OPERATIONS AND MAINTENANCE MANUAL
EXPEDITIONARY REFRIGERATOR (xFridge)

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1.1 SCOPE

This Technical Manual provides general operation and maintenance procedures for the Expeditionary Refrigerator (xFridge).

1.2 SAFETY DEFINITIONS

1.2.1 Warning

WARNING

A WARNING INDICATES A HAZARD WHICH MAY RESULT IN INJURY OR DEATH TO PERSONNEL.

1.2.2 Caution

CAUTION

A CAUTION INDICATES A HAZARD THAT MAY RESULT IN DAMAGE TO EQUIPMENT.

1.2.3 Note

NOTE

Highlights an essential operation or maintenance procedure condition or statement.

1.3 ACRONYMS AND ABBREVIATIONS

ECM	Electronic Control Module
Li-ion	Lithium-ion
xFridge	Expeditionary Refrigerator
SOC	State of Charge

1.4 EQUIPMENT DESCRIPTION

The Expeditionary Refrigerator (xFridge) is a ruggedized portable refrigeration system designed to maintain cold payloads while being operated in hot and humid environments. The system also offers a Heat Mode that a user can select to keep payloads warm if required. The key operational specifications for the xFridge are listed in Table 1.

Table 1: xFridge Operational Specifications

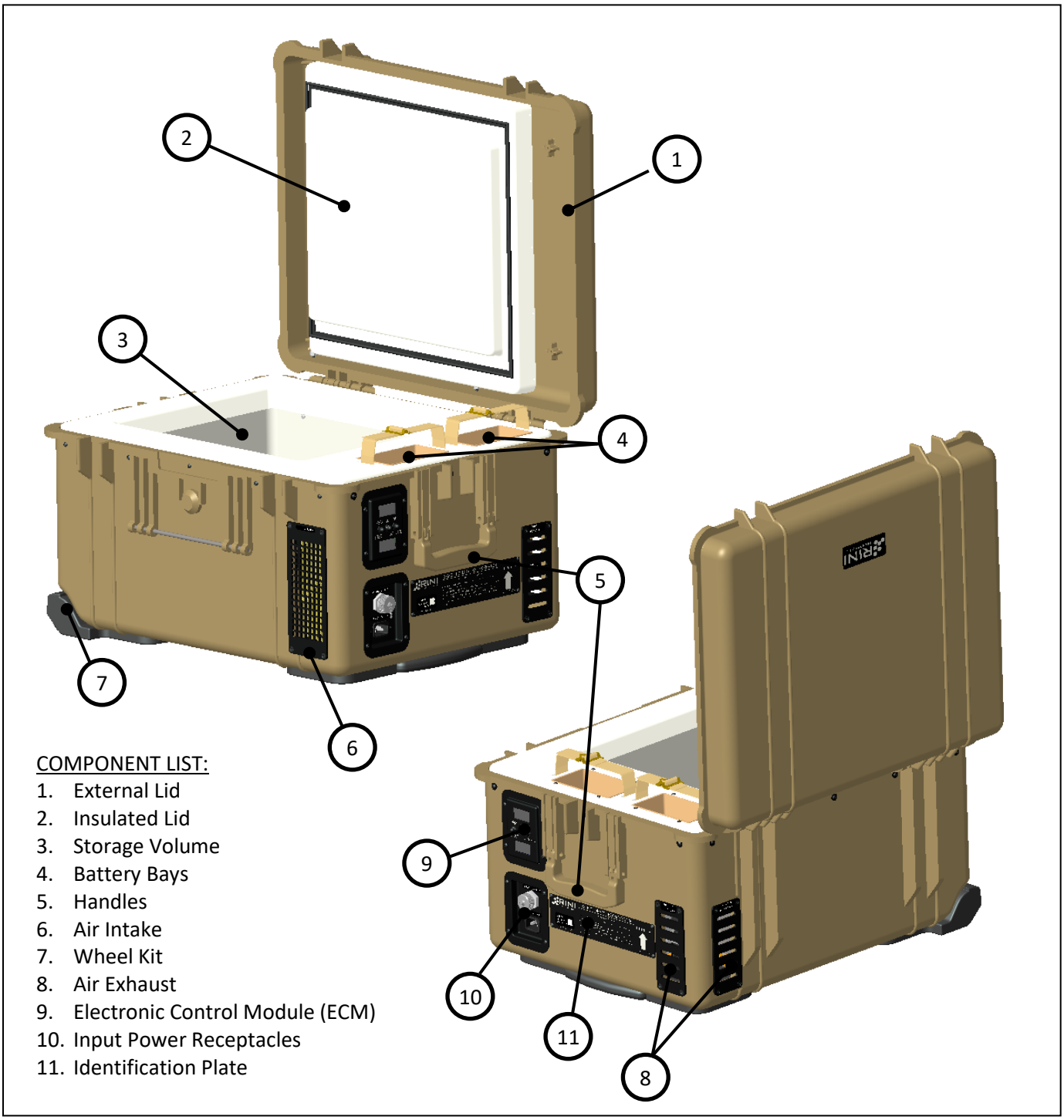
OPERATIONAL SPECIFICATIONS	
Refrigerated Storage Volume Temperature Regulation	4°C ±2°C
Heated Storage Volume Temperature Regulation	30°C to 50°C
Operating Ambient Air Temperatures	-20°C to 52°C
System Storage Temperatures	-25°C to 71°C
Temperature Data Logging	1 Entry/Hour
Design Ratings	MIL-STD-810
PHYSICAL SPECIFICATIONS	
External Dimensions (L x W x D) Units in inches	24.8 x 19.6 x 13.9
Storage Volume Dimensions (L x W x D) Units in inches	15.0 x 12.5 x 8.0
Storage Volume Capacity	25 Liters
Tare Weight (w/o Batteries)	62 pounds

The main features of the xFridge are listed below:

1) Employs a miniature vapor compression refrigeration cycle to minimize size, weight, and power requirements.
2) Uses highly efficient insulation to minimize heat leak into and out of the Storage Volume.
3) Provides cold storage at a fixed Control Temperature of 4°C ±2°C in REFRIGERATION MODE.
4) Equipped with Freeze Protection that prevents the Control Temperature from dropping below 1.75°C:
   a) Automatically engages/disengages based on Control Temperature.
   b) Utilizes on-board heaters to regulate Control Temperature to 4°C ±2°C.
5) Provides heated storage within a user-selectable range between 30°C and 50°C in HEAT MODE.
6) Operates using any of the following power sources:
   a) Up to two (2) replaceable BB-2590 batteries carried onboard.
   b) 120 to 240 VAC, 50/60 HZ, 2A Max
   c) 12 to 48 VDC, 7A MAX.
7) Enables the charging of the BB-2590 batteries while simultaneously operating the system.
8) Includes storage temperature monitoring, data logging and alarm logging capabilities:
   a) Real-time external display of the Control Temperature and Battery State of Charge.
   b) Time and Temperature are recorded and stored automatically whenever the system is powered. Stored data can be displayed by accessing the Data Log.
   c) Visual and audible alarms activate in the event the Control Temperature exceeds the control range. Alarms are also recorded in a separate log and can be displayed by accessing the Alarm log.

1.5 FEATURES AND INTERFACES

The xFridge main features and the interfaces are referenced in the graphic in Figure 1.



COMPONENT LIST:

1. External Lid
2. Insulated Lid
3. Storage Volume
4. Battery Bays
5. Handles
6. Air Intake
7. Wheel Kit
8. Air Exhaust
9. Electronic Control Module (ECM)
10. Input Power Receptacles
11. Identification Plate

Figure 1: xFridge – System Components

1.6 CONTROL INTERFACE

The xFridge Electronic Control Module (ECM) is the control interface for the user. An overview of the displays and interfaces are shown in Figure 2. Details on the Electronic Control Module operation are found in Section 2.4.

USER INTERFACES:

1. Main Display
2. Battery Status Display
3. Navigation Buttons
   a. Menu/Select
   b. Toggle Up
   c. Toggle Down/Activate

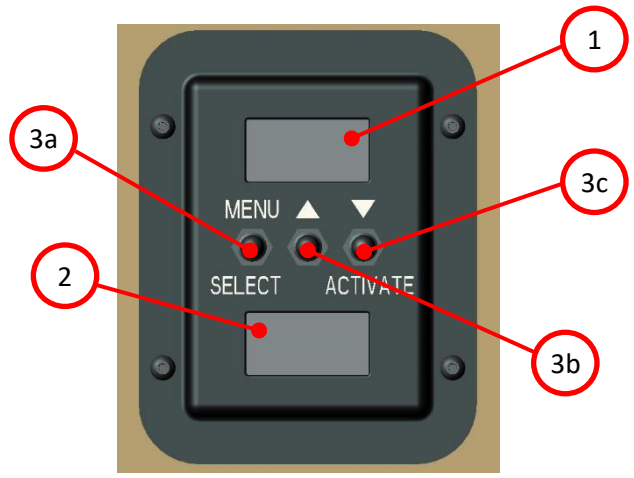


Figure 2: xFridge ECM Interface

1.7 POWER INTERFACES

The xFridge can be powered from a variety of power sources, detailed below in Table 2, using the power ports shown in Figure 3.

POWER INPUTS:

1. Battery Bays
2. AC Receptacle
3. DC Receptacle

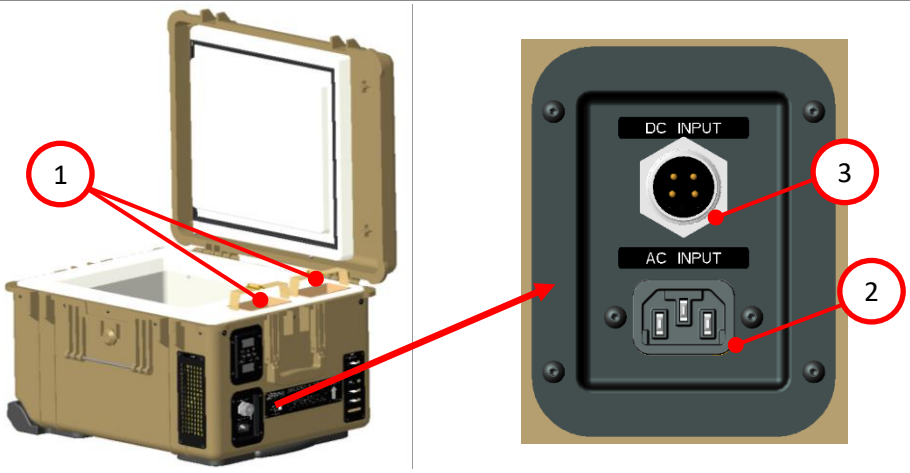


Figure 3: xFridge Power Interfaces

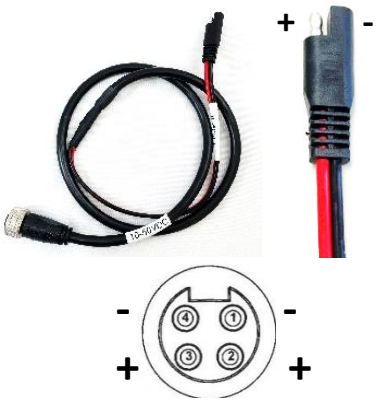
Table 2: xFridge Power Interface Specifications

FEATURE	SPECIFICATION
POWER INPUTS	• BB-2590 Military Batteries • 120 to 240 VAC, 50/60 HZ, 2A Max • 12 to 48 VDC, 7A Max
CHARGING RATE	• Max Charging Rate of 150W

1.7.1 Power Cable Accessories

The xFridge utilizes two Power accessory cables to operate from external power sources. These are listed in Table 3.

Table 3: xFridge Power Accessory Cables

EXTERNAL POWER	SPECIFICATIONS	
AC Power Cable (Included)	• NEMA 5-15P Plug (AC End) • IEC 60320 • IP67 • Input: 120 to 240 VAC • 6-foot Length	
DC Power Cable (Included)	• 2-pin SAE (DC End) • iMINI-A 4P Plug (xFridge End) • 12 to 48 VDC • 4-foot Length	

1.7.2 xFridge Battery Requirements

The xFridge can only use battery chemistries and battery types that have been approved for use and referenced in this manual. The only battery approved for use in the xFridge is the BB-2590 Lithium Ion (Li-Ion) battery, shown in Figure 4, with a manufacture date within 5 years of use. This battery adheres to MIL-PRF-32383 and/or MIL-PRF-32052 specifications and is tested extensively.

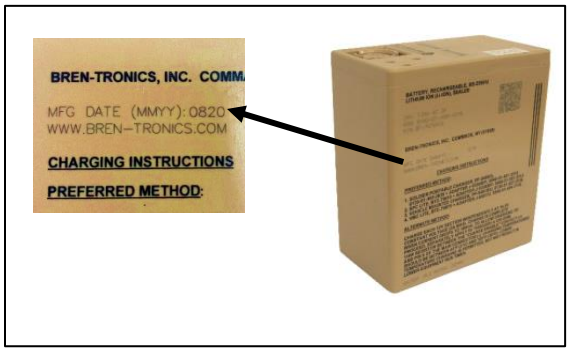


Figure 4: BB-2590 Lithium-ion battery

CAUTION

DO NOT ALTER OR MODIFY BATTERY CONNECTIONS TO ACCOMMODATE BATTERIES THAT ARE DIFFERENT THAN THOSE RECOMMENDED FOR USE IN THIS MANUAL.

NOTE

When using two batteries they must be of the same model and energy capacity otherwise the performance duration will be compromised.

NOTE

Consult battery manufacturer for information on proper battery storage, maintenance, and safety.

A listing of the BB-2590 batteries that RINI recommends for use in the xFridge is provided in Table 4. To maximize Battery-Only durations, RINI recommends the use of BB-2590 batteries with energy capacity ratings ≥ 7.5Ah.

Table 4: RINI Approved Batteries for Use

BATTERY MODEL	BATTERY TYPE	MANUFACTURER	CAGE	PART NUMBER	ENERGY CAPACITY
BB-2590	Rechargeable Li-Ion	BREN-TRONICS, INC.	51828	BT-70791JV NSN: 6140-01-677-2619	10.3Ah
				BT-70791CG NSN: 6140-01-659-6604	9.9Ah
				BT-70791CK NSN: 6140-01-490-4316	7.5Ah

CHAPTER 2: OPERATION

2.1 SETUP

WARNING

THE XFRIDGE WEIGHS 62 LBS (28 KGS) EMPTY. ALWAYS USE AT LEAST TWO PEOPLE WHEN LIFTING OR MOVING TO PREVENT PERSONAL INJURY.

1) Place xFridge on a level surface with the External Lid facing UP (See Figure 5 and Figure 6).

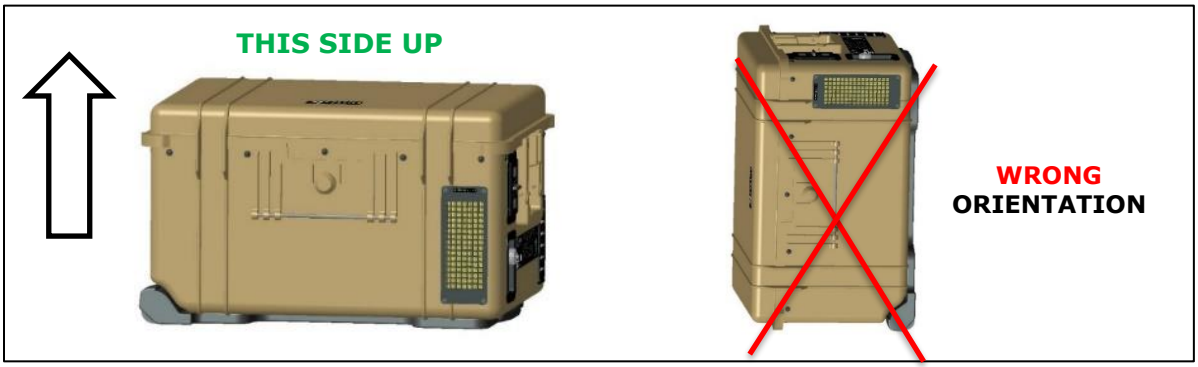


Figure 5: xFridge Operational Orientation

CAUTION

DO NOT TILT THE XFRIDGE MORE THAN 30° FOR PERIODS LONGER THAN 30 MINUTES DURING OPERATION. OPERATING THE SYSTEM AT ORIENTATIONS GREATER THAN 30° CAN DAMAGE THE REFRGIERATION SYSTEM.

2) Ensure there is at least 6 inches of clearance in front of the Air Intake (front) and Air Exhaust (right and back) as shown in Figure 6. Do not operate in an enclosed space that does not provide ventilated air.

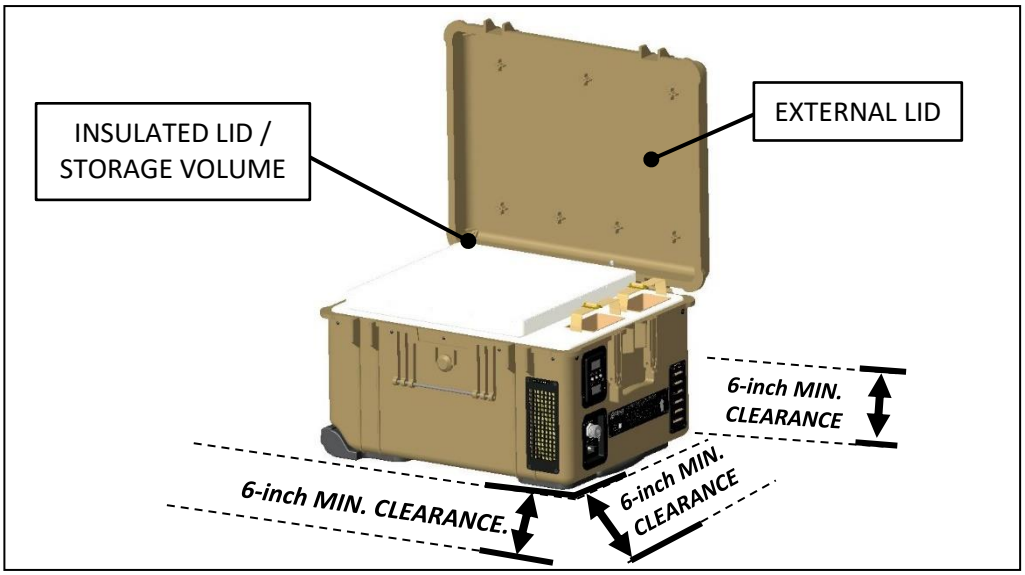


Figure 6: xFridge Setup

3) Verify the seal on the Insulated Lid is clean and intact.

4) Ensure the volume is empty and clean prior to use.

5) Ensure the Insulated Lid seats properly above the Storage Volume to create a proper seal.

NOTE:

For optimal performance, operate the system with the External Lid closed and latched to ensure a good seal between the Insulate Lid and the Storage Volume.

6) Connect Power Source.

a) **BATTERY**:

NOTE

Consult Section 2.10.3 and Section 2.10.4 for proper battery care and maintenance prior to installation

Verify SMBus sticker has been removed and that each bank has at least a one-segment State-of-Charge, as shown in Figure 7. Align the Battery pins with the receptacle in the bottom of xFridge Battery Bay. Insert Battery into the bay and press down to engage connector. Secure batteries by sinching strap *tightly* to prevent movement.

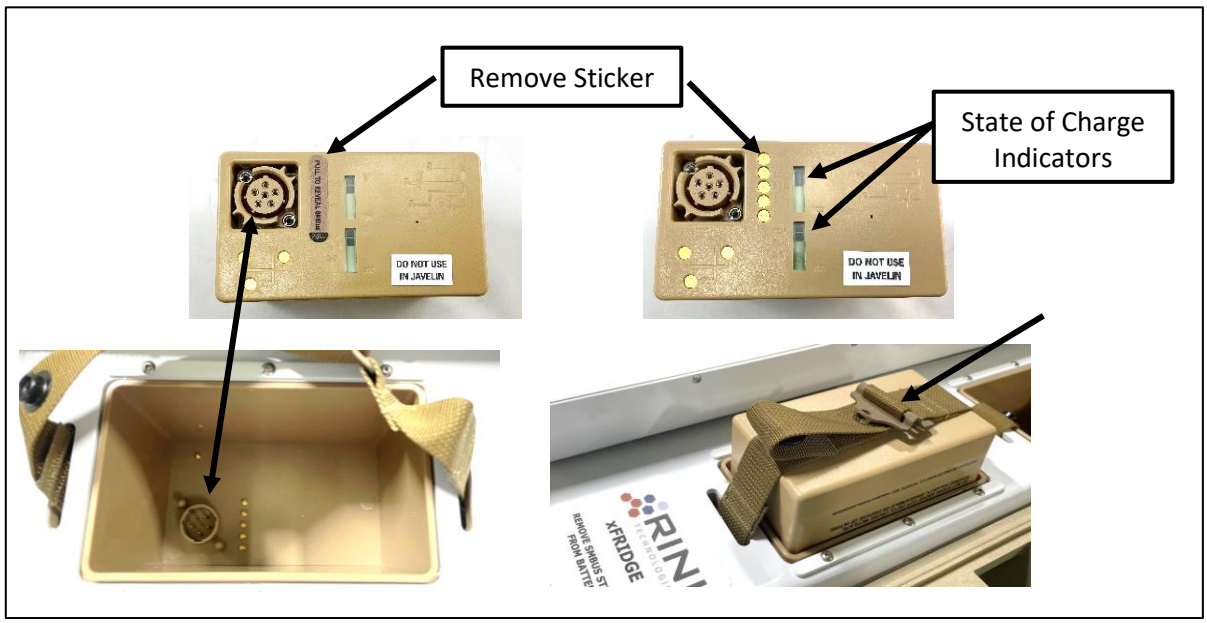


Figure 7: BB-2590 Installation

WARNING

THE XFRIDGE UTILIZES LITHIUM-ION BATTERIES. ALWAYS FOLLOW THE BATTERY MANUFACTURER'S RECOMMENDATIONS FOR SAFE USE AND HANDLING OF THE BATTERIES TO AVOID PERSONAL INJURY

b) **AC INPUT POWER:** Plug the rectangular 3-pin AC power cord into the lower receptacle.

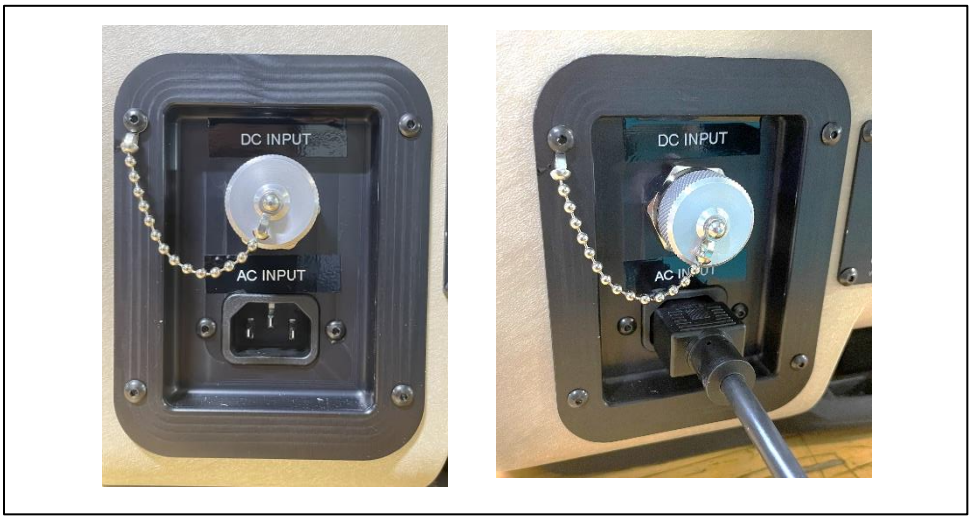


Figure 8: AC Power Connection

WARNING

TO AVOID SHOCK OR PERSONAL INJURY DO NOT OPPERATE THE XFRIDGE WITH AC POWER IN WET CONDITIONS.

c) **DC INPUT POWER:** Remove the dust cover from the 4-pin DC receptacle. Plug the circular 4-pin DC power cord into the receptacle.

Figure 9: DC Power Connection

CAUTION

DO NOT POWER THE XFRIDGE WITH AC AND DC INPUT POWER SOURCES SIMULTANEOUSLY. THIS COULD RESULT IN DAMAGE TO THE SYSTEM AND/OR POWER SOURCE.

7) Once a power source is connected, the xFridge will startup within 3-5 seconds as indicated by the ECM Displays (see Figure 10)

NOTE:

Default operation is in Refrigeration Mode as detailed in Section 2.2.

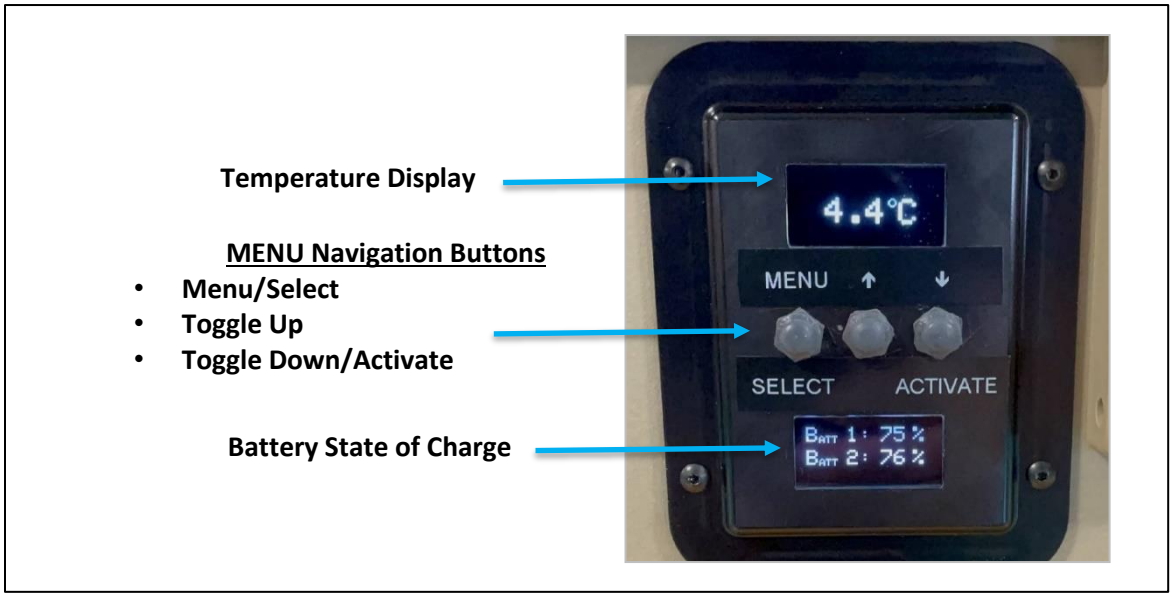


Figure 10: ECM Display, Startup Screen – Battery Example

8) When the xFridge is no longer in use, remove the batteries and/or unplug all power cables. Ensure the Storage Volume is clean and dry per Section 2.10.1. Close the External Lid and latch.

2.2 OPERATIONAL MODES

2.2.1 REFRIGERATION MODE (DEFAULT)

Once the xFridge is powered, the ECM will determine the operational status of the xFridge:

- If the Control Temperature at startup is greater than 6°C, the refrigerator will become ACTIVE to perform an initial cool down to 2°C.

- If the Control Temperature at startup is between 2°C and 6°C, the refrigerator will remain IDLE. Once the temperature reaches 6°C, the refrigerator becomes ACTIVE to pull the temperature back down to 2°C.

- During steady-state operation, the refrigerator will cycle between ACTIVE and IDLE which maintains the Control Temperature at 4°C ±2°C.

The xFridge is also equipped with onboard heaters to provide freeze protection capability while operating in REFRIGERATION MODE:

- If the Control Temperature decreases below 1.75°C, Freeze Protection is automatically enabled and the on-board heaters maintain the Control Temperature at 4°C ±2°C.

- Freeze Protection will automatically disable when no longer needed and the system will resume normal REFRIGERATION MODE operation.

2.2.2 HEAT MODE

The xFridge can be operated in a HEAT MODE to maintain the Control Temperature from 30°C to 50°C at pre-determined intervals that the user may select from.

- HEAT MODE is enabled manually as highlighted in Section 2.5.

- Once HEAT MODE is enabled, the user must choose a target temperature range list in 5°C windows:
    - 30°C – 35°C
    - 35°C – 40°C
    - 40°C – 45°C
    - 45°C – 50°C

- The on-boards heaters will maintain the Control Temperature to the center of each respective range within ±2°C.

- HEAT MODE can be disabled manually as highlighted in Section 2.5, or by simply cycling power as detailed in Section 2.8.

2.2.3 SYSTEM PERFORMANCE AND EFFICIENCY

The power consumption of the xFridge and overall performance is dependent on many variables including but not limited to:

- Ambient temperature of the environment.
- Operational status (Active, Idle, Freeze-protection, Heat Mode)
- The State of Charge (SOC) of the batteries (when applicable).
- The charging status and energy capacity of the batteries (when applicable).
- The initial temperature of the payload when it is loaded into the xFridge Storage Volume.

When batteries are installed, power is supplied to the system primarily from the batteries even if external power is also supplied. As the energy stored in the batteries is consumed, the external power source will recharge the batteries once the SOC drops below 95%. Battery charging accounts for the highest power consumption of the system.

During Battery-Only operation, the peak amount of power is used when the system is ACTIVE. When the system is IDLE, it is effectively in a stand-by mode and consumes little power. When the total power is averaged over the entire length of the cycle (ACTIVE and IDLE), the xFridge has a low effective power consumption rate.

NOTE

In order to achieve optimal Battery-Only performance, RINI recommends the initial cool-down be conducted using external power (if available) to conserve the charge of the BB-2590 Batteries.

2.3 DATA AND ALARM LOGGING

The xFridge provides on-board data logging and Alarm recording features as highlighted below.

2.3.1 Temperature Data Recording:

- When the xFridge system is powered, the Storage Volume Control Temperature is recorded once an hour on the hour and stored in memory. If the system loses power, the data files will still be preserved, and accessible once power is restored. The on-board clock has a battery back-up so that Date and Time can be maintained when the system is not being powered.
- Data files are created based on the DATE and are titled accordingly. (i.e. MMDDYYYY.txt). A new file is created at the beginning of each day the system is powered so that the data will span from 00:00 to 23:59 for a given file.
- Data Files are formatted as shown in Figure 11, and are accessible via the Display Menu as highlighted in Section 2.4.

```
TIME……TEMP
14:08 …… 4.8 °C
15:00 …… 2.2 °C
16:00 …… 5.2 °C
17:00 …… 4.8 °C
```

Figure 11: xFridge Data Log

2.3.2 Alarm Recording:

- An Alarm file will be created if the Storage Volume Control Temperature reading is outside the control temperature bands during normal operation, except during the initial pull down or while in HEAT MODE.
    - Over-temp Alarm: 6.05°C
    - Under-temp Alarm: 1.25°C
- Data points are collected every minute from the start of the Alarm.
- Alarm data files are created based on the DATE and are titled accordingly. (i.e., MMDDYYYY.txt). A new file is created at the beginning of each day the system is powered and in an alarm state. If the system loses power, the alarm data files will still be preserved, and accessible once power is restored.
- Alarm Files are formatted identically to the Data Files, shown in Figure 11, and are accessible via the display menu as highlighted in Section 2.4.

2.4 TEMPERATURE AND MENU DISPLAY – REFRIGERATION MODE

The Electronic Control Module (ECM) is the main user interface of the xFridge as detailed in Section 1.6. It has two display screens and three control buttons. The Main Display (top screen) has two modes as detailed in the following sections.

1) Temperature Display Mode (Default)

a) Displays Control Temperature, as illustrated in Figure 12.

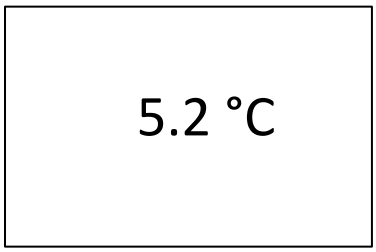


Figure 12: xFridge Temperature Display

2) MENU

a) Access the MENU, as shown in Figure 13, by pressing the MENU/SELECT button in Temperature Display Mode. Use the ▲ and ▼ buttons to toggle between the menu items and press MENU/SELECT again to step to the highlighted option. Highlight "←EXIT" and press MENU/SELECT to return to Temperature Display Mode.

NOTE

If no buttons are pushed within 10 seconds while in MENU mode the display will automatically revert back to Temperature Display Mode.

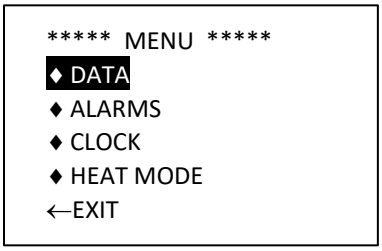


Figure 13: xFridge Menu Display

3) MENU - DATA

To access the DATA LOG, press MENU/SELECT button and use the ▲ and ▼ to highlight "DATA" then press MENU/SELECT again. This will bring up a menu with the ability to VIEW or DELETE Data Logging Files as shown in Figure 14. More information on Data Logging files can be found in Section 2.3.1.

a) To VIEW files, use the ▲ and ▼ buttons to highlight "VIEW DATA" and press MENU/SELECT button (Refer to Figure 14 Row A). Use the ▲ and ▼ buttons to highlight desired file and press MENU/SELECT. This will open the data log for that date. Use ▲ and ▼ to scroll through the data log or press MENU/SELECT again to return to the file list. Highlight and MENU/SELECT "TOP" to jump to the first file or "BACK" to return to the DATA LOG menu.

b) To DELETE files, use the ▲ and ▼ buttons to highlight "DELETE DATA" on the DATA LOG menu and press MENU/SELECT button (Refer to Figure 14 Row B). This will navigate to a screen for the user to confirm the selection. Press the MENU/SELECT button to confirm and DELETE <u>all</u> data files. Press the ▼ button to return back to the DATA LOG menu.

c) To return to the MENU, use the ▲ and ▼ buttons to highlight "MENU" and press MENU/SELECT (Refer to Figure 14 Row C).

d) To return to Temperature Display Mode, use the ▲ and ▼ buttons to highlight "EXIT" and press MENU/SELECT (Refer to Figure 14 Row D).

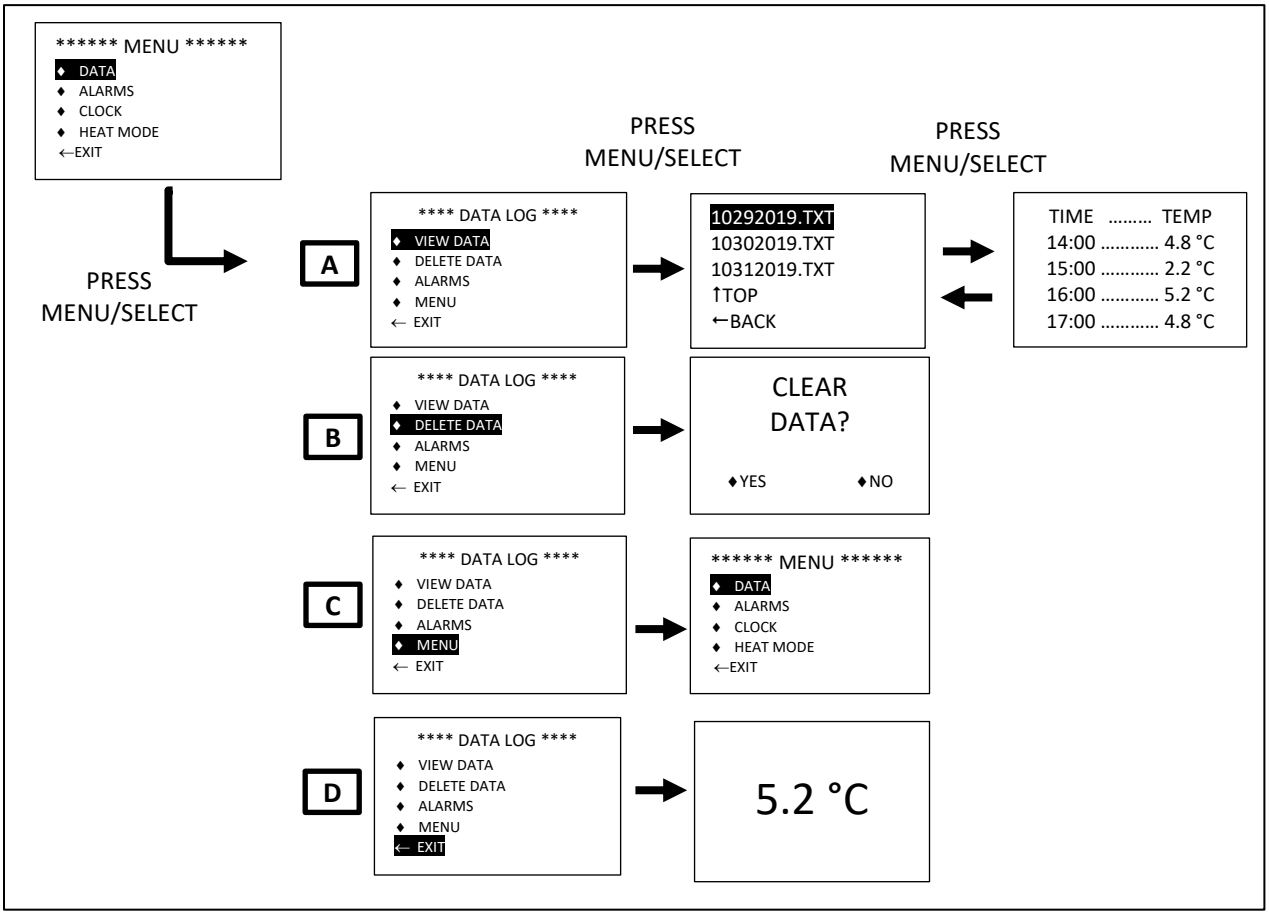


Figure 14: xFridge Data Log Menu

4) MENU - ALARMS

To access the ALARM LOG, press MENU/SELECT and use the ▲ and ▼ to highlight "ALARMS" then press MENU/SELECT again. This will bring up a menu with the ability to VIEW or DELETE files as shown in Figure 15. If there are no alarms, the screen will inform the user and return to the main Menu. More information on Alarms can be found in Section 2.3.2.

a) To VIEW files, use the ▲ and ▼ buttons to highlight "VIEW ALARMS" and press MENU/SELECT button (Refer to Figure 15 Row A). Use the ▲ and ▼ buttons to highlight desired file and press MENU/SELECT. This will open the alarm log for that date. Press MENU/SELECT again to return to the list. Highlight and MENU/SELECT "TOP" to jump to the first file or "BACK" to return to the ALARM LOG menu.

b) To DELETE files, use the ▲ and ▼ buttons to highlight "DELETE ALARMS" and press MENU/SELECT button (Refer to Figure 15 Row B). This will navigate to a screen for the user to confirm the selection. Press the MENU/SELECT to confirm and DELETE <u>all</u> Alarm data files OR press the ▼ button to return to the ALARM LOG menu and leave the Alarm files stored in memory.

c) To return to the MENU, use the ▲ and ▼ buttons to highlight "MENU" and press MENU/SELECT (Refer to Figure 15 Row C).

d) To return to Temperature Display Mode, use the ▲ and ▼ buttons to highlight "EXIT" and press MENU/SELECT (Refer to Figure 15 Row D).

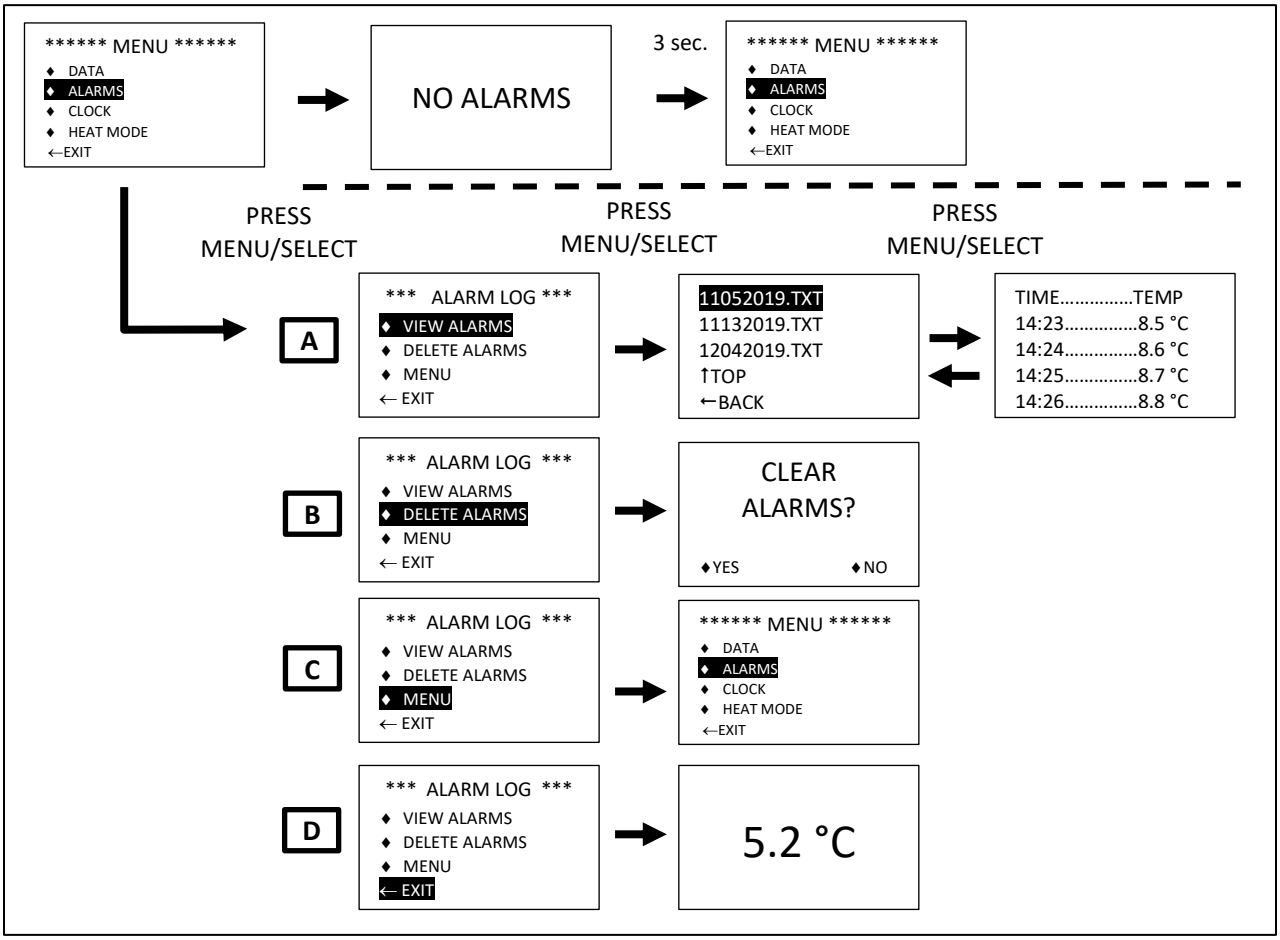


Figure 15: xFridge Alarm Log Menu

5) MENU - CLOCK

To access the CLOCK settings, press MENU/SELECT and use the ▲ and ▼ to highlight "CLOCK" then press MENU/SELECT again. This will bring up a menu with the ability to set the Time and Date as shown in Figure 16.

a) To SET the Time/Date, press MENU/SELECT and use the ▲ and ▼ to adjust the value. Press MENU/SELECT again to advance to the next setting. Repeat this to advance through the MM/DD/YYYY DATE sequence and the HH:MM TIME sequence. Once MM values have been adjusted, use the MENU/SELECT button to set the time and return to the CLOCK display.

b) Press ▲ to return to the MENU.

c) Press ▼ to return to Temperature Display Mode.

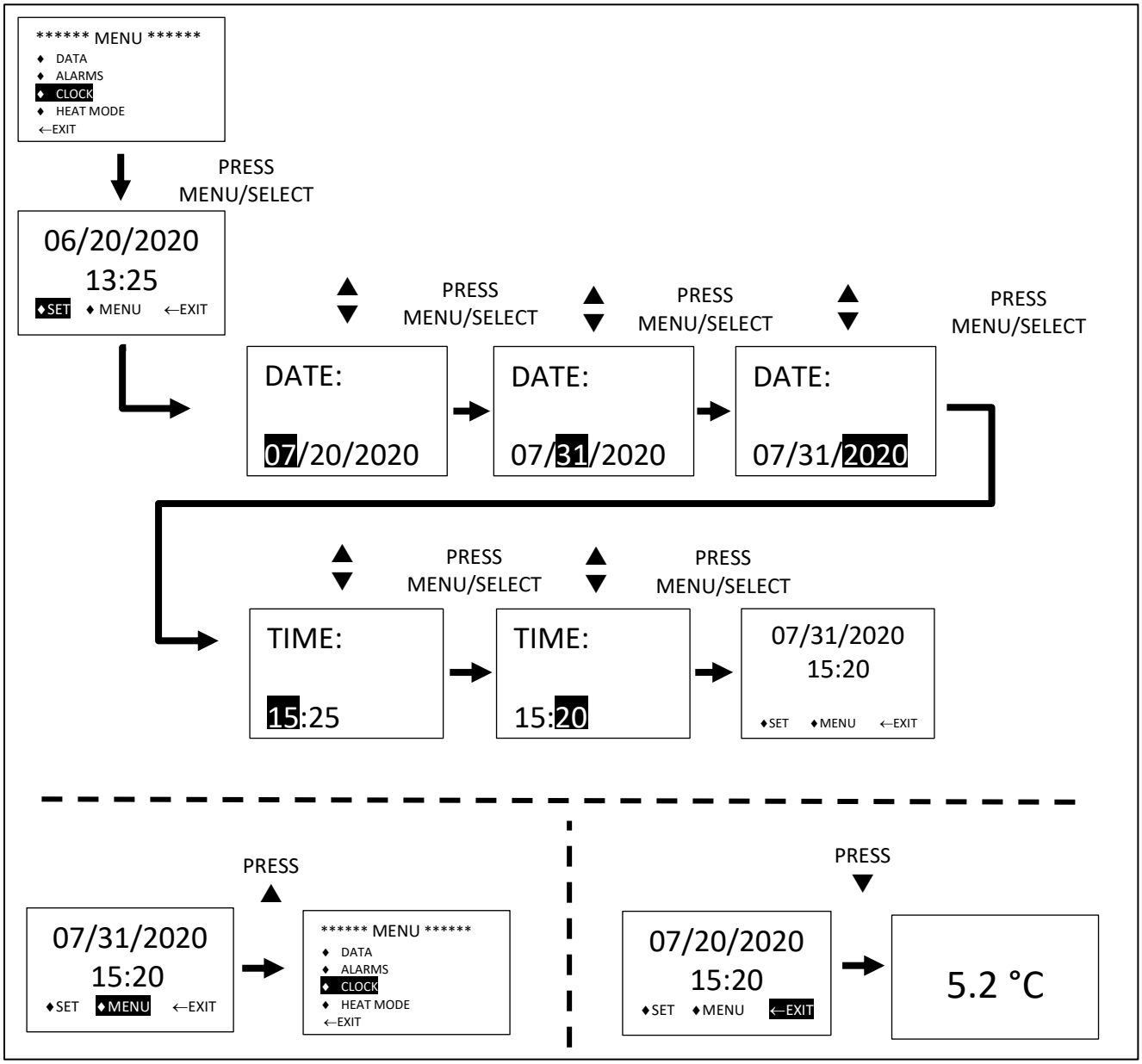


Figure 16: xFridge Date and Time Setup Screen

2.5 TEMPERATURE AND MENU DISPLAY – HEAT MODE

The following section highlights the MENU navigation to access and control HEAT MODE:

1) MENU – ENABLE HEAT MODE

a) Press MENU/SELECT and use ▲ and ▼ to highlight "HEAT MODE", then press MENU/SELECT as shown in Figure 17.

b) Access to DATA and CLOCK are identical to the REFRIGERATION MODE. (See Section 2.4)

c) ALARMS are not accessible while in HEAT MODE.

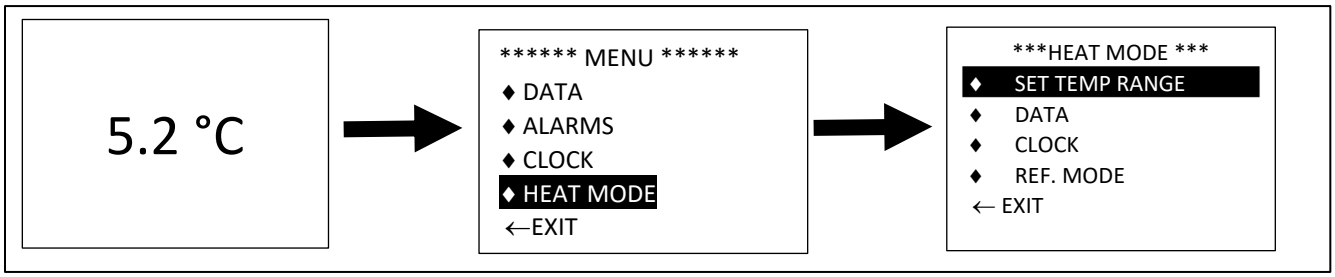


Figure 17: xFridge Heat Mode Access

2) HEAT MODE – SET TEMP RANGE

a) Press MENU/SELECT and use ▲ and ▼ to highlight "SET TEMP RANGE" then press the MENU/SELECT as shown in Figure 18.

b) Use ▲ and ▼ to highlight the desired range then press MENU/SELECT. Once the range is selected, the display will return to the Temperature Display Mode and HEAT MODE will be active as indicated by the screen.

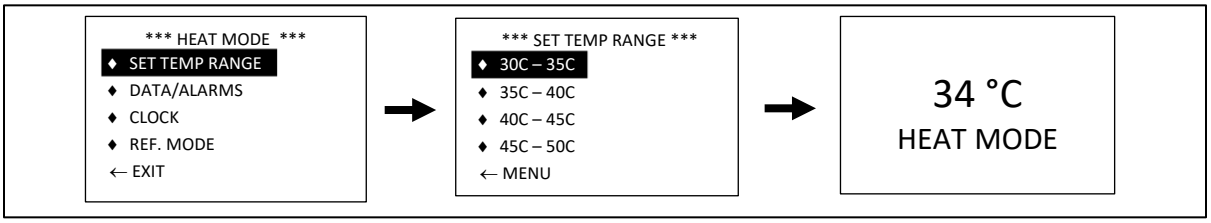


Figure 18: xFridge Heat Mode Temperature Selection

3) HEAT MODE – RETURN TO REFRIGERATION MODE

a) The system can be returned to REFRIGERATION MODE by either:
   i) Cycling the power to return to the default operation mode or
   ii) Press MENU/SELECT and use ▲ and ▼ to highlight and select REF. MODE as shown in Figure 19

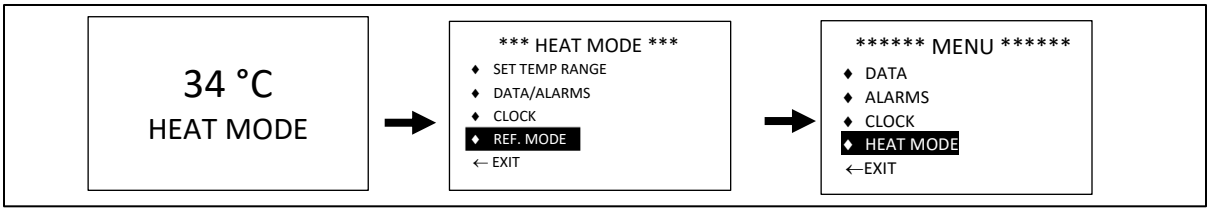


Figure 19: Return to REFRIGERATION MODE from HEAT MODE

2.6 BATTERY STATUS DISPLAY

Information on the battery status for the xFridge is displayed on the bottom display of the ECM. The display modes are highlighted below and represented in Figure 20:

a) No Batteries – External power only (AC or DC).
b) One battery present – Indicates when battery is being charged by external power.
c) Two batteries present – Indicates when batteries are being charged by external power.

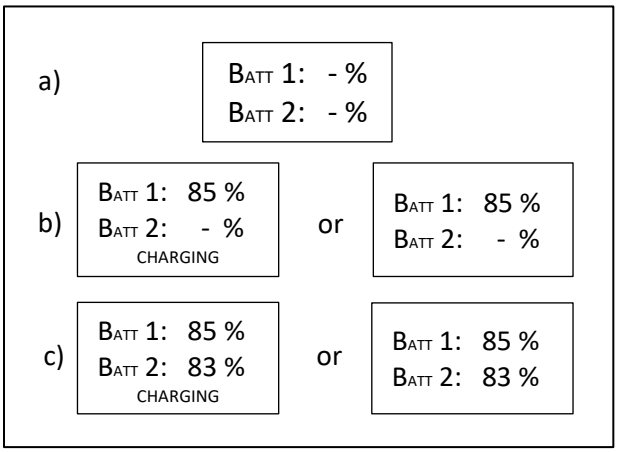


Figure 20: xFridge Battery Status Display

2.7 BATTERY CHARGING

The xFridge is equipped with battery charging capability which allows the system to charge both on-board batteries while simultaneously operating the system.

2.7.1 Normal Battery

- The xFridge will automatically charge batteries when an input power source is detected (AC or DC).
- The battery with the lowest SOC will charge first until both batteries are even, then they will both charge equally at the same time until both reach 100% SOC.
- If a fully charged battery is installed, charging is not enabled until the battery SOC drops below 95%.

2.7.2 Fully Discharged Battery

- There must be a minimum of 2% SOC in a single battery for the system to operate.
- If there is a fully discharged battery installed in the xFridge, the system will remain off and the display will remain black until enough energy is built up in the battery by an external power connection.

NOTE

It could take up to 15 minutes for the system to respond after external power is applied when a fully discharged battery is installed.

2.8 CYCLE POWER TO RESTART

If an Alarm is triggered (See Section 2.3.2) or an operational anomaly occurs, the ECM display will indicate to the user to "CYCLE POWER TO RESTART". Cycling the power will re-boot the control electronics and reset the xFridge to nominal REFRIGERATION MODE operation. This can be done any time the user deems it is necessary or when the unit indicates to do so.

To fully Cycle Power:

1. Remove all power sources including on board batteries, AC input or DC Input.
2. Wait at least 10 sec.
3. If using **BATTERY ONLY**, reinstall batteries one at a time.
4. If using **EXTERNAL POWER**, plug external cable into designated port
5. If using **EXTERNAL POWER AND BATTERY**, install the batteries **FIRST** one at a time, then plug external power in.

2.9 GENERAL TROUBLESHOOTING

Table 5 can be used as a guideline. If these steps do not mitigate or eliminate the issue then call RINI's Service department for additional guidance at support@rinitech.com or (407) 359-7138.

Table 5: xFridge Troubleshooting Matrix

ISSUE	POSSIBLE CAUSE	SOLUTION
Temperature Display Not Functioning (Not illuminated or frozen screen)	Electronic Control Module Malfunction	1. Cycle power to the system by removing batteries from the bays and/or physically disconnect any external power cables. Wait 10 sec. then reapply power. 2. If this does not reset the screen, contact RINI Technologies at support@rinitech.com or (407)-359-7138.
	Failure of Power Module Assembly	3. If the Electronic Control Module is replaced and the temperature display does not recover, contact RINI Technologies at support@rinitech.com or (407)-359-7138.
Temperature Displayed on Screen does not match the storage temperature (>5°C difference)	Faulty Temperature Probe	1. Cycle power to the system by removing batteries from the bays and/or physically disconnect any external power cables. Wait 10 sec. then reapply power. 2. If Temperature still does not match independent measurement, contact RINI Technologies at support@rinitech.com or (407)-359-7138.
Storage Volume is not Getting Cold but System is Running in REFRIGERATION MODE	Insulated Lid Missing or Not Seated Properly	1. Check that the Insulated Lid is present. 2. Verify that the Insulated Lid seal is clean and seated properly onto the Storage Volume.
	Insulated Lid Damaged - Replace	3. If there is visible damage to the Insulated Lid, contact RINI Technologies at support@rinitech.com or (407)-359-7138.
	Check Air Inlet / Exhaust	4. Verify that the Air Inlet and Air Exhaust grates are free of debris and are not blocked.
	Issue with Refrigeration System	5. If Refrigeration system runs continuously but the Storage Volume does not cool, return to RINI Technologies for further evaluation.
System will not operate with Batteries or Batteries will not charge	Batteries are Dead or Incorrect Battery Installed	1. Verify SOC of BB-2590 batteries. 2. Verify batteries are BB-2590 for system to operate properly.
	Battery Receptacle Damage	3. If corrosion present on Battery Bay receptacle pins. Remove all external power sources and clean with alcohol. 4. If pins are broken or damaged, contact RINI Technologies at support@rinitech.com or (407)-359-7138.
	Failure of Power Module Assembly	5. Verify System functionality using AC power. 6. If the System will not operate, contact RINI Technologies at support@rinitech.com or (407)-359-7138.
System will not operate with external power source	Faulty Cables	1. Replace suspect AC or DC power input cables.
	Failure of Power Module Assembly	2. Verify System functionality using batteries. 3. Inspect condition of connectors on xFridge Power Plate. 4. If pins are broken or damaged, contact RINI Technologies at support@rinitech.com or (407)-359-7138.

2.10 PREVENTATIVE MAINTENANCE CHECKS

WARNING

DISCONNECT ALL EXTERNAL POWER SOURCES AND REMOVE BATTERIES BEFORE PERFORMING MAINTENANCE OR SERVICE TO AVOID INJURY TO PERSONNEL.

RINI has identified a series of Maintenance tasks associated with the xFridge with a recommended maintenance frequency schedule. All maintenance tasks as detailed in Table 6 are preventative but can be considered corrective maintenance when performed during ongoing use of the xFridge. The general procedures for each of these maintenance tasks whether preventative or corrective are the same.

Table 6: RECOMMENDED XFRIDGE PREVENTATIVE / CORRECTIVE MAINTENANCE

SEE PARAGRAPH	MAINTENANCE TASK	RECOMMENDED FREQUENCY
2.10.1	Storage Volume Wipe-down	• Prior to each use • As needed
2.10.2	Inspect Refrigeration Air Intake / Exhaust Vents	• Prior to each use • As Needed
2.10.3	Inspect Battery Terminal/Pins	• Prior to installing batteries
2.10.4	Keep Batteries Charged	• As Needed

2.10.1 Storage Volume Wipe-down

- The Storage Volume should be cleaned with soap and water.

CAUTION

CAUSTIC CHEMICALS SHOULD NOT BE USED TO WIPE DOWN AS THIS MAY CAUSE DAMAGE TO THE STORAGE VOLUME FINISH.

2.10.2 Inspect Refrigeration Air Intake / Exhaust Vents

- The location of the xFridge Refrigeration Air Intake / exhaust vents are shown in Figure 21.
- The vents should not be blocked or obstructed and should be free of any debris. Physically remove debris from vents or used compressed air to clear the debris.

Figure 21: Inspect xFridge Air Intake / Exhaust

2.10.3 Inspect for Battery Terminal Corrosion or Broken Pins

- There are two (2) Battery Bays with receptacles in the xFridge as shown in Figure 22.
- The integrity of the Battery Bay receptacles and pins should be examined for corrosion or damage. A photograph of receptacle and SMBus pins are shown in Figure 22.
- If corrosion cannot be removed or if the pins on the battery pins are damaged or broken the xFridge requires Depot Level Maintenance.

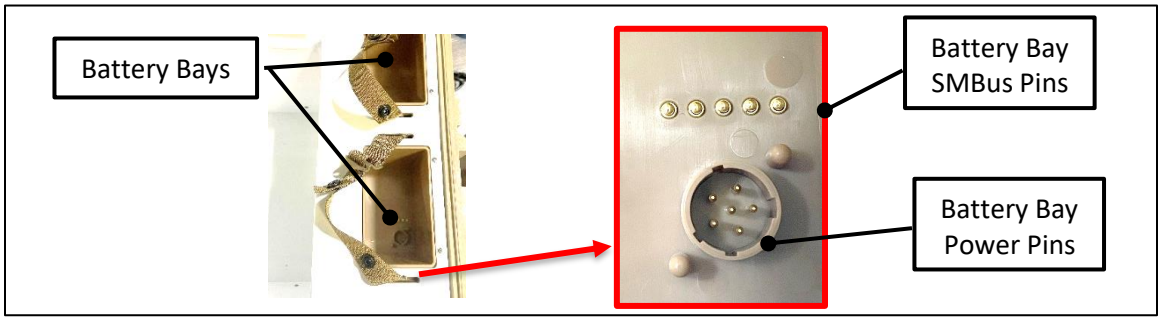


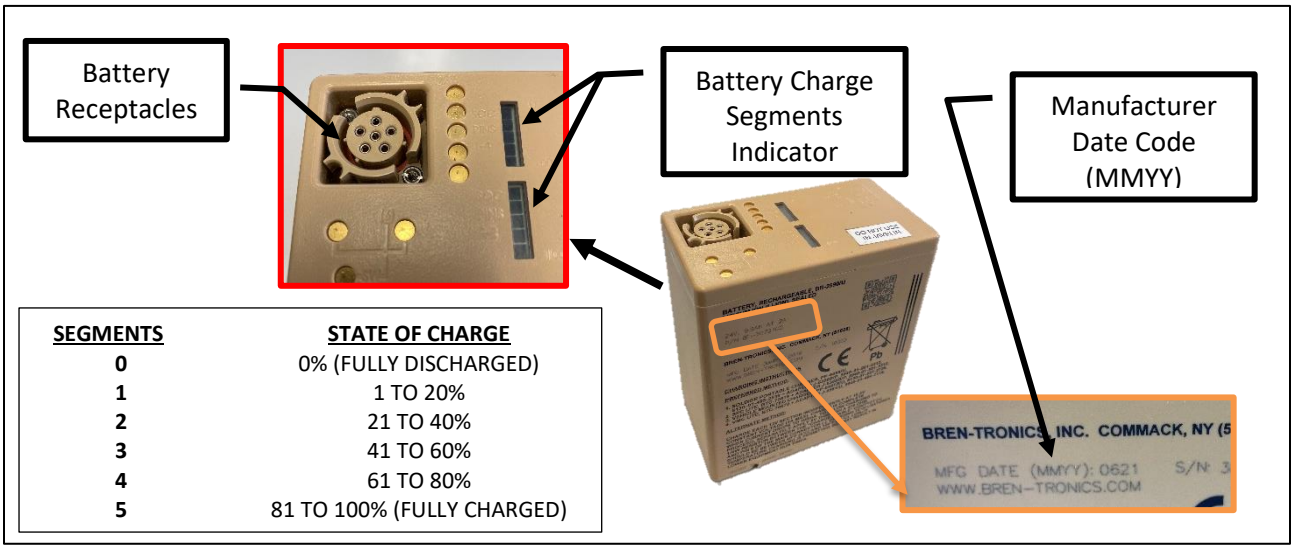
Figure 22: Inspect xFridge Battery Terminals

2.10.4 Battery Maintenance

WARNING

THE XFRIDGE UTILIZES LITHIUM-ION BATTERIES. ALWAYS FOLLOW THE BATTERY MANUFACTURER'S RECOMMENDATIONS FOR SAFE USE AND HANDLING OF THE BATTERIES TO AVOID PERSONAL INJURY.

- Ensure the battery contacts are clean as shown in Figure 23. Low pressure air or distilled water can be used to clean the battery contacts.
- Batteries should not be stored fully discharged for more than two (2) days without recharging. This can result in the inability to revive or recharge the batteries. Battery State of Charge can be visually verified using the indicator as shown in Figure 23.
- Battery life varies by model and manufacturer. Estimate three to five (3-5) years average once in use. Only batteries with date codes within five years of the use date should be used.



SEGMENTS	STATE OF CHARGE
0	0% (FULLY DISCHARGED)
1	1 TO 20%
2	21 TO 40%
3	41 TO 60%
4	61 TO 80%
5	81 TO 100% (FULLY CHARGED)

Figure 23: Inspect Battery Receptacle

2.11 SERVICE MAINTENANCE

In the event Maintenance repairs are required to restore the xFridge to OEM performance contact your local Maintenance group. The xFridge Repair Manual (D30709) can provide guidance to personnel trained in the maintenance and repair of the xFridge.

In the event the Maintenance group requires additional assistance they can contact RINI at (407) 359-7138 for further guidance.

WARNING

DISCONNECT ALL EXTERNAL POWER SOURCES AND REMOVE BATTERIES BEFORE PERFORMING MAINTENANCE OR SERVICE TO AVOID PERSONAL INJURY.

CHAPTER 3: MISCELLANEOUS

3.1 WARRANTY

The xFridge is covered under warranty for a period of one year from sale and subsequent shipment.

3.2 STORAGE

CAUTION

DO NOT SIT OR STAND ON THE XFRIDGE. THIS CAN DAMAGE THE INSULATION AND CAUSE DAMAGE OR REDUCED THERMAL PERFORMANCE OF THE SYSTEM.

CAUTION

THE XFRIDGE MUST BE STORED/OPERATED HORIZONTALLY WITH EXTERNAL LID FACING UP. THE XFRIDGE MAY BE SAFELY STACKED NO MORE THAN TWO HIGH.DO NOT STORE THE UNIT VERTICALLY AS THIS CAN CAUSE PERFORMANCE ISSUES WITH THE SYSTEM.

CAUTION

DO NOT STORE THE XFRIDGE WITH BATTERIES INSTALLED.

CAUTION

STORE BATTERIES SEPARATELY IN A DRY LOCATION AWAY FROM DIRECT SUNLIGHT. ENSURE A PROPER STATE OF CHARGE PER THE BATTERY MANUFACTURER PRIOR TO STORAGE.

3.3 TRANSPORTATION

- The xFridge Control electronics module contains a 350mAh Lithium-ion battery and must adhere to the U.S. DOT 49 Class 9 ID 3480 Regulations for shipment.
- The BB-2590 Rechargeable Lithium-ion batteries used in the xFridge must be transported in accordance with U.S. DOT 49 CFR Class 9 ID 3480 Regulations.

CAUTION

DO NOT TRANSPORT THE XFRIDGE WITHOUT THE INSULATED LID INSTALLED INTO THE STORAGE VOLUME. ENSURE THAT THE EXTERNAL LID IS SHUT AND LATCHES SECURED.

3.4 ENGINEERING INFORMATION

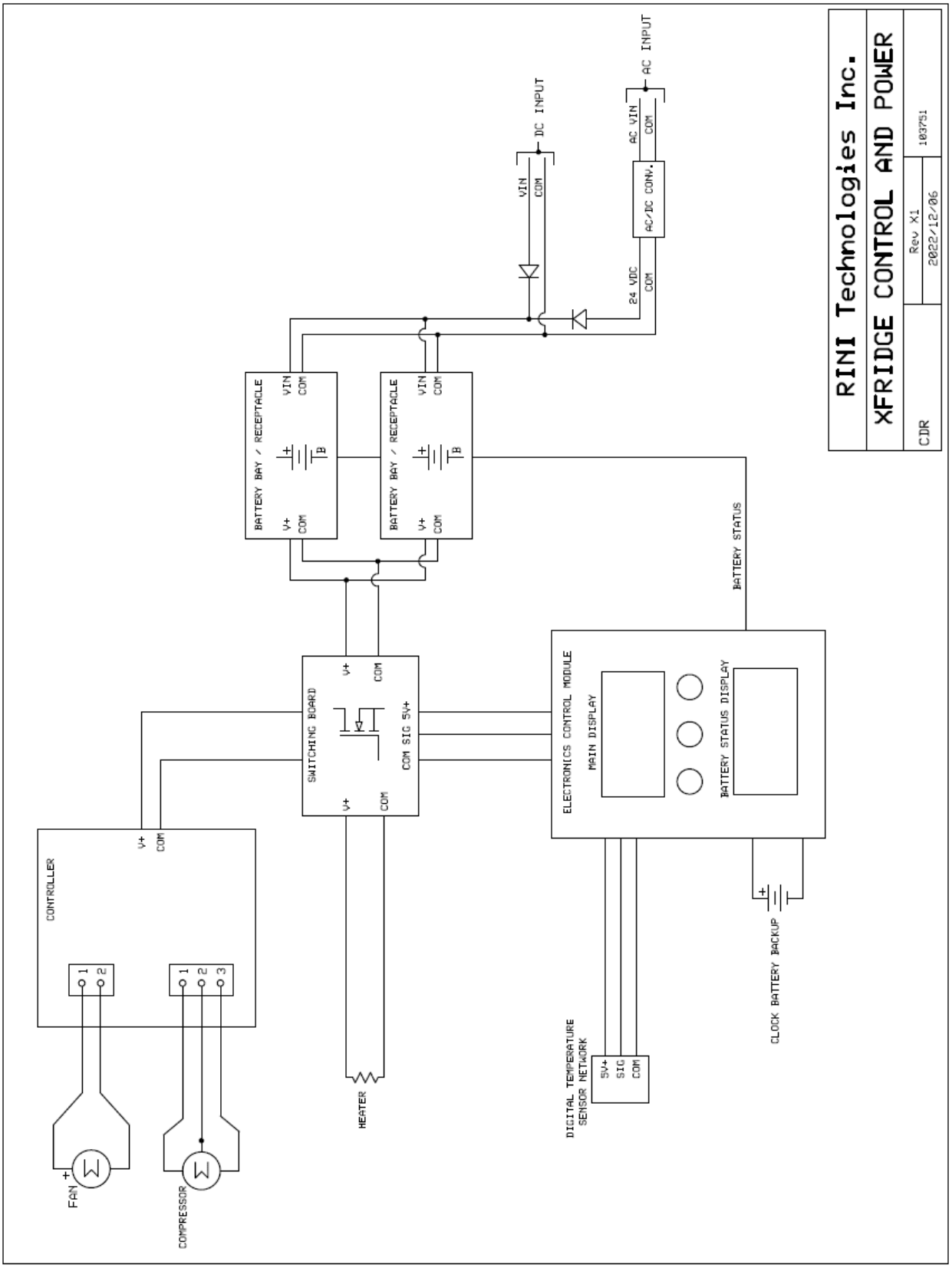
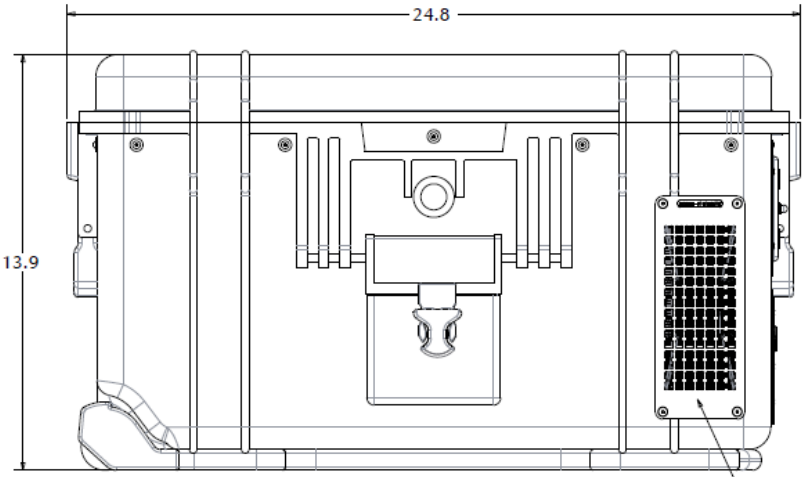


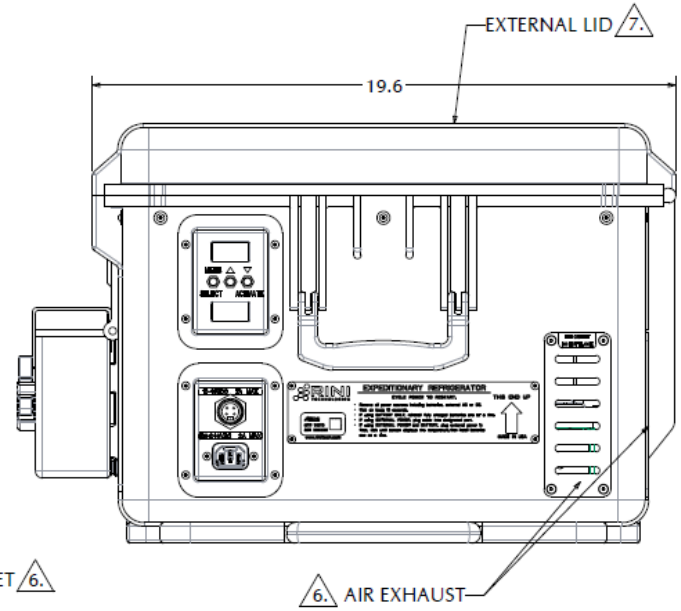
Figure 24: RINI xFridge Power and Control Electronics Schematic

NOTES:

1. INTERPRET DRAWING PER ASME Y14.41-2003 AND Y14.5-2009.
2. STORAGE VOLUME CONTROL TEMPERATURE:
   REFRIGERATION MODE: 2°C - 6°C (36°F - 43°F)
   HEATER MODE: 30°C - 52°C (86°F - 125°F)
3. POWER SUPPLIED BY REPLACEABLE ON-BOARD BATTERIES OR EXTERNAL POWER SOURCE:
   AUX DC: 12 to 48V, 7A MAX
   AC: 120VAC to 240VAC, 2A MAX
4. MAX OPERATING TEMPERATURE: 52°C (125°F).
5. DO NOT OPERATE XFRIDGE WITHOUT INSULATED LID PROPERLY INSTALLED.
6. DO NOT BLOCK AIR INLET OR EXHAUST SURFACES.
7. KEEP XFRIDGE UPRIGHT (EXTERNAL LID UP) WITHIN 30° FOR OPTIMUM OPERATION.
8. TARE WEIGHT OF SYSTEM IS 62 LBS (28 KGS). USE CAUTION WHEN LIFTING.

REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	X1	PRELIMINARY	22/01/17	CDR





UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND DECIMALS AND AFTER FINISH.
X.X ± 0.1
X.XX ± 0.01
X.XXX ± 0.005
X.XXXX ± 0.0005
THIRD ANGLE PROJECTION

APPROVALS	DATE
CDR	22/01/17
CDR	22/01/17

RINI TECHNOLOGIES
582 S ECON CIRCLE
OVIEDO, FL 32765

TITLE
ASSY XFRIDGE

SIZE	CAGE CODE	DRAWING NUMBER	REV
O	1NDY5	102751	X1

SCALE 2:5 SHEET 1 OF 2

QT-423-006rev.A

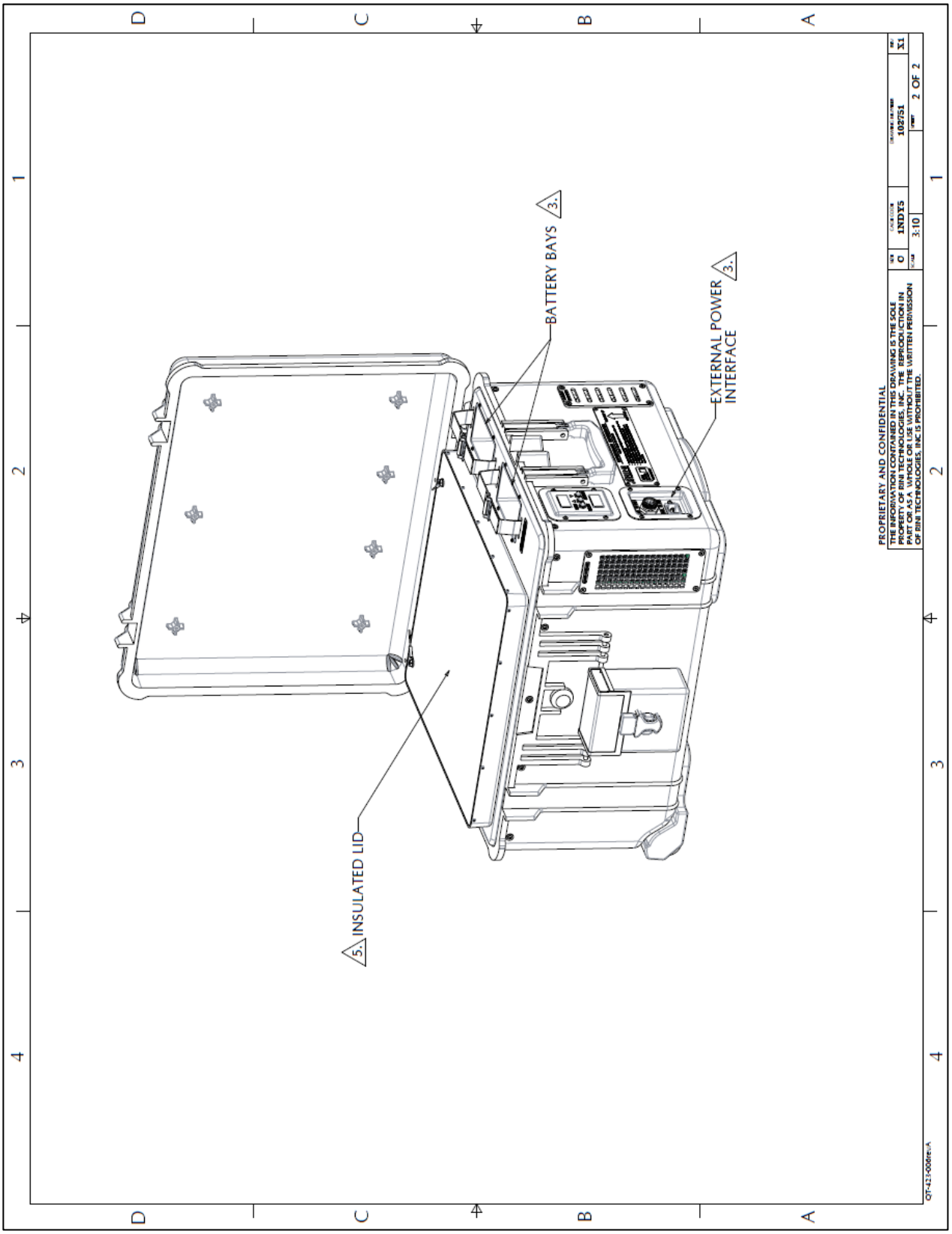


Figure 25: RINI xFridge Drawing