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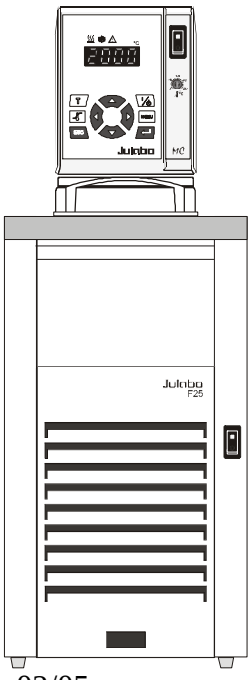
Find the *Julabo F32-MC* at our website: ***Click HERE***

English

Operating manual

Refrigerated and Heating Circulators

F12-MC	**F25-MC**	**F26-MC**
F32-MC	**F33-MC**	**F34-MC**
FS18-MC	**FP40-MC**	**FP50-MC**
		FPW50-MC



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Operating manual	Pages 2 to 15
Operating instructions	Pages 16 to 54

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.

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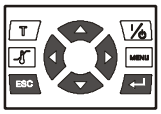
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Operating manual

Description

JULABO circulators have been designed for temperature application to specific fluids in a bath tank. The units provide pump nozzles for temperature application to an external system (loop circuit).





- ☑ 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.

PID2

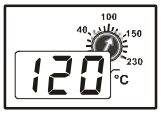
- ☑ The PID temperature control adapts the heat supplied to the thermal requirements of the bath.

ATC3

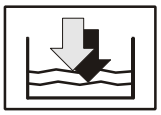
- ☑ Absolute Temperature Calibration (ATC3) provides a high temperature stability in the bath. With the 3-point calibration an offset is adjusted at three temperatures to ensure an accurate temperature pattern at the selected spot in the bath over the full temperature range.

RS232

- ☑ Electrical connections:
  The serial interface RS232 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.

PPC

- ☑ **P**ump **P**ressure **C**ontrol. The pump capacity (electronically adjustable via the motor speed) enables to adapt to varying conditions for internal and external temperature applications.

IEC
EN
DIN

- ☑ 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).

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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.
When using hazardous materials, the circulator may only be operated by persons that 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

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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.

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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 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 materials.
When using hazardous materials, **the user must** attach the enclosed safety labels to the front of the unit so they are well visible: The yellow warning label W09 (danger area) and the blue mandatory label M018 or Semi S1-0701 Table A1-2 #9 (Carefully read the user information prior to beginning operation).

Warning label W09: Colours: yellow, black		Danger area. Attention! Observe instructions. (operating manual, safety data sheet)
Mandatory label M018 Colours: blue, white		Carefully read the user information prior to beginning operation Scope: EU
Semi S1-0701 Table A1-2 #9		Carefully read the user information prior to beginning operation Scope: NAFTA

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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.
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.
This unit contains the refrigerants R134a or R404A or R507– at this time considered not to have any negative effects on the ozone layer. However, during the long operating period of the unit, disposal prescriptions may change. So only qualified personnel should take care of disposal.

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Warranty conditions

JULABO USA, Inc. 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 no less than

TWO (2) YEARS

or a maximum of ten thousand hours (10,000), whichever comes first, from the date of delivery of the products. To avoid forfeiture of the warranty and to allow JULABO to be of continuing service to the scientific community, the record of the purchase is required to be returned to JULABO or one of its authorized representatives within 30 days of receipt of equipment.

JULABO's sole obligation shall be to repair or to replace at JULABO's option, F.O.B. its plant or locally, without charge, any part(s) that prove defective within the warranty period, providing the customer notifies JULABO promptly and in writing of any such defect. Compensation for labor other than Julabo's employees will not be JULABO's obligation. Part(s) replacement does not constitute an extension of the original warranty period.

JULABO will not assume responsibility for unauthorized product modifications, or for repairs, replacements, or modifications negligently or otherwise improperly made or performed by persons other than JULABO employees or authorized representatives.

JULABO MAKES NO WARRANTY OR MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, AS TO THE DESIGN, SALE, INSTALLATION, OR USE OF ITS PRODUCTS, AND SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF ITS PRODUCTS.

While JULABO's personnel or that of its authorized representatives are available to advise customers concerning general applications of all manufactured products, oral representations are not warranties with respect to particular applications, and should not be relied upon if inconsistent with product specifications or the terms stated herein.

All glassware, such as reference thermometers, etc, are expressly excluded from this warranty declaration.

In any event, the terms and conditions contained in JULABO's formal sales contracts shall be controlling and any change must be in writing and signed by an authorized executive of JULABO USA, Inc.

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Technical specifications

		F12-MC	F25-MC
Working temperature range	°C	-20 ... 200	-28 ... 200
Temperature stability	°C	±0,01	
Temperature selection		digital	
via key pad indication on MULTI-DISPLAY (LED)			
remote control via personal computerindication 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	2,0
Heater wattage (at 115V)	kW	1.0	1.0
Cooling capacity	°C	+20 0 -10	+20 0 -20
Medium ethanol	W	150 100 60	260 200 60
Refrigerant		R134a	R134a
Electronically adj. pump capacity	stages	1 ... 4	
Flow rate	l/min at 0 bar	11 ... 16	
Pressure max.	bar at 0 liter	0.22 ... 0.45	
Electrical connections:			
External alarm device 24-0 V DC / max. 25 mA			
Computer interface RS232			
Overall dimensions (WxDxH)	cm	20x36x56	23x42x61
Bath opening (WxL)	cm	15x16	12x14
Bath depth	cm	13	14
Filling volume	liters	3 ... 4,5	3 ... 4,5
Weight	kg	23	31
Ambient temperature	°C	5 ... 40	5 ... 40
Mains power connection 230 V/50 Hz	V/ Hz	207-253 / 50	207-253 / 50
Current input (at 230 V)	A	11	12
Mains power connection 230 V/60 Hz	V/ Hz	207-253 / 60	207-253 / 60
Current input (at 230 V)	A	11	12
Mains power connection 115 V/60 Hz	V/ Hz	103-127 / 60	103-127 / 60
Current input (at 115 V)	A	12	13
Mains power connection 100 V/60 Hz	V/ Hz	-------	90-115 / 50-60
Current input (at 100 V)	A	-------	13

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

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		F26-MC	F32-MC
Working temperature range	°C	-28 ... 200	-35 ... 200
Temperature stability	°C	±0,01	±0,01
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	2,0
Heater wattage (at 115V)	kW	1.0	1.0
Cooling capacity	°C	+20 0 -20	+20 0 -20 -30
Medium ethanol	W	260 200 60	450 390 150 50
Refrigerant		R134a	R134a
Electronically adj. pump capacity	stages	1 ... 4	
Flow rate	l/min at 0 bar	11 ... 16	
Pressure max.	bar at 0 liter	0.22 ... 0.45	
Electrical connections:			
External alarm device 24-0 V DC / max. 25 mA			
Computer interface RS232			
Overall dimensions (WxDxH)	cm	42x42x42	31x42x64
Bath opening (WxL)	cm	12x14	18x12
Bath depth	cm	14	15
Filling volume	liters	3 ... 4,5	5,5 ... 8
Weight	kg	31	37
Ambient temperature	°C	5 ... 40	5 ... 40
Mains power connection 230 V/50 Hz	V/ Hz	207-253 / 50	207-253 / 50
Current input (at 230 V)	A	12	13
Mains power connection 230 V/60 Hz	V/ Hz	-------	-------
Current input (at 230 V)	A	-------	-------
Mains power connection 115 V/60 Hz	V/ Hz	-------	103-127 / 60
Current input (at 115 V)	A	-------	14
Mains power connection 100 V/60 Hz	V/ Hz	-------	90-115 / 50-60
Current input (at 100 V)	A	-------	14

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

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		F33-MC	F34-MC
Working temperature range	°C	-30 ... 200	-30 ... 150
Temperature stability	°C	±0,01	±0,01
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	2,0
Heater wattage (at 115V)	kW	1.0	1.0
Cooling capacity	°C	+20 0 -20 -30	+20 0 -20 -30
Medium ethanol	W	500 320 120 30	450 320 140 30
Refrigerant		R134a	R134a
Electronically adj. pump capacity	stages	1 ... 4	
Flow rate	l/min at 0 bar	11 ... 16	
Pressure max.	bar at 0 liter	0.22 ... 0.45	
Electrical connections:			
External alarm device 24-0 V DC / max. 25 mA			
Computer interface RS232			
Overall dimensions (WxDxH)	cm	36x46x69	38x58x62
Bath opening (WxL)	cm	23x14	24x30
Bath depth	cm	20	15
Filling volume	liters	12 ... 16	14 ... 20
Weight	kg	44	42
Ambient temperature	°C	5 ... 40	5 ... 40
Mains power connection 230 V/50 Hz	V/ Hz	207-253 / 50	207-253 / 50
Current input (at 230 V)	A	12	12
Mains power connection 230 V/60 Hz	V/ Hz	207-253 / 60	-------
Current input (at 230 V)	A	12	-------
Mains power connection 115 V/60 Hz	V/ Hz	103-127 / 60	103-127 / 60
Current input (at 115 V)	A	14	14
Mains power connection 100 V/60 Hz	V/ Hz		
Current input (at 100 V)	A		

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

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		FS18-MC
Working temperature range	°C	-35 ... 150
Temperature stability	°C	±0,01
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
Cooling capacity	°C	+20 0 -20 -30
Medium ethanol	W	460 340 150 50
Refrigerant		R134a
Electronically adj. pump capacity	stages	1 ... 4
Flow rate	l/min at 0 bar	11 ... 16
Pressure max.	bar at 0 liter	0.22 ... 0.45
Electrical connections:		
External alarm device 24-0 V DC / max. 25 mA		
Computer interface RS232		
Overall dimensions (WxDxH)	cm	31x42x64
Bath opening (WxL)	cm	--
Bath depth	cm	--
Filling volume	liters	1,7 ... 3
Weight	kg	37
Ambient temperature	°C	5 ... 40
Mains power connection 230 V/50 Hz	V/ Hz	207-253 / 50
Current input (at 230 V)	A	12
Mains power connection 230 V/60 Hz	V/ Hz	-------
Current input (at 230 V)	A	-------
Mains power connection 115 V/60 Hz	V/ Hz	103-127 / 60
Current input (at 115 V)	A	14

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

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		FP40-MC	FP(W)50-MC
Working temperature range	°C	-40 ... 200	-50 ... 200
Temperature stability	°C	±0,02	±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	2,0
Cooling capacity	°C	+20 0 -20 -40	+20 0 -20 -40
Medium ethanol	W	680 500 320 40	900 800 500 160
Refrigerant		R404A	R404A / R507
Electronically adj. pump capacity	stages	1 ... 4	
Flow rate	l/min at 0 bar	11 ... 16	
Pressure max.	bar at 0 liter	0.22 ... 0.45	
Electrical connections:			
External alarm device 24-0 V DC / max. 25 mA			
Computer interface RS232			
Overall dimensions (WxDxH)	cm	37x46x69	42x49x70
Bath opening (WxL)	cm	23x14	18x12
Bath depth	cm	20	15
Filling volume	liters	9 ... 16	5,5 ... 8
Weight	kg	48	55
Ambient temperature	°C	5 ... 40	5 ... 40
Mains power connection 230 V/50 Hz	V/ Hz	207-253 / 50	207-253 / 50
Current input (at 230 V)	A	13	14
Current input (at 230 V) (CH)	A	9+3	9+4
Mains power connection 230 V/60 Hz	V/ Hz	207-253 / 60	207-253 / 60
Current input (at 230 V)	A	13	14
Mains power connection 115 V/60 Hz	V/ Hz	------	------
Current input (at 115 V)	A	------	------

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

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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 (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.

Only for water-cooled models:

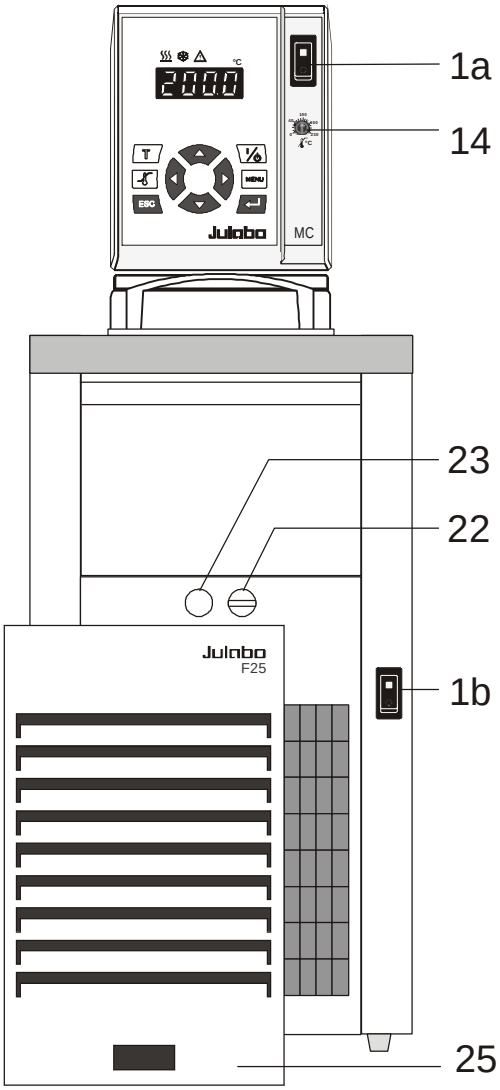
Cooling water pressure (IN / OUT)	max.	6 bar
Difference pressure (IN - OUT)		3.5 to 6 bar
Cooling water temperature		<20 °C
Quality of cooling water:		
pH at 25 °C		7 to 8.5
Suspended matter		<30 mg/l
Size of suspended matter	max.	0.1 mm
Growth of algae		not permissible

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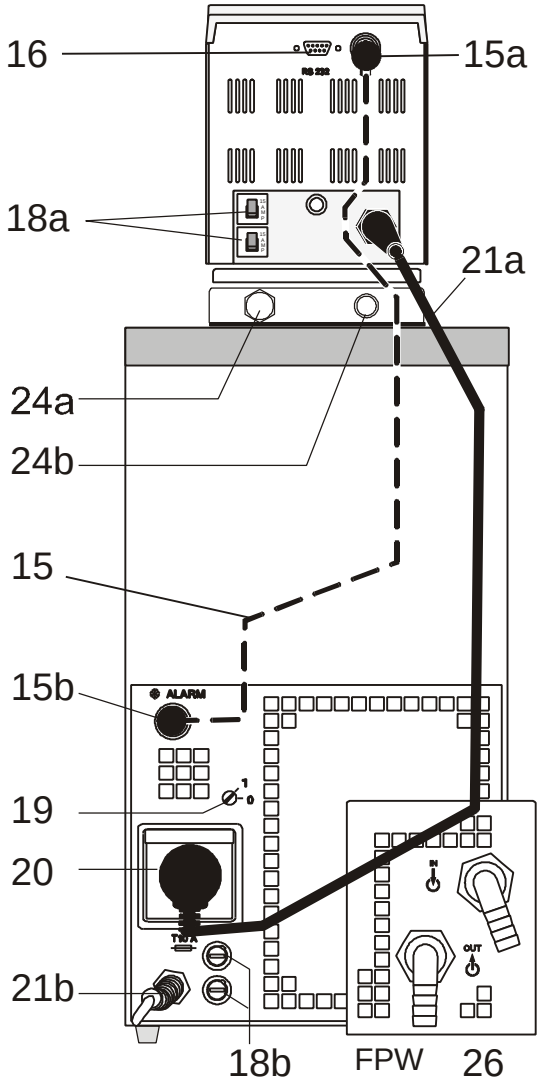
Operating instructions

1. Operating controls and functional elements

Front view



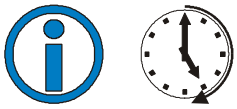
Rear view



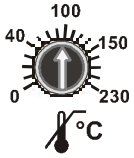
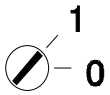
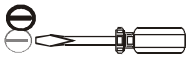
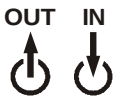
1a		Mains power switch, illuminated	for circulator
1b		Mains power switch, illuminated	for cooling machine
2		Start / stop key	
3		Key for selecting the working temperature	
4		Key for selecting the warning and safety values	
5		Menu functions	
6		Cursor keys	(left or right)
7		Edit keys	(increase or decrease)

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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
15		Socket: control cable of JULABO refrigerated circulator
15a 15b		or output for alarm messages
16		Interface RS232 : remote control via personal computer
18a		Mains fuses: Safety cutout 15 A
18b		Mains fuses for cooling machine, T10A
19		Selector dial for cooling machine (only F25, F26, F34) Position "1" for operation with MC circulator.
20		Built-in mains outlet for connection of circulator
21a		Mains power cable with plug for circulator
21b		Mains power cable with plug cooling machine
22		Drain tap
23		Drain port (not on F12)
24a		Pump connector: feed
24b		Pump connector: return
25		Venting grid, removable
26		Only for water cooled models: Cooling water OUTLET and INLET

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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

- Place the unit on an even surface on a pad made of **non-flammable** material.
  F34-MC: The circulator fitted with a stainless steel bridge is placed on on the back of the bath tank leaving the bath open on the front side.
- Set selector dial for cooling machine (19) in position "1" for operation with MC circulator.  (only F25, F26, F34)
- Keep at least 20 cm of open space on the front and rear venting grids.
- Do not set up the unit in the immediate vicinity of heat sources and do not expose to sun light
- Before operating the unit after transport, wait about one hour after setting it up. This will allow any oil that has accumulated laterally during transport to flow back down thus ensuring maximum cooling performance of the compressor.

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Only for water cooled models:
Ensure circulation of cooling water by connecting the tubing to cooling water inlet and outlet on the rear of the refrigerated circulator.
Cooling water pressure 3,5 - 6 bar.
Cooling water temperature <20 °C.

3.2. Bath fluids



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

Recommended bath fluids:

Bath fluids	Temperature range	Flash point	fire point
deionized water	5 °C ... 80 °C		
mixture water/glycol	-30 °C bis 50 °C		
Thermal M	+40 °C ... +170 °C	>280 °C	>305 °C
Thermal H	+20 °C ... +250 °C	>270 °C	>360 °C
Thermal HY	-80 °C ... +55 °C	>75 °C	>80 °C
Thermal H5S	-50 °C ... +105 °C	>110 °C	>130 °C
Thermal H10S	-20 °C ... +180 °C	>175 °C	>210 °C
Thermal H20S	+0 °C ... +220 °C	>230 °C	>270 °C

Order No. 10 liters	Bath fluids	Order No. 5 liters
8 940 100	Thermal M	8 940 101
8 940 102	Thermal H	8 940 103
8 940 104	Thermal HY	8 940 105
8 940 106	Thermal H5S	8 940 107
8 940 114	Thermal H10S	8 940 115
8 940 108	ThermalH20S	8 940 109

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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 50 mm^2 /s at the respective working temperature)
- have corrosive characteristics or
- tend to cracking.

ATTENTION: The maximum permissible viscosity is 50 mm^2 /s·



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.

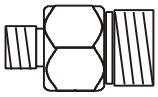
- Are all tubes and electrical cables connected and installed?
  Note:
  sharp edges, hot surfaces in operation, moving machine parts, etc.
- Do dangerous steams or gases arise when heating?
  Is an exhaust needed when working?
- What to do when a dangerous substance was spilled on or in the unit?
 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

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3.3. 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
8 930 209 8 930 210 8 930 211 8 930 214	0.5 m 1.0 m 1.5 m 3.0 m	Metal tubing, triple insulated, M16x1 *	-100 °C to +350 °C
8 930 220 8 930 221 8 930 222 8 930 223	0.5 m 1.0 m 1.5 m 3.0 m	Metal tubing, insulated, M16x1 *	-50 °C to +200 °C



*) 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:

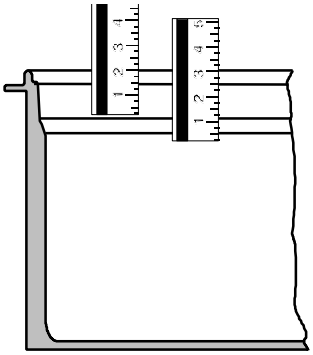
- Burning of skin
- Difficulties in breathing due to hot atmosphere

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.

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3.4. Filling / draining



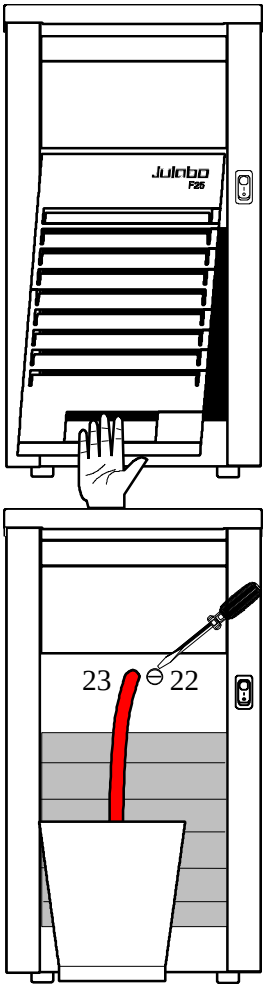
Filling

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

- Recommended maximum filling level with water as bath fluid: 20 mm below the tank rim
- Recommended maximum filling level with bath oils: 30 mm below the tank rim

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

ⓘ The circulator provides an early warning system for low level (description – please refer to page 30) that may be triggered when changing samples in the bath.



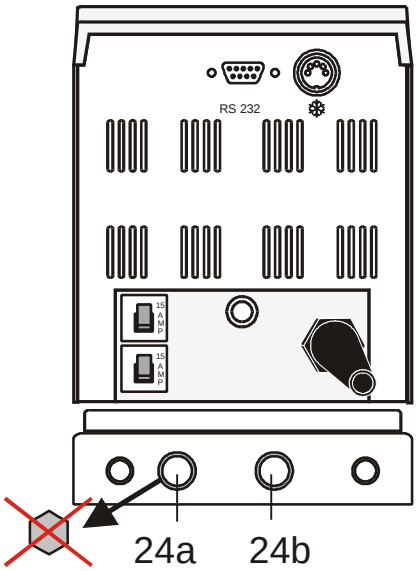
Draining

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

Notice:
Pay attention to the thermal expansion of bath oil during heating to avoid overflowing of the liquid.
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).
Store and dispose the used bath fluid according to the laws for environmental protection.

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3.5. Temperature application to external systems



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 and insulation for tubing see page 21

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

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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.

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

4.2. Switching on / Start - Stop



Switching on:

- Circulator and cooling machine may be turned on and off with separate mains switches. The integrated control light will illuminate to indicate that power has beeen applied.



Version



F25



FP50



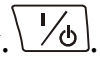


ⓘ The unit performs a self-test. All segments of the 4-digit MULTI-DISPLAY (LED) and all indicator lights will illuminate.
Then the software version (example: V1.00) and the configuration (example: c225) of the unit appears.
The display „**OFF**“ or „**R OFF**“ indicates the unit is ready to operate.

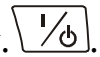
ⓘ The circulator enters the operating mode activated before switching the circulator off:
keypad control mode (manual operation, factory setting)
or
remote control mode (operation via personal computer).

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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".



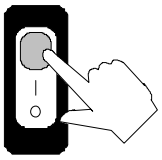
Caution: **F12-MC**
If the circulator is turned off with the mains switch (1a), or in operating state „OFF“ or „rOFF“, the refrigerating unit is not switched off simultaneously.
Turn off the refrigerating unit with the mains switch (1b) as well.
Danger of freezing when water is used as bath fluid!



ⓘ Control of the cooling machine:

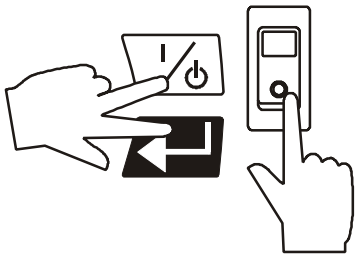
With the mains switch (1b) turned on, the circulator automatically switches the cooling machine off and on.

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



ⓘ To save energy, turn off the cooling machine with the mains switch (1b) whenever cooling is not required.

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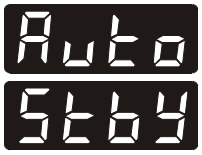


AUTOSTART ON / OFF

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.

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5. T Setting the temperatures



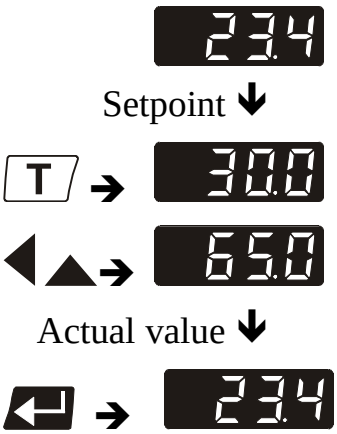
The function of the T key is configurable.

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 't3t', then assign a menu with 3 pre-adjustable setpoints to the T key. (see page 39)



5.1. 1-setpoint mode

Example: Actual value

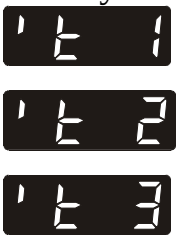


1. Press the T key. The setpoint value instead of the actual value is indicated on the display. The value can now be changed.
2. **Change the value**: (Example: 30.0 °C to 65.0 °C)
   - Use the cursor keys ◀ ▶ to move left or right on the display until the numeral you wish to change blinks.
   - Use 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:



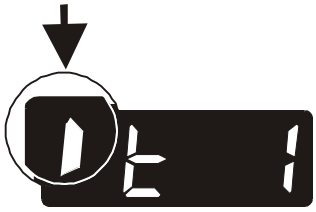
Press the T key to call up the menu for temperature selection.

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.

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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: .

Example: Indication of effective actual value

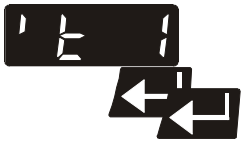


4. Press enter ↵ to store the selected value.
   Press ESC to update the display immediately.

ⓘ 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

T



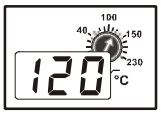
ESC

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.

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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 .

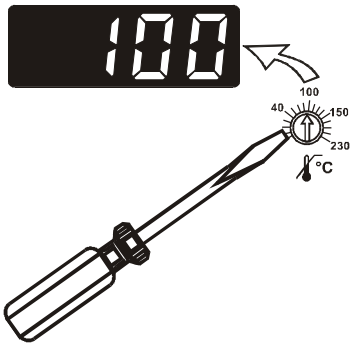
6.1. Excess temperature protection







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: 100 °C)
4. Press ESC to update the display immediately.

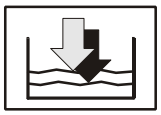
Recommendation:
Set the excess temperature protection at 5 to 10 °C above the working temperature setpoint.

Warning:

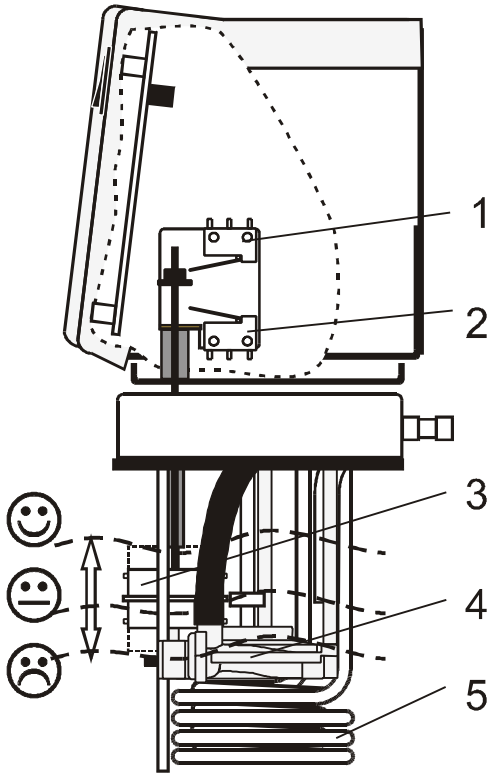
The excess temperature protection >tSA< should be set at least 25 °C below the fire point of the bath fluid used.
In the event of wrong setting there is a fire hazard!
We disclaim all liability for damage caused by wrong settings!

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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 46)



Warning:
For refill always use the same bath fluid type that is already in the bath. Bath oils must not contain any water contaminants and should be pre-heated to the actual bath temperature! Explosion hazard at higher temperatures!

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6.2. High and low temperature warning functions

Factory settings:



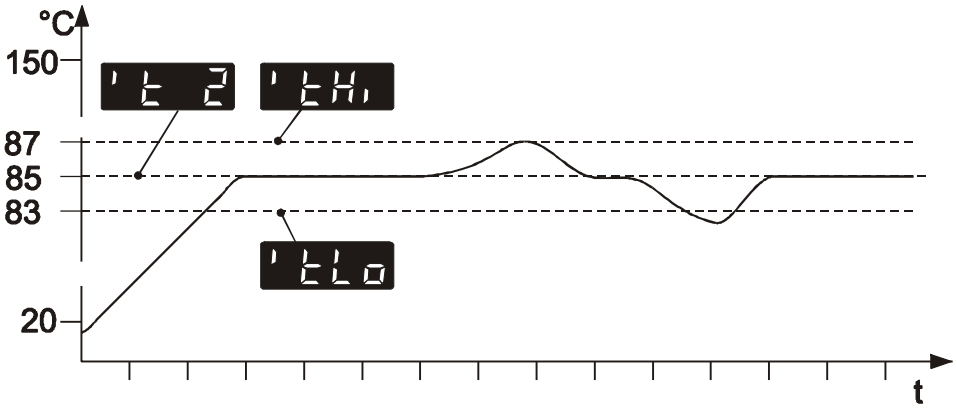
High temperature limit
t High 205 °C



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  to update the display immediately

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ⓘ 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 31) 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  to update the display immediately.

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



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 31)

Factory setting: Li 0





 t High
High temperature limit

 t Low
Low temperature limit

- 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.

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7. MENU Menu functions

MENU

The term „menu functions“ refers to adjustments such as

➢  Pump

- electronically adjustable pump capacity

➢  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 <.

➢ 

- Change-over the T key mode.

➢  Remote

- Online communication, with adjustable interface parameters

➢  Baudrate

➢  Handshake

➢  Parity

➢  XP

- PID temperature control, control parameters

➢  Tn

➢  Tv

➢  Reset

- Factory setting

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7.1. Setting the pump pressure



The pressure of the circulating pump is adjustable in four grades

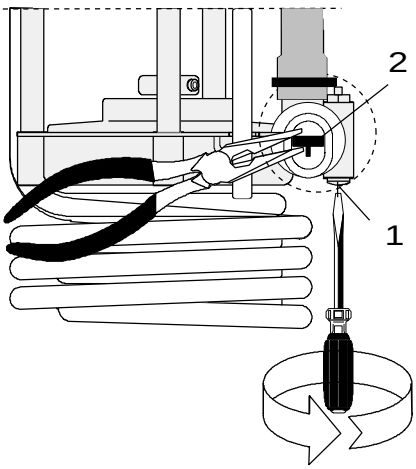
Flow rate: 11 ... 16 l/min
Pump pressure: 0.22 ... 0.45 bar

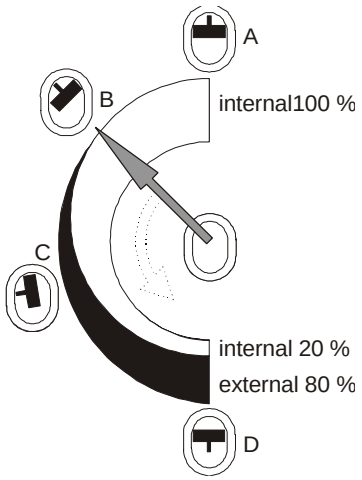
Factory setting:
Stage 2



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 ▼ ▲ (1 ... 4).
4. Press enter ↵ to store the selected parameter.
   Press ESC to update the display immediately.





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.

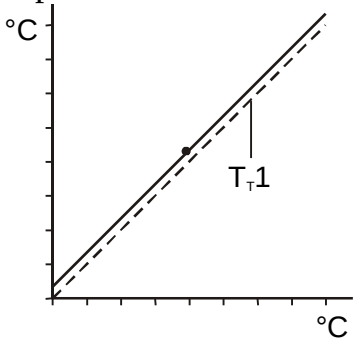
Examples:
Internal applications in the bath
A 100 % internal bath circulation
(for large bath tanks)
B Reduced internal bath circulation
(for smooth surface of bath fluid)
External/internal applications
C 40 % external discharge,
60 % internal circulation
(for large bath tanks)
D 80 % external discharge,
20 % internal circulation
(for small bath tanks)

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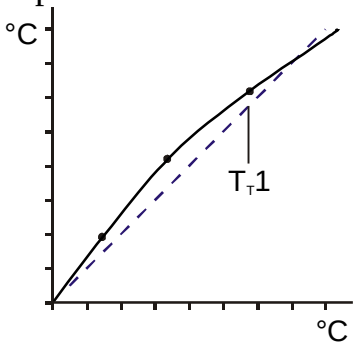
7.2. ATC Absolute Temperature Calibration, 3-point calibration

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

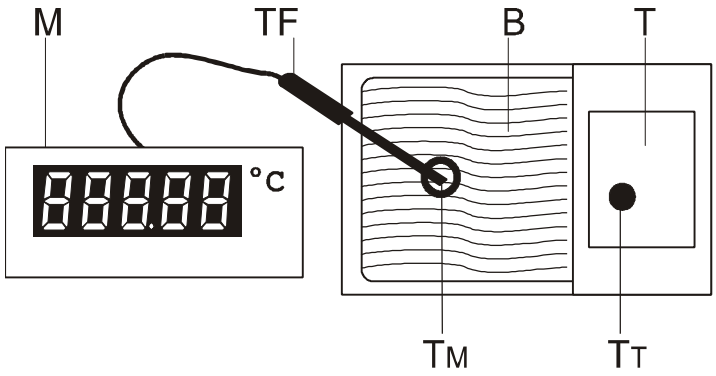


3-point calibration



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.



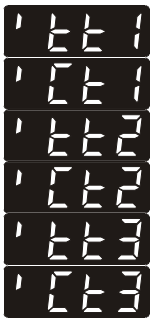
M = Temperature measuring instrument with temperature sensor (TF)
B = Bath tank with T = circulator
T_M = Temperature on measuring point
T_T = Temperature on circulator

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.

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Example: 3-point calibration

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).

Examples:
T_T = 80.0 °C
T_M = 79.7 °C

T_T = 120.0 °C
T_M = 119.5 °C

T_T = 160.0 °C
T_M = 159.3 °C

1. **Calibration procedure:**
   Press T and set the first temperature value under e g.  for example (example 1st value = 80 °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



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ⓘ 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:**

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  (80.00 °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 120 °C and 160 °C.
Store the values under  or  resp.

From example on page 37 for T_M = Ctx

 = 79.7 °C

 = 119.5 °C

 = 159.3 °C

☞ Notice:

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

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7.3. Change-over of the T key mode



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.

Factory setting: no

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.

7.4. Remote control: activate – deactivate



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<.

Factory setting: no

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.

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The display changes from



keypad control mode (manual operation) to



remote control mode (operation via personal computer).

7.5. 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.

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7.6. 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:

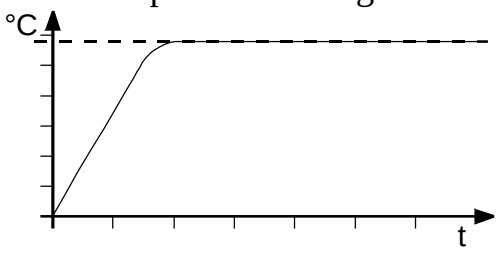
   Use the cursor keys ◀ ▶ to move left or right on the display until the numeral you wish to change blinks.

   Use the increase/decrease arrows ▼ ▲ to change the selected numeral (-, 0, 1, 2, 3, ... 9).
4. Press enter ↵ to store the selected value.

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Optimization instructions for the PID control parameters:

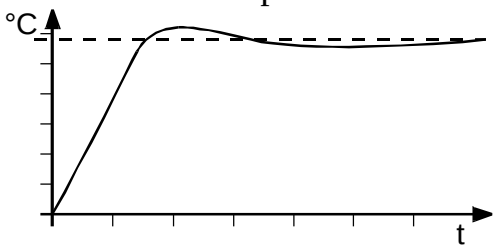
optimum setting



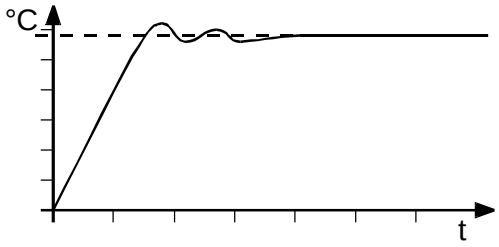
The heat-up curve reveals inappropriate control settings.

Inappropriate settings may produce the following heat-up curves**:**

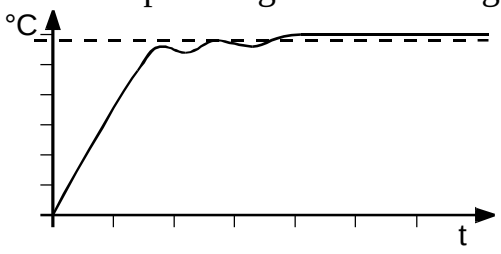
Xp too low



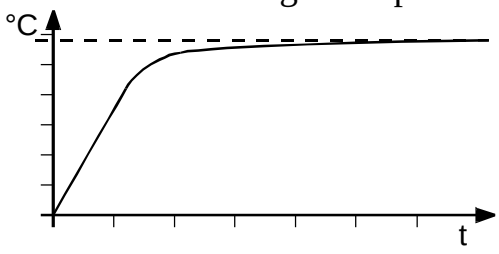
Tv/Tn too low



Xp too high or Tv too high



Tv/Tn too high or Xp too high



7.7. Reset



Use this to reset all values to factory setting.

Factory setting: no



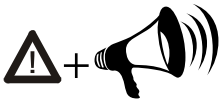


1. Press the MENU button until the menu item 

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<.

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8. Troubleshooting guide / Error messages

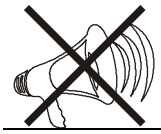


Alarm with a complete shutdown of the unit

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.

E 01 A

- 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.

E 02 A

- 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.

E 03 W A

- 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<

E 04 W A

- 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<

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- 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.



- 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.
- Cooling compressor overload protection
  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.

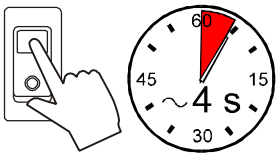
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- Cable of the excess temperature sensor interrupted or short-circuited.



- 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.

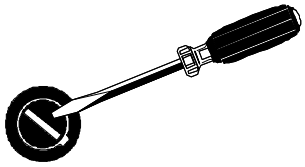
Disturbances that are not indicated.

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 fuses:

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



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

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

Example:

Manufacturer	Supplier	Type	Order No.
Wickmann	Wickmann	G- fuse insert T10,0A 5x20 mm	No. 19195

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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!
- 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).
- 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!

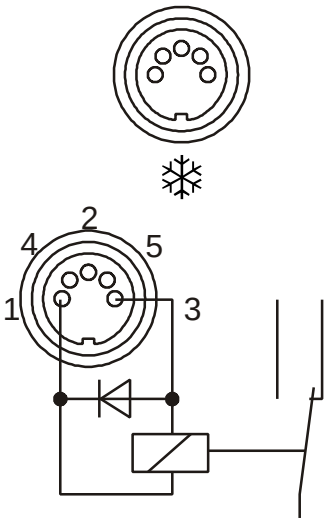
- Excess temperature protection according to IEC 61010-2-010
  With a screwdriver turn back the adjustable excess temperature protection until the shut-down point (actual temperature).
- Low level protection according to IEC 61010-2-010
  To check the function of the float, it can be manually lowered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

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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.

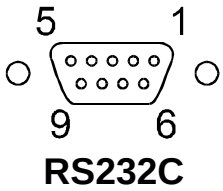
Circuit: Operation = relay powered
Alarm = relay not powered

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:

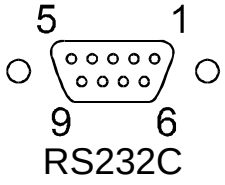
Pin 2	RxD	Receive Data
Pin 3	TxD	Transmit Data
Pin 5	0 V	Signal GND
Pin 6	DTR	Data terminal ready
Pin 7	RTS	Request to send
Pin 8	CTS	Clear to send

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

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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 40)
- Set the menu item >Remote< from >no< to >YES<.
  (see page 39).
- 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

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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 51)
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.

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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

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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.

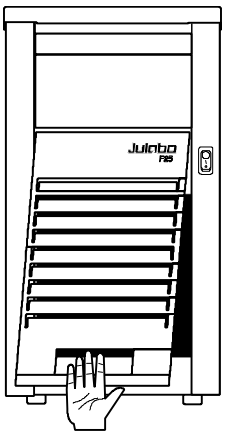
11.5. Error messages

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.
-13 WARNING : VALUE EXCEEDS TEMPERATURE LIMITS	Value lies outside the adjusted range for the high and low temperature warning limits. But value is stored.

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Error messages	Description
-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. Maintaining the cooling performance



To maintain the full cooling performance, clean the condenser from time to time.

- Switch off the unit, disconnect mains power cable.
- Hold the venting grid, pull out and remove.
- Clean the ribbed condenser with a vacuum cleaner.
- Replace the venting grid.
- Switch on the unit.

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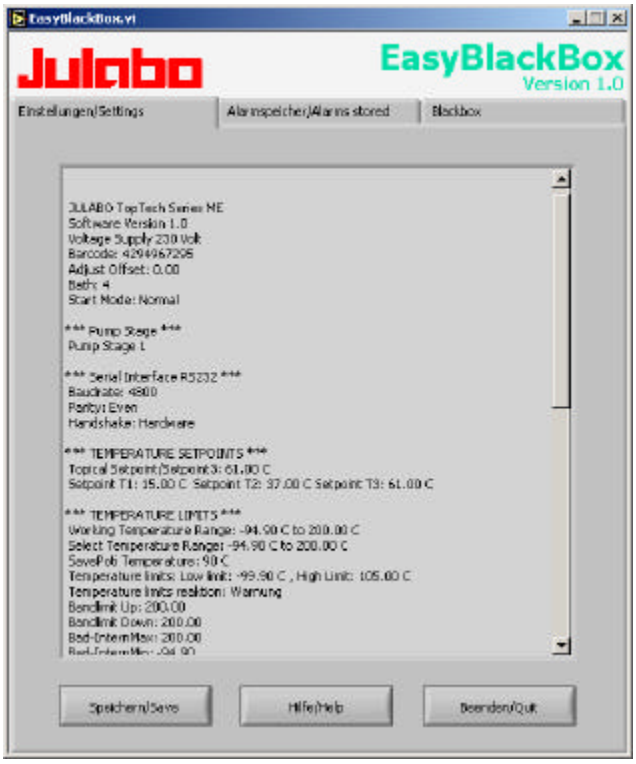
13. JULABO Service – Online remote diagnosis

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.com \ 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 ServiceUSA@Julabo.com, JULABO's service department. JULABO is thus able to provide rapid support.

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14. Cleaning the unit

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

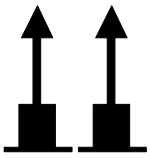
For cleaning the bath tank and the immersed parts of the circulator, use low surface tension water (e.g., soap suds).
Clean the outside of the unit using a wet cloth and low surface tension water.

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.

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