

Operating instructions

LAUDA
Low-temperature thermostat
RL 6 CH

From Serie X30
07/99
YACE0055




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Appendix

Accessories

Circuit diagrams

- 1.9 Set the overtemperature protection at the control  to some value above the setpoint. When the red signal lamp lights up, reset the system by pressing the reset key .
- 1.10 When connecting up an external system, ensure that filling this system does not cause the level inside the thermostat to fall more than is permitted.
- 1.11 If the setpoint of the bath liquid is reached, the yellow pilot lamp "Heating"  starts to flash. Having settled the digital thermometer displays the setpoint.
- 1.12 Operating safety
- The thermostat must be operated only with non-flammable bath liquids, or with flammable bath liquids up to no more than 25 K below their flashpoint, otherwise there is a possibility that a flammable atmosphere may form (see Item 4.2).
- 1.13 **WARNING**
- Parts of the bath cover may reach temperatures above 70°C when working at higher temperatures. The outflow and return pipes of the pumps reach the operating temperature. Touching them is dangerous because of high or low temperatures.

LAUDA Compact Low-Temperature Thermostat
RL 6 CH

2. Technical data to DIN 58966

RL 6 CH

| | | |
|---|-------------|--|
| Operating temperature range | (°C) | -80...100 |
| Ambient temperature range | (°C) | 5...40 |
| Temp. setting/ resolution | (°C) | digital with 10-turn potentiometer and numerical display/ 0.1 °C |
| Bath temperature measurement | | built-in digital thermometer with LED display ; 0.1°C resolution; absolute accuracy better than 0.2% of reading \pm 0.2 K*); temperature probe Pt 100 to DIN IEC 751. |
| External temperature measurement | | built-in separate measuring system using external Pt 100 to DIN IEC 751; 4-wire circuit; can be switched to LED display; accuracy 0.05% of reading \pm 0.1 K (without temperature probe) |
| Temperature control | | PID controller with adjustable external proportion and adjustable X_p |
| Temperature variation at -10°C in the bath | (\pm °C) | 0.02...0.05*) |
| Heater power | (kW) | 1.2 |
| Cooling | | can be switched manually |
| Effective cooling capacity with ethanol at 20°C ambient temperature | (kW) | |
| 20°C | | 0.45 |
| -50°C | | 0.25 |
| -70°C | | 0.19 |
| -80°C | | 0.11 |
| Safety system | | adjustable overtemperature protection and low-level protection to EN 61010 (DIN 12879 class 2) |
| Pump output against zero head | (l/min) | 22 |
| max. pump pressure | (bar) | 0.5 |
| Pump connections | | M 16 x 1, nipples 13 mm \varnothing |
| Filling volume | (l) | 4...6 |
| Bath opening (W x D) | (mm) | 120x105 |
| Bath depth | (mm) | 190 |
| Usable liquid depth | (mm) | 150 |
| Height to top of bath | (mm) | 540 |
| Overall size (W x D x H) | (mm) | 495x615x740 |
| Weight | (kg) | 98 |
| Supply | (V;Hz) | 230;50 / 230;60 Protection Class 1 to VDE 0106 |
| Loading (max.) without accessories | (kW) | 2,5 |
| Current take-up (max.) with accessories | (A) | 16 |
| Nominal current of fuses on customer's side | (A) | T 16 A |

Units are conform to EU Guideline 89/336/EWG (EMC) and 73/23/EWG (low-voltage) and carry the CE mark.

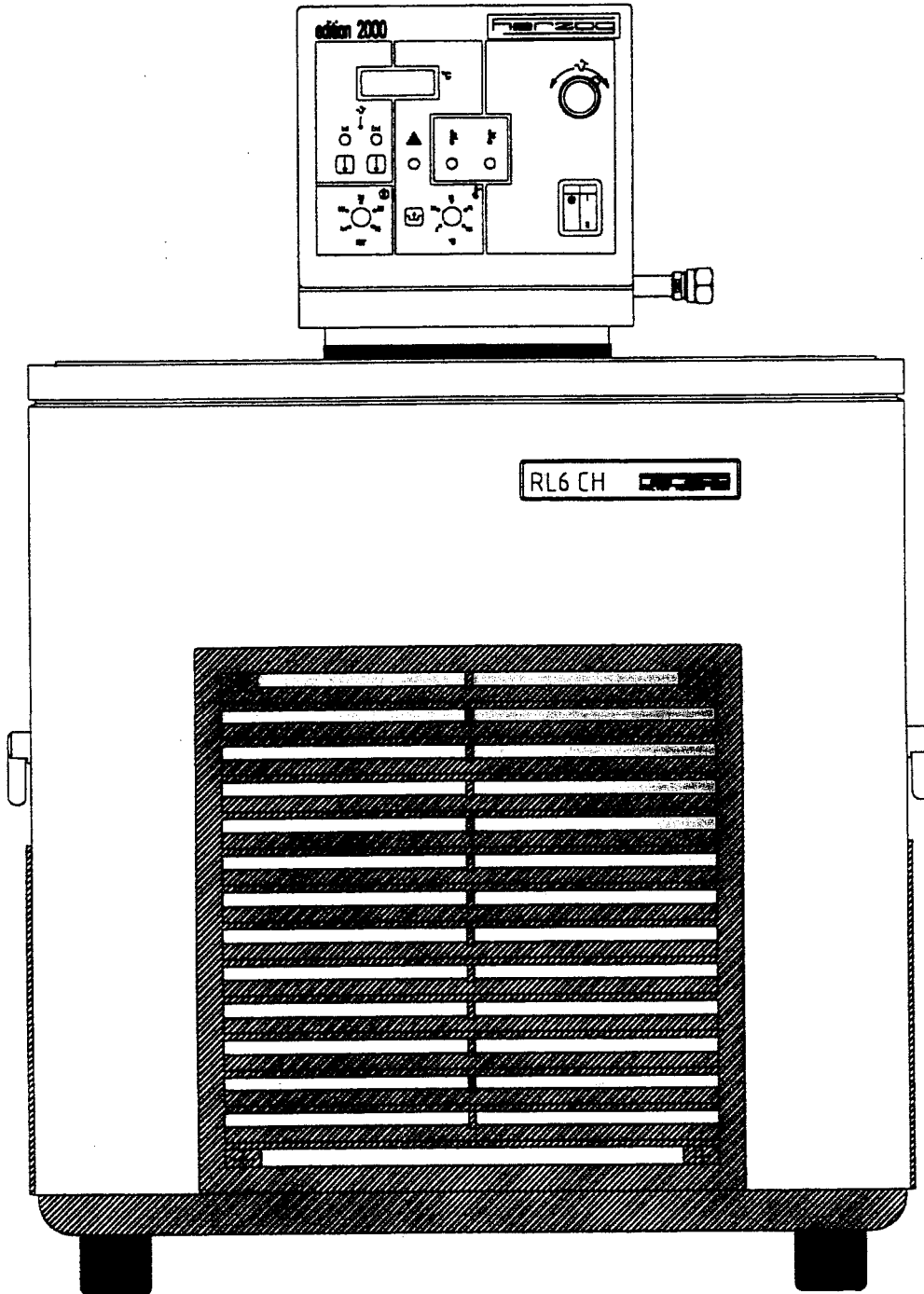
Cat.-No.: 230 V; 50/60 Hz

LSO 0080

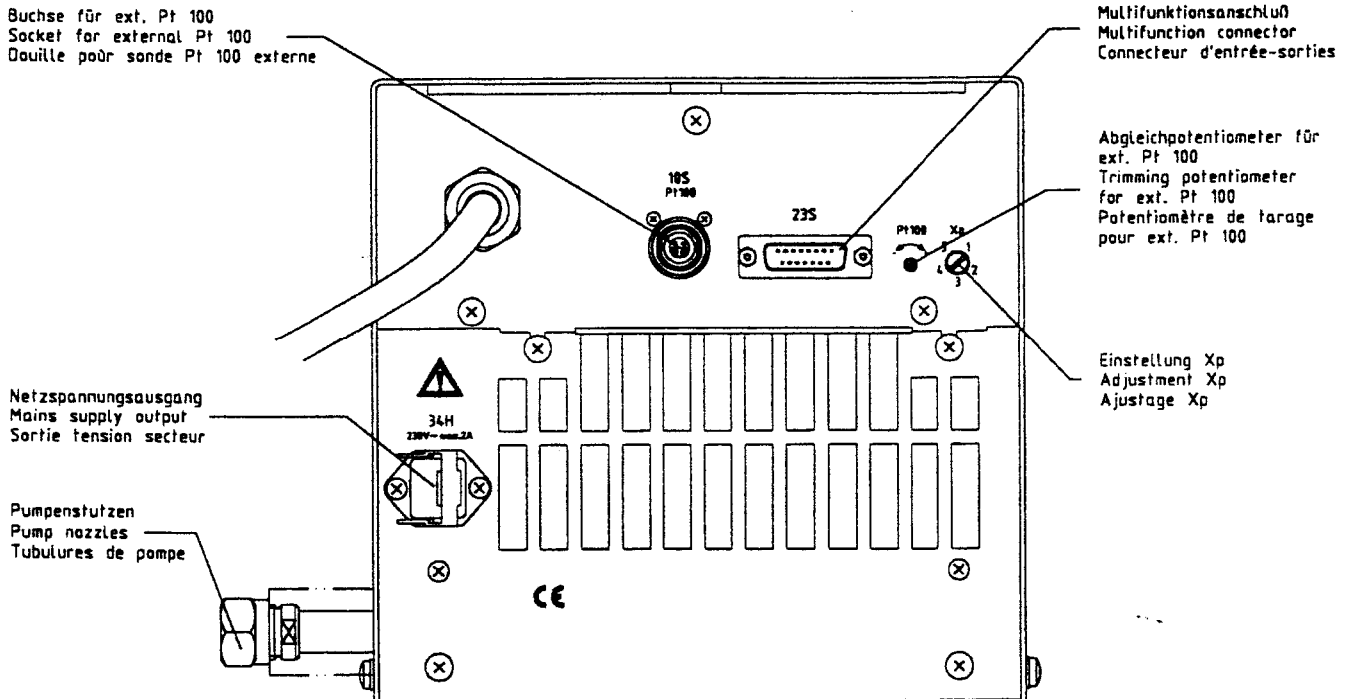
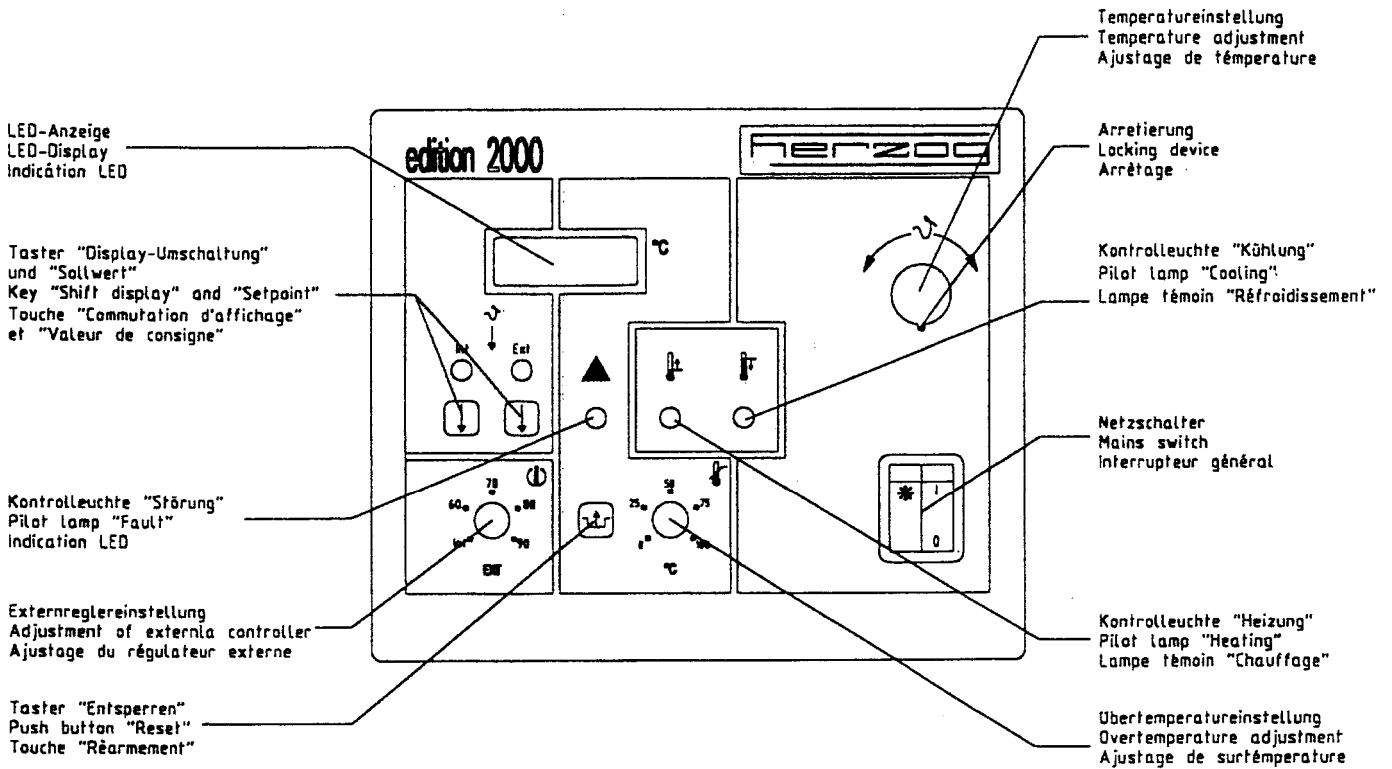
Technical changes reserved!

*) see Item 4.3

LAUDA Compact Low-Temperature Thermostat
RL 6 CH



LAUDA Compact-Kältethermostat
RL 6 CH



3. General construction and technical description

3.1 Operating principle

Laboratory thermostats operate with liquids (operating medium, heat transfer fluid) which serve for energy transfer to the product to be thermostated.

The thermostated products can be immersed in the thermostatic bath (bath thermostat), or placed in an external open bath whose liquid is circulated by the pump of the thermostat.

When operating as circulator the thermostatic liquid is pumped through an external heat exchanger arranged by the user in which a product is being thermostated (jacketed vessels, reactors, heat exchangers).

3.2 Materials

All materials in contact with the bath liquid are made from high-grade stainless steel or materials of similar anti-corrosion properties. Additionally, materials of PTFE and PETP are used.

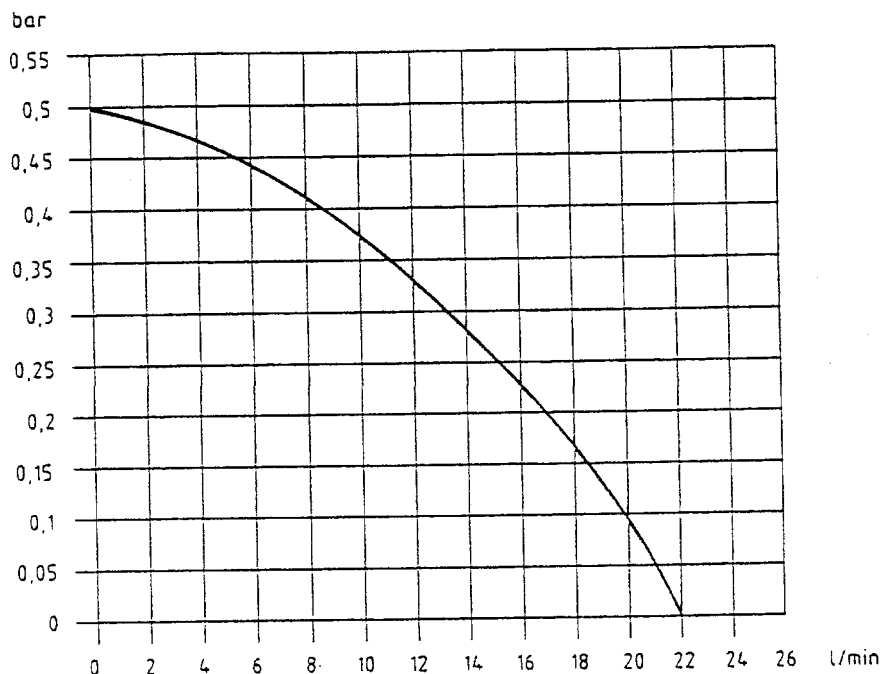
3.3 Pumps

The unit is equipped with a centrifugal pressure/suction pump. This can be used to operate closed external systems (reactors).

The pump is driven by an external-runner motor with a thermally shielded shaft.

The pump operates perfectly up to a viscosity of approx. 30 mm²/s, with the pump output and the cooling capacity decreasing rapidly with increasing viscosity.

Pump characteristic
230 V/50 Hz



3.4 Control


The unit employs a Pt 100 resistance thermometer for measuring the bath temperature. The temperature is indicated on a green LED display. The setpoint is selected on a 10-turn precision potentiometer with locking device and is indicated on the LED display. A PID controller produces fully electronic control of the tubular heater (in the bath) using a triac with burst firing action. Tubular heaters with a surface loading of approx. 6 W/cm² are employed.

3.5 External controller

An additional signal circuit permits connection of an external Pt 100 resistance thermometer to DIN IEC 751 whose indication can be switched to the display; a proportion of this signal can be coupled into the control system. This arrangement greatly reduces the influence of disturbances on the temperature in the external consuming device.

The external measurement is also available on the multifunction connector 23 S (see Item 3.7).

Pin connections socket 10 S Pt 100

| | | | |
|-------|-----|--------------|---|
| Pin 1 | + I | current path |  |
| 2 | + U | voltage path | |
| 3 | - U | voltage path | |
| 4 | - I | current path | |

4-pin plug for Pt 100 connection

Cat. No. EQS 014

Use screened connecting cables. Connect screen to plug case. Cover connectors not in use with protective caps!

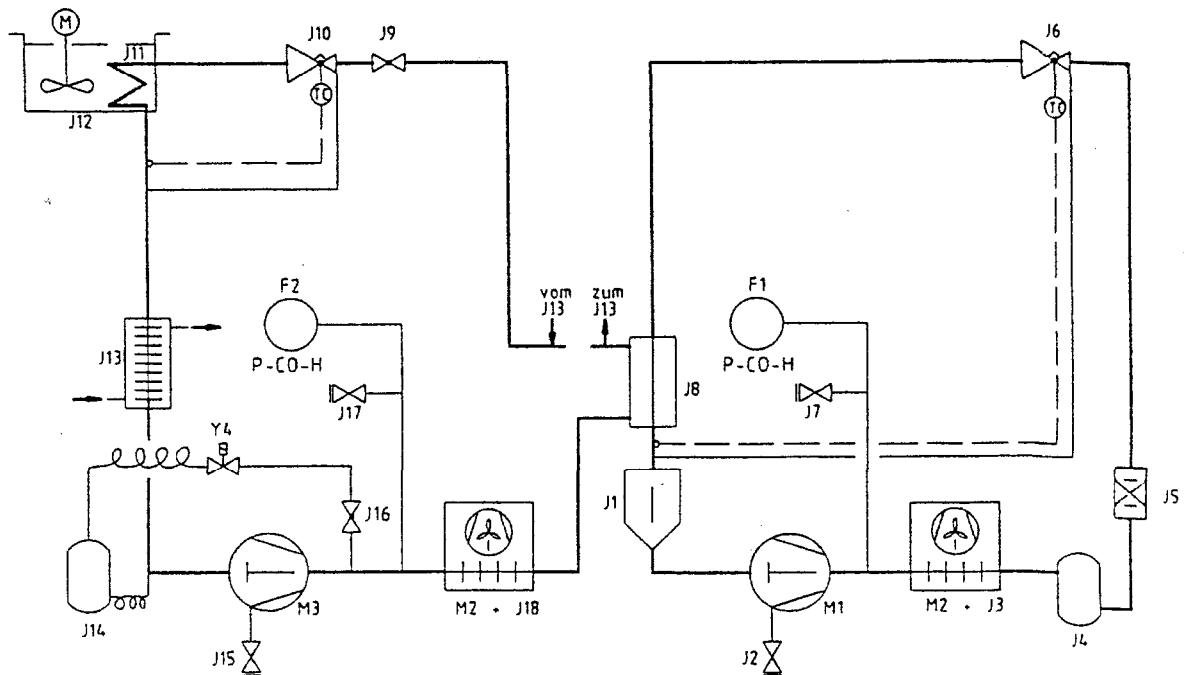
3.6 Refrigeration system

The refrigeration system consists essentially of a hermetically sealed compressor. The condensation and motor heat is dissipated through a fan cooled finned tube condenser. Fresh air is drawn in at the front, heated and discharged at the back and the sides. To ensure problem-free air circulation the ventilation openings must not be restricted.

The refrigeration unit consists of a two-circuit cascade with electronic starting control of the low-temperature stage.

The compressors are fitted with a temperature monitor which responds to the compressor temperature and its current take-up. The cooling system is additionally protected against excessive pressure by a pressure monitor.

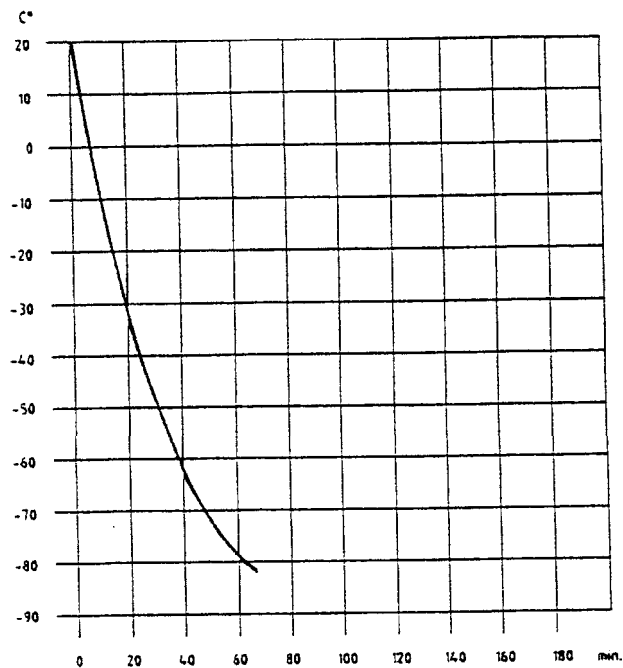
For working temperatures below approx. 40°C the refrigeration system is running continuously and removes a certain amount of heat from the bath, the heater operates against this with the heating power which is automatically adjusted by the control circuit.



F 1 Überdruckschalter Stufe 1 / Overpressure switch stage 1 / Disjoncteur de surpression etage 1
F 2 Überdruckschalter Stufe 2 / Overpressure switch stage 2 / Disjoncteur de surpression etage 2

- J 1 Flüssigkeitsabscheider / Liquid separator / Separateur de liquide
J 2 Kontrollventil Saug Stufe 1 / Control valve suction stage 1 / Vanne de controle aspiration etage 1
J 3 Kondensator Stufe 1 / Condenser stage 1 / Condensateur etage 1
J 4, J 14 Sammelflasche / Receiver / Receveur
J 5 Trockner / Drier / Deshydrateur
J 6 Expansionsventil Stufe 1 / Expansion valve stage 1 / Vanne d'expansion etage 1
J 7 Kontrollventil Druck Stufe 1 / Control valve pressure stage 1 / Vanne de controle pression etage 1
J 8 Wärmetauscher / Heat exchanger / Echangeur thermique
J 9, J 16 Absperrventil / Shut-off valve / Vanne d'arret
J 10 Expansionsventil Stufe 2 / Expansion valve stage 2 / Vanne d'expansion etage 2
J 11 Verdampfer / Exchanger / Echangeur
J 12 Flüssigkeitsbad / Bath liquid / Bain de liquide
J 13 Wärmetauscher / Heat exchanger / Echangeur thermique
J 15 Kontrollventil Saug Stufe 2 / Control valve suction stage 2 / Vanne de controle aspiration etage 2
J 17 Kontrollventil Druck Stufe 2 / Control valve pressure stage 2 / Vanne de controle pression etage 2
J 18 Kondensator Stufe 2 / Condenser stage 2 / Condensateur etage 2
- M 1 Kompressor Stufe 1 / Compressor stage 1 / Compresseur etage 1
M 2 Ventilator / Fan / Ventilateur
M 3 Kompressor Stufe 2 / Compresseur stage 2 / Compresseur etage 2
- Y 4 Magnetventil Druckausgleich / Solenoid valve pressure compensation / Vanne solenoide compensation de pression

Cooling diagram



3.7 Multifunction connector

15-pin connector 23 S on the back, with multiple function.

Use screened connecting cables. Connect screen to plug case. Cover connectors not in use with protective caps!

Pin 1: bath temperature recorder connection, correct sign; 10 mV/K;
Ri 100 Ohm; internal recorder resistance ≥ 1 MOhm min. (0V pin 3)


Pin 2: Pt 100 EXT; 4-wire; - current path

Pin 3: 0V reference potential for measurement signals \uparrow

Pin 4: programme or external setpoint input 10 mV/K, added to the selected setpoint. The sum of both setpoints is displayed on pressing key \downarrow

Ri = 20 kOhm (0V pin 3)

Pin 5: output signal, only for accessory units (0V pin 12)

- Pin 6: setpoint output 10 mV/K, R_i 100 Ohm. Load resistance \geq 10 kOhm min.
(0V pin 3)
- Pin 7: + 12 V supply voltage, max. additional loading 20 mA
- Pin 8: reference voltage approx. 5V, load resistance \geq 10 kOhm
(0V pin 3)
- Pin 9: Pt 100 EXT; 4-wire; - voltage path
- Pin 10: -12 V supply voltage, max. additional loading 20 mA (0V pin 12)
- Pin 11: Pt 100 EXT; 4-wire; + current path
- Pin 12: 0V load reference potential 
- Pin 13: 18V if red fault lamp is alight, i.e. safety circuit to DIN 12879 has operated.
 R_i 1 kOhm, I max. = 10 mA (0V pin 12)
- Pin 14: recorder connection for external temperature, correct sign, 10 mV/K;
 R_i 100 Ohm; internal recorder resistance \geq 1 MOhm min. (0V pin 3)
- Pin 15: Pt 100 EXT; 4-wire; + current path

Pins 2, 9, 11 and 15 Pt 100 EXT are parallel to socket 10 S. They must not be connected up if socket 10 S is in use.

In case of a fault the signals appearing at this connector can usefully be employed for the initial investigation of the fault.

15-pin connector
Housing for above

Cat. No. EQM 030
Cat. No. EQG 017

3.8 Mains supply output 34 H

The 230 V supply voltage is available at the socket 34 H at the back in normal operation and with the unit switched on. The maximum current which can be drawn there is 2 A. In case of a fault this voltage is switched off. This output can be used e.g. to connect a non-return fitting (Cat. No. UD 125).

Suitable mating plug

Cat. No. EQS 045

3.9 Remote operation (FBC) (option)

As an option the units can be converted for remote control; the entire electronics with control panel is removed from the unit and used for remote operation. An adapter for the cable connections is required on the basic unit and the control panel is placed in an extra housing. The conversion must be carried out by a qualified electrician. All necessary components except for the connection cables are supplied as part of the kit.

Please specify the length of the connection cables.

Conversion kit for remote operation FBC Cat. No. LCZ 960

Set of cables for remote operation FBC
5 m long Cat. No. UK 235

Set of cables for remote operation FBC
length as specified Cat. No. UK 238

19" adapter to take the control panel
of the remote operation system FBC 5 HE
for one or two panels Cat. No. LRZ 009

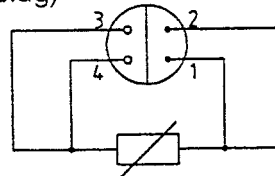
3.10 SAD connection to NE 28 (option)

The connector according to NAMUR recommendation NE 28 is located at the back of the control unit if option SAD is fitted.

Use screened connecting cables. Connect screen to plug case. Cover connectors not in use with protective caps!

8S: Pt 100 connection (EXT) (Lemosia plug)

| | | |
|---|----------------|-----|
| 1 | = Pt 100 (EXT) | I + |
| 2 | = Pt 100 (EXT) | U + |
| 3 | = Pt 100 (EXT) | U - |
| 4 | = Pt 100 (EXT) | I - |



4-pin plug for Pt 100 connection

Cat. No. EQS 022

Note: only one of the Pt 100 inputs, socket 10 S or 8 S, may be used at a time!

54 S: signal connection

| | |
|---|--|
| 1 | = external temperature 0 - 10 V (0 V = -100°C / 10 V = 400°C) |
| 2 | = internal temperature 0 - 10 V (0 V = -100°C / 10 V = 400°C) |
| 3 | = earth of measurement signals (pin 1, 2, 5) |
| 4 | = control signal 4 - 20 mA (4 mA = -100°C / 20 mA = 400°C) at 0°C setpoint setting! |
| 5 | = control signal 10 mV/K (parallel to MF 23 S pin 4) |
| 6 | = earth of the control signal (linked int. to pin 3) |

6-pin mating plug

Cat. No. EQS 057

Note: of the three control signal (programmer) inputs (23 S pin 4, 54 S pin 4 and 5) only one pin may be used at a time!

12 N floating contact general fault

- 1 = n.o. (closing)
- 2 = common
- 3 = n.c. (opening)
- 1, 2 = are closed under normal conditions

3-pin mating socket

Cat. No. EQD 047

14 N contact input, fault

- 1 = n.o. (closing)
 - 2 = common
 - 3 = not used
- mating plug with link 1, 2 is included in the unit

3-pin mating plug

Cat. No. EQS 048

Interface SAD to NE 28
factory fitted or retrofit kit


Cat. No. LCZ 959

4. Safety devices and warning notes


4.1 Safety functions

The built-in overtemperature limiter is adjustable with a tool (screwdriver) between 0°C and 100°C.

The bath temperature is sensed by a separate Pt 100 resistance thermometer and processed by a separate electronics. When exceeding the set switching point the unit is switched off permanently on all poles (limiter function).

The red signal lamp  lights up and at the multifunction connector 23 S a signal of approx. 18 V appears at contact 13.

A float switch with magnetic coupling acts as low-level cut-out and also switches off the unit (pump and heater) permanently on all poles.
The switch-off function of the safety circuit remains stored during a break in the supply or after switching off the supply.

Reset is possible only after rectifying the fault, using the reset key .

The safety devices are conform to EN 61010-2-010.

The pump motor is fitted with a temperature monitor which switches off if the motor winding overheats. The heater is also switched off simultaneously. After the motor winding has cooled down the pump starts up automatically.

4.2 Why can a thermostat be dangerous?

1. Thermostats are equipped with heaters which supply the necessary heat to the thermostating liquid. If the temperature control fails or if the liquid level is too low, the heater may reach temperatures which can lead to a fire in the laboratory, especially in combination with flammable liquids.
2. When using the thermostat as a circulation thermostat a hose may break, causing hot liquid to spill and endangering people and goods.

The safety requirements on thermostats therefore depend on whether

- o non-flammable or flammable liquids are used
- o operation is with or without supervision.

The thermostats described in these Operating Instructions are protected against overtemperature and low liquid level if used according to the descriptions indicated in these Operating Instructions.

The units can be operated with non-flammable bath liquids, and with flammable bath liquids up to 25 K below their flashpoint (EN 61010), while DIN 12879 requires a safety spacing of only 5 K to the flashpoint. In each case it is assumed that there is correct adjustment and regular testing (see Item 8.6) of overtemperature and low-level protection.

4.3 Important Notes

The user is only protected against those hazards which are caused by exceeding the temperature and by low liquid level.

Further hazards may arise from the type of product being thermostated, e.g. a shift above or below certain temperature levels or fracture of the container and a reaction with the thermostatic liquid etc.

It is impossible to cover all possible causes and they remain largely within the decision and responsibility of the user.

Values for temperature variation and indication accuracy apply under normal conditions according to DIN 58966. In special cases high-frequency electromagnetic fields may lead to less favourable values. There is no loss of safety.

Warning: The units must only be used according to the descriptions indicated in the Operating Instructions.

This includes operation by properly qualified and instructed personnel.
The units are not designed for operation under medical conditions according to EN 60601-1 or IEC 601-1!

4.4 Warning notes

4.4.1 Temperatures

Parts of the bath cover may reach temperatures above 70°C when working at higher temperatures. The outflow and return pipes of the pumps reach the operating temperature. Touching them is dangerous because of high or low temperatures!

4.4.2 Mains connection

Connect the unit only to mains sockets with protective earth contact (PE) which must not have a fuse higher than T 16 A.

4.4.3 Mains cable

We have ensured that the mains cable and other plug connections do not touch any hot parts. Please check that there is no contact between the connecting tubings filled with hot liquid, other hot parts and the mains cable.

4.4.4 Fume extraction

Depending on the bath liquid used and the operating method there is a possibility that toxic vapours may be produced. In that case it is necessary to provide appropriate fume extraction. Pull out the mains plug before cleaning the bath with solvents. Provide appropriate fume extraction. Before starting up the unit it is absolutely essential to ensure that the bath contains no explosive mixture. If necessary purge it with nitrogen!

4.4.5 Steam production

When changing the bath liquid from water to heat transfer fluids for temperatures above 100°C any remaining water - including the one in the hoses and external system - has to be removed completely. Otherwise there is a danger of burns because of delayed boiling.

5. Bath liquids and hose connections

The operating temperature ranges specified for the bath liquids and the tubings are for general information only and may be restricted through the operating temperature range or safety requirements specified in the appropriate standards (see Item 4.2).

5.1 Bath liquids

Operating temperature range 5...90°C

Use softened water. Make up evaporation losses at elevated temperatures. Losses can be reduced by providing suitable bath covers (see Accessories).

Distilled or deionised high-purity water is corrosive and should only be used with the addition of about 0.1 g sodium carbonate per litre water. Otherwise its use may lead to corrosion.

Temperatures near zero and below:

Water - monoethylene glycol mixture, preferably Glycoshell P 300, in the ratio 1:1

| | | |
|-------------------|------------------------|--------------------------|
| temperature range | -30...100°C | <u>Ultra-Therm G 100</u> |
| boiling point | 110°C | Cat. No. LZB 009 |
| viscosity at 20°C | 4 mm ² /sec | |
| non-flammable | | |

When operating for longer periods at higher temperatures the proportion of water decreases. The mixture approaches the properties of pure glycol and becomes flammable (flashpoint 128°C). The mixture ratio should therefore be checked from time to time against the original mixture, e.g. using a hydrometer.

Recommended operating temperature range -85°C...30°C

Ultra-Therm XLT
(Silicone oil)
extended temperature range 40°C
according to DIN 12879

Cat. No. LZB 013

| | |
|--------------------|--------------------------|
| viscosity at 20°C | 1.5 mm ² /sec |
| viscosity at -70°C | 11 mm ² /sec |
| flashpoint | 54°C |

Recommended operating temperature range -20°C...140°C

Ultra-Therm 160 MS
(Silicone oil)

Cat. No. LZB 016

| | |
|--------------------|-------------------------|
| viscosity at 20°C | 10 mm ² /sec |
| viscosity at -30°C | 34 mm ² /sec |
| flashpoint | 170°C |

Ethanol

| | |
|--------------------|------------------------|
| boiling point | 78 °C |
| viscosity at 20 °C | 1,5 mm ² /s |
| flashpoint | 12 °C |
| freezing point | -114 °C |

Warning: For operating temperatures below -60°C ethanol is normally used. However, due to the fact its flashpoint is at 12°C the use of ethanol is not in accordance with the standard requirements (see Item 4.2).

It is absolutely necessary to supervise the unit continuously.

Safety data sheets according to EU Guidelines are available on request.

5.2 Hose connections

- 5.2.1 Perbunan tubing, uninsulated Cat. No. RKJ 011
9 mm int. diameter.
Temperature range 0...120°C.
Suitable for all bath liquids listed above
- Perbunan tubing, insulated Cat. No. LZS 004
9 mm int. diameter, approx. 30 mm ext. diameter.
Temperature range -60...120°C.
Particularly suitable
for low-temperature operation
- Perbunan tubing, uninsulated Cat. No. RKJ 012
11 mm int. diameter.
Temperature range 0...120°C.
- Perbunan tubing, insulated Cat. No. LZS 008
11 mm int. diameter, 9 mm insulation
Temperature range -60...120°C.
Particularly suitable
for low-temperature operation.
- 5.2.2 Silicone tubing, uninsulated Cat. No. RKJ 059
11 mm int. diameter.
Temperature range -30...100°C.
For water and water-glycol mixture.
- Silicone tubing, insulated Cat. No. LZS 007
11 mm int. diameter, 9 mm insulation.
Application as for uninsulated Silicone tubing.
Temperature range -60...100°C.

Note: do not use Silicone tubing in conjunction with Silicone oils !

5.2.3 Metal hoses (single-layer insulation 9mm)

Temperature range -90...150°C

| | | |
|-------------------|----------------|------------------|
| Metal hose MK 50 | (50 cm long) | Cat. No. LZM 052 |
| Metal hose MK 100 | (100 cm long) | Cat. No. LZM 053 |
| Metal hose MK 150 | (150 cm long) | Cat. No. LZM 054 |
| Metal hose MK 200 | (200 cm long) | Cat. No. LZM 055 |

Metal hose connections to link pump outlets (insulated)
Temperature range -90...150°C

Cat. No. LZM 045

Highly-flexible, thermally insulated stainless steel (V2A) metal hoses with M 16 x 1 mm connecting thread. Int. diameter 10 mm. These hoses offer optimum security.

Further details on thermostatic liquids and hoses can be found in our special publication.

6. Unpacking, assembly and setting up

6.1 Unpacking

Goods are packed carefully, largely preventing transport damage. If unexpectedly some damage is visible on the equipment, the carrier or the postal authority has to be informed so that it can be inspected.

Standard accessories

| | |
|----------------------|------------------|
| 1 Bath cover | Cat. No. HDQ 075 |
| 2 Nipples 13 mm dia. | Cat. No. HKO 026 |
| 2 Screw caps | Cat. No. HKM 032 |
| 2 Closing plugs | Cat. No. HKN 065 |

Operating Instructions

6.2 Setting up, operation as bath thermostat

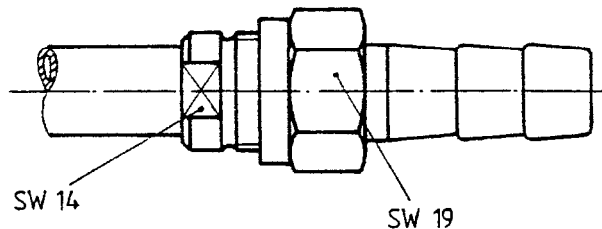
Set up the unit conveniently so that the control panel is towards the front. Ensure that the air circulation for the refrigeration system through the grid in the lower part of the unit and the ventilating openings at the back of the unit is not restricted. A minimum spacing of 40 cm between grid and wall is recommended.

Close the drain cock at the back of the bath!

When operating as bath thermostat - no external system connected up - it is advisable to ensure internal circulation by removing the closing plugs from the pump flow and return connections. Remove the screw caps and link the pump connections together using a piece of tubing.

As a permanent arrangement the hose link of flexible insulated metal tubing (Cat. No. LZM 045) is the best and safest solution.

NOTE: When loosening or tightening the screw caps (19 mm a/f), hold the threaded nipple on the tubing connections with a spanner (14 mm a/f)!



7. Connection of external systems

7.1 Closed external circuits

Remove the closing plugs by releasing the threaded rings (19 mm a/f) from the outflow and return connections and replace them by the tubing nipples (13 mm dia.) supplied.

If the thermostat is connected to closed external circuits, additional liquid must be poured in after the thermostat is switched on until the level in the bath remains at the correct height (approx. 2 cm below top plate).

For suitable tubing materials see Section 5.

With external systems at a high level it may happen even in closed circuits that the external volume drains down and the thermostat tank overflows if the pump is stopped and air enters the thermostated system!

Always ensure the maximum possible flow area in the external circuit (nipples, tubing, system). This results in a larger flow and therefore improved thermostatic control.

NOTE: Always protect tubings with hose clips against slipping off, or use stainless steel hoses with screwed connections.

NOTE: When loosening or tightening the screw caps (19 mm a/f) at the tubing connections hold the threaded nipple with a spanner (14 mm a/f)!

8. Starting up

8.1 Filling

Fill the unit with bath liquid to suit the operating temperature, see Section 5. The filling volume is given under Technical data. In general the thermostat must be filled no higher than 2 cm below the cover plate. The level must not fall below the minimum, otherwise the low-level protection switches off the unit (see Safety circuit). The same applies to filling an external system by the pump during start-up.

8.2 Connection to supply

Connect the unit only to an earthed socket (PE). Compare the details on the label with the mains voltage (see Item 4.4.2).

When working without external system, ensure that the pump connections are linked together (metal hose link Cat. No. LZM 045), or use the closing plugs.



8.3 Basic functions

8.3.1 Set potentiometer EXT fully anticlockwise (INT)!



Set the potentiometer for the overtemperature switch-off point to suit the required operating temperature, with due consideration for the bath liquid. When operating below ambient temperature the overtemperature cut-out setting must of course be above ambient temperature until the operating temperature is reached. Then the switch-off point can be set slightly above the bath temperature (at least approx. 0°C).


8.3.2 Switch on the unit with the mains switch.




Working without refrigeration (operating temperatures above approx. 40°C)



mains switch (green)  on I (ON) (green lamp lights up)
"Cooling" switch (yellow)  on 0 (OFF)


Working with refrigeration (operating temperature below approx. 40°C)


mains switch (green)  on I (ON) (green lamp lights up)
"Cooling" switch (yellow)  on I (ON)


The green LED  shows the operation of the low-temperature stage. Depending on the application the low-temperature stage starts running after a period of approx. 10 s to 20 min after the starting of the refrigeration unit.


Briefly press the left key  Int. The bath temperature is indicated. When the red signal lamp  lights up, briefly press the reset key .

8.3.3 Using the keys  Int and  Ext the display can be switched to bath temperature (Int) or the temperature of the external Pt 100 (Ext) irrespective of the control mode selected (INT-EXT).

The indication is on the green signal lamps Int and Ext. At the same time the display indicates the setpoint when pressing one of the two keys .

8.3.4 To adjust the setpoint press one of the keys , release the locking device on the setpoint knob and select the setpoint according to the display. Lock the knob again - release the key.

8.3.5 The lamp  shows the operation of the heater. At the control point this lamp flashes according to the heater power.

After the operating temperature has been lowered the lamp  obviously starts to flash only after the set temperature has been reached.

The controller gain X_p can be adjusted on the back of the control unit. The adjustment range 1...5 corresponds to a proportional band of 0.4...16°C referred to the heater control signal. The standard setting at which the unit is shipped from the factory is 3. Usually it is not necessary to change the adjustment.


The scale is non-linear with the following values:


| X_p | P band |
|-------|--------|
| 1 | 0.4°C |
| 2 | 1.5°C |
| 3 | 2.5°C |
| 4 | 4.5°C |
| 5 | 16.0°C |


If there are any control oscillations, e.g. in small baths with bath liquids of low thermal capacity and high viscosity, X_p is set to the next higher setting (e.g. from 2 to 3).

8.4 External control


8.4.1 Connect the Pt 100 resistance thermometer to socket 10 S (see Item 3.5).

Switch over the display by pressing the key  Ext. The temperature display flashes if no external Pt 100 is connected.

Using the potentiometer Pt 100  on the back of the control unit the external Pt 100 can be trimmed to a known temperature. This can be done using the bath temperature, for example, if no other temperature reference is available.

8.4.2 When used with external control, i.e. the measurement point for the control parameter is located outside the thermostat at a point selected by the user, the potentiometer EXT  can be used to select a value between approx. 50% and 90% for the proportion of the external probe. The closer the external Pt 100 resistance thermometer is connected with the circulated bath liquid, the higher the external proportion (e.g. 90%) can be chosen. This increases the quality of the control results related to the external measuring points.

8.4.3 Suggested setting for a 2 litre jacketed reactor with water-glycol, external resistance thermometer in the product space, product slightly stirred.

EXT  90%, X_p 2.

8.4.4 With the selected simple control method there remains a permanent deviation between external controlled temperature and setpoint, depending on the proportion of the external measurement parameter; this deviation has to be compensated by re-adjusting the setpoint.


Example: selected potentiometer EXT  80, setpoint 80°C.

After the system has settled down, the external measured temperature is 79.5°C.

Increase the setpoint by 0.5 K, then the external measured temperature rises to 80°C.

8.5 Operation with programmer



A programmer Type PM 351-1 can be connected to the multifunction connector 23 S to vary the setpoint of the thermostat according to a given programme. This requires that the energy balance (heating, cooling, load) of the thermostat matches the requirements of the programme (heating rate, cooling rate, operating temperature). The plug must not be put into 23 S when adjusting the unit setpoint to the lowest temperature of the programme. This value is entered as value A when programming the programmer. Do not change the unit setpoint any more and put in the plug of the programmer connecting cable.

Operation of the push buttons  indicates on the digital display the current setpoint which is provided by the programmer and on which the unit is operating. For further details refer to the Operating Instructions for the PM 351-1.

8.6 Safety circuit

The operation of the safety devices of the unit has already been described in Item 4.1. After starting up the user should confirm the correct operation of the safety devices. If the unit is operating unsupervised we recommend that this check should be carried out daily.

- 8.6.1 For proper operation of the low-level limiter it is essential that the float switch is operating correctly. This can be checked by draining some of the liquid. When the level drops below the minimum level (about 20 mm above the upper heater winding) the pump and the heater are switched off on all poles.

The pilot lamp "Fault"  is on. For restarting fill in bath liquid and press the Reset key .

- 8.6.2 To check the overtemperature limiter its switch-off point is gradually reduced.

When it is below the value shown on the digital thermometer the unit must switch off as under Item 8.6.1.

To distinguish between "Overtemperature" and "Level" faults the dot on the right in the display is flashing when the overtemperature switch-off point has been exceeded. Faults in the temperature probe (break, short circuit) also lead to switch-off and flashing of the right dot in the display.

Set the switch-off point again above the bath temperature and operate the Reset key.

- 8.6.3 In case of any failure in Items 8.6.1 and 8.6.2 the unit must immediately be taken out of operation and must be tested by a qualified engineer, otherwise its safety is no longer ensured.

9 Maintenance

9.1 Safety notes in case of repairs

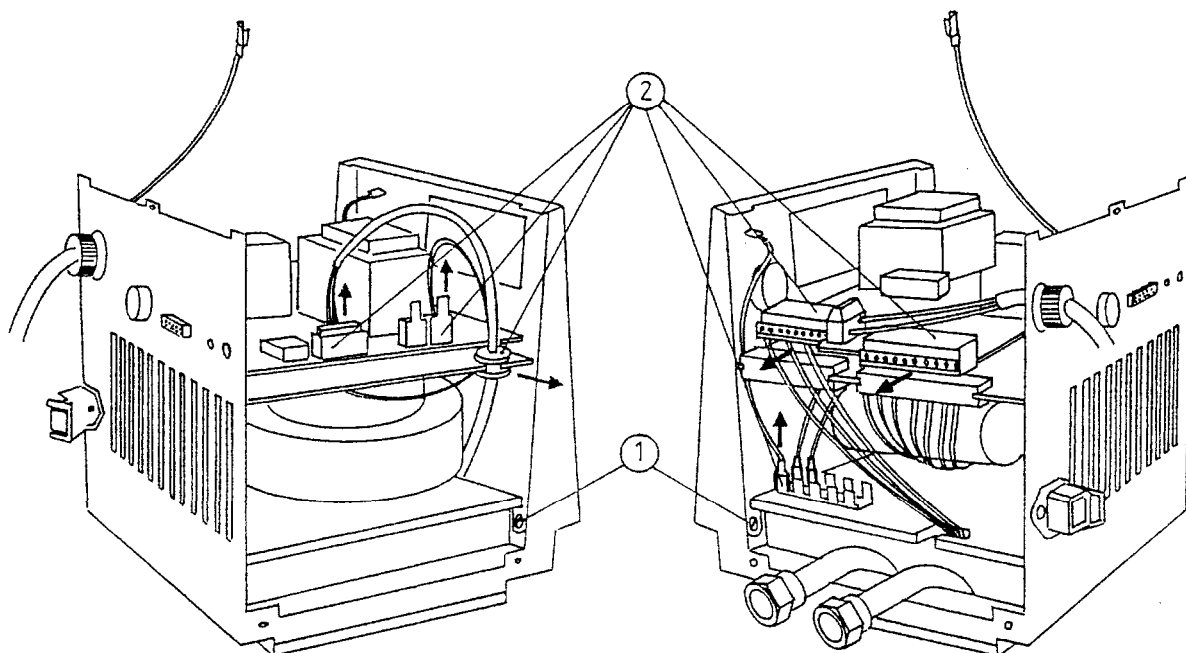
Always pull out the mains plug for all repair and cleaning operations! Repairs on the control unit with cover removed must only be carried out by a qualified electrician.

9.2 Repair

LAUDA thermostats are largely free from maintenance. Dirty thermostatic liquid should be removed through the drain cock and replaced. If the unit should become faulty it may be advisable to return only the faulty module where appropriate.

The control unit can readily be removed after removing the cover, releasing 2 screws ① (2 turns) behind the front panel and 2 screws at the rear and disconnecting the electrical connections ②.

The module with pump, heater, temperature probe etc. can also be easily separated from the bath.



There is no provision for a fuse for the complete unit since the necessary 16 A fuse corresponds to the mains fuse usually provided at the location. The control circuit of the unit has a separate fuse; a fuse 5 x 20 F4A is located in the control unit. It is accessible after removing the cover. When the fuse has blown the green lamp in the mains switch does not light up.

9.3 Maintenance of the refrigeration system

The refrigeration system operates largely without maintenance. If the unit is being operated in a dusty atmosphere we recommend cleaning the refrigeration system condenser at intervals of 4 to 6 months. This is best done with compressed air or nitrogen by blowing for a few minutes into the ventilation openings. If necessary unscrew the front grille.

Repair and disposal note

In the high-temperature stage the cooling circuit of the unit is filled with CFC-free refrigerant R 404 A; their low-temperature stage is filled with CFC-free refrigerant TP 5 R 3. Repair and disposal only by a qualified refrigeration engineer!

9.4 Cleaning

The unit can be cleaned using a cloth moistened with water with the addition of a few drops of (domestic) detergent. No water must find its way into the control unit.

The user is responsible for any necessary decontamination if dangerous materials have been spilled on or inside the unit. This applies in particular if the unit is removed for a different use, for repair, storage etc.

The method of cleaning or decontamination is determined by the expertise of the user himself. If the user has any doubts on whether this may damage the unit he has to contact the manufacturer.

9.5 Spares ordering

When ordering spares please specify the equipment type and number on the label. This avoids queries and prevents supply of incorrect goods!

We shall always be happy to deal with queries, suggestions and complaints.

LAUDA DR. R. WOBSE
GMBH & CO. KG

Accessories for LAUDA Low-Temperature Thermostats RC-P and RK-P

LAUDA Pt 100 platinum resistance thermometers
to DIN IEC 751 Class A for external control
and other temperature measurement

Pt 100-42

all-glass version with NS 14/23 ground taper DIN 12242
Temp. range -100...300°C
50% response time 0.8 sec
Overall length approx. 115 mm
4-wire circuit
Fig. 1

Cat. No. ETP 049

Pt 100-44

all-glass version with NS 14/23 ground taper DIN 12242
Temp. range -100...300°C
50% response time 0.8 sec
Overall length approx. 320 mm
Fig. 2

Cat. No. ETP 007

Pt 100-66

as Pt 100-44
Overall length approx. 430 mm
Fig. 2

Cat. No. ETP 008

Pt 100-90

stainless steel protection tube 4 mm dia.
Temp. range -100...300°C
50% response time 1.5 sec
Overall length approx. 120 mm
4-wire circuit
Fig. 3

Cat. No. ETP 050

Pt 100-70

stainless steel protection tube 4 mm dia.
Temp. range -200...300°C
50% response time 1.5 sec
Overall length approx. 290 mm
4-wire circuit
Fig. 3

Cat. No. ETP 009

Pt 100-92

stainless steel protection tube 4 mm dia.
with attached Silicone cable 2 m long and plug
Temp. range -100...200°C
50% response time 3 sec
Overall length approx. 250 mm
4-wire circuit
Fig. 4

Cat. No. ETP 051

Connecting cable

with 4-pin plug for external control on
all C-and K-units and for
digital thermometer for Pt 100-44 and
Pt 100-66 1.5 m
length as specified

Cat. No. UK 048

Cat. No. UK 213

for Pt 100-42, Pt 100-70, Pt 100-90 1.5 m
length as specified

Cat. No. UK 047

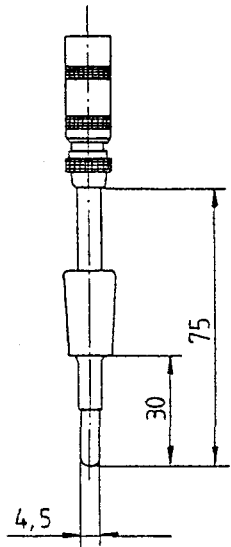
Cat. No. UK 212

Screw clamp fitting

stainless steel, with Teflon pressure ring
for Pt 100 resistance thermometer 4 mm dia.
Fig 5

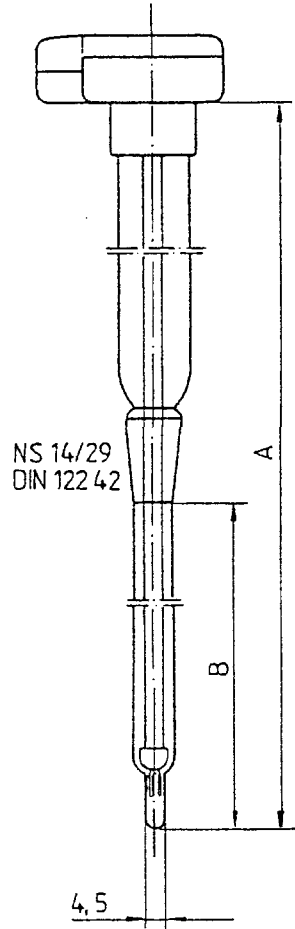
Cat. No. HX 078

Fig. 1



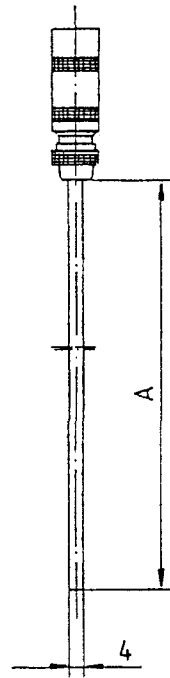
Pt 100-42

Fig. 2



| | A | B |
|-----------|-----|-----|
| Pt 100-44 | 300 | 135 |
| Pt 100-66 | 410 | 245 |

Fig. 3



| | A |
|-----------|-----|
| Pt 100-90 | 80 |
| Pt 100-70 | 250 |

Fig. 4

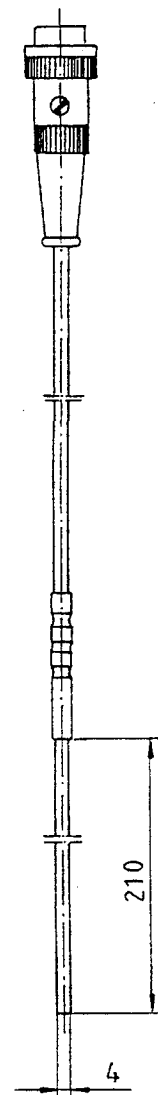
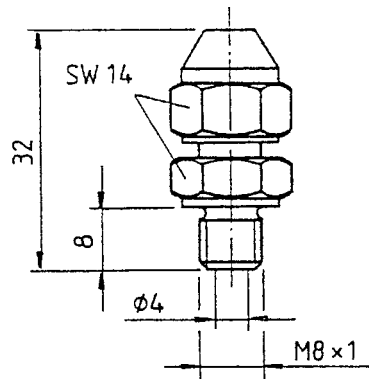


Fig. 5



Geräteliste Schaltplan
List of parts Circuit diagram
Liste de pièces schéma de connexions
230V; 50Hz / 60Hz

RL 6 CH

| | | | |
|---|---|--|---------------------|
| A | 1 | Leiterplatte „Netz“ Printed circuit board „Mains“ Circuit imprimé „Secteur“ | UL 432-3 |
| A | 2 | Leiterplatte „Anzeige“ Printed circuit board „Indication“ Circuit imprimé „Affichage“ | UL430-2 |
| B | 1 | Pt 100 Fühler Sicherheitskreis Pt 100 Probe Safety circuit Pt 100 Sonde Circuit sécurité | ETP 047 |
| B | 2 | Pt 100 Fühler Regelung Pt 100 Probe Controller Pt 100 Sonde Réglage | |
| B | 3 | Niveausensor Level sensor Niveau sensor | EKS 034 |
| C | 1 | Motorkondensator Motor condenser Condensateur moteur | 1,5 uF ECA 012 |
| E | 1 | Heizkörper Heater Corps de chauffe | 1.2 kW EH 163 |
| F | 1 | Klixon Pumpe Klixon Pump Klixon Pompe | _____ |
| F | 2 | Überdruckschalter Stufe 1 Overpressure switch stage 1 Disjoncteur de surpression étage 1 | ES 035 |
| F | 3 | Klixon Kompressor Stufe 1 Klixon Compressor stage 1 Klixon Compresseur étage 1 | _____ |
| F | 4 | Überdruckschalter Stufe 2 Overpressure switch stage 2 Disjoncteur de surpression étage 2 | ES 035 |
| F | 5 | Klixon Kompressor Stufe 2 Klixon Compressor stage 2 Klixon Compresseur étage 2 | _____ |
| M | 1 | Pumpenmotor Pump motor Moteur de pompe | EM 062 |
| M | 2 | Kompressor Stufe 1 Compressor stage 1 Compresseur étage 1 | _____ |
| M | 3 | Ventilator Fan Ventilateur | _____ |
| M | 4 | Kompressor Stufe 2 Compressor stage 2 Compresseur étage 2 | _____ |
| R | 1 | Potentiometer Sollwert Setpoint potentiometer Potentiomètre valeur de consigne | 10kOhm UD 339 |
| S | 1 | Netzschalter Mains switch Interrupteur secteur | EST 082 |
| X | 1 | Netzanschluß / Netzkabel Mains connection / Mains cable Branchement secteur / Câble de secteur | EKN 008 |
| X | 2 | Anschlußbuchse Rücklaufsicherung Connection socket Reflow security valve Douille de jonction Protection de refoulement | EQD 037+ EQZ 006 |