

Operation Manual

Recirculating Chiller F-360



Imprint

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1 About this document

This operation manual is applicable for all variants of the instrument.
Read this operation manual before operating the instrument and follow the instructions to ensure safe and trouble-free operation.
Keep this operation manual for later use and pass it on to any subsequent user or owner.

BÜCHI Labortechnik AG accepts no liability for damage, faults and malfunctions resulting from not following this operation manual.

If you have any questions after reading this operation manual:

- Contact BÜCHI Labortechnik AG Customer Service.

<https://www.buchi.com/contact>

1.1 Mark-ups and symbols



NOTE

This symbol draws attention to useful and important information.

- ☑ This character draws attention to a requirement that must be met before the instructions below are carried out.
- This character indicates an instruction that must be carried out by the user.
- ⇒ This character indicates the result of a correctly carried out instruction.

Mark-up	Explanation
<i>Window</i>	Software Windows are marked-up like this.
<i>Tab</i>	Tabs are marked-up like this.
<i>Dialog</i>	Dialogs are marked-up like this.
<i>[Button]</i>	Buttons are marked-up like this.
<i>[Field names]</i>	Field names are marked-up like this.
<i>[Menu / Menu item]</i>	Menus or menu items are marked-up like this.
Status	Status is marked-up like this.
Signal	Signals are marked-up like this.

1.2 Trademarks

Product names and registered or unregistered trademarks that are used in this document are used only for identification and remain the property of the owner in each case.

1.3 Connected devices

In addition to these operating instructions, follow the instructions and specifications in the documentation for the connected devices.

2 Safety

2.1 Intended use

The instrument has been designed and built as an item of laboratory equipment. It is intended to be used for cooling sealed circulation systems (e.g. evaporators, reaction vessels).

2.2 Use other than that intended

Use of any kind other than that referred to and any application that does not comply with the technical specifications in Chapter 3.4 "Technical data", page 14 constitutes use other than that intended.

In particular, the following applications are not permissible:

- Installation of the instrument in areas that require apparatus that is safe to use in potentially explosive atmospheres.
- Use of accessories or replacement parts that are not specified in the operating instructions provided.
- The instrument may not be used in conjunction with flammable substances.
- Placing objects on top of the instrument, that are not part of the installation.
- Use of the instrument without following the instructions of the connected devices.

Damage or hazards attributable to use of the product other than as intended are entirely at the risk of the user alone.

2.3 Staff qualification

Unqualified persons are unable to identify risks and are therefore exposed to greater dangers.

The instrument may only be operated by suitably qualified laboratory staff.

These operating instructions are aimed at the following target groups:

Users

Users are persons that meet the following criteria:

- They have been instructed in the use of the instrument.
- They are familiar with the contents of these operating instructions and the applicable safety regulations and apply them.
- They are able on the basis of their training or professional experience to assess the risks associated with the use of the instrument.

Operator

The operator (generally the laboratory manager) is responsible for the following aspects:

- The instrument must be correctly installed, commissioned, operated and serviced.
- Only suitably qualified staff may be assigned the task of performing the operations described in these operating instructions.
- The staff must comply with the local applicable requirements and regulations for safe and hazard-conscious working practices.
- Safety-related incidents that occur while using the instrument should be reported to the manufacturer (quality@buch.com).

BUCHI service technicians

Service technicians authorized by BUCHI have attended special training courses and are authorized by BÜCHI Labortechnik AG to carry out special servicing and repair measures.

2.4 Warning notices in this document






Warning notices warn you of dangers that can occur when handling the instrument. There are four danger levels, each identifiable by the signal word used.

Signal word	Meaning
DANGER	Indicates a danger with a high level of risk which could result in death or serious injury if not prevented.
WARNING	Indicates a danger with a medium level of risk which could result in death or serious injury if not prevented.
CAUTION	Indicates a danger with a low level of risk which could result in minor or medium-severity injury if not prevented.
NOTICE	Indicates a danger that could result in damage to property.

2.5 Warning and directive symbols

The following warning symbols are displayed in this operation manual or on the instrument.

Symbol	Meaning
	General warning
	Dangerous electrical voltage
	Heavy item
	Explosive substances
	Flammable substances
	Health-harming or irritant substances
	Hot surface
	Device damage
	Dangerous gases
	Corrosive
	Cuts by sharp edges

Symbol	Meaning
	Flooding
	Wear laboratory coat
	Wear safety goggles
	Wear protective gloves
	Heavy weight, lifting requires more than one person

2.6 Residual risks

The instrument has been developed and manufactured using the latest technological advances. Nevertheless, risks to persons, property or the environment can arise if the instrument is used incorrectly.

Appropriate warnings in this manual serve to alert the user to these residual dangers.

2.6.1 Overheating and toxic vapors

Should the instrument overheat and/or catch fire, corrosive and toxic vapors may be produced.

- ▶ Do not inhale vapors in the event of fire and/or explosion.
- ▶ Wear a protective breathing mask.
- ▶ Avoid overheating the instrument by carefully following the installation instructions.

2.6.2 Corrosive refrigerant

Direct contact with the refrigerant (see Chapter 3.4 "Technical data", page 14) can cause freeze burns and eye injuries.

- ▶ If liquid escapes: avoid contact with skin and eyes.
- ▶ Wear safety goggles.
- ▶ Wear protective gloves.

2.6.3 Faults during operation

If an instrument is damaged, sharp edges, moving parts or exposed electrical wires can cause injuries.

- ▶ Regularly check instruments for visible damage.
- ▶ If faults occur, switch off the instrument immediately, unplug the power cord and inform the operator.
- ▶ Do not continue to use instruments that are damaged.

2.7 Personal protective equipment

Depending on the application, hazards due to heat and/or corrosive chemicals may arise.

- ▶ Always wear appropriate personal protective equipment such as safety goggles, protective clothing and gloves.
- ▶ Make sure that the personal protective equipment meets the requirements of the safety data sheets for all chemicals used.

2.8 Modifications

Unauthorized modifications can effect safety and lead to accidents.

- ▶ Use only genuine BUCHI accessories, spare parts and consumables.
- ▶ Carry out technical changes only with prior written approval from BUCHI.
- ▶ Only allow changes to be made by BUCHI service technicians.

BUCHI accepts no liability for damage, faults and malfunctions resulting from unauthorized modifications.

3 Product description

3.1 Description of function

The instrument is a closed-circuit cooler for use with evaporators. It has a control unit and display built in to regulate and indicate the actual and set value of the cooling temperature.

3.1.1 Process overview

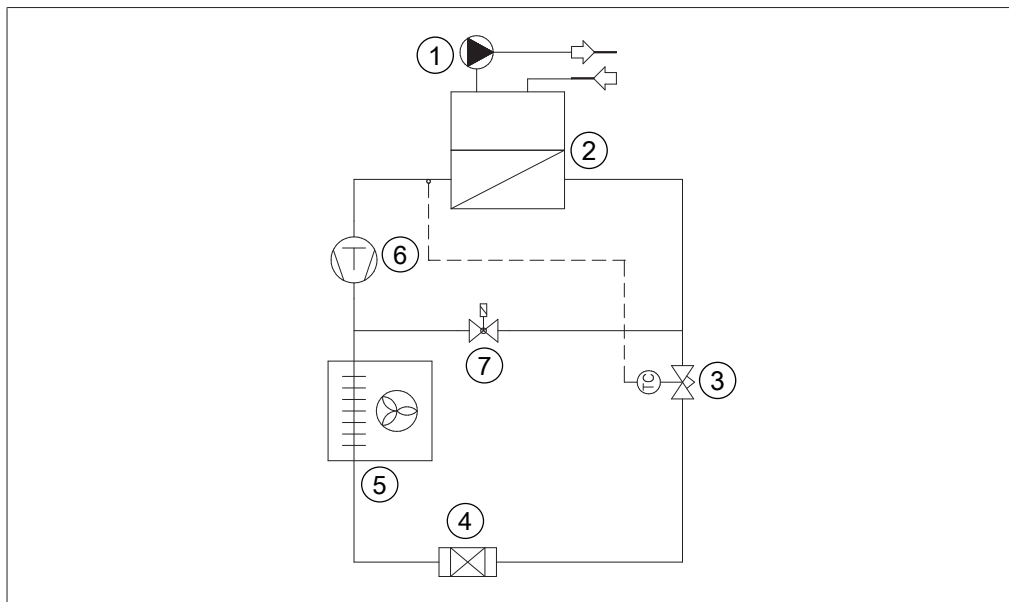


Fig. 1: Process overview

- | | | | |
|---|------------------------------|---|----------------|
| 1 | Circulation pump | 5 | Heat exchanger |
| 2 | Heat exchange container | 6 | Compressor |
| 3 | Thermostatic expansion valve | 7 | In-line valve |
| 4 | Filter dryer | | |

3.2 Configuration

3.2.1 Front view

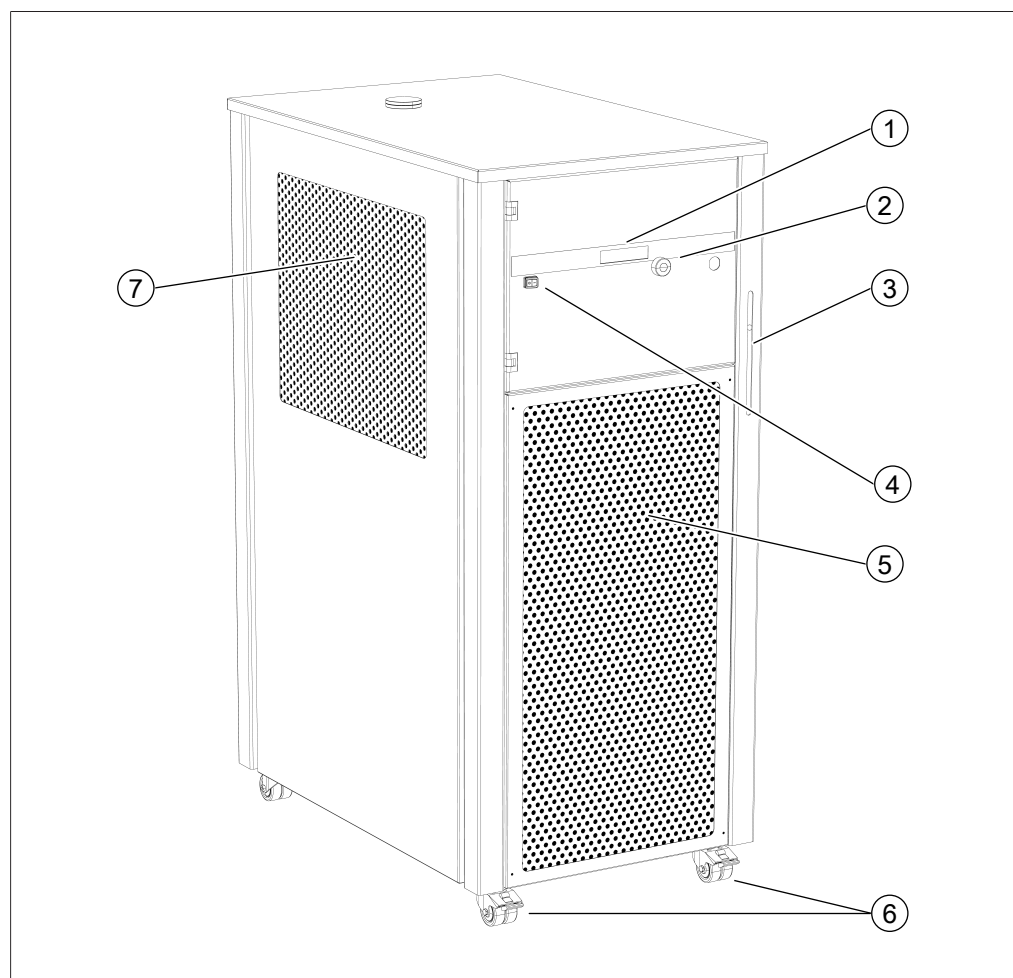


Fig. 2: Front view

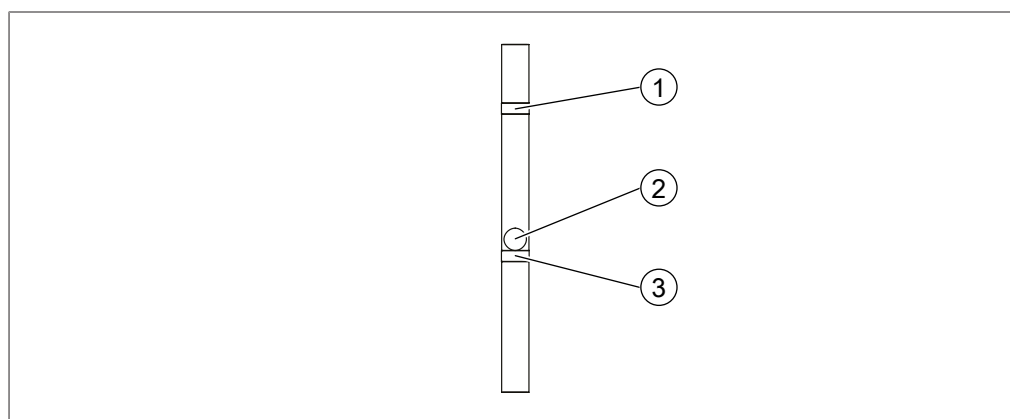
- | | | | |
|---|---|---|-------------------------|
| 1 | Display (see Chapter 3.2.2 "Display", page 12) | 5 | Air in for ventilation |
| 2 | Navigation control | 6 | Castor wheels |
| 3 | Coolant level indicator (see Chapter 3.2.3 "Fill level indicator", page 12) | 7 | Air out for ventilation |
| 4 | On-/Off masterswitch | | |

3.2.2 Display



- | | | | |
|---|------------------------|---|---|
| 1 | Operating status | 4 | Indicates connection to the BUCHI vacuum controller |
| 2 | Actual temperature | 5 | Options activated if control knob is pressed |
| 3 | Set temperature locked | 6 | Set temperature |

3.2.3 Fill level indicator



- | | | | |
|---|-------------------------------|---|---------------------|
| 1 | Max fill level mark | 3 | Min fill level mark |
| 2 | Current fill level indication | | |

3.2.4 Rear view

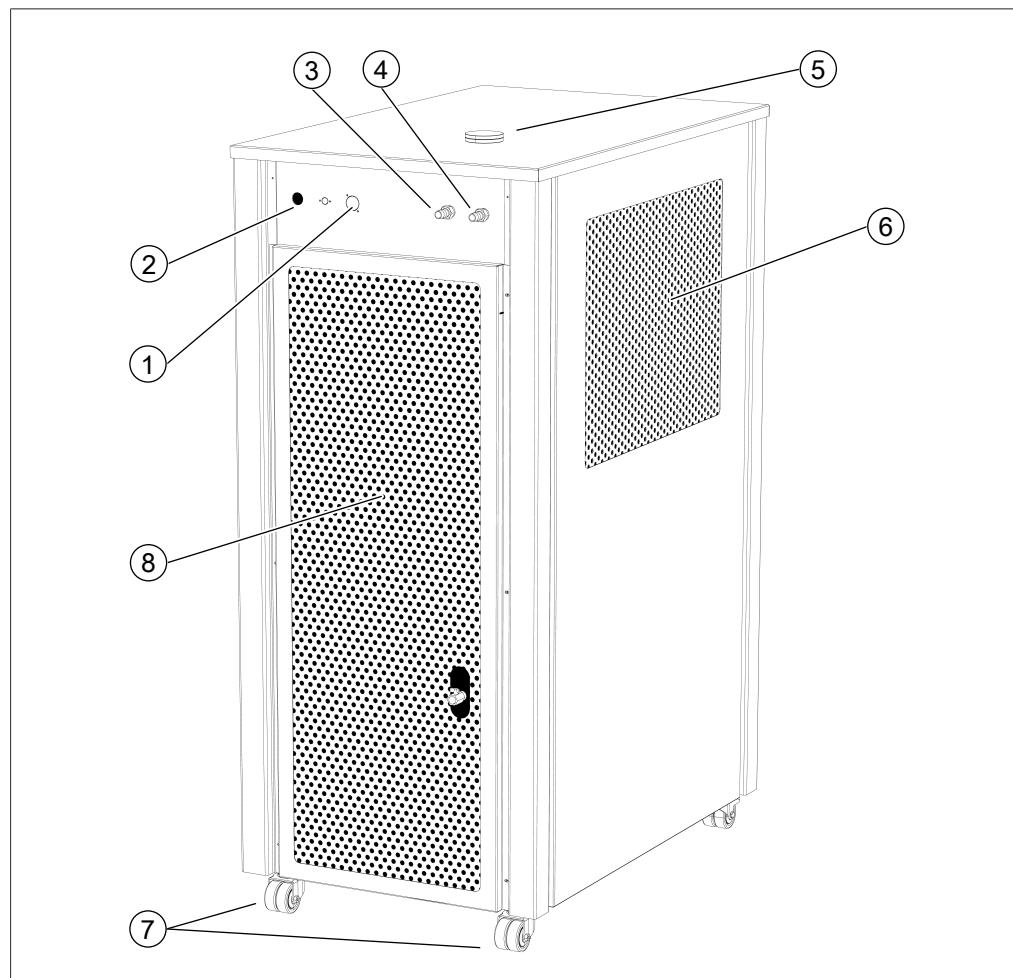


Fig. 3: Rear view

- | | | | |
|---|-----------------------|---|--------------------------------|
| 1 | COM port | 5 | Filling connection for coolant |
| 2 | Power cable | 6 | Slots for air flow out |
| 3 | Main coolant flow IN | 7 | Castor wheels |
| 4 | Main coolant flow OUT | 8 | Drain of coolant |

3.2.5 Type plate

The type plate is on the rear of the instrument.

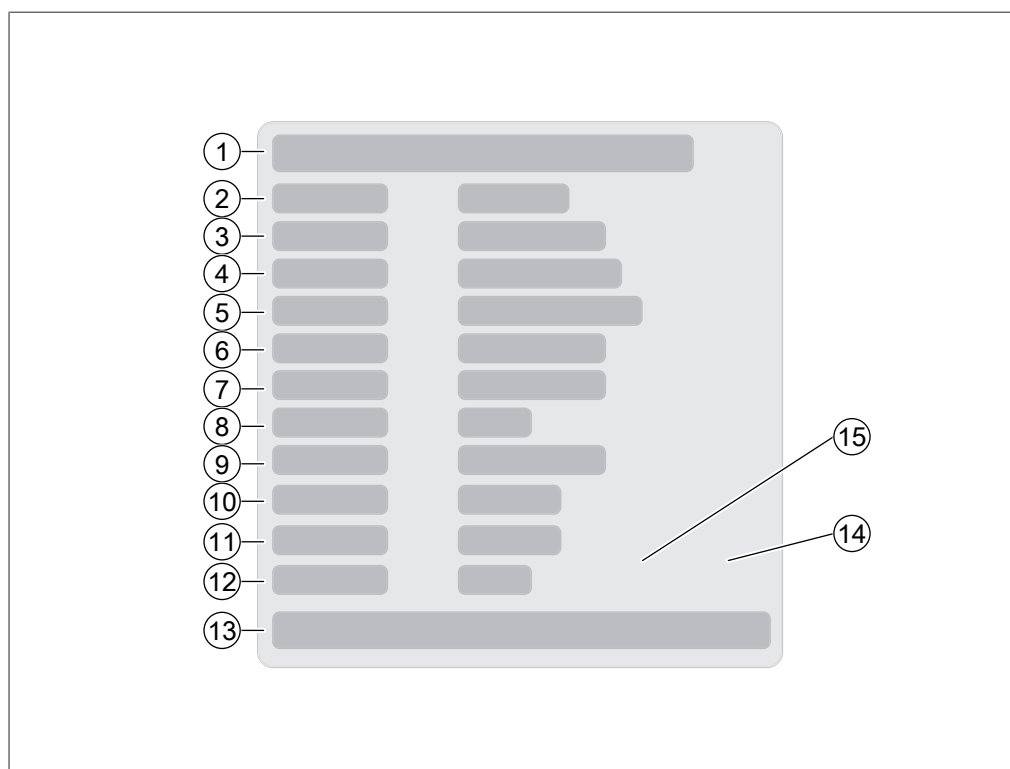


Fig. 4: Type plate

- | | |
|------------------------------|--|
| 1 Instrument name | 9 Fuse protection |
| 2 Serial number | 10 Working pressure max. HP |
| 3 Article number | 11 Working pressure max. LP |
| 4 Refrigerant | 12 Year of manufacture |
| 5 CO ₂ equivalent | 13 Company name and address |
| 6 Input voltage | 14 Symbol CE Certification |
| 7 Frequency | 15 Symbol for "Do not dispose of as household waste" |
| 8 Power consumption max. | |

3.3 Scope of delivery



NOTE

The scope of delivery depends of the configuration of the purchase order.

Accessories are delivered as per the purchase order, order confirmation, and delivery note.

3.4 Technical data

3.4.1 Recirculating Chiller

	F-360
Dimensions (W x D x H)	650 x 850 x1300 mm
Weight	220 kg
Cooling capacity at 15 °C*	6000 W

F-360	
Temperature range	-10 to +25 °C
Heating emission	9100 W
Power consumption	6200 W
Voltage	400 VAC ± 10 %
Frequency	50 or 60 Hz
Temperature reading resolution	0.1 °C
Hysteresis	± 1 °C
Refrigerant	R513a
Tank capacity	30 L
Tubing connector	13.5 mm
Pump pressure	3 bar
Pump delivery rate	20 L/min
Overvoltage category	II
Display	digital, resolution 0.1 °C

* Measured at 20°C ambient temperature.

3.4.2 Ambient conditions

For indoor use only.

Max. altitude above sea level	2000 m
Ambient temperature	5 - 35 °C (25 °C)
Maximum relative humidity	80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C
Storage temperature	max. 45 °C

3.4.3 Materials

Component	Material
Casing	Stainless steel (1.4301), powder-coated
Internal piping and condenser	Copper
Foil	Polyester (PES)
Circuit board	Glass-fiber reinforced epoxy resin
Cable	Polyvinyl chloride (PVC)
Refrigerant	R513a

3.5 Safety features

3.5.1 High temperature cut-out

The instrument is equipped with a high-temperature cut-out for the compressor and the motor.

3.5.2 Fill level sensor

The instrument has an integrated fill level sensor. The fill level sensor checks whether the instrument is filled with the minimum amount of coolant. See also Chapter 3.2.3 "Fill level indicator", page 12.

4 Transport and storage

4.1 Transport



NOTICE

Risk of breakage due to incorrect transportation

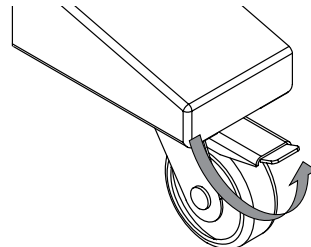
- ▶ Make sure that all parts of the instrument are safely packed in such a way as to prevent breakage, ideally in the original box.
 - ▶ Avoid sharp movements during transit.
-
- ▶ Transport the instrument in an upright position.
 - ▶ Empty the coolant tank before transportation.
 - ▶ After transportation, check the instrument for damage.
 - ▶ Damage that has occurred in transit should be reported to the carrier.
 - ▶ Keep packing for future transportation.

4.2 Storage

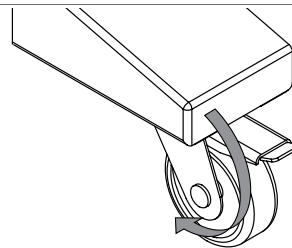
- ▶ Make sure that the ambient conditions are complied with (see Chapter 3.4 "Technical data", page 14).
- ▶ Wherever possible, store the instrument in its original packaging.
- ▶ Empty the coolant tank before storing the instrument.
- ▶ After storage, check the instrument and all tubing for damage and replace if necessary.

4.3 Moving the instrument

- ▶ Release the castor breaks.
- ▶ Move the instrument to the designated place.



- ▶ Lock the castor breaks.



5 Installation

5.1 Important considerations prior to commissioning



DANGER

Risk of fatal injury if used in potentially explosive atmospheres

- ▶ Do not bring the device into close proximity with flammable vapors.
- ▶ Do not place any open solvent containers near to the device.



WARNING

Risk of fire from overheating device

- ▶ Do not cover over the device.
- ▶ Make sure there is adequate air circulation.

5.2 Installation site

The installation site must meet the following requirements:

- Firm and level surface
The installation site has enough space that cables / tubes can be routed safely.
- Clearance on all sides: at least 40 cm
- Adequate air circulation
- Power supply outlet easily accessible (even after device has been set up)

The instrument is intended for use in laboratory environments (see Chapter 3.4 "Technical data", page 14).

5.3 Establishing electrical connections



WARNING

Death or serious burns by electric current.

- ▶ Have the installation carried out by an electrician or a person with similar expert knowledge.
- ▶ After installation, check electrical safety.

The instrument is design for stationary installation.

Precondition:

- ☒ The electrical installation is as specified in the technical data. See Chapter 3.4 "Technical data", page 14
- ☒ The installation site is as specified in the technical date. See Chapter 3.4 "Technical data", page 14
- ▶ Have the installation carried out by an electrician or a person with similar expert knowledge.
- ▶ Carry out the installation according to the instructions. See *Guide for electrical installation*

5.3.1 Connecting a mains plug

Precondition:

- ☒ The instrument is delivered with a mains cable connected to the instrument.

- Install a plug to the cable, considering the following color code:

Brown	L1
Black	L2
Grey	L3
Blue	N
Green/Yellow	PE

5.4 Installing the hoses

Precondition:

- ☒ Only use hoses that match with the specifications given in Chapter 3.4 "Technical data", page 14.
- Connect the instrument outlet (OUT) to the connected instrument (Rotavapor®) inlet.
- Connect the instrument inlet (IN) to the connected instrument (Rotavapor®) outlet.

5.5 Filling and draining the coolant tank



NOTICE

Risk of instrument damage if wrong coolant is used.

- Make sure that the coolant fits the specifications in Chapter 3.4 "Technical data", page 14.

Recommended : Ethylene glycol : Water = 40 % : 60 %

5.5.1 Filling the coolant tank

Precondition:

- ☒ The instrument is not in operation.
- ☒ The instrument is in ambient temperature.
- ☒ The instrument is not connected to any other device.
- Remove the coolant filler cap (see location of the tap in chapter Chapter 3.2 "Configuration", page 11).
- Pour coolant into the filler neck.
- Keep an eye on the fill level indicator (see Chapter 3.2.3 "Fill level indicator", page 12).
- In the case of large cooling systems fill the coolant tank to the maximum level.
- Replace filler cap on coolant filler neck.
- Connect other devices to the instrument. See Chapter 5.4 "Installing the hoses", page 18.

5.5.2 Draining the coolant tank

Precondition:

- ☒ The instrument is not in operation.
- ☒ The instrument is in ambient temperature.
- ☒ The instrument is not connected to any other device.
- Place a suitable receptacle below the drain tap (see location of the tap in chapter Chapter 3.2 "Configuration", page 11).
- Open the drain tap and allow coolant to run into the receptacle.
- Wait until the the coolant drained.
- Close the drain tap.

- Connect other devices to the instrument. See Chapter 5.4 "Installing the hoses", page 18.

6 Operation

6.1 Operating chiller with remote control system (option)

All functions of the instrument can be controlled by an external control system.

Precondition:

- ☑ All commissioning operations have been completed. See Chapter 5 "Installation", page 17.
- ▶ Switch the On/Off master switch to On.
 - ⇒ The instrument is ready to use.
- ▶ Check the fill level of the coolant tank (see Chapter 7.4 "Checking the coolant level", page 21).
- ▶ Connect the external control system to the instrument with a cable (see Chapter 3.2 "Configuration", page 11).
- ▶ Set the required temperature via the external control system.
- ▶ Start/stop the chilling process via the external control system.

6.2 Operating chiller without control system

Precondition:

- ☑ All commissioning operations have been completed. See Chapter 5 "Installation", page 17.
- ▶ Switch the On/Off masterswitch to On.
 - ⇒ The instrument is ready to use.
- ▶ Check the fill level of the coolant tank (see Chapter 7.4 "Checking the coolant level", page 21).
- ▶ Set the required temperature using the navigation control (see Chapter 3.2 "Configuration", page 11).
- ▶ Start/stop the chilling process by pressing the navigation control.

6.3 Locking the set temperature

Precondition:

- ☑ The instrument has a locking function that prevents the set temperature being inadvertently altered.
- ▶ To lock the set temperature, press and hold the navigation control.
 - ⇒ The padlock symbol appears on the display.
- ▶ To cancel the lock function, press and hold the navigation control.
 - ⇒ The padlock symbol disappears.

6.4 Shutting down the instrument

- ▶ Switch the **On/Off** master switch to Off.

7 Cleaning and servicing



NOTE

Users may only carry out the servicing and cleaning operations described in this section.

Any servicing and repair work which involves opening up the casing may only be carried out by BÜCHI service technicians.

7.1 Regular maintenance work

Action		Daily	Weekly	Monthly	Twice a year	Additional information
7.4	Checking the coolant level	1				
7.2	Cleaning the housing		2			
7.5	Cleaning the ventilation slots			1		
7.3	Checking and replacing tubing				1	
7.6	Exchanging the coolant				1	

1 - User; 2 - Operator

7.2 Cleaning the housing

- ▶ Wipe down the housing with a damp cloth.
- ▶ If heavily soiled, use ethanol or a mild detergent.
- ▶ Wipe down the display with a damp cloth.

7.3 Checking and replacing tubing

- ▶ Check all tubing for wear.
- ▶ Replace any damaged tubing.

7.4 Checking the coolant level

The coolant fill level must always be checked before using the instrument. The required level of coolant depends on the length of the tubing and/or the number of laboratory instruments and condensers connected. For details, see Chapter 3.2.3 "Fill level indicator", page 12. If necessary add or drain coolant, see Chapter 5.5 "Filling and draining the coolant tank", page 18.

7.5 Cleaning the ventilation slots

- ▶ Remove dust and foreign objects from the ventilation slots using compressed air or a vacuum cleaner.

7.6 Exchanging the coolant

- ▶ See Chapter 5.5 "Filling and draining the coolant tank", page 18.

8 Help with faults

8.1 Faults and rectifying them

Prior to all repair work and fault rectification, e.g. fuse replacement, disconnected the instrument from the power supply by unplugging the power cord from the power outlet.

8.1.1 Indication of faults on the display

A fault code is shown on the display if a malfunction has occurred on the instrument.

Fault code	Fault	Remedy
E01	Temperature sensor defective	<ul style="list-style-type: none"> ▶ Switch off the instrument. ▶ Allow it to cool down.
E02	Temperature error	<ul style="list-style-type: none"> ▶ Clean the air intake (see Chapter 7.2 "Cleaning the housing", page 21). ▶ Switch the instrument on again. ▶ If the problem cannot be rectified contact BUCHI Customer Service.
E03	Coolant tank empty or level too low, pump malfunction	<ul style="list-style-type: none"> ▶ Switch off the instrument. ▶ Allow it to cool down. ▶ Top up coolant level (see Chapter 7.4 "Checking the coolant level", page 21). ▶ Switch the instrument on again. ▶ If the problem cannot be rectified contact BUCHI Customer Service.
E04	Compressor pressure fault	<ul style="list-style-type: none"> ▶ Switch off the instrument. ▶ Allow compressor to cool down. ▶ Switch the instrument on again. ▶ If the problem cannot be rectified contact BUCHI Customer Service.
E05	Data error	<ul style="list-style-type: none"> ▶ Switch the instrument off. ▶ Switch the instrument on again. ▶ If the problem cannot be rectified contact BUCHI Customer Service.
E06	Electronic circuitry overheated	<ul style="list-style-type: none"> ▶ Switch off the instrument. ▶ Allow it to cool down. ▶ Clean the air intake (see Cleaning the ventilation slots). ▶ Switch the instrument on again. ▶ If the problem cannot be rectified contact BUCHI Customer Service.

8.1.2 Other malfunctions

Fault	Cause	Remedy
Instrument fails to operate	Instrument is overheated	<ul style="list-style-type: none"> ▶ Switch off the instrument. ▶ Allow it to cool down. ▶ Check whether the installation site meets the required conditions, see Chapter 5.2 "Installation site", page 17.
	Tripped fuse	<ul style="list-style-type: none"> ▶ Switch off the instrument. ▶ Follow the instructions in Resetting the fuse

8.1.3 Resetting the fuse



DANGER

Risk of shock hazard

A failure in carrying out this operation can result in death or serious injury.

- ▶ Only suitably qualified personnel should carry out this operation.
- ▶ Disconnect the power cord before opening the housing of the instrument.

-
- ▶ Switch off the instrument.
 - ▶ Disconnect the instrument from the power supply.
 - ▶ Open the housing with the provided tool.
 - ▶ Reset the fuse marked with **F1** by pushing it up.

⇒ The fuse is reset and in its upper position.

9 Taking out of service and disposal

9.1 Taking out of service

- ▶ Drain the coolant.
- ▶ Switch off the instrument and disconnect it from the mains power supply.
- ▶ Clean the instrument.
- ▶ Remove all tubing and communication cables from the device.

9.2 Disposal

The operator is responsible for proper disposal of the instrument.



CAUTION

Potential environmental hazard

The refrigerant (see Chapter 3.4 "Technical data", page 14) used to operate the instrument is toxic and must not be allowed to enter the soil or groundwater.

- ▶ Dispose the instrument properly, if necessary using a professional disposal service.
-
- ▶ When disposing, observe the disposal regulations of the materials used. Materials used see Chapter 3.4 "Technical data", page 14.

9.3 Returning the instrument

Before returning the instrument, contact the BÜCHI Labortechnik AG Service Department.

<https://www.buchi.com/contact>

10 Appendix

10.1 Spare parts and accessories

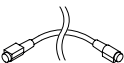
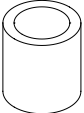
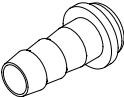
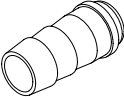
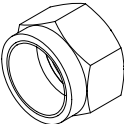
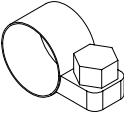
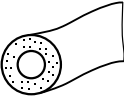
Use only genuine BUCHI consumables and spare parts in order to ensure correct, safe and reliable operation of the system.



NOTE

Any modifications of spare parts or assemblies are only allowed with the prior written permission of BUCHI.

10.1.1 Spare parts

	Order no.	Image
Communication cable. BUCHI COM, 1.8 m, 6p	11058707	
Tubing, PVC, 10/15 mm, transparent, per m	027146	
Hose barb, 9.5 mm	046792	
Hose barb, 13.5 mm	040329	
Union nut, M16x1, Rf, for hose barbs	019889	
Hose clip, 8-16 mm	022352	
Hose insulation, Kaiflex, 16/27 mm, 1 m, black	11075642	



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