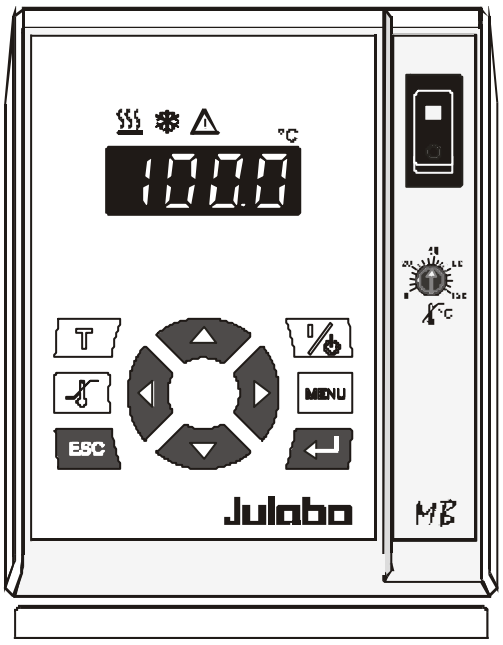
English

Operating manual

Heating Immersion Circulator

MB



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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 principles of operating and possibilities of our circulators. For optimum utilization of all functions, we recommend that you thoroughly study this manual prior to beginning operation.

Quality Management System

The JULABO **Q**uality **M**anagement **S**ystem:
Development, production and distribution of temperature application instruments for research and industries conform to the requirements according to DIN EN ISO 9001:2000.

Certificate Registration No. QA 051004008.

Unpacking and checking

Unpack the circulator and accessories and check for damages incurred during transit. These should be reported to the responsible carrier, railway, or postal authority, and a request for a damage report should be made. 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.

Printed in Germany

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Operating manual

Description

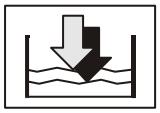
JULABO circulators have been designed for temperature application to specific fluids in a bath tank.

- ☑ The circulators are operated via the splash-proof keypad. The implemented microprocessor technology allows to set and to store different values that can be indicated on the MULTI-DISPLAY (LED). Three menu keys facilitate adjusting setpoints, warning and safety functions and menu functions.

- ☑ The PID temperature control adapts the heat supplied to the thermal requirements of the bath.
- ☑ Absolute Temperature Calibration (ATC3) provides a high temperature stability 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 full temperature range.

- ☑ Electrical connections:
  The serial interface RS232 to allows modern process technology without additional interface.
  Alarm output for external alarm message or control of JULABO refrigerating baths or solenoid valve (cooling water).

- ☑ The excess temperature protection conforming to IEC 61010-2-010 is a safety installation independent from the control circuit. This protection can be indicated and set on the MULTI-DISPLAY (LED).



- ☑ The early warning system for low level signals that bath fluid needs to be refilled before the low level protection conforming to IEC 61010-2-010 causes a complete shut-down of the main functional elements.

- ☑ The circulator conforms to the relevant requirements specified by European guidelines.

JULABO circulators are not conceived for direct temperature application to food and luxury articles or pharmaceutical and medico-technical products. Direct temperature application means: Unprotected contact of the object with the bath medium (bath fluid).

Operator responsibility – Safety recommendations

The products of JULABO Labortechnik GmbH warrant a safe operation if installation, operation and maintenance is carried out according to common safety regulations. This section informs you about potential dangers that may arise from operating the circulator and also mentions the most important safety precautions

Persons:
The operator is responsible for the qualification of the personnel operating the units.
The operator should be constantly informed about the dangers involved with their job activities as well as preventive actions.
Make sure all persons expected to carry out operation, installation and maintenance of the unit read and understand the safety information and operating instructions.
If you have any questions concerning the operation of your unit or the information in this manual, please contact us!

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Handling:
You received a product conceived for industrial use. Nevertheless, avoid strikes to the housing, vibrations, damages to the keypad foil (keys, display) or contamination.
Make sure the product is regularly checked for proper condition. Regularly check (at least every 2 years) the proper condition of the mandatory, warning, prohibition and safety labels.
Take care that the mains supply features a low impedance to avoid any negative affects on the instrument being operated in 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 influence other units with components susceptible to magnetic fields
(e.g. a monitor). We recommend to keep a minimum distance of 1 m.
Permissible ambient temperature: max. 40 °C, min. 5 °C.
Permissible relative air humidity: 50 % (40 °C).
Do not store in an aggressive atmosphere. Protect from contaminations. Do not expose to sunlight.

Operation:
Only qualified personnel is authorized to perform configuration, installation, maintainance and repairs of the circulator.
Routine operation can also be carried out by untrained personnel who should however be instructed by trained personnel. The summarized user guidance (short manual) and the specification table with information on individual parameters are sufficient for this.

Use:
The bath may **not** be filled with flammable materials. Fire hazard!
Only use recommended materials (bath fluids). Only use non-acid materials.

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: Colours: 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.

Disposal:
The circulator contains a so-called back-up battery that supplies voltage to memory chips when the unit is switched off. Do not dispose of the battery in domestic waste!
Depending on battery regulations in your country, you might be obliged to give back used or defect batteries to gathering places.

EC Declaration of Conformity

Heating Immersion Circulator: MB

The products mentioned comply with the requirements outlined by the following European guidelines:

Guideline 73/23/EEC of the Council of 19 February 1973 with respect to legal harmonization of the member countries concerning electric devices for use within certain voltage limits

Guideline 89/336/EEC of the Council of 3 May 1989 with respect to legal harmonization of the member countries concerning electromagnetic compatibility

Guideline 98/37/EC of the European Parliament and the Council of 22 June 1998 for harmonization of legal and administrative regulations of the member countries with respect to machinery

The units conform to the following standards:

EN 1050: 1996-11 EN 292-1: 1991-09 EN 292-2: 1991-09

EN 61010-1: 2001 EN 61010-2-10: 1994-07 EN 60204-1: 1997-12

EN 563: 1994-06 EN 61326: 1997 + A1: 1998 + A2: 2001

Julabo

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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.

Technical specifications

		MB
Working temperature range	°C	20 ... 100
Temperature stability	°C	±0.02
Temperature selection		digital
via keypad		indication on MULTI-DISPLAY (LED)
remote control via personal computer		indication on monitor
Temperature indication		MULTI-DISPLAY (LED)
Resolution	°C	0.1
Absolute **T**emperature **C**alibration	°C	±3
Temperature control		PID
Heater wattage (at 230 V)	kW	2,0
Heater wattage (at 115V)	kW	1.0
Pump capacity		
Flow rate	l/min at 0 bar	10
Pressure max.	bar at 0 liter	0.12
Electrical connections:		
External alarm device 24-0 V DC / max. 25 mA		
Computer interface RS232		
Overall dimensions (WxDxH)	cm	13x15x33
Usable bath depth	cm	from 8 to 16.5
Weight	kg	4.0
Ambient temperature	°C	5 ... 40
Mains power connection	V/ Hz	190 ... 253 / 50-60
or	V/Hz	100 ... 115 / 50-60
Current input at 208 V / 230 V	A	8 / 9

All measurements have been carried out at:
rated voltage and frequency operating temperature: 70 °C
ambient temperature: 20 °C bath fluid: water
Technical changes without prior notification reserved.

Safety installations according to IEC 61010-2-010:

Excess temperature protection	adjustable from 0 °C ... 120 °C
Low liquid level protection	float switch
Classification according to DIN 12876-1	class I

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 (for storage and transportation)
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

Protection class according to IEC 60 529 IP21

Power supply: corresponds to Class I; according to VDE 0106 T1

not for use in explosive atmosphere

Max. mains fluctuations of ±10 % are permissible.

Overvoltage category	II
Pollution degree	2

Standards for interference resistance EN 61326: 1997 + A1: 1998 + A2: 2001

Emitted interferences

The unit adheres to the threshold values for emitted interferences according to table 3.

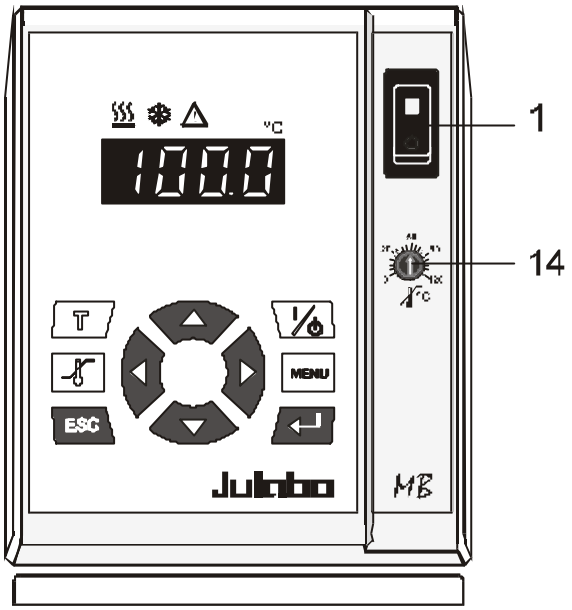
Interference resistance

The unit conforms to the requirements according to table B.1.

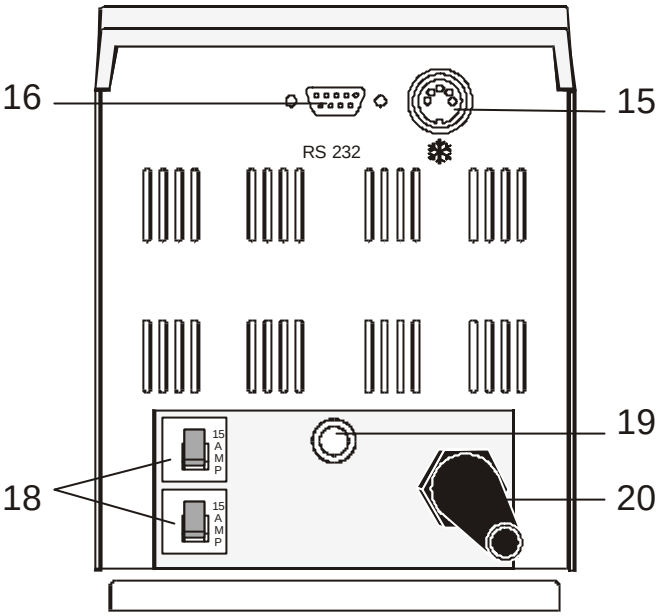
Operating instructions

1. Operating controls and functional elements

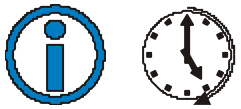
Front view



Rear view



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



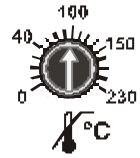
Note:
After about 30 seconds, the display automatically returns to the standard display.

10		MULTI-DISPLAY (LED) temperature indication, menu indication

11  Control indicator –Heating

12  Control indicator – Cooling (without function)

13  Control indicator – Alarm

14 

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

Rear view

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

16 

Interface RS232: remote control via personal computer

18  Mains fuses: Safety cutout 15 A

19 Threaded fitting (10 mm) for stand rod attachment

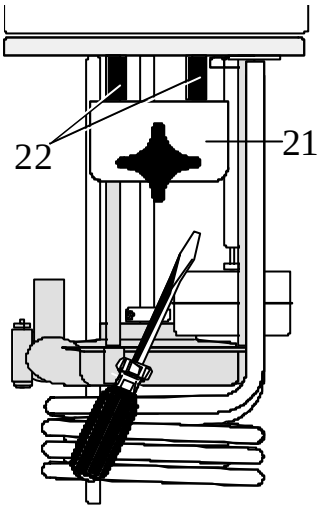
20 Mains power cable with plug

2. Safety notes for the user

	In addition to the safety warnings listed above, warnings are posted throughout the 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 described according to an alarm keyword. Read and follow these important instructions.
	**Warning:** Describes a possibly highly dangerous situation. If this is not avoided, 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 damage can also be contained in the text.
	**Notice:** Describes a possibly harmful situation. If this is not avoided, the product or anything in its surroundings can be damaged.

3. Preparations

3.1. Installation



The heating immersion circulator is mounted using a bath attachment clamp (21) designed for bath wall thicknesses up to 26 mm.

Use the two sleeves (22) supplied with the unit to reduce the immersion depth from 165 mm to 145 mm (see drawing).

For use with glass vessels an upright stand rod (order no. 8 970 020), available as optional accessory, may be screwed in the threaded fitting (19).

3.2. Bath fluids

Caution:

No liability for use of other bath fluids!
Do not use flammable bath fluids!

Recommended bath fluids: deionized water

Notice:

Please contact JULABO before using other than recommended bath fluids.

JULABO takes no responsibility for damages caused by the selection of an unsuitable bath fluid.

Unsuitable bath fluids are liquids which e.g.

- are very highly viscous
  (much higher than 20 mm^2 /s at the respective working temperature)
- have corrosive characteristics or
- tend to cracking.

Caution:

The temperature controlling i.e. of fluids in a reactor constitutes normal circulator practise.

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

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

i.e.: **dangerous**
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.

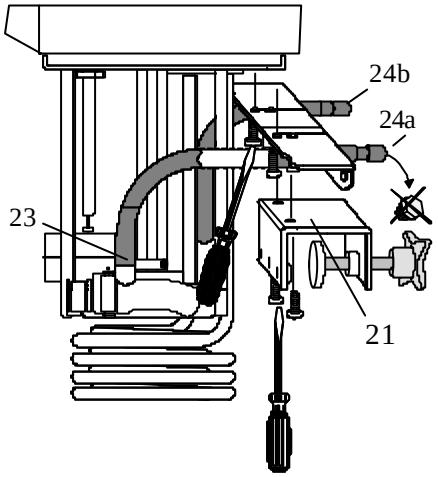
- Are all tubes and electrical cables connected and installed?
  Note:
  sharp edges, hot surfaces in operation, moving machine parts, etc.
- Do dangerous steams or gases arise when heating?
  Is an exhaust needed when working?
- What to do when a dangerous substance was spilled on or in the unit?
  Before starting to work, obtain information concerning the substance and determine the method of decontamination.

3.3. Temperature application to external systems

The circulator is used for temperature application to external, closed systems (loop circuit).

3.3.1. Pump set

	Order No.	Description
Accessories	8 970 140	Pump set



Mounting the pump set:

- Remove the bath attachment clamp (21).
- Screw the pump set to the circulator, and then fix the bath attachment clamp to the pump set.
- Slide the short piece of tubing supplied with the pump set onto the short pump nozzle and the pump connector (23).
- Thus the total immersion depth is reduced to 145 mm.
- Adjusting the pump for external bath circulation see example D on page 18.

Connecting an 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).

Caution: **Securely attach all tubing to prevent slipping.**

3.3.2. Tubing

Recommended tubing:

Order No.	Length			Temperature range
8 930 008	2 m	CR® tubing	8 mm inner dia.	-20 °C to 120 °C
8 930 010	2 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	2 m	Insulation for tubing	8 mm or 10 mm inner dia.	-50 °C to 100 °C

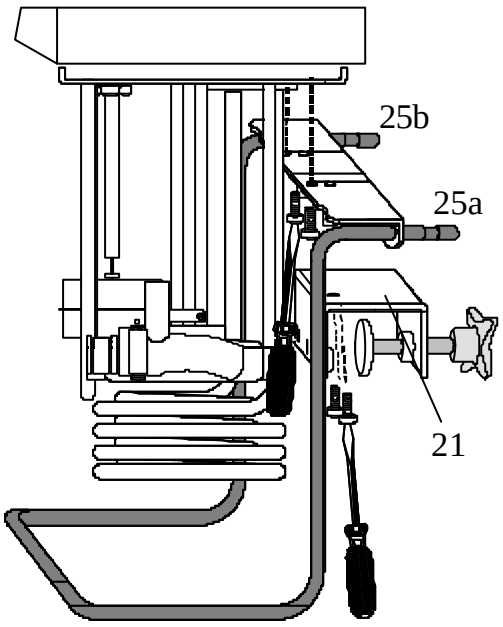
Warning: Tubing:
At high working temperatures the tubing used for temperature application and cooling water supply represents a danger source.
A damaged tubing line may cause hot bath fluid to be pumped out within a short time.
This may result in:

- 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.

3.4. Countercooling



For applications near the ambient temperature, the cooling coil (order no. 8 970 105) must be connected to the water mains.

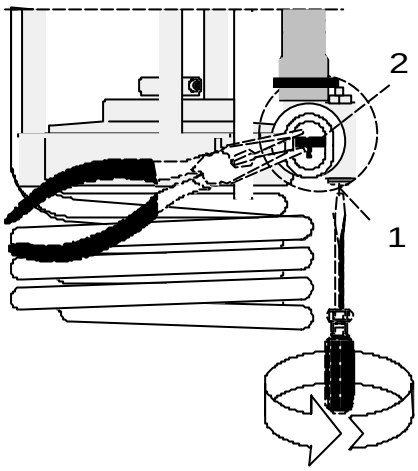
Mounting the cooling coil:

- Remove the bath attachment clamp (21).
- Screw the cooling coil to the circulator, and then fix the bath attachment clamp to the cooling coil.
- Thus the total immersion depth is reduced to 145 mm.

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).
A specific water flow rate of 45 ml/minute is sufficient to compensate for the characteristic temperature.

Caution: **Securely attach all tubing to prevent slipping.**

3.5. Adjusting the pump flow



Adjusting the pump flow

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

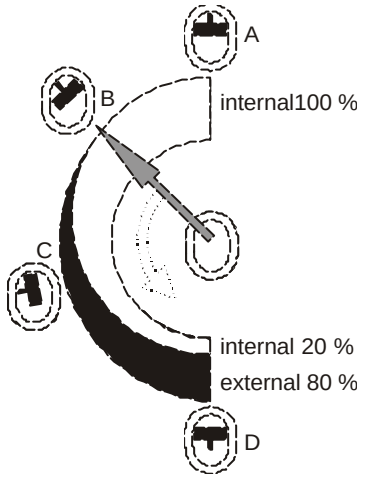
- Using a screwdriver turn the screw (1) anti-clockwise by 360 °.
- Using flat pliers turn the marking of the slide (2) to the desired position.
- Tighten the screw.

Examples:

Internal applications in the bath

A 100 % internal bath circulation
(for large bath tanks)

B Reduced internal bath circulation
(for smooth surface of bath fluid)



External/internal applications

C 40 % external discharge,
60 % internal circulation
(for large bath tanks)

D 80 % external discharge,
20 % internal circulation
(for small bath tanks)

4. Operating procedures

4.1. Power connection

Caution:
Connect the unit only to a grounded mains power socket!
We disclaim all liability for damage caused by incorrect line voltages!

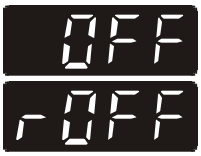
Check to make sure that the line voltage matches the supply voltage specified on the identification plate.
Deviations of ±10 % are permissible.

4.2. Switching on / Start - Stop

Switching on:

- Turn on the mains power switch (1).

ⓘ The unit performs a self-test. All segments of the 4-digit MULTI-DISPLAY (LED) and all indicator lights will illuminate.
Then the software version (example: V1.00) appears. The display „**OFF**“ or „**R OFF**“ indicates the unit is ready to operate.



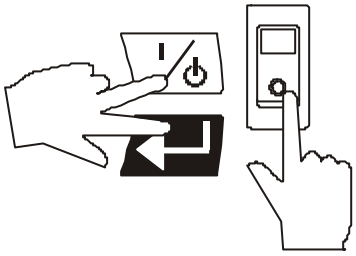
ⓘ The circulator enters the operating mode activated before switching the circulator off:
keypad control mode (manual operation, factory setting)
or
remote control mode (operation via personal computer).

Start:

- Press the start/stop key.  .
The MULTI-DISPLAY (LED) indicates the actual bath temperature. The circulating pump starts with a slight delay.

Stop:

- Press the start/stop key.  .
The MULTI-DISPLAY (LED) indicates the message "OFF".

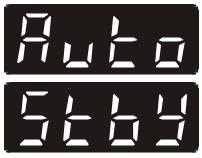


AUTOSTART ON / OFF

❶ Keep depressed enter ↵ and the start/stop key ⏻

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

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



⇨ AUTOSTART on.

⇨ 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“ or „rOFF“, resp. on the MULTI-DISPLAY (LED). A complete shutdown of the main functional elements such as heater and circulation pump is effected simultaneously.

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

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.

5. T Setting the temperatures

The function of the T key is configurable.

1. If the key is pressed, normally only one adjustable working temperature is displayed (factory setting).
2. Press the MENU button to call up the menu  , then assign a menu with 3 pre-adjustable setpoints to the T key. (see page 32)

5.1. 1-setpoint mode

Example: Actual value

Setpoint ↓

Actual value ↓

1. Press the T key. The setpoint value instead of the actual value is indicated on the display. The value can now be changed.
2. **Change the value**: (Example: 30.0 °C to 65.0 °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).
3. Press enter ↵ to store the value.

ⓘ Setting can be carried out in the start/stop condition.

5.2. 3-setpoint mode

Factory settings:

 25 °C

 37 °C

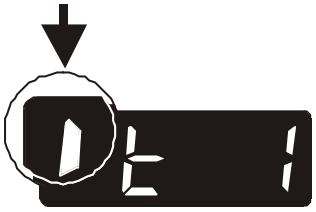
 70 °C

Press the T key to call up the menu for temperature selection.

3 different working temperatures are adjustable. Their values are freely selectable within the operating temperature range.

ⓘ Setting can be carried out in the start/stop condition.

Identifier of a menu window



Example: Setting working temperature "t 3":

1. Press the T key until the desired menu window is indicated on the MULTI-DISPLAY (LED).
   Example: t 3
2. Press enter ↵ to indicate the adjusted value for t 3 on the MULTI-DISPLAY (LED).
   Example: 70.0 °C (last digit blinks)
3. **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.

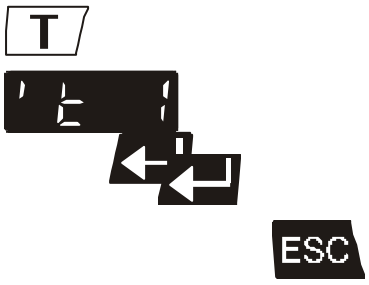
   Use the increase/decrease arrows ▼ ▲ to change the selected numeral (-, 0, 1, 2, 3, ... 9).
   Example: 85.0.

Example: Indication of effective actual value

4. Press enter ↵ to store the selected value.
   Press ESC to update the display immediately.

ⓘ In the >Start< condition, the circulator immediately uses this value for control of the working temperature.

☞ **Notice:** see chapter 6.3. Limitation of the operating temperature range



Example: Selecting the working temperature

- Press the T key until the desired menu window is indicated on the MULTI-DISPLAY (LED).
- Press enter ↵ twice.
  The circulator uses the new working temperature value for temperature control.

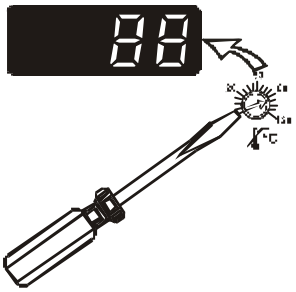
6. Safety installations, warning functions

Settings for the excess temperature protection according to IEC 61010-2-010 and for the high and low temperature warning functions are made

in a menu that is called up with the key .

6.1. Excess temperature protection

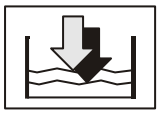
This safety installation is independent of the control circuit. When the temperature of the bath fluid has reached the safety temperature, a complete shutdown of the heater and pump is effected.
The alarm is indicated by optical and audible signals (continuous tone) and on the MULTI-DISPLAY (LED) appears the error message "**E**rror **14**".



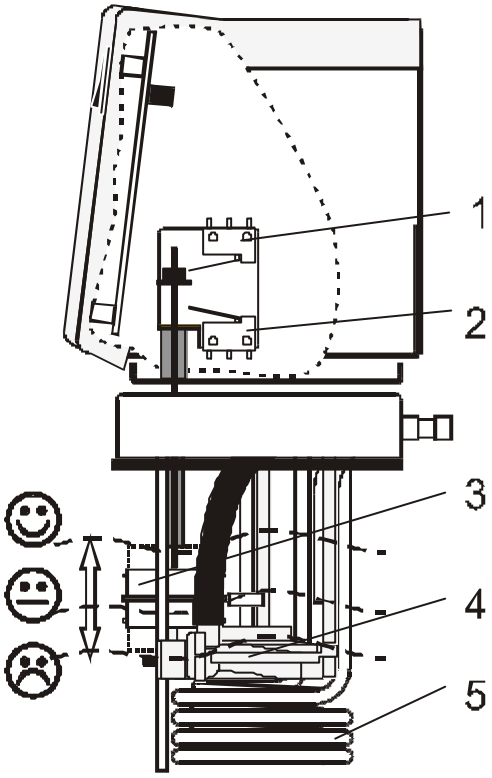
1. Press the key and call up the menu tSA.
2. Press enter .
   The adjusted cut-out value is indicated on the MULTI-DISPLAY (LED).
3. Set the new cut-out value using a screwdriver via the MULTI-DISPLAY (LED). (Example: 88 °C)
4. Press ESC to update the display immediately.

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

6.1.1. 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 defined fluid level 😐.
   An audible warning (interval tone) sounds and on the MULTI-DISPLAY (LED) the message "**E 40**" appears.
   Refill bath fluid!

2. 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 >CODE 01< appears on the MULTI-DISPLAY (LED).

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 38)

Warning:
For refill always use the same bath fluid type that is already in the bath.

6.2. High and low temperature warning functions

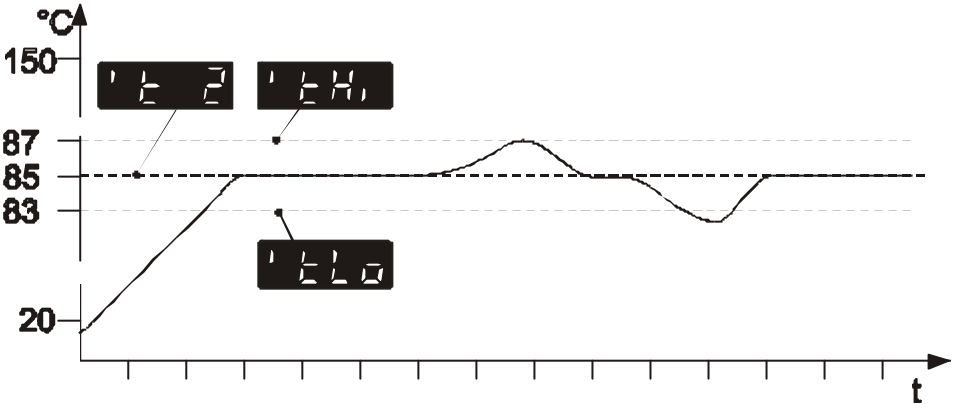
Factory settings:

High temperature limit
t High 205 °C

Low temperature limit
t Low -55 °C

If for a sensitive temperature application task adherence to a working temperature value (setpoint) is to be supervised, then set high and low temperature warning values.
In the example below, the >Setpoint< of 85 °C is surrounded by the values > t High < 87 °C and > t Low < 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 > Li < (Warning or Alarm).

(see chapter 6.4. Change-over of the warning function to shutdown function).



1. Press the key  until the menu item  or  is displayed.
2. Press enter ↵ to indicate the adjusted value on the MULTI-DISPLAY (LED) (digit blinks).
3. 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).
4. Press enter ↵ to store the selected value.
   Press ESC to update the display immediately

ⓘ 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 >t High< 5 °C to10 °C above the working temperature setpoint

Set the low temperature warning value >t Low< 5 °C to 10 °C below the working temperature setpoint

6.3. Limitation of the operating temperature range

Factory settings:

t Hig**hS**etpoint: 200 °C

t Low**S**etpoint: -50 °C

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 Setpoint 1, 2, 3 and also for > t High < and > t Low < (see page 25) are automatically defered within the limit range.

1. Press the key  until the menu item  or  is displayed.
2. Press enter ↵ to indicate the adjusted value on the MULTI-DISPLAY (LED) (digit blinks).
3. 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).
4. Press enter ↵ to store the selected value.
   Press ESC to update the display immediately.

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

Factory setting: Li 0

 t High
High temperature limit

 t Low
Low temperature limit

For the two menu items > t High < and > t Low < 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 25)

- Setting >Li / 0<
  An audible warning (**interval tone**) sounds and a meassage appears on the MULTI-DISPLAY (LED).
  t High t Low
   or 
- Setting >Li / 1<
  A complete shutdown of heater and circulating pump is effected.
  An audible alarm (**continuous tone**) sounds and a message appears on the MULTI-DISPLAY (LED).
  t High t Low
   or  .

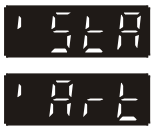
1. Press the key  until the menu item  is displayed.
2. Press enter ↵ to indicate the adjusted parameter on the MULTI-DISPLAY (LED) (digit blinks).
3. Select the parameter with the keys ▼ ▲ (0 / 1).
4. Press enter ↵ to store the selected parameter.
   Press ESC to update the display immediately.

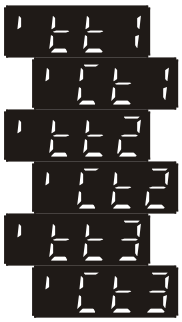
7. MENU Menu functions

MENU

The term „menu functions“ refers to adjustments such as

➢  ATC





- ATC - Absolute Temperature Calibration

  ATC status

  Type (Art): >1. point<, >2. point < or >3. point < calibration

  2 values per calibration point
  ttx = Defined temperature value of the calibration point. This value is automatically stored with >Ctx< and can be indicated for control purposes.

  Ctx = The „Calibration value“ is determined with a temperature measuring device and stored under menu item > Ctx <.

➢ 

➢  Remote

➢  Baudrate

➢  Handshake

➢  Parity

- Change-over the T key mode.
- Online communication, with adjustable interface parameters

➢  XP

➢  Tn

➢  Tv

- PID temperature control, control parameters

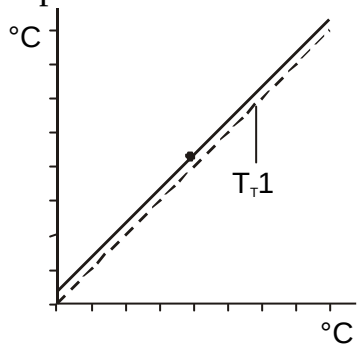
➢  Reset

- Factory setting

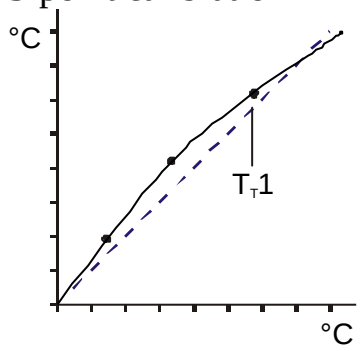
7.1. ATC Absolute Temperature Calibration, 3-point calibration

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.

Examples:
1-point calibration

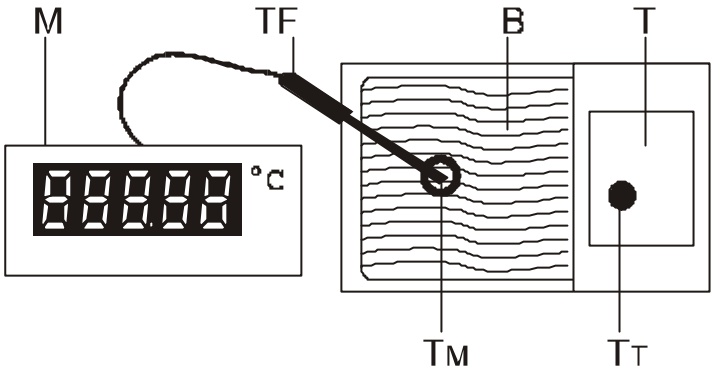


3-point calibration



T_T 1 = Original curve

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



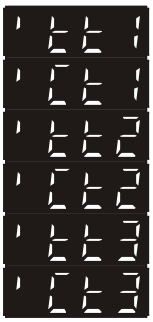
M = Temperature measuring instrument with temperature sensor (TF)
B = Bath tank with T = circulator
T_M = Temperature on measuring point
T_T = Temperature on circulator

1. 

The menu ATC - Absolute Temperature Calibration is structured in 2 levels.

2. 

ATC status
Calibration type: 1-, 2-, 3-point calibration



2 values per calibration point
ttx = Temperature indication on circulator
Indicates the value of the calibration point entered last.
Ctx = Calibration temperature x
Input of the new value for the calibration curve.

Example: 3-point calibration

Examples:
T_T = 40.0 °C
T_M = 39.7 °C

T_T = 75.0 °C
T_M = 74.5 °C

T_T = 90.0 °C
T_M = 89.3 °C

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

1. **Calibration procedure:**
   Press T and set the first temperature value under e g.  for example (example 1st value = 40 °C).

2. Wait until this temperature is maintained constant in the bath for about 5 minutes.

3. **Call up the >ATC< menu:**
   Press the MENU button until the menu item  is displayed and press enter ↵ to switch to menu level 2.

4. **Adjusting menu item >ATC Status<:**  .
   Press enter ↵ and indicate the parameter.
   Select the parameter with the keys ▼ ▲ (no / YES).
   Press enter ↵ to store the selected parameter.

ATC status

Factory setting: YES

>**no**<	During the calibration process >**no**< needs to be set. Continue: Press the MENU button to call up the menu item >Art<.
>**YES**<	The controller of the circulator uses the new calibration curve. Set this parameter after the calibration process. Continue: Press ESC to quit the menu.

5. **Determine the calibration type:**
   (1-point, 2-point or 3-point calibration.)
   Press the MENU button until the menu item  is displayed and press enter ↵ to indicate the parameter.
   Select the parameter with the keys ▼ ▲ (1, 2, 3).
   Press enter ↵ to store the selected parameter.

Example

ⓘ Depending on which calibration type is selected (1-point, 2-point or 3-point calibration) only the necessary menu items are indicated.

For 1-point calibration: >tt1< and >Ct1<

For 2-point calibration: >tt1< and >Ct1<
>tt2< and >Ct2<

For 3-point calibration: >tt1< and >Ct1<
>tt2< and >Ct2<
>tt3< and >Ct3<

6. **Setting and storing the value:**

From example on page 30 for T_M = Ctx


= 39.7 °C


= 74.5 °C


= 89.3 °C

Press the MENU button until the menu item  is displayed and press enter ↵ to open the input window.
Read the value of T_M on the temperature measuring device and enter the respective 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).

Press enter ↵ and the circulator also stores the value of T_T as value for  (40.00 °C).
The first of the 3 points is now calibrated.

ⓘ The values for >ttx< can only be displayed, but they cannot be modified.

7. Repeat the calibration procedure for 75 °C and 90 °C.
Store the values under  or  resp.

Notice:

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

7.2. Change-over of the T key mode

Factory setting: no

Normally, the T key is used to indicate only one adjustable working temperature.

Press the T key, to call up a menu with 3 pre-adjustable setpoints.

1. Press the MENU button until the menu item  is displayed.

2. Press enter ↵ to indicate the parameter.

3. Select the parameter with the keys ▼ ▲ (YES/no).
4. Press enter ↵ to store the selected parameter.

>no< Key T in 1-setpoint mode

>YES< Key T in 3-setpoint mode

Continue: Press ESC to quit the menu.

7.3. Remote control: activate – deactivate

Factory setting: no

The circulator is to be prepared for remote control by a personal computer via the serial interface RS232: Set the menu item >**r**emote< from >no< to >YES<.

1. Press the MENU button until the menu item  is displayed.
2. Press enter ↵ to indicate the parameter.

3. Select the parameter with the keys ▼ ▲ (YES/no).

4. Press enter ↵ to store the selected parameter.

>no< No remote control via RS232

>YES<

Continue: Press ESC to quit the menu.

The display changes from

keypad control mode (manual operation) to

remote control mode (operation via personal computer).

7.4. Interface - Baud rate, Handshake, Parity

Factory settings:
4.8 kBauds
2 = even
Hardware handshake

To allow communication of the circulator with a PC or a superordinated process control system take care the interface parameters of both units match.

Adjustable interface parameters

Baud rate
4.8 = 4800 bauds
9.6 = 9600 bauds
19.2 = 19200 bauds
38.4 = 38400 bauds

Example: 4.8 kbauds

Parity
0 = no Parity
1 = odd
2 = even

Example: 2 = even

Handshake

0 = Xon/Xoff protocol software handshake
1 = Protocol RTS/CTS hardware handshake

Data bits = 7; Stop bits = 1

1. Press the MENU button until the desired menu item is displayed.
2. Press enter ↵ to indicate the parameter.
3. Select the parameter with the keys ▼ ▲.
4. Press enter ↵ to store the selected parameter.

7.5. Control parameters – Xp, Tv, Tn

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

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 %.

Setting range::
1 ... 9999

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.

Setting range:
0 ... 99

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.

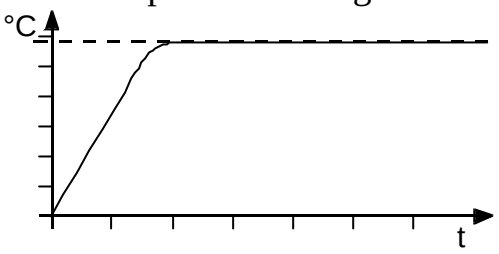
1. Press the MENU button until the desired menu item is displayed.
2. Press enter ↵ to indicate the parameter.
3. Set value:

   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).
4. Press enter ↵ to store the selected value.

Optimization instructions for the PID control parameters:

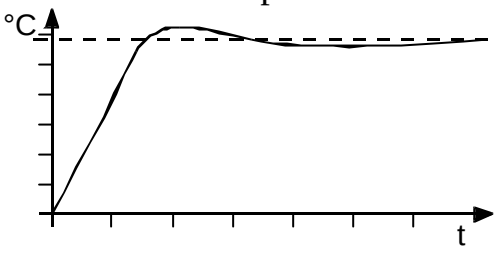
optimum setting



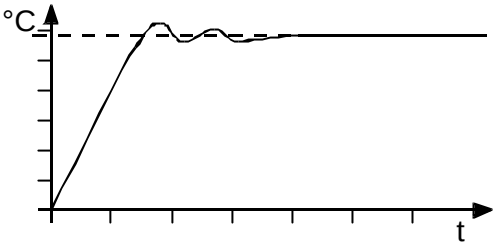
The heat-up curve reveals inappropriate control settings.

Inappropriate settings may produce the following heat-up curves:

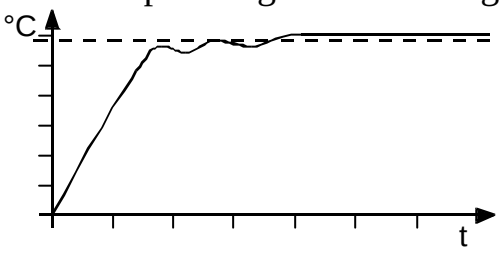
Xp too low



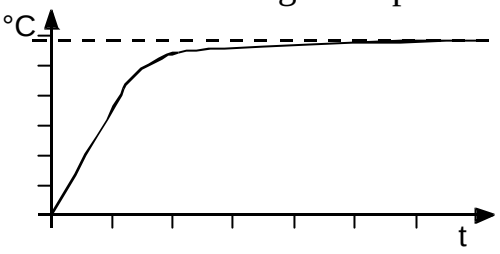
Tv/Tn too low



Xp too high or Tv too high



Tv/Tn too high or Xp too high



7.6. Reset

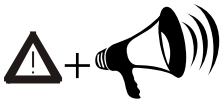
Use this to reset all values to factory setting.

Factory setting: no

1. Press the MENU button until the menu item 

is displayed.
2. Press enter ↵ to indicate the parameter (no).
3. Press the keys ▼ ▲ to select the parameter (YES).
4. Press enter ↵ to confirm the reset.
   After the reset is carried out, the parameter is automatically set to >no<.

8. Troubleshooting guide / Error messages



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 „⚠“ illuminates and a continuous signal tone sounds. The MULTI-DISPLAY (LED) indicates the cause for the alarm in form of a code.

Warning without a complete shutdown of the unit

The MULTI-DISPLAY (LED) 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.

- 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.

- 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.

- Excess temperature warning or
  Excess temperature alarm with a complete shutdown of the main functional elements being effected.
  Warn type: >Li 0 = Warning< or > Li 1 = Alarm<

- Low temperature warning or
  Low temperature alarm with a complete shutdown of the main functional elements being effected.
  Warn type: >Li 0 = Warning< or > Li 1 = Alarm<

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

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

- Other errors (I^2C-BUS errors)

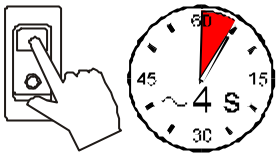
- Error in A/D converter

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

ⓘ Error messages 20 to 25 only appear in combination with refrigerating machines!	
	• Cooling of the condenser is affected. Clean air-cooled condenser. Check the flow rate and cooling water temperature on water-cooled condenser.
	• Compressor stage 1 does not work. After a short cooling interval, the compressor motor will be automatically reconnected and the message "CODE 21" no longer appears.
	• Compressor stage 2 does not work. • <u>Cooling compressor overload protection</u> The motor of the cooling compressor is equipped with an overload protector, which will be activated by excessive temperature in the capsule or by excessive current consumption. • Causes for motor disconnection: - poor air circulation - small distance to walls - dirt accumulated on condenser - high ambient temperature - switch-off and on for short intervals
	• Excess temperature in stage 1 of the compressor.
	• Excess temperature in stage 2 of the compressor.
	• Short-circuit in the control cable for the refrigerating machine during self-test.

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

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



A 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.

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.

Pump motor overload protection:
The pump motor is protected against overloading. After a short cooling interval, the motor will automatically start running.

Mains fuses

The mains fuses on the rear of the unit are safety cutouts – 15A.

9. Safety recommendations

Follow the safety recommendations to prevent damage to persons or property. Further, the valid safety instructions for working places must be followed.

- Connect the unit only to a grounded mains power socket!
- Operation is permitted with **non-flammable** liquids only.
- Place the instrument on an even surface on a pad made of **non-inflammable** 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.
- Observe the fire point of the bath medium used.
  The excess temperature protection should be set at least 25 °C below the fire point.
- 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 penetrating into the hot bath oil.
- Exercise caution when emptying hot bath fluids!
  Check the temperature of the bath fluid prior to draining (by switching the unit on for a short moment for example).
- Observe the limited working temperature range when using plastic bath tanks.
- Employ suitable connecting tubing.
  Make sure that the tubes are securely attached.
- Never operate damaged or leaking equipment.
- 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 empty the bath before moving the unit.
- Never operate equipment with damaged mains power cables.

- Some parts of the bath cover and the pump connections may become extremely warm during continuous operation. Therefore, exercise particular caution when touching these parts.

Notice:

Check the safety installations at least twice a year!

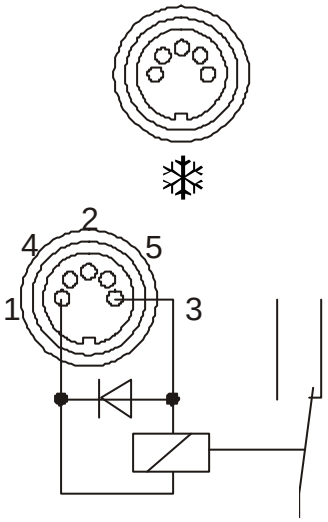
- Excess temperature protection according to IEC 61010-2-010
  With a screwdriver turn back the adjustable excess temperature protection until the shut-down point (actual temperature).
- Low level protection according to IEC 61010-2-010
  To check the function of the float, it can be manually lowered with a screwdriver for example.

10. 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.



❄ / Control output

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

Circuit: Operation = relay powered
Alarm = relay not powered

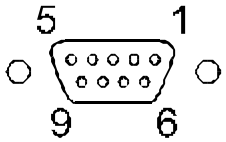
Pin assignment:

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

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:



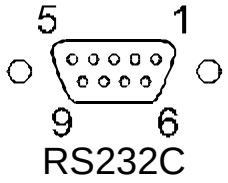
RS232C

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

RS232 interface cable 9-pin / 9-pin, 2.5 m
Order No.: 8 980 073

11. Remote control

11.1. Setup for remote control



- Check the interface parameters for both interfaces (on circulator and PC) and make sure they match.
  (Serial interface - see page 33)
- Set the menu item >Remote< from >no< to >YES<.
  (see page 32).
- 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.

11.2. Communication with a PC or a superordinated data system

If the circulator is put into remote control mode via the menu item >Remote<, the MULTI-DISPLAY (LED) 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: After a power interruption the order to start and all values which have to be adjusted must be resent from the personal computer via the interface.
AUTOSTART is not possible.

A transfer sequence consists of:

- command
- space (⇔; Hex: 20)
- parameter (the character separating decimals in a group is the period)
- end of file (↵; Hex: 0D)

The commands are divided into **in** or **out** commands.

in commands: asking for parameters to be displayed

out commands: setting parameters

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

Examples:
Command to set the working temperature >t 1< to 55,5 °C:

out_sp_00 ⇔ 55.5¿

Command to ask for the working temperature >t 1<:

in_sp_00¿

Response from the circulator:

55.5¿

11.3. List of commands

out commands: Setting parameters or temperature values.

Command	Parameter	Response of circulator
version	None	Number of software version (V X.xx)
status	none	Status message, error message (see page 44)
out_mode_01	0	Use working temperature >t 1<
out_mode_01	1	Use working temperature >t 2<
out_mode_01	2	Use working temperature >t 3<
out_mode_05	0	Stop the unit = R –OFF-.
out_mode_05	1	Start the unit.
out_sp_00	xxx.xx	Set working temperature. „t 1“
out_sp_01	xxx.xx	Set working temperature. „t 2“
out_sp_02	xxx.xx	Set working temperature. „t 3“
out_sp_03	xxx.xx	Set high temperature warning limit „t High“
out_sp_04	xxx.xx	Set low temperature warning limit „t Low“
out_sp_07	x	Set the pump pressure stage. (1 ... 4)
out_par_06	xxx	Xp control parameter of the internal controller.
out_par_07	xxx	Tn control parameter of the internal controller.
out_par_08	xxx	Tv control parameter of the internal controller.

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

Command	Parameter	Response of circulator
in_pv_00	none	Actual bath temperature.
in_pv_01	none	Heating power being used (%).
in_pv_03	none	Temperature value registered by the safety sensor.
in_pv_04	none	Setpoint temperature („SafeTemp“) of the excess temperature protection
in_sp_00	none	Working temperature „t 1“
in_sp_01	none	Working temperature „t 2“
in_sp_02	none	Working temperature „t 3“
in_sp_03	none	High temperature warning limit „t High“
in_sp_04	none	Low temperature warning limit „t Low“
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_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_mode_01	none	Selected setpoint: 0 = Setpoint „t 1“ 1 = Setpoint „t 2“ 2 = Setpoint „t 3“
in_mode_05	none	Circulator in Stop/Start condition: 0 = Stop 1 = Start

11.4. 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.

11.5. 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.
-06 SENSOR DIFFERENCE ALARM	Sensor difference alarm. Working temperature and safety sensors report a temperature difference of more than 25 °C.
-07 I^2C-BUS ERROR	Internal error when reading or writing the I^2C 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.

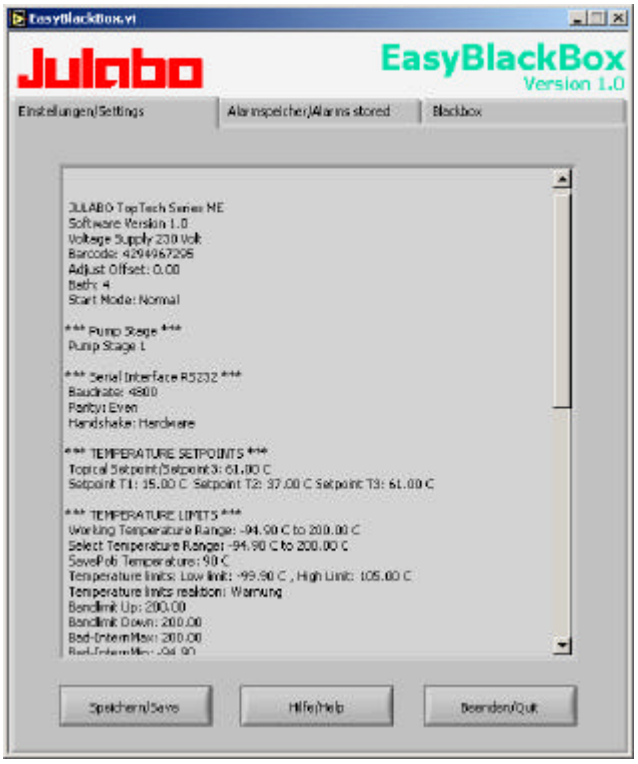
Error messages	Description
-13 WARNING : VALUE EXCEEDS TEMPERATURE LIMITS	Value lies outside the adjusted range for the high and low temperature warning limits. But value is stored.
-14 EXCESS TEMPERATURE PROTECTOR ALARM	Excess temperature protection alarm 
-20 WARNING: CLEAN CONDENSOR OR CHECK COOLING 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 refrigerating machine.
-30 CONFIGURATION ERROR: CONFIRM BY PRESSING <ENTER> ON CIRCULATOR	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.

12. JULABO Service – Online remote diagnosis

JULABO circulators of the HighTech series are equipped with a so-called 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. The respective program is available for **free** download from www.julabo.de \ EasyBlackBox.

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

- Data read-out is possible in the conditions „OFF“, „R OFF“ or „ALARM“.
- Connect the circulator to the computer using an interface cable.
- Start the EasyBlackBox program.
  The program asks for the used port (COM1, ...) and the baud rate of the unit.
  You do not have this information on hand? Simply try it out!
  The program keeps on sending this request until the actually used port and correct baud rate are entered.



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

  ← see example

- After pressing >Speichern/Save< a text file is compiled. The program proposes a filename -
  >C:\model description and barcode no.<.
  Modifications are possible.
- E-mail this file to service@julabo.de, JULABO's service department. JULABO is thus able to provide rapid support.

13. Cleaning the unit

Caution:
Before cleaning the unit, disconnect the power plug from the mains socket!
Prevent humidity from entering into the circulator.

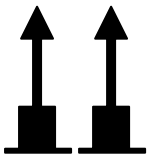
For cleaning the bath tank and the immersed parts of the circulator, use low surface tension water (e.g., soap suds).
Clean the outside of the unit using a wet cloth and low surface tension water.

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.