Leosmak

Compact Freeze Dryer

Operating Manual

Please, keep for later use!

I. INQUIRY AND COPYRIGHT

In case of inquiries, please, use the contact information at this page and state the following information:
Model name: LEO-004, LEO-004L, LEO-007, LEO-007L, LEO-010 or LEO-010L,
Serial number: a number called “serial number” provided on the Name Plate.

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III. GENERAL INFORMATION

3.1. Importance of the Operating Manual

A fundamental requirement for a safe and trouble-free operation of the Freeze Dryer is to be familiar with the fundamental safety instructions and all possible hazards. The Operating Manual includes important information concerning the safe operation of the Freeze Dryer. This Operating Manual, and in particular the notes on safety and hazards, must be observed by all persons operating the Freeze Dryer. In addition, the local rules and regulations for the prevention of accidents and workers safety must be complied with. Do not operate the Freeze Dryer if you are unsure about its proper connection, way of functioning etc. Maintain this Operating Manual for future needs and always keep it close to the Freeze Dryer in easily accessible place. The Operating Manual must be handed over to any subsequent owner or Operator of the Freeze Dryer. In case you have any questions or need of inquiry, contact Leosmak using the contact data provided in "I. Inquiry and copyright" section.

3.2. Definitions

If a term is written in Capital letter within this Operating Manual, it should have a following meaning:

- Agreement – a contract or an order, including general terms and conditions, accepted by first purchaser defining the conditions for the construction and delivery of the Freeze Dryer,
- Compressor – a compressor unit installed in the Freeze Dryer,
- Declaration of Conformity – EC Declaration of conformity for the Freeze Dryer attached to the Operating Manual,
- Freeze Dryer – a device designed, manufactured, and delivered by Leosmak exclusively for its Intended Use, encompassing the following models: LEO-004, LEO-004L, LEO-007, LEO-007L, LEO-010 or LEO-010L (Compact Freeze Dryer),
- Freeze Drying or Sublimation – a process of dehydration due to vaporization, which proceeds in very low pressure and temperature,
- Intended Use – Freeze Drying of solid or liquid food, food additives or beverages in the Freeze Dryer, that also includes observation of all the notes and instructions included in the Operating Manual, compliance with the inspection and maintenance instruction, prohibition of any type of extensions to, or conversions of the Freeze Dryer,
- Leosmak – Leosmak Sp. z o.o. with its registered office in Wroclaw, Poland, that designed, manufactured and delivered the Freeze Dryer in accordance with the Agreement,
- Name Plate – a marking sign permanently attached to the Freeze Dryer, holding the information about model, serial number and other important information, put by Leosmak,
- Operating Manual – this document, maintaining important notes and safety information on the Freeze Dryer,
- Operator – a natural person, that is directly operating the Freeze Dryer in accordance with this Operating Manual,
- Vacuum Pump – a vacuum pump installed in the Freeze Dryer,
- Warranty – a representation made by Leosmak in the Agreement that a refund, repair, or replacement will be made if the Freeze Dryer proves defective or unsatisfactory within a period specified in the Agreement.

3.3. Warranty

All Warranty conditions are stipulated in the Agreement. Please, note, that Warranty conditions can differ depending on the model of your Freeze Dryer. General Warranty conditions for Compact Freeze Dryer are presented below:

WARRANTY/LIABILITY FOR MATERIAL DEFECTS
Repairs to the Freeze Dryer may be performed by persons authorized to do so by Leosmak or by authorized Leosmak service centers (in this case, the cost of repair is covered by Leosmak). Use only parts supplied with the Freeze Dryer or original spare parts. It is forbidden to use parts or components in the Freeze Dryer that have not been provided by Leosmak for the Freeze Dryer. Otherwise, the warranty or liability for material defects will be invalidated.

FREEZE DRYER WARRANTY
Leosmak provides a warranty for the Freeze Dryer device purchased from Leosmak. The warranty is granted for the Freeze Dryer device under the terms and conditions set forth in this warranty statement and in the Agreement. Defects revealed during the Warranty period will be repaired free of charge by Leosmak or by Leosmak's authorized warranty service according to the following rules:
(1) The person entitled under the Warranty is obliged to provide proof of legal purchase of the Freeze Dryer, under sanction of forfeiture of warranty rights, only in the situation of assertion of warranty claims,
(2) The entitled person shall lose his/her rights under the Warranty if he/she has not notified Leosmak of the defect within 30 (thirty) days of its disclosure. Sending notice of the defect in accordance with the Agreement information before the expiration of the aforementioned period shall suffice to meet the deadline,
(3) The Warranty for the sold goods does not exclude, limit or suspend the purchaser's rights under the warranty provisions for defects of the sold goods,
(4) The Freeze Dryer shall be repaired by an Leosmak or by Leosmak authorized representative (in which case the cost of repair will be carried by Leosmak), within the time agreed in the Agreement,
(5) The deadline for the removal of the defect may be extended by the time needed to import the necessary spare parts or when the Freeze Dryer requires technical expertise,
(6) In the case of substantial repair, the Warranty period shall run anew from the moment of protocol release of the repaired Freeze Dryer. In other cases, the Warranty period shall be extended by the time during which, due to a defect in the warranted item, the warrantee could not use it. Only repairs pertaining to the removal of a defect that renders the entire device completely unusable will be considered essential. Repairs relating to a defect, the occurrence of which after the expiration of the warranty period will not entail significant costs for the purchaser, will be considered non-substantial,
(7) Warranty repair shall not include the activities provided for in the Operating Manual, which the user is obliged to perform, such as regular maintenance, or annual recommended service of the machine provided by Leosmak,

(8) The Warranty does not cover:

a. mechanical damage to the device caused by the user and the defects caused by it,
b. damages caused by external factors and beyond the Leosmak's control,
c. damages and defects of the device resulting from:
- usage that is not in line with Intended Use or inconsistent with the operating instructions or safety instructions for use, storage, or maintenance of the Freeze Dryer,
- arbitrary (made by an entity other than the services indicated in Section 4., including the user) repairs, modifications or structural changes,
d. non-original parts, or damage and defects in the device caused by the use of such parts;
e. consumable parts directly related to the device, such as trays,
f. events that occur in accordance with section “XII. Disclaimer”.

(9) The Warranty covers the Freeze Dryer purchased and used exclusively in the territory of the Republic of Poland, European Union countries, Andorra, Bosnia and Herzegovina, Iceland, Moldova, Monaco, Montenegro, North Macedonia, Norway, Serbia, Switzerland, Turkey, Ukraine and the United Kingdom, or country of seat of the first purchaser, who signed the Agreement with Leosmak at the moment of its signing,

(10) Exercise of rights under the Warranty may only take place in the territory of the Republic of Poland, European Union countries, Andorra, Bosnia and Herzegovina, Iceland, Moldova, Monaco, Montenegro, North Macedonia, Norway, Serbia, Switzerland, Turkey, Ukraine and the United Kingdom, or country of seat of the first purchaser, who signed the Agreement with Leosmak at the moment of its signing.

THE PURCHASER’S SERVICE

In the subject of a warranty or post-warranty claim, please send a notice in accordance with contact details provided in the Agreement, at “I. Inquiry and copyright” section or use the form located at website www.leosmak.com under the "Contact" tab.

IV. SAFETY

4.1. Marking of the Freeze Dryer

The following symbols are used for the Freeze Dryer. Yellow triangular symbols indicate critical information, non-observance of these symbols can cause serious health problems up to life-endangering injuries. Note, that not all the symbols can be used in your Freeze Dryer.

	Dangerous voltage. Direct hazard to the life and health of persons due to electrical voltage.		Power ON.
	Hot surface. Mild or even severe burns possible.		Power OFF.
	Risk of bruising.		Name Plate placed on the back panel of the Freeze Dryer.
	Attention! Consult the Operating Manual.		CE mark in compliance with the Directive 2006/42/EC and other relative directives stipulated in Declaration of Conformity.
	Protective earth (ground).		Unplug the device.
	Earth (ground).		Risk of catching fire (flammable material).

4.2. Responsibility of the Operator

The Operator working with the Freeze Dryer must be:

- 18 years old or older,
- specifically trained and aware of dangers originating from the Freeze Dryer,
- familiar with the fundamental regulations concerning workplace safety and accident prevention,
- aware of safety sections and warning notes prescribed in this Operating Manual and confirmed this with his or her signature.

Safety and danger indications on the Freeze Dryer must be always kept readable. If necessary, they must be replaced. The Freeze Dryer must be maintained regularly (see section “X. Maintenance and service”). Components that are not in a perfect state must be replaced immediately.

4.3. General safety

The following instructions must be observed prior to every Freeze Drying process:

- ensure that the Freeze Dryer was set up and connected properly (see section “VII. Set-up and connection”),
- connections to customer-provided hoses and pipes must be force- and torque-free,
- maintain a safety distance of at least 50 cm around the Freeze Dryer,
- do not store any dangerous goods in the safety area of the Freeze Dryer,
- the Freeze Dryer can maintain flammable fluids; no source of open fire can be put in the room with the Freeze Dryer,
- do not stay in the safety area longer than what is absolutely necessary for the operation of the Freeze Dryer,
- only use accessories (in particular trays) that have been approved by the manufacturer,
- use with proper care vessels made of glass, steel or synthetic materials, do not use vessels of poor quality as they can be fragile and break, contaminating chamber and operational area around the Freeze Dryer,
- do not hesitate to contact the emergency physician (ambulance) in case of any hazardous accidents!

4.3. Electrical safety

The Freeze Dryers is a unit of safety class I. Please comply with the following points to preserve the safety features:

- ensure that the local mains voltage matches the nominal voltage that is stated on the Name Plate,
- do not place any dangerous material, e.g. glass vessels containing liquid substances, within the safety area of 50 cm around the Freeze Dryer,
- ensure that water drainage valve is properly connected, water pipe or hose is properly distributed from the drainage pipe and does not generate any kind of leakage,
- poured liquids may get into the Freeze Dryer and damage the electrical or mechanical component,
- work on the power supply system must only be performed by certified electricians,
- inspect the electrical equipment of the Freeze Dryer regularly. Defects such as loose or burnt cables must be eliminated or exchanged immediately,

- do not use stream of water for cleaning of any other part of the Freeze Dryer apart for the internal space of the chamber. Note, that direct water stream can come into contact with electrical equipment of the Freeze Dryer, generating risk of its damage or of hazardous electric shock,
- note, that Compressor, chamber and other components of Freeze Dryer's cooling system can become very cold during work, so water from the surrounding air can condense on their surface and gather at the top of the frame or at the bottom of the Freeze Dryer. This is normal process which should not influence work of the Freeze Dryer. Any condensed water should vaporize in subsequent operating stages of the Freeze Dryer. See the section "Maintenance and service" to maintain all parts of the Freeze Dryer clean and dry,
- In case of hazardous electrical incident, set the control switch to the "0" position in order to interrupt the power supply completely. While ensuring your own safety, interrupt the circuit as quickly as possible (control switch). Keep the affected persons warm and calm. Get medical attention immediately! Check consciousness and breathing continuously. In the case of unconsciousness or lack of normal breathing, perform cardiopulmonary resuscitation (CPR).

4.4. Mechanical safety

To ensure the safe operation of the Freeze Dryer, please comply with the following points:

- do not use the Freeze Dryer if it was installed incorrectly,
- do not use the Freeze Dryer with trays that show signs of damage or curvature,
- do not place the Freeze Dryer on inclined surface,
- do not place the Freeze Dryer on soft or unreinforced surface, as it can collapse!
- if your Freeze Dryer is equipped with wheels with breaks, never release breaks and move the Freeze Dryer alone and without certainty, that it can be stopped after movement is started. Note, that Freeze Dryer is very heavy!
- Carefully load or unload trays as they can fall and injure an Operator,
- only use the Freeze Dryer with accessories that have been approved by Leosmak. In case of doubt, contact the Leosmak (see section "I. Inquiry and copyright"),
- do not hit or move the Freeze Dryer during its operation,
- check the Freeze Dryer and the accessories before every cycle for any visible signs of damage,
- do not use any substances that could damage the material of the ice condenser chamber, drying chamber, doors/lids, or accessories in any way, e.g. highly corrosive substances such as hydrogen chloride (HCl),
- stop the Freeze Dryer immediately in the event of a malfunction,
- ensure that all repairs are performed only by authorized and specialized personnel.

4.5. Fire prevention

Your Free Dryer contains flammable service fluids or gases. Never use open fire in the same room with the Freeze Dryer! In case of any detected leakage, switch off the power supply for the Freeze Dryer and contact Leosmak immediately!

Automatic fuses protect certain electrical circuits within the Freeze Dryer against overcurrent conditions. To avoid risk of catching fire:

- always use automatic fuses of the same type and rating,
- do not freeze dry explosive or flammable substances,
- do not use the Freeze Dryer within hazardous locations where there is a risk of explosion,
- provide proper oil change to the Vacuum Pump and yearly maintenance provided by Leosmak,
- note, that a fire in the electrical control system must be extinguished with a CO2 fire extinguisher!
- burning oil must be extinguished with a CO2 fire extinguisher or powder fire extinguisher!

4.6. Thermal safety

During the operation of the Freeze Dryer, the ice condenser can reach surface temperatures of ca. -50°C depending on the power. At the same time, some parts of Freeze Dryer, such as Vacuum Pump or shelves, can become hot (even up to ca. +100°C). To avoid thermal injuries:

- wear suitable protective gloves when installing or removing system with trays,
- do not reach into the ice condenser chamber without gloves – your limbs may freeze onto the chamber walls or ice condenser tubes!
- avoid touching any part of the working Freeze Dryer without protective wears,
- in case of service and maintenance, defrost the chamber, open the chamber doors and wait for at least an two hours after switching the Freeze Dryer off, to allow its components to achieve normal environment temperatures,
- in case of burns, cool small-area burns (e.g. finger) immediately with cold water for approximately 2 minutes; do not cool if larger areas of the body surface are burnt since there is a risk of hypothermia; cover the burns loosely and in a sterile manner (e.g. with sterile dressing), keep the affected persons warm and calm and call the medical assistance.

4.7. Biological safety

The Freeze Dryer is designed for Intended Use purposes only, which include only food, food additives and beverages products. If infectious, toxic or pathogenic substances are intended to be dried, it is in the responsibility of the Operator to ensure that all necessary safety regulations, guidelines, precautions, and practices are adhered to accordingly. To avoid microbiological contamination of your products:

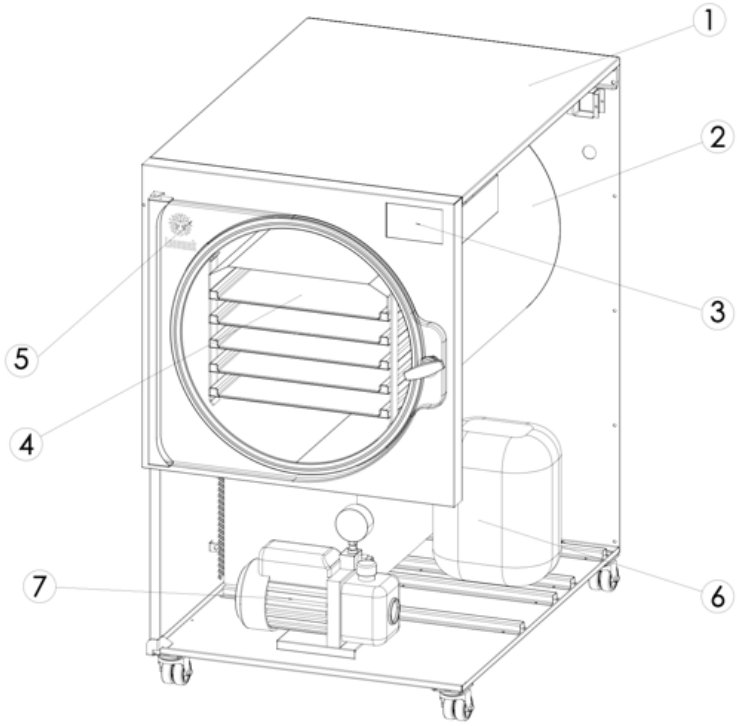
- keep the inner chamber space clean and dry when not in use,
- pay special attention to the cleanness of the inner part of the chamber and door,
- clean the inner part of the chamber and lids/doors regularly in accordance to instructions in “X. Maintenance and service” section.

V. LAYOUT AND GENERAL OPERATION

5.1. Layout of the Compact Freeze Dryer

The typical layout of the Compact Freeze Dryer is presented below. Note, that exact location of components can differ from the schema below depending on your exact Freeze Dryer model.

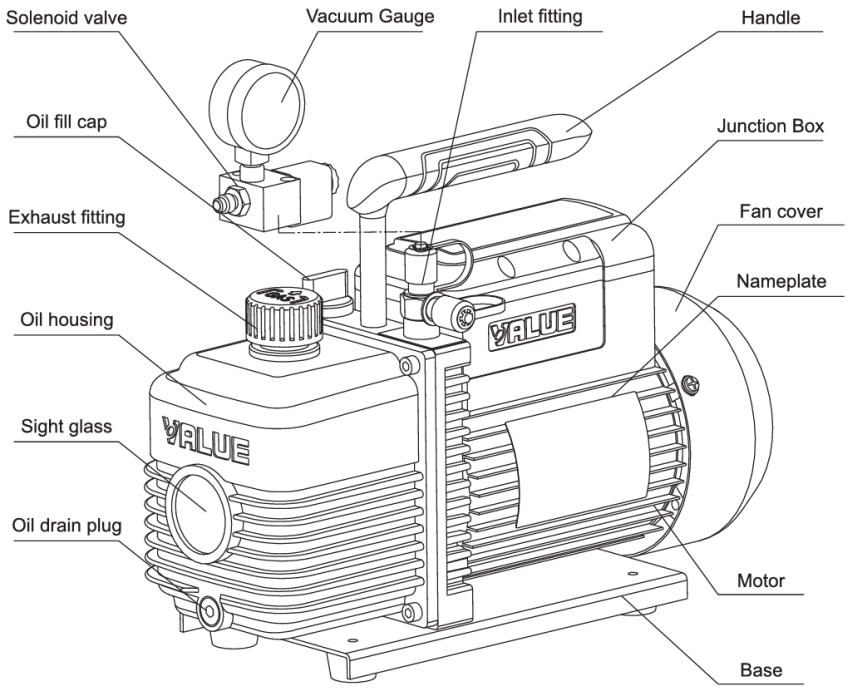
Main switcher is placed at the left upper side of the back panel of the Freeze Dryer. Chamber with Vacuum Pump also has the switcher for power outrage.



1) Casing
2) Chamber
3) LCD 5’’
4) Shelves
5) Door (transparent acrylic)
6) Freezing system including Compressor
7) Vacuum pump

5.2. Sketch of Vacuum Pump

Vacuum Pump is one of the most important components of the Freeze Dryer. Vacuum Pump demands regular care to maintain its proper work (see section “X. Maintenance and service”). The principle of pump work is the following: the pump and motor are connected by flexible coupling. As the rotor rotates two vanes, placed in rotor vane groove, turn making contact with the internal surface of the cylinder due to centrifugal force. The inhaled gas is trapped between two vanes as the rotating vane passes through the inlet passage and this trapped gas is compressed as it rotates toward exhaust valve and eventually exhaust through valve. The vacuum oil is supplied to the moving parts for lubrication and tight sealing. Regular exchange of oil is critical to maintain the mechanism of the Vacuum Pump in proper condition. The sketch for the Vacuum Pump used in your Freeze Dryer is presented below.



HVAC Vacuum Pump Schema

5.3. Name Plate

Schema of the Name Plate that is mounted on your device is presented below. Note, that exact parameters on your exact model can differ.

CE	Leosmak
Serial No.:**0000001**	Month/year of manufacture:**10/2023**
Type: **Freeze Dryer** Model name: **LEO-000**	Chamber material: **AISI 304 (stainless steel)**
Transportation marking	**This way up ↑ Do not tilt**
Cool. system	**1. stage**
Vacuum pump oil filling	**0,25 l**
Refrigerant, filling	**R-452B: 0,30 kg**
IP protection according to DIN 60529	**65**
Max. pressure	**27 bar**
Min./max. temp.	**-45°C/+70°C**
Power	**220 V / 50 Hz | 16 A / 1,76 kVA**
Dimensions, dead weight	**600x930x1070 mm, 165 kg**
Manufactured by	**Leosmak Sp. z o.o., ul. E. Kwiatkowskiego 4, 52-326 Wrocław, Poland** **Made in European Union**

5.4. General information on Freeze Drying

Understanding physics of Freeze Drying allows to understand the work of the Freeze Dryer. Freeze Drying, also called as Sublimation or lyophilization, is a procedure of very gentle drying of high quality products. The product is dried thanks to physical process named Sublimation, thanks to vaporizing of water from ice into gas stage, without passing through the liquid phase. This happens under vacuum (very low pressure). During Sublimation, the properties of the product are preserved and all product compounds remain unchanged from a qualitative and quantitative point of view. After the addition of water, the product will have the same characteristics as the original product.
The Figure 1 below describes the process of Sublimation based on the example of water, since most products that are processed by Freeze Drying are aqueous solutions. The vapor pressure curve above ice describes the phase transition as a function of the pressure and temperature. The higher the temperature is, the higher the vapor pressure. For example, as it is presented at the Figure 1:

- if the vapor pressure is higher than 6.11 mbar (point A), water passes through all three phases: solid, liquid, and gas,
- if the vapor pressure is below 6.11 mbar (point B) and energy is added, the ice will be directly converted into water vapor once the sublimation curve is reached. This transition is called “Sublimation”. If thermal energy is added to pure ice with a temperature of less than –30°C at a pressure of 0.37 mbar, it will be converted into water vapor once it reaches –30°C.

It is important to mention, that vacuum prevents the melting of ice when energy is added. If thermal energy is added to a frozen product under vacuum, thawing of the product will be prevented and the water that is contained within the product will be released in the form of water vapor.

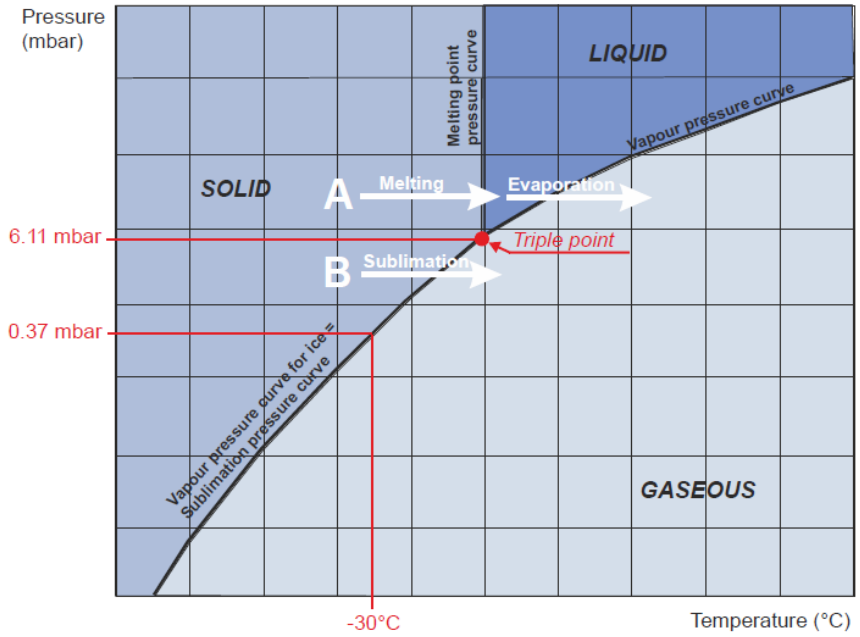


Figure 1: example of Sublimation

From a physical point of view, the Freeze Drying process covers three major phases (see Figure 2 below):

- (1) freezing: the product to be dried is frozen under atmospheric pressure. This can be done either directly in the Freeze Dryer or in a separate deepfreeze. The freezing temperature should be approximately 10˚C below the solidification point of the product,
- (2) evacuation: to decrease pressure, the Vacuum Pump is activated. The pressure inside the drying chamber will be lowered to the value that corresponds to the freezing temperature in accordance with the vapor pressure curve above ice,
- (3) sublimation: thermal energy is added to the product, thus starting the sublimation process. Due to the added energy, the water in the product is converted into water vapor. Since the ice condenser is much colder than the product that is to be dried, the vapor pressure in the ice condenser is considerably lower than above the product. As a result, the water vapor that is released by the product streams to the ice condenser, where it condenses on the condenser coils.

Once the free water has been extracted from the product during the main drying phase, the last traces of bound water will also be removed at a final pressure that is as low as possible and at higher temperatures. This takes place by way of desorption. This drying phase is also called secondary (or final) drying (4).

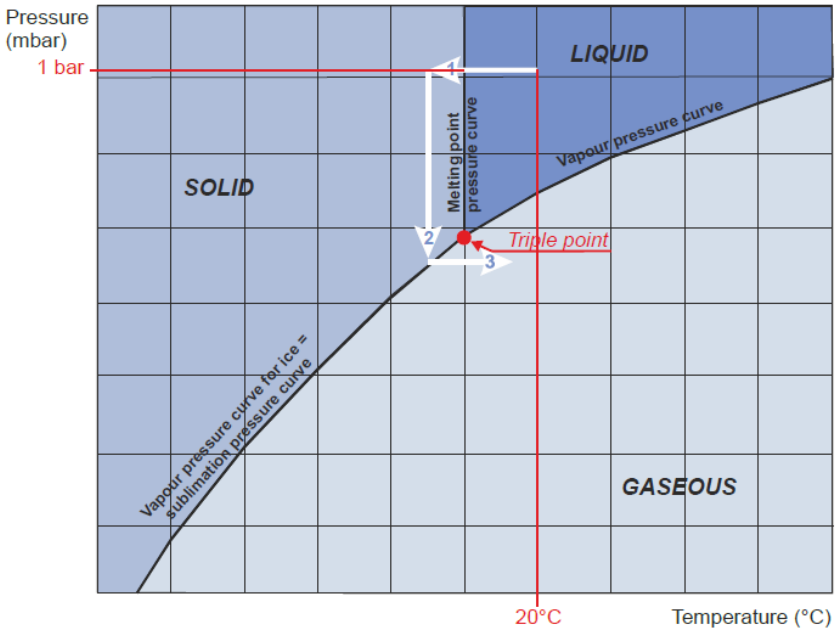


Figure 2: phases of Freeze drying

Thanks to its unique characteristics, Freeze Drying is widely used in number of industries, such as food, pharmaceutical, archeological, cosmetic etc. Widely known examples of Freeze Drying include instant coffee, breakfast cereals, dried fruits, mushrooms, soups, meat, sweets etc. Your Freeze Dryer is specially designed to cover all phases (1), (2), (3) and (4) to Freeze Dry any food, food additives or beverages.

5.4.1. Preparation

Prepare the product you would like to Freeze Dry, in accordance with the prescription. Avoid covering the product, products with thick peels etc. to help water better vaporize during the process. Note that sliced and fragmented pieces of food would undergo Freeze Drying faster, improving the energy efficiency of your production. Avoid overloading of the trays and multi-layers of product, as this can influence quality of freeze dryer significantly.
The ice condenser chamber must be clean and dry. Any water residues from a preceding Freeze Drying cycles must be removed. The water drain valve must be closed (which is done automatically; please avoid manual opening of the back side valves of the Freeze Dryer as leaving of these valves in open position will prevent the Freeze Dryer from reaching low pressure and sublimation will not be completed).
Put your product on the trays. Open the front door of the Freeze Dryer and put the trays one by one on each shelf. Close the front chamber door firmly and twist side handle. Please note, that doors are equipped with special guidance bolt. Do not apply much force to the handle. Pay attention not to leave any dirt on inner door side, as it can prevent the chamber from reaching vacuum, which is the frequent reason of Freeze Dryer malfunction.

5.4.2. Freezing

Start the Freeze Drying by choosing the proper menu option (see section “VIII. Operation”). The product that is to be dried should be frozen in the next stage. This can be carried out either directly in the Freeze Dryer or before putting the product on the shelves. In case your product is pre-frozen outside of the Freeze Dryer, use “Cooling down the shelves” option to avoid melting of the ice in your product after loading of the product in trays on the shelves. The product is cooled or warmed by direct contact of trays with shelves. Please, avoid any dirt or third objects between shelves and trays, as this can significantly influence temperature exchange and make the freezing process much longer.

5.4.3. Sublimation (main drying)

When the product is frozen to a sufficiently deep extent, the sublimation phase commences. The pressure inside the drying chamber has to be lowered to the value that corresponds to the freezing temperature in accordance with the vapor pressure curve above ice. At the same time, thermal energy will be added to the product. As a result, the Sublimation process starts.
Note, that at the beginning of the drying process, the maximum drying rate will be reached. The more the sublimation area recedes into the product, the further the produced water vapor must pass through the layers that have already been dried. Under certain conditions, it is possible that the pressure inside of the chamber increases during the sublimation phase although the valve towards the vacuum pump is closed. From a physical point of view, this is due to the pumping effect of the ice condenser ("cryo-pumping effect") and is a normal part of the process. The Freeze Dryer will automatically restore the desired pressure.
The required drying time depends strongly on the drying vacuum. At 1.0 mbar, one gram of ice takes up a volume of 1 m^3 of vapor, at 0.1 mbar a volume of 10 m^3 of vapor, and at 0.001 mbar a volume of 100 m^3. The closer the vacuum is to the solidification point, the smaller is the resulting vapor volume. The drying rate increases and the drying time decreases. The end of the sublimation phase is reached, when the product temperature and the shelf temperature are nearly identical.

5.4.4. Secondary drying

Secondary (final) drying is an option whenever one requires a product with minimal residual moisture. In the physical sense, this process is a desorption process, i.e. the removal of adsorptively bound water. Secondary drying is performed under the lowest possible final pressure that depends on the ice condenser temperature in accordance with the vapor pressure curve above ice as well as on the final vacuum of the Vacuum Pump that is used. The process is supported by a higher shelf temperature (i.e., you can pre-program +5-+10°C at this stage). The product should be removed after this process is finished. Wait until air is returned to the chamber by automatic valve opening (it is not possible to open the front chamber door before the pressure is equalized with the normal atmospheric pressure due to big forces pushing on the front chamber door). Open the front chamber door and remove the trays. Note, that external moisture of the working room can influence the moisture of the product after opening the front chamber door. To avoid increase of moisture in the freeze dried product, maintain low humidity in the working room and shorten the time of packing. Clean the trays after product is removed. Note, that Freeze Dryer will not allow to start defrosting stage before product removal is manually confirmed on a touch screen located on the doors.

5.4.5. Defrosting

Your Freeze Dryer is equipped with defrost function, that allows shelves to heat to speed up removal of ice on the ice condenser tubes. Make sure that water drainage hose is properly connected to the Freeze Dyer before starting defrosting and no leakage can happen, as big amounts of water can damage electronics and components of the Freeze Dryer. Just start the process and wait till all the ice collected during Freeze Drying is removed from the ice condenser. Keep in mind, that products can loose on average 90% of their initial weight during Freeze Drying. Most of this weight is water removed in Sublimation phase, which in turn needs to be removed during defrosting phase. The chamber of the Freeze dryer is specially designed so that all the water is removed by itself by force of gravity. Nevertheless, third objects can prevent all the water to be removed from the chamber at the end. See “X. Maintenance and service” section to clean the Freeze Dryer when needed.

5.4.6. Working parameters

Target working levels of the parameters of Freeze Dryer by default in normal mode are set as following:

Phase	Shelves temperature, °C	Condenser temperature, °C	Pressure, Pa
Starting point	Room temperature	Room temperature	~ 100 000, ±1 500
Freezing	-25 or less	Irrelevant	~ 100 000, ±1 500
Sublimation	+40, ±2	-35 or less	~ 150, ±150
Secondary drying	+40, ±2	-35 or less	~ 150, ±150
Defreeze	+60, ±5	Irrelevant	~ 100 000, ±1 500

Improper parameters in normal mode, can indicate a need of service of the Freeze Dryer (see section “IX. Malfunctions and errors”).

VI. STORAGE AND TRANSPORT

In order to ensure the protection against mechanical and climatic influences, the storage of the Freeze Dryer must be:

- dust-free,
- dry,
- free from excessive temperature fluctuations,
- free from a mechanical load, including vibrations.

Before starting transport or move:

- switch the Freeze Dryer off and unplug the Freeze Dryer from the power,
- cover the Freeze Dryer and the LCD control panel (see no. 8 in section “5.1. Layout of the LEO-010 Freeze Dryer”) by original protective material.

Note, that the Freeze Dryer is heavy equipment that cannot be lifted manually. Use only forklifts that are adjusted to the Freeze Dryer dimensions and weight (see section “XII. Technical data sheet”). To lift the Freeze Dryer, always apply the lift force at bottom parts of the frame or casing (see no. 1 in section “5.1. Layout of the LEO-010 Freeze Dryer”). Always keep Freeze Dryer in vertical position. When transporting the Freeze Dryer for long distances, use pallets and cover sides of the Freeze Dryer by protective packaging, such as wooden panels or cardboard, to avoid scratches or other mechanical damage.
Your Freeze Dryer can be equipped with wheels and brakes. In such case, over short distances, the Freeze Dryer can be transported by a suitable number of persons by pushing at the frame. To start moving Freeze Dryer, release breaks by pushing on breaks handle of each wheel by foot and start moving the Freeze Dryer. After stop, apply breaks on each wheel by foot. Always keep breaks on the wheels when the Freeze Dryer is not being moved. Never move the Freeze Dryer if you are not sure that surface is even and able to hold the dead weight of the Freeze Dryer. Never move the Freeze Dryer if you are not sure if you would be able to stop the Freeze Dryer when needed.
Caution! Always apply your local country safety regulations for proper transport of heavy equipment! Always install all transport safety devices, to avoid moving of the Freeze Dryer during transport. Do not tilt the Freeze Dryer during transport! Never move the Freeze Dryer with product, trays or other objects inside of the chamber, as they can damage the ice condenser, shelves or heating/freezing pipes. Never move the Freeze Dryer with ice or water inside of the chamber! To avoid damage, never grab, hit, push, pull or otherwise touch the Freeze Dryer at the LCD control panel during moving or transport.

VII. SET UP AND CONNECTION

For best performance of your Freeze Dryer, please, follow the following guidance concerning the set up and installation site:

- operate the Freeze Dryer only in closed and dry rooms,
- the floor must be firm and solid, adjusted to heavy equipment,
- ensure sufficient ventilation. Do not place any paper, cloth, or similar material behind or under the unit, since otherwise the air circulation can be impaired,
- keep a safety distance of at least 100 cm around the Freeze Dryer so that the vents in the unit remain fully effective,
- it is recommended that the ambient temperature is in the range of +10°C to +30°C. The unit can work also in extreme temperatures; however, its efficiency can be lower in such circumstances,
- do not subject the Freeze Dryer to thermal stress, e.g. by positioning it near heat generators,
- prevent thermal overload, e.g. caused by other equipment in the direct vicinity of the Freeze Dryer,
- avoid open fire sources with the room where Freeze Dryer is located,
- avoid direct sunlight (UV radiation),
- always apply all breaks (on each wheel) when the Freeze Dryer is set in place.

In terms of connection, follow the below rules:

- the operating voltage on the name plate must correspond to the local supply voltage,
- the Freeze Dryer is a unit of safety class I and have a three-wire power cord with a fixed cable,
- typically, the Freeze Dryer must be protected with automatic 16 Amp fuses,
- connect the drain hose (included in the scope of supply) to the hose connector,
- after the end of a Freeze Drying process, the unit should be defrosted and condensed water and water from melted ice have to be removed via the drainage valve (which is done automatically),
- note, that after each cycle big amount of water can has to be removed. In case vessel is used to collect the water, ensure vessel for water removal is big enough to hold such amount of water,
- in case of usage of collecting vessel, place it close to the Freeze Dryer,
- the hose must be laid with a continuous slope and the end of the hose must always be above the liquid level in the collecting vessel. This prevents water and dirt residues from being sucked into the chamber if there is negative pressure when the media drain valve is opened,
- regularly check the tightness of the drainage connection, as severe leakage can damage the Vacuum Pump, ventilator or other components of the Freeze Dryer,
- place the Freeze Dryer sufficiently close to the electricity connection point. Avoid long distances from connection point to avoid damage of power cable. Do not use extension cords and use only original power cable provided by Leosmak! The Freeze Dryer demands high nominal power and usage of extension cord can lead to its abnormal heating or even cause a fire,

- your Freeze Dryer is equipped with Wi-Fi connection module. Be sure that there are no strong radio-wave emitters nearby Freeze Dryer for its proper functioning. To set up Wi-Fi connection, set the Wi-Fi connection parameters in section 8.4. Menu specification. Note: Wi-Fi radio frequency band should be 2.4 GHz,
- to monitor the Freeze Dryer online, download Leosmak via App Store or Google Play, enter the Wi-Fi connection menu (see section 8.4. Menu specification) and scan the QR code of the unit to link your Freeze Dryer to the application on your mobile device.

VIII. OPERATION

8.1. Initial start-up and installation of accessories

Before connecting the Freeze Dryer to the network, please, follow the recommendations in section “VII. Set up and connection”. When you are sure the Freeze Dryer is properly set up, attach the power cord to the electricity point. Never attach wet power cord to the socket, as it can result in severe injury or even death. Please, follow your local rules and regulations on proper usage of electrical equipment.

Proper usage of the Freeze Dryer demands GN-standard trays (AISI 304 stainless steel). Initial set of trays is provided together with the Freeze Dryer. In case of hard products, it is recommended to use silicone mats adjusted to the tray size to avoid adhesion of the product to the tray (not supplied with the Freeze Dryer). Never use cracked, broken, burst, bent, cambered or otherwise damaged trays for Freeze Drying, as it can lead to inefficient Freeze Drying, or even damage the Freeze Dryer. Exchange improper trays before their usage.

8.2. Switching on the Freeze Dryer

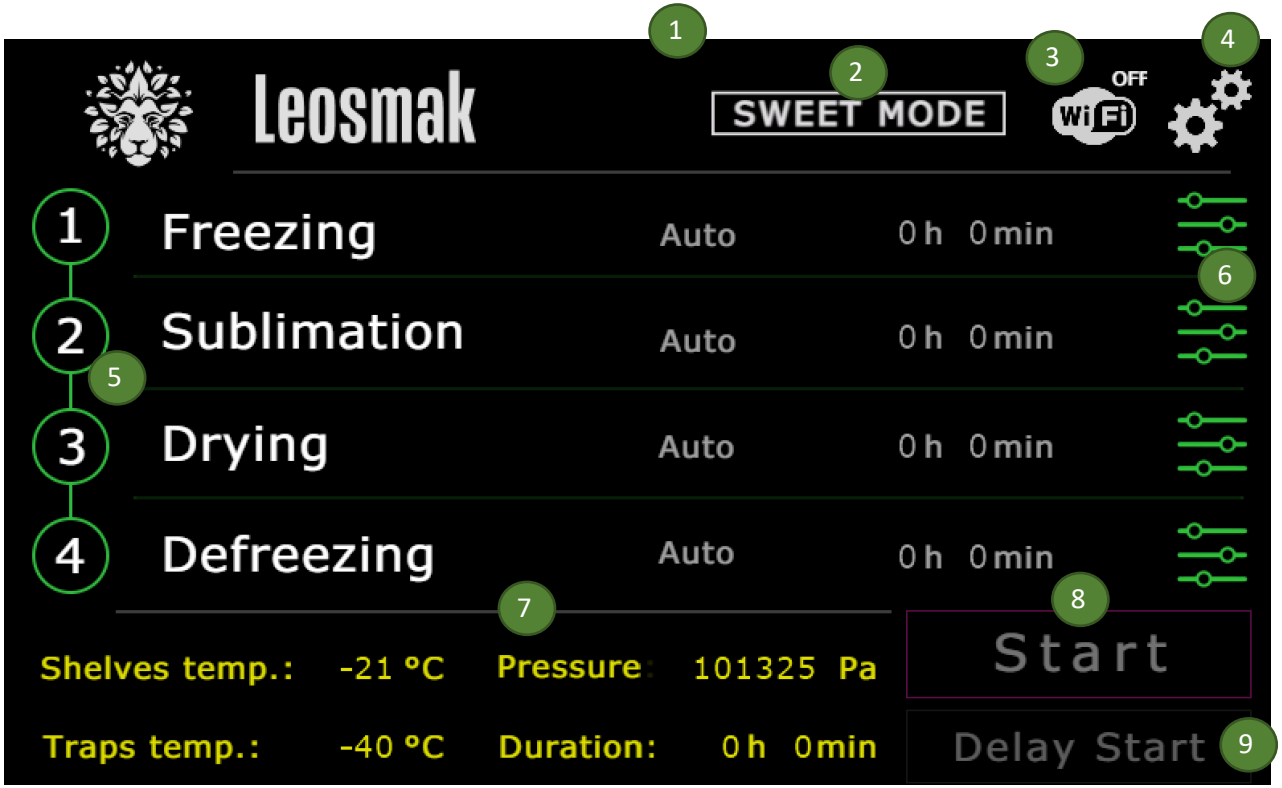
Use the major “ON” switch on the back panel of the Freeze Dryer marked with “ I ” sign as well as low-voltage switcher in vacuum pump chamber to turn on the Freeze Dryer. Proper connection and turning on is followed by the Leosmak logo appearance on major LCD screen (see no. 8 at Section “5.1. Layout of the Freeze Dryer”), which consequently turns into a major menu selection in accordance to section “8.3. User interface”. If screen is not reacting to switching on, or takes longer time to load, see the section “IX. Malfunctions and errors”.

8.3. Basic user interface

The basic user interface displayed at the major touch screen (see no. 8 in accordance to section “5.1. Layout of the Freeze Dryer”) contains following information and buttons, moving from the left to right and from the upper part of the screen to the lower part:

Basic user interface schema

1. Basic user interface screen
2. Normal or sweet mode selection
3. Wi-Fi connection menu
4. Settings
5. Freeze drying stages
6. Automatic vs manual parameters set
7. Current status information
8. Start of the operation button
9. Function of delayed start

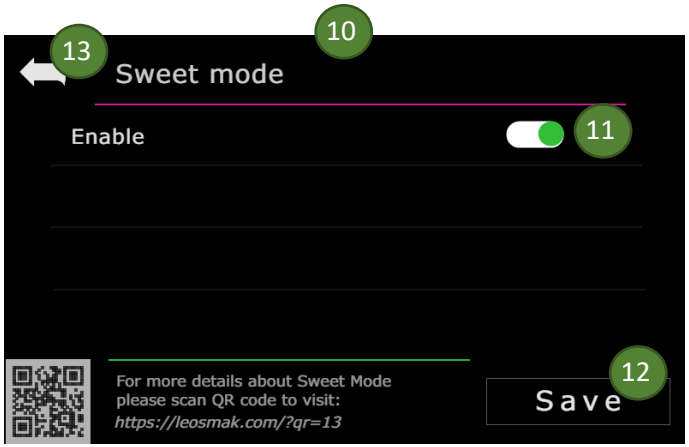


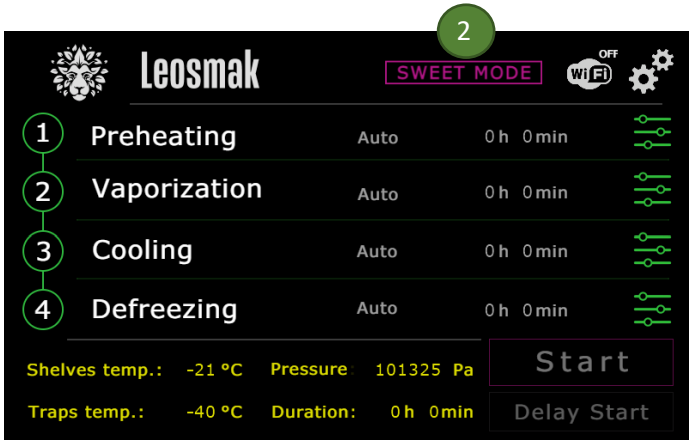
8.4. Menu specification

Operating of the Freeze Dryer is intuitive. Below is the presentation with description of different menu positions, which appear on the screen depending on your choice:

When pressing “Sweet Mode” (2) on the Basic user interface (see section “8.3. Basic user interface”), the screen allowing change to the Sweet mode (10) appears. Change the parameter to “Enable” (11) and press “Save” button (12) to confirm Freeze Dryer operation change to the “Sweet Mode” or hit the back arrow (13) to return to previous menu. While being in the Sweet Mode, “Sweet Mode” prescription changes into violet and Freeze drying stages (5) change to “Preheating”, “Vaporization”, “Cooling” and “Defreezing” adequate to the Sweet Mode, as shown at the picture at the bottom right below.
To switch off the Sweet Mode and to return to the “Basic user interface” screen, just press the “Sweet Mode” (2) again and disable the Sweet Mode by pressing “Enable” (11) button and hitting “Save” button (12).

To operate the Freeze Dryer in the Sweet Mode, use the same buttons as in case of “Basic user interface” screen.





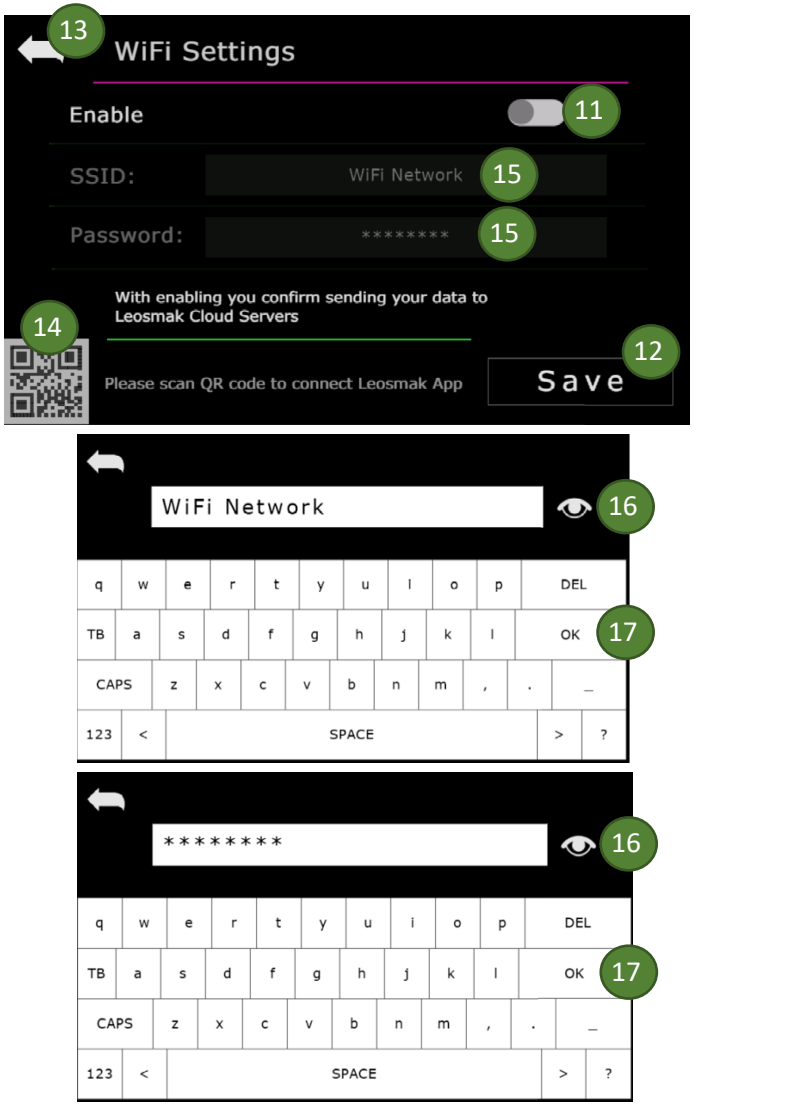
When pressing Wi-Fi connection icon (3) on the Basic user interface (see section “8.3. Basic user interface”), the screen allowing to enable Wi-Fi Setting appears, as shown on pictures to the right. Change the parameter to “Enable” (11) and press “Save” button (12) to confirm Freeze Dryer to connect to Wi-Fi or hit the back arrow (13) to return to previous menu.

To disable the Wi-Fi, repeat the actions as above.

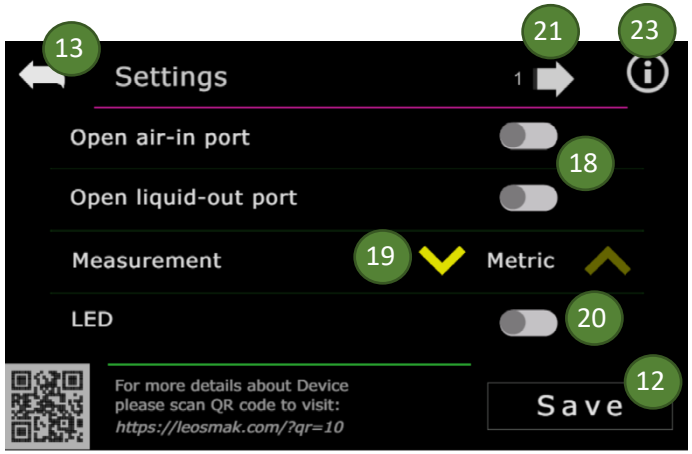
To connect the Freeze Dryer to the Leosmak App, install it either from App Store or Google Play (correspondingly for iOS or Android operating systems). Next, scan the QR code (14) to connect the device to your application. If the light in the room is insufficient, you can scan the QR code can be impossible. You can press the QR code (14) to enlarge it. Press QR code once again to exit enlargement.

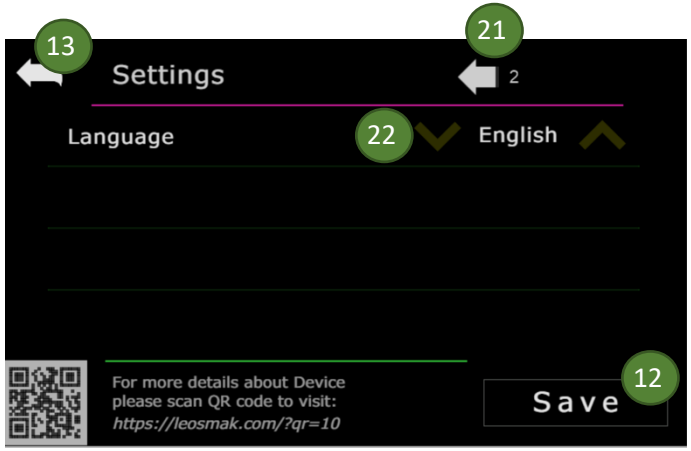
To connect the Freeze Dryer to your Wi-Fi network, please, enter Wi-Fi Network name (SSID) and password by correspondingly hitting fields at (15). After pressing (15) fields, intuitive keyboards appear as shown to the right. When entering Wi-Fi Network (SSID) name and password, “eye” symbol (16) can be pressed to make the string that is being entered visible or encoded with “*” marks. Please note, that Wi-Fi Network (SSID) name and password are not saved before “OK” button (17) and “Save” button (12) are pressed.

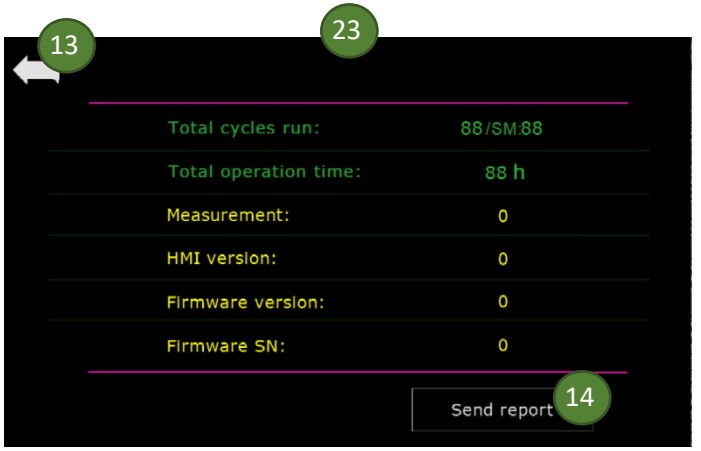
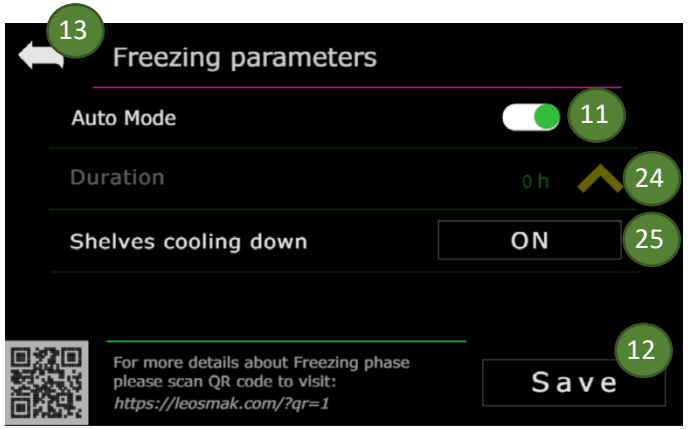
During the connection, the Wi-Fi icon (3) (see section “8.3. Basic user interface”) will change from default “off” pictograph to pictograph with rolling arrows. When the Wi-Fi is properly connected, the Wi-Fi icon (3) (see section “8.3. Basic user interface”) will change to green “on” pictograph. Please, refer to the “IX. Malfunctions and Errors” section if you experience issues with connection to your Wi-Fi network.



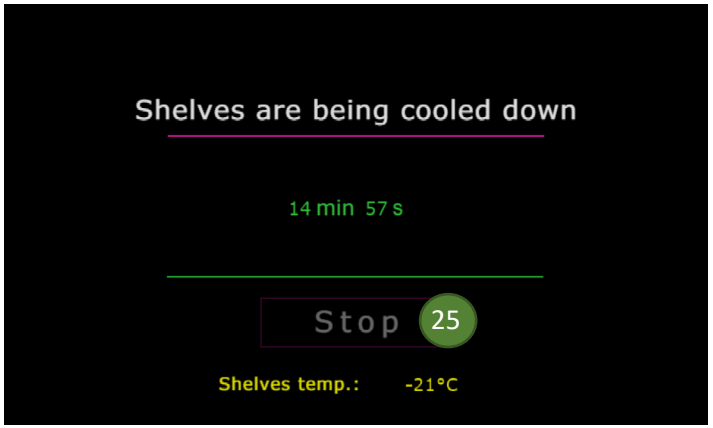
When pressing Settings icon (4) on the Basic user interface (see section “8.3. Basic user interface”), the screen allowing to change basic parameters appears as well as to make some service actions, as shown on pictures to the right.
You can manually open air-in port or liquid-out (drainage) ports by pressing appropriate switcher (18) in the same menu. Please use these functionalities with care. In particular, do not open the liquid-out port while vacuum is in the chamber to avoid intake of water from the drainage vessel, which can damage the product of even destroy some components of the Freeze Dryer.
Change the metric/imperial units of measurement by selecting yellow arrows (19).
If you model is equipped with LED illumination, you can enable or disable the LED light by switching the “Enable” (20) option.
It is possible to move to further Settings parameters selection by pressing further or back arrows (21).
Language parameter can be changed by using yellow arrows (22) (not in all models).
The same screen also contains basic statistics on Freeze Dryer work which is visible after pressing “I” icon (23).
After configuration is complete, press “Save” button (12) to confirm changes or hit the back arrow (13) to return to previous menu.



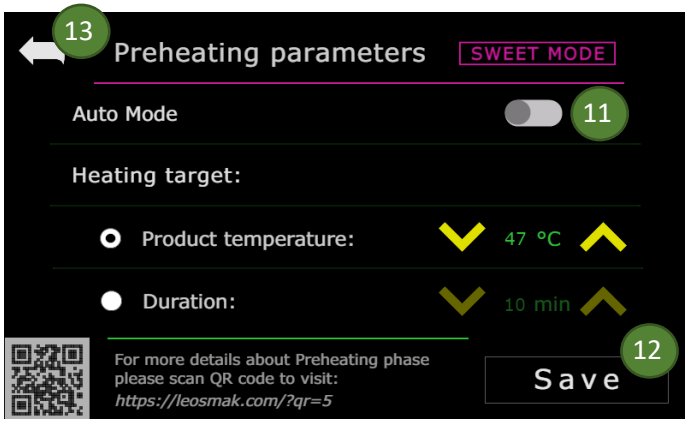


The information screen after pressing “i” icon (23) is presented to the right. Press the “Send report” button in case of malfunction and a need to send report on unit working parameters to Leosmak. Hit the back arrow (13) to return to previous menu.	
When pressing Automatic versus manual parameters set (6) on the Basic user interface (see section “8.3. Basic user interface”) on the level of corresponding of Freeze drying stage (5), the screens allowing to set specific parameters of freeze drying for each freeze drying stage appear, as shown on pictures to the right and below. The picture to the right shows possibility to change freezing parameter in normal mode. To enable manual selection of the parameter, disable Auto mode (11), then change the parameter using preset and yellow arrow (24) and press “Save” button (12) to confirm change or hit the back arrow (13) to return to previous menu. Please note, that the screen changes depending on the mode the Freeze Dryer is set to (normal or “Sweet Mode”). The same screen allows to use “Shelves cooling down” function after pressing “ON” button (25). The screen that appears after enabling “Shelves cooling down” function, is presented on the picture below.	

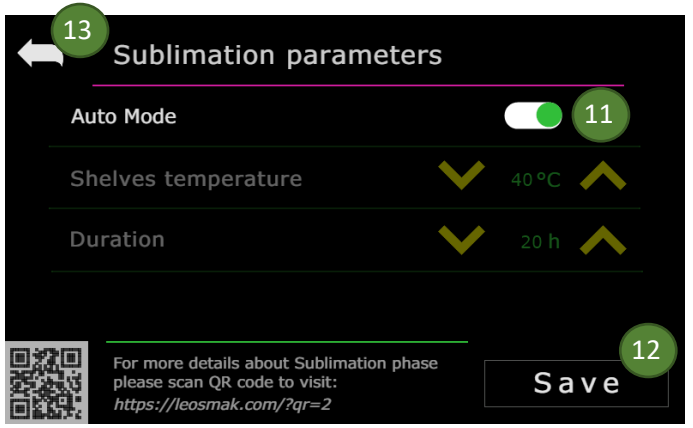
After “Shelves cooling down” function is selected, the countdown time in total of 15 minutes is displayed, in pair with current shelves temperature indicator. Press the “Stop” button (25) to interrupt this process any time.



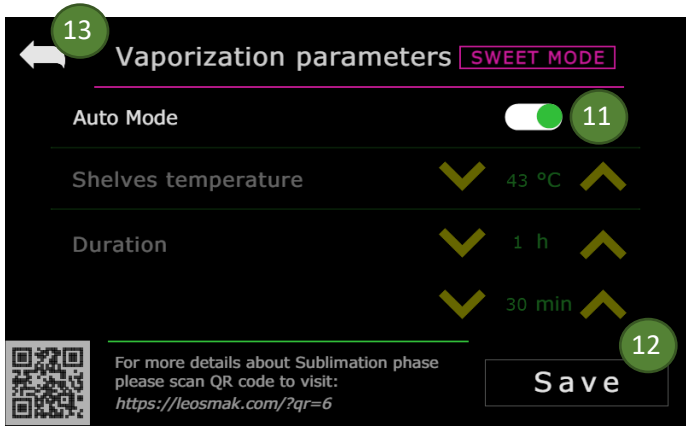
The picture to the right shows possibility to change preheating parameters in the Sweet Mode. To enable manual selection of parameters, disable Auto mode (11), then change the parameter using presets and yellow arrows and press “Save” button (12) to confirm change or hit the back arrow (13) to return to previous menu.



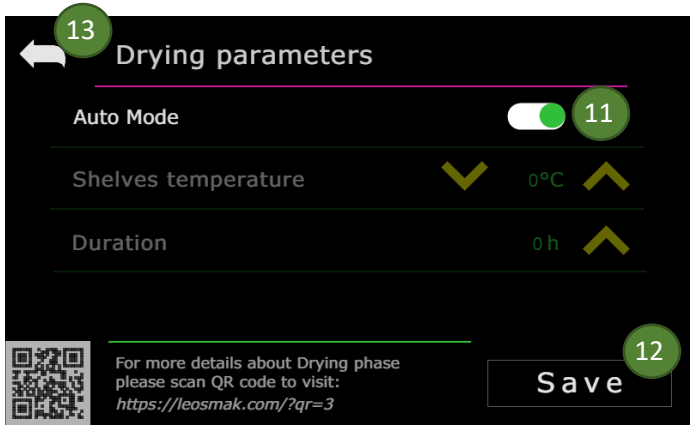
The picture to the right shows possibility to change sublimation parameters in normal mode. To enable manual selection of parameters, disable Auto mode (11), then change the parameter using presets and yellow arrows and press “Save” button (12) to confirm change or hit the back arrow (13) to return to previous menu.



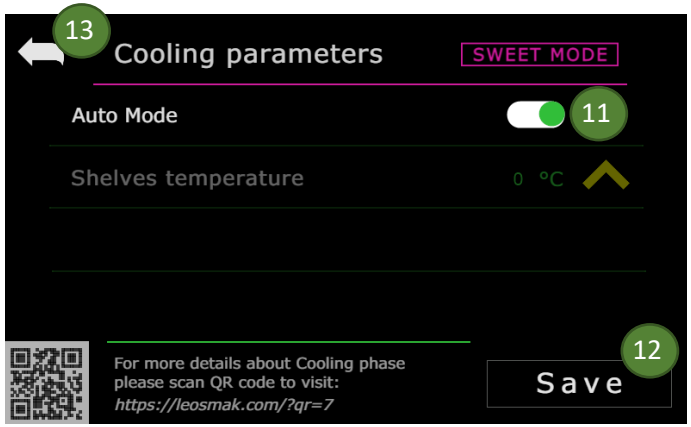
The picture to the right shows possibility to change vaporization parameters in the Sweet Mode. To enable manual selection of parameters, disable Auto mode (11), then change the parameter using presets and yellow arrows and press “Save” button (12) to confirm change or hit the back arrow (13) to return to previous menu.



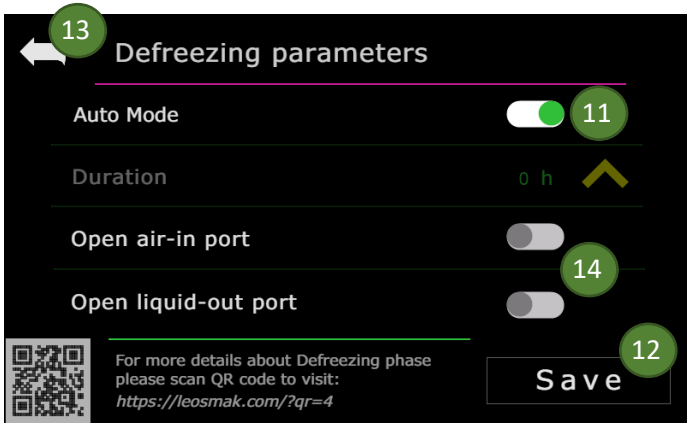
The picture to the right shows the possibility to change secondary drying parameters in normal mode. To enable manual selection of parameters, disable Auto mode (11), then change the parameter using presets and yellow arrows and press “Save” button (12) to confirm change or hit the back arrow (13) to return to previous menu.



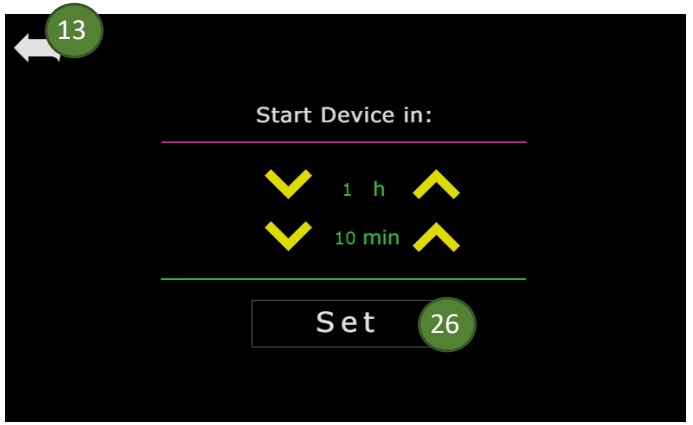
The picture to the right shows the possibility to change the cooling parameters in the Sweet Mode. To enable manual selection of parameters, disable Auto mode (11), then change the parameter using presets and yellow arrows and press “Save” button (12) to confirm change or hit the back arrow (13) to return to previous menu.



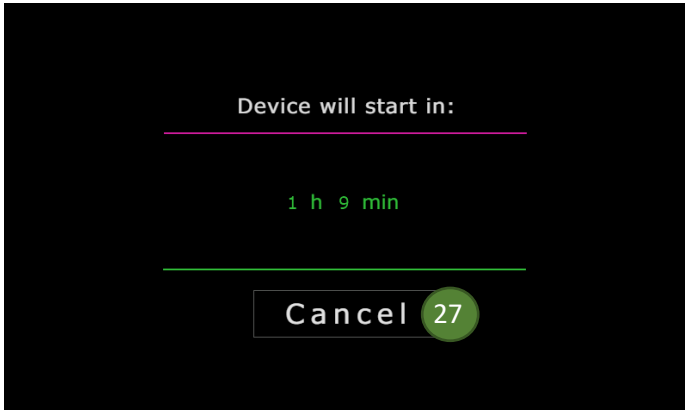
The picture to the right shows the possibility to change the Defreezing parameters in both normal mode and the Sweet Mode. To enable manual selection of parameter, disable Auto mode (11), then change the parameter using preset and yellow arrow and press “Save” button (12) to confirm change or hit the back arrow (13) to return to previous menu.
You can also manually open air-in port or liquid-out (drainage) ports by pressing appropriate switcher (18) in the same menu. Please use these functionalities with care. In particular, do not open the liquid-out port while vacuum is in the chamber to avoid intake of water from the drainage vessel, which can damage the product of even destroy some components of the Freeze Dryer.



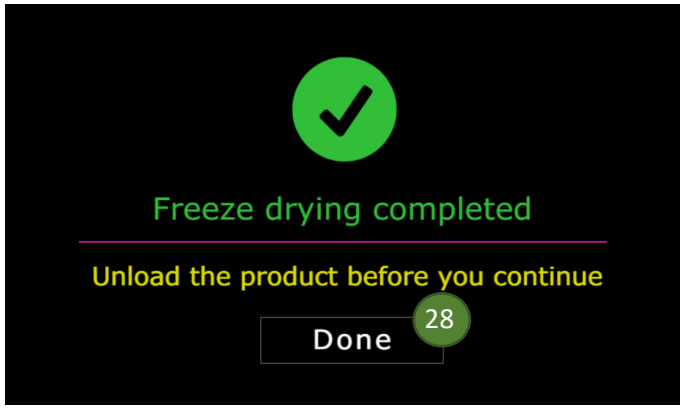
The picture to the right shows the possibility to set up the Delayed Start after Delay button (9) is pressed (see section “8.3. Basic user interface”). Maximum delay time can be set to 24 hours. Change the parameter using yellow arrows and press “Set” button (26) to set the Delayed Start. Use arrow (13) to return to previous menu.



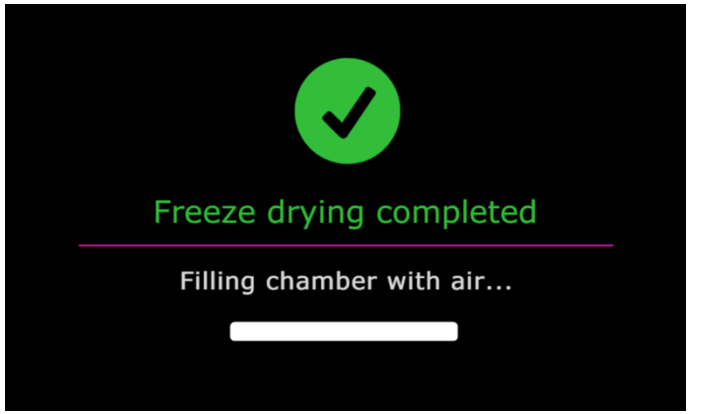
The picture to the right demonstrates the screen of the Freeze Dryer after the Delayed Start is on. Please note, that countdown is rounded to full minutes, so last 30 seconds before start of the device will show 0 h and 0 min left. You can abort Delayed Start any time by pressing the Cancel button (27).



The picture to the right demonstrates the screen after the Secondary Drying stage is finished and product is ready to be unloaded. Please note, that before Done button (28) is pressed, the unit maintains the ice on the condenser circuits and the product is safely kept in the chamber. After Done button (28) is pressed, the chamber starts to be filled with air, to allow front chamber door opening and unloading of the product. The trapped ice will start melting in the chamber after Done button (28) is pressed.

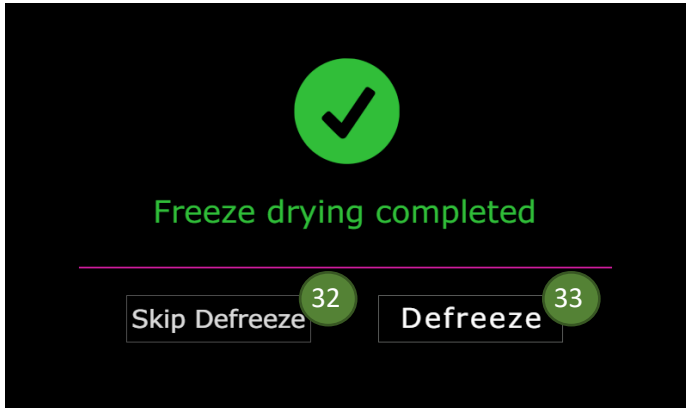


The picture to the right demonstrates the screen when the Done button (28) is pressed. Please note, that during this stage no operation with the Freeze Dryer is possible. When chamber is filled with air, the confirmation screen (29) (see below) is displayed.

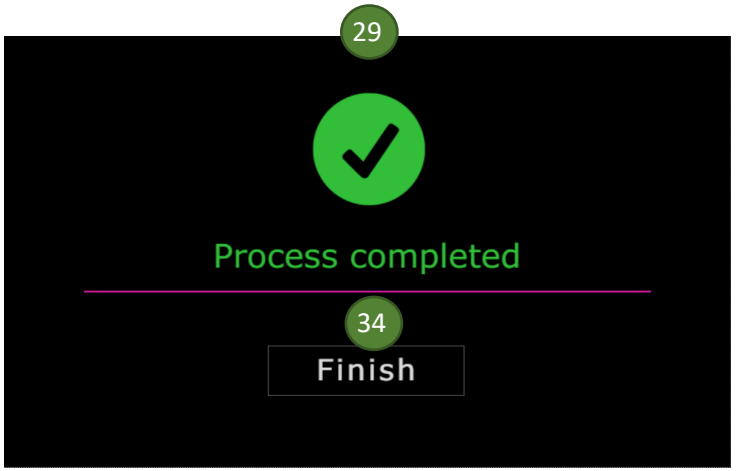


The picture to the right demonstrates the screen after the product is unloaded in Normal Mode. Operator has a possibility to start defreeze by hitting Defreeze (30) button or to finish the process by pressing “Finish” button (31) (in that case, defreeze will be made with the help of natural process using the room temperature).

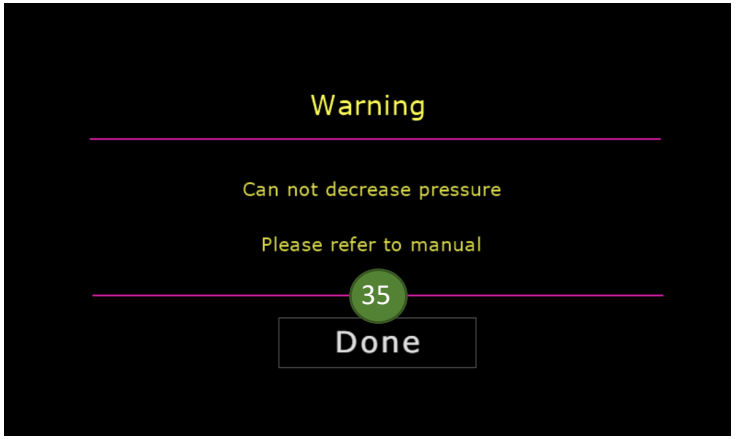
The picture to the right demonstrates the screen after the product is unloaded in the Sweet Mode. Operator has a possibility to skip defreeze by hitting Skip Defreeze (32) button or to start defreezing stage by pressing Defreeze button (33). The reason to this is that during the Sweet Mode, little ice is gathered on the condenser, so it is possible to run two cycles in Sweet Mode, without the necessity to defreeze the whole unit in order to save time for the operation. Please use this functionality with care, as some ice left in the chamber can influence quality of your product during next cycle.



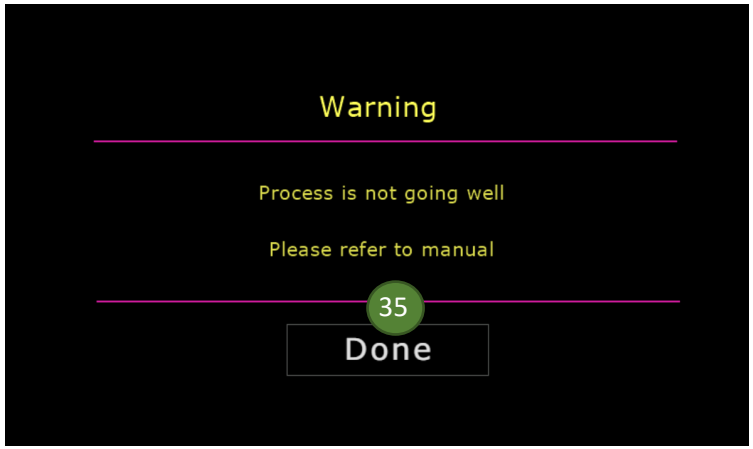
The picture to the right demonstrates the confirmation screen (29), which appears when the process is finished. Press “Finish” button (34) to return to the main menu.



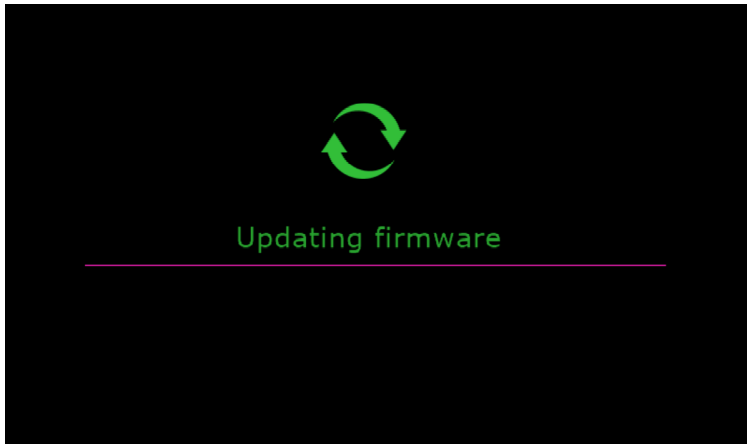
The picture to the right demonstrates the information screen, which appears when low pressure can not be reached. Press “Done” button (35) to return to the main screen and refer to “IX. Malfunctions and Errors” section in this case.



The picture to the right demonstrates the information screen, which appears when other abnormalities in the process are detected. Press “Done” button (35) to return to the main screen and refer to “IX. Malfunctions and Errors” section in this case.



The picture to the right demonstrates the screen which is visible when software update remotely is installed. Please, do not switch off the Freeze Dryer during this stage. The screen will switch off automatically returning to the main menu after software update is completed.



8.5. Special functions

Following functions are complementary to the basic parameters of the Freeze Dryer:

- Wi-Fi Connection. All Freeze Dryer models are equipped with Wi-Fi module. To connect the Freeze Dryer to network and to be able to monitor its work online, follow the instructions in section “Set up and connection”.
- “Sweet Mode”. Your Freeze Dryer is equipped with special mode to freeze dry candies or sweets. Just follow the touch screen instructions to run “Sweet Mode” cycle. Note, that different candies or sweets can demand different temperature regimes as well as duration. Be sure to apply proper temperature and time of processing to receive the best effect from this mode.
- Oil quality warning. Your Freeze Dryer is equipped with algorithm that detects decrease in Vacuum Pump efficiency, which is typically caused by decrease in oil quality inside of the Vacuum Pump. Please, change the oil when the screen with oil warning appears.
- Maintaining the process during power shortage. Short interruption of power does not stop the process, which continues thanks to the accumulators which support the motherboard and the screen of the Freeze Dryer in case of power loss. When power returns, all other components of the Freeze Dryer like Compressor or Vacuum Pump will continue to work normally. Please, note, that long period of time without power in the process can influence the quality of the product in the chamber. In case of long period of lack of normal power supply, ice gathered on ice condenser tubes can start to melt while pressure can rise, which can spoil the product in the chamber. If power shortage happened when the Freeze Dryer was in the middle of changing of the valves position, the Freeze Dryer would need to be completely switched off and turned back on to ensure proper flow of the process (see “Switching off the Freeze Dryer” section below).

8.6. Switching off the Freeze Dryer

Use the major “OFF” switch on the back panel of the Freeze Dryer marked with “ **0** ” sign as well as low-voltage switcher inside of the vacuum pump chamber to switch off the motherboard and the screen to completely turn off the Freeze Dryer. Switching off the Freeze Dryer can be done at any time, also in case of malfunction. The Freeze Dryer is equipped with memory allowing to save basic configuration parameters (i.e. Wi-Fi connection configuration), also after the Freeze Dryer is switched off. Please, check your current product parameters after resuming current Freeze Drying stage in case it was interrupted. Note, that too long break in Freeze Drying can result in abnormal parameters for current batch, so restart of the whole cycle can be needed (see section “IX. Malfunctions and errors”).

IX. MALFUNCTIONS AND ERRORS

The list of most typical malfunctions and errors in pair with recommendations for their removal is presented in a table below. Please, contact Leosmak in case of any of the below described problems to get detailed instructions and qualified service support.

Problem	Possible reason	Actions needed (to be done by Leosmak or persons authorized by Leosmak)
Control abnormalities	- Memory overload/wrong data processed by firmware	- Reboot the Freeze Dryer every 2-3 cycles to avoid mistakes in the control.
Heating not working properly	- Thermal fuse on heaters to be changed - Heater is broken - Relay is broken	- Replace thermal fuse in accordance to received guidance. - Replace the heater. - Replace the relay.
Internet/connection failure	- Wrong Wi-Fi network (SSID) name or password - Wrong band of the router - The same Wi-Fi network (SSID) name for dual band routers (2,4 GHz/5 GHz) - Internet provider/router malfunction - Too distant / too weak signal - Wi-Fi module damaged	- Input correct Wi-Fi Network name and/or password. - the Freeze Dryer will not work within 5 GHz Wi-Fi signal, change to 2.4 GHz. - Connect the Freeze Dryer to 2.4 GHz router with unique network (SSID) name. - Check your local service provider and router configuration. - Be sure that unit is close to the router. - Contact Leosmak for further assistance.
Leakage of refrigerant	- Mechanical damage of pipes and/or valves	- Call for local technical gas/fluid leakage detection service. Contact Leosmak for confirmation of possibility to remove the leakage in case of its detection.
Long loading of the device	- Too distant location from Wi-Fi router	- Bring the Freeze Dryer closer to Wi-Fi router
Monitor failure	- Dirt gathered on the screen - Monitor damaged	- Clean the screen with demineralized water and clean, soft cloth. - Replace the monitor
Power failure	- Automatic fuse engaged - Improper voltage connection - Insufficient nominal power	- Check the electric schema provided by Leosmak and turn on the fuse again. Contact Leosmak if problem persists. - Be sure to connect the Freeze Dryer in accordance to Name Plate specification. - Check your local electricity network.

Pressure withing working range 0-300 Pa cannot be reached	- Damaged sealing of a technical hole with sensor cables	- This damage can happen during transportation. Fulfil the sealing in accordance to Leosmak instructions.
	- Dirt on door	- Clean the door and the chamber wall with clean, dry cloth, to remove any potential dirt.
	- Door closure mechanism untightened	- Be sure to tighten the door before start of Freeze Drying. Check the doors and locking mechanisms for any mechanical damages.
	- Door sealing uneven, demanding change	- Although Leosmak uses elastic sealing that can serve for a long time, material becomes fatigue with time run. Replace door sealing if needed.
	- Untightened back cover	- Tighten the back cover after each inspection/usage.
	- Vacuum Pump malfunction	- Fulfil or replace vacuum pump oil. Check the vacuum pump and invertor for vacuum pump for errors.
	- Water drain valve opened	- Check if water drain valve if free from dirt, pieces of products etc. as this can prevent the valve from closing automatically.
Product contains too much moisture after the cycle	- Too short process time	- In majority of cases, lack of desired effect results from too short sublimation time set by the user for current amount of load. Extend the sublimation and drying times if necessary.
	- Unit overloaded	- Avoid overloading of the Freeze Dryer. Some products contain big amounts of liquid even if the load in kilograms is approximately suited for the device. Note, that limit of the device load is defined by the maximum ice condenser capacity.
	- Interrupted Freeze Drying cycle	- In the event of a power failure in the sublimation of secondary drying phase, the batch may become unusable. Whether the batch can be saved or not depends on the drying phase in which the product was when the power failure occurred: in the final drying phase, the product has reached a residual moisture content of approx. 1-4% and can be quickly packed as ready. If the product is in the main drying phase and the break lasts for long period of time, it is recommended to restart the cycle, lowering the time needed

		for each freeze drying phase (depends on condition of the product).
	- Product irrelevantly prepared	- Some products should be additionally prepared before being Freeze Dried, for example: unpacked, sliced or cut into pieces, peeled off etc. Be sure you prepared the product properly before putting it into the Freeze Dryer. Avoid too thick or big parts of the product to ensure it is dried properly.
	- Too humid air	- Pay attention to the humidity of the air of the room the Freeze Dryer works in. It is strongly recommended to pack the ready product in controlled low-humid environment to avoid re-gain of the moisture by the product after its unloading from the Freeze Dryer.
Temperature abnormalities on shelves	- Compressor malfunction	- Check if Compressor turns on and if there are no alarms on the invertor for compressor. Check intake vents and air filters for dirt. Check the cable connection.
	- Insufficient volume of refrigerant	- See “Leakage” problem description. Remove leakage and fulfill the refrigerant in accordance to Name Plate specification.
	- Heat/freezer flow pump malfunction	- Check if heat/freezer flow pump turns on with 70W, check the flow pump for displayed errors.
	- Improper level of immersion fluid in the shelves	- Check the shelves for any leakages. Control the level of immersion fluid in the shelves.
	- Temperature sensor damaged	- Replace temperature sensor.
Temperature abnormalities on traps	- Compressor malfunction	- Check if Compressor turns on and if there are no alarms on the invertor for compressor. Check intake vents and air filters for dirt. Check the cable connection.
	- Insufficient volume of refrigerant	- See “Leakage” problem description. Remove leakage and fulfill the refrigerant in accordance to Name Plate specification.
	- Temperature sensor damaged	- Replace temperature sensor.
	- Flow pump malfunction	- Check if heat/freezer flow pump turns on with 70W, check the flow pump for displayed errors.

Vacuum sensor malfunction	- Damaged vacuum sensor - Damaged vacuum pump	- Replace damaged sensor. Contact Leosmak for further assistance. - Avoid running the vacuum pump without sufficient oil level, otherwise the pump can be broken without warranty claim for such malfunction to be considered by Leosmak.
Water drain valve malfunction, water drainage insufficient or working improperly	- Dirt and organic leftovers from products can fall into the drainage hole at the bottom of the chamber and/or to the drainage valve, subsequently blocking normal water outflow - Water drain valve opened while vacuum in the chamber and water hose sitting in vessel with water	- Use standard hydraulic methods for clearing the drain, such as metal pipe clearing agent mixed by water and added to the drain valve, mechanical removal with thin plunger or alike. Avoid big pieces of the product to fall of the trays and being washed to the drain hole. Never connect pressurized water hose to the water drainage valve (for reverse water flow) to avoid dirt flowing back into the chamber, as it can lead to microbiological contamination. - Never start defreeze before removal of the product from the chamber via doors. This will ensure correct decompression and prevent water and dirt from being sucked back into a chamber while there is vacuum inside.

X. MAINTANANCE AND SERVICE

The general state of the Freeze Dryer must be checked at regular intervals. For Compact Freeze Dryer periodic inspection is recommended to be made at least once a year. Any defects must be eliminated immediately. The following points are of particular importance: dirt, leaks, corrosion, bent system components, loose screw and flange connections, higher noise levels, loose cables, open cable ducts, missing or illegible safety notes and hazard warnings, missing or illegible inscriptions on components, broken pipes and cables, etc.
To clean the Freeze Dryer:

- switch the Freeze Dryer off by actuating the mains power switch and disconnect the power cord from the outlet before cleaning,
- if the Freeze Dryer has been contaminated with toxic or pathogenic substances, clean the inner chamber part immediately with a suitable decontamination agent (depending on the type of contamination),
- remove product residues thoroughly with a clean cloth,
- you can use pressured water (including hot) flow to clean the inner part of the chamber; open water drain valve from a menu to allow water outflow during such cleaning,
- open the door to the chamber when the Freeze Dryer is not in use so moisture can freely evaporate.

Before each start-up, ensure that the chamber is free from water residues. If needed, open the water drain valve manually to drain off any liquid. The drainage valve closes automatically before each cycle.
Under normal operating conditions, the following maintenance tasks concerning the Vacuum Pump must be performed at regular intervals:

- check the oil level of the vacuum pump once per week via oil gauge window through the side panel (see section “5.2. Sketch of Vacuum Pump”). If necessary, top it up with oil,
- check the running Vacuum Pump for any unusual noise,
- ensure that the Vacuum Pump has reached its operating temperature prior to changing the oil,
- perform the oil change when you notice oil is dirty, changed color or foams due to big amount of water by:
    - inspection Vacuum Pump gauge window,
    - placing oil basin or other appropriate vessel under the oil drain plug,
    - opening oil drain plug and connecting oil removing cable and
    - by closing oil drain plug and adding precise amount of oil stipulated at Name Plate via opened oil intake plug (see section “5.2. Sketch of Vacuum Pump”).

The oil mist that is emitted by the Vacuum Pump in quantities that depend on the working pressure are led to oil mist trap. The oil captured by the mist trap is removed automatically back to the Vacuum Pump. Please, follow your local regulation on used oil utilization.
In terms of the accessories such as trays, chemical reactions as well as stress-corrosion (combination of oscillating pressure and chemical reaction) can affect or destroy the metal and plastic parts. Barely detectable cracks on the surface can expand and weaken the material without any visible signs. Check the material regularly (at least once a month) for cracks, visible damage of the surface, pressure marks, signs of corrosion and other changes. Replace any damaged components immediately for your own safety. Immediately rinse off the accessories if

any liquids that may cause corrosion come into contact with them. Clean the accessories outside the Freeze Dryer once a week or preferably after each use.

To disinfect the chamber, use commercially-available disinfectants. The Freeze Fryer and the accessories consist mainly of AISI 304 stainless steel, but some parts and components may consist of other materials. A possible incompatibility must be considered. Do not use carbon containing substances, e.g. alcoholic compounds, to clean vacuum or temperature sensors, as this reduces their service life dramatically. Before using cleaning or decontamination agents, contact Leosmak to ensure that such a procedure will not damage the Freeze Dryer.

In the event of service work that requires the removal of the panels, there is a risk of electric shock or mechanical injury. Only qualified specialist personnel is authorized to perform this service work. The Freeze Dryer is subject to high mechanical stress. In order to be able to withstand this high level of stress, high quality components were used during the production of the Freeze Dryer. Nevertheless, wear and material fatigue cannot be excluded and it may not be visible from the outside. This is why we recommend having the Freeze Fryer checked by the Leosmak or its authorized representatives during an inspection once per year.

To avoid fire, never run Freeze Dryer close to open sources of fire.

All sensors, fuses, valves, sealings etc. used in the Freeze Dryer have a limited service life and can be ordered as spare parts. Contact Leosmak in accordance to contact details provided in section “I. Inquiry and Copyright” to receive appropriate assistance.

XI. DISPOSAL

Before disposing of an old, scrap unit no longer in use, it is imperative to render it safe and inoperative at once. Disconnect power supply plug and cut off connection lead. Disconnect and remove major Freeze Dryer components that is: Vacuum Pump, Compressor, electric board, LCD control panel, camera (if supplied), cooling/heat pump and ventilator. Dispose those units separately, in accordance to your local country regulations on electric equipment disposal. Please observe that Freeze Dryer unit contains insulating gases and coolants (called refrigerants) which require specialized waste disposal. Please, contact your local refrigerant specialist to safely remove these gases without leakage. Entrust the disposal of a scrap unit categorically to the competence of your local waste disposal service and contact your local authority or your dealer if you have any questions. Please ensure that the pipework of your Freeze Dryer unit does not get damaged prior to being picked-up by the relevant waste disposal service, and contribute to environmental awareness by insisting on an appropriate, anti-pollution method of disposal. Major metal parts of the Freeze Dryer such as frame and chamber can be 100%-scrapped and recycled as stainless steel (AISI 304).
All the original packaging materials employed in the packing of your Freeze Dryer may be disposed without danger to the environment. The cardboard box or wooden panels may be broken or cut into smaller pieces and given to a waste disposal service. The wrapping foil is made of polyethylene and the polystyrene pads and stuffing contain no fluorochlorichydrocarbons. All these valuable materials may be taken to a waste materials collecting center and used again after adequate rework (recycling). Consult your local authorities for the name and address of the waste materials collecting centers and waste paper disposal services nearest to your location.

XII. DISCLAIMER

The manufacturer is not responsible for any damages, malfunctions, or other issues arising from the irregular usage of the Freeze Dryer. Irregular usage includes, but is not limited to:

- Operating the Freeze Dryer in extreme temperature conditions (below 10°C and above +30°C), which may cause improper functioning or damage to the unit.
- Operating the Freeze Dryer in extreme humidity conditions, which can significantly affect the product immediately after opening.
- Operating the Vacuum Pump without, or with improper, or with contaminated oil, which can lead to pump loss in effectiveness, failure and other related damages.
- Forcibly opening the doors while there is reduced pressure inside the chamber, which can damage the sealing and compromise the safety and effectiveness of the Freeze Dryer.
- Opening the water drainage valve while there is lowered pressure inside the chamber, which may result in equipment damage or safety hazards.
- Pouring water on any part of the Freeze Dryer other than the stainless chamber, which may lead to electrical short circuits, corrosion, or other types of damage.
- Running the Compressor unit without oil, which can cause severe damage to the Compressor and affect the overall operation of the Freeze Dryer.
- Mechanical damage to the sealing, resulting from improper handling or maintenance, which can lead to leaks and reduced efficiency.
- Forced closing of the doors, which can damage the closing mechanism and compromise the integrity of the Freeze Dryer.
- Mechanical damage to the transparent parts of the doors, which may affect visibility.
- Operating the Freeze Dryer with a significant amount of liquid water in the chamber, which can cause malfunctioning or damage to the Freeze Dryer.
- Exposing the Freeze Dryer to mechanical vibrations.
- Leaving too little space around the Freeze Dryer preventing proper ventilation and airflow, which can reduce general efficiency or decrease lifespan of the major components.
- Improper electrical connections or use of incorrect power supply, which may result in electrical failures, safety hazards, or damage to the Freeze Dryer.
- Failure to perform regular maintenance, as outlined in the operating manual, including but not limited to changing oils, cleaning filters, and checking seals, which can lead to premature wear and malfunction.

The manufacturer shall not be liable for any direct, indirect, incidental, or consequential damages arising from the misuse or irregular use of the Freeze Dryer. It is the responsibility of the user to operate the Freeze Dryer according to the instructions provided in the manual and to ensure that the unit is used under the recommended conditions.

XII. TECHNICAL DATA SHEET

GENERAL INFORMATION						
Manufacturer	Leosmak Sp. z o.o., Wrocław, Poland					
Type	Freeze Dryer					
Model	LEO-004	LEO-004L	LEO-007	LEO-007L	LEO-010	LEO-010L
PERFORMANCE DATA						
Optimal batch weight, kg/cycle	4.0	7.0	7.0	10.0	10.0	16.0
Ice condenser - min. capacity, kg - working temperature - chamber volume, l	 6.0 -40˚C 50	 9.0 -40˚C 50	 10.0 -40˚C 79	 14.0 -40˚C 79	 15.0 -40˚C 125	 18.0 -40˚C 125
Working shelf temperatures	-35˚C to +70˚C					
Minimal and maximum temperatures	-45˚C to +70˚C					
Maximum no. of shelves	4	8	5	8	5	8
Maximum no. of trays	4	8	5	8	5	8
Shelf size, mm	260 x 330		345 x 355		540 x 345	
Max. shelf surface area, sq. m.	0.34	0.69	0.61	0.98	0.93	1.49
Spacing between shelves, mm	50	28	50	28	50	28
Height of trays, mm	20 or 40	20	20 or 40	20	20 or 40	20
Trays format	GN 1/2		GN 2/3		GN 1/1	
Pre-freezing	In the device					
Observation system	Transparent door					
HMI	LCD touchscreen					
Loading	Manual					
CONNECTION AND POWER						
Connecting power, kW	3.5		3.5		3.5	
Nominal power, kW	1.8		2.5		3.2	
Approximate power consumption, kWh/1h	0.9		1.2		1.4	
Voltage, V	220 (208-240)					
Nominal current, A	7.0		9.0			
Mains fuse	16A					
Protection class	I					
Water drain valve	G 1/2					
Vacuum pump connection (inside)	SAE 1/4” (7/8-20 UNF)					
Wi-Fi standard	2.4 GHz Wi-Fi (802.11 b/a/g/n/ax)					

REFRIGIRATION						
System type	One-stage					
Working temperature	10°C to 30°C					
Refrigerant	R452B					
GWP Index	675					
Filling quantity, g	300		400		600	
CO_2 equivalent, t	0,20		0,27		0,41	
PHYSICAL DATA						
Dimensions						
- width, mm	500		550		600	
- length, mm	650		800		930	
- height, mm	770		770		1070	
Dead weight, kg	70	90	90	100	159	179
Chamber material	AISI 304 (stainless steel)					
Max. noise level according to DIN 45635, dB(A)	65					
EMC according to EN 55011	Class B					
IP category acc. to DIN 60529	65					

XIII. EC DECLARATION OF CONFORMITY

C E
Certification

EC Declaration of conformity

We:

Leosmak Sp. z o.o. (Leosmak Ltd.)
ul. E. Kwiatkowskiego 4
52-326 Wrocław, Poland

declare, under our sole responsibility, that the following product:

Product name:
Freeze Dryer

Model numbers:
LEO-004, LEO-004L, LEO-007, LEO-007L, LEO-010, LEO-010L

is in conformity with the relevant Union harmonization legislations:
Directive 2006/42/EC (Machinery),
Directive 2014/30/EU (EMC),
Directive 2014/35/EU (LVD),
Regulations 1935/2004 (Food contact).

Used standards:
EN ISO 13849-1, EN ISO 14121-1, EN ISO 13850:2015, EN ISO 14159:2008, EN 60204-1:2018, EN 1672-2:2020, EN IEC 61000-6-1:2019, EN IEC 61000-6-3:2021

Authorized person to compile the technical file:
Iurii Panchenko, Technical Director
Phone: +48 71 715 66 00, e-mail: office@leosmak.com

I, the undersigned, representing the manufacturer's authorized representative in EU, declare the sole responsibility, that the product specified above, to which this declaration relates, conforms to the above-mentioned Directives and Standards.

Andrij Włach
Członek Zarządu

Andrij Włach, Member of the Board

CE

This product carries CE mark, which was first applied in 2022

Date and place of issue: 4th October 2024, Wrocław, Poland

LEOSMAK Sp. z o.o.
ul. E. Kwiatkowskiego 4, 52-326 Wrocław
NIP: 8943170814, REGON: 389508910
KRS: 0000911963

DECLARATION OF CONFORMITY NO.DOC-2410-02-004