned pins.
- The RS232 interface can be easily checked on a connected PC with the Microsoft Windows operating system. Using the HyperTerminal program for Windows® 95/98/NT/XP.

Starting with Windows Vista, HyperTerminal is no longer an integral part of Windows. However, it is possible to purchase and download the program. Alternatively, there are also free Open Source terminal programs such as putty with a similar range of functions.

4.6 Alarm output 12N

Available functions

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

- View of flange connector (front) or solder side coupling socket
- Max. 30 V DC; 1 A

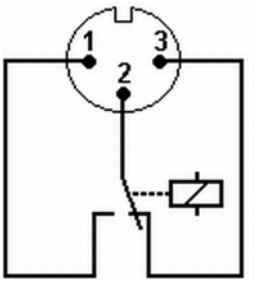


Fig. 11: Flange connector (front) in idle state

1 Normally open contact
2 Centre
3 Normally closed contact

Idle state

- The device is in idle state when it is switched off and in the case of failure.
- Pins 1 and 2 are open.
- Pins 3 and 2 are closed.

GO state

- The device is in GO state immediately after switching on and during normal operation without faults.
- Pins 1 and 2 are closed.
- Pins 3 and 2 are open.

Note the following:

- The equipment connected to the low voltage inputs and outputs must have safe separation from dangerous voltages according to DIN EN 61140 such as by double or reinforced insulation according to DIN EN 60730-1 or DIN 60950-1.
- Only use shielded connection cables; connect the shield to the connector case. Cover unused plug connections with protective caps.

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 liquids.
- 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	Mono ethylene 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 reduces during long operating with higher temperatures and the mixture becomes flammable (flame 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 the corrosive properties. Ultra-pure water and distillates are suitable as 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 Filling device with heat transfer liquid

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 plug. For this, turn the plug clockwise as far as the stop.
2. Attach a suitable hose to the overflow connection of the device.

The permitted hose diameter for the overflow must be complied with. Further information about the suitable hose diameter can be found in the technical data ↳ *Chapter 11.3 'Hydraulic circuit' on page 62*.

3. Insert this hose into a suitable canister to collect overflowing heat transfer liquid.

   Running dry of the consumer can also occur in a closed temperature control circuit with consumer at a higher level in the case of stopped pump and ingress of air into the temperature control circuit (for example, a not completely closed or defective bleed valve). Match the size of the overflow container to this if possible.

4. Carefully pull up the cover of the filler nozzle; do not turn.
5. Fill the heat transfer liquid into the filler nozzle carefully. Monitor the level indicator. Fill the device up to the maximum fill level.

   If necessary, use a funnel for the filling.

   The level indicator must not be above the maximum fill level.

6. Press the cover carefully into the filler nozzle.

5.3 Establishing power supply

Personnel: ■ Operating personnel

NOTICE!
Use of unauthorised mains voltage or mains frequency

Device damage

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

Also note the following:

- The mains plug of the device provides a mains power disconnection component. The mains plug must be easily recognisable and easily accessible.
- Only connect the device to an earthed (PE) power socket.

5.4 Switching on the device

WARNING!
Overheating of the pump

Device damage

- Never operate device without heat transfer liquid.

Personnel: ■ Operating personnel

1. Switch on the device using the mains power switch.
   ▶ A signal tone sounds. The actual temperature is shown on the display. The pump is started. The refrigeration unit is started after approx. 2 minutes. The blue LED lights if the refrigeration unit is active.
2. Depending on the size of the consumer, heat transfer liquid must be refilled if necessary. Monitor the level indicator for this.

Further information about refilling heat transfer liquid can be found in *Chapter 5.5 'Refilling heat transfer liquid' on page 35*.

5.5 Refilling heat transfer liquid

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.

1. Check whether the drain plug is closed.

   The drain plug is closed if it is turned clockwise as far as the stop.

2. Carefully pull up the cover of the filler nozzle; do not turn.
3. Fill the heat transfer liquid into the filler nozzle carefully. Monitor the level indicator.

   If necessary, use a funnel for the filling.

   The level indicator must not be above the maximum fill level.

   The level indicator must be above the minimum level. Otherwise a warning is output and the device is switched off with an alarm after approx. 5 minutes.

4. Press the cover carefully into the filler nozzle.

5.6 Setting pump pressure

For devices with bypass (starting from MC 600), 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, impact, cutting

- A bypass regulator is provided to set the pump pressure (starting from MC 600).
- 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 outlet 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 Switching on the device

WARNING!
Overheating of the pump

Device damage

- Never operate device without heat transfer liquid.

Personnel: ■ Operating personnel

1. Switch on the device using the mains power switch.
   ► A signal tone sounds. The actual temperature is shown on the display. The pump is started. The refrigeration unit is started after approx. 2 minutes. The blue LED lights if the refrigeration unit is active.
2. Depending on the size of the consumer, heat transfer liquid must be refilled if necessary. Monitor the level indicator for this.

Further information about refilling heat transfer liquid can be found in ↳ *Chapter 5.5 'Refilling heat transfer liquid' on page 35*.

6.2 Default display and menu items

1. Press the ENTER button to reach the menu items from the default display of the actual temperature.

If no button has been pressed for longer than 4 seconds, you exit from the menu item or input window.

2. Scroll from menu item to menu item using the arrow buttons.
3. Press the ENTER button at the selected menu item.
   ► The display flashes.
4. The value or the setting can be changed using the arrow buttons.
5. The changed value or setting is applied immediately by pressing the ENTER button.

If no button has been pressed for longer than 4 seconds, changed values or settings are applied automatically and you exit from the menu item or input window.

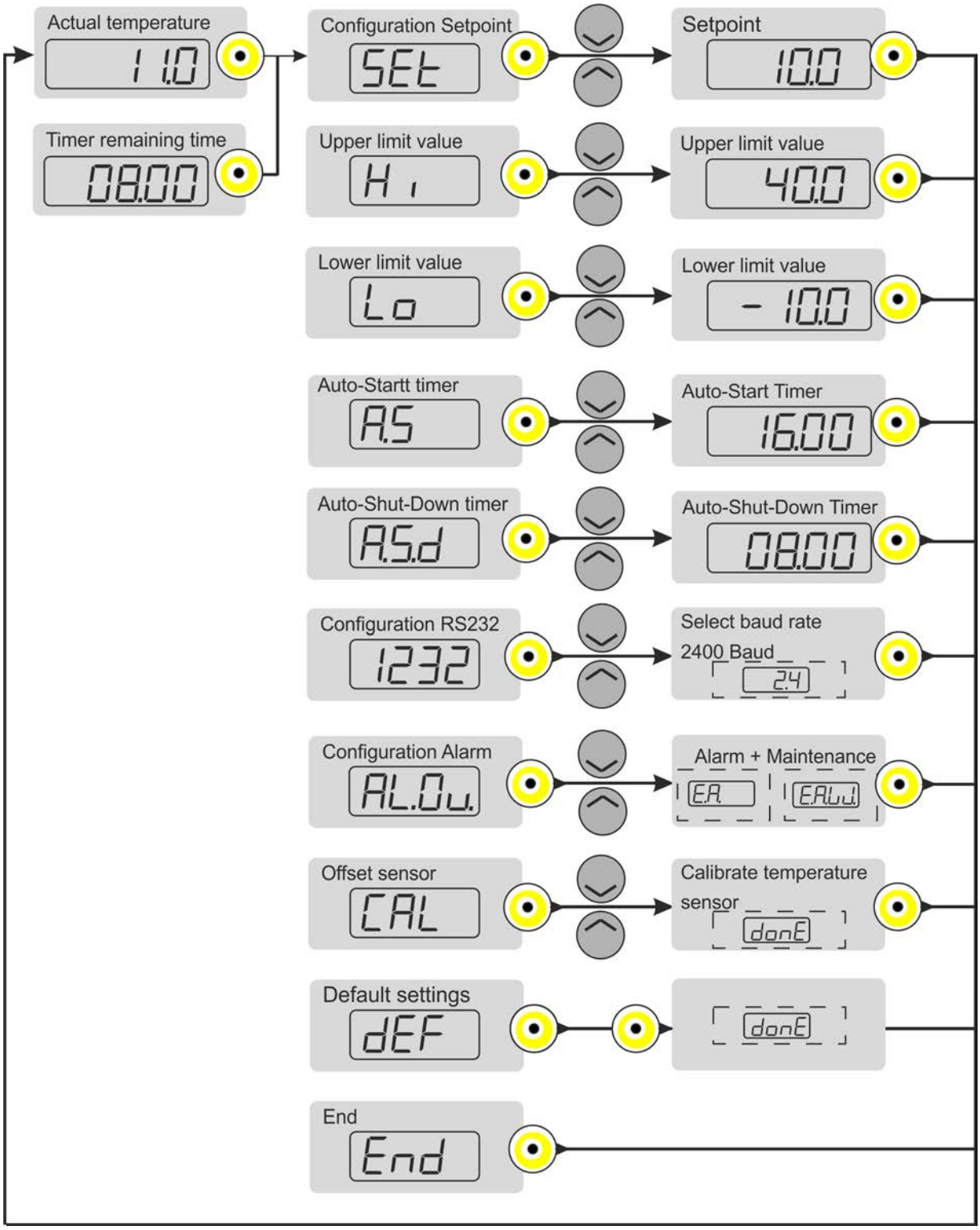

Actual temperature
11.0
Timer remaining time
08.00
Configuration Setpoint
SEt
Setpoint
10.0
Upper limit value
H i
Upper limit value
40.0
Lower limit value
Lo
Lower limit value
- 10.0
Auto-Startt timer
A.S
Auto-Start Timer
16.00
Auto-Shut-Down timer
A.S.d
Auto-Shut-Down Timer
08.00
Configuration RS232
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. 12: Menu

6.3 Screen displays

Default display

Fig. 13: Default display

The default display is the indication shown in the screen if no other operations such as configuring settings are being performed. The actual temperature of the machine is shown in the default display.

Menu

The machine menu with possible settings can be invoked using the ENTER button.

Further information about the menu structure and the menu navigation can be found in ↳ *Chapter 6.2 'Default display and menu items' on page 38*.

Editing display

The display flashes when a menu item in the screen has been selected. The setting can now be made. The value entered is applied when the setting is confirmed.

6.4 Specifying the setpoint temperature

Relationship between temperature setpoint and temperature limit values

You specify a setpoint for the temperature control. This value specifies to which temperature the heat transfer liquid will be cooled. The upper and lower temperature limit values of the device have been set to the default values 45.0 °C and 5.0 °C. The temperature limits define the temperature range of your application, i.e. in which range any temperature control can take place. A warning is output by the device if the temperature is outside the limits. This range is necessary so that no unnecessary warnings are output during transient conditions of the temperature regulation. The default values can be limited subsequently depending on the heat transfer liquid.

For operation of the device with Aqua 90, the temperature setpoint must not be set smaller than 5 °C. Also use the lower temperature limit value *Lo* ↳ *'Lower temperature limit value' on page 42* and set this to 3 °C so that a warning is output for lower temperatures.

The yellow LED on the device lights if any temperature setpoint or actual temperature is less than 5 °C. It warns about incorrect use of the heat transfer liquid and consequential damage to the device.

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

Fig. 14: Setpoint input

Personnel: ■ Operating personnel

1. Select the menu item for specifying the temperature setpoint.
2. Specify the setpoint.

   If the entered setpoint is outside the specified temperature limit values, the value cannot be adopted. Editing mode is active. An audible signal is also output. You can input the setpoint again.

3. Confirm with the ENTER button.

6.5 Restricting temperature limit values

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

Practical temperature limit values are:

Aqua 90	- Set the range to the values 42 °C and 3 ℃.
Kryo 30 (water / glycol)	- Set the range to the values 42 °C and -12 ℃.

By adjusting the temperature limit values, the configurable setpoint range is automatically limited to as 2 °C below the upper temperature limit and 2 °C above the lower temperature limit.

Upper temperature limit value

Fig. 15: Upper limit value

Personnel: ■ Operating personnel

1. Select the menu item for the upper temperature limit value.
2. Confirm with the ENTER button.
3. Specify the upper limit value.

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

4. Confirm with the ENTER button.

Lower temperature limit value

Fig. 16: Lower limit

Personnel: ■ Operating personnel

1. Select the menu item for the lower temperature limit value.
2. Confirm with the ENTER button.
3. Specify the lower limit value.

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

4. Confirm with the ENTER button.

6.6 Configuring timer

The integrated timer can be used for switching the device on and off automatically. The timer can be viewed and configured during normal operation of the device.

Special features of the timer

- The timer is configured using a number of hours and minutes in the format hh.mm. The first two digits represent the number of hours and the last two are the minutes. The timer can be set to a maximum of 99 hours and 59 minutes.
- The timer is only active while the machine is switched on. If the machine is switched off using the mains power switch during the running time of the timer, the timer is reset.

Functions for automatic switching off - Auto-Shut-Down

- If Auto-Shut-Down of the timer is active, the current actual temperature on the display is shown with a flashing decimal point.
- If Auto-Shut-Down is invoked using the corresponding menu item, the remaining time, for example *05.30*, is shown flashing. If Auto-Shut-Down is deactivated, *00.00* is shown flashing.
- Once the time for Auto-Shut-Down has elapsed, the device is not switched off completely but switched to standby. Standby means all components of the device are switched off and only the display of the device is still supplied with power.

Functions for automatic switching on - Auto-Start

- If Auto-Start of the timer is configured, the device switches to standby and Auto-Start is active immediately. If any Auto-Shut-Down is active, the Auto-Start is not active until after completion of the Auto-Shut-Down.
- If Auto-Start is active, the remaining time until the automatic start is shown on the display. An audible signal is also output during the complete last minute before starting the device.

Configuring Auto-Shut-Down

Fig. 17: Auto-Shut-Down

1. Select the menu item for specifying the Auto-Shut-Down.
2. Confirm with the ENTER button.
3. Specify the time until the device should be switched to standby.

   Wait for approx. 4 seconds if you would not like to apply the specified value. The screen automatically returns to the default display.

4. Confirm with the ENTER button.

   The value must be confirmed within 4 seconds after the last input. Otherwise the screen returns to the default display.

   ▶ The device will be switched to standby after the time entered. This is shown on the display as follows.

Fig. 18: Standby

5. Auto-Start can now be configured before the expiry of Auto-Shut-Down to switch the device on again afterwards after a specified time. Otherwise you can start the device manually by pressing the ENTER button.

Configuring Auto-Start

CAUTION!
Automatic device start using the auto-start timer

Frostbite, risk of injury, device damage

- Before using the auto-start timer, ensure that all preparations for the intended use have been made.

Fig. 19: Auto-Start

1. Select the menu item for specifying the Auto-Start.
2. Confirm with the ENTER button.
3. Specify the time until the device should be switched on again.

   If no Auto-Shut-Down is configured for the device, the device is switched directly into standby with the confirmation.

   Wait for approx. 4 seconds if you would not like to apply the specified value. The screen automatically returns to the default display.

4. Confirm with the ENTER button.

> The value must be confirmed within 4 seconds after the last input. Otherwise the screen returns to the default display.

Displaying and editing remaining time

1. Select the menu item for the Auto-Shut-Down or Auto-Start.
2. Confirm with the ENTER button.
   - ▶ The remaining time is displayed.
3. You have the following options:
   - Wait approx. 4 seconds if you only want to display the remaining time. The default display is shown again.
   - To edit the remaining time, set the time accordingly. Confirm with the ENTER button.

Reset

1. Select the menu item for the Auto-Shut-Down or Auto-Start.
2. Input 00.00.
3. Confirm with the ENTER button.

> The value must be confirmed within 4 seconds after the last input. Otherwise the screen returns to the default display.

Restart manually

If the device has been switched to standby using Auto-Shut-Down and no Auto-Start is configured, the device can be switched on again manually.

1. Press the ENTER button to switch the device on again.

> This function is only available if no Auto-Start is active.

6.7 RS232 interface

6.7.1 Configuring RS232 interface

The baud rate for the RS232 interface can be configured using the display.

Fig. 20: RS232 interface

Personnel: ■ Operating personnel

1. Select the menu item for configuration of the RS232 interface.
2. Select the appropriate baud rate.

   The following baud rates can be selected:

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

   The hundreds and thousands digits are not visible on the display.

3. Confirm with the ENTER button.

   Your input is applied automatically after approx. 4 seconds.

6.7.2 Protocol

RS232 protocol

Note the following:

- The interface operates with 1 stop bit, no parity bit and 8 data bits.
- Selectable transmission speed: 2400, 4800, 9600 (factory setting) or 19200 baud.
- The RS232 interface can be operated with or without hardware handshake (RTS/CTS).
- The command from the computer must be terminated with CR, CRLF or LFCR.

  CR = Carriage Return (hex: 0D); LF = Line Feed (hex: 0A)
- The response from the thermostat is always terminated with CRLF.

Example for setpoint transfer of 30.5 °C to the thermostat.

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

6.7.3 Write commands

The write commands are data specifications to the thermostat.

Command	Meaning
OUT_SP_00_XXX.XX	Setpoint transfer with max. 3 digits before the decimal point and max. 2 digits afterwards
OUT_SP_04_XXX	[Hi] Upper limit of flow temperature
OUT_SP_05_XXX	[Lo] Lower limit of flow temperature
START	Switches on device (from standby)
STOP	Switches device to standby (pump, refrigeration unit off).

Note the following:

- For "_", " " (space character) is also permitted.
- Response from the thermostat “OK” or “ERR_X” in the case of an error.

Permitted data formats

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

6.7.4 Read commands

The following read commands are data requests to the thermostat.

Command	Meaning
IN_PV_00	Query of the bath temperature (outlet temperature)
IN_SP_00	Query of the temperature setpoint
IN_SP_04	Query of the outlet temperature limit Hi
IN_SP_05	Query of the outlet temperature limit Lo
TYPE	Query of the device type (response = "MC").
VERSION	Query of the software version number

Command	Meaning
STATUS	Query of the device status, 0 = OK, -1 = fault
STAT	Query for the fault diagnosis, response: XXXXXXX; X = 0 no fault, X = 1 fault Character 1 = error Character 2 = not assigned Character 3 = not assigned Character 4 = not assigned Character 5 = low level Character 6 = not assigned Character 7 = not assigned

Note the following:

- For "_", " " (space character) is also permitted.
- Unless otherwise specified for the command, the reply is always in fixed decimal format "XXX.XX" or "-XXX.XX" for negative values or "ERR_X".

6.7.5 Error messages

The error messages of the modules are described in the following.

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

6.8 Configuring alarm output

In the case of an alarm or error, an electrical signal is output via the alarm output of the device as default. However, you can also configure that a signal will also be output in the case of a warning.

Personnel: ■ Operating personnel

Fig. 21: Alarm output

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

Fig. 22: Option error and alarm

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

Fig. 23: Option with additional warning

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

Wait for approx. 4 seconds if you would not like to apply the specified value. The screen automatically returns to the default display.

4. Confirm with the ENTER button.

The value must be confirmed within 4 seconds after the last input. Otherwise the screen returns to the default display.

6.9 Inputting offset of the temperature sensor

The calibration overwrites the factory calibration.

If any temperature difference is discovered when checking the device with a reference thermometer, the offset (additive part of the characteristic curve) of the internal measurement chain can be adjusted using the *CAL* menu item.

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

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

Personnel: ■ Operating personnel

Fig. 24: Calibrating temperature sensor

1. Select the menu item CAL.
2. Enter the temperature value read from the reference thermometer at the device.

3. Keep the ENTER button pressed for approx. 3 seconds afterwards.
   ▶ The display shows *donE*. The new value has been applied.

6.10 Restoring the factory settings

Execute this menu item if you would like to restore the factory settings stored 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 at the alarm output is reset to *alarms and faults*.
- The baud rate is reset to *9600 baud*.

Personnel: ■ Operating personnel

Fig. 25: Factory settings

1. Select the menu item (dEF) for restoring the factory settings.
2. Confirm with the ENTER button.
3. Keep the ENTER button pressed for approx. 3 seconds afterwards.
   ▶ The display shows *donE*. The factory settings have been restored.

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.

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
daily	Inspection of the drain plug by visual inspection from the outside
monthly	Inspection of the external hoses for material fatigue
	Cleaning of the condenser (only 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 the 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 cover by holding underneath with both hands and pulling the grating to the front. Remove the front cover slowly and carefully to prevent damage.
3. Brush off or vacuum the condenser.
4. Replace the front cover carefully.

7.5 Cleaning the water filter

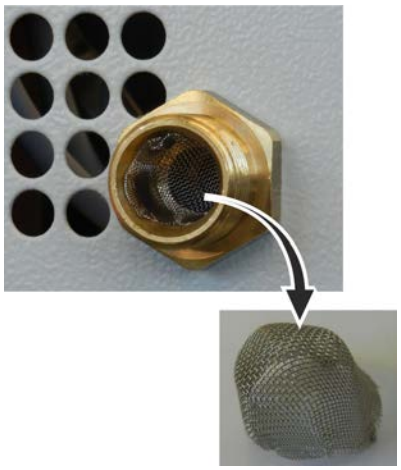


Fig. 26: Removing water filter

Personnel: ■ Operating personnel

1. Switch off the device using the mains power switch.
2. Undo the union nut at the supply of the water cooling.
3. Remove the cooling water hose with the hose nozzle from the threaded connection.
4. Remove the water filter from the threaded connection carefully.

> If necessary, use tweezers to remove / insert the water filter.

5. Clean the water filter and then put it back into the threaded connection.
6. Press the cooling water hose with the hose nozzle back onto the threaded connection of the supply. Carefully tighten the water hose using the union nut at the threaded connection.

7.6 Decalcification of the cooling water circuit

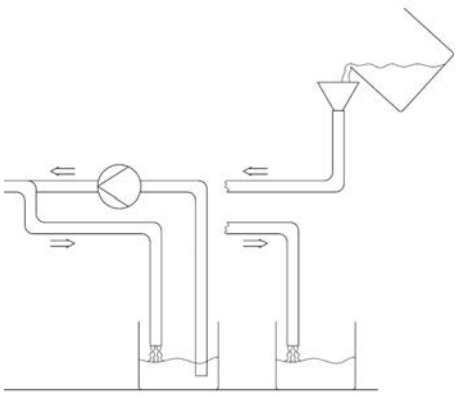


Fig. 27: Decalcification

Personnel: ■ Operating personnel

1. Switch off the device and prepare the decalcification process accordingly.

> The descaling agent should be fed to the water cooling using a pump or a funnel through the supply hose. The descaling agent return flow should be via flow hose of the water cooling into a container with sufficient capacity (at least 10 litres).

> LAUDA descaling agent (catalogue number LZB 126, 5 kg packaging) is required for decalcification. Read the safety instructions and the instructions for use on the packaging for handling the chemical.

2. Clean the water filter of the device. The water filter is in the supply of the water cooling.

> Further information for cleaning the water filter can be found in *Chapter 7.5 'Cleaning the water filter' on page 52*.

3. Fill the supply hose of the water cooling with LAUDA descaling agent (pump or funnel). Continuously refill or pump the descaling agent. Continue this process until the foaming reaction goes down. This is usually the case after approx. 20 to 30 minutes.

4. Drain the condenser afterwards.

Further information about draining the condenser can be found in .

5. Reconnect the device to the water supply and rinse it thoroughly.

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

7.7 Checking the heat transfer liquid

Soiled or degenerated 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 on the display as 7-segment text.

Procedure in the event of alarms

Alarms can be cancelled using the ENTER button after rectification of the cause of the fault.

A list of alarms can be found in *Chapter 8.2 'Alarms overview' on page 55*.

Procedure in the event of warnings

Warnings can be cancelled using the ENTER button after rectification of the cause of the fault.

A list of warnings can be found in *Chapter 8.3 'Warnings overview' on page 55*.

Procedure in the event of errors

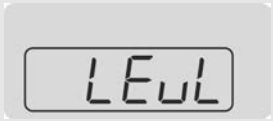
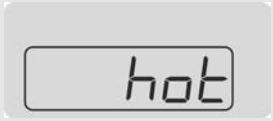
A two-tone signal is output if any error occurs. The red LED on the device also lights.

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 contact LAUDA Service Constant Temperature Equipment. Contact details can be found in *Chapter 12.3 'LAUDA contact' on page 63*.

Errors are symbolised with an *E* and a sequential three-digit number.

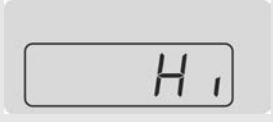
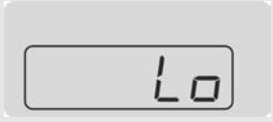
8.2 Alarms overview

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. The red LED on the device also lights.

Output on the display	Description
	In the event of a Low Level alarm, the fill level of the heat transfer liquid is below the minimum limit. The fault which caused this low fill level must be rectified to cancel the alarm. Heat transfer liquid must also be refilled. Warnings are output before the alarm is emitted. The alarm is output after approx. 5 minutes.
	The pump is blocked for any pump alarm. This can be caused by unacceptably high viscosity of the heat transfer liquid or by foreign bodies in the circuit.
	The temperature of the electronics is higher than 75 °C.

8.3 Warnings overview

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. You are therefore reminded in the event of an existing fault.

Indication on the display	Description
	In the event of a Low Level warning, the fill level of the heat transfer liquid is below the minimum limit. The fault which caused this low fill level must be rectified to cancel the warning. Heat transfer liquid must also be refilled. If this warning is ignored, a Low Level alarm will be output after approx. 5 minutes and the components of the device such as the pump will be switched off.
	The upper temperature limit has been exceeded for this warning. The device fault must be rectified to remove this warning.
	The lower temperature limit has been undercut for this warning. The device fault must be rectified to remove this warning.

Indication on the display	Description
	NTC sensor break
	NTC short circuit

9 Decommissioning

9.1 Draining the device

Personnel: ■ Operating personnel

WARNING!
Contact with cold heat transfer liquid

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 plug.

   The heat transfer liquid discharges directly from the device when the drain plug is opened.

4. Open the drain plug. Turn anticlockwise for this.

9.2 Draining condenser (only water-cooled devices)

Personnel: ■ Operating personnel

1. Bring the device to room temperature if required and switch off the device.
2. Unscrew the water hose from the supply nozzle of the device.
3. Remove the water filter from the threaded connection. Clean the water filter and then put it back into the threaded connection.

   Further information for cleaning the water filter can be found in *Chapter 7.5 'Cleaning the water filter' on page 52*.

4. Unscrew the water hose from the outlet nozzle of the device.
5. Place a bucket under the outlet nozzle to collect the discharging water.

6. Without switching on the device, blow compressed air through the supply nozzle into the device. Continue blowing compressed air through the device until all the water has flowed out of the device.

10 Disposal

10.1 Disposing of refrigerant

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

CAUTION!
Uncontrolled escape of refrigerant

Impact, cutting

- Do not dispose of any pressurised cooling circuit.
- The decommissioning is only permitted by a specialist.

Refrigerant	$GWP_{(100a)}$
R134a	1430

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

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

10.2 Device disposal

The device must be disposed of according to EC Directive 2002/96/EC.

10.3 Disposing of packaging

The packaging must be disposed of in accordance with EU 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.

Data	Value	Unit
Placement	Indoor areas	
Height above sea level	up to 2,000	m
Relative humidity	Highest relative humidity 80% at 31 °C and up to 40 °C decreasing linearly by up to 50%	
Ambient temperature range	5 ... 40	°C
IP degree of protection	IP 32	
Contamination level	2	
Clearance from surroundings (front and rear sides)	40	cm
Overvoltage	Overvoltage category II and transient surge voltages according to category II	
Protection class for electrical operating equipment DIN EN 61 140 (VDE 0140-1)	1	
Classification according to DIN 12 876-1 (class designation / identification)	I/NFL	
Display	7-segment, LED	
Display resolution	0,1	°C
Setting resolution	0,1	°C
Temperature constancy	±0,5	K
Storage temperature range	5 ... 40	°C

Data	Value	Unit
Transport temperature range	-20 ... 60	°C

	Operating temperature range	Dimensions (W x D x H)	Weight
	°C	mm	kg
MC 250	-10 ... 40	200 x 350 x 465	26
MC 600	-10 ... 40	350 x 480 x 595	51
MC 1200	-10 ... 40	450 x 550 x 650	64
MC 1200 W	-10 ... 40	450 x 550 x 650	64

11.2 Refrigeration unit

Cooling capacity

	Cooling capacity (20 °C)	Cooling capacity (10 °C)	Cooling capacity (0 °C)	Cooling capacity (-10 °C)	Refrigerant
	kW	kW	kW	kW	
MC 250	0.23	0.2	0.15	0.09	R134a
MC 600	0.6	0.5	0.36	0.15	R134a
MC 1200	1.15	1.05	0.75	0.4	R134a
MC 1200 W	1.15	1.05	0.75	0.4	R134a

The cooling capacity is measured for a specified temperature of the heat transfer liquid. Information is provided 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 Hydraulic circuit

	Fill capacity	Maximum flow	Maximum flow pressure	Pump connection	Drain tap	Overflow connection
	Litres	l/min (water 20 °C)	bar (water 20 °C)	(internal diameter in mm)		(internal diameter in mm)
MC 250	2 ... 4	16	0.35	Olive ½" (10)	G ½"	Olive ½" (10)
MC 600	4 ... 8	35	1.3	G ¾ (15), olive ¾"	G ½"	Olive 16 mm (12)
MC 1200	7 ... 14	35	1.3	G ¾ (15), olive ¾"	G ½"	Olive 16 mm (12)
MC 1200 W	7 ... 14	35	1.3	G ¾ (15), olive ¾"	G ½"	Olive 16 mm (12)

11.4 Voltage-dependent data

Power consumption

	MC 250	MC 600	MC 1200	MC 1200 W
	kW	kW	kW	kW
230 V; 50 Hz	0.23	0.7	1.15	1.2

Catalogue numbers

	MC 250	MC 600	MC 1200	MC 1200 W
230 V; 50 Hz	LWM 118	LWM 120	LWM 121	LWM 122
220 V; 60 Hz	LWM 218	LWM 220	LWM 221	LWM 222
115 V; 60 Hz	LWM 418	LWM 420	LWM 421	LWM 422
100 V; 50/60 Hz	LWM 618	LWM 620	LWM 621	LWM 622

12 General

12.1 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.

12.2 Technical changes

Technical details subject to change.

12.3 LAUDA contact

Contact LAUDA Service Constant Temperature Equipment in the following cases:

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

Contact our Sales Department for application-specific questions.

Contact details

LAUDA Service Constant Temperature Equipment

Telephone: +49 (0)9343 503 372

Fax: +49 (0)9343 503 283

E-Mail: service@lauda.de

12.4 EC conformity

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

- Machinery Directive 2006/42/EC
- EMC Directive 2004/108/EC

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

The device does not come under the Pressure Equipment Directive 97/23/EC as the device is classified in the area of Article 3.3. The requirements from the above mentioned Directives are thus sufficiently met for the pressure-relevant hazards of the device.

13 Index

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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