Operating Manual

ME

Refrigerated and Heating Circulators

F25-ME
F26-ME
F32-ME
F33-ME
F34-ME

FP40-ME
FP50-ME

water-cooled
FPW50-ME
Congratulations!
You have made an excellent choice.
JULABO thanks you for the trust you have placed in us.
This operating manual has been designed to help you gain an understanding of the operation and possible applications of our circulators. For optimal utilization of all functions, we recommend that you thoroughly study this manual prior to beginning operation.

The JULABO Quality Management System

Temperature control devices for research and industry are developed, produced, and distributed according to the requirements of ISO 9001 and ISO 14001. Certificate Registration No. 01 100044846

Unpacking and inspecting

Unpack the circulator and accessories and inspect them for possible transport damage. Damage should be reported to the responsible carrier, railway, or postal authority, and a damage report should be requested. These instructions must be followed fully for us to guarantee our full support of your claim for protecting against loss from concealed damage. The form required for filing such a claim will be provided by the carrier.

Important: keep operating manual for future use
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Operating manual

1. Intended use

JULABO circulators have been designed to control the temperature of specific fluids in a bath tank. The units feature pump connections for temperature control of external systems (loop circuit).

JULABO circulators are not suitable for direct temperature control of foods, semi-luxury foods and tobacco, or pharmaceutical and medical products.

Direct temperature control means unprotected contact of the object with the bath medium (bath fluid).

1.1. Description

- The circulators are operated via the splash-proof keypad. The microprocessor technology allows different values to be set, stored, and displayed on the VFD COMFORT-DISPLAY. Three menu keys facilitate the adjustment of setpoints, warning and safety functions, and menu functions.

- Temperature- and time-dependent processes can be stored and executed using the integrated programmer.

- The adjustable PID cascade temperature control automatically adjusts the heat supply to the thermal requirements of the bath.

- Absolute Temperature Calibration (ATC3) provides high temperature stability at all points in the bath. With the 3-point calibration, an offset is adjusted at three temperatures to ensure an accurate temperature pattern at the selected spot in the bath over the entire temperature range.

- Electrical connections:
  - RS232 interface for modern process technology without an additional interface.
  - Connection for external Pt100 sensor for external temperature measurement and control.
  - Alarm output for external alarm message or control of JULABO refrigerating baths or solenoid valve (cooling water).

- The excess temperature protection according to IEC 61010-2-010 is a safety device independent from the control circuit. Its safety value can be displayed and adjusted on the VFD COMFORT-DISPLAY.

- The early warning system for low level signals that bath fluid needs to be refilled before the low level protection according to IEC 61010-2-010 triggers a safety shutdown of the main functional elements.

- Intelligent pump system: the pump capacity (electronically adjustable via the motor speed) can be adapted to different conditions for internal and external temperature-control applications.
2. Operator responsibility – Safety recommendations

The products of JULABO ensure safe operation when installed, operated, and maintained according to common safety regulations. This section explains the potential dangers that may arise when operating the circulator and also specifies the most important safety precautions to preclude these dangers as far as possible.

- The operator is responsible for the qualification of the personnel operating the units.
- The personnel operating the units should be regularly instructed about the dangers involved with their job activities as well as measures to avert these dangers.
- Make sure all persons tasked with operating, installing, and maintaining the unit have read and understand the safety information and operating instructions.
- When using hazardous materials or materials that could become hazardous, the circulator may be operated only by persons who are absolutely familiar with these materials and the circulator. These persons must be fully aware of possible risks.

If you have any questions concerning the operation of your unit or the information in this manual, please contact us!

Contact
JULABO GmbH
Eisenbahnstraße 45
77960 Seelbach / Germany
Tel. +49 (0) 7823 / 51-0
Fax +49 (0) 7823 / 24 91
info@julabo.de
www.julabo.de

Safety instructions for the operator:

- You have received a product designed for industrial use. Nevertheless, avoid strikes to the housing, vibrations, damage to the operating-element panel (keypad, display), and contamination.
- Make sure the product is checked for proper condition regularly (depending on the conditions of use). Regularly check (at least every 2 years) the proper condition of the mandatory, warning, prohibition and safety labels.
- Make sure that the mains power supply has low impedance to avoid any negative effects on instruments being operated on the same mains.
- This unit is designed for operation in a controlled electromagnetic environment. This means that transmitting devices (e.g., cellular phones) should not be used in the immediate vicinity. Magnetic radiation may affect other devices with components sensitive to magnetic fields (e.g., monitors). We recommend maintaining a minimum distance of 1 m.
- Permissible ambient temperature: max. 40 °C, min. 5 °C.
- Permissible relative humidity: 50% (40 °C).
- Do not store the unit in an aggressive atmosphere.
- Protect the unit from contamination.
- Do not expose the unit to sunlight.

Appropriate operation

Only qualified personnel is authorized to perform configuration, installation, maintenance and repairs of the circulator. Routine operation can also be carried out by untrained personnel who should however be instructed by trained personnel.
Use:

The bath can be filled with flammable materials. Fire hazard!
There might be chemical dangers depending on the bath medium used.
Observe all warnings for the used materials (bath fluids) and the respective instructions (safety data sheets).
Insufficient ventilation may result in the formation of explosive mixtures. Only use the unit in well ventilated areas.

Only use recommended materials (bath fluids). Only use non-acid and non corroding materials.

When using hazardous materials or materials that could become hazardous, the operator must affix the enclosed safety labels (1 + 2) to the front of the unit so they are highly visible:

1

<table>
<thead>
<tr>
<th>Warning label W00:</th>
<th>Colors: yellow, black</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger area. Attention! Observe instructions.</td>
<td>(operating manual, safety data sheet)</td>
</tr>
</tbody>
</table>

2

<table>
<thead>
<tr>
<th>Mandatory label M018:</th>
<th>Colors: blue, white</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carefully read the user information prior to beginning operation.</td>
<td><strong>Scope: EU</strong></td>
</tr>
</tbody>
</table>

or

2

<table>
<thead>
<tr>
<th>Semi S1-0701 Table A1-2 #9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carefully read the user information prior to beginning operation.</td>
</tr>
</tbody>
</table>

**Scope: USA, NAFTA**

Particular care and attention is necessary because of the wide operating range.
There are thermal dangers: Burn, scald, hot steam, hot parts and surfaces that can be touched.

<table>
<thead>
<tr>
<th>Warning label W26:</th>
<th>Colors: yellow, black</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot surface warning.</td>
<td>(The label is put on by JULABO)</td>
</tr>
</tbody>
</table>

Observe the instructions in the manuals for instruments of a different make that you connect to the circulator, particularly the respective safety recommendations. Also observe the pin assignment of plugs and technical specifications of the products.

2.1. Disposal

The circulator contains a back-up battery that supplies voltage to memory chips when the unit is switched off. Do not dispose of the battery with household waste!
Depending on battery regulations in your country, you might be obliged to give back used or defect batteries to gathering places.
The product may be used with oil as bath fluid. These oils fully or partially consist of mineral oil or synthetic oil. For disposal, observe the instructions in the safety data sheets.
These units contains refrigerants– at this time considered not to have any negative effects on the ozone layer. However, during the long operating period of the unit, disposal prescriptions may change. So only qualified personnel should take care of disposal.

Valid in EU countries
See the current official journal of the European Union – WEEE directive.
This directive requires electrical and electronic equipment marked with a crossed-out trash can to be disposed of separately in an environmentally friendly manner.
Contact an authorized waste management company in your country.
Disposal with household waste (unsorted waste) or similar collections of municipal waste is not permitted!
2.2. EC Conformity

The products described in the operating instructions conform to the requirements of the following European guidelines:


EMC guideline with respect to legal harmonization of the member countries concerning electromagnetic compatibility.

2.3. Warranty conditions

JULABO GmbH warrants its products against defects in material or in workmanship, when used under appropriate conditions and in accordance with appropriate operating instructions for a period of ONE YEAR.

Extension of the warranty period – free of charge

With the ‘1PLUS warranty’ the user receives a free of charge extension to the warranty of up to 24 months, limited to a maximum of 10 000 working hours.

To apply for this extended warranty the user must register the unit on the JULABO web site www.julabo.de, indicating the serial no. The extended warranty will apply from the date of JULABO GmbH’s original invoice.

JULABO GmbH reserves the right to decide the validity of any warranty claim. In case of faults arising either due to faulty materials or workmanship, parts will be repaired or replaced free of charge, or a new replacement unit will be supplied.

Any other compensation claims are excluded from this guarantee.
### 2.4. Technical specifications

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<th>F26-ME</th>
<th>F32-ME</th>
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<tr>
<td>Working temperature range</td>
<td>°C  -28 ... 200</td>
<td>°C  -30 ... 200</td>
<td>°C  -30 ... 200</td>
</tr>
<tr>
<td>Temperature stability</td>
<td>°C  ±0,01</td>
<td>°C  ±0,01</td>
<td>°C  ±0,01</td>
</tr>
<tr>
<td>Cooling capacity</td>
<td>°C  +20 0 -20</td>
<td>°C  +20 0 -20</td>
<td>°C  +20 0 -20</td>
</tr>
<tr>
<td>Medium ethanol</td>
<td>kW  0.26 0.2 0.06</td>
<td>kW  0.26 0.2 0.06</td>
<td>kW  0.45 0.39 0.15 0.05</td>
</tr>
<tr>
<td>Refrigerant</td>
<td>R134a</td>
<td>R134a</td>
<td>R134a</td>
</tr>
<tr>
<td>Overall dimensions</td>
<td>(WxDxH) cm 23x42x61</td>
<td>(WxDxH) cm 42x42x42</td>
<td>(WxDxH) cm 31x42x64</td>
</tr>
<tr>
<td>Bath opening</td>
<td>(WxL) cm 12x14</td>
<td>(WxL) cm 12x14</td>
<td>(WxL) cm 18x12</td>
</tr>
<tr>
<td>Bath depth</td>
<td>cm 14</td>
<td>cm 14</td>
<td>cm 15</td>
</tr>
<tr>
<td>Filling volume</td>
<td>from ... to liters 3 ... 4,5</td>
<td>from ... to liters 5,5 ... 8</td>
<td>from ... to liters 5,5 ... 8</td>
</tr>
<tr>
<td>Weight</td>
<td>kg 31</td>
<td>kg 31</td>
<td>kg 37</td>
</tr>
<tr>
<td>Mains power connection</td>
<td>230 V/50 Hz V/ Hz 207-253 / 50</td>
<td>230 V/60 Hz V/ Hz 207-253 / 60</td>
<td>230 V/60 Hz V/ Hz 207-253 / 60</td>
</tr>
<tr>
<td>Current draw</td>
<td>(at 230 V) A 12</td>
<td>(at 230 V) A 12</td>
<td>(at 230 V) A 12</td>
</tr>
<tr>
<td>Mains power connection</td>
<td>230 V/60 Hz V/ Hz 207-253 / 60</td>
<td>(at 115 V) A 13</td>
<td>(at 115 V) A 14</td>
</tr>
<tr>
<td>Current draw</td>
<td>(at 230 V) A 12</td>
<td>(at 115 V) A 13</td>
<td>(at 100 V) A 14</td>
</tr>
<tr>
<td>Mains power connection</td>
<td>115 V/60 Hz V/ Hz 103-127 / 60</td>
<td>100 V/50-60 Hz V/ Hz 90-115 / 50-60</td>
<td>100 V/50-60 Hz V/ Hz 90-115 / 50-60</td>
</tr>
<tr>
<td>Current draw</td>
<td>(at 100 V) A 13</td>
<td>(at 115 V) A 14</td>
<td>(at 100 V) A 14</td>
</tr>
</tbody>
</table>

All measurements have been carried out at:
- rated voltage and frequency
- ambient temperature: 20 °C
Technical changes without prior notification reserved.
### Operator responsibility – Safety recommendations

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<tr>
<th></th>
<th>F33-ME</th>
<th>F34-ME</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Working temperature range</strong></td>
<td>°C -30 ... 200</td>
<td>°C -30 ... 150</td>
</tr>
<tr>
<td><strong>Temperature stability</strong></td>
<td>°C ±0,01</td>
<td>±0,01</td>
</tr>
<tr>
<td><strong>Cooling capacity</strong></td>
<td>°C +20 0 -20 0 -30</td>
<td>+20 0 -20 -30 -30</td>
</tr>
<tr>
<td><strong>Medium ethanol</strong></td>
<td>kW 0.5 0.32 0.12 0.03</td>
<td>0.45 0.32 0.14 0.3</td>
</tr>
<tr>
<td><strong>Refrigerant</strong></td>
<td>R134a</td>
<td>R134a</td>
</tr>
</tbody>
</table>

| Overall dimensions (WxHxD) | cm 36x46x69         | 38x58x62            |
| Bath opening (WxL)         | cm 23x14            | 24x30               |
| Bath depth                 | cm 20               | 15                  |
| Filling volume             | from ... to liters  | 12 ... 16           | 14 ... 20           |
| **Weight**                 | kg 44               | 42                  |

| Mains power connection    | 230 V/50 Hz V/ Hz 207-253 / 50 | 207-253 / 50          |
| Current draw              | (at 230 V) A          | 12                   |

| Mains power connection    | 230 V/60 Hz V/ Hz 207-253 / 50 | 207-253 / 60          |
| Current draw              | (at 230 V) A          | 12                   |

| Mains power connection    | 115 V/60 Hz V/ Hz 103-127 / 60 | 103-127 / 60          |
| Current draw              | (at 115 V) A          | 15                   |

All measurements have been carried out at:
- rated voltage and frequency: ambient temperature: 20 °C
- Technical changes without prior notification reserved.
<table>
<thead>
<tr>
<th><strong>ME</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature selection</td>
<td>digital</td>
</tr>
<tr>
<td>via keypad</td>
<td>indication on VFD COMFORT-Display</td>
</tr>
<tr>
<td>remote control via personal computer</td>
<td>indication on monitor</td>
</tr>
<tr>
<td>Temperature indication</td>
<td>VFD COMFORT-DISPLAY</td>
</tr>
<tr>
<td>Resolution °C</td>
<td>0.01</td>
</tr>
<tr>
<td>Absolute Temperature Calibration INT/EXT °C</td>
<td>±3 / ±9</td>
</tr>
<tr>
<td>Temperature control</td>
<td>PID3 cascade temperature control</td>
</tr>
<tr>
<td>Heater wattage (at 230 V) kW</td>
<td>2.0</td>
</tr>
<tr>
<td>Heater wattage (at 115 V) kW</td>
<td>1.0</td>
</tr>
<tr>
<td>Electronically adj. pump capacity stages</td>
<td>1 ... 4</td>
</tr>
<tr>
<td>Flow rate at 0 bar l/min</td>
<td>11 ... 16</td>
</tr>
<tr>
<td>Pressure max. at 0 liter bar</td>
<td>0.22 ... 0.45</td>
</tr>
<tr>
<td>Electrical connections:</td>
<td></td>
</tr>
<tr>
<td>External alarm device Vdc/mA</td>
<td>24-0 / max. 25</td>
</tr>
<tr>
<td>Computer interface</td>
<td>RS232</td>
</tr>
<tr>
<td>External temperature sensor</td>
<td>Pt100</td>
</tr>
<tr>
<td>Ambient temperature °C</td>
<td>5 ... 40</td>
</tr>
</tbody>
</table>
Operator responsibility – Safety recommendations

Safety installations according to IEC 61010-2-010:
Excess temperature protection adjustable from 0 °C ... 230 °C
Low liquid level protection float switch
Classification according to DIN 12876-1 class III

Supplementary safety installations
Early warning system for low level float switch
High temperature warning function optical + audible (in intervals)
Low temperature warning function optical + audible (in intervals)
Supervision of working sensor plausibility control
Reciprocal sensor monitoring between working and safety sensors difference > 35 K
Alarm message optical + audible (permanent)
Warning message optical + audible (in intervals)

Environmental conditions according to IEC 61 010-1:
Use only indoor.
Altitude up to 2000 m - normal zero.
Ambient temperature: +5 ... +40 °C
Air humidity:
Max. rel. humidity 80 % for temperatures up to +31 °C,
linear decrease down to 50 % relative humidity at a temperature of +40 °C
Max. mains fluctuations of ±10 % are permissible.

Protection class according to IEC 60 529 IP21
The unit corresponds to Class I
Overvoltage category II
Pollution degree 2

Caution: The unit is not for use in explosive environment

Standards for interference resistance according to EN 61326-1
This unit is an ISM device classified in Group 1 (using high frequency for internal purposes) Class A (industrial and commercial range).
2.5. Cooling water connection

Cooling water pressure (IN/OUT) max. 6 bar
Pressure difference (IN - OUT) 3.5 to 6 bar
Cooling water temperature < 20 °C

Notice: Cooling water circuit
Risk of oil leaking from the refrigeration system (compressor) of the recirculating cooler into the cooling water in case of a fault in the cooling water circuit!
Observe the laws and regulations of the water distribution company valid in the location where the unit is operated.

Notice: Danger of corrosion of heat exchanger due to unsuitable quality of cooling water.
- Due to its high content of lime, hard water is not suitable for cooling and causes scale in the heat exchanger.
- Ferrous water or water containing ferrous particles will cause formation of rust even in heat exchangers made of stainless steel.
- Chlorinated water will cause pitting corrosion in heat exchangers made of stainless steel.
- Due to their corrosive characteristics, distilled water and deionized water are unsuitable and will cause corrosion of the bath.
- Due to its corrosive characteristics, sea water is not suitable.
- Due to its microbiological (bacterial) components, which settle in the heat exchanger, untreated and unpurified river water and water from cooling towers is unsuitable.
- Avoid particulate matter in cooling water.
- Avoid putrid water.

Recommended quality of cooling water:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.5 to 9.0</td>
</tr>
<tr>
<td>Sulfate [SO4 2-]</td>
<td>&lt; 100 ppm</td>
</tr>
<tr>
<td>Hydrocarbonate [HCO3-]/sulfate [SO4 2-]</td>
<td>&gt; 1 ppm</td>
</tr>
<tr>
<td>Hardness [Ca 2+, Mg 2+]/[HCO3-]</td>
<td>&gt; 0.5 °dH</td>
</tr>
<tr>
<td>Alkalinity</td>
<td>60 ppm &lt; [HCO3-] &lt; 300 ppm</td>
</tr>
<tr>
<td>Conductivity</td>
<td>&lt; 500 μS/cm</td>
</tr>
<tr>
<td>Chloride (Cl -)</td>
<td>&lt; 50 ppm</td>
</tr>
<tr>
<td>Phosphate (PO4 3-)</td>
<td>&lt; 2 ppm</td>
</tr>
<tr>
<td>Ammonia (NH3)</td>
<td>&lt; 0.5 ppm</td>
</tr>
<tr>
<td>Free chlorine</td>
<td>&lt; 0.5 ppm</td>
</tr>
<tr>
<td>Trivalent iron ions (Fe 3+)</td>
<td>&lt; 0.5 ppm</td>
</tr>
<tr>
<td>Manganese ions (Mn 2+)</td>
<td>&lt; 0.05 ppm</td>
</tr>
<tr>
<td>Carbon dioxide (CO2)</td>
<td>&lt; 10 ppm</td>
</tr>
<tr>
<td>Hydrogen sulfide (H2S)</td>
<td>&lt; 50 ppm</td>
</tr>
<tr>
<td>Content of oxygen</td>
<td>&lt; 0.1 ppm</td>
</tr>
<tr>
<td>Algae growth</td>
<td>impermissible</td>
</tr>
<tr>
<td>Suspended solids</td>
<td>impermissible</td>
</tr>
</tbody>
</table>
Operating instructions

3. Safety notes for the user

3.1. Explanation of safety notes

In addition to the safety warnings listed, warnings are posted throughout the operating manual. These warnings are designated by an exclamation mark inside an equilateral triangle. “Warning of a dangerous situation (Attention! Please follow the documentation).” The danger is classified using a signal word. Read and follow these important instructions for averting dangers.

Warning:
Describes a possibly highly dangerous situation. If these instructions are not followed, serious injury and danger to life could result.

Caution:
Describes a possibly dangerous situation. If this is not avoided, slight or minor injuries could result. A warning of possible property damage may also be contained in the text.

Notice:
Describes a possibly harmful situation. If this is not avoided, the product or anything in its surroundings can be damaged.

3.2. Explanation of other notes

Note!
Draws attention to something special.

Important!
Indicates usage tips and other useful information.

This icon is used in the operating instructions to indicate flashing values or parameters which have to be set or confirmed.
3.3. **Safety recommendations**

Follow the safety instructions to avoid personal injury and property damage. Also, the valid safety instructions for workplaces must be followed.

- Only connect the unit to a power socket with an earthing contact (PE – protective earth)!
- The power supply plug serves as a safe disconnecting device from the line and must always be easily accessible.
- Place the unit on an even surface on a base made of nonflammable material.
- Do not stay in the area below the unit.
- Make sure you read and understand all instructions and safety precautions listed in this manual before installing or operating your unit.
- Set the excess temperature safety installation at least 25 °C below the fire point of the bath fluid.
- Observe the limited working temperature range when using plastic bath tanks.
- Never operate the unit without bath fluid in the bath.
- Pay attention to the thermal expansion of bath oil during heating to avoid overflowing of the fluid.
- Prevent water from entering the hot bath oil.
- Do not drain the bath fluid while it is hot! Check the temperature of the bath fluid prior to draining (e.g., by switching the unit on for a short moment).
- Use suitable connecting tubing.
- Avoid sharp bends in the tubing, and maintain a sufficient distance from surrounding walls.
- Make sure that the tubing is securely attached.
- Regularly check the tubing for material defects (e.g., for cracks).
- Never operate damaged or leaking units.
- Always turn off the unit and disconnect the mains cable from the power source before performing any service or maintenance procedures, or before moving the unit.
- Always turn off the unit and disconnect the mains cable from the power source before cleaning the unit.
- Always empty the bath before moving the unit.
- Transport the unit with care.
- Sudden jolts or drops may cause damage in the interior of the unit.
- Observe all warning labels.
- Never remove warning labels.
- Never operate units with damaged mains power cables.
- Repairs are to be carried out only by qualified service personnel.

- Some parts of the bath tank and the pump connections may become extremely hot during continuous operation. Therefore, exercise particular caution when touching these parts.
Caution:
The temperature controlling i.e. of fluids in a reactor constitutes normal circulator practice.
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

The user alone is responsible for the handling of these substances!
The following questions shall help to recognize possible dangers and to reduce the risks to a minimum.
- Are all tubes and electrical cables connected and installed?
  Note: sharp edges, hot surfaces in operation, moving machine parts, etc.
- Do dangerous steams or gases arise when heating?
  Is an exhaust needed when working?
- What to do when a dangerous substance was spilled on or in the unit?
  Before starting to work, obtain information concerning the substance and determine the method of decontamination.

Notice: Check the safety installations at least twice a year!
- Excess temperature protection according to IEC 61010-2-010.
  With a screwdriver turn back the adjustable excess temperature protection until the shut-down point (actual temperature).
- Low level protection according to IEC 61010-2-010.
  To check the function of the float, it can be manually lowered with a screwdriver for example.
4. Operating controls and functional elements

4.1. Circulator

Front view

Rear view

1. Key: >OK< Start / Stop (pump / heater)
2. >OK< in the menu Menu item / select submenu for setting
   - Save set value
   - Save selected parameter
   A beep signals the end of setting

After the actions Start, Stop and change from VFD Display to standard display the key >OK< is locked for a short time.
The above graph “front side” shows an example for standard display.

3. Key: >Return< Stop (pump / heater)
   1. Key: >Return< Stop (pump / heater)
2. >Return< in the menu one menu level down
   Correction function for parameters or values (prior to OK)
   - immediately back to standard display

4. Key: >Up / Down< temperature – increase/decrease setpoint
   1. Key: >Up / Down< temperature – increase/decrease setpoint
2. >Up/Down< in the menu selection of menu items / parameters

Mains power switch, illuminated
Operating controls and functional elements

Menu keys

5  Key: start the menu > warning and safety values

6  Key: start the menu > temperature setpoints

7  Key: display of MENU structure

10  VFD COMFORT-DISPLAY

Header: Control indicators see sections 11 and 12

Line 1: Actual value internal or external
The display is depending on the selected control mode in the menu > Control < (internal or external).

Line 2: Working temp. setpoint, constantly S xxx.xx

Line 3: Actual value (E = external or I = internal)
Alternating with the display in line 1

11  Control indicators in the header:
Heating / Cooling / Alarm / Rremote control

12  Control indicators in the header:
Temperature indication Internal or External actual value
Temperature indication in °C (°F not possible on this unit)

13  Display of set pump pressure stage
Four stages, can be set via the key MENU, under > MENU - PUMP <.

14  Adjustable excess temperature protection according to IEC 61010-2-010

15  Socket: control cable of JULABO refrigerated circulator
or output for alarm messages

16  Interface RS232: remote control via personal computer

17  Socket for external measurement and control sensor
or external setpoint programming

18  Mains circuit breakers (resettable) 15 A

20  Mains power cable with plug
4.2. Cooling Machine

1b Mains power switch, illuminated for cooling machine

15a Socket: control cable of JULABO refrigerated circulator
15b

18b Mains fuses for cooling machine, T10A, D5 x 20 mm

20a Mains power cable with plug for circulator
20b Mains power cable with plug cooling machine

21 Built-in mains outlet for connection of circulator

22 Drain tap

23 Drain port

24a Pump connector: feed
24b Pump connector: return

25 Venting grid, removable

26 OUT IN Cooling water OUTLET and INLET. ¾”

27 Selector dial for cooling machine (only F25, F26, F34)
Position “1” for operation with ME circulator.
5. Preparations

5.1. Installation

- Place the unit on an even surface on a pad made of non-flammable material. F34: The circulator fitted with a stainless steel bridge is placed on the back of the bath tank leaving the bath open on the front side.

- The place of installation should be large enough and provide sufficient air ventilation to ensure the room does not warm up excessively because of the heat the instrument radiates to the environment. (Max. permissible ambient temperature: 40 °C). With regard to a disturbance in the cooling loop (leakage), the guideline EN 378 prescribes a certain room space to be available for each kg of refrigerant. The necessary amount of refrigerant is specified on the type plate.
  > For 0.25 kg of refrigerant R134a, a room space of 1 m³ is required.
  > For 0.52 kg of refrigerant R404A, a room space of 1 m³ is required.
  > For 0.49 kg of refrigerant R507, a room space of 1 m³ is required.

- Set selector dial for cooling machine (19) in position "1" for operation with ME circulator. (only F25, F26, F34)
- Keep at least 20 cm of open space on the front and rear venting grids.
- Do not set up the unit in the immediate vicinity of heat sources and do not expose to sun light
- Before operating the unit after transport, wait about one hour after setting it up. This will allow any oil that has accumulated laterally during transport to flow back down thus ensuring maximum cooling performance of the compressor.
- Ensure circulation of cooling water by connecting the tubing to cooling water inlet and outlet on the rear of the refrigerated circulator.

Cooling water see page 13

5.2. Bath fluids

**Caution:**
Carefully read the safety data sheet of the bath fluid used, particularly with regard to the fire point!
If a bath fluid with a fire point of ≤65 °C is used, only supervised operation is possible.

**Water:** The quality of water depends on local conditions.
- Due to the high concentration of lime, hard water is not suitable for temperature control because it leads to calcification in the bath.
- Ferrous water can cause corrosion - even on stainless steel.
- Chloric water can cause pitting corrosion.
- Distilled and deionized water is unsuitable. Their special properties cause corrosion in the bath, even in stainless steel.

**Recommended bath fluids:**

<table>
<thead>
<tr>
<th>Bath fluid</th>
<th>Temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>soft/decalcified water</td>
<td>5 °C to 80 °C</td>
</tr>
<tr>
<td>mixture water/glycol, mixture 1:1</td>
<td>-20°C to 50°C</td>
</tr>
</tbody>
</table>

**JULABO bath fluids**

<table>
<thead>
<tr>
<th>JULABO Description</th>
<th>Thermal G Order Number</th>
<th>Thermal HY Order Number</th>
<th>Thermal H5 Order Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 liters</td>
<td>8 940 124</td>
<td>8 940 104</td>
<td>8 940 106</td>
</tr>
<tr>
<td>5 liters</td>
<td>8 940 125</td>
<td>8 940 105</td>
<td>8 940 107</td>
</tr>
<tr>
<td>Temperature range</td>
<td>°C</td>
<td>-30 ... 80</td>
<td>-80 ... 55</td>
</tr>
<tr>
<td>Flash point</td>
<td>°C</td>
<td>78</td>
<td>124</td>
</tr>
<tr>
<td>Fire point</td>
<td>°C</td>
<td>80</td>
<td>142</td>
</tr>
<tr>
<td>Color</td>
<td></td>
<td>light yellow</td>
<td>clear</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JULABO Description</th>
<th>Thermal H10 Order Number</th>
<th>Thermal H20S Order Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 liters</td>
<td>8 940 114</td>
<td>8 940 108</td>
</tr>
<tr>
<td>5 liters</td>
<td>8 940 115</td>
<td>8 940 109</td>
</tr>
<tr>
<td>Temperature range</td>
<td>°C</td>
<td>-20 ... 180</td>
</tr>
<tr>
<td>Flash point</td>
<td>°C</td>
<td>190</td>
</tr>
<tr>
<td>Fire point</td>
<td>°C</td>
<td>216</td>
</tr>
<tr>
<td>Color</td>
<td></td>
<td>clear</td>
</tr>
</tbody>
</table>

See website for list of recommended bath fluids.

**ATTENTION:** The maximum permissible viscosity is 50 mm²/s.

**Caution:**

Fire or other dangers when using bath fluids that are not recommended:

Use only nonacidic and noncorrosive bath fluids. JULABO assumes no liability for damage caused by the selection of an unsuitable bath liquid. Unsuitable bath fluids are fluids which, e.g.,

- are highly viscous (much higher than recommended at the respective working temperature)
- have a low viscosity and have creep characteristics
- have corrosive characteristics or
- tend to crack.

**No liability for use of other bath fluids!**
5.3. Temperature application to external systems

Caution: Securely attach all tubing to prevent slipping.

If the circulator is operated without external system, close the pump connector (24a) with the cap nut.

The circulator is used for temperature application to external, closed systems (loop circuit) with simultaneous temperature application in the circulator bath.

Connecting the external system

- Unscrew the collar nuts from the pump connector (24a).
- Slide the tubing onto the pump connector for feed (24a) and return flow (24b) and secure with hose clamps.

5.3.1. Tubing

**Recommended tubing:**

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Length</th>
<th>Tubing Type</th>
<th>Temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>8930 008</td>
<td>1 m</td>
<td>CR® tubing</td>
<td>8 mm inner dia. -20 °C to 120 °C</td>
</tr>
<tr>
<td>8930 010</td>
<td>1 m</td>
<td>CR® tubing</td>
<td>10 mm inner dia. -20 °C to 120 °C</td>
</tr>
<tr>
<td>8930 108</td>
<td>1 m</td>
<td>Viton tubing</td>
<td>8 mm inner dia. -50 °C to 200 °C</td>
</tr>
<tr>
<td>8930 110</td>
<td>1 m</td>
<td>Viton tubing</td>
<td>10 mm inner dia. -50 °C to 200 °C</td>
</tr>
<tr>
<td>8930 410</td>
<td>1 m</td>
<td>Insulation for tubing</td>
<td>8 mm or 10 mm inner dia. -50 °C to 100 °C</td>
</tr>
<tr>
<td>8970 480</td>
<td></td>
<td>2 tubing clamps. size 1, tubing 8 mm inner dia.</td>
<td></td>
</tr>
<tr>
<td>8970 481</td>
<td></td>
<td>2 tubing clamps. size 2, tubing 10 or 12 mm inner dia.</td>
<td></td>
</tr>
<tr>
<td>8930 209</td>
<td>0.5 m</td>
<td>Metal tubing, triple insulated, M16x1*</td>
<td>-100 °C to +350 °C</td>
</tr>
<tr>
<td>8930 210</td>
<td>1.0 m</td>
<td>Metal tubing, insulated, M16x1*</td>
<td>-50 °C to +200 °C</td>
</tr>
<tr>
<td>8930 211</td>
<td>1.5 m</td>
<td>Metal tubing, insulated, M16x1*</td>
<td>-50 °C to +200 °C</td>
</tr>
<tr>
<td>8930 214</td>
<td>3.0 m</td>
<td>Metal tubing, insulated, M16x1*</td>
<td>-50 °C to +200 °C</td>
</tr>
<tr>
<td>8930 220</td>
<td>0.5 m</td>
<td>Metal tubing, insulated, M16x1*</td>
<td>-50 °C to +200 °C</td>
</tr>
<tr>
<td>8930 221</td>
<td>1.0 m</td>
<td>Metal tubing, insulated, M16x1*</td>
<td>-50 °C to +200 °C</td>
</tr>
<tr>
<td>8930 222</td>
<td>1.5 m</td>
<td>Metal tubing, insulated, M16x1*</td>
<td>-50 °C to +200 °C</td>
</tr>
<tr>
<td>8930 223</td>
<td>3.0 m</td>
<td>Metal tubing, insulated, M16x1*</td>
<td>-50 °C to +200 °C</td>
</tr>
</tbody>
</table>

*) Adapter for metal tubing M10x1 on M16x1 Order No. 8970 444

**Warning:** Tubing:

At high working temperatures the tubing used for temperature application and cooling water supply represents a danger source.
A damaged tubing line may cause hot bath fluid to be pumped out within a short time.
This may result in:
- Burning of skin
- Difficulties in breathing due to hot atmosphere
Safety recommendations
- Employ suitable connecting tubing.
- Make sure that the tubing is securely attached.
- Avoid sharp bends in the tubing, and maintain a sufficient distance from surrounding walls.
- Regularly check the tubing for material defects (e.g. for cracks).
- Preventive maintenance: Replace the tubing from time to time.

5.4. Filling / draining

Notice:
- Pay attention to the thermal expansion of bath oil during heating to avoid overflowing of the liquid.
  Do not drain the bath fluid while it is hot!
  Check the temperature of the bath fluid prior to draining (by switching the unit on for a short moment, for example).
- Always turn off the unit and disconnect the mains cable from the power source before cleaning the unit, or before moving the unit.
- Store and dispose the used bath fluid according to the laws for environmental protection.

Filling
Take care that no liquid enters the interior of the circulator.

- Recommended maximum filling level with water as bath fluid: 30 mm below the tank rim
- Recommended maximum filling level with bath oils: 40 mm below the tank rim

After filling, immerse the samples in the bath or place the lid on the bath, in case the opening is not to be used.

The circulator provides an early warning system for low level that may be triggered when changing samples in the bath.

Draining
- Turn off the circulator and cooling machine.
- Hold the venting grid, pull out and remove.
- Slide a short piece of tube onto the drain port (23) and hold it into a pail.
- Unscrew the drain tap (22) and empty the unit completely.

Tighten the drain tap.
6. Operating procedures

6.1. Power connection

**Caution:**
- Only connect the unit to a power socket with earthing contact (PE – protective earth)!
- The power supply plug serves as safe disconnecting device from the line and must be always easily accessible.
- Never operate equipment with damaged mains power cables.
- Regularly check the mains power cables for material defects (e.g. for cracks).
- We disclaim all liability for damage caused by incorrect line voltages!

Check to make sure that the line voltage matches the supply voltage specified on the identification plate. Deviations of ±10 % are permissible.

- Connect the circulator with mains power cable (20a) to the mains outlet (21).
- Connect the control cable (15a) between the connectors *(15, 15b).*
- Connect the refrigerated circulator with mains power cable (20b) to the mains socket.

6.2. Switching on / Start - Stop

6.2.1. Switching on the circulator

**Switching on:**
- Turn on the mains power switch (1).

⚠️ The unit performs a self-test.
Then the software version (example: V 1.xx) appears. The display „OFF“ or „R OFF“ indicates the unit is ready to operate.

⚠️ The circulator enters the operating mode activated before switching the circulator off:
- **keypad control mode** (manual operation)
  or
- **remote control mode** (operation via personal computer).
Start:
- Press OK key.
The actual bath temperature is displayed on the VFD COMFORT-DISPLAY. The circulating pump starts with a slight delay.

Stop:
- Press OK key.
or
Keep → key pressed.
The VFD COMFORT-DISPLAY indicates the message "OFF".

6.2.2. Switching on the Cooling Machine

Switching on:
- Switch on the cooling machine using the switch (1b).

Control of the cooling machine:
With the mains switch (1b) turned on, the circulator automatically switches the cooling machine off and on.
- It is switched off, if:
  - the actual working temperature is increased by >30 °C (cooling is not required).
  - the heater operates at full power (>800 W) for longer than 5 minutes.
- It is switched on, if:
  - cooling is necessary for maintaining the bath temperature.
After switch-off, the cooling machine automatically switches on only after a delay of 5 minutes for protecting the cooling compressor.

To save energy, turn off the cooling machine with the mains switch (1b) whenever cooling is not required.
7. **Setting of temperatures**

7.1. **Using the pre-settings in the °C menu**

Press the °C key to call up the menu for temperature selection.

3 different working temperatures can be adjusted. Their values are freely selectable within the operating temperature range.

- The temperatures can be set in start or stop mode.
- Press key if a value is to be retained

**Setting of working temperature in the °C menu**

1. Press the °C key. The value flashes
2. Select SETPOINT 1 or 2 or 3 using the key or .
3. Confirm by pressing the key.

- The circulator uses the new working temperature value for temperature control.

**Example: Adjustment/modification of the pre-setting of "SETPOINT 3"**

1. Press the °C key.
2. Select SETPOINT 3 by pressing the key. Example: SETPNT 3 / 70.00 °C
3. Keep the key pressed until the integer digits flash (example: <70>)
4. Adjust value by pressing the key and the key to 85.00 °C and confirm by pressing the key.
   The decimal digits flash and can be adjusted if desired.
   Confirm once more by pressing the key. Example on the left: SETPNT 3 / 85.00.

- If the active setpoint (SETPNT) is changed, the new value is immediately used for the control of the working temperature.
  The heater control indicator flashes.
- If the other two setpoints (not activated for control) are changed the MENU has to be left by pressing the key after the decimal digits have been confirmed

Notice: Refer to SETPOINT MAX / MIN in chapter 9.8. MENU LIMITS
7.2. Direct setting of temperatures

The circulator uses the setpoint of SETPNT 1 or 2 or 3 for temperature control.

The indicated setpoint temperature can be changed directly any time. Example: change 25.00 °C to 50.00 °C

1. By pressing the key the circulator switches to the active SETPOINT< example on the left: >SETPNT / 1 25.00°C<. The integer digits flash (example: <25>).

2. By pressing the keys and the value is changed to 50.00 °C and is confirmed by pressing the key. The decimal digits flash and can be adjusted if desired. Confirm once more by pressing the key.

- The circulator uses the new working temperature value for temperature control.
- The temperatures can be set in start or stop mode.
**8. Safety installations, warning functions**

Check the safety installations at least twice a year! Refer to (page 16)

**SECVAL** *(Security Values)*

- **SAFETMP**
- **AL-TYPE**
- **OVERTMP**
- **SUBTEMP**

Settings for the excess temperature protection > SAFETMP < and for the warning functions for high > OVERTMP < and low > SUBTEMP < temperature are made in a menu which is called up by pressing the key .

Menu item > AL-TYPE < allows choosing between a warning and an alarm cut-off for the menu items > OVERTMP < and > SUBTEMP <.

### 8.1. Excess temperature protection

**Warning:**

The excess temperature protection must be set at least 25 °C below the fire point of the bath fluid used!

In case of wrong setting there is a fire hazard!

We disclaim all liability for damage caused by wrong settings!

This excess temperature protection is independent of the control circuit. When activated heater and circulating pump are completely shut down. The alarm is indicated by optical and audible signals (continuous tone) and the error message "ALARM-CODE 14" appears on the VFD COMFORT-DISPLAY together with the ticker:

> EXCESS TEMPERATURE PROTECTOR ALARM-CHECK ADJUSTMENT <

Setting range: 20 °C ... 230 °C

1. Rough setting can be effected by using the temperature scale.

**Exact setting:**

1. Press the key to display menu > SAFETMP <.
2. Press the key and the set shutdown value is indicated.
3. Set the new shutdown value within 30 seconds using a screwdriver. The value is indicated on the VFD COMFORT-DISPLAY

Example: SAFETMP / 100 °C

**Recommendation:**

Set the excess temperature protection at 5 °C to 10 °C above the working temperature setpoint.
8.1.1. Early warning system, low level protection

This low level protection is independent of the control circuit and is divided into two sections:

1. Switch in stage 1 recognizes a defined fluid level 😞. An audible warning sounds (interval tone) and together with the ticker: > LOW LEVEL WARNING-FILL MEDIUM < a message appears on the VFD COMFORT-DISPLAY:

     ![WARNING CODE 40]
     
     Refill the bath fluid!

2. Switch in stage 2 recognizes a low fluid level 😫. If stage 2 of the low level protection according to IEC 61010-2-010 is triggered, a complete, all-pole shutdown of heater and circulating pump is effected. A continuous alarm sounds and together with the ticker: > LOW LEVEL ALARM-FILL MEDIUM < a message appears on the VFD COMFORT-DISPLAY:

     ![ALARM CODE 1]
     
     Turn off the unit with the mains switch, refill bath fluid and turn the unit on again!

3. Float

4. Circulating pump

5. Heater

**Warning:**

When adding bath fluid, always use the type of fluid which is identical with the fluid in the bath. Bath oils must not contain any water and should be pre-heated approximately to the current bath temperature! Explosion hazard at high temperatures!
8.2. Switch-over from warning to shutdown function

If a shutdown of functional elements (e.g. heater, circulating pump) is required when the limit values are exceeded or undercut the circulator can be changed over from warning function >WARNING< to shutdown function >ALARM<.

Factory setting: >WARNING<

1. Press the key  
2. Select the menu >SECVAL -AL-TYPE< by pressing the key.
3. Press the key and the set parameter will flash (Example: WARNING)
4. Change the parameter by pressing the key and confirm by pressing the key.
   or press the key if the parameter is to retained.

Setting >WARNING<

A mere warning function with optical and audible warning signal (interval tone) A message appears on the VFD COMFORT-DISPLAY:

- OFF -
ALARM
CODE 03
OVERTMP or
- OFF -
ALARM
CODE 04
SUBTEMP

Setting >ALARM<

Temperature limit with shutdown of heater and circulating pump. An audible alarm sounds (continuous tone) and a message appears on the VFD COMFORT-DISPLAY:

- OFF -
ALARM
CODE 03
OVERTMP or
- OFF -
ALARM
CODE 04
SUBTEMP
8.3. Over and Sub temperature warning function

If the observance of a working temperature value >SETP< has to be supervised for a sensitive temperature application, then set over and sub temperature warning values. In the example below the SETPOINT 85 °C is surrounded by the values OVERTMP 87 °C and SUBTEMP 83 °C. The electronics immediately register if the actual temperature breaches one of the set limit values. The resulting reaction is defined in a further menu item. (See chapter 8.2.)

1. Press the key.
2. By pressing the or key select the menu >OVERTMP< or >SUBTEMP<.
3. Press the key. The integer digits flash
4. Change the values to 87 °C and/or 83 °C by pressing the and key and confirm with the key. The decimal digits flash and can be adjusted if desired. Confirm once more by pressing the key. See above examples.

The warning functions are only activated if the actual bath temperature remains within the set limit values for 3 seconds after switch-on.

Recommendation:
Set the over temperature warning value >OVERTMP< 5 °C to 10 °C above the working temperature setpoint.
Set the sub temperature warning value >SUBTEMP< 5 °C to 10 °C below the working temperature setpoint.
Menu functions

9. **Menu functions**

The term „Menu functions“ refers to settings such as:

**Menu level 1**

- Start program
- Administration and creation of programs
- Electronically adjustable pump capacity
- Configuration of the unit
- Control characteristics and parameters
- Adjustable interface parameters
- ATC - Absolute Temperature Calibration
- Limitations of temperature and capacity

**Menu level 2**

1. Open the menu by pressing the **key**.
2. Use the **keys** to scroll in menu level 1.
3. Press the **key** to change to menu level 2.

Press the **key** if settings are to be retained.
9.1. MENU PROGRAM – START

This menu will start a previously set program.

Requirements:
1. Create a program. (refer to next chapter)
2. Return to the Start-MENU and confirm the desired setting of each MENU item with the key OK.
3. Set a start time (>TIME< >DATE< >YEAR<) if the program is to be started by the internal timer.

Menu level 1

| > STEP< | Program start at section 1 ... 10 |
| > RUNS< | Number of repetitions 1 ... 99 |
| > END< | Status at end of program (STDBY/SETPNT) Standby or last setpoint |
| > GO< | Time of start (NOW/TIMER) |

Level 2 Parameter level

Press the key if a parameter is to be retained. Correction function for parameters or values (prior to OK)

- Set program step with and OK
  example: STEP 1

- Set number of runs with and OK
  example: 1 run

- Set desired parameters with and OK.
  (STDBY / SETPNT)
  Parameter STanDBY: the circulator switches to – OFF-.
  Parameter SETPoINT: the circulator constantly keeps the temperature at the value of the last step.

- Confirm >NOW< with the key and the program will start immediately

  or
  start at the set time under parameter (TIMER ).
  Set time in the example below:
  09. August 2009, 11:15 hrs
Menu functions

<table>
<thead>
<tr>
<th>Submenu TIMERR</th>
<th>Parameter level</th>
<th>Description</th>
</tr>
</thead>
</table>
| TIME           | TIME 11:15     | >TIME< hours/minutes (hh:mm), set both values one after the other and confirm.  
- hours flash, set by pressing +   
- minutes flash, set by pressing + OK |
| DATE           | DATE 09:08     | >DATE< day/months (TT/MM), set both values one after the other and confirm.  
- day flashes, set by pressing +   
- month flashes, set by pressing + OK |
| START          | OK             | The program starts at the set time.  
- Display of time until start:  
  In line 3 the notice >TIMER< and the set values for „TIME“ and „DATE/YEAR“ are alternately indicated.  
- Check the correct setting of the internal real time clock if required (see MENU CONFIG) |
| START          | OK             | The program starts at the set time.  
- Display of time until start:  
  In line 3 the notice >TIMER< and the set values for „TIME“ and „DATE/YEAR“ are alternately indicated.  
- Check the correct setting of the internal real time clock if required (see MENU CONFIG) |

The started program

After the start the program will indicate the currently calculated setpoint in line 2:
S XX.XX. The value increases within the time period >TSLICE< until the target temperature >SETPNT< of the section is reached. If the time period in a section is set to „0“, the next section will not begin until the target temperature has been reached.

Use the edit keys + - to scroll to line 3. The display changes approximately every 4 seconds between the current section (STEP XX) and the

- A remaining time of the section
- B remaining time of the program
- C current bath temperature

I xxx.xx - internal actual value or
### Termination / Interruption of a program

1. The program can be terminated any time by pressing the key.
2. In case of power failure the program is interrupted. The circulator switches to -OFF-. If the AUTOSTART-function is activated the programmer starts again at the point in time approx. 5 minutes prior to the interruption. However, an uncontrolled change of the bath temperature has occurred.

### 9.2. MENU PROGRAM – creation, administration

**Menu level 1**

**MENU PROGRAM**

1 program

10 sections

<table>
<thead>
<tr>
<th>STEP (Nr.)</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>SETPNT (°C)</td>
<td>100</td>
<td>180</td>
<td>180</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>TIME (hh:mm)</td>
<td>00:20</td>
<td>00:10</td>
<td>00:20</td>
<td>00:50</td>
<td>00:20</td>
</tr>
</tbody>
</table>

**Graph 1**

- Sections without set value and time are skipped. They can be defined retroactively and the integrated into the program.
Menu functions

### Menu level 1

<table>
<thead>
<tr>
<th>Menu functions</th>
<th>&gt;EDIT&lt;</th>
<th>Create, administer program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt;STEP&lt;</td>
<td>Program step (1 ... 10)</td>
</tr>
<tr>
<td></td>
<td>&gt;SETPNT&lt;</td>
<td>Temperature setpoint of step ...</td>
</tr>
<tr>
<td></td>
<td>&gt;TSLICE&lt;</td>
<td>Duration of step ...</td>
</tr>
<tr>
<td></td>
<td>&gt;DELETE&lt;</td>
<td>delete program step (01 ... 10, ALL)</td>
</tr>
</tbody>
</table>

1. Press key, if a parameter is to be retained. Correction function for parameters or values (prior to OK)

### Level 2

<table>
<thead>
<tr>
<th>PROGRAM EDIT</th>
<th>EDIT STEP</th>
<th>STEP</th>
<th>(STEP 1 ... 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

1. Set program step with and 

(Example: EDIT STEP 01)

1. For STEP 01 the values for SETPOINT 01 and TSLICE 01 are set one after the other

### Level 3

<table>
<thead>
<tr>
<th>EDIT STEP</th>
<th>SETPTN</th>
<th>(values within working temp. range)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

1. Integer digits flash, set by pressing 

1. Decimal digits flash, set by pressing 

### Parameter level

<table>
<thead>
<tr>
<th>EDIT TSLICE</th>
<th>TSLICE</th>
<th>(time slice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>00.10</td>
<td>00.10</td>
<td></td>
</tr>
</tbody>
</table>

1. Set duration by pressing and 

1. Delete program

Program steps can be deleted individually or entirely. (STEP 01, 02, ... 10, ALL).

1. Set parameters by pressing and 

36
9.3. **MENU PUMP – Setting of pump pressure**

The capacity of the circulating pump is set by adjusting the motor speed

Settings: stage / LEVEL 1 ... 4

Display: with illuminated indicator

Flow rate: 11 ... 16 l/m
Pump pressure: 0,22 ... 0,45 bar

Factory setting: stage 2

1. Press the **MENU** key.
2. Select the menu >PUMP< pressing the **key and confirm by pressing the **key.
The set parameter flashes (example: >LEVEL 2<)
3. Change the parameter by pressing **and confirm by pressing the **key.
or
Press the **key if the parameter is to be retained.

The pump flow is pre-adjusted in the factory and can be modified to suit user requirements.

- Using a screwdriver turn the screw (1) anti-clockwise by 360 °.
- Using flat pliers turn the marking of the slide (2) to the desired position.
- Tighten the screw.

Examples:

**Internal applications in the bath**

A 100 % internal bath circulation  
(for large bath tanks)
B Reduced internal bath circulation  
(for smooth surface of bath fluid)

**External/internal applications**

C 40 % external discharge,  
60 % internal circulation  
(for large bath tanks)
D 80 % external discharge,  
20 % internal circulation  
(for small bath tanks)
### 9.4. MENU CONFIG – Configuration of unit

**Menu level 1**

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A RESET can be effected only in the &gt;OFF&lt; mode. Switch off circulator by pressing the OK key and call up the menu CONFIGURATION.</td>
</tr>
</tbody>
</table>

**Level 2**

<table>
<thead>
<tr>
<th>CONFIG</th>
<th>Parameter level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Press the key if a parameter is to be retained. Correction function for parameters and values (prior to OK).</td>
</tr>
</tbody>
</table>

#### 1. Remote control

- Switch on and off remote control by pressing and OK.
- Control display in the topline for Remote.
- For remote control refer to 59.
- Connect RS232 with PC.

#### 2. Autostart

- Switch on and off autostart by pressing AUTOSTART on = on
- AUTOSTART off = off
- See WARNING page 39

#### 3. OFFMODE

- Switch on and off OFFMODE by pressing
- PUMP ON continuous operation of circulating pump
- PUMP OFF circulating pump is linked to Start/Stop

**Level 3**

<table>
<thead>
<tr>
<th>CONFIG</th>
<th>Parameter level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hours flash, set by pressing + OK</td>
</tr>
<tr>
<td>2</td>
<td>Minutes flash, set by pressing + OK</td>
</tr>
</tbody>
</table>

#### DATE

- Day flashes, set by pressing + OK
- Month flashes, set by pressing + OK
### Level 3 Parameter level

<table>
<thead>
<tr>
<th>Level 3</th>
<th>Parameter level</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="TIME/DT" /></td>
<td><img src="image" alt="YEAR" /></td>
</tr>
<tr>
<td><img src="image" alt="OK" /></td>
<td><img src="image" alt="OK" /></td>
</tr>
<tr>
<td><img src="image" alt="OK" /></td>
<td><img src="image" alt="OK" /></td>
</tr>
</tbody>
</table>

- Year flashes, set by pressing `+` and `OK`

| ![CONFIG](image) | ![RESET](image) |
| ![OK](image) | ![OK](image) |
| ![OK](image) | ![OK](image) |

- Return to factory settings by pressing `OK`

**RESET** returns all set values to the factory setting except for date and time.

1. A RESET can be effected only in the –OFF- mode.
2. During the message –RUN- all parameters are reset to factory settings.

### 9.4.1. REMOTE

**Factory setting:** OFF

The control electronics offer two ways of adjusting a setpoint.

1. Adjustment of setpoint using the keypad or the integrated programmer.
2. Adjustment of setpoint via the serial interface RS232 using a PC or a superordinated process control system.

- The topline of the VFD-DISPLAY shows a bright "R" FOR remote control; - remote control discontinued.

**IMPORTANT:** additional measures for remote control

- Connect the circulator to the PC using an interface cable.
- Check the interface parameters of both interfaces (circulator and PC) and make sure they match.
  (refer to 12.1. Setup for remote control page 59)

### 9.4.2. AUTOSTART

**Warning:**

For supervised or unsupervised operation with the “AUTOSTART“ function avoid any hazardous situation to persons or property. Take care to fully observe the safety and warning functions of the circulator.

**Factory setting:** OFF

**Notice:**

The circulator has been configured and delivered by JULABO in accordance with the NAMUR recommendations. This means for the start mode that the unit must enter a safe operating status after a power failure. This safe operating status is indicated by the message „OFF“ or „R OFF“ on the VFD COMFORT-DISPLAY.

A complete, all-pole shutdown of the main functional elements such as heater and pump motor is effected.

The values set on the circulator remain saved and the unit is restarted by pressing the start/stop key in manual control.

In remote control mode the values need to be resent by the PC via the
If such a safety standard is not required, the NAMUR recommendations can be bypassed with the AUTOSTART function thus allowing a direct start of the circulator by pressing the mains switch or using a timer.

**9.4.3. OFF-MODE**

Factory setting:  
PMP OFF

Usually the circulating pump is controlled with the key OK or the start/stop command. If the circulating pump is to work in the –OFF-mode, the adjustment can be set in a sub-menu.

⚠️ The pump motor will be shutdown in case of alarm anyhow.

**9.4.4. Setting of clock and date**

The internal real time clock allows starting a program any time. The clock is set to the local mean time (MEZ) at the factory.

⚠️ If the unit is operated in a different time zone, the clock can be adjusted in this menu.

⚠️ Change summer/winter time in this menu.

**9.4.5. RESET – Factory settings**

A Reset will return all values to factory setting except for date and time.

⚠️ A RESET can be effected in the >OFF< mode only.

Switch off the circulator by pressing the key OK and call up the menu CONFIGURATION.
### 9.5. MENU CONTROL – Control characteristics and parameters

#### Menu level 1

- **The circulator is qualified for internal and external temperature control**
- **The switchover is carried out in the menu >C-TYPE< (INT or EXT).**
- **For external temperature control and measurement connect a Pt100 external sensor to the socket at the rear of the circulator.**
- **Press the key if a parameter is to be retained. Correction function for parameters or values (prior to OK)**

#### Level 2

<table>
<thead>
<tr>
<th>Parameter level</th>
<th>Control characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-TYPE INTERNAL</td>
<td></td>
</tr>
<tr>
<td><strong>CONTROL</strong></td>
<td><strong>DYNAMIC</strong></td>
</tr>
<tr>
<td>C-TYPE</td>
<td>DYNAMIC</td>
</tr>
<tr>
<td>INT ⊗</td>
<td>NORM</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Switchover of control type by pressing and OK</td>
</tr>
<tr>
<td></td>
<td>• The control type can be adjusted in the -OFF- mode only.</td>
</tr>
<tr>
<td></td>
<td>• Depending on the adjustment only the active parameters are displayed.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>XP INT</td>
<td></td>
</tr>
<tr>
<td>0.1 ... 99.9</td>
<td>• The parameter flashes, set by pressing + OK</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>IN INT</td>
<td></td>
</tr>
<tr>
<td>3 ... 9999</td>
<td>• The parameter flashes, set by pressing + OK</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>TV INT</td>
<td></td>
</tr>
<tr>
<td>0 ... 9999</td>
<td>• The parameter flashes, set by pressing + OK</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>C-TYPE EXTERNAL</td>
<td></td>
</tr>
<tr>
<td><strong>CONTROL</strong></td>
<td><strong>XP EXT</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The parameter flashes, set by pressing + OK</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The parameter flashes, set by pressing + OK</td>
</tr>
<tr>
<td>IN EXT</td>
<td></td>
</tr>
<tr>
<td>3 ... 9999</td>
<td>• The parameter flashes, set by pressing + OK</td>
</tr>
</tbody>
</table>
### Menu functions

<table>
<thead>
<tr>
<th>Level 2</th>
<th>Parameter level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="CONTROL TV EXT" /></td>
<td><img src="image" alt="TV EXT" /></td>
<td>OK → 55</td>
</tr>
<tr>
<td><img src="image" alt="CONTROL XPU" /></td>
<td><img src="image" alt="XPU" /></td>
<td>OK → 30</td>
</tr>
</tbody>
</table>

### 9.5.1. CONTROL – Control INTERNAL / EXTERNAL

- **Pt100**
  - Switchover can only be effected if a Pt100 external sensor is connected.
  - Factory setting: INT

**IMPORTANT:** Additional measures for external temperature control

- Suggested settings for external temperature control: BAND HIGH / LOW and INTERN MAX / MIN
  - See chapter >LIMITS< page 52.
- Sensor calibration of the Pt100 external sensor is carried out in the menu >ADJUST<, submenu >ATC SENSOR - EXT<; set ATC STATUS< to >OFF< (See page 46).

**Attention:**
Place the external sensor into the temperature-controlled medium and securely fix the sensor.

### Accessory: Pt100 external sensor

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Description</th>
<th>Material</th>
<th>Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>8981003</td>
<td>200x6 mm Ø</td>
<td>stainless steel</td>
<td>1.5 m</td>
</tr>
<tr>
<td>8981005</td>
<td>200x6 mm Ø</td>
<td>glass</td>
<td>1.5 m</td>
</tr>
<tr>
<td>8981006</td>
<td>20x2 mm Ø</td>
<td>stainless steel</td>
<td>1.5 m</td>
</tr>
<tr>
<td>8981010</td>
<td>300x6 mm Ø</td>
<td>stainless steel</td>
<td>1.5 m</td>
</tr>
<tr>
<td>8981015</td>
<td>300x6 mm Ø</td>
<td>stainless steel / PTFE coated</td>
<td>3 m</td>
</tr>
<tr>
<td>8981013</td>
<td>600x6 mm Ø</td>
<td>stainless steel / PTFE coated</td>
<td>3 m</td>
</tr>
<tr>
<td>8981016</td>
<td>900x6 mm Ø</td>
<td>stainless steel / PTFE coated</td>
<td>3 m</td>
</tr>
<tr>
<td>8981014</td>
<td>1200x6 mm Ø</td>
<td>stainless steel / PTFE coated</td>
<td>3 m</td>
</tr>
<tr>
<td>8981103</td>
<td>Extension cable for Pt100 sensor</td>
<td></td>
<td>3.5 m</td>
</tr>
<tr>
<td>8981020</td>
<td>M+R in-line Pt100 sensor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The M+R in-line Pt100 sensor is a flow sensor and can be installed loop circuit.
9.5.2. Dynamic internal

This parameter affects the temperature sequence only in case of internal control.

Factory setting: APER (aperiodic)

Possible parameters:

NORM  Allows for reaching the setpoint faster – with setpoint change or ramp function – but overshooting of up to 5 % is possible.

APER  Ramp function: the increase of temperature occurs temporally offset and achieves the target temperature without overshooting.
Setpoint change: The temperature increases at the same rate, the target temperature is achieved without overshooting.

With both settings constant temperature is achieved after approximately the same time.

9.5.3. Control parameters – XPU-, XP-, TN-, TV- EXTERNAL

In most cases the control parameters preset in the factors are adequate for achieving an optimum temperature sequence. The control parameters allow adjustment to special control processes.

Proportional range >Xpu<

The proportional range Xpu of the cascaded controller is only needed for external control.
9.5.4. Control parameters – XP-, TN-, TV- INTERNAL

In most cases the control parameters preset in the factory are adequate for achieving an optimum temperature sequence. The control parameters allow adjustment to special control processes.

**Proportional range >Xp<**

The proportional range is the range below the setpoint in which the control circuit reduces the heating capacity from 100% to 0%.

Setting range: 0.1 ... 99.9

**Reset time >Tn< (Integral component)**

Compensation of the remaining control deviation due to proportional regulation. An insufficient reset time may cause instabilities. Excessive reset times will result in unnecessary prolongation of compensation of the control difference.

Setting range: 3 ... 9999

**Lead time >Tv< (Differential component)**

The differential component reduces the transient time. An insufficient lead time will prolong the time required for compensation of disturbance effects and cause high overshooting during run-up. An excessive lead time could cause instabilities (oscillations).

Setting range: 0 ... 999

**Optimization instructions for the PID control parameters**

Optimum setting

Control parameters XP-, TN-, TV- INTERNAL as well as EXTERNAL

The heat-up curve reveals possible faulty settings of the control parameter.

Inappropriate settings may produce the following heat-up curves:

- **Xp too low**
- **Tv/Tn too low**
- **Xp too high or Tv too high**
- **Tv/Tn too high or Xp too high**
# 9.6. MENU SERIAL - BAUDRATE, HANDSHAKE, PARITY

For communication between circulator and a PC or a superordinated process control system the interface parameters of both units must be identical.

For remote control refer to page 59

Factory settings:
- 4800 Baud
- even
- hardware handshake

## Level 2 Parameter level

| SERIAL | BAUDRATE | **4800**
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>9600</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>19200</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>38400</strong></td>
<td></td>
</tr>
</tbody>
</table>

- Press the key if a parameter is to be retained.

- The parameter flashes, switch by pressing \( \text{↑} \) and **OK**

| SERIAL | PARITY | **EVEN**
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>ODD</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>NO</strong></td>
<td></td>
</tr>
</tbody>
</table>

- The parameter flashes, switch by pressing \( \text{↑} \) and **OK**

- even: Data bits = 7; Stop bits = 1
- odd: Data bits = 7; Stop bits = 1
- no: Data bits = 8; Stop bits = 1

| SERIAL | HSHAKE | **HARD**
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>SOFT</strong></td>
<td></td>
</tr>
</tbody>
</table>

- The parameter flashes, switch by pressing \( \text{↑} \) and **OK**

- Xon/Xoff-protocol (Software handshake)
- Protocol RTS/CTS (Hardware handshake)
9.7. MENU ATC - Absolut Temperature Calibration

ATC serves to compensate a temperature difference that might occur between circulator and a defined measuring point in the bath tank because of physical properties.

**Principle:**
For ATC calibration, in steady state the bath temperature at the location of the temperature sensor (CT) is determined at the respective adjusted working temperature. This value is then set on the circulator in the menu >ATCalibration< under menu item >CTEMP X<. This can be a 1-point, 2-point or 3-point calibration.

Example:
1-point calibration

![Graph showing 1-point calibration]

3-point calibration

![Graph showing 3-point calibration]

**Legend:**
- **M**: Temperature measuring instrument with temperature sensor
- **B**: Bath tank (INTernal or EXTernal)
- **T**: circulator
- **CT**: Temperature on measuring point
- **TT**: Temperature on circulator
### Menu level 1

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td><strong>Menu</strong></td>
<td><strong>ATC</strong></td>
</tr>
<tr>
<td><strong>OK</strong></td>
<td><strong>↓</strong></td>
</tr>
</tbody>
</table>

### Level 2

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td><strong>Parameter level</strong></td>
<td></td>
</tr>
</tbody>
</table>

1. Press the ⬇️ key if parameter is to be retained. Correction function for parameters or values (prior to OK).

- The parameter flashes, switch by pressing ⬆️ ⬇️ and **OK**

- On level 2 a (I) is indicated for internal or an (E) for external.

Example: 🟢 **ATC (I)** 🟢 **ATC (E)**

2. The parameter flashes, switch by pressing ⬆️ ⬇️ and **OK**

- 🟢 **>NO<** Carry out an ATC calibration
- 🟢 **>YES<** return to standard operation after calibration.

3. The parameter flashes, switch by pressing ⬆️ ⬇️ and **OK**

- 🟢 A **>1-point<**, **>2-point<** or **>3-point< calibration** can be carried out.

The selected calibration is indicated on level 2 by 1 or 2 or 3.

4. The value 🟢 **TMPVAL** is only indicated

- In addition the measured temperature value 🟢 **CALVAL X** is saved during the next step.

- Integer digits flash, set by pressing ⬆️ ⬇️ + **OK**

- Decimal digits flash, set by pressing ⬆️ ⬇️ + **OK**

5. If only a 1-point calibration is carried out, the following menu items are not indicated anymore.
Menu functions

<table>
<thead>
<tr>
<th>ATC (I)</th>
<th>TMPVAL2</th>
<th>The value is only indicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK →</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATC (I)</td>
<td>CALVAL2</td>
<td>• Integer digits flash, set by pressing + OK</td>
</tr>
<tr>
<td>OK →</td>
<td></td>
<td>• Decimal digits flash, set by pressing + OK</td>
</tr>
</tbody>
</table>

① If only a 2-point calibration is carried out, the following menu items are not indicated anymore

<table>
<thead>
<tr>
<th>ATC (I)</th>
<th>TMPVAL3</th>
<th>The value is only indicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK →</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATC (I)</td>
<td>CALVAL3</td>
<td>• Integer digits flash, set by pressing + OK</td>
</tr>
<tr>
<td>OK →</td>
<td></td>
<td>• Decimal digits flash, set by pressing + OK</td>
</tr>
</tbody>
</table>

9.7.1. ATC SENSOR - INTERNAL / EXTERNAL

In the first submenu the ATC function is set for the >INTERN< internal or the >EXTERN< external temperature sensor.

Calibration can be carried out for the internal temperature sensor and for the external temperature sensor connected to the socket „ext. Pt100“.

The circulator is able to save both parameter sets. However only the one which has been set under menu item >ATC SENSOR< is displayed.

9.7.2. ATC STATUS - YES / NO

In the second submenu the ATC function for the temperature sensor selected above is activated >YES< or deactivated >NO<.

>YES< (factory setting) The controller of the circulator uses the original curve of the temperature sensor or the new curve measured during the ATC calibration.

Important: Set to >NO< during the calibration process

>NO< An ATC calibration is to be carried out.

Important: Set to >YES< after calibration.

① In the > ATC STATUS < >YES< the ATC calibration always affects the current working temperature; also the one set via interface.
9.7.3. CALIBRATION TYPE: 1 -/ 2 -/ 3 POINT

A >1-point<, >2-point< or >3-point< calibration can be carried out.

First geometrically define the location for calibration (measuring point CT), then determine the temperature values of the calibration points. The type of calibrations also determines the number of the following pairs of values indicated on the LCD DIALOG-DISPLAY.

Pairs of values:

**TMPVAL X:** Circulator temperature 1 or 2 or 3 (actual value TT)

The actual temperature of the bath is simultaneously saved with the "calibration value" >CALVAL< and can be indicated for control purposes (value does not flash).

**CALVAL X:** Calibration temperature 1 or 2 or 3 (actual value CT)

The "calibration value" is determined with a temperature measuring device and saved under menu item >CALVAL<. (value flashes \(\checkmark\))
9.7.4. Example: 3-point calibration for internal control

In the temperature range from 80 °C to 160 °C the calibration curve of the temperature sensor (TT) is to be adjusted to the actual temperatures at measuring point (CT).

1. Set circulator to internal control:
   MENU CONTROL page 41

The type of control can be set only in the –OFF- mode.

2. Set working temperature setpoint – SETPNT:

Refer to „Direct temperature setting“ page 27

- By pressing the key the circulator switches to the active >SETPOINT< see example on the left: >SETPNT / 1 25.00°C<. The integer digits flash (Example: <25>).
- Change the value to 80.00 °C by pressing the keys and and confirm by pressing the key . The decimal digits flash. Confirm once more by pressing the key .
- The bath is heated up. Wait for approx. 5 minutes until the temperature is constant.

3. Reading of temperature measuring device

Read the value of measuring point CT on the device and enter under menu item >CALVAL X< by using the keypad.

>CALVAL 1< (79.70 °C)
>CALVAL 2< (119.50 °C)
>CALVAL 3< (159.30 °C)

4. Calibration

Press the key if parameter is to be retained. Correction function for parameters or values (prior to OK).

Setting is required only for the first calibration point.

Set SENSOR INTERN:
- The parameter flashes, switch by pressing and .
An ATC calibration is to be carried out. Set to >NO<
- The parameter flashes, switch by pressing  and  .

A >3-point< calibration is carried out.
- The parameter flashes, switch by pressing  and  .
- Integer digits flash, set by pressing  (79) +  
- Decimal digits flash, set by pressing  (70) +  
- The first of 3 points is calibrated.

The value >TMPVAL< is only indicated
- Integer digits flash, set by pressing  (119) +  
- Decimal digits flash, set by pressing  (50) +  
- The second of 3 points is calibrated.

The 3-point calibration is completed

5. Return to standard operation
- Set >YES< after calibration. (Standard operation)
### 9.8. MENU LIMITS

#### Menu level 1

<table>
<thead>
<tr>
<th>Menu function</th>
<th>Parameter level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LIMITS</strong></td>
<td><strong>SETMAX</strong></td>
<td>Press the key if parameter is to be retained. Correction function for parameters or values (prior to OK).</td>
</tr>
<tr>
<td><strong>LIMITS</strong></td>
<td><strong>SETMIN</strong></td>
<td></td>
</tr>
<tr>
<td><strong>LIMITS</strong></td>
<td><strong>HEATMAX</strong></td>
<td></td>
</tr>
<tr>
<td><strong>LIMITS</strong></td>
<td><strong>COOLMAX</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Level 2**

<table>
<thead>
<tr>
<th>Parameter level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SETMAX</strong></td>
<td>Integer digits flash, set by pressing + OK</td>
</tr>
<tr>
<td><strong>SETMIN</strong></td>
<td>Integer digits flash, set by pressing + OK</td>
</tr>
<tr>
<td><strong>HEATMAX</strong></td>
<td>Integer digits flash, set by pressing + OK</td>
</tr>
<tr>
<td><strong>COOLMAX</strong></td>
<td>Integer digits flash, set by pressing + OK</td>
</tr>
</tbody>
</table>

In case of external control these menu items are additionally indicated.

<table>
<thead>
<tr>
<th>Parameter level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INTMAX</strong></td>
<td>Integer digits flash, set by pressing + OK</td>
</tr>
<tr>
<td><strong>INTMIN</strong></td>
<td>Integer digits flash, set by pressing + OK</td>
</tr>
<tr>
<td><strong>BAND-H</strong></td>
<td>The value flashes, set by pressing + OK</td>
</tr>
<tr>
<td><strong>BAND-L</strong></td>
<td>The value flashes, set by pressing + OK</td>
</tr>
</tbody>
</table>
9.8.1. Limits for internal control

**SETPOINT MAX / MIN** – Maximum and minimum setpoint
Restriction of the adjustable temperature range

The limitation of the operating temperature range affects the temperature setting in the menu with the key \( T \).

Only setting of working temperatures which lie within the determined limits is possible.

Existing settings for SETPNT 1, -2, -3, as well as those for >OVERTMP< and >SUBTMP< (refer to page 31), are automatically deferred into the limit range.

**Setting range**: -94.90 °C ... +200.0 °C

1. **SET MAX > SET MIN**
   Interchange of values is not possible.

**Set maximum heating / cooling**

The heating and cooling capacity of the unit are adjustable. 100 % corresponds to the technical specification of the equipment.

**Setting range**:

- **HEAT MAX** – 0 to 100 % in 1 % steps
- **COOLING MAX** – 0 to 100 % in 1 % steps

9.8.2. Limits for external control

**INTERN MAX / MIN**
Restriction for the temperature range of the internal bath.

**Setting range**: -94.9 °C ... +200.0 °C

The limits INT MAX and INT MIN are only active in external control. INT MAX and INT MIN determine fixed limits for the temperature within the internal bath. The temperature controller cannot exceed these limits even if it would be necessary for achieving the temperature in an external system. Therefore it is possible that the external setpoint cannot be achieved.

**Sense of limit setting**:

- Protects the bath fluid from overheating.
- Prevents an undesired alarm shutdown by the excess temperature protection - >ALARM CODE 14<.
  Set the value of > INT MAX at least 5 °C below the value of >SAFETMP<.
- Protects the pump motor from high viscosity of the bath fluid at low temperatures.
- For refrigerated circulators. Freezing protection when using water as bath fluid.
**BAND HIGH / LOW – Band limitation**

The band limitation is active during external control. Varied, practice-oriented setting are feasible for heat-up and cool-down phases.

**Setting range:** 0 °C ... 200 °C

**BAND HIGH** and **BAND LOW** allow for the limitation of the difference between the temperatures in the internal bath and the external system to any maximum value for the heat-up and cool-down phase. During the heat-up phase this difference value is always added to the actual external temperature. During the cool-down phase the difference value is subtracted.

Sense of a band limitation:
- 🌟 Protection of objects and samples by gentle temperature control
- 🌟 Protection of e.g. glass reactors from thermal shock.
10. Troubleshooting guide / error messages

**Alarm with complete shutdown:**
If one of the following failures occur a complete, all-pole shutdown of the heater and circulating pump is effected.

⚠️ lights up and a continuous signal sounds.
The code for the cause of alarm is indicated on the VFD COMFORT-DISPLAY.

**Alarm without shutdown:**
The code for the cause of alarm is indicated on the VFD COMFORT-DISPLAY. The warning signal sounds in regular intervals. The messages appear every 10 seconds.

Press the key **OK** to stop the signal

- **Error message with ticker:** >LOW LEVEL ALARM-FILL MEDIUM <
- **Low level alarm**
The circulator is operated without or insufficient bath fluid. Switch the unit off with the mains switch, refill bath fluid and switch on!
Tube breakage has occurred (insufficient filling level of bath fluid caused by pumping-out)
Replace the tubing and refill bath liquid.
The float is defect (e.g. transport damage).
Repair by authorized JULABO service personnel.

- **Error message with ticker:** > REFRIGERATOR ALARM-CHECK CONNECTION <
During the self-test after switch-on a short –circuit is detected between pin 2 and pin 4 of the control line or the control line was disconnected during operation.
Reconnect the control line or repair short-circuit.

- **Error message with ticker:** > EXCESS TEMPERATURE WARNING-CHECK LIMITS <
Excess temperature warning or Excess temperature alarm
**Type of warning:** set to >warning< or >alarm< (refer to page 30)

- **Error message with ticker:** > LOW TEMPERATURE WARNING-CHECK LIMITS <
Low temperature warning or Low temperature alarm.
**Type of warning:** set to >warning< or >alarm< (refer to page 30)

- **Error message with ticker:** > WORKING SENSOR ALARM-CALL SERVICE <
Cable of working temperature sensor is disconnected or short-circuited.
Troubleshooting guide / error messages

**ALARM CODE 06**
Error message with ticker:
>SENSOR DIFFERENCE ALARM-CHECK VISCOSITY AND PUMP STAGE<
Defect of working or excess temperature protector.
Working temperature sensor and excess temperature protector report a
temperature difference of more than 35 K.

**ALARM CODE 07**
Error message with ticker:
>INTERNAL HARDWARE ERROR-CALL SERVICE <
Other errors

**ALARM CODE 12**
Error message with ticker:
>EXCESS TEMPERATURE PROTECTOR ALARM-CHECK ADJUSTMENT <
Excess temperature protector defect.
The protection temperature is below the set working temperature setpoint.
Set the protection temperature to a higher value.

**ALARM CODE 14**
Error message with ticker:
>EXTERNAL SENSOR ALARM-CHECK EXTERNAL SENSOR <
External control was set but the Pt100 external sensor was not connected or is
defect.

**ALARM CODE 20**
Error message with ticker:
>CLEAN CONDENSER OR CHECK COOLING WATER <
Insufficient cooling of condenser. Clean the air-cooled condenser. Check the
flow and the temperature of the cooling water of a water-cooled condenser.

**ALARM CODE 21**
Error message with ticker:
>COMPRESSOR FAILURE-CHECK REFRIGERATOR <
Stage 1 of the compressors does not work.
Automatic restart after short cool-down, message E 21 goes off.

**WARNING CODE 22**
Stage 2 of the compressor does not work.
Cooling machine – overload protection
The driving motor of the cooling compressor is equipped with an overload
protection which is triggered by increased internal temperatures or excessive
current consumption.
Shutdown can be caused by
- insufficient ventilation,
- insufficient wall distance,
- soiled condenser,
- high room temperature
- switching off and on in short sequence

**WARNING CODE 23**
Excess temperature in stage 1 of the compressor.

**WARNING CODE 24**
Excess temperature in stage 2 of the compressor.

**WARNING CODE 25**
Short circuit of control line to cooling machine during self-test.
Error message with ticker:
> SAFETY SENSOR ALARM-CALL SERVICE <
The cable of the excess temperature protector has been disconnected or short-circuited.

Error message with ticker:
> LOW LEVEL WARNING-FILL MEDIUM <
The early warning system for low level reports a critical fluid level. Refill bath fluid.

By quickly switching off and restarting the unit the alarm is cancelled. If the error occurs once more after the restart, a remote diagnosis is required.

Error message with ticker:
> CONFIGURATION ERROR-PRESS OK<
The configuration of the circulator does not correspond with its current application.
Press the OK key for a non-recurring, automatic change of the configuration.
In this case please call the JULABO Technical Service or an authorized dealer.

**Disturbances that are not indicated.**
The electronic pump motor is overload-protected by an electronic current limiter. If viscosity of the bath fluid is or becomes too high, the motor stops running.

Mains circuit breakers (resettable) 15 A

Cooling machine: Fuse T 10.0 A, dia.5 x 20 mm
The mains fuses (8b) on the rear of the unit may easily be exchanged as shown on the left.

**Warning:**
Before exchanging the fuses, turn off the mains power switch and disconnect the power plug from the mains socket!
Only use fine fuses with a nominal value as specified.

Example:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Supplier</th>
<th>Type</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wickmann</td>
<td>Wickmann</td>
<td>G- fuse insert</td>
<td>No. 19195</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T10,0A 5x20 mm</td>
<td></td>
</tr>
</tbody>
</table>
11. Electrical connections

**Notice:**

Use shielded cables only.
The shield of the connecting cable is electrically connected to the plug housing. The unit ensures safe operation if connecting cables with a maximum length of 3 m are used. The use of longer cables does not affect proper performance of the unit, however external interferences may have a negative impact on safe operation (e.g. cellular phones).

**Socket for external Pt100 sensor**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I+</td>
</tr>
<tr>
<td>2</td>
<td>U+</td>
</tr>
<tr>
<td>3</td>
<td>U-</td>
</tr>
<tr>
<td>4</td>
<td>I-</td>
</tr>
</tbody>
</table>

The shield of the connecting cable is electrically connected to the plug housing and the sensor tube.

**RS232 serial interface**

This port can be used to connect a computer with an RS232 cable for remote control of the circulator.

**Pin assignments RS232:**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>RxD</td>
<td>Receive Data</td>
</tr>
<tr>
<td>3</td>
<td>TxD</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>5</td>
<td>0 V</td>
<td>Signal GND</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>Request to send</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>Clear to send</td>
</tr>
</tbody>
</table>

Pin 1; 4; 6, 9 Reserved - do not use!

**RS232 interface cable**

<table>
<thead>
<tr>
<th>Circulator (9-pol)</th>
<th>PC (9-pol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 2 RxD</td>
<td>Pin 3 TxD</td>
</tr>
<tr>
<td>Pin 3 TxD</td>
<td>Pin 2 RxD</td>
</tr>
<tr>
<td>Pin 5 GND</td>
<td>Pin 5 GND</td>
</tr>
<tr>
<td>Pin 7 RTS</td>
<td>Pin 8 CTS</td>
</tr>
<tr>
<td>Pin 8 CTS</td>
<td>Pin 7 RTS</td>
</tr>
</tbody>
</table>

**Accessories:**

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 980 073</td>
<td>RS232 interface cable 9-pol./9-pol. , 2,5 m</td>
</tr>
<tr>
<td>8 900 110</td>
<td>USB interface adapter cable</td>
</tr>
</tbody>
</table>
Control output

The connector may be used for control of JULABO refrigerated circulators or as output for alarm messages.

Circuit:  
Operation = relay powered
Alarm = relay not powered

Pin assignment:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24 V (I max. current 25 mA)</td>
</tr>
<tr>
<td>2</td>
<td>0 V</td>
</tr>
<tr>
<td>3</td>
<td>Alarm relay</td>
</tr>
<tr>
<td>4</td>
<td>Reserved - do not use!</td>
</tr>
<tr>
<td>5</td>
<td>Cooling pulse</td>
</tr>
</tbody>
</table>

12. Remote control

12.1. Setup for remote control

1. Check the interface parameters for both interfaces (on circulator and PC) and make sure they match.  
(Serial interface refer to page 45)

2. In the menu > MENU CONFIG < set the menu item > REMOTE < to > ON < .

3. Connect both units with an interface cable.

Like all parameters which can be entered through the keypad, interface parameters are stored in memory even after the circulator is turned off.
12.2. Communication with a PC or a superordinated data system

If the circulator is put into remote control mode via the configuration level, the VFD COMFORT-DISPLAY will read “R -OFF-” = REMOTE STOP. The circulator is now operated via the computer. In general, the computer (master) sends commands to the circulator (slave). The circulator sends data (including error messages) only when the computer sends a query.

In remote control mode, the start command and all values to be set must be resent by the PC via the interface in case of a power interruption. AUTOSTART is not possible.

A transfer sequence consists of:
- command
- space ( ; Hex: 20)
- parameter (decimal separation with a period)
- end of file ( ; Hex: 0D)

The commands are divided into in and out commands.

- in commands: retrieve parameters
- out commands: set parameters

Important times for a command transmission:
To ensure a safe data transfer, the time gap between two commands should be at least 250 ms.

The circulator automatically responds to an in command with a data string followed by a LF (Line Feed). The next command should only be sent after 10 ms.

The out commands are valid only in remote control mode.

Command to set the working temperature > SETPNT 1< to 55.5 °C
\[
\text{out}_{\text{sp}}{00} \leftrightarrow 55.5
\]

Command to retrieve the working temperature > SETPNT 1< in sp_00
\[
\text{in}_{\text{sp}}{00} \rightarrow
\]

Response from the circulator:
55.5
### 12.3. List of commands

**out commands:** Setting temperature values or parameters.

<table>
<thead>
<tr>
<th>Command</th>
<th>Parameter</th>
<th>Response of circulator</th>
</tr>
</thead>
<tbody>
<tr>
<td>out_mode_01</td>
<td>0</td>
<td>Use working temperature &gt; SETPNT 1&lt;</td>
</tr>
<tr>
<td>out_mode_01</td>
<td>1</td>
<td>Use working temperature &gt; SETPNT 2&lt;</td>
</tr>
<tr>
<td>out_mode_01</td>
<td>2</td>
<td>Use working temperature &gt; SETPNT 3&lt;</td>
</tr>
<tr>
<td>out_mode_04</td>
<td>0</td>
<td>Temperature control of internal bath.</td>
</tr>
<tr>
<td>out_mode_04</td>
<td>1</td>
<td>External control with Pt100 sensor.</td>
</tr>
<tr>
<td>out_mode_05</td>
<td>0</td>
<td>Stop the unit = R –OFF-.</td>
</tr>
<tr>
<td>out_mode_05</td>
<td>1</td>
<td>Start the unit.</td>
</tr>
<tr>
<td>out_mode_08</td>
<td>0</td>
<td>Set the control dynamics - aperiodic</td>
</tr>
<tr>
<td>out_mode_08</td>
<td>1</td>
<td>Set the control dynamics - standard</td>
</tr>
<tr>
<td>out_sp_00</td>
<td>xxx.xx</td>
<td>Set working temperature. „SETPNT 1“</td>
</tr>
<tr>
<td>out_sp_01</td>
<td>xxx.xx</td>
<td>Set working temperature. „SETPNT 2“</td>
</tr>
<tr>
<td>out_sp_02</td>
<td>xxx.xx</td>
<td>Set working temperature. „SETPNT 3“</td>
</tr>
<tr>
<td>out_sp_03</td>
<td>xxx.xx</td>
<td>Set high temperature warning limit „OVERTMP“</td>
</tr>
<tr>
<td>out_sp_04</td>
<td>xxx.xx</td>
<td>Set low temperature warning limit „SUBTMP“</td>
</tr>
<tr>
<td>out_sp_07</td>
<td>x</td>
<td>Set the pump pressure stage. (1 ... 4)</td>
</tr>
<tr>
<td>out_par_04</td>
<td>x.x</td>
<td>CoSpeed 0 ... 5.0 Band limit during external control. Setting the maximum difference between the temperatures in the internal bath and external system.</td>
</tr>
<tr>
<td>out_par_06</td>
<td>xxx</td>
<td>Xp control parameter of the internal controller. 0.1 ... 99.9</td>
</tr>
<tr>
<td>out_par_07</td>
<td>xxx</td>
<td>Tn control parameter of the internal controller. 3 ... 9999</td>
</tr>
<tr>
<td>out_par_08</td>
<td>xxx</td>
<td>Tv control parameter of the internal controller. 0 ... 999</td>
</tr>
<tr>
<td>out_par_09</td>
<td>xxx</td>
<td>Xp control parameter of the cascade controller. 0.1 ... 99.9</td>
</tr>
<tr>
<td>out_par_10</td>
<td>xxx</td>
<td>Proportional portion of the cascade controller. 1 ... 99.9</td>
</tr>
<tr>
<td>out_par_11</td>
<td>xxx</td>
<td>Tn control parameter of the cascade controller. 3 ... 9999</td>
</tr>
<tr>
<td>out_par_12</td>
<td>xxx</td>
<td>Tv control parameter of the cascade controller. 0 ... 999</td>
</tr>
<tr>
<td>out_par_13</td>
<td>xxx</td>
<td>Maximum internal temperature of the cascade controller.</td>
</tr>
<tr>
<td>out_par_14</td>
<td>xxx</td>
<td>Minimum internal temperature of the cascade controller.</td>
</tr>
<tr>
<td>out_par_15</td>
<td>xxx</td>
<td>Band limit (upper) 0 ... 200 °C</td>
</tr>
<tr>
<td>out_par_16</td>
<td>xxx</td>
<td>Band limit (lower) 0 ... 200 °C</td>
</tr>
</tbody>
</table>
**Remote control**

**in commands**: Asking for parameters or temperature values to be displayed.

<table>
<thead>
<tr>
<th>Command</th>
<th>Parameter</th>
<th>Response of circulator</th>
</tr>
</thead>
<tbody>
<tr>
<td>version</td>
<td>none</td>
<td>Number of software version (V X.xx)</td>
</tr>
<tr>
<td>status</td>
<td>none</td>
<td>Status message, error message (see page 63)</td>
</tr>
<tr>
<td>in_pv_00</td>
<td>none</td>
<td>Actual bath temperature.</td>
</tr>
<tr>
<td>in_pv_01</td>
<td>none</td>
<td>Heating power being used (%)</td>
</tr>
<tr>
<td>in_pv_02</td>
<td>none</td>
<td>Temperature value registered by the external Pt100 sensor.</td>
</tr>
<tr>
<td>in_pv_03</td>
<td>none</td>
<td>Temperature value registered by the safety sensor.</td>
</tr>
<tr>
<td>in_pv_04</td>
<td>none</td>
<td>Setpoint temperature of the excess temperature protection</td>
</tr>
<tr>
<td>in_sp_00</td>
<td>none</td>
<td>Working temperature „SETPNT 1“</td>
</tr>
<tr>
<td>in_sp_01</td>
<td>none</td>
<td>Working temperature „SETPNT 2“</td>
</tr>
<tr>
<td>in_sp_02</td>
<td>none</td>
<td>Working temperature „SETPNT 3“</td>
</tr>
<tr>
<td>in_sp_03</td>
<td>none</td>
<td>High temperature warning limit „OVERTEMP“</td>
</tr>
<tr>
<td>in_sp_04</td>
<td>none</td>
<td>Low temperature warning limit „SUBTEMP“</td>
</tr>
<tr>
<td>in_sp_07</td>
<td>none</td>
<td>Pump pressure stage</td>
</tr>
<tr>
<td>in_par_01</td>
<td>none</td>
<td>Te - Time constant of the external bath.</td>
</tr>
<tr>
<td>in_par_02</td>
<td>none</td>
<td>Si - Internal slope</td>
</tr>
<tr>
<td>in_par_03</td>
<td>none</td>
<td>Ti - Time constant of the internal bath.</td>
</tr>
<tr>
<td>in_par_04</td>
<td>none</td>
<td>CoSpeed - Band limit (max. difference between the temperatures in the internal bath and external system).</td>
</tr>
<tr>
<td>in_par_05</td>
<td>none</td>
<td>Factor pk/ph0: Ratio of max. cooling capacity versus max. heating capacity</td>
</tr>
<tr>
<td>in_par_06</td>
<td>none</td>
<td>Xp control parameter of the internal controller.</td>
</tr>
<tr>
<td>in_par_07</td>
<td>none</td>
<td>Tn control parameter of the internal controller.</td>
</tr>
<tr>
<td>in_par_08</td>
<td>none</td>
<td>Tv control parameter of the internal controller.</td>
</tr>
<tr>
<td>in_par_09</td>
<td>none</td>
<td>Xp control parameter of the cascade controller.</td>
</tr>
<tr>
<td>in_par_10</td>
<td>none</td>
<td>Proportional portion of the cascade controller.</td>
</tr>
<tr>
<td>in_par_11</td>
<td>none</td>
<td>Tn control parameter of the cascade controller.</td>
</tr>
<tr>
<td>in_par_12</td>
<td>none</td>
<td>Tv control parameter of the cascade controller.</td>
</tr>
<tr>
<td>in_par_13</td>
<td>none</td>
<td>Adjusted maximum internal temperature of the cascade controller.</td>
</tr>
<tr>
<td>in_par_14</td>
<td>none</td>
<td>Adjusted minimum internal temperature of the cascade controller.</td>
</tr>
<tr>
<td>in_par_15</td>
<td>none</td>
<td>Band limit (upper)</td>
</tr>
<tr>
<td>in_par_16</td>
<td>none</td>
<td>Band limit (lower)</td>
</tr>
</tbody>
</table>
### Command Parameter Response of circulator

<table>
<thead>
<tr>
<th>Command</th>
<th>Parameter</th>
<th>Response of circulator</th>
</tr>
</thead>
<tbody>
<tr>
<td>in_mode_01</td>
<td>none</td>
<td>Selected setpoint:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = SETPNT 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 = SETPNT 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 = SETPNT 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 = Last setpoint setting was carried out through an external programmer</td>
</tr>
<tr>
<td>in_mode_04</td>
<td>none</td>
<td>Internal/external temperature control:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = Temperature control with internal sensor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 = Temperature control with external Pt100 sensor.</td>
</tr>
<tr>
<td>in_mode_05</td>
<td>none</td>
<td>Circulator in Stop/Start condition:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = Stop</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 = Start</td>
</tr>
<tr>
<td>in_mode_08</td>
<td>none</td>
<td>Adjusted control dynamics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = aperiodic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 = standard</td>
</tr>
</tbody>
</table>

### 12.4. Status messages

<table>
<thead>
<tr>
<th>Status messages</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00 MANUAL STOP</td>
<td>Circulator in „OFF“ state.</td>
</tr>
<tr>
<td>01 MANUAL START</td>
<td>Circulator in keypad control mode.</td>
</tr>
<tr>
<td>02 REMOTE STOP</td>
<td>Circulator in „r OFF“ state.</td>
</tr>
<tr>
<td>03 REMOTE START</td>
<td>Circulator in remote control mode.</td>
</tr>
</tbody>
</table>

### 12.5. Error messages

<table>
<thead>
<tr>
<th>Error messages</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-01 LOW LEVEL ALARM</td>
<td>Low liquid level alarm.</td>
</tr>
<tr>
<td>-02 REFRIGERATOR ALARM</td>
<td>Control cable of the refrigerated circulator or MVS solenoid valve controller short-circuited or interrupted.</td>
</tr>
<tr>
<td>-03 EXCESS TEMPERATURE WARNING</td>
<td>High temperature warning.</td>
</tr>
<tr>
<td>-04 LOW TEMPERATURE WARNING</td>
<td>Low temperature warning.</td>
</tr>
<tr>
<td>-05 WORKING SENSOR ALARM</td>
<td>Working temperature sensor short-circuited or interrupted.</td>
</tr>
<tr>
<td>Error messages</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>-06 SENSOR DIFFERENCE ALARM</td>
<td>Sensor difference alarm. Working temperature and safety sensors report a temperature difference of more than 35 K.</td>
</tr>
<tr>
<td>-07 I²C-BUS ERROR</td>
<td>Internal error when reading or writing the I²C bus.</td>
</tr>
<tr>
<td>-08 INVALID COMMAND</td>
<td>Invalid command.</td>
</tr>
<tr>
<td>-09 COMMAND NOT ALLOWED IN CURRENT OPERATING MODE</td>
<td>Invalid command in current operating mode.</td>
</tr>
<tr>
<td>-10 VALUE TOO SMALL</td>
<td>Entered value too small.</td>
</tr>
<tr>
<td>-11 VALUE TOO LARGE</td>
<td>Entered value too large.</td>
</tr>
<tr>
<td>-12 TEMPERATURE MEASUREMENT ALARM</td>
<td>Error in A/D converter.</td>
</tr>
<tr>
<td>-13 WARNING : VALUE EXCEEDS TEMPERATURE LIMITS</td>
<td>Value lies outside the adjusted range for the high and low temperature warning limits. But value is stored.</td>
</tr>
<tr>
<td>-14 EXCESS TEMPERATURE PROTECTOR ALARM</td>
<td>Excess temperature protector alarm</td>
</tr>
<tr>
<td>-15 EXTERNAL SENSOR ALARM</td>
<td>External control selected, but external Pt100 sensor not connected.</td>
</tr>
<tr>
<td>-20 WARNING: CLEAN CONDENSOR OR CHECK COOLING WATER CIRCUIT OF REFRIGERATOR</td>
<td>Cooling of the condenser is affected. Clean air-cooled condenser. Check the flow rate and cooling water temperature on water-cooled condenser.</td>
</tr>
<tr>
<td>-21 WARNING: COMPRESSOR STAGE 1 DOES NOT WORK</td>
<td>Compressor stage 1 does not work.</td>
</tr>
<tr>
<td>-22 WARNING: COMPRESSOR STAGE 2 DOES NOT WORK</td>
<td>Compressor stage 2 does not work.</td>
</tr>
<tr>
<td>-23 WARNING: HIGH TEMPERATURE ON COMPRESSOR STAGE 1</td>
<td>Excess temperature on compressor stage 1.</td>
</tr>
<tr>
<td>-24 WARNING: HIGH TEMPERATURE ON COMPRESSOR STAGE 2</td>
<td>Excess temperature on compressor stage 2.</td>
</tr>
<tr>
<td>-25 REFRIGERATOR WARNING</td>
<td>Error in the cooling machine.</td>
</tr>
<tr>
<td>-30 CONFIGURATION ERROR: CONFIRM BY PRESSING &lt;OK&gt; ON CIRCULATOR</td>
<td>The configuration of the circulator does not conform to its present use. Press OK to automatically perform a single modification of the configuration.</td>
</tr>
<tr>
<td>-33 SAFETY SENSOR ALARM</td>
<td>Excess temperature sensor short-circuited or interrupted.</td>
</tr>
<tr>
<td>-40 NIVEAU LEVEL WARNUNG</td>
<td>Low liquid level warning in the internal reservoir.</td>
</tr>
</tbody>
</table>
13. JULABO Service – Online remote diagnosis

JULABO circulators of the HighTech series are equipped with a black box. This box is implemented in the controller and records all significant data for the last 30 minutes. In case of a failure, this data can be read out from the unit by using special software. This software is available as a free download from www.julabo.de \ EasyBlackBox.

- Installation is easy and is performed step by step. Please observe the instructions.

- Data read-out is possible in the conditions "OFF", "R OFF" or "ALARM".

- Connect the circulator to the computer using an interface cable.

- Start the EasyBlackBox program. The program asks for the port used (COM1, ......) and the baud rate of the unit. You do not have this information on hand? Simply try it out! The program continues to send the request until the correct settings are made.

- Data is read out and shown on the monitor divided into the sections >Einstellungen/Settings<, >Alarmspeicher/Alarms stored<, >Blackbox<

  ➯ see example

- After pressing >Speichern/Save<, a text file is created. The program suggests a filename - >C:\model description and barcode no.<. Modifications are possible.

- E-mail this file to service@julabo.de, JULABO's service department. JULABO is thus able to provide rapid support.
14. Cleaning / repairing the unit

Caution:
- Always turn off the unit and disconnect the mains cable from the power source before cleaning the unit.
- Prevent humidity from entering into the circulator.
- Electrical connections and any other work must be performed by qualified personnel only.

Maintaining the cooling performance
To maintain the full cooling performance, clean the condenser from time to time.
- Switch off the unit, disconnect mains power cable.
- Hold the venting grid, pull out and remove.
- Clean the ribbed condenser with a vacuum cleaner.
- Replace the venting grid.
- Switch on the unit.

Cleaning:
For cleaning the bath tank and the immersed parts of the circulator, use low surface tension water (e.g., soap suds).
Clean the outside of the unit using a wet cloth and low surface tension water.
The circulator is designed for continuous operation under normal conditions. Periodic maintenance is not required.
The tank should be filled only with a bath fluid recommended by JULABO. To avoid contamination, it is essential to change the bath fluid from time to time.

Repairs
Before asking for a service technician or returning a JULABO instrument for repair, please contact an authorized JULABO service station.

When returning the unit:
- Clean the unit in order to avoid any harm to the service personnel.
- Attach a short fault description.
- During transport the unit has to stand upright. Mark the packing correspondingly.
- When returning a unit, take care of careful and adequate packing.
- JULABO is not responsible for damages that might occur from insufficient packing.

JULABO reserves the right to carry out technical modifications with repairs for providing improved performance of a unit.