



MAGIO™ MS



**Bridge, circulation, ultra-low refrigerated circulators,
ultra-low refrigerated circulators**

Translation of the original operating manual

30001639.J

2026/06/01
US

Foreword

Congratulations

You have made a good choice.

JULABO thanks you for the trust you have placed in us.

These operating instructions are intended to familiarize you with the operation and possible applications of our appliances. Please read the operating instructions carefully. Keep the operating instructions to hand at all times.

Copyright

The content of these operating instructions is protected by copyright.

Information, including texts, images and other content may not be reproduced, distributed, transmitted, stored, passed on or used in any other form without prior express written permission.

Illustrations in these operating instructions are for illustrative purposes only and are not necessarily true to scale.

The rights to the operating instructions and their contents belong exclusively to JULABO GmbH.

Imprint

Headquarters

JULABO GmbH

Gerhard-Juchheim-Strasse 1

77960 Seelbach

Seelbach, Germany

Phone: +49 7823 51-0

info.de@julabo.com

www.julabo.com

Branch Office

JULABO USA, Inc.

884 Marcon Boulevard

Allentown, PA 18109

Phone: +1(610) 231-0250

info@julabo.us

www.julabo.us

Table of contents

1	General information.....	8
1.1	About these operating instructions.....	8
1.2	Accessories.....	8
1.3	Symbols used.....	9
1.4	Operator obligations.....	9
1.5	Qualification of the operating personnel.....	9
2	Safety instructions.....	10
2.1	Meaning of the warnings.....	10
2.2	General safety instructions.....	11
2.3	Intended use.....	14
2.4	Foreseeable misuse.....	14
2.5	Safety markings.....	15
2.6	Attaching the safety label.....	16
2.7	Protective devices.....	16
3	Technical data.....	18
3.1	Technical data refrigerated circulators.....	20
3.2	Materials and media compatibility.....	25
3.2.1	Materials of the parts in contact with the medium.....	25
3.2.2	Temperature control media.....	25
3.3	Temperature control hoses.....	26
4	Structure and function.....	28
4.1	Product overview.....	28
4.2	Functional description.....	29
4.3	Operating and functional elements.....	30
4.4	Interfaces.....	32
4.4.1	Connection of external equipment.....	32
4.4.2	Stakei output.....	33
4.4.3	Pt100 temperature sensor connection.....	34
4.4.4	RS232-/RS485-Schnittstelle.....	35
4.4.5	Ethernet interface.....	36
4.4.6	USB-A interface.....	36
4.4.7	USB-B interface.....	36
4.4.8	CAN socket.....	37
4.4.9	Analog interfaces (option).....	37
5	Transportation.....	41

6	Set up.....	42
6.1	Set up the device at the place of operation.....	42
7	Commissioning.....	43
7.1	Setup wizard.....	43
7.2	Basic settings.....	43
7.2.1	Setting the language.....	43
7.2.2	Setting the date and time.....	44
7.2.3	Activating the autostart function.....	45
7.2.4	Setting the physical units.....	46
7.3	Fitting the bridge thermostat.....	47
7.4	Installing a circulator, refrigeration or ultra-low refrigerated circulator.....	48
7.5	Connecting the device to the power supply.....	49
7.5.1	Connecting the bridge or heated circulator.....	49
7.5.2	Connecting the refrigerated circulator or ultra-low refrigerated circulator.....	51
7.6	Connecting an external system.....	53
7.6.1	Connecting an external system with screw connections.....	55
7.6.2	Connecting an external system with hose clamps.....	57
7.7	Internal cooling coil.....	59
7.8	Setting the high temperature cut-off.....	60
7.9	Filling the device.....	62
7.10	Setting up the power supply.....	63
7.11	Setting the cooling mode.....	64
7.12	Set limit values.....	65
7.12.1	Setting setpoint limits.....	65
7.12.2	Setting temperature warning limits.....	66
7.12.3	Setting actual value limits.....	67
7.12.4	Band limits with external control.....	68
7.12.5	Setting the band limits.....	69
7.13	Connecting an external temperature sensor.....	70
8	Operation.....	71
8.1	User interface.....	71
8.2	Softkeys and status icons.....	72
8.3	Abbreviations.....	73
8.4	Alarm and warning messages.....	74
8.5	Operator messages.....	75
8.6	Main menu.....	75
8.6.1	Adjust safety menu.....	76

8.6.2	Determine thermodynamics menu.....	77
8.6.3	Connect device menu.....	78
8.6.4	Use programmer menu.....	79
8.6.5	Record data menu.....	79
8.6.6	Install device menu.....	80
8.6.7	Settings menu.....	80
8.6.8	Device access menu.....	81
8.6.9	Service menu.....	86
8.6.10	About the device menu.....	86
8.7	Switching on the device.....	87
8.8	Switching off the device.....	87
8.9	Starting temperature control.....	87
8.10	Record data.....	89
8.10.1	Recording measurement data.....	89
8.10.2	Reading out black box data.....	90
8.10.3	Display alarm memory.....	90
8.11	Thermodynamics.....	91
8.11.1	Control parameters.....	91
8.11.2	Optimizing temperature curves.....	93
8.11.3	Setting the controller.....	94
8.11.4	Limit cooling capacity and heating capacity.....	95
8.11.5	Setting the pump.....	95
8.12	Remote control of the device.....	96
8.12.1	Remote control of device via USB interface.....	96
8.12.2	Controlling the device remotely via the RS232 interface.....	97
8.12.3	Controlling the device remotely via the RS485 interface.....	99
8.12.4	Setting the EPROG input.....	100
8.12.5	Setting up the actual value source.....	101
8.12.6	Set up external setpoint specification.....	102
8.12.7	Setting the control value.....	103
8.12.8	Watchdog function.....	104
8.12.9	Handshake alternative.....	104
8.13	Working with the programmer.....	105
8.13.1	Setting the timer.....	106
8.13.2	Creating and editing tempering profiles.....	107
8.13.3	Export tempering profile.....	108
8.13.4	Importing a temperature control profile.....	109
8.13.5	Delete tempering profile.....	110

8.13.6 Set up profile series.....	111
8.13.7 Activating the programmer.....	112
8.14 Configuring signal outputs.....	113
8.14.1 Configuring the Stakei output.....	113
8.14.2 Configuring the signal outputs of the REG/EPROG socket.....	113
8.14.3 Configuring the alarm output.....	114
8.15 Activating the standby input.....	115
8.16 Adjusting the temperature sensor (ATC).....	115
8.16.1 Adjusting the internal temperature sensor.....	116
8.16.2 Adjusting the internal temperature sensor - multi-point adjustment.....	117
8.16.3 Adjusting the external temperature sensor.....	118
8.17 Reset device.....	119
9 Cleaning and maintenance.....	120
9.1 Maintenance intervals.....	120
9.2 Checking the function of the high temperature cut-off.....	120
9.3 Checking the function of the low level protection.....	122
9.4 Checking the safety markings.....	122
9.5 Replacing the detachable mains cable.....	124
9.6 Check and replace the main fuse.....	125
9.7 Check and replace the Stakei fuse.....	126
9.8 Emptying the appliance.....	127
9.9 Cleaning the appliance.....	128
9.10 Taking the device out of operation and storing it.....	129
9.11 Sending in the device.....	130
9.12 Warranty.....	131
10 Faults and troubleshooting.....	134
10.1 Alarm and warning messages.....	134
11 Disposal.....	140
12 Appendix.....	141
12.1 Interface commands.....	141
12.1.1 IN commands.....	142
12.1.2 OUT commands.....	146
12.2 Status messages.....	148

1 General information

1.1 About these operating instructions

These operating instructions contain important notices for the safe commissioning, operation and maintenance of the devices listed on the cover page.

It is intended for all persons who install, operate or maintain these appliances.



NOTE

Observe the safety instructions!

Read the operating instructions in full before commissioning the appliance and keep them for future reference.

1.2 Accessories

JULABO offers a wide range of accessories for the devices. The accessories are not described in these operating instructions.

The complete range of accessories for the devices described in these operating instructions can be found on our website www.julabo.com. Use the search function on the website.

1.3 Symbols used

Various symbols are used in these operating instructions to make them easier to understand. The list describes the symbols used.

- ▶ Prerequisite for the following procedure
- 1. Numbered action steps
- ⇒ Intermediate result for individual steps
- ✓ Final result of a procedure
- < > Terms in angle brackets indicate operating menus
- [] Terms in square brackets refer to keys, softkeys and buttons

1.4 Operator obligations

The operator must comply with the following obligations in order to ensure safe operation:

- The operator is responsible for the qualification of the operating personnel.
- The operator is responsible for instructing the operating personnel in the use of the device.
- Instruct the operating personnel at regular intervals about the hazards that arise during their activities and the measures to prevent them.
- The operator must ensure that the persons entrusted with operation, installation and maintenance have read and understood the operating instructions.
- The appliance may only be configured, installed, serviced and repaired by appropriately qualified personnel.
- If hazardous substances or substances that could become hazardous are used, the device may only be operated by persons who are qualified to handle these substances and the device.
- The operator must ensure that the appliance is checked for safe and proper condition at regular intervals depending on its use.
- The operator must ensure that the mains supply has a low impedance in order to avoid interference with devices that are operated on the same mains supply.
- The appliance is not suitable for children or persons with mental or severe physical disabilities.

1.5 Qualification of the operating personnel

Technical personnel are defined as persons who have successfully completed vocational training. They must be able to assess the work assigned to them and independently recognize and avoid potential hazards based on their technical training and professional experience.

2 Safety instructions

2.1 Meaning of the warnings

The operating instructions contain warnings intended to increase safety when using the appliance. Always follow the warnings.

A warning sign in signal color precedes the signal word. The colored signal word classifies the severity of the danger.



DANGER

The signal word indicates a hazard with a high degree of risk which, if not avoided, will result in death or serious injury.



WARNING

The signal word indicates a hazard with a medium degree of risk which, if not avoided, could result in death or serious injury.



CAUTION

The signal word indicates a hazard with a low level of risk which, if not avoided, may result in minor or moderate injury.



NOTE

The signal word indicates a potentially harmful situation. If it is not avoided, the system or objects in its vicinity may be damaged.

2.2 General safety instructions

The appliance is built in accordance with the state of the art and recognized safety regulations. Nevertheless, its use may pose a risk to the life and limb of the user or third parties.

Read and observe the following safety instructions before use.



CAUTION

Improper use!

If the appliance is used in a manner not intended by the manufacturer, the protection provided by the appliance may be impaired.



CAUTION

Take the appliance out of operation immediately and disconnect it from the power supply in the event of

- Leakage of medium (leakage),
- Unusual noises, odors or vibrations,
- Smoke, sparks or flames in or on the appliance.

Do not continue to operate the appliance. The appliance may only be put back into operation after it has been professionally checked and repaired by qualified personnel.



DANGER

Electric shock from electrical system!

Touching damaged live parts can lead to serious electric shocks and can injure or kill people.

- Have damaged insulation and components of the electrical system repaired immediately by a JULABO service technician or a qualified specialist workshop.
- Replace damaged mains cables immediately.
- Do not operate the appliance if the mains cable is damaged.
- When making a connection with a mains plug, this must always be freely accessible.



DANGER

Danger to life due to electric shock!

An electric shock can cause serious injury or even death.

- Only operate the appliance on a mains connection protected by an RCD (type B, $I_a = 30 \text{ mA}$).
- Only operate the appliance on mains sockets with a protective earth contact (PE).



DANGER

Danger to life due to electric shock!

An electric shock can cause serious injury or even death.

- Live parts are enclosed in the appliance housing. If the appliance housing is damaged, live parts can be touched.
- If the appliance housing is damaged, do not connect the appliance to the power supply!



DANGER

Danger to life due to electric shock!

An electric shock can cause serious injury or even death.

- The appliance may only be opened by a qualified electrician.
- Work on the electrical system may only be carried out by qualified electricians.



WARNING

Risk of burns from flammable heat transfer fluid!

If a flammable heat transfer fluid is used, it can ignite and cause severe burns on contact with the skin.

- Ensure that no ventilation openings are blocked.
- Do not smoke! No naked flames!
- When working in the vicinity of the device and the application system, do not use any electrical parts that can generate sparks.
- Drain and refill the heat transfer fluid when the device is idle, the heat transfer fluid is used with an open bath tank and the heat transfer fluid is highly volatile at ambient temperature.
- The surface temperature of a flammable heat transfer fluid must not reach the flash point of the heat transfer fluid under normal conditions and under conditions of a single fault.
- When using a flammable heat transfer fluid, attach a sign with the symbol  to the appliance.



WARNING

Hot surfaces!

The following parts and components can become hot during operation or remain hot for some time after operation:

- Heat transfer fluid
- Heating element
- Bath cover
- Bath surface

Contact may cause severe burns or scalds to hands, arms, face and limbs.

- Keep sufficient distance from hot surfaces and liquids.
- Wear suitable protective gloves.

**WARNING****Suspended loads!**

Falling loads can cause serious injury and damage the appliance.

- Do not stand under suspended loads.
- Transport the appliance with suitable and safe lifting gear.
- Wear personal protective clothing.

**WARNING****Maintenance and repair work!**

Improper maintenance and repair work endangers operational safety. This can result in serious injury or death.

- Only carry out work that is described in these operating instructions.
- Switch off the appliance and disconnect the mains plug before starting work.
- Repairs may only be carried out by JULABO service technicians or an authorized specialist workshop.

**NOTE****No liability if unsuitable temperature control media are used!**

Unsuitable temperature control media that have not been approved by JULABO can damage the device.

- Use temperature control media recommended by JULABO.
- Check parts in contact with the heat transfer fluid for compatibility before filling.
- Do not exceed the maximum permissible viscosity during operation.
- Consult JULABO before using a heat transfer fluid other than the recommended one.

**NOTE****Only use original JULABO spare parts!**

Use of non-original spare parts voids the JULABO warranty.

**NOTE****Only use original JULABO accessories!**

Use of unsuitable accessories voids the JULABO warranty.



NOTE

Wear personal protective equipment!

Missing or unsuitable personal protective equipment increases the risk of damage to health and injury to persons.

Examples of personal protective equipment are

- Work gloves
- safety shoes
- protective clothing
- respiratory protection
- hearing protection
- Face and eye protection
- Determine and provide personal protective equipment for the respective application.
- Only use personal protective equipment that is in proper condition and provides effective protection.
- Adapt personal protective equipment to the person, e.g. size.



NOTE

Keep safety signs in legible condition!

Safety signs on the appliance warn of hazards at danger points and are an important part of the appliance's safety equipment. Missing safety markings increase the risk of injury to persons.

- Clean dirty safety signs.
- Replace damaged and illegible safety signs immediately.

2.3 Intended use

JULABO circulators are laboratory devices designed for temperature control of liquid media in a bath vessel or with a cooling machine. An external temperature control circuit can be connected to the pump connections for constant temperature control of the media.

2.4 Foreseeable misuse

The appliance is not suitable for direct temperature control of foodstuffs and luxury foods or pharmaceutical and medical products.

The appliance is not suitable for use in a potentially explosive environment.

The appliance is not suitable for use in a corrosive or aggressive environment.

The device is not intended for use in residential areas. Interference to radio reception may occur.

2.5 Safety markings

The following safety labels are affixed to the appliance.

Symbol	Symbol Description	Location
	Warning of a danger zone. Observe operating instructions.	Rear of appliance
	Read the operating instructions before switching on.	Rear of appliance
	Warning of hot surface	Rear of appliance
	Warning of cold surface	Rear of appliance

2.6 Attaching the safety label

The following section only applies to appliances with natural refrigerants that are operated in the USA or Canada.

After unpacking the appliance, affix the enclosed safety stickers in the places shown.

2.7 Protective devices

Technical safety devices ensure safe operation. If a safety device is triggered, the operator is warned by a message on the display and an acoustic signal.

Adjustable high temperature cut-off

The high temperature cut-off prevents the heater from overheating.

If the measured temperature exceeds the set protection temperature, an error message appears on the display. The pump and heater are switched off. A restart is required.

Overheating protection

The overheating protection prevents the heater from overheating.

The protective mechanism triggers if the appliance detects a temperature difference of more than 20 K between the working temperature sensor and the safety temperature sensor. An error message appears on the display. A restart is required.

Overlevel warning

A level switch detects when the level of the temperature control liquid in the bath tank is too high and threatens to overflow. The appliance warns with a continuous warning tone and a warning message on the display.

The overlevel warning can be deactivated in the **<Adjust safety>** menu.

Low level protection

A level switch detects if the level of the temperature control liquid in the bath tank is too low. The appliance warns in two stages to prevent the heater from overheating and the pump from running dry.

- The low level warning is triggered when the liquid level in the bath tank has reached approximately half the fill level. An error message appears on the display. The temperature control fluid must be refilled.
- The low level alarm is triggered when the float reaches its lower limit stop. The appliance switches off the pump and heater. A continuous signal tone sounds. An error message appears on the display. A restart is required.

3 Technical data

Performance data measured according to DIN12876. Performance data apply at an ambient temperature of 20 °C.

The cooling capacity up to 20°C was measured with ethanol, above 20°C with thermal oil and may deviate with other temperature control media.

Group classification of the device according to CISPR 11:

- The device is a Group 1, Class A ISM device using radio frequency for internal purposes
- Class A: Use in an industrial electromagnetic environment

According to IEC 61010-1, the device is designed for safe operation under the following environmental conditions

- Indoor use
- Altitude up to 2000 m NHN
- Ambient temperature +5 ... +40 °C (unless otherwise specified in the technical data)
- Maximum relative humidity 80 % at air temperatures up to 31 °C, decreasing linearly up to 50 % relative humidity at 40 °C
- Pollution degree 2



NOTE

The maximum transportation temperature is +70°C.

Temperature data

Working temperature range	°C	+20 ... +300
Temperature stability	K	±0.01
Temperature resolution	K	0.01
Temperature control		ICC
Temperature setting		Digital
ATC sensor adjustment		10-point adjustment

Dimensions and weight

Total dimensions (W x D x H)	cm	23 (MS-Z: 34) x 19 x 36
Total weight	kg	7.2
Immersion depth	cm	15

Pump capacity

Pump capacity*	%	40	60	80	100
Volume flow	l/min	16	22	27	31
Delivery pressure	bar	0.24	0.44	0.68	0.92
Suction pressure	bar	0.16	0.27	0.37	0.40
Viscosity max.	cSt	70			

**Pump stages of the previous model correspond to the following pump performance:
1=55%, 2=65%, 3=75%, 4=85%*

Display

Display		7" TFT LCD
Display resolution		1024 x 600
Display function		10-point multi-touch function

Electrical connection data

Mains connection	V Hz	100-115 50/60		200-230 50/60	
	V Hz	100 50/60	115 50/60	200 50/60	230 50/60
Power consumption	A	11	11	10	11
Switzerland	A	-	-	10	10
Heating capacity	kW	0.8	1.0	1.6	2.0
Mains fuse 2x		T 15A 230 VAC 6.3 x 32 mm			
Fuse Stakei		T 0.5A 500 VAC 6.3 x 32 mm			

3.1 Technical data refrigerated circulators

Technical data MAGIO MS-310F

Temperature data

Operating temperature range	°C	-30 ... +200				
Cooling capacity	°C	+20	0	-10	-20	-30
- Lowest pump stage	kW	0.33	0.28	0.23	0.13	0.05
- Highest pump stage	kW	0.26	0.21	0.17	0.10	0.01
Mains connection	V	100	115	230		
Permissible voltage tolerance	%	±10	10	5		

Dimensions

Total dimensions (W x D x H)	cm	23 x 40 x 65				
Usable bath opening	cm	13 x 15				
Bath depth	cm	15				
Volume min. ... max.	l	3.0 ... 4.0				
Weight	kg	29				

Technical data MAGIO MS-449F

Temperature data

Working temperature range	°C	-30 ... +200				
Cooling capacity	°C	+20	0	-10	-20	-30
- Lowest pump stage	kW	0.46	0.37	0.29	0.22	0.08
- Highest pump stage	kW	0.40	0.31	0.24	0.19	0.05
Permissible voltage tolerance	%	±10				

Dimensions

Total dimensions (W x D x H)	cm	37x 59 x 69				
Usable bath opening	cm	28 x 35				
Bath depth	cm	20				
Volume min. ... max.	l	18.0 ... 26.0				
Weight	kg	42				

Technical data MAGIO MS-450F**Temperature data**

Working temperature range	°C	-30 ... +200				
Cooling capacity	°C	+20	0	-10	-20	-30
- Lowest pump stage	kW	0.46	0.39	0.29	0.17	0.07
- Highest pump stage	kW	0.40	0.33	0.24	0.12	0.01
Mains connection	V	100	115	230		
Permissible voltage tolerance	%	±10	10	5		

Dimensions

Total dimensions (W x D x H)	cm	23 x 40 x 65				
Usable bath opening	cm	13 x 15				
Bath depth	cm	15				
Volume min. ... max.	l	3.0 ... 4.0				
Weight	kg	29				

Technical data MAGIO MS-600F**Temperature data**

Working temperature range	°C	-30 ... +200					
Cooling capacity	°C	+20	+10	0	-10	-20	-30
	kW	0.60	0.52	0.44	0.27	0.16	0.04
Mains connection	V	100		115		230	
Permissible voltage tolerance	%	±10		10		±10	

Dimensions

Total dimensions (W x D x H)	cm	33 x 47 x 69				
Usable bath opening	cm	22 x 15				
Bath depth	cm	15				
Volume min. ... max.	l	5.0 ... 7.5				
Weight	kg	38.3				

Technical data MAGIO MS-601F							
Temperature data							
Working temperature range	°C	-35 ... +200					
Cooling capacity	°C	+20	+10	0	-10	-20	-30
	kW	0.60	0.52	0.44	0.27	0.16	0.04
Mains connection	V	100		115		230	
Permissible voltage tolerance	%	±10		10		±10	
Dimensions							
Total dimensions (W x D x H)	cm	33 x 47 x 74					
Usable bath opening	cm	22 x 15					
Bath depth	cm	20					
Volume min. ... max.	l	8.0 ... 10.0					
Weight	kg	41.5					

Technical data MAGIO MS-800F						
Temperature data						
Working temperature range	°C	-40 ... +200				
Cooling capacity	°C	+20	0	-20	-30	-40
	kW	0.86	0.76	0.41	0.28	0.14
Grid connection	V	100		115		230
Permissible voltage tolerance	%	±10		10		±10
Dimensions						
Total dimensions (W x D x H)	cm	33 x 47 x 70				
Usable bath opening	cm	18 x 13				
Bath depth	cm	15				
Volume min. ... max.	l	5.0 ... 7.5				
Weight	kg	44				

Technical data MAGIO MS-1000F**Temperature data**

Working temperature range	°C	-50 ... +200					
Cooling capacity	°C	+20	0	-10	-20	-30	-40
	kW	1.00	0.96	0.70	0.51	0.25	0.11
Mains connection	V	100			115		230
Permissible voltage tolerance	%	±10			10		±10

Dimensions

Total dimensions (W x D x H)	cm	42 x 49 x 70					
Usable bath opening	cm	18 x 13					
Bath depth	cm	15					
Volume min. ... max.	l	5.0 ... 7.5					
Weight	kg	54.1					

Technical data MAGIO MS-1200F**Temperature data**

Working temperature range	°C	-50 ... +200				
Cooling capacity	°C	+20	0	-20	-30	-40
	kW	1.26	1.11	0.64	0.39	0.22
Permissible voltage tolerance	%	±10				

Dimensions

Total dimensions (W x D x H)	cm	33 x 47 x 70					
Usable bath opening	cm	18 x 13					
Bath depth	cm	15					
Volume min. ... max.	l	5.0 ... 7.5					
Weight	kg	44					

Technical data MAGIO MS-1200FW

Temperature data

Working temperature range	°C	-50 ... +200				
Cooling capacity 1	°C	+20	0	-20	-30	-40
	kW	1.26	1.11	0.64	0.39	0.22
Cooling capacity 2	°C	+20	0	-20	-30	-40
	kW	1.20	1.05	0.58	0.33	0.16
Mains connection	V	100		115		230
Permissible voltage tolerance	%	±10		±10		±10

Dimensions

Total dimensions (W x D x H)	cm	33 x 47 x 70				
Usable bath opening	cm	18 x 13				
Bath depth	cm	15				
Volume min. ... max.	l	5.0 ... 7.5				
Weight	kg	44				

Technical data MAGIO MS-1000FF

Temperature data

Working temperature range	°C	-90 ... +100					
Cooling capacity	°C	+20	0	-20	-40	-60	-80
MAGIO MS 1000FF 50 Hz	kW	1.10	1.00	0.90	0.85	0.65	0.22
MAGIO MS 1000FF 60 Hz	kW	1.25	1.15	1.10	1.00	0.70	0.22
Permissible voltage tolerance	%	±10					

Dimensions

Total dimensions (W x D x H)	cm	50 x 60 x 94				
Usable bath opening	cm	13 x 15				
Bath depth	cm	16				
Volume min. ... max.	l	7.5 ... 10.0				
Weight	kg	106				

3.2 Materials and media compatibility

3.2.1 Materials of the parts in contact with the medium

The following table lists the materials that can come into contact with the heat transfer fluid.

The information can be used to check compatibility with the heat transfer fluid used.

- 1.4301 / 304 / S30400
- 1.4307 / 304L / S30403
- 1.4401 / 316 / S31600
- 1.4404 / 316L / S31603
- 1.4571 / 316Ti / S31635
- FPM / FKM 75

3.2.2 Temperature control media

The most important criterion when selecting the heat transfer fluid is the working temperature range in which the application is operated.

- Select the heat transfer fluid in such a way that its flash point cannot be exceeded at any time where it comes into contact with the ambient air.
- Recommended temperature control media and further information can be found on the JULABO website.



WARNING

Risk of burns from flammable heat transfer fluid!

If a flammable heat transfer fluid is used, it can ignite and cause severe burns on contact with the skin.

- Ensure that no ventilation openings are blocked.
- Do not smoke! No naked flames!
- When working in the vicinity of the device and the application system, do not use any electrical parts that can generate sparks.
- Drain and refill the heat transfer fluid when the device is idle, the heat transfer fluid is used with an open bath tank and the heat transfer fluid is highly volatile at ambient temperature.
- The surface temperature of a flammable heat transfer fluid must not reach the flash point of the heat transfer fluid under normal conditions and under conditions of a single fault. Set the high temperature cut-off at least 25 K below the flash point of the heat transfer fluid used. Set the high temperature cut-off as described in the chapter "Setting the high temperature cut-off".
- When using a flammable heat transfer fluid, attach a sign with the symbol  to the appliance.



NOTE

No liability if unsuitable temperature control media are used!

Unsuitable temperature control media that have not been approved by JULABO can damage the device.

- Use temperature control media recommended by JULABO.
- Check parts in contact with the heat transfer fluid for compatibility before filling.
- Do not exceed the maximum permissible viscosity during operation.
- Before using a heat transfer fluid other than the recommended one, consult JULABO.



NOTE

The addition of ammonia to the heat transfer fluid is not permitted!

Water quality requirements

When using water as a heat transfer fluid, the following water quality requirements apply:

- Calcium carbonate concentration: 0.7 - 1.4 mmol/l
- pH value: 6 - 8.5
- Ultrapure water / distilled water is suitable as a heat transfer fluid after adding 0.15 g NaHCO_3 per liter of water.



NOTE

The following types of water are unsuitable as a heat transfer fluid:

- Distilled, deionized, demineralized water
- seawater
- Water containing halogens or halogenides (e.g. chlorinated water or fluorinated water)
- Contaminated water
- water containing iron
- river water

3.3 Temperature control hoses

Temperature control hoses for connection to an external system must be matched to the working temperature range and the respective temperature control application.

You can find temperature control hoses for every area of application on our homepage.

Temperature control hoses must meet the following requirements:

- Temperature resistance
- Pressure resistance
- Suitable material properties for the heat transfer fluid used

**CAUTION****Risk of scalding due to damaged temperature control hoses!**

Hot heat transfer fluid can escape from damaged temperature control hoses and cause severe scalding on contact with the skin.

- Check temperature control hoses regularly to ensure they are intact.
- Replace damaged temperature control hoses immediately.
- Do not kink the temperature control hoses.
- Replace temperature control hoses regularly.
- Check pump connections for leaks.

**NOTE****Damage to the temperature control hoses due to kinking!**

Temperature control hoses are damaged by kinking and can leak.

- Lay the temperature control hoses in large radii.
- Avoid kinking the temperature control hoses.

**NOTE****Damage to the mains cable due to excessive temperature!**

The temperature control hoses must not touch the mains cable during operation.

- Keep the temperature control hoses and mains cable separate.

4 Structure and function

4.1 Product overview

The circulators can be combined with various baths and cooling machines.

Bridge thermostat



MAGIO MS-Z: Circulator with extendable telescopic bridge for mounting on open bath tanks.

Circulation thermostat



Circulator with closed stainless steel bath tank.

Example: MAGIO MS-BC4 for temperature control in the bath or an external application.

Refrigerated circulator



Circulator with a single-stage cooling machine for temperature control down to -50°C .

Example: MAGIO MS-1200FW

Ultra-low refrigerated circulator



Modified circulator with a two-stage cooling machine for temperature control down to -90°C .

Example: MAGIO MS-1000FF

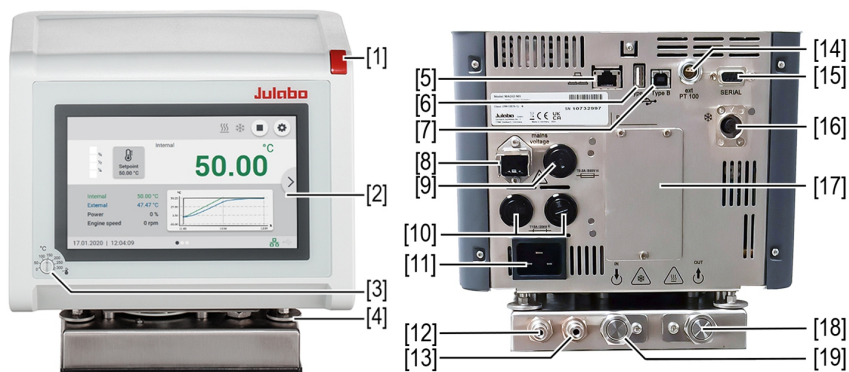
4.2 Functional description

The circulator is used for internal and external temperature control and operates in a temperature range between -90°C and $+300^{\circ}\text{C}$, depending on the device combination and accessories used.

Mounted on a bath tank, the circulator becomes a heated circulator. In combination with a cooling machine, it becomes a refrigerated circulator. In combination with an ultra-low cooling machine, the modified circulator becomes an ultra-low refrigerated circulator.

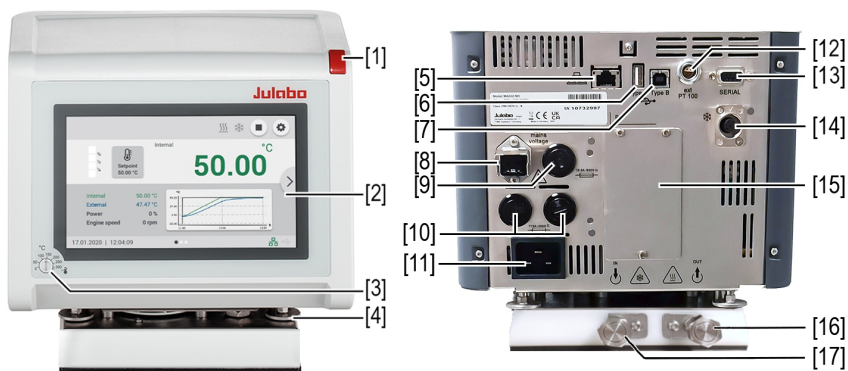
4.3 Operating and functional elements

This chapter describes the operating and functional elements and shows their position on the device.



Operating and functional elements

1. Power switch
2. Touch screen
3. High temperature cut-off setting
4. Fixing screw
5. Ethernet interface
6. USB-A interface
7. USB-B interface
8. Stakei output, fused
9. Fuse for Stakei output, resettable
10. Mains fuse
11. Mains connection
12. Water connection for cooling coil
13. Water connection for cooling coil
14. Interface for external temperature sensor
15. RS232 / RS485 interface
16. CAN socket for connection to cooling machine
17. Cover for electronics plug-in unit with analog connections (accessory)
18. Pump connection flow
19. Pump connection return flow



Operating and functional elements MAGIO MS cryogenic circulator

1. Mains switch
2. Touch screen
3. High temperature cut-off setting
4. Fixing screw
5. Ethernet interface
6. USB-A interface
7. USB-B interface
8. Stakei output, fused
9. Fuse for Stakei output, resettable
10. Mains fuse
11. Mains connection
12. Interface for external temperature sensor
13. RS232 / RS485 interface
14. CAN socket for connection to cooling machine
15. Cover for electronics plug-in unit with analog connections (accessory)
16. Pump connection flow
17. Pump connection return flow

4.4 Interfaces

This section describes the electronic interfaces available on the device with the corresponding pin assignments and connection values.

4.4.1 Connection of external equipment

External equipment connected to the device must be reinforced or double-insulated from the mains and the maximum voltage must be below the values of 30 VAC / 60 VDC.

Also observe the maximum voltage specifications in the technical specifications of the individual interfaces.

4.4.2 Stakei output

The Stakei output is a control output that can be adapted to solenoid valves with different tasks via the operating menu. The desired function is set and activated in the operating menu.



DANGER

Danger to life due to electric shock!

Mains voltage is present at the connection pins of the Stakei output, which can cause an electric shock if touched directly. An electric shock can lead to serious injuries, burns or even death.

- The connection may only be wired correctly by qualified electricians or appropriately trained personnel in compliance with the 5 safety rules.

The use of the Stakei output and its control functionality is the responsibility of the operator. The operator must ensure that the built-in functionality is monitored.

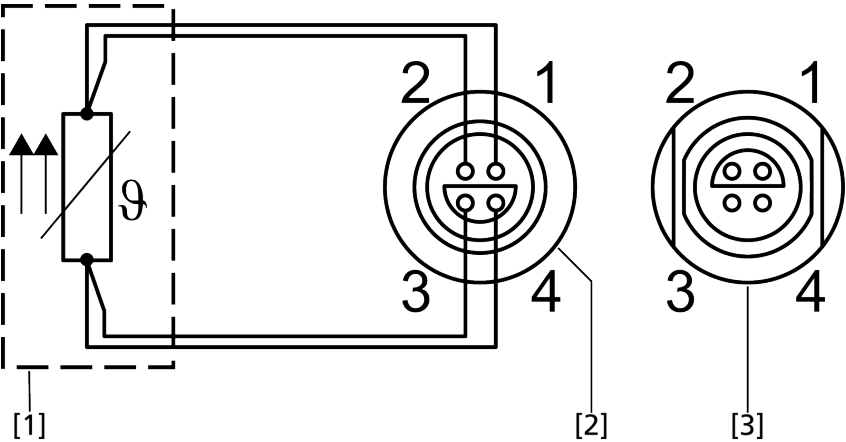
The Stakei output can be assigned the following functions:

- **Refill device:** The Stakei output switches when a low level warning is triggered. If the level of the temperature control fluid falls below a certain level, voltage is applied to the Stakei output and a connected refill device can be activated. This pumps tempering fluid into the bath tank until the level has reached a non-critical level again.
- **Cooling pulse:** The function is activated by the current cooling capacity of the appliance. If the temperature setpoint is lower than the actual temperature detected by the appliance, a pulse-width modulated signal is output via the Stakei output. This signal can be used to control a solenoid valve for pulsed counter-cooling via a cooling coil.
- **Backflow:** The function is used as backflow protection in a system in which the connected application is higher than the circulator. When the pump is running, voltage is present at the Stakei output and a non-return valve inserted between the circulator and the application can be activated. This prevents temperature control fluid from flowing back from the application into the bath tank when the pump is not running and causing an overflow.

Technical data	Stakei output
Mains connection 100-115 V	100-115 V / 0.5 A
Mains connection 200-230 V	200-230 V / 0.5 A

4.4.3 Pt100 temperature sensor connection

An external Pt100 temperature sensor is connected to the ext. Pt100 socket. The following section describes the wiring of the socket and the connecting cable of the temperature sensor.



Connection of external Pt100 temperature sensor

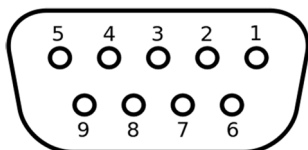
- 1. Pt100 temperature sensor
- 2. Plug, view solder side
- 3. Connection socket on the device

PIN assignment Pt100 connection

pin	signal
1	I+
2	U+
3	U-
4	I-

4.4.4 RS232-/RS485-Schnittstelle

The RS232/RS485 interface is a 9-pin D-Sub socket for connecting the device to a PC.



RS232/RS485 socket

Pin assignment RS232 interface

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

Pins 1, 4, 6 and 9 are reserved. Do not use.

Pin assignment RS485 interface

Pin	Assignment	Pin	Assignment
Pin 3	B	Pin 6	+5 V (max. 50 mA)
Pin 5	0 V Signal GND	Pin 8	A

Pins 1, 2, 4, 7 and 9 are reserved. Do not use.

Factory setting RS232/RS485 interface

Parameters	Parameter Value
Parity	even
Baud rate	4800 baud
Handshake (RS232)	Hardware address
Address (RS485)	0
Data bit	7
Stop bit	1

4.4.5 Ethernet interface

The device can be connected to a network or directly to a PC via the Ethernet interface.

Technical data Ethernet interface

Parameters	Value	Unit
Voltage level	3.3	VDC

4.4.6 USB-A interface

The device has a USB-A interface. A USB stick can be connected to the USB-A interface. The device can read data from and save data to the USB stick.

Technical data USB-A interface

Parameters	Value	Unit of measurement
Output voltage	5	VDC
Maximum current	500	mA

4.4.7 USB-B interface

The device has a USB-B interface. A computer can be connected to the USB-B interface as a higher-level control system.

Technical data USB-B interface

Parameters	Value	Unit of measurement
Output voltage	5	VDC
Maximum current	500	mA

4.4.8 CAN socket

The device has a CAN socket as a connection for cooling machines. This is used for communication between the cooling machine and the circulator.

Technical data CAN socket

Parameters	Parameter Value	Unit
Output voltage	24	VDC
Maximum current	500	mA

4.4.9 Analog interfaces (option)

The analog interfaces are optionally installed ex works.



Plug-in unit with analog connections

1. Alarm output
2. REG/EPROG socket
3. Standby input

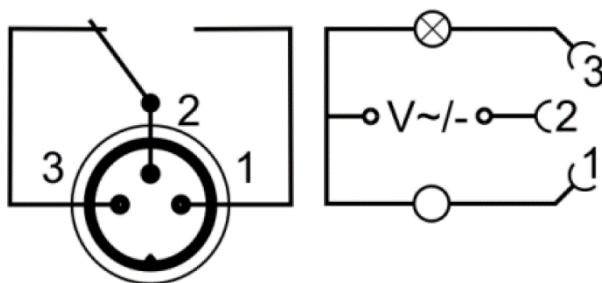
**NOTE****Applying external voltages or feeding external current to the analog outputs**

The analog outputs (0...10 V and 4...20 mA) are intended exclusively for signal output. Applying external voltages or supplying external current to these contacts can lead to permanent destruction of the output stage.

- **No external voltage:** Ensure that no external voltage sources (e.g. power supply units or active sensors) are connected directly to the outputs.
- **Potential equalization:** Check the potential conditions before connection to avoid equalizing currents via the signal lines.
- **Wiring check:** Before switching on the supply voltage, check the correct assignment of the terminals according to the wiring diagram.
- **Protective circuit:** If there is a risk of inductive coupling or overvoltage, the use of suitable overvoltage protection modules (e.g. from Phoenix Contact) or isolating amplifiers is recommended.

4.4.9.1 Alarm output

The alarm output is designed as a potential-free changeover contact that can be used to switch an externally connected circuit.



Alarm output diagram

A defined status can be selected as the trigger for the **<Alarm output>** in the **<Analog module>** menu.

Pin 2 and pin 3 are connected when the respective status is reached:

- Standby
- alarm
- Alarm + Standby
- Pump on

When the respective status is reached, pin 1 and pin 2 are connected:

- Standby/Inverse
- Alarm/Inverse
- Alarm + Standby/Inverse
- Pump on/inverse

Technical data alarm output

Alarm output parameter	Parameter Value	Unit
Maximum switching capacity	30 /25	W / VA
Maximum switching voltage	30 /25	VDC / VAC
Maximum switching current	1	A

4.4.9.2 REG/EPROG socket

The REG/EPROG socket has three signal outputs and one signal input.

A connected signal generator can specify the setpoint temperature or the power as a control variable via the program generator input. The input signal can be a voltage source or a current source.

The signal outputs can be used in parallel. Two of the three output channels are designed as voltage outputs, the third as a current output.

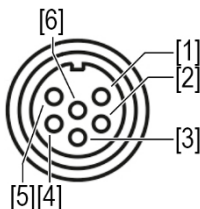


Diagram REG/EPROG socket

1. Voltage output channel 1 (0-10 VDC, max. 10 mA)
2. Voltage output channel 2 (0-10 VDC, max. 10 mA)
3. Gnd for outputs (0 V)
4. EPROG programmer (0-10 VDC/0-20 mA, max. 24 VDC)
5. Current output channel 3 (4-20 mA/0-20 mA, max. 24 VDC)
6. Gnd for EPROG programmer (0 V)

4.4.9.3 Standby input

The device can be switched to standby mode by an external signal transmitter via the standby socket.

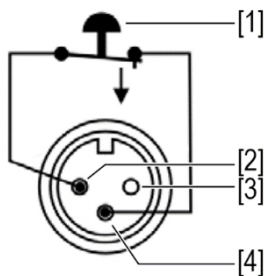


Diagram of standby socket

1. External contact, e.g. switch
2. Pin 3
3. Pin 1
4. Pin 2

5 Transportation



CAUTION

Hot / cold surface!

The heating element can still be hot even after the appliance has been switched off and can cause burns if touched.

- Wear temperature-resistant protective gloves.
- Allow the appliance to cool down to room temperature after switching off.



CAUTION

Risk of crushing due to falling appliance!

An unsecured appliance can fall down and cause crushing injuries if transported incorrectly.

- Secure the appliance against tipping and falling during transportation.
- Secure loose parts against falling during transportation.
- Transport the appliance in an upright position using a suitable means of transportation.
- Wear safety shoes.

The circulator can be transported together with the cooling machine when assembled.

Prerequisites

- ▶ The appliance is switched off and disconnected from the mains.
- ▶ The heat transfer fluid has been drained.
- ▶ All external connections have been removed.

Procedure

1. Lift the appliance by the recessed grips on the cooling machine - using two people if necessary - and place it in the middle of the transport trolley.

! NOTE See technical data for weight specifications.

2. Secure the appliance in the middle of the transport trolley with straps to prevent it from tipping over.
 3. Place loose parts, such as cables, on the transport trolley with the appliance.
- ✓ The appliance is ready for transportation and can be transported safely to its installation site.

6 Set up

6.1 Set up the device at the place of operation

Prerequisites

- ▶ The device has been transported to the place of operation.
- ▶ The size and infrastructure of the place of operation are suitable for operating the device.

! **NOTE** Recommended minimum distance of 1 m from neighboring devices to avoid electromagnetic interference.

Procedure

1. Set up the appliance on a flat, smooth, non-flammable surface.

! **NOTE**

- Ensure that the appliance is stable.
- Leave at least 20 cm of free space in front of and behind the appliance.
- All ventilation openings in the casing must not be covered.
- The refrigerant cycle must not be damaged.
- At high temperatures, gases may be produced depending on the heat transfer fluid. Extraction may be necessary under certain circumstances.

- ✓ The appliance is installed at the place of operation.

7 Commissioning

7.1 Setup wizard

The setup wizard starts when the device is switched on for the first time. It guides the user through the basic settings. Once the setup wizard is complete, the device is set up.

Commissioning is initially carried out according to the instructions in this operating manual. The system may only be started after being prompted to do so in the corresponding chapter.

7.2 Basic settings

7.2.1 Setting the language

The language of the user interface can be switched to one of the available languages.

Prerequisites

- The device is switched on.

Procedure

1. Call up the **<Main menu>**.
 2. In the **<Settings>** submenu, select the **<Language>** menu item.
 - ⇒ The **<Language>** submenu lists all the languages installed on the device.
 3. Select the desired language.
- ✓ The selected language is activated immediately.

7.2.2 Setting the date and time

The date and time are preset at the factory. This section describes how to change the date and time.

Prerequisites

- The device is switched on.

Procedure

1. Call up the **<Main menu>**.
 2. In the **<Settings>** submenu, select the **<Date/Time>** menu item.
 - ⇒ The submenu shows the currently set date and time as well as selectable display formats.
 3. Set the date and time.
 4. Save settings with **[OK]**.
- ✓ The date and time are set.

7.2.3 Activating the autostart function

The autostart function enables temperature control to be started directly with the mains switch or via an intermediate timer.

The appliance is configured at the factory so that it switches to a safe operating state in the event of a power failure. The autostart function is deactivated. "OFF" appears on the display. The cooling unit, the heater and the pump motor are disconnected from the mains voltage.



WARNING

Unattended auto-start of the appliance!

When commissioning the appliance, ensure that an unattended auto-start of the appliance, e.g. after a power failure, cannot pose a risk to persons or systems.

- Ensure that the protective and warning devices on the appliance are functioning correctly.

Prerequisites

- The appliance is switched on.

Procedure

1. Call up the **<Main menu>**.
 2. In the **<Adjust safety>** submenu, select the **<Autostart>** menu item.
 3. Activate the setting with the **<Yes>** selection field.
- ✓ The autostart function is activated. The next time it is switched on, temperature control starts immediately with the preset values. A timer can be interposed and programmed. In this case, the mains switch of the appliance must remain switched on.

7.2.4 Setting the physical units

The physical units for temperature, pressure and flow rate can be set in the menu.

Prerequisites

- The device is switched on.

Procedure

1. Call up the **<Main menu>**.
 2. Call up the **<Units>** menu item in the **<Settings>** submenu.
 3. Set the desired units by activating the selection fields.
- ✓ The physical units are set.

7.3 Fitting the bridge thermostat

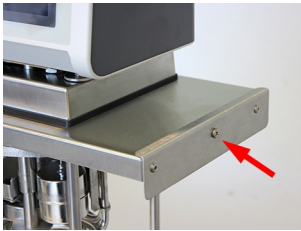
With the extendable Teleksop bridge, the circulator can be mounted on open bath tubs with a width of 33 cm to 68 cm.

Requirements

- ▶ Phillips screwdriver, size 2.
- ▶ The circulator is equipped with the telescopic bridge.
- ▶ The bath tank is empty.

Procedure

1. Remove the two screws on the sides of the telescopic bridge.



2. Pull the telescopic bridge apart.



3. Carefully insert the circulator into the bath tank.



4. Push the telescopic bridge together until the side angle plates rest on the outside of the edge of the bath tank.
- ✓ The circulator is mounted on the open bath tank as a bridge thermostat.

7.4 Installing a circulator, refrigeration or ultra-low refrigerated circulator

In the case of a circulator, a refrigeration or ultra-low refrigerated circulator, the circulator is mounted on the closed bath or on the refrigeration/ ultra-low cooling machine.

If the circulator is removed, e.g. due to a change of appliance or for servicing purposes, it can then be easily reinstalled with the connection box.

Requirements

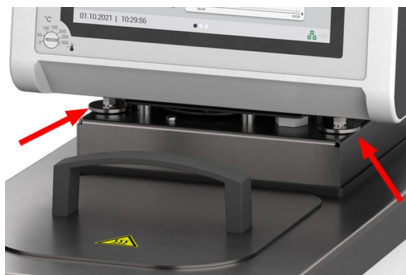
- ▶ Open-end wrench, size 7 mm.
- ▶ The circulator is ready for mounting on a closed bath, a refrigeration or ultra-low cooling machine.
- ▶ The bath is empty.

Procedure

1. Carefully insert the circulator into the bath. Align the four holes of the connection box with the four threaded sleeves of the bath.



2. Position the fixing screws in the holes of the plenum box.
3. Tighten the fixing screws.



4. Check the correct fit and seal.
- ✓ The circulation thermostat or refrigeration/refrigeration circulation thermostat is fitted.

7.5 Connecting the device to the power supply

7.5.1 Connecting the bridge or heated circulator

This section describes the electrical connection of the device with mains plug.



DANGER

Electric shock from electrical system!

Touching damaged live parts can lead to serious electric shocks and can injure or kill people.

- Have damaged insulation and components of the electrical system repaired immediately by a JULABO service technician or a qualified specialist workshop.
- Replace damaged mains cables immediately.
- Do not operate the appliance if the mains cable is damaged.
- When making a connection with a mains plug, this must always be freely accessible.



DANGER

Danger to life due to electric shock!

An electric shock can cause serious injury or even death.

- Only operate the appliance on a mains connection protected by an RCD (type B, $I_a = 30 \text{ mA}$).
- Only operate the appliance on mains sockets with a protective earth contact (PE).



DANGER

Danger to life due to electric shock!

An electric shock can cause serious injury or even death.

- Live parts are enclosed in the appliance housing. If the appliance housing is damaged, live parts can be touched.
- If the appliance housing is damaged, do not connect the appliance to the power supply!



NOTE

Damage to the mains cable due to excessive temperature!

The mains cable must not touch any parts that become hot during operation.

- Keep the mains cable away from surfaces that can become hot.

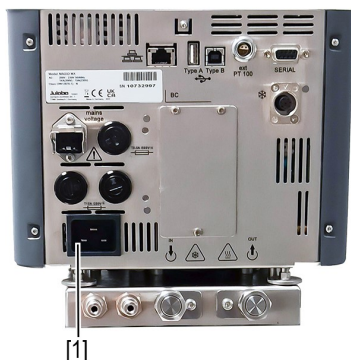
Prerequisites

- ▶ The circulator is installed as a bridge or heated circulator.
- ▶ The mains cable is ready.

! NOTE If the 200-230 V 50/60 Hz variant is used in the United States or Canada, the JULABO mains cable USA 3x12AWG (order number 7.901.2694) must be used. This power cable is not included in the scope of delivery.

Procedure

1. Insert the appliance plug of the supplied mains cable into the mains connection socket on the back of the appliance [1].



2. Insert the plug of the mains cable into the socket.
- ✓ The appliance is electrically connected.

7.5.2 Connecting the refrigerated circulator or ultra-low refrigerated circulator

This section describes how to connect the circulator as a refrigerated circulator or ultra-low refrigerated circulator.



DANGER

Electric shock from electrical system!

Touching damaged live parts can lead to serious electric shocks and can injure or kill people.

- Have damaged insulation and components of the electrical system repaired immediately by a JULABO service technician or a qualified specialist workshop.
- Replace damaged mains cables immediately.
- Do not operate the appliance if the mains cable is damaged.
- When making a connection with a mains plug, this must always be freely accessible.



DANGER

Danger to life due to electric shock!

An electric shock can cause serious injury or even death.

- Only operate the appliance on a mains connection protected by an RCD (type B, $I_a = 30 \text{ mA}$).
- Only operate the appliance on mains sockets with a protective earth contact (PE).



DANGER

Danger to life due to electric shock!

An electric shock can cause serious injury or even death.

- Live parts are enclosed in the appliance housing. If the appliance housing is damaged, live parts can be touched.
- If the appliance housing is damaged, do not connect the appliance to the power supply!



NOTE

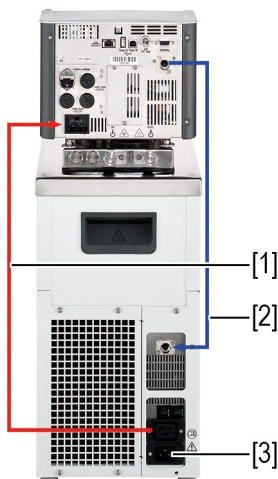
Damage to the mains cable due to excessive temperature!

The mains cable must not touch any parts that become hot during operation.

- Keep the mains cable away from surfaces that can become hot.

Prerequisites

- ▶ The circulator is mounted on the cooling machine.
- ▶ The connection cable, mains cable and CAN bus cable are ready.



Procedure

1. Connect the circulator to the cooling machine using the connecting cable [1].
 2. Connect the CAN sockets of the two devices via the CAN bus cable [2].
 3. Connect the cooling machine to the mains via the mains cable [3].
- ✓ The appliance is electrically connected. Alternatively, both appliances can be connected to separate power circuits. If necessary, the power supply must be set up in the device settings.

7.6 Connecting an external system

The appliance is used to control the temperature of external closed systems in a temperature control circuit. An external system is connected to the pump connections of the appliance.



CAUTION

Risk of scalding due to damaged temperature control hoses!

Hot heat transfer fluid can escape from damaged temperature control hoses and cause severe scalding on contact with the skin.

- Check temperature control hoses regularly to ensure they are intact.
- Replace damaged temperature control hoses immediately.
- Do not kink the temperature control hoses.
- Replace temperature control hoses regularly.
- Check pump connections for leaks.



CAUTION

Injuries and material damage due to incompatible externally connected system!

If the temperature range and/or pressure parameters of an externally connected system do not match the appliance, this can lead to damage to individual components or even failure of the entire system. Hot heat transfer fluid can escape under high pressure or cause components to burst.

- Before making the connection, check whether the external system is compatible with the specifications of the temperature control unit.
- If an external system is connected that is not designed for the maximum pressure of the appliance (e.g. glass apparatus), limit the delivery rate of the pump in the settings and take suitable measures to limit the pressure (e.g. pressure relief devices).
- Allow for sufficient safety reserves. System-related pressure peaks can briefly exceed the specified maximum delivery pressure.
- Do not install shut-off valves in the return flow.
- Check the pump settings before and during commissioning and adjust if necessary.
- If an external system is connected, the safety of the entire system is the responsibility of the operator.



NOTE

Hot pump connections!

The pump connections can become very hot during operation. Heat-sensitive parts or pipes can be damaged if touched.

- Pump connections must be free during operation.
- No loose parts or lines must come into contact with the pump connections during operation.



NOTE

Overflow of heat transfer fluid through externally connected systems!

If the externally connected system is higher than the temperature control system, heat transfer fluid may flow back and overflow when the system is switched off.

- Arrange the connected external system at the same or lower level than the temperature control system.
- Install a shut-off valve or solenoid valve as a backflow preventer between the external system and the temperature control system.



NOTE

Damage to the temperature control hoses due to kinking!

Temperature control hoses are damaged by kinking and can leak.

- Lay the temperature control hoses in large radii.
- Avoid kinking the temperature control hoses.



NOTE

Material damage due to overflow of the heat transfer fluid!

The maximum filling volume of the system can be exceeded if the heat transfer fluid expands during operation. Uncontrolled escaping heat transfer fluid can cause damage to the appliance.

- Do not fill the appliance unattended.
- Connect the hose to the overflow and guide it into a suitable collecting vessel.
- Never close the overflow at the back of the appliance!
- Allow for approx. 12 % volume change per 100 °C temperature change.

7.6.1 Connecting an external system with screw connections

This section describes how to connect an external closed system with screw connections to the appliance.



NOTE

Avoid seizing of the stainless steel connections

Apply an anti-seize agent (e.g. Loctite 8009) to the threads before assembly. This reduces friction and prevents the stainless steel connections from seizing.

Requirements

- ▶ Two open-end wrenches, size 14 mm and 19 mm
- ▶ Torque wrench
- ▶ The temperature control hoses of the external system are equipped with an M16x1 internal thread and conical seal.

Procedure

1. Remove the union nuts from the pump connections.



2. Remove the sealing plugs.



3. Apply an anti-seize agent to the threads.

! **NOTE** Do not apply anti-seize agent to the sealing surfaces.

4. Screw the hoses onto the pump connections by hand.

! **NOTE** Pay attention to the flow and return positions.



5. Tighten the pump connections to a recommended torque of 20 Nm using the 19 mm open-end wrench. Hold the nut (SW 14) with the open-end wrench.

! **NOTE** The maximum tightening torque is **25 Nm**. A higher torque can damage the connection.



- ✓ The external system is connected.

! **NOTE** If the external system is dismantled, the pump connections must be closed again with the sealing plugs so that no temperature control fluid can spray out during operation.

7.6.2 Connecting an external system with hose clamps

This section describes how to connect an external, closed system with hose olives to the device.



NOTE

Avoid seizing of the stainless steel connections

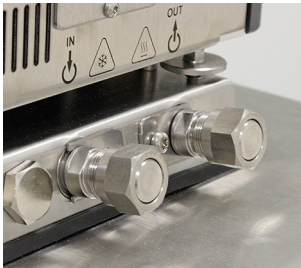
Apply an anti-seize agent (e.g. Loctite 8009) to the threads before assembly. This reduces friction and prevents the stainless steel connections from seizing.

Requirements

- ▶ Two open-end wrenches, size 14 mm and 19 mm
- ▶ Torque wrench
- ▶ Hose clamps for mounting the external system are available.

Procedure

1. Remove the union nuts from the pump connections.



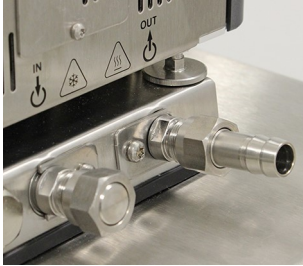
2. Remove the sealing plugs.



3. Apply an anti-seize agent to the threads.

! **NOTE** Do not apply anti-seize agent to the sealing surfaces.

4. Push one hose olive through each union nut.
5. Fit the hose olives to the pump connections using the union nuts.



6. Tighten the pump connections to a recommended torque of 20 Nm using the 19 mm open-end wrench. Hold the nut (SW 14) with the open-end wrench.

! **NOTE** The maximum tightening torque is **25 Nm**. A higher torque can damage the connection.



7. Attach the hoses of the external system to the hose olives.

! **NOTE** Pay attention to the flow and return positions.

8. Secure the hoses against slipping with hose clamps.

! **NOTE** Check the hoses for firm and tight fit.

- ✓ The external system is connected.

! **NOTE** If the external system is dismantled, the pump connections must be closed again with the sealing plugs so that no temperature control fluid can spray out during operation.

7.7 Internal cooling coil

For work close to the ambient temperature, some appliances are equipped with an internal cooling coil. This serves to compensate for the circulator's own temperature.

The cooling capacity depends on the inlet temperature of the cooling water.

Cooling hoses intended for connection must be selected in such a way that damage caused by pressure and the expected temperatures can be ruled out.

Technical data		
Operating temperature range	°C	+5 ... +80
Max. permissible pressure	bar	4
Outlet		unpressurized



NOTE

Corrosion and scaling due to unsuitable cooling water!

Unsuitable cooling water can lead to calcification or corrosion of system-relevant components and thus to failure of the appliance.

- Observe the recommended cooling water quality
- Do not use hard water, water containing iron, water containing chlorine, distilled and deionized water, seawater, water from cooling towers or rivers.
- Optionally, use an upstream cooling water filter (available from JULABO).

Requirements

- Suitable cooling water hoses are available.

Procedure

1. Connect the cooling water hoses to the cooling coil.
2. Secure the cooling water hoses with hose clamps to prevent abrasion.

! **NOTE** Ensure that they are tight and firmly seated.

- ✓ The cooling coil can be used.

7.8 Setting the high temperature cut-off

The temperature for the high temperature cut-off must be set before each new temperature control task. The set value must be below the flash point and at least 25 K below the focal point of the heat transfer fluid used. The surface temperature of the heat transfer fluid must not exceed the flash point at any time. An alarm is triggered if the set value is exceeded.

Requirements

- ▶ Slotted screwdriver size 3
- ▶ The device is connected

Procedure

1. Switch on the appliance.

 **NOTE** If no temperature control fluid has been added, the under-temperature alarm is triggered.

 **NOTE** Depending on the presetting, the high temperature cut-off alarm is displayed.

2. Call up the <Main menu>.
3. In the <Settings>/<Customize start screen> submenu, activate the **[High temperature cut-off]** display value.
4. Call up the start screen.
5. Swipe sideways to call up the home screen view, which displays the T_{Protect} high temperature cut-off value.
6. Use the screwdriver to set the high temperature cut-off.
 - ⇒ The set value is shown on the display.
 - ⇒ The set value is active immediately.

! NOTE The set value must be below the flash point and at least 25 K below the flash point of the heat transfer fluid used.



7. Switch off the appliance so that the alarm messages are reset.
- ✓ The high temperature cut-off is set.

7.9 Filling the device

This section describes how to fill the device with heat transfer fluid during commissioning.

The filling quantity can be found in the technical data.



NOTE

Material damage due to overflow of the heat transfer fluid!

The maximum filling volume of the system can be exceeded if the heat transfer fluid expands during operation. Uncontrolled escaping heat transfer fluid can cause damage to the appliance.

- Do not fill the appliance unattended.
- Connect the hose to the overflow and guide it into a suitable collecting vessel.
- Never close the overflow at the back of the appliance!
- Allow for approx. 12 % volume change per 100 °C temperature change.

Prerequisites

- The drain is closed.
- The appliance is switched off.

Procedure

1. Remove the bath cover.
2. Fill with heat transfer fluid up to about halfway

! NOTE As the temperature rises, the temperature control medium expands and can overflow.

! NOTE If the temperature falls, the low level protection may be triggered and interrupt the temperature control process.

3. Switch on the appliance and start the temperature control process.
4. Monitor the fill level and, if necessary, adjust it by refilling or draining.

! NOTE The level of the heat transfer fluid in the bath tank should be above the heating coil of the circulator or above the cooling coil of the cooling machine at the working temperature and with the temperature control product inserted.

5. Close the bath opening with the bath lid.
- ✓ The appliance is filled with heat transfer fluid.

7.10 Setting up the power supply

The power supply is configured at the factory. The circulator is supplied with power from the cooling machine. Alternatively, both devices can be connected to separate power circuits with one power cable each. The type of power supply is set in the menu.

Prerequisites

- ▶ A cooling machine is connected to the circulator.
- ▶ Both appliances are switched on.

Procedure

1. Call up the **<Main menu>**.
 2. In the **<Install device>** submenu, select the **<Power supply>** menu item.
 3. Select the type of power supply:
 - **[Via cooling machine]** for connection to the same mains supply
 - **[Separate supply]** for connection to separate power grids
- ✓ The power supply for the cooling circulator is set up.

7.11 Setting the cooling mode

The cooling mode is preset to automatic mode at the factory. Three different cooling modes can be selected in the operating menu:

- Automatic mode: The control unit calculates the duration of the heating process if the setpoint jumps by more than +5 K. Based on the calculated heating time, the control unit decides whether or not to switch off the cooling machine depending on demand.
- Always switched on: The cooling machine is permanently switched on during operation.
- Always switched off: The cooling machine remains switched off during operation.

Prerequisites

- ▶ A cooling machine is connected to the circulator.
- ▶ Both appliances are switched on.

Procedure

1. Call up the **<Main menu>**.
2. Call up the **<Refrigeration mode>** menu item in the **<Install device>** submenu.

 **NOTE** The menu item can only be called up if the circulator detects a connected cooling machine.

3. Select the desired cooling mode.
- ✓ The cooling mode is set.

7.12 Set limit values

7.12.1 Setting setpoint limits

The temperature setpoint limits [Setpoint max.] and [Setpoint min.] define the upper and lower limits of the adjustable setpoint temperature range.

The setpoint limit for the pump defines the upper limit for the pump output that can be set in the <Determine thermal dynamics> menu. The lower limit value is set to 40% at the factory.

Prerequisites

- The device is switched on.

Procedure

1. Call up the **<Main menu>**.
2. Call up the **<Adjust safety>** submenu.

 **NOTE** Only values that are within the performance values of the device can be entered.

3. Enter the setpoint limit [Setpoint **max.**] and confirm with [✓].
 4. Enter the setpoint limit [Setpoint **min.**] and confirm with [✓].
 5. Enter the setpoint limit [**Pump max.**] and confirm with [✓].
- ✓ The setpoint limits are set.

7.12.2 Setting temperature warning limits

Low temperature and high temperature are adjustable temperature limits that serve as warning limits for the device. If one of the warning limits is exceeded during temperature control, the device warns with an acoustic signal and a warning message on the display.

Prerequisites

- The device is switched on.

Procedure

1. Call up the **<Main menu>**.
2. Call up the **<Adjust safety>** submenu.

 **NOTE** Only values that are within the performance values of the appliance can be entered.

3. Enter the limit value for the **<overtemperature alarm>** and confirm with [**✓**].
 4. Enter the limit value for the **<overtemperature warning>** and confirm with [**✓**] to confirm.
 5. Enter the limit value for the **<subtemperature alarm>** and confirm with [**✓**] to confirm.
 6. Enter the limit value for the **<subtemperature warning>** and confirm with [**✓**].
- ✓ The temperature limits are set.

7.12.3 Setting actual value limits

The **Internal minimum** and **Internal maximum** actual value limits are effective in **External control** mode. They define the limits for the expected temperature in the internal bath. The temperature controller cannot exceed these limits. Under certain circumstances, the external setpoint may not be reached.

Prerequisites

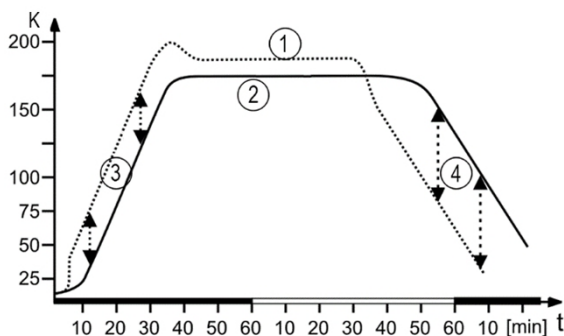
- The device is switched on

How to proceed

1. Call up the **<Main menu>**.
 2. Call up the **<Adjust safety>** submenu.
 3. Enter the limit value **<Internal max.>** and **confirm** with [✓].
 4. Enter the limit value **<Internal min.>** and **confirm** with [✓].
- ✓ The actual value limits are set and immediately active.

7.12.4 Band limits with external control

If an external system is controlled, a temperature difference occurs during both the heating phase and the cooling phase due to inertia. The curve illustrates the relationship between the internal and external temperature curve.



Schematic temperature curve internal / external

1. Internal temperature curve
2. External system temperature curve
3. Upper band limit
4. Lower belt limit

Maximum permissible temperature differences can be set for the heating phase and the cooling phase in order to maintain a gentle temperature in the external system or, for example, to protect a glass reactor from thermal stresses.

7.12.5 Setting the band limits

The upper and lower band limits are specified in K. In the heating phase, the set value is added to the external actual value. In the cooling phase, the set value is subtracted from the external actual value. The setting range is 1 to 200 K.

Prerequisites

- The device is switched on

Procedure

1. Call up the **<Main menu>**.
 2. Call up the **<Adjust safety>** submenu.
 3. Enter the limit value **<Upper band limit>** and **confirm** with [✓].
 4. Enter the limit value **<Lower band limit>** and **confirm** with [✓].
 5. Set the lower and upper band limits in the dialog box that appears and confirm the entry.
- ✓ The band limits are set and immediately active.

7.13 Connecting an external temperature sensor

A Pt100 temperature sensor can be connected to the front of the device.

Prerequisites

- ▶ The device is switched off.
- ▶ A Pt100 temperature sensor with a suitable connection is available.

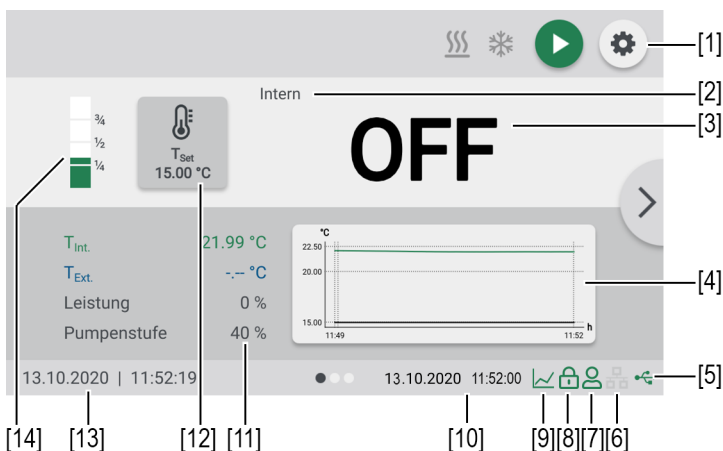
Procedure

1. Connect the Pt100 to the Ext. Pt100 socket.
 2. Switch on the device.
 3. Call up the **<Main menu>**.
 4. In the **<Determine thermodynamics>** submenu, select the **<Set controller>** menu item.
 5. Call up the **<External>** menu item for external control.
 6. Set the control parameters for external control.
- ✓ The external temperature sensor is connected and ready for operation.

8 Operation

8.1 User interface

The device is operated via the touchscreen. After switching on, the display shows the start screen. You can switch between three different views of the start screen by swiping sideways or tapping the arrows on the side.



Start screen

1. Softkey **[Settings]** opens the **<Main menu>**
2. Display internal / external control
3. Display current temperature internal / external, display Off in standby mode
4. Temperature curve setpoint temperature / current temperature internal and external
5. USB status
6. Ethernet status
7. User logged in
8. Operation locked
9. Quick access programmer (when programmer is active)
10. Programmer status display (when programmer is active)
11. Display of current performance parameters
12. **Setpoint setting** softkey , display of setpoint temperature
13. Date / time
14. Liquid level display

8.2 **Softkeys and status icons**

The user interface contains the following softkeys and status icons.

Icon	Icon Description
	Temperature control start
	Temperature control stop
	Call up main menu
	Close menu
	Heating display active
	Cooling active display

8.3 Abbreviations

The following abbreviations are used on the start screen:

Abbreviation	Explanation
TSet	Setpoint temperature
TOver. warn.	Overtemperature warning
TSub. warn.	Subtemperature warning
TOver. alarm	Overtemperature alarm
TSub. alarm	Subtemperature alarm
TProtect	High temperature cut-off
TSafety	Temperature Safety temperature sensor
TSet max.	Maximum setpoint temperature
TSet min.	Minimum setpoint temperature
TMax int.	Maximum internal temperature
TMin int.	Minimum internal temperature
Band high	Upper band limit
Band low	Lower band limit
Pump max.	Maximum adjustable pump output
TInt.	Internal actual temperature
TExt.	External actual temperature

8.4 Alarm and warning messages

Alarms and warnings are indicated by error codes on the display. Important error codes are described in the chapter entitled **Faults and troubleshooting**. If an error cannot be rectified by the operator, contact Technical Service.

Warning:

In the event of a warning, temperature control is not interrupted. A warning message appears on the display. An intermittent signal tone sounds. The signal tone can be switched off by touching the touchscreen. Once the cause of the warning has been rectified, the warning disappears. Depending on the cause, warnings may disappear by themselves after some time.



Warning message display

Alarm:

In the event of an alarm, temperature control is stopped. The actuators are switched off. At the same time, a continuous acoustic signal sounds and an alarm message appears on the display. The signal tone can be switched off by touching the touchscreen. The cause of the alarm must be eliminated. A restart is required.



Alarm message display



NOTE

The list of alarm and warning messages can be found in **chapter 10 Faults and troubleshooting**.

8.5 Operator messages

Operator messages are informal messages that inform the operator about changes to the status of the appliance.

Operator messages provide information about the operating status of individual units in the status bar of the start screen. Status messages from a connected cooling machine are also displayed as operator messages.



8.6 Main menu



The main menu is called up using the cogwheel softkey on the start screen. The main menu is divided into menu items, each of which contains further sub-menus or in which settings can be made directly.

The **<Main menu>** is divided into the following menu items:

- Adjust safety
- Determine thermodynamics
- Connect device
- Use programmer
- Record data
- Installing the device
- Device settings
- Device access
- Device service
- About the device

8.6.1 Adjust safety menu

In the **<Adjust safety>** menu, limit values are defined to set a range for a safe process flow.

- Activate / deactivate autostart
- Set pump mode:
 - Automatic
 - Pump run-on
 - Pump always on
- Setpoint limits:
 - Setpoint max.
 - Setpoint min.
 - Pump max.
- Temperature limits:
 - Overtemperature alarm
 - Overtemperature warning
 - Subtemperature alarm
 - Subtemperature warning
 - High temperature cut-off
 - Internal max. temperature
 - Internal temperature min.
 - Upper band limit
 - Lower band limit
- Activate / deactivate overlevel warning

8.6.2 Determine thermodynamics menu

In the **<Determine thermodynamics>** menu, the control parameters for the temperature curve are defined and the pump output is set.

- Set controller:
 - Internal / external control
 - Set control behavior: automatic, Xp, Tn, Tv, Xpu, Cospeed
- Actual value source:
 - Pt100
 - Serial
 - USB PORT
 - Ethernet
 - Modbus TCP/IP
 - EPROG
- Set pump:
 - Performance
- Set limits:
 - Max. Heating
 - Max. Cooling

8.6.3 Connect device menu

The device can be connected to a PC and controlled remotely via the USB interface, the RS232 / RS485 interface or via Ethernet. In addition, external programmers can be connected via analog interfaces. The parameters for remote control mode are set in the **<Connect device>** menu.

- Remote control:
 - Off
 - Serial
 - USB
 - Ethernet
 - TCP/IP mode
- Interfaces:
 - Serial: Mode, baud rate, parity, handshake
 - Ethernet: Obtain IP via DHCP, MAC address, IP address, subnet mask, standard gateway, remote control port, device name
 - Modbus TCP/IP: Modbus port, device ID
 - Control output: cooling pulse, refill, return flow
- Watchdog:
 - on/off
 - Timeout
 - Setpoint
 - Reset
 - Generate warning
 - Reset warning
- Switch-on behavior:
 - Manual setting
 - Remote setting
- External setpoint:
 - Off
 - Pt100
 - EPROG
- Control value specification:
 - Controller
 - Digital
 - EPROG

8.6.4 Use programmer menu

In the **<Use programmer>** menu, temperature curves are programmed that can be called up according to definable rules.

- Programmer
 - Activate programmer: activate, select profile, repeat indefinitely, number of runs, end status, plan start, series type, use end date, end date
 - Manage profile: Create, manage, import and export profiles. Graphical display of individual profile progressions
- Timer: activate, schedule start, set value, end status, duration

8.6.5 Record data menu

The device can record data on an external storage medium. The conditions for this are defined in the **<Record data>** menu and recording is started. The recorded data can be used for subsequent evaluation.

- Record measurement data
- Read out black box data
- Read out alarm memory

8.6.6 Install device menu

Some basic settings are made in the **<Install device>** menu. Depending on the device configuration, not all menu functions may be available.

- Adjust temperature sensor
 - ATC Internal
 - ATC External
- Save / load device settings
- Reset device (factory init)
- Power supply
 - Separate supply
 - via cooling machine
- Set cooling mode
 - Automatic
 - Always on / off
- Activate / deactivate booster heater
- Enable options

8.6.7 Settings menu

Basic device settings are made in the **<Settings>** menu.

- Set language
- Set the date and time
- Set physical units
- Customize start screen
- Adjust screen brightness

8.6.8 Device access menu

The access rights for the user groups are managed in the **<Device access>** menu item.

Simple users and advanced users can log in to this menu item. By logging in, the rights assigned to them are enabled.

The administrator manages the access rights for both user groups and can change passwords.

- Log in / log out of the device
- Lock device
- Activate / deactivate the inactivity manager
- Set inactivity duration
- Set access rights for simple and extended users

8.6.8.1 Change password

The password ensures that only authorized persons have access to defined device functions. The administrator password is required to change a password. Passwords can be created and changed for the following user groups:

- Simple users, factory setting password: 0000
- Advanced users, factory setting password: 00000
- Administrators, default password: 000000

Prerequisites

- The device is switched on.

Procedure

1. Call up the **<Main menu>**.
2. Call up the **<Settings>** menu item in the **<Device access>** submenu.
 - ⇒ An input field opens.

3. Enter the administrator password and **confirm** with [✓].

! NOTE Factory setting for the administrator password: 000000

4. Select one of the three user groups.
5. Select the **[Change password]** softkey.
 - ⇒ An input field opens. The new password may consist of up to 19 digits.

! NOTE The previous password is overwritten when a new password is entered. It cannot be restored! This also applies to the factory-set password.

6. Enter the new password and **confirm** with [✓].
 7. Repeat the password and **confirm** with [✓].
- ✓ The password has been changed and is immediately active. In this way, the password can be changed for each user group.

8.6.8.2 Define user-dependent settings

The administrator manages the access rights of the user groups. The menus they can access and whether they are authorized to enter the setpoint and start or stop the device can be defined for simple users and advanced users. The administrator password is required to change the access rights.

Prerequisites

- The device is switched on.

Procedure

1. Call up the **<Main menu>**.
2. Call up the **<Settings>** menu item in the **<Device access>** submenu.
 - ⇒ An input field opens.
3. Enter the administrator password and confirm with [✓].

! NOTE Factory setting for the administrator password: 000000

4. Select a user group.
 5. Activate / deactivate the desired access rights and menus.
- ✓ The settings for the user group are active immediately.

8.6.8.3 Define user-independent default settings

The user-independent default settings relate to the operation of the device when no user is logged in. For users who are not logged in, operation of the device can be restricted to certain functions.

Prerequisites

- The device is switched on.

Procedure

1. Call up the **<Main menu>**.
2. Call up the **<Settings>** menu item in the **<Device access>** submenu.
 - ⇒ An input field opens.
3. Enter the administrator password and confirm with [✓].

! **NOTE** Factory setting for the administrator password: 000000

4. Select the **<Preferences>** menu item.
5. Activate / deactivate the desired access rights and menus.
- ✓ The settings for the user group are active immediately.

8.6.8.4 Log in user

When a user logs in, the access rights assigned to the user group are released.

Prerequisites

- The device is switched on.

Procedure

1. Call up the **<Main menu>**.
2. Press the **[Log in]** softkey in the **<Device access>** submenu.
 - ⇒ An input field opens.
3. Enter the password for the user group and confirm with [✓].

! **NOTE** Factory setting for simple users: 0000

! **NOTE** Factory setting for advanced users: 00000

- ✓ The registered user group is shown on the display. The access rights are active immediately. If the device is switched off and on again, the user group last logged in is still active.

8.6.8.5 Logging out users

If an active user is logged off, the user-independent access rights are automatically activated, which can be operated by any person.

Prerequisites

- ▶ The device is switched on.

Procedure

1. Call up the **<Main menu>**.
 2. Press the **[Logout]** softkey in the **<Device access>** submenu.
 3. Enter the password for the user group and confirm with **[✓]**.
- ✓ The user is logged out immediately and the user-independent access rights are activated

! NOTE Current temperature control remains active. If it is not possible to stop or change an active temperature control due to the user-independent access rights, a Notice is displayed stating that access is blocked. The block can be removed by the administrator or the last user.

8.6.8.6 Locking the device

A registered user can lock the appliance to prevent unwanted interventions. Active temperature control is not interrupted. A locked device cannot be operated; it must first be unlocked by the last user or an administrator.

Prerequisites

- ▶ The device is switched on.
- ▶ A simple or extended user is logged in.

Procedure

1. Call up the **<Main menu>**.
 2. Call up the **<Device access>** submenu.
 - ⇒ The logged-in user group is displayed.
 3. Activate the **[Lock device]** button.
- ✓ The device is locked. The lock symbol is displayed at the bottom of the start screen.

8.6.8.7 Setting up the inactivity timer

After a defined period of time without activity on the display, the device is automatically locked. The inactivity timer can be set up by a logged-in user.

Prerequisites

- ▶ The device is switched on.
- ▶ A basic or extended user is logged in.

Procedure

1. Call up the **<Main menu>**.
 2. Call up the **<Device access>** submenu.
 - ⇒ The logged in user group is displayed.
 3. Activate the **[Inactivity duration]** button.
 - ⇒ An input field opens.
 4. Enter the time period for the inactivity timer in the specified time format and confirm the entry.
 - ⇒ The time period is displayed on the **[Inactivity duration]** button.
 5. Activate the **[Inactivity duration]** button.
- ✓ The inactivity timer is set up and active. As soon as the time period has elapsed without activity on the display, the device is locked.

8.6.8.8 Resetting the settings

All settings in the **<device access>** menu can be reset to the factory settings at any time. The administrator password is required to reset the settings.

Prerequisites

- The device is switched on.

Procedure

1. Call up the **<Main menu>**.
 2. Call up the **<Device access>/<Settings>** submenu.
 - ⇒ An input field opens.
 3. Enter the administrator password and **confirm** with [✓].
 - ❗ **NOTE** Factory setting for the administrator password: 000000
 4. Press the **[Reset]** button.
 5. Confirm the security prompt with **[OK]**.
- ✓ All device access settings are reset to the factory settings.

8.6.9 Service menu

The **<Service>** menu is password protected. Only JULABO service technicians have access.

8.6.10 About the device menu

The **<About the device>** menu provides information about the installed software status.

- Display of the device identity with voltage variant and firmware version
- Display of the installed open source software with licenses

8.7 Switching on the device

This section describes how to switch on the device.

Prerequisites

- The device is connected and ready for operation.

Procedure

1. Switch on the device at the power switch.
 - ⇒ The software boots and starts the device. The display shows the device name, the voltage variant and the loaded configuration.
- ✓ The device is switched on. It switches to the last active operating mode. If the autostart function is activated, the appliance starts the temperature control directly with the last setting.



NOTE

When the remote control is activated, it is not possible to operate the device.

8.8 Switching off the device

This section describes how to switch off the device.

Prerequisites

- The device is switched on.

Procedure

1. Stop the current temperature control.
 - ! **NOTE** Do not switch off the appliance until it is in standby mode.
2. Switch off the appliance at the mains switch.
- ✓ The appliance is switched off.

8.9 Starting temperature control

A temperature control task can be started directly on the appliance. Other options include controlling the temperature control via the timer and remote control via a connected PC.

Prerequisites

- ▶ The appliance is switched on.

Procedure

1. Select the [T_{Set}] softkey on the start screen.
 2. Enter the desired setpoint and confirm with [✓].
 3. Press the [▶] softkey.
- ✓ The device starts temperature control immediately. The temperature control can be stopped with the [■] softkey. The setpoint entered is saved.



NOTE

Note for heating thermostats:

For temperature control tasks close to or below the ambient temperature: Use a cooling coil or JULABO immersion cooler.

8.10 Record data

8.10.1 Recording measurement data

Measurement data from a running temperature control system can be recorded synchronously on a USB stick. The date, time, setpoint temperature, internal actual, external actual and the percentage output are documented in the recording. The data is saved as a .txt file and can be analyzed retrospectively.

Prerequisites

- ▶ The device is switched on.
- ▶ A USB stick is available.

Procedure

1. Call up the **<Main menu>**.
 2. Call up the **<Record data>** submenu.
 - ⇒ The following message appears: *No external storage medium recognized.*
 3. Insert the USB stick into the USB socket on the back of the device.
 4. Press the **[File]** button to change the displayed file name if necessary.
 5. Press the **[Scanning time]** button and set the desired scanning interval.
 6. Press the **[Active]** button.
- ✓ Measurement data recording is started and indicated on the display by a red dot. The data is saved to the USB stick under the file name entered. The recording is stopped by deactivating the **[Active]** button.

8.10.2 Reading out black box data

The black box can be read out and the data sent to the Technical Service for analysis.

Prerequisites

- ▶ The device is switched on.
- ▶ A USB stick is available.

Procedure

1. Call up the **<Main menu>**.
 2. Call up the **<Record data>** submenu.
 - ⇒ The following message appears: *No external storage medium detected.*
 3. Insert the USB stick into the USB socket on the back of the device.
 4. Press the **[File]** button to change the displayed file name if necessary.
 5. Press the **[Save]** button.
- ✓ The black box data is saved to the USB flash drive as a .txt file.

8.10.3 Display alarm memory

Alarm messages are saved with the date, time, alarm code and device ID. The data can be displayed via the menu.

Prerequisites

1. The device is switched on.

Procedure

1. Call up the **<Main menu>**.
 2. In the **<Record data>** submenu, select the **<Alarm memory>** menu item.
 - ⇒ The device lists the stored alarm messages.
 - ⇒ Individual alarm messages can be called up by tapping on them.
 - ⇒ Individual alarm messages can be deleted by swiping to the left and confirming the displayed delete symbol.
- ✓ The alarm memory is displayed.

8.11 Thermodynamics

8.11.1 Control parameters

The appliance works with PID control. With the factory-set control parameters, experience has shown that an optimum temperature curve is achieved in the temperature control material.

The internal and external control parameters can be adjusted in the **<Set controller>** submenu.

Automatic

The device automatically calculates the control parameters during temperature control and adjusts them automatically. It is not possible to change the control parameters and dynamics manually.

Proportional range X_p

The proportional range X_p is the range around the setpoint in which the P component of the controller is active. Within this range, the P component of the controller behaves proportionally to the control deviation. The smaller X_p , the faster the controller becomes. A value for X_p that is too small can cause the system to oscillate.

Reset time T_n

The reset time T_n is a measure of the “strength” of the I component of the controller. The I component builds up by adding up the control deviation over time and thus ensures that no permanent control deviation occurs. A small T_n leads to a faster elimination of the control deviations, but increases the risk of overshoot and oscillations. If T_n is set to 0 s, the I component of the controller is deactivated.

Derivative time T_v

The derivative action time T_v influences the D component of the controller, which reacts to the rate of change of the control deviation and counteracts it. This allows overshoots to be damped. The greater T_v , the greater the damping effect. However, if T_v is set too high, this can lead to unsteady control behavior. If T_v is set to 0 s, the D component of the controller is deactivated. This is how it is configured on delivery, as satisfactory control behavior can usually also be achieved with a pure PI controller.

Dynamics

With internal control, you can choose between standard and aperiodic for the control dynamics:

- With Aperiodic, the temperature rise is delayed and the actual temperature does not overshoot.
- With Standard, the temperature rise is faster and the actual temperature can overshoot by up to 5 %.

CoSpeed factor

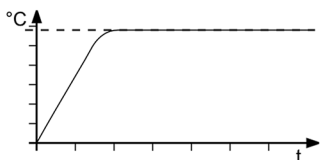
The CoSpeed factor influences the temperature curve with external control. It acts directly on Xpu and results in more aggressive temperature control.

Proportional band Xpu

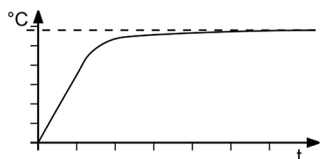
The proportional band Xpu plays a role in external control. It corresponds to the proportional range Xp for internal control.

8.11.2 Optimizing temperature curves

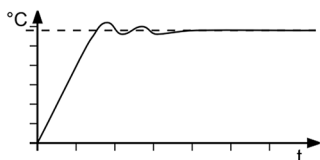
The temperature curve shown on the display provides information on how individual control parameters can be optimized to achieve a better result.



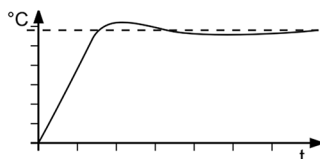
Optimum temperature control curve, temperature quickly reaches the setpoint without overshooting and maintains the setpoint.



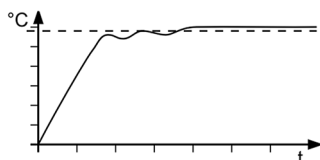
Symptom: Temperature curve approaches the setpoint slowly and does not quite reach it.
Remedy: Reduce T_v and/or T_n , increase X_p .



Symptom: Temperature curve approaches the setpoint quickly, overshooting with oscillations occurs. Remedy: Increase T_v and/or T_n .



Symptom: Temperature curve quickly approaches the setpoint, overshooting occurs. Remedy: Increase X_p .



Symptom: Temperature curve is rapidly approaching the setpoint value, temperature builds up, setpoint value is exceeded. Remedy: Reduce X_p and/or T_v .

8.11.3 Setting the controller

The individual control parameters for internal and external control are set in the **<Set controller>** menu.

Prerequisites

- ▶ The device is switched on.

Procedure

1. Call up the **<Main menu>**.
 2. In the **<Determine thermodynamics>** submenu, select the **<Set controller>** menu item.
 - ⇒ The dialog box for setting the controller appears on the display.
 3. Activate internal or external control.
 - ⇒ This results in the respective adjustable control parameters. External control is only possible with an externally connected Pt100 temperature sensor.
 4. Switch to the **<Set control behavior>** submenu.
 5. Set the desired parameters in the dialog window and confirm the entry .
 -  **NOTE** For internal control: Activate aperiodic temperature curve or the standard temperature curve.
- ✓ The control parameters are set and immediately active.

8.11.4 Limit cooling capacity and heating capacity

The cooling capacity and heating capacity are limited in the **<Set limits>** menu.

Prerequisites

- The appliance is switched on.

Procedure

1. Call up the **<Main menu>**.
 2. In the **<Determine thermodynamics>** submenu, select the **<Set limits>** menu item.
 3. Set the limit values for the cooling capacity and heating capacity in the dialog box that appears and confirm the entry.
- ✓ The values are set and immediately active.

8.11.5 Setting the pump

The pump output can be set in one percent increments.

Prerequisites

- The appliance is switched on.

Procedure

1. Call up the **<Main menu>**.
 2. In the **<Determine thermodynamics>** submenu, call up the **<Set pump>** menu item.
 3. Enter the desired value for the pump output as a percentage and confirm the entry.
 - ⇒ The minimum value is set internally in the device. The maximum value is limited by the adjustable maximum pump output in the **<Adjust safety>** menu.
- ✓ The pump is set.

If necessary, the pump output must be increased. This is especially true at low temperatures: The higher viscosity of the temperature control fluid can cause the circulation to decrease, which in turn affects the temperature stability.

8.12 Remote control of the device

The device can be connected to a PC via its interfaces and controlled remotely using a program such as EasyTemp. It is also possible to send interface commands to the device via a terminal program. The respective interface is set up when remote control is deactivated. If remote control mode is activated, no operation is possible on the device.

8.12.1 Remote control of device via USB interface

Prerequisites

- ▶ The device is switched off.
- ▶ A terminal program is installed on the PC.

Procedure

1. Connect the device and PC with a standard USB cable.
 2. Download the appropriate USB driver from the website www.julabo.com in the download area (up to and including Microsoft Windows 8).

! NOTE Depending on the operating system of the connected PC, it may be necessary to install the USB driver.
 3. Install the USB driver on the PC.
 4. Switch on the device.
 5. Call up the **<Main menu>** on the device.
 6. Activate the USB interface in the **<Connect device>/<Remote control>** submenu.

⇒ An **R** for remote control mode is displayed on the start screen.
 7. Start the terminal program on the PC.
 8. Select the COM port of the device in the terminal program and establish a connection.
- ✓ Remote control via the USB interface is active. The device can be controlled remotely using the interface commands via the terminal program. For interface commands, see appendix.

8.12.2 Controlling the device remotely via the RS232 interface

The device can be controlled remotely via the RS232 interface. A null modem cable is required for connection to a PC.

The interface parameters cannot be changed during remote control operation. If they differ from the factory settings, they must be set before activating remote control mode.

Setting parameters

Prerequisites

- ▶ Remote control is deactivated.

Procedure

1. Call up the **<Main menu>**.
 2. Select the **<Serial>** menu item in the **<Connect device>/<Interfaces>** submenu.
 3. Set the interface parameters **[Baud rate]**, **[Handshake]** and **[Parity]** if they differ from the factory settings.
 - ⇒ With parity **None** , the number of data bits is set to 8.
- ✓ The interface parameters are set and immediately active.

Remote control device

Prerequisites

- ▶ The device is switched off.
- ▶ A terminal program is installed on the PC.

Procedure

1. Connect the device and PC with a null modem cable.
2. Switch on the device.
3. Call up the **<Main menu>** on the device.
4. In the **<Connect device>/<Interfaces>/<Serial>/<Mode>** submenu, activate the serial interface **[RS232]** .
5. In the **<Connect device>/<Remote control>** submenu, activate the **[Serial]** connection type.
 - ⇒ An **R** for remote control mode is displayed on the start screen.

6. Start the terminal program on the PC.
7. Enter the interface parameters in the terminal program.
8. Select the COM port of the device in the terminal program and establish a connection.
- ✓ Remote control via the RS232 serial interface is active. The device can be remote-controlled via the terminal program using the interface commands. For interface commands, see appendix.

8.12.3 Controlling the device remotely via the RS485 interface

The device can be controlled remotely via the RS485 interface. A null modem cable is required for connection to a PC.

Setting parameters

Prerequisites

- ▶ Remote control is deactivated.

Procedure

1. Call up the **<Main menu>**.
 2. Select the **<Serial>** menu item in the **<Connect device>/<Interfaces>** submenu.
 3. Set the interface parameters **[Baud rate]**, **[Handshake]** and **[Parity]** if they differ from the factory settings.
 - ⇒ With parity **None** , the number of data bits is set to 8.
- ✓ The interface parameters are set and immediately active.

Remote control device

Prerequisites

- ▶ The device is switched off.
- ▶ A terminal program is installed on the PC.

Procedure

1. Connect the device and PC with a null modem cable.
2. Switch on the device.
3. Call up the **<Main menu>** on the device.
4. In the **<Connect device>/<Interfaces>/<Serial>/<Mode>** submenu, activate the serial interface **[RS485]** .
5. In the **<Connect device>/<Remote control>** submenu, activate the **[Serial]** connection type.
 - ⇒ An **R** for remote control mode is displayed on the start screen.

6. Start the terminal program on the PC.
7. Enter the interface parameters in the terminal program.
8. Select the COM port of the device in the terminal program and establish a connection.
- ✓ Remote control via the RS485 serial interface is active. The device can be remote-controlled via the terminal program using the interface commands. For interface commands, see appendix.

8.12.4 Setting the EPROG input

An external voltage or current signal can be transmitted to the circulator via the EPROG input. Depending on the setting, the circulator interprets the input signals as setpoint temperature, power, flow rate, pressure or actual value and can output the values as a display on the home screen.

Observe the technical data of the REG/EPROG socket.

Prerequisites

- ▶ The device is switched on.
- ▶ The remote control mode is deactivated.
- ▶ An external voltage or current source is connected via the REG/EPROG socket.

Procedure

1. Call up the **<Main menu>**.
2. Call up the **<Connect device>** submenu.
3. Call up the **<Interfaces>/<Analog module>/<EPROG>** submenu.
4. Select the input variable **[Setpoint]**, **[Power]**, **[Flow rate]** or **[Actual value]** in the selection window.
 - ⇒ If **[Setpoint]** is selected, the external setpoint specification must be set up.
 - ⇒ If **[Power]** is selected, the control value specification must be set up.
5. Select the voltage or current signal type.
6. Approach the lower limit value with the external voltage/current source.
 - ⇒ The applied voltage or current is displayed as a measured value.

7. Select the **[Lower value]** button and enter the lower limit value.
8. Repeat steps 6 and 7 for the upper limit value.
- ✓ The EPROG input is set. The values for display on the start screen can be selected in the **<Settings>** submenu. Setpoint temperature or power can also be used as an external setpoint specification or as a control value specification. The actual value can be used as the actual value source.

8.12.5 Setting up the actual value source

By default, the actual value is measured via a Pt100 temperature sensor. The device also offers the option of specifying the actual value via one of the interfaces.

Prerequisites

- ▶ The device is switched on.
- ▶ Remote control mode is deactivated.

Procedure

1. Call up the **<Main menu>**.
2. Call up the **<Determine thermodynamics>/<actual value source>** submenu.
3. Select **[Pt100]**, **a digital interface** or **[EPROG]**.

! NOTE [EPROG] can only be selected if the analog option is available and **[Actual value]** has been defined as an input variable in the **<Analog module>** submenu for EPROG.

- ✓ The actual value source is set up.

8.12.6 Set up external setpoint specification

By default, the setpoint is set on the device or via the programmer. In addition, the device offers the option of specifying the setpoint externally via the analog REG/EPROG socket or an external Pt100 temperature sensor.

Prerequisites

- ▶ The device is switched on.
- ▶ Remote control mode is deactivated.

Procedure

1. Call up the **<Main menu>**.
2. Call up the **<Connect device>/<External setpoint>** submenu.
3. Select **[Pt100]** or **[EPROG]**.

! NOTE [Pt100] can only be selected if an external Pt100 temperature sensor is connected to the device. The setpoint is then set via the external temperature sensor.

! NOTE [EPROG] can only be selected if the analog option is available and **[Setpoint]** has been defined as an input variable in the **<Analog module>** submenu for EPROG.

- ✓ The external setpoint specification is set up.

8.12.7 Setting the control value

If the device is in remote control mode, the actuating variable (power) with which the cooling unit or heater is controlled can be specified via interface commands. This section describes how to set up the control value specification.

Prerequisites

- The device is switched on.

Procedure

1. Call up the **<Main menu>**.
2. Call up the submenu **<Connect device>/<Control value preset>**.
3. Select **[Digital]** or **[EPROG]** in the dialog box.

! NOTE [Digital] can only be selected if remote control mode is active.

! NOTE [EPROG] can only be selected if the electronics module with analog connections is available and **[Power]** has been defined as the input variable in the **<Analog module>** submenu for EPROG. Remote control mode must be deactivated.

- ✓ The control value specification is set up.

8.12.8 Watchdog function

During temperature control in remote control mode, the watchdog function monitors the active interfaces. In the event of a fault in the higher-level data processing system, the watchdog function ensures that the device switches to a previously defined safe operating state.

Monitoring works via cyclical data communication between the higher-level master computer and the device. If there is an interruption in data transmission, the watchdog function is activated after a defined time.

If the device is switched to standby (temperature control stops), monitoring is paused. The watchdog function is reactivated when temperature control is restarted.

Various conditions for the safe operating state can be defined in the operating menu:

- **Mode:** specifies how the device should react when the watchdog function is activated.
- **Timeout:** defines how long an interruption in data transmission from the host computer may last before the watchdog function is activated.
- **Setpoint:** Defines the setpoint temperature that is activated to put the device in a safe state.
- **Reset:** Selection of whether the watchdog function should only be reset when the setpoint temperature is received or via all valid commands.
- **Activate / deactivate warning message:** When the watchdog function is activated, a warning message can be issued.
- **Reset warning message:** Here you can set whether the warning message is reset manually or automatically.

8.12.9 Handshake alternative

There is a menu item **[Handshake alternative]** in the **<Interfaces>/<Serial>** menu if **[Handshake]** is set to **[Software]**

- **Controller inactive:** Standard function. The device sends handshake characters if it is not ready to receive. As the device can receive and process several commands in succession, handshake characters are not sent after each command received.
- **Controller active:** Downward-compatible handshake function. A handshake character is transmitted after each command received and after each response sent. This means that after each command received, the connected control system is informed that the device is not ready to receive and after each processing of the received command, it is informed that it is ready to receive again.

8.13 Working with the programmer

Temperature control profiles are defined temperature curves with a set target temperature and a specified temperature control duration or gradient.

The programmer calculates a temperature ramp from these programmed values.

Temperature control profiles can be started directly or with a time delay using the programmer. The number of repetitions can be set, as can the start time and the days of the week on which the temperature control profile is to run.

Several temperature control profiles can be combined to form a profile series.

The appliance must remain switched on for programmed temperature control profiles to run automatically.



NOTE

Falling level of the temperature control fluid!

During prolonged temperature control, the level of the temperature control liquid in the bath tank may fall below the alarm limit due to evaporation. A low level alarm is triggered and temperature control is stopped.

- During prolonged temperature control, regularly check the level of the temperature control liquid in the bath tank.
- If the level is low, top up the temperature control fluid.

8.13.1 Setting the timer

The timer can be used to program the duration of temperature control from 0 to 999 minutes and the start time. The target temperature is set as the setpoint temperature.

After the set duration has elapsed, the appliance switches to the previously defined state:

- Standby mode
- Maintain target temperature
- Temperature control to original setpoint temperature

Prerequisites

- The appliance is switched on.

Procedure

1. Call up the **<Main menu>**.
2. Call up **<Use programmer>/<Timer>** in the submenu.
 - ⇒ The setting options for the timer are displayed in the submenu.

 **NOTE** No parameters can be changed when the timer is active. To do this, the timer must be deactivated.

3. Use the **[Schedule start]** button to enter the desired start time and date and confirm each entry.
 4. Set the **[Setpoint]** and the desired **[Duration]** and confirm the entry.
 5. In the **<Final state>** field, select how the appliance should behave after the temperature control has ended.
 6. Select the **[Activate]** field to activate the timer.
- ✓ The timer is programmed and active. The set time period begins to elapse as soon as the setpoint temperature is reached.

8.13.2 Creating and editing tempering profiles

Eight individual temperature control profiles can be created, each with up to 60 individual steps. The programmer processes the programmed steps of a temperature control profile according to the specifications.

Prerequisites

- The device is switched on.

Procedure

1. Call up the **<Main menu>**.
 2. Call up the **<Use programmer>/<Programmer>/<Manage profile>** submenu.
 3. Select one of the profiles.
 4. Call up the **<Edit profile>** submenu.
 - ⇒ The existing steps of the profile are displayed. If no steps are available, the **[Add step]** softkey appears.
 5. Add a new step with the **[Add step]** softkey.
 - ⇒ The added step opens as an editable dialog box.
 6. Tap one of the displayed steps and select the step type using the **[Approach via]** softkey.
 - ⇒ Depending on the step type, the **[Slope]** or **[Time]** parameter is specified.
 7. Enter and confirm the parameters using the **[Setpoint]** and **[Slope]** or **[Time]** softkeys.
 8. If necessary, add a new step using the **[Add step]** softkey.
 - ❗ **NOTE** In the **<Manage profile>** submenu, the created profile can be displayed as a diagram using the **[Display profile]** softkey.
 9. After editing the temperature control profile, press the **[Back]** softkey to return to the **<Use programmer>** submenu.
- ✓ The temperature control profile is created and saved.

8.13.3 Export tempering profile

Temperature control profiles can be exported to a USB stick in order to use them on other devices, for example.

Prerequisites

- ▶ The device is switched on.
- ▶ Temperature control profiles are saved in the **<Programmer>** submenu.

Procedure

1. Insert the empty USB stick into the USB socket.
 2. Call up the **<Main menu>**.
 3. Call up a profile in the **<Use programmer>/<Programmer>/<Manage profile>** submenu.
 4. Click on the [Export profile as] button.
 5. Enter a name for the profile to be exported and confirm the entry.
 6. Click on the [Export profile] button.
- ✓ The temperature control profile is exported to the USB flash drive as a .txt file and can be imported to other devices.

8.13.4 Importing a temperature control profile

Temperature control profiles can be imported from another device via a USB stick.

Prerequisites

- The device is switched on.

Procedure

1. Insert the USB stick with the temperature control profile to be imported into the USB socket.
 2. Call up the **<Main menu>**.
 3. Call up the **<Use programmer>/<Programmer>/<Manage profile>** submenu.
 4. Call up a profile.
 5. Click on the **[Import profile]** button.
 6. In the dialog box, select the temperature control profile to be imported on the USB stick and confirm the entry.
 - ⇒ The temperature control profile is imported and saved in the selected profile on the device.
- ✓ The temperature control profile is imported.

8.13.5 Delete tempering profile

Existing temperature control profiles can be deleted completely. This deletes all saved profile data.

Prerequisites

- ▶ The device is switched on.
- ▶ Temperature control profiles are saved in the **<Programmer>** submenu.

Procedure

1. Call up the **<Main menu>**.
 2. Call up the **<Use programmer>/<Programmer>/<Manage profile>** submenu.
 3. Select a temperature control profile.
 4. To delete the selected temperature control profile, press the **[Delete profile]** softkey.
 5. Confirm the security prompt with **[OK]** to delete the temperature control profile.
- ✓ The temperature control profile is deleted.

8.13.6 Set up profile series

The **<Enable programmer>** submenu is used to set up the sequence of a profile series. The start time, the number of runs, the cycle and the behavior of the device at the end of the profile series are defined here.

Prerequisites

- The device is switched on.

Procedure

1. Call up the **<Main menu>** .
 2. Call up the **<Use programmer>/<Programmer>/<Activate programmer>** submenu.
 3. Select the **[Series type]** softkey.
 - ⇒ You can choose between daily, weekly and individual weekdays.
 4. Use the **[Use end date]** softkey to select whether the profile series should end on a specific date.
 5. If necessary, enter the desired end date using the **[End date]** button.
 - ⇒ If no end date is used, the profile series runs until it is ended manually.
- ✓ The profile series is set up. If the programmer is activated, the profile series starts immediately or at the specified start time and processes the selected profile with the defined settings. The programmer then starts the profile again according to the set series type. Once the profile series has been completed, the device switches to the defined end state. A running profile series can be ended manually at any time.

8.13.7 Activating the programmer

The programmer is started with a selected profile and processes the profile according to the specifications.

Prerequisites

- ▶ The appliance is switched on.
- ▶ The programmer is deactivated.

Procedure

1. Call up the **<Main menu>**.
 2. Call up the **<Use programmer>/<Programmer>/<Enable programmer>** submenu
 3. Use the **[Select profile]** softkey to select the desired temperature control profile.
 4. Use the **[Number of runs]** softkey to select how often the selected profile should be repeated.
 5. Use the **[End state]** softkey to select how the appliance should behave after the run.
 6. Use the **[Schedule start]** softkey to select the start time and start date.
 - ⇒ If the programmer is activated, the start time is shown in the programmer status display on the start screen. As soon as temperature control starts, the active profile is displayed.
 7. Activate the programmer at the top of the menu.
- ✓ The programmer is activated. It starts either immediately or at the programmed start time on the specified start date and runs through the specified number of cycles one after the other. After the last cycle, the appliance switches to the defined end state.

! NOTE When the programmer is active, the **[Quick access programmer]** button is displayed at the bottom of the start screen. This button can be used to stop or end the programmer and edit the active profile.

8.14 Configuring signal outputs

8.14.1 Configuring the Stakei output

A solenoid valve connected to the Stakei output can be assigned various functions depending on the application.

When using the Stakei output, a minimum current of 20 mA must be taken into account.

Prerequisites

- ▶ The device is switched on.
- ▶ A solenoid valve is connected to the Stakei output.

Procedure

1. Call up the **<Main menu>**.
 2. Call up the **<Connect device>/<Interfaces>** submenu.
 3. Use the **[Control output]** softkey to select the desired function for the connected solenoid valve.
- ✓ The Stakei output is set up and active.

8.14.2 Configuring the signal outputs of the REG/EPROG socket

Three channels are available as signal outputs with the REG/EPROG socket. The voltage values or current values output via these channels can be processed externally.

The following values can be output:

- Setpoint: set set setpoint
- Internal: Value of the internal temperature sensor
- External: Value of an external Pt100 temperature sensor
- Power: Value of the control variable

Prerequisites

- The device is switched on.
- The plug-in unit with analog connections is installed.

Procedure

1. Call up the **<Main menu>**.
2. Call up the **<Connect device>** submenu.
3. Call up the **<Interfaces>/<Analog module>** submenu.
4. Select the output variable Setpoint, Internal, External or Power for **[Channel 1]**.
5. Enter the lowest output value for the 0 V value.
6. Enter the highest output value for the 10 V value.
7. Repeat steps 4 and 6 for **[Channel 2]**.

! NOTE The current output is configured for **[Channel 3]** . 0 mA or 4 mA can be selected for the lowest output value.

8. Enter the lowest output value for the 0 mA/4 mA value.
9. Enter the highest output value for the 20 mA value.
- ✓ The signal outputs of the REG/EPROG socket are configured.

8.14.3 Configuring the alarm output

This section describes how to configure the alarm output.

Prerequisites

- The device is switched on.
- The electronics module with analog connections is fitted.

Procedure

1. Call up the **<Main menu>**.
2. Call up the **<Connect device>/<Interfaces>/<Analog module>/<Alarm output>** submenu.
3. Activate the **[Standby]** softkey.
- ✓ The standby input is activated and can be used.

8.15 Activating the standby input

This section describes how to activate the standby input.

Prerequisites

- ▶ The device is switched on.
- ▶ The electronics module with analog connections is installed.

Procedure

1. Call up the **<Main menu>**.
 2. Call up the **<Connect device>/<Interfaces>/<Analog module>** submenu.
 3. Activate the **[Standby]** softkey.
- ✓ The standby input is activated and can be used.

8.16 Adjusting the temperature sensor (ATC)

For physical reasons, a temperature difference can form in the bath tank between the temperature sensor and a defined, more distant point within the temperature control medium volume. As a result, the measured temperature deviates slightly from the actual temperature in the bath. Adjusting the temperature sensor can increase the accuracy of the temperature control.

When adjusting a temperature sensor, the temperature difference between the temperature sensor and the reference thermometer is determined. Three adjustment options are available:

- 1-point adjustment: When a sample is tempered to a specific setpoint. The adjustment curve is shifted parallel to the measurement curve by the reference amount.
- 2-point adjustment: If the temperature is adjusted between two setpoints. The gradient of the temperature curve is adjusted between two points.
- Multi-point adjustment: If the temperature is adjusted within a temperature range. This results in a curved temperature curve.

8.16.1 Adjusting the internal temperature sensor

This section describes how to adjust the internal temperature sensor of the device.

Prerequisites

- ▶ The bath tank is filled.
- ▶ The appliance is switched on.
- ▶ A calibrated reference thermometer is ready.

Procedure

1. Temper the sample to the desired setpoint temperature.
 2. Wait until the temperature in the bath tank has stabilized and is shown on the display of the circulator.
 3. Hang the calibrated reference thermometer in the bath vessel near the temperature-controlled sample.
 4. Read the temperature on the reference thermometer.
 5. Call up the **<Main menu>**.
 6. Call up the **<Install device>/<Adjust temperature sensor>/<ATC internal>** submenu.
 7. Tap the **[Add new correction point]** softkey.
 - ⇒ Two options are displayed for selection.
 8. Tap the **[Accept current temperature]** softkey.
 - ⇒ The current measured temperature is accepted and the dialog box for entering the corresponding correction value opens.
 9. Tap the **[Enter temperature]** softkey.
 - ⇒ The dialog box for entering the temperature value and correction value opens.
 10. Enter the required value and confirm the entry.
- ✓ The internal temperature sensor is adjusted with a correction point.

8.16.2 Adjusting the internal temperature sensor - multi-point adjustment

This section describes how to adjust the internal temperature sensor of the device using several correction points. The adjustment can be carried out with up to ten correction points.

Prerequisites

- ▶ The device is switched on.
- ▶ The bath tank is at least two thirds full.
- ▶ A calibrated reference thermometer is available.

Procedure

1. Temper the sample to the desired setpoint temperature.
 2. Wait until the temperature in the bath has stabilized and is shown on the display of the circulator.
 3. Hang the calibrated reference thermometer in the bath vessel near the temperature-controlled sample.
 4. Read the temperature on the reference thermometer.
 5. Call up the **<Main menu>**.
 6. Call up the **<Install device>/<Adjust temperature sensor>/<ATC internal>** submenu.
 7. Tap the **[Add new correction point]** softkey.
 - ⇒ Two options are displayed for selection.
 8. Tap the **[Accept current temperature]** softkey.
 - ⇒ The current measured temperature is accepted and the dialog box for entering the corresponding correction value opens.
 9. Tap the **[Enter temperature]** softkey.
 - ⇒ The dialog box for entering the temperature value and correction value opens.
 10. Enter the required value in each case and confirm the entry.
 11. Repeat steps 7 to 10.
 - ⇒ Up to 10 correction points can be created for the adjustment.
- ✓ The multi-point adjustment is complete. The internal temperature sensor is adjusted.

8.16.3 Adjusting the external temperature sensor

Measurable temperature differences can also occur in a connected application. As with the internal temperature sensor, adjusting the external temperature sensor can improve the accuracy of the temperature control in the application.

Prerequisites

- ▶ The device is switched on.
- ▶ An external temperature sensor is connected.
- ▶ The bath tank is at least two thirds full.
- ▶ A calibrated reference thermometer is available.

Procedure

1. Temper the sample to the desired setpoint temperature.
 2. Wait until the temperature in the bath tank has stabilized and is shown on the display of the circulator.
 3. Hang the calibrated reference thermometer in the bath vessel near the temperature-controlled sample.
 4. Read the temperature on the reference thermometer.
 5. Call up the **<Main menu>**.
 6. Call up the submenu **<Install device>/<Adjust temperature sensor>/<ATC external>**.
 7. Tap the **[Add new correction point]** softkey.
 8. Enter the read reference value in the input window and confirm the entry.
 - ⇒ The correction value is active immediately.
- ✓ The external temperature sensor is adjusted.

! NOTE The external temperature sensor is adjusted using up to ten correction points in the **<ATC external>** submenu in the same way as the internal temperature sensor.

8.17 Reset device

This function is used to reset the device to the factory settings.

Prerequisites

- The device is switched on.

Procedure

1. Call up the <Main menu>.
 2. In the <Install device> submenu, select the <Reset device> menu item.
 3. To reset the device, confirm the security prompt with [OK].
- ✓ The device is reset to the factory settings.

9 Cleaning and maintenance

9.1 Maintenance intervals

The table lists the regular maintenance work according to their maintenance intervals. The specified maintenance intervals refer to single-shift operation. The times given are approximate values.

Interval	Activity	Qualification	Duration [min]
Every 6 months	Check the function of the low level protection	Operator	15
Every 6 months	Check the function of the high temperature cut-off	Operator	5
Every 2 years	Check safety markings	Operator	1



NOTE

For the JULABO maintenance and service offer, contact JULABO sales or service.

9.2 Checking the function of the high temperature cut-off

This section describes how to check the function of the high temperature cut-off.

Requirements

- ▶ Slotted screwdriver, size 3
- ▶ The appliance is switched on.
- ▶ Temperature control has started.

Procedure

1. Set the screen display so that the high temperature cut-off value is displayed.
2. Use the screwdriver to set the high temperature cut-off to a temperature that is below the actual value displayed.
 - ⇒ An acoustic signal sounds and the alarm message *Set protection temperature exceeded* is displayed. The high temperature cut-off is working.
3. Set a value that is above the actual value.
 - ⇒ The alarm message is deactivated.

4. Set the high temperature cut-off.
- ✓ The high temperature cut-off is set and its function checked.

9.3 Checking the function of the low level protection

This section describes how to check the function of the sub-level protection.



CAUTION

Risk of scalding from hot heat transfer fluid!

The heat transfer fluid can become very hot during the temperature control process. Contact with hot heat transfer fluid can lead to scalding.

- Allow the appliance to cool down to room temperature before emptying.
- Avoid direct contact with hot heat transfer fluid
- Wear protective gloves.

Prerequisites

- ▶ The device is switched on.
 - ▶ The appliance must be in standby mode (OFF state).
 - ▶ The medium is at room temperature.
1. Remove the bath cover.
 2. Use an elongated object to carefully push the float of the circulator down to the mechanical stop.
 - ⇒ A signal tone sounds and the alarm message *Tempering liquid level too low* is displayed. The low level protection device is working.
 3. Switch off the appliance and switch it on again after a short waiting time.
 - ⇒ The alarm message is deactivated.
 4. Close the bath opening.
- ✓ The function of the low level protection device has been checked.

9.4 Checking the safety markings

The following section only applies to appliances with natural refrigerants that are operated in the USA or Canada.

The safety markings on the appliance must be clearly legible at all times. Their condition must be checked every two years.

Procedure

1. Check the safety markings on the appliance for legibility and completeness.
2. Replace defective or missing safety labels.

 **NOTE** Safety labels can be reordered from JULABO.

- ✓ The safety labels on the appliance have been checked.

9.5 Replacing the detachable mains cable

The appliance is equipped with a detachable mains cable.



NOTE

The appliance may only be operated with the mains cable supplied. If the mains cable needs to be replaced due to a defect, it can be reordered.

Order number	Designation
7.901.2655	EU mains cable, 200-230 V
7.901.2701	Mains cable CH, 200-230 V
7.901.2665	Mains cable CN, 230 V
7.901.2657	Mains cable GB, 200-230 V
7.901.2656	Mains cable US, 100-115 V

9.6 Check and replace the main fuse

If the appliance can no longer be switched on, a defective fuse may be the cause.

Fuse: T15 A/250 VAC E 6.3 x 32 mm



NOTE

The interruption value of the fuse must be E or H.

Fuse: F16 A/500 VAC H 6.3 x 32 mm

Requirements

- ▶ Slotted screwdriver, size 3
- ▶ The appliance is switched off and disconnected from the power supply.
- ▶ The appliance has cooled down to room temperature.

Procedure

1. Unscrew the fuse holders with the flat-blade screwdriver.



2. Check the fuse.



3. Replace the defective fuse with a new one.
4. Refit the fuse holder with the checked or new fuse.
5. Carry out a function test.

! NOTE If the appliance cannot be switched on with new fuses, contact the technical service.

- ✓ The fuses have been checked and replaced.

9.7 Check and replace the Stakei fuse

If the appliance can no longer be switched on, a defective fuse may be the cause.

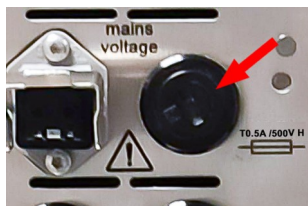
Fuse: T0.5 A/500 VAC H 6.3 x 32 mm

Requirements

- ▶ Slotted screwdriver, size 3
- ▶ The appliance is switched off and disconnected from the power supply.
- ▶ The appliance has cooled down to room temperature.

Procedure

1. Unscrew the fuse holders with the flat-blade screwdriver.



2. Check the fuse.



3. Replace the defective fuse with a new one.
4. Refit the fuse holder with the checked or new fuse.
5. Carry out a function test.

! NOTE If the appliance cannot be switched on with new fuses, contact the technical service.

- ✓ The fuses have been checked and replaced.

9.8 Emptying the appliance

If the appliance is to be sent in for technical service or disposed of properly, it must be completely drained.

The appliance should always be completely emptied before it is taken out of service for any length of time and when the external application is changed.



CAUTION

Risk of scalding from hot heat transfer fluid!

The heat transfer fluid can become very hot during the temperature control process. Contact with hot heat transfer fluid can lead to scalding.

- Allow the appliance to cool down to room temperature before emptying.
- Avoid direct contact with hot heat transfer fluid
- Wear protective gloves.

Prerequisites

- ▶ The device is switched off.
- ▶ The appliance is at room temperature.
- ▶ A sufficiently large collection container is available under the drain of the appliance.

Procedure

1. Remove the bath lid.
 2. Open the drain valve.
 - ⇒ The temperature control fluid flows into the collecting vessel provided.
 3. When the appliance is completely empty, close the bath tank.
 4. Close the drain valve.
- ✓ The appliance is drained.

9.9 Cleaning the appliance

The outside of the device should be cleaned at regular intervals. Before using a cleaning or decontamination method other than that recommended by JULABO, consult JULABO to ensure that the intended method will not damage the device.



NOTE

Damage to the electronics due to water ingress!

Water ingress can damage the electronics of the appliance and cause it to fail.

- Only clean the outside of the appliance with a damp cloth.
- Prevent water from entering the appliance .

Requirements

- ▶ Lint-free cloth
- ▶ Mild cleaning agent
- ▶ The appliance is switched off.
- ▶ The appliance is disconnected from the power supply.

Procedure

1. Allow the appliance to cool down to room temperature.
2. Clean the surface of the appliance with a damp cloth.

! **NOTE** You can use a little washing-up liquid for cleaning. If in doubt, ask Technical Service for alternative cleaning agents.

- ✓ The appliance is cleaned.

9.10 Taking the device out of operation and storing it

If an appliance is not to be used for a longer period of time or is to be sent to the Technical Service for repairs, for example, it is taken out of operation. The procedure described must be followed to ensure that it continues to function reliably after a longer period of storage.

Prerequisites

- The appliance is switched off and disconnected from the power supply.

Procedure

1. Empty the appliance completely (see **Emptying the appliance**).
 2. Dismantle the external application.
 3. Drain the heat transfer fluid completely.
 4. Clean the inside and outside of the appliance.
 5. Remove all cleaning fluid residues from the pipe system (e.g. with compressed air).
 6. Close all connections and drain valves.
 7. Store the appliance in a sufficiently ventilated, dust-free, dry and frost-free location. Avoid corrosive and aggressive environments.
- ✓ The appliance is protected and stored safely. It can be put back into operation if required.

9.11 Sending in the device

In the event of faults on the appliance that the operator cannot rectify himself, contact Technical Service.



NOTE

Observe the following before shipping:

- Drain the appliance completely (heat transfer fluid,).
- Clean and decontaminate the appliance properly to prevent any risk to service personnel.
- Close all connections tightly with nuts and sealing caps.
- Carefully pack the appliance to protect it from damage.
- Mark the packaging so that the device can be transported upright.
- Complete the online return form at <https://julabo.us/contact-us/product-returns/>.



NOTE

For safe return transportation to JULABO, use the original packaging if possible.

Shipping address

JULABO USA, Inc.

884 Marcon Boulevard

Allentown, PA 18109

Phone: +1(610) 231-0250

info@julabo.us

www.julabo.us

9.12 **Warranty**

The following warranty terms apply to products sold in North America by JULABO ("Seller") to the company listed as the buyer ("Buyer") on the Seller's invoice.

Initial Warranty

Upon Seller's receipt of full payment for the Products, and subject to Buyer's compliance with the Terms of Sale and all other agreements with Seller with respect to the Products, Seller warrants to Buyer that the Products manufactured by Seller will be free from defects in materials and workmanship for a period not to exceed two (2) years of operation from the date the Product was shipped by Seller to Buyer (the "Initial Warranty").

EXCLUSION OF ALL OTHER EXPRESS WARRANTIES; EXCLUSION OF ALL IMPLIED WARRANTIES

OTHER THAN THE INITIAL WARRANTY, NO OTHER EXPRESS WARRANTIES ARE GIVEN. ALL IMPLIED WARRANTIES OF ANY KIND, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, ARE EXCLUDED IN ALL RESPECTS AND FOR ALL PURPOSES. SELLER DISCLAIMS AND MAKES NO IMPLIED WARRANTIES OF ANY KIND.

Exclusions

The initial warranty does not cover damage to the product resulting from accident, misuse, improper installation or operation, unauthorized or improper repair, replacement or alteration (including, but not limited to, repair, replacement or alteration performed by anyone other than Seller's employees or authorized representatives), failure to perform (or improper performance of) maintenance, unreasonable or unintended use or misuse of the product, or failure to follow written installation or operating instructions.

Buyer must return proof of purchase of the Product to Seller or one of its authorized representatives within thirty (30) days of the date the Product was shipped to Buyer by Seller in order to make a claim under the Initial Warranty. Notwithstanding anything to the contrary herein, all glassware, including but not limited to reference thermometers, is expressly excluded from the Initial Warranty.

Buyer's Exclusive Remedies; Seller's Limitations of Liability

Buyer's sole and exclusive remedy under the Initial Warranty shall be limited, at Seller's sole discretion, to either: (i) repair of defective parts; or (ii) replacement of defective parts. In either case, the warranty period for the product receiving a repaired or replaced part under the terms of the original warranty will not be extended. Any repairs or replacements made by Seller under this warranty shall be made at one of Seller's facilities in Allentown, Pennsylvania, U.S.A., or at the facility of an authorized representative of Seller, which location shall be determined by Seller in its sole discretion; provided, however, that Seller may, in its sole discretion, make such repairs or replacements at Buyer's facility, in which case Buyer shall be responsible for travel, living and other expenses incurred by Seller in making such repairs or replacements at Buyer's facility. As a condition precedent to Seller's obligation to repair or replace any Product part under the Initial Warranty, Buyer shall (i) promptly notify Seller in writing of any such defect; (ii) return the proof of purchase of the Product to Seller or Seller's authorized representatives within thirty (30) days from the date the Product was shipped by Seller; and (iii) assist Seller in all respects in its attempts to determine the legitimacy and basis of any claim made by or on behalf of Buyer, including, but not limited to, granting Seller access to the Product to verify the operating conditions. If Buyer fails to notify Seller in writing within the Initial Warranty Period or fails to return the proof of purchase of the Product as described above, Seller shall have no further liability or obligation to Buyer therefor. In no event shall Seller's liability under the Initial Warranty exceed the original purchase price of the Product that is the subject of the alleged defect.

THE REMEDIES PROVIDED IN THE ORIGINAL WARRANTY ARE THE SOLE AND EXCLUSIVE REMEDIES AVAILABLE TO BUYER. NOTWITHSTANDING ANYTHING TO THE CONTRARY CONTAINED HEREIN, AND EVEN IF THE SOLE AND EXCLUSIVE REMEDIES FAIL OF THEIR ESSENTIAL PURPOSE FOR ANY REASON, IN NO EVENT SHALL SELLER BE LIABLE FOR BUYER'S MANUFACTURING COSTS, LOST PROFITS, GOODWILL OR OTHER SPECIAL, INDIRECT, PUNITIVE, INCIDENTAL OR CONSEQUENTIAL DAMAGES TO BUYER OR ANY THIRD PARTY, AND ALL SUCH DAMAGES ARE HEREBY DISCLAIMED.

Assignment

Buyer may not assign its rights or obligations hereunder without Seller's prior written consent; provided, however, that if Buyer is a distributor of Seller, Buyer's rights and obligations under these warranty terms shall inure to the benefit of and be binding upon Buyer's customers upon presentation to Seller of proof of purchase of the Product in accordance with the terms set forth herein. The Seller shall be entitled to assign its rights and obligations hereunder in whole or in part without the prior consent of the Buyer.

Governing Law

The warranty provisions and all questions relating to their validity, interpretation, performance and enforcement shall be construed in accordance with and governed by the substantive laws of the Commonwealth of Pennsylvania, without regard to principles of conflict of laws.

Waiver

Seller's failure to insist upon strict compliance with the terms of this warranty shall not constitute a waiver of such right. No claim or right arising out of any breach of warranty by Buyer may be waived in whole or in part by a waiver of the claim or right unless the waiver is in writing and signed by an authorized representative of Seller. Seller's waiver or acceptance of any breach by Buyer of any provision of the Warranty shall not constitute a waiver or excuse for failure to comply with any other provision of the Warranty or for any prior or subsequent breach of the same provision.

Freight

Seller shall arrange and pay for the cost of returning the device to Buyer.

Out of Box Failure (OBF)

Out of Box Failure (OBF) is defined as a product failure immediately after unpacking and installation of a newly delivered product. JULABO grants a 14-day grace period after the date of shipment within which the delivered product must be checked for defects. The same exclusions apply to the OBF classification as to the regular warranty. For example, JULABO is not liable for transport damage, damage caused by the customer or third parties, or for defects caused by improper installation or use.

10 Faults and troubleshooting

10.1 Alarm and warning messages

Alarm and warning messages are described in the table.

If a displayed error code is not described in the table, or if the error continues to occur after switching off and on again, contact Technical Service and inform them of the error code.

Code	Cause	Action
E01	The level has fallen below the minimum fill level.	Top up the heat transfer fluid. Check the temperature control hoses for damage and replace if necessary.
E03	The measured temperature is above the set overtemperature limit.	Increase the "Overtemperature" temperature limit or reduce the temperature setpoint.
E04	The measured temperature is below the set lower temperature limit.	Reduce the "low temperature" temperature limit or increase the temperature setpoint.
E05	Interruption or short circuit in the working temperature sensor of the overtemperature protection device.	Contact JULABO Service.
E06	There is too great a temperature difference between the working temperature sensor and the safety temperature sensor.	Increase circulation. Check the viscosity of the heat transfer fluid. If the fault is not rectified, contact Technical Service.
E14	The set protection temperature has been exceeded.	Check the working temperature range of the application. Increase the value of the protection temperature or reduce the setpoint temperature until it is lower than the set protection temperature  WARNING Set the high temperature cut-off at least 25 K below the flash point of the heat transfer fluid used.
E15	The cable of the external temperature sensor is short-circuited or interrupted.	Check the electrical connection to the external temperature sensor

E33	The line of the safety temperature sensor is short-circuited or interrupted.	Contact JULABO Service.
E38	The setpoint specification is set to external temperature sensor, but no signal is present.	Check whether an external temperature sensor is connected or whether the electrical connection is interrupted. If necessary, change the setpoint setting.
E40	The low level protection signals a critical fluid level.	Refill heat transfer fluid.
E41	The early warning system for excess level signals a critical fluid level.	Drain heat transfer fluid
E60	Internal read/write error.	Switch off the device at the power switch, wait 4 seconds and then switch the device back on.
E61	Connection error between circulator and cooling machine	Check connection cable for damage and replace if necessary. Switch the appliance back on. If the fault has not been rectified, contact Technical Service. Alternatively: Deactivate the cooling machine. The circulator is working as a heating circulator.
E62	CAN bus error	Switch off the device at the power switch, wait 4 seconds and then switch the device on again.
E63	Watchdog function has tripped.	Switch off the device at the power switch, wait 4 seconds and then switch the device back on.
E70	Device is operated with incompatible voltage or frequency or the device is incorrectly configured.	Check the permissible operating voltage of the device and its configuration.
E72	Configuration between circulator and connected cooling machine failed.	Switch off the appliance at the power switch, wait 4 seconds and then switch the appliance back on.
E83	Excessive power consumption via USB interface.	Check the inserted external data carrier for errors and replace if necessary. The USB interface is not suitable for consumers with a higher power requirement than the maximum permissible.

E104	The A/D conversion of the AF overtemperature protection device is working incorrectly.	Contact JULABO Service.
E106	Error in the internal temperature detection.	Contact JULABO Service.
E107	Error in the internal temperature detection.	Contact JULABO Service.
E108	The latching function of the safety device is still active.	Switch off the appliance at the mains switch, wait 4 seconds and then switch the appliance back on.
E112	Error in the internal temperature detection.	Contact JULABO Service.
E114	Error in the internal temperature detection.	Contact JULABO Service.
E115	Error in the internal temperature detection.	Contact JULABO Service.
E116	The latching function of the safety device is still active.	Switch off the appliance at the mains switch, wait 4 seconds and then switch the appliance back on.
E118	Error in the internal temperature detection.	Contact JULABO Service.
E142	Device started, actual value source of external temperature set to display, receive timeout of external temperature via CAN bus.	Contact JULABO Service.
E143	Set temperature limit overtemperature alarm exceeded.	Increase temperature limit overtemperature alarm or reduce temperature setpoint.
E144	The temperature has fallen below the set subtemperature alarm limit.	Reduce temperature limit subtemperature alarm or increase temperature setpoint.
E145	Measured current of heater 1 is below the limit value, although heating is required.	Contact JULABO Service.
E146	Measured current of heater 2 is below the limit value, although heating is required.	Contact JULABO Service.

E159	The measured temperature of the heat sink in the control section of the booster heater has exceeded the warning limit. The heating output of the booster heater is reduced.	Check the ambient temperature and reduce if necessary. Check the ventilation openings on the control section of the booster heater for dirt and clean if necessary. If the fault is not rectified, contact Technical Service.
E160	Frequency/voltage measurement error.	The fuse has tripped or there is a fault in the wiring.
E201	Pump pressure measurement faulty.	Contact JULABO Service.
E301	Pressure in the external temperature control circuit has exceeded the entered limit value for 1 second.	Contact JULABO Service.
E302	Pressure in the external temperature control circuit has exceeded the entered limit value for 5 seconds.	Contact JULABO Service.
E401	The cable of the evaporator outlet temperature sensor is short-circuited.	Contact JULABO Service.
E402	The line of the evaporator outlet temperature sensor is interrupted.	Contact JULABO Service.
E413	The evaporation pressure sensor is short-circuited.	Contact JULABO Service.
E414	The evaporation pressure sensor is interrupted.	Contact JULABO Service.
E417	The condensation pressure sensor is short-circuited.	Contact JULABO Service.
E418	The condensation pressure sensor is interrupted.	Contact JULABO Service.
E421	Ambient temperature outside the specification.	Check ambient temperature and reduce if necessary. Check condenser for soiling and clean if necessary. Switch off the appliance at the power switch, wait 4 seconds and then switch the appliance back on. If the fault is not rectified, contact Technical Service.

E427	The maximum permissible condensation pressure has been exceeded.	Check ambient temperature and reduce if necessary. Check condenser for soiling and clean if necessary. Switch off the appliance at the power switch, wait 4 seconds and then switch the appliance back on. If the fault has not been rectified, contact Technical Service.
E431	The maximum permissible current consumption at the compressor has been exceeded.	Check mains voltage for nominal voltage. If the fault has not been rectified, contact Technical Service.
E503	External setpoint specification set via EPROG, but no analog module connected.	Connect analog module or deactivate external setpoint setting via EPROG.
E504	External actuating value specification set via EPROG, but no analog module connected.	Connect analog module or deactivate external actuating value specification via EPROG.
E505	The analog module is sending an invalid setpoint.	Check EPROG settings.
E999	Internal error.	If it occurs repeatedly, contact JULABO Service.
E1103	Level detection faulty.	Contact JULABO Service.
E1109	Viscosity of the heat transfer fluid too high or circulation too low.	Check heat transfer fluid for suitability in the temperature range used or adjust circulation.
E1217	Mains frequency measurement faulty.	Contact JULABO Service.
E1218	Mains frequency measurement faulty.	Contact JULABO Service.
E1302	The pressure limit for blocking the heating output has not been reached. Motor defective or viscosity of the medium too high.	Check the pump setting and adjust if necessary. Check the viscosity of the heat transfer fluid and adjust if necessary.
E1305	The pump speed is too low. Pump defective or viscosity of the medium too high.	Check the pump setting and adjust if necessary. Check the viscosity of the heat transfer fluid and adjust if necessary.

E1427	The warning threshold for high condensation pressure has been exceeded.	Check ambient temperature and reduce if necessary. Check condenser for soiling and clean if necessary. Switch off the appliance at the mains switch, wait 4 seconds and then switch the appliance back on. For water-cooled appliances: Check the cooling water temperature and supply. If the fault is not rectified, contact Technical Service.
E1431	The current consumption at the compressor has fallen below the minimum permissible value.	Check mains voltage for nominal voltage. The specified voltage tolerance of the appliance must not be exceeded. Check the cooling machine's mains cable for damage and replace if necessary. Check ambient temperature and lower if necessary. Check CAN bus cable for damage and replace if necessary. If the fault is not rectified, contact Technical Service.
E1501	Timeout on digital interface.	If the watchdog is activated, the temperature setpoint must be sent cyclically to the device at least according to the set timeout.
E1502	Pressure in the temperature control circuit exceeds the entered warning limit.	Correct the pressure setpoint downwards or Set warning limit upwards (if justifiable from a safety point of view).
E1503	Pressure in the temperature control circuit falls below the entered warning limit.	Correct pressure setpoint upwards or Set warning limit downwards (if justifiable from a safety point of view).
E2426	Evaporation temperature below warning threshold.	Check pump setting Check hose cross-section of the connection to the application . Check connection to the application for free passage . Check heat transfer fluid for suitability .

11 Disposal

When disposing of the appliance, observe the applicable national regulations.



This symbol on the product or its packaging notices that it must not be disposed of with household waste.

Proper disposal avoids negative effects on people and the environment and allows valuable raw materials to be reused.

Information on collection points for old appliances can be obtained from the city or municipality or an authorized disposal company.

12 Appendix

12.1 Interface commands

The device can be controlled remotely via interface commands. Parameters can be called up and the current status can be queried. To do this, the device must be connected to the host computer via a digital interface.

The interface commands are entered via a terminal program.

Interface commands are divided into IN commands and OUT commands.

String element	Symbol	Hex character
Space character	␣	20
Carriage return	←	0D
Line feed	LF	0A

- IN commands: Retrieve parameters
Command structure: Command + ←

Example: Querying the setpoint temperature:

```
IN_SP_00←  
(RS485: A32_IN_SP_00← )
```

Ex. response from the device:

```
55.5 ← LF  
(RS485: A032_55.5 ← LF)
```

- OUT commands: Set parameters (only in remote control mode)
Command structure: Command + ␣ + parameter + ←

Example of setting the setpoint temperature to 55.5 °C:

```
OUT_SP_00_55.5←  
(RS485: A032_OUT_SP_00_55.5 ← )
```

When working with the RS485 interface, each command is preceded by the three-digit device address, e.g. address Ad32 = A032.

12.1.1 IN commands

IN commands are used to retrieve parameters from the device.

Process values	Comment
version	Version
Status	status
in_pv_00	Actual temperature value
in_pv_01	Current manipulated variable [%]
in_pv_02	Current temperature of the external Pt100 temperature sensor
in_pv_03	Current temperature of the temperature safety sensor
in_pv_04	Current setting value of the overtemperature protection device
in_pv_06	Current pressure. EPROG input must be set to pressure
in_pv_07	Current flow rate. EPROG input must be set to flow rate
in_pv_15	Query external actual temperature
in_pv_16	Current level of temperature control fluid (%)

Setpoints and warning limits	Comment
in_sp_00	Set temperature setpoint
in_sp_03	Set overtemperature warning limit
in_sp_04	Set low temperature warning limit
in_sp_05	Set working temperature via EPROG
in_sp_06	Set setpoint temperature of the watchdog function
in_sp_07	Set pump stage
in_sp_010	Set control value specification via serial interface
in_sp_11	Set temperature unit: 0 = °C 1 = °F
in_sp_12	Set pressure unit
in_sp_13	Set flow unit
in_sp_14	Set upper pressure warning limit
in_sp_15	Set pressure warning limit at bottom
in_sp_16	Set pressure alarm limit (5s)
in_sp_17	Set pressure alarm limit (1s)
in_sp_27	Set pump setting
in_sp_28	Set low temperature alarm limit
in_sp_29	Set low temperature alarm limit

Device modes	Comment
in_mode_03	Setting the operating mode of the EPROG input: 0 = 0...10 V 1 = 4...20 mA
in_mode_04	Setting the operating mode of the temperature control 0 = Internal 1 = External
in_mode_05	Set operating mode of the temperature control system: 0 = Stop 1 = Start
in_mode_08	Set controller dynamics for internal temperature control: 0 = Aperiodic 1 = Standard
in_mode_11	Control value source: 0 = Circulator 1 = Serial 2 = Analog (EPROG)

IN-PAR	Comment
in_par_00	Set sensor difference between working temperature sensor and safety temperature sensor
in_par_01	Set time constant of the external bath TE
in_par_02	Set internal slope value SI
in_par_03	Set time constant of the internal bath TI
in_par_04	Set optimization parameter CoSpeed
in_par_05	Ratio of cooling/heating capacity pk to ph
in_par_06	Set control parameter Xp of the internal controller
in_par_07	Set control parameter Tn of the internal controller
in_par_08	Set control parameter Tv of the internal controller
in_par_09	Set pump operating mode
in_par_10	Set control parameter Xpu of the subordinate controller (cascade control)
in_par_11	Set control parameter Tn of the cascade controller
in_par_12	Set control parameter Tv of the cascade controller
in_par_13	Set maximum permissible internal temperature InternMax for cascade control
in_par_14	Set minimum permissible internal temperature InternMin for cascade control
in_par_15	Set upper band limitation for cascade control
in_par_16	Set lower band limit for cascade control

Auxiliary parameter	Comment
in_hil_00	Set control value limitation of the cooling capacity (%)
in_hil_01	Set control value limitation of the heating output (%)

12.1.2 OUT commands

OUT commands are used to set parameters on the device. Remote control mode must be active for this.

Setpoints and warning limits	Comment
out_sp_00	Setting the setpoint temperature
out_sp_03	Setting the overtemperature warning limit
out_sp_07	Setting the pump stage
out_sp_09	Pressure unit setting
out_sp_10	Setting the control value specification via serial interface
out_sp_11	Setting the temperature unit: 0 = °C 1 = °F
out_sp_12	Setting the pressure unit
out_sp_14	Setting the upper pressure warning limit
out_sp_15	Setting the lower pressure warning limit
out_sp_17	Setting the pressure alarm limit (1s)
out_sp_27	Setting the pump output [%]
out_sp_28	Setting the overtemperature alarm limit
out_sp_29	Setting low temperature alarm limit

Device modes	Comment
out_mode_03	Setting the EPROG operating mode: 0 = 0-10 V 1 = 0-20 mA
out_mode_04	Setting the temperature control: 0 = Internal control 1 = External control
out_mode_05	Start/stop command of the device in remote control mode: 0 = Stop temperature control 1 = Start temperature control
out_mode_08	Setting the internal control dynamics: 0 = Aperiodic 1 = Standard
out_mode_11	Control value source: 0 = Circulator 1 = Serial 2 = Analog (EPROG)

Auxiliary parameter	Comment
out_hil_00	Setting the control value limitation of the cooling capacity (0 - 100%)
out_hil_01	Setting the control value limitation of the heating output (0 - 100%)

12.2 Status messages

Status message	Explanation
00 MANUAL STOP	Device in standby mode manual operation
01 MANUAL START	Device in manual mode
02 REMOTE STOP	Device in standby mode remote control mode
03 REMOTE START	Device in remote control mode
-08 INVALID COMMAND	Device did not recognize last received command
-09 COMMAND NOT ALLOWED INCUR- RENT OPERATING MODE	Last received command is not allowed in the operating mode
-10 VALUE TOO SMALL	The last set value is too small
-11 VALUE TOO LARGE	The last set value is too large
-13 VALUE EXCEEDS TEMPERATURE LIMITS	The value is not within the set temperature limits

