LAUDA

Operating Instructions

# LAUDA Compact
# Low-Temperature Thermostats
# RLS 6, RLS 6-D
# to DIN 12879

08/89
Valid from Series H01
YACE0024

LAUDA DR. R. WOBSER GMBH & CO. KG
Postfach 12 61, D 97912 Lauda Königshofen
Tel. (0 93 43) 503 - 0, Fax (0 93 43) 50 32 22
E-mail info@lauda.de, Internet http://www.lauda.de

Contents



Enclosures

## 1. Brief description

1.1 Check the thermostat and accessories during unpacking for any transport damage and if necessary inform the forwarding agent.

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

1.3 Connect tubing to the pump connections:

**Without external system:** link pump connectors together with the insulated Silicone tubing (-60 ... 100°C max.), perbunan tubing (120°C max.), Viton or metal tubing as supplied. Note: do not use Silicone tubing in conjunction with Silicone oils (SK Frigor, SK Super Frigor)!

**With external system:** make hose connections to the external system.

Fit tubing clips to prevent tubing slipping off.

1.4 Fill the bath up to a level approx. 1 cm below the plastic cover. For bath liquids see Section 5.

1.5 The spacing of the grill from any object which might interfere with free air flow must be at least 0.5 m.

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

1.7 Switch on the main switch. The green signal lamp in the switch lights up. The refrigerator starts running, but stops again automatically if it is not required after approx. 10 min.

1.8 Overtemperature cut-out has to be set according to bath temperature and bath liquid (see Section 4). To release the safety circuit lock-out it may be necessary to operate the unlocking key .

1.9 When operating with an external system ensure that the level inside the thermostat does not drop too much when the external system is being filled with the bath liquid.

1.10 The digital thermometer shows the actual bath temperature.

1.11 To set the temperature press the button , this changes the digital display from bath temperature to setpoint. Now select the desired temperature by turning the knob . The fine adjustment (± 0.2°C) is also effective and simplifies setting by greater resolution. The refrigerator switches on automatically as required.

1.12 Under normal conditions, i.e. when no accessory units are connected to the thermostat, the three slide switches on the back of the unit should be in the bottom position (see Section 9).

1.13 When the thermostating liquid has reached the selected setpoint the yellow lamp "heating" or the green lamp "cooling" begins to flash. After the system has settled down the digital thermometer shows the bath temperature previously selected.

1.14 The red signal lamp always flashes when the bath temperature is more than 5°C above the selected setpoint.

1.15 Safety features

The thermostat conforms to Class 2. It must only be operated with liquids (see Section 5) whose flashpoint is above 40°C. Inflammable liquids must only be used to 5°C below the flashpoint, otherwise there is a danger of an explosive atmosphere.

1.16 Important Note

The outlet and inlet pipes are at the operating temperature. This may lead to overtemperatures of more than 60°C!

## 2. Data table

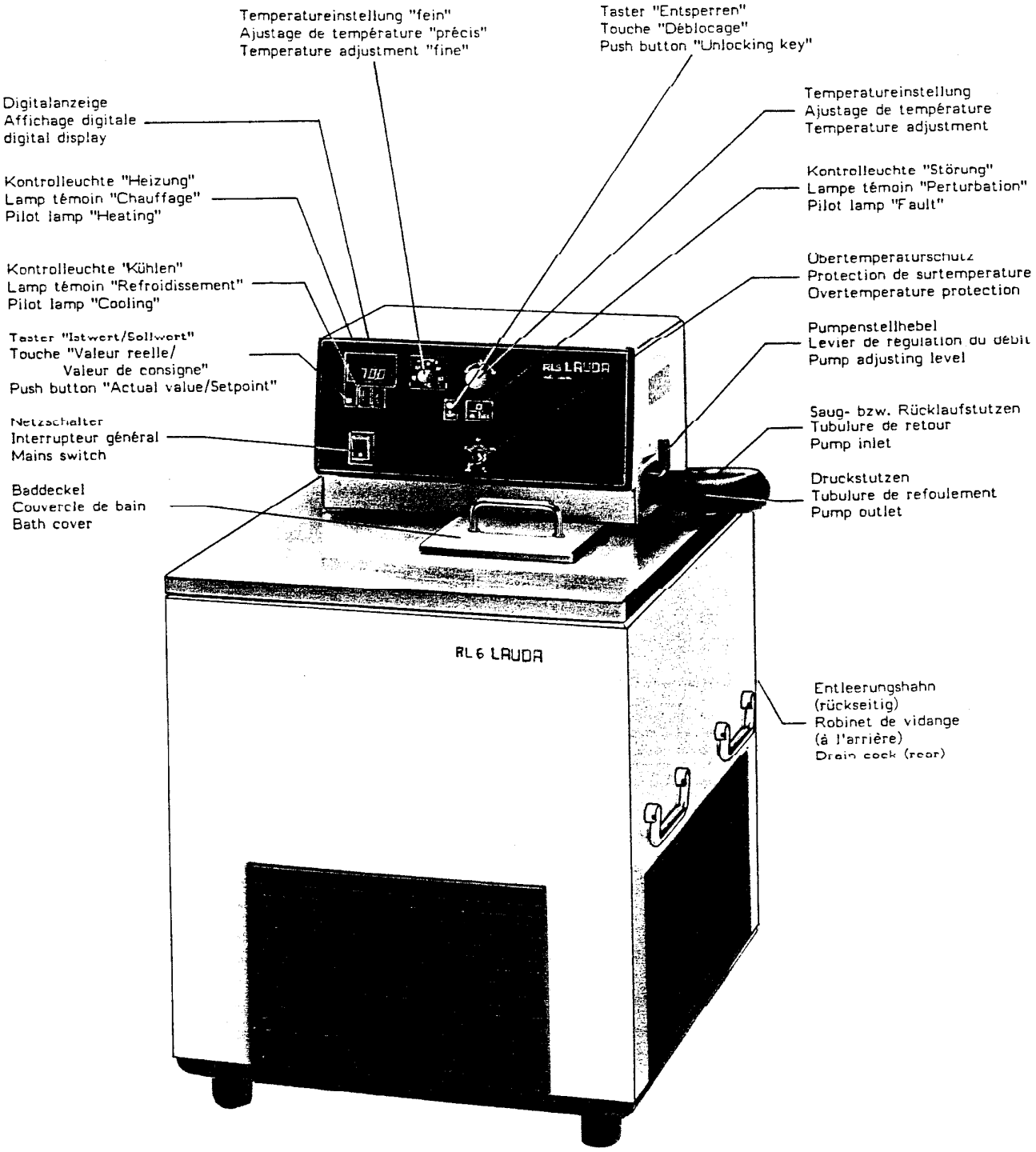
These thermostats meet the requirements of DIN 12879

| Technical data (to DIN 58966) | | RLS 6 | RLS 6-D |
|---|---|---|---|
| Operating temp. range | (°C) | -75 ... 100 | |
| Temperature setting/ resolution | (°C) | rough and fine adjustment with digital display / 0.1°C resolution | |
| Fine temperature setting range/resolution | (°C) | ± 0.2 / 0.01 | |
| Temp. indication/ resolution | | digital indication by green LED / 0.1°C resolution; accuracy ± 0.2% of reading ± 0.2°C. | |
| Temperature probe/ Control action | | Pt 500 / PID with proportional cooling | |
| Constancy of temp. (at -10°C) | (°C) | ± 0.02 ... ± 0.05 | |
| Heating capacity max. | (kW) | 1.2 | |
| Cooling capacity, effective at: | (kW) | | |
| 20°C | | 0.40 | |
| 0°C | | 0.32 | |
| -10°C | | 0.28 | |
| -20°C | | 0.26 | |
| -40°C | | 0.20 | |
| -60°C | | 0.15 | |
| -70°C | | 0.10 | |
| -75°C | | 0.05 | |
| | | Refrigerator is switched on and off as required. Proportional cooling. | |
| Class to DIN 12879 | | 2 | |
| SIMPLEX pumps | | | |
| Flow rate at zero pressure (pump capacity) with olive 11/13 dia. | (l/min) | 11 / 15 | --- |
| max. manometric pressure | (bar) | 0.25 | --- |

| Technical data (to DIN 58966) | | RLS 6 | RLS 6-D |
|---|---|---|---|
| **DUPLEX pumps (-D)** | | | |
| Flow rate with olive 11/13 dia. pressure; suction | (l/min) | --- | 10; 8/13; 9 |
| max. manometric pressure; pressure; suction | (bar) | --- | 0.25; 0.23 |
| Charging capacity | (l) | 4.0 ... 6.0 | |
| Bath opening W x D | (mm) | 120 x 105 | |
| Depth of bath | (mm) | 190 | |
| Usable bath depth | (mm) | 150 | |
| Floor area (W x D) x height | (mm) | 470 x 555 x 720 | |
| Weight | (kg) | 92.0 | |
| Power supply | | 220 - 240 V, 50 Hz / 230 V, 60 Hz<br>2.1 kW<br>Protection Class I to VDE 0100 | |
| Interference suppression | | Class N | |
| Ref.No.<br>220 - 240 V, 50 Hz<br>230 V, 60 Hz | | LCK 131<br>LCK 231 | LCK 132<br>LCK 232 |

LAUDA Compact Low-Temperature Thermostats
RLS 6, RLS 6-D





## 3. Basic construction

These Operating Instructions apply to:

Bath / Circulating thermostat RLS 6

With SIMPLEX pump for thermostating in the bath and in closed external systems at -75 to 100°C operating temperature.

Bath / Circulating thermostat RLS 6-D

With DUPLEX pump for thermostating in the bath and in closed and open external systems at -75 to 100°C operating temperature.

On all units the metal parts in contact with the bath liquid are made from stainless chrome nickel steel. Furtheron the plastic (POM) and Teflon are used which are both resistant at working temperature range. DUPLEX pumps have a suction and a pressure stage with level control.

The two-stage refrigerator is switched on automatically when required. Cooling is controlled through solenoid valves which are operated from the electronics through the PID-controller.

The units consist of a bath and refrigerator assembly and the control and pump assembly which can be separated from each other (see Section 12).

The control assembly contains the complete electronics with digital display for actual temperature and setpoint, PID controller with triac packet switching relay, controls for the refrigerator and the solenoid valves, temperature probe, heater, safety system and pump. All units have at the back a multi-function output with inputs for programmer and accessory units and with outputs for recorder, fault signal etc. (see Sections 8 and 10). The main data of the thermostat are summarised in Section 2.

## 4. Safety system

4.1 The DIN specification 12879 for laboratory thermostats entitled "Liquid Thermostats, General and Safety Requirements" has been in operation since May 1, 1979. This specification lays down the safety devices required and divides thermostats into different safety classes.

4.2 Why can it be dangerous to operate a thermostat?

1. Thermostats are fitted with heaters which provide the necessary heating energy for the thermostatic liquid. If the temperature control fails, or if the liquid level is too low, the heater may reach a temperature which in combination with inflammable thermostatic liquids can cause a fire in the laboratory.

2. When using the thermostat as a circulation thermostat, failure of the tubing can cause discharge of hot liquid and endanger persons and materials.

The classification of thermostats depends on:

- o whether non-inflammable or inflammable thermostatic liquids are used;

- o whether the thermostat is operated under supervision or unsupervised.

4.3 The units RLS 6 and RLS 6-D as described in these Operating Instructions are to Class 2, they are protected against overtemperature and low level. Class 2 requires:

- o a temperature limiter as overtemperature protection which switches off the thermostat on all poles of the line supply when an adjustable switch-off temperature is exceeded.

- o a liquid level limiter as low-level protection which switches off the thermostat on all poles of the line supply when the liquid level falls below a setting adjustable between the minimum and the maximum filling volume.

- o only those bath liquids can be used whose flashpoint is above 40°C. The operating temperature must not be higher than 5°C below the flashpoint. Non-inflammable liquids can, of course, be used.

**Important note**

Even with Class 2 the user is only protected against hazards resulting from excess temperature and low level.
Other hazards may arise from the type of products being thermostated, e.g. a shift above or below certain temperature levels or breaking of the container followed by reaction with the thermostatic liquid etc. It is impossible to provide protection against all possible cases and they remain largely within the decision and responsibility of the user.

## 5. Bath liquids and tubing

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

### 5.1 Bath liquids

Operating range 5 ... 100°C

Use decalcified water only. Remember to make up losses through evaporation at elevated temperatures. Losses can be reduced by using suitable bath covers.

Temperatures close to zero and below:

Use water/monoethylene glycol mixture, preferably Glycoshell P 300, in the ratio 1 : 1.

Operating range -30 ... 100°C **Ultra-Therm G 100** — Ref.No. LZB 009

| | |
|---|---|
| Boiling point | 110°C |
| Viscosity at 20°C | 4 mm² /sec |
| Non-inflammable | |

Prolonged operation at elevated temperatures results in a decreasing proportion of water in the mixture which gradually approaches the properties of pure glycol and thus becomes inflammable (flashpoint 128°C). The mixture ratio must therefore be checked from time to time, i.e. against the original mixture, or with a hydrometer.

Operating range -60 ... 50°C **Ultra Therm-SK Frigor** (Silicone oil) — LZB 002

| | |
|---|---|
| Viscosity at 20°C | 3 mm² /sec |
| Flashpoint | 70°C |

Depending on requirements regarding accuracy of temperature control and heat transfer, Ultra-Therm SK Frigor can be used down to approx. -75°C.

Operating range -50 ... 115°C **Ultra-Therm-SK Superfrigor** (Silicone oil) — LZB 003

| | |
|---|---|
| Viscosity at 20°C | 5 mm² /sec |
| Flashpoint | 120°C |

Operating range -95 ... 40°C **Methanol**

| | |
|---|---|
| Boiling point | 65°C |
| Viscosity at 20°C | 0.6 mm² /sec |
| Flashpoint | 11°C |
| Freezing point | -98°C |

**Important note!**

Methanol is commonly used at operating temperatures below -60°C. Since the flashpoint of methanol is 11°C, its use does not conform to the provisions of DIN 12879. If it is necessary to meet the requirements of DIN 12879 when operating below -60°C please contact the factory regarding suitable bath liquids.

**Ref.No.**

Operating range 20 ... 180°C Ultra Therm 330 SCB — LZB 007
(synthetic heat transfer liquid)

| | |
|---|---|
| Viscosity at 20°C | 34 mm²/sec |
| Flashpoint | 190°C |
| Start of boiling | 390°C |

5.2 Tubing (continuous lengths)

Silicone tubing, uninsulated — RKJ 016
8 mm internal dia. Application range -30 ... 100°C.
For water and water-glycol mixture.

Silicone tubing, insulated — LZS 001
8 mm internal dia. With foam rubber insulation,
external dia. 30 mm approx. Use as for uninsulated
Silicone tubing. Application range -60 ... 100°C.

Silicone tubing, heavy insulation (Zellcoror) — LZS 002
8 mm internal dia. With foam rubber insulation,
external dia. 50 mm approx. Use as for uninsulated
Silicone tubing. Application range -130 ... 100°C.

Silicone tubing, uninsulated — RKJ 059
11 mm internal dia. Application range -30 ... 100°C.
For water and water-glycol mixture.

Silicone tubing, insulated — LZS 007
11 mm internal dia. With foam rubber insulation,
external dia. 35 mm approx. Use as for uninsulated
Silicone tubing. Application range -60 ... 100°C.

Silicone tubing, heavy insulation (Zellcoror) — LZS 009
11 mm internal dia. With foam rubber insulation,
external dia. 55 mm aprox. Use as for uninsulated
Silicone tubing. Application range -130 ... 100°C.

| | Ref.No. |
|---|---|
| Perbunan tubing, uninsulated<br>11 mm internal dia. Application range 0 ... 120°C. | RKJ 012 |

**Note:** Silicone tubing must not be used with Silicone oils!

Secure tubing with clips to prevent it slipping off.

| | |
|---|---|
| Metal tubing lengths for linking together the pump connectors (insulated)<br>Application range -60 ... 150°C<br>At lower temperatures apply additional insulation after fitting. | LZM 045 |

Metal tubing (single insulation)
Application range -60 ... 150°C

| | |
|---|---|
| Metal tubing MK 50 ( 50 cm long) | LZM 052 |
| Metal tubing MK 100 (100 cm long) | LZM 053 |
| Metal tubing MK 150 (150 cm long) | LZM 054 |
| Metal tubing MK 200 (200 cm long) | LZM 055 |

Highly flexible, thermally insulated stainless steel tubing (V2A) with M 16 x 1 mm connecting threeds. Internal dia. 10 mm. This tubing offers maximum security.

Further information on thermostat liquids and tubing are contained in our special Information Bulletin.

## 6. Unpacking, assembly and setting up

6.1 The units are packed carefully to prevent transport damage. If, however, the unit should arrive damaged, the carrier or the railway authorities have to be informed so that it can be inspected.

Standard accessories

| | | |
|---|---|---|
| 1 Bath cover | HDQ | 054 |
| 2 Olives 13 dia. (fitted) | HKO | 026 |
| 2 Olives 11 dia. | HKO | 025 |
| 1 m Silicone tubing, insulated, 11 mm int.dia. | LZS | 007 |

Operating Instructions

6.2 The unit is best set up so that the narrow side is to the front and the air flow to the refrigerator (grills in the lower part) is not obstructed.
Close the drain cock.

If no external circulation is required the pump connections are linked together with a piece of tubing; the pump adjusting lever should be open to improve the circulation inside the bath. For permanent use the link tubing (Ref.No. LZM 045) offers the best and most reliable solution.

## 7. Connecting external systems

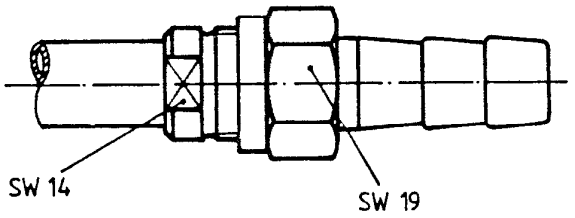
7.1 If the thermostat is connected to closed external systems, liquid must be added to the unit until the bath level remains at the correct heigt (approx. 2 cm below the plastic cover). For suitable tubing material refer to Section 5. With a high-level external system, entry of air in the thermostatic circuit while the pump is stopped may cause the external volume to drain down, resulting in flooding of the thermostatic bath!

7.2 When thermostating open external systems (bath) the tubes are placed over the side in the bath (protect them against slipping out), preferably on opposite sides. The suction tube should have a notch cut at the end so that it does not suck itself to the side or the bottom of the bath. Before switching on the unit the bath is filled with liquid to the required height.
If thermostat and external bath are not at the same level, the connecting tubes must be vented after switching off the thermostat by pulling them out of the liquid in order to prevent flooding.

Always ensure maximum flow area in the external circulation (olives, tubing, external system). This produces a larger flow rate and thereby improves the thermostating action.

Protect the tubes with hose clips against slipping off or use stainless steel tubing with screw fittings.

Note: For tightening the union nuts (SW 19) at the the tube connectors hold up the threaded nipple with fork wrench SW 14.




## 7.3 Circulating pumps

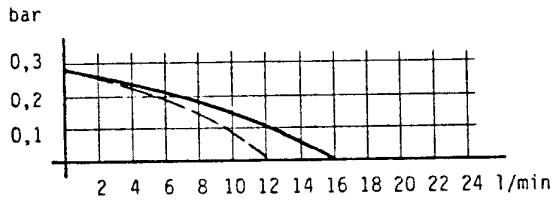
Essentially there are two different types: SIMPLEX pumps on RLS 6 and DUPLEX pumps on RLS 6-D.

SIMPLEX pumps are used for operation with closed external systems. They require that the external system is pressure-tight.

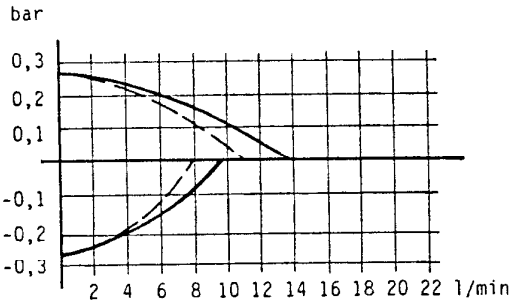
DUPLEX pumps are used mainly with open external systems, e.g. open baths. They differ from SIMPLEX pumps by having a pressure and a suction stage as well as a float for level control. The DUPLEX pump automatically maintains a contant level in the thermostat independently of the level in the external bath. The open bath is filled with liquid until a level is reached in the thermostat at which the pressure and suction stages have identical output. If the level difference between open external bath and thermostat bath exceeds 0.5 m there is a possibility that the control range of the level control is insufficient. A tubing clip is then used to restrict one of the tubes, the suction tube if the external level is higher, or the discharge tube if the external level is lower, until the thermostat reaches a constant level at which the pump float is within its control range.
DUPLEX pumps can of course also be used with closed external systems. There they offer the advantage that the liquid flows through the external system virtually without pressure (important with thin-walled glass vessels). When operating with closed systems or as a bath thermostat the bath should be filled to the highest level (to 1 cm below the cover).

All LAUDA circulating pumps are fitted with a lever to permit continuous adjustment of the flow rate (pump capacity) through the external system from zero up to the maximum. All driving motors are fitted with overload protection which is embedded in the motor winding.
The pumps operate perfectly with liquids whose viscosity does not exceed approx. 150 $mm^2/sec$.

Performance diagrams




RLS 6




RLS 6-D

_____ Olive 13 mm int. dia.
-------- Olive 11 mm int. dia.
measured according to DIN 58 966

## 8. Starting up

### 8.1 Filling

The unit is filled with a suitable bath liquid depending on the operating temperature as discussed in Section 5. For charging volume refer to Section 2 (Data Table). Charge the bath preferably up to the maximum level indication, i.e. approx. 1 cm below the plastic cover plate.

Note: When cooling down the bath level decreases!

8.2 Connect the unit only to a grounded socket. Check the details on the rating label against the supply voltage.

8.3 Ensure that the pump conntectors are linked together when there is no external system! (Metal tubing link LZM 045)

8.4 Switch on the mains switch. The green lamp inside the mains switch lights up. The refrigerator starts up and switches off again automatically after about 10 min if it is not required. The second stage of the cooling aggregate switches on after 10 sec to 5 min depending on the precooling of the heat exchanger. The refrigerator switches on and off completely automatically so that temperature programs can be operated over a wide range without any manual action. In addition, temperature control is performed by heating or by cooling (proportional cooling) only, depending on whether heat has to be added or removed.

The digital display indicates the actual bath temperature. Set the over-temperature switch-off point [key] a little higher than the desired operating temperature. When operating below ambient temperature, the switch-off point must obviously be first set above ambient temperature until the actual operating temperature is reached. The over-temperature cut-out can then be set a little above the bath temperature, if desired, as described in Section 10 (min. approx. 0°C). To unlock the safety cut-out circuit, the unlocking key may have to be operated if the unit has been switched off through a fault.

The three slide switches on the back of the unit should normally (if no accessory unit is connected) be in the bottom position. The Xp selector (proportional range) is moved to position 1 only if bath liquids are used with low thermal capacity or excessively high viscosity and excessive fluctuations in the temperature control occur.

You can further optimize the control parameter by changing the position of the Xp-potentiometer which is located next to the Xp switch. At the factory the unit is set to a middle Xp-position which is approx. 4. The most common application does not require a different adjustment. The proportional range Xp and the integral part (Tn) of the PID-controller are both switched over by the Xp-switch.

Following value combinations are possible

| Xp switch position | Potentiometer adjustment | |
|---|---|---|
| | 1 | 5 |
| 1 | Xp = 3.5°C<br>Tn = 45 s | Xp = 21°C<br>Tn = 45 s |
| 2 | Xp = 3°C<br>Tn = 20 s | Xp = 15°C<br>Tn = 20 s |

Special demands on the transient response might require a readjustment of the Xp potentiometer.

Basically a larger proportional range results in a damping of the control circuit, i.e. the hunting reduces. Whereas a reduction of the Xp results in faster settling time and lower overswing, but can cause huntings.

Press key [key] , the selected setpoint now appears on the digital display. Select the desired temperature by rotating the knob (10-turn potentiometer). The fine adjustment (± 0.2°C) is also active and simplifies the adjustment through increased resolution. Then release the key again, the display now shows the actual bath temperature again. The digital display ends at 199.9°C; above this value only the number 1 appears.

When the temperature setting has been reached the yellow LED "heating" (f≈0.5 ... 1 Hz) or the green LED "cooling" (f≈0.2 Hz) begins to flash. The ratio of the ON-time to the cycle-time provides an indication of the energy introduced into or abstracted from the bath.
After the unit has settled down the digital thermometer indicates the previously selected setpoint.

## 8.5 Operation with programmer

A programmer Type PM 351-1 can be connected to the multifunction output 30 S so that the setpoint of the thermostat can be varied according to a preset program. This requires that the energy balance (heating, cooling, load) of the thermostat matches the requirements of the program (heating rate, cooling rate, operating temperatures).
The "PROGR" key at the back side is in position "0", i.e. the programmer connected to the unit has no influence on the setpoint. Adjust the unit setpoint to the lowest temperature of the program; this value is entered as value A when programming the programmer.Do not change the unit setpoint any more and switch the "PROGR" key to "I". Operation of the key 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.

## 8.6 Operation with external controller R 22

When using the external controller R 22 the temperature at the remote point (product or double jacket) can also be indicated on the digital display. In addition the thermostat control can be influenced from this external probe using a Pt 100 probe.
For this purpose the switch at the back is moved to "EXT". For further details see the Operating Instructions for R 22.

## 9. Cooling Circuit

9.1 The refrigeration system removes heat from the bath liquid through the evaporator mounted in the bath. The units operate with compressor cooling with 2-stage refrigeration systems in cascade.

The refrigeration circuits are charged ready for use with safety refrigerants (Frigen or Freon) and special low-temperature oils and require no maintenance. The compressors are fully-hermetically sealed units.

The second stage only starts up after suitable pre-cooling, depending on previous operation and the standstill time this can take between 10 sec and 5 min.

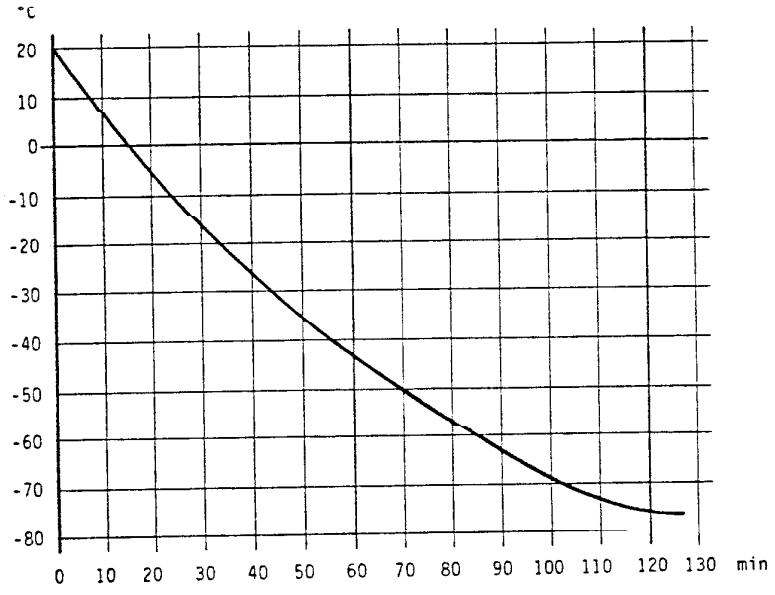
The heat of condensation and the heat losses of the motor are removed through a finned condenser cooled by a powerful fan. Fresh air is drawn in at the front of the unit and discharged at the back.

The air flow must never be restricted; the spacing between the ventilation grills and any walls must therefore be at least 0.5 m. The units should also not be operated close to sources of heat (such as heating radiators etc.). The rating specified in the technical data are based on 20°C ambient temperature. Higher temperatures result in reduced performance. Above 35°C the refrigerator is switched off automatically. The specified heat dissipation to ambient includes both the heat removed from the bath and the power supplied through the line supply.
The proportional cooling is provided by three special solenoid valves.

9.2 The refrigerator operates to a large extent without maintenance. If the unit operates under dusty conditions we recommend that the refrigeraor condenser is cleaned ever 4 to 6 months. This is done best with compressed air or nitrogen which is blown into the ventilation openings for a few minutes. If necessary unscrew the ventilation grill.

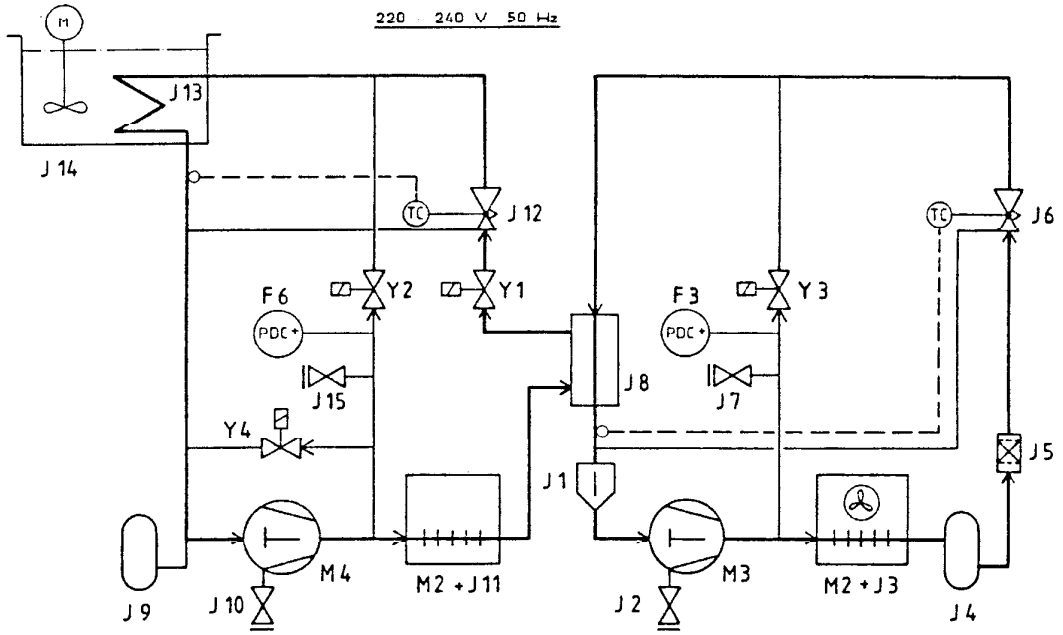
9.3 The refrigeration unit operates to a large extent without maintenance. If the unit operates under dusty conditions we recommend that the condenser is cleaned every 4 to 6 months. This is done best with compressed air or nitrogen which is blown into the ventilation openings for a few minutes. If necessary unscrew the ventilation grill.

**Cooling diagram** RLS 6 (-D)




Bath liquid: Methanol

Schema Kältekreislauf / Schéma circuit de réfrigération / Diagram refrigerating circuit




F 3 Überdruckschalter Stufe I
Disjoncteur de surpression Etage I
Overpressure switch Stage I

F 6 Überdruckschalter Stufe II
Disjoncteur de surpression Etage II
Overpressure switch Stage II

J 1 Flüssigkeitsabscheider
Séparateur de liquide
Liquid separator

J 2 Kontrollventil / Saug Stufe I
Vanne de contrôle / Aspiration Etage I
Control valve / Suction Stage I

J 3 Kondensator Stufe I
Condensateur Etage I
Condenser Stage I

J 4 Sammelflasche 0.9 l
Receveur
Receiver

J 5 Trockner
Deshydrateur
Drier

J 6 Expansionsventil Stufe I
Vanne d'expansion Etage I
Expansion valve Stage I

J 7 Kontrollventil / Druck Stufe I
Vanne de contrôle / Pression Etage I
Control valve / Pressure Stage I

J 8 Wärmetauscher
Echangeur thermique
Heat exchanger

J 9 Sammelflasche 0.9 l
Receveur
Receiver

J 10 Kontrollventil / Saug Stufe II
Vanne de contrôle / Aspiration Etage II
Control valve / Suction Stage II

J 11 Kondensator Stufe II
Condensateur Etage II
Condenser Stage II

J 12 Expansionsventil Stufe II
Vanne d'expansion Etage II
Expansion valve Stage II

J 13 Verdampfer
Echangeur
Exchanger

J 14 Flüssigkeitsbad
Bain de liquide
Liquid bath

J 15 Kontrollventil / Druckstufe II
Vanne de contrôle / Pression Etage II
Control valve / Pressure Stage II

M 2 Ventilator
Ventilateur
Fan

M 3 Kompressor Stufe I
Compresseur Etage I
Compressor Stage I

M 4 Kompressor Stufe II
Compresseur Etage II
Compressor Stage II

Y 1 Magnetventil Kühlen Stufe II
Vanne solenoide Refroidissement Etage II
Solenoid valve Cooling Stage II

Y 2 Magnetventil Heizen Stufe II
Vanne solenoide Chauffage Etage II
Solenoid valve Heating Stage II

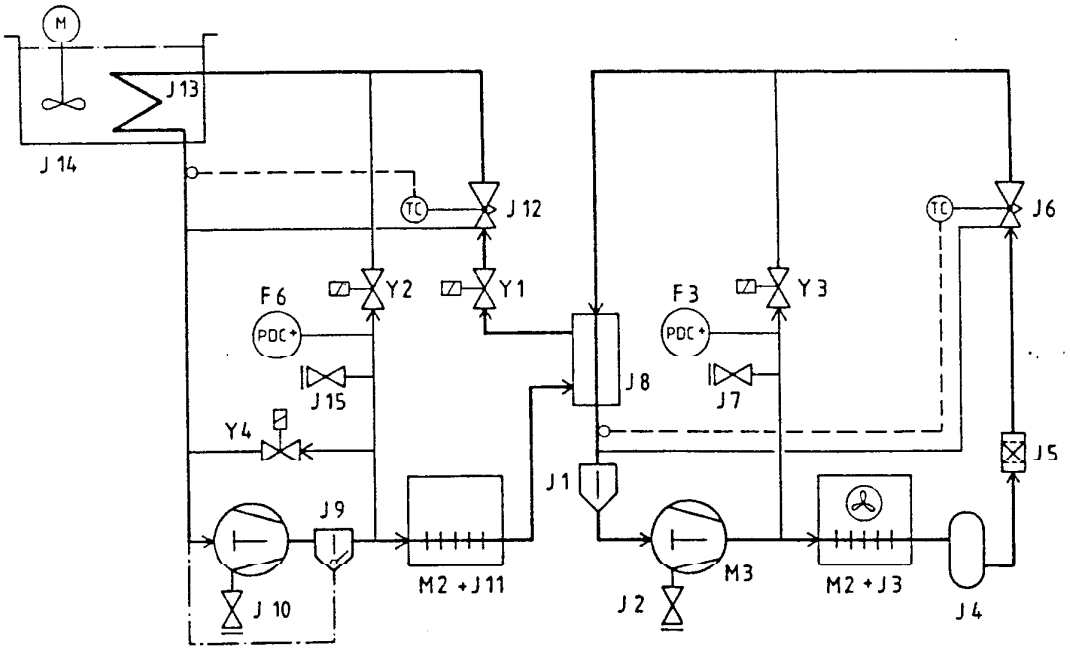
Y 3 Magnetventil Heizen Stufe I
Vanne solenoide Chauffage Etage I
Solenoid valve Heating Stage I

Y 4 Magnetventil Druckausgleich
Vanne solenoide Compensation de pression
Solenoid valve Pressure compensation

Kältemittel / Réfrigérant / Refrigerant:
Stufe / Etage / Stage I - R 502
Stufe / Etage / Stage II - R 503 + R 12

Schema Kältekreislauf / Schéma circuit de réfrigération / Diagram refrigerating circuit

230 V 60 Hz




F 3 Überdruckschalter Stufe I
Disjoncteur de surpression Etage I
Overpressure switch Stage I

F 6 Überdruckschalter Stufe II
Disjoncteur de surpression Etage II
Overpressure switch Stage II

J 1 Flüssigkeitsabscheider
Séparateur de liquide
Liquid separator

J 2 Kontrollventil / Saug Stufe I
Vanne de contrôle / Aspiration Etage I
Control valve / Suction Stage I

J 3 Kondensator Stufe I
Condensateur Etage I
Condenser Stage I

J 4 Sammelflasche 0.9 l
Receveur
Receiver

J 5 Trockner
Deshydrateur
Drier

J 6 Expansionsventil Stufe I
Vanne d'expansion Etage I
Expansion valve Stage I

J 7 Kontrollventil / Druck Stufe I
Vanne de contrôle / Pression Etage I
Control valve / Pressure Stage I

J 8 Wärmetauscher
Echangeur thermique
Heat exchanger

J 9 Ölabscheider
Séparateur d'huile
Oil separator

J 10 Kontrollventil / Saug Stufe II
Vanne de contrôle / Aspiration Etage II
Control valve / Suction Stage II

J 11 Kondensator Stufe II
Condensateur Etage II
Condenser Stage II

J 12 Expansionsventil Stufe II
Vanne d'expansion Etage II
Expansion valve Stage II

J 13 Verdampfer
Echangeur
Exchanger

J 14 Flüssigkeitsbad
Bain de liquide
Liquid bath

J 15 Kontrollventil / Druckstufe II
Vanne de contrôle / Pression Etage II
Control valve / Pressure Stage II

M 2 Ventilator
Ventilateur
Fan

M 3 Kompressor Stufe I
Compresseur Etage I
Compressor Stage I

M 4 Kompressor Stufe II
Compresseur Etage II
Compressor Stage II

Y 1 Magnetventil Kühlen Stufe II
Vanne solenoide Refroidissement Etage II
Solenoid valve Cooling Stage II

Y 2 Magnetventil Heizen Stufe II
Vanne solenoide Chauffage Etage II
Solenoid valve Heating Stage II

Y 3 Magnetventil Heizen Stufe I
Vanne solenoide Chauffage Etage I
Solenoid valve Heating Stage I

Y 4 Magnetventil Druckausgleich
Vanne solenoide Compensation de pression
Solenoid valve Pressure compensation

Kältemittel / Réfrigérant / Refrigerant:
Stufe / Etage / Stage I - R 502
Stufe / Etage / Stage II - R 503 + R 12

## 10. Safety circuit

10.1 Safety circuit to DIN 12879 Class 2.

The unit is protected against low level by a float switch set permanently to minimum level, and against overtemperature by a cut-out which can be adjusted by means of a tool between ambient temperature and the upper limit of the operating temperature range. When the safety cut-out operates the red lamp lights up continuously and an audible warning signal is produced. The pump and the heater are cut off from the supply on all poles. An alarm signal is produced at the output 30 S at the back between the contact 12 (U V) and 15 (18 V). The fault signal and the cut-off are maintained after the fault has been rectified and after the mains supply has been switched off. By operating the "Unlocking" key the unit can be brought back into operation after the fault has been cleared.

The unlocking key can also be used for optimum adjustment of the overtemperature cut-off point. Hold the key down and adjust the overtemperature cut-out while observing the fault signal lamp. This short-cuts the switch-off of pump and heating so that the control is not affected. The overtemperature limiter can now be adjusted so that it is just above the operating temperature, a condition which may be useful in certain cases to protect the material which has to be thermostated.

The low-level cut-out and the overtemperature cut-out should be checked from time to time for correct operation. The low-level cut-out can be tested simply by switching the unit on briefly before charging it while the user is present; the overtemperature cut-out must of course be set well above ambient temperature and it is essential to ensure that there is no explosive mixture in the bath which could ignite at the heater in case the low-level cut-out switch does not operate correctly and the heating is switched on. The unit must immediately go to "Fault" (audible signal, red lamp on). The overtemperature cut-out can be checked at any time by setting the cut-out temperature below the actual bath temperature. After the "fault" has been corrected the instrument must be switched on and the "Unlocking" key has to be operated.

10.2 On-line warning circuit >5°C

The "Fault" lamp also produces a flashing signal when the bath temperature is more than 5°C above the set temperature. This signal does **not** switch off the unit, its purpose is simply a warning. When this safety circuit operates the output 30 S has an 18 V signal on contact 5.

## 11. Multi-function output

15-pin connector 30 S at the back with multiple function.

Contact 1: Recorder connection for bath temperature, correct sign; 10 mV/°C; Ri = 100 Ohm; recorder input resistance ≧ 1 MOhm (0 V contact 3)

Contact 2: Used in conjunction with external controller R 22.

Contact 3: 0 V reference potential for measuring signals

Contact 4: Programmer or external setpoint input 10 mV/°C, added to setpoint selected internally. Sum is indicated as the setpoint, Ri = 24.6 kOhm (0 V contact 3).

Contact 5: 18 V, if fault light flashes, i.e. operating temperature is more than 5°C above setpoint. Ri 1 kOhm (0 V contact 12).

Contact 6: Setpoint output 10 mV/°C, Ri ≈ 100 Ohm. Load resistance ≧ 10 kOhm (0 V contact 3).

Contact 7: + 12 supply, max. additional load 50 mA (0 V contact 12).

Contact 8: 9 V reference voltage for external setpoint, Ri ≈ 1 kOhm, max. load 1 mA (0 V contact 3).

Contact 9: Controller output, for accessory units only (0 V contact 12)

Contact 10: -12 V supply voltage, max additional load 30 mA (0 V contact 12)

Contact 11: Spare

Contact 12: 0 V load reference potential

Contact 13: 18 V, if fault lamp shows red continuously, i.e. safety circuit to DIN 12879 is activated. Max. load 20 mA (0 V contact 12).

Contact 14: Spare

Contact 15: Used in conjunction with external controller R 22.

In case of a fault the signals at this connector can readily be used for an initial fault diagnosis.

| | |
|---|---|
| 15-pole mating connector | Ref.No. EQM 030 |
| Case for above | Ref.No. EQG 017 |

## 12. Maintenance

LAUDA thermostats are designed for continuous operation. They require no regular maintenance. Contaminated bath liquid should be discharged through the drain cock and replaced by fresh liquid. If the instrument should become defective through a fault in the control unit or the pump it is recommended that this part should be removed by a qualified person and returned to the factory.

The following procedure should be used:

Important Note:

Before opening up the unit pull out the line supply plug.

Remove the cover after taking off the 4 screws at the side. The control unit together with the pump can now be separated from the bath balance after releasing the according screws and electrical connections.

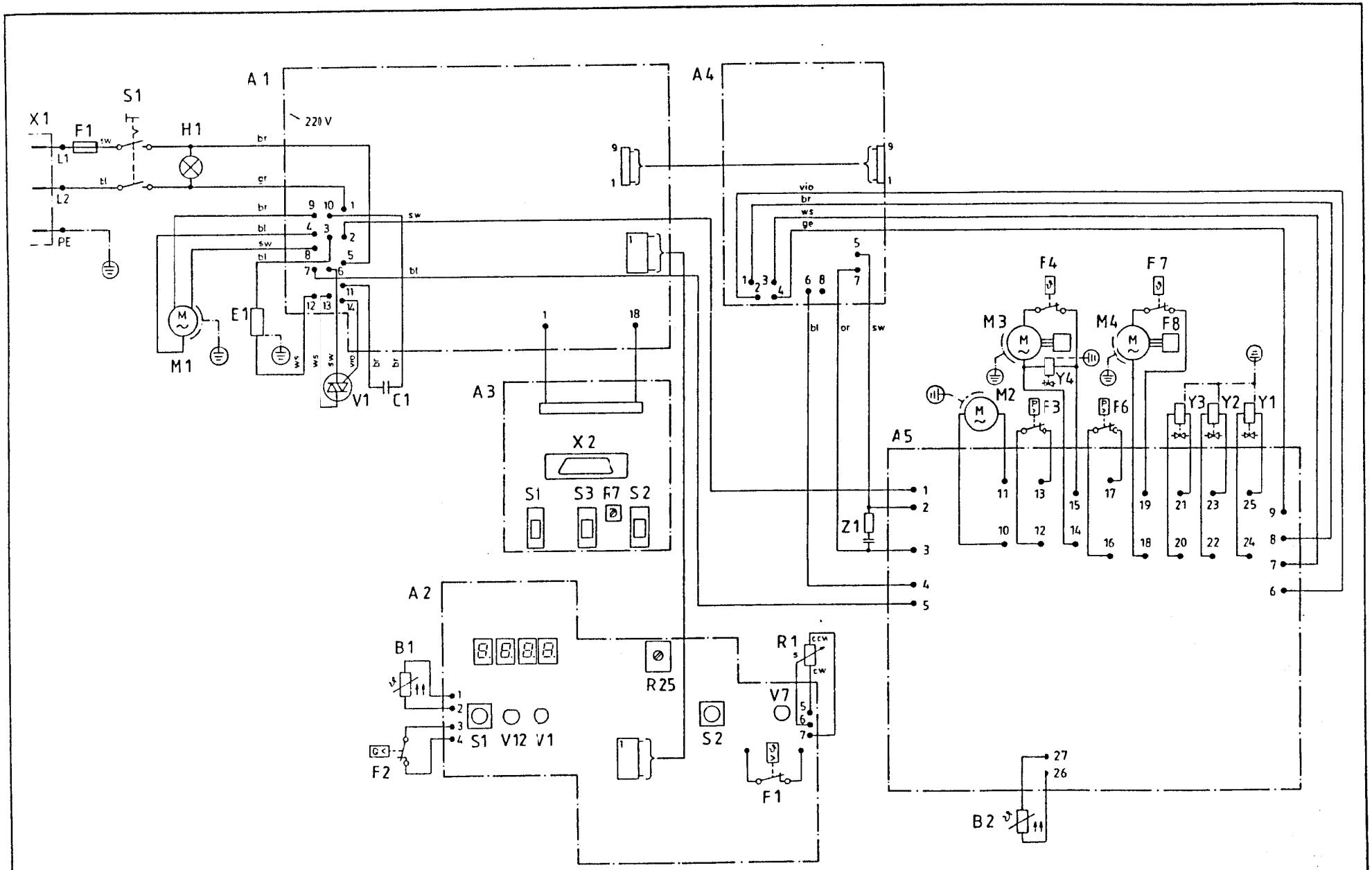
We shall always be happy to deal with queries, suggestions and complaints.

LAUDA DR. R. WOBSER
GMBH & CO. KG

LAUDA Compact Low-Temperature Thermostats
RLS 6, RLS 6-D

## Accessories for LAUDA Compact Low-Temperature Thermostats Series RLS

| Type | Ref.No. |
|---|---|
| External Controller R 22 | LRT 910 |
| To indicate the temperature at an external point (consumer) and to control the temperature according to this point. Probe for the above Pt 100 to DIN 43760 | |
| Programmer PM 351-1 | LRP 012 |
| Microprocessor controlled programmer with up to 50 program segments and a program range of 350°C for unrestricted individual programming of temperature courses. | |
| LAUDA digital thermometer | |
| For a temperature range of -200 ... 800°C with 0.1 or 0.01°C resolution. Pt 100 as measure probe. | |
| Stainless steel insert racks | |
| For test tubes, centrifuge tubes etc. on request | |
| Socle with castors | LCZ 036 |
| Height adjustable for RM 20, RC, RK and RL units. Cover plate of the unit can be adjusted to required table height. | |




| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Datum | 26.2.86 | | LAUDA Dr. R. Wobser GmbH & Co. KG | Schaltplan<br>Schéna de connexions<br>Circuit diagran | RLS 6, RLS 6 -D |
| | | | | Bearb. | | | | | |
| | | | | Gepr. | 27.2.86 | | | | 220-240 V 50 Hz<br>230 V 60 Hz |
| Zustand | Anderung | Datum | Name | Norm. | | Urspr. | Ers. f. | Ers. d. | ab/ à partir/ from<br>Serie H 01 |

Blatt

Geräteliste Schaltplan
Liste de piéces Schéma de connexions
List of parts Circuit diagram
RLS 6, RLS 6-D

A 1 Leiterplatte Netz UL 288
Carte électronique Secteur
Printed circuit Mains

A 2 Leiterplatte LED-Anzeige UL 287
Carte électronique Affichage LED
Printed circuit LED-Indication

A 2 - F 1 Temperaturbegrenzer 0...100°C
Limiteur de température
Temperature limiter

A 2 - R 25 Sollwert Feineinstellung 100 kOhm
Réglage fin de la valeur de consigne
Setpoint fine adjustment

A 2 - S 1 Taster: Istwert/Sollwert
Touche: Valeur réelle/Valeur de consigne
Key: Actual value/Setpoint

A 2 - S 2 Taster: Entsperren
Touche: Déblocage
Push button: Reset

A 2 - V 1 LED-Anzeige Heizimpuls
Affichage LED Impulsion chauffage
LED-Indication Heating impulse

A 2 - V 7 LED-Anzeige Störung
Affichage LED Perturbation
LED-Indication Disturbance

A 2 - V 12 LED-Anzeige Kühlen
Affichage LED Refroidissement
LED-Indication Cooling

A 3 Leiterplatte Ausgang 30 S UL 198
Carte électronique Sortie 30 S
Printed circuit Output 30 S

A 3 - R 7 Xp-Abgleich 20 k Ohm
Xp-Ajustage
Xp-Adjustment

A 3 - S 1 Wahlschalter: Regelung extern/intern
Commutateur de sélection: Réglage ext/int
Selector: Control extern/intern

A 3 - S 2 Wahlschalter: Xp 1/2
Commutateur de sélection: Xp 1/2
Selector: Xp 1/2

A 3 - S 3 Wahlschalter: Programmbetrieb Ein/Aus
Commutateur de sélection: Programmation M/A
Selector: Program operating On/Off

A 3 - X 2 Ausgang 30 S
Sortie 30 S
Output 30 S

A 4 Leiterplatte Kälte UL 182
Carte électronique Refroidissement
Printed circuit Cooling

A 5 Leiterplatte Kompressorsteuerung UL 276
Carte électronique Commande compresseur
Printed circuit Control compressor

B 1 Temperaturfühler Pt 500
Sonde de température
Temperature probe

B 2 Temperaturfühler KTY 81
Sonde de température
Temperature probe

C 1 Kondensator 1.5 µF
Condensateur
Condenser

E 1 Heizung 1.2 kW
Chauffage
Heater

F 1 Sicherung T 12,5 A
Fusible
Fuse

F 2 Niveauschutz
Protection de niveau
Level protection

F 3 Überdruckschalter Stufe I
Disjoncteur de surpression Etage I
Overpressure switch Stage I

F 4 Klixon Stufe I
Klixon Etage I
KLixon Stage I

F 5 Anlaufvorrichtung Stufe I
Dispositif de démarrage Etage I
Starting device Stage I

F 6 Überdruckschalter Stufe II
Disjoncteur de surpression Etage II
Overpressure switch Stage II

F 7 Klixon Stufe II
Klixon Etage II
Klixon Stage II

F 8 Anlaufvorrichtung Stufe II
Dispositif de démarrage Etage II
Starting device Stage II

H 1 Lampe Netz
Lampe Secteur
Lamp Mains

M 1 Pumpenmotor
Moteur de pompe
Pump motor

M 2 Ventilator
Ventilateur
Fan

M 3 Kompressor Stufe I
Compresseur Etage I
Compressor Stage I

M 4 Kompressor Stufe II
Compresseur Etage II
Compressor Stage II

R 1 Sollwerteinstellung 1 kOhm
Ajustage de la valeur de consigne
Setpoint adjustment

S 1 Netzschalter
Interrupteur général
Mains switch

V 1 Triac 15 A 700 V

X 1 Netzanschluß
Branchement Secteur
Mains connection

Y 1 Magnetventil Kühlen Stufe II
Vanne solenoide Refroidissement Etage II
Solenoid valve Cooling Stage II

Y 2 Magnetventil Heizen Stufe II
Vanne solenoide Chauffage Etage II
Solenoid valve Heating Stage II

Y 3 Magnetventil Heizen Stufe I
Vanne solenoide Chauffage Etage I
Solenoid valve Heating Stage I

Y 4 Magnetventil Druckausgleich
Vanne solenoide Compensation de pression
Solenoid valve Pressure compensation

Z 1 Entstörglied 0.1 µF+47 Ohm
Condensateur antiparisite
Anti-interference capacitor