Thermo Haake

Instruction Manual
Phoenix P1 Circulator
(V1.05)

Part No. 003-7634
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1. Key to Symbols

1.1 Symbols used in this manual

! Warns the user of possible damage to the unit, draws attention to the risk of injury or contains safety notes and warnings.

☞ Denotes an important remark.

1 Indicates the next operating step to be carried out and ...

⇒ ... what happens as a result thereof.

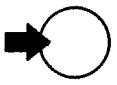
1.2 Symbols used on the unit (front)

Caution: Read the instruction manual before operating.

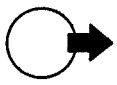
O Instrument in "off" position.

I Instrument in "on" position.

1.3 Symbols used on the unit (rear)



Pump connection: back flow (suction) from the external object.



Pump connection: pressure to the external object.

1.4 Symbols used on the display

ALARM — **ALARM** flashes and heater element, pump and if available, cooling circuit have been switched off. Any cause of the alarm is displayed in a second line.

Appears,
if heater is active and flashes during the control phase.

1.  if cooling is active with full cooling capacity.

2.  if cooling is active with partial cooling capacity.

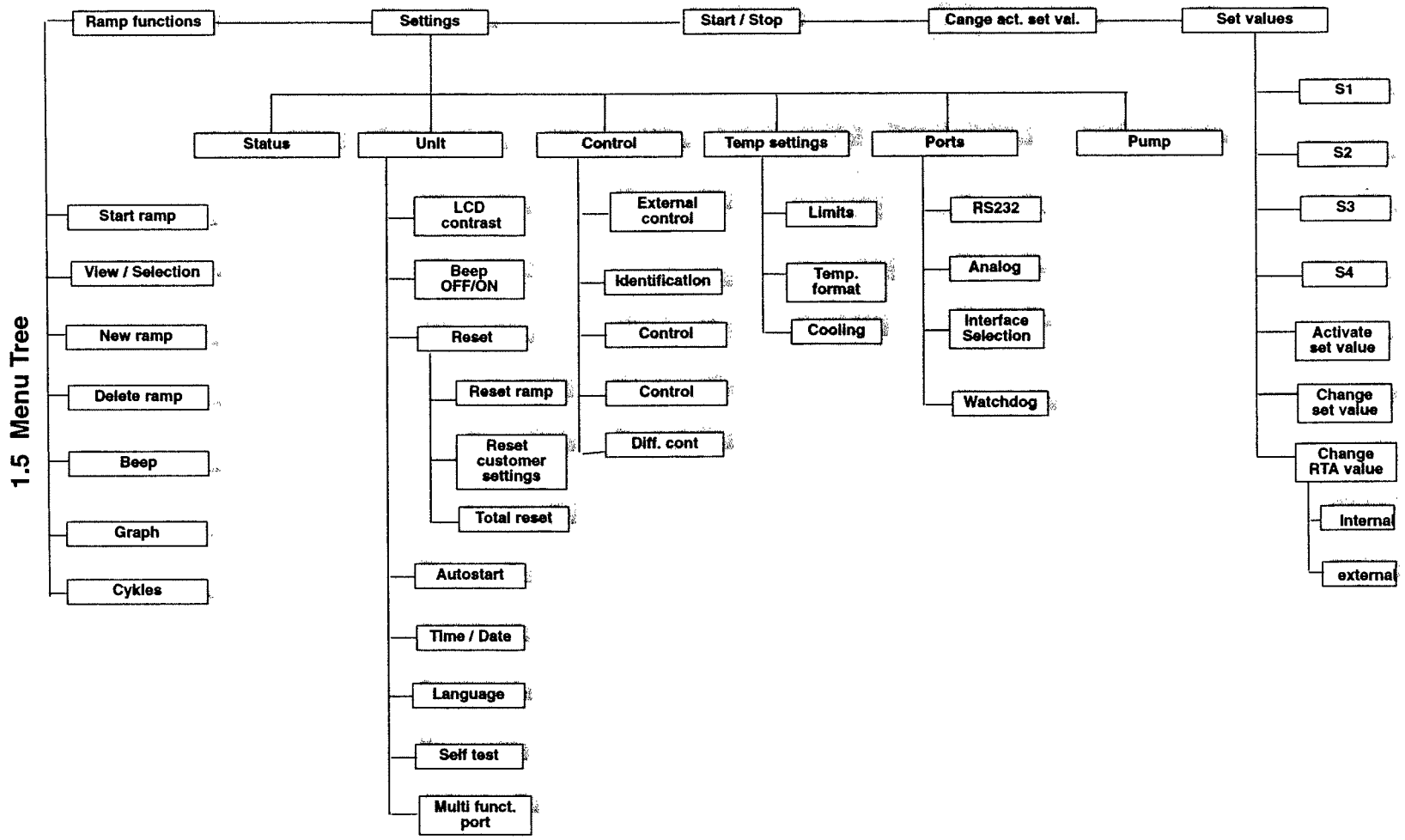
Star 1 and 2 are blinking alternately when the cooling is on.

The crossed out star is on when the cooling unit is off.

if ramp function is activated.

IDENT — **IDENT** flashes: After starting the control and after entering a new set temperature, the FuzzyStar® controller determines suitable control parameters. It can happen that heating or cooling is interrupted during this process and the displayed temperature changes. This is because the control unit requires some time to determine the parameters.
For this function the identification has to be activated ("Settings„ / "Control„ menu).

1.5 Menu Tree


Ramp functions
Settings
Start / Stop
Cange act. set val.
Set values
Status
Unit
Control
Temp settings
Ports
Pump
Start ramp
View / Selection
New ramp
Delete ramp
Beep
Graph
Cykles
LCD contrast
Beep OFF/ON
Reset
Reset ramp
Reset customer settings
Total reset
Autostart
Time / Date
Language
Self test
Multi funct. port
External control
Identification
Control
Control
Diff. cont
Limits
Temp. format
Cooling
RS232
Analog
Interface Selection
Watchdog
S1
S2
S3
S4
Activate set value
Change set value
Change RTA value
Internal
external

2. Quality Assurance

Dear customer,
Thermo Haake implements a **Q**uality **M**anagement **S**ystem certified according to EN 29001.
This guarantees the presence of organizational structures which are necessary to ensure that our products are developed, manufactured and managed according to our customers expectations. Internal and external audits are carried out on a regular basis to ensure that our **QMS** system is fully functional.
We also check our products during the manufacturing process to certify that they are produced according to the specifications as well as to monitor correct functioning and to confirm that they are safe. This is why we initiate this monitoring process of important characteristics already during manufacturing and record the results for future reference.

The "Final Test" label on the product is a sign that this unit has fulfilled all requirements at the time of final manufacturing.

Please inform us if, despite our precautionary measures, you should find any product defects. You can thus help us to avoid such faults in future.

3. Your Contacts at Thermo Haake

Please get in contact with us or the authorized agent who supplied you with the unit if you have any further questions.

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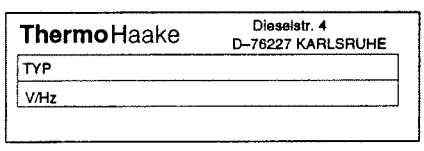


The following specifications should be given when product enquiries are made:

- **Unit name** printed on the front of the unit,
- **TYP** as specified on the name plate.
- **Version** of the operating software (see chap. 13.5.1).

4. Thermo Haake Test Certificate

This is to certify that the tempering device which you have acquired and to which these instructions for operation refer has been tested and equilibrated by Thermo Haake in compliance with the regulations of a certified Quality Assurance System according to DIN ISO 9001.

Testing for constancy of temperature has been carried out in keeping with DIN standard DIN 12876 for laboratory equipment. (follow–up standard to DIN standard 58966).

The measuring equipment used in the testing process is regularly calibrated and can be traced back to the national norms of the Physikalisch Technische Bundesanstalt (PTB) Deutschlands[1] or to other national norms. In those cases where there are no norms and standards on a national level, the testing process is in keeping with currently valid technical rules and regulations, norms and standards.

All required measuring data are listed on this page of the Test Certificate.

Measuring conditions

Ambient temperature:	+ 20°C
Power supply / –frequency:	230V ± 5V / 50 Hz
respectively	115V ± 5V / 60Hz

System parameters

Volume:	8 litre
Liquid:	Water
Rated temperature:	+70°C

Measuring process

Checking constancy of temperature in bath according to DIN 12876, part 2 (follow–up standard to DIN 58966, part 2, paragraph 4.3)

Measuring agent

Type of sensor used for measuring:	Quartz Inexactitude of measurement
according to DIN IEC 751	+/– 0,1 K

Test results

Constancy of temperature (Width of control range):	+/– 0,01 K
Stability of temperature (persistent):	+/– 0,01 K
Accuracy at +70°C:	+/– 0,1 K

The individual test certificate for your thermostat will be provided upon request.

We and our partners shall gladly be at your disposal for a calibration of your thermostat at your premises. Just contact us.

5. Safety Notes

These notes are intended to draw your attention to risks which only **YOU** can recognize and avoid or overcome. They are intended to enhance your own safety consciousness.

We have set the highest quality standards for ourselves and this unit during development and production. Every unit meets relevant safety regulations. **The correct unit usage and proper handling is however solely your responsibility.**

The intended workplace should correspond to a laboratory or pilot plant environment. The user should have an education level which is at least equivalent to a trained laboratory worker or specialized chemist. The following list should be seen as an example.

! **The device may not be operated if there are any doubts regarding a safe operation due to the outer appearance (e.g. damages).**

! **A safe operation of the instrument cannot be guaranteed if the user does not comply with this instruction manual.**

! **Ensure that this manual is always at hand for every unit operator.**

! **Only use this unit solely for the intended application.**

! **Repairs, alterations or modifications must only be carried out by specialist personnel. Considerable damage can be caused by improper repairs. The Thermo Haake service department is at your disposal for repair work.**

! **Do not operate the unit with wet or oily hands.**

! **Do not expose the unit to spray water or immerse it in water.**

! **Do not clean the unit with solvents (fire risk!) – a wet cloth soaked in household detergent is normally sufficient.**

! **This device is not designed according to the standard EN 60601-1: 1990 (DIN VDE 0750-1 and IEC 601-1) and should not be operated in rooms used for medical purposes and/or in the vicinity of patients.**

Safety Notes

! **Many units parts can become hot as a result of normal unit functionIng - there is a high risk of burns! The overall temperature of the marked zone (see fig.) will become hIgher than 70°C when the bath temperature exceeds approx. 200°C. Please ensure that adequate contact protection Is provided.**

! **Do not move the unIt from the positIon where it was set up during operation or when it Is still hot. There Is a high risk of burns!**

! **Only use the heat transfer liquids recommended by Thermo Haake. Please refer to the respective EC Safety Data Sheet.**

! **The temperature controllIng i.e. immersIng of test tubes, ErlenmeyerflasksorsimilarobjectsdirectlywithIn the circulator constitutes normal circulator practise.**

We do not know which substances are contained within these vessels. Many substances are:

- inflammable, easily ignited or explosive
- hazardous to health
- environmentally unsafe

i.e.: **dangerous**

You alone are responsible for the handlIng of these substances!

Our advIce:

- If in doubt, consult a safety specialist.
- Read the product manufacturer's or supplier's EC Safety Data Sheet according to directive 91/155/EEC.
- Read relevant regulations concerning dangerous materials.
- Observe relevant guidelines for laboratories in your country.

The following measures were taken for the protection of the operator:

- Protection Class I according to VDE 0106 T1 (IEC 536) i.e. protection against electric shocks by grounding all parts which carry the risk of electric contact.

☞ The device must only be connected to mains receptacles with a protective ground.

- Protection IP 30 according to EN 60529 for all Phoenix-temperature control units, i. e. regarding the protection against accidently touching live parts and damage by foreign matter, it has been ensured that foreign bodies with a thickness or diameter of more than 2.5 mm cannot penetrate.

- Protection IP 20 according to EN 60529 for all cooling units, i. e. regarding the protection against accidently touching live parts and damage by foreign matter, it has been ensured that foreign bodies with a thickness or diameter of more than 12 mm cannot penetrate.

☞ No special precautions were taken against the penetration of water and dust. The device should therefore not be used in a dusty atmosphere or in the neighborhood of spray water.

☞ Do not insert wires or tools in any of the openings.

! **Complete separation from the mains is required when:**

- **all dangers caused by this device are to be avoided,**
- **cleaning is carried out,**
- **repairs or maintenance work is about to be carried out.**

Complete separation means:

Pull out the mains plug!

6. Unit Description

All units fulfill the requirements of safety class 2 according to DIN 12876 and are thus suitable for unsupervised continuous operation.

The circulator pump motor is protected against thermal overloading. All temperature sensors are permanently monitored according to break or short circuit. The cooling machine is integrated into the general safety circuit.

The control of the preselected temperature is carried out automatically via the FuzzyStar® control with neural adaptation.

6.1 Safety features

The comprehensive safety system is designed on the principle of the concept of the "single fault" (EN 61010). This assumes that two separate faults do not occur simultaneously. This system therefore offers protection against *one* (single) fault. This one fault will effectively occur automatically ...

- if you do not read this manual,
- if you do not correctly set the excess temperature protection, i.e. the safety reserves have already been used up.

Such faults can include e.g.:

Fault in the temperature control unit:
⇒ Excess temperature ⇒ poss. fire danger

Leakage in the liquid circuit or
Evaporation of heat transfer liquid:
⇒ Low liquid level ⇒ poss. fire danger

Pump blocked:
⇒ poss. fire danger

Or also:
Excess temperature protection level not correctly set:
⇒ poss. fire danger

6.2 Safety class 2 according to DIN 12876

A variably adjustable excess temperature protection and independent low liquid level protection which is preset to the lowest level allow the usage of different heat transfer liquids.

If a safety element is triggered...

- the cause for the fault is displayed,
- the **safety-relevant components** (heating element, motor and compressor) are switched off immediately i.e. the safety circuit transfers the unit to a stable, safe condition,
- the temperature of the heat transfer liquid gradually adjusts to ambient temperature.

6.3 Applications

As open-bath circulator:

For temperature controlling samples within the circulator's own bath.

As heating circulator:

For temperature controlling closed temperature control circuits such reactors, heat exchangers or similar objects. Temperature controlling of open vessels using the built-in combined pressure and suction pump

6.4 Temperature ranges

Working temperature range:

The temperature range of the circulator without additional heating or cooling sources.

Operating temperature range:

The temperature range of the circulator which can be reached if additional heating or cooling sources are used.

Tap water can be used as a cooling source. In this case the minimum working temperature possible is approx. 3°C above that of the tap water temperature.

! **High operating temperatures mean the unit surfaces heat up. Protective measures must be taken!**

Mains cable:

The mains cables used are specially designed for usage with heating elements. They can be allowed to come into contact with parts which are heated up to a temperature of **max. 250°C**.

! **Mains cables may be changed only from authorized technical personnel.**

! **Warning for maintenance personnel: Please ensure that the same sort of cable is used in case of replacement!** (Thermo Haake order no. 082-2409)

7. Unpacking / Setting Up

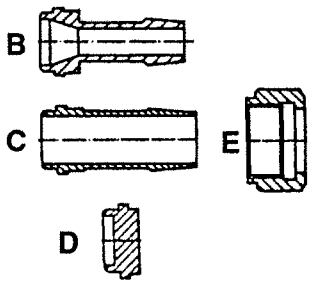
7.1 Transportation damage?

- Notify carrier (forwarding merchant, railroad) etc.
- Compile a damage report.

Before return delivery:

- Inform dealer or manufacturer
  (Small problems can often be dealt with on the spot).

7.2 Contents



2 Coupling Nuts (E), (already assembled)
2 Plug pieces (D), (already assembled)
2 Hose fittings for hoses 8 mm ∅ (B),
2 Hose fittings for hoses 12 mm ∅ ⟨C)
4 Hose clamps,
1 Instruction Manual
1 Warranty Card **(please fill out and return)**

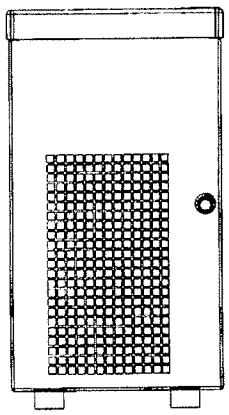
7.3 Ambient conditions according to EN 61010

- indoors, max. 2000 meters above sea level,
- ambient temperature 5 ... 40° C,
- relative humidity max. 80%/31°C (→ 50%/40°C)
- excess voltage category II, contamination level 2

7.4 Resting time after transportation (only for refrigerated circulators)

As we can unfortunately not guarantee that our refrigerated circulators are always transported according to our recommendations (i.e. upright), lubrication oil can leak from the compressor into the cooling circuit.
If the refrigerated circulator is started up whilst still in this state, the compressor may be damaged to the lack of oil.
Therefore:

! **Rest the unit for 24 hours after setting up.**



7.5 Ventilation

☞ Keep all ventilation grids (on front and rear) free from obstruction to ensure unhindered air circulation.

! **Blocked ventilation grids lead to increased unit heating which in turn reduces the cooling capacity and thus impairs correct functioning.**

7.6 Information concerning the CE sign

Thermo Haake measuring and control instruments carry the CE sign which confirms that they are compatible with the EU guideline 89/336/EEC (electromagnetic compatibility). The tests are carried out according to module H (official sheet L380 of the European Community) as our quality assurance system is certified according to DIN / ISO 9001.

It was tested according to the strict EMV test requirements of the EN61326-1/A1 (EMV requirements for electrical equipment for measuring technology, conduction technology and laboratory usage). This means it was tested for interference resistance and interference emission according to public low-voltage mains (household and commercial usage).
The following basic standards were applied in detail:

Interference resistance:

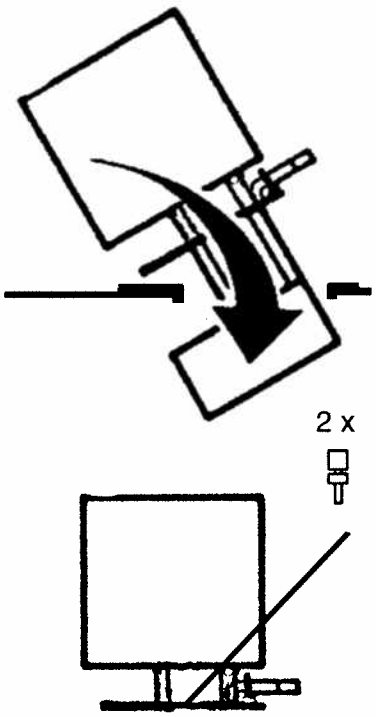
EN61000–4–2	electrostatic discharge
EN61000–4–3	electromagnetic fields
EN61000–4–4	fast transients
EN61000–4–5	surge voltages
EN61000–4–6	wire–guided HF–signals
EN61000–4–8	magnetic field of mains frequency
EN61000–4–11	voltage drop/short–time interruption

Interference emission:

CISPR16/class B	wire–guided interference emission
CISPR16/class B	radiated interference emission
EN 61000–3–2	Voltage variations and flickering
EN 61000–3–3	Over-compensation voltage flows

The application in industrial and commercial (public mains) environments is thus possible.
A declaration of conformity is supplied with the ordered unit on request.

Our strict standards regarding operating quality and the resulting considerable amount of time and money spent on development and testing reflect our commitment to guarantee the high level of quality of our products even under extreme electromagnetic conditions. Practice however also shows that even units which carry the CE sign such as monitors or analytical instruments can be affected if their manufacturers accept an interference (e.g. the flimmering of a monitor) as the minimum operating quality under electromagnetic compatibility conditions. For this reason we recommend you to observe a minimum distance of approx. 1 m from such units.



7.7 Mounting onto baths and bath bridges

The temperature control unit and bath bridges will be delivered unassembled by means of transportation.

! **Switch off the unit and pull out the mains plug.**

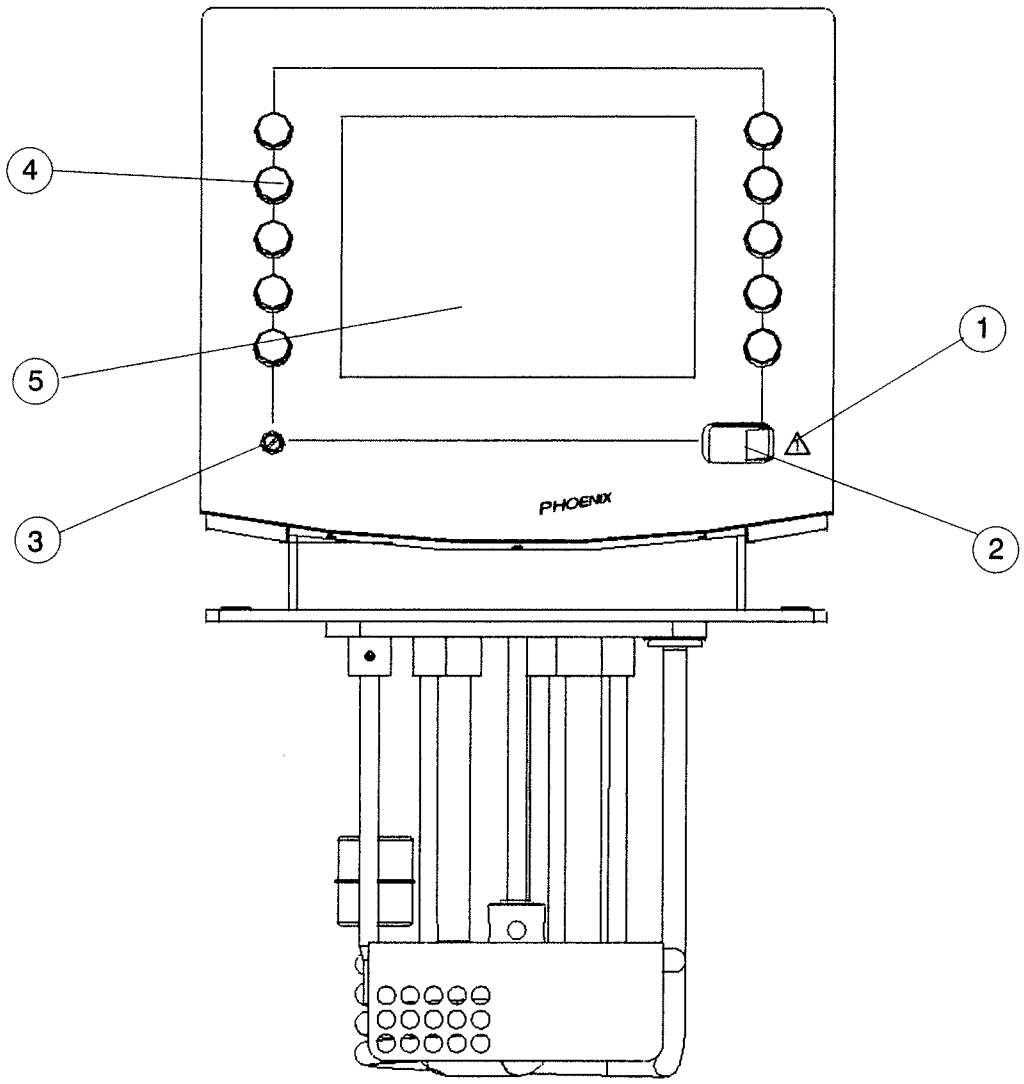
[1] Guide the unit down into the opening in a curve.

! **Do not damage Floats, possibly easily raise.**

[2] Attach the unit with 2 screws.
Tighten only by hand.

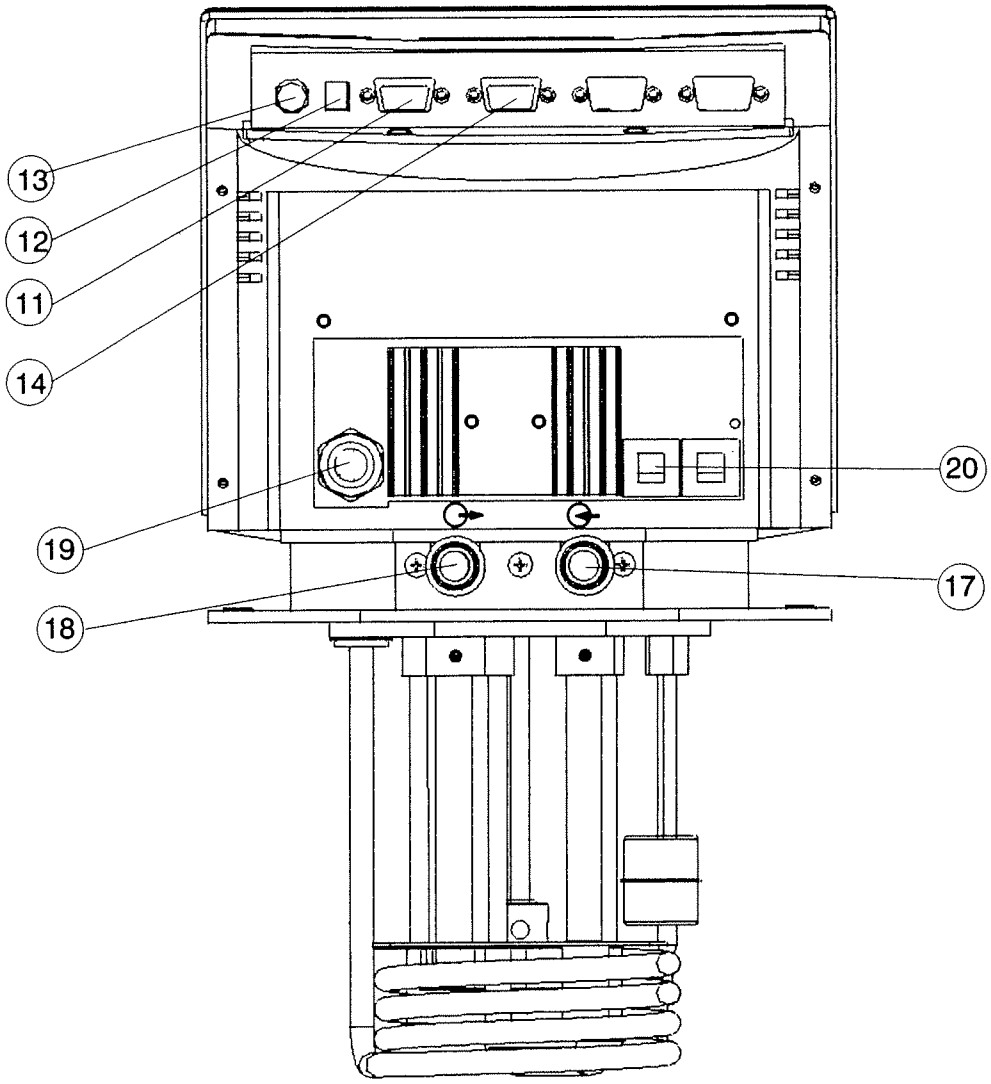
8. Functional Elements

8.1 Front Phoenix P1



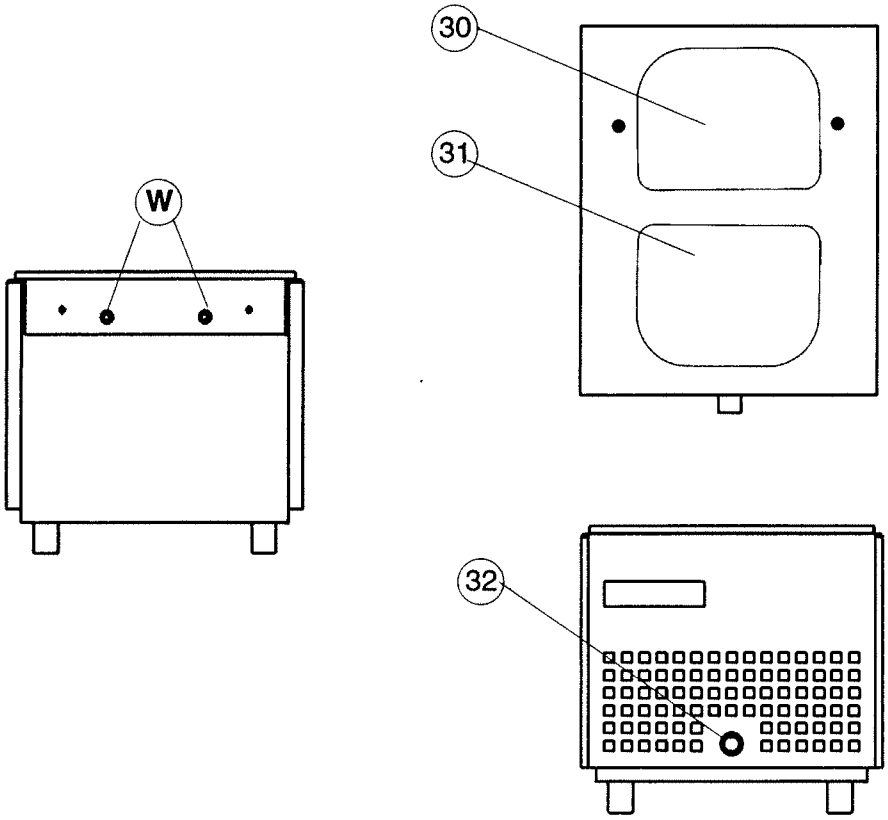
1 Symbol: Read the instruction manual!
2 Mains switch
3 Excess temperature setting
4 10 control keys to the function and menu selection
5 LCD display

8.2 Rear Phoenix P1



11 Multi–function connection
12 DIP–Switch for multi–function connection
13 Socket for external Pt100 sensor
14 RS 232C interface
17 Pump inlet: back flow from the external object
18 Pump outlet: pressure to the external object
19 Mains cable (coolers with control cable)
20 Fuses (not in conjunction with refrigerated baths), if the fuses are triggered, see chap.12.4

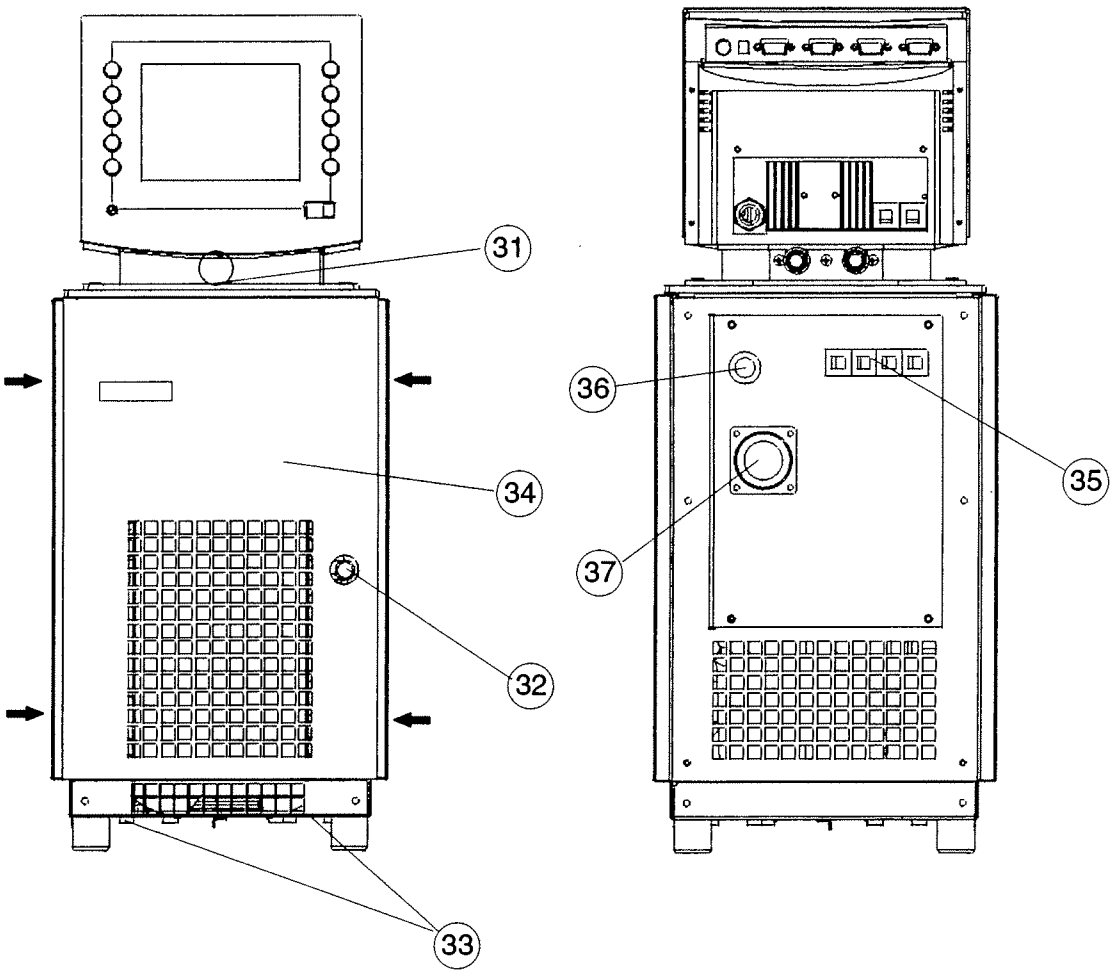
8.3 Bath vessel B5 (example model for B7 and B12)



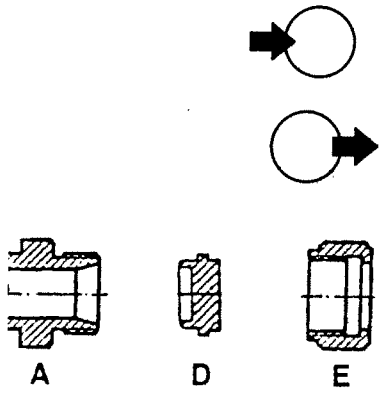
30 Opening for temperature control module
31 Bath opening with bath covering (standard feature)
32 Drainage nozzle

W **All bath containers contain an additional tap water cooling coil (for hoses with 8 mm inner ø). The flow direction of the water can be freely selected.**

8.4 Refrigerated bath C25P (example model C20P, C35P, C40P, C41P, C50P and C75P)



31 Bath opening with bath cover (standard feature)
32 Drainage nozzle
33 Handles for transport purposes
34 Ventilation grid (removeable, four mounting points: ⬇)
35 Fuses (if the fuses are triggered, see chap. 12.4)
36 Mains cable
37 Connection for combined mains connection and control cable **19** of Phoenix



9. Hoses

9.1 Connecting Hoses

Pump nozzle **A**:
return flow from external object

outlet to external object (pressure side)

Hoses are normally used to connect the pump with an external vessel. If objects are to be temperature controlled in the internal bath only, the pump nozzles **A** can be closed with a covering plate **D** attached with a union nut **E** (supplied as standard). However, in order to achieve a better temperature constancy, it is recommended not to close but to connect the two nozzles with a short hose with a min. length of 50 cm.

General recommendations concerning the max. allowable length of hoses cannot be given. It all depends largely on the size, form and material of the external vessel to be temperature controlled. It should be understood that the length of a hose and its diameter combined with the circulating capacity have a large effect on the temperature control effectiveness. Whenever possible, the decision should be made in favor of the wider hose diameter and the vessel to be temperature controlled should be placed as close as possible to the circulator.

! **High operating temperatures will lead to high temperatures on the hose surface, this is even more so at the metal nozzles. In this case: DO NOT TOUCH!**

! **The required hose material is dependent on the heat transfer liquid used.**

! **Hoses must not be folded or bent!**
A wide radius should be used if turns have to be made!

! **Hoses may become brittle after prolonged use or they may get very soft. They should, therefore, be checked regularly and exchanged if necessary!**

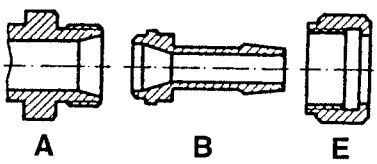
! **Secure all hose connections using hose clamps!**

9.2 Selecting Hoses

Thermo-Haake circulators will be delivered without any hoses. Due to the unknown application at the time of shipment and the extremely wide temperature range of the circulators it became impossible to deliver hoses as standard accessories. Please select the proper hoses from the following table.

Hoses

Description	Order-No.
Insulated **metal hoses** made from stainless steel with M 16 x 1 unions on both ends. To be used from –90 to +105°C	
100 cm long	**333-0578**
150 cm long	**333-0579**
Coupling to connect 2 hoses to each other	**001-2560**
Insulated **metal hoses** made from stainless steel with M 16 x 1 unions on both ends. To be used from –50 to +300°C	
50 cm long	**333-0292**
100 cm long	**333-0293**
150 cm long	**333-0294**
Coupling to connect 2 hoses to each other	**001-2560**
PVC hoses to be used only with water	
8 mm i. Ø; per meter	**082-0745**
12 mm i. Ø; per meter	**082-0304**
Viton hoses for a temperature range of –60 to +200°C	
8 mm i. Ø; per meter	**082-1214**
12 mm i. Ø; per meter	**082-1215**
Silicone hoses for a temperature range of –30 to +220°C (not to be used with any silicone oil, for example SIL or Synth 60)	
8 mm i. Ø; per meter	**082-0663**
12 mm i. Ø; per meter	**082-0664**
Perbunan hoses for a temperature range of –40 to +100°C	
8 mm i. Ø; per meter	**082-0172**
12 mm i. Ø; per meter	**082-0173**
Foam rubber insulation for PVC, Viton, Silicone und Perbunan hoses	
for hoses with 8 mm i. Ø; per meter	**806-0373**
for hoses with 12 mm i. Ø; per meter	**806-0374**

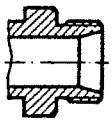


9.2.1 Plastic and rubber hoses

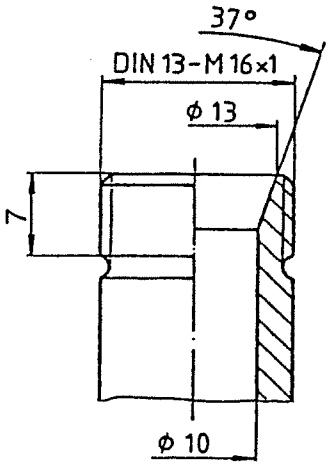
If other Plastic and rubber hoses are used it must be ensured that the hoses selected are fully suitable for the particular application, i.e. that they will not split, crack or become disengaged from their nozzles.

The hoses are connected using the hose fittings **B** supplied for 8 or 12 mm Ø which are attached to the pump nozzle **A** with the coupling nut **E**.

For the isolation it is highly recommended to use the foam rubber isolation.



A



9.2.2 Metal hoses

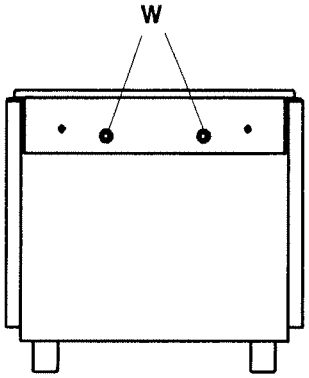
Thermo Haake metal hoses (stainless steel insulated) offer a particularly high degree of safety and are suitable for both low and high temperatures.

The metal hoses are attached directly to the nozzle **A**, gaskets are not required.

! The hoses must not be extremely bent or subjected to mechanical strain!

These hoses are available in lengths of 0.5, 1.0 and 1.5 meters from Thermo Haake. Couplings for connecting two hoses are also available if other lengths should be required for a particular application.

The smallest opening inside the metal hoses is 10 mm. The metal hoses are provided with coupling nuts (M16 x 1, DIN 12 879, part 2) at either end. The counter piece for attaching them complies to the left hand sketch.



9.3 Tap water cooling

Only for units without own refrigeration unit!

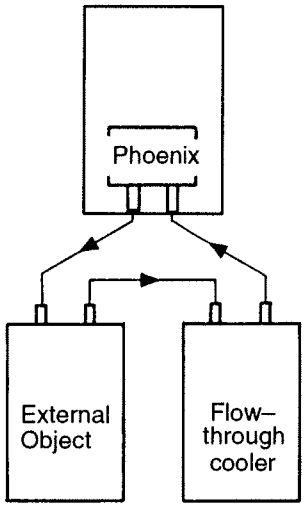
9.3.1 Connection to cooling (tap) water

Using the cooling coil a lowest operating temperature approx. 3°C above the given cooling water temperature can be achieved.

[1] Use hoses with 8 mm internal ∅ and connect to the tab water cooling coil **W.** The direction of the flow can be freely selected. It must be taken care that at the outlet side, the water can run out unhindered.

Pressure fluctuations of the public water net may hamper the temperature constancy. For proper results the water pressure should be stable or measures should be taken to keep it stable.
The min. pressure should not be below 1 bar.

[2] The amount of flow should be set to a min. value. At first the full flow should be used so that the unit can reach its operating temperature. Then, the amount of flow should be reduced using the water cock or a hose clamp. The actual temperature will rise above the set temperature if the water flow is insufficient. If so increase the water flow.



9.4 External Cooling Devices

With the flow-through cooler DK15 from Thermo Haake, the heat transfer liquid can be cooled down and the circulator can be rendered independent of tap water.

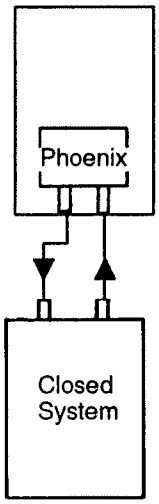
The flow-through cooler is hooked up into the return flow line of the external vessel and from there to the circulator (see figure).

The assembly and application are described in the cooler instruction manual in detail.

9.5 Pressure pump

9.5.1 Temperature controlling an object in the internal bath

Close pump pressure and return port with the closing pieces and coupling nuts (see chap. 9.1) or for a better temperature accuracy connect the two nozzles with a short hose.

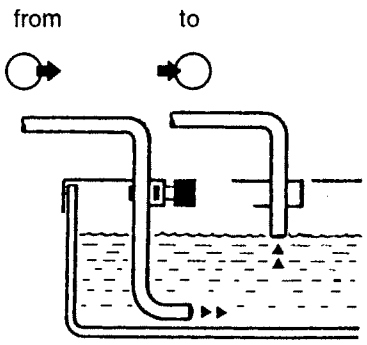


9.5.2 Connection of external closed systems

E.g. instruments with a pressure-tight temperature jacket or coil or a heat exchanger (external system).

Hose connection: From the pressure port to the external system and then back to the return port.

If it cannot be avoided that the external object is situated higher than the circulator, the heat transfer will only not flow back on the condition that the system is completely tight and leak-free. To be on the safe side it may be considered necessary to fit stop cocks to the inlet and outlet hoses.



9.5.3 Connection of external open systems

Hose connection: From the pressure port to the external bath and then back to the suction port.
With a hose support (optional accessory) which is employed for baths with a wall thickness up to 26 mm, both the pressure and suction hose are securely held.
With a clamp in the pressure hose the amount of the circulating liquid is balanced with that of the amount floating back. It is recommended to use a hose with 8 mm interior-∅ as pressure hose and one with 12 mm interior-∅ as suction hose.
The end of the pressure hose in the bath vessel should be placed in a position where an optimum circulation within the bath is achieved.
The liquid level of the external bath can be adjusted with the end of the suction hose.

The external system and the temperature unit have to be arranged so that they have the same liquid level in order to prevent draining by siphoning action. In case the application requires that both systems have to be situated at different levels, the two hose lines have to be closed prior to turning off the temperature unit.

! **When a safety element causes a shut off, the siphoning of one of the vessels cannot be prevented.**

10. Filling with Bath Liquid

The selection of the proper bath liquid (heat transfer liquid) influences the capacity of a temperature control unit decisively. The technical data with special emphasis on the temperature accuracy was established in accordance with DIN 58 966 (water at 70°C).
The temperature accuracy will decrease the higher viscosity of the heat transfer liquid and the lower its heating capacity is.
It is difficult to arrive at valid statements which can be applied as a general rule as the length of the hoses, the volume and the material of the connected systems have a great influence on this accuracy.

The heating up and the cooling down time of a system to be temperature controlled can be influenced by the bath liquid too. Oil, for instance, cuts this time in half when compared to water.

10.1 Recommended bath liquids

5 to 95°C *Distilled Water*

- Normal tap water leads to calcareous deposits necessitating frequent unit decalcification.

! **Calcium tends to deposit itself on the heating element. The heating capacity is reduced and service life shortened!**

- Water, of course, can be employed up to 95°C, however above 80°C water vaporization reaches a level which necessitates the liquid to be constantly replenished.

–10 to 80°C *Water with Antifreeze*

In applications below 5°C the water has to be mixed with an antifreeze. In doing so, the amount of antifreeze added should cover a temperature range 10°C lower than the operating temperature of the particular application. This will prevent the water from gelling (freezing) in the area of the evaporating coil the surface area of which is much colder than the working temperature. An excess of antifreeze deteriorates the temperature accuracy due to its high viscosity.

–40 to 145°C *SIL180*

...this heat transfer liquid is suitable for covering nearly the entire range with just one liquid especially when used with the cooling units C25P, C40P and C41P.
Unfortunately *SIL180* has a creeping tendency necessitating the occasional cleaning of the bath cover.

–75 to –10°C *Methanol or Ethanol*

Those liquids are usually only used at lower temperatures. Their flash point is at about 10°C. Therefore, they cannot be used in accordance with the standards EN 61010 or DIN 12879.

other temperatures

Thermo Haake offers a range of heat transfer liquids for these temperature control applications.

Synth ... : Synthetic thermal liquid with a medium life span (some months) and little smell annoyance.

SIL ... : Silicone oil with a very long life span (> 1 year) and negligible smell.

Please use the table on the next page or get in contact with us if you should have any questions. We are glad to advise you and can help you to choose a heat transfer liquid suitable for your application.

Thermo Haake heat transfer liquids are supplied with an EC Safety Data Sheet.

! Important ! **Thermo Haake takes no responsibility for damages caused by the selection of an unsuitable bath liquid. Unsuitable bath liquids are liquids which e.g.**

- are very highly viscous (much higher than 30 mPa·s at the respective working temperature)
- have corrosive characteristics or
- tend to cracking

Older bath liquids also tend to crack and are therefore not suitable for this application. The bath liquid should be regularly changed.

! Important ! **It is absolutely mandatory that the overtemperature cut-off point is set lower than the fire point for the heat transfer liquid selected (see chapter 15.).**

! Important ! **The highest working temperature as defined by the EN 61010 (IEC 1010) must be limited to 25°C below the fire point of the bath liquid.**

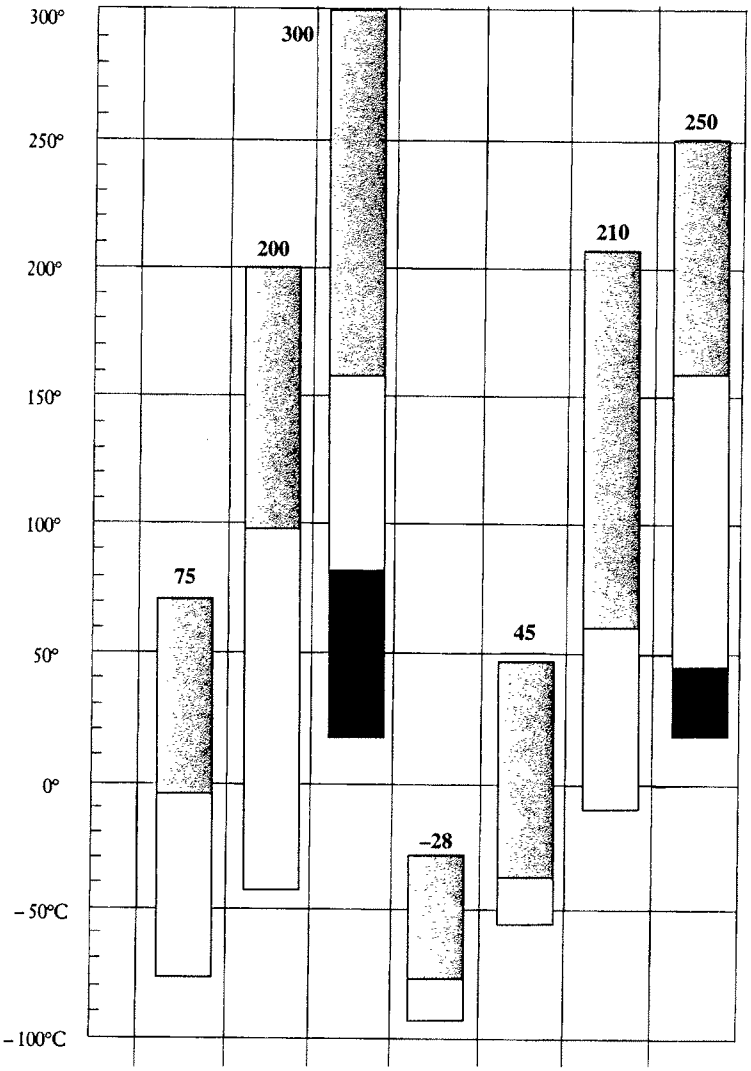
! Important ! **Please ensure when selecting other heat transfer liquid than ours that no toxic gases can be generated and bear in mind that inflammable gases can build up over the liquid during usage.**

! Important ! **At bath temperatures of over 200°C the usage of a heat take-off is recommended.**

Filling

Range of Application		Sil 100	Sil 180	Sil 300	Synth 20 *)	Synth 60	Synth 200	Synth 260
Fire point	°C	>100	>225	>325	no sp.	70	>235	275
Flash point	°C	57	170	300	–3	59	227	260
Viscosity	at 20°C [mPas]	3	11	200	<1	2	100	140
Density	at 20°C [kg/dm^3]	0,89	0,93	1,08	0,77	0,76	0,86	1,03
Specific heat capacity	[kJ/kg*K]	1,67	1,51	1,56	no sp.	2,10	1,96	2,00

Temperature range



Colour	trans-parent, colour-less	trans-parent, colour-less	trans-parent, colour-less	trans-parent, colour-less	trans-parent, colour-less	trans-parent, light–brown	trans-parent, yellow
Reacts with	Silicone	Silicone	Silicone	Light–metals Zinc	Rubber Silicone	Copper Light-metals Bronze	Copper Light-metals Bronze
Order-No. 10 l Container	999-0202	999-0204	999-0206	999-0208	999-0210	999-0226	999-0214
5 l Container	999-0201	999-0203	999-0205	999-0207	999-0209	999-0225	999-0213

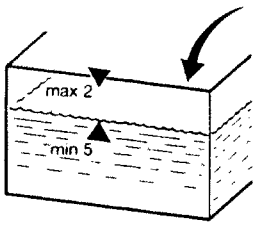
*) Cannot be exported; use methylcyclohexan as bath liquid.
no sp. = no specifications

EC-Safety Data Sheets will be delivered together with each container of liquid.

Heating-up range

operating temperature range

Working temperature range



10.2 Filling with heat transfer liquid

Filling level of the interior bath:
max. up to 2.0 cm below the cover plate,
min. up to 5.0 cm below the cover plate.

When working with water or water with antifreeze: or with oil below ambient temperature:
the filling level should be 2 cm below the deck plate.

When working with oil above 80°C:
Keep level somewhat lower. Oil expands when being heated. Rule of thumb: 10% volume increase per 100°C heat increase.

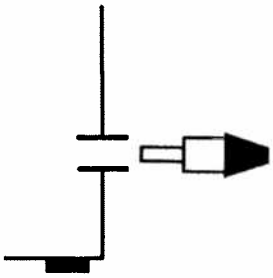
External systems included within the circulating circuit have to be filled with the same heat transfer liquid in order to avoid too much liquid being drawn from the internal bath.

☞ The bath level should be checked when the preset temperature has been reached!

Quite often closed external systems cannot be prefilled as suggested. In this case the internal bath of the unit has to be filled to the max. level. After starting the unit, the pump will feed the necessary liquid to the external system. Should the demand be higher than the volume difference between high and low, the low liquid level sensor will be activated and the pump switched off.

In this case:

1. Replenish the liquid.
2. Reset the unit:
   Depress the reset button.
   ⇒ The unit goes to the basic condition.
3. Repeat this action if necessary.



11. Draining

The temperature control unit is drained at the nozzle.

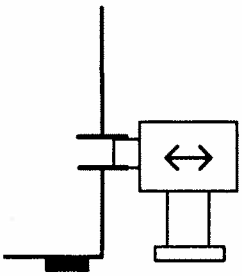
1 Place a suitable vessel underneath nozzle.

☞ Bear in mind that the liquid will run out in a slight arc.

2 Turn plug slowly until it becomes disengaged from the thread. A pin will prevent the liquid from running out right away.

3 Pull out plug (pin) in one quick motion. The liquid will start to run out.

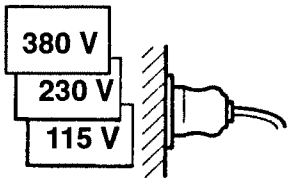
4 Possible residues can be drained by tilting the circulator slightly.



Option:

Use the liquid drain (order no. 333–0499). This push and pull version makes emptying easier.
For assembly it is necessary to use a fork wrench of 17 mm. Double safety against unintended opening is avoided if the nozzle will be closed by the closing screw after use.

! Hot Baht liquid or very cold bath liquids should not be drained! When certain conditions make draining necessary, please act safety conscious: Wear protective clothing and protective gloves!



12. Connecting Up

12.1 Connecting to the mains

Only attach this unit to mains sockets with a grounded earth. Compare the local mains voltage with the specifications written on the name plate. Voltage deviations of +/- 10% are permissible. The socket must be rated as suitable for the total power consumption of the unit.

Make sure that the temperature controller Phoenix is safely connected to the refrigerated unit with the cable **19**.

12.2 Checking the liquid circuit

Before switching on, check again to make sure that the pressure and suction ports are either connected with each other or blocked with covering plugs or alternatively if an external object is to be temperature controlled, that the hoses are connected correctly and secured (see chapter 9.).

12.3 Changing the mains plug (e.g. for Great Britain)

! This should only be carried out by qualified specialist personnel!

The mains cable wires have the following colors:

Brown	=	**Live**
Blue	=	**Neutral**
Green/Yellow	=	**Earth**

12.4 Fuses on the unit

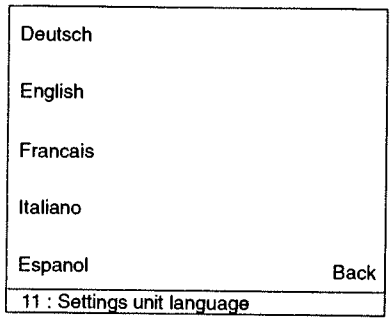
All units are equipped with automatic thermally-triggered fuses.

If the fuse has triggered...

- the fuse does not have to be exchanged – resetting suffices;
- a white marking is visible;
- a certain cooling down time should be allowed (approx. 5 min) before the (dip) switch can be pressed again.

! Do not use tools; do not use force. Both destroy the fuse.

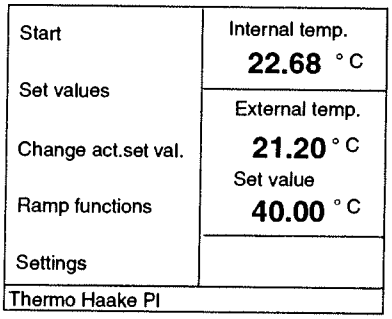
! If the fuse should be triggered again after resetting, the unit probably has a defect. In this case the unit should be sent in for servicing.



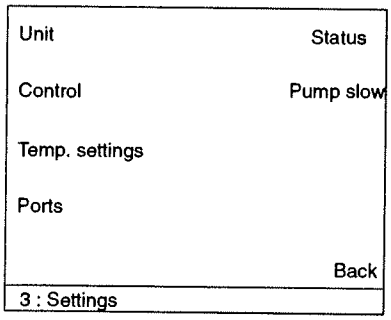
13. Configuration

Especially when putting into operation for the first time it is necessary to adjust some parameters.

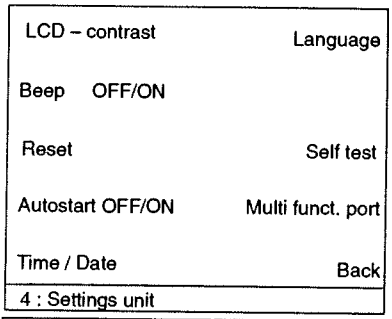
After switching on the unit for the first time you are asked for your desired user language (see Chap. 13.3). After the selection the language you arrive to in the main menue.



Select „Settings" in the main menu.



Under „Settings" there are several submenus available. In the following display pictures you can see the path which has been selected and the accompanying menu number in the bottom line (status line).

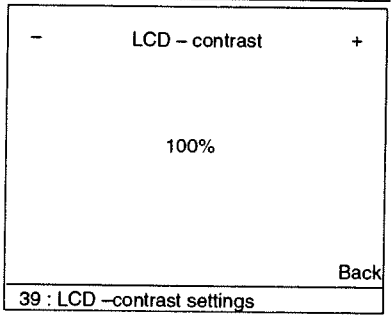


13.1 Setting unit

13.1.1 Display contrast adjustment

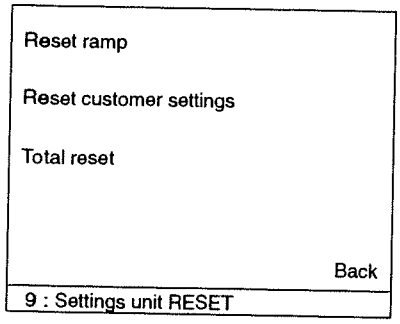
For contrast adjustment of the display select „Unit" and then „LCD-contrast".

Change the voltage using the (+) / (-) keys. The value will be shown in %, The contrast changes with a short delay.



13.1.2 Acoustic Signal

Select „Unit" and then „Beep ON/OFF".
If the beep is switched on, there is an acoustic signal each time you press a key.



13.1.3 Reset

Select „Unit" and then „Reset".

„Reset ramp" deletes all ramp programs and ramp segments.
„Reset customer settings" deletes all ramps, set values and RTA values.
„Total reset" to the default parameter settings !

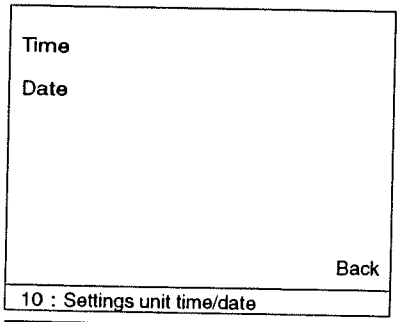
13.1.4 Autostart

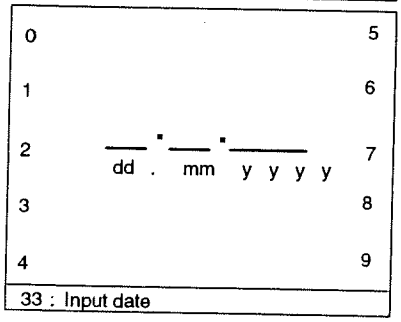
Select „Unit".
With the assigned function keys confirm „Autostart-ON or OFF"

Autostart: OFF
The temperature control module switches itself off in case of a power failure. Switching on again is only possible with the „Start" command in the main menue. This is due to safety reasons. The unit reacts in the same way if it is switched on via a mains switch in the laboratory.

Autostart: ON
The temperature control module switches on automatically after a power failure and will be operating with the saved values.

! Please consider any possible resulting risks!





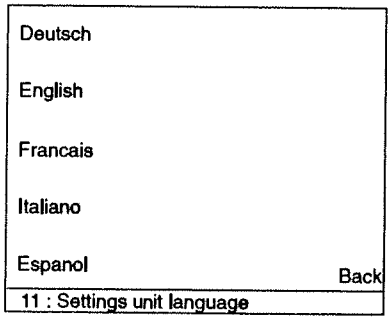
13.1.5 Setting of time and date

Select „Unit" and then „Time/Date"

In order to adjust the time/ date, you select „Time/Date" and enter the hours, minutes and seconds (and day, month, and year) with two or four digits each via the assigned function keys.

Confirm with Yes.

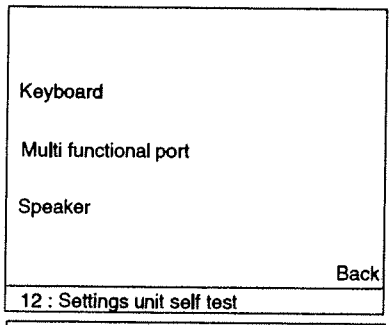
The actual values are shown in the bottom line.



13.1.6 Language

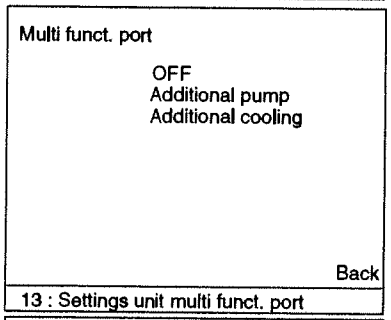
Select „Unit“ and then „Language“.

Confirm the selected language with assigned function keys.



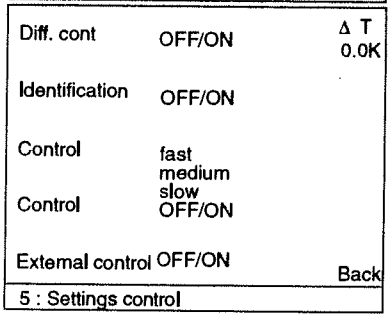
13.1.7 Self test

With the self test the functions thermostats are checked. Select for this " unit " / " self test " and activate you then the functions, which want to check you.
Warning: After testing the key functions you can only return to the main menu by switching the unit off and on again at the mains.



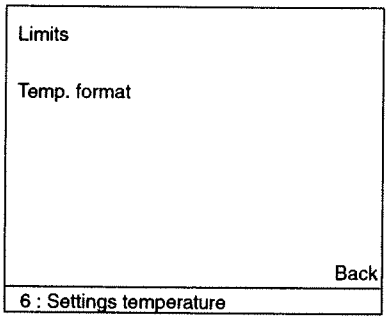
13.1.8 Multi functional port

It is possible to integrate additional units such as an additional pump, cooling or heating into the safety circuit of the circulator by connecting it to the multi functional port.
Port „OFF“ is the presetting of the factory which is used at normal operation.



13.2 Setting Regulation

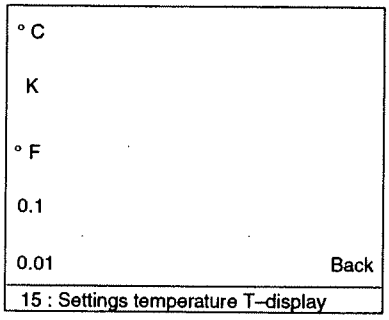
see chapter 14.5



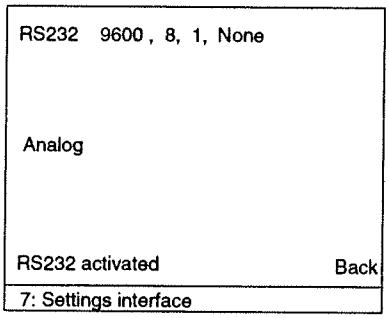
13.3 Setting Temperature

13.3.1 Temperature display

Select „Temp. settings" and then „Temp. format".



Confirm the standard (°C, °F or K) and the resolution (0.1 or 0.01) using the assigned function key.



13.4 Setting Interface

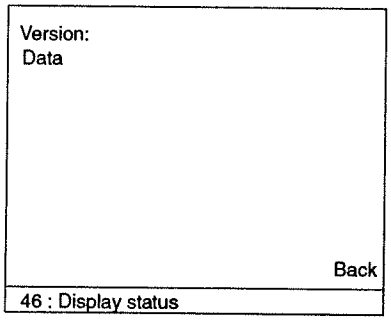
13.4.1 Interface RS232C

Select „Ports" and then „RS232" (for further information see19.2) for setting the interface parameters.
After that activate the desired interface by pressing the left down function key several times.

13.4.2 Analog interface (option!)

Select „Ports" and then „Analog". This is an option which is described separately. This function only has a meaning when the optional analog interface box is connected to the RS232C interface.

13.5 Setting Status



13.5.1 Version numbers

For servicing or in case of product enquiries the version numbers of the software or the FuzzyStar® control should be given.

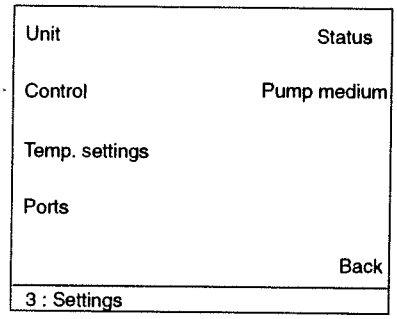
Select „Settings" and then „Status". The version numbers will be shown.

13.6 Operation status

For information about the operating status (alarm circuit of the instrument or cooling device (C-AL...), internal or external control and interface) please select „Settings" and then „Status".
In addition, the set overtemperature value is displayed in this menu point without changing the setting (see Section 15.).

13.7 Settings the pump speed

In order to adjust the circulator to the respective application, the pump speed can be varied in three steps. In the „Settings" menu the pump speed can be selected by pressing the pump function several times.



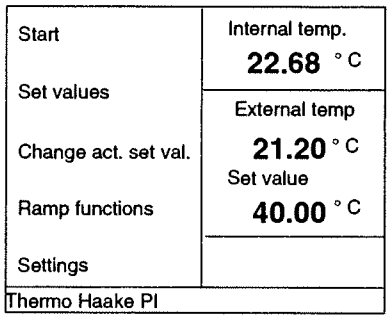
„Pump fast" = (maximum power): This setting is only necessary when external systems are connected or when the bath volumes are very large to achieve better controlling results.

„Pump medium" = (set by the factory): This speed is sufficient in most cases, especially at bath applications.

„Pump slow": This setting should only be selected when great turbulences have to be avoided in the bath.
It is also recommendable when you want to work in the refrigerated bath at the lowest bath temperatures that can be reached because the heat supply by the pump is very low at this setting.

14. Operating

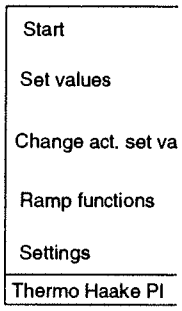
14.1 Switching on



[1] Switch on the unit via the mains switch (2) at the temperature control unit Phoenix.

⇒ On the main display two or three temperatures are displayed:
On the top right the internal actual temperature (here: 22.68°C)
in the middle the external actual temperature (here: 21.20°C).
Attention: value is only displayed when an external PT100 sensor is connected.
Below the middle the intended set temperature is displayed (here: 40.00°C).
Depending on the selected control the corresponding actual value is displayed in bold numbers.
(e.g. if the external control is activated, the temperature value of the external PT100 sensor is displayed in bold numbers.)

This results in the following display if 'AUTOSTART: OFF'



⇒ " start " appears in the display

[2] If need be, change the settings or temperature settings and „Start" with the corresponding function key.

The main menu display then shows „Stop". By pressing the „Stop" functional key the control can be stopped at any time.

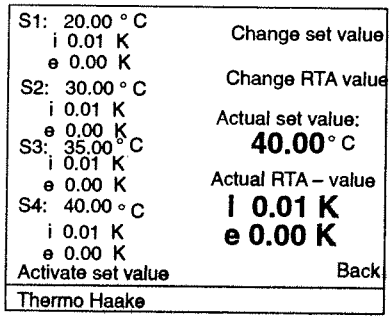
! **If the unit is restarted within about 5 min after stopping via the menu function, the cooling machine is switched on only with delay for safety reasons.**

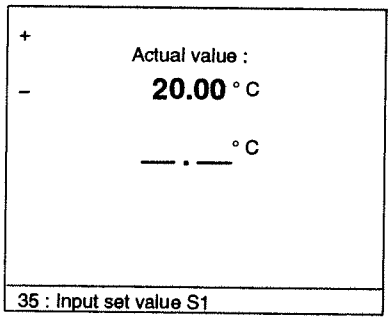
! **To increase the life time of the cooling unit we recommend to wait about 5 min before restarting the unit after having switched it off via the mains switch.**

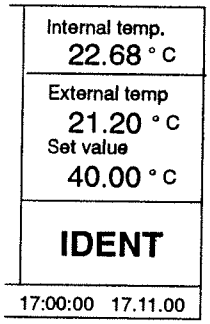
This results in the following display if 'AUTOSTART: ON'

The unit begins to work immediately. The pump, heating, cooling and control functions are active straight away.

Controlling can be stopped by pressing the „Stop" key in the main menu.







14.2 Setting the desired set value

14.2.1 Setting the desired set temperature

The settings apply to the internal or external control sensors according to the selected mode Intern/Extern (see chapter13.2).

14.2.2 Setting and selecting the set values

1 Select „Set values" in the main menu.

⇒ In the left area of the display the 4 stored set temperatures with the accompanying RTA values are displayed S1–S4.

There are two possibilities:

- Change set value
  Select the set temperature you want to change by pressing the assigned function key and then activate „Change set value".
  Now you select the plus minus sign (+ or –) of the new set value by pressing the corresponding function key.
  Then you enter the new value via the number keys with 3 digits before and 2 digits after the decimal point.
  After entering the last digit you are asked whether you want to activate the value. If not, you can enter a set temperature again, otherwise you get back to the set values submenu.

! In case of a wrong entry, all empty digits have to be entered before you can enter a new value. Aborting during the entry is not possible.

- Taking over and activating existing set values
  For this select the desired set temperature by pressing the assigned function key and thereafter take over the value by „Activate set value".
  After that, the main menu is displayed automatically.

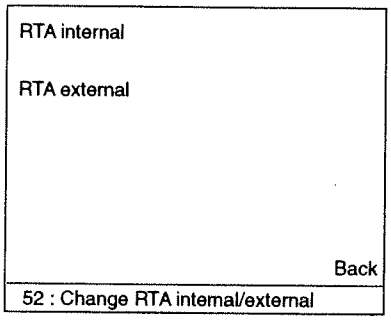
⇒ After pressing „Start **IDENT** flashes in the display if the identification is activated. The FuzzyStar-controller is determining the right parameter. It can happen that heating or cooling is interrupted during this process and the displayed temperature changes. This is because the control unit requires some time to determine the parameters.

To deactivate the identification, select "Settings" and "Control". Switch "Identification" to "OFF".

☞ To switch off the identification please see chapter 14.5 .

The input is blocked if a temperature setting over I/O port already exists or the programmer is active.

14.2.3 Setting the RTA system correction value

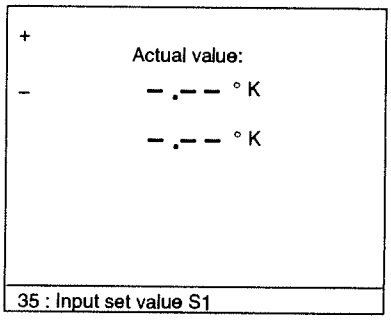


The display shows the actual temperature at the internal or external control sensor with the selected resolution.

This temperature does not correspond directly to the temperature in the circulator's bath and even less to the temperature in the external connected system.

The temperature difference is determined by measuring the actual current temperature using a suitable measuring device (calibrated or gauged thermometer).

It is entered into the circulator as the correction factor RTA and remains stored there.



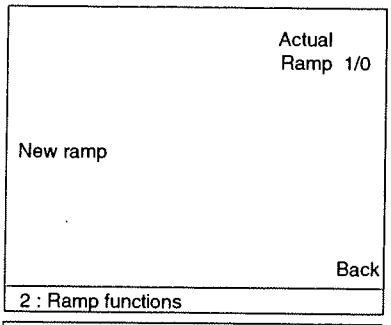
A separate internal (i) and external (e) RTA value is assigned to each of the 4 storable set temperatures.

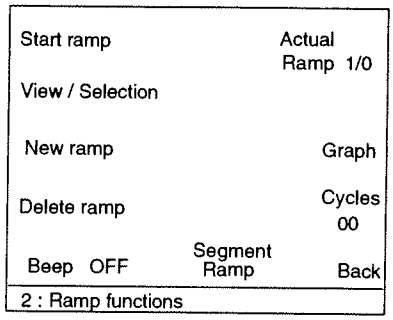
The correction factor only refers to this one application. A new correction value is required for any new temperature or altered test setup.

1. Select „Set values" and then the set temperature whose RTA values you want to change. Activate „Change RTA" and select the desired RTA value (internal/ external) and change the display in the same way as decribed in Chapter 14.2.1.

14.3 Change actual set value quickly

The function „Change actual set value" in the main menu allows to change the currently active set temperature quickly without going to the „Set values" submenu first.
The changed set value is stored permanently and is activated immediately.





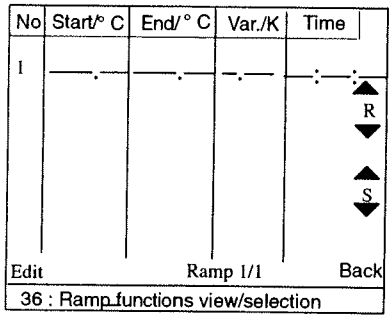
14.4 Ramp functions

Select „Ramp functions" in the main menu.
You can choose between 6 possibilities:
„Start ramp", „View/ Selection", „New ramp", „Delete ramp", „Beep" and „Graphic".
If no ramp is available, only the function „New ramp" is displayed.
The number of the active ramps is displayed in the right part of the display: „Actual ramp" {No. of active ramp}/ {total number of stored ramps}.

A maximum of 1 temperature programmes with a maximum of 10 segments each can be stored.

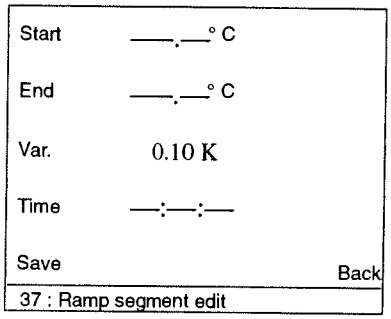
The max. duration of each segment is 23h 59min and 59sec.

! The execution of the ramp function is closed, if a temperature specification via I/O port is available.



14.4.1 Entering a temperature program

Select „New ramp".
In the display a table with the following columns appears:
No. / Start/ °C / End/ °C / Var. /K / Time
1 / —.— / —.— / 0.10 / —:—:—
Here „No." is the number of the program segment, „Start/ °C" and „End/ °C" is the start or end temperature of the segment and „Time" the duration of the segment.
The value „Variation/K" shows which variation in Kelvin (= °C) there may be between the actual temperature and the start temperature of the first program segment. This value can only be set in the first segment. The value 0.10 K (= +/ – 0.10°C) is preset.

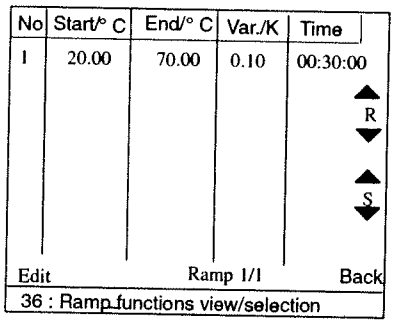


Select „Edit" in order to enter the values for the selected segment.
In the following menu the start and end temperature and the duration of the selected segment are displayed (in the first segment also the variation). By activating the functions the values can be entered. (Entering the values is done in the same way as entering set values, see Chap. 14.4).
After that you confirm the values for the segment with „Save".

A new empty line is added automatically to the table of the temperature program when a segment has been entered completely.

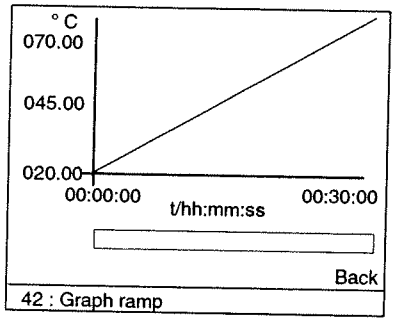
The segment you want to edit can be selected with the two arrow keys above and under the „S" at the right of the display and can be changed with „Edit".
After having ended the programming you go back to the ramp menu via „Back".

14.4.2 Viewing stored programs



Via the function „View/ Selection" the temperature programs which have been stored can be viewed and selected.
The display in this menu corresponds to the settings menu as described in 14.4.1.
Then the program segments are displayed in the table. With the two arrow keys above and under the „S" the desired segments can be selected. When required, they can be changed with „Edit". After selecting and/or changing the temperature program you get back to the ramp menu with „Back".

14.4.3 Graphical display of the active temperature program



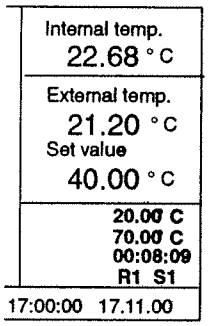
With the function „Graphic" of the ramp menu the course of the set values of the temperature program is displayed graphically and can be seen at one glance.
The x–axis shows the time and the y–axis the accompanying set temperatures.
You get back to the ramp menu by pressing the „Back" function key.

14.4.4 Deleting a program

The currently selected ramp program can be deleted quickly by pressing the „Delete ramp" function.

14.4.5 Selecting beep

With the function „Beep" you can select whether a signal sounds after the end of each segment, after the end of each ramp or if there is no signal.



14.4.6 Running a temperature program

The currently selected program is run by the „Start ramp" function.
In the main menu „Stop ramp" is displayed instead of „Start". After that the unit heats/ cools until the start temperature +/ – the set variation is reached. After that the first segment is started automatically.
In the main menu the end temperature and the remaining time of the current segment as well as the number of the ramp and the number of the segment are displayed next to the ramp symbol. When the course of the program has been ended, the circulator maintains the last set temperature. The end of a segment or the end of the program can be indicated by an acoustic signal (see 14.4.5).

14.4.7 Stopping the temperature program

You can stop a running program with the „Stop ramp" function. The unit now maintains constantly the last set temperature of the program.
When restarting the program, the unit heats/ cools, until the start temperature +/ – the set variation is reached. Then the program starts again with the first segment.

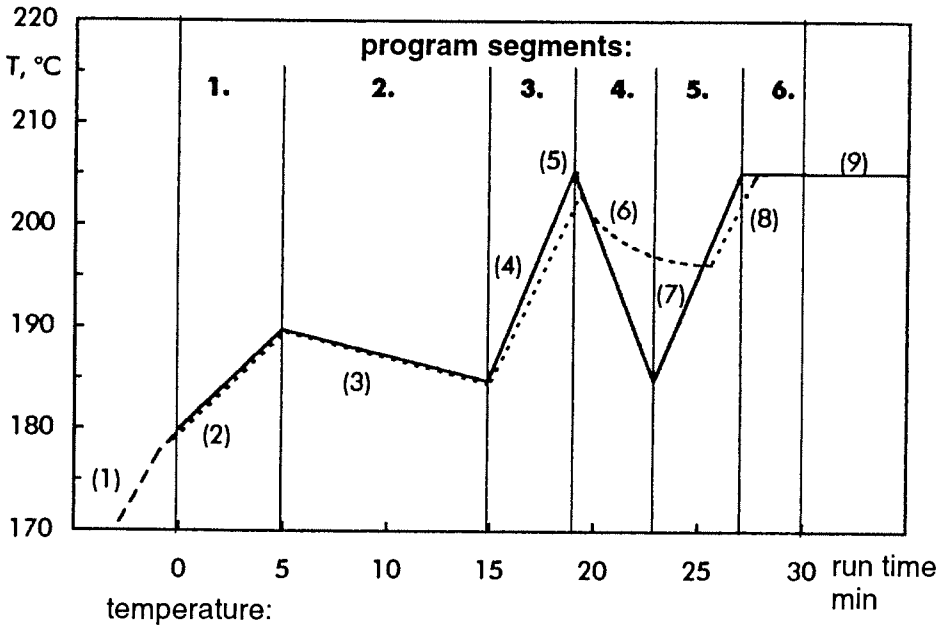
14.4.8 Example of a program

The progress of a program is explained in the following example. The current set temperature should be 200°C. The actual temperature is approx. 170°C. The unit runs without cooling bath.

The following segments be programmed :

Segment:	T-START	T-ENDE	TIME
1	180°C	190°C	5 min
2	190°C	185°C	10 min
3	185°C	205°C	4 min
4	205°C	185°C	4 min
5	185°C	205°C	4 min
6	205°C	205°C	3 min

1. After starting the program the heating is switched off. If you change to the main display, you see „IDENT" flashing, which indicates that control parameters are determined. When RAMP starts flashing, the heating is activated to reach the start temperature of segment no. 1.
2. The unit heats linear to the end temperature of segment no. 1. Only towards the end of the segment the heating is circled (symbol heater flashes). Three temperatures are shown on the main display:
   - The end temperature of the segment;
   - The current actual temperature;
   - The current set temperature. This is the temperature that should be achieved with an exact linear temperature gradient. The current actual temperature is slightly lower.
3. In segment no. 2 a small negative temperature gradient is given so that the bath is to cool down slower than without controlling. During the whole run of segment no. 2 the heating is circled (symbol heater flashes).
4. The temperature gradient of segment no. 3 is so high that the heating of the unit is not sufficient. Thus the actual temperature is below the set temperature and the curve of the actual temperature is flatter.
5. At the end of the segment the actual temperature is still below the end temperature, when the program starts segment no. 4. A negative temperature gradient is available. As long as the momentary set temperature is higher than the actual temperature at the beginning of the segment the unit heats until the two temperature curves (i.e. set and actual temperature) intersect.



temperature:

——— before and after running the program

while running the program:

——— set temperature

- - - - - - - actual temperature

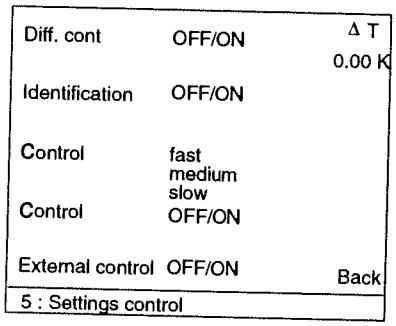
6. At this point the heating is inactivated. The temperature decrease given in segment no. 4 is too fast for a circulator without cooling aggregate. Thus the actual temperature decrease is slower than the set temperature.

7. After segment no. 4 is finished no. 5 starts. At first the set temperature is higher than the actual temperature. The heating is activated, until the linear rising set temperature equals the actual temperature.

8. The heating is activated again. As the temperature gradient set in segment no. 5 is too fast, at the end of the segment the set end temperature has not been reached yet. In segment no. 6 the end temperature of no. 5 is to be maintained. The unit heats as long as this temperature has been reached . Then by means of circled heating the temperature is maintained constant until the end of the segment.

9. At the end of segment no. 6 the program has been finished. Now the unit maintains the last set temperature of the program, i.e. 205°C.

☞ **The times of segments no. 3 and no. 4 should be extended so that the circulator can keep the given values.**



14.5 Working with internal or external control sensors

14.5.1 Selection between external and internal control

The internal control sensor is an immovable fixture. Any commercially available Pt100 sensor equipped with 4-wire technology can be used as the external sensor. For connecting up see chapter 18.

The circulator must be switched off and on again after inserting an external sensor.

Select Settings, then Control and choose if you want to work in the INTERNAL or EXTERNAL mode, n which you switch by means of function key "Intern/Extern".

"External" mode can only be selected if a PT100 sensor is connected and the follow–up control is not activated.

14.5.2 Speed of the external control.

Different control speeds can be selected in EXTERNAL mode.

14.5.2.1. Automatic setting

Activate "Identification" before starting the unit. The controller automatically determines the optimum settings for the system. Depending on the system, determination of the parameters can take a few minutes. The determined parameters are saved as "I values".

14.5.2.2. Manual adjustments

To make manual adjustments to the external controller speed, it is necessary to deactivate "Identification".

Select Settings → Control → Control

The setting "I value" uses the parameters that were determined in the last automatic identification. This setting is recommended if the temperature control system was not changed or was changed only slightly, or if temperature programs run repeatedly in the range ±50°C at around the temperature at which the identification was carried out.

The unit is preset to the control speed „slow". Overswinging is thus avoided for the most part. The time until the desired temperature has been reached can however be quite long. If you would like to shorten this, select „medium" or „fast". When using the setting „fast" you should reckon with quicker control times. The setting „medium" results in moderate overswinging and medium control speeds. The level of over-

swinging is dependent on a number of factors such as the volume of the external system. the heat transfer liquid used, hose length, the working temperature and many others. No general statements can thus be made at this point.

14.5.3 Differential control

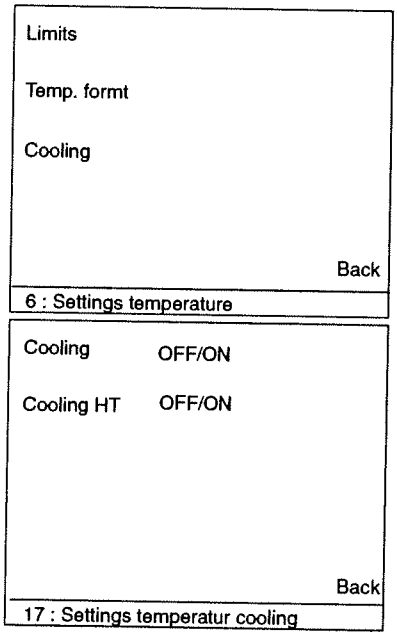
In Follow–up control mode, the value measured at the external sensor is taken as the new set value. This function is only displayed if "External control" is deactivated.

To activate this special function, select
„Settings/Control/Diff. cont „On"

With the „ΔT" function a correction value with plus minus signs for setting set values via the external sensor can be set. Example: The bath temperature should always be 1.51°C above the temperature measured at the external sensor. For this, call up „ΔT" and set a value of + 001.51°C.

After activating the differential control the measured external temperature plus 1.51°C is then used as new set temperature for the circulator bath.

The follower control can be activated only with attached Pt100–Sensor. It is closed, if a temperature specification via I/O port is available.



14.6 Working with or without cooling (only in combination with cooling units)

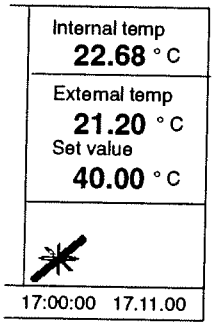
You should decide if the usage of the cooling aggregate (if fitted) is necessary depending on the desired set temperature.

[1] Select „Settings"/"Temp. setting" and then „Cooling". Switch the cooling aggregate ON or OFF. The crossed-out star is on when the cooling unit is off.

When chosing Cooling ON the complete cooling capacity is available for the cooling unit of the C25P. All the other units are cooling controlled.

If you quickly switch between the OFF and ON or in the event of a short mains disconnection, the refrigeration machine will for safety reasons only start up with a 5 minute delay.

If the set temperature value is higher than 100°C the cooling unit will not be switched on. Nevertheless, for special applications, e. g. an expected exothermal reaction, it could be suitable to let the cooling unit run (only partial cooling capacity of 30% of the full capacity).



[2] Select „Settings" / „Temp. settings", then „Cooling" and then Cooling-HT. Switch to ON if the cooling unit should run (default setting is OFF).

14.7 Setting temperature limit values

The setting range of the operating temperature of the circulator can be limited if the application or the flash point of the selected heat transfer liquid requires this.

! This is an additional safety element to avoid error when operating the unit. The supervision of the temperature limits is only active when the control is running. The excess temperature protection has to be set separately.

When in the external control mode (for „Extern" setting see chapter 14.5), the limits set restrict the temperature in the circulator's own bath in order to guarantee a higher degree of safety against unintentional heating up or cooling down.

Select „Settings" / „Temp. settings" and then „LImits". Alter the display in same way as described in chapter 14.2.1. First High and then Low-Limits.

The minimum and maximum limit values that can be set depend on the unit combination.

(operating temperature ranges see Technical Specification)

14.8 Controlling heating and cooling

Heating and cooling are cycled. is illuminated when heating is activated. or is illuminated when cooling is activated. Flashing of the star means a cooling control between 30 and 100%.

lights up if cooling is active with full cooling capacity,

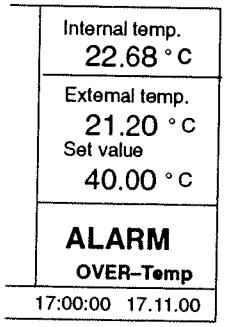
lights up if cooling is active with partial cooling capacity,

lights up if the cooling unit is off.

14.9 Operating without control

Heating and cooling can be switched off without switching off the pump at the same time.
In the „Settings"/ „Control" menu this function can be activated by pressing the „Control OFF" functional key. This is useful for many applications which still need bath intermixing after a heating/cooling phase without maintaining a particular temperature.

To restart the controller, the Stop function must be activated in the main menu, followed by the Start function.



15. Excess Temperature Protection

If this safety device is triggered:

- The alarm indication on the display flashes
- the message „excess temp" appears on the display
- An acoustic signal is sounded
- all voltage conducting unit components (the heating element, the pump motor and if available, the compressor) are switched off immediately i.e. the safety circuit transfers the unit to a stable, safe condition.

☞ **The fault cause must be identified and remedied.**

After the fault has been eliminated the unit can be started again by pressing the reset key.

When the fault has been eliminated the unit can be started again by pressing the function key next to the release symbol.

15.1 Excess temperature protection dial

It offers protection against dangers caused by an uncontrolled heating up of the heat transfer liquid above the desired set temperature.

The cut-off temperature is adjusted with the excess temperature setting dial.

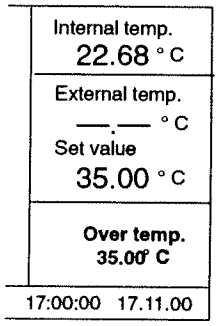
☞ **Proper protection can only be guaranteed if the cut-off point has been correctly set.**

At the first start-up of the circulator the function of the excess temperature protector has to be checked.

There are two main aims for correct setting:

- **Safety (primary importance):**
  Protection against ignition of the heat transfer liquid. The cut-off point must be set at least 25°C **below** the flash point of the bath liquid used.
- **Protection of the object to be temperature controlled (secondary importance):**
  Additional protection, e.g. of a biological sample. The cut-off point should be set as close as possible to the desired temperature value.

Excess Temperature Protection



15.1.1 Setting the excess temperature

The cut-off point is set with the excess temperature dial with a rough scale of temperature values arranged around it. This scale, of course, can only serve as an approximate setting means for this cut-off point. However, the cut-off point can be determined to act exactly if the following procedure is adhered to:

If for instance a bath liquid has a flash point of 60°C the unit should cut off after reaching 35°C at the latest:

[1] First set the desired set value to exactly 35°C.

[2] After the circulator has reached this temperature, turn the excess temperature dial backwards very slowly (to the left) until the unit cuts off (acoustic signal, alarm is flashing).

[3] Then set the set temperature to the actual temperature (< 35°C).

[4] Reset the unit via the reset key after the heat transfer liquid has cooled down somewhat.

⇒ The unit can now be used for temperatures below 35°C. As soon as 35°C is reached, it is securely switched off.

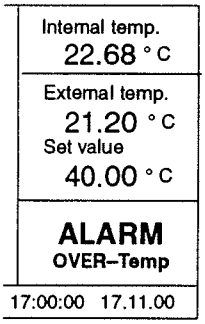
15.1.2 Testing the cut-off point

Set the set temperature to a higher value than 35°C, set the unit to heat up and watch the digital display. The value indicated when the alarm goes on is the real cut-off temperature.

The set overtemperature value can be read off at any time in the "Settings / Status" menu.

16. Fault Displays

An acoustic signal is sounded and "ALARM" is shown on the display. The heating element, the pump and if available, the compressor are completely switched off.



16.1 Excess temperature

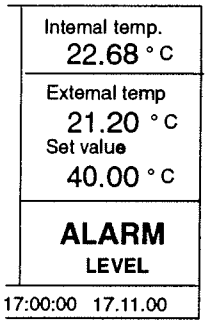
The excess temperature protection can be triggered if:

- Excess temperature has been set too closely to the desired working temperature

  ⇒ increase value slightly according to specifications made in chapter 15.1.1.

- the control function is defective

  ⇒ Return unit for servicing.



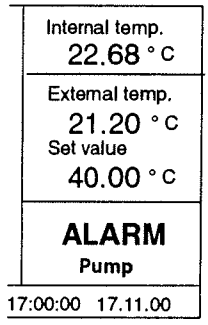
16.2 Low liquid level cut-off

The low liquid level protection can be triggered if:

- there is not enough liquid in the bath

  ⇒ check for leaks, top up if necessary,

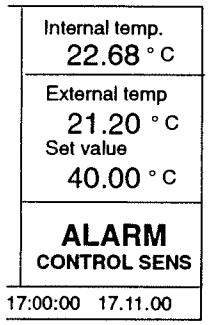
  ⇒ fluid has evaporated, replenish liquid.



16.3 Pump or motor overloading

The motor or pump is blocked:

⇒ If the circulator switches off again after a short time, return the unit for servicing!



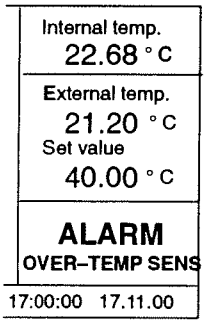
16.4 Sensor breakage or short circuit

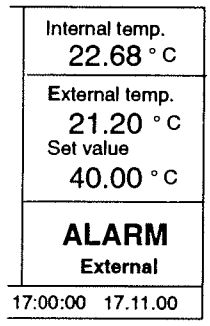
The error can refer either to the internal control sensor "Control sens", the electronic overtemperature sensor "O–temp sens" or the external PT100 sensor "Ext sens".

⇒ Improve shielding of the sensor connector cable. (see chapter 18.5)

⇒ Check that the external sensor is firmly and securely in the socket.

⇒ The sensor must be tested and possibly exchanged by qualified service personnel.





16.5 External fault

The circulator has been switched to fault status via the alarm input of the multi functional interface.

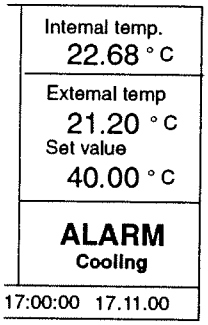
⇒ Check external system.
Voltage at Pin 5 and 6 is 0V.

Message: „External"

16.6 External fault RS232C

The circulator has been switched to fault status via the interface.

⇒ Check the external system.



16.7 Error in connection with cooling units

If the compressor of the cooling unit is overloaded the circulator will be switched to fault status: "COOLING". Allow the unit to cool down for a few minutes and then try to start up again. If the fault occurs again ...

⇒ return unit for servicing.

16.8 Fault displays of the Fuzzy control

Message :Control

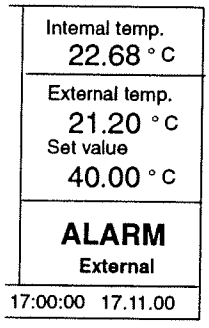
Fault 1: Fault during identification

If at the beginning of the identification the set temperature is changed by the user so that the temperature difference between the actual temperature and the new set temperature is smaller then 5°C, fault 1 occurs.

⇒ Switch off and on unit.

or

⇒ RESET actuate in the „Settings"/ „Unit" menu.



Fault 4 and **Fault 5: Fault during identification**

During the identification, to determine ideal control parameters the Fuzzy control repeatedly measures temperature gradients, delay times etc.

The identification result, which is made up of a great number of measurements, is continually checked for plausibility. In case of discrepancy en error message appears.

In order to remove the fault two different modes have to be distinguished:

Operation with programmer:

If **fault 4 or 5** occurs while a program is running:

⇒ return unit for servicing.

Operation without programmer:

If **fault 4** occurs, the identification is considerably disturbed by external heat flow.

⇒ Arrange for constant temperature conditions and try another identification run.

⇒ As this fault only occurs during the identification, switch off the identification if necessary:
Select „Settings", then „Control", then „Identification" and define whether to switch on or off the identification.

If the fault occurs repeatedly:

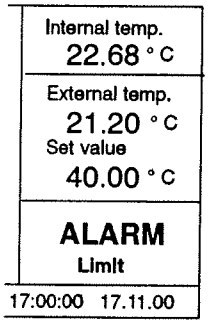
⇒ return unit for servicing.

If **fault 5** occurs, this indicates the influence of a high level of external cooling or heating during identification.

⇒ Reduce the influence and try another identification run.

If the fault occurs repeatedly:

⇒ Please contact the Thermo Haake product specialists.



Fault 15: Bath temperature < L-Limit

If the low temperature limit (L-Limit) is changed so that is above the actual temperature, fault 15 occurs.

⇒ In the „Settings" / „Temp. settings" / „Limits" menu select a low temperature limit that is below the actual temperature.

⇒ ALARM is still visible on the display.

⇒ The reset key must be pressed in order to start up the unit again. ALARM disappears on the display and the unit can be operated again.

Fault 16: Heating defective (internal/external control)

During the identification, to determine new control parameters the Fuzzy control measures the time necessary for a temperature step of 1°C at the control sensor.

If this takes longer than 300 s (internal control) or 720 s (external control), respectively, Fuzzy control assumes a fault in the heating system, so that fault 16 occurs.

⇒ Return unit for servicing.

16.9 Has the fault been eliminated?

⇒ Press the „Release" function key to reset the unit.

17. Testing the Safety Features

The safety features for excess temperature protection and low liquid level protection must be checked at regular intervals. The level of regularity of checking depends on the unit's designated application and the heat transfer liquid used (inflammable or non-inflammable). Practical experience has shown that between 6 to 12 times a year is sufficient.

17.1 Excess temperature protection

Set a cut-off temperature (see chapter 15.1) that is lower than the desired set temperature. Switch on the circulator and check if the circulator really does switch itself off at the set cut-off temperature
If not follow the specifications detailed in chapter 15.1.1.

It may be deemed necessary to have the unit checked over by qualified service personnel.

17.2 Low liquid level protection

Drain the heat transfer liquid **slowly** during operation (use a drain tap if necessary) and check if the unit really does switch itself off.
If not the unit must be checked over by qualified service personnel.

18. External Connections

! **Only use shielded cable (see chapter 18.5).**

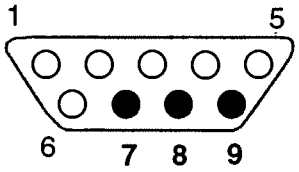
18.1 Interface RS232C see chapter 19.

18.2 Multi–function connection

The multi–function connection (11) is on the rear of the circulator. Different functions are available on the different pins of the 9 pole SUB–D plug. This has to be considered when external units are connected.

Important! The DIP–switches (12) have always to be tilted to position „1 2" (both switches are down) with the exception of function 17.2.3 (external alarm input).

18.2.1 Remote alarm



Potential free contact with the following pin assignment:

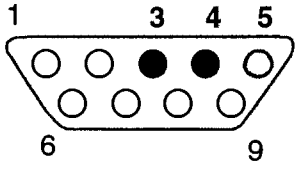
Pin 7 = make contact

Pin 9 = middle

Pin 8 = break contact

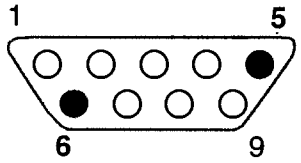
Alarm relay in the circulator:
The relay contacts 9 and 7 are open in case of an alarm and when the instrument is switched off.

Rating: max. 30 V
max. 0.1 A



18.2.2 Contact input for unit ON/OFF

Assignment of the Pins 3 and 4:
Voltage at Pin 3 and 4 = 0V: Unit is switched ON
Voltage at Pin 3 and 4 = +5V: Unit is switched OFF



18.2.3 5V relay for alarm triggering

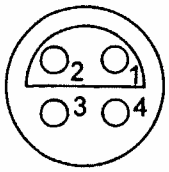
Assignment of the Pins 5 and 6:

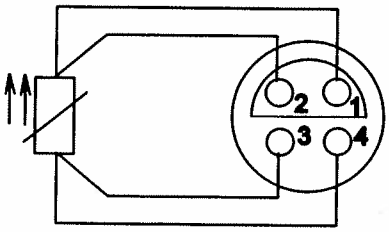
Voltage at Pin 5 and 6 = 0V: Unit is set on alarm; display on the display: „Alarm → external"

Voltage at Pin 5 and 6 = +5V: Unit works without accident.

! **Tilt DIP switches in position „open" (both switches are up).**

Pt100





18.3 External Pt100 sensor

A sensor in four wire technology is necessary.
Only sensors with shielded wires can be used to fulfill the EMC requirements. The shielding must be connected with the housing of the plug and the sensor shaft.

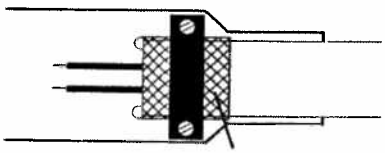
This sensor has to be connected according to the wiring diagram.

Pin assignment:

Pin 1 = current I +
Pin 2 = voltage U +
Pin 3 = voltage U –
Pin 4 = current I –

18.4 I/O port (option!)

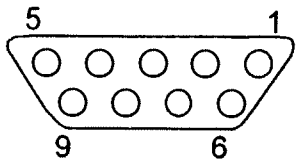
This port for analog small voltage will be delivered as an option and is described separately (see appendix).



Attach shielding plane

18.5 Shielded Cables

In order to keep the electromagnetic noise in the instrument within the tolerable limits it is indispensable to use only shielded cables and high quality plug connections. The complete contact of the shielding within the plugs is of special importance. Insufficient contact may lead to noise penetration and result in performance errors.



19. RS232C Interface

The following circulator functions can be controlled by a computer via the interfaces:

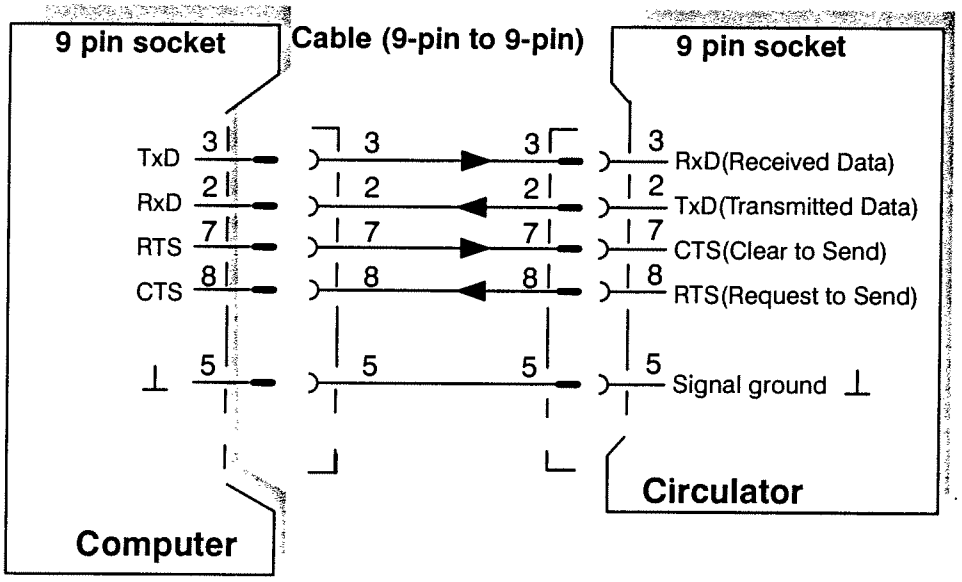
- Setting the desired set temperature, the upper and lower limit temperatures and correction factor is possible;
- the actual temperature can be read off;
- the circulator can be reset, started or stopped;
- any fault messages can also be displayed.

The RS232C interface uses separate lines for sending and receiving data.

19.1 Connecting to a computer

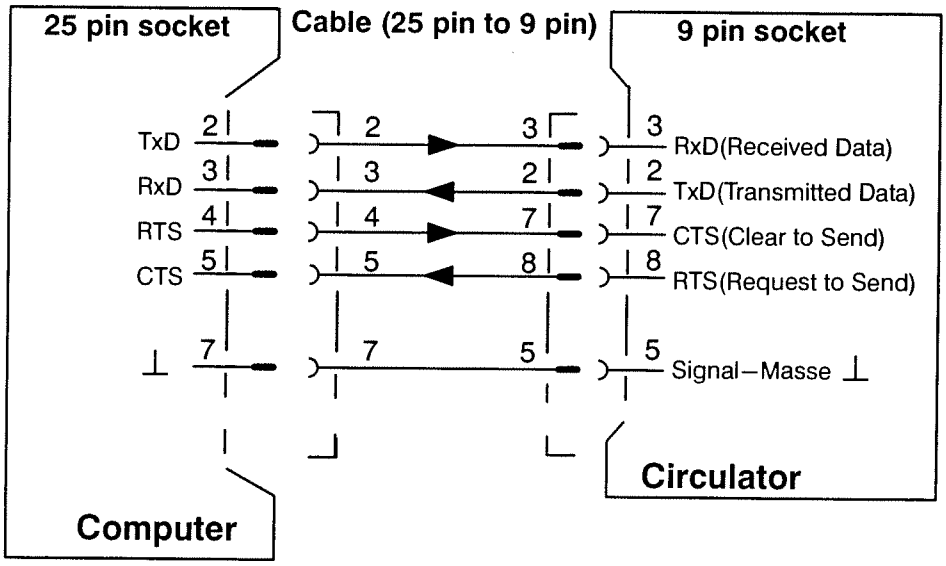
19.1.1 PC with an RS232C interface

The pin assignment required when connecting the circulator to a computer via a **9-pin** socket is as follows:

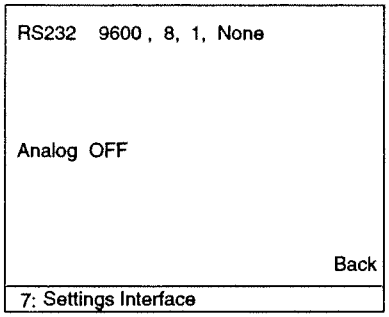


Serial Interface

The pin assignment required when connecting the circulator to a computer via a **25-pin** socket is as follows:



19.2 Interface parameter



Interface parameters can be set via the circulator as follows:

First select the „Settings“ sub menu in the main menu. After that select „Interfaces“ .

The currently set parameters are shown following the name of the interface in one line each:
For RS232 those are: baud rate, 8 data bits, 1 stop bit, parity.

Then determine for which interface these parameters have to be set (RS232C).

After that select the parameter you want to change and activate the desired value.

The saved parameters will be listed in the first line. Changes will be done in the following line.

☞ All these transfer parameters **cannot** be altered via the interface.

Maximum baud rate

Recommendation for the maximum baudrate: **9600 bauds**

The communication between the computer and the circulator should not take place at a baud rate higher than 9600. Occasional transfer failures ca occur at a baud rate of 19200.

19.3 Requirements made of external units

Only units which have been tested according to EN 60950 (=IEC 950) should be connected to the interface of the circulator.

19.4 Setting the desired set value

If the desired set value is set via the computer, this means:

- If the connection is interrupted, the thermostat continues to regulate at the last set temperature defined via the interface.
- After the mains supply current has been switched off and on, the circulator controls the temperature to the last value entered via its keyboard and not the value given by the computer.

19.5 Correction value

If the desired correction value is set via the computer, this means:

- If the interface connection is interrupted, the circulator operates to the last correction value entered via the interface.
- After the mains supply current has been switched off and on, the circulator operates to the last value entered via its keyboard and not the value given by the computer.

19.6 Controlling a circulator

The interfaces can be controlled by the user either via a BASIC program or a higher programming language (under DOS) or via the Windows-Terminal (under Winwows 3.1x).

19.7 Sets of commands

For the communication there are three different sets of commands. Commands of the different sets can be combined at will.

- Standard set of commands
- Extended set of commands
- Set of commands according to NAMUR.

☞ **In the following table a blank is represented by a "_",** for example "R_V1" or "S__*<value>*"

☞ **Every command must be confirmed with** <cr>.

☞ **For all three sets of commands there is no difference between upper case and lower case letters.** I.e. there is no difference between entering "start", "Start", "START" or "StArT".

☞ **In case of the "standard set of commands" be sure to keep the right number of digits when entering a value.**

☞ **In case of the "extended set of commands" and the "set of commands acc. to NAMUR", empty places need not be filled with "0" (in contrast with the "standard set of commands").**

Standard set of commands:

If you have already controlled a circulator DC50 via the PC you can use the same set of commands for the circulators of the Phoenix line.

Serial Interface

Standard	Extended	NAMUR	Command
V	R_V1	–	**Version** ... of the operating software
B – –	R_BS R_FB R_FE	– – –	**Operating status** call up fault messages (19.8) call up fuzzy control call up fuzzy error number
I or F1 F2	– –	IN_PV_1 IN_PV_2	**Actual temperature** Call up actual temperature (internal) actual temperature (external)
S S__<*value*>	R_SW W_SW_<*value*>**)	IN_SP_1 OUT_SP_1___<*value*>	**Set temperature** (resolution 0,01°C) Call up set temperature Select set temperature *)
<*value*> = {00000 ... 20000} => 0°C ... 200,00°C <*value*> = {00000 ... –5000 } => 0°C ... –50,00°C e.g.: set temperature= 20,0°C => "S__02000" set temperature= –10,5°C => "S –1050"; "–" replaces 1st digit			
C CE C__<*o.s.*><*value*> CE_<*o.s.*><*value*>	R_CI R_CE W_CI<_*value*>**) W_CE_<*value*>**)	IN_SP_2 IN_SP_4 OUT_SP_2___<*value*> OUT_SP_4___<*value*>	**RTA (correction factor c)** (resolution 0,01°C) Call up RTA (internal) Call up RTA (external) Set RTA (internal) Set RTA (external)
<*o.s.*> = {+,–}; operational sign <*value*> = {0000 ... +/–0255} => 0°C ... +/–2,55°C "blank" and "+" can be used as positive signs, e.g.: c = 1,23°C => "c__0123" or "c_+0123"			
HL LL – –	R_HL R_LL W_HL_<*value*>**) W_LL_<*value*>**)	IN_SP_6 IN_SP_7 – –	**Temperature limit values** (resolution 0,01°C) Call up high limit temperature Call up low limit temperature Set high limit temperature Set low limit temperature
AL	W_AL	OUT_MODE_4_0 OUT_MODE_4_1	**Alarm** ... triggering (main relay missing, heating and pump off) Alarm confirming

" _ " = blank

*) When a new set temperature is set while the start segment is triggered or when the ramp is set on pause, it is stopped and continues to work with the new set value.

**) at values with decimal places, put in a point e.g. 20.01 (no comma!!!)

Standard	Extended	NAMUR	Command
ER	W_EG		**Unlocking** ... after switching on or fault
GO ST	W_TS0 W_TS1	OUT_MODE_5_0 OUT_MODE_5_1	**Unit ON/OFF** Heating and pump ~~ON~~ OFF Heating and pump ~~OFF~~ ON
– –	– W_SR W_ER	IN_MODE_5 0: control OFF 1: control ON START	**Control ON/OFF** Call up control ON/OFF Regulation ON Regulation OFF (pump continues)
– IN EX	– W_IN W_EX	IN_MODE_2 0: internal 1: external OUT_MODE_2_0 OUT_MODE_2_1	**Internal/external control** Call up internal/external control Switching to INTERNAL control Switching to EXTERNAL control
– – –	R_FR W_FR_0 W_FR_1	– – –	**Diff.cont on/off** call up status OFF ON
– – –	R_ZA W_ZA_0 W_ZA_1	– – –	**Autostart** call up status OFF ON
– – –	R_Zi W_Zi_0 W_Zi_1	– – –	**Fuzzy ID** identification call up status OFF ON
– – –	R_ZB W_ZB_0 W_ZB_1	– – –	**BEEP Programmer** call up status OFF ON
– – – –	R_XT R_XD W_XD_*<HH>*_*<MM>*_*<SS>* W_XD_*<DD>*_*<MM>*_*<YY>*	– – 	**Real time clock** Call up time Call up date Select time Select date

" _ " = blank

Standard	Extended	NAMUR	Command
			Temperature scale
–	W_TE_C	–	Select Celsius
–	W_TE_K	–	Select Kelvin
–	W_TE_F	–	Select Fahrenheit
			Watchdog
–	W_WD_1	–	ON
–	W_WD_0	–	OFF
–	R_WD	–	Call up status WD0: inactive WD1: active
–	W_WS	–	Specifies the setpoint for watch-dog response time in 2 sec. raster
–	R_WS	–	Call up setpoint
			Cooling
–	R_CC	–	call up status
–	W_CC_0	–	OFF
–	W_CC_1	–	ON
			Pump
–	R_PF	–	Call up value 5 to 100%
–	W_PF_<value>	–	Select value Area 5 to100
			Display corresponds %
			fast 100
			medium 75
			slow 50
			Heating and Cooling control
	~~W_FS~~	–	External control
	W_FS 0	–	OFF
	W_FS 1	–	ON
			after switching the unit on it is always set to 0
			Heating capacity
–	W_HS_<Wert>	–	External control only when external control is set to on range 0 to 100 %
			Cooling capacity
–		–	External control
–	W_KS_<Wert>	–	only when external control is set to on range 0 to 100 %
			lock Keyboard
–	W_SP_0	–	OFF
–	W_SP_1	–	ON

"_" = blank

Temperature program over Interfaces

With the **extended set of commands** a temperature program with 10 ramp segments can be defined. For every segment four parameters must be set:

- Segment number
- Start temperature of the segment
- End temperature of the segment
- Segment time

In addition, the temperature variation (= allowed deviation of the actual temperature from the start temperature of the ramp) has to be set for the first segment.

These parameters can be entered separately or in one line.

Extended	Command
Before entering the parameters at least one temperature program and one segment have to be entered.	
R_AR	Read number of ramps
W_AR	Create ramp
W_RN_<Nr>	Set ramp number for processing
W_SA	Create a ramp segment (max.10)
After selection of the segment number, the start and end temperature and the segment time can be entered in any order.	
Fault F123 = "RANGE ERROR"	
If a value is entered that is out of the temperature limit, error message "F123" appears. After that enter a correct value.	
W_SN_*<no.>*	Select **segment nummer** (no.: 1–10)
W_SS_*<value>***)	Set **start temperature**
W_SE_*<value>***)	Set **end temperature**
The start and end temperature of the segment (in °C, resolution 0,01°C) must be between the high and the low limit temperature of the circulator (see 14.7).	
W_SD_*<time>***)	Set **segment time** (in s, resolution 0,01 s; minimum 0 s, maximum 86,400 s = 24 hour)
W_SB_*<value>***)	**Temperaturband** definieren (max 9.99°C)
R_SP_*<no.>*	Call up parameters of segment <no.>
W_SP_*<no.>_<start>_<end>_<time>* *<tape> only 1 segment.*	Set **all parameters** of segment<no.>
W_AS_*<no.>*	**Run segment** Run to start temperature (segment no.: 1–6)
Before starting a segment first enter W_ASxx. Then the circulator runs to the start temperature of the segment.	

" _ " = blank

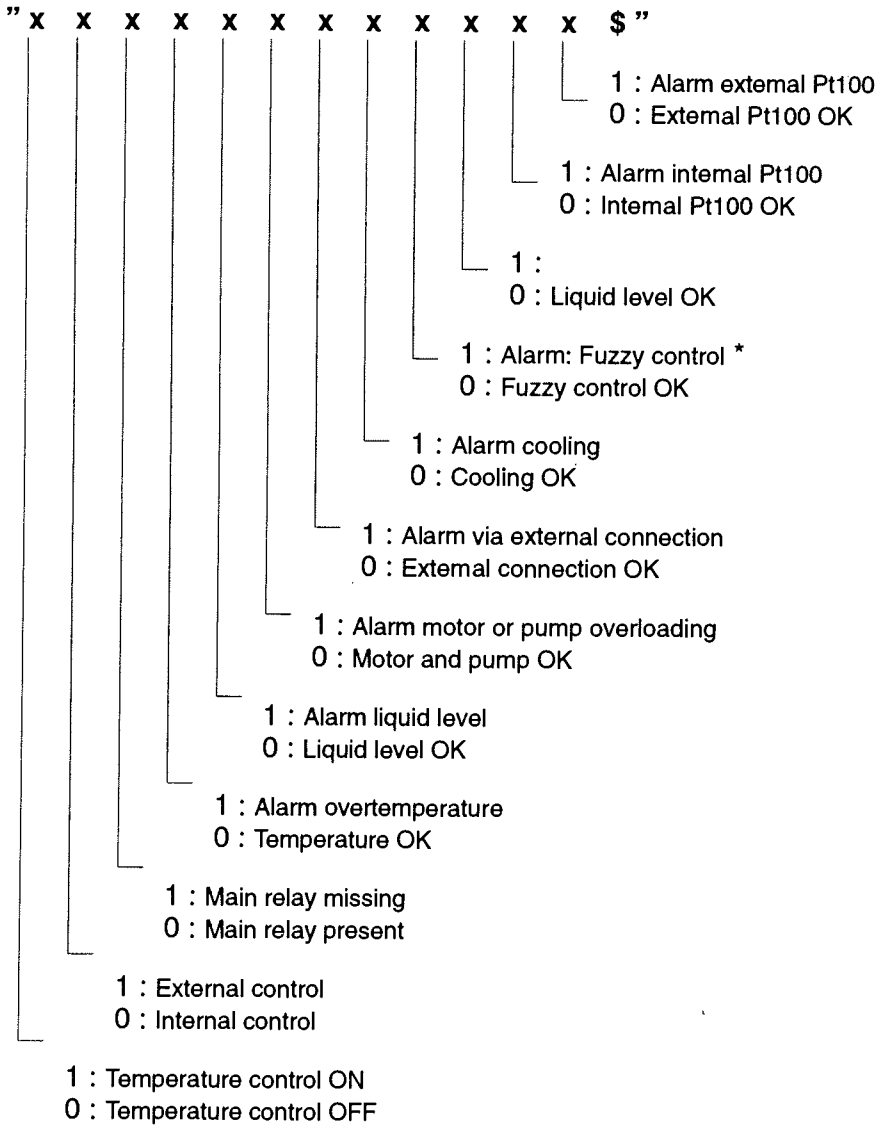
Extended	Command
Fault F126 = "RAMP ERROR"	
If you select a segment for which not all the parameters have been defined, error message "F126" appears. In this case either select another segment or define the parameters.	
W_AS_<no>	Trigger start temperature and without start ramp.
W_RS_<no>	Immediate start of the ramp without triggering the start temperature
W_RB	Stop ramp
W_RP	Interrupt ramp
You can interrupt the program with W_RP. Then the segment time is hold and the momentanous temperature is maintained. The interrupted program can either be continued with W_RS or another segment can be selected with W_RB.	
Fault F127 = "PAUSE ERROR"	
The command W_RP "interrupt ramp" is only available while a program is running, i.e. if the commands W_AS_<no.> or W_RS_<no.> have been entered before.If this is not the case "F127" appears when entering the command W_RP "interrupt ramp".	
Fault F001 = "COMMAND UNKNOWN "	
If a command is entered that is not defined in any set of commands, error message F001 appears. In this case enter one of the commands listed above.	
The single ramps can be repeated cyclically:	
R_RZ	Call up number of cycles
W_RZ_*<number>*	Set number of cycles
Call up for information:	
R_CR	Read current (active) ramp number.
R_CS	Read current (active) ramp segment.
R_RN	Read ramp number which is currently run.
R_SA	Read number of segments of the current ramp.
R_RI	Read remaining ramp time and internal sensor value.
R_RE	Read remaining ramp time and external sensor value.
R_XR	Read status ramp continuation
Answer „ XR_< program no. >_< segment no. >_< segment remain time >_ < setpoint step >_< actual ramp setpoint >_< segment end temperature > „	

"_" = blank

19.8 Operating status / Error message

Call up operating status:
Standard set of commands: B<cr> or
Extended set of commands: R_BS<cr>

After entering one of these commands, the following twelve "state flags" are shown:



*) With the command R_FE the number of the individual Fuzzy-Error can be read (error list see chapter 16.8)

19.9 Example definition of a ramp program by PC

The comfortable programmer functions integrated in the Phoenix units can also be controlled by PC through the RS232C interface.

1. Select the **number for the program** you would like to define (max. 10 programs possible):

W␣RN␣<**program no.**>
␣ Space Bar ␣ *1 ... 10*

2. Then define the **number of program cycles**.
A program can be repeated up to 90 times (i.e. 90 program cycles):

W␣RZ␣<**number of cycles**>
␣ *1 ... 90*

3. W_SA will create a new segment.
A segment number will automatically be assigned to the programmed segments. Now you can enter the following parameters for each **segment number**:

- the **start** temperature of the segment
- the **end** temperature of the segment
- the **run time** of the segment in seconds (≥1)

W␣SP␣<**segment no.**>␣<**start**>␣<**end**>␣<**run time**>
␣<**tape**>

Example: segment no. 1

start	=	23.0°C
end	=	27.0°C
run time	=	600 sec
tape	=	0.5°C

W␣SP␣1␣23.0␣27.0␣600␣0.5

All other segments can be defined accordingly. Please note that the temperature program is continual for all defined segments. This means that the end temperature of segment i must be the start temperature of segment i+1.

4. Start the program by entering the respective program no. (This START command corresponds to the START of the ramp via the menu function) without starting the start temperature:

W_RS_<**program no.**>

For starting the start temperature the instruction

W_AS_<**program no.**>

must be input before

This will transfer the program from the PC to the circulator. The PC can now be switched off or be used for other tasks. The interface cable can be unplugged from the circulator.

After switching off the circulator the programs are lost.

Example of a program: Program no. 3 with 6 segments and 23 program cycles

1.) W_RN_3

2.) W_SA
W_SN1
W_SP_1_180.0_190.0_300_0.1

3.) W_SA
W_SN2
W_SP_2_190.0_185.0_600

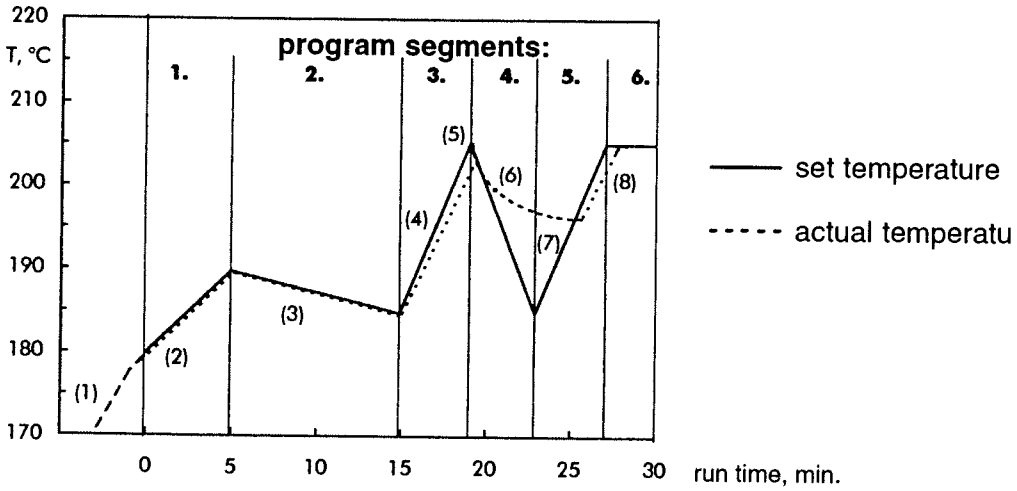
4.) W_SA
W_SN3
W_SP_3_185.0_205.0_240

5. W_SA
W_SN5
W_SP_4_205.0_185.0_240

6.) W_SA
W_SN6
W_SP_5_185.0_205.0_240

7.) W_SA
W_SN7
W_SP_6_205.0_205.0_180

8.) W_RS_3



(1) After starting the program the heating is switched off and control parameters are determined. Then the heating is activated to reach the start temperature of segment no. 1.

(5) At the end of the segment the actual temperature is still below the end temperature, when the program starts segment no. 4. A negative temperature gradient is available. As long as the momentary set temperature is higher than the actual temperature at the beginning of the segment the unit heats until the two temperature curves intersect.

(6) At this point the heating is inactivated. The temperature decrease given in segment no. 4 is too fast for a circulator without cooling aggregate. Thus the actual temperature decrease is slower than the set temperature.

☞ **The times of segments no. 3 and no. 4 should be extended so that the circulator can keep the given values.**

20. Cooling

The refrigerated bath is used mainly for enabling lower than ambient or tap water temperatures in circulators or for cooling a heated bath down to a low temperature level very quickly.

The working temperature range is shown in the technical specifications.

☞ **Safety measures have been taken in order to avoid an excessively high temperature in the cooling circuit which would then result in the excess temperature protection being triggered and the compressor being switched off.**

The cooling capacity is controlled according to the heat removal requirements. At bath temperatures >70°C the cooling unit is operated with basic cooling, at temperatures >100°C the unit is switched off (exceptions see 14.6 Working with or without cooling).

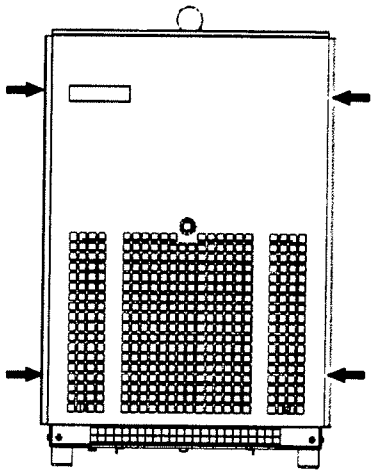
21. Maintenance

The stainless steel surfaces of the bath vessel and of the housing may after some time show spots and become tarnished. Normal stainless steel cleaners as they are used in the kitchen can be used. The bath vessel and built-in components should occasionally (at least every time the bath liquid is changed) be cleaned using a household cleaner. Vinegar-based cleaners have proved to be suitable used according to the manufacturers recommendations.

☞ **Do not use scouring powder!**

The inside of the bath vessel must be kept clean in order to ensure a long service life. Substances containing acidic or alkaline substances and metal shavings should be removed quickly as they could harm the surfaces causing corrosion. If corrosion (e.g. small rust marks) should occur in spite of this, cleaning with stainless steel caustic agents has proved to be suitable. These substances should be applied according to the manufacturers recommendations.

21.1 Cleaning the fins of the Ilquefier



In order to maintain the cooling capacity of the unit, cleaning has to be done two to four times per year, depending on the grade of soiling.

! **Switch off the unit and pull out the mains plug.**

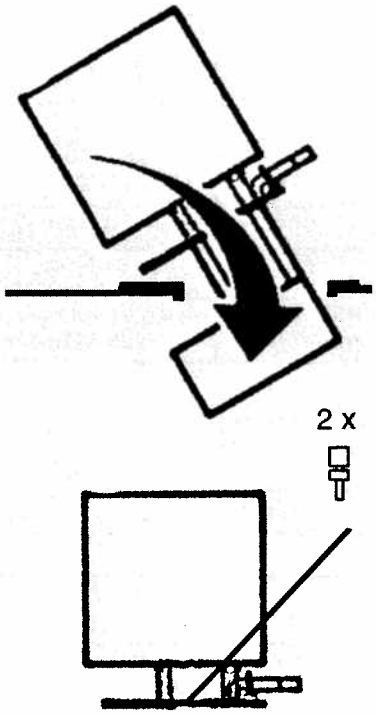
1 Release ventilation grids in front: pull grids slightly forward at the bottom and press out the four snap springs at the fastening points with a screw driver.

2 Fit in grids again and press in the snap springs at the four fastening points.

21.2 Discarding the unit:

One day the life span of your cooling unit will end.
Therefore:

! **The units contain the ozone-friendly coolants R134a, R404A or R23. The units may however only be discarded by authorized personnel.**



22. Disassembly of Temperature Control Module and Bath Vessel

! **Switch off the unit and pull out the mains plug.**

[1] Unscrew the 2 screws.

[2] Incline the unit slightly whilst lifting it.

! **Lift the float to avoid any damage.**

23. Technical Specifications

23.1 Bridge Circulators

Technical specifications acc. to DIN 58966		P1–H70
Working temperature range with tap water cooling with other cooling	°C °C °C	30..250 20..250 -75..250
Temperature accuracy	±K	0.01
Heater capacity 230 V / 115 V	W	2000/1200
Pump: Pressure/Flow rate max. Suction/Flow rate max.	mbar/ l/min mbar/ l/min	560/24 380/22
Immersion depth from..to	mm	70..150
Width of the bath bridge from..to	mm	320..800
Overall dimensions: WxLxH	cm	32x17x36
Net weight	kg	
Total wattage 230 V / 115 V	VA	2100/1250
Order no. for 230 V / 50..60 Hz for 115 V / 60 Hz		440-0511 440-0512

23.2 Heating Circulators P1

Technical specifications acc. to DIN 58966		P1-B5	P1-B7	P1-B12	P1-W26	P1-W45
Working temperature range with tap water cooling with other cooling	°C °C °C	38..250 20..250 -60..250	38..250 20..250 -60..250	35..250 20..250 -60..250	35..250 20..250 -60..250	30..250 20..250 -60..250
Temperature accuracy	±K	0,01	0,01	0,01	0,01	0,01
Heater capacity 230 V / 115 V	W	2000/1200	2000/1200	2000/1200	2000/1200	2000/1200
Pump: Pressure/Flow rate max. Suction/Flow rate max.	 mbar/ l/min mbar/ l/min	 560/24 380/22	 560/24 380/22	 560/24 380/22	 560/24 380/22	 560/24 380/22
Bath opening: WxLxD	cm	14x14.5x15	13x10x20	22x14x20	30x35x20	30x35x30
Bath volume	l	4,5	7	12	26	42
Overall dimensions: WxLxH	cm	24x38x44	25x38x50	34x38x50	35x54x44	36x54x55
Net weight	kg	10,2	11,8	13	11	19
Total wattage 230 V / 115 V	VA	2100/1250	2100/1250	2100/1250	2100/1250	2100/1250
Order no. for 230 V / 50..60 Hz for 115 V / 60 Hz		440–0051 440–0052	440–0071 440–0072	440–0121 440–0122	440–0071 440–0072	440–0121 440–0122

23.3 Refrigerated Circulators

Technical specifications acc. to DIN 58966		P1-C25P	P1-C30P	P1-C35P	P1-C40P	P1-C41P	P1-C50P
Working temperature range	°C	-28..150	-30..200	-35..200	-40..150	-40..150	-50..150
Temperature accuracy	±K	0,01	0,01	0,01	0,01	0,01	0,01
Heater capacity 230 V / 115 V	W	2000/1200	2000/–	2000/1200	2000/–	2000/–	2000/–
Cooling capacity at 20°C	W	300	800	400	700	1000	850
at 0°C	W	200	620	300	550	750	700
at -20°C	W	70	450	150	300	400	500
Pump: Pressure/Flow rate max.mbar/ l/min		560/24	560/24	560/24	560/24	560/24	560/24
Suction/Flow rate max.mbar/ l/min		380/22	380/22	380/22	380/22	380/22	380/22
Bath opening: BxLxT	cm	13x10x15	22x14x20	22x14x15	29x15x15	29x15x20	22x14x15
Bath volume	l	4,5	12	8	12	15	8
Overall dimensions: WxLxH	cm	26x48x63	40x51x77	40x51x71	40x51x71	40x51x77	40x51x77
Net weight	kg	26,3	46,0	40,0	41,0	45,0	46,0
Total wattage 230 V / 115 V	VA	2450/1450	2600/–	2500/1500	2550/–	2600/–	2650/–
Order no. for 230 V / 50..60 Hz		440–0251	440–0301	440–0351	440–0401	440–0411	440–0501
for 230 V / 60 Hz		440–0251	440–0309	440–0351	440–0409	440–0419	440–0509
for 115 V / 60 Hz		440–0252	–	440–0352	–	–	–

23.4 Cryostats

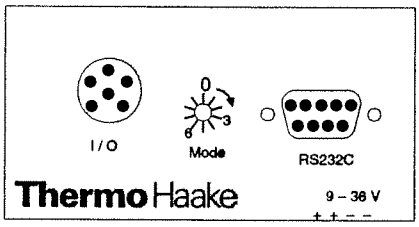
Technical specifications acc. to DIN 58966		P1-C75P
Working temperature range	°C	-75..100
Temperature accuracy	±K	0,02
Heater capacity 230 V / 115 V	W	1000
Cooling capacity at 20°C / 0°C	W	280/220
at -20°C / -40°C	W	180/130
at -60°C / -80°C	W	50/–
Pump: Pressure/Flow rate max.	mbar/ l/min	560/24
Suction/Flow rate max.	mbar/ l/min	380/22
Bath opening: WxLxH	cm	13x10x20
Bath volume	l	4,5
Overall dimensions: WxLxH	cm	38x46x74
Net weight	kg	68
Total wattage 230 V / 115 V	VA	2500
Order no. for 230 V / 50 Hz		440–0751
for 220 V / 3 Ph / 60 Hz		440–0759

23.5 Fuse values

Unit type	Mains voltage	Fuse(s) at the rear panel	Fuse(s) in the unit
P1/1kW/Cool	230V	-	-
P1/1,2kW	115V	15A	-
P1/1,2kW/Cool	115V	-	-
P1/2kW	230V	2x15A	-
P1/2kW/Cool	115V	-	-
C25P	230V/50Hz	2x13A	-
	115V/60Hz	2X13A	-
C30P	230V/50Hz	2x13A	-
	220V/60Hz	2x13A	-
C35P	230V/50Hz	2x13A	-
	115V/60Hz	2x13A	-
C40	230V/50Hz	2x13A	-
	220V/60Hz	2x13A	-
C41P	230V/50Hz	2x13A	-
	220V/60Hz	2x13A	-
C50P	230V/50Hz	2x13A	-
	220V/60Hz	2x13A	
C75P	230V/50Hz	2x13A	-
	200V/50–60Hz	2x13A	-

24. Appendix

24.1 Connection of the external analog box



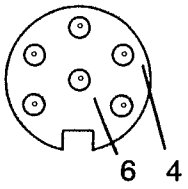
The analog box is connected to the RS232C interface of the Phoenix circulator with the enclosed interface cable.
You activate the analog input in the „Settings"/„ Interfaces" menu.
The power supply of the analog box is done via the marked connection clips.
For this a direct voltage between 9V and 36V is required.

! Attention: The power supply (mains transformer or similar) is not included in the delivery.

24.2 Pin assignment

! Attention: The pin 087–1336 for the I/O port is not included in the delivery.

24.2.1 Signal input

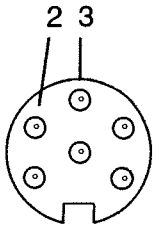


For signal input the socket has the following pin assignment:

4 = reference input + (set value),
6 = reference input – (set value).

Working resistance for current input: < 150 Ω,
Input impedance for voltage input: > 50 kΩ.

24.2.2 Signal output



For signal output the socket has the following pin assignment:

2 = measuring value + (actual value),
3 = measuring value – (actual value).

Working resistance for current input: < 500 Ω,
Output impedance for voltage input: > 10 kΩ.

For the operation of the circulator with an analog low voltage normal signal via the I/O port you can choose between

1) voltage input,
2) voltage output,
3) current input and
4) current output.

I.e. with this interface you can

- define set values (voltage and current input) and simultaneously

- show actual values (voltage and current output)

of an external device.

24.3 Selecting the signal range

Selecting the signal range (resolution) and type (voltage or current) is done with the rotary switch at the analog box. A narrow notch on the side of the switch indicates the position.

The following settings are possible:
Voltage input and output: Switch position: „Mode"

a)	0...10 V = 0...100°	0
b)	−1...3 V = −100...300°C (10mV/°C Änderung; 0,0V=0,0°C)	1
c)	0...10 V = −100...400°C	2

Current input and output:

d)	0...20 mA =	−100...400°C	3
e)	0...20 mA =	0...100°C	4
f)	4...20 mA =	−100...400°C	5
g)	4...20 mA =	0...100°C	6

! Before changing the signal range, switch off the thermostat and the voltage supply of the analog box. Then set the range and switch the thermostat and analog box back on.

24.4 Simultaneous operation of input and output

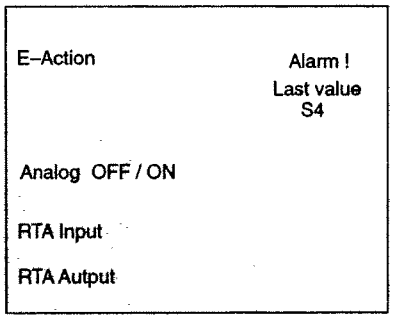
Via the I/O plug you can either

- give set values (voltage or current input),
- monitor actual values (voltage or current output) or
- simultaneously give set values and monitor actual values. In this case, input and output channels can be combined at will.

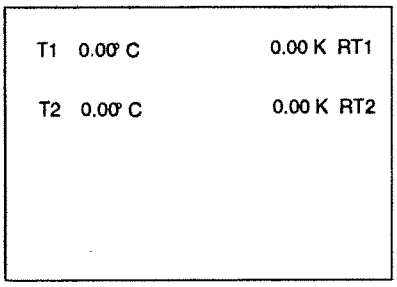
24.5 Offset adjustment of the set temperatures and actual temperatures

If the analog interface on the thermostat display is activated, two new functions "RTA input and RTA output" appear. If an offset is shown between the analog defined set temperature and the set temperature shown in the display, the difference between the two values can be entered as the correction value with the function "RTA input". After the function is activated, two temperature values RT1 and RT2 can be seen in the display with the associated correction values RT1 and RT2. For T1, define the temperature value at which the devi-

ation was measured. Next, enter this deviation for RT1. If the offset was determined only for one temperature, it is necessary to enter for T2 and RT2 the identical values as for T1 and RT1. RT1(2) is then added to the display.



If the deviation of the set temperature was determined for a value different to T1, this can be defined as RT2 for T2. Then, in addition to an additive offset, the increase of the characteristic is also changed. The value correction on the display takes place automatically for the entire range of values. If an offset is shown between the analog output actual temperature and the actual temperature shown in the display, the difference between the two values can be entered as the correction value with the function "RAT output". The entered value is added via the interface to the analog box output actual value.



These two RTA values are effective only for the connected analog box.

24.6 Reaction in the event of alarm

Following activation of the analog interface, the new function "E–action" appears in the display. Pressing the function key several times enables you to select how the thermostat should behave when the analog box shows a malfunction or if the connection is interrupted.

If "ALARM" is selected, the thermostat goes into the alarm state, i.e. the pump and heating are switched off.

In the case of "Last value", the thermostat continues to run with the last set value defined via the analog interface.

With "S4", the set value S4 is used as the new set temperature in the event of an alarm.

24.7 Stopping the input via the I/O plug

In order to end the entry via the analog connection, you deactivate the analog interface in the „Settings" / „Interfaces" menu.