

OPERATING INSTRUCTIONS # 149

LAUDA/BRINKMANN CIRCULATOR

All Models In The K-4/R Series

(Please read notes on this page)

- CAUTION:
1. This circulator is designed for normally supervised laboratory use. If unattended or over-night operation is required, a suitable back-up safety system should be used in order to prevent possible secondary damage due to leakage or uncontrolled heating. BRINKMANN INSTRUMENTS cannot assume liability for damage to the circulator or the laboratory in which it is located, beyond the replacement, within the warranty period, of defective components as specified in paragraph II.
 2. In order to avoid damage to the compressor and eliminate an excessive starting current which may result in a blown fuse, the compressor should not be turned on for at least 15 minutes after having been turned off. This time interval will permit the Freon to reach the pressure which is needed for a proper start-up.

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PLEASE NOTE: This manual covers models K-4/R and K-4/RD. The term "K-4/R" as used in the text refers to both models. Differences in specifications and spare parts are indicative wherever applicable.

I. UNPACKING

Please check the packing material carefully to be sure that all components have been received and that nothing is accidentally discarded. The following items must be received:

- identifying numbers refer to Fig.1, page 2 -

- (1) Bath housing with built-in pump and controls
- (1) Thermoregulator (contact thermometer)-35 to +105°C — (1)
with
Metal sleeve for above — (2) and
Rotating magnet in plastic housing — (3)
- (1) Control (reading) thermometer with tapered joint connection — (4)
- (1) Piece of hose for temperatures to 150°C (not illustrated)
- (1) Cover for access opening (mounted) — (5)

Any shortage or damage must be reported to your supplier within 7 (seven) days after receipt — see paragraph II.

II. WARRANTY

In lieu of other warranties, either expressed or implied, all LAUDA constant temperature circulators are unconditionally guaranteed for repair or replacement of all parts (except tubes and thermometers) which become defective due to manufacturing defects or faulty materials, for a period of one year from date of delivery. This warranty is effective only if the instrument is returned to our plant at Westbury, N.Y. for examination and repairs, and becomes void if the equipment has been tampered with unless specifically authorized by us. Damage resulting from misuse of the equipment is not covered by this guarantee, neither will we be responsible for secondary damage due to continued unsupervised use of equipment which has become partially defective. Damage incurred during shipment must be reported to the carrier immediately since an inspection is essential to the settlement of any claim. All packing materials must be retained until their disposal is authorized by the carrier or his representative.

III. OPERATING INSTRUCTIONS

- A. Fill in water to maintain level approximately 1 inch below top of bath. The circulating liquid should be poured into the reservoir within one inch of the top. Since a certain amount of liquid will be required for the external circulating system, the level should be checked after the first few minutes of operation. The cover may then be replaced.

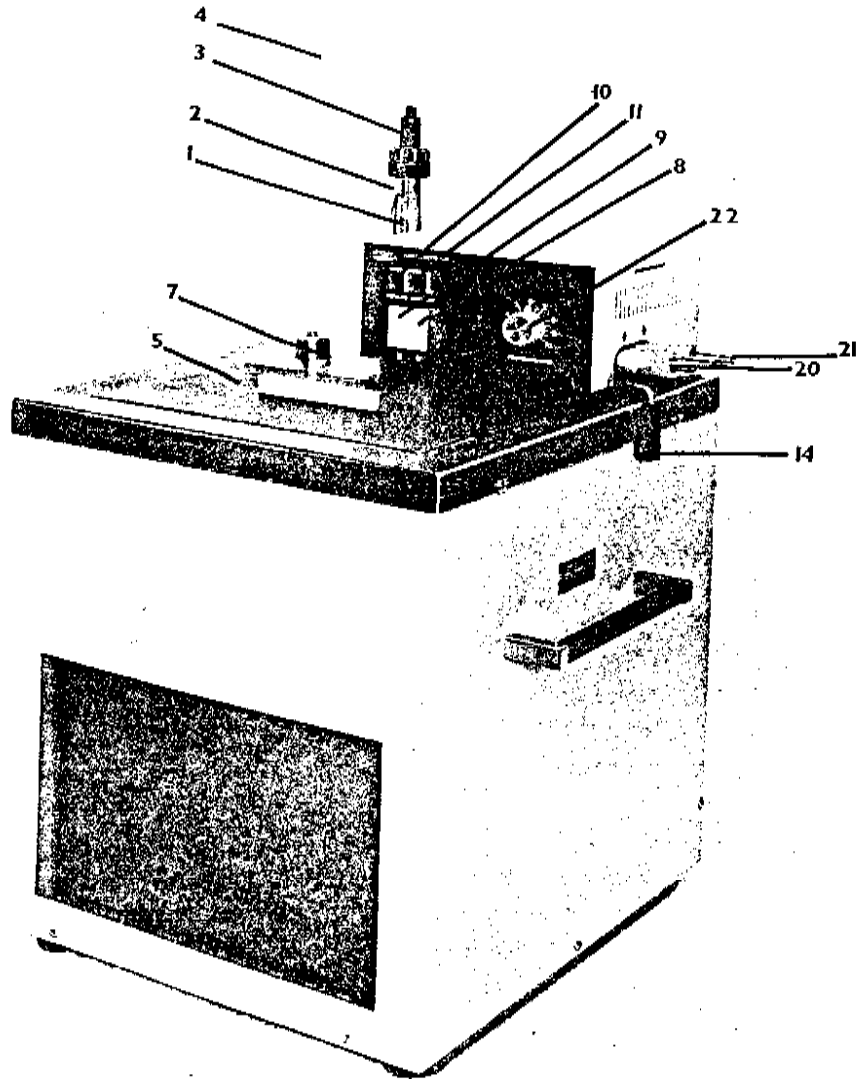


Figure No. 1

K-4/R Front and Side View

- 1 - Contact thermometer (thermoregulator)
- 2 - Sleeve
- 3 - Rotating magnet
- 4 - Control thermometer (reading thermometer)
- 5 - Bath cover
- 7 - Tapered opening for control thermometer
- 8 - Sliding switch (compressor)
- 9 - Sliding switch (circulator)
- 10 - Heater indicating light
- 11 - Compressor indicating light
- 14 - Control valve lever
- 20 - Pump nozzle OUT
- 21 - Pump nozzle IN
- 22 - Proportioning control

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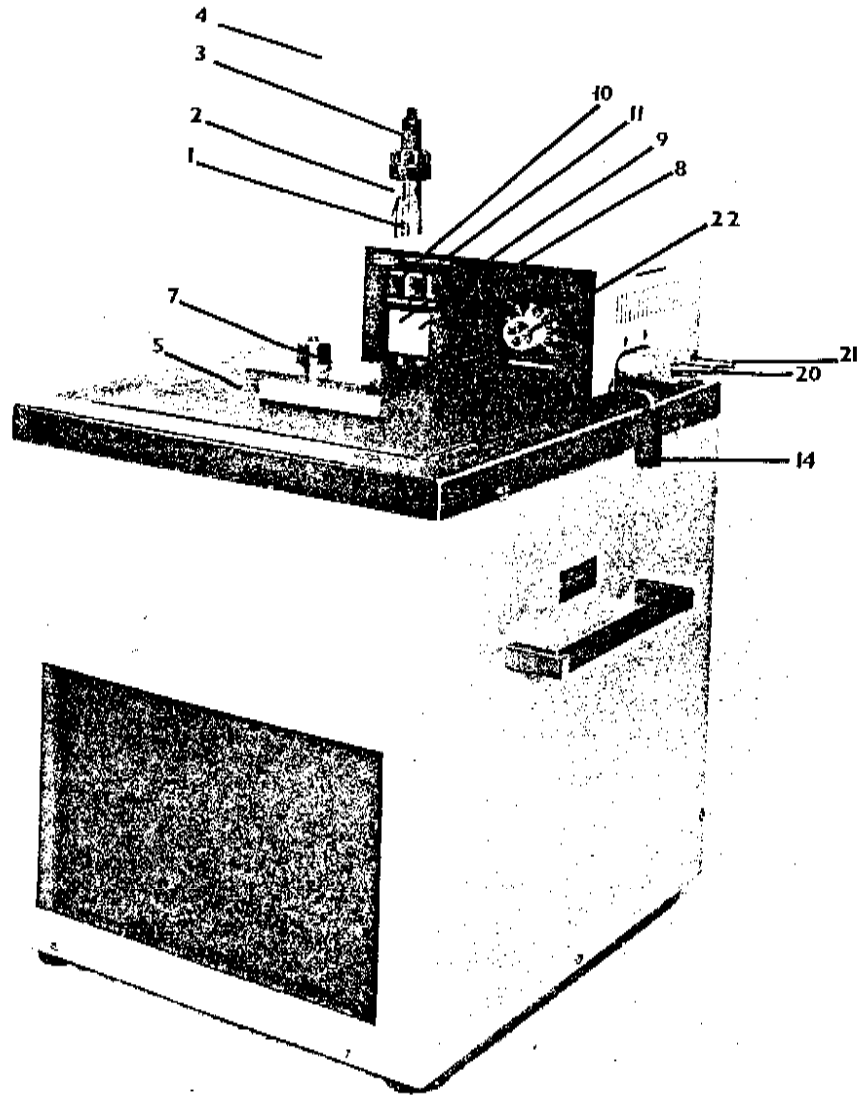


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- B. For external circulation connect circuit hoses to OUT nozzle (20) and IN nozzle (21). After the instrument has been turned ON and liquid has been circulated through the external system, the internal level should be checked and additional liquid should be added as may be required (see "A" above). The K-4/R is designed for external circulation through a closed system only. It is not recommended that this circulator be used for circulation through an open bath or reservoir although this is possible if the external bath level is sufficiently above that of the K-4/R in order to permit a continuous gravity return. In this case, the control valve (14) must be adjusted in such a way that the pumping rate will not exceed the gravity return rate.
- C. Without external circulation — Connect a short piece of hose across nozzles 20 and 21. This connection is necessary because the amount of internal agitation is directly related to the flow rate through the above-mentioned nozzles as controlled by lever 14.
- D. Supplementary Instructions for K-4/R Series Circulators which are equipped with Duplex Pumps (K-4/RD)

Duplex pumps consist of separate pressure and suction sections which are connected to one and the same motor. The suction section operates continuously at its maximum flow rate. The rate of liquid which is pumped out by the pressure section is continuously regulated by a float-operated valve which will increase or decrease the output in order to maintain a constant level within the internal reservoir. For additional information on the operation and performance of Duplex pumps, please read the following paragraphs:

- a. This pump can be used both for circulating in a "closed" circuit, through an external, jacketed appliance, or for circulating through a "broken" circuit such as an open water bath. In the latter case, the open ends of the two hoses from the circulating nozzles are merely immersed in the liquid of the open bath; return to the circulator is accomplished by the suction state of the pump. To balance possible variations between the pressure and suction stages, the pump is equipped with a floating valve regulator which controls the amount of liquid flowing out of the circulator; thus maintaining a constant niveau (level) in the circulator within an accuracy of ± 1 mm. The external (open) bath may be mounted 1 meter higher or lower than the circulator without disturbing this relationship.
- b. When first placing the system in operation, fill the ex-

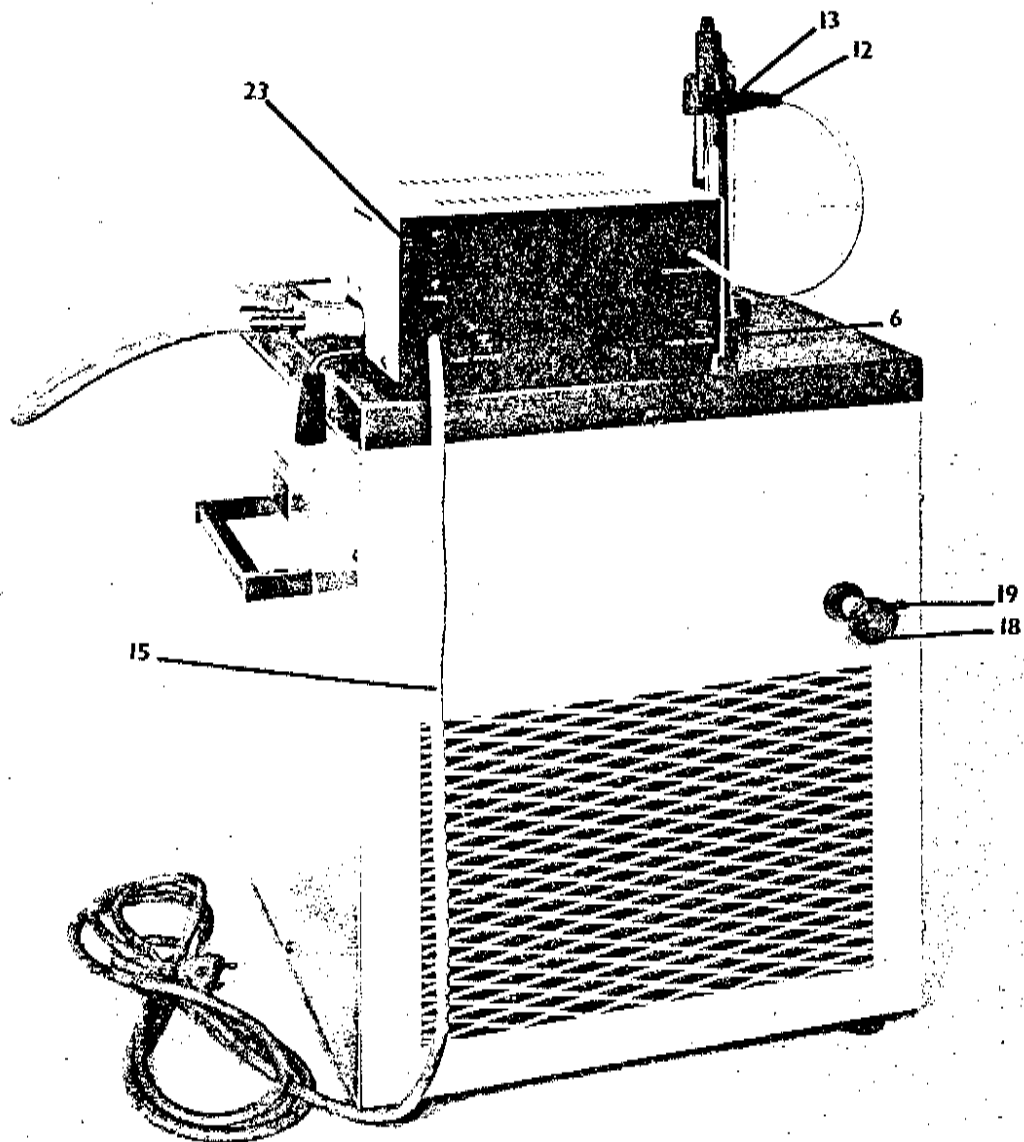


Figure No. 2

K-4/R Rear View

- 6 - Opening for metal sleeve
- 12 - Female plug of connecting cable
- 13 - Male receptacle on contact thermometer
- 15 - Line cord
- 18 - Drain valve knob
- 19 - Drain valve nozzle
- 23 - Female receptacle for R20/K connecting cable

ternal bath to the desired height. The circulator maintains its own level and the external bath must be filled accordingly.

- c. The front nozzle of the pump is the pressure side and the rear nozzle is the suction side. If an open bath is tempered by simply immersing the open ends of the hose in the external bath, it is advisable to cut the hose end at a slant (diagonal cut) to eliminate any possibility of the suction hose attaching itself to the inside of the tank wall (by suction) and cutting off the return flow of liquid.
 - d. Trouble-free circulating operation can only be guaranteed if the circulated liquid does not have a viscosity higher than 50 cP at 20°C.
 - e. The flow-control valve is not as effective on the Duplex pump as on the Simplex version because of varying forces in the pressure and suction side and because of the floating valve. Therefore, with the Duplex pump, this valve should normally be open (pushed to the front) or closed (pushed to the rear). Generally, this is not a disadvantage because even when circulating through a small external system (capacity 1 liter), there is no evidence of a violent reaction (waves) in the external bath.
 - f. If a system with a Duplex pump is used for circulating through a closed circuit (refractometer, spectrophotometer, viscometer, etc.), the liquid in the circulator must be filled within 30 mm (1-1/2") of the top. Otherwise, the rate of circulation may be restricted by the floating valve in the pressure side. This valve closes as the bath level falls. If the liquid level is insufficient, it will continue to stay closed in an effort to suck liquid out of the other side of the circuit. Do not forget that liquid fills the hose circuit which may require that some refilling of the bath is necessary. Ideally, for closed circuit operation, the floater of the pump in the bath should be as close as possible to the top of the circulator tank.
- E. Adjust lever 14 for the rate of flow which is required. Flow rate is zero when the lever is on the extreme right; do not select maximum flow rate until circulator has been turned on.
- F. Install metal sleeve (2) for thermoregulator in opening (6) provided and push down firmly. End of sleeve closest to center of cut-out for scale must be at top.

- G. Install thermoregulator (1) by gently but firmly pushing it into sleeve. Push down as far as it will go. Then connect two-prong plug on line from left side of circulator to connectors on thermoregulator. Now, mount rotating magnet in housing (3) on top of thermoregulator and adjust temperature setting on scale by rotating magnet (see para. IV.).
- H. Install reading thermometer (4) into tapered opening (7).
- I. Connect three-prong plug attached to end of line cord (15) to a 115 V A.C., 60 cycle outlet, fused for a minimum of 15 amps.
- J. The circulator can now be turned "ON" with sliding switch (9) down. In this position a red dot on the top of the switch will be exposed. For operation above 40°C the compressor switch (8) should be in the OFF position. At all temperatures below 40°C this switch should be ON.
- K. The K-4/R is equipped with a solid state triac controlled electronic relay which also includes a wattage proportioning control (22) and a noise suppression circuit. The proportioning control can be set for 20-100% of the maximum rated output (750 Watts). For initial heat-up or maximum heating, the proportioning control should be set to 10 (100%). When the circulator cycles at its operating temperature, as indicated by the heater light (10), the control accuracy can be increased by reducing the proportioning control to a setting at which the ratio of heating vs. non-heating cycles is approx. 1:2. If the proportioning control is set too low, the heater will stay on continuously because the wattage output will not be high enough to overcome the cooling effect of the refrigeration system which is operating at all times. Very brief and infrequent heating pulses are indicative of a proportioning setting which is too high, and thus, results in excessive temperature variations.

IV. USE OF THERMOREGULATORS

- A. Setting the Temperature (control point) — Proceed as follows:
 - 1. After loosening the locking screw on the magnet housing, place the magnet on top of the contact thermometer.
 - 2. On the upper (exposed) scale of the thermoregulator, there is a small horizontal black bar which moves up or down on a spindle depending on the direction in which the magnet is rotated.
 - 3. Rotate the magnet in the desired direction until the top of the moving bar is approximately level with the desired temperature on the scale. Clockwise rotation increases the set point; counter-clockwise rotation lowers the temperature. One complete turn on the standard -35/+105°C thermometer is equal to a change of approximately 0.5°C. Then lock the magnet with screw; not too tight.

4. After putting the bath in operation, the temperature will stabilize near the set point. However, some adjustment is usually necessary since the operating temperature may be 1°C above or below the desired temperature. To assist the user, each magnet housing is calibrated and the change in temperature, per division of rotation, can be determined with the particular thermoregulator being used. On the thermoregulator -35/+105°C one division on the magnet scale represents a temperature change of approximately 0.05°C. In adjusting the thermoregulator, the switching point (point at which the operating temperature exactly equals the set temperature) can be determined visually with the aid of the signal lamp (10). When heating is required, this lamp is "ON".
5. For operation at temperatures above 100°C, we now deliver only the longer stem thermoregulators which must be used with the long metal support sleeve. This was done because experience has shown that if the scale is left in the bath liquid at high temperatures, the mercury may be distilled only to condense again at a higher, cooler location. This shortens the mercury column of the thermoregulator (breaking contact) which causes the system to call for heat while the actual temperature climbs steadily beyond the control point. By mounting the scale above the bath liquid, this problem has been eliminated on our baths.
6. When not in daily use, always set the thermoregulator above room temperature (if possible). This prevents continuous contact between the contact wire and the mercury column.

B. Trouble Shooting the Thermoregulator

It is possible that due to shock encountered in transportation, the mercury column in the thermoregulator has separated. To remedy this, proceed as follows:

1. Rotate the magnet until the reading bar on the face of the thermoregulator is above the scale.
2. Carefully heat the mercury bulb of the thermometer over a small flame until the mercury column rises into the excess temperature collector, between upper and lower scales, where it will rejoin.
3. Cool thermometer slowly. If mercury does not rejoin, it may be necessary to heat again until it collects in the neck between the two scales. Then tap bulb of thermometer on a soft padded surface and shake out manually.

C. Testing Defective Thermoregulator

If the circulator does not function correctly - heater does not begin to operate and system does not maintain temperature - , the thermoregulator may be defective. To test, proceed as follows:

1. Disconnect cable and plug (12) from receptacle on thermoregulator.
2. Short circuit the connecting plug (12) by inserting a piece of wire. The signal lamp (10) must go off. If it does not go off and does not disengage the heater, the defect must be in the control circuit.

V. USE OF R20/K AND PT-12

A. Description

The use of the above accessories, as shown in Ill. 3, permits a more convenient method of changing the temperature setting than is possible with the contact thermometer. The R20/K — PT-12 system offers the further advantage of permitting the K-4/R to be programmed with the P-120 Program Controller which can only be used in conjunction with R-20 digital temperature controllers.

B. Theory of Operation

The R20K is a bridge-circuit controller in which the resistance of the probe (PT-12) and adjustable internal resistor are compared. The Resistance of this circuit is based on the international standard value of 100Ω at 0°C . In setting the temperature of the R20K one changes the resistance to that which the PT-probe will have at that temperature.

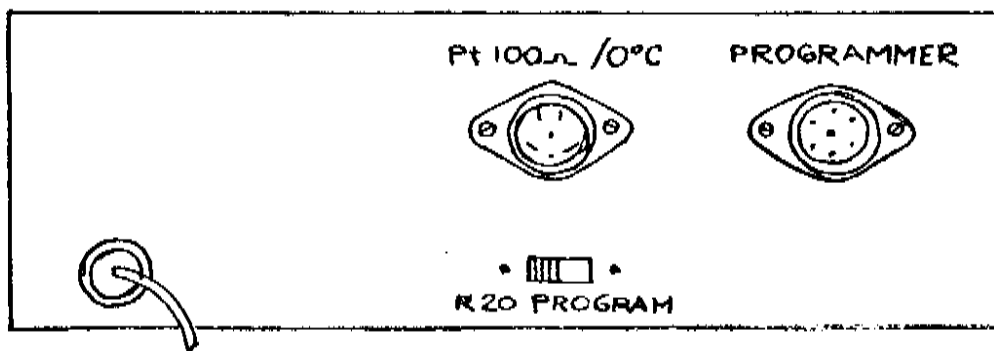


Figure No. 3
Rear View of R20/K

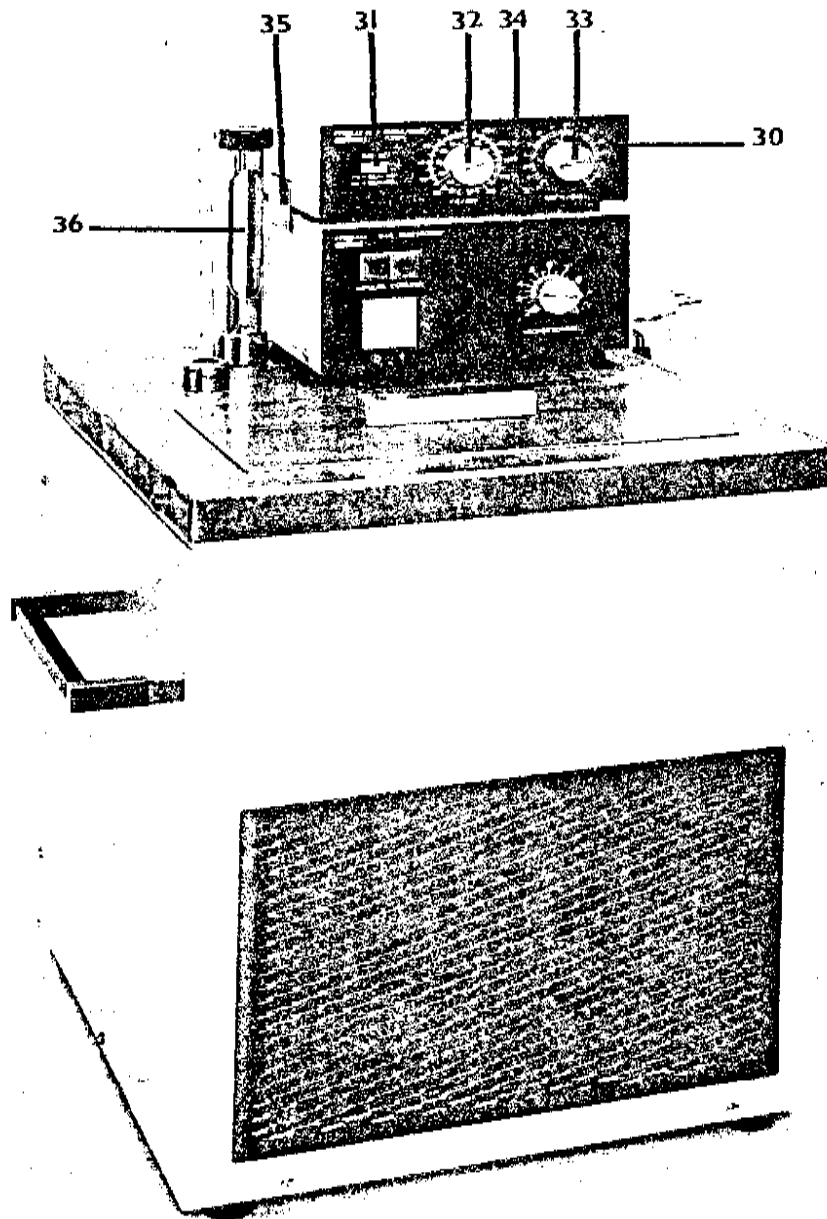


Figure No. 4

K-4/R with R20/K and PT-12

- 30 - R20/K
- 31 - Range switch
- 32 - Coarse temperature control
- 33 - Fine temperature control
- 34 - Calibration adjustment
- 35 - Clamp(s)
- 36 - PT-12 thermometer

C. Connection

1. Place the R20/K (30) above the relay of the K-4/R
2. Push gently on the R20/K and insert the two clamps (35) - then release pressure on the R20/K
3. Insert plug (37) into receptacle (23)
4. Insert PT-12 (36) into sleeve (2)
5. Using cable supplied with the R20/K, connect male receptacle at the top of PT-12 to receptacle PT 100 Ω /0°C on R20/K (38).
6. No connections are made to receptacle PROGRAMMER (39) and plug on contact thermometer cable (12).

D. Operation

1. Set switch (40) to R20
2. Set switch (31) to proper range - it should be in the depressed position for the range +50 to +150°C.
3. Set fine control (33) to 0
4. Set coarse control (32) to proper temperature
5. When the intermittent flashing of light (10) indicates that the preset temperature has been reached, the exact temperature should be read on the control thermometer (4) and a final adjustment made on the fine adjustment (33).
6. Internal calibrating adjustments to compensate for minor temperature differences can be made with the control (34). Set control (33) to 0, control (32) to the actual temperature of the bath and adjust control (34) until the light (10) flashes, indicating that the control point has been reached.

VI. OPERATION IN VARIOUS TEMPERATURE RANGES

- A. The K-4/R is equipped with contact and control thermometers which cover a range of -35 to +105°C. If this circulator is to be used at temperatures above or below the above-mentioned range, it will be necessary to obtain additional thermometers which are listed in the Lauda catalog. PLEASE NOTE that adjacent to each contact thermometer, we list the length of the metal protecting sleeve with which it must be

used. The K-4/R comes equipped with a short sleeve; such a sleeve should not be purchased at the same time. In lieu of additional thermometers, it may be more convenient to use a platinum resistance thermometer with the R20/K temperature controller.

- B. Below +10°C — We recommend a 50:50 Methanol/water mixture. Please use distilled water only. Switches (8) and (9) must be in the ON position. For external circulation we would recommend the use of our foam-rubber insulated silicone hose, cat. no. 27 59 200-7.
- C. From +10 to +40°C — We recommend the use of distilled water. Operation is the same as listed under "B" above.
- D. From +40 to +95°C — We suggest the use of distilled water. The compressor switch (8) must be in the OFF position. For external circulation we recommend our perbunan hose, cat. no. 27 59 100-1.
- E. From +95 to +150°C — We recommend the use of special liquids as listed in paragraph VII. The compressor switch (8) must be left in the OFF position at all times. For external circulation use perbunan hose cat. no. 27 59 100-1.

VII. RECOMMENDED CIRCULATING LIQUIDS

- A. Distilled water (+10 to 95°C)
- B. Methanol (-70 to 50°C) — Although Methanol is toxic, we do recommend its use if it is handled with reasonable care. For operation from -10°C to ambient, it may be used diluted with water on a 50/50 basis.
- C. Ultra-Therm 250 W (+20 to +250°C) — Cat. No. 27 57 010-1 — Our own mixture. A hydrocarbon oil which is water soluble for easy exchange. It is not transparent and has a distinct brown/green color.
- D. Silicone oils (-30 to +150°C) — a phenyl-methyl silicone oil but one having a very low viscosity of 5 cST at 20°C.
 - 1. Type SK Frigor (-60 to +120°C) — Cat. No. 27 57 100-0
 - 2. Type SK Super-Frigor (-50 to +160°C) — Cat. No. 27 57 110-7

VIII. SUGGESTED HOSES FOR EXTERNAL CIRCULATION AND MISC ACCESSORIES

- A. Foam-rubber insulated silicone hose, 8 mm i.d., 30 mm o.d., Cat. No. 27 59 200-7

XI. SERVICE

A. Refrigeration

Compressor	Copeland FDAL
Refrigerant	Freon 12 - approx. 6 psi
Suction pressure	approx. 4-5 psig after approx. 20 min. of operation. Then pressure will go down to approx. 7 in. of vacuum at -30°.

B. General

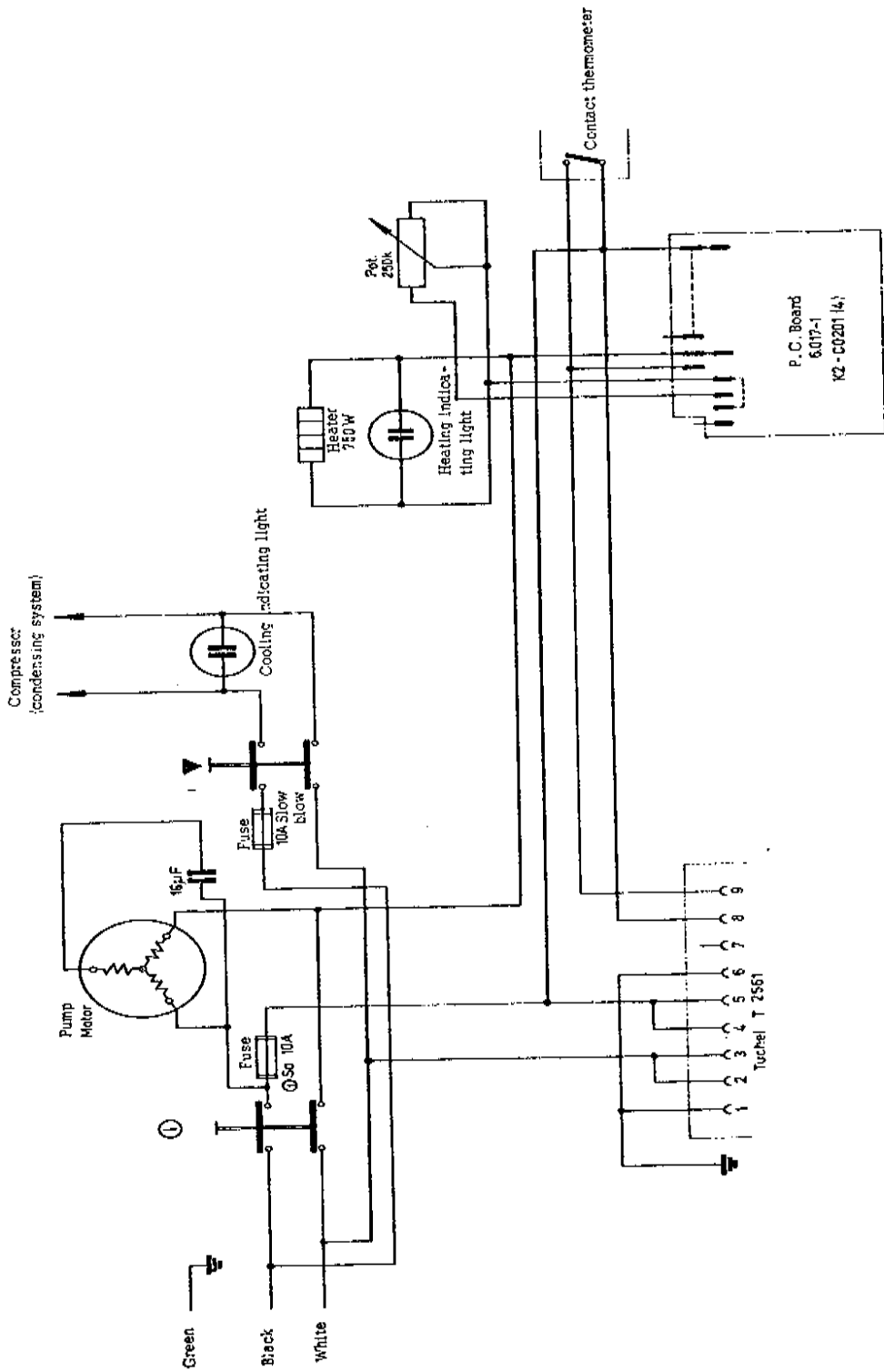
Any Lauda constant temperature circulator, or component thereof, may be returned to our shops in New York for service, overhaul or replacement of parts.

For information, contact:

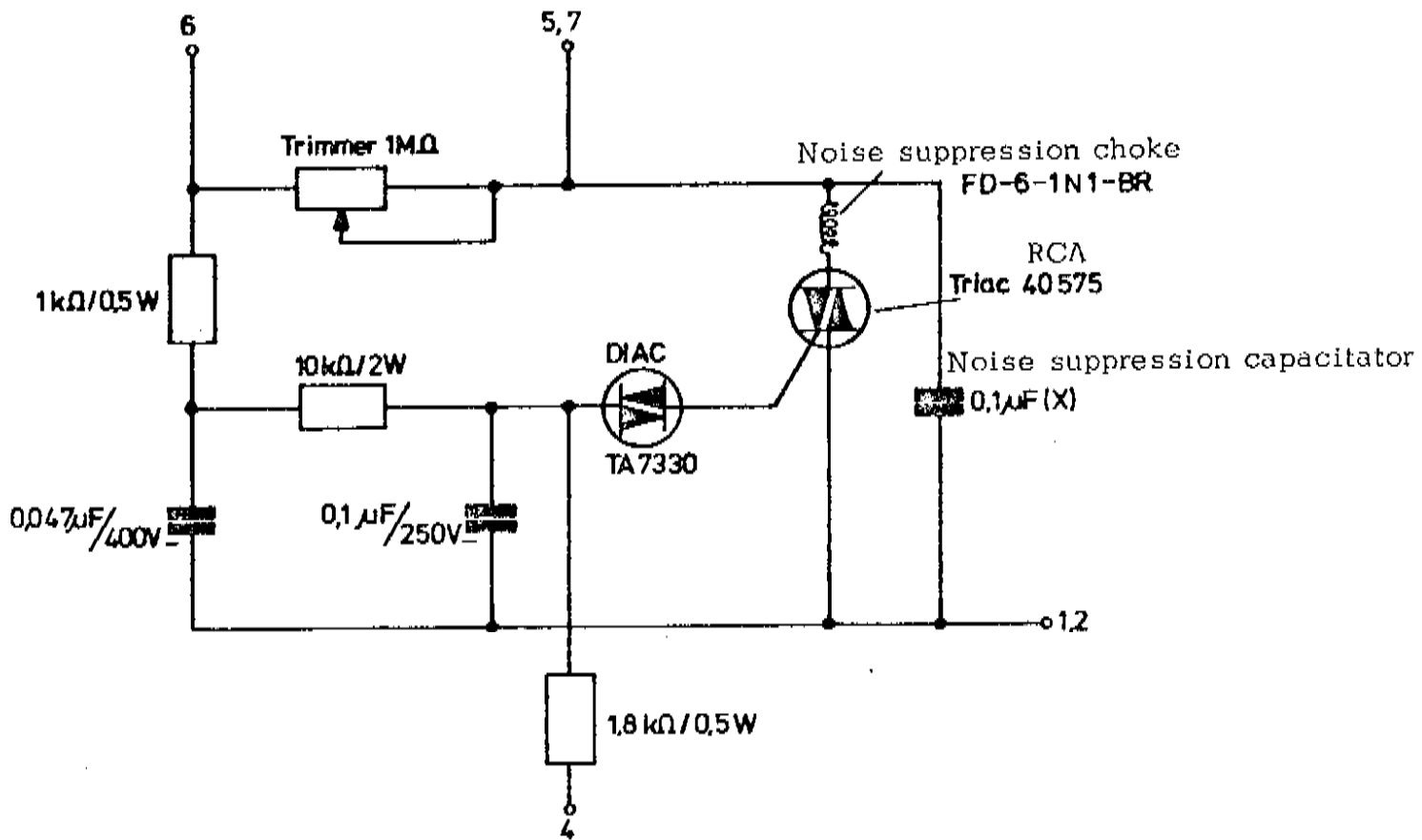
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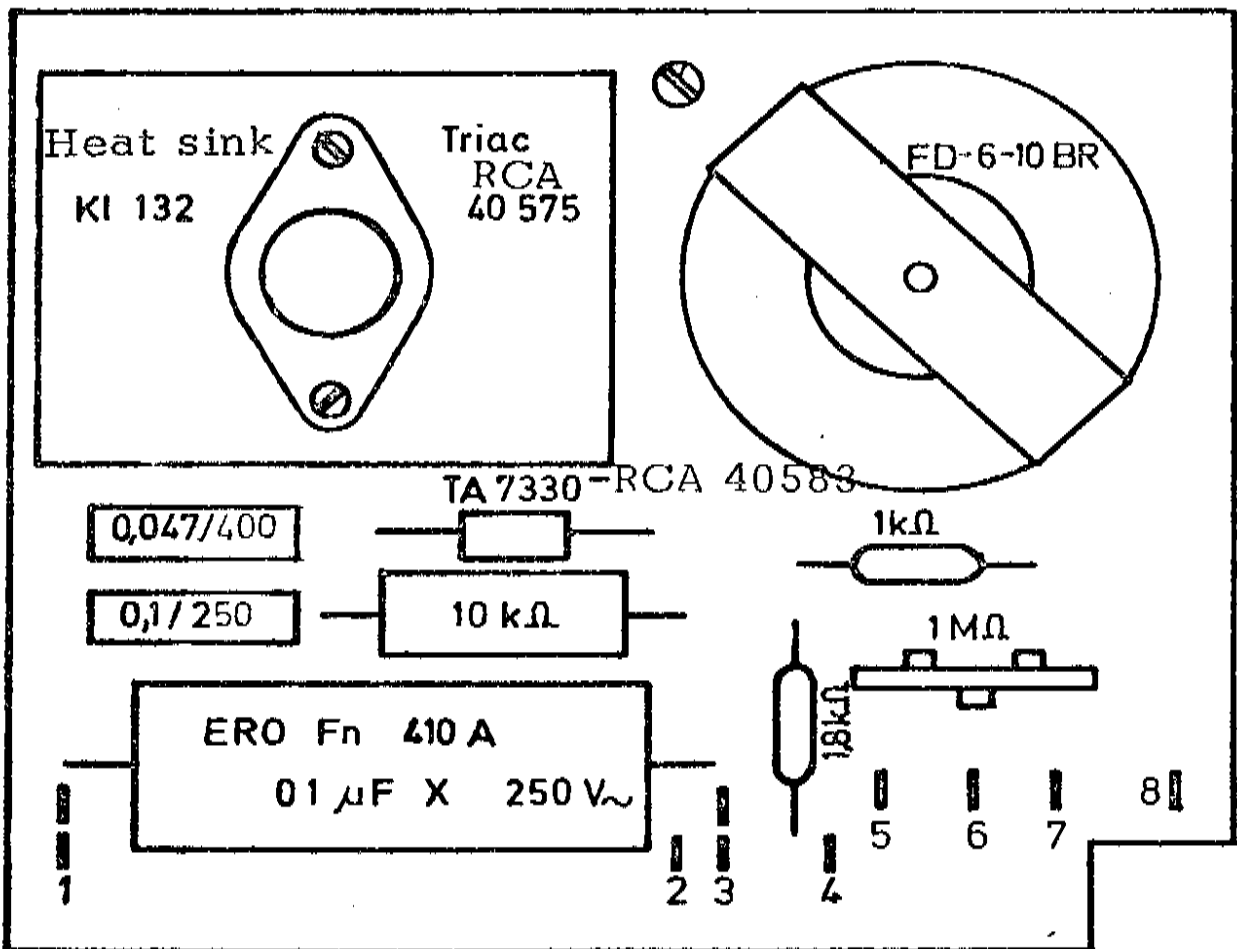
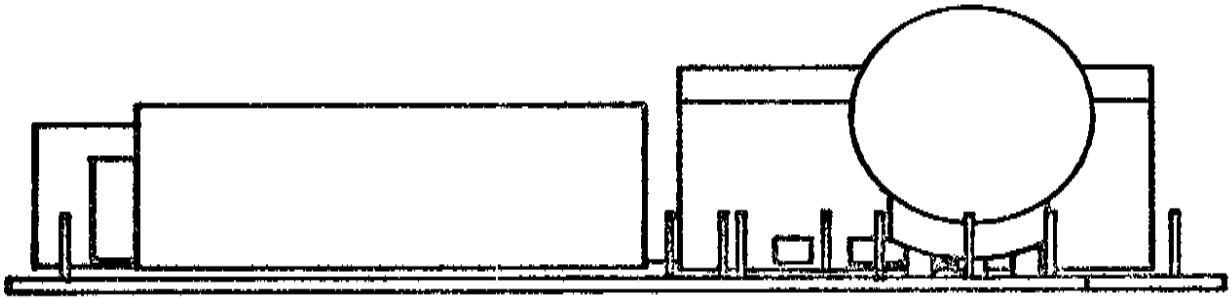
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Cantiague Road
Westbury, New York 11590



K-4/R WIRING DIAGRAM



WIRING DIAGRAM P. C. BOARD 6.017-1
 Figure No. 6



PICTORIAL DIAGRAM P.C. BOARD 6.017-1

Figure No. 7