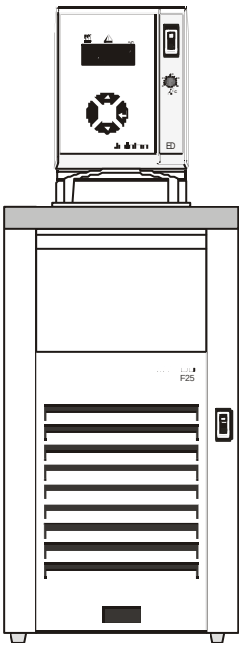
English

Operating manual

Refrigerated and Heating Circulators

F12-ED F25-ED

F26-ED F34-ED



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Contents

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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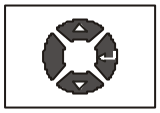
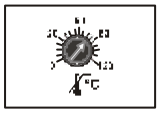
Description

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 the setpoint that can be indicated on the LED temperature display.



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



☑ The excess temperature protection conforming to IEC 61010-2-010 is a safety installation independent from the control circuit. The safety value is set using a tool (screwdriver).

☑ 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 USA, Inc. 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:
This unit contains the refrigerants R134a – 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.

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.

Technical specifications

		F12-ED	F25-ED
Working temperature range	°C	-20 ... 100	-28 ... 100
Temperature stability	°C	±0,03	±0,03
Temperature selection		digital	
Temperature indication		LED	
Resolution	°C	0.1	
Temperature control		PID1	
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
Circulating pump:			
discharge, max.at 0 bar	l/min	15	15
pressure, max. at 0 l	bar	0.35	0.35
Overall dimensions (WxDxH)	cm	20x36x56	23x42x61
Bath opening (WxL)	cm	15x16	12x14
Bath depth	cm	15	15
Filling volume	liters	3 ... 4,5	3 ... 4,5
Weight	kg	22	30
Ambient temperature	°C	5 ... 40	5 ... 40
Rated voltage and frequency	V/Hz	230 / 50	230 / 50
or	V/Hz	230 / 60	230 / 60
or	V/Hz	115 / 60	115 / 60
Mains power connection ±10 %	V/Hz	230 / 50	230 / 50
or	V/Hz	230 / 60	230 / 60
or	V/Hz	115 / 60	115 / 60
Total power consumption	kW	2.3 (at 230 V)	2.35 (at 230 V)
	kW	1.3 (at 115V)	1.35 (at 115V)

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

		F26-ED	F34-ED
Working temperature range	°C	28 ... 100	-30 ... 100
Temperature stability	°C	±0,03	±0,03
Temperature selection		digital	
Temperature indication		LED	
Resolution	°C	0.1	
Temperature control		PID1	
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
Medium ethanol	W	260 200 60	450 320 140
Refrigerant		R134a	R134a
Circulating pump:			
discharge, max.at 0 bar	l/min	15	15
pressure, max. at 0 l	bar	0.35	0.35
Overall dimensions (WxDxH)	cm	42x42x42	38x58x62
Bath opening (WxL)		cm	12x14 24x30
Bath depth	cm	15	15
Filling volume	liters	3 ... 4,5	14 ... 20
Weight	kg	30	41
Ambient temperature	°C	5 ... 40	5 ... 40
Rated voltage and frequency	V/Hz	230 / 50	230 / 50
or	V/Hz	230 / 60	230 / 60
or	V/Hz	115 / 60	115 / 60
Mains power connection ±10 %	V/Hz	230 / 50	230 / 50
or	V/Hz	230 / 60	230 / 60
or	V/Hz	115 / 60	115 / 60
Total power consumption	kW	2.3 (at 230 V)	2.35 (at 230 V)
	kW	1.3 (at 115V)	1.35 (at 115V)

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

Safety installations according to IEC 61010-2-010:

Excess temperature protection	adjustable from 20 to 120 °C
Classification according to DIN 12876-1	class I
Alarm indication	optical + audible (permanent)

Environmental conditions according to EN 61 010, part 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 EN 60 529 IP21

Power supply: according to class 1, VDE 0106 T1

not for use in explosive atmosphere
Max. mains fluctuation 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.

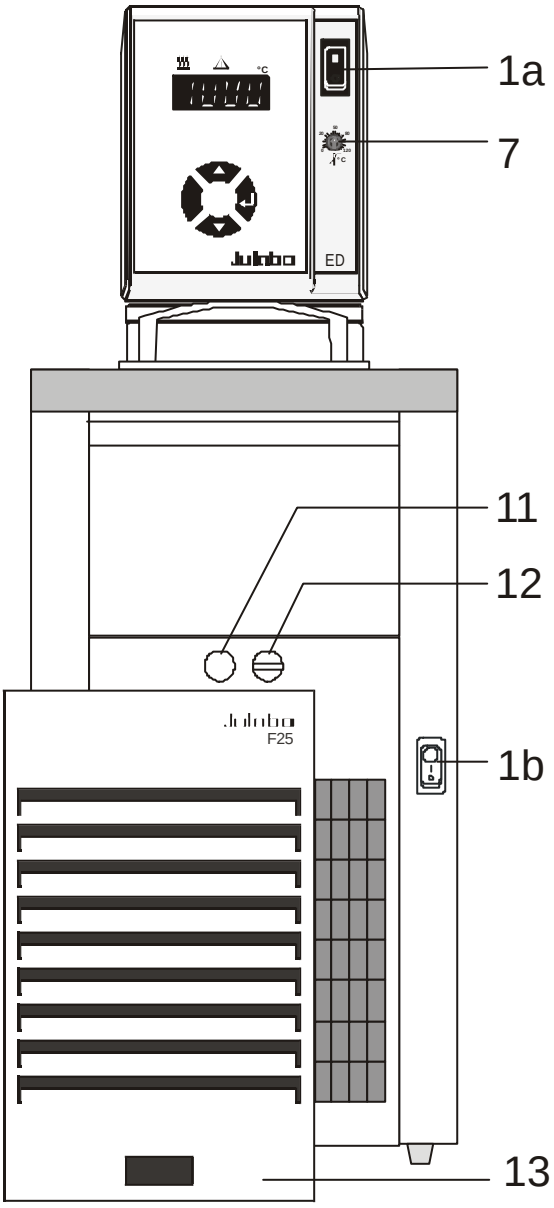
Interference resistance

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

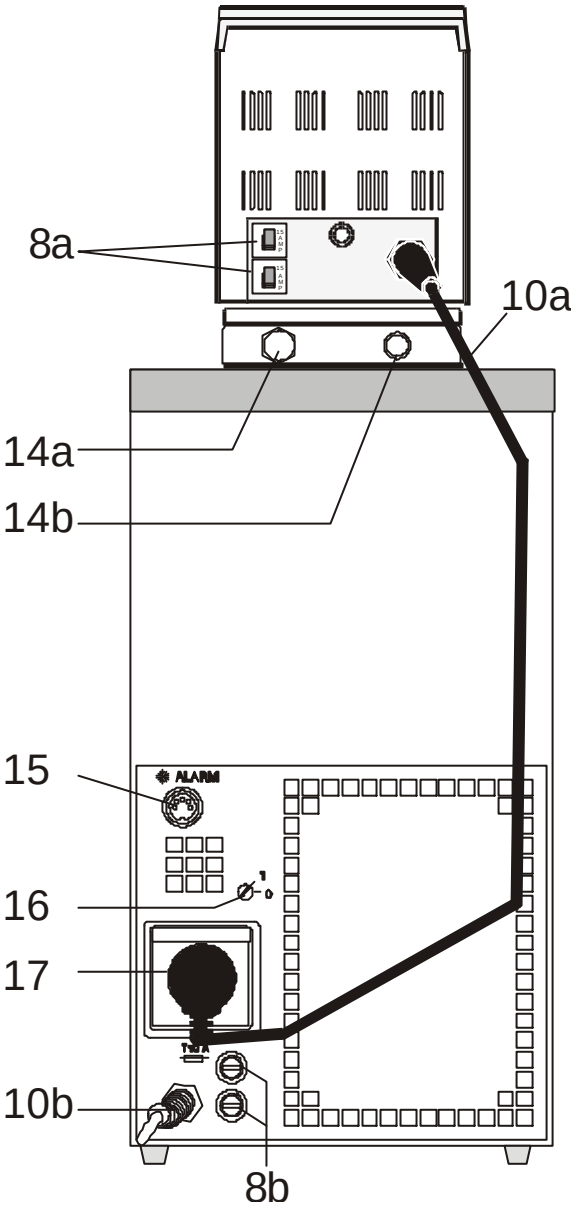
Operating instructions

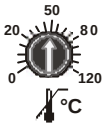
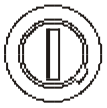
1. Operating controls and functional elements

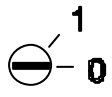
Front view



Rear view



1a		Mains power switch, illuminated for circulator
1b		Mains power switch, illuminated for cooling machine
2		Edit keys (increase/decrease setting)
3		Enter key (store)
4		LED temperature display, menu indication
5		Control indicator –Heating
6		Control indicator – Alarm
7		Adjustable excess temperature protection according to IEC 61010-2-010
8a		Mains fuses for circulator: Safety cutout 15 A
8b		Mains fuses for cooling machine: T 10,0 A, D5 x 20 mm

10a		Mains power cable with plug for circulator
10b		Mains power cable with plug Kältemaschine
11		Drain port (only F25, F26, F34)
12		Drain tap (F12, F25, F26, F34)
13		Venting grid, removable
14a		Pump connector for feed
14b		Pump connector for return
15		Connector: Cooling machine control (only F25, F26, F34) (not in use for operation with ED circulator)
16		Selector dial for cooling machine (only F25, F26, F34) Position "0" for operation with ED circulator.
17		Built-in mains outlet for connection of circulator

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 in an upright position.
  F34-ED: 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 (16) in position "0" for operation with ED 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.

3.2. Bath fluids

Caution:

No liability for use of other bath fluids!

Do not use flammable bath fluids!

Glycol: - Low toxicity - Strictly observe the safety data and handling instructions from the manufacturer.

No liablity for use with water.
Danger of freezing at working temperatures <5 °C.

- Recommended bath fluid:

Bath liquids	Temperature range
deionized water	5 °C ... 90 °C
mixture water/glycol mixture 1:1	-30 °C ... 50 °C

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

Caution:

The temperature controlling i.e. immersing of test tubes, Erlenmeyer flasks or similar objects directly within the circulator constitutes normal circulator practise.

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

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

i.e.: dangerous

You alone are responsible for the handling of these substances!

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.

3.2.1. Tubing

Recommended tubing:

Order No.	Length		Temperature range
8930008	2 m	CR® tubing 8 mm ID	-20 °C ... 120 °C
8930010	2 m	CR® tubing 10 mm ID	-20 °C ... 120 °C
8930108	1 m	Viton tubing 8 mm ID	-50 °C ... 200 °C
8930110	1 m	Viton tubing 10 mm ID	-50 °C ... 200 °C
8930410	2 m	Insulation for tubing 8 mm ID or 10 mm ID	-50 °C ... 100 °C

Warning: Tubing:

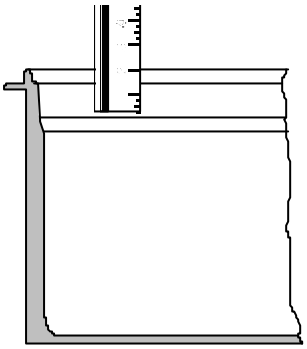
At high working temperatures the tubing used for temperature application and cooling water supply represents a danger source.
A damaged tubing line may cause hot bath fluid to be pumped out within a short time.
This may result in:

- 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.

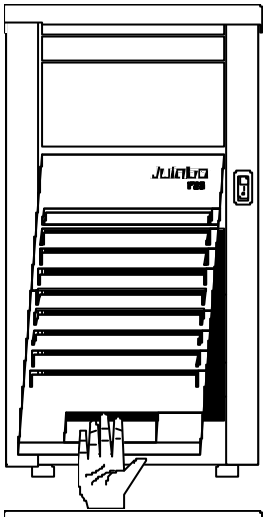
3.3. Filling / Draining



Filling

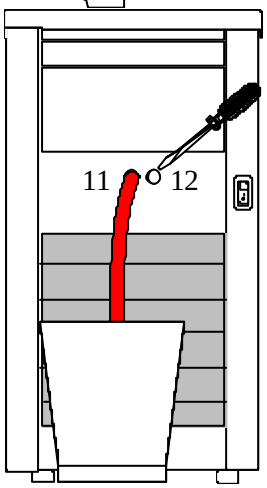
- Take care that no liquid enters the interior of the circulator..
- Recommended maximum filling level with water as bath liquid: 20 mm below the tank rim

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



Draining:

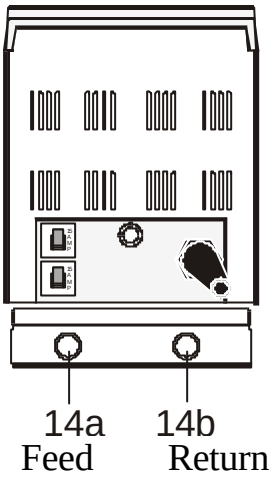
- Turn off the circulator and cooling machine.
- Hold the venting grid, pull out and remove.



- Slide a short piece of tube onto the drain port (11) and hold it into a pail. (only F25, F26, F34)
- Unscrew the drain tap (12) and empty the unit completely.
- Tighten the drain tap.

Notice:
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 liquid according to the laws for environmental protection.

3.4. Temperature application to external systems



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

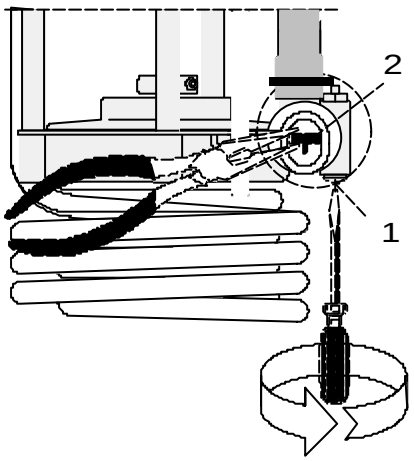
Connecting an external system:

- Unscrew the collar nut from the pump connector (14a).
- Slide the tubing onto the pump connectors for feed and return flow (14a, 14b).

ⓘ Tubing and insulation for tubing see page 14

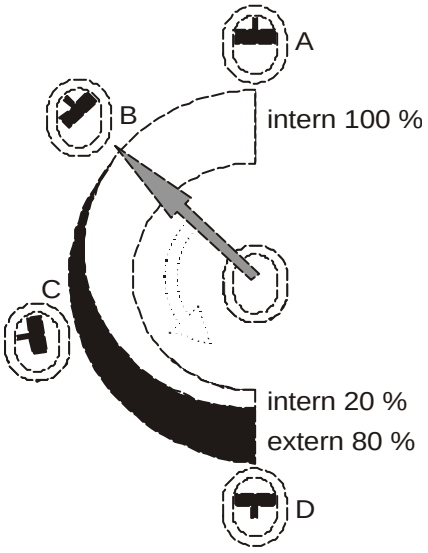
Caution: **Securely attach all tubing to prevent slipping.**

3.5. 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.

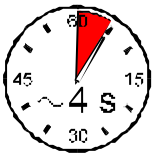
- Connect the circulator with mains power cable (10a) to the mains outlet (17).
- Connect the refrigerated circulator with mains power cable (10b) to the mains socket.

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.

- The unit performs a self-test. All segments of the 4-digit LED temperature DISPLAY and all indicator lights will illuminate (as illustrated on the left).

  The display "**OFF**" indicates the unit is ready to operate (standby mode).



Start:

- Press enter ↵ **for about 4 seconds.**
  The LED temperature DISPLAY indicates the actual bath temperature.

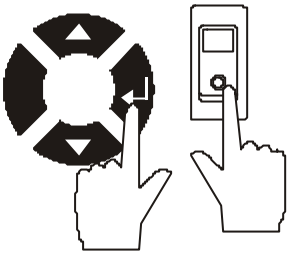
Stop:

- Turn the unit off with the mains power switch.

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

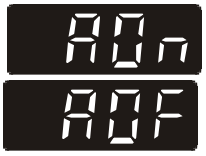
Caution:
If the circulator is turned off with the mains switch (1a), the refrigerating unit is not switched off simultaneously.
Turn off the refrigerating unit with the mains switch (1b) as well.
Danger of freezing when water is used as bath fluid!

4.3. Automatic / non-automatic start mode



❶ Keep depressed enter ↵ and
❷ turn on the circulator with the mains power switch.

For a short while the LED temperature 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“ on the LED temperature display. A complete shutdown of the main functional elements such as heater and circulating 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.

4.4. Setting the temperatures

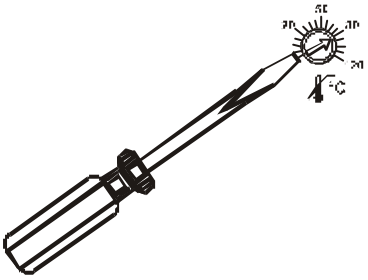
Factory setting:
25 °C

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

1. Press one of the keys ▼ ▲ for a short moment. The setpoint value instead of the actual value is indicated on the display for about 8 seconds. The value can now be changed.
2. Change value:
   Press ▲ to set a higher value.
   Press ▼ to set a lower value.
   Keep the keys depressed for the value to change fast.
3. Press enter ↵ to store the value.

4.5. 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.



Setting range: 20 °C to 120 °C

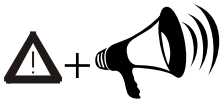
- Using a screwdriver turn the setting screw to the desired value.

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

Notice:
Check the safety installation for proper function 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).

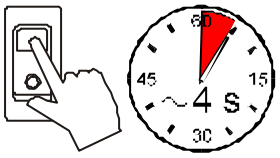
5. Troubleshooting guide / Error messages



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 LED temperature display indicates the cause for the alarm in form of a code.

- Defect of the working or safety temperature sensor.
- The safety temperature value lies below the working temperature setpoint.
  Set the excess temperature protection to a higher value.
- 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 wires of the working temperature sensor are interrupted or short-circuited.



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.

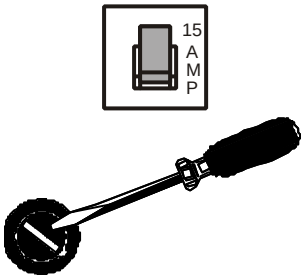
Disturbances that are not indicated.

Pump motor overload protection

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

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. Poor air circulation (distance to walls, dirt accumulated on condenser) may cause the motor to be disconnected. After a short cooling interval, the motor will be automatically reconnected.



Mains fuses:

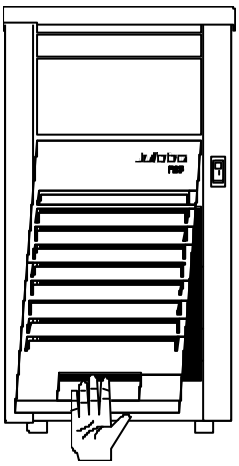
The mains fuses on the rear of the unit are safety cutouts – 15A.

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.

6. 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.

7. 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.
- Never operate the unit without bath fluid in the bath.
- 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.

8. 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 circulator 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.