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LAUDA

# Operating Instructions

LAUDA Compact Low-Temperature Thermostats
RC 6 CS, RC 20 CS, RC 25 CS, RL 6 CS,
RK 8 CS, RK 8 KS, RK 20 KS

from Series U01
08/96 E
YACE0050

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Appendix

Accessories

Circuit diagrams


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## 1. Brief Operating Instructions

1.1 Even if you find these brief instructions initially sufficient please read the following sections, especially Section 4: "Safety devices and warning notes".
For safe operation of the equipment it is essential that the information in these Operating Instructions is observed.

1.2 Check thermostat and accessories during unpacking for any transport damage and if necessary inform the carrier or the postal authority.

1.3 Assemble the unit according to Section 6 and add extra items as appropriate.

1.4 Fitting the tubing to the pump connections:

Without external system: for improved circulation within the bath remove the closing plugs from the two pump connections, fit the tubing nipples and link them together with e.g. Perbunan tubing (up to 120°C) or better a metal tubing.

With external system: make tubing connections to the external system.

Protect tubing with hose clips against slipping off.

1.5 Use only softened water or LAUDA bath liquids (Section 5). Fill the bath up to a level about 2 cm below the cover plate.

1.6 Check the supply voltage against the details on the label.
Insert the mains plug.

Set the potentiometer EXT  fully anticlockwise to INT!

1.7 Types RK: switch on the unit with the mains switch (green lamp lights up).

Types RC and RL:

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). |

When starting up the refrigeration unit after it has been off for a longer period it may take up to 20 min., depending on ambient temperature and equipment type, until the normal cooling performance is available.

1.8 Move the temperature setting to the required temperature.

Pressing the key  shows the operating temperature setpoint on the display. The adjustment is made on the potentiometer  . Release the locking device before moving this control.

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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.

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## 2. Technical data to DIN 58966

| | | RC 6 CS | RC 20 CS | RC 25 CS | RL 6 CS | RK 8 CS | RK 8 KS | RK 20 KS |
|---|---|---|---|---|---|---|---|---|
| Operating temperature range | (°C) | -35...150 | -35...150 | -35...150 | -80...100 | -50...150 | -45...150 | -40...150 |
| 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 ± 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 ± 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 | (±°C) | 0.02*) | 0.02*) | 0.02*) | 0.02...0.05*) | 0.02*) | 0.02*) | 0.02*) |
| Heater power | (kW) | 2 | 2 | 2 | 1,2 | 2 | 2 | 2 |
| | | (1,2) | (1,2) | (1,2) | | | | |
| Cooling | | can be switched manually; | | proportional cooling with automatic compressor control | | | | |
| Effective cooling capacity with ethanol at 20°C ambient temperature | (kW) | | | | | | | |
| 20°C | | 0.3 | 0.3 | 0.3 | 0.46 | 0.8 | 0.8 | 0.8 |
| 0°C | | 0.24 | 0.24 | 0.24 | 0.38 | 0.7 | 0.7 | 0.7 |
| -30°C | | 0.1 | 0.1 | 0.1 | 0.30 | — | — | — |
| -40°C | | — | — | — | 0.27 | 0.14 | 0.12 | 0.12 |
| -50°C | | — | — | — | 0.25 | 0.03 | — | — |
| -60°C | | — | — | — | 0.23 | — | — | — |
| -70°C | | — | — | — | 0.17 | — | — | — |
| -80°C | | — | — | — | 0.05 | — | — | — |
| Safety system | | adjustable overtemperature protection and low-level protection to EN 61010 (DIN 12879 class 2) | | | | | | |
| Pump output against zero head | | | | | | | | |
| Pressure/suction | (l/min) | 20/16 | 20/16 | 20/16 | 20/16 | 20/- | 24/18 | 24/18 |
| max. pump pressure | (bar) | 0.32/0.25 | 0.32/0.25 | 0.32/0.25 | 0.32/0.25 | 0.3/- | 0.5/0.34 | 0.5/0.34 |
| Pump connections | | | | M 16 x 1, nipples 13 mm Ø | | | | |
| Filling volume | (l) | 4...6 | 10...14 | 19...27 | 4...6 | 5.5...8 | 5.5...8 | 11...18 |
| Bath opening (W x D) | (mm) | 150x130 | 300x175 | 300x350 | 120x105 | 150x130 | 150x130 | 300x175 |
| Bath depth | (mm) | 160 | 160 | 200 | 190 | 200 | 200 | 200 |
| Usable liquid depth | (mm) | 140 | 140 | 180 | 150 | 180 | 180 | 180 |
| Height to top of bath | (mm) | 450 | 450 | 575 | 540 | 575 | 575 | 575 |
| Overall size (W x D x H) | (mm) | 280x375x650 | 375x415x650 | 375x590x775 | 495x615x740 | 400x500x775 | 400x500x775 | 400x500x775 |
| Weight | (kg) | 35 | 42 | 54 | 98 | 62 | 62 | 62 |
| Supply | (V;Hz) | | | 230;50 / 230;60 Protection Class 1 to VDE 0106 | | | | |
| | | | | (100;50 / 115;60) | | | | |
| Loading (max.) without accessories | (kW) | 2.4 (1,5) | 2.5 (1,6) | 2.5 (1,6) | 2.5 | 2.7 | 2.7 | 2.7 |
| Current take-up (max.) with accessories | (A) | 15 | 15 | 15 | 16 | 16 | 16 | 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 (230 V; 50 Hz).

| Cat.-No.: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 230 V; 50 Hz | LCK 170 | LCK 172 | LCK 174 | LCK 182 | LCK 176 | LCK 178 | LCK 180 |
| 230 V; 60 Hz | LCK 270 | LCK 272 | LCK 274 | LCK 282 | LCK 276 | LCK 278 | LCK 280 |
| (100 V; 50 Hz / 115 V; 60 Hz) | (LCK 770) | (LCK 772) | (LCK 774) | | | | |

Units of different power supplies have different heating capacities as well as different values for power consumption (see type lable).

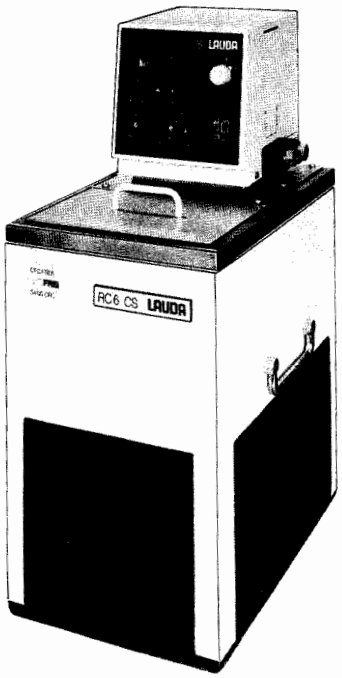
Technical changes reserved!

*) see item 4.3

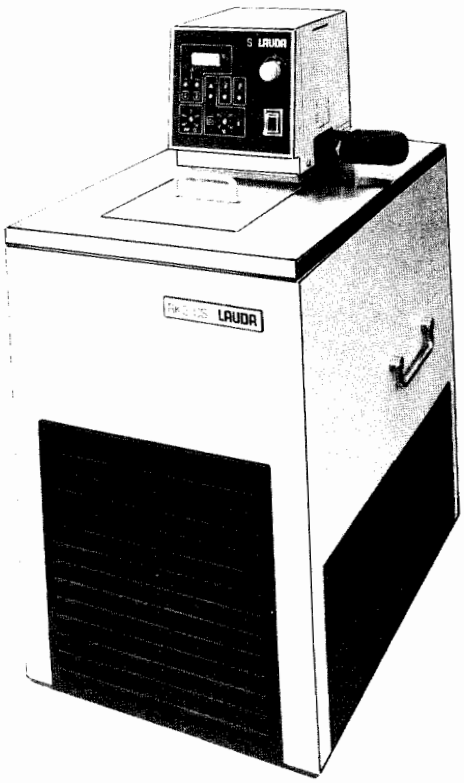
Values in brackets, e. g. (1,2) are valid for 100 V; 50 Hz / 115 V; 60 Hz units.

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# DA Compact-Kältethermostate/Compact low temperature thermostats/Cryothermostats
## 6 CS, RC 20 CS, RC 25 CS, RL 6 CS, RK 8 CS, RK 8 KS, RK 20 KS




RC 6 CS
RC 20 CS

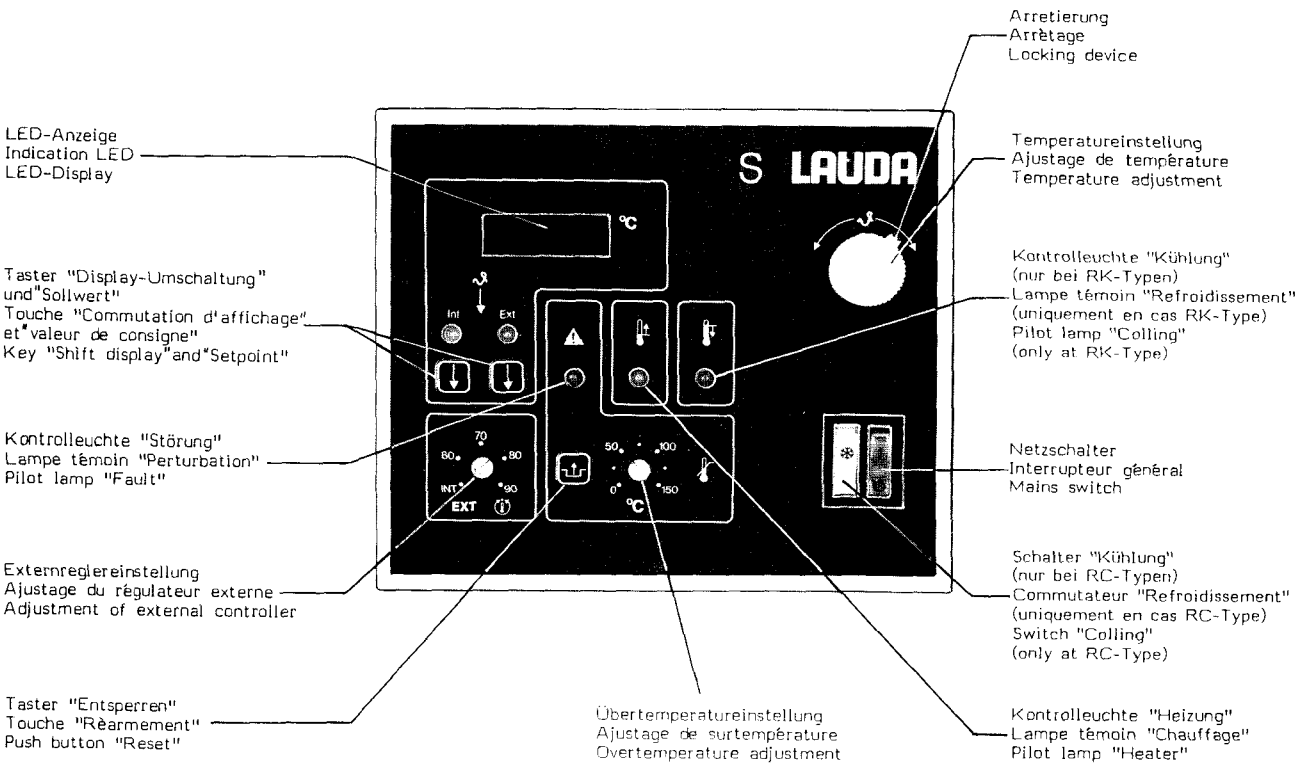


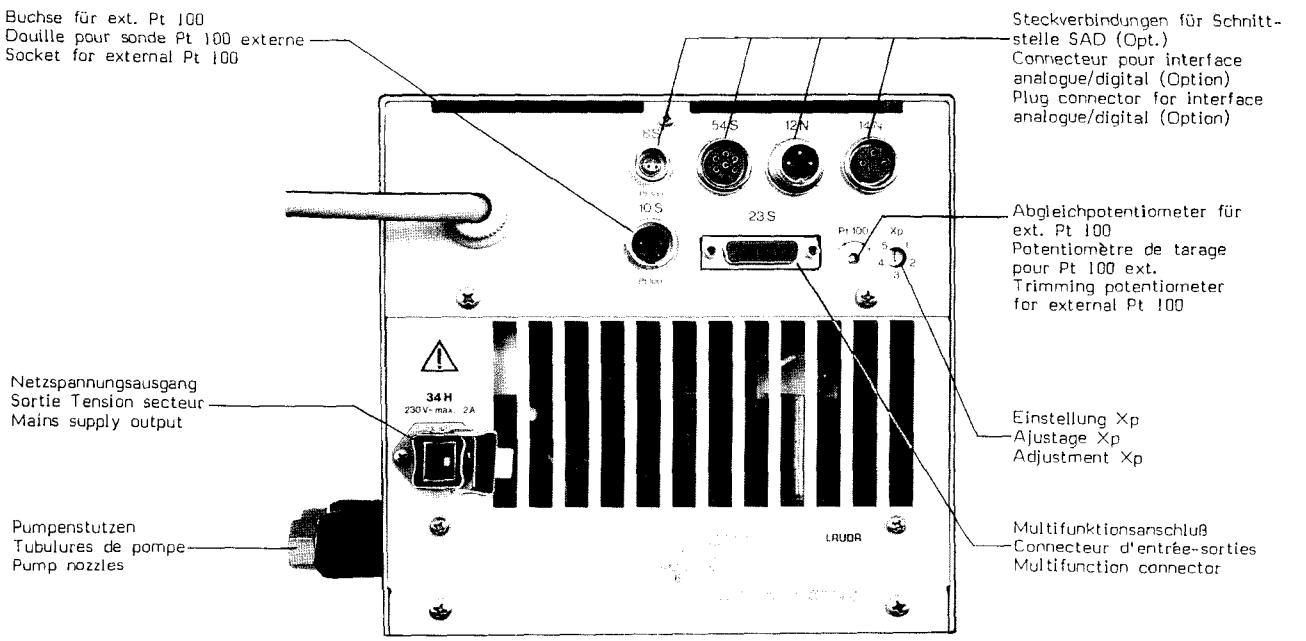

RC 25 CS
RL 6 CS
RK 8 CS
RK 8 KS
RK 20 KS

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# LAUDA Compact-Kältethermostate/Compact low temperature thermostats/Cryothermostats
# RC 6 CS, RC 20 CS, RC 25 CS, RL 6 CS, RK 8 CS, RK 8 KS, RK 20 KS




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## 3. General construction and technical description

### 3.1 Operating principle

The LAUDA bath/circulation thermostats Series RC, RL and RK with Electronics S differ in bath volume, bath depth, pump type and output as well as in cooling capacity and working temperature range (see also Item 3.6).

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 the 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. Materials of PTFE and PETP are also used in the thermostats Series RL.

### 3.3 Pumps

All units except Type RK 8 CS are equipped with a centrifugal pressure/suction pump. This can be used to operate both external open baths and closed external systems (reactors).

The immersion pumps are supplied in the two performance classes C and K.

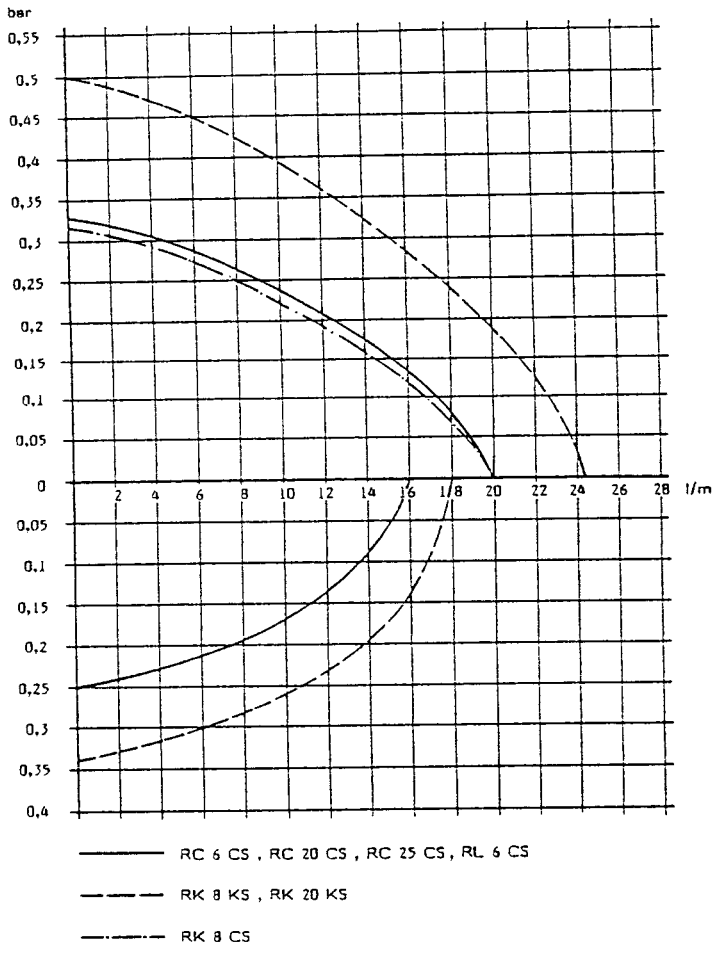
The thermostat RK 8 CS is fitted with a pure pressure pump since this unit operates specially with external circulation.

The pumps are driven by external-runner motors with a continuous shaft (except for RL).

The pumps operate perfectly up to a viscosity of approx. 70 $mm^2/s$ (RK 8 CS approx. 120 $mm^2/s$), with the pump output decreasing rapidly with increasing viscosity.

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Pump characteristic
230 V/50 Hz




## 3.4 Control

The units employ 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/cm$^2$ are employed.

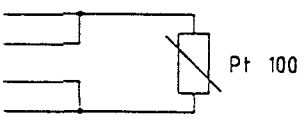
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## 3.5 External controller

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 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.

RC units

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.

RL units

Thermostats Series RL work with continuous heating (similar to RC units). Their refrigeration unit consists of a two-circuit cascade with electronic starting control of the low-temperature stage.

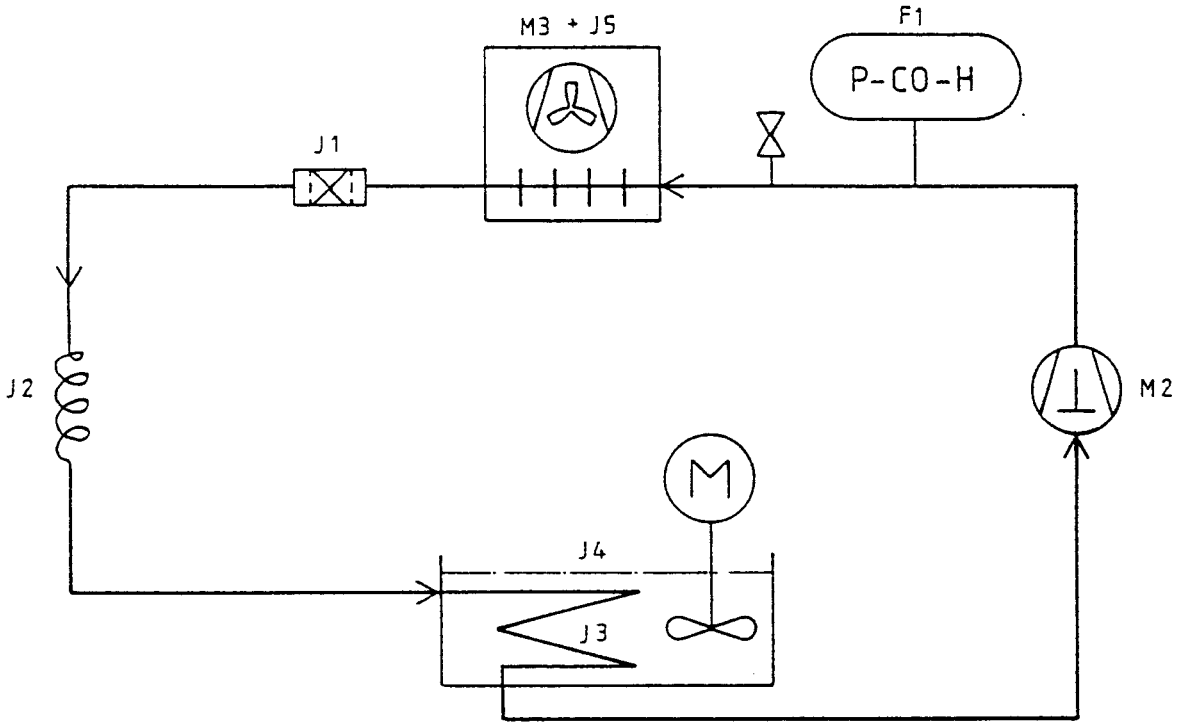
RK units

The more powerful refrigeration unit is operated by the automatic electronic compressor control. The LAUDA proportional cooling system controls the cooling capacity through solenoid valves with sound insulation, using the PID temperature controller. This ensures minimum energy consumption and minimal environmental warming on fully automatic operation over the entire working temperature range with differing load conditions.

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Schematic diagram cooling circuit

RC



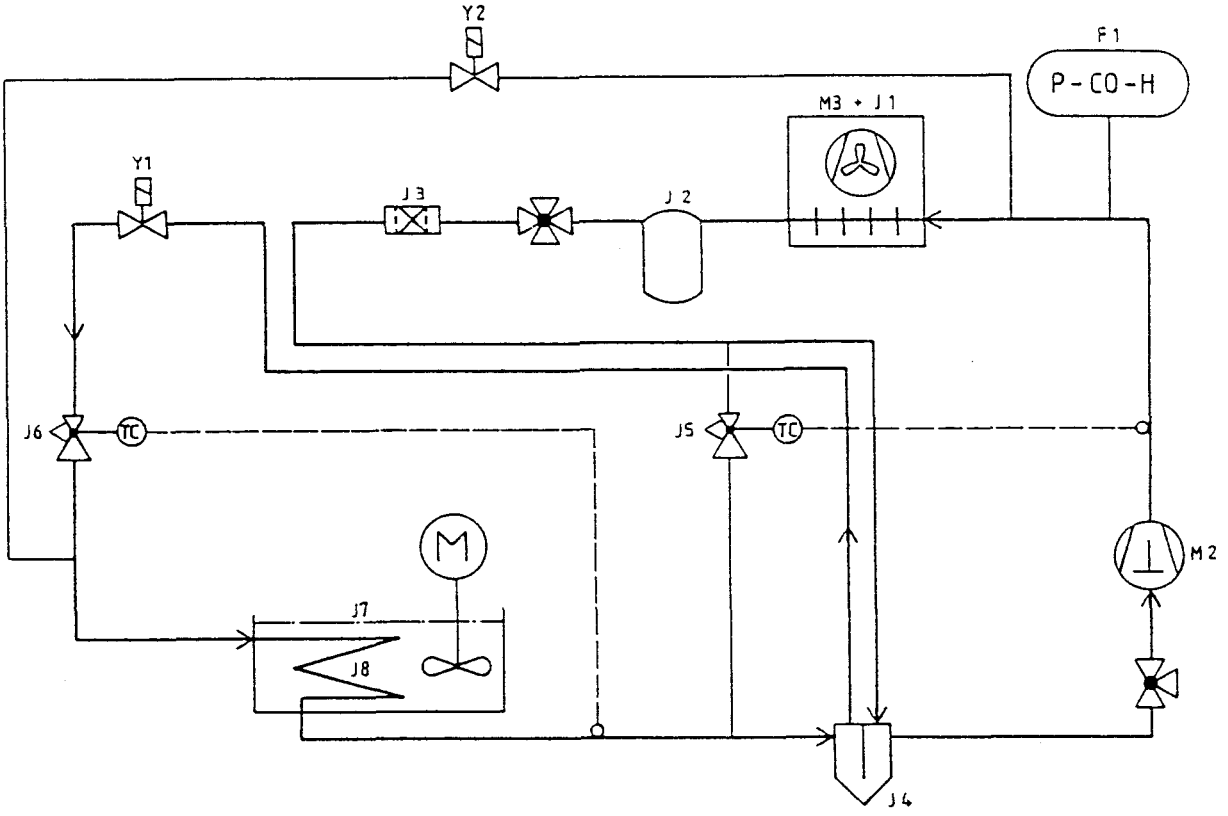

F 1 Überdruckschalter / Overpressure switch / Disjoncteur de surpression

J 1 Trockner / Drier / Secheur
J 2 Kapillarrohr / Capillary / Tube capillaire
J 3 Verdampferschlange / Evaporator coil / Evaporateur à serpentins
J 4 Flüssigkeitsbad / Liquid bath / Bain de liquid
J 5 Verflüssiger / Condenser / Condensateur

M 2 Verdichter / Compressor / Compresseur
M 3 Ventilator / Fan / Ventilateur

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RK



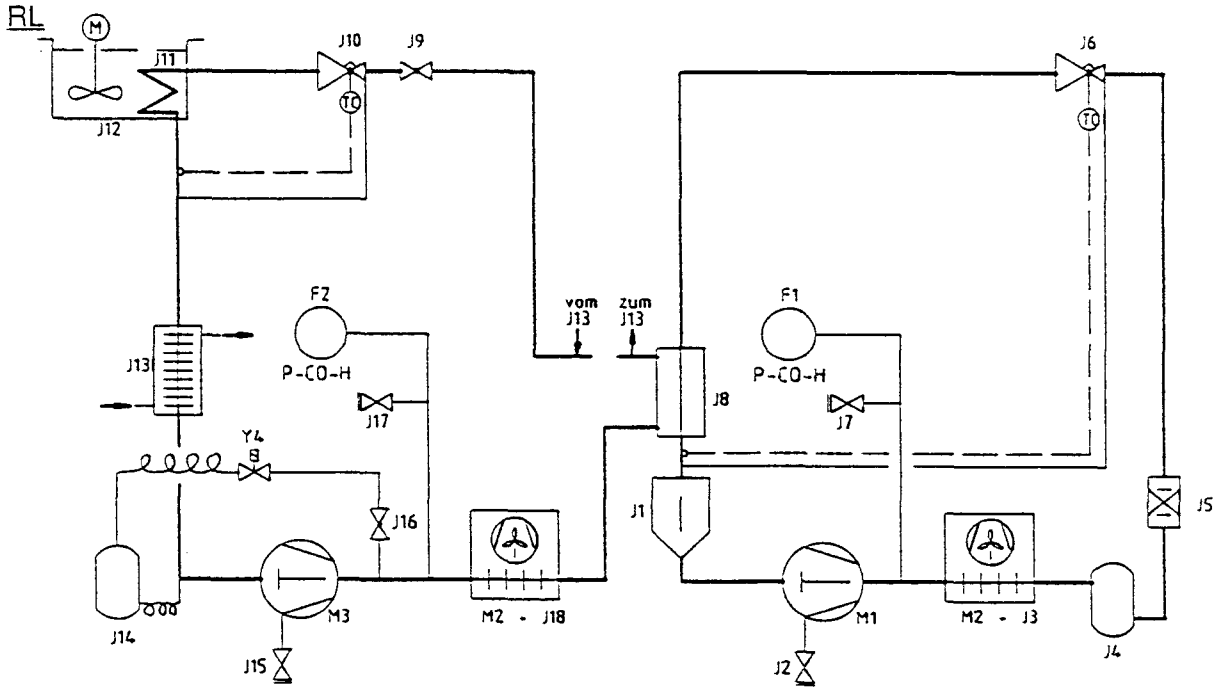

F 1 Überdruckschalter / Overpressure switch / Disjoncteur de surpression

J 1 Verflüssiger / Condenser / Condensateur
J 2 Sammelflasche / Receiver / Réceveur
J 3 Trockner / Drier / Secheur
J 4 Flüssigkeitsabscheider / Liquid separator
J 5 Nachspritzventil / Re-injection valve / Soupape de rè-injection
J 6 Einpritzventil / Injection valve / Soupape d'injection
J 7 Flüssigkeitsbad / Liquid bath / Bain de liquide
J 8 Verdampfer / Exchanger / Echangeur

M 2 Verdichter / Compressor / Compresseur
M 3 Ventilator / Fan / Ventilateur

Y 1 Magnetventil Kühlen / Solenoid valve cooling / Vanne solenoide réfroidissement
Y 2 Magnetventil Bypass / Solenoid valve Bypass / Vanne solenoide Bypass

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

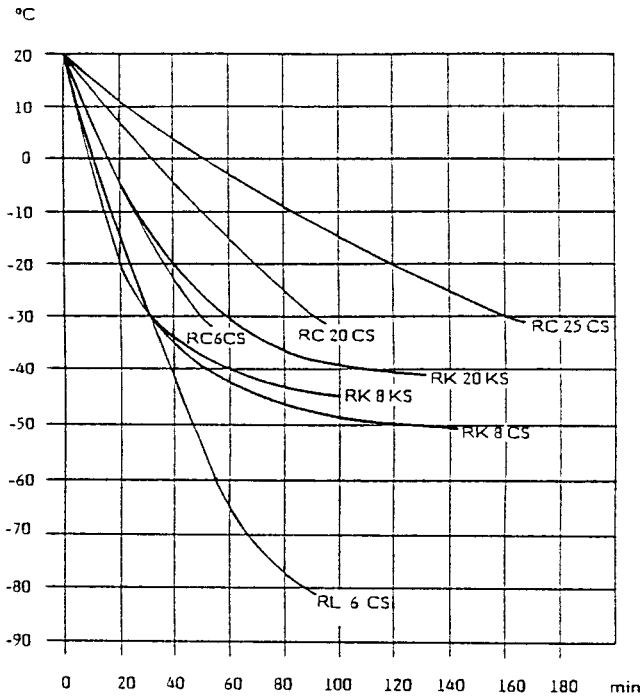
J 1 Flüssigkeitsabscheider / Liquid separator / Separateur de liquide
J 2 Kontrollventil Saug Stufe 1 / Control valve suction stage 1 / Vanne de contrôle aspiration étage 1
J 3 Kondensator Stufe 1 / Condenser stage 1 / Condensateur étage 1
J 4, J 14 Sammelflasche / Receiver / Receveur
J 5 Trockner / Drier / Déshydrateur
J 6 Expansionsventil Stufe 1 / Expansion valve stage 1 / Vanne d'expansion étage 1
J 7 Kontrollventil Druck Stufe 1 / Control valve pressure stage 1 / Vanne de contrôle pression étage 1
J 8 Wärmetauscher / Heat exchanger / Echangeur thermique
J 9, J 16, J 19, J 20 Absperrventil / Shut - off valve / Vanne d'arrêt
J 10 Expansionsventil Stufe 2 / Expansion valve stage 2 / Vanne d'expansion étage 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 contrôle aspiration étage 2
J 17 Kontrollventil Druck Stufe 2 / Control valve pressure stage 2 / Vanne de contrôle pression étage 2
J 18 Kondensator Stufe 2 / Condenser stage 2 / Condensateur étage 2

M 1 Kompressor Stufe 1 / Compressor stage 1 / Compresseur étage 1
M 2 Ventilator / Fan / Ventilateur
M 3 Kompressor Stufe 2 / Compressor stage 2 / Compresseur étage 2

Y 4 Magnetventil Druckausgleich / Solenoid valve pressure compensation / Vanne solenoide compensation de pression

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Cooling diagram




| Bath liquid: Ethanol | Refrigerant | Time for diagram |
|---|---|---|
| | Water-Glycol 1:1 (to -25°C) | = x1,7 |

## 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 ⏚

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 ↓.
Ri = 20 kOhm (0V pin 3)

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

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Pin 6: setpoint output 10 mV/K, Ri 100 Ohm. Load resistance ≥ 10 kOhm min. (0V pin 3)

Pin 7: + 12 V supply voltage, max. additional loading 20 mA

Pin 8: reference voltage approx. 5 V, load resistance ≥ 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: 18 V if red fault lamp is alight, i.e. safety circuit to DIN 12879 has operated. Ri 1 kOhm, I max. = 10 mA (0V pin 12)

Pin 14: recorder connection for external temperature, correct sign, 10 mV/K; Ri 100 Ohm; internal recorder resistance ≥ 1 MOhm (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 | Cat. No. EQM 030 |
| Housing for above | 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 |

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## 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<br>5 m long | Cat. No. UK 235 |
| Set of cables for remote operation FBC<br>length as specified | Cat. No. UK 238 |
| 19" adapter to take the control panel<br>of the remote operation system FBC 5 HE<br>for one or two panels | Cat. No. LRZ 009 |

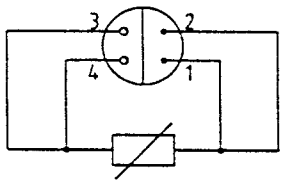
## 3.10 SAD connection to NE 28 (option)

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) (Lemosa 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)<br>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!

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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

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## 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 150°C (resp. 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

- non-flammable or flammable liquids are used
- 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.

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## 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

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be removed completely. Otherwise there is a danger of burns because of delayed boiling.

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## 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

| | | |
|---|---|---|
| working temperature range | -30...100°C | Ultra-Therm G 100 |
| boiling point | 110°C | Cat. No. LZB 009 |
| viscosity at 20°C | 4 mm²/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 30°C...165°C

Ultra-Therm 330 SCB — Cat. No. LZB 007
(synthetic heat transfer oil)
extended temperature range 185°C
according to DIN 12879

| | |
|---|---|
| viscosity at 20°C | 34 mm²/sec |
| flashpoint | 190°C |
| boiling point | 390°C |

Recommended operating temperature range 80°C...280°C

Ultra-Therm SW 300 N — Cat. No. LZB 008
(Silicone oil)
extended temperature range 300°C
according to DIN 12879

| | |
|---|---|
| viscosity at 20°C | 260 mm²/sec |
| viscosity at 100°C | 20 mm²/sec |
| flashpoint | 305°C |

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

Ultra-Therm XLT — Cat. No. LZB 013
(Silicone oil)
extended temperature range 40°C
according to DIN 12879

| | |
|---|---|
| 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 — Cat. No. LZB 016
(Silicone oil)

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

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 !

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5.2.3 Metal hoses (single-layer insulation)

Temperature range 0...400°C

| | | |
|---|---|---|
| Metal hose MC 50 | ( 50 cm long) | Cat. No. LZM 040 |
| Metal hose MC 100 | ( 100 cm long) | Cat. No. LZM 041 |
| Metal hose MC 150 | ( 150 cm long) | Cat. No. LZM 042 |
| Metal hose MC 200 | ( 200 cm long) | Cat. No. LZM 043 |

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 hoses with special insulation (3-layer insulation)

Temperature range 0...350°C

| | | |
|---|---|---|
| Metal hose MC 50 S | ( 50 cm long) | Cat. No. LZM 046 |
| Metal hose MC 100 S | ( 100 cm long) | Cat. No. LZM 047 |
| Metal hose MC 150 S | ( 150 cm long) | Cat. No. LZM 048 |
| Metal hose MC 200 S | ( 200 cm long) | Cat. No. LZM 049 |

Metal hose connections to link pump outlets (insulated) Cat. No. LZM 045
Temperature range -90...150°C

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.

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## 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 070 | for RC 6 CS |
| 1 Bath cover | Cat. No. HDQ 067 | for RC 20 CS, RK 20 KS |
| 2 Bath covers | Cat. No. HDQ 067 and HDQ 068 | for RC 25 CS |
| 1 Bath cover | Cat. No. HDQ 073 | for RL 6 CS |
| 1 Bath cover | Cat. No. HDQ 042 | for RK 8 CS, RK 8 KS |
| 2 Nipples 13 mm dia. | Cat. No. HKO 026 | |
| 2 Screw caps | Cat. No. HKM 032 | |
| 2 Closing plugs | Cat. No. HKN 065 | not for RK 8 CS |
| 1 Pump link | Cat. No. LZM 045 | for RK 8 CS |

Operating Instructions

### 6.2 Setting up, operation as bath thermostat

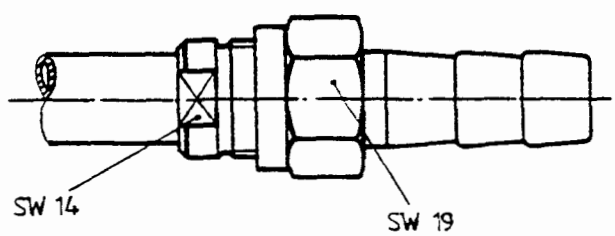
Set up the unit conveniently so that the control panel is towards the front and ensure that the air circulation for the refrigeration system through the grid in the lower part of the unit and the ventilating openings at the back of the unit is not restricted. On air-cooled units a minimum spacing of 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 advisible 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)!




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## 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).

At higher operating temperatures it is necessary to allow during filling for the expected expansion in volume of approx. 8% per 100°C.

For suitable tubing materials see Section 5.
We recommend metal tubings for temperatures above 100°C.

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 tubing 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)!

### 7.2 Open systems (baths)

The units (except for RK 8 CS) are equipped with a pressure/suction pump. This can be used for circulation to closed external circuits at higher pump outputs and in particular also to open external baths. There are two possibilities for maintaining the level in external baths:

1. The suction tubing is mounted in the external bath so that its end is at the required liquid level. The flow of the pressure stage is restricted with a tubing clamp on the hose from the pressure connection to the external bath so that the flow of the pressure stage is restricted slightly below that of the suction stage. This becomes noticeable by the entry of air into the suction tubing.

This operating method is not recommended, in particular at temperatures below 0°C and when using oil at elevated temperatures.

2. The preferred solution is the use of the LAUDA level controller (Cat. No. LPZ 901) which provides the functions of adjustable level control with float, srew-on connetion for external bath, and clamp fitting for 4 mm dia. Pt 100 probe.

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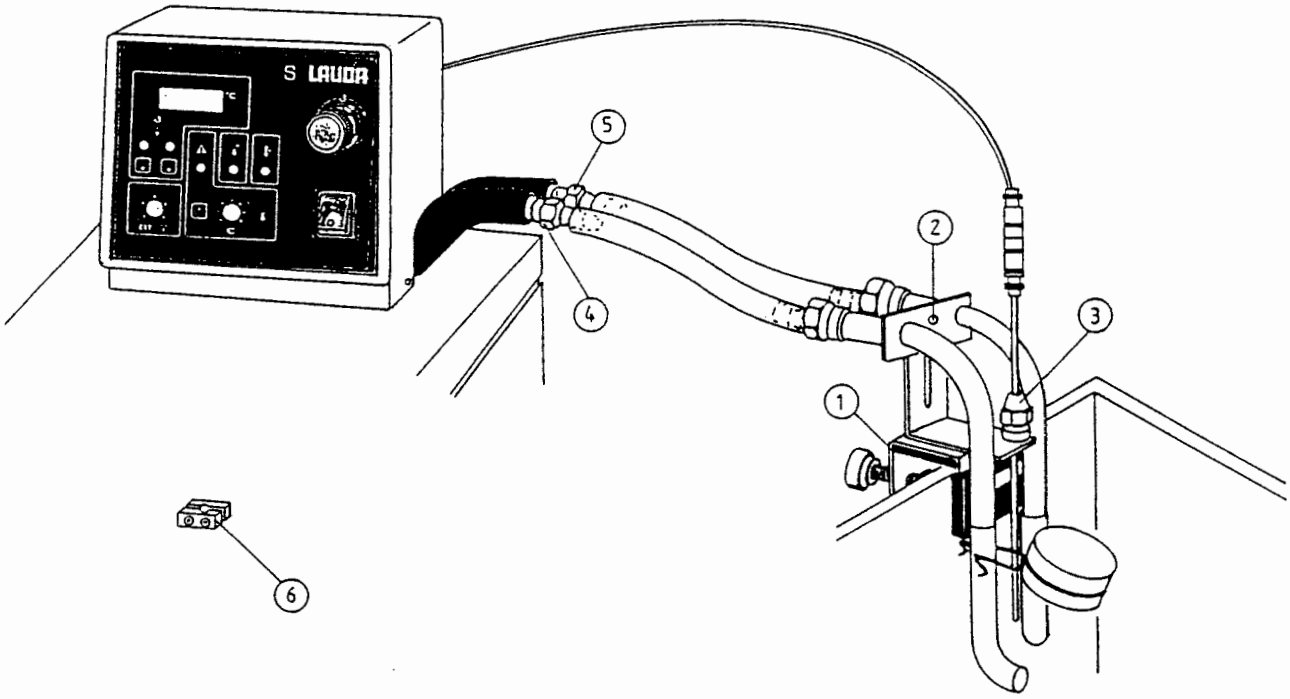
## 7.2.1 Fitting the level controller

Cat. No. LPZ 901

The level controller is mounted on the external bath using the screw clamp ①. The mounting is suitable for both round and rectangular baths.
Height adjustment after loosening the screw ②.
Make sure that there is good circulation and that the float can move freely!

Make the hose connections to the thermostat, connect the pressure nipple ④ to the pressure side and the suction nipple ⑤ to the suction side (see diagram).

Clamp fitting for Pt 100 probe (4 mm dia.) ③.
The clamp ⑥ is not required on these units!




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It is advisable to set up the external bath at the same level.

If the difference in level between the open external bath and the thermostat bath is greater than 0.5 m there is the possibility in certain applications that the control range of the level controller is not sufficient. With higher external bath level the suction hose should then be clamped off to such an extent that a constant level in the bath is obtained at which the float is within its control range. If the external level is low the pressure hose has to be similarly restricted by partly clamping it off.

WARNING: If thermostat and external bath are not at the same level it is essential to provide venting of the connecting hoses when the pump is swiched off in order to prevent overflowing.

It is preferable to use the Non-Return Fitting (see Accessories) which is mounted at the highest point of hose connection (bath or thermostat connection) and which is linked electrically to the mains output 34 H.

Non-Return Fitting Cat. No. UD 125

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

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

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## 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. When working with thermal oils (e.g. Ultra-Therm 330 SCB) slightly less liquid should be used to allow for expansion. The level must obviously not fall below the minimum, otherwise the low-level protection swiches 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 (i) 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 Types RK:

Switch on the unit with the mains switch. The green signal lamp lights up. Depending on the temperature setting and the energy demand the refrigeration system switches on automatically. The signal lamp indicates the cooling function.

Types RC and RL:

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) |

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With thermostats Series RL 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, or the lamp according to the cooling output.

After the operating temperature has been lowered the lamp obviously starts to flash only after the set temperature has been reached (on Types RC and RL).

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.

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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 oscilliations, 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 Pt100 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 probe 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.

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Example: selected potentiometer EXT (i) 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 temperatures).
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 units 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.

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# 9 Maintenance

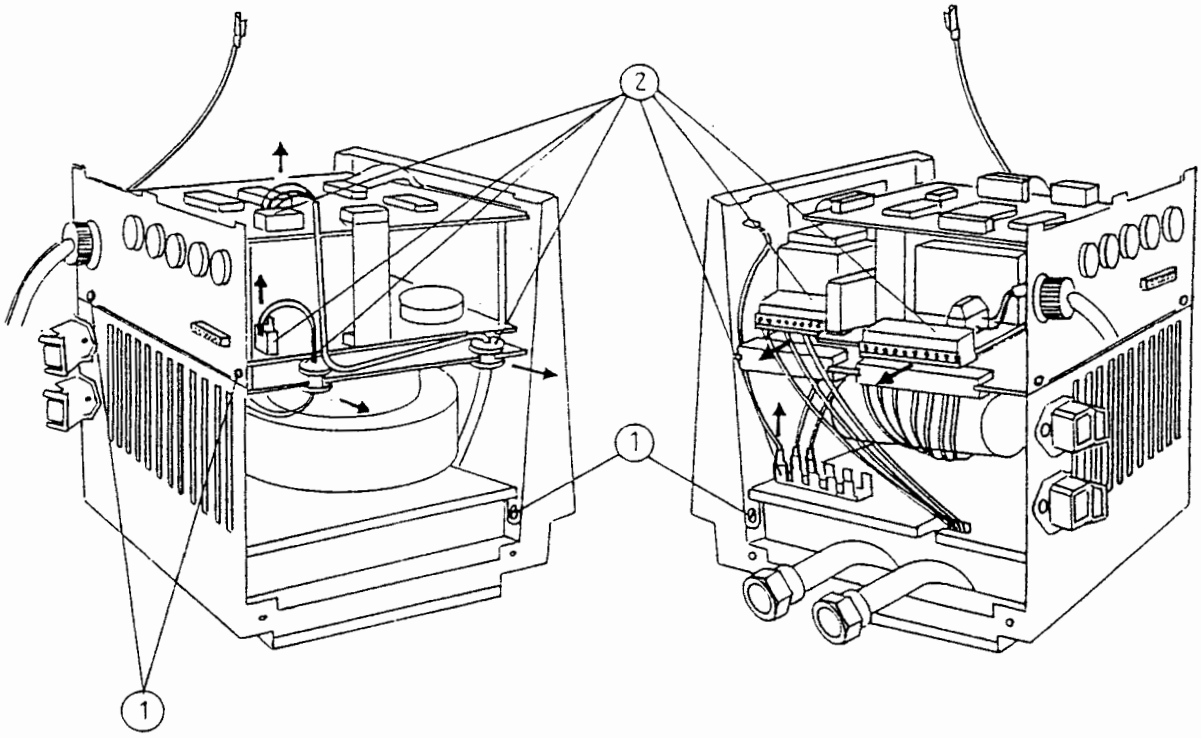
## 9.1 Safety notes in case of repairs

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.




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There is no provision for a fuse for the complete unit since the necessary 16A 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. This 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

The cooling circuit of the types RC is filled with the CFC-free refrigerant R 404 A (HP 62), the cooling circuit of the types RK is filled with the mixture of refrigerants HP 80. The high-temperature stage of the RL-units is filled with CFC-free refrigerant R 404 A; their low-temperature stage is filled with CFC-free refrigerant R 23. 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. WOBSER
GMBH & CO. KG

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

**RS 232 C Interface R 61/2** — Cat. No. LRT 013

Using the RS 232 C (V24) Interface with A/D and D/A converter it is possible with all suitably equipped computers to read out temperatures from the thermostat and to transmit a temperature (setpoint) to the thermostat. In addition the fault signal can be called up.
Programming and automatic running of ramps and contact programming are possible.

**Connecting cable** PM 351-1 or R 61/2 to thermostat length 1.2 m — Cat. No. UK 085

**Racks** in stainless steel
for test tubes, centrifuge tubes etc.

| | | |
|---|---|---|
| Bath RC 20 up to 2 racks | | |
| RD 13 | for 56 tubes 10 - 13 dia., 80 mm immersion | Cat. No. UG 066 |
| RD 18/1 | for 33 tubes 14 - 18 dia., 80 mm immersion | Cat. No. UG 067 |
| RD 18/2 | for 33 tubes 14 - 18 dia., 110 mm immersion | Cat. No. UG 068 |
| RD 30 | for 14 tubes 24 - 30 dia., 110 mm immersion | Cat. No. UG 069 |
| Bath RC 25 up to 4 racks | | |
| Bath RK 20 up to 2 racks | | |
| RE 13 | for 56 tubes 10 - 13 dia., 80 mm immersion | Cat. No. UG 070 |
| RE 18/1 | for 33 tubes 14 - 18 dia., 80 mm immersion | Cat. No. UG 071 |
| RE 18/2 | for 33 tubes 14 - 18 dia., 110 mm immersion | Cat. No. UG 072 |
| RE 30 | for 14 tubes 24 - 30 dia., 110 mm immersion | Cat. No. UG 073 |
| Bath RC 6 1 rack | | |
| RF 18/1 | for 20 tubes 14 - 18 dia., 80 mm immersion | Cat. No. UG 074 |
| RF 18/2 | for 20 tubes 14 - 18 dia., 110 mm immersion | Cat. No. UG 075 |
| Bath RK 8 1 rack | | |
| RG 18/1 | for 20 tubes 14 - 18 dia., 80 mm immersion | Cat. No. UG 076 |
| RK 18/2 | for 20 tubes 14 - 18 dia., 110 mm immersion | Cat. No. UG 077 |

Details of other racks on request.

**Rising platform** for retrofitting
size 250x160 mm, with continuous height adjustment suitable for: — Cat. No. LCZ 012

Bath RC 20 (1 platform)
Bath RC 25 (2 platforms)
Bath RK 20 (1 platform)

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| | |
|---|---|
| Gable cover, stainless steel for RC 25 | Cat. No. LCZ 011 |
| Gable cover, stainless steel for RC 25<br>(Beer forcing test for bottles of 0.5 l) | Cat. No. LCZ 058 |
| Level controller<br>for thermostating an open external bath<br>using pressure/suction pump | Cat. No. LPZ 901 |
| Non-return fitting<br>for automatic venting of the connecting hoses<br>when thermostating an open external bath | Cat. No. UD 125 |
| Nipples<br>for pump connections<br>13 mm dia., 10 mm int. dia.<br>11 mm dia., 7 mm int. dia. | <br><br>Cat. No. HKO 026<br>Cat. No. HKO 025 |
| Equipment trolley<br>for all compact bench thermostats RM 20-, RC-, RK- and RL-; movable; stepless height adjustment; cover plate of the units can be adjusted to height of laboratory bench | Cat. No. LCZ 036 |

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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

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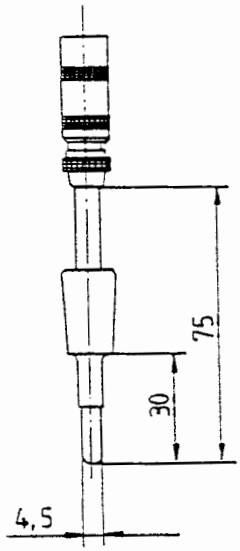
Connecting cable
with 4-pin plug for external control on
all C-and K-units and for
digital thermometer for Pt 100-44 and
Pt 100-66 1.5 m — Cat. No. UK 048
length as specified — Cat. No. UK 213

for Pt 100-42, Pt 100-70, Pt 100-90 1.5 m — Cat. No. UK 047
length as specified — Cat. No. UK 212

Screw clamp fitting
stainless steel, with Teflon pressure ring
for Pt 100 resistance thermometer 4 mm dia. — Cat. No. HX 078
Fig 5

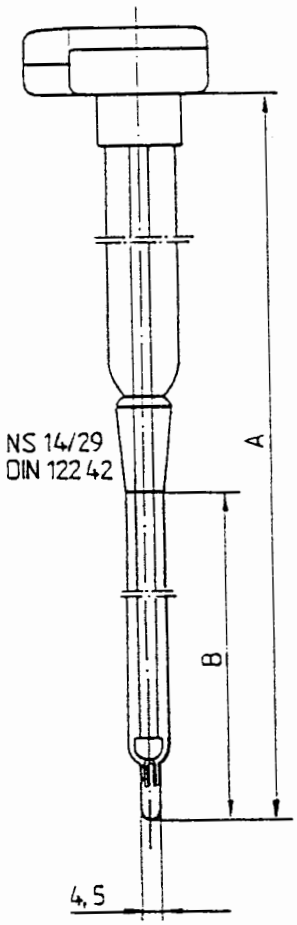
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Fig. 1



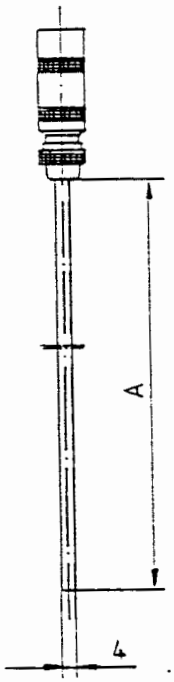

Pt 100-42

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

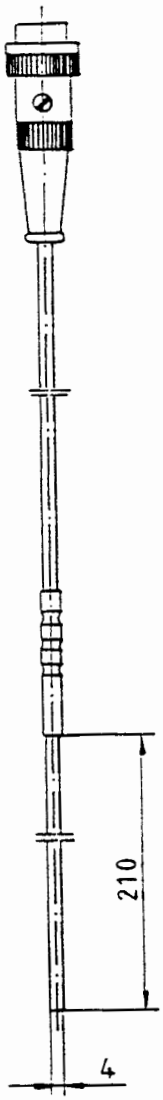
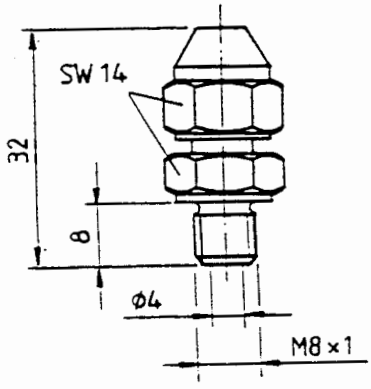
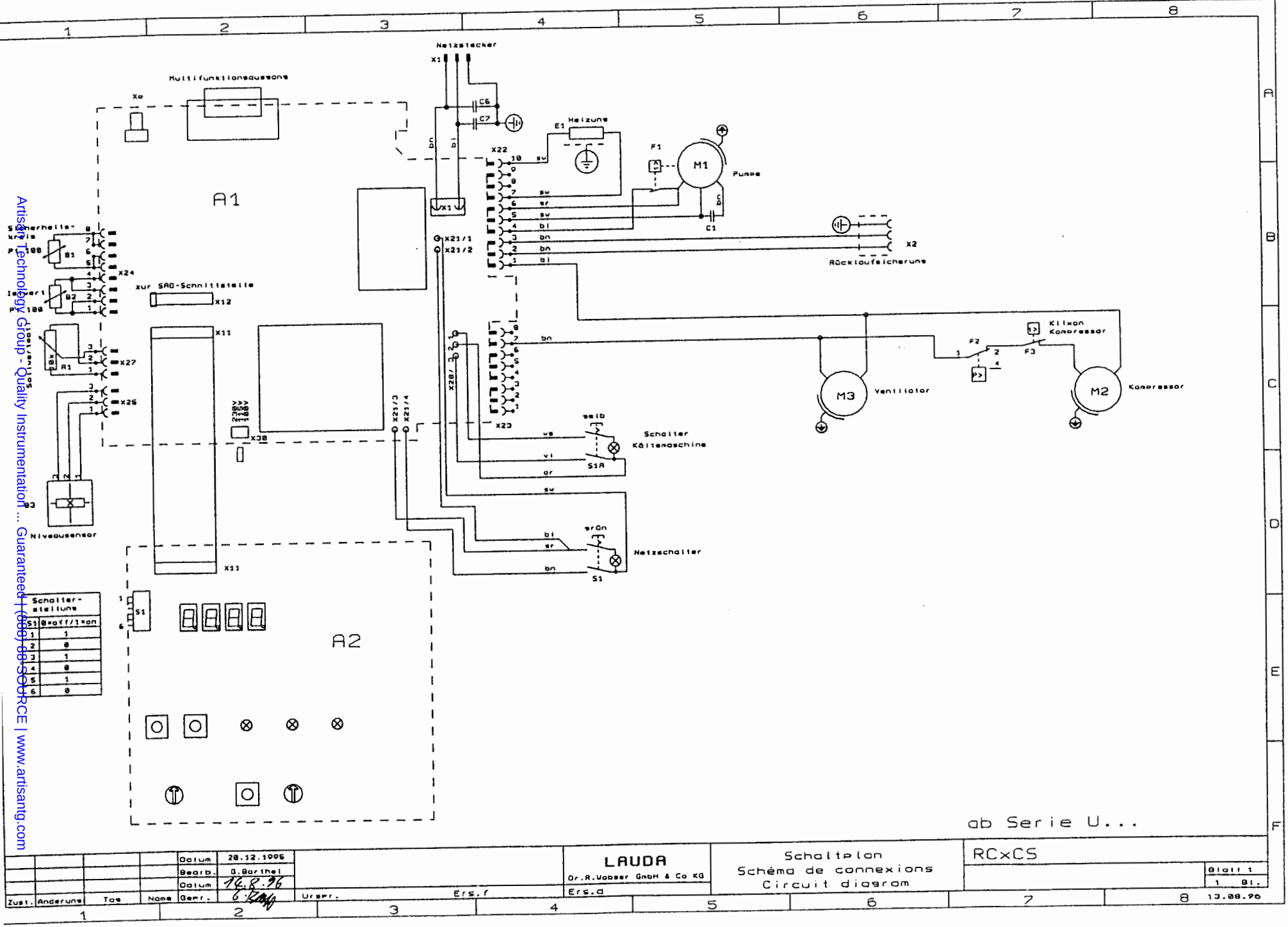



Fig. 5




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

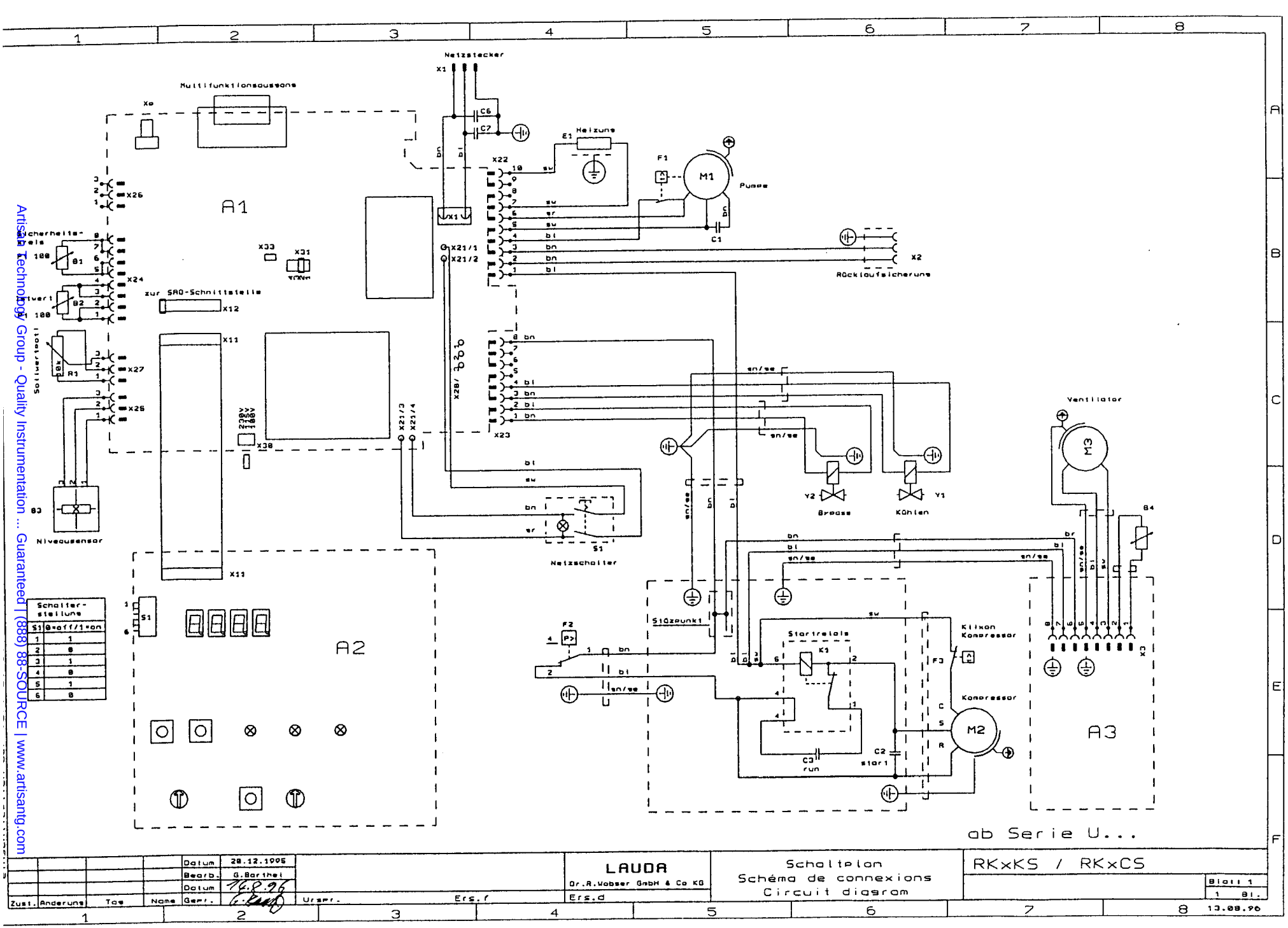
**RC 6 CS**
**RC 20 CS**
**RC 25 CS**

| | | | |
|---|---|---|---|
| A | 1 | Leiterplatte „Netz"<br>Printed circuit board „Mains"<br>Circuit imprimé „Secteur" | UL 429-3 |
| A | 2 | Leiterplatte „Anzeige"<br>Printed circuit board „Indication"<br>Circuit imprimé „Affichage" | UL430-2 |
| B | 1 | Pt 100 Fühler Sicherheitskreis<br>Pt 100 Probe Safety circuit<br>Pt 100 Sonde Circuit securité | US 060<br>(ETP 046) |
| B | 2 | Pt 100 Fühler Reglung<br>Pt 100 Probe Controller<br>Pt 100 Sonde Réglage | |
| B | 3 | Niveausensor<br>Level sensor<br>Niveau sensor | EKS 034 |
| C | 1 | Motorkondensator<br>Motor condenser<br>Condensateur moteur | 1,5 uF ECA 012 |
| E | 1 | Heizkörper<br>Heater<br>Corps de chauffe | 2 kW EH 162 |
| F | 1 | Klixon Pumpe<br>Klixon Pump<br>Klixon Pompe | ——— |
| F | 2 | Klixon Kompressor<br>Klixon Compressor<br>Klixon Compresseur | ——— |
| F | 3 | Überdruckschalter<br>Overpressure switch<br>Disjoncteur de surpréssion | ES 035 |
| M | 1 | Pumpenmotor<br>Pump motor<br>Moteur de pompe | EM 093 |
| M | 2 | Kompressor<br>Compressor<br>Compresseur | EMV 001 |
| M | 3 | Ventilator<br>Fan<br>Ventilateur | EML 011 |
| R | 1 | Potentiometer Sollwert<br>Setpoint potentiometer<br>Potentiomètre valeur de consigne | 10kOhm UD 339 |
| S | 1 | Netzschalter<br>Mains switch<br>Interrupteur secteur | EST 082 |
| X | 1 | Netzanschluß / Netzkabel<br>Mains connection / Mains cable<br>Branchement secteur / Câble de secteur | EKN 008 |
| X | 2 | Anschlußbuchse Rücklaufsicherung<br>Connection socket Reflow security valve<br>Douille de jonction Protection de refoulement | EQD 037+<br>EQZ 006 |

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**Geräteliste Schaltplan**
**List of parts Circuit diagram**
**Liste de pièces schéma de connexions**
**230V; 50Hz / 230V; 60Hz**
**bis Serie U99...**

| | | | RK 8 KS | RK 20 KS | RK 8 CS |
|---|---|---|---|---|---|
| A | 1 | Leiterplatte „Netz"<br>Printed circuit board „Mains"<br>Circuit imprimé „Secteur" | UL 432-3 | UL 432-3 | UL 432-3 |
| A | 2 | Leiterplatte „Anzeige"<br>Printed circuit board „Indication"<br>Circuit imprimé „Affichage" | UL 430-2 | UL430-2 | UL430-2 |
| A | 3 | Leiterplatte „Drenzahlregelung Lüftermotor"<br>Printed circuit board „Speed control ventilator motor"<br>Circuit imprimé „Régulation de vitesse moteur de ventilateur" | UL 446<br>(UD 349) | UL 446<br>(UD 349) | UL 446<br>(UD 349) |
| B | 1 | Pt 100 Fühler Sicherheitskreis<br>Pt 100 Probe Safety circuit<br>Pt 100 Sonde Circuit securité | US 060<br>(ETP 046) | US 060<br>(ETP 046) | US 060<br>(ETP 046) |
| B | 2 | Pt 100 Fühler Regtung<br>Pt 100 Probe Controller<br>Pt 100 Sonde Réglage | | | |
| B | 3 | Niveausensor<br>Level sensor<br>Niveau sensor | EKS 034 | EKS 034 | EKS 034 |
| B | 4 | Fühler für Drenzahlregleung<br>Probe for speed control<br>Sonde pour régulation de vitesse | US 041 | US 041 | US 041 |
| C | 1 | Motorkondensator<br>Motor condenser<br>Condensateur moteur | 5 uF ECA 007 | 5 uF ECA 007 | 5 uF ECA 007 |
| E | 1 | Heizkörper<br>Heater<br>Corps de chauffe | 2 kW EH 149 | 2 kW EH 149 | 2 kW EH 149 |
| F | 1 | Klixon Pumpe<br>Klixon Pump<br>Klixon Pompe | ——— | ——— | ——— |
| F | 2 | Klixon Kompressor<br>Klixon Compressor<br>Klixon Compresseur | ——— | ——— | ——— |
| F | 3 | Überdruckschalter<br>Overpressure switch<br>Disjoncteur de surpression | ES 035 | ES 035 | ES 035 |
| K | 1 | Anlaufrelais<br>Starting relay<br>Relais de demarrage | ——— | ——— | ——— |
| M | 1 | Pumpenmotor<br>Pump motor<br>Moteur de pompe | EM 094 | EM 094 | EM 094 |
| M | 2 | Kompressor<br>Compressor<br>Compresseur | ——— | ——— | ——— |
| M | 3 | Ventilator<br>Fan<br>Ventilateur | ——— | ——— | ——— |
| R | 1 | Potentiometer Sollwert<br>Setpoint potentiometer<br>Potentiomètre valeur de consigne | 10kOhm UD 339 | 10kOhm UD 339 | 10kOhm UD 339 |
| S | 1 | Netzschalter<br>Mains switch<br>Interrupteur secteur | EST 032 | EST 032 | EST 082 |
| X | 1 | Netzanschluß / Netzkabel<br>Mains connection / Mains cable<br>Branchement secteur / Câble de secteur | EKN 008 | EKN 008 | EKN 008 |
| X | 2 | Anschlußbuchse Rücklaufsicherung<br>Connection socket Reflow security valve<br>Douille de jonction Protection de refoulement | EQD 037+<br>EQZ 006 | EQD 037+<br>EQZ 006 | EQD 037+<br>EQZ 006 |



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| Geräteliste Schaltplan<br>List of parts Circuit diagram<br>Liste de pièces schéma de connexions<br>230V; 50Hz / 230V; 60Hz<br>bis Serie U99... | | | RK 8 KS | RK 20 KS | RK 8 CS |
|---|---|---|---|---|---|
| Y | 1 | Magnetventil Kühlen<br>Solenoid valve Cooling<br>Vanne solenoide Réfroidissement | EVM 027 | EVM 027 | EVM 027 |
| Y | 2 | Magnetventil Bypass<br>Solenoid valve Bypass<br>Vanne solenoide Bypass | EVM 027 | EVM 027 | EVM 027 |



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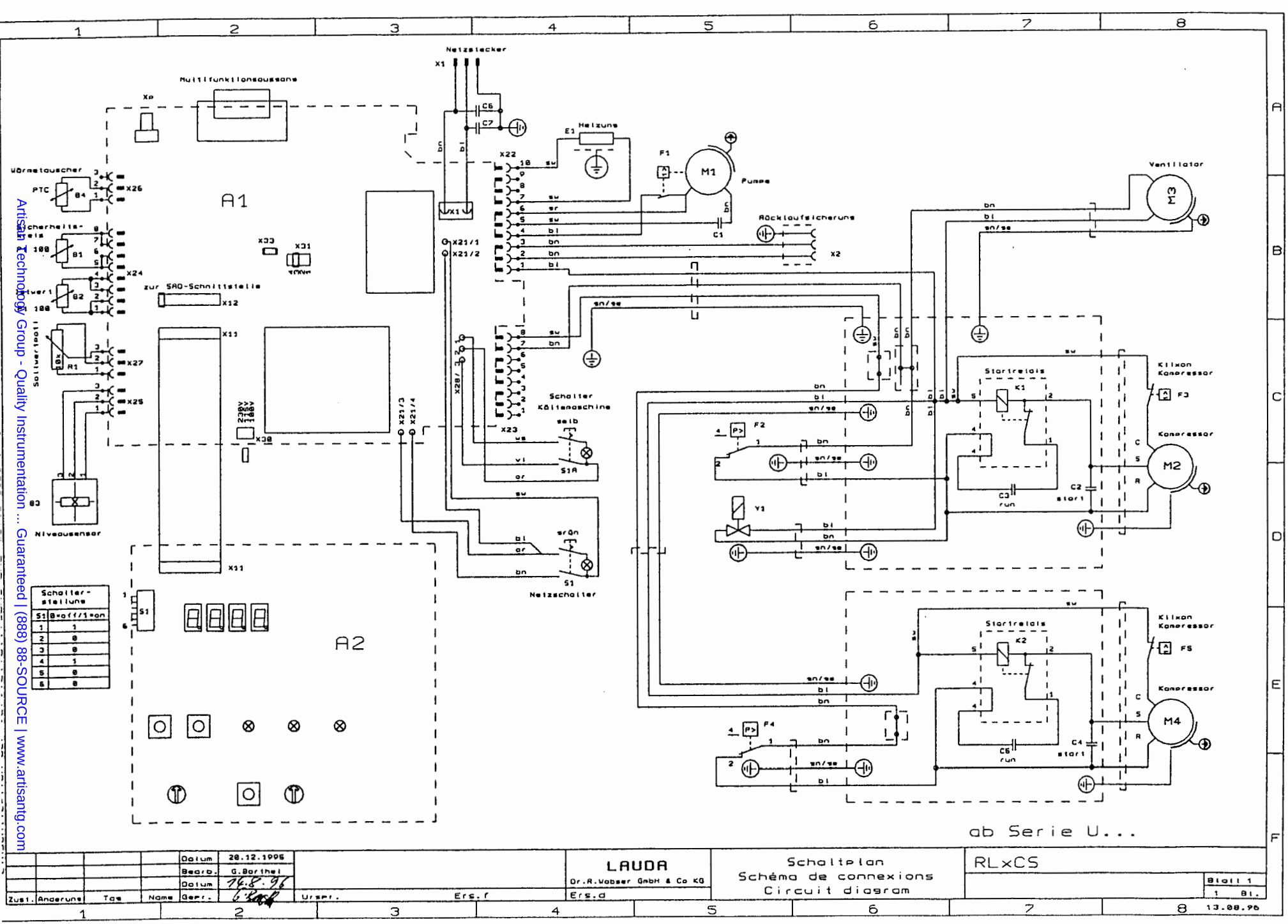
Geräteliste Schaltplan
List of parts Circuit diagram
Liste de pièces schéma de connexions
230V; 50Hz / 230V; 60Hz
ab Serie V01__

| | | | RK 3 KS | RK 20 KS | RK 3 CS |
|---|---|---|---|---|---|
| A | 1 | Leiterplatte „Netz"<br>Printed circuit board „Mains"<br>Circuit imprimé „Secteur" | UL 432-3 | UL 432-3 | UL 432-3 |
| A | 2 | Leiterplatte „Anzeige"<br>Printed circuit board „Indication"<br>Circuit imprimé „Affichage" | UL 430-2 | UL430-2 | UL430-2 |
| A | 3 | Leiterplatte „Drehzahlregelung Lüftermotor"<br>Printed circuit board „Speed control ventilator motor"<br>Circuit imprimé „Régulation de vitesse moteur de ventilateur" | UL 473<br>(UD 395) | UL 473<br>(UD 395) | UL 473<br>(UD 395) |
| B | 1 | Pt 100 Fühler Sicherheitskreis<br>Pt 100 Probe Safety circuit<br>Pt 100 Sonde Circuit securité | US 060<br>(ETP 046) | US 060<br>(ETP 046) | US 060<br>(ETP 046) |
| B | 2 | Pt 100 Fühler Regung<br>Pt 100 Probe Controler<br>Pt 100 Sonde Réglage | | | |
| B | 3 | Niveausensor<br>Level sensor<br>Niveau sensor | EKS 034 | EKS 034 | EKS 034 |
| B | 4 | Fühler für Drehzahlregelung<br>Probe for speed control<br>Sonde pour regulation de vitesse | US 041 | US 041 | US 041 |
| C | 1 | Motorkondensator<br>Motor concenser<br>Condensateur moteur | 5 uF ECA 007 | 5 uF ECA 007 | 5 uF ECA 007 |
| E | 1 | Heizkörper<br>Heater<br>Corps de chauffe | 2 kW EH 149 | 2 kW EH 149 | 2 kW EH 149 |
| F | 1 | Klixon Pumpe<br>Klixon Pump<br>Klixon Pompe | ——— | ——— | ——— |
| F | 2 | Klixon Kompressor<br>Klixon Compressor<br>Klixon Compresseur | ——— | ——— | ——— |
| F | 3 | Überdruckschalter<br>Overpressure switch<br>Disjoncteur de surpression | ES 035 | ES 035 | ES 035 |
| K | 1 | Anlaufrelais<br>Starting relay<br>Relais de demarrage | ——— | ——— | ——— |
| M | 1 | Pumpenmotor<br>Pump motor<br>Moteur de pompe | EM 034 | EM 034 | EM 034 |
| M | 2 | Kompressor<br>Compressor<br>Compresseur | ——— | ——— | ——— |
| M | 3 | Ventilator<br>Fan<br>Ventilateur | ——— | ——— | ——— |
| R | 1 | Potentiometer Sollwert<br>Setpoint potentiometer<br>Potentiometre valeur de consigne | 10kOhm UD 039 | 10kOhm UD 039 | 10kOhm UD 039 |
| S | 1 | Netzschalter<br>Mains switch<br>Interrupteur secteur | EST 032 | EST 032 | EST 032 |
| X | 1 | Netzanschluß / Netzkabel<br>Mains connection / Mains cable<br>Branchement secteur / Câble de secteur | EKN 008 | EKN 008 | EKN 008 |
| X | 2 | Anschlußbuchse Rückdauersicherung<br>Connection socket Reflow security valve<br>Douille de joncoon Protection de refoulement | EQD 037+<br>EQZ 006 | EQD 037+<br>EQZ 006 | EQD 037+<br>EQZ 006 |

| Geräteliste Schaltplan<br>List of parts Circuit diagram<br>Liste de pièces schéma de connexions<br>230V; 50Hz / 230V; 60Hz<br>ab Serie V01... | | | RK 8 KS | RK 20 KS | RK 8 CS |
|---|---|---|---|---|---|
| Y | 1 | Magnetventil Kühlen<br>Solenoid valve Cooling<br>Vanne solenoide Réfroidissement | EVM 027 | EVM 027 | EVM 027 |
| Y | 2 | Magnetventil Bypass<br>Solenoid valve Bypass<br>Vanne solenoide Bypass | EVM 027 | EVM 027 | EVM 027 |



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

**RL 6 CS**

| | | | |
|---|---|---|---|
| A | 1 | Leiterplatte „Netz"<br>Printed circuit board „Mains"<br>Circuit imprimé „Secteur" | UL 432-3 |
| A | 2 | Leiterplatte „Anzeige"<br>Printed circuit board „Indication"<br>Circuit imprimé „Affichage" | UL430-2 |
| B | 1 | Pt 100 Fühler Sicherheitskreis<br>Pt 100 Probe Safety circuit<br>Pt 100 Sonde Circuit securité | ETP 047 |
| B | 2 | Pt 100 Fühler Reglung<br>Pt 100 Probe Controller<br>Pt 100 Sonde Réglage | |
| B | 3 | Niveausensor<br>Level sensor<br>Niveau sensor | EKS 034 |
| B | 4 | PTC Temperaturfühler KTY 81<br>PTC Temperature probe KTY 81<br>PTC Sonde de témperature KTY 81 | ETP 027 |
| C | 1 | Motorkondensator<br>Motor condenser<br>Condensateur moteur | 1,5 uF ECA 012 |
| E | 1 | Heizkörper<br>Heater<br>Corps de chauffe | 1,2 kW EH 163 |
| F | 1 | Klixon Pumpe<br>Klixon Pump<br>Klixon Pompe | ——— |
| F | 2 | Überdruckschalter Stufe 1<br>Overpressure switch stage 1<br>Disjoncteur de surpréssion étage 1 | ES 035 |
| F | 3 | Klixon Kompressor Stufe 1<br>Klixon Compressor stage 1<br>Klixon Compresseur étage 1 | ——— |
| F | 4 | Überdruckschalter Stufe 2<br>Overpressure switch stage 2<br>Disjoncteur de surpréssion étage 2 | ES 035 |
| F | 5 | Klixon Kompressor Stufe 2<br>Klixon Compressor stage 2<br>Klixon Compresseur étage 2 | ——— |
| M | 1 | Pumpenmotor<br>Pump motor<br>Moteur de pompe | EM 062 |
| M | 2 | Kompressor Stufe 1<br>Compressor stage 1<br>Compresseur étage 1 | ——— |
| M | 3 | Ventilator<br>Fan<br>Ventilateur | ——— |
| M | 4 | Kompressor Stufe 2<br>Compressor stage 2<br>Compresseur étage 2 | ——— |
| R | 1 | Potentiometer Sollwert<br>Setpoint potentiometer<br>Potentiomètre valeur de consigne | 10kOhm UD 339 |
| S | 1 | Netzschalter<br>Mains switch<br>Interrupteur secteur | EST 082 |
| X | 1 | Netzanschluß / Netzkabel<br>Mains connection / Mains cable<br>Branchement secteur / Câble de secteur | EKN 008 |
| X | 2 | Anschlußbuchse Rücklaufsicherung<br>Connection socket Reflow security valve<br>Douille de jonction Protection de refoulement | EQD 037+<br>EQZ 006 |

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