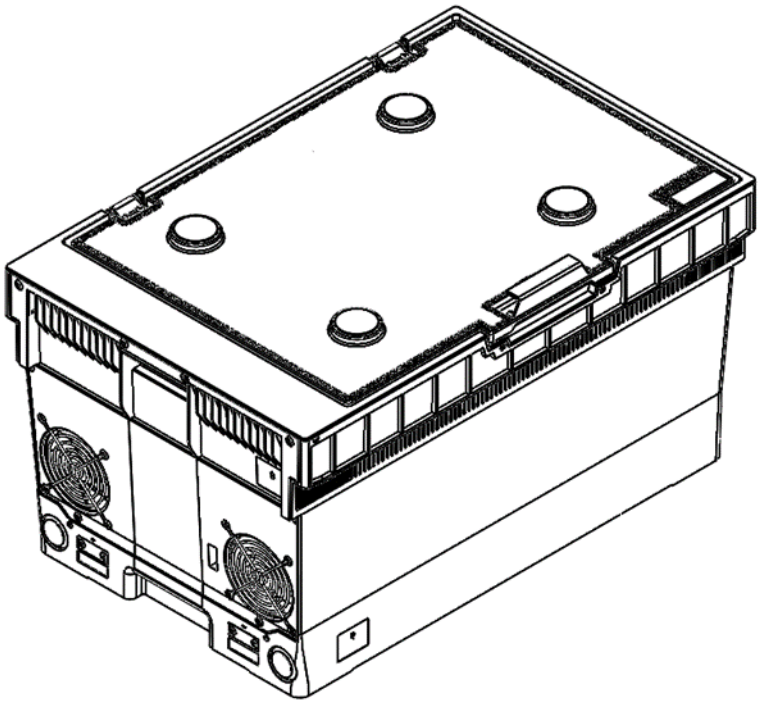
PHONONIC

Installation and Operating Manual

F451 Intelligent Actively Chilled Freezer/Refrigerator



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SAFETY PRECAUTIONS

All electrical appliances present some risk of injury. Your F451 is designed to meet safety standards.

Take care to carry and move your F451 with caution. Do not place it where it can fall, be dropped, or where the electrical connection can be submerged into water or other liquids.

Refer to “Unpacking Your Freezer/Refrigerator” for details on handling and moving the unit.

There are no user-serviceable parts within the F451 product.

Symbols used in this manual are described as follows:

Used to indicate an electrical shock hazard.

Used when advice is given to prevent malfunction or injury.

Do not remove the side cover or operate unit with side cover removed. Removal of the side cover can result in electrical shock. Service only by a factory authorized service person.

CAUTION: Never touch contacts when either side is plugged in as all contacts will be live.

Before installing, using, or maintaining this product, read the manual and product warning labels carefully. Failure to follow these instructions may cause the product to malfunction, which could result in injury or damage.

WARNING: This product is not to be used by persons under 8 years, persons with reduced physical, sensory, or mental capabilities, or persons who lack experience and knowledge unless they have been given supervision or instruction.

WARNING: Do not allow children to play with this product.

WARNING: Do not step or stand on the product.

WARNING: This product is for packaged food only – fresh food must be placed in a bag or other container prior to being placed in the freezer/refrigerator.

CAUTION: Cells/batteries shall be tested and pass applicable regulations based on type and use such as:

- ANSI/NEMA C18: ‘Safety Standards for Primary, Secondary, and Lithium Batteries'
- UL1642: ‘Standard for Safety for Lithium Batteries’

Transport regulations based on the following: International Air Transport Association (IATA), International Civil Aviation Organization (ICAO), International Maritime Dangerous Goods (IMDG) Code, Transport of Dangerous Goods (TDG).

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAUTION: ICES-003 Class B Notice – Avis NMB-003, Class B

This Class B digital apparatus complies with Canadian ICES-003.

SPECIFICATIONS AND FEATURES

		F451 Freezer	F451 Refrigerator
Basics	Model	F451	F451
	Materials	Polypropylene Shell ABS Side Cover	Polypropylene Shell ABS Side Cover
	Power Input	24VDC, 15A	24VDC, 15A
Performance	Temperature Set Point	-18 °C / 0 °F	3.3 °C / 38 °F
	Temperature Uniformity	< 3 °C / 6 °F	< 3 °C / 6 °F
	Temperature Stability	< 1 °C / 2 °F	< 1 °C / 2 °F
	Noise Level	52 dB (A) Max	52 dB (A) Max
	Energy	3.6 kWh/day @ 28 °C / 82 °F ambient 0.96 kWh/day @ 4 °C / 39 °F ambient	0.48 kWh/day @ 28 °C / 82 °F ambient N/A
	Rated Amps	13.5 Amps	13.5 Amps
	Refrigerant	R744 (CO2)	R744 (CO2)
Safety	Certifications	UL/CSA 60335-1, FCC, Materials are compliant to NSF51 Standard	UL/CSA 60335-1, FCC, Materials are compliant to NSF51 & NSF7 Standards
Storage	Internal Volume	27.5 L	27.5 L
Dimensions	Internal Dimensions	398 mm W x 295 mm D x 246 mm H 15.7 in W x 11.6 in D x 9.7 in H	398 mm W x 295 mm D x 246 mm H 15.7 in W x 11.6 in D x 9.7 in H
	External Dimensions	600 mm W x 400 mm D x 340 mm H 23.6 in W x 15.7 in D x 13.4 in H	600 mm W x 400 mm D x 340 mm H 23.6 in W x 15.7 in D x 13.4 in H
	Minimum Clearance Requirement	50 mm top & sides / 300 mm fan side 1.9 in top & sides / 11.8 in fan side	50 mm top & sides / 300 mm fan side 1.9 in top & sides / 11.8 in fan side
	Weight	14.3 kg / 31.5 lb	14.3 kg / 31.5 lb
	Full Parts and Labor	1 Year	1 Year

AGENCY APPROVALS

Agency	Compliance
NRTL Mark	MET
RoHS	YES
REACH	YES
NSF51	COMPLIANT
NSF7	COMPLIANT (applicable to refrigerator only)

ENVIRONMENTAL OPERATING CONDITIONS

Condition	
Operating Ambient Temperature	3 °C – 28 °C (37 °F – 82 °F)
Storage Environmental Range	-40 °C – 60 °C (-40 °F – 140 °F) Relative Humidity: 10%RH - 100%RH non-condensing
Operating Humidity	No more than 65% RH non-condensing Product approved for indoor use only
Altitude	For Operation of up to 2,000 m (6,560 ft)
Pollution Degree	2

This freezer/refrigerator is designed for indoor use only. Do not locate or store your freezer/refrigerator outdoors.

UNPACKING YOUR FREEZER/REFRIGERATOR

Phononic recommends you move the box as close as possible to its final location before unpacking. It is recommended that two people unpack the freezer/refrigerator.

Once unpacked, please take a moment to inspect your new freezer/refrigerator for damage that may have occurred during shipping. To request service support or a Return Material Authorization (RMA) from Phononic, Inc., please reference the Customer Support section.

IDENTIFYING ALL PARTS

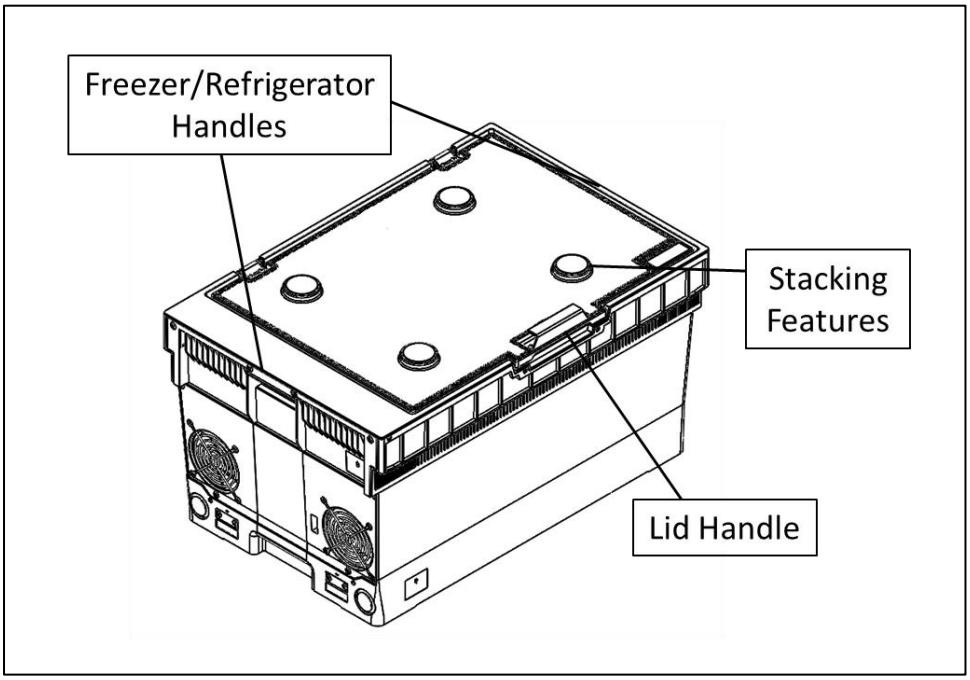


Figure 1: Labeled diagram of F451 Intelligent Actively Chilled Freezer/Refrigerator showing Freezer/Refrigerator Handles, Lid Handle, and Stacking Features

NOTE: Desiccant bags included inside the freezer/refrigerator may be discarded.

HANDLING GUIDELINES

Always place the unit on a flat table or durable shelf capable of supporting the unit's weight. The unit should not be on an inclined surface during loading or unloading to maintain unit stability.

Wherever possible, freezers/refrigerators should be moved using carts or robots. Manual lifting or carrying of the freezer/refrigerator should be minimized to avoid dropping or damaging the freezer/refrigerator.

Always use both freezer/refrigerator handles to lift the freezer/refrigerator. Do not lift the freezer/refrigerator using the lid handle.

Opening and Closing the Lid

To open the lid to access the cooled interior chamber, use the metal lid handle to lift the lid.

To close the lid, gently lower the lid towards the freezer/refrigerator body. Do not allow the lid to drop freely and slam into the freezer/refrigerator body.

PROVIDING VENTILATION

Your freezer/refrigerator is equipped with a ventilation area on the side of the unit. Do not block or cover the vent area as this can impact performance. It is recommended that the side of the freezer/refrigerator be placed no less than 300 mm / 11.8 in from a solid wall and have open air clearance of no less than 100 mm / 3.9 in above the top and sides of the unit (Figure 2).

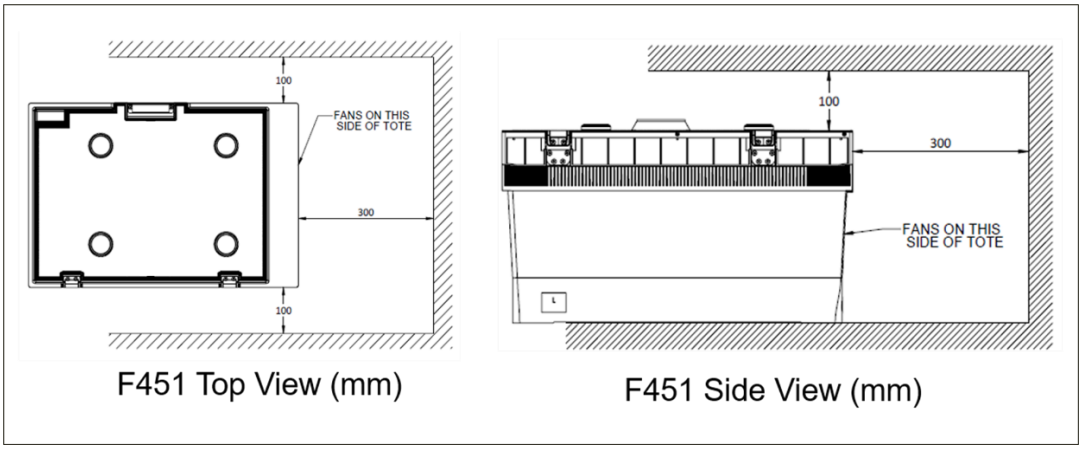


Figure 2: Diagrams depicting the top and side views of the F451

The external fans operate at intervals of variable speeds as needed.

WARNING: The technical compartment/fan area has moving parts, uninsulated electrically live parts, and hot parts. To avoid damaging the unit, do not remove fan covers or insert objects into the fan screens.

POWERING ON

- Only use the freezer/refrigerator with an approved power module designed to power your specific model.
- Only power the freezer/refrigerator using an SELV (Safety Extra-Low Voltage) source.

There is no on/off switch. Once plugged in, the freezer/refrigerator will begin cooling.

NOTE: The electrical safety of this product may become impaired if the user disregards the power safety steps listed above.

Set Point Temperature

When you power on the unit, the fan will run, and the system will work to reach the default set point of -18 °C / 0 °F for a freezer or 3.3 °C / 38 °F for a refrigerator. At an ambient temperature of 24 °C / 75 °F, the freezer/refrigerator will reach the default set point in less than 2.5 hours. The LED indicator will turn green once the unit reaches the set point.

Do not load product until the set point temperature is reached.

LOADING FREEZER/REFRIGERATOR

Once the Set Point Temperature has been reached, you may begin loading your products in the freezer/refrigerator.

IMPORTANT: Always provide adequate clearance around air ventilation.

WARNING: Do not load the freezer/refrigerator to exceed 22.6 kg / 50 lb. The freezer/refrigerator has a maximum food load of 8.1 kg / 18 lb.

Loading Plastic Bags

If multiple product types are being loaded, load products in plastic bags. Hook plastic bag handles onto the bag hooks as shown in Figure 3. These hooks can be used to prevent the bags from collapsing.

Figure 3: F451 plastic bag hooks

Allow adequate clearance around the door seal and air ventilation (inlet/outlet) as shown in Figure 4 & Figure 5. Avoid having plastic bags or any products extend over the door seal area or blocking the fan inlet at the bottom of the freezer/refrigerator interior as this can hinder unit performance.

Figure 4: F451 fan outlet and fan inlet

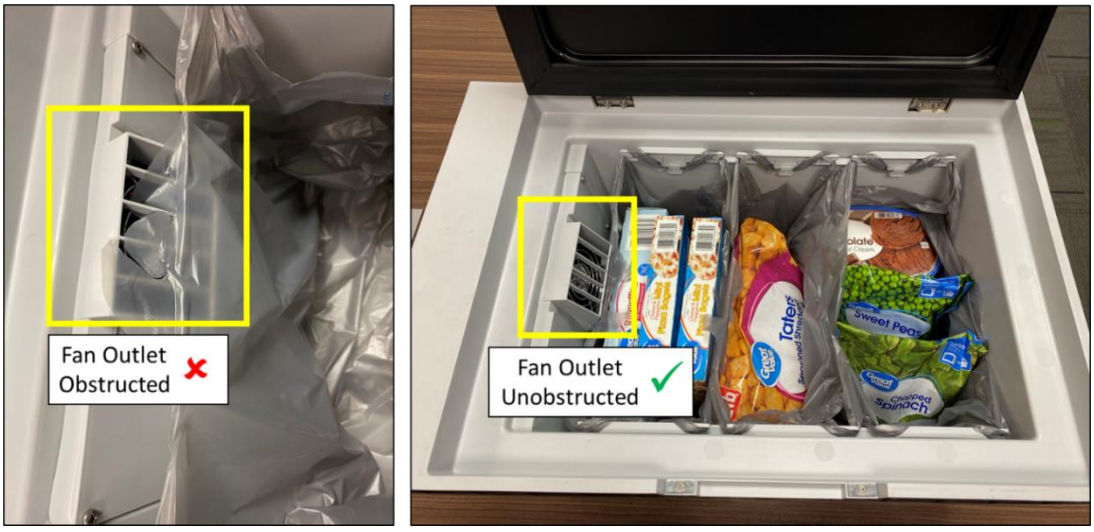


Figure 5: Comparison of F451 with fan outlet obstructed (left) and fan outlet unobstructed (right)

IMPORTANT: Always provide adequate clearance around air ventilation and door seal.

Inventory Freezer/Refrigerator Loading

Inventory freezers/refrigerators can be loaded without plastic bags as they contain only one product type. Leave a minimum of 51 mm / 2 in between the fan inlet and the product load and do not fill freezer/refrigerator above maximum fill height as shown in Figure 6.

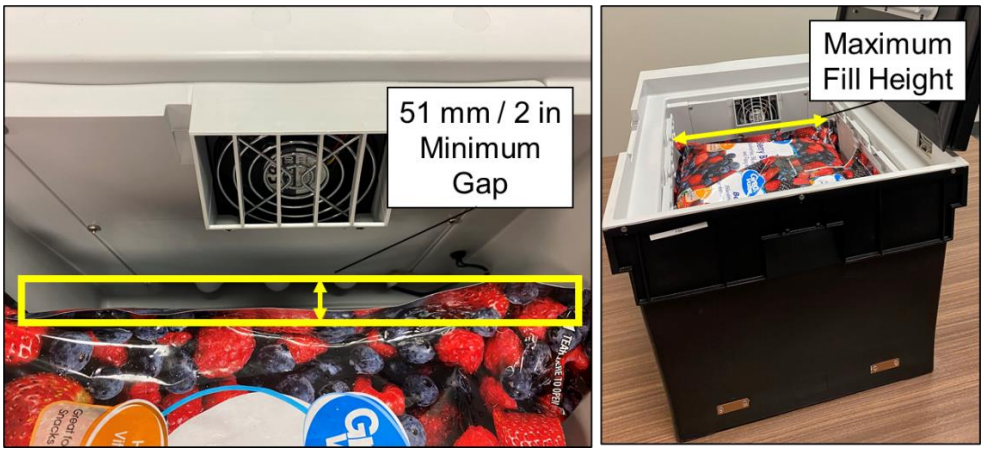


Figure 6: F451 displaying minimum gap and maximum fill height

STACKING FREEZERS/REFREGERATORS

Your freezer/refrigerator is equipped with features to allow stacking for storage and transportation as shown in Figure 7.

IMPORTANT: To avoid a tipping hazard, do not stack more than 3 freezers/refrigerators high.

IMPORTANT: If stacking freezers/refrigerators on a wheeled dolly, take note of the weight rating and maximum incline rating for the dolly.

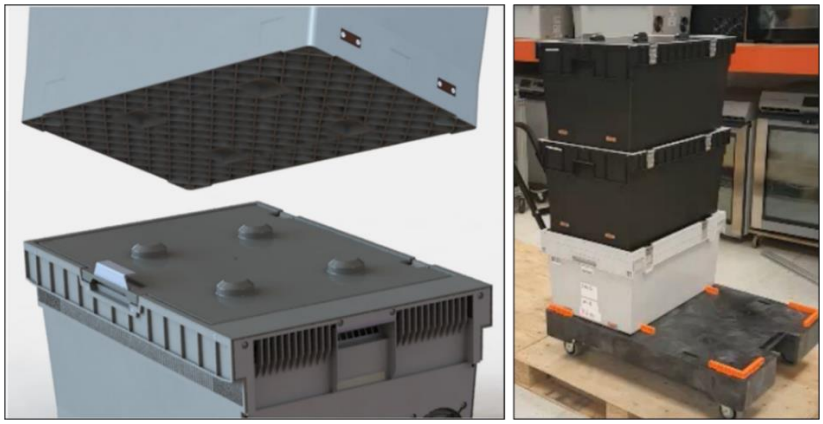


Figure 7: Diagram of F451 displaying stacking features and the maximum stack of 3 freezers/refrigerators

PRODUCT MAINTENANCE

Manual Defrost

The freezer should be manually defrosted at regular intervals to prevent performance degradation. Phononic recommends defrosting the freezer according to the schedule outlined below:

Operating Ambient	Maximum number of lid openings between defrosts	Maximum operation time between defrosts [days]
28 °C / 82 °F	9	7
4 °C / 39 °F	40	14

To complete a manual defrost:

1. Fully open the lid using the metal lid handle.
2. Empty the freezer of food and plastic bags.
3. Wait for internal temperature to warm up above 15 °C / 59 °F. To speed up the process, use a fan to blow room temperature air into the freezer.
4. Once the freezer has completely warmed up, use a cloth or vacuum to remove defrost water from within the unit.

NOTE: Manual defrost only applies to the freezer model.

Cleaning Guidelines

Below are general guidelines for cleaning the product. Follow your local health guidelines when cleaning any spilled food products.

Suitable products for cleaning interior/exterior:
The unit may be cleaned, when needed, using a mild detergent and a damp cloth.

IMPORTANT: Avoid the use of chlorides (cleaners with bleach) as well as abrasive cleaners and scrubbers such as steel wool.

IMPORTANT: When cleaning, avoid spraying with water as this can damage the freezer/refrigerator.

Cleaning around ventilation area and precautions:
Periodically inspect and monitor the ventilation area above the side cover for dust accumulation. It may be cleaned with a duster or vacuum cleaner with a dust attachment.

NOTE: Do not remove the side cover.

NOTE: For the refrigerator model, water condensate should be cleaned/removed from the drip tray under the fan side if it accumulates.

Drying Copper Contacts

Copper contacts are used to power the freezer/refrigerator (Figure 8). Always wipe the copper contacts dry with a clean dry cloth before inserting the freezer/refrigerator back into the automated rack system.

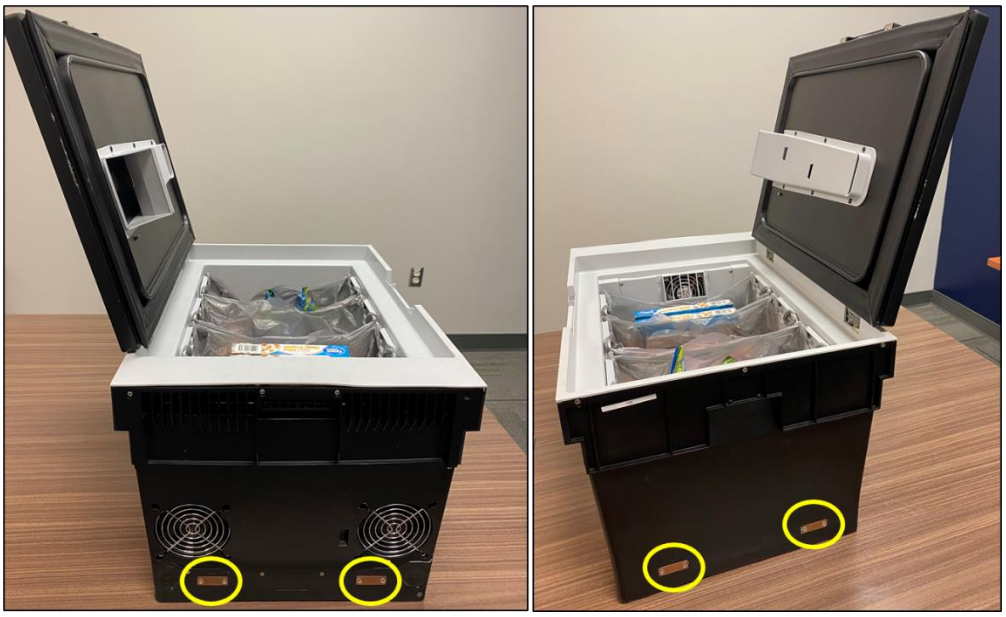


Figure 8. Copper contacts located on both the fan and non-fan sides of the F451

END OF LIFE DISPOSAL

When the unit needs to be disposed of, Phononic recommends sending the unit to a local metal recycler for metal reclaim.

FREQUENTLY ASKED QUESTIONS

How does this solid-state refrigeration technology work?
Phononic freezers and refrigerators are built on solid state refrigeration technology. It uses a non-toxic, non-hazardous refrigerant embedded in the walls to absorb and channel heat energy to an internal, solid-state heat pump; this component replaces the compressor in a typical freezer. The heat pump cools the refrigerant material when it channels the heat energy out of the system and into the ambient environment.

How reliable is the system?
Phononic completes strenuous life-testing studies to understand system reliability. Phononic thermal systems have no internal mechanical parts, are easy to operate, and require minimal maintenance.

Can you guarantee performance?
Our thermal management solutions are tested according to the most demanding consumer and industrial product safety and reliability standards. The heat pump meets or exceeds Telcordia and JEDEC electronic performance, testing, and certification standards. Our cooling system contains very few mechanical parts (only fans), eliminating the most common point of failure.

Where can I find the serial number?
Product serial number, model number, and regulatory approvals are printed on the stickers on the unit side cover.

What kind of maintenance is required?
Check the external fans for dust build-up once a year and clean as necessary.

Periodically check for internal condensation to be wiped out. For freezer models, perform a manual defrost as needed. Otherwise, there is no maintenance required to keep the system working at peak performance.

How long before I can use the product?
The expected time to set point in different operating ambient temperatures is outlined in the table below:

Operating Ambient	Expected Time to Set Point (hours)
28 °C / 82 °F	3
24 °C / 75 °F	2
4 °C / 39 °F	1

Why is there condensation on the lid gasket?
Any obstruction of the lid gasket can result in the gasket being colder than the dew point and condensation forming. Inspect the lid seal gasket for damage or obstructions such as the lid lanyard cable. Operation in a high humidity environment (above 28 °C [18 °F] / 65%RH) can cause condensation.

How long can I run the unit continuously?
Phononic recommends defrosting freezer models according to the schedule outlined in the Manual Defrost section.

TROUBLESHOOTING

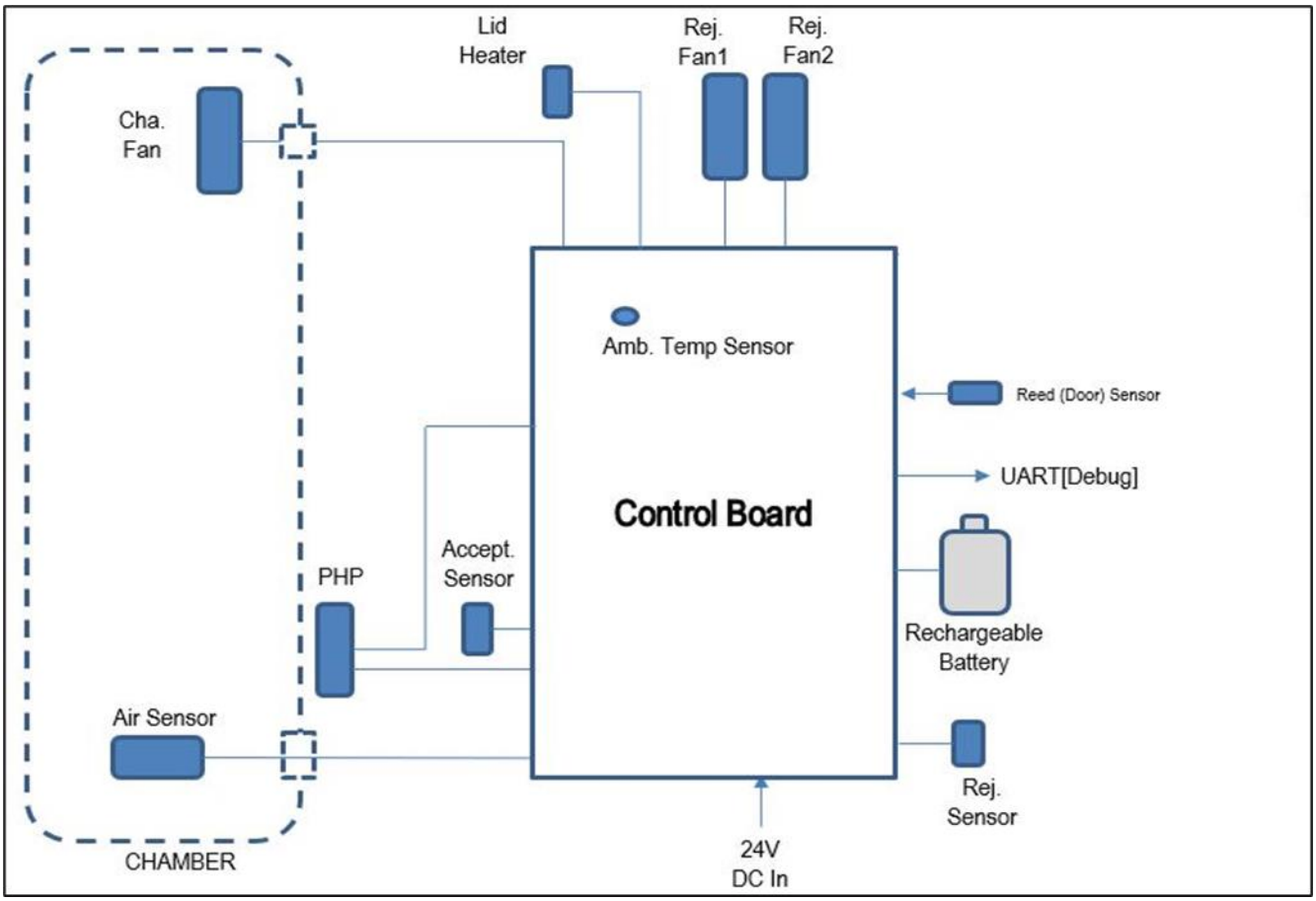
Issue	Customer Resolution
Unit does not power on	Ensure that both copper contacts (Figure 8) are fully seated on the external power module contacts. Incomplete mating of one or both contacts could cause the freezer/refrigerator to not power up. Some external power modules have a proximity sensor that must be depressed before power can be delivered to the freezer/refrigerator. If your installation has a proximity sensor, check that the proximity switch is fully depressed.
Unit has frost buildup	If the lid is being opened frequently, the cooling system is continuously working to maintain the set point temperature. As a result, water vapor may create frost buildup. Frost buildup is normal for manual defrost, forced air freezers like the F451. Defrost the freezer per Manual Defrost instructions if desired.
Lid does not close/closes incorrectly	Check to make sure something isn't blocking the lid from closing completely. For freezer models, if frost buildup prevents proper lid sealing, unplug the freezer and defrost per Manual Defrost instructions.

CUSTOMER SUPPORT

To request service support or a Return Material Authorization (RMA) from Phononic, Inc., please call 919-908-6300 (option 4) or contact support@phononic.com. An RMA may not be authorized if a product is out of its Warranty period, or the failure is caused by a defect not resulting from defective parts, materials, or workmanship within the Warranty period.

For any questions regarding accessories on spare parts, please either refer to the F451 Service Manual or contact Phononic support via the phone number or email address listed previously.

APPENDIX 1: SYSTEM BLOCK DIAGRAM



APPENDIX 2: WIRING BLOCK DIAGRAM