

LAUDA

OPERATING INSTRUCTIONS

LAUDA Ultra-Thermostats
UB 20 F, UB 20 J, UB 30 J, UB 40 J

to DIN 12879

valid from series K02
08/95
YATE0007

Contents	page
1. Brief description	1
2. Data table	3
3. Basic construction and technical description	5
3.1 Type selection	5
3.2 Construction	5
3.3 Thermostatic bath	6
3.4 Circulating pump	6
3.5 Heating	7
3.6 Control and operating unit R 400	7
4. Safety system Δ	12
5. Bath liquids and tubing connections	15
6. Unpacking, assembly and setting up	17
7. Connection with external systems	18
8. Cooling of the thermostat	19
9. Starting up	20
9.10 Operation with programmer	21
9.11 Operation with external controller EXT (optional)	22
9.12 Operation with solenoid valve Module MV (optional)	24
9.13 Safety circuit	26
10. Multifunction output	27
11. Maintenance	28

Enclosures

Circuit diagrams

Accessories

1. Brief description

Even if these brief instructions are sufficient for you, be sure to read the information below, in particular Section 4, "Safety system".

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 the tubing to the pump connector:

Without external system: link together the pump connectors with the enclosed Perbunan tubing (up to 120°C max.), Viton or metal tubing.


With external system: connect the tubing with the external system.


Secure tubing from slipping off with hose clips !

1.4 Connect external cooling (see section 8) when operating at ambient temperature, i.e. at lower temperature than the operating range.

1.5 Use decalcified water or LAUDA bath liquids only! (see Section 5)
Fill the unit up to approx. 2 cm below the cover plate. The yellow LED  must not shine yet!

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

1.7 On the controller R 400 set the low-level cut-out with a screwdriver on the rotary switch  to "min".




1.8 Set the overtemperature cut-out potentiometer  with a screwdriver slightly above the required operating temperature, but at least above ambient temperature.

1.9 Select the desired operating temperature on the digit switch, set the value after the decimal point with the knurled disc.

1.10 Do not operate the "PROGR." push button switch.

1.11 Switch on the mains switch. Green lamp in mains switch lights up. The pump starts running. Make sure that the level of the thermostat does not decrease excessively when the external system is connected and charged. Watch the level indication!

The temperature display indicates the actual bath temperature.

- 1.12 If the red "Fault" LED  lights up permanently, press the push button "Reset"  .
- 1.13 When the bath liquid has reached the set point the yellow pilot lamp "Heating"  starts to flash. After the unit has settled down the digital thermometer indicates the previously selected bath temperature.
- 1.14 The red pilot lamp always flashes, when the bath temperature is more than 5°C above the selected setpoint.

1.15 Safety:

The thermostat conforms to Class 3. 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!

Parts of the bath cover may heat up to more than 60°C at higher operating temperatures! Pump outflow and return are at the operating temperature.

LAUDA Ultra-Thermostats
 UB 20 F, UB 20 J, UB 30 J, UB 40 J

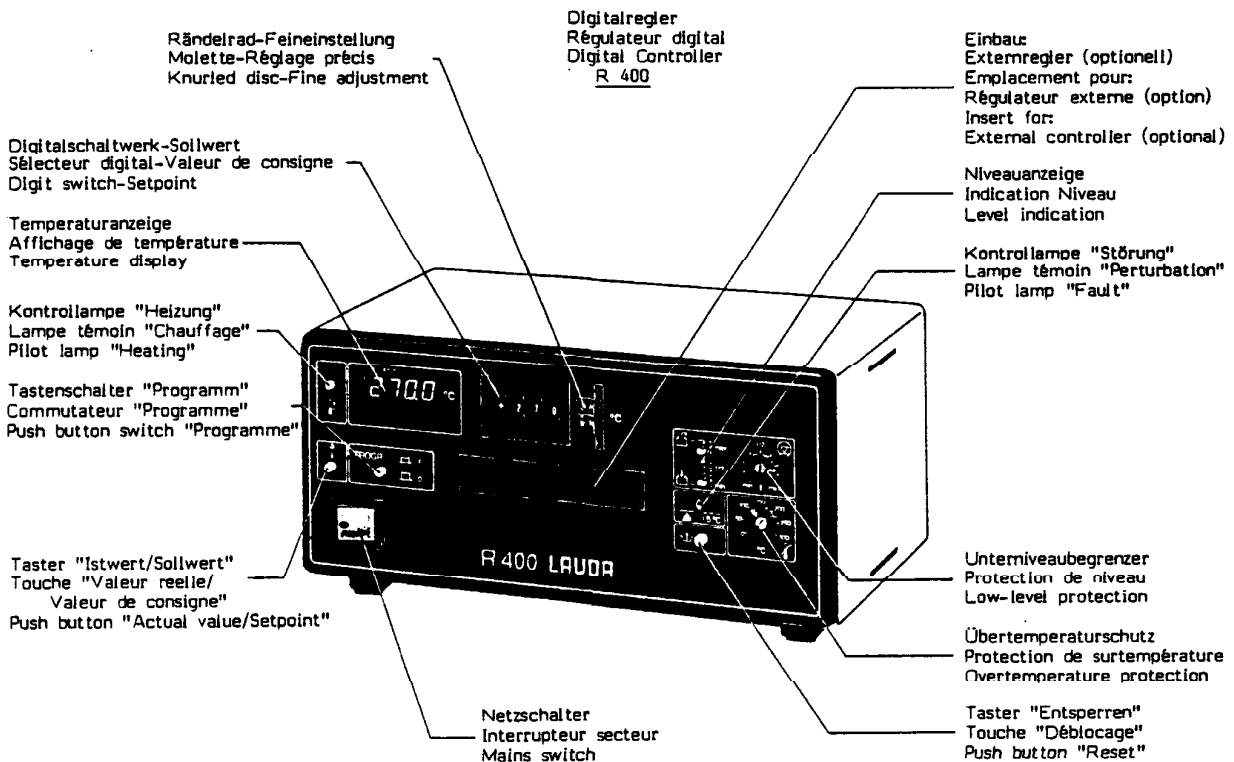
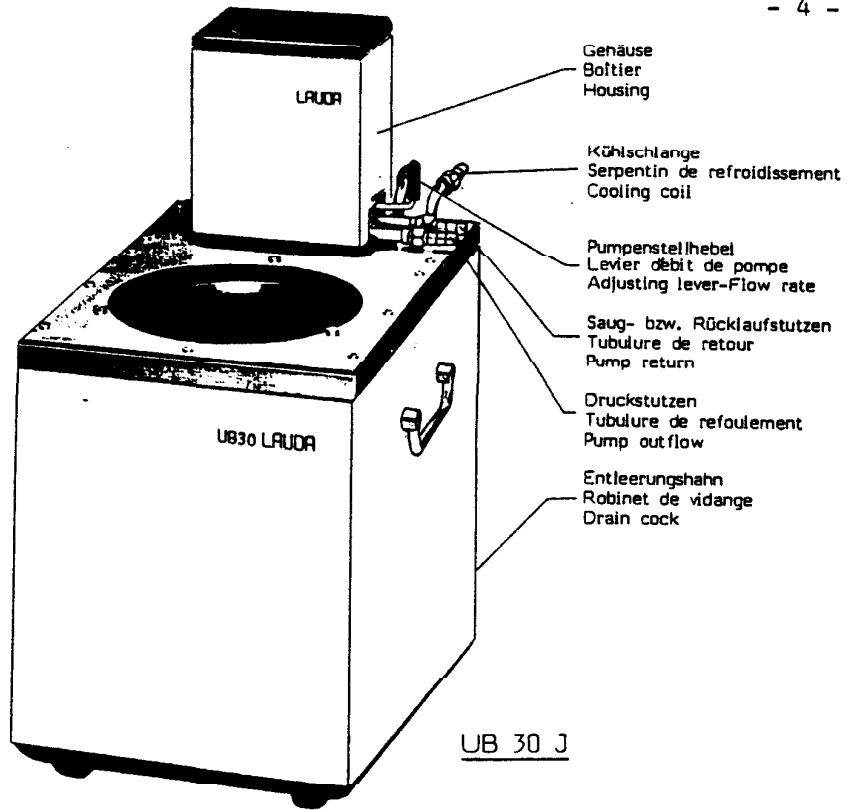
- 3 -

2. Data table These thermostats are according to DIN 12879

Technical data (to DIN 58966)		UB 20 F	UB 20 J	UB 30 J	UB 40 J
Operating temp. range as supplied	(°C)	35...200	45...300	40...300	35...300
	with water cooling	(°C)	20...200	20...300	20...300
Operating temp. range (with external cooling)	(°C)	-30...200	-30...300	-30...300	-30...300
Temperature setting/resolution	(°C)	digit switch / 1,0			
Fine temperature setting range/resolution	(°C)	-0,2...1,2 / 0,01			
Temp. measurement/resolution	(°C)	digital indication by green LED/0,1; accuracy Class A to DIN 43760 $\pm 0,2$ °C			
Temp. sensor/control action		Pt 500 class A to DIN 43760 / PID			
Constancy of temp. (at 70 °C)	(°C)	$\pm 0,005$		$\pm 0,005... \pm 0,01$	
Heater power max.	(kW)	1,2	3	3	3
Safety class to DIN 12879		3, additional level indication			
Flow rate at zero pressure (pump capacity) with olive 11 μ / 13 μ int. dia. max. discharge pressure	(l/min)	8/12		8/15	
	(bar)	0,2	0,3	0,3	0,3
Pump connectors		M 16 x 1 10 mm I.d.			
Capacity	(l)	15...18	15...18	22,5...30,5	32...40,5
Bath liquid 5...100°C -30...100°C		decalcified water water/monoethylene glycol mixture 1:1 for further bath liquids see Section 5			
Bath opening	(mm)			0 195	
Depth of bath	(mm)	195	195	320	450
Usable bath depth	(mm)	175	175	300	430
Bench area (WxD) x height (thermostat only)	(mm)	(300x450)x465	(300x450)x465	(300x450)x590	(300x450)x720
Weight (with R 400)	(kg)	27	27	33	39
Power supply	(V,Hz)	220 - 240 V, 50 Hz / 230 V, 60 Hz			
Power consumption	(kW)	1,4	3,2	3,2	3,2
		Protection class I to VDE 0100			
Interference suppression		according to VDE 0875			
Ref.No.		LTB 139	LTB 136	LTB 137	LTB 138
220 - 240 V, 50 Hz		LTB 239	LTB 236	LTB 237	LTB 238
230 V, 60 Hz					

LAUDA Ultra-Thermostats
 UB 20 F, UB 20 J, UB 30 J, UB 40 J

- 4 -



3. Basic construction and technical description

3.1 Type selection

The series of rectangular Ultra calibration thermostats includes 4 different models.

All models are equipped with a cylindric operating chamber which is adjustable approx. 20 mm in height. By this facility the bath surface can be adjusted so that it can even be above the cover plate. This simplifies the calibration of fully immersed thermometers, for example. The separate operating chamber offers a constant immersion depth, independent from the volume expansion of the bath liquid and a very good temperature accuracy and temperature distribution. All units are also provided with pump outlets for connecting up closed external thermostating systems.

Calibration thermostat UB 20 F

for testing and calibrating clinical thermometers and their capillaries. By limiting the operating temperature range and using suitable heater and pump the typical temperatures between 37°C and 42°C are possible without cooling and with very high temperature accuracy.

Calibration thermostat UB 20 J

with standard heating capacity and pump output. Usable immersion depth 175 mm.

Calibration thermostat UB 30 J

Usable immersion depth increased to 300 mm.

Calibration thermostat UB 40 J

Usable immersion depth increased to 430 mm.

3.2 Construction

The units consist of 3 groups:

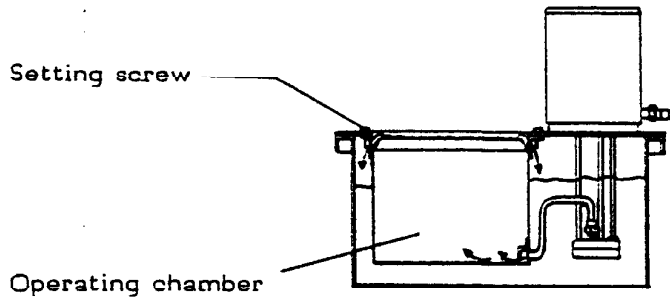
- insulated bath with operating chamber
- pump with bridge and functional elements as temperature probe, heater etc.
- control and operating unit R 400

3.3 Thermostatic bath

The stainless steel bath vessel is mounted together with a temperature resistant insulating material into an outer jacket. The cover plate is mounted from the outside onto the bath edge, which is easy-to-service. Between the cover plate and bath edge a sealing is placed. The threads for the fixing screws are closed to the bath insulation, so that no thermostating liquid can penetrate.

The cooling coil is installed in the cover plate. Stainless steel cylindrical operating chamber, adjustable approx. 20 mm in height. All parts which are in contact with the bath liquid are manufactured in high-grade stainless steel, pump, heater, temperature probe etc. included.

The operating temperature range of type UB 20 F is up to 200 °C. The other models have a special insulation and a 3 kW heater for operation up to 300 °C.



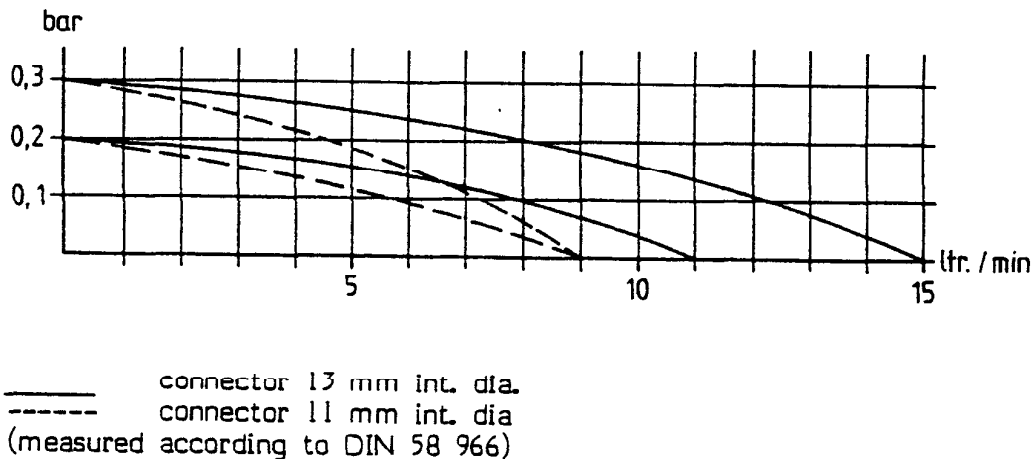
3.4 Circulating pump

The units are fitted with pressure pumps (submerged centrifugal pumps) which we call SIMPLEX pumps.

The SIMPLEX pump has only one pressure stage; it is used for thermostating closed external systems. In case of the calibration thermostats it is mainly used for circulating the liquid between bath and operating chamber.

The pump is driven by a nonsynchronous outside rotor motor with overload protection embedded in the motor winding. It is fitted with a lever with which the flow rate can be adjusted between maximum and zero. The pump operates perfectly with liquids up to a viscosity of approx. 150 mm²/sec.

Performance diagrams



3.5 Heating


All units are supplied with a 3 kW tubular heater with low surface strain.

3.6 Control and operating unit R 400

3.6.1 The complete electronics and all necessary operating elements for temperature indication, temperature setting and safety features are located in a separate equipment, the controller R 400. Separation of thermostat and control unit enables to use the equipment with remote control, e.g. when the thermostat is placed under the fume hood and the control unit outside.

3.6.2 Control

The units operate with a Pt 500 conforming to 5 x DIN 43760 to sense the bath temperature. This is indicated digitally on the R 400 with a resolution of 0.1°C. Within the operating temperature range the accuracy of indication is optimised and outside of the operating temperature range still useable values can be gained. The limitation of the indication is then provided by the temperature range of the probe.

The setpoint is selected on a digit switch in 1°C steps with sign. It can be adjusted up to 399°C, but the setting is limited internally by the electronics to approx. 310°C. Additionally a knurled disc provides analog adjustment over the range -0,2 ... 1.2°C with 0.01°C scale divisions. The value from the programmer input which is switched in with the push button switch "PROGR" is always added to the selected setpoint. The sum can be displayed by operating the push button  .

The comparison between setpoint and actual value is carried out by a PID controller whose output ranges from 100% heating via 0% heating or 0% cooling to 100% cooling in case of installed MV-Option (solenoid valve). This ensures under all operating conditions that the amount of energy removed from the bath or introduced into the bath is only sufficient to maintain the selected temperature. This principle of control 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.

3.6.3 Cooling with Option MV

The controller R 400 can trigger a solenoid valve for controlled cooling (cooling water control) when the Option MV is added additionally. The controller output line is then automatically enlarged below 0% heating into the cooling range so that the cooling will automatically be according to the need. Cooling display and switch for cooling ON are located at the back.

3.6.4 External control Option EXT

Additionally an extension with the external control Option EXT is possible. This offers the possibility to measure and indicate the temperature at external measuring points, e.g. in a reactor. A Pt 100 resistance thermometer to DIN 43760 in four-wire circuit serves as measuring probe, which can be connected by means of the multifunction connector. A cascade control is given when the external control is switched on. The cascade control compares the real value at the external measuring point with the selected setpoint. This makes operating easier and provides better control results.

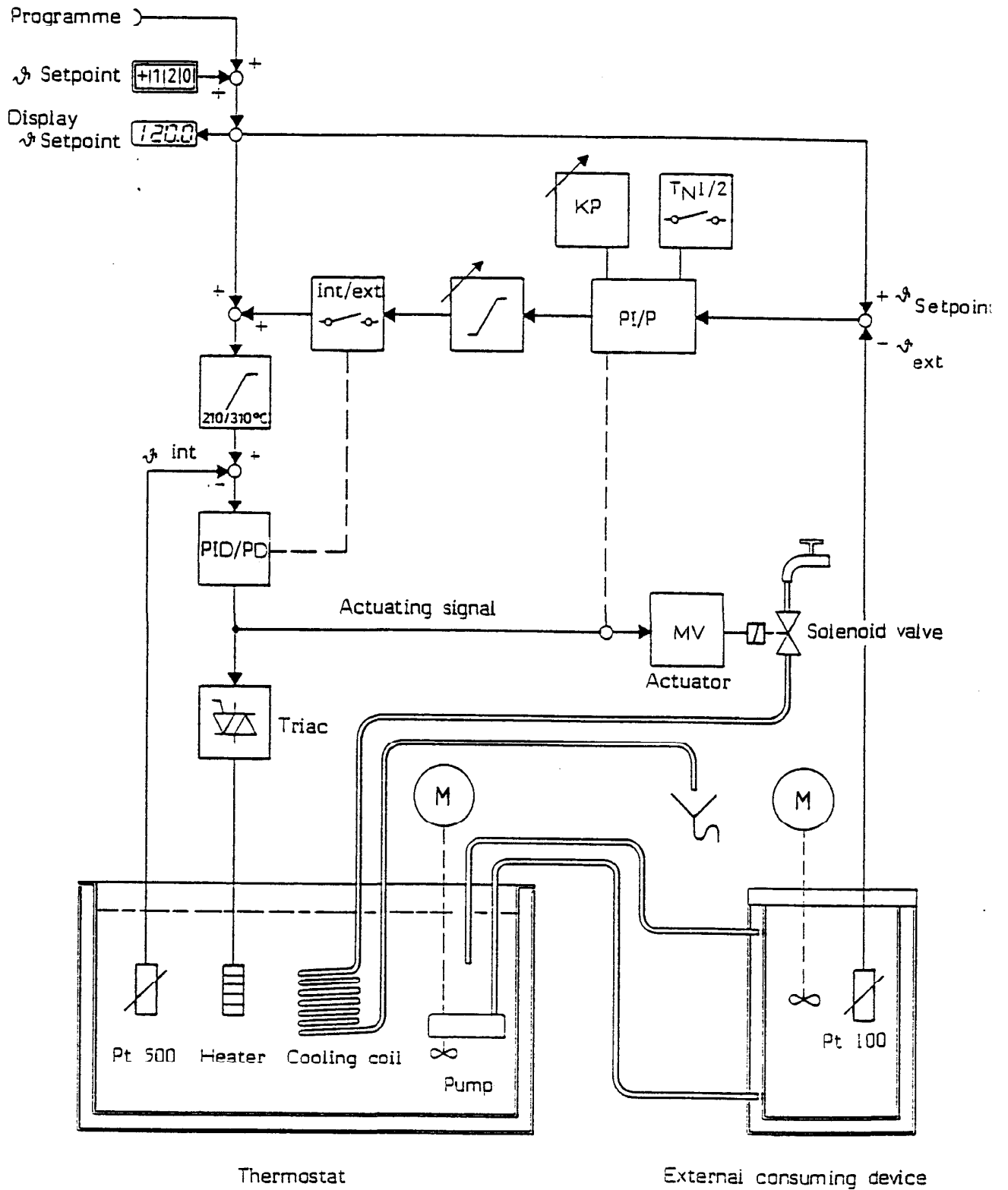
The external controller functions as PI controller with P-PI-structure commutation and adjustable limitation of correction value.

The Option MV as well as the EXT can be installed into the controller R 400 by qualified personnel later.

3.6.5 Technical data		Control and operating unit R 400
Temperature controller		
Control range	(°C)	-100 ... 310
Temperature setting/ resolution	(°C)	Digit switch / 1 selectors for sign +/- hundreds tens units
Fine temperature setting range/resolution	(°C)	-0.2 ... 1.2 / 0.01
Setting accuracy		0.1 % of setpoint + 0.1°C
Temperature probe/control action		Pt 500, accuracy Class A to DIN 43760 / PID, $X_p = 1 \dots 15^\circ\text{C}$, $T_v \approx 35 \text{ sec}$, $T_n \approx 30 \text{ sec}$.
Temperature measurement		
Range	(°C)	-100 ... 400
Resolution	(°C)	0.1
Instrument accuracy (without probe)		0.1 % of reading + 0.1°C
Display		green LED, 10 mm
Power module for heater		triac, automatic zero-voltage full-wave switching and burst- firing, interference suppression grade N, power capacity 3 kW max. or 14 A
Safety system		Class 3 to DIN 12879 adjustable overtemperature protection (switch-off point 0 ... 300°C), adjustable low-level protection in 9 steps
Overtemperature measurement		Pt 500 with short-circuit and open-circuit protection.
Level indication		in 10 steps through LED linear display
Additional functions		automatic warning circuit if actual temperature is more than 5°C above setpoint heating is switched off when level is too high

Multifunction output		connection possibility for:
		- programmer with 10 mV/K
		- computer through A/D-converter
		- recorder for actual value
		- remote transmission of fault indication
Bench area (W x D) x height	(mm)	300 x 170 x 150
Weight	(kg)	4.5
Power supply		220 - 240 V, 50/60 Hz Protection Class I to VDE 0100
<u>Option MV</u>		
Solenoid valve output		220 - 240 V, 50/60 Hz 0.3 A max.
Time for pulse with modulation	(s)	approx. 5
<u>Option EXT</u>		
Temperature measurement		
Measuring range	(°C)	-100 ... 400
Accuracy (without probe)		0.1 % from measuring value \pm 0.1°C on display of R 400
Indication		(internal or external temperature alternatively)
Probe		Pt 100 to DIN 43760 in four-wire circuit
Master controller		
Setpoint		of R 400
Control action		PI
Tn	(s)	40 / 220
Amplification		0.2 ... 4 times
Limitation of correction value	(°C)	\pm 0 ... 100

Block Diagram R 400 with MV- and EXT-Option



4. Safety system Δ

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 thermostats as described in these Operating Instructions are to Class 3, they are protected against overtemperature and low level. Class 3 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 3 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


- 4.2.1 The built-in overtemperature limiter is adjustable on the R 400 between 0°C and 300°C with approx. 5°C overrun. In accordance with DIN 12879 a tool (screwdriver) must be used for this operation. The bath temperature is sensed by a separate Pt 500 and processed by a separate electronics. The circuit recognizes short-circuit or open-circuit conditions at the probe.

When the selected setpoint is exceeded the unit is switched off, maintaining the all-poled status (limiter function); the red LED  lights up permanently, there is an audible signal and at the multifunction output 42 S an electrical signal appears at contact 12 (0 V) and 13 (12 V).

- 4.2.2 In accordance with DIN 12879 Class 3 the switch-off point of the low-level limiter is also adjustable. This prevents pumping out an unnecessarily large quantity of bath liquid at the lowest setting. The bath level is sensed by a float whose position is digitised with hall sensors through a magnetic coupling. An LED chain on the R 400 provides remote level indication in 10 steps. At the overflow step  the unit continues to operate, but the heating is switched off. This prevents overflow caused by liquid expansion during heating. The yellow LED only provides a visual warning; the same applies to the yellow refill LED  which is always alight when the selected switch-off stage coincides with the actual level. Any further fall in level then results in shut-down and a fault indication as for "overtemperature".

- 4.2.3 The operation of the safety shut-down circuit is kept in the memory 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 push button .

4.3 Constant-spaced warning circuit > 5°C

The "fault" pilot lamp  flashes when the bath temperature is more than 5°C above the selected setpoint. This signal does not switch off the unit, it only acts as a warning. Operation of this safety circuit produces a 12 V signal at the output 42 S on contact 5.

When working with external control the lamp > 5°C can start flashing during the response period, although there is no fault in operation.

4.4 Important notes !

4.4.1 Temperatures

Parts of the bath cover may heat up to more than 60°C at higher operating temperatures. Pump outflow and return are at the operating temperature.

4.4.2 Tube connections

Secure tubing from slipping off with hose clips or use stainless steel metal tubing with screwed connections!

Ensure that also without external circuit the pump connectors are linked together with a piece of tubing. For this purpose the metal tubing pump connector MC 18, Ref. No. LZM 044, offers the best and most reliable solution, especially when working with higher temperature ranges.
Open adjusting lever in order to improve the circulation in the bath.

4.4.3 Control cable and plug connection 10 H

The plug connection 10 H at the controller R 400 must only be performed or loosened when the unit is switched off.

When working with higher temperatures mains cable and connecting control cable must not touch pump connectors or cover plate ! Damaged cables must be replaced immediately by qualified personnel. Otherwise electrical safety cannot be guaranteed.

The connection between thermostat and controller R 400 is provided by a special power line which has high-voltage as well as weak current. Additionally an especially for this purpose developed plug-connector is used. In case of repair genuine spare parts must be used only, otherwise electrical safety cannot be guaranteed.

4.4.4 Testing of Safety Functions

Carry out the tests regularly according to Section 9.13.

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.

Ref.No.

Operating range -30 ... 100°C Ultra-Therm G 100

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

Operating range 20°C ... 180°C Ultra-Therm 330 SCB
(synthetical heat carrier)

LZB 007

Viscosity at 20°C 34 mm²/sec.
Flashpoint 190°C
Initial boiling point 390°C

Operating range 50 ... 300°C Ultra-Therm SW 300 N
(Silicone oil)

LZB 008

Viscosity at 20°C 260 mm²/sec.
at 100°C 21 mm²/sec.
Flashpoint 305°C

5.2 Tubing

Ref. No.

Perbunan tubing, uninsulated

RKJ 011

9 mm int. dia. Application range 0 ... 120°C.
Suitable for all above named bath liquids.

Perbunan tubing, insulated

LZS 004

9 mm int. dia.; external dia. approx. 30 mm.
Temperature range -60 ... 120°C. Especially suitable
for working at low temperatures.

Perbunan tubing, uninsulated

RKJ 012

11 mm int. dia. Application range 0 ... 120°C

Silicone tubing, uninsulated

RKJ 059

11 mm int. dia. Application range -30 ... 100°C
For water and water-glycol-mixture.

Silicone tubing, insulated

LZS 007

11 mm int. dia. external dia. 35 mm approx.
Use as for uninsulated Silicone tubing.
Application range -60 ... 100°C.

Note: Silicone tubing must not be used with Silicone oils!
Secure tubing with clips to prevent it slipping off.

Metal tubing pump connector for linking together the pump
connectors (insulated) MC 18; Application range 0 ... 350°C

LZM 044

Metal tubing (single insulation)

Application range 0 ... 350°C

Metal tubing MC 50 (50 cm long)

LZM 040

Metal tubing MC 100 (100 cm long)

LZM 041

Metal tubing MC 150 (150 cm long)

LZM 042

Metal tubing MC 200 (200 cm long)

LZM 043

Metal tubing with special insulation (3 layers)

Application range 0 ... 350°C

Metal tubing MC 50 S (50 cm long)

LZM 046

Metal tubing MC 100 S (100 cm long)

LZM 047

Metal tubing MC 150 S (150 cm long)

LZM 048

Metal tubing MC 200 S (200 cm long)

LZM 049

Highly flexible, thermally insulated stainless steel tubing (V2A) with M 16 x
1 mm connecting threads. 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

4 Olives 13 dia. (fitted)	HKO	026
2 Olives 11 dia.	HKO	025
1 m Perbunan tubing, 11 mm int.dia.	RKJ	012
1 Control and operating unit R 400	LRK	006
1 15-pin plug and housing (only at Option EXT)	EQM	030 and
	EQG	017

Operating Instructions

- 6.2 Set thermostat and controller R 400 next to each other. Make the control-plug-connection at the socket 10 H on the switched off unit. Ensure that the latching device clicks home.
Insert the mains plug (12 H).

Important Note!


When working with higher temperatures mains cable and connecting control cable must not touch pump connectors or cover plate! Damaged cables must be replaced immediately by qualified personnel. Otherwise electrical safety can not be guaranteed.

Ensure that also without external circuit the pump connectors are linked together with a piece of tubing. For this purpose the metal tubing pump connector MC 18 (Ref. No. LZM 044) offers the best and most reliable solution, especially when working in higher temperature ranges. Open the pump adjusting lever because it improves the circulation inside the bath.

7. Connection with 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 height (approx. 2 cm below the cover plate).

Important Note!

Yellow LED  overflow must not light up, because the unit will not heat up that way.

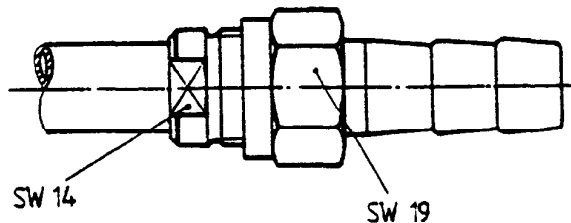
For suitable tubing material refer to Section 5.

With external systems placed higher than the thermostat, entry of air in the thermostatic circuit while the pump is stopped may cause the external volume to drain, resulting in flooding of the thermostatic bath!

Always ensure maximum flow area in the external circulation (connectors, 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 tube connectors hold up the threaded nipple with fork wrench SW 14.



7.2 Circulating pumps

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

All LAUDA circulating pumps are fitted with a lever to permit continuous adjustment of the flow rate (pump output) through the external system from zero up to the maximum (see also Section 3.4).


7.3 Adjustment of the bath level

By alternately turning of the three screws arranged at the circular opening of the coverplate. Set the bath level to the required height. Adjust the operating chamber during the operation in a way that the liquid overflows regularly.

8. Cooling of the thermostat

Caused by the heat resulting from operation of the circulating pump thermostating without cooling can first start at a considerable higher temperature than ambient (see Technical Data, Operating temperature range lower limit). For lower temperatures one must work with cooling. There are following cooling possibilities:

8.1 Mains water cooling

Depending on the water temperature to be used down to 15°C. The thermostats have a cooling coil (), which is connected by tubing with the water tap and the drain. Keep the flow as small as possible. This saves water and improves the constancy of temperature. The cooling coil connectors can be changed for the pump connectors (11 int. dia.) when needed. For controlled water cooling the controller R 400 can be supplied with a clocked solenoid valve control. This operates especially water and energy saving. (see Section 3.6.3 and 9.12)

8.2 Through-flow coolers DLK 10, DLK 20, DLK 40

Depending on the type of thermostat to be used down to -15°C (DLK 10), -30°C (DLK 30 or DLK 40, limited by Thermostat). More precise temperature control than water cooling. Use insulated tubing for connection between outflow and return nipple of the pump and connectors to the through-flow cooler. If the thermostat is connected with an external closed system, the through-flow cooler is interposed in the return tubing from the external system to the thermostat. Charge with water-glycol-mixture (in ratio 1 : 1).

8.3 LAUDA - Small low-temperature thermostat








Naturally each small low-temperature thermostat can be used for cooling the thermostat. This rather costly solution is only adviseable when a small low-temperature thermostat is already available in the laboratory.

9. Starting up

9.1 Filling

The unit is filled with a suitable bath liquid depending on the operating temperature as discussed in Section 5. See Section 2 "Data Table" for charging volume. When starting up the unit for the first time, fill the bath preferably up to the maximum level indication, i.e. approx. 2 cm below the cover plate. After charging an external system the bath may have to be topped up. Use the bath cover or cover the bath as much as possible in order to avoid evaporation or smell.


When operating above 250 °C fill the bath only up to the level indication "min". When operating at 300 °C the bath will be filled up to "max" due to oil expansion.

- 9.2 Set the overtemperature protection  above the desired operating temperature, but at least above the bath temperature when switching on the unit. If the fastest possible shut-down is required the exact switch-off point can be found by using the following procedure: hold down the push button  unlocking (this short-circuits the shut-down of pump and heating) and observe the fault lamp while adjusting the overtemperature protection potentiometer. Then increase the setting slightly. The setting is now just above the operating temperature; this may be useful in certain cases to protect the items being thermostated.
- 9.3 Set the low-level protection  to the min. position. After the operating temperature and the final bath level have been reached the low-level protection should be set to one step below the indicated bath level. This ensures maximum security.
- 9.4 Switch the 3 buttons on the installed EXT controller to the home position (not pressed).
- 9.5 Set the desired operating temperature on the digit switch. Values after the decimal point are set on the knurled disc. When an external setpoint unit is connected up, the external setting is always added to the value set on the unit. The sum can be indicated by pressing the key  .
The unit must be connected to a socket with ground connection.
Check line voltage and frequency against the data on the unit label of thermostat and R 400 controller!
- 9.6 Switch on the main switch. The green pilot lamp in the switch lights up.
- 9.7 If the fault LED is on permanently this indicates a fault; press the unlocking push button  .
- 9.8 When the temperature setting has been reached the yellow LED "heating"  ($f \approx 0.7$ Hz) or with switched on MV cooling on the back the green LED "cooling"  ($f \approx 0.2$ 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 selected setpoint.

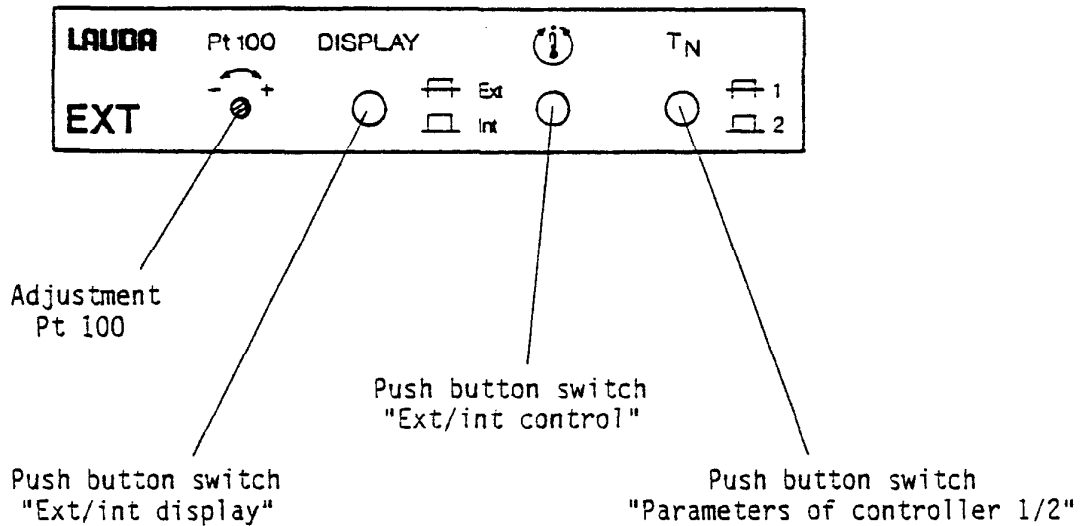
- 9.9 The back of the controller R 400 carries two setting potentiometers:
- 9.9.1 The Xp potentiometer is used to match the control action of the controller to the characteristics of the controlled system; these depend on the bath, on the external system, on the bath liquid etc.
The standard setting 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. 15°C.
In individual cases the Xp potentiometer can be used to optimise the control to suit the particular application.
- 9.9.2 The Pt 500 potentiometer serves for additive alignment of the Pt 500 bath temperature probe to the electronics. This alignment is made at the factory according to the ideal condition, i.e. 500 at 0°C. Since the probes used are to DIN 43760 Class A this may result in a maximum error of + 0.2°C at 0°C. This method appears appropriate in order to ensure easy interchangeability.

Where increased accuracy is required and suitably accurate means of temperature measurement are available, the alignment of the probe can be optimised at any particular temperature by means of the Pt 500 potentiometer.

9.10 Operation with programmer

A programmer Type PM 351 can be connected to the multifunction output 42 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 push button switch "PROGR" 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 press the push button switch "PROGR". Operation of the push button  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.

9.11 Operation with external controller EXT (optional)






When using the external controller EXT the temperature in the external consuming device (product or double-jacket) can also be indicated on the digital display. In addition the control action of the thermostat can be influenced from this external probe (Pt 100).


- 9.11.1 Connect the Pt 100 resistance thermometer with the multifunction output. Any Pt 100 to DIN 43760 can be used. The connection is carried out in four-wire circuit.

Pin assignment at socket 42 S:

- Contact 2: - I current
- 9: - U potential
- 11: + I current
- 15: + U potential

The time constant of the resistance thermometer should be as short as possible, because it enters the controlled member parameter.

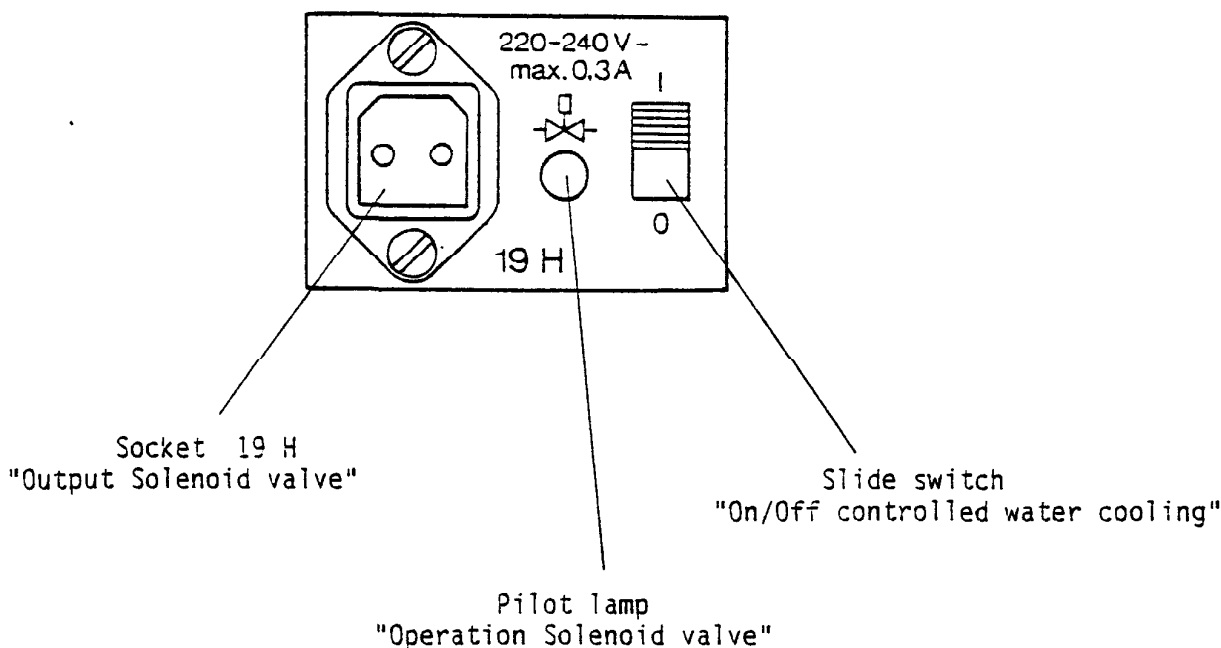
- 9.11.2 When used as external measuring point the display can be switched to the external measuring value by pressing the push button switch "DISPLAY" (). The connected resistance thermometer can be adjusted with the potentiometer  .
The easiest way to do this is to dip the external used resistance thermometer into the thermostatic bath and to adjust the external display according to the internal display.
- 9.11.3 The commutation to external control (cascade control) is achieved by pressing the push button switch  . Simultaneously the bath controller is switched from PID to PD, so that in the cascade only the integral part is active.
- 9.11.4 The control parameter of the EXT master controller are adjusted to $T_n \approx 40$ sec at unpressed push button switch (2), the controller amplification K_p (back) to 1. When using slow consumers with e.g. thick and bad stirred products, it is advisable to adjust the reset time T_n to 220 sec (position 1, push button switch pressed). Just as advisable can be to switch the amplification K_p to smaller values, e.g. to 0.5 or 0.2.
- 9.11.5 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. During the starting period this correction value can be very high, e.g. 200°C, when using slow consumers. Without limitation of correction value a variety of thermal overstress can occur, e.g. bath liquid starts boiling, flash-point is exceeded, temperature falls below freezing point, overtemperature switch off point is exceeded, product is thermal overloaded etc.

Additionally the behaviour during the starting period is improved. This limitation of correction value can be adjusted at the potentiometer  at the back of the R 400 controller. The basic adjustment is $+ 20^\circ\text{C}$. 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.

Note the block diagram in Section 3.6!

Connecting cable 42 S to LAUDA Pt 100-70, 72, 80, 82 Ref.No. UK 095

9.12 Operation with solenoid valve Module MV (optional)



When the R 400 controller is supplied with the Option MV one can work with controlled water cooling. Insert plug of solenoid valve into rear socket (19 H). The corresponding solenoid valve can be installed on the cooling coil as well as at a 1/2" water tap.

Although the installation on the cooling coil is quite common, the installation directly at the water tap has two major advantages: when the valve is closed the tubing is not pressurized. Therefore no pressure increase occurs when the valve is switched on and the danger of bursting is definitely smaller. **Use hose clips!**

Turn slide switch to I on the back of the unit.

When operating with controlled cooling the solenoid valve clocks with a time period of approx. 5 sec. Reduce water supply as much as possible. This ensures better control and saves cooling water.

Important Note!

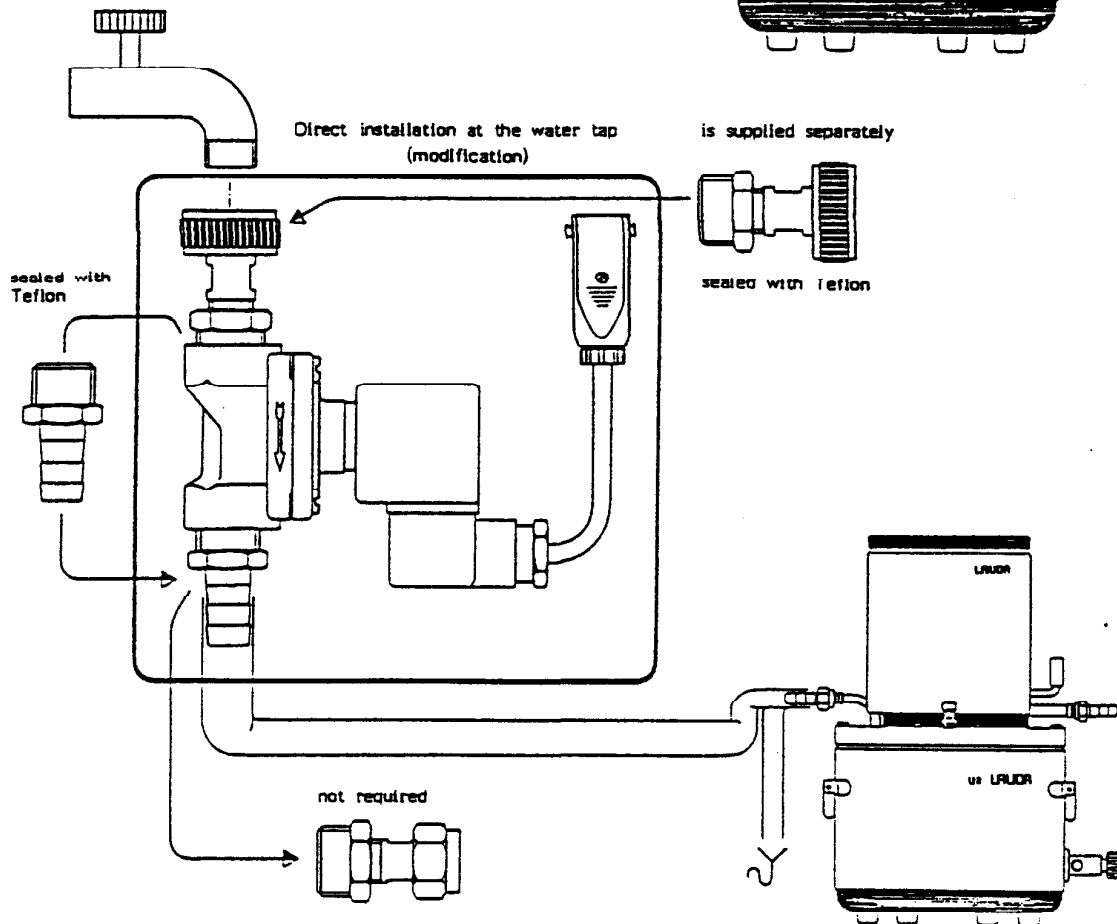
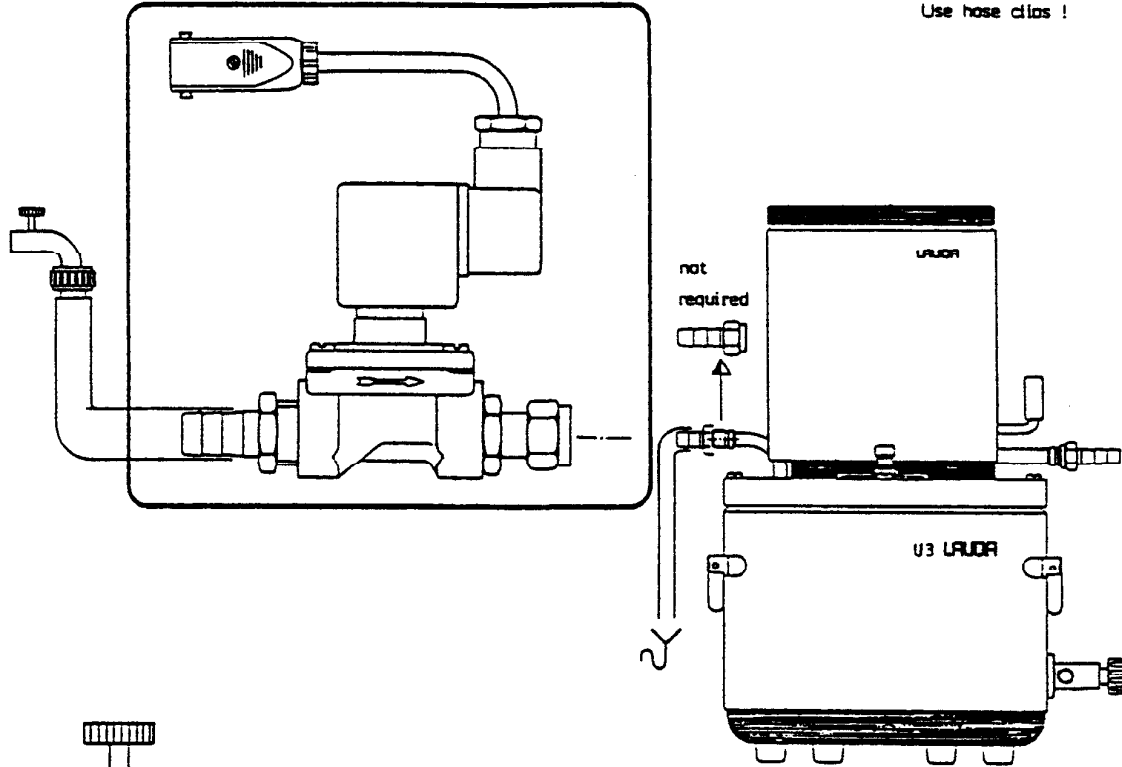
Ensure that the discharge from the cooling coil is open, especially when working at operating temperatures above 100°C. Steam formation! The use of controlled cooling is especially helpful for the introduction of exothermal reactions or programmer operation.

Connection plug for competition model solenoid valve Ref.No. EQS 005

Connection instruction for solenoid valve

Direct installation on the cooling coil (as supplied)




Note !
Use hose clips !



9.13 Safety circuit


The operation of the safety devices in the unit has already been described in Section 4.2.

After the unit has been started up it is advisable to check the correct operation of the safety devices to DIN 12879.

- 9.13.1 Correct operation of the low-level protection requires satisfactory indication of the level. This can be checked by changing the level in the bath by draining some of the liquid or adding more liquid. The indication must follow these changes. If the selector switch for the level cut-out is set to the same position as the level indication the yellow LED "fill up" lights up. Setting to a higher position, or in the case of "max" level to "T" (Test) causes the red fault lamp to light up and an audible signal is produced. Pump and heating are switched off on all poles. For restarting: set the low-level cut-off point below the level indication and press the push button "Reset"  .
- 9.13.2 To check the overtemperature protection  lower its switch-off point slowly. As soon as the setting is below the value shown on the digital thermometer the unit must switch off as explained under 9.13.1. Move the switch-off point back above the bath temperature and operate the push button "Reset"  .
- 9.13.3 If the checks under 9.13.1 and 9.13.2 do not operate correctly the unit must be shut down immediately and checked by a technician, otherwise safe operation cannot be guaranteed.

10. Multifunction output

15-pin connector 42 S at the back of R 400 with multiple function.

- Contact 1: recorder connection for bath temperature, correct sign; 10 mV/°C; $R_i = 100 \text{ Ohm}$; internal recorder resistance $\geq 1 \text{ MOhm}$ (0 V contact 3)
- Contact 2: Pt 100 EXT, 4-wire circuit, neg. current
- Contact 3: 0 V reference potential for signals
- Contact 4: Programme or external setpoint input 10 mV/°C, added to setpoint selected internally. Sum is indicated with push button . $R_i = 24.6 \text{ kOhm}$ (0 V contact 3).
- Contact 5: 12 V if fault light flashes, i.e. operating temperature is more than 5°C above setpoint. $R_i \approx 10 \text{ kOhm}$, $I_{\text{max}} = 1 \text{ mA}$ (0 V contact 12)
- Contact 6: Setpoint output 10 mV/°C, $R_i \approx 100 \text{ Ohm}$. Load resistance $\geq 10 \text{ kOhm}$ (0 V contact 3)
- Contact 7: +12 supply, max. additional load 20 mA
- Contact 8: Reference voltage 10 V $\pm 0.1\%$. Load resistance $\geq 10 \text{ kOhm}$ (0 V contact 3)
- Contact 9: Pt 100 EXT; 4-wire circuit, neg. potential
- Contact 10: -12 V supply, max additional load 20 mA (0 V contact 12)
- Contact 11: Pt 100 EXT; 4-wire circuit, pos. current
- Contact 12: 0 V load reference potential
- Contact 13: 12 V when fault lamp shows red continuously, i.e. safety circuit to DIN 12879 is activated. $R_i \approx 10 \text{ kOhm}$; $I_{\text{max}} = 1 \text{ mA}$ (0 V contact 12).
- Contact 14: recorder connection for external temperature, correct sign, 10 mV/°C; $R_i \approx 100 \text{ Ohm}$; internal recorder resistance $\geq 1 \text{ MOhm}$ (0 V contact 3)
Signal available only with built-in EXT module!
- Contact 15: Pt 100 EXT; 4-wire circuit, pos. potential

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

15-pole mating connector
Case for above

Ref. No. EQM 030
Ref. No. EQG 017

11. Maintenance

- 11.1 LAUDA Ultra Thermostats operate largely without maintenance. Contaminated bath liquid should be drained through the drain cock and replaced by fresh liquid.
- 11.2 If the pump head or the controller R 400 should become defective it is recommended to contact your next service department (sales office).
- 11.3 For cleaning the bath the cover plate can be removed from the bath container completely.

Separation of the pump head from the cover plate:

After loosening the four screws M 3 at the rear of the unit the pump case can be pulled off. Remove the 4 nuts M 4 from the stud bolt. Now the pump with heater etc. can be removed from the cover plate.

Important Note:

Before opening up the cover of the upper part of the pump or the R 400 controller pull out the line supply plug!

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

LAUDA DR. R. WOBSEK
GmbH & Co KG

LAUDA Ultra-Thermostats
UB 20 F, UB 20 J, UB 30 J, UB 40 J

Accessories for LAUDA Thermostats (rectangular form)

Type	Ref. No.
<u>Module EXT-external controller</u>	LRZ 903
In connection with Pt 100 to DIN 43760: temperature indication of the external system, control of the thermostat bath temperature according to the temperature of the external system (cascade control)	
<u>Module MV solenoid valve actuator</u> for clocked cooling water control	LRZ 002
<u>Solenoid valve for module MV</u> installation either on cooling coil with thread M 16 x 1 or water tap 1/2"	UD 085
<u>Triac actuator R 17</u> for the installation of additional heaters up to 3 kW capacity. The heater must be checked from case to case. Additional heater controls the heater of the unit.	LRT 012
<u>RS 232 C interface R 61</u> serial interface for transfer of temperature and alarm signals from the multifunction output to the computer and vice versa.	LRT 001
<u>19" adaptor for rack mounting of the</u> operating unit R 400. 3 HE	LRZ 004
<u>Programmer PM 351-1</u> Microprocessor controlled programmer with 50 program segments max. and a program range of 350°C for individual programming of temperature courses. Programmable control of range of tolerance. External controllable start, stop and reset function.	LRP 012
<u>LAUDA digital thermometer</u> for a temperature range of -200 ... 800°C with 0.1 or 0.01°C resolution. Pt 100 in accordance with DIN 43760 as measuring probe. Also available with degree-Kelvin, indication of temperature difference, and maximum value and minimum value register memory.	
Rotary racks for Calibration Thermostats on request.	

