LAUDA

Operating instruction

ECOLINE ★ STAREDITION

Low-temperature thermostats
RE 304, RE 305, RE 306,
RE 307, RE 310, RE 312, RE 320

Valid from series 04-0001(see item 8.3)
08/05
from software version 2.2
YACE0065

Safety notes

Before operating the equipment please read carefully all the instructions and safety notes. If you have any questions please phone us!

Follow the instructions on setting up, operation etc. This is the only way to avoid incorrect operation of the equipment and to ensure full warranty protection.

- Transport the equipment with care!

- The unit may NEVER be overturned or put upside down!

- Equipment and its internal parts can be damaged:

  - By dropping

  - by shock.

- Equipment must only be operated by technically qualified personnel!

- Never operate the equipment without the bath liquid!

- Do not start up the equipment if

  - it is damaged or leaking

  - the supply cable is damaged

- Switch off the equipment and pull out the mains plug:

  - for servicing or repair

  - before moving the equipment!

- Drain the bath before moving the equipment!

- Have the equipment serviced or repaired by properly qualified personnel only!

The Operating Instructions include additional safety notes which are identified by a triangle with an exclamation mark. Carefully read the instructions and follow them accurately! Disregarding the instructions may have serious consequences, such as damage to the equipment, damage to property or injury to personnel!

We reserve the right to make technical alterations!

Safety notes

Table of contents

1 Safety notes

1.1 General safety notes

A laboratory thermostat is intended for heating and pumping liquids according to the needs of the user. This leads to hazards by high temperatures, fire, and the general hazards by the use of electrical energy.

The user is largely protected through the application of the appropriate standard specifications

Additional hazards may arise from the type of material being thermostated, e.g. when going above or below certain temperature levels or through breaking of the container and reaction with the thermostating liquid.
It is not possible to cover all possibilities; they remain largely within the responsibility and the judgement of the user

The unit must only be used as intended and as described in these Operating Instructions. This includes operation by suitably instructed qualified personnel.

The units are not designed for use under medical conditions according to EN 60601-1 or IEC 601-1 !

1.2 Other safety notes

- Connect the unit only to grounded mains power (PE).

- Parts of the bath cover may reach surface temperatures above 70 °C when operating at higher temperatures. Take care when touching it!

- Use suitable hoses ⇨ Section 6.3

- Protect tubing with hose clips against slipping off. Prevent kinking of tubing!

- Check tubing from time to time for possible material defects!

- Heat transfer tubing and other hot parts must not come into contact with the supply cable!

- When using the thermostat as circulation thermostat, failure of tubing may lead to leaking of hot liquid and become a danger to personnel and objects.

- When no external circuit is connected to the thermostat the pump outflow must be closed (use closing plugs) or linked to the return.

- Allow for expansion of the bath oil at elevated temperatures!

- Depending on the bath liquid used and the mode of operation it is possible for toxic vapours to be produced. Ensure appropriate ventilation!

- When changing the bath liquid from water to oil, for temperatures above 100 °C, carefully remove all traces of water, also from tubing and from the external consumer, otherwise → danger of burns through delayed boiling !

- Always pull out the mains plug before cleaning, maintenance or moving the thermostat!

- Repairs on the control unit and the refrigeration system must be carried out by properly qualified personnel only!

- Values for temperature control and indicating accuracy apply under normal conditions according to DIN 12876. High-frequency electromagnetic fields may under special conditions lead to unfavourable values. This does not affect the safety!

Explanation of signs:

Danger: This sign is used where there may be injury to personnel if a recommendation is not followed accurately or is disregarded.

Note: Here special attention is drawn to some aspect. May include reference to danger.

Reference: Refers to other information in different sections.

2 Brief operating instructions

> ⚠ These brief instructions shall give you the possibility to operate the unit quickly. For safe operation of the unit it is absolutely necessary to read carefully all the instructions and safety notes!

1. Assemble unit and add items as appropriate ⇨ Section 6.
   Take care of the hose tubing connections ⇨ Section 6.1. and6.4.

2. Fill the unit with corresponding liquid. (⇨ Section 6.3.). The units are designed for operation with non-flammable and flammable liquids to
   EN 61010-2-010. → Take care of the level of the bath liquid! (⇨ Section 6.2.)

3. Connect the unit only to a socket with a protective earth (PE) connection.
   Compare the information on the rating label with the supply details.

4. Using a screwdriver, set the over temperature cut-out point to a value clearly above ambient temperature ⇨ Section 7.5.1
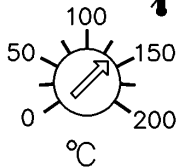
5. Switch on at the mains switch

6. The function "Manual Start" (display **STArt**) is activated. To start the unit and enter the basic menu, press the key .

7. Setting of the functions
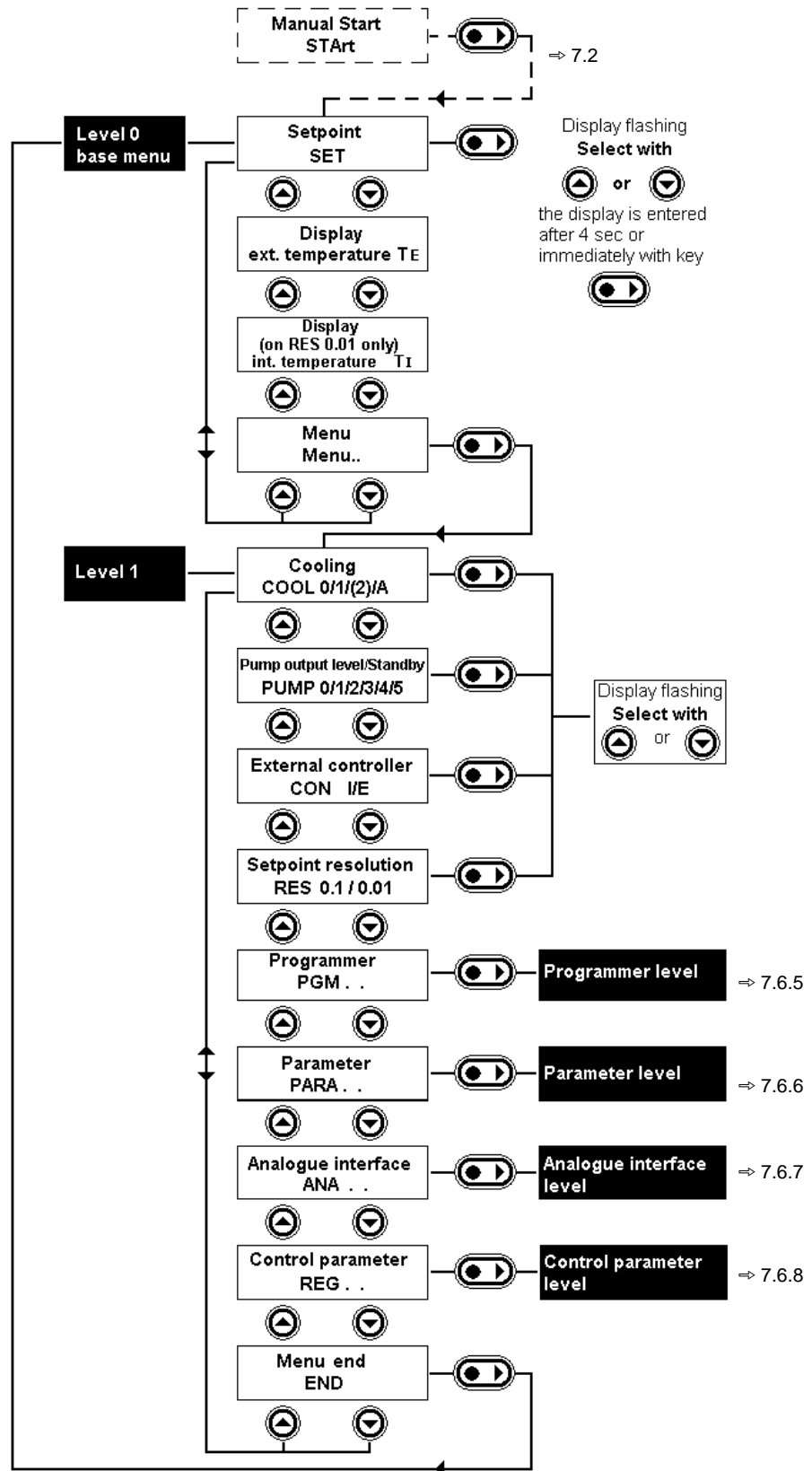
The Parameter menu includes a default function ⇨ Section 7.6.6.8 which produces a basic adjustment of nearly all functions and permits basic operation with internal control.

3 Control and functional elements

Cooling

LED green, Supply ON

Menu functions

Pump connections:
– return to bath
– pump outflow, pressure outlet
 (⇒ labeling housing)

Bath bridge

Setting of the overtemperature
switch-off point

Mains switch

Bath cover

Analogue Input/ Output 66S

Pt 100 ext. 10S

Alarm contact 31N

RS 232/ 485 65S
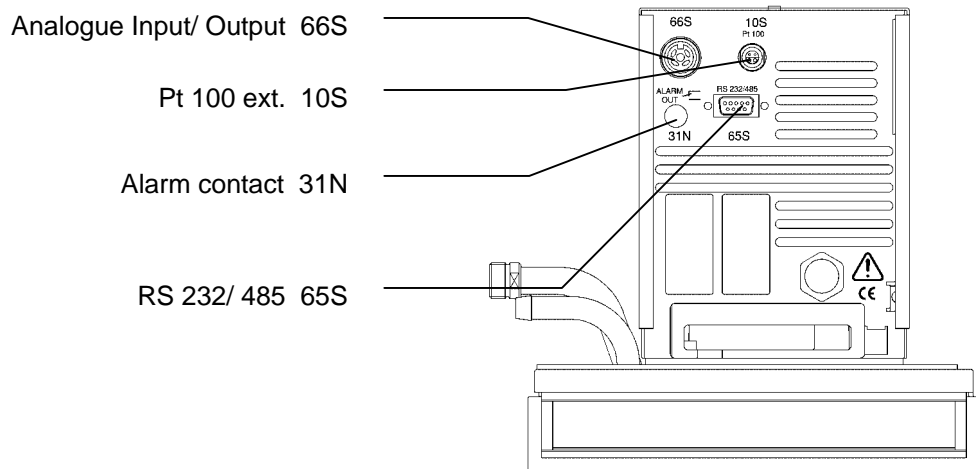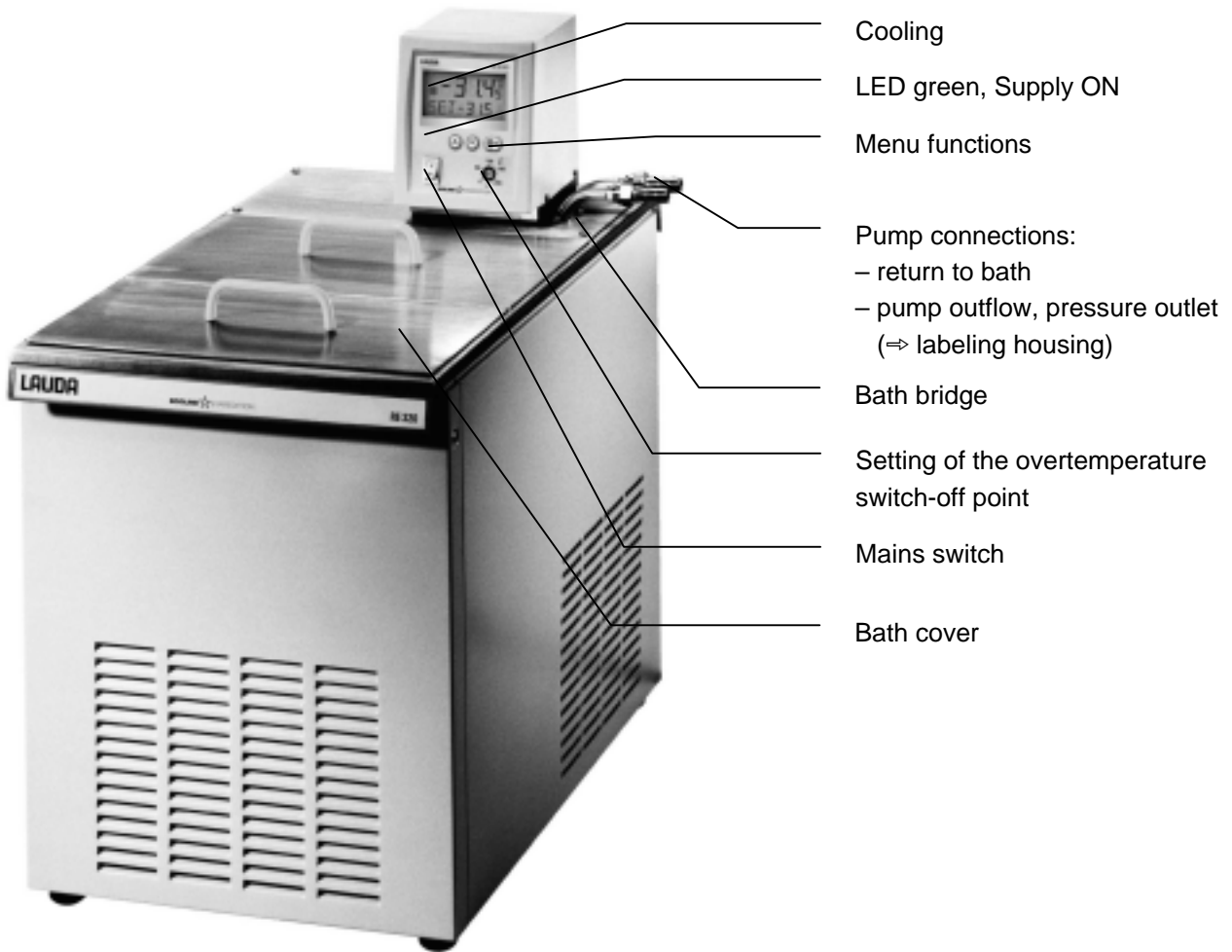
4 Unit description

4.1 Environmental conditions

The operation of the thermostats is only allowed under the following conditions as specified in EN 61010-2-010:2003 and EN 61010-1:2001:

– Indoor use.

– Altitude up to 2000 m above sea level.

– Foundation must be dense, even, non-slippery and non-flammable.

– Keep clear distance (⇨ Section 6.1 Assembly and setting up).

– Ambient temperature range (⇨ Section 9 Technical Data (according to DIN 12876)).
  Use only within this range for an undisturbed operation.

– Mains supply voltage fluctuations (⇨ Section 9 Technical Data (according to DIN 12876)).

– Maximum relative humidity 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C.

– Transient over voltage according to Installation Categories (Over voltage Categories) II

– Pollution degree: 2.

4.2 Unit types

The type designation of the Ecoline low-temperature thermostats consists of the letter R (identification as low-temperature unit), the control unit E 300, and the type of bath and refrigeration system.

Example: Control unit E 300 and bath RE 007 produces Thermostat Type RE 307.

4.3 Baths

All units provide a stainless steel bath. The last two digits of the model no. correspond to the approximate total volume in Litre (e.g. bath RE 306 = approx. 6 Litre).

Part of this volume may be used to insert objects.

Exception!

Model no. RE 305 was especially optimised for tempering external vessels and therefore does not provide any usable bath volume for inserting objects.

4.4 Pump

All units are equipped with a pressure pump with vario drive. The pump has an outflow which is connected with the pump outlet nipple. An additional outflow provides circulation inside the bath. By turning the flow setting knob it is possible to choose between both outlets or to divide the flows.

The pump can be used up to viscosities of 150 mm²/s; however, to get an optimum accuracy of control a viscosity of < 30 mm²/s is recommended.

One of five pump output steps can be selected using the operating menu.
On small low-temperature thermostats (e.g. RE 306) and with operation as bath thermostat it is advisable to use output step 1 to 3.

When operating as circulation thermostat with an external circuit it is preferable to use a larger flow rate in order to ensure a small temperature difference, especially at higher temperatures and in conjunction with oil as the bath liquid.

The pump connections of Types RE 3xx are fitted with M 16x1 nipples.

The pump connection outflow can be closed off without causing any damage to the pump.

Pump characteristics (⇨ Section 9 Technical data)

4.5 Materials

All parts which come into contact with the bath liquid are made from high-grade materials appropriate to the operating temperature. These are rust-free stainless steel, PPS plastics and fluoride rubber.

4.6 Temperature indication, control and safety circuit

The units are provided with a 2-line back-lit LC display to indicate the measurements and settings as well as the operational status. The set point and other settings are selected under menu guidance using two or three keys.

A Pt 100 temperature probe senses the outflow temperature inside the bath. The measurement is processed by a high-resolution AD converter. Further processing involves a special control algorithm to operate the heating triac (with reduced reaction on the mains supply) and the automatic compressor control.

An external Pt 100 for sensing an external temperature can be connected to a socket (10S). This value can be indicated and used (if required) as controlling variable when the external controller (cascade control) is activated. The system is then controlled from the external measurement and not from the outflow temperature.

The safety system conforms to EN 61010-2-010. A double-channel system is employed with the two micro controllers checking each other. There is a low-level alarm and a second bath temperature probe (Pt 100) used in the safety circuit to switch off in case of over temperature and for checking the measuring/control probe.

The over temperature switch-off point is adjusted with a screwdriver (tool) on the control head. The setting is also automatically indicated on the display.

With low liquid level, over temperature and certain system faults the heating is switched off on all poles. The pump and refrigeration compressor are also switched off.
This fault shut-down is permanent, i.e. the blockage is stored in the memory and has to be reset by operating the key after the fault has been rectified. The fault blockage is retained after the mains supply is switched off.

Other instrument functions are described in the appropriate Sections and in Section 7 Starting up

4.7 Programmer

The unit is provided with a programmer function which permits storage of 5 temperature-time programmes. Each programme consists of several temperature-time segments. In addition there is the information of the number of times the programme has to run. The total number of all the segments of all programmes must not exceed 150.

4.8 Interfaces

Connectors for fault (alarm) contact output, analogue inputs and outputs, external Pt 100 and serial RS232/RS485 interfaces are located on the back of the control head.

For further description of the interfaces see under Section 7.7 and 7 Starting up.

4.9   Refrigeration system

The refrigeration system consists essentially of a hermetically sealed compressor. Heat of condensation and motor heat are dissipated by a fan-cooled finned condenser. Fresh air is drawn in at the front of the unit, warmed air is discharged at the back and to the sides. The ventilation openings must not be restricted in order to ensure proper air circulation.

At working temperatures below approx. 30 °C the refrigeration system operates continuously to remove a certain amount of heat, with the heater acting in opposition to provide automatically controlled heating power.

The compressors are fitted with a temperature monitor which responds both to the compressor temperature and to the motor current. In addition the cooling system is protected against excessive pressure by a pressure monitor. The refrigeration unit is switched on either automatically or manually through the operating menu (⇨ Section 7.6.1.).

Types RE 307, RE 310, RE 312 and RE 320 are additionally provided with a cooling capacity adjustment which saves energy in many operating situations, reduces the load on the refrigeration system and produces a better temperature control. This feature, too, can be operated either automatically or manually.

When the fault circuit operates the refrigeration unit is also switched off..

Cooling curves (⇨ Section 9 Technical data)

5   Unpacking

After the unit and accessories have been unpacked they have to be examined for possible transport damage. If there is any damage visible on the unit, the forwarding agent or the post office has to be notified so that the shipment can be examined.

Standard accessories:

Article-number	Quantity	Designation	
LDSM 2002	1	WinTherm Plus	CD-Rom with PC-Software
HDQ 084	1	Bath cover RE004	only at RE 304
HDQ 086	1	Bath cover RE012	at RE 305, RE 310 and at RE 312
HDQ 085	1	Bath cover FBC 020	at RE 306 and at RE 307
HDQ 082 HDQ 083	1 1	Bath cover E012 Bath cover E020	only at RE 320
HKO 026 HKM 032	2 2	2x 13 mm diameter nipple 2x union nuts (M16x1)	
HKN 065	2	Closing plugs	
EZB 260	1	Warning label ⚠	
YACE 0065	1	Operating instruction	

6   Preparations

6.1   Assembly and setting up

−   Place the unit on a flat surface.
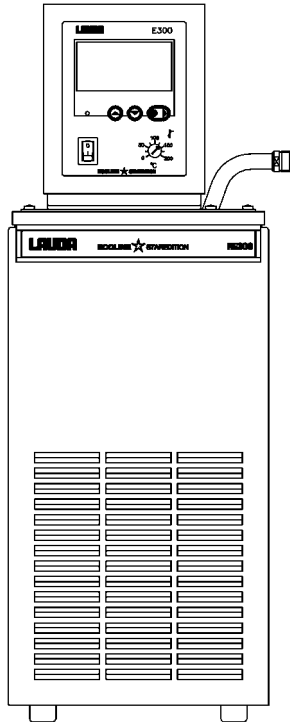
☞   −   The unit may NEVER be overturned or put upside down!

−   After transport and before starting up, store it standing in upright position for two hours if possible.

−   Do not cover the ventilation openings at the back of the unit and its lower part.

−   Keep clear distance of at least 40cm.

−   Adjust the flow setting knob so that when using the unit as bath thermostat (no external circulation) the flow emerges at the opening for the bath circulation (see fig. 3), or link together the pump connections.

Operation with external circuit (circulation thermostat) (⇨Section 6.4.)

Adjustments of the pump outflows (⇨Section 6.4)
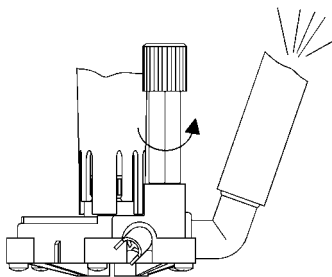
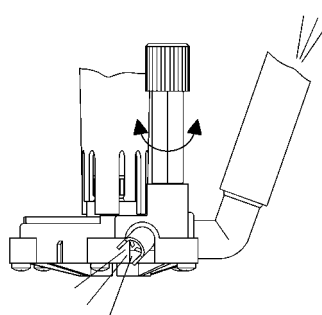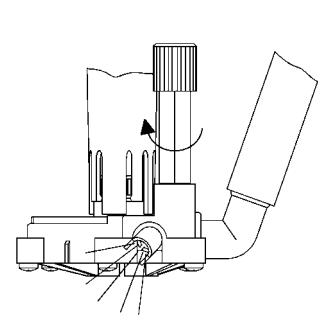| Fig. 1	Fig. 2	Fig. 3.
Flow setting knob turned anticlockwise	Flow setting knob medium position	Flow setting knob turned clockwise

−   When operating as bath thermostat without external circuit the pump connection outflow has to be closed (use closing plugs) or linked to the return.

−   At bath temperatures above 70°C the label supplied must be affixed on the bath in a clearly visible position!

☞
- The unit can be operated safely up to an ambient temperature of 40°C.

- Depending on the loading of the refrigeration system it may switch off temporarily especially at ambient temperatures above 35°C. Elevated ambient temperatures also result in reduced cooling capacity.

- When starting up the refrigeration system after it has been out of operation for longer time it may take up to 30 min, depending on ambient temperature and unit type, before the nominal cooling capacity is reached.

6.2   Filling and emptying

<u>Filling</u>
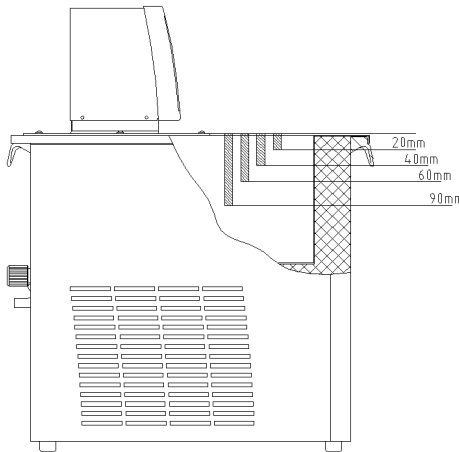
- Close the drain cock.

- Fill bath up to a maximum level of 20 mm below the bath bridge.

- Optimum operation at 20-40 mm below the bath bridge.

- Operation is possible down to 60 mm below the bath bridge.

- The low-level cut-out operates approx. 90 mm below the bath bridge!!!

☞
- When using thermal oils it is necessary to allow for an expansion of approx. 8 %/100 C.

- When operating with an external circuit the total expansion takes place in the bath.

<u>Emptying</u>
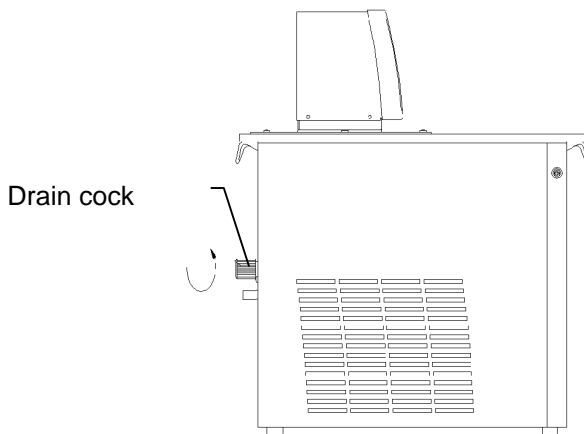
- Switch off the thermostat, pull out the mains plug!

- Drain the bath liquid through the drain cock → using tubing.

Drain cock

☞   –   The units are designed for operation with non-flammable and flammable liquids to EN 61010-2-010! Flammable liquids can be operated up to no more than 25°C below the fire point
(⇨ Section 6.3.).

         –   Observe the appropriate regulation when disposing of used thermostating liquid..

         –   When connecting an external circuit take care that the level of the bath liquid does not decrease too much → top up bath liquid if necessary

⚠	Do not drain the thermostating liquid when it is hot or very cold (below 0°C)!!

6.3 Bath liquids and hose connections

<u>**Bath liquids**</u>

LAUDA Designation	Working temperature range	Chemical Designation	Visco-sity (kin)	Viscosity (kin) at Temperature	Fire-point	Ref. No. Quantity		
	Former designation	from °C to °C		mm²/s at 20°C	mm²/s		5 l	10 l	20 l
Aqua 90 ①	water ①	+5...+90	deionised water	1	--	--	LZB 120	LZB 220	LZB 320
Kryo 30 ②	G 100 ②	-30...+90	Mono-ethylene-glycol/water	4	50 bei -25°C	--	LZB 109	LZB 209	LZB 309
Kryo 51	---	-50...+120	Silicone oil	5	34 bei -50°C	> 160	LZB 121	LZB 221	LZB 321
Kryo 20	160 MS	-20...+180	Silicone oil	11	28 bei -20°C	> 230	LZB 116	LZB 216	LZB 316
Ultra 350 ③	330 SCB ③	+30...+200	synthetic thermal oil	47	28 bei +30°C	> 240	LZB 107	LZB 207	LZB 307
Therm 200	RDS 50	+60...+200	Silicone oil	44	28 ... +60°C	> 362	LZB 117	LZB 217	LZB 317

☞ ① At higher temperatures → Evaporation losses → Use bath covers (⇨ Section 10. Accessories). Distilled water or fully deionised water must only be used with the addition of 0.1g sodium carbonate (Na_2CO_3) /l water, otherwise→ danger of corrosion!

② Water content falls after prolonged operation at higher temperatures → mixture becomes flammable (flash point 128 °C) → Check the mixture ratio with a densimeter.

③ Do not use in conjunction with EPDM tubing!

– When selecting bath liquids it should be noted that performance must be expected to worsen at the lower limit of the operating temperature range due to increasing viscosity. The full operating range should only be utilised if really necessary.

– The operating ranges of the bath liquids and tubing represent general data which may be limited by the operating temperature range of the unit.

⚠ Silicone oil causes pronounced swelling of Silicone rubber → never use Silicone oil with Silicone tubing!

DIN Safety data sheets are available on request!

LAUDA

Hose connections

a) Elastomer tubing

Tubing type	Int. dia. Ø mm	Temperature range °C	Application	Ref. No.
EPDM-tubing, non-insulated	9	+10...+120	for all bath liquids except for Ultra 350 and mineral oils	**RKJ 111**
EPDM-tubing, non-insulated	12	+10...+120	for all bath liquids except for Ultra 350 and mineral oils	**RKJ 112**
EPDM-tubing insulated	12 ext. dia. 35mm approx	-60...+120	for all bath liquids except for Ultra 350 and mineral oils	**LZS 021**
Silicone tubing, non-insulated	11	+10...+100	water, water/glycol mixture	**RKJ 059**
Silicone tubing, insulated	11 ext. dia. 35mm approx.	-60...+100	water, water/glycol mixture	**LZS 007**
Viton	11	+10...+200	for all bath liquids	**RKJ 091**
Viton insulated	8,5 ext. dia. 30mm approx.	-60...+150	for all bath liquids	**LZS 017**
Viton insulated	11 ext. dia. 32mm approx.	-60...+150	for all bath liquids	**LZS 018**

⚠ − EPDM-tube, not for Ultra 350 and not for mineral oils!

− Silicone oil causes pronounced swelling of Silicone rubber → never use Silicone oil with Silicone tubing!

− Protect tubing with hose clips against slipping off.

b) Metal hoses for Types RE 3xx, rust-free stainless steel, with M 16 x 1 union nut, 10 mm int. diameter

| Type	Length (cm)	Temperature range °C	Notes	Ref. No.
MC 50	50	+10...400	With single insulation for all bath liquids	**LZM 040**
MC 100	100	+10...+400	"	**LZM 041**
MC 150	150	+10...+400	"	**LZM 042**
MC 200	200	+10...+400	"	**LZM 043**
Pump connection link	20	+10...+400	"	**LZM 044**
MK 50	50	-90...+200	with foam insulation for low temperatures for all bath liquids	**LZM 052**
MK 100	100	-90...+200	"	**LZM 053**
MK 150	150	-90...+200	"	**LZM 054**
MK 200	200	-90...+200	"	**LZM 055**
Pump connection link	20	-90...+200	"	**LZM 045**

6.4   Connection of external circuits

Operation as circulation thermostat
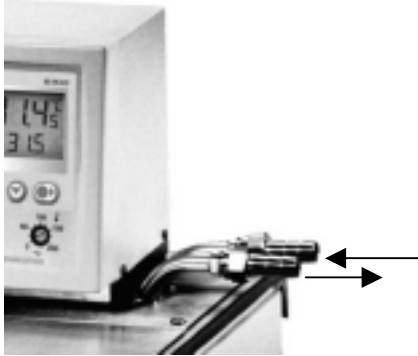
– When used as circulation thermostat, care for shortest hose connections with largest inner diameter as possible. This gives the best flow.

– Connect the metal hoses (⇒ Section 6.3.) to the pump connector.

– Pump connection:
  – return to bath
  – Pump outflow, pressure outlet
    (⇒ Labelling Housing)

☞ – If the cross-section of the tubing is too small → temperature drop between bath and external system due to low flow rate. Increase the bath temperature appropriately.

– Always ensure the maximum possible flow cross-section in the external circuit!

– When tightening the union nut hold on to the pump nipple with a SW 14 spanner (see fig.)!

– When external control is to be used, provide Pt 100 probe in external circuit. (⇒ Section 7.5.2 and 7.6.3)

SW14 —   — SW19
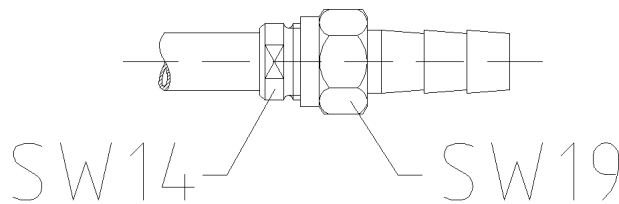
⚠ – When the external circuit is placed at higher level than the thermostat and the pump is stopped and air penetrates into the thermostating circuit the external liquid may drain down into the bath even with a closed system → danger of flooding the thermostat!

– Protect tubing with hose clips against slipping off!

– When no external circuit is connected to the thermostat, the pump connection outflow must be closed (use closing plugs) or linked to the return!
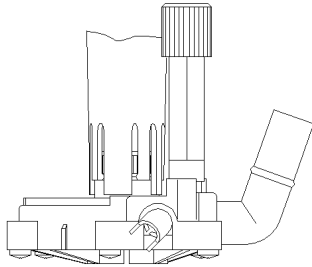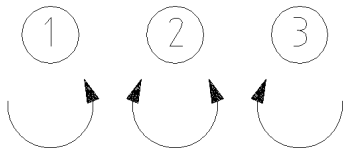
- Using the flow setting knob at the pump outflows, divide up the pump flow in accordance to the thermostating task (⇒ Section 6.1)

- Position ① → maximum flow in the external circuit (flow setting knob turned anticlockwise).

- Position ②→ flow passes through pump outflow and outlet for bath circulation (flow setting knob in medium position).

- Position ③ → external circuit is closed and the outlet for bath circulation fully open (flow setting knob turned clockwise).

⚠	– Operate the flow setting knob only when the bath contents are near the ambient temperature. – When no tubing is connected, close the pump connection with closing plugs even in position ③.

7 Starting up

7.1 Connection to the supply

Compare the supply voltage against the data on the rating label.

Model according to EMC directive EN 61326-1 Class B. *

⚠️	− Connect the unit only to a grounded mains power socket (PE).
	− No warranty when the thermostat is connected to a wrong supply!
	− Please make sure that your mains plug is equipped with at least the following safety fuses.
	Power supply Fuse protection
	    230V 16A
	    208V 15A
	    115V 15A
	− The start current of the refrigerating machine may exceed those currents distinctly for a short time.
	− Without external circuit ensure that the pump pressure outflow is closed or linked to the pump return.
	− Ensure that the unit is filled in accordance with Section 6.2 !

7.2 Switching on
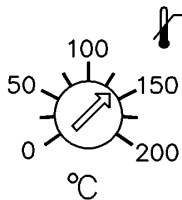
− Using a screwdriver, set the over temperature switch-off point to a value clearly above ambient temperature.

− Switch on at the mains switch.
The green LED for "Supply ON" lights up.

− A tone sounds for approx. 0,25 sec

0,25 sec
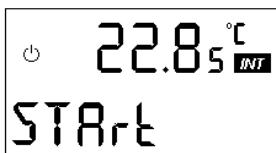
− The unit self-test starts up. All display segments and symbols light up for approx. 1 sec. Then the software version (VER x.x) is indicated for approx. 1 sec

− The display only appears if function "Manual Start" is activated which means that every time the unit was

OFFline, it has to be started with the key ⬤▷
(⇒ Section 7.6.6.2)
In case "Autostart" is activated, the following display is shown immediately after unit has been switched ON.
Attention: If the key pad is locked (KEY-function) the KEY-function must be switched OFF first.
(⇒Section 7.3.2)

* Notice only valid for EU countries!

LAUDA

22.8s °C

SET 79.7

– Display shows the actual bath temperature (above) (resolution 0,05 °) and the set point. The pump starts up. The values which were active before switching off are used.

☞
– If necessary add more bath liquid to replace the amount pumped out to the external circuit.

– If the pump does not purge the system immediately, the unit may switch off again although it is filled sufficiently (only when starting up for the first time).

– A double signal tone sounds.

22.8 °C

LEVEL ⚠

– The display for **LEVEL** (low-level) appears.

– The fault triangle is flashing.

– Press the key. If necessary repeat several times.

– Also press the key if the unit had switched off under a fault condition.

7.3 Key functions

7.3.1 General

– Change to the next level, also marked by two dots behind the symbol.

– Activates input, display is flashing.

or
– Scroll with keys within the particular level.

– or setting numerical values.

22.8s °C

SET 69.8
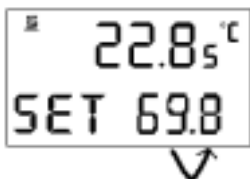
– Accelerated input through:

   a) holding down the keys, **or**

   b) pressing and holding down one of the two keys and immediately afterwards pressing the other key briefly.

– Briefly (1 sec) releasing the key(s) and again pressing one of the keys moves one **digit to the right**.

– **In principle:** after the setting has been completed it is entered automatically after approx. 4 sec **or**

– immediate entry of the setting with key.

7.3.2   Key inhibit (KEY)

− Key operation can be inhibited with the **KEY** function in order to prevent unauthorised alterations of the thermostat settings via the keys.
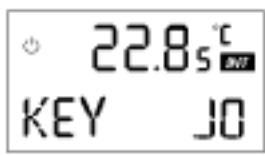
− Press key and hold it down.

− Within 4 sec press also and hold it down.

The display shows

− and 4x 0 appear consecutively.

− **KEY** is displayed.

− Release both keys.
  The keys are now non-functional. When any keys are operated the display shows **KEY**.

For de-inhibiting:
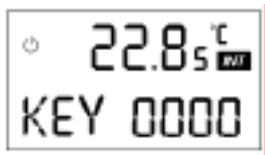
− Press key and hold it down,

− Within 4 sec press also and hold it down.

  The display shows

− and 4x 0 disappear consecutively and **KEY** disappears.

− The keys are de-inhibited.

7.4   LC-Display

Standby symbol   Heating symbol

Line 1 shows ext. actual temperature TE

Line 1 shows int. actual temperature (bath temperature)

Line 1

Line 2

Cooling symbol   Error symbol
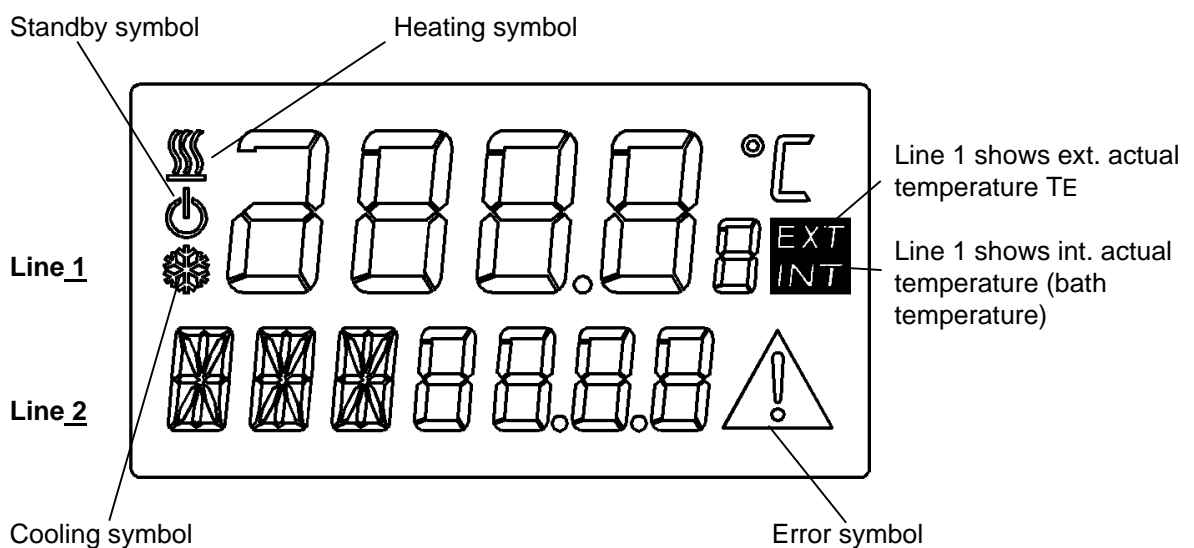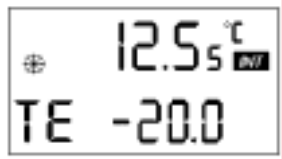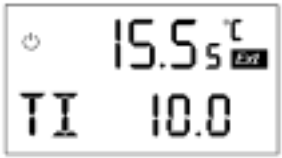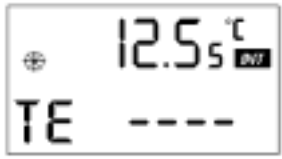
7.5 **Level 0 (base menu)** and level 1

Manual Start
STArt — ⟳ ⇒ 7.2

Level 0
base menu — Setpoint
SET — ⟳

Display flashing
Select with
▲ or ▼
the display is entered
after 4 sec or
immediately with key
⟳

Display
ext. temperature T E

Display
(on RES 0.01 only)
int. temperature T I

Menu
Menu.. — ⟳

Level 1 — Cooling
COOL 0/1/(2)/A — ⟳

Pump output level/Standby
PUMP 0/1/2/3/4/5 — ⟳

Display flashing
Select with
▲ or ▼

External controller
CON I/E — ⟳

Setpoint resolution
RES 0.1 / 0.01 — ⟳

Programmer
PGM . . — ⟳ — **Programmer level** ⇒ 7.6.5

Parameter
PARA . . — ⟳ — **Parameter level** ⇒ 7.6.6

Analogue interface
ANA . . — ⟳ — **Analogue interface level** ⇒ 7.6.7

Control parameter
REG . . — ⟳ — **Control parameter level** ⇒ 7.6.8

Menu end
END — ⟳

7.5.1 Set point selection (Level 0)

or   − Press keys until SET (set point) appears.

− Enter, display is flashing

or   − Enter set point with both keys.
($\Rightarrow$ Section 7.3.1)

```
 ☀   22.8s℃ INT
SET 69.8
```

− Display is flashing 4 sec → new value is entered automatically, **or**

− value entered immediately with key.

☞   − For safety reasons the set point can only be set up to 2°C above the upper limit of the operating temperature range of the particular thermostat type

```
 ⏻   26.0₀℃ INT
ANALOG
```

− Appears when analogue set point input is activated ($\Rightarrow$ section 7.6.7.1).

7.5.2 External temperature

− switches line 2 of the display from set point **SET** to the external actual temperature **TE**.

```
 ⊕   12.5s℃ INT
TE -20.0
```

− or outflow temperature **TI** if external controller is activated.

```
 ⏻   15.5s℃ EXT
TI  10.0
```

− When external Pt 100 is not connected.

```
 ⊕   12.5s℃ INT
TE ----
```

Connection of the external Pt 100 to Lemo socket 10S:

Contact

1	+	I	current path	Pt 100
2	+	U	voltage path	DIN EN 60751
3	-	U	voltage path	
4	-	I	current path	
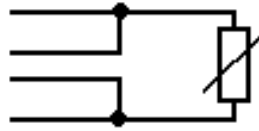
− 4-pin Lemosa plug for Pt 100 connection (Cat. No. EQS 022).

− Use screened connecting cable. Connect screen to connector case.

7.5.3 Display variants
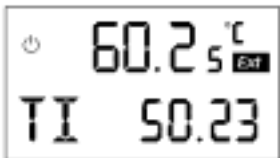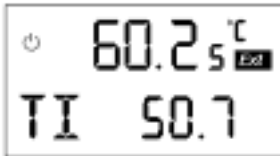
− With external controller switched on, line 1 shows the external actual temperature. The indicator field changes from INT to EXT.
Line 2 can then show the actual internal temperature (bath temperature).

− With the set point resolution (**RES**) set to 0.01°C (⇒ Section 7.6.4) line 2 can show both bath temperature **T**I and external temperature **T**E with 0.01°C resolution.

7.5.4 Menu . .
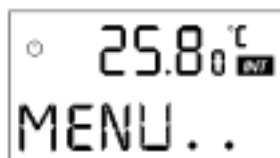
− Scroll to level 1.

7.6 Level 1

− see 7.5

7.6.1 Refrigerator

22.8 s °C
COOL 1
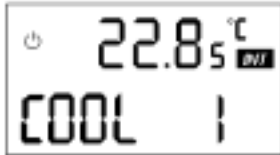
− Display shows current bath temperature, **COOL** and selected operating mode. To alter the setting press the key alongside

22.8 s °C
COOL ☀

or

− 0 = refrigerator OFF
1 = refrigerator ON
2 = cooling capacity approx. 50% (RE305, RE 307, 310, 312, 320 only)
A = automatic operation (⇨ Section 4.9)

− Scroll with key to pump output.

− The refrigerator can normally be operated in mode A (automatic). The refrigerator then automatically switches on and off depending on temperature and operating status.

− In special cases the refrigerator can be switched completely to "0", to continuous operation "1", or to 50% output "2".

⚠	− The refrigerating machine cannot be added manually while running at maximum heating output, because then the maximum currents (⇨ 7.1) would be exceeded.
	− The maximum heating output will be required for great set-point leaps.

7.6.2 Pump output

− with key scroll from **COOL** function.

22.8 s °C
PUMP 1
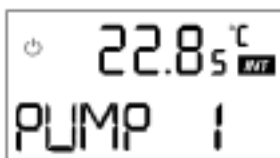
− Display shows current bath temperature, PUMP, and current pump output step. To alter the setting press key alongside.

22.8 s °C
PUMP ☀
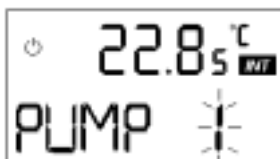
− Display is flashing approx. 4 sec.

LAUDA

or

⇨
Standby

⏻ **22.8**s ℃ _INT_

PUMP 0
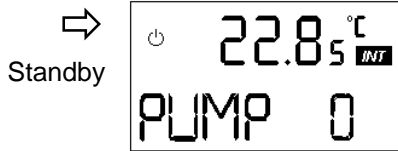
- During this time start setting the required pump output level with one of the keys.
  0 = pump stopped, heating off, refrigerator off (standby).
  The symbol ⏻ on the display left lights up.
  1 = low pump output
  2 , 3 , 4 = medium pump output
  5 = maximum pump output
- Pump responds immediately (this can be heard). Value is entered after approx. 4 sec.

- Scroll with key to "External control ON or OFF (**CON**) **or**

- with key back to **COOL**.

7.6.3   External control (CON)

⏻ **10.3**₀ ℃ _INT_

CON   ⊰⊱
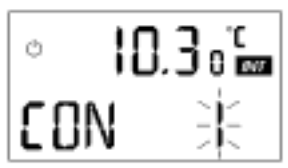
- External control can be activated here:
- The external temperature is normally sensed by the Pt 100 connected to socket 10S (⇒ Section 7.5.2)
  The external actual value can also be introduced as a standard signal (socket 66S). (⇒Section 7.6.7.)
- I = internal control, the thermostat controls the bath temperature

⏻ **22.8**₀ ℃ _EXT_   ⇦

CON   E
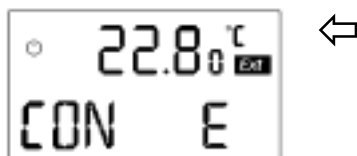
- E = External control **ON**, the control operates as cascade controller with an external actual value.
- With external control switched on, line 1 of the display automatically shows the external temperature. The indicator field changes from _Int_ to _Ext_.
- If no Pt 100 is connected to socket 10S and there is no standard analogue signal connected to 66S, the display shows **FAIL** when an attempt is made to activate external control.
- De-inhibit with key.

- Scroll with key to "Indication resolution".

7.6.4 **Selecting the set point resolution** (indication resolution)

– Scroll with key from **CON** function.

– Current bath temperature is being displayed, also **RES** and the selected indication mode.

– To change the setting press key alongside.

or

– Using one of the two keys set the required indication mode. Normal setting → 0.1 = 0.1 °C set point resolution or 0.01 = 0.01 °C set point resolution, → On set point input the display shows only S instead of SET. → With 0.01 resolution, bath temperature or external temperature can be shown with 0.01°C resolution in line 2 (⇨ Section 7.5.3)

– Scroll with key to programmer level.

7.6.5 **Programmer level (PGM)**

The programmer function of the units permits storage of 5 temperature-time programmes. Each programme consists of several temperature-time segments. In addition there is the information how many times the programme should be run (LOOP). The total number of all the segments of all programmes must not exceed 150.

A segment is normally a ramp which is defined by the target temperature, i. e. the temperature at the end of the segment, and the duration from the start to the end of the segment. It is possible to have temperature steps i. e. the time is zero, and also temperature hold phases, i. e. the same temperature at the start and at the end of a segment. At the start of the programme the current actual temperature is taken as the start temperature of the first segment.

– It is recommended to adjust the set point to a defined value before the start of the programme, and to terminate the programme at the same temperature.

– The programmer can also be operated or modified via the RS 232.

LAUDA

7.6.5.1 Example of programme

1	Heating thermostat
2	Cooling thermostat
3	Heating thermostat with solenoid valve cooling water

Cooling-down time depending on thermostat volume, external system etc.
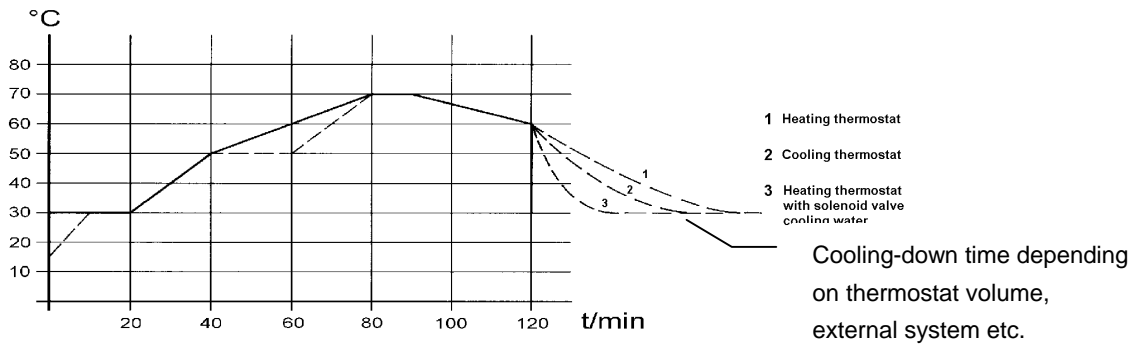
Original programme example			Edited programme example		
Segment	Temperature °C	Time min	Segment	Temperature °C	Time min
1	30,0	20	1	30,0	20
2	50,0	20	2	50,0	20
3	70,0	40	3	**50,0 ①**	**20 ①**
4	70,0	10	4	70,0	**20 ②**
5	60	30	5	70	10
6	30	0	6	60	30
			7	60	0

① Insert new segment (⇨ Section 7.6.5.3)
② Alter segment time (⇨ Section 7.6.5.6)

7.6.5.2 Menu structure
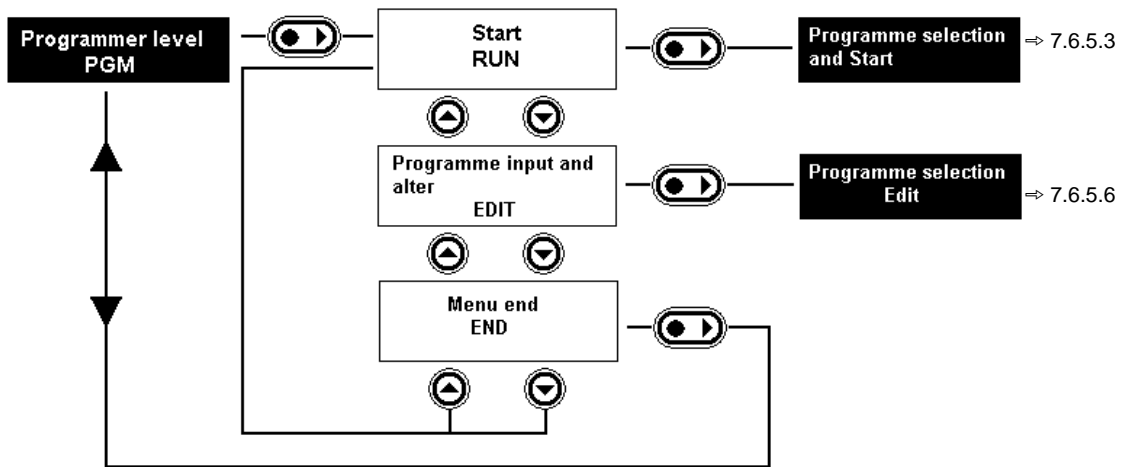
or, when programme is running
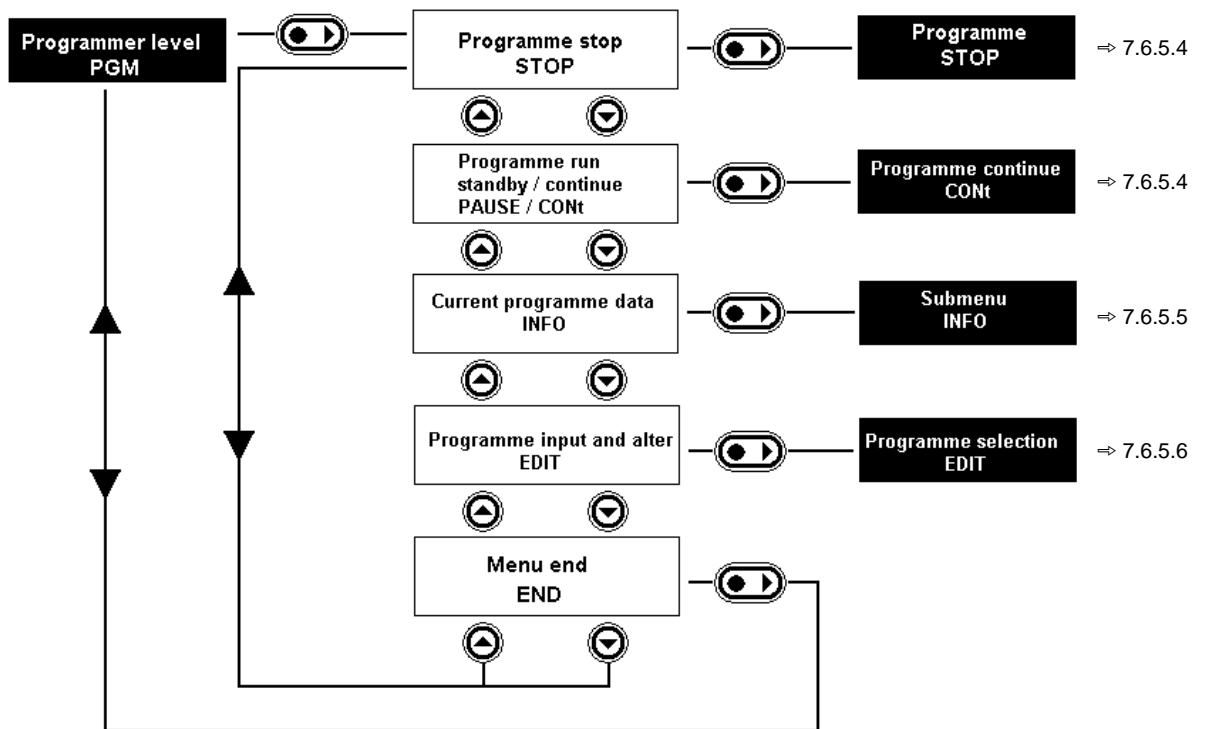
7.6.5.3 Programme selection and start
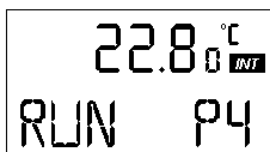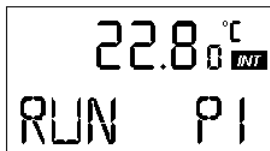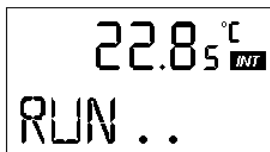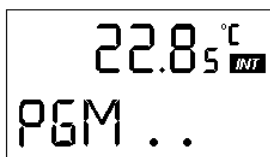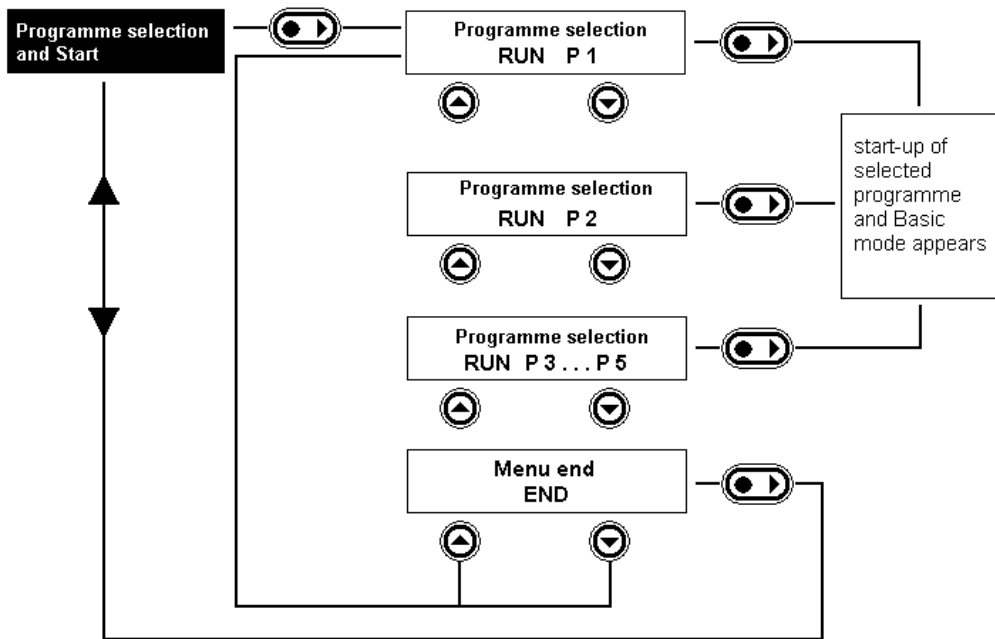
	− Press the key to go to the submenu of the programmer function.
	− Press the key to go to programme selection.
	− Press the keys to go to the programmes **P1**, **P2**....**P5**, **or** backwards.

```
22.8₀°C
     INT
P1   30.0
```
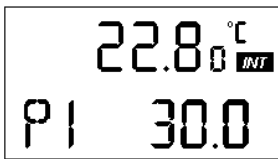
– Key starts the programme. Display changes to basic menu (level 0) and shows e. g. **P1** (instead of **SET**). **P1** blinks briefly; this indicates that the programme is running. On selecting a programme number which has not been configured with a programme, the basic menu shows **SET**.

7.6.5.4 Terminate, pause, continue the programme

<u>Terminate:</u>

```
35.7s°C
     INT
PGM . . .
```

```
35.7s°C
     INT
STOP    4
```
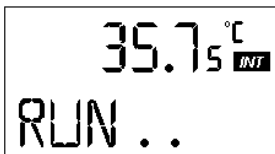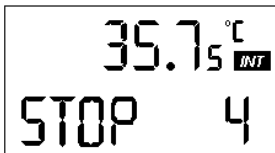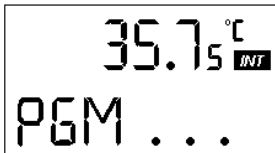
– On going into the **PGM** menu while a programme is running, the display shows **STOP** and the programme number.

– I. e. pressing the key terminates the programme run. The final set point is retained.

```
35.7s°C
     INT
RUN . .
```

– You are at the beginning of the start menu. The programme can be started from the beginning (segment 01) (⇒ Section 7.6.5.3) or you can exit the menu with **END** (⇒Section 7.6.5.2).

<u>Pause:</u>

```
65.7s°C
     INT
STOP    5
```

```
68.0₀°C
     INT
PAUSE  5
```
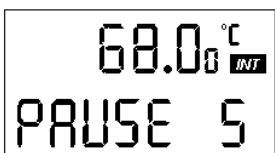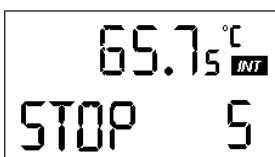
– With the instruction **PAUSE** the programme run is stopped (held) at the current position. The display changes to **CONt**.

68.0₀°C INT

CONt   5
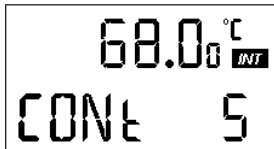
– You can exit the menu with **END** in the usual way.

68.0₀°C INT

CONt   5

Continue:

– Pressing the key continues the programme at the point where it has been stopped (held).

– After the supply has been OFF and ON again while the programme is running, the programme is pause (held), i. e. it can be continued with **CONt**.

7.6.5.5 INFO submenu
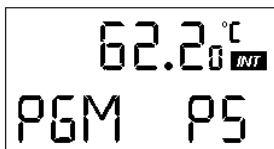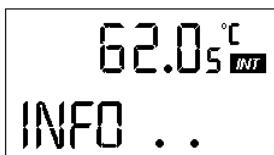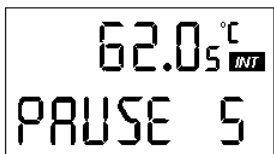
– In this area the current programme data can be indicated at any time while the programme is running. (⇨ Menu structure 7.6.5.2).

62.0ₛ°C INT

PAUSE 5

– With this key from **PAUSE** or **CONt** to the **INFO** menu.

62.0ₛ°C INT

INFO . .

– On pressing this key, line 2 of the display shows the number of the programme selected.

– Line 2 shows programme 5.

62.2₀°C INT

PGM   P5

– Pressing the key changes the display to the current programme **LOOP**.

– "1" means that the programme is running in the first of the programmed runs.

62.0₀°C INT

LOOP   1

$\bigodot$

    6 1.2 °C INT

    SEG   04
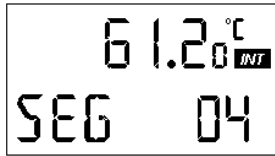
– Pressing the key changes the display to indicate the current segment number.

$\bigodot$

    65.1 °C INT

    TIME   15
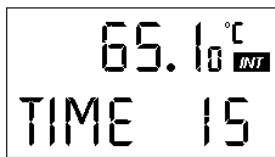
– Pressing the key changes the display to indicate the elapsed time in minutes for the current segment. The currently selected minute is shown.

$\bigodot$

    60.0 °C INT

    END
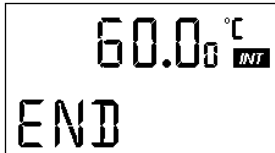
– You can exit the **INFO** submenu in **END**.

7.6.5.6 Edit submenu

Here there are the following functions:

- Select programme
- Input a programme
- Show the programme data of a stored programme and alter the segment data.
- Insert or add a new segment.
- Delete a segment.
- Input the number of programme runs

☞
– Programme alterations are stored permanently only after exit from the Edit menu.

– When the programmer is activated, new segments can be inserted and existing segments can be altered, incl. The one which is currently activated. In addition, all segments can be deleted at any time with the exception of the one currently activated.

– Alterations are possible while the segment is running. The segment is continued as if the alteration had applied since the start of the segment.

  But: If the new segment time is shorter than the segment time which has already elapsed, then the next segment is activated.

– If a segment time > 999 min has to be programmed, this time must be split between several consecutive segments.

Programme selection:

38.3 °C INT
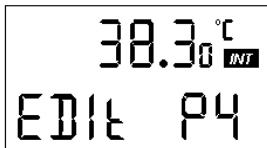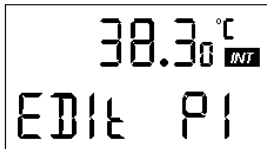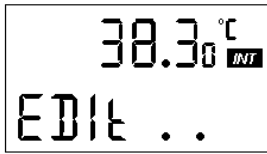
EDIt ..

– Press key to enter **Edit** mode.

38.3 °C INT

EDIt P1

– The display shows the selection for programme 1 (**P1**).

– Press the key to select **P2, P3, P4, P5**.

38.3 °C INT

EDIt P4

– Press key to enter.

Input of a programme: ⇨ Programming example 7.6.5.2

```
Edit mode        ──(● ▷)──    Segment / Target temp./ Time    ──(● ▷)
  P x                              0...x
                                  (▲)        (▽)

                              Insert segment              ──(● ▷)
                                 NEW
                                  (▲)        (▽)

                              Delete segment              ──(● ▷)
                                 DEL
                                  (▲)        (▽)

                              Runs of programme            ──(● ▷)
                                 LOOP
                                  (▲)        (▽)

                               Menu end                   ──(● ▷)
                                 END
                                  (▲)        (▽)
```

```
  30.5s℃ INT

NEW      0
```
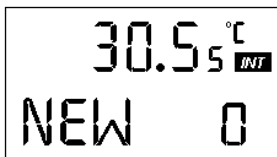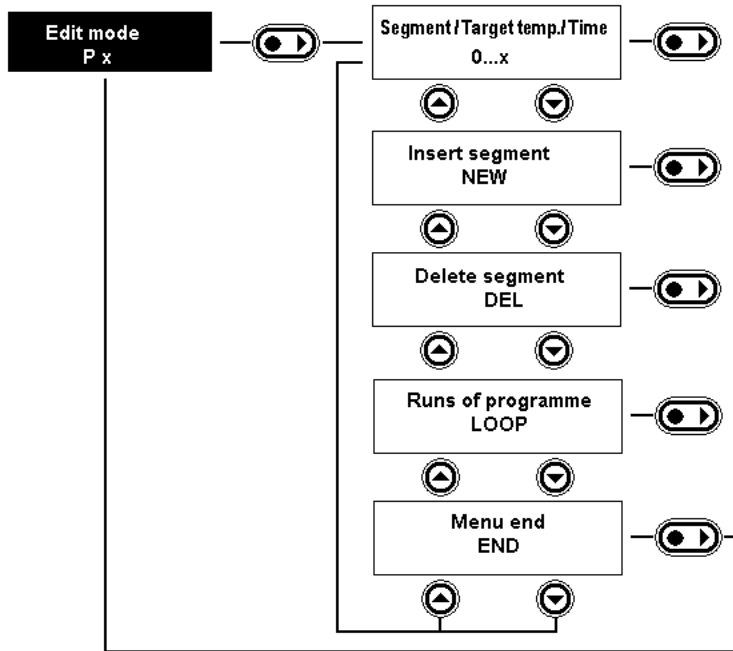
– This display appears if the programme storage position is empty; i. e. no segment has been defined.

(● ▷)**2x**

– Increments the number of segments by one each time until the required number of segments appears. In this example 6 segments.

(▲) … (▲)

– Press several times until the display below appears. The segment indication runs backwards.

Segment target temperature

```
   0.0 ℃

 1        0
```

Segment number

Segment time in minutes

(● ▷)

– Press key. Segment target temperature flashes with brief **OFF** period.

```
  30.0 ℃

 1        0
```
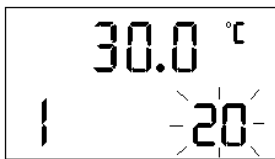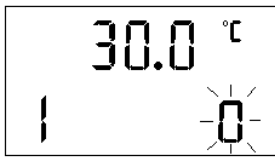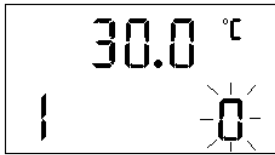
- Press again.
- Segment target temperature flashes in input mode (longer OFF time).

$-30.0-\,^\circ\text{C}$

| 0

- Input the target temperature.

- Enter the value, or it is entered automatically after 4 sec.

- Segment time flashes with brief **OFF** period.

$30.0\,^\circ\text{C}$

| -0-

- Press to enter.

$30.0\,^\circ\text{C}$

| -0-

- Input the segment time 0 ... 999 min.

- Enter the value, or it is entered automatically as above.

$30.0\,^\circ\text{C}$

| -20-

- Click forward to **End**.

$30.0\,^\circ\text{C}$

| -End-

- Terminates input mode for segment 1.

⊙

```
 30.0 ℃

 6    End
```
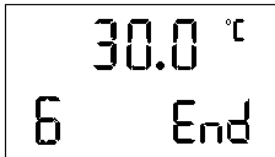
− Click forward to segment 2. Further inputs as for segment 1 etc. until the final segment 6.

◉▷

− Programme has been input completely.
It is useful to check the contents of the programme store.

To do this, press ◓ to segment 1 and with ⊙ show all segment data consecutively on the display.

Display of a stored programme and alteration of the segment data:
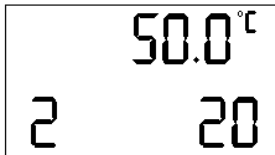
− Start as described under Edit, programme selection, then scroll with ⊙ through the segment data.

```
 50.0℃

 2     20
```

− With ◉▷ select Edit; the temperature value blinks briefly. Continue as for programme input.

Adding or inserting a new segment:

Both alterations increase the number of segments!

Adding:

− Extending a programme by new segments at the programme end.

```
 32.5 s ℃ INT

NEW     6
```
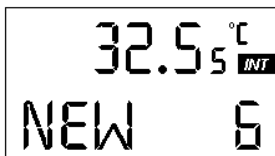
− In the Edit submenu clock forward until the display shows **NEW**. The display shows the final segment number of the programme.

◉▷ **2x**

− Press ◉▷ twice to add new segment number.

```
 32.5 s ℃ INT

NEW     7
```

◓
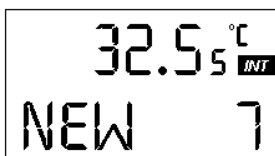
− Press key to go back to segment 7.

```
 30.0 ℃

 7      0
```
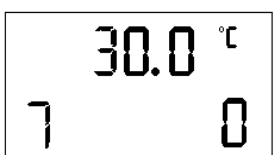
− Input segment data for segment 7 and data as described under input.
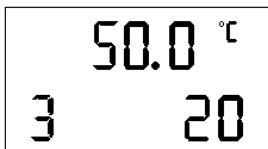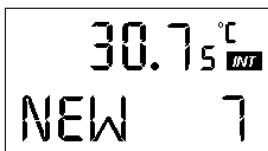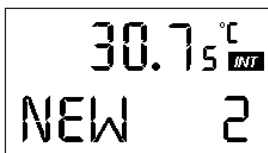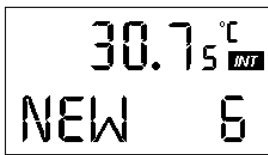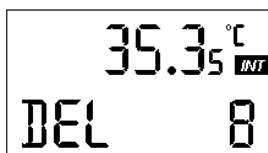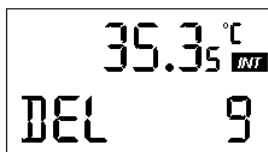
Inserting:

– Inserting a new segment.

– For <u>inserting</u> one or more segments, proceed as described above

```
30.7s ℃
      INT
NEW    6
```

– Then using the key, select the segment <u>after</u> which a new segment has to be inserted.

4x

```
30.7s ℃
      INT
NEW    2
```

– Press key to enter.

```
30.7s ℃
      INT
NEW    7
```

– It can be seen that the total number of segments has increased.

5x

```
50.0 ℃

3     20
```

– Input data for new segment as described above..

Deleting a segment:

Deleting the last segment:

– In the Edit submenu clock forward until the display shows **DEL**. The display shows the final segment number of the programme.

```
35.3s ℃
      INT
DEL    9
```

2x

– Press key twice to delete the final segment.

– As protection against unintentional deletion, this function is performed only after confirmation of key .

– The display shows the new final segment number.

```
35.3s ℃
      INT
DEL    8
```

Deleting a particular segment:

35.3 s °C INT

DEL 9
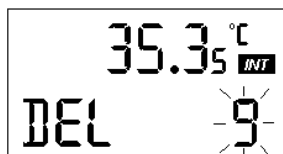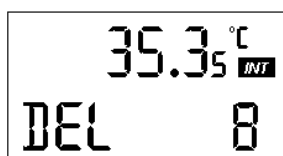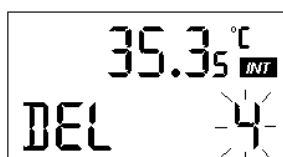
– To delete any particular programme segment, confirm this by pressing key ●▶.

 approx. **5x**

35.3 s °C INT

DEL 4

35.3 s °C INT

DEL 8

– The display shows the new final segment number.

Deleting all segments:

This operation is recommended before input a new segment number with **NEW** at a programme storage position which has already been used.

35.3 s °C INT

DEL 9
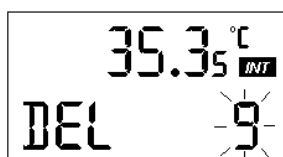
– Press key ●▶ to delete all segments.

– Press key to **DEL ALL**.

35.3 s °C INT

DEL ALL

– By pressing the key the total programme is deleted.

```
 35.3s ℃
        INT
DEL  ALL
```

Input of the number of programme runs:

```
 35.3s ℃
        INT
LOOP   1
```
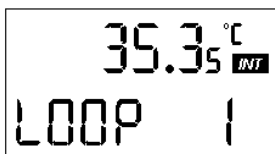

– In the Edit submenu, click until the display shows **LOOP**.

```
 35.3s ℃
        INT
LOOP  -1-
```
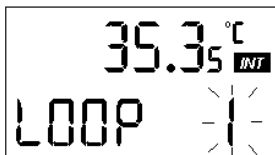

– Using the keys select the number of programme runs.
   Enter immediately with or the value is entered
   automatically after 4 sec.
   Up to 250 runs can be programmed. With input "0" to
   programme is repeated indefinitely until **STOP**.

7.6.6 Parameter level (PARA)

```
Parameter level ───── Serial interface
                      RS 232 / RS 485          ◉▸

                      Address
                      ADR 1...32                       Display flashing
                                                       Select with
                      Baudrate                         ▽  or  △
                      KBD 2,4 / 4,8 / 9,6/ 19,2  ◉▸
                                                       the display is
                      Remote control ON / OFF          entered after 4
                      REM                        ◉▸    sec, or
                                                       immediately with
                      Manual Start / Autostart         key  ◉▸
                      STArt                      ◉▸

                      Display backlightning
                      LED                        ◉▸

                      Outflow temp. high limit
                      TiH                        ◉▸

                      Outflow temp. low limit
                      TiL                        ◉▸

                      Neutral contact function   31N
                      OUT                        ◉▸

                      Tolerance range contact
                      WIN

                      Sensor calibration internal TI
                      CAL I                      ◉▸
                                                 4s

                      Sensor calibration external TE
                      CAL E                      ◉▸
                                                 4s

                      Base settings
                      Default                    ◉▸    o.K.
                                                 4s

                      Menu end
                      END                        ▽
```

7.6.6.1 Serial interface parameters / Remote control

22.8 s ℃ INT
RS 232

— Selection whether **RS 232** or **RS 485** is being set.

22.8 s ℃ INT
ADR -2-
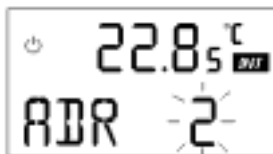
— On **RS 485** the device address has to be set from 1 to 32.

22.8 s ℃ INT
KBD -9.6-
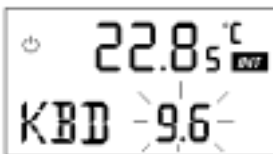
— On **RS 232** the display shows immediately the selection menu for baud rate. It can be set to **2.4 / 4.8 / 9.6 / 19.2.**

Remote control (FBT)

22.8 s ℃ INT
REM OFF
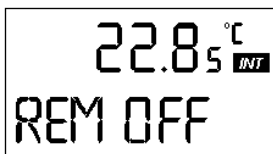
— To activate the connected remote control set **"ON"** Set to **"OFF"** without FBT.

22.8 s ℃ INT
REM FAIL ⚠
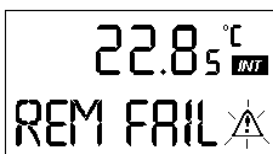
— When communication between thermostat and FBT is interrupted there is a fault message and an acoustic signal. This is also the case when the FBT is switched off.

Unit is switched off as it is in case of fault.

– Release after eliminating the cause of fault (only possible at the thermostat).

7.6.6.2 Manual Start – Autostart

– Select "Manual Start" or "Auto start" when mains are ON

22.8 5 ℃ INT
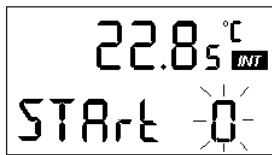
STArt -0-

0 = Manual Start
I = Auto start

– In case of "Auto start" the unit is started automatically as soon as mains are switched ON or in case of voltage failure as soon as voltage returns.

– In case of "Manual Start" the ⬤▶ key has to be pressed each time the mains are switched ON or after mains failure and return.

7.6.6.3 Display backlighting

22.8 5 ℃ INT

LED -ON-
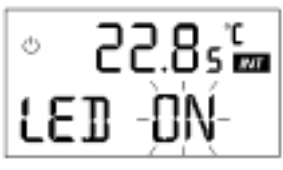
– The display backlighting can be switched off if necessary **(LED OFF)**.

7.6.6.4 Outflow temperature limit
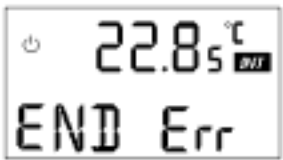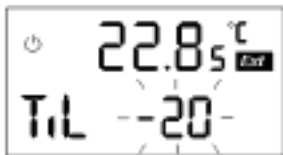
High limit (TiH)

– The temperature set here limits the outflow temperature (bath temperature) by switching off the heating. Especially with external control this limitation avoids the undesirable permanent shut-down through the safety circuit (over temperature) during the start-up phase.

Low limit (TiL)

– The temperature set here limits the outflow temperature against low values through switching off the refrigeration compressor or the cooling, e.g. in order to prevent freezing.

– Input of a value for TiH which is below the value for TiL causes Err to appear as error message at menu end.

– The values for TiH and TiL are entered only after leaving the submenu!!

7.6.6.5 Neutral contact function
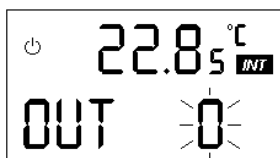
– **OUT** determines the function that is reported through the neutral contact.

   0 = Overall fault (default setting ⇨ 7.8.4)
   1 = Tolerance range monitoring ⇨ 7.6.6.6

7.6.6.6 Tolerance range contact

22.8 °C
WIN 0.2
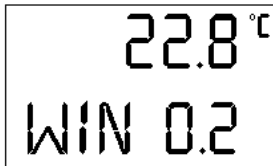
− With **WIN** (Window) a tolerance range can be chosen. Input range 0.2...20.0°C. The input value corresponds to the half of the tolerance range. Comparisons are made between set point and controlled variable, at internal control with T_I, at external control with T_E. If the difference is greater than the input value the neutral contact 31N switches.
1, 3 closed = controlled value within window
1, 2 closed = controlled value outside of window

7.6.6.7 Sensor calibration (CAL)

Calibration with key should only be activated if a sufficiently accurate temperature measurement device is available as reference.
The change causes the factory calibration to be lost. Maximum calibration range ±3°C. The calibration produces an additive shift over the entire measuring range.
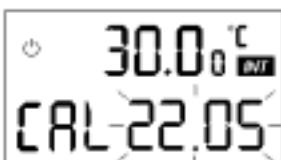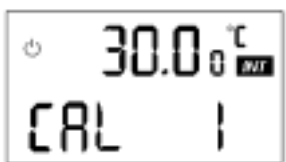
Calibrating the internal Pt 100 (bath temperature sensor)

− Measure the bath temperature with the reference probe.

30.0 °C INT
CAL I

4 sec

30.0 °C INT
CAL 22.05

− Press approx. 4 sec. Input the correct value.

Calibrating the external-Pt 100 (external sensor)

30.0 °C INT
CAL E
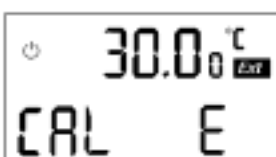
− Place the reference sensor at the location of the external Pt 100. Press approx. 4 sec. Input the corrected value. If no external Pt 100 is connected the display shows **FAIL.**

4 sec

```
 ⏻    30.0₀ ℃ Ext
 CAL 25.22
```

7.6.6.8 Base settings (DEFAULT)

```
 ⏻    22.8 s ℃ INT
 DEFAULT
```
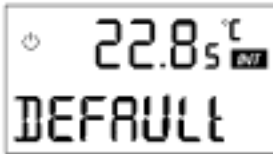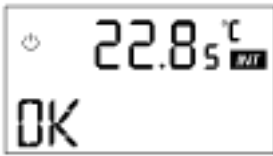
− Pressing the key ⬤▷ approx. 4 sec programs certain essential functions to the factory settings. These include internal control with manual set point input, standard control parameters etc.

4s

```
 ⏻    22.8 s ℃ INT
 OK
```

− The display shows **OK**.

7.6.6.9 Menu end „Parameter"

```
 ⏻    22.8 s ℃ INT
 END
```
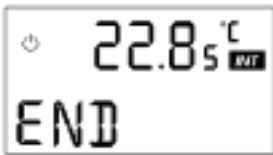
− Leads to **PARA . .** at level 1.

7.6.7 Analogue interface (ANA)

The thermostat is provided with two standard analogue signal inputs and 3 outputs. Each input and output can be set to the standard signals 0 - 10 V, 0 - 20 mA or 4 - 20 mA. The signals are connected to a 6-pin plug (66S) according to NAMUR NE 28.
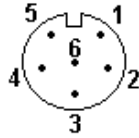
– View on socket (front) or plug solder face.

☞ Use screened cables. Connect screen to connector case!!

Coupling connector 6-pin   Cat. No. EQS 057

– Pin 1   Output 1
 Pin 2   Output 2
 Pin 3   0V reference potential
 Pin 4   Set point input
 Pin 5   Output 3
 Pin 6   Input ext. actual temperature

– The inputs are permanently assigned to the following signals: set point and external actual temperature.
 The outputs can be configured as required for outflow temperature T_I, external actual temperature T_E, set point S and electrical output Y.
 The temperatures can be scaled in the range -100.0 to 400.0°C, the electrical output -100 to 100%.
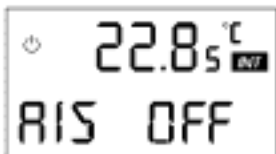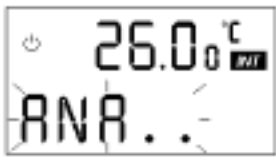
– Pressing the ⬤ key leads to the submenu "Analogue interface level". All settings for the analogue inputs and outputs can be found there.

– Accuracy of the inputs and outputs after calibration is better than ± 0.1% full scale.

– Resolution of outputs
 Temperature   < 0,01% of the range however not < 0,01°C
 Controller output Y 0,1%

– Current inputs   input impedance < 100 Ohm
 Voltage inputs   input impedance > 50 kOhm
 Current outputs   max. burden 400 Ohm
 Voltage outputs   min. load 10 kOhm

Menu flow diagram:

Analogue interface level

- **Analogue setpoint input** AIS I / U / OFF → Submenu Analogue inputs ⇨ 7.6.7.1
- **Analogue input EXT. temp** AIE I / U / OFF
- **Analogue output** A01 U. t S → Submenu Analogue outputs ⇨ 7.6.7.2
- **Analogue output** A02 U. t S
- **Analogue output** A03 OFF
- **Calibration** CAL . . → Submenu Calibration (ANA) ⇨ 7.6.7.3
- **Menu end** END → Level 1 Analogue interface ANA

AIS OFF
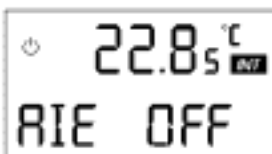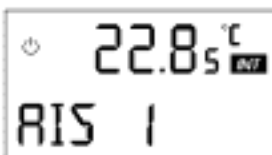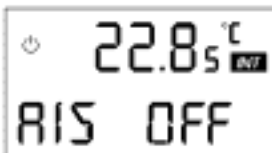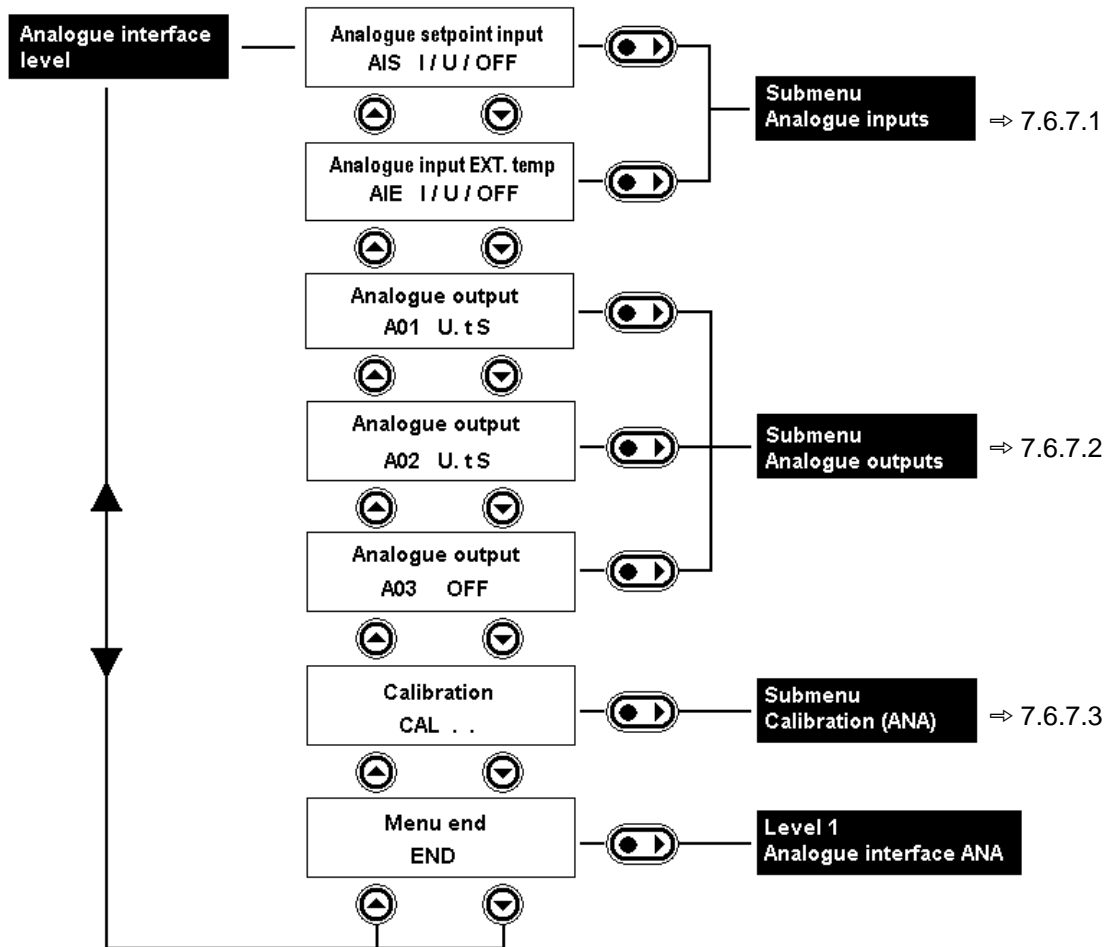
– **AIS** = analogue input set point
OFF = set point input is switched off, i.e. manual value setting or via serial interface is active.

AIS I

– Analogue set point input is switched on, with current input (I) configuration. With voltage the display shows **AIS U.**

– Scroll to **AIE**
or

– Pressing the key leads to the submenu "Set point, analogue inputs". ⇨ Section 7.6.7.1

AIE OFF

– **AIE** = analogue input external actual temperature as standard signal / instead of Pt 100 on input 10S.
OFF = this input is switched off, the measurement of the Pt 100 at socket 10S is valid.

```
⟳  22.8s℃
RIE  I
```
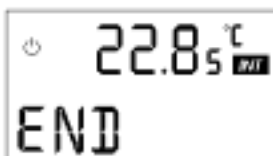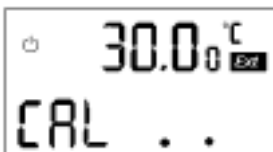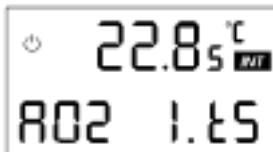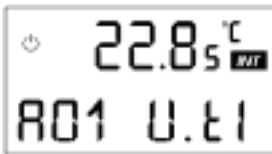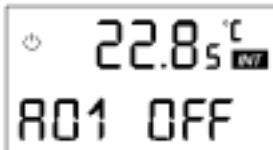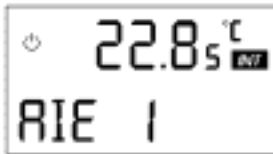
- Input is switched on.
  With current configuration (I). In case of voltage the
  display shows **AIE U**.

- Pressing the key leads to the submenu "Analogue input
  external actual temperature". ⇨ Section 7.6.7.1
  or


```
⟳  22.8s℃
R01  OFF
```

- **A01** = analogue output 1

- **OFF** = switched off.

```
⟳  22.8s℃
R01  U.t1
```

- Analogue output 1 is switched on. With voltage output
  (U) configured and the internal temperature signal, i.e.
  outflow temperature (t I).


```
⟳  22.8s℃
R02  I.t5
```

- I = current output
  tE = external temperature
  tS = set point
  Y = electrical output

- Outputs 2 and 3 are similar to output 1.

- Pressing leads to the submenu "Analogue
  outputs". ⇨ Section 7.6.7.2

```
⟳  30.0₀℃
CRL  . .
```

- **CAL** = calibration of inputs and outputs at 0 and 10 V or
  0 and 20 mA.

- Pressing leads to the submenu "Calibration".
  (⇨Section 7.6.7.3)

```
⟳  22.8s℃
ENI
```


- Leads to **ANA** at level 1.

7.6.7.1 Submenu Analogue inputs
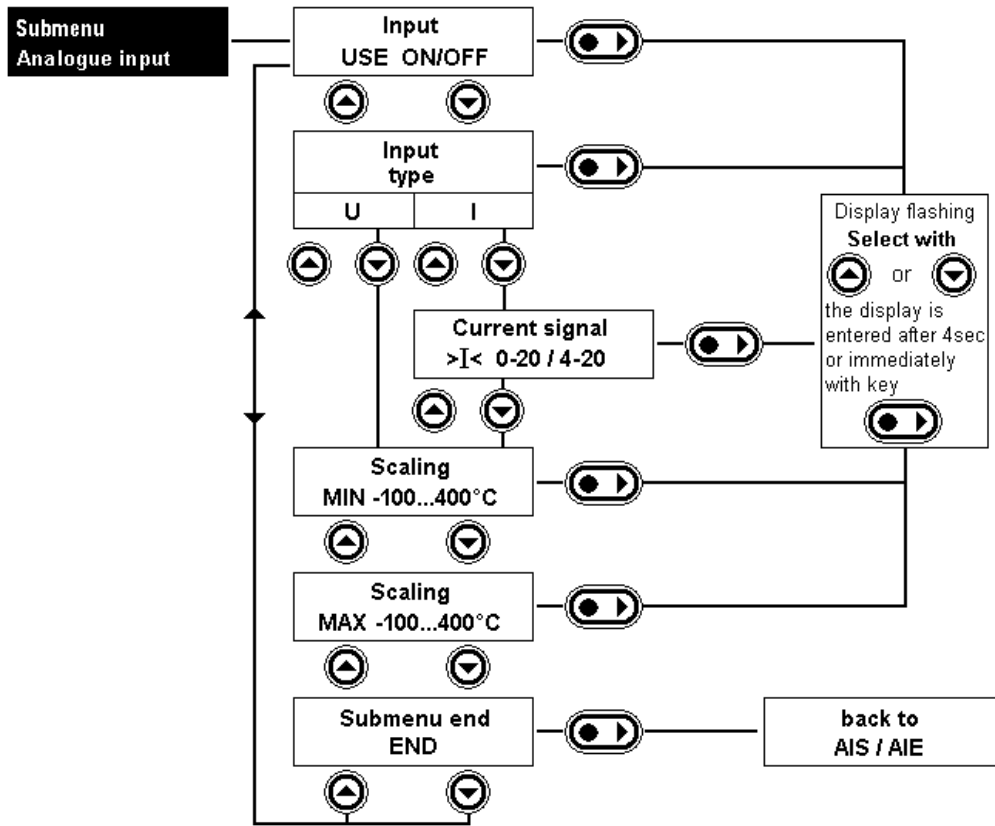
— from **AIS** scroll to
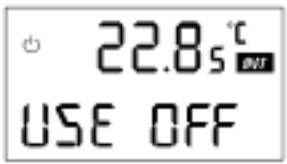
— **USE** = here the input set point can be switched ON and OFF.
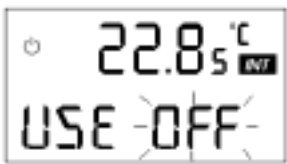
— Enter the required status with .
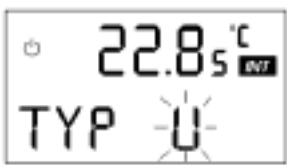
— **Type** = input signal type, Voltage 0 - 10 V (U) or current 0 - 20 mA (4 - 20 mA) (I).

```
[ ⏻  22.8 s °C INT ]
[ TYP  -1-      ]
```

⊙ (down button)

⬤ (enter button)

```
[ ⏻  22.8 s °C INT ]
[ >I<  -0-20-   ]
```

– If a current range has been selected there is also a request whether range 0 - 20 mA or range 4 - 20 mA is required.

⊙ (down button)

```
[ ⏻  22.8 s °C INT ]
[ >I<  -4-20-   ]
```

⊙ (down button)

⬤ (enter button)

```
[ ⏻  22.8 s °C INT ]
[ MIN  -50-     ]
```

– **MIN** = minimum temperature in °C
For determining the temperature range to which the current or voltage range has to be assigned.

⊙ (down button)

⬤ (enter button)

```
[ ⏻  22.8 s °C INT ]
[ MAX  -150-    ]
```

– **MAX** = maximum temperature in °C
For determining the temperature range to which the current or voltage range has to be assigned.
Example: 0 – 10°C is to correspond to -50 to 150°C
MIN = -50; MAX = 150. At the set point input only values in the range –30°C to 200°C are processed since this corresponds to the operating range of the thermostat. Outside this range the display shows the limit value.

⊙ (down button)

LAUDA

```
 ⏻   22.8 s ℃
            OUT
END
```

– Back to **AIS**.

```
 ⏻   22.8 s ℃
            OUT
AIE  OFF
```
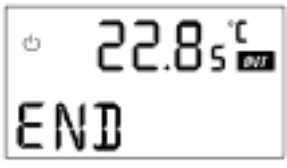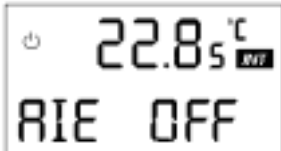
– Scroll to submenu "Analogue inputs", but referred to the configuration and scaling of the external temperature input. (⇨ Section 7.6.7.1)

```
 ⏻   22.8 s ℃
            OUT
USE  OFF
```
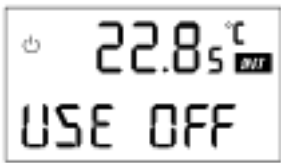
– Continue as for set point input **AIS**.

```
 ⏻   22.8 s ℃
            OUT
AIS 0-4 ⚠
```
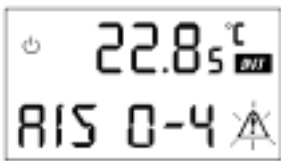
– **Error message**, in the current range 4 - 20 mA the current is less than 4 mA (0 to 4 mA).

7.6.7.2 Submenu Analogue outputs
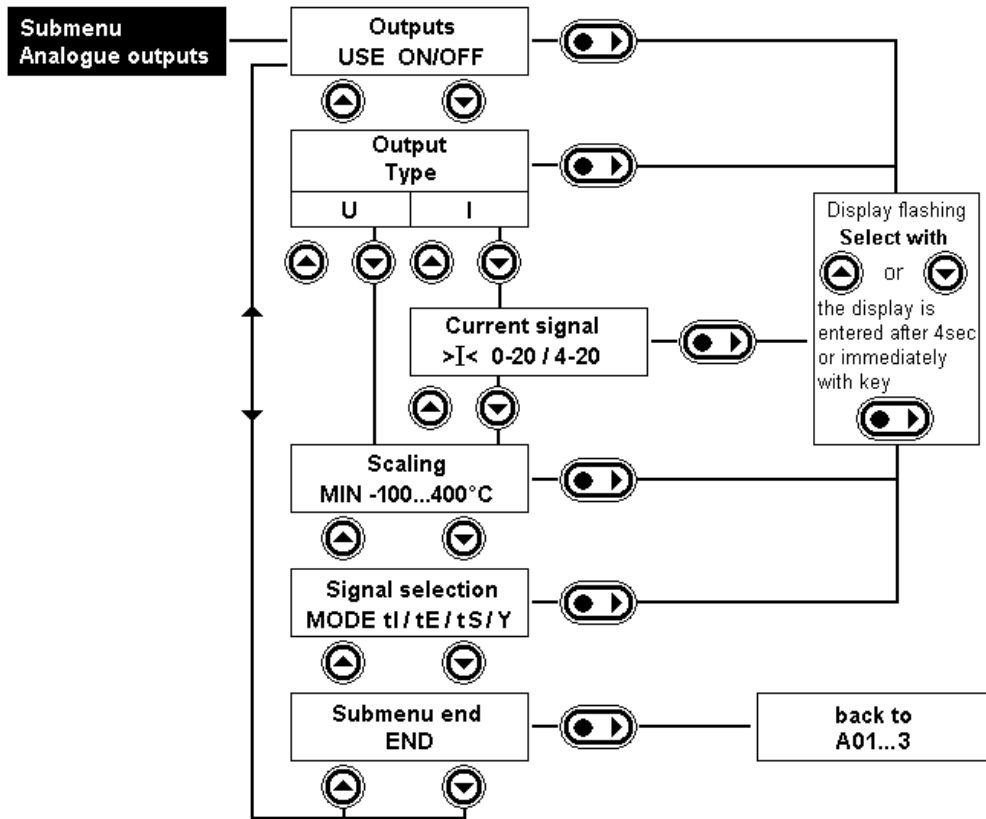
— From A01 scroll to
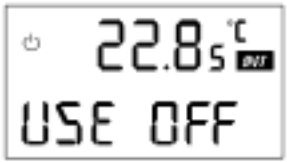
— **USE** = here the analogue output 1 (or, depending on previous steps, output 2 or output 3) can be switched ON and OFF.
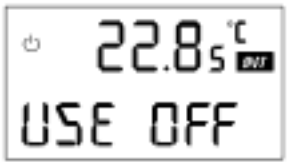
— Enter required status with ⬭.
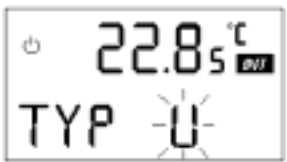
— **Type** = output signal type; voltage 0 - 10V (U) or current 0 - 20mA (4 - 20mA) (I).
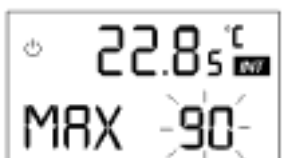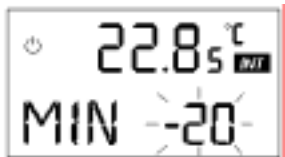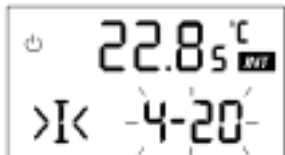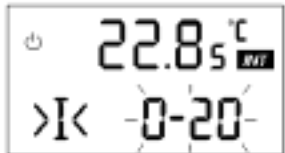
LAUDA

– If a current range has been selected there is also a request whether range 0 - 20mA or range 4 - 20mA is required.

– **MIN** = minimum temperature in °C (or electrical output). For determining the temperature range to which the current or voltage range has to be assigned.

– **MAX** = maximum temperature in °C (or electrical output). For determining the temperature range to which the current or voltage range has to be assigned.

Starting up

```
 ⏻   22.8s ℃
             INT
MODE -tI-
```
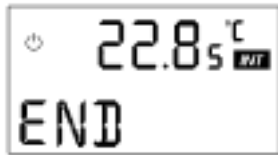
– **MODE** = operating mode, assignment of signal source to output.
  tI = outflow temperature, bath temperature (internal)
  tE = external actual temperature
  tS = set point
  Y = electrical output (± 100%).

```
 ⏻   22.8s ℃
             INT
END
```

– Back to **A01** or **A02** or **A03**.

☞ – On changing from temperature range to electrical output recheck MIN, MAX!!

LAUDA

7.6.7.3 Submenu Calibration (ANA)

```
Submenu Calibration        ▶│◀▶       Input setpoint  current    ▶│◀▶
Inputs, Outputs                        C In   S.I
                            ▲    ▼
                                       Input setpoint voltage     ▶│◀▶      Input
                                        C In   S.U                          calibration
                            ▲    ▼
                                       Input ext. temp. current   ▶│◀▶
                                        C In   E.I
                            ▲    ▼
                                       Input ext. temp. voltage   ▶│◀▶
                                        C In   E.U
                            ▲    ▼
                                       Output 1 current           ▶│◀▶
                                        C Out   I.I
                            ▲    ▼
                                       Output 1 voltage           ▶│◀▶
                                        C Out   I.U
                            ▲    ▼
                                       Output 2 current           ▶│◀▶
                                        C Out   2.I
                            ▲    ▼                                          Output
                                       Output 2 voltage           ▶│◀▶      calibration
                                        C Out   2.U
                            ▲    ▼
                                       Output 3 current           ▶│◀▶
                                        C Out   3.I
                            ▲    ▼
                                       Output 3 voltage           ▶│◀▶
                                        C Out   3.U
                            ▲    ▼
                                       Submenu end                ▶│◀▶      back to
                                        END                                 CAL . .
                            ▲    ▼
```

▶│◀▶
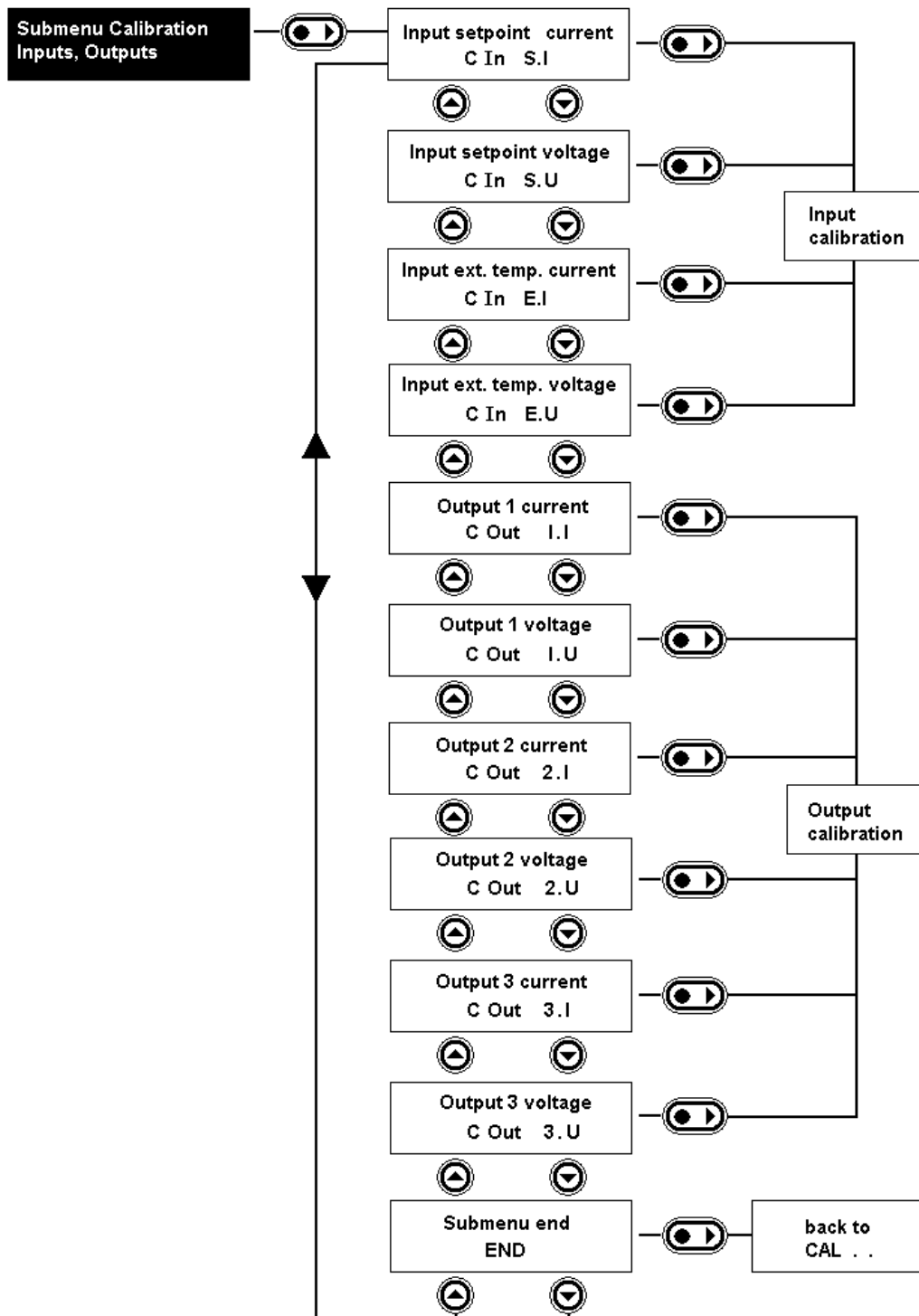
– From **CAL . .** scroll to
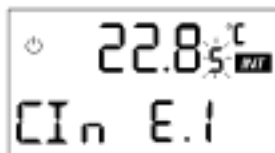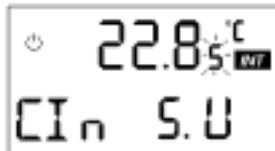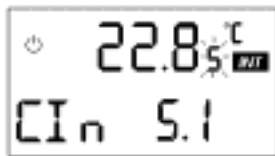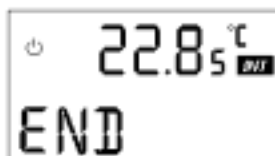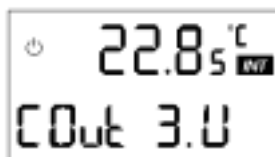
⏻ **22.8**s°℃ INT **CIn 5.I**	– **C In** = calibrate (C); Input (In); S.I = set point; current signal (I)
⊙ (down arrow)	
⏻ **22.8**s°℃ INT **CIn 5.U**	– **S.U** = set point; voltage signal (U)
⊙ (down arrow)	
⏻ **22.8**s°℃ INT **CIn E.I**	– **E.I** = external actual temperature input (E), current signal (I)
⊙ (down arrow) **etc.**	– Continue see fig. start 7.6.7.3
⏻ **22.8**s°℃ INT **COut 3.U**	– **Out** = analogue output 3 (Out 3); voltage signal
⊙ (down arrow)	
⏻ **22.8**s°℃ INT **END**	
⊙ (left arrow)	– Scrolls to **CAL** in menu Analogue interface menu.
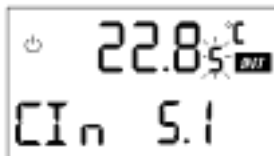
Calibrating of the inputs

– Apply the voltage or current for the appropriate range limit (0V, 10V, 0mA, 20mA). Deviations up to approx. 10% of range can be corrected.

– The calibration values remain stored!

– Factory calibration is performed at 0V, 10V, 0mA and 20mA.

– Feed in current **0mA** at contacts 4 (+) and 3 (-) on connector 66S.

after approx. 2 sec

– Feed in current **20mA**.

after approx. 2sec

– Calibration of set point input current is completed.

– Set point input voltage and external actual temperature input current and voltage are calibrated similarly.

LAUDA
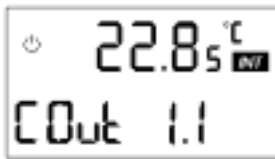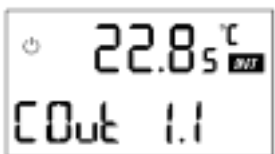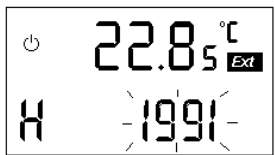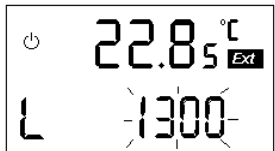
Calibrating of the outputs

22.8 s ℃ INT

COut 1.1

– Connect up the device to be supplied or an accurate multimeter with a current range 0 - 20mA or a voltage range 0 - 10V.

– Calibrate the outputs with the required termination resistance.

22.8 s ℃ INT

. .

4 sec

– after approx. 4 sec. the second point.

22.8 s ℃ Ext

L -1300-

– Take current reading on the meter and set it with ⊙ ⊙ e.g. **1300** = 1.3mA.

22.8 s ℃ Ext

H -1991-

– Take current reading on the meter and set it with ⊙ ⊙ e.g. **1991** = 19.91mA.

22.8 s ℃ INT

COut 1.1

– After calibration has been completed this display appears again.

or with standard voltage signal 0 - 10V

– after approx. 4 sec. the second point.

22.8 s ℃ INT

. .

4 sec

22.8 s ℃ Ext

L   -500-

22.8 s ℃ Ext
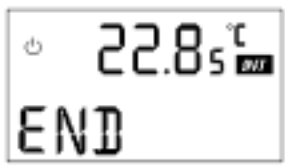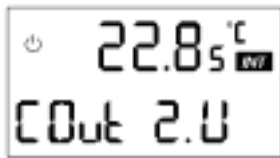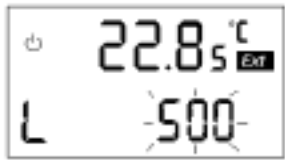
H   -9000-

− Corresponding start values for voltage calibration are **L 500** and **H 9000** = 0.5V and 9V.

22.8 s ℃ INT

COut 2.U

− After calibration has been completed this display appears again.

22.8 s ℃ INT

END

− Back to the menu Analogue interface **CAL**.

7.6.8   Control parameter level

<u>**With internal control (bath control):**</u>
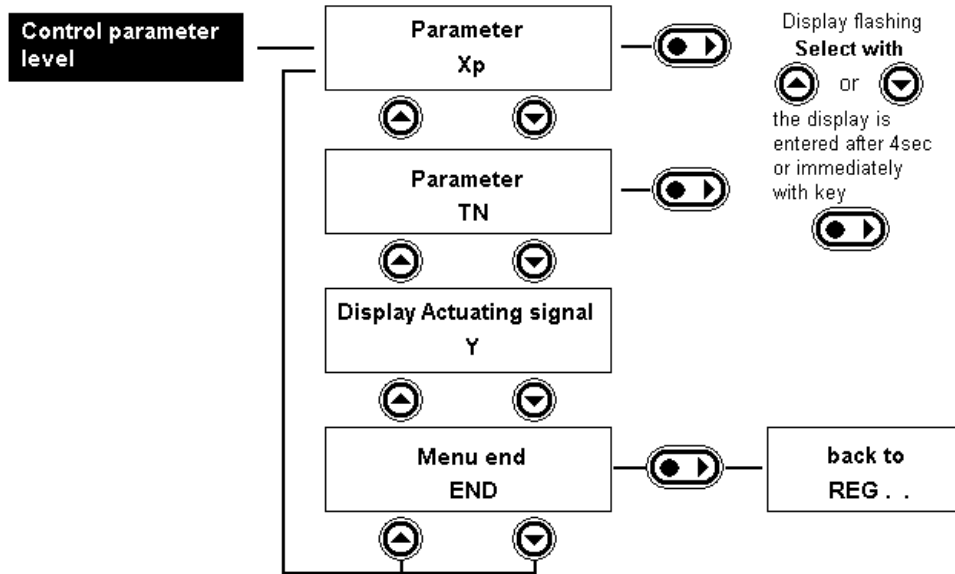
<u>**With external control switched on:**</u>
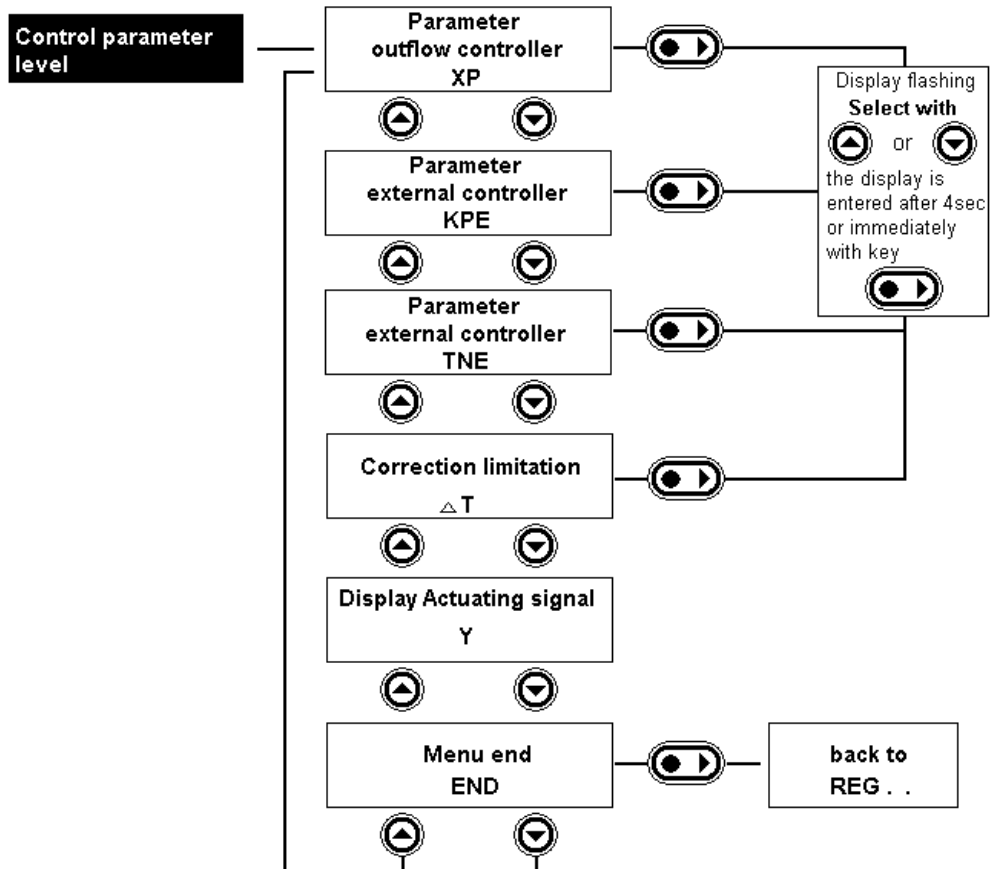
–   Pressing ⊙▷ scrolls from **REG . .** to the input for the control parameters.
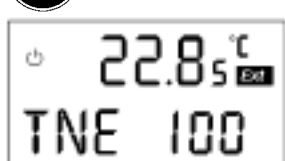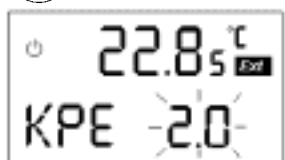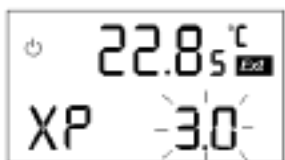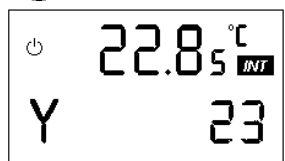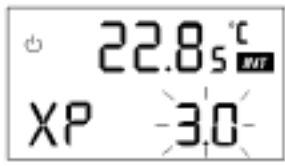
With Internal control (CON I)

− With internal control (**CON I**) select here the proportional band Xp for the bath controller. Input range 0.1 – 10°C. Useful values are 2 – 7°C, depending on bath size, external circuit and thermostating liquid.
If the value is too small (e.g. 2°C) this may result in control oscillations.
If the value is too large (e.g. 8°C) the compensation of interference may be worse and more sluggish.

− Select here the reset time **TN** for the bath controller. Input range 1 - 200 sec. 200 is followed by OFF, i.e. the integral function of the controller is switched off, the controller operates as a proportional controller with permanent control offset. OFF is normally not used. Suitable values are 20 - 100 sec.

− Small values produce rapid control action but also lead to instability. Values around 50 sec usually give reasonable results.

− The controller output can be indicated here, e. g. for use during servicing.

With external control (CON E) switched on:

− Proportional band **Xp** for bath controller. When working with the external controller the bath controller operates as proportional controller in the cascade circuit.

− The criteria are similar to internal control.

− Control gain of the master controller of the cascade. Larger values produce a faster reaction and possibly instability.

− Suggested value **KPE = 5.0**

− Reset time **TN** of the master controller.
KPE and **TN** depend largely on the conditions, i.e. volume, heat transfers, pump output and location of external controller.

− Suggested value for **TN = 100s**.
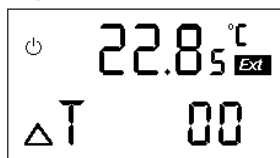
– It is essential to ensure that there is optimal thermal coupling between thermostating liquid and external sensing point. Otherwise satisfactory control can not be achieved. Under unfavourable conditions, simple outflow temperature control may give better results.

– Correction limitation:
Here it is possible to set a limit for the difference between external temperature (T_E) and the outflow temperature. This is used e.g. for gentle heating of the product being heated. It can also be helpful for a better stabilisation of the external temperature. 00 means that this function is de-activated. Values between 1°C and 200°C can be set.

7.7   Serial Interfaces RS 232, RS 485

7.7.1   RS 232 Interface

Connecting cables and interface test:

Computer					Thermostat		
Data	**9-pin sub-D socket**		**25-pin sub-D socket**		**9-pin sub-D socket**		**Data**
	①	②	①	②	①	②	
R x D	2	2	3	3	2	2	T x D
T x D	3	3	2	2	3	3	R x D
DTR	4		20		4		DSR
Signal Ground	5	5	7	7	5	5	Signal Ground
DSR	6		6		6		DTR
RTS	7		4		7	⌐ 7	CTS
CTS	8		5		8	⌐ 8	RTS

① with hardware handshake: When connecting the thermostat to the computer please use a 1:1 cable and not a zero-modem cable!

② without hardware handshake: The computer needs an operating mode: ”without hardware handshake”. In the plug of the thermostat a bridge has to be inserted between Pin 7 and 8.

☞
  - Use screened connecting cables.
  - Connect the screen to the plug case.
  - The lines are electrically isolated from the remaining electronics.
  - Unoccupied pins must not be connected!

The RS 232 Interface can easily be tested with the PC connected, using the MS-Windows operating system. On Windows 3.11 with the programme "Terminal" and on Windows® 95/ 98/ NT/ XP with the programme "Hyper Terminal".

Protocol:

☞
  - The interface operates with 1 stop bit, no parity bit and 8 data bits.
  - Transfer rate either 2400, 4800, 9600 (factory setting) or 19200 baud as selected.
  - 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.
  - The response of the thermostat is always terminated with CRLF.

CR = carriage return (hex: 0D)
LF = line feed (hex: 0A)

Example: Transfer of set point 30.5°C to the thermostat.

Computer	Thermostat
„OUT_SP_00_30.5"CRLF	⇨
⇦	„OK"CRLF

7.7.2   RS 485 Interface

Connecting cable:

Thermostat	
9-pin sub-D-socket	
pin	Data
1	Data A
5	SG (Signal Ground) optional
6	Data B

☞
- Use screened connecting cables.
- Connect the screen to the plug case.
- The lines are electrically isolated from the remaining electronics.
- Unoccupied pins must not be connected!

The **RS 485** bus absolutely needs a bus termination in form of a terminating network which ensures a defined unattended time in the high-resistance phases. The bus terminal is defined as follows
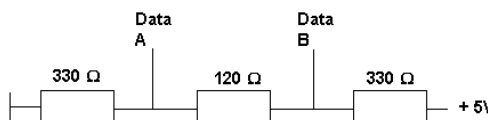
Generally this network is integrated on the plug-in card of the computer (RS 485).

Protocol:

☞
- The interface operates with 1 stop bit, no parity bit and 8 data bits.
- Transfer rate either 2400, 4800, 9600 (factory setting) or 19200 baud as selected.
- The RS485 commands are always preceded by the device address. There is provision for 127 addresses. The address must always have 3 digits. (A000_... to A127_...).
- The command from the computer must be terminated with CR.
- The response of the thermostat is always terminated with CR.
- CR = carriage return (hex: 0D)

68   Starting up   15.02.06/ YACE0065

Example: Transfer of set point 30.5°C to the thermostat with address 15.

Computer	Thermostat
„A015_OUT_SP_00_30.5"CR	⇨
⇦	„A015_OK"CR

7.7.3   Write commands (data commands to the thermostat)

Command	Explanation
OUT_SP_00_XXX.XX	Set point transfer with up to 3 places before the decimal point and up to 2 places behind
OUT_SP_01_XXX	Pump output step 1, 2, 3, 4, or 5; 0 = Stop (Standby)
OUT_SP_02_XXX	Refrigerator 0 = OFF / 1 = ON 100% / 2 = 50% (reduced output on model RE 305, RE 307, RE 310, RE 312, RE 320) / A = automatic operation
OUT_SP_04_XXX.XX	TiH outflow temperature high limit
OUT_SP_05_XXX.XX	TiL outflow temperature low limit
OUT_PAR_00_XXX.XX	Setting of control parameter Xp for controller (0.1 – 10°C)
OUT_PAR_01_XXX	Setting of control parameter Tn (5 - 200 sec)
OUT_PAR_04_XXX.XX	Setting of control parameter KPE (0.1 - 10.0)
OUT_PAR_05_XXX	Setting of control parameter TNE (5 - 200 sec)
OUT_PAR_08_XXX.XX	Setting of the WIN value for tolerance range monitoring
OUT_MODE_00_X	Keys: 0 = free / 1 = inhibited (corresponds to "KEY")
OUT_MODE_01_X	Control: 0 = internal / 1 = external
START	To switch on the unit (standby mode or "Manual Start" ON if mains are OFF)
STOP	Switches thermostat to standby (pump, heating, refrigerator off).
RMP_SELECT_X	Selection of the programme (1-5) to which the further instructions apply. When the unit is switched on, programme 5 is selected automatically.
RMP_START	Start the programmer
RMP_PAUSE	Hold (pause) the programmer
RMP_CONT	Restart the programmer after pause
RMP_STOP	Terminate the programmer
RMP_RESET	Delete the programmer
RMP_OUT_00_XXX.XX_XXX	Set a programme segment (temperature and time). A segment is added and appropriate values are applied to it.
RMP_OUT_02_XXX	Number of times the programme runs: 0 = unlimited / 1...250

☞

– For "_" use also " " (blank character).

– Response from thermostat "OK" or in case of error "ERR_X" (RS485 interface e.g. "A015_OK" or in case of error "A015_ERR_X").

– If different dates for one parameter (except for set point) are continuously transmitted to the thermostat due to bugs, this can lead to the destruction of the storage location in the thermostat. The storage locations can be overwritten up 100.000 times.

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				

7.7.4 Read commands (data requested from thermostat)

Command	Explanation
IN_PV_00	Read bath temperature (outflow temperature)
IN_PV_01	Read external temperature T$_E$.
IN_SP_00	Read temperature set point
IN_SP_01	Read pump output step
IN_SP_02	Read operating mode of refrigerator 0 = OFF / 1 = ON 100% / 2 = ON 50% (reduced output on model RE 305, RE 307, RE 310, RE 312, RE 320) / 3 = automatic operation
IN_SP_03	Read current over temperature switch-off point
IN_SP_04	Read current outflow temperature limit TiH.
IN_SP_05	Read current outflow temperature limit TiL.
IN_PAR_00	Read current value of Xp
IN_PAR_01	Read current value of Tn (201 = OFF)
IN_PAR_04	Read current value of KPE
IN_PAR_05	Read current value of TNE (201 = OFF)
IN_PAR_08	Read current value of WIN for tolerance range monitoring
IN_DO_01	State of the neutral contact: 0 = make-contact open/ 1 = make-contact closed
IN_MODE_00	Keys: 0 = free / 1 = inhibited
IN_MODE_01	Control: 0 = internal / 1 = external
IN_MODE_02	Standby: 0 = unit ON / 1 = unit OFF
TYPE	Read thermostat type
VERSION	Read software version number
STATUS	Read thermostat status 0 = OK, -1 = error
STAT	Read error diagnosis response: XXXXXXX → X = 0 no error, X = 1, 2, 3 error Char. 1 = error (Exx) Char. 2 = pump error Char. 3 = low level error Char. 4 = over temperature error Char. 5 = 0 Char. 6 = no external temp. probe (T$_E$ FAIL) Char. 7 = error analogue inputs 0 = OK / 1 = current analogue set point input < 4 mA / 2 = current

	analogue act. temperature input < 4 mA / 3 both current inputs < 4 mA
RMP_IN_00_XXX	Read a programme segment XXX (response: e. g. 030.00_010.00 = 30.00°C and 10 min)
RMP_IN_01	Read the current segment number
RMP_IN_02	Read the set number of programme runs
RMP_IN_03	Read the current programme run
RMP_IN_04	Read the programme to which further instructions apply
RMP_IN_05	Read which programme is running now (0=none)

☞ − For "_" use also " " (blank character).

   − The thermostat response is always in the fixed decimal format "XXX.XX" or for negative values "-XXX.XX" or "ERR_X". (RS485 interface e.g. "A015_XXX.XX" or "A015_-XXX.XX" or "A015_ERR_X").

7.7.5   Error messages

Message	Explanation
ERR_2	Wrong input (e.g. buffer overflow)
ERR_3	Wrong command
ERR_5	Syntax error in value
ERR_6	Illegal value
ERR_8	Channel (ext. temperature) not available
ERR_30	Programmer, all segments occupied
ERR_31	Set point not possible, analogue set point ON
ERR_32	TiH <= TiL
ERR_33	No external sensor
ERR_34	Current below 4 mA
ERR_35	Auto is selected
ERR_36	No set point input possible. Programmer is running or is paused.
ERR_37	No start from programmer possible, analogue set point input is switched on.
ERR_50	Communication between thermostat and remote control FBT is interrupted.

7.7.6   Driver software for LABVIEW®

An individual, easy-to-use control and automation software for operating the ECOLINE, INTEGRAL T and WK/WKL units can be programmed with the aid of the National Instruments programme development tool LABVIEW® (http://sine.ni.com/apps/we/nioc.vp?cid=1381&lang=US). In order to make programme operation possible on the RS 232/ RS 485 interface, LAUDA provides drivers specially designed for LABVIEW® which can be downloaded free of charge under www.lauda.de/.

7.8 Warning and safety functions

7.8.1 Over temperature protection and testing

– The units are designed for operation with non-flammable and flammable liquids to EN 61010-2-010
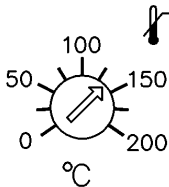
– Set the over temperature switch-off point. Recommended setting 5°C above required bath temperature.

– Not higher than 25 °C below the fire point of the bath liquid (⇨ Section 6.3).
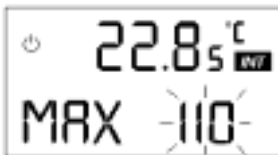
– The actual switch-off point is indicated on the display, e.g. **MAX 110°C.**

– When the switch-off point is being adjusted by more than 2°C → display shows **MAX** and actual over temperature switch-off point with 1°C resolution for approx. 4 sec.

– The position of the potentiometer is decisive for the setting. The display is just a help for the setting.

– Setting is possible only up to a upper limit of the operating temperature range + 5°C.

– When the value temperature exceeds the over temperature switch-off point:

1. double signal tone sounds.

2. The display shows the indication for over temperature (**TEMP**), the fault triangle is flashing
→ heating is switched off on both poles,
→ pump and refrigeration system are switched off by the electronics.

– Rectify the cause of the fault.

– Wait until the bath temperature has cooled down below the switch-off point or set the switch-off point at a higher value.

– When the display shows **TEMP**, reset with the key.

– Before the unit is running unattended for longer periods **overtemperature protection** should be tested. **Therefore**
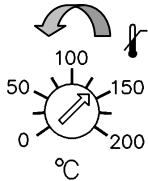
– Turn the potentiometer slowly anticlockwise. → The unit must switch off at the bath temperature.
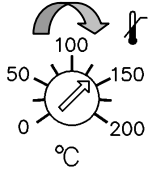
– Step 1 - 2 (see above) must follow

– Set the over temperature switch-off point again above the bath temperature and wait until the indication TEMP appears on the display, then.

– reset with the key.

7.8.2 Low-level protection and testing

– Double signal tone sounds, if the bath liquid falls so much that the heater is no longer completely covered with liquid.

1. The display shows **LEVEL** (low-level) and the fault triangle is flashing
   → heating is switched off on both poles,
   → pump and refrigeration system are switched off by the electronics.

2. Top up the bath (⇨ Section 6.2), wait until **LEVEL** appears and reset with the key.

– If necessary repeat several times in case that the pump does not purge immediately.

– **Testing at regular intervals** by lowering the bath level. Place a hose on the pump connector and pump some of the bath liquid into a suitable container.

– Step 1 - 2 must follow.

– Bath temperature during this test not below 0°C or higher than 50°C, otherwise danger of burn injuries!

– If there is any irregularity when testing the safety devices, switch off the unit immediately and pull out the mains plug!

– Have the unit checked by the **LAUDA service** or the local service organisation!

7.8.3   Pump motor monitoring

☞   −   In case of pump motor overload or a blockage the heating and the pump are switched off.

−   Double signal tone sounds.

° **22.8**s°C ᴇₓₜ

PUMP ⚠

−   The display shows **PUMP** and the fault triangle is flashing.

−   Rectify the cause of the fault, e.g. clean the pump or check the viscosity, **then**

−   reset with the key.

−   If several faults appear simultaneously, they have to be reset individually.

7.8.4   Connection floating contact "Combination fault" 31 N

This function is only available if in the parameter menu **OUT** is set to 0 (⇒ Section 7.6.6.5)

(Alarm out) 3-pole locking connector
1 = common, 2 = n.c. (break) , 3 = n.o. (make). When the unit is o.k. 1 and 3 are closed (see ill.). Max contact rating: 0.2A 24 V. 3-pin plug (⇒ Section 10 Accessories).
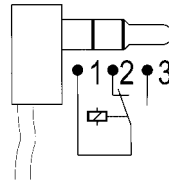
☞   −   Contact operates in case of error at over temperature protection, low-level protection, pump monitoring or any other error message.

7.8.5 Other error messages
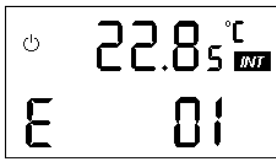
→ Pump fault, proceed as 7.8.3.

– In case of error message pull out the mains supply plug and insert a screwdriver through the lower ventilation aperture on the back to attempt to rotate the motor by means of a fan blade..

– After rectifying the fault, reset with the key..

Multiple error messages are indicated as follows
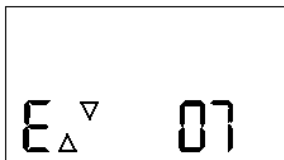
Error codes are shown sequentially using the keys ⬆ and ⬇.

Message	Explanation
01	Pump does not start up (stopped at dead position)
02	Pump takes too much current
03	Can not write to data memory
04	Data memory contains data errors
05	Break or short-circuit of temperature sensor
06	Temperature measurement circuit does not respond
07	Measurement circuit for analogue inputs does not respond
08	Message from control system: temperatures of safety and control systems not identical
09	Message from safety system: temperatures of safety and control systems not identical
10	No communication between safety and control systems
11	Programme error safety system
12	Break of safety temperature sensor
13	Programme error control system
14	Data error control system
15	System error control system

8 Maintenance

8.1 Cleaning

⚠	Before cleaning the unit, pull out the mains plug!

The unit can be cleaned with water adding a few drops of detergent (washing-up liquid), using a moist cloth.

⚠	Water must not enter the control unit

☞
- Carry out appropriate detoxification if dangerous material has been spilled on or inside the unit.
- Method of cleaning and detoxification are decided by the special knowledge of the user. In case of doubt please contact the manufacturer.

8.2 Maintenance and repair

⚠	– Before any maintenance and repair work pull out the mains plug!!
	– Repairs on the control unit must only be carried out by properly qualified personnel!

LAUDA thermostats are largely maintenance-free. If the thermostating liquid becomes dirty it has to be replaced (⇨ Section 6.2)

☞
- If a fuse blows (→ supply indication not alight) fit only fuses as specified (2 x T 16 A; 1 x T 2,5 A, size 5 x 20 → fuses are inside the unit).

UL 487-1B

F1; T 16 A

F2; T 16 A

F3; T 2,5 A
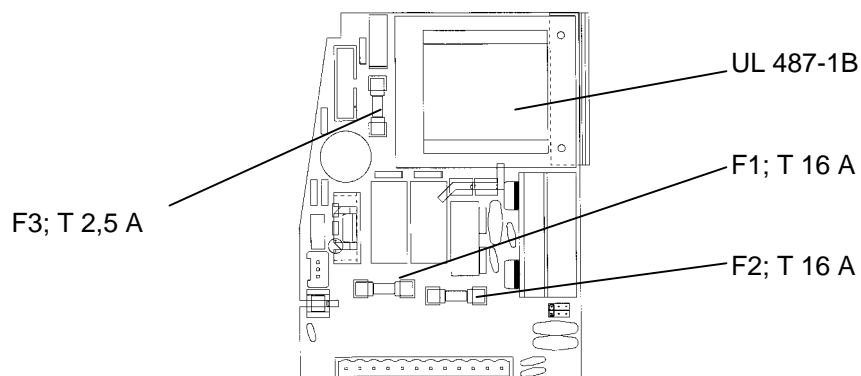
8.2.1 Maintenance of the refrigeration unit

The refrigeration unit operates largely without maintenance. Depending on the ambient dust conditions and the operating time, any dust on the heat exchanger (condenser) must be removed at intervals of 2 weeks or longer. This is done after taking off the front grille. Brush off the condenser and if necessary blow through with compressed air.
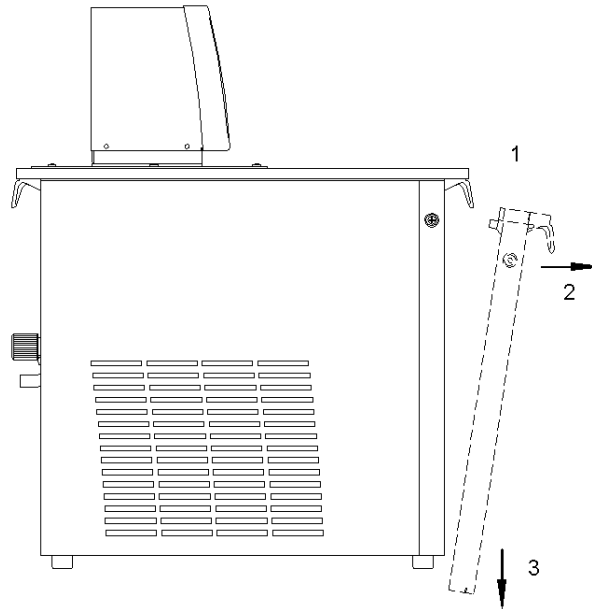
8.2.2 Note on repair and disposal

The refrigeration circuit is filled with a CFC-free refrigerant. Type and charging quantity are indicated on the unit. Repair and disposal by a qualified refrigeration engineer only!

If the equipment does have to be returned to the factory, it may only be necessary to dismantle the thermostat unit and return.

☞ − If the equipment has to be returned to the factory, please ensure that it is carefully and properly packed. LAUDA accepts no responsibility for damage due to unsatisfactory packing.

8.3   Ordering spares

When ordering spares please quote instrument type and serial number from the rating label. This avoids queries and supply of incorrect items.

The serial number is combined like following, for example **LCK0863-06-0001**

LCK0863 = Article order number/ Ref. No.
06 = manufacturing year 2006
0001 = continuous numbering

Your contact for service an support

LAUDA Service Centre
Phone: +49 (0)9343/ 503-236 (English and German)
E-mail   service@lauda.de

We are available any time for your queries, suggestions and criticism!

LAUDA DR. R. WOBSER GMBH & CO.KG
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Germany
Phone: +49 (0)9343/ 503-0
Fax: +49 (0)9343/ 503-222
e-mail   info@lauda.de
Internet http://www.lauda.de/

9 Technical Data (according to DIN 12876)

		RE 304	RE 305
Operating temperature range	°C	-20...200	-40...200
Ambient temperature range	°C	5...40 (⇨ Section 6.1)	
Setting resolution	°C	0.1 / 0.01	
Indication resolution	°C	0.05 / 0.01	
Indication accuracy		±0.2°C ③, additive re-calibration	
Temperature control	± °C	0.02	0.02
Safety features ①		III/ FL	
Additional function		2-line back-lit LCD-display. programmer, external controller, analogue inputs/outputs	
		automatic compressor control	automatic compressor control + cooling adjustment
Heater power 230 V; 50/ 60 Hz	kW	2.25	
115 V; 60 Hz		1.3	
100 V; 50/60 Hz		1.0	
Cooling capacity 20°C	kW	0.5	
(eff.) @ with ethanol 0°C		0.42	
at 20°C ambient -10°C		0.36	
temperature -20°C		0.27	
-30°C		0.14	
-40°C		0.04	
Pump type		pressure pump with choice of 5 output step	
Max. discharge pressure.②	bar	0.4	
Max. flow rate. ②	l/min	17	
Pump connections	mm	nipples 13 mm dia. (M 16 x 1)	
Max. bath volume.	l	3...4.5	3...4.5 no usable capacity
Bath opening (W x D)	mm	130x105	200x200
Bath depth	mm	160	40
Usable depth	mm	140	20
Height top edge of bath	mm	363	441
Overall size (W x D x H)	mm	180x320x524	280x400x602
Weight	kg	19	30
Mains connection	V; Hz	see Cat. No. below Protection Class 1 to DIN VDE 106-1	
Power 230 V; 50/ 60Hz	kW	2.3	2.3
con- 115 V; 60 Hz		1.4	1.4
sumption 100 V; 50/60 Hz		1.1	1.3
Ref. No. 230 V±10%; 50/60 Hz		**LCK 0863**	-----
230 V±10%; 50 Hz		-----	**LCK 1902**
115 V±10%; 60 Hz		-----	**LCK 4902**

* @ -10°C
① FL suitable for flammable and non-flammable liquids
② at pump output step 5
③ → Section 1.2 last item

We reserve the right to make technical alterations!

Units to EU Directive 89/336/EWG (EMC) and 73/ 23/ EWG (low-voltage) with CE-mark.

			RE 306	RE 307	RE 310	RE 312	RE 320
Operating temperature range		°C	- 20...200	- 35...200	- 40...200	- 30...200	- 30...200
Ambient temperature range		°C	5...40 (⇨ Section 6.1)				
Setting resolution		°C	0.1 / 0.01				
Indication resolution		°C	0.1 / 0.05 / 0.01				
Indication accuracy			±0.2°C ③, additive re-calibration				
Temperature control		± °C	0.01	0.02	0.02	0.02	0.02
Safety features ①			FL				
Additional function			2-line back-lit LCD-display. programmer, external controller, analogue inputs/outputs				
			automatic compressor control	automatic compressor control + cooling adjustment			
Heater power	230 V; 50/ 60 Hz	kW	2.25				
	115 V; 60 Hz		1.3				
	100 V; 50/60 Hz		1.0				
Cooling capacity	20°C	kW	0.20	0.30	0.50	0.30	0.35
(eff.) @ with ethanol	0°C		0.15	0.22	0.42	0.23	0.25
at 20°C ambient	-20°C		0.05	0.10	0.27	0.13	0.10
temperature	-30°C		----	0.06	0.14	0.04	0.04
	-40°C		----	----	0.04	----	----
Pump type			pressure pump with choice of 5 output step				
Max. discharge pressure.②		bar	0.4				
Max. flow rate. ②		l/min	17				
Pump connections		mm	nipples 13 mm dia. (M 16 x 1)				
Max. bath volume.		l	4...6	4...6	6,5...9,5	9...12	14...20
Bath opening (W x D)		mm	150x130	150x130	200x200	200x200	300x350
Bath depth		mm	160	160	160	200	160
Usable depth		mm	140	140	140	180	140
Height top edge of bath		mm	396	396	441	441	441
Overall size (W x D x H)		mm	200x400x557	200x400x557	280x400x602	250x400x602	350x530x602
Weight		kg	24	25,2	30	28	41,5
Mains connection		V; Hz	see Ref .No. below Protection Class 1 to DIN VDE 106-1				
Power con-sumption	230 V; 50/ 60Hz	kW	2.3	2.3	2.3	2.3	2.3
	115 V; 60 Hz		1.4	1.4	1.4	1.4	1.4
	100 V; 50/60 Hz		1.1	1.1	-----	1.1	1.2
Ref. No.	**230 V±10%; 50/60 Hz**		**LCK 0866**	**-----**	**-----**	**-----**	**-----**
	230 V±10%; 50 Hz		**-----**	**LCK 1869**	**LCK 1884**	**LCK 1872**	**LCK 1875**
	230 V±10%; 60 Hz		**-----**	**LCK 2869**	**-----**	**LCK 2872**	**LCK 2875**
	115 V±10%; 60 Hz		**LCK 4866**	**LCK 4869**	**LCK 4884**	**LCK 4872**	**LCK 4875**
	100 V±5%; 50/60 Hz		**LCK 6866**	**LCK 6869**	**-----**	**LCK 6872**	**LCK 6875**
	208-230V±10%; 60Hz				**LCK 8884**		

* @ -10°C
① FL suitable for flammable and non-flammable liquids
② at pump output step 5
③ → Section 1.2 last item

We reserve the right to make technical alterations!

Units to EU Directive 89/336/EWG (EMC) and 73/ 23/ EWG (low-voltage) with CE-mark.

Standard settings of control parameters and pump ⇨ Section 7.6.6

Unit Type	Xp (°C)	Tn (s)	Pump outflow step
RE 304	---	---	---
RE 305	8,5	40	3
RE 306	4,0	20	2
RE 307	3,0	25	3
RE 310	5,0	25	4
RE 312	4,5	30	4
RE 320	2,0	25	5

We reserve the right to make technical alterations!

Pump characteristics
measured with water
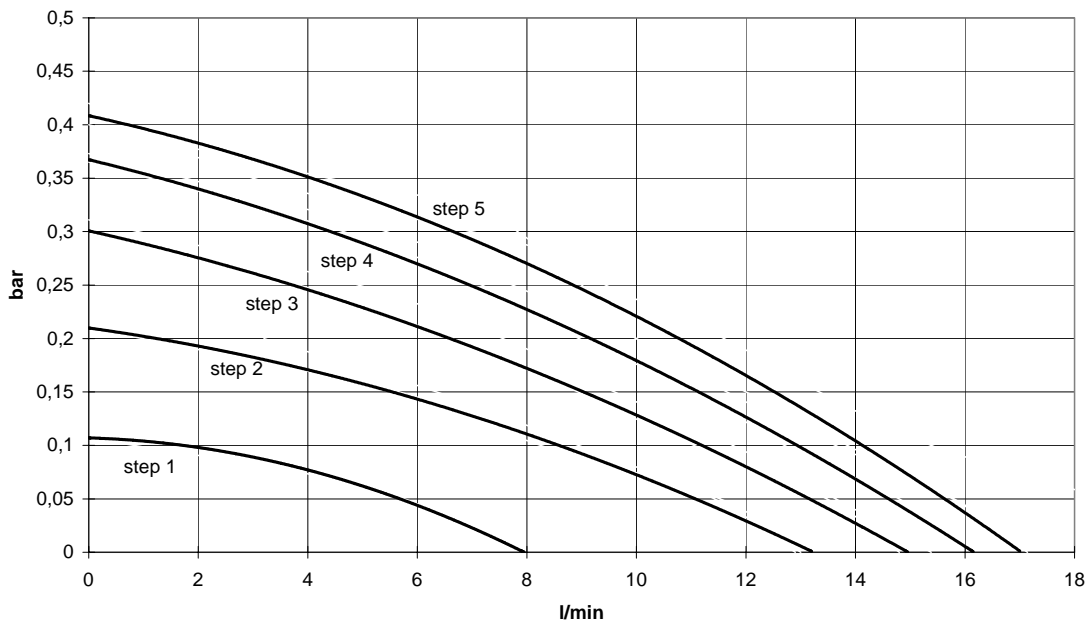
Cooling curve
measured with ethanol

Chart — X-axis: **Abkühlzeit / Cool down time [h:min]** (0:00 to 3:00); Y-axis: **Badtemperatur / Bath Temperature [°C]** (-50,00 to 20,00)

Legend boxes:
- RE 120 / RE 220 / RE 320
- RE 104 / RE 204 / RE 304
- RE 106 / RE 206 / RE 306
- RE 112 / RE 212 / RE 312
- RE 107 / RE 207 / RE 307
- RE 110 / RE 210 / RE 310
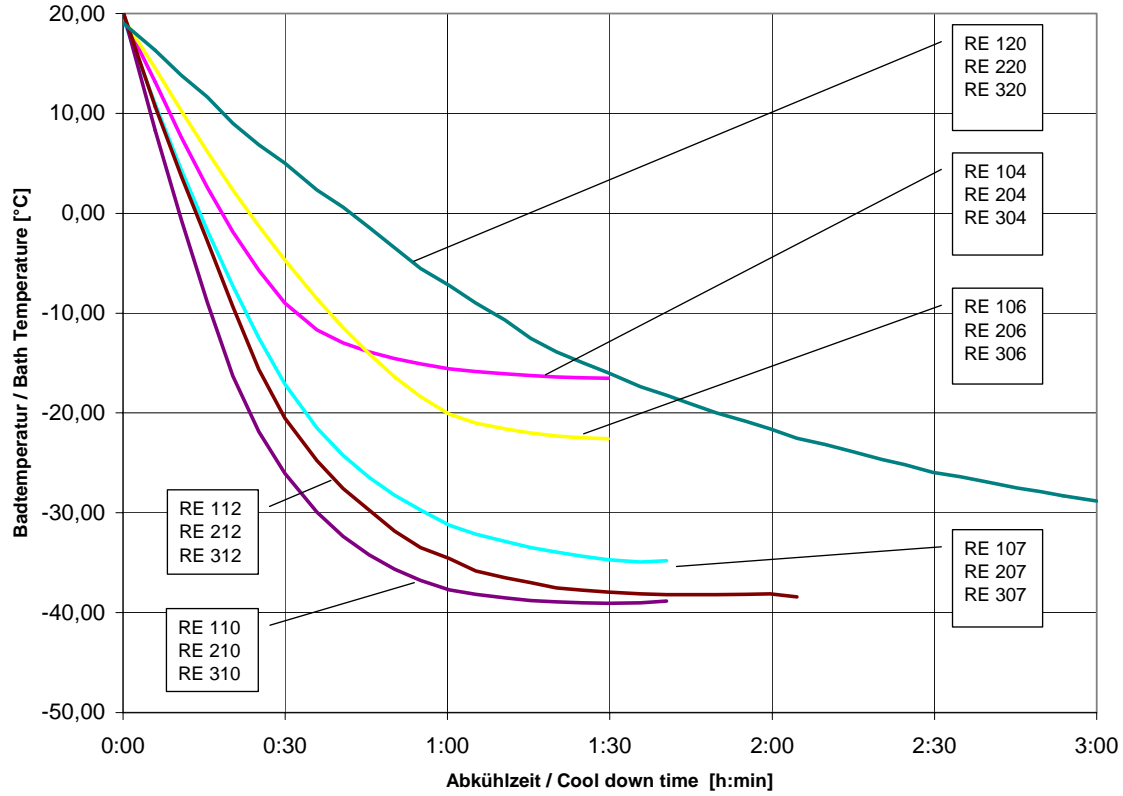
Bath liquid:
water/glycol 1:1
(to -25°C) as bath liquid

Time from graph
x 1,7

10 Accessories

Accessories	suitable for	Ref. No.
Gable cover	RE 320	LCZ 011
Rising platform 8 steps	RE 306, RE 307	LCZ 0646
Rising platform 8 steps	RE 310, RE 312	LCZ 0647
Rising platform 8 steps	RE 320	LCZ 0635
Pump short circuit	all RE 3xx models	LZM 045
3-pole locking connector (floating contact "Combination fault" 31 N)	for all units	EQS 054

For further accessories please contact us.

For all units

Platinum resistance thermometers to DIN EN 60751		
Pt 100-70	Temperature range –200...300°C 50% response time 1 sec 4 mm dia., length 250 mm Accuracy Class A Lemo plug	ETP 009
Pt 100-94	Temperature range –100...200°C 4 mm dia, length 250 mm Accuracy class A, with attached Silicone cable (2 m long) and 4-pin Lemo plug	ETP 059
Clamping fitting 4 mm dia suitable for Pt100-70, Pt 100-94		HX 078
Connecting cable, 2.5 m long Lemo/Lemo plug suitable for Pt 100-70		UK 246
Cable length as specified		UK 247
Remote control FBT 1/3 19"; 4 elevation marks		LWZ 028
Housing for FBT		LWZ 027
Cable for Remote control FBT, length 5m		EKS 057
Cable for Remote control FBT, length on demand, max. 50m		UK 258

11 Circuit diagrams

alle RE1xx ohne Magnetventil Y1

REx020	230V:60Hz
REx020	100V:50/60Hz

REx020	230V:50Hz
REx020	115V:60Hz

REx06	100V:50/60Hz o.Y1
REx07	100V:50/60Hz
REx07	230V:60Hz
REx10	100V:50/60Hz
REx10	208V:60Hz
REx12	100V:50/60Hz
REx12	230V.60Hz

REx06	230V:50/60Hz o.Y1
REx06	115V.60Hz o.Y1
REx07	230V:50Hz
REx07	115V:60Hz
REx10	230V:50Hz
REx10	115V:60Hz
REx12	230V:50Hz
REx12	115V:60HZ

REx06 230V50/60Hz
ohne Kondensator C

REx04	230V:60Hz
REx04	100V:50/60Hz

bis Serie X.Y.Z.A19

REx04	230V:50/60Hz
REx04	115V:60Hz
REx04	100V:50/60Hz

ab Serie X10...

a	99/014	24.02.99	B.Sch.	Datum	02.03.1998	**LAUDA**	Ecoline RE xxx	Blatt 2
				Bearb.	B.Schmies		Schaltplan	
Zus1.	Änderung	Tag	Name	Gepr.		Dr.R.Wobser GmbH & Co KG	Circuit diagram	2 Bl.
						Art.Nr. YEC 0001		17.06. 4

LAUDA

			RE 3xx
	A 1	Printed circuit board „Mains"	UL 487-1B
	A 2	Printed circuit board „Display"	UL 515
	A 3	Printed circuit board serial interface RS 232/RS 485	UL 516
	A 4	Printed circuit board Mains LED-Backlight	UL 517
	A 5	Printed circuit board Display LED-Backlight	UL 518
	B 1	Pt100 probe safety circuit	ETP 057
	B 2	Pt100 probe actual value	
	E 1	Heater 1,5 kW	----------
	E 2	Heater 2,25 kW	EH 169
	M 1	Pump motor	EM 109
	S 1	Mains switch	EST 101
	U 3	SSR (BRT22H) Y 1 output A1	---------
	X 1	Mains connection	EKN 001
	X 2	Lock screw	2x EQZ 048
	X 8	Connection socket Cooling (Stakei 2)	EQK 004
			EQZ 006
	X 10	Connection socket Cooling unit (Stakei 200)	EQD 037
			EQZ 006
	X 13	Housing 2pol.	EQF 067
	X 21	Plug strip terminal 12pol.	EQF 079
	X 23	Line up terminal 2pol.	EZK 063
RE x04	F 4	Pressure switch	ES 045
	M 2	Compressor	EMV 050
	M 3	Fan	EML 052
RE x05	F 4	Pressure switch	ES 048
	M 2	Compressor	EMV 056
	M 3	Fan	EML 057
	U 3	SSR (BRT22H) Y 1 output A1	---------
	Y 1	Solenoid valve	EVM 077
RE x06	F 4	Pressure switch	ES 045
	M 2	Compressor	EMK 186
	M 3	Fan	---------
RE x07	F 4	Pressure switch	ES 045
	M 2	Compressor	EMV 011
	M 3	Fan	EML 042
	U 3	SSR (BRT22H) Y 1 output A1	---------
	Y 1	Solenoid valve	EVM 077
	[T 3	Transformer	EIT 125]
RE x10	F 4	Pressure switch	ES 048
	M 2	Compressor	EMV 056
	M 3	Fan	EML 057
	U 3	SSR (BRT22H) Y 1 output A1	---------
	Y 1	Solenoid valve	EVM 077
RE x12	F 4	Pressure switch	ES 045
	M 2	Compressor	EMV 011
	M 3	Fan	EML 042
	U 3	SSR (BRT22H) Y 1 output A1	---------
	Y 1	Solenoid valve	EVM 077
	[T 3	Transformer	EIT 125]
RE x20	F 4	Pressure switch	ES 045
	M 2	Compressor	EMK 146
	M 3	Fan	
	U 3	SSR (BRT22H) Y 1 output A1	---------
	Y 1	Solenoid valve	EVM 077
	[T 3	Transformer	EIT 125]

115V; 60Hz ◆ [100V; 50/60Hz] ◆ *208V 60Hz*   from serial number: 04-0001

				RE 3xx
	A 1	Printed circuit board „Mains"		UL 499
	A 2	Printed circuit board „Display"		UL 488-1C
	A 3	Printed circuit board serial interface RS 232/RS 485		UL 490
	A 4	Printed circuit board Mains LED-Backlight		UL 492
	A 5	Printed circuit board Display LED-Backlight		EAO 015
	B 1	Pt100 probe safety circuit		ETP 057
	B 2	Pt100 probe actual value		
	E 1	Heater	1,3 kW at 115V	EH 171
			1,0 kW at 100V	
	M 1	Pump motor		EM 109
	S 1	Mains switch		EST 101
	U 3	SSR (BRT22H)	Y 1 Output to A1	---------
	X 1	Mains connection		EKN 003
	X 2	Lock screw		2x EQZ 048
	X 8	Connection socket Cooling (Stakei 2)		EQK 004+EQZ 006
	X 10	Connection socket Cooling unit (Stakei 200)		EQD 037+EQZ 006
	X 13	Housing 2pol.		EQF 067
	X 21	Plug strip terminal 12pol.		EQF 079
	X 23	Line up terminal 2pol.		EZK 063
RE x05	F 4	Pressure switch		ES 048
	M 2	Compressor		EMV 055
	M 3	Fan		EML 056
	U 3	SSR (BRT22H)	Y 1 Output to A1	---------
	Y 1	Solenoid valve		EVM 079
RE x06	F 4	Pressure switch		ES 045
	M 2	Compressor		EMK 187
	M 3	Fan		----------
	[T 3	Transformer		EIT 122]
RE x07	F 4	Pressure switch		ES 045
	M 2	Compressor		EMV 012
	M 3	Fan		EML 033
	U 3	SSR (BRT22H)	Y 1 Output to A1	---------
	Y 1	Solenoid valve		EVM 079
	[T 3	Transformer		EIT 122]
RE x10	F 4	Pressure switch		ES 048
	M 2	Compressor		EMV 055
	M 2	*Compressor*		*EMV 057*
	M 3	Fan		EML 056
	M 3	*Fan*		*EML 057*
	U 3	SSR (BRT22H)	Y 1 Output to A1	---------
	Y 1	Solenoid valve		EVM 079
	Y 1	*Solenoid valve*		*EVM 077*
RE x12	F 4	Pressure switch		ES 045
	M 2	Compressor		EV 012
	M 3	Fan		EML 033
	U 3	SSR (BRT22H)	Y 1 Output to A1	---------
	Y 1	Solenoid valve		EVM 079
	[T 3	Transformer		EIT 122]
RE x20	F 4	Pressure switch		ES 045
	M 2	Compressor		EMK 181
	M 3	Fan		
	U 3	SSR (BRT22H)	Y 1 Output to A1	---------
	Y 1	Solenoid valve		EVM 079
	[T 3	Transformer		EIT 122]

12   Pipe plans

Kältemittel / Refrigerant / Refrigerant: R134a

					Datum	Name	LAUDA	Rohrleitungsplan	RE 104/ 204/ 304/ 106/ 206/ 306	
				Bearb	19 09 97	Haas				
				Gepr	03 02 98	Firmbach	DR. R. WOBSER GMBH & CO KG	Pipe plan	YRC 0001	Blatt1
Ausg	Änderung	Tag	Name	Norm						1 Bl

Für diese Zeichnung behalten wir uns alle nicht ausdrücklich eingeräumten Nutzungsrechte einschließlich der Vervielfältigung und Weitergabe an Dritte vor. Technische Änderungen vorbehalten.

Kältemittel / Refrigerant / Refrigerant: R404A

					Datum	Name	LAUDA	Rohrleitungsplan	RE 207/ 307/ 212/ 312	
				Bearb	19 09 97	Haas				
				Gepr	03 02 98	Firmbach	DR. R. WOBSER GMBH & CO KG	Pipe plan	YRC 0004	Blatt1
Ausg	Änderung	Tag	Name	Norm						1 Bl

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LAUDA

Kältemittel / Refrigerant / Refrigerant: R404A

				Datum	Name	**LAUDA**	Rohrleitungsplan	RE 205/ 305/ 210/ 310	
			Bearb	20 02 03	Haas				
			Gepr	20 02 03	Braun		Pipe plan	YRC 0010	Blatt 1
Ausg	Änderung	Tag	Name	Norm		DR R WOBSER GMBH & CO KG			1 Bl

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Kältemittel / Refrigerant / Refrigerant: R404A
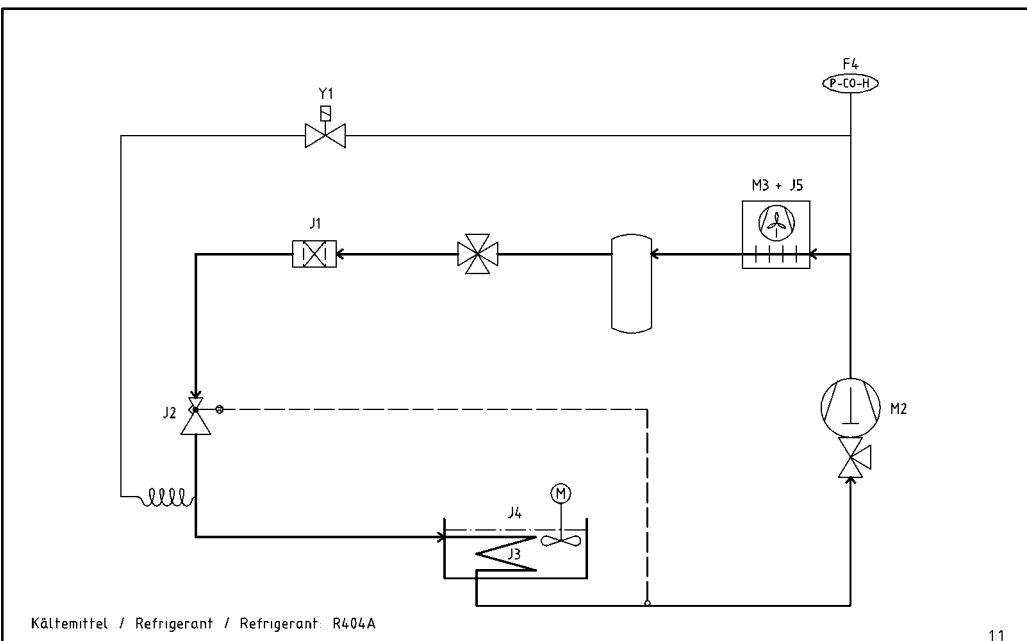
				Datum	Name	**LAUDA**	Rohrleitungsplan	RE 220/ 320	
			Bearb	22 09 97	Haas				
			Gepr	03 02 98	Firmbach		Pipe plan	YRC 0005	Blatt 1
Ausg	Änderung	Tag	Name	Norm		DR R WOBSER GMBH & CO KG			1 Bl

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230V; 50Hz ◆ 230V 50/60Hz ◆ [230V; 60Hz]   from serial number: 04-0001

RE 304	F 4	Pressure switch	CC80 24/18bar	ES 045
	M 2	Compressor	GD 36 MBd	EMV 050
	J 1	Drier		EO 003
	J 2	Capillary		HKA 114
	J 3	Evaporator		----------
	J 4	Bath		----------
RE 305	F 4	Pressure switch	CC25 28/18bar	ES 048
	M 2	Compressor	NE2134GK Code: 953AA51B9AY	EMV 056
	M 3	Fan	Type:NET4T10ZVN001/ 10W	EML 057
	J 1	Filter drier / receiver	CNO 732 s	EO 044
	J 2	Injection valve	TLEX-00216	EVE 128
	J 3	Injection valve	AEL0,5 1-7bar;Type: AEL 222200	EVE 135
	J 4	Evaporator		----------
	J 5	Bath		----------
	J 6	Condenser	D 38668	EOW 089
	Y 1	Solenoid valve	2/2Wege 6mm Löt / Type: 1028/2	EVM 077
RE 306	F 4	Pressure switch	CC80 24/18bar	ES 045
	M 2+M 3+J 5	Cooling unit	AZ 0411 YS	EMK 186
	J 1	Drier		EO 003
	J 2	Capillary		HKA 114
	J 3	Evaporator		----------
	J 4	Bath		----------
RE 307	F 4	Pressure switch	CC80 24/18bar	ES 045
	M 2	Compressor	AZ 0411 YS	EMV 011
	M 3	Fan	W2S 130-AA75-A3; LV1831	EML 042
	J 1	Filter drier / receiver	CNO 432 s	EO 040
	J 2	Injection valve	TLK 0,3 R404A MOP 2,5	EVE 111
	J 3	Evaporator		----------
	J 4	Bath		----------
	J 5	Condenser		EOW 085
	Y 1	Solenoid valve	2/2Wege 6mm Löt / Type: 1028/2	EVM 077
	[T 3	Transformer	ESS 550VA Pr.208-230V; sec.245V-50/60Hz BV:039-293	EIT 125]
RE 310	F 4	Pressure switch	CC25 28/18bar	ES 048
	M 2	Compressor	NE2134GK Code: 953AA51B9AY	EMV 056
	M 3	Fan	Type:NET4T10ZVN001/ 10W	EML 057
	J 1	Filter drier / receiver	CNO 732 s	EO 044
	J 2	Injection valve	TLEX-00216	EVE 128
	J 3	Injection valve	AEL0,5 1-7bar;Type: AEL 222200	EVE 135
	J 4	Evaporator		----------
	J 5	Bath		----------
	J 6	Condenser	D 38668	EOW 089
	Y 1	Solenoid valve	2/2Wege 6mm Löt / Type: 1028/2	EVM 077
RE 312	F 4	Pressure switch	CC80 24/18bar	ES 045
	M 2	Compressor	AZ 0411 YS	EMV 011
	M 3	Fan	W2S 130-AA75-A3; LV1831	EML 042
	J 1	Filter drier / receiver	CNO 432 s	EO 040
	J 2	Injection valve	TLK 0,3 R404A MOP 2,5	EVE 111
	J 3	Evaporator		----------
	J 4	Bath		----------
	Y 1	Solenoid valve	2/2Wege 6mm Löt / Type: 1028/2	EVM 077
	[T 3	Transformer	ESS 550VA Pr.208-230V; sec.245V-50/60Hz BV:039-293	EIT 125]
RE 320	F 4	Pressure switch	CC80 24/18bar	ES 045
	M 2+M 3+J 5	Cooling unit	UB 6144 Z/2	EMK 146
	J 1	Drier	DML 032 s	EO 041
	J 2	Injection valve	TLK -0,5 R404A MOP 3,3	EVE 112
	J 3	Evaporator		----------
	J 4	Bath		----------
	Y 1	Solenoid valve	2/2Wege 6mm Löt / Type: 1028/2	EVM 077
	[T 3	Transformer	ESS 550VA Pr.208-230V; sec.245V-50/60Hz BV:039-293	EIT 125]

115V; 60Hz ◆ [100V; 50/60Hz] ◆ *208V; 60Hz*   from serial number: 04-0001

RE 305	F 4	Pressure switch	CC25 28/18bar	ES 048
	M 2	Compressor	NE2134GK Code: 952AG51B9AY	EMV 055
	M 3	Fan	Type:NET3T09PUN302/ 9W	EML 056
	J 1	Filter drier / receiver	CNO732s	EO 044
	J 2	Injection valve	TLEX-00216	EVE 128
	J 3	Injection valve	AEL 0,5 1-7bar; Type: AEL 222200	EVE 135
	J 4	Evaporator		----------
	J 5	Bath		----------
	J 6	Condenser	D 38668	EOW 089
	Y 1	Solenoid valve	2/2Wege 6mm Löt / Type: 1028/2	EVM 079
RE 306	F 4	Pressure switch	CC80 24/18bar	ES 045
	M 2+M 3+J 5	Cooling unit	AZ 4419 Y/A	EMK 187
	J 1	Drier		EO 003
	J 2	Capillary		HKA 114
	J 3	Evaporator		----------
	J 4	Bath		----------
	[T 3	Transformer	ESS 550VA Pr.110V; sec.110V-50/60Hz BV:039-266	EIT 122]
RE 307	F 4	Pressure switch	CC80 24/18bar	ES 045
	M 2	Compressor	AZ 4419 Y-A	EMV 012
	M 3	Fan	W2E 142-CC13-16	EML 033
	J 1	Filter drier / receiver	CNO 432 s	EO 040
	J 2	Injection valve	TLK 0,3 R404A MOP 2,5	EVE 111
	J 3	Evaporator		----------
	J 4	Bath		----------
	J 5	Condenser		EOW 085
	Y 1	Solenoid valve	2/2Wege 6mm Löt / Type: 1028/2	EVM 079
	[T 3	Transformer	ESS 550VA Pr.110V; sec.110V-50/60Hz BV:039-266	EIT 122]
RE 310	F 4	Pressure switch	CC25 28/18bar	ES 048
	M 2	Compressor	NE2134GK Code: 952AG51B9AY	EMV 055
	M 2	*Compressor*	*NE2134GK Code: 953AD*	*EMV 057*
	M 3	Fan	Type:NET3T09PUN302/ 9W	EML 056
	M 3	*Fan*	*Type:NET4T10ZVN001/ 10W*	*EML 057*
	J 1	Filter drier / receiver	CNO732s	EO 044
	J 2	Injection valve	TLEX-00216	EVE 128
	J 3	Injection valve	AEL 0,5 1-7bar; Type: AEL 222200	EVE 135
	J 4	Evaporator		----------
	J 5	Bath		----------
	J 6	Condenser	D 38668	EOW 089
	Y 1	Solenoid valve	2/2Wege 6mm Löt / Type: 1028/2	EVM 079
	Y 1	*Solenoid valve*	*2/2Wege 6mm Löt / Type: 1028/2*	*EVM 077*
RE 312	F 4	Pressure switch	CC80 24/18bar	ES 045
	M 2	Compressor	AZ 4419 Y-A	EMV 012
	M 3	Fan	W2E 142-CC13-16	EML 033
	J 1	Filter drier / receiver	CNO 432 s	EO 040
	J 2	Injection valve	TLK 0,3 R404A MOP 2,5	EVE 111
	J 3	Evaporator		----------
	J 4	Bath		----------
	Y 1	Solenoid valve	2/2Wege 6mm Löt / Type: 1028/2	EVM 079
	[T 3	Transformer	ESS 550VA Pr.110V; sec.110V-50/60Hz BV:039-266	EIT 122]
RE 320	F 4	Pressure switch	CC80 24/18bar	ES 045
	M 2+M 3+J 5	Cooling unit	UB 6144 Z/2	EMK 181
	J 1	Filter drier	DML 032 s	EO 041
	J 2	Injection valve	TLK -0,5 R404A MOP 3,3	EVE 112
	J 3	Evaporator		----------
	J 4	Bath		----------
	Y 1	Solenoid valve	2/2Wege 6mm Löt / Type: 1028/2	EVM 079
	[T 3	Transformer	ESS 550VA Pr.110V; sec.110V-50/60Hz BV:039-266	EIT 122]

BESTÄTIGUNG / CONFIRMATION / CONFIRMATION

LAUDA

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