Operating Manual

Heating Circulators

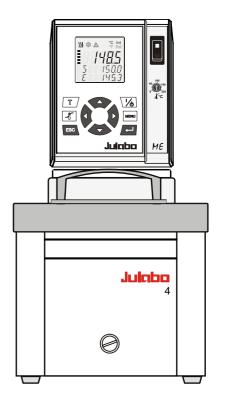
ME-4

ME-6

ME-12

ME-26

Open Bath Circulator ME-39





JULABO Labortechnik GmbH 77960 Seelbach / Germany

+49 (0) 7823 / 51-0

+49 (0) 7823 / 24 91

≢≡"

info@julabo.de

www.julabo.de

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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.

Quality Management System



The JULABO Quality Management System:

Temperature control devices for research and industry are developed, produced, and distributed according to the requirements of DIN EN ISO 9001:2000. 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.

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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 Labortechnik GmbH

Eisenbahnstraße 45

77960 Seelbach / Germany

3 07823 / 51-0

■ 07823 / 2491

info@julabo.de

info@jula

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 to the front of the unit so they are highly visible:

If this unit is intended for use within the United States of America, all 3 warning labels **must** be affixed to the housing of the unit prior to use.

Directions for the positioning of the individual warning labels are enclosed with the warning labels included in the delivery. Warning labels must be easily visible to users.

1

Warning label W00: Colors: yellow, black Danger area. Attention! Observe instructions. (operating manual, safety data sheet)

2



Mandatory label M018: Colors: blue, white

Carefully read the user information prior to beginning operation.

Scope: EU

or 2



Semi S1-0701 Table A1-2 #9

Carefully read the user information prior to beginning operation.

Scope: USA, NAFTA

3

WARNING: This product contains chemicals known to the state of California to cause cancer, birth defects or other reproductive harm.

Warning label Proposition 65

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.



Warning label W26: Colors: yellow, black

Hot surface warning.

(The label is put on by JULABO)

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.



Valid in EU countries

Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE).

This directive requires electrical and electronic equipment marked with a crossedout 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. Use in Sous-Vide cooking

Some JULABO product may be used for low temperature cooking.

Sous-Vide cooking should only be used by trained professionals.

For proper food safety it is important to maintain precise and consistent conditions and a hygienic environment.

It is vitally important to maintain procedures that minimize the risk from anaerobic bacteria, e.g. costridium botulinum.

Please make sure to follow the Sous-Vide techniques of your trained professional or cooking publication and we remind you to consider the following:

- Use high quality ingredients from known suppliers:
- Separate raw and cooked food areas from each other;
- Establish minimum cooking temperature for meat and fish;
- Adhere to the maximum storage temps and times suggested by your teacher or literature;
- ➤ Label contents with date of preparation as well as expiration date;
- Operate in a sterile environment including, utilization of sterile gloves when filling the Sous-Vide bags;
- Use separate vacuums for raw and cooked materials.

Additionaly, it is important that your kitchen staff employ an appropriate HACCP (Hazard's Analysis and Critical Control Point Program) to address the movement of food from delivery to service.

Monitor the quality of water in the Sous-Vide bath and change regularly.

Be observant of potential breaks in the cold chain or unnecessary holding time.

Additionally, please make sure to employ the appropriate time to cool cooked food before storage.

To achieve pasteurization, food cooked in the Sous-Vide method should achieve at least 65 °C (149 °F) at its core. Utilization of a temperature probe or other thermometer may be required.

Last, please follow the Sous-Vide cooking regulations mandated by your local Health Bureau or any applicable food regulations for your jurisdiction.

2.3. EC Conformity

((

The product described in the operating instructions conforms to the requirements of the following European guidelines:

Low voltage regulations with respect to legal harmonization of the member countries concerning electric devices for use within certain voltage limits.

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



Eisenbahnstr. 45 77960 Seelbach / Germany

2.4. Warranty conditions

JULABO Labortechnik 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 Labortechnik GmbH's original invoice.

JULABO Labortechnik 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.

2.5. Technical specifications

			ME
Working temperature range		°C	20 200
Temperature stability		°C	±0,01
Temperature selection			digital
via keypad			indication on VFD COMFORT-Display
remote control via personal	computer		indication on monitor
Temperature indication			VFD COMFORT-DISPLAY
Resolution		°C	0.1
Absolute Temperature Calibrat	ion	°C	±3
Temperature control			PID3 cascade temperatur control
Heater wattage (at 230 V)		kW	2,0
Heater wattage (at 115 V)		kW	1,0
Electronically adj. pump capaci	ty	stages	1 4
Flow rate	at 0 bar	l/min	11 16
Pressure max.	at 0 liter	bar	0.22 0.45
Electrical connections:			
External alarm device		Vdc/mA	24-0 / max. 25
Computer interface			RS232
External temperature sensor	or		Pt100
Ambient temperature		°C	5 40
Mains power connection	230 V/50 Hz	V/ Hz	190 253 / 50-60
Current draw (at 20	8 V / 230 V)	А	8/9
Mains power connection 1	15 V/60 Hz	V/ Hz	90 127 / 50-60
Current draw (at 10	0 V / 115 V)	А	8/9

All measurements have been carried out at:

rated voltage and frequency bath fluid: water ambient temperature: 20 °C operating temperature: 70 °C

Technical changes without prior notification reserved.

Heating circulators		ME-4	ME-6	ME-12	ME-26
Bath opening (WxL)	cm	13x15	13x15	22x15	22x30
Bath depth	cm	15	20	20	20
Filling volume	liters	3 4,5	4,5 6	7,5 12	18 26
Overall dimensions (WxDxH)	cm	21x42x38	21x43x42	30x43x45	36x61x45
Weight	kg	9,6	12,5	13,0	26,0

Open Bath Circulators		ME-39	
Bath opening (WxL)	cm	36x30	
Bath depth	cm	30	
Filling volume from to	liters	33 39	
Overall dimensions (WxDxH)	cm	54x34x52	
Weight	kg	19,0	

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 >25 °C

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

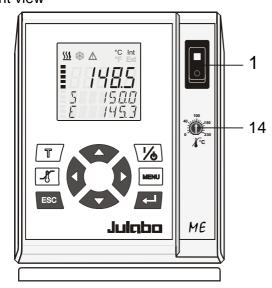
Standards for interference resistance according to EN 61326-1

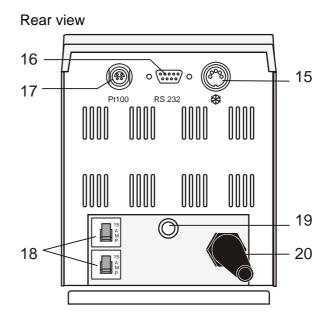
This unit is an ISM device classified in Group 1 (using high frequency for internal purposes) Class A (industrial and commercial range).

Operating instructions

3. Operating controls and functional elements

Front view





1		Mains power switch, illuminated
2	[\psi]	Start / stop key
3	T	Key for selecting the working temperature - Setpoint 1, 2, 3
4		Key for selecting the warning and safety values
5	MENU	MENU button - for selecting the menu functions
6	4	Cursor keys (left or right)
7		Edit keys (increase or decrease)
8		Enter key 1) Store value / parameter 2) Next lower menu level
9	ESC	Escape key 1. Cancel entries 2. Return to a higher menu level

			IVIL
10	S S A C Int E A C Int E A C I D C A C E A C E A C E A C E A C E A C E A C E A C E A C E A C E A C C E A C E A C E A C E A C E C E A C C E C E C C C C C C C C C C	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)	
44		Alternating with the display in line 1	
11	₩ ♣ Δ	Control indicators in the header: Heating / Cooling / Alarm / Remote control	
12	5 4	Control indicators in the header:	
	°C Int °F Ext	Temperature indication in °C (°F not possible on this unit)	
		Display for the adjusted pump pressure stage	
13	₹	Four stages, adjustable via the MENU button, in the menu >PUMP<.	
14	100 40 150 230 230	Adjustable excess temperature protection according to IEC 61010-2-010	
15	*	Socket: control cable of JULABO refrigerated circulator or output for alarm messages	
16	∘ ເວົ່າທີ່ o RS232	Interface RS232: remote control via personal computer	
17	ext Pt100	Socket for external measurement and control sensor or external setpoint programming	
18	15 A M P	Mains circuit breakers (resettable) 15 A	
19		Threaded fitting (10 mm) for stand rod attachment	
20		Mains power cable with plug	

4. Safety notes for the user

4.1. 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.

4.2. Explanation of other notes



Note!

Draws attention to something special.



Important!

Indicates usage tips and other useful information.

4.3. 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.
- Use of your JULABO product in Sous-Vide cooking should only be done by someone trained in proper Sous-Vide cooking techniques and safety. For proper food safety it is important to maintain precise consistent conditions and a hygienic environment. Proper procedures minimize the risk from anaerobic bacteria, Julabo makes no warranty and excludes all claims concerning food products prepared under Sous-Vide techniques.



 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.

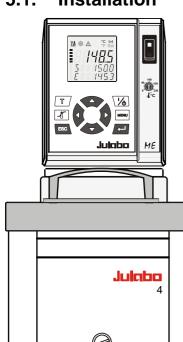


WARNING

This product contains chemicals known to the state of California to cause cancer, birth defects or other reproductive harm.

5. **Preparations**

5.1. Installation



Heating circulators

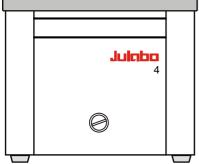
Place the unit on an even surface on a pad made of nonflammable material.

ME-4

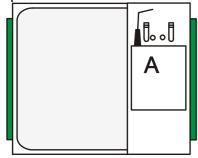
ME-6

ME-12

ME-26



Top view



ME-39

The circulator (A) fitted with a stainless steel bridge is placed on the right side of the bath tank leaving the bath open on the left side.

Accessorie:

Flat stainless steel bath cover:

Order-No. 8970263 Bath tank 39

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:

Bath fluid	Temperature range
soft/decalcified water	5 °C to 80 °C



See website for list of recommended bath fluids.

Contact: see page 6



Caution:

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

Please contact JULABO before using other than recommended bath fluids. 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 50 mm² x s⁻¹ 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!

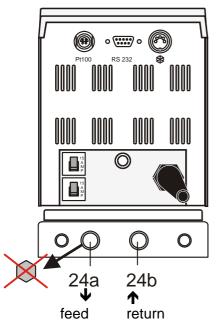
ATTENTION: The maximum permissible viscosity is 50 mm²/s·

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.

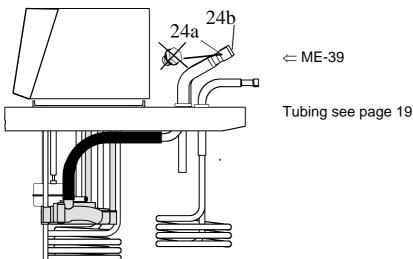


The circulator is used for temperature application to external, closed systems (loop circuit) with simultaneous temperature application in the circulator bath.

Connecting the external system

- Unscrew the collar nuts from the pump connector (24a).
- Slide the tubing onto the pump connectors for feed and return flow (24a, 24b).

Tubing see page 19



5.3.1. **Tubing**

Recommended tubing:

Order No.	Length		Temperature range
8 930 008	1 m	CR [®] tubing 8 mm inner dia.	-20 °C to 120 °C
8 930 010	1 m	CR [®] tubing 10 mm inner dia.	-20 °C to 120 °C
8 930 108	1 m	Viton tubing 8 mm inner dia.	-50 °C to 200 °C
8 930 110	1 m	Viton tubing 10 mm inner dia.	-50 °C to 200 °C
8 930 410	1 m	Insulation for tubing 8 mm or 10 mm inner dia.	-50 °C to 100 °C
8 930 209	0.5 m	Metal tubing, triple insulated,	-100 °C to +350 °C
8 930 210	1.0 m	M16x1 *	
8 930 211	1.5 m		
8 930 214	3.0 m		
8 930 220	0.5 m	Metal tubing, insulated, M16x1 *	-50 °C to +200 °C
8 930 221	1.0 m		
8 930 222	1.5 m		
8 930 223	3.0 m		



*) Adapter for metal tubing M10x1 on M16x1

Order No. 8 970 444



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:

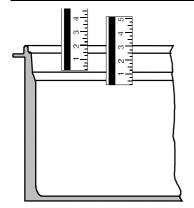
Pay attention to the thermal expansion of bath oil during heating to avoid overflowing of the liquid.

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.

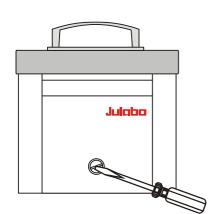
Store and dispose the used bath fluid according to the laws for environmental protection.



Filling

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

- Cooking in the Sous-Vide method
 The recommended minimum filling level with water as bath fluid is 50 mm below the tank rim.
- 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



- (i) 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 (description please refer to page 26) that may be triggered when changing samples in the bath.

Draining

- Turn the unit off with the mains switch.
- Place the heating circulator near the rim of the table. Use a suitable vessel as recipient for the bath fluid.
- Unscrew the drain plug on the front of the bath tank to drain the bath.

Draining ME-39

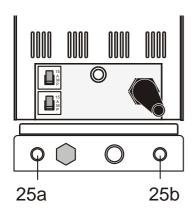
- Turn off the unit and disconnect the mains cable from the power source before moving the unit.
- Press the mains switch to turn the circulator off.
- Remove the circulator from the bath tank.
- Empty the bath tank.

5.5. Countercooling



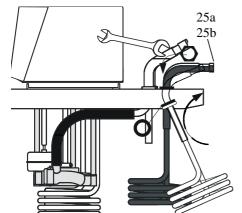
Notice:

Observe the laws and regulations of the water distribution company valid in the location where the unit is operated.



For applications near the ambient temperature, the cooling coil must be connected to the water mains.

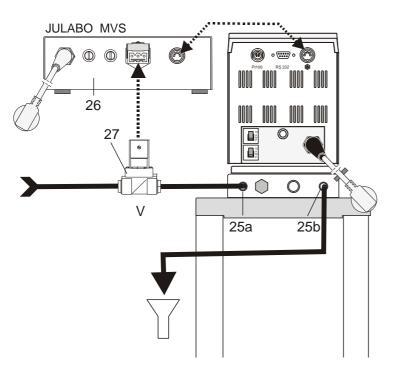
- Using tubing, connect the cooling coil (25a) to the tap water supply, and lead the tap water in a sink through the return connector (25b).
- (i) A specific water flow rate of 100 ml/minute is sufficient to compensate for the characteristic temperature.
- For applications near ambient temperature (20 °C), the cooling water temperature should at least be 5 °C below the working temperature.



Mounting the cooling coil:

Fix the cooling coil to the bridge.

Order no. 8 970 180

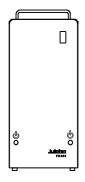


- (i) By installing the MVS controller (26) and a solenoid valve (27), sudden temperature increases can be rapidly reversed by tap water flowing through the built-in cooling coil.
- (i) For applications requiring constant near-ambient temperature, tap water is thus only used in small amounts.

The circulator provides the necessary control pulse via the connector (15).

Cooling coil connectors (25a, 25b)

Order No. Description
9 790 000 MVS controller
8 980 700 Solenoid valve



FD200 Flow-through cooler Order No. 9 655 825

The FD200 is suitable as cooling device for liquids in closed circuits (loops).

This unit is integrated in the return flow circuit from the external system connected to a circulator, and continuously withdraws heat from the liquid.

Operating procedures 6.

6.1. **Power connection**



Caution:

- Only connect the unit to a power socket with earthing contact (PE protective
- 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.

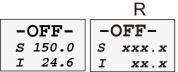
6.2. Switching on / Start - Stop















Switching on:

- Turn on the mains power switch (1).
- i 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.
- (i) The circulator enters the operating mode activated before switching the circulator off:

keypad control mode (manual operation)

remote control mode (operation via personal computer).

Start: Press the start/stop key

The actual bath temperature is displayed on the VFD COMFORT-DISPLAY. The circulating pump starts with a slight delay.

Stop: Press the start/stop key

The VFD COMFORT-DISPLAY indicates the message "OFF".

6.3. AUTOSTART ON / OFF

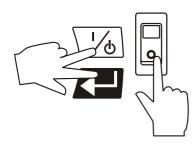


Warning:

For supervised or unsupervised operation with the AUTOSTART function, avoid any hazardous situation to persons or property.

The circulator does no longer conform to N.A.M.U.R. recommendations.

Take care you fully observe the safety and warning functions of the circulator.



● Keep depressed enter ■ and the start/stop key

2 and turn on the circulator with the mains power switch.

For a short while the VFD COMFORT-DISPLAY indicates the effective start mode:

88888 AUTOST ON

AUTOSTART on

88888 AUTOST OFF

AUTOSTART off

Note:

The circulator has been configured and supplied by JULABO according to N.A.M.U.R. recommendations. This means for the start mode, that the unit must enter a safe operating state after a power failure (non-automatic start mode). This safe operating state is indicated by **OFF**, resp. **R OFF** on the VFD COMFORT-DISPLAY. A complete shutdown of the main functional elements such as heater and circulating pump is effected simultaneously.

The values set on the circulator remain stored, and the unit is returned to operation by pressing the start/stop key (in manual control mode). In remote control mode, the values need to be resent by the PC via the interface.

Should such a safety standard not be required, the AUTOSTART function (automatic start mode) may be activated, thus allowing the start of the instrument directly by pressing the mains power switch or using a timer.

7. T Setting the temperatures



Factory settings:

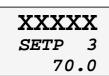
SETP 1 25 °C SETP 2 37 °C SETP 3 70 °C Press the key to call up the menu for temperature selection.

3 different working temperatures are adjustable. Their values are freely

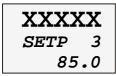
This setting may be carried out with the circulator being in the Start or Stop condition!

Example: Setting working temperature "SETPoint 3"

selectable within the operating temperature range.



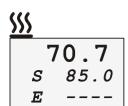
Press the key until the desired menu window is indicated on the VFD COMFORT-DISPLAY Example: SETP 3 / 70.0 °C (last digit blinks)



2. Change the value to 85 °C.

Use the cursor keys to move left or right on the display until the numeral you wish to change blinks.

Use the increase/decrease arrows to change the selected numeral (-, 0, 1, 2, 3, ... 9). see example left: SETP 3 / 85.0.



3. Press enter to store the value.

in the >Start< condition this value is immediately used for controlling the working temperature.

The indication on the VFD COMFORT-DISPLAY is updated.

The heater control indicator blinks.

Notice: See SETMAX and SETMIN in chapter 9.5. MENU LIMITS



Example: Selecting the working temperature

SETP 1 SETP 2 SETP 3 1. Press the \(\bullet \) key until the desired menu item is indicated on the VFD COMFORT-DISPLAY.

2. Press enter .

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

8. Safety installations, warning functions



> SAFETMP

OVERTMP

SUBTMP

➤ LIMITSR

Settings for the excess temperature protection > SAFETMP< according to IEC 61010-2-010 and for the high > OVERTMP< and low> SUBTMP< temperature warning functions are made in a menu that is called up with the key.

Menu item > LIMITSR <: "Warning" or "Alarm"

For the two menu items > OVERTMP< and >SUBTMP< choose between a warning message being signalled or a complete shutdown of the main functional elements such as heater and circulating pump being effected.

Important: Check the safety installations from time to time. See page 16

8.1. Excess temperature protection



XXX.X SAFETMP 80

XXXXX ALARM CODE 14



This safety installation is independent of the control circuit. When the temperature of the bath fluid has reached the safety temperature, a complete shutdown of the heater and pump is effected.

The alarm is indicated by optical and audible signals (continuous tone) and on the VFD COMFORT-DISPLAY appears the error message "ALARM-CODE 14".

Setting range: 20 °C ... 320 °C

- 1. Press the button until the menu item > SAFETMP < is displayed.
- Set the new cut-out value using a screwdriver via the VFD COMFORT-DISPLAY (Example: 100 °C)
- **3.** Press to update the display immediately, or the unit automatically returns to the effective display after about 30 seconds.

Recommendation:

Set the excess temperature protection at 5 to 10 °C above the working temperature setpoint.



Warning:



The excess temperature protection >SafeTemp< should be set at least 25 °C below the fire point of the bath fluid used.

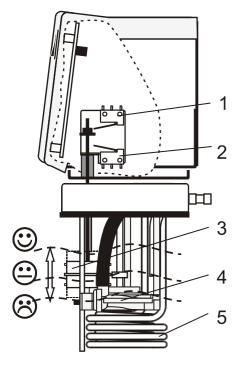
In the event of wrong setting there is a fire hazard!

We disclaim all liability for damage caused by wrong settings!

8.1.1. Early warning system, low level protection



(patented)



This low level protection is independent of the control circuit and is divided in two sections.

1. Switch in stage 1 recognizes a critical fluid level . An audible warning (interval tone) sounds and a message appears on the VFD COMFORT-DISPLAY.

XXXXX WARNING CODE 40

Refill bath fluid!

Switch in stage 2 recognizes a low fluid level 😊.

If stage 2 of the low level protection device (according to IEC 61010-2-010) is triggered, a complete shutdown of the heater and circulating pump is effected.

A continuous alarm tone sounds and a message >ALARM< >CODE 01< appears on the VFD COMFORT-DISPLAY.



Turn off the unit with the mains switch, refill bath fluid and turn the unit on again!

- 3. Float
- 4. Circulating pump
- 5. Heater

Important: Check the safety installations from time to time. See page 16



Warning:

When adding bath fluid, always use the same bath fluid type that is already in the bath.

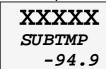
Bath oils must not contain any water and should be pre-heated approximately to the current bath temperature! Explosion hazard at high temperatures!

8.2. Over and Sub temperature warning functions

Over temperature

XXX.X OVERTMP 200.0

Sub temperature

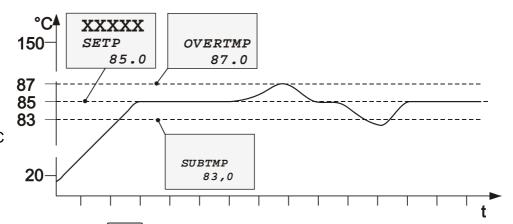


Factory settings:

OVERTEMP 305 °C SUBTEMP -94.9 °C If for a sensitive temperature application task adherence to a working temperature value > SETP < is to be supervised, then set over and sub temperature warning values.

In the example below, the > SETP < of 85 °C is surrounded by the values > OVERTEMP < 87 °C and > SUBTEMP < 83 °C. The electronics immediately registers when the actual temperature attains a temperature out of the limits and it follows a reaction according to what is set in the menu item >LIMITSR<.

(see chapter 8.2.1. Change-over of the warning function to shutdown function)



- 1. Press the button until the menu item > OVERTMP < or >SUBTMP< is displayed.
- 2. Set value:

Use the cursor keys to move left or right on the display until the numeral you wish to change blinks.

Use the increase/decrease arrows to change the selected numeral (-, 0, 1, 2, 3, ... 9).

- **3.** Press enter to store the value.
- The warning functions are only triggered when the actual bath temperature, after start from the "OFF" or "rOFF" mode, lies within the set limits for 3 seconds.

Recommendation::

Set the high temperature warning value > OVERTMP < at 5 °C to 10 °C above the working temperature setpoint.

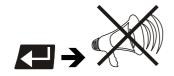
Set the low temperature warning value > SUBTMP < at 5 °C to 10 °C below the working temperature setpoint.

8.2.1. Change-over of the warning function to shutdown function

XXX.X LIMITSR WARNING

XXX.X LIMITSR ALARM

Factory setting: >WARNING<



For the two menu items > OVERTMP< and >SUBTMP< choose between a warning message being signalled or a complete shutdown of the main functional elements such as heater and circulating pump being effected (see page 27).

 Setting >WARNING
 An audible warning (interval tone) sounds and a meassage appears on the VFD COMFORT-DISPLAY.

XXXXX WARNING CODE 03

01

XXXXX WARNING CODE 04

SUBTMP

Setting >ALARM

OVERTMP

A complete shutdown of heater and circulating pump is effected. An audible alarm (**continuous tone**) sounds and a message appears on the VFD COMFORT-DISPLAY.



oer



OVERTMP

SUBTMP

- 1. Press the button until the menu item >LIMITSR< is displayed.
- 2. Select the parameter with the keys (>WARNING< or >ALARM<)
- **3.** Press enter to store the selected parameter.

9. Menu functions

MENU	The term "menu functions" refers to adjustments such as	
> PUMP	electronically adjustable pump capacity	page 30
> CONTROL	PID Cascade Control, control parameters CONTROL - internal or external control DYNAMIC - internal Control parameters - XP, TN, TV internal Control parameters - XP, TN, TV, XPU external	page 32
> CONFIG	Configurationen of the unit SET (Setpoint) – keypad control or remote control OFF MODE – Motor on / off RESET – Factory settings TIME / DATE – Setting time and date	page 37
> SERIAL	Adjustable interface parameters BAUDRAT, H-SHAKE, PARITY (Baud rate, Handshake, Parity)	page 40
> LIMITS	Limits to temperature or capacity SET MAX / MIN - Maximum and minimum setpoint HEAT MAX - Adjusted maximum heating COOL MAX - Adjusted maximum cooling INTERN MAX / MIN – Limitation of the working temperature ran BAND HIGH / LOW – Band limit	page 41
> PROGRAM	Integrated programmer	page 43
> ADJUST	ATC - Absolute Temperature Calibration, Sensor calibration, 3-point calibration	page 48

Example: Menu level 1



Continue: Press to quit the menu.

Menu level 1:

Press the button to scroll in menu level 1. If the desired (>) menu item is indicated on the VFD COMFORT-DISPLAY, press enter to change to menu level 2.

• Menu level 2:

Press the MENU button to scroll in the selected menu item, line 3 of the display blinks.

If a value is set or a parameter selected, press enter to confirm.

Each input can be cancelled with the ESC. The cursor then returns to the next higher menu level.

Legend:

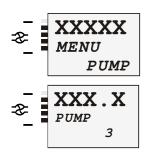


The display remains visible for approx. 30 seconds . Start to set a value within this period,

or press the MENU button to scroll in the menu level

or press ESC to return to the next higher menu level.

9.1. MENU PUMP - Setting the pump pressure



Factory setting: stage 2

The pressure of the circulating pump is adjustable in four stages. After setting, the VFD COMFORT-DISPLAY indicates the corresponding value.

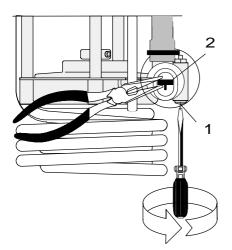
Adjustable pump capacity stage 1 ... 4

Illuminated display: 🍣 for pump pressure

Flow rate: 11 ... 16 l/min Pump pressure: 0.22 ... 0.45 bar

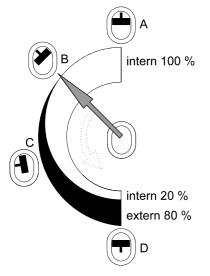
- 1. Press the MENU button until the menu item > MENU / PUMP < is displayed.
- 2. Press enter to indicate the parameter.
- 3. Select the parameter with the keys \(\bigvieval) \(\bigvieval) \((1 \ldots 4) \).
- **4.** Press enter to store the selected parameter.

Continue: Press ESC or (1).



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.



Beispiele:

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

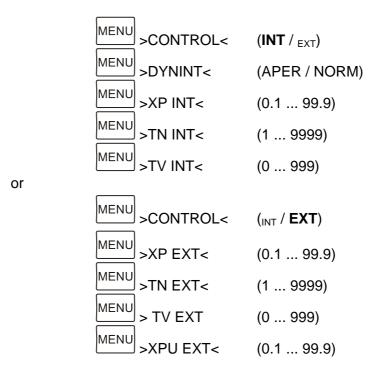
- C 40 % external discharge,60 % internal circulation(for large bath tanks)
- D 80 % external discharge,20 % internal circulation(for small bath tanks)

9.2. MENU CONTROL - Control parameters





CONTROL: Press enter to switch to menu level 2



9.2.1. CONTROL – internal / external control

XXX.X CONTROL INT



Pt100

Factory setting: INT

The circulator is conceived for internal and external temperature control. Switching is carried out in this submenu. Depending on what is set, only the respective set of parameters is indicated.

(i) For external temperature control, connect a Pt100 sensor to the socket on the rear of the circulator.

Possible parameters:

INT internal temperature control

EXT external temperature control with external Pt100 sensor

The control type can only be adjusted in the -OFF- condition

1. Press the MENU button until the submenu >CONTROL< is displayed.

3. Press enter to store the selected parameter.

Continue: Press ESC or



IMPORTANT:

Additional measures for external temperature control.

- (i) Suggested adjustments for external temperature control: BAND HIGH / LOW and INTERN MAX / MIN see chapter > LIMITS < on page 41.
- (i) Sensor calibration of the external Pt100 sensor is carried out in the >MENU / ADJUST<, in the submenu >ATC SEN / EXT< (see page 48).



Notice

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



IMPORTANT: Measures for external control

For external control and temperature measurement an external Pt100 sensor must be connected to the socket (17) on the rear of the circulator.

Order No.	Description	Material	cable
8 981 003	200 x 6 mm dia.,	stainless steel	1.5 m
8 981 005	200 x 6 mm dia.,	glass	1.5 m
8 981 006	20 x 2 mm dia.,	stainless steel	1.5 m
8 981 010	300 x 6 mm dia.,	stainless steel	1.5 m
8 981 013	600 x 6 mm dia.,	stainless steel/Teflon	3 m
8 981 014	1200 x 6 mm dia.,	stainless steel/Teflon	3 m
8981103	Extension cable for	Pt100 sensor	3.5 m
8 981 020	M+R in-line Pt100 se	ensor	

(i) The M+R in-line Pt100 sensor is a flow sensor and can be installed in the loop circuit.



i Use in Sous-Vide cooking:

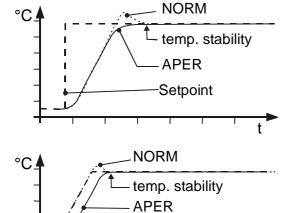
For external temperature measurement an external Pt100 sensor must be connected to the socket (17) on the rear of the circulator.

Order No.	Description	cable
8 981 018	Pt100 core temperature sensor 130 x1. 6 mm dia., stainless steel pointed end	1.5 m
8 970 006	Adhesive tape for Pt100 core temperature sens to seal the puncture on the Sous-Vide plastic ballength: 4 m	

9.2.2. DYN INT - Dynamic internal

XXXXX DYN INT APER

Factory setting: APER (aperiodic)



temperature ramp

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

Possible parameters:

NORM Allows for reaching the setpoint faster, but overshooting of up to 5 % is possible.

APER Target temperature is attained without overshooting.

i) With both adjustments an adequate temperature stability is reached after approximately the same time.

- 1. Press the button until the submenu > DYN INT < is displayed.
- 2. Select the parameter with the keys (NORM / APER)
- 3. Press enter to store the selected parameter.

Continue: Press ESC or

9.2.3. Control parameters – XP, TN, TV internal

The control parameters preset in factory are in most cases adequate for achieving an optimum temperature pattern for the samples requiring temperature application.

Each parameter may be manually set via the keypad if necessary, to allow optimum control performance.



Setting range: 0.1 ... 99.9



Setting range: 1 ...9999



Setting range: 0 ... 999

Proportional range >Xp<

The proportional range is the range below the selected temperature value in which the control circuit reduces the heating power from 100 % to 0 %.

Resetting time >Tn< (Integral component)

Compensation of the remaining control deviation due to proportional regulation. An insufficient resetting time may cause instabilities to occur. Excessive resetting time will unnecessarily prolong compensation of the control difference.

Lead time >Tv< (Differential component)

The differential component reduces the control settling time. An insufficient lead time will prolong the time required to compensate for disturbance effects and cause high overshooting during run-up. An excessive lead time could cause instabilities (oscillations) to occur.

- 1. Press the NENU button until the desired submenu is displayed XP INT, TN INT, TV INT.
- 2. Set value:

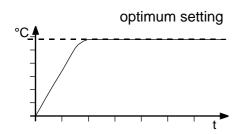
Use the cursor keys to move left or right on the display until the numeral you wish to change blinks.

Use the increase/decrease arrows to change the selected numeral (-, 0, 1, 2, 3, ... 9).

3. Press enter to store the value.

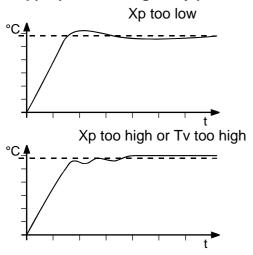
Continue: Press MENU / ESC or O

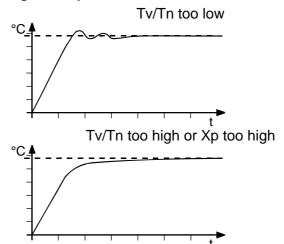
Optimization instructions for the PID control parameters: (internal and external)



The heat-up curve reveals inappropriate control settings.

Inappropriate settings may produce the following heat-up curves:





9.2.4. Control parameters – XPU, XP, TN, TV external

The control parameters preset in factory are in most cases adequate for achieving an optimum temperature pattern for the samples requiring temperature application.

Each parameter may be manually set via the keypad if necessary, to allow optimum control performance.

1. Press the MENU button until the desired submenu is displayed - XP EXT, TN EXT, TV EXT, XPU EXT.

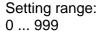
2. Set value:

Use the cursor keys to move left or right on the display until the numeral you wish to change blinks.

Use the increase/decrease arrows to change the selected numeral (-, 0, 1, 2, 3, ... 9).

3. Press enter to store the value.

Continue: Press MENU / ESC or C



TV

XXXXX

Setting range: 0.1 ... 99.9

XXXXX

TN EXT

Setting range: 1 ...9999

XXXXX

EXT 0.7

720

EXT

55

XP



Setting range: 0.1 ... 99.9

Proportional range >Xpu<

The proportional range Xpu of the cascaded controller is only needed for external control.

9.3. MENU CONFIG - configuration





CONFIG: Press enter to switch to menu level 2

MENU >SETP<

(KEY / SERIAL)

Keypad control or remote control

MENU >OFFMODE<

(PMP OFF / PMP ON)

Motor on / off

MENU >RESET<

(NO / YES) Factory settings

MENU >TIME<

(hh: mm) Setting time

MENU >DATE<

(TT/MM.JJ) Setting date

and \

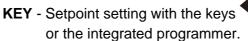
EPROG* Indication only when electronic module is mounted.

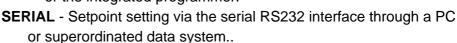
9.3.1. SETPOINT – Keypad control or remote control

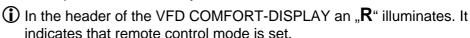
Werkseinstellung: KEY

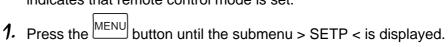


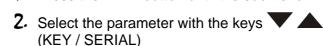
The circulator provides three possibilities for setpoint setting.











3. Press enter to store the selected parameter.







Important:

- (i) Connect the circulator to a PC using an interface cable...
- (i) Check the interface parameters of both interfaces (on circulator and PC) and make sure they match.

 (see chapter 12.1. Setup for remote control page 55)

9.3.2. OFF-MODE – Pump motor on / off



Factory setting: PMP OFF

Normally the circulating pump is switched via the start/stop signal. However, if circulation should be maintained also for the -OFF- condition, the parameter >**PMP ON<** needs to be set.

Possible parameters:

PMP ON Pump motor onPMP OFF Pump motor off

- 1. Press the MENU button until the submenu > OFFMOD < is displayed.
- 2. Select the parameter with the keys (PMP ON / PMP OFF)
- 3. Press enter to store the selected parameter.

 Continue: Press MENU / ESC or O
- in case of an alarm state, a shutdown of the pump motor is still effected.

9.3.3. RESET – Factory settings



Factory setting: NO

Use this to reset all values to factory setting (except date and time). A RESET can only be carried out in the -OFF- condition.

Possible parameters:

NO / YES

- 1. Press the MENU button until the submenu > RESET < is displayed.
- 2. Select the parameter with the keys \(\neg \) (NO / YES).
- **3.** Press enter to store the selected parameter.



(i) As long as the message -RUN- appears all parameters a reset to factory settings.

9.3.4. TIME / DATE – setting time and date



hh mm

XXXXX DATE 10/1203

TT/MM.JJ

The integrated clock allows starting a profile at any date and time. The clock is preset in the factory.

- 1. Press the button until the submenu > TIME < or > DATE < is displayed.
- 2. Setting time / date:

Use the cursor keys to move left or right on the display until the numeral you wish to change blinks.

Use the increase/decrease arrows to change the selected numeral (-, 0, 1, 2, 3, ... 9).

3. Press enter to store the value.

(i) Clock: Only hours and minutes are set.

Settings are checked for plausibility.

MENU SERIAL - BAUDRATE, HANDSHAKE, PARITY 9.4.

XXXXX **MENU** SERIAL

Factory settings: 4800 Bauds even hardware handshake MENU SERIAL: Press enter to switch to menu level 2 >BAUDRAT< MENL >PARITY< MENL >H-SHAKE<

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

Adjustable interface parameters

BAUDRAT 4800

BAUDRATE 4800 bauds 9600 bauds 19200 bauds 38400 bauds

XXXXX **PARITY EVEN**

XXXXX

PARITY no odd

even

XXXXX H-SHAKE HARD

HANDSHAKE

SOFT = software handshake HARD = hardware handshake

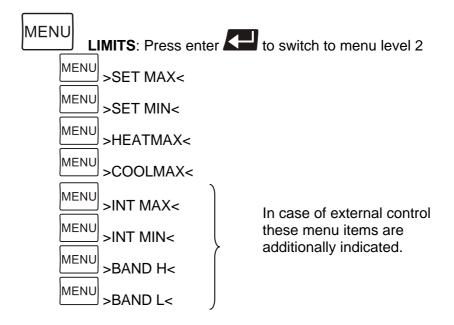
Data bits = 7; Stop bits = 1

- 1. Press the MENU button until the desired menu item is displayed.
- 2. Select the parameter with the keys \(\bigvarpsi
- **3.** Press enter to store the selected parameter.

Continue: Press MENU / ESC

9.5. MENU LIMITS





- 1. Press the MENU button until the desired submenu is displayed
- 2. Set value:

Use the cursor keys to move left or right on the display until the numeral you wish to change blinks.

Use the increase/decrease arrows to change the selected numeral (-, 0, 1, 2, 3, ... 9).

3. Press enter to store the value.

Continue: Press MENU / ESC or Continue:

Factory settings

XXXXX SET MAX 200.0

XXXXX SET MIN -94.9 **SETPOINT MAX / MIN -** Maximum and minimum setpoint Restriction for the adjustable temperature range.

The limitation of the operating temperature range effects the temperature setting under the menu called up with the T key.

It is possible to adjust only working temperatures that lie within the limit range set here.

Existing settings for SETP 1, 2, 3 and also for >OVERTEMP< and >SUBTEMP< (see page 27) are automatically defered within the limit range.

Setting range:: -94.99 °C ... +200.0 °C

Factory settings



XXXXX COOLMAX 0

Factory settings







Factory settings:





Adjusted maximum heating / cooling.

Heating and cooling powers of the circulator are adjustable. 100 % corresponds to the values in the technical specifications of the equipment.

Setting range:

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

INTERNAL MAX / MIN Limit setting

Setting range: -94.9 °C ... +200.0 °C

The limits INT MAX and INT MIN are only valid for external control. INT MAX and INT MIN are used to limit the expected internal bath temperatures to any upper and lower values. The temperature controller cannot exceed these limits even if it would be required for reaching the temperature in the external system. Consequently the external setpoint may thus not be reached.

Sense of a limit setting:

- ✓ Protects the bath fluid from overheating.
- ☑ Prevents an undesired alarm shutdown by the excess temperature protection >ALARM CODE 14<.

 Set >INTMAX:< to a value at least 5 °C below the >SAFETEMP:< value.
 </p>
- Protects the pump motor from high viscosity of the bath fluid at low temperatures.

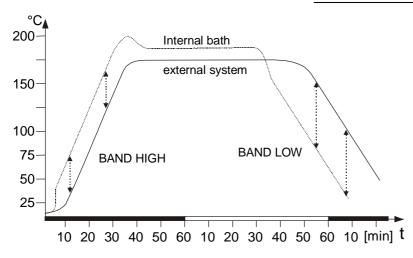
For refrigerated circulators: Freezing protection when using water as bath fluid.

BAND HIGH / LOW - Band limit

For the heat-up and cool-down phases different settings to conform to the requirements of the particular application are possible.

Setting range: 0 ... 200 °C

Using **BAND HIGH** and **BAND LOW**, the difference between the temperatures in the internal bath and the external system can be limited to any maximum value for the heat-up or the cool-down phase. During the heat-up phase the difference value always adds to the actual external temperature. During the cool-down phase, the difference value is subtracted.



Sense of a band limit:

- ☑ Ensures gentle heating for the objects requiring temperature application.
- ☑ Protects glass reactors, for example, from thermal shock.

The **INTMAX**: and **INTMIN**: values are superordinated to this band limit.

9.6. MENU PROGRAM – Integrated programmer

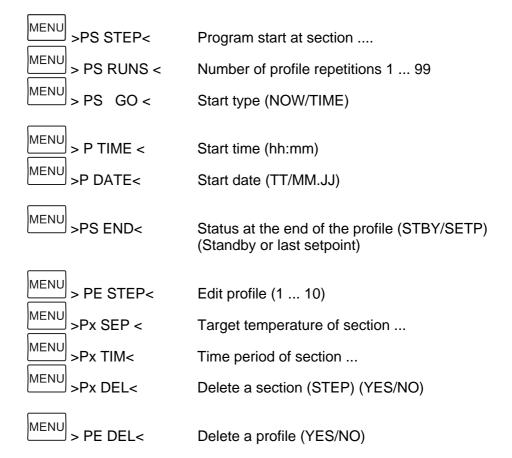
XXXXX MENU PROGRAM

MENU

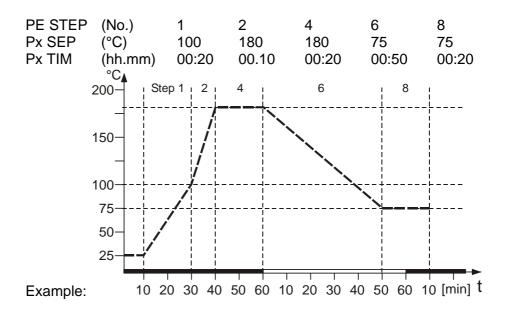
PROGRAM: Press enter to switch to menu level 2

(i) First create a profile. If the start shall be at a certain moment, then also set hour (TIME) and day (DATE).

- 1 Profil
- 10 Sections (STEP)
- 99 Repetitions



The integrated programmer allows any desired temperature program sequences to be realized. Such a temperature sequence is called profile. A profile consists of individual sections defined by duration (t:) and target temperature. Target temperature is the setpoint (T:), that is achieved at the end of a section. The programmer uses time and temperature difference values within a section to calculate a temperature ramp.



- 1. Press the MENU button until the desired submenu is displayed.
- 2. Set value:

Use the cursor keys to move left or right on the display until the numeral you wish to change blinks.

Use the increase/decrease arrows to change the selected numeral (-, 0, 1, 2, 3, ... 9).

or select the parameter with the keys ...

3. Press enter to store the value / parameter

Continue: Press MENU / ESC or Or

9.6.1. Description of the menu-items

Start-MENU

Starting a profile

The programmer can be started with the following 3 menu items.

(i) Condition:

- 1. First create a profile (see page 47)
- 2. Set a starting time (>TIME< >DATE<) if the start shall be effected with the internal clock timer (see page 46)
- 3. Return to the Start menu and confirm the desired settings on each MENU

>PS STEP< (1 ... 10)

Select the section with which the profile should be started. (STEP) Example: STEP 1

Select the number of profile repetitions. Example: RUNS 10 The profile is repeated 10 times.

>PS GO<

The profile can be started immediately with the parameter (NOW 📥), or (▼) at the set time with the parameter (TIME ■). Example page 46: 19 December 2005 14:25 hrs

-OFF-S XX

Indicating during the waiting time until the start:

The advice >TIMER< and the adjusted values for "TIME" und "DATE" are shown alternately in line 3.

TIMER

XXXXX

PS STEP

XXXXX

PS RUNS

XXXXX

PS

10

GO

TIME

The started programmer

The started programmer indicates the actually calculated setpoint S XX.X in line 2. This value increases within the time period >Px TIM< until the target temperature >Px SEP< of the section is reached.

If time in a section is set to "0", the next section starts only as soon as the target temperature is reached.

Use the edit keys to scroll in line 3. The display changes in intervals of approx. 4 seconds between the valid section (STEP X) and

- Remaining time of the valid section
- Remaining total time: Profile x number of repetitions or
- Actual bath temperature

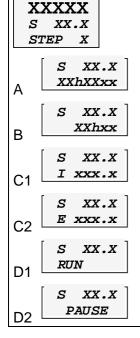
I xxx.x - internal actual value or

E xxx.x - external actual value

RUN – the programmer is started or

<u>ゲ</u>d. Time is stopped PAUSE – the profile was interrupted with the key and the temperature is maintained constant at the last calculated setpoint value.

1/b Continue: Press



-OFF-S xxx.x I xx.x

Interrupting / Termination of a profile

(i) A profile can be terminated by pressing



(i) Power failure with the programmer started:

- The reaction of the circulator is the same as when switched off and on again with the mains switch. The VFD COMFORT-DISPLAY indicates "OFF".
- If the AUTOSTART function is activated, the programmer starts again at a point approx. 20 seconds before the interruption took place. However, an uncontrolled change of the bath temperature happened.

Setting time/date for the start

XXXXX TIME 14h25ss >TIME<

Enter the start time. Example: 14:25 hrs

>DATE<

Enter the start date. Example: 19 December 2005

(i) Check the setting of the internal real time clock (see page 39).

XXXXX DATE 19/1205

Status at the end of the profile

XXXXX PS END SETP >PS END< (STBY / SETP)

Set the status for the end of the profile.

With the parameter **ST**and**BY** the circulator enters the –OFF– state. With the parameter **SETP**oint the circulator maintains the temperature at the value of the last section.

Compiling profiles, indicating sections

Example: Section 2



Press the MENU button until the submenu >PE STEP x< is displayed.

- 1.1 Use the increase/decrease arrows to set the number of the desired section (1, 2, 3, ... 10).
- 1.2 Press to enter menu level 3.

Menu level 3:

Submenu >Px SEP< (SETPOINT) Set a temperature value: Example: 180 °C

- 2.1 Use the cursor keys to move left or right on the display until the numeral you wish to change blinks.
 - 2.2 Use the increase/decrease arrows \checkmark **a** to change the selected numeral (-, 0, 1, 2, 3, ... 9).
 - 2.3 Press enter to store new the value.

XXXXX P2 TIM 00h10

XXXXX P2

DEL

NO

XXXXX P2 SEP

180.0

2.4 Continue: Press

3 Submenu >Px TIM< (TIME) Set a time. Example: 10 minutes.

- 3.1 Use the cursor kevs to move left or right on the display until the numeral you wish to change blinks.
- 3.2 Use the increase/decrease arrows \checkmark **a** to change the selected numeral (-, 0, 1, 2, 3, ... 9).
- 3.3 Press enter to store new the value.

3.4 Continue: Press

Submenu >Px DEL< (DELETE) Standard setting (NO)

Set the parameter to YES to delete the values in this section.

- If necessary, use the arrows \times to set the parameter to YES and press
- to return to submenu >Px SEP< in menu level 3. 5 Or
- Press ESC to return to submenu >PE STEP x< in menu level 2.

XXXXX P1XXX (i) Sections without value or time indication (including the value 0) are skipped. But they can be integrated in the profile at a later time. Example: Section 1

Deleting a profile

XXXXX PF. DELYES

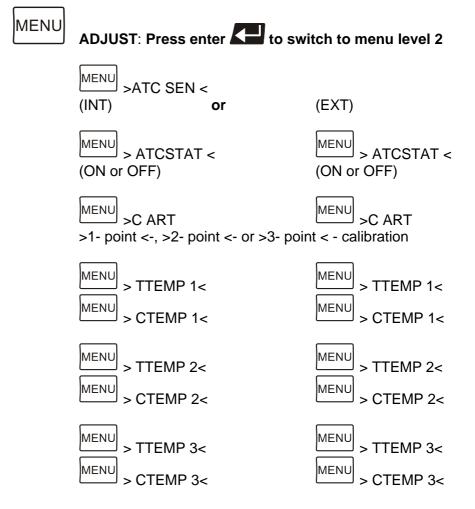
>PE DEL< (YES/NO)

Set the parameter to YES to delete all sections >PE STEP / 1 to 10<.

9.7. MENU ADJUST – ATC Absolute 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.





- 1. Press the MENU button until the desired submenu is displayed.
- 2. Set value /parameter:

Use the cursor keys to move left or right on the display until the numeral you wish to change blinks.

Use the increase/decrease arrows to change the selected numeral (-, 0, 1, 2, 3, ... 9).

select the parameter with the keys \(\bigvee \textstar{\textstar} \textstar{\textstar}.

3. Press enter to store the value / parameter

Continue: Press MENU / ESC or O

ATC SENSOR - INTERNAL / EXTERNAL

XXX.X ACT SEN INT In the first submenu the ATC function is set for the >INT< internal or >EXT< 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".

XXX.X
ACT SEN
EXT

The circulator is able to store both parameter sets. However, only the one set under this menu item is indicated.

ATC STATUS - ON / OFF

XXX.X ATCSTAT OFF In the second submenu the ATC function for the temperature sensor selected above is activated >ON< or deactivated >OFF<.

>OFF< The controller of the circulator uses the original curve of the temperature sensor.

Important: During the calibration process > **OFF** < needs to be set.

XXX.X ATCSTAT ON

>ON< The controller of the circulator uses the new calibration curve.

Important: When the calibration process is finished, set to **>ON<**.

In the ATC STATUS > ON<, the ATC calibration curve always affects the effective working temperature (also the one set via the interface).

Calibration type

XXX.X
C ART
x POINT

CALIBRATION ART: 1, 2, 3-point calibration

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 calibration type also determines the number of pairs of values indicated on the VFD COMFORT-DISPLAY.

XXX.X TTEMP 1 CTEMP 1 x 80.0 x 79.7

2 values per calibration point

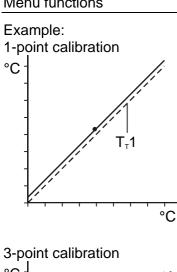
TTEMP X: Temperature on circulator (TT) 1 or 2 or 3 Defined temperature value of the calibration point.

This value is simultaneously stored with > CTEMP < and can be indicated for control purposes.

XXX.X
TTEMP 2 CTEMP 2
X 120.0 X 119.5

CTEMP X: Calibration temperature (actual value CT) 1 or 2 or 3 The "Calibration value" is determined with a temperature measuring device and stored under menu item > CTEMP <.

XXX.X TTEMP 3 X 160.0 X 159.3

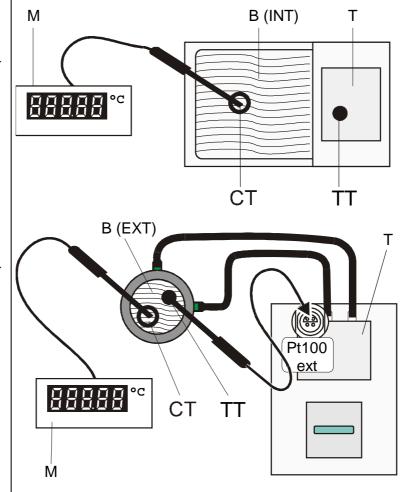


°C °C T_T 1 = Original curve

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.



M = Temperature measuring instrument with temperature sensor

B = Bath tank (INTernal or EXTernal)

T = circulator

CT = Temperature on measuring point

TT = Temperature on circulator

Example:

3-point calibration for internal control.

In the temperature range of 80 °C to 160 °C the calibration curve of the temperature sensor (TT) should be assimilated to the actual temperatures on the measuring point (CT).

XXXXX MENU CONTROL

XXX.X

XXXXX

ADJUST

SETP

MENU

XXX.X CONTROL INT

1

80.0

Set controller to internal control:

- The control type can only be adjusted in the -OFF- condition
- 1. Press the button until the menu item > MENU / CONTROL< is displayed and press enter.
 - 1.1. Under the menu >CONTROL< set the parameter to > INT < and press enter (see page 32).

Continue: Press ESC

2. Press the start/stop key \(\frac{1/6}{\dot}\)

Setting working temperature SETP:

- 3. Press T and set the first temperature value under > SETPoint 1 < for example (example 1st value = 80 °C).
 - 3.1. Wait until this temperature is maintained constant in the bath for about 5 minutes.

XXX.X ACT SEN INT

XXX.X ATCSTAT OFF

XXX.X C ART 3 POINT

XXX.X CTEMP 1 I 79.7

XXX.X TTEMP 1 I 80.0

↑ "I" for internal control

Calibration procedure:

- **4.** Press the button until the menu item > MENU / ADJUST < is displayed and press enter.
 - 4.1. Set menu item >ATC SEN< to >INT<,
 - 4.2. Set menu item >ATCSTAT< to >OFF<,
 - 4.3. Set menu item >C ART< to >3 POINT <.
- These 3 settings are maintained for the length of the 3-point calibration procedure.
- **5.** Read the value of CT on the temperature measuring device and enter the respective value under menu item > CTEMP 1<
 - **5.1.** Set value: (79.7 °C)

Use the cursor keys to move left or right on the display until the numeral you wish to change blinks.

Use the increase/decrease arrows to change the selected numeral (-, 0, 1, 2, 3, ... 9).

5.2. Press enter and the circulator also stores the value of TT as value for >TTMP 1< (80.0 °C) .

The first of the 3 points is now calibrated.

Continue: Press ESC

6. Repeat the calibration procedure for 120 °C and 160 °C. (point **3.** to **5.**).

Important: After the calibration process, set the menu item ATC STATUS to **>ON<**.

Examples:

TT = 80.00 °C

CT = 79.7 °C

TT = 110.00 °C CT = 109.5 °C

TT = 150.00 °C

CT = 149.3 °C

10. Troubleshooting guide / Error messages

XXXXX ALARM CODE 01

Alarm with a complete shutdown of the unit

Whenever the microprocessor electronics registers a failure, a complete shutdown of the heater and circulating pump is performed. The alarm light

"A" illuminates and a continuous signal tone sounds.

The VFD COMFORT-DISPLAY indicates the cause for the alarm in form of a code.



XXXXX WARNING CODE 40 Warning without a complete shutdown of the unit

The VFD COMFORT-DISPLAY indicates the cause for the warning in form of a code and an acoustic signal sounds in regular intervals.

These messages appear every 10 seconds.



Press enter to quit the audible signal.

ALARM CODE 01

- The circulator is operated without bath fluid, or the liquid level is insufficient. Replenish the bath tank with the bath fluid.
- Tube breakage has occured (insufficient filling level due to excessive bath fluid pumped out). Replace the tubing and replenish the bath tank with the bath fluid.
- The float is defect (e. g., because damaged in transit). Repair by authorized JULABO service personnel.

ALARM CODE 02

 During the self-test after switch-on a short-circuit is registered between pin 2 and pin 4 of the control cable or the control cable is interrupted during operation.

Reconnect the cable or eliminate the short-circuit.

WARNING CODE 03

 Excess temperature warning or

Excess temperature alarm

ALARM CODE 03

Warning type: Set to>Warning< or >Alarm< (see page 28)

WARNING CODE 04

 Low temperature warning or

Low temperature alarm.

ALARM CODE 04

Warning type: Set to>Warning< or >Alarm< (see page 28)

ALARM CODE 05

• Cable of the working temperature sensor interrupted or short-circuited.

ALARM CODE 06

Defect of the working or excess temperature sensor.
 Working temperature and excess temperature sensors report a temperature difference of more than 25 °C.

ALARM CODE 07

• Other errors (I²C-BUS errors)

ALARM CODE 12

Error in A/D converter

ALARM CODE 14

- Excess temperature sensors defect.
- The excess temperature value lies below the working temperature setpoint. Set the excess temperature to a higher value.

ALARM CODE 15

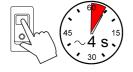
 External control selected, but external Pt100 sensor not connected or defect.

ALARM CODE 33

• Cable of the excess temperature sensor interrupted or short-circuited.

WARNING CODE 40

• The early warning system for low level signals a critical fluid level. Replenish the bath tank with the bath fluid.



After eliminating the malfunction, press the mains power switch off and on again to cancel the alarm state.

If the unit cannot be returned to operation, contact an authorized JULABO service station.

XXXXX CONFIG ERROR Special message "CONFIGURATION ERROR"

The configuration of the circulator does not conform to its present use.

Press enter to automatically perform a single modification of the configuration.

Then contact an authorized JULABO service station.

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

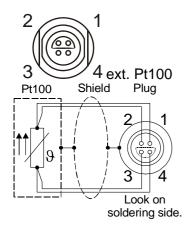
11. Electrical connections



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

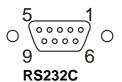
Pin assignment:

<u>Pin</u>	Signal
1	l+
2	U+
3	U-
4	I-

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:

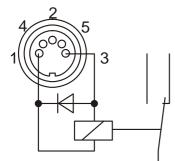
Pin 2	RxD	Receive Data
Pin 3	TxD	Transmit Data
Pin 5	0 V	Signal GND
Pin 6	DTR	Data terminal ready
Pin 7	RTS	Request to send
Pin 8	CTS	Clear to send

Accessories:	Order No.	Description
	8 980 073	RS232 interface cable 9-pol./9-pol., 2,5 m
	8 900 110	USB interface adapter cable



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

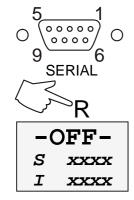


Pin assignment:

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

12. Remote control

12.1. Setup for remote control



- Check the interface parameters for both interfaces (on circulator and PC) and make sure they match. (Serial interface see page 40)
- In the menu > MENU / CONFIG < set the menu item > SETPoint < to > SERIAL < .
 (see 9.3.1.SETPOINT Keypad control or remote control on page 37)
- 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



The **out** commands are valid only in remote control mode.

Command to set the working temperature > SETP 1< to 55.5 °C out_sp_00 ⇔ 55.5 ↓

Command to retrieve the working temperature > SETP 1<

in sp 00↓

Response from the circulator:

55.5↓

12.3. List of commands

out commands: Setting temperature values or parameters.

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

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

Command	Parameter	Response of circulator	
version	none	Number of software version (V X.xx)	
status	none	Status message, error message (see page 58)	
in_pv_00	none	Actual bath temperature.	
in_pv_01	none	Heating power being used (%).	
in_pv_02	none	Temperature value registered by the external Pt100 sensor.	
in_pv_03	none	Temperature value registered by the safety sensor.	
in_pv_04	none	Setpoint temperature of the excess temperature protection	
in_sp_00	none	Working temperature "SETP 1"	
in_sp_01	none	Working temperature "SETP 2"	
in_sp_02	none	Working temperature "SETP 3"	
in_sp_03	none	High temperature warning limit "OVERTEMP"	
in_sp_04	none	Low temperature warning limit "SUBTEMP"	
in_sp_07	none	Pump pressure stage	
in_par_01	none	Te - Time constant of the external bath.	
in_par_02	none	Si - Internal slope	
in_par_03	none	Ti - Time constant of the internal bath.	
in_par_04	none	CoSpeed - Band limit (max. difference between the temperatures in the internal bath and external system).	
in_par_05	none	Factor pk/ph0: Ratio of max. cooling capacity versus max. heating capacity	
in_par_06	none	Xp control parameter of the internal controller.	
in_par_07	none	Tn control parameter of the internal controller.	
in_par_08	none	Tv control parameter of the internal controller.	
in_par_09	none	Xp control parameter of the cascade controller.	
in_par_10	none	Proportional portion of the cascade controller.	
in_par_11	none	Tn control parameter of the cascade controller.	
in_par_12	none	Tv control parameter of the cascade controller.	
in_par_13	none	Adjusted maximum internal temperature of the cascade controller.	
in_par_14	none	Adjusted minimum internal temperature of the cascade controller.	
in_par_15	none	Band limit (upper)	
in_par_16	none	Band limit (lower)	

Remote control

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

12.4. Status messages

Status messages	Description
00 MANUAL STOP	Circulator in "OFF" state.
01 MANUAL START	Circulator in keypad control mode.
02 REMOTE STOP	Circulator in "r OFF" state.
03 REMOTE START	Circulator in remote control mode.

12.5. Error messages

Error messages	Description	
-01 LOW LEVEL ALARM	Low liquid level alarm.	
-02 REFRIGERATOR ALARM	Control cable of the refrigerated circulator or MVS solenoid valve controller short-circuited or interrupted.	
-03 EXCESS TEMPERATURE WARNING	High temperature warning.	
-04 LOW TEMPERATURE WARNING	Low temperature warning.	
-05 WORKING SENSOR ALARM	Working temperature sensor short-circuited or interrupted.	

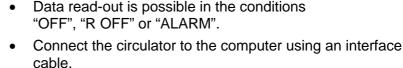
Error messages	Description
-06 SENSOR DIFFERENCE ALARM	Sensor difference alarm. Working temperature and safety sensors report a temperature difference of more than 25 °C.
-07 I ² C-BUS ERROR	Internal error when reading or writing the I ² C bus.
-08 INVALID COMMAND	Invalid command.
-09 COMMAND NOT ALLOWED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

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.



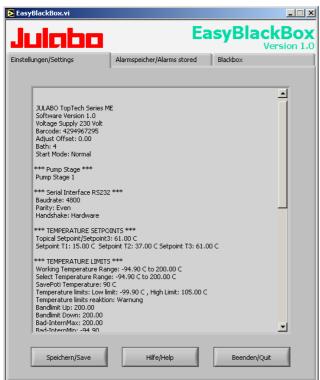
Start the EasyBlackBox program.

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 <u>service@julabo.de</u>, 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.

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.