

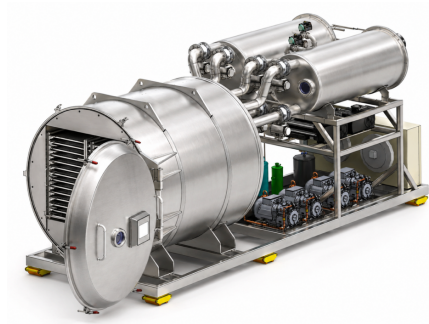


Leosmak

INDUSTRIAL FREEZE DRYER

Operating Manual

LEO-030 / LEO-030L / LEO-130 / LEO-300 / LEO-600
and larger modular configurations



Read this manual before unloading, connecting or operating the unit. Keep it near the unit for future use.

Revision 5.1 | 25 August 2026

DOCUMENT CONTROL AND CONTACT

QUESTIONS OR PROBLEMS?

Contact Leosmak before continuing if any instruction, connection, alarm or operating condition is unclear: +48 71 715 66 00 | office@leosmak.com | <https://leosmak.com/en/support>. For an installed unit, use its dedicated WhatsApp support group whenever available.

Manufacturer	Leosmak S.A., ul. E. Kwiatkowskiego 4, 52-326 Wrocław, Poland
Contact	+48 71 715 66 00 office@leosmak.com www.leosmak.com
Document	Industrial Freeze Dryer Operating Manual, Revision 5.1
Applies to	LEO-030, LEO-030L, LEO-130, LEO-300, LEO-600 and larger modular configurations
Required unit data	Model, serial number, supply data and refrigerant data from the Name Plate
Warranty	Warranty conditions are stated in the Agreement for the individual unit.

Record the unit details before first operation:

Field	Entry
Model	
Serial number	
Installation address	
SAT date	
Leosmak support group	

Online support: <https://leosmak.com/en/support>

Administration panel: <https://admin.leosmak.com/Leosmak>

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1. ABOUT THIS MANUAL

1.1 Scope, intended use and document priority

This manual explains safe receipt, installation, acceptance testing, operation, cleaning, maintenance and first-line troubleshooting of Leosmak industrial freeze dryers. It is intended for trained adult operators and authorised service personnel.

The unit is intended for freeze drying solid or liquid food, food ingredients and beverages. Processing infectious, toxic, explosive, flammable or otherwise hazardous material is outside the standard intended use unless it is covered by a separately approved configuration, risk assessment and written Leosmak instructions.

DOCUMENT PRIORITY

The Name Plate, as-built electrical and piping drawings, FAT records, order-specific instructions and written Leosmak service guidance take priority over generic values in this manual.

- **Operator:** a trained person who runs and monitors the unit.
- **Cold trap:** the cold surface on which water vapour freezes during drying.
- **FAT:** Factory Acceptance Test completed by Leosmak before dispatch.
- **SAT:** Site Acceptance Test completed after transport and before the first production cycle.
- **Fast Defreeze:** the automatic function that melts ice on the cold traps.

1.2 Unit identification and support

Use the model and serial number on the Name Plate whenever you contact Leosmak. The exact location and specification of components can differ between units because industrial systems are made in different configurations.

FAT AND SAT

Every Leosmak industrial unit undergoes a meticulous Factory Acceptance Test before dispatch. Transport can still loosen a connection, disturb a seal or damage a component. The obligatory SAT in Section 6 confirms that the installed unit was not damaged in transit.

A dedicated WhatsApp support group is normally created for the unit. Leosmak support grants access to the administration panel through this group. If the group has not been created, contact Leosmak before the first production cycle.

1.3 Three functions in one unit

THREE PROCESSES

A Leosmak industrial unit combines blast chilling/freezing, freeze drying and vacuum drying in one controlled system. Performance depends on the model, load, tray arrangement, ambient conditions and validated settings.

Function	Typical capability	Primary use
Blast chilling / freezing	Cool from +70 °C to +3 °C within 90 minutes, or from +70 °C to -18 °C within 4 hours.	Rapidly chill or freeze a suitable product before the drying stage.
Freeze drying	Freeze, create vacuum, sublime ice and complete final drying.	Remove water while preserving product structure and quality.
Vacuum drying - Sweet Mode	Preheating, vaporization, cooling and defreezing without a standard freeze-drying sequence.	Dry suitable confectionery and other validated products under reduced pressure.

For typical food recipes, download the **Leosmak Cook Book** from <https://leosmak.com/en/support>. Treat every recipe as a starting point and validate it for the actual product, slice size, tray load, moisture target and package.

2. SAFETY

2.1 Safety pictograms and message boxes

Warnings are placed directly beside the relevant action. The coloured frame shows how the operator should respond: red means stop immediately and make the condition safe; amber means control the hazard before continuing; green marks a mandatory operating action; dark green/grey provides important technical information.

	Electrical	High voltage, phase loss, damaged cables and electrical cabinets.
	Hot / cold surfaces	Shelves, pumps and compressors can be hot. Traps and refrigeration components can cause cold burns.
	Heavy load	The unit and loaded trays can crush feet or hands. Use lifting equipment rated for the actual load.
	Vacuum	Do not force a door or technical end cover while the chamber is under vacuum.
	Biological	Product residue and contaminated process water can create a hygiene hazard.
	General warning	Stop if an abnormal sound, smell, leak, temperature or alarm is detected.

2.2 Operator duties and personal protection

- Only trained persons aged 18 or over may operate the unit.
- Keep the safety area clear. Maintain at least 1 m of free space around ventilation openings unless the as-built layout specifies more.
- Wear safety footwear when handling trays, trolleys or lifting equipment. Wear thermal gloves when touching cold or hot parts.
- Keep warning labels, the Name Plate and operating controls clean and readable.
- Inspect the unit before every cycle. Do not use damaged trays, seals, hoses, cables, doors, viewports or guards.
- Only authorised personnel may open electrical cabinets, remove covers, change inverter parameters or repair refrigeration and vacuum systems.

2.3 Main hazards

Hazard	Possible consequence	Required control
Electrical	Electric shock, fire, damaged electronics	Match the Name Plate supply. Use protective devices specified in the electrical drawing. Keep water away from cabinets, HMI, motors and cables. Electrical work is for qualified electricians only.
Mechanical	Crushing, falling trays, uncontrolled movement	Lock wheels. Use the frame as the lifting point. Keep hands and feet clear. Never move the unit with product, trays, ice or water inside.
Vacuum	Door movement, water ingestion, seal damage	Never force a door. Equalise the chamber with Open air-in port . Never open the liquid-out port while the chamber is under vacuum.
Thermal	Burns and cold burns	Allow components to reach a safe temperature. Use thermal gloves. Do not touch traps, compressors, pumps or hot shelves without protection.
Fire / refrigerant	Fire, oxygen displacement, toxic decomposition products	No open flame. Do not use the unit in an explosive atmosphere. Switch off and ventilate if a refrigerant or oil leak is suspected. Contact Leosmak.

Hazard	Possible consequence	Required control
Biological / hygiene	Contamination of product and equipment	Remove residues. Clean the chamber, seals, trays, drain and viewports. Use only material-compatible cleaning agents.

DO NOT	Do not use a pressure washer on the unit. Do not direct water at sensors, seals, electrical parts, insulation, motors or the HMI. Do not connect pressurised water backwards through the drain.
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2.4 Health hazards and immediate response

FIRST RESPONSE ONLY	Use the site emergency plan, local emergency number and applicable Safety Data Sheet (SDS). Do not put the rescuer at risk. First aid and CPR/AED should be given by trained persons.
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Exposure / injury	Immediate safe response	Medical escalation
Electrical shock	Do not touch the person until power is isolated. Call for help. If the person is unresponsive and not breathing normally, begin CPR and use an AED if trained.	Treat as urgent. Call emergency services for loss of consciousness, abnormal breathing, chest symptoms or electrical burns.
Hot surface / thermal burn	Remove the heat source. Cool the burn under clean, cool running water for at least 20 minutes. Do not use ice, creams or grease. Cover loosely after cooling.	Urgent care for electrical, chemical, large, deep or facial burns, or when the site first-aid plan requires it.
Cold surface / frostbite	Move to a warm area. Do not rub or massage. Warm with warm - not hot - water only if refreezing cannot occur.	Seek medical attention promptly for numb, white, hard, blistered or extensive areas.
Refrigerant, vapour or oil mist	Do not enter an unsafe atmosphere. If safe, move the exposed person to fresh air. Flush exposed eyes/skin with clean water and follow the refrigerant or oil SDS.	Call emergency services for breathing difficulty, dizziness, collapse, eye injury or persistent symptoms.
Crushing, falling tray or cut	Stop movement and secure the load. Do not move an unstable unit or free a trapped person unless it is safe. Control bleeding using the site first-aid procedure.	Call emergency services for crushing, severe bleeding, suspected fracture or head injury.
Cleaning chemical / biological residue	Isolate the spill or contaminated area. Use specified PPE. Rinse exposed skin/eyes as stated in the product SDS and remove contaminated clothing when safe.	Contact occupational health or emergency services after significant exposure or if symptoms occur.

3. RECEIVING, TRANSPORT AND STORAGE

3.1 Receipt inspection and original packaging

- Before unpacking, photograph all sides of the packaging and any visible impact, tilt or moisture damage.
- Check transport indicators, straps, doors, technical end covers, piping, valves, viewports, HMI and frame before power is applied.
- Compare delivered accessories with the packing list. Do not connect a visibly damaged unit.
- Report transport damage promptly to the carrier and Leosmak. Keep the photographs and shipping documents.
- Retain the original pallet, wooden panels, protective foam and covers. They are required for safe movement between locations or return transport.

3.2 Safe unloading and movement

HEAVY EQUIPMENT

Confirm the actual unit weight and centre of gravity in the shipping documentation. Use lifting equipment and accessories with an adequate rated capacity. Establish an exclusion zone.

- Operate forklifts and other powered lifting equipment slowly. Place the forks fully under the structural frame. Never lift under a cover, pipe, electrical cabinet, HMI, door or drain connection.
- LEO-030, LEO-030L and LEO-130 units may be lifted around the chamber using durable, correctly positioned lifting straps. The lifting system must be rated for a load of up to 3 tonnes and the lift must be planned by a competent person.
- Keep the unit upright. Do not tilt, drop or subject it to vibration or impact.
- For short moves on wheels, use enough people to control the mass and route. Release and reapply every brake. Do not move on a slope or weak floor.
- For LEO-300, LEO-600 and larger modular systems, follow the project-specific lifting and module connection plan.

3.3 Storage and acclimatisation

- Store the unit upright in a dry, dust-free room without vibration, direct sun or major temperature fluctuations.
- If the unit arrives cold or has been stored outdoors, allow it to reach room temperature and dry completely before switching it on. Condensation can damage electronics, valves and sensors.
- Keep the chamber dry and the door slightly open during long storage. Protect the HMI and all open connections.

4. INSTALLATION AND CONNECTIONS

4.1 Unit schematic and optional connections

The drawing shows a typical industrial configuration. Component position and the separation between chamber and cooling module can differ by model and project. Use the unit-specific as-built drawings for installation and service.

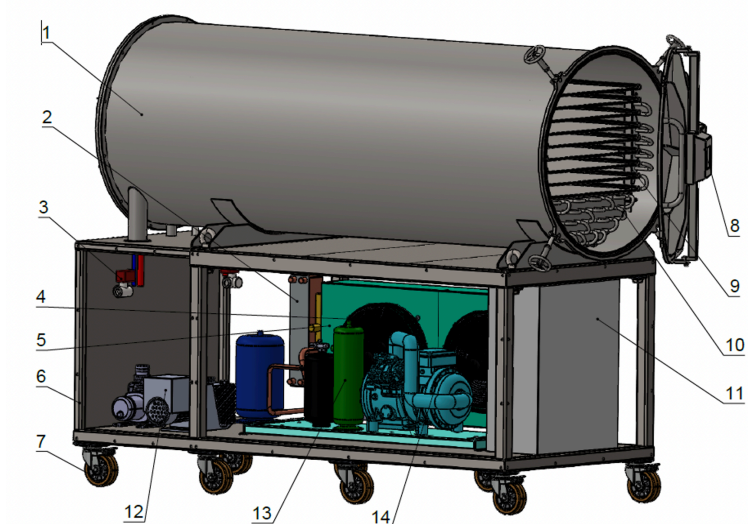


Figure 1. Typical industrial freeze dryer with optional chilled-water plate heat exchanger

No.	Component	No.	Component
1	Chamber	9	Shelves and tray system
2	Refrigeration heat exchanger	10	Cold-trap evaporators
3	Three-way valve	11	Control cabinet(s)
4	Air condenser	12	Vacuum pump
5	Condenser fan	13	Liquid separator
6	Structural frame	14	Compressor
7	Wheels, where fitted		
8	HMI / control panel		

OPTIONAL CONNECTIONS

Connect chilled water, steam generator, heat distribution etc. through the optional plate heat exchanger only when this configuration was ordered. Follow the detailed Leosmak connection instruction for the specific unit.

4.2 Site requirements

Requirement	Minimum condition before SAT
Room	Closed, dry, clean and ventilated. No explosive atmosphere or open flame.
Ambient temperature	Recommended +10 °C to +30 °C. Performance can fall and inverter/compressor alarms can occur above this range.

Requirement	Minimum condition before SAT
Floor	Level, rigid, non-combustible and rated for the operating mass of the unit, product, trolley and service loads.
Clearance	At least 1 m around ventilation openings and service access, unless the project layout requires more.
Drain	Correct hose or fixed drain, continuously sloped, unobstructed and sized for the full ice load.
Ventilation	Condenser screens and air inlets remain clear. Heat from the unit must not recirculate into the intake.
Services	Power, chilled water, steam, compressed air or other media exactly as shown in the as-built drawings.

4.3 Electrical supply and inverters

- A qualified electrician must verify voltage, frequency, phases, phase sequence, protective earth, cable size, disconnection device and protection against overcurrent.
- Use the Name Plate and the unit-specific electrical drawing. Do not use extension leads or temporary adapters.
- The unit contains inverters that control compressors and vacuum pumps. Local supply conditions can require parameter adjustment if the available power is unsuitable.
- Do not change inverter settings yourself. Contact Leosmak. Incorrect settings can prevent starting or damage a compressor or pump.

RESTART INTERVAL

After stopping or finishing a cycle, wait at least 2 minutes before starting the next cycle or restarting the unit. This allows refrigerant pressure and other internal media pressures to equalise. An earlier restart can fail or cause equipment damage.

4.4 Drain, chilled water, steam and CIP

- Connect the condensate drain so water flows by gravity. Keep the hose end above the liquid level in any collection vessel to prevent contaminated water from being sucked back into the chamber.
- A full batch can produce a large volume of melt water. Size the drain or collection vessel for the unit's maximum ice capacity.
- For non-standard chilled-water, steam or other utility connections, use only the detailed connection guidelines issued by Leosmak for the specific project.
- LEO-300 and LEO-600 can be supplied with a CIP-ready construction if this option was ordered. Do not connect or operate CIP unless it appears in the as-built documentation. Obtain the separate CIP connection and operation instruction from Leosmak.
- Do not apply force or torque from customer piping to unit connections. Support external pipes independently.

4.5 Wi-Fi, mobile app and administration panel

Step	Connect the Leosmak mobile app
1	Download the Leosmak app to the operator's phone from the Apple App Store or Google Play.
2	On the HMI, open the Wi-Fi menu, enable Wi-Fi and connect the unit to a unique 2.4 GHz network. A 5 GHz-only network is not supported.
3	In the mobile app, select the option to add/link a device and open the QR-code scanner.
4	Tap the QR code shown in the HMI Wi-Fi menu to enlarge it, then scan it with the Leosmak app.
5	Confirm that the unit is linked. Enable notifications for phase changes and cycle completion.

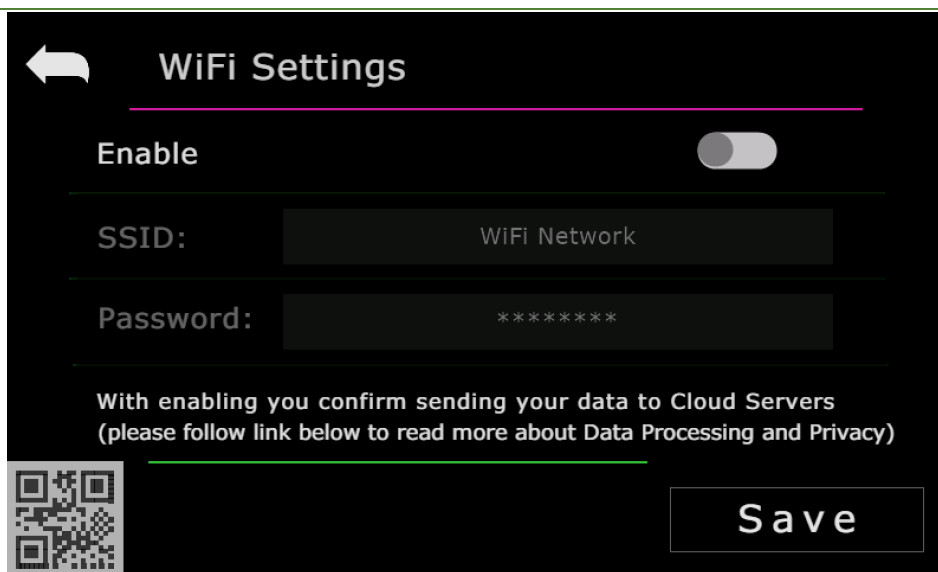


Figure 2. Wi-Fi menu with the unit QR code

- Cycle graphs and remote information are available at the Leosmak administration panel. Access is granted by support in the dedicated WhatsApp group.
- If no support group exists, contact Leosmak before relying on remote monitoring.
- Remote notifications assist the operator but do not replace local supervision, safety checks or product validation.

Administration panel address: <https://admin.leosmak.com/Leosmak>

5. FREEZE-DRYING BASICS

5.1 Sublimation in plain language

SIMPLE DEFINITION

Freeze drying removes water while it is frozen. Below the triple point of water, liquid water is not a stable phase: water can exist only as ice or vapour. Under this low pressure, controlled heat causes ice in the product to change directly into water vapour. This direct change is sublimation.

The cold traps are colder than the product. Water vapour therefore moves from the product to the traps and freezes there. Vacuum does not dry the product by itself. Drying requires the correct combination of frozen product, low pressure, cold traps, controlled shelf heat and sufficient time.

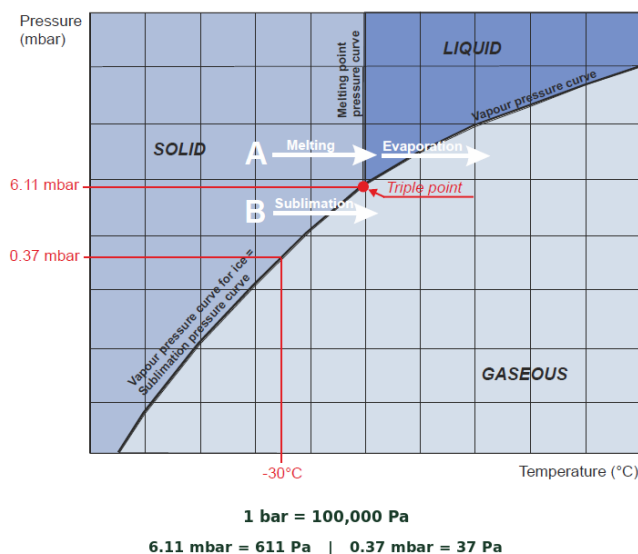


Figure 3. Water phase diagram and the sublimation region, with pressure values in mbar and Pa

5.2 Process phases and product preparation

Phase	What the unit does	Operator focus
1. Freezing	Freezes the product at atmospheric pressure.	Freeze the whole product. Thick pieces and high-sugar products may require more time.
2. Sublimation	Cools traps, starts the vacuum pump and adds controlled shelf heat so ice becomes vapour.	Pressure, trap temperature and shelf temperature must progress normally.
3. Drying	Removes more tightly bound moisture at low pressure, often at a higher shelf temperature.	Confirm the product and packaging target, especially water activity.
4. Defreezing	Melts ice collected on the traps and drains the water.	Remove product first. Confirm the drain is connected and clear.

- Cut or slice products with skins, shells or large thickness. Use an approved perforator where appropriate.
- Spread product in an even layer. Do not overload trays or block airflow and heat transfer.
- Keep tray bottoms and shelf surfaces clean so the trays make full contact with the shelves.
- Use only undamaged AISI 304 trays and accessories approved for the unit.
- For starting recipes for typical foods, download the Leosmak Cook Book at <https://leosmak.com/en/support>. Validate the final recipe for your own product, load, target moisture and packaging.

6. SITE ACCEPTANCE TEST (SAT)

OBLIGATORY

Complete and record the SAT after installation and before the first production cycle. Do not load product during the SAT.

6.1 SAT prerequisites

- The unit passed receipt inspection and shows no unresolved transport damage.
- The unit has acclimatised to the room and is dry.
- Power, protective devices, earth, phase supply and all ordered utilities have been checked by qualified personnel.
- The chamber, door seal and viewports are clean. The door and technical end covers close correctly.
- The drain is connected, clear and positioned to prevent backflow.
- All customer piping is supported and connected according to the Leosmak drawings.
- The chamber is empty and all personnel are outside the hazard area.

6.2 Obligatory SAT procedure

1

Connect the unit to a Wi-Fi network

- Turn the main power switch to ON and press the green start button.
- Select the Wi-Fi icon on the HMI.
- Enable Wi-Fi. Enter the SSID and password for a 2.4 GHz network.
- Press **Save**. Confirm that the Wi-Fi status changes from Off to On.

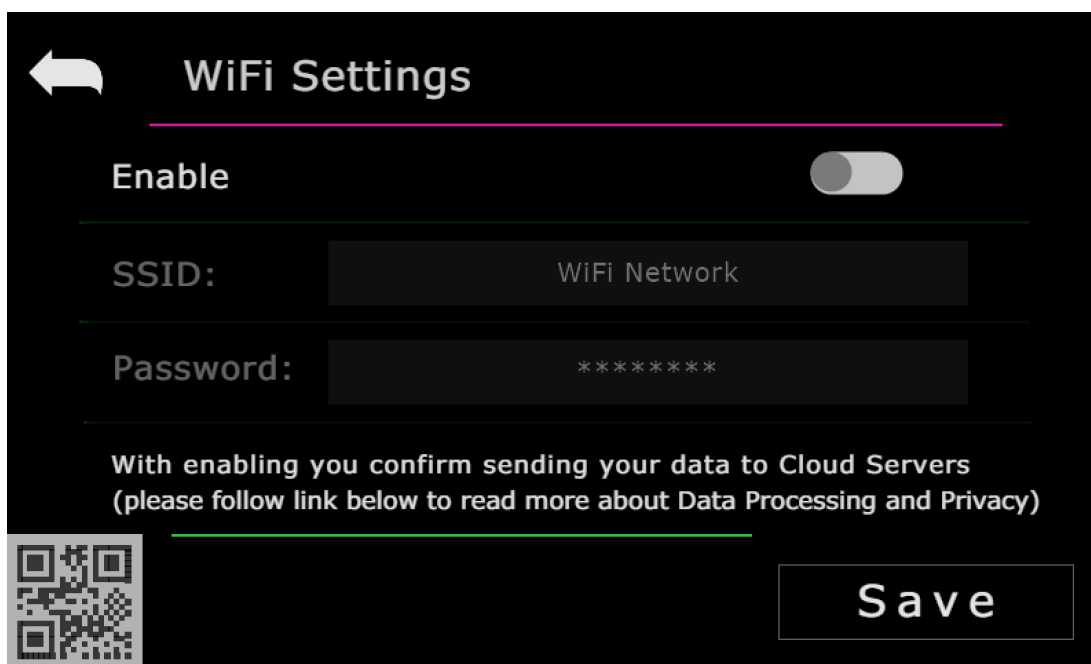


Figure 4. Wi-Fi Settings screen

2

Start a test sublimation cycle

- Open the **Freezing** phase settings.
- Disable **Auto Mode**.
- Set **Duration** to 0 h and press **Save**.
- Return to the main screen and press **Start**. The unit bypasses freezing and begins the sublimation sequence.

3

Monitor the parameters for approximately 30-45 minutes

- Cold-trap temperature reaches -30 °C or below.
- The vacuum pump starts automatically when the cold-trap temperature reaches -20 °C.
- Chamber pressure falls below 350 Pa.
- Shelf heaters start when pressure falls below 350 Pa. Shelf temperature then begins to rise.
- No abnormal noise, smell, vibration, liquid leak, refrigerant/oil mark or persistent alarm is present.

4

Stop and equalise the chamber

- When all acceptance criteria are met, press **Stop** on the main screen.
- Open **Settings** and select **Open air-in port**.
- Wait until chamber pressure is equal to atmospheric pressure. Do not force the door.
- Wait at least 2 minutes before starting another cycle.

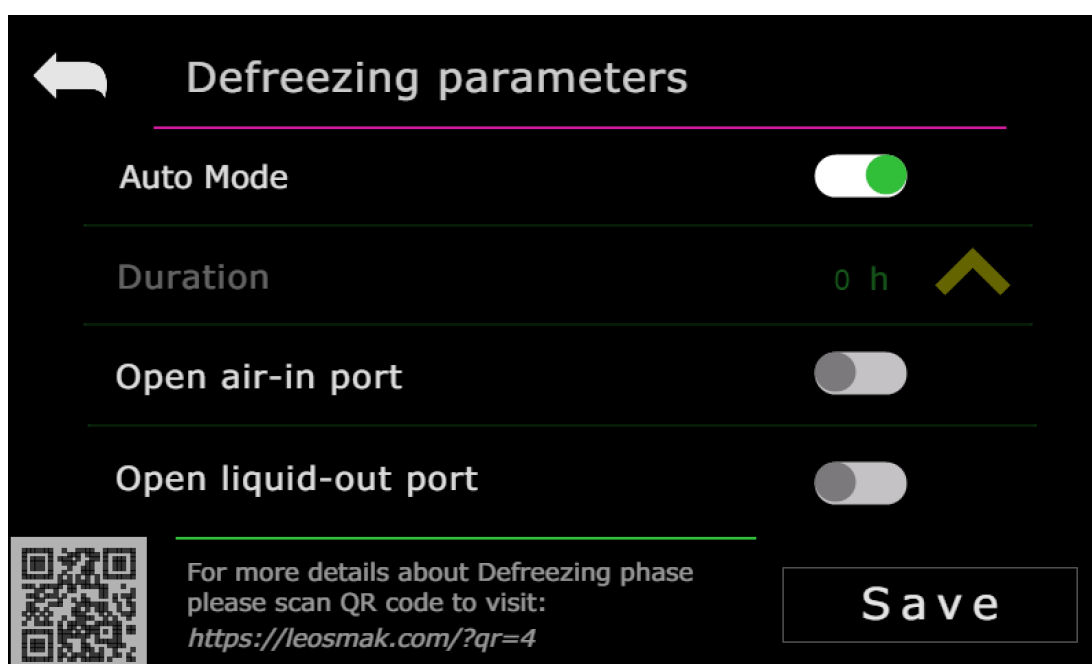


Figure 5. Defreezing parameters and manual port controls

5

Record and report the result

- Complete the SAT record in Appendix B.
- If any acceptance criterion is not met, do not start production. Use **Send report** if available and contact the dedicated Leosmak WhatsApp support group.

7. DAILY OPERATION

7.1 Pre-cycle checklist

Check before every cycle	OK
Chamber, shelves, traps, drain and viewports are clean and dry	☐
Door seal and technical end-cover seals are clean, seated and undamaged	☐
Drain hose is connected, clear and protected against backflow	☐
Ventilation grilles and condenser screens are clean and unobstructed	☐
Trays are flat, undamaged and correctly loaded	☐
No liquid, ice or loose objects remain from the previous cycle	☐
No active alarm, visible leak, unusual smell or unusual noise is present	☐
At least 2 minutes have passed since the preceding stop or cycle end	☐

7.2 Loading and tray handling

- LEO industrial units can use a loading/unloading trolley. LEO-600 and larger modular systems can use a conveyor rail if this option was ordered.
- Position loaded trays carefully on the trolley. Heavy trays can slide or fall onto the operator's foot. Wear safety footwear and keep feet outside the fall zone.
- Confirm that every tray is stable before moving the trolley. Move slowly and avoid sudden stops.
- Insert trays fully and evenly. Do not strike shelves, traps, sensors, viewports or door seals.
- Keep the viewport surfaces clean. Dirty viewports reduce inspection quality and can hide ice, water or product residue.
- Close the door gently and evenly. Make sure the seal is not twisted, contaminated or displaced. Do not use excessive force on the locking mechanism.

7.3 Starting, monitoring and restarting

- Use **Auto Mode** and a validated recipe for routine production. Change manual parameters only when the recipe and product limits are understood.
- Press **Start** and confirm that the expected phase begins. Monitor shelf temperature, trap temperature, pressure and elapsed time.
- If the cycle stops, an inverter alarms or the HMI resets, record the screen and parameters before restarting.
- After any stop, wait at least 2 minutes before the next start so refrigerant and other internal pressures can equalise.
- If repeated restarting is needed, stop production and contact Leosmak. Repeated resets can hide an electrical, sensor, flow or software fault.

CYCLE INTERRUPTION

A long power interruption during sublimation can melt trap ice, increase chamber pressure and damage the batch. When power returns, inspect the phase, product and parameters. Contact Leosmak if the correct recovery path is uncertain.

7.4 Unloading and Fast Defreeze

- At the end of drying, follow the HMI prompt to admit air. Wait for atmospheric pressure before opening the door.
- Unload and package the product quickly in a controlled low-humidity area. Freeze-dried product absorbs moisture rapidly.
- Remove the product before starting defreezing.
- Every industrial unit has **Fast Defreeze**. It heats the system to melt ice on the traps. Typical melting time is about 60 minutes and depends on ice mass, model and room conditions.
- Confirm the drain is connected and clear before Fast Defreeze. Monitor the water flow.

- Open the main door and technical end covers cautiously after defreezing or service. Water can remain inside and may pour out when a door or end cover is opened.

End-of-cycle sequence	Operator confirmation
1. Complete drying	The HMI shows completion and the validated product end point is met.
2. Admit air	Chamber pressure returns to atmospheric pressure; the door opens without force.
3. Unload	Trays are stable on the trolley/rail and the product is protected from room humidity.
4. Package	Use suitable moisture- and oxygen-barrier packaging without unnecessary delay; packaging within 15 minutes is recommended.
5. Fast Defreeze	Product is removed, drain is clear, melt water flows safely and the chamber is dried afterwards.

8. HMI AND REMOTE MONITORING

8.1 Main screen

SCREEN EXAMPLE

The screenshots show one software revision and one choice of units. Labels, available options and °C/°F display can differ with software and configuration.

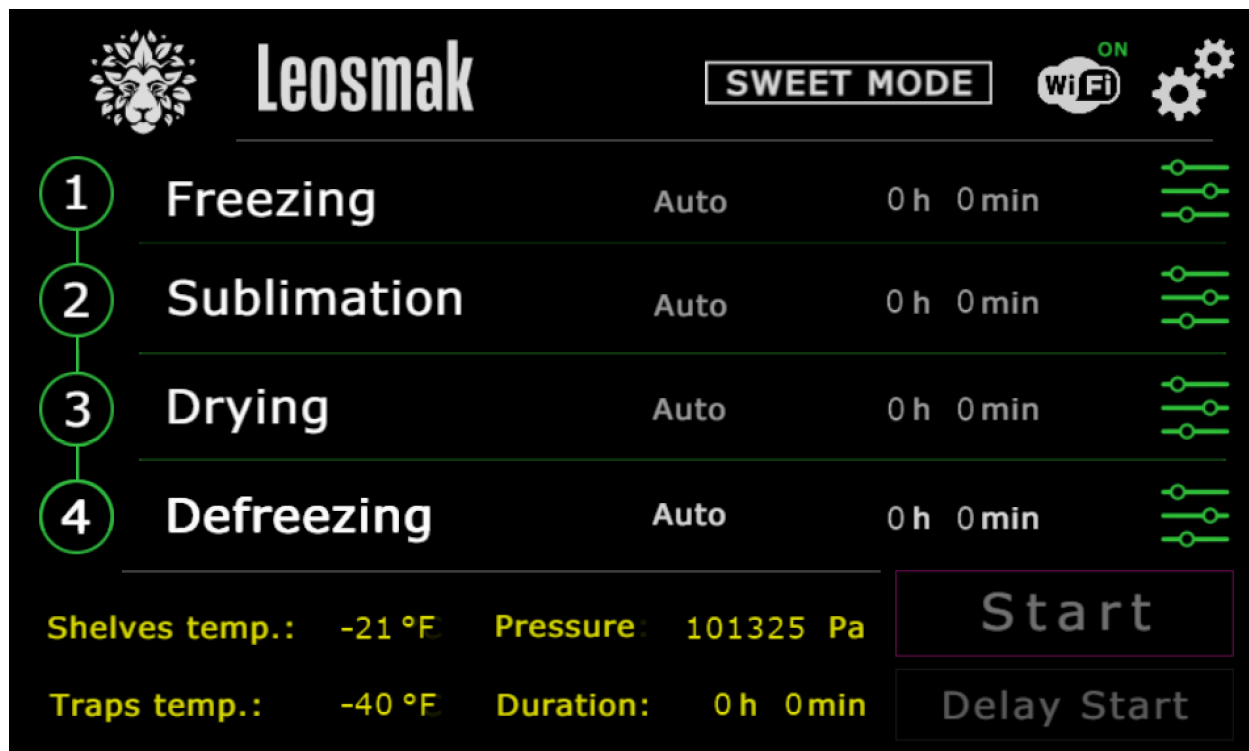
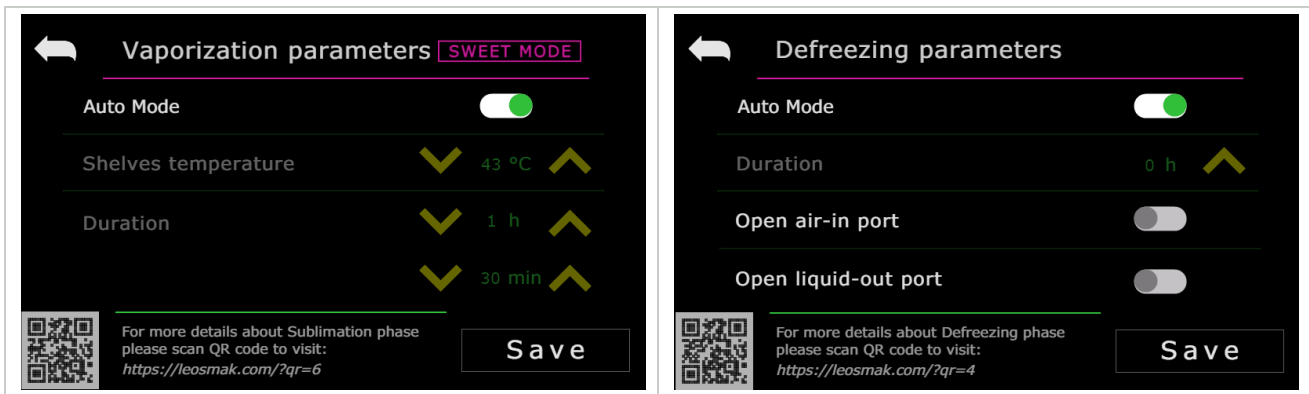


Figure 6. Normal-mode main screen

Area	Purpose
Freezing / Sublimation / Drying / Defreezing	Shows the four process phases. Select a phase or its settings icon to review or change parameters.
Auto / duration	Shows whether the phase uses the automatic setting and displays the programmed duration.
Shelves temp.	Live shelf-circuit temperature.
Traps temp.	Live cold-trap temperature.
Pressure	Live chamber pressure in Pa.
Start	Starts the programmed cycle when interlocks permit.
Delay Start	Sets a delayed start. Do not use it unless the unit and room can remain safely unattended.
Wi-Fi / Settings	Opens network and general settings.

8.2 Phase settings and operating modes



Use the switch to enable or disable **Auto Mode**. When Auto Mode is off, use the arrows to set temperature and duration, then press **Save**. The exact editable parameters depend on the phase and software version.

MANUAL SETTINGS

Incorrect shelf temperature or duration can overheat, under-dry or damage a product. Validate manual recipes on a small load before full production.

Sweet Mode is a vacuum-drying mode with Preheating, Vaporization, Cooling and Defreezing phases. Use it only for suitable products and with a validated recipe.

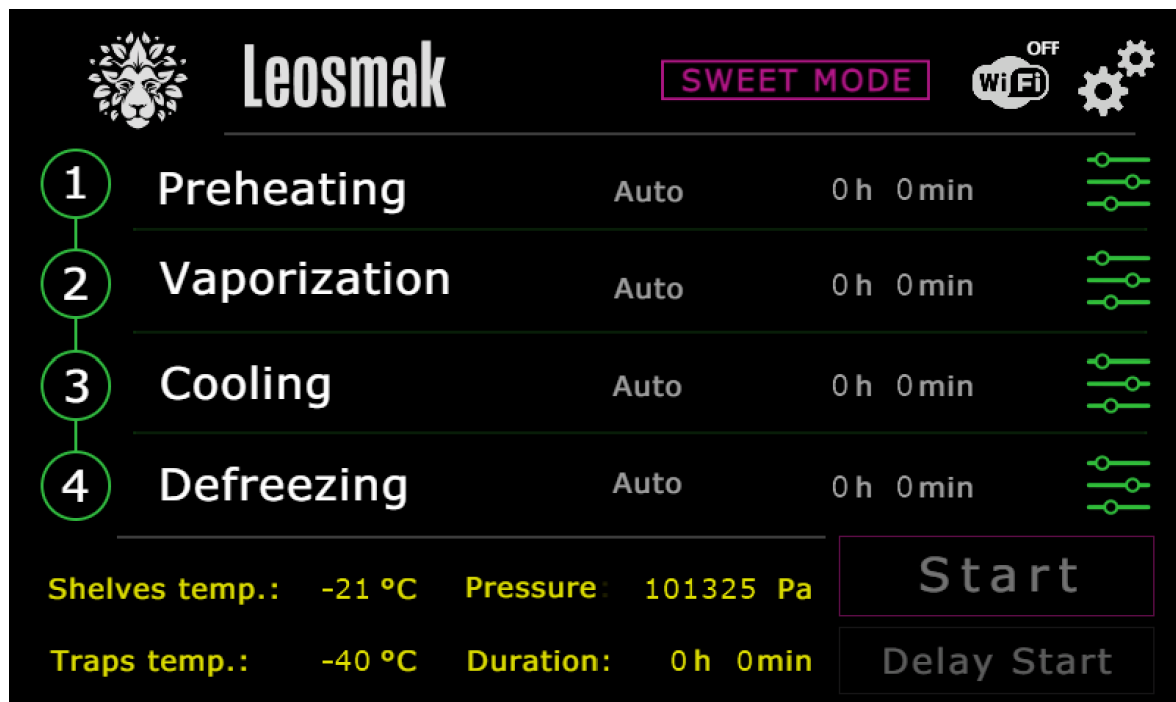


Figure 7. Sweet Mode main screen

8.3 Wi-Fi, settings, reports and notifications

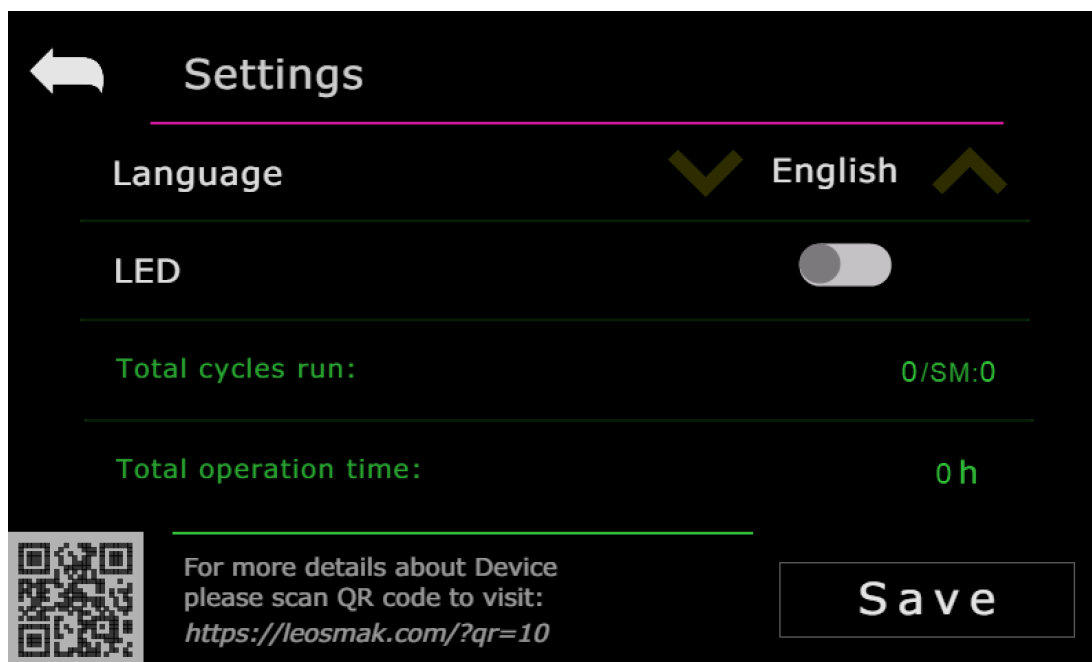


Figure 8. General Settings screen

Task	HMI path / action
Connect Wi-Fi	Select Wi-Fi → Enable → enter 2.4 GHz SSID and password → Save.
Change language	Select Settings → Language arrows → Save. Availability depends on software version.
Enable LED	Select Settings → LED switch → Save, if the unit has chamber lighting.
Open air-in port	Select the defreezing/settings page → Open air-in port. Use to equalise chamber pressure.
Open liquid-out port	Use only when the chamber is at atmospheric pressure and the drain route is safe.
Send diagnostic report	Open the information/service page and select Send report, if available. Then notify the WhatsApp support group.
Pair the mobile app	Open Wi-Fi on the HMI. In the app, select add/link device. Tap the HMI QR code to enlarge it, scan it and confirm pairing.
App notifications	After pairing, enable notifications for phase changes and cycle completion.
Cycle graphs	Open https://admin.leosmak.com/Leosmak with credentials granted by support.
SENSOR DISPLAY	A value such as 9999 or -9999 normally indicates a missing, disconnected or invalid sensor signal. Stop the cycle if the value affects process control. Photograph the screen and contact Leosmak.

9. VACUUM SYSTEM

Industrial units can use an oil-sealed or oil-free vacuum pump. The actual pump configuration and maintenance requirements are shown in the order documentation and on the pump Name Plate.

9.1 Oil-sealed vacuum pump

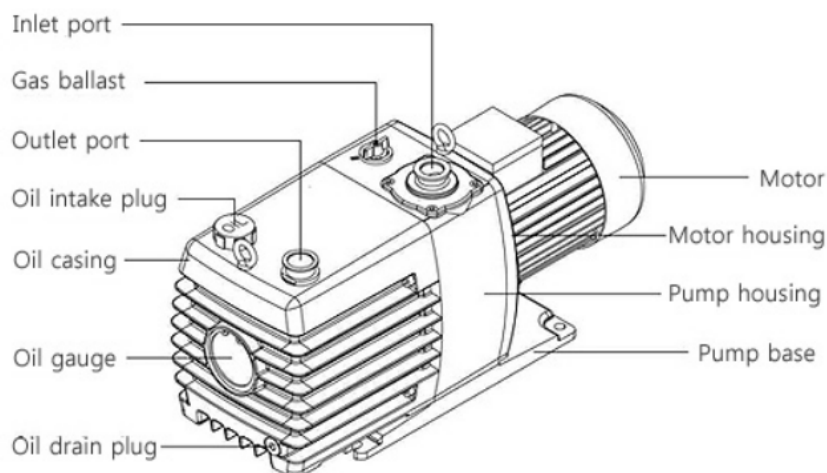


Figure 9. Typical oil-sealed vacuum pump

- Check the oil level in the sight glass at least weekly and before demanding production. Use only the specified oil (ISO VG 100 where stated for the installed pump).
- Change oil when it becomes dark, cloudy, emulsified, foamy or contaminated with water or product residue, and when the HMI oil-change warning appears.
- Never run an oil-sealed pump with insufficient oil. Do not continue if the pump expels oil, makes abnormal noise or cannot rotate.
- Water in the pump often indicates that the liquid-out port was opened under vacuum, the drain allowed backflow or condensable vapour exceeded the pump handling conditions. Correct the cause before fitting new oil.
- Dispose of used oil according to local law.



Figure 10. Vacuum-pump oil change warning

9.2 Oil-free vacuum pump

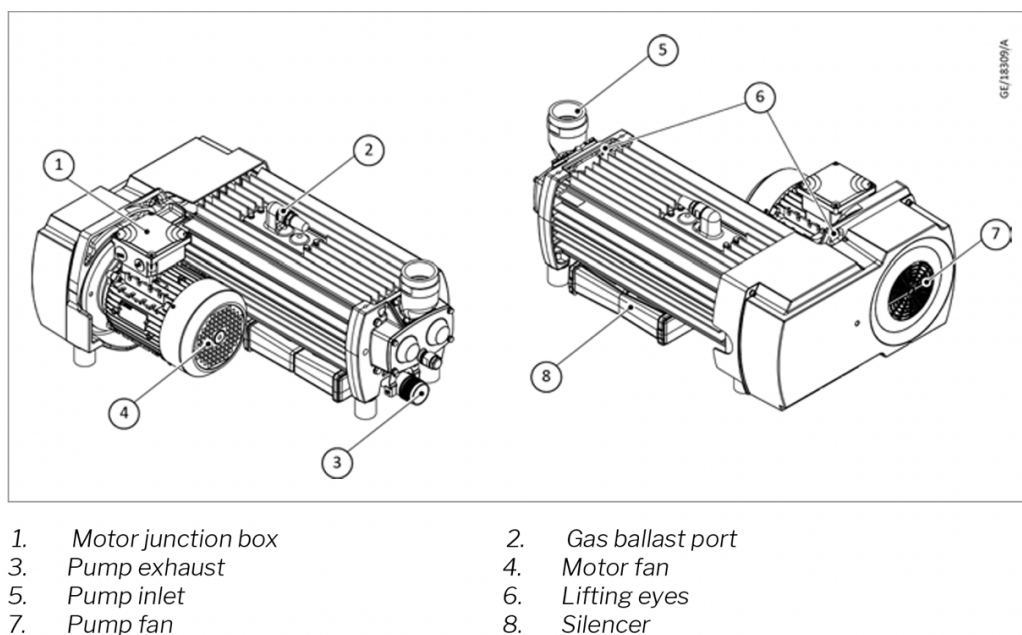


Figure 11. Typical oil-free dry screw vacuum pump

The oil-free pump is a dry-compressing screw pump. Two synchronised, counter-rotating rotors trap gas, compress it and discharge it without process oil in the compression chamber. This avoids routine process-oil and oil-filter changes and reduces the risk of oil contamination.

- Keep cooling-air inlets and the exhaust clear. Do not allow liquid or solid particles to enter the pump.
- Use the gas ballast as specified for condensable vapours. Gas ballast can reduce ultimate vacuum but helps prevent internal condensation.
- After pumping a wet load, follow the pump-specific drying or purge procedure. Where instructed for the installed pump, run it for about 30 minutes with the process valve closed and gas ballast open.
- Follow the manufacturer maintenance schedule. Periodic work can include timing-belt replacement every 6000 working hours and authorised service.

10. CLEANING AND MAINTENANCE

10.1 Cleaning after a cycle

- Switch off the unit and isolate energy before manual cleaning, unless a controlled HMI function is needed to open a valve.
- Remove all product residues. Clean trays, chamber, shelves, traps, door seal, technical end-cover seals, drain and viewports with clean, soft, non-abrasive materials.
- Use cleaning and disinfecting agents compatible with stainless steel, seals, sensors and other installed materials. Ask Leosmak if compatibility is uncertain.
- Do not use carbon-containing or aggressive compounds on vacuum and temperature sensors unless specifically approved.
- Do not use a pressure washer. Do not spray electrical equipment, HMI, motors, insulation or external covers.
- Drain all water. Leave the chamber open until it is dry. Confirm it is dry again before the next cycle.

CIP OPTION

Only LEO-300/LEO-600 units ordered in a CIP-ready configuration may be connected to CIP. Use the separate Leosmak CIP instruction. A standard chamber is not automatically CIP compatible.

10.2 Maintenance schedule and annual service

Interval	Operator / service task
After every cycle	Clean and dry the chamber, trays, seals, viewports and drain. Inspect for damage, leaks and residues.
Weekly	Check ventilation screens, hoses, cables, fasteners and unusual noise. For an oil pump, check oil level and condition.
Monthly	Inspect trays, trolley/rail, seals, doors, viewports, piping and safety labels for wear, cracks, corrosion or looseness.
As required	Fast Defreeze; clean the drain; change oil; replace filters or consumables according to the installed component instructions.
Once per year	Mandatory service inspection for every industrial unit. Contact Leosmak to arrange the inspection.

The shelf-medium circulation pump has speed control. Its setting can be adjusted to balance circulation when required. Do not change it without understanding the hydraulic circuit. If shelf temperatures are uneven or flow is abnormal, contact Leosmak for the correct setting.

The compressors and vacuum pumps are controlled by inverters. Supply quality, available power and local electrical conditions can require inverter reprogramming. Only Leosmak or authorised personnel may change these parameters.

11. TROUBLESHOOTING

CONTACT LEOSMAK

For questions, alarms or unresolved problems, use the dedicated WhatsApp support group or contact +48 71 715 66 00, office@leosmak.com or <https://leosmak.com/en/support>. Always provide the model and serial number.

11.1 First response and diagnostic package

1

Make the condition safe

- Press **Stop**. Use the main disconnect or emergency stop if there is smoke, a major leak, burning smell, uncontrolled heating, severe vibration or electrical danger.
- Do not open electrical cabinets or refrigeration circuits.

2

Record the evidence

- Model and serial number; date and time; current phase; product and load; shelf temperature; trap temperature; pressure; alarm code.
- Photograph the HMI and the affected area. Record a short video for abnormal sound, movement or leaking.

3

Use approved first-line checks

- Check door closure, seal cleanliness, drain position, room temperature, ventilation, visible connectors and external power indication.
- Wait at least 2 minutes before one controlled restart. Do not repeatedly reset an unresolved fault.

4

Send the report and contact support

- Select **Send report** on the HMI if the option is available and Wi-Fi is connected.
- Send the evidence to the dedicated WhatsApp support group. If no group exists, contact Leosmak.

11.2 Symptom-based troubleshooting

Symptom	Safe operator checks	Stop / contact Leosmak when
Unit will not start after a stop	Wait at least 2 minutes. Confirm the main switch, green start button, emergency stop and room protection are on. Check for an active HMI or inverter alarm.	If it still will not start, or protection trips again.
Breaker trips / inverter alarm	Stop. Record the alarm code. Confirm ambient temperature, ventilation and that no phase or facility power was lost.	Immediately. Inverter parameters and cabinet checks are for Leosmak/qualified electricians.
Pressure does not fall below 350 Pa	Clean and close the door seal. Confirm the door/technical end cover is fully locked, the drain valve is closed and the drain is clear. Check visible vacuum-hose connections and pump status.	If pressure remains high, a seal, valve, sensor, pump or transport-damaged connection may require service.
Door cannot be opened	Do not force it. Stop the cycle and use Open air-in port . Wait for atmospheric pressure.	If pressure does not equalise or the valve does not respond.
Trap temperature does not reach -30 °C / returns to Freezing	Check room temperature, 1 m clearance, condenser screens and airflow. Record compressor/inverter status and any oily/refrigerant marks.	If the compressor alarms, traps warm during sublimation or a leak is suspected.
Shelves do not freeze or heat evenly	Confirm tray contact and load distribution. Record temperatures by shelf. Do not change circulation-pump speed unless instructed.	If several shelves differ, the circuit may contain air, low medium, a pump fault or a sensor fault.

Symptom	Safe operator checks	Stop / contact Leosmak when
HMI freezes, resets or cycle stalls	Photograph the screen. Record phase and parameters. Use Send report . After a safe stop, wait 2 minutes and perform one restart.	If the fault repeats, the unit must not be used until Leosmak reviews software, HMI, power and cabling.
Sensor shows 9999 / -9999	Treat the reading as invalid. Stop if the sensor is used for process control. Photograph the screen.	Contact Leosmak for sensor, connector or controller diagnosis.
Wi-Fi will not connect	Use a unique 2.4 GHz SSID. Re-enter the password. Move the access point closer and confirm internet service.	If the HMI remains Off or connecting, or the module is not detected.
Water or emulsified oil in vacuum pump	Stop the pump. Check whether the liquid-out port was opened under vacuum or the drain hose was submerged. Correct backflow conditions. Follow the pump oil procedure.	If liquid entered an oil-free pump, the pump expelled oil, will not rotate or vacuum remains poor.
Oil becomes dark after few cycles	Review product carry-over, filtration, gas-ballast use and wet-load procedure. Check for water ingestion and use the specified oil.	If contamination is rapid or repeated; filters, pump or process protection may need service.
Water does not drain	Stop at atmospheric pressure. Check hose slope, kinks, collection vessel and visible blockage at the drain opening. Remove residues safely.	Do not reverse-flush with pressurised water. Contact Leosmak for valve or actuator faults.
Water pours out when a door/end cover opens	Open slowly and stand clear. Confirm Fast Defreeze is complete and the drain is clear. Dry the chamber before the next cycle.	If drainage is blocked, water returns under vacuum or a pressure sensor is implausible.
Product remains wet	Check slicing, layer thickness, total water load, recipe time, trap temperature, pressure and packaging humidity. Extend validated drying rather than only increasing heat.	If parameters were abnormal, only part of the load dried, or the fault repeats with a validated recipe.
Visible oil/refrigerant leak or unusual smell	Stop, isolate power if safe, ventilate and keep ignition sources away. Do not touch or repair the circuit.	Immediately. Refrigeration and vacuum repairs require authorised service.

12. SHUTDOWN, DISPOSAL AND DISCLAIMER

12.1 Normal shutdown and storage

- For normal shutdown, finish or stop the cycle, equalise chamber pressure, remove product, complete required defreezing, drain water and allow the chamber to dry.
- Switch off the HMI/control supply as applicable, press the red stop button and turn the main switch to Off. Isolate energy for maintenance or long storage.
- Keep the unit-specific Declaration of Conformity, electrical drawings, FAT/SAT records and service history with the unit.
- For long storage, keep the clean, dry chamber slightly open and protect the HMI, openings and connections. Retain the original packaging for future relocation.

12.2 Disposal and recycling

AUTHORISED DECOMMISSIONING

The unit contains electrical equipment, refrigerant, oils and other controlled materials. Decommissioning and refrigerant recovery must be performed by authorised specialists according to applicable local law.

- Disconnect and secure all energy sources and utilities before dismantling. Prevent accidental restart.
- Do not cut, puncture or damage refrigerant piping. Recover refrigerant and pump/compressor oil using approved equipment and routes.
- Separate electrical and electronic assemblies, motors, sensors, controls, insulation, oils and refrigerants for the appropriate regulated waste streams.
- Stainless-steel chamber, frame and other metal parts can be recycled after safe decontamination and removal of controlled components.
- Reuse or recycle the pallet, wooden panels, cardboard, film and protective foam according to local rules. Keep service and disposal records with the unit file.

12.3 Disclaimer and limits of use

DISCLAIMER

To the maximum extent permitted by applicable law, Leosmak is not responsible for malfunction, equipment damage, product loss or process failure caused by use outside the Name Plate, as-built documentation, order-specific specification, validated recipe or written Leosmak instructions. Contractual liability and warranty remain governed by the Agreement and mandatory law.

- Excluded causes include unauthorised modification or repair; incorrect electrical supply or utilities; changed inverter settings; improper lifting, transport or storage; insufficient ventilation; neglected annual service; incompatible cleaning agents; and operation with damaged seals, trays, cables or piping.
- Do not force a chamber door, open the liquid-out port under vacuum, operate an oil pump with insufficient or unsuitable oil, run a cycle with liquid water remaining in the chamber, or restart before the required 2-minute pressure-equalisation interval.
- Recipes and operating parameters supplied in this manual or the Cook Book are starting references. The operator is responsible for validating product preparation, load, cycle, residual moisture/water activity, hygiene, packaging and shelf life.
- Wi-Fi, the mobile app, notifications and the administration panel are monitoring aids. Availability is not guaranteed and they do not replace local supervision, safety interlocks, operator checks or product validation.

APPENDIX A. INDICATIVE OPERATING PARAMETERS

REFERENCE ONLY

The values below are indicative normal-mode observations, not universal recipes or acceptance limits. The HMI configuration, Name Plate, order-specific documents and validated product recipe take priority.

Phase / condition	Shelves	Cold traps	Pressure
Start / idle	Room temperature	Room temperature	Approximately atmospheric
Freezing	Typically -25 °C or lower	Configuration dependent	Approximately atmospheric
SAT sublimation check	Begins to rise after vacuum threshold	≤ -30 °C	< 350 Pa
Typical sublimation	Recipe dependent; often around +40 °C	Typically ≤ -35 °C	Low vacuum; process dependent
Drying	Recipe dependent	Typically ≤ -35 °C	Low vacuum; process dependent
Fast Defreeze	Controlled heating	Ice melts; about 60 min typical	Atmospheric before opening

A freeze-drying cycle is complete only when the product meets its validated moisture/water-activity target and quality specification. Similar shelf and product temperatures can support an end-point assessment, but product validation remains the operator's responsibility.

APPENDIX B. SAT FORM

Complete this detachable form during the obligatory Site Acceptance Test described in Section 6. Keep the signed form with the unit documentation.

Model	
Serial number	
Installation site	
Date / time	
Operator	
Leosmak support contact	

Check	Required	Measured / observed	Pass / fail
Receipt inspection	No unresolved transport damage		
Power and utilities	Match Name Plate/as-built drawings		
Wi-Fi	2.4 GHz; status On		
Cold traps	$\leq -30\text{ }^{\circ}\text{C}$		
Vacuum pump start	Automatic at trap temperature $\leq -20\text{ }^{\circ}\text{C}$		
Pressure	$< 350\text{ Pa}$		
Shelf heating	Starts below 350 Pa; temperature rises		
Leaks / alarms	None		
Stop / air-in	Pressure equalises correctly		
Restart interval	At least 2 minutes observed		

Final result: ☐ Accepted for operation ☐ Not accepted

Open actions: _____

Operator signature: _____ Date: _____

Leosmak confirmation/reference (if required): _____

APPENDIX C. EC DECLARATION OF CONFORMITY

DOCUMENT CONTROL

The signed EC Declaration supplied with the individual unit and any project-specific declaration take priority over this reproduced copy. Before handover, confirm that the declaration covers the delivered model and retain it with the technical file.



Leosmak

C E Certification

EC Declaration of conformity

We:

Leosmak S.A. (Leosmak JSC)
ul. E. Kwiatkowskiego 4
52-326 Wrocław, Poland

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

Product name:

Freeze Dryer

Model numbers:

LEO-030, LEO-030L, LEO-130, LEO-300, LEO-600

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

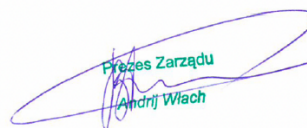
I, the undersigned, representing the manufacturer's authorized representative in EU, declare the sole responsibility, that the product specified above, to which this declaration relates, conforms to the above-mentioned Directives and Standards.



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

Date and place of issue:

9th October 2025, Wrocław, Poland


Przewodniczący Zarządu
Andrzej Włach

Andrzej Włach, Chairman of the Board

LEOSMAK S.A.
ul. E. Kwiatkowskiego 4, 52-326 Wrocław
NIP: 8943170614, REGON: 389508910
KRS: 0001199055

DECLARATION OF CONFORMITY

NO.DOC-2510-03-006

Figure 12. EC Declaration of Conformity for the listed Leosmak industrial freeze dryer models