

## Operating Instructions

LAUDA Circulating Cooling Units

UKS 3000 H, UKS 3000 WH  
UKS 6000 H, UKS 6000 WH

From Series P30  
04/93 E  
YAWE0017

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
Appendix



Accessories

Circuit and pipe diagram

## 1. Brief operating instructions

Even if you find these short instructions sufficient please read the following sections, especially Section 4: "Safety features and notes".

- 1.1 Check circulating cooling unit and accessories during unpacking for any transport damage and if necessary inform the carrier.
- 1.2 Assemble the unit according to Section 6 and add extra items as appropriate.
- 1.3 Water-cooled units (marked "W" in the type designation) must be connected to the mains water supply with the hoses supplied. See Section 6.  
With air-cooled units the spacing of the grills from any object which might obstruct the free air flow must be at least 0.5 m.
- 1.4 Pump nozzles opened, fill the bath up to the upper marking of the level indicator. For this the flap in the cover is opened, filler lid underneath. Check that the drain cock behind the right side panel is closed (spanner 12 a/f).
- 1.5 Fitting the tubing to the pump connections:  
  
Make tubing connections to the external system. Secure tubing connections with clips against slipping off.  
Only use tubing suitable for the heating liquid and for at least 6 bar operating pressure.
- 1.6 Check the supply voltage against the details on the label. Insert the mains plug.
- 1.7 When using water-cooled units turn on the water tap.  
Set the overtemperature cut-out potentiometer  with a screwdriver slightly above the required operating temperature, but at least above ambient temperature.
- 1.8 Check that the tubing connections have been made in accordance with Section 1.4! Switch on the main switch (I). The temperature indication on the controller shows the actual bath temperature.
- 1.9 Press key  for pressure indication. a positive pressure must be indicated when the pump is running. If a negative pressure is indicated, immediately switch off the unit with the main switch (see Section 8.3).
- 1.10 If the red fault lamp  is on permanently press the unlocking key. See also chapter 4.
- 1.11 The selected operating temperature is indicated by pressing the key  .  
Selection is made with potentiometer  after the lock has been released.

1.12 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.

1.13 Safety features

The thermostat conforms to Class 2 according to DIN 12879. 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.

Attention

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

2. Data table

	UKS 3000 H	UKS 3000 WH	UKS 6000 H	UKS 6000 WH
Operating temperature range (°C)	-25 to 80			
Condenser cooling	air (controlled fan speed)/ water (controlled flow rate)			
Ambient temperature range (°C)	0 to 40			
Temperature measurement (outflow)/ resolution/accuracy	Pt 500, green digital 7-segment-LED-display / 0.1°C / Class A to DIN IEC 751 ± 0.2°C over operating temperature range			
Temperature setting/ resolution	10-turn potentiometer with digital indication / 0.1°C; can be locked manually			
Temperature control (±°C)	better than 0.1			
Control	LAUDA proportional cooling with PID action, automatic compressor control external controller			
Cooling capacity (effective with ethanol at 20°C ambient temperature)	(kW)			
at 20°C	3.4	4.2	6.5	8.0
0°C	2.5	2.6	3.2	4.0
-25°C	0.5	0.5	0.6	0.7
Heating capacity (kW)	2		6	
Safety features	level protection, adjustable overtemperature- protection acc. to DIN 12879, Class 2, protection against pump running dry, level indication; Adjustable alarm contact against overtemperature and low temperature with LED indication and neutral contact (24 V; 0.2 A)			
Flow rate at pressure head 0 (l/min)	42			
Max. discharge pressure (bar)	6			

LAUDA Circulating Cooling Units  
 UKS 3000 H, UKS 3000 WH, UKS 6000 H, UKS 6000 WH

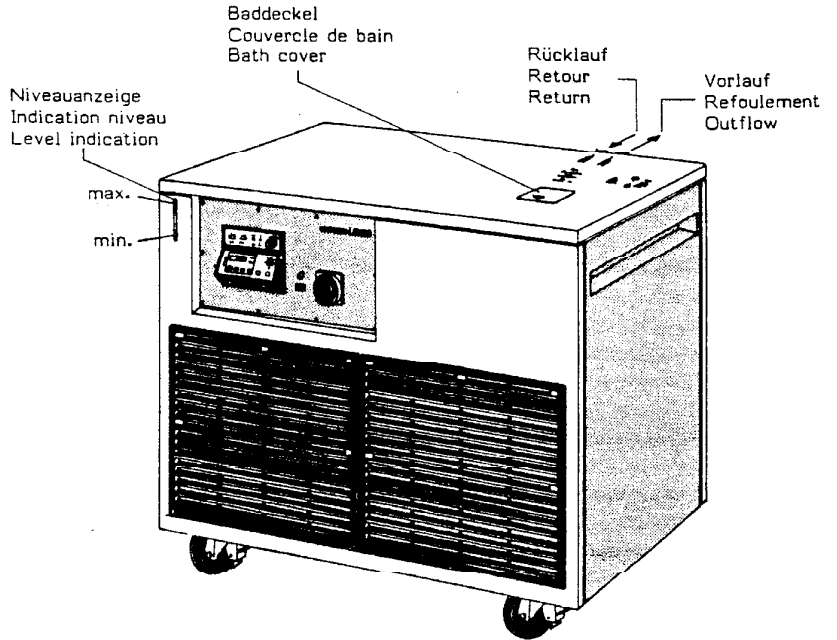
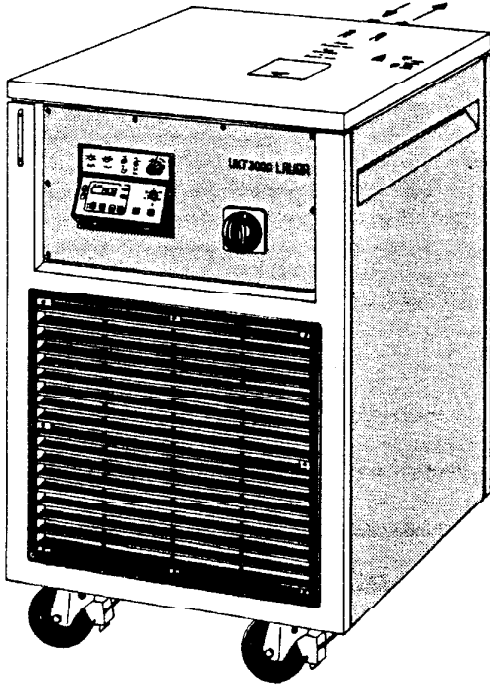
**UKS 3000 H   UKS 3000 WH   UKS 6000 H   UKS 6000 WH**

Pump connections	G 3/4   15 mm int. dia.			
Pressure indication range/resolution	(bar)	digital	0...7/0.1	
Capacity	(l)	28...43	60...90	
Floor area (WxD)x height	(mm)	550 x 735 x 900	1000 x 735 x 900	
Weight	(kg)	150	240	
Protection to DIN 40050		IP 54		
Power supply	(V;Hz)	220/380 V;3/N/PE 50 Hz		
Total power consumption	(kW)	4.5/4.4	10.2/10.0	
Interference suppression	suppressed to VDE 0875			
<b>Ref.No</b>	<b>LWG 222</b>	<b>LWG 223</b>	<b>LWG 228</b>	<b>LWG 229</b>
Standard: Options	MF, RT, ER, DR FB		MF, RT, ER, UP, DR FB	

Details of extra functions:

- RT = Return flow temperature measurement, Pt 500 mounted inside the unit.
- ER = External Controller for controlling from measuring point in external systems with Pt 100. Master controller PI, slave controller PD.
- MF = Multifunction output on terminals.
- FB = Remote operation. Control unit including supply ON/OFF in separate housing remote from unit.
- UP = Additional pump for internal tank circulation. Required to ensure good temperature control and performance in external systems with high back-pressure. Pump for external circulation can be switched off by push-button.
- DR = Digital pressure indication

LAUDA Circulating Cooling Units  
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Reglerumschaltung int/ext  
 Commutation du régulateur int/ext  
 Controller commutation int/ext

Reglerzeitkonstante Tn  
 Constante de temps du régulateur Tn  
 Controller time constant

Reglerverstärkung kp  
 Amplification kp  
 Amplification kp

Korrekturgrößenbegrenzung  
 Sélecteur de correction d'écarts  
 Correction limitation

Digitalanzeige  
 Affichage digital  
 Digital display

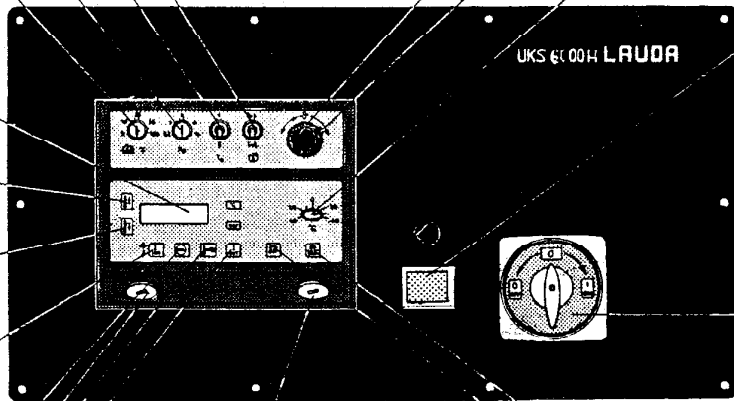
Anzeige "Heizen"  
 Affichage "Chauffage"  
 Display "Heating"

Anzeige "Kühlen"  
 Affichage "Refroidissement"  
 Display "Cooling"

Vorlauftemperatur/Sollwert  
 Température de refoulement/  
 Valeur de consigne  
 Outflow temperature/  
 Setpoint

Druckanzeige  
 Affichage digital de la pression  
 Pressure indication

Blindstopfen für Multi-  
 funktionsausgang  
 Bouchon pour connecteur  
 d'entrées-sorties  
 Plug for multi-function  
 outlet



Blindstopfen für EIN/AUS-Fernbedienung  
 Bouchon pour commande à distance  
 MARCHE/ARRET  
 Plug for remote control ON/OFF

Anzeige der Temperatur vom ext. Pt 100  
 Indication de la température du Pt 100 ext.  
 Temperature indication by Pt 100 ext.

Rücklauftemperaturanzeige  
 Affichage de la température de retour  
 Temperature indication of Return

SollwertEinstellung  
 Ajustage de la valeur de consigne  
 Setpoint adjustment

Arretierung  
 Arrêtage  
 Locking device

Übertemperatureinstellung  
 Ajustage de la surtempérature  
 Overtemperature adjustment

Schalter Umwälzpumpe  
 Commutateur Pompe  
 de circulation  
 Switch circulating pump

(nur bei UKS 6000 H,  
 UKS 6000 WH)  
 (seulement à UKS 6000H,  
 UKS 6000 WH)  
 (at UKS 6000H,  
 UKS 6000 WH only)

Hauptschalter  
 Interrupteur général  
 Main switch

Signalleuchte "Störung"  
 Lampe témoin "Perturbation"  
 Pilot lamp "Fault"

Meldekontaktsignalleuchte  
 Lampe témoin de l'interrupteur d'alarme  
 Alarm contact pilot lamp

### 3. General construction and technical description

#### 3.1 Type selection

The circulating cooling units Class UKS are compact floor-standing cooling units. The letter H in the type designation indicates, that the unit is equipped with a controlled heating, reaching an operating temperature of +80°C. The models UKS 3000 H and UKS 6000 H operate on 3-phase supply and differ in their cooling rates, heating rates and size. They are available as air-cooled or water-cooled units (W after the type designation).

#### 3.2 Construction

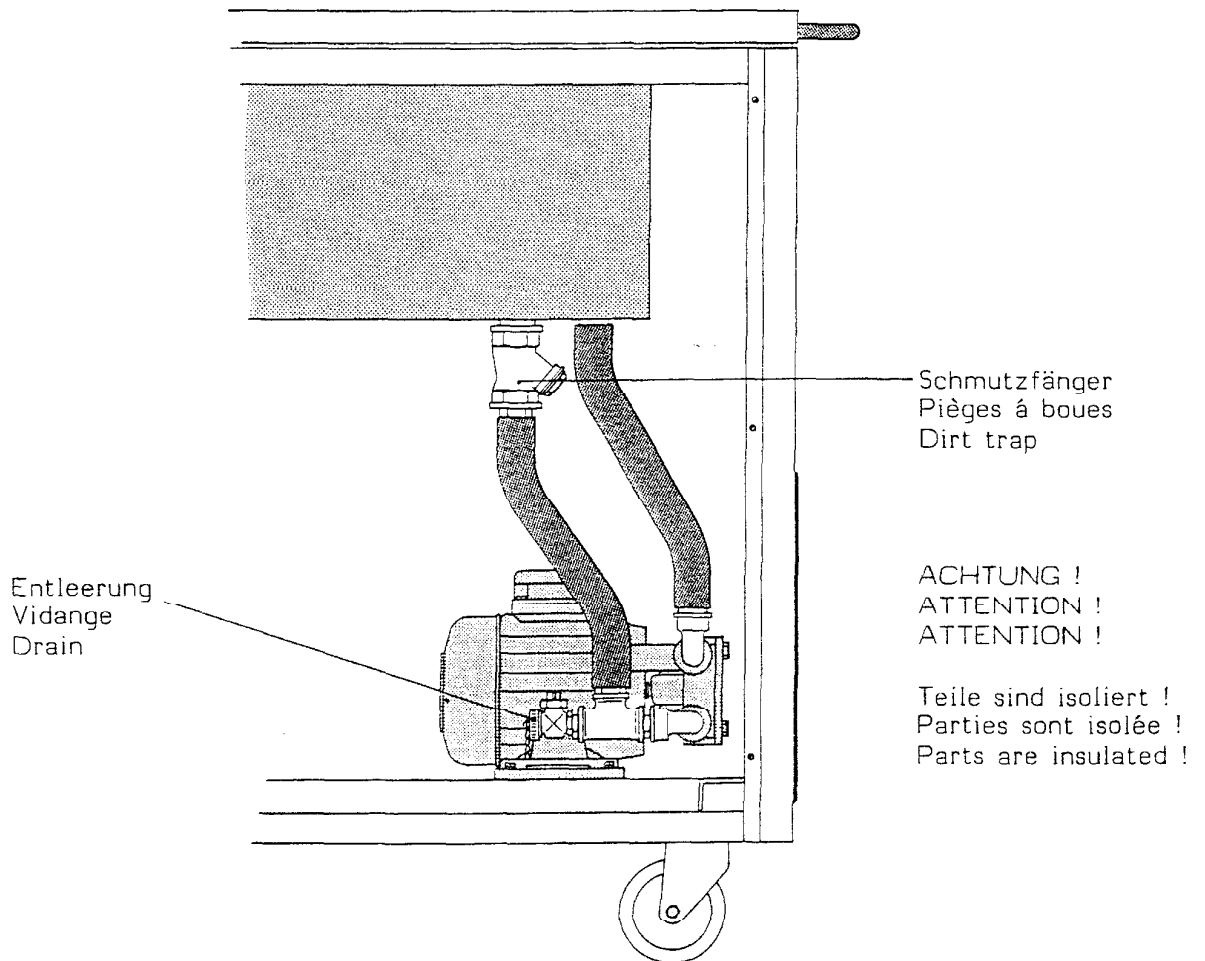
The refrigeration system and the pump are mounted inside the lower part of the unit. The liquid tank is mounted on top.

A frame of steel sections forms the support which is covered by 4 panels. The unit is mounted on 4 castors, with the two front ones lockable. The front and back panels are fitted with large ventilation grills which provide heat dissipation, especially on the air-cooled units. The sides have recesses which allow the units to be placed side-by-side. The electronics for the indication of temperature and pump output with the controller and the compressor control electronics are located in a control box behind the front panel. The indications and controls are arranged mainly on this front panel.

#### 3.3 Thermostatic bath

The bath tank of high-grade stainless steel is insulated with polyurethane foam in accordance with the operating temperature range. The heat exchanger for the refrigeration and one or three tubular heating elements for the heating are incorporated in a part of the bath. All parts in contact with the bath liquid are high-grade stainless steel, copper or plastic (PVC) which can withstand the operating temperature range, or fibre-reinforced rubber. The bath drain cock is accessible behind the right side panel.

A dirt trap is fitted at the tank outlet (towards the pump suction) whose screen can be removed for cleaning.



### 3.4 Circulating pump

The units are fitted with a free-standing side channel pump with sliding ring seal. This pumps the bath liquid through the outflow connection on the back of the unit through the pressure-tight external system. The return flow connection leads back into the bath.

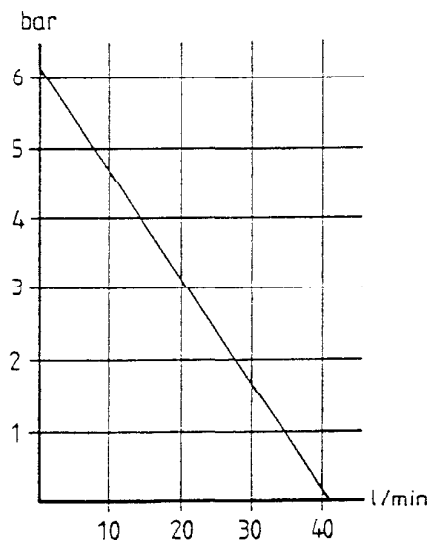
Caution:

With a restricted or closed circuit it is possible for pressures up to 7 bar to build up (glass!).

### 3.4.1 Circulating pump UP

The units type UKS 6000 H and UKS 6000 WH are equipped with an additional circulating pump for internal tank circulation. It ensures good temperature control and performance by improved heat transfer at the evaporator in case of very reduced external circulation. Pump for external circulation can be switched off by push-button at the control unit.

#### Performance diagram



### 3.5 Refrigeration system

3.5.1 The refrigeration system removes heat from the bath liquid through the evaporator mounted in the bath. The units operate with compressor cooling.

The refrigeration circuits are charged ready for use with partly halogenated safety refrigerant R 22 and special low-temperature oil and require no maintenance. The compressors are hermetically sealed units.


3.5.2 The heat of condensation and the heat losses of the motor are removed through a finned condenser cooled by a powerful fan. The fan speed is electronically controlled in accordance with the loading of the cooling circuit. 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 ratings specified in the technical data are based on 20°C ambient temperature. Higher temperatures result in reduced performance. Above 40°C the refrigerator can switch off automatically because of overload. The heat dissipated to the air includes both the heat removed from the bath and the power supplied through the mains supply.

### 3.5.3 Water-cooled version

The heat of condensation and the heat losses of the motor are removed through a water-cooled countercurrent heat exchanger. The connections for inlet (from water tap) and outlet (drain) are located on the back of the unit below the back panel. Inlet on the left and outlet to the drain on the right, viewed from the rear of the unit. The cooling water rate is matched to the requirement through the condensation pressure. It ranges between 50 and 350 l/h (UKS 6000 50....600 l/h). The water temperature should not exceed 25°C.

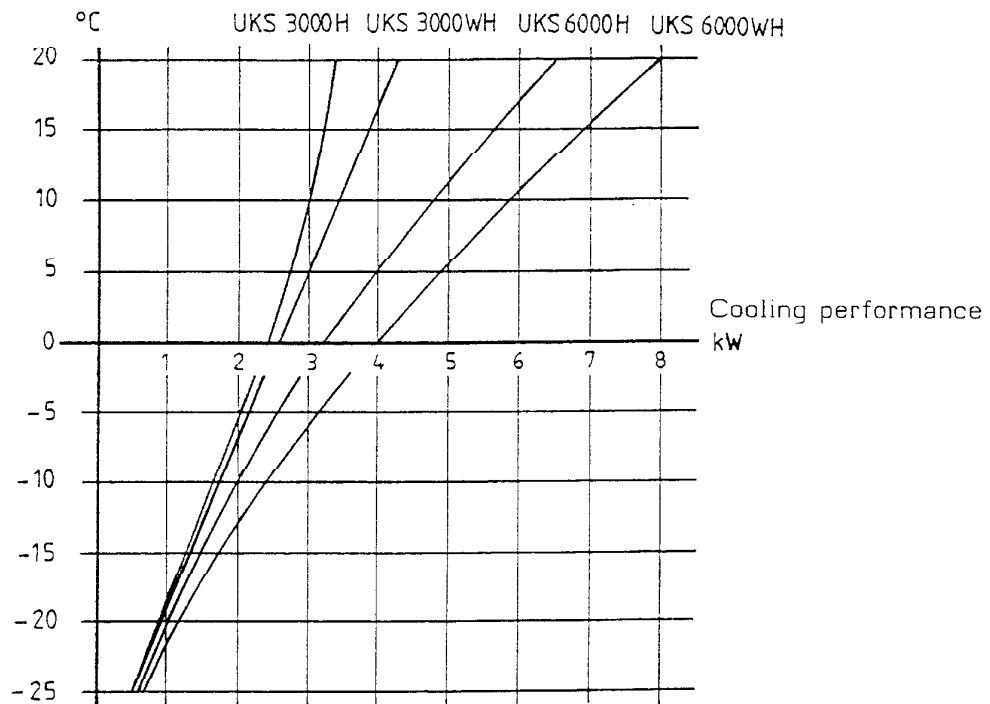
### 3.5.4 Safety devices of the refrigeration system

- 3.5.4.1 The compressor is fitted with three temperature cut-outs which cut-out if the temperature of the windings increases.
- 3.5.4.2 The cooling circuit is protected against excessive condensation pressures by a pressure switch. When activated a red fault LED on the control panel lights up. When the pressure has decreased the unlocking key must be pressed in order to restart the unit. In most cases this fault condition arises through insufficient condenser cooling, i.e. insufficient or missing cooling water supply or dirty finned condenser on air-cooled units.

When the solenoid valves are on position "cooling" the green lamp  on the control panel lights up.

Cooling performance diagrams

Outflow  
performance

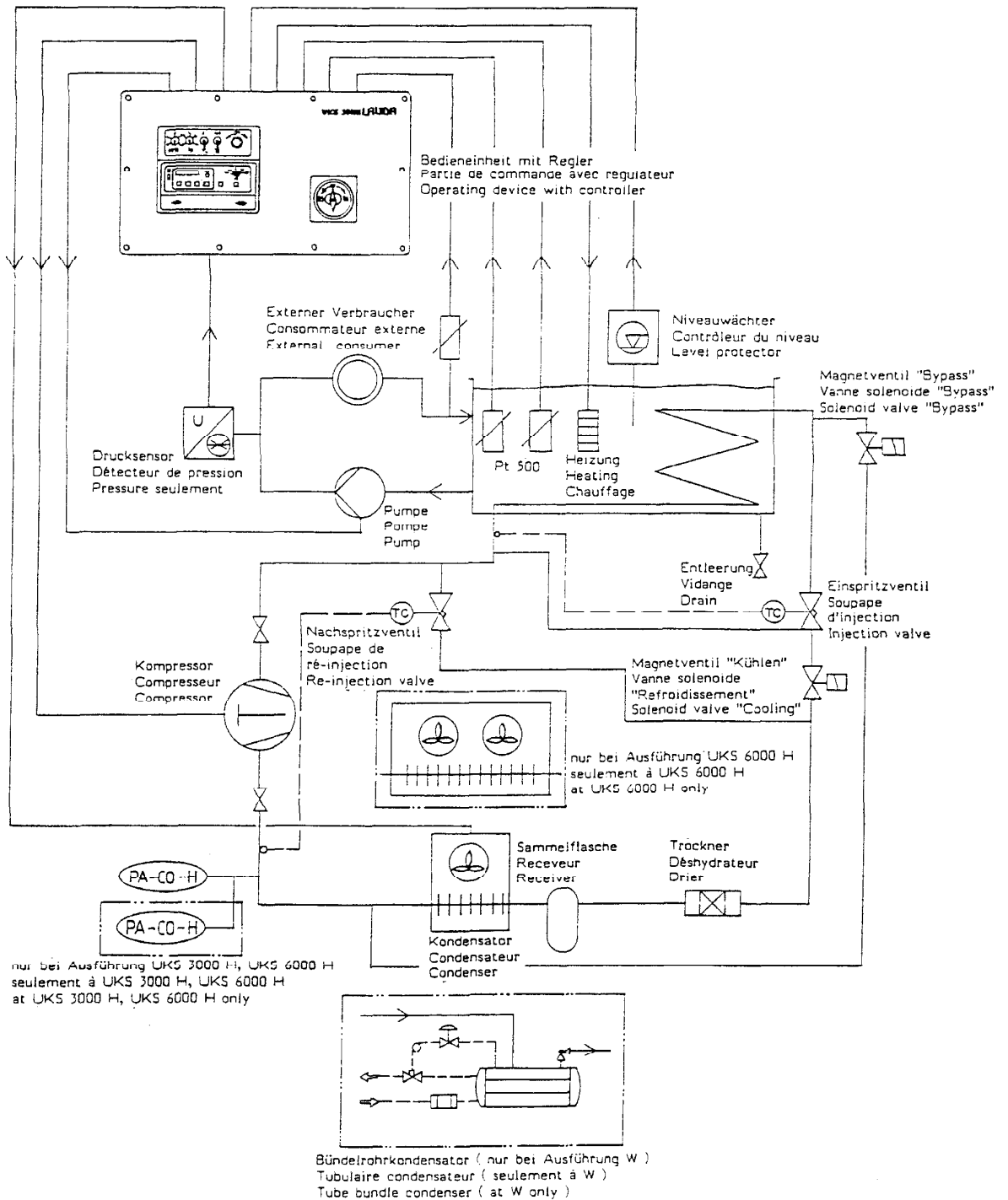


Important: Empty the condenser on water-cooled units if there is danger of frost (e.g. transport in winter)! Heat the bath liquid to approx. 20°C. Remove water hose from the mains supply. Set the setpoint for example to -20°C and blow compressed air into the water inlet hose (on the left seen from the back) as soon as the compressor starts up.

Arrange the outflow hose as flat as possible so that the unit can be emptied completely. Switch off the unit again immediately.

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Cooling and temperature control circuit diagram



### 3.6 Heating

UKS 3000 (W)H units are equipped with a tubular 2 kW heater, UKS 6000 (W)H units with three 2 kW tubular heaters. The corresponding three-phase actuator is located in a housing behind the front panel.

### 3.7 Control

- 3.7.1 The units operate with a Pt 500 conforming to 5 times DIN IEC 751 to sense the bath temperature. The bath temperature is indicated digitally with a resolution of 0.1°C. The setpoint is selected on a precision 10-turn-potentiometer with locking device. At the same time the key  must be pressed to indicate the setpoint. The value from the programmer input (setpoint, see description of multifunction output) is added to the selected setpoint. The sum can be displayed by operating the key .

The comparison between setpoint and actual value is followed by a continuous PID controller whose output ranges from 100% cooling through 0% cooling or from 0% heating to 100% heating. This ensures under all operating conditions that the amount of energy removed or introduced is only sufficient to maintain the selected temperature. This form of operation is referred to as proportional cooling.

The heater is operated through a burst-firing triac with zero-switching action. The cycling time is approx. 1.5 sec.

Cooling is controlled through pulse duration modulation with a cycle time of approx. 5 sec, using special low-noise solenoid valves. Additionally the refrigeration unit is automatically switched off immediately if the setpoint is more than 5°C above the actual temperature or if no cooling pulses have been demanded by the controller for more than 10 min.

A standstill monitor ensures that the minimum standstill time of the unit is 40 sec.

### 3.7.2 External control operation

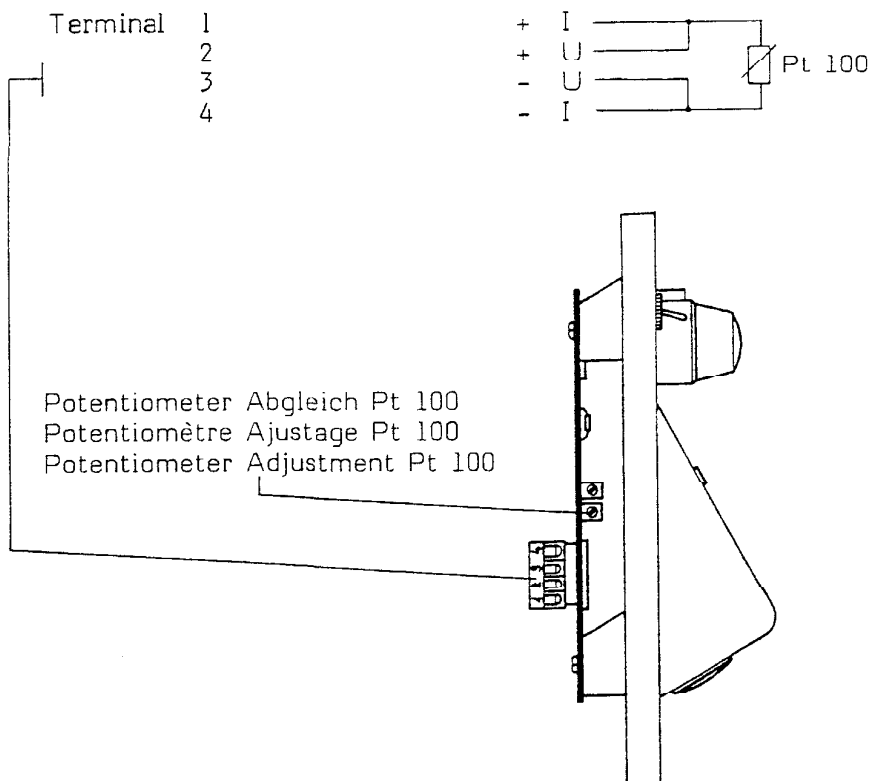
Additionally operation with the installed external controller is possible. This offers the possibility to record and indicate the temperature at external measuring points, e.g. in a reactor. A Pt 100 resistance thermometer to DIN IEC 751 in four-wire circuit serves as measuring probe, which can be connected inside the control housing. A cascade control is given when the external control is switched on. The cascade control compares the real value at the external measuring point. This makes operating easier and provides better control results.

The external controller functions as PID controller with PD-PID-structure commutation and adjustable limitation of correction value.


Technical Data Master controller

Control behaviour	PID
Tn	(s) 40/220
Tv	(s) 20
Amplification	0.2...4 times
Limitation of correction value	(°C) <u>±</u> 5 ... 100

Terminal accumulation for external measuring point, Pt 100 according to DIN IEC 751. X 14 on printed circuit board A 4 behind front panel of control unit (see 8.8).



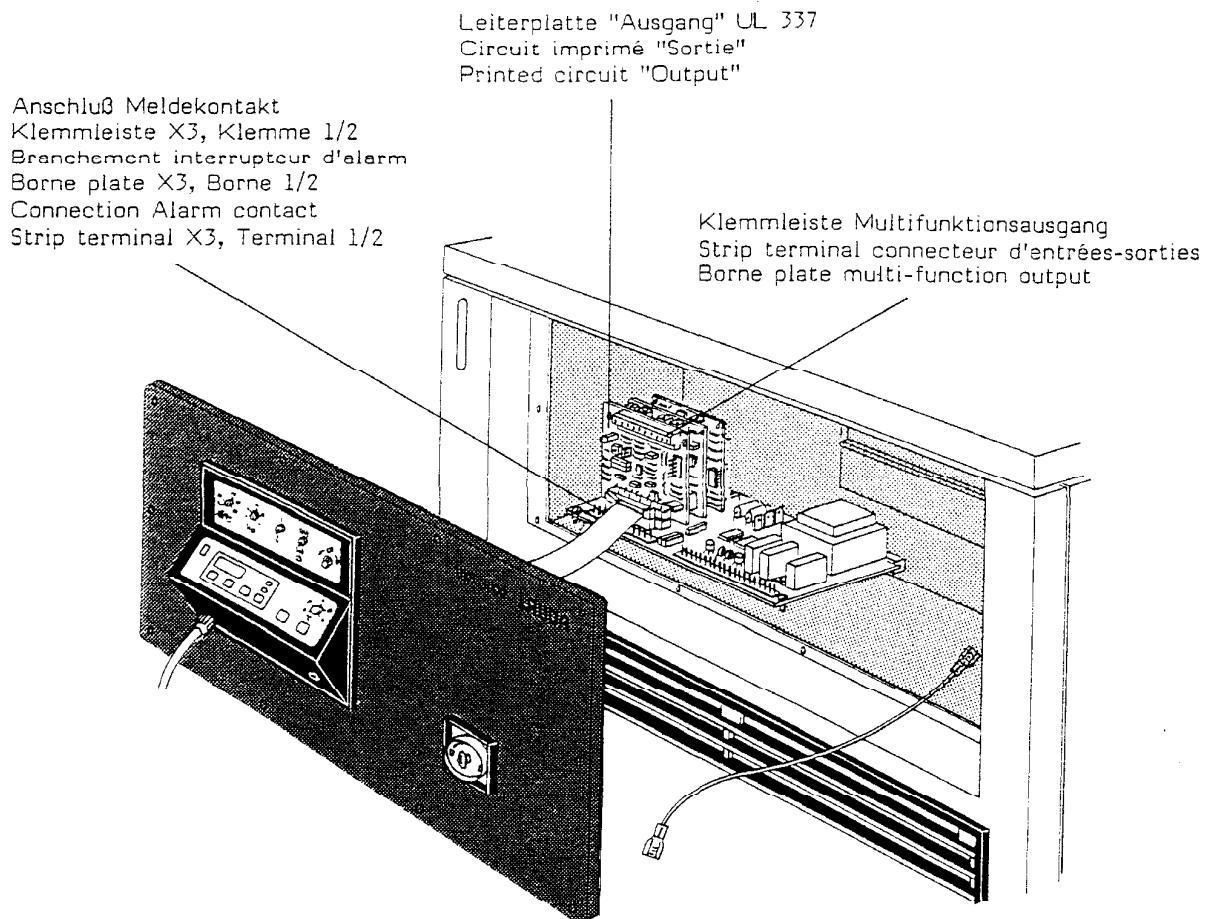
3.8 Pressure measurement







A pressure sensor is connected to the pump outlet which senses the pressure built up in the remaining thermostating circuit. It is indicated in bar by operating the key . The pressure measurement provides information on the liquid flow rate (see pump characteristic 3.4) and shows changes in the external thermostating circuit.

### 3.9 Multifunction output


As the unit described is designed to Protection IP 54 the multifunction output is arranged on terminals in the control box. The external connections must be made through appropriate cable glands.

Important: Connections in the control unit must only be made with the mains plug removed and only by a qualified electrician.



- Terminal 1: Control deviation 100 mV/°C approx. for service purposes only (0 V terminal 5)
- Terminal 2: Temperature of the external measuring point (for external controller), Pt 100 recorder output, correct sign, 10 mV/°C,  $R_i = 100 \text{ Ohm}$ . Internal recorder resistance  $\geq 1 \text{ MOhm}$  (0 V terminal 5)
- Terminal 3: Setpoint output 10 mV/°C,  $R_i \approx 100 \text{ Ohm}$  approx.; load resistance  $\geq 10 \text{ kOhm}$  min. (0 V terminal 5)
- Terminal 4: -12 V supply, max. additional load 20 mA (0 V terminal 7)
- Terminal 5: 0 V reference potential for measurement signals
- Terminal 6: +12 V supply, max. additional load 20 mA (0 V terminal 7)
- Terminal 7: 0 V load reference potential
- Terminal 8: Reference output 10 V + 0.1 V;  $R_i = 1 \text{ kOhm}$ ; load resistance  $\geq 10 \text{ kOhm}$  min. (0 V terminal 5)
- Terminal 9: +18 V unstabilised, additional load 20 mA max. (0 V terminal 7)
- Terminal 10: Recorder connection for (int.) outflow temperature, correct sign 10 mV/°C;  $R_i = 100 \text{ Ohm}$ ; internal recorder resistance  $\geq 1 \text{ MOhm}$  min. (0 V terminal 5)
- Terminal 11: Recorder connection for return flow temperature (  ), correct sign 10 mV/°C;  $R_i \approx 100 \text{ Ohm}$ , internal recorder resistance  $\geq 1 \text{ MOhm}$  min. (0 V terminal 5).
- Terminal 12: 12 V when red LED  alight;  $R_i \approx 10 \text{ kOhm}$ ; I max 1 mA (0 V terminal 7)
- Terminal 13/14: Neutral contact closed when red LED  alight; 24 V max. 0.2 A (SELV)
- Terminal 15: Recorder connection for outflow pressure signal (  ), correct sign 10 mV/bar;  $R_i \approx 10 \text{ Ohm}$ ; internal recorder resistance  $\geq 1 \text{ MOhm}$  min. (0 V terminal 5)
- Terminal 16: Programmer or external setpoint input 10 mV/°C; added to setpoint selected internally. Sum is displayed with key   ;  $R_i = 24 \text{ kOhm}$  (0 V terminal 5)

3.10 Return flow temperature measurement RT

The units are fitted with return flow temperature measurement as an option. In that case a Pt 500 resistance thermometer is fitted into the return flow pipe at the bath inlet. After operating the key  the return flow temperature is shown on the display. See also 3.8, terminal 11.

3.11 Remote operation FB (option)

On the version for remote operation the control unit is arranged outside the unit in a separate bench housing which also includes a mains switch for the remote operation of the unit. The green mains switch remains on the unit itself. The connection between unit and remote control is made with two separate cables for mains voltage and low voltage.

4. Safety features and notes 

4.1 The circulation coolers UKS 3000 (W)H and UKS 6000 (W)H are fitted with heaters. Therefore these units must be considered as circulation thermostats according to the safety regulations.

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

4.1.2 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.

4.1.3 The circulating coolers 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

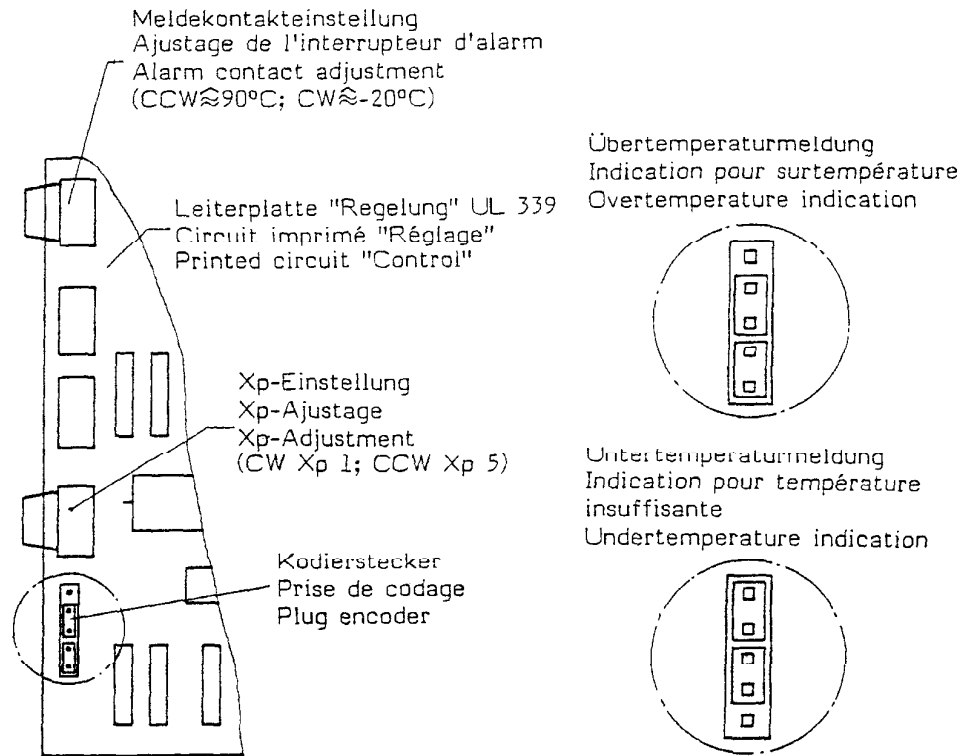
Even with Class 2 the user is only protected against hazards resulting from excess temperature and low level.

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.

#### 4.2 Safety functions of the circulating cooler

- 4.2.1 The built-in overtemperature limiter is adjustable at the operating unit between -20°C and 80°C with approx. 5°C overrun. In accordance with DIN 12879 a tool (screwdriver) must be used for this operation. The outflow temperature is sensed by a separate Pt 500 and processed by a separate electronics. The circuit recognises short-circuit or open-circuit conditions at the probe. When the selected setpoint is exceeded the unit is switched off, maintaining the allpoled status (limiter function); the red LED  lights up permanently, there is an audible signal and at the multifunction outlet the neutral contact is closed and indicates Fault (terminal 13/14, see 3.9).
- 4.2.2 According to DIN 12879 Class 2, the units are equipped with a level protector. If the level falls below minimum it results in shut-down of the unit and a fault indication as for "overtemperature".
- 4.2.3 The operation of the safety shut-down circuit is held in the memory even after a line supply failure or after the unit has been switched off. It can only be reset after the fault has been rectified by operating the unlocking key .
- 4.2.4 The circulation pump is fitted with a winding temperature cut-out which switches off compressor and pump in case of a pump overload. Also in case of incorporated circulation pump UP. Unit can be reset after the front panel of the control unit has been removed by a qualified electrician.
- 4.2.5 The overpressure cut-out of the refrigeration system also activates the security circuit.
- 4.3 The complete unit is protected by three coupled, electromagnetic K-type safety cut-outs which are accessible after the front panel of the control unit has been removed by a qualified electrician.

- 4.4 A signal contact, which is adjustable with a screwdriver within the operating temperature range, indicates via a yellow LED when the selected temperature has been exceeded. The adjustment is on the printed circuit board UL 339 in the control unit (see drawing). The selected temperature can be indicated on the display by pressing the keys Inlet  and Setpoint  simultaneously. At the same time the neutral contact (signal contact 24 V; 0.2 A SELV) is closed. This contact is located in the control unit on the main circuit board A 2 connector X 3 terminal 1/2.
- The direction of the signal contact function can be reversed by setting the plug encoder near the contacts to the other position - LED is alight and the neutral contact closes when the temperature falls below the set limit.



- 4.5 The control unit is designed to Protection Class IP 54. In order to safeguard this, the cables must be introduced into the unit through appropriate cable glands.

4.6 Important!

Any work in the control unit must only be performed by a qualified electrician and after the main switch has been switched off!

## 5. Bath liquids and tubing connections

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

### 5.1 Bath liquids

Operating range 5 to 90°C

Use decalcified water. Make up losses through evaporation at elevated temperatures.

Temperatures close to zero and below:

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

Operating range	-30 to 100°C	<u>Ultra-Therm G 100</u>
Boiling point	110°C	
Viscosity at 20°C	4 mm <sup>2</sup> /sec	Ref. No. LZB 009

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 against the original mixture, e.g. with a hydrometer.

### 5.2 Tubing (continuous lengths)

Rubber tubing with fabric reinforcement  
3/4", uninsulated  
-40 to 100°C. For water, water-glycol mixture,  
alcohols and silicone oils. Operating pressure 10 bar max.

Ref. No. RKJ 032

Insulation tubing  
(28 mm int. dia; 9 mm thick)  
in length of 2 m for insulating 3/4" rubber tubing

Ref. No. RKJ 013

Secure tubing with clips to prevent it slipping off!

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

## 6. Unpacking, assembly and setting up

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

### Standard accessories:

1 Bath cover for filler opening	EZU 070
2 Connectors 3/4"	EOA 004
2 Cable glands PG 11 with reinforcement	EKV 042
1 Square spanner	EZ 127
2 of 1/2" water hoses, each 5 m long, with quick-release coupling (only with water-cooled units)	
Operating Instructions	

- 6.2 The units are best set up so that the control unit is to the front and the air flow to the refrigerator (grills in the lower part) is not obstructed. With air-cooled units keep a minimum spacing of 0.5 m between ventilation grills and any wall (see 3.5.2).  
With water-cooled units (with W in the type designation) make the tube connections to water tap and drain (see 3.5.3)

Secure tubing with clips to prevent it slipping off!

Check that the drain cock behind the right side panel is closed (spanner 12 a/f).

## 7. Filling and connection of external systems

- 7.1 Fill the unit with bath liquid depending on the operating temperature according to Section 5.  
For venting the pump at initial filling, the pressure nozzle has to be opened; otherwise the pump will be damaged.  
The filler opening is located under a flap in the cover. When starting up the unit for the first time, fill the bath preferably up to the maximum level indication. After charging an external system the bath may have to be topped up.
- 7.2 Link the pump connections on the back of the unit to the external system. Only pressure-tight systems may be connected.

Attention: Pressures of up to 7 bar may occur if the return flow is accidentally closed.





Apparatus made of glass normally only withstand very much lower pressures!  
(see accessories: "Overflow valve").









For suitable tubing material please refer to Section 5. With a high-level external system, entry of air into the thermostatic circuit while the pump is stopped may cause the external volume to drain down even with a closed circuit, resulting in flooding of the thermostatic bath!


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

Secure the tubing with clips to prevent it slipping off!

## 8. Starting up

- 8.1 The unit must only be connected to a shuttered line supply. Check the sense of rotational direction on air-cooled units according to Section 8.3. Check the line voltage and frequency against the data on the unit! Turn on the water tap in case of water-cooled units!
- 8.2 Set the overtemperature protection  above the desired operating temperature, but at least above the bath temperature when switching on the unit; latter will normally be ambient temperature. When operating below ambient temperature the overtemperature protection can be readjusted after the operating temperature has been reached.  
If the fastest possible shut-down is required the exact switch-off point can be determined by following procedure: observe the fault lamp while turning the overtemperature protection potentiometer slowly anticlockwise until the cut-off point is reached (unit must be switched on, see section 8.3). Then increase the setting slightly and press "Reset" key . The setting is now just above the operating temperature; this can also be useful in order to protect the items being thermostated.
- 8.3 Switch on the main switch on the right of the control panel (I). The green digital display indicates the actual outflow temperature.  
During initial start-up the fault-LED may light up, it is equivalent to a fault indication.  
Press unlocking key  !
- Check the rotational direction of the pump, also the fan on air-cooled units, by switching on the pressure indication with key  .  
A positive pressure value must be indicated. On air-cooled units the fan at the front of the unit must draw in air at the same time and discharge it backward. If a negative pressure value is indicated and, at the same time, the fan rotates in the wrong direction, a qualified electrician must reverse the direction of the 3-phase current by interchanging two phases in the mains connection.
- 8.4 If there is no flow of bath liquid despite sufficient liquid level the pump cannot fill with liquid due to a build-up of air. Venting the external system at its highest point will rectify this!

- 8.5 Unlocking the locking device of the setpoint selector  by turning it anticlockwise to the top. Press the key  , the setpoint is displayed. Keep this key pressed. The setpoint can now be set by rotating the knob  . Then release the key and tighten the locking device by turning it in clockwise direction. Depending on the temperature selected the compressor starts up (possibly after a delay). The cooling lamp  at the control unit then lights up. The unit now controls the selected temperature by operation of the solenoid valves or the heating.
- 8.6 On the printed circuit board UL 339 in the control unit there is a potentiometer for the selection of the adjustment range (Xp) of the controller (see 4.4). The standard setting at which the unit is shipped from the factory is 3. The adjustment range extends from 1 to 5; position 1 corresponds to approx. 1°C proportional band, position 5 to approx. 35°C. In individual cases the Xp potentiometer can be used to optimise the control to suit the particular application.
- 8.7 The pressure which builds up at the external system can be indicated by pressing the key  (see Section 3.8 and 3.9).
- 8.8 Operation with External controller
- When using the external controller the temperature at the remote point (product or jacket) can also be indicated on the digital display  . In addition the control action of the circulating cooling unit can be influenced from this external probe (Pt 100).
- 8.8.1 Connect the Pt 100 resistance thermometer. Any Pt 100 to DIN IEC 751 can be used. The connection is carried out in four-wire circuit (see 3.7.2). The time constant of the resistance thermometer should be as short as possible, because it enters the controlled member parameter.
- 8.8.2 When used as external measuring point the display can be switched to the external measuring value by pressing key  . The connected resistance thermometer can be adjusted with the potentiometer in the control unit (see Section 3.7.2 and 4.5). The easiest way to do this is to dip the external used resistance thermometer into the bath of the cooling unit and to adjust the external display according to the internal display (see 3.7.2).
- 8.8.3 The commutation to external control (cascade control) is achieved by pressing the toggle switch  . Simultaneously the internal controller is switched from PID to PD, so that in the cascade only the integral part is active.
- 8.8.4 The control parameter of the master controller are adjusted to Tn 40 sec at button key position 2, the controller reinforcement Kp to 1. When using slow consumers, e.g. thick and bad stirred products, it is advisable to adjust the reset time Tn to 220 sec (position 1). Just as advisable can be to switch the reinforcement Kp to smaller values, e.g. to 0.5 or 0.2.

- 8.8.5 A special feature of the EXT controller is the adjustable double (+) effective limitation of correction value.  
The master controller works as follows: the correction value, which corresponds with the temperature difference between bath (int.) and consumer (ext.), is given to the bath controller. When using slow consumers this correction can be very high, e.g. 100°C. Without limitation of correction value a variety of thermal overstress can occur, e.g. bath liquid starts boiling, flashpoint is exceeded, temperature falls below freezing point, product is thermal overloaded etc. Additionally the behavior during the starting period is improved. This limitation of correction value can be adjusted at the potentiometer  at the operating unit. The basic adjustment is + 20°C. When judging the adjustment consider that the remaining deviation of the bath controller, which works at EXT-controller operation as PD-controller, is entered as well.
- 8.8.6 Example for double-jacketed two liter glass-vessel with stirrer:

Reset time:	Tn 1 ( approx. 220s)
Amplification:	Kp 4
Correction limitation:	10°C

#### 8.9 Safety circuit

The operation of the safety devices in the unit has already been discussed in section 4.2.

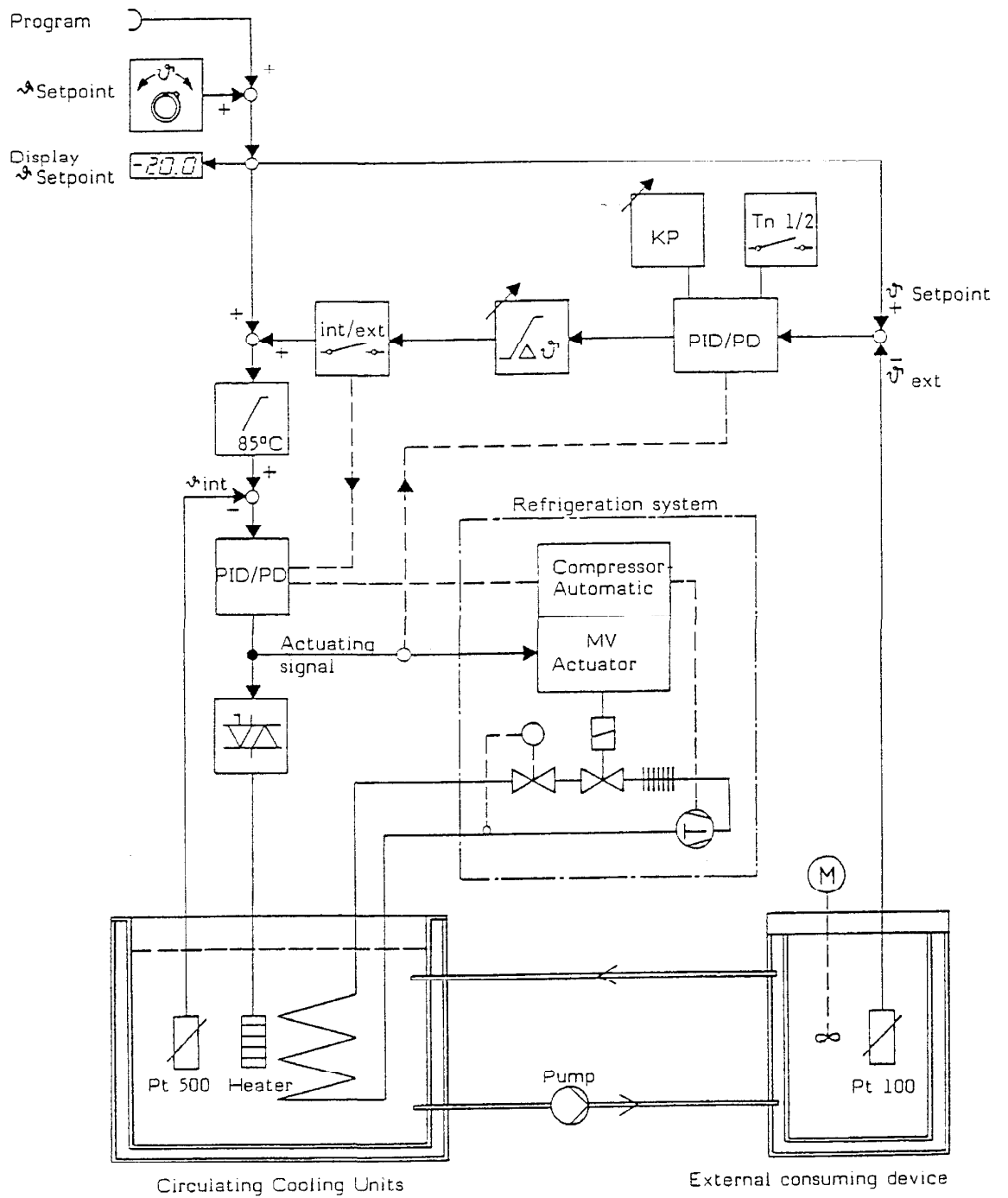
After start-up it is advisable to check the correct operation of the safety devices to DIN 12879.

The low level protection can be tested easily by switching on the instrument under supervision before it has been filled up. The overtemperature switch-off point must be adjusted clearly above the ambient temperature. Please ensure that there are no explosive mixtures in the bath, because in case the low level security circuit does not function, the heating will switch on, and the mixtures may catch fire at the heater.

The unit must immediately go to "Fault" (audible signal, red lamp on).

The overtemperature limiter can always be checked by adjusting its switch-off point below the actual bath temperature. After elimination of the 'fault', push the unlocking key while the unit is switched on.

Block circuit diagram Control with external controller



#### 8.10 Operation with programmer

A programmer Type PM 351 or an external setpoint selector can be connected to the terminals of the multifunction output (see Section 3.9) so that the setpoint of the circulating cooling unit can be varied according to a preset programme. This requires that the energy balance (heating, cooling, load) of the circulating cooling unit matches the requirements of the programme (heating rate, cooling rate, operating temperatures). The programmer output or setpoint selector output is set to 0 Volt. Adjust the unit setpoint to the lowest temperature of the programme; this value is entered as value A when programming the programmer. The unit setpoint is not changed any more. 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.

#### 8.11 Operation with RS 232 C (V 24) Interface R 61/2 (MF required)

If a computer can be connected to the Interface RS 232 C (V24) R 61 with A/D-converter, it is possible to transfer three signals of 10 mV-scale from the multifunction output of the circulating cooler to the computer and to transmit one value as setpoint value from the computer to the circulating cooler. Error signal can also be determined.

Depending on type and kind of equipment of the circulating cooler the below mentioned actual value signals are at disposal (see multifunction output 3.9):

1. Setpoint output (terminal 3)
2. Outflow temperature (terminal 10)
3. Return flow temperature (terminal 11)
4. Outflow pressure (terminal 15)
5. External temperature (terminal 2)

If required, the R 61 inputs IN 1 (brown), IN 2 (red) and IN 3 (white) can be connected to 3 signals of those 5 mentioned above.

Programming and automatic processing of ramp segments as well as programmable contacts possible.

## 9. Maintenance

- 9.1 LAUDA circulating cooling units operate largely without maintenance. Contaminated bath liquid should be drained through the drain cock and replaced by fresh liquid.

The refrigerating system operates largely without maintenance. On air-cooled units the finned condenser of the refrigerator must be cleaned in regular time intervals, e.g. every 6 months, depending on the amount of dust. In order to do so, the ventilation grill mounted at the front may have to be unscrewed. Then remove the dust on the finned condenser located behind it via an appropriate method, e.g. blow compressed air or nitrogen into the ventilation grill for several minutes.

- 9.2 In case of reduced pump output the dirt trap (see Section 3.3) can be unscrewed and cleaned after removing the right side panel and the insulation.
- 9.3 On water-cooled units a dirt trap is located in the cooling water inlet which must be cleaned in case of faults in the system.
- 9.4 The outside of the units can be cleaned using a damp cloth, wetted with water and some drops of a tenside (wash-up liquid).
- 9.5 Safety notes in case of repair

Always unplug mains supply before performing any maintenance procedures or repairs. Repairs on the unit must only be performed by a qualified electrician!

- 9.6 Notes on Repair and Disposal

The refrigerating circuit is filled with partly halogenated Chlorofluorocarbon R 22. Repair on the circuit as well as disposal of the CFC R 22 by qualified technician only.

- 9.7 Order of spare parts

When ordering spare parts, please always state the type designation and unit number as indicated on the unit label. We rely on your cooperation as this prevents unnecessary delays due to further inquiries or wrong deliveries.

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

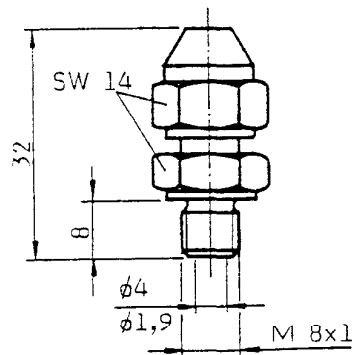
LAUDA DR. R. WOBSE  
GMBH & CO. KG

LAUDA Circulating Cooling Units  
UKS 3000 H, UKS 3000 WH, UKS 6000 H, UKS 6000 WH

Type \_\_\_\_\_ Ref.No. \_\_\_\_\_

LAUDA Resistance thermometer Pt 100-70 ETP 009  
In stainless steel protecting tube, diameter 4 mm,  
length 250 mm. Temperature range -200...300°C.  
50% time 1.5 sec.. Four conductor connection.  
Four pole Lemo-connector size 1.

Clamping gland, stainless steel HX 078  
According to figure below. With Teflon pressure ring.  
Thread M 8 x 1, suitable for 4 mm dia. resistance  
thermometers.



Connecting cable UK 176  
for connection of the Pt 100-70 to UKS units with  
external controller. Length approximately 3 m.