



**Isotemp**

# Isotemp Basic -86C Freezers

Installation and Operation Manual

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**7008953 Rev. 0**

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**Important installer and user information:**

A redundant temperature sensing device has been included in this ULT freezer. This device is a type “T” thermocouple. For convenient access, the thermocouple (Figure 1-3) terminates in an interconnect jack (Figure 1-5) behind the base front cover. (May be located differently in chests. See Section 1.) It is strongly recommended that this thermocouple be attached to a redundant 24 hour 7 day monitoring system with alarm capabilities. Connecting the sensor to a monitoring and alarm system separate from the freezer provides the utmost in product safety, should the integral system fail. ▲

**Packing List**

Part Number	Description	Quantity
34040	Key Ring	1
122005	Key	2
380520	Neoprene Cap	2
510016	1/4-20 x 5-1/2" Bolt	2
195763	Retaining Clip	1
370563	Remote Alarm Connector	1

Catalog Number	Model	Capacity (cu. ft.)	Voltage
IE1386V	8953	13	230/50
IE1386D	8954	13	230/60
IE1386A	8955	13	120/60
IE1786A	8956	17	120/60
IE1786D	8957	17	230/60
IE1786V	8958	17	230/50
IE2386V	8959	23	230/50
IE2386D	8963	23	230/60
IE2386A	8964	23	120/60

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REV	ECR/ECN	DATE	DESCRIPTION	By



**Important** Read this instruction manual. Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel, and poor equipment performance. ▲

**Caution** All internal adjustments and maintenance must be performed by qualified service personnel. ▲

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Important operating and/or maintenance instructions. Read the accompanying text carefully.



Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol.



Equipment being maintained or serviced must be turned off and locked off to prevent possible injury.



Hot surface(s) present which may cause burns to unprotected skin, or to materials which may be damaged by elevated temperatures.



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- ✓ Always use the proper protective equipment (clothing, gloves, goggles, etc.)
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- ✓ Always follow good hygiene practices.
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# Section 1 Installation and Start-Up

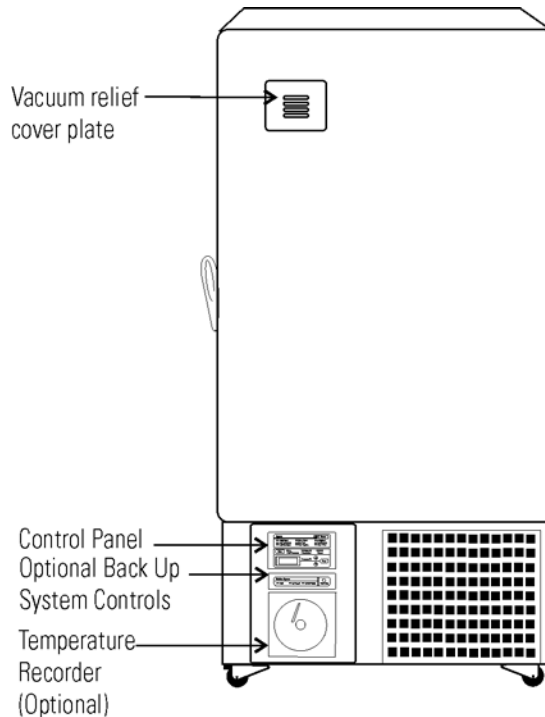


Figure 1-1

- Control Panel - keypad, displays and indicators.
- BUS (Optional Back Up System) panel.
- Optional temperature recorder - 7 day, one pen or Datalogger.
- Vacuum relief port cover plate

Figure 1-1. Front View

Figure 1-2

- Remote alarm contacts.
- Power Inlet for power cord connection.
- Optional BUS connections for probe and solenoid.
- Power Switch (mains disconnect).

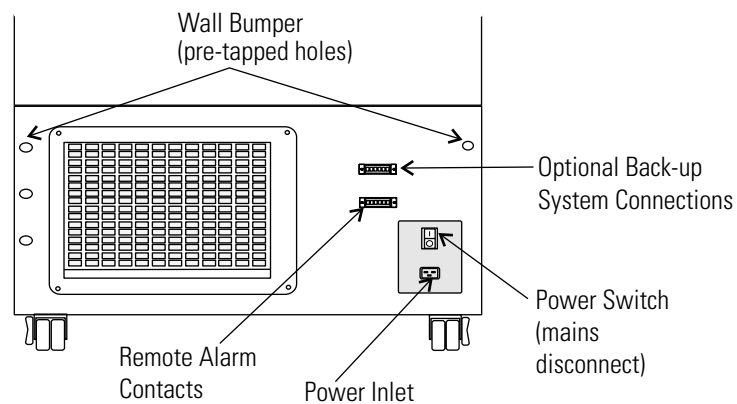
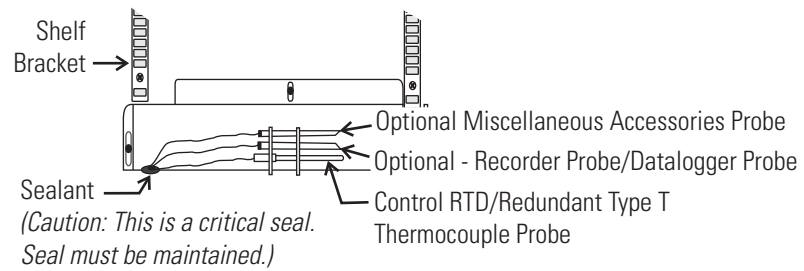
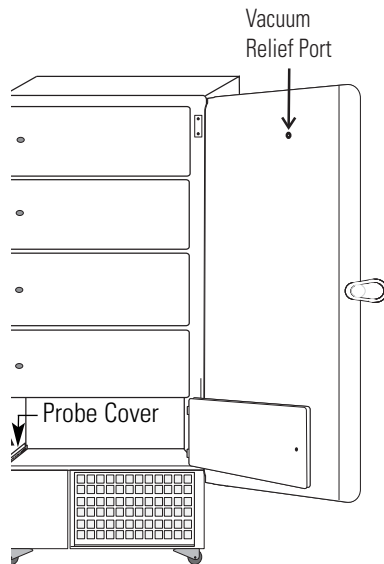


Figure 1-2. Rear View





**Figure 1-3.** Chamber Probe



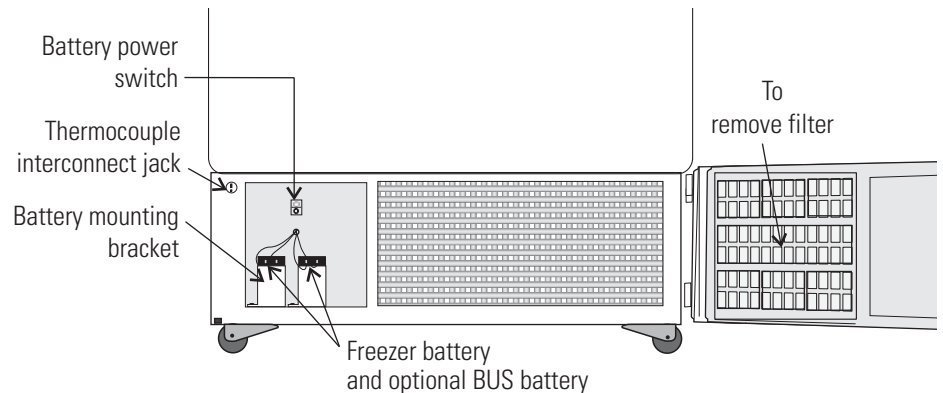
**Figure 1-4.** Vacuum Relief and Probe Cover Location

Figures 1-3 and 1-4

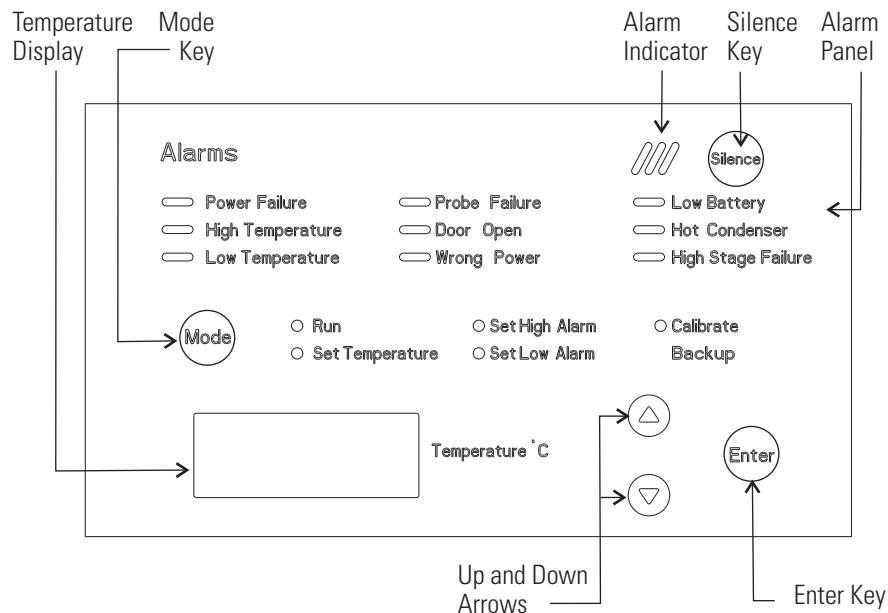
- Vacuum relief port - pressure equalization port.
- Probe cover - houses control, optional recorder, datalogger or other accessory probes.

Figure 1-5

- Battery mounting bracket(s)
- Battery power switch (freezer and BUS)
- Freezer battery
- Optional BUS battery
- Freezer filter location



**Figure 1-5.** Battery(s) Location and Switch



**Figure 1-6.** Control Panel

## Control Panel Keys, Displays/Indicators

Refer to Figure 1-6 for the items indicated.

- **Temperature Display** - Displays temperature in degrees Celsius.
- **Mode Select Switch** - Used to select Run, Set Temperature, Set High Alarm, Set Low Alarm, Calibrate, Backup.
- **Alarm Indicator** - Light pulses on/off during an alarm condition of the cabinet.
- **Silence** - Silences the audible alarm.
- **Alarm Panel** - indicates the current alarm condition.
- **Up and Down Arrows** - Increases or decreases values, toggles between choices.
- **Enter** - Stores the value into memory.

## Keypad Operation

This Isotemp freezer has five basic modes which allow freezer setup and operation. Press the Mode key to scroll through the mode selections.

Up Arrow: Increases or toggles the parameter value.

Enter: Must press Enter key to save to memory all changed values.

Down Arrow: Decreases or toggles the parameter value.

Silence Key: Press to silence the audible alarm. See Section 3 for alarm ringback times.

## Install Freezer

**Caution** If tipped more than 45°, allow the unit to set upright for 24 hours before start up. ▲

To remove the freezer from the pallet, use the 7/16" wrench to remove all the bolts securing the shipping bracket to the pallet.

Remove the shipping bracket. Remove the ramp boards from the pallet and place the slotted end over the ramp brackets on the pallet. The support blocks on the ramps will be facing down. Before moving the freezer, make sure the casters are unlocked and moving freely. Align the caster with the ramp boards. Use adequate personnel to roll the freezer off the pallet.

The freezer can be easily pushed to the desired approved location, described in the following section. If necessary, the doors and lower front panel may be opened to move the unit through tight openings. When the freezer is in position, set the front caster brakes.

**Caution** The freezer must not be moved with the product load inside. ▲

**Caution** For proper ventilation and airflow, minimum clearance of 5" at the rear and top and clearance of 8" on the side of the freezer is required. Allow adequate space on freezer front for door opening. ▲

## Choose the Location

Locate the freezer on a firm, level surface in an area with an ambient temperature between 18°C and 32°C. Provide ample room to reach the mains disconnect switch (power switch) located on the rear of the freezer.

## Install the Wall Bumpers

The parts bag, located inside the cabinet, contains the following parts.

Quantity	Stock #	Description	Purpose
2	510016	1/4-20 x 5-1/2" Bolt	Wall Bumper
2	380520	Neoprene Cap	Cap Protector

Install the bolts into the pre-tapped holes on the back of the compressor section. Install a neoprene cap on each bolt. Refer to Figure 1-2 for the locations of the pre-tapped holes.

## Install the Shelves

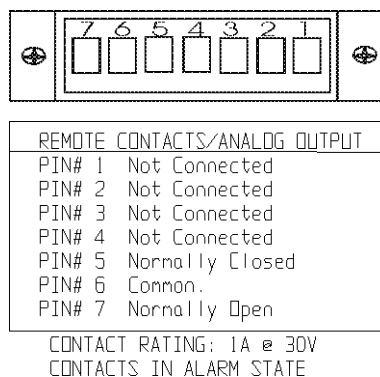
Install the shelf clips into the shelf pilasters (front and back) at the desired shelf level. Install the shelves in the cabinet onto the clips.

**Note** Maximum shelf load is 100 lbs (45.4 kg) per shelf. ▲

**Note** On units having the optional 5 inner door option, refer to the instructions accompanying the inner door kit. ▲

## Remote Alarm Contacts

See Figure 1-2 for the location of the remote alarm contacts. The remote alarm connector is located in the parts bag provided with the manual. It must be installed if connecting the freezer to an alarm system. After installing the wiring from the alarm system to the connector, install the connector to the freezer microboard and secure with the two screws provided. The remote alarm provides a NO (normally open) output, a NC (normally closed) output and COM (common). The contacts will trip on a power outage, high temperature alarm or low temperature alarm. They will also trip on high stage, control probe or microboard failure. Figure 1-8 shows the remote contacts in alarm state.

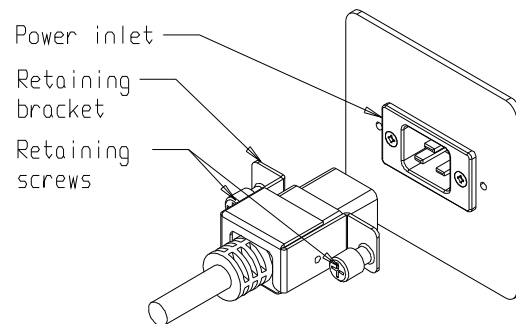


**IMPORTANT USER INFORMATION**  
Caution! Stored product should be protected by a redundant 24 hour/day monitoring system with alarm capability. An interconnect jack and thermocouple are installed for centralized monitoring, should on-board system fail.

**Figure 1-8.** Remote Alarm Contacts

## Attach the Power Cord

Insert the power cord into the power inlet module. Place the retaining bracket (P/N 195763) over the connector. Tighten retaining screws to secure.



**Figure 1-9.** Power Cord Connection

## Connect the Unit to Electrical Power

**Note** See the serial tag on the side of the unit for electrical specifications, or refer to the electrical schematics in this manual. ▲

The freezer should be operated on a dedicated grounded service. Check the voltage rating on the serial tag of the unit and compare it with the outlet voltage. Then, with the power switch turned off, plug the line cord into the wall outlet.

First, turn on the freezer power switch. Then open the lower front door by grasping the bottom left corner. Locate the battery switch (Figure 1-5) and turn it to Standby mode (⏻). During initial freezer start-up, the system battery may require charging and the Low Battery indicator may illuminate.

**Caution** Ensure the battery switch is turned to Standby mode (⏻). The rechargeable batteries require 36 hours to charge at initial start-up. A “Low Battery” alarm may occur until the batteries are fully charged. Should a power failure occur during the initial start-up period, the electronics will have limited operation. ▲

## Freezer Start-Up

With the freezer properly installed and connected to power, system set points can be entered. The following set points can be entered in Settings mode: control temperature, high temperature alarm set point, low temperature alarm set point, and (optional) BUS set point. Default settings are shown in the table below.

Control Set Point	-80°C
High Temperature Alarm	-70°C
Low temperature alarm	-90°C
Optional BUS Set Point	-60°C

**Caution** If the set point is changed and the low temperature and high temperature alarms are set 10° from the set point, the alarm set points will adjust automatically to maintain a distance of at least 10° from set point. ▲

## **Set the Operating Temperature**

All Isotemp Basic freezers have an operating temperature range of -50°C to -86°C, depending on ambient temperature. The freezer is shipped from the factory with a temperature set point of -80°C. To change the operating temperature set point:

1. Press the Mode key until the Set Temperature indicator lights.
2. Press the up/down arrow key until the desired temperature set point is displayed.
3. Press Enter to save the set point.
4. Press the Mode key until the Run indicator lights for Run mode

If no keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.

## **Set the High Temperature Alarm**

The high temperature alarm will activate an audible/visual warning when the freezer chamber temperature has reached or exceeded the high temperature alarm set point. To set the high temperature alarm set point:

1. Press the Mode key until the Set High Alarm indicator lights.
2. Press the up or down arrow key until the desired high temperature alarm set point is displayed.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

If no control keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.

**Note** The high alarm set point must be set at least 5°C from the control set point. ▲

**Note** At initial start-up, the high temperature alarm is disabled until the cabinet reaches set point or 12 hours elapse. ▲

## Section 1

### Installation and Start-Up

## Set the Low Temperature Alarm

The low temperature alarm will activate an audible/visual warning when the freezer chamber temperature has reached or decreased below the low temperature alarm set point. To set the low temperature alarm set point:

1. Press the Mode key until the Set Low Alarm indicator lights.
2. Press the up or down arrow key until the desired low temperature alarm set point is displayed.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode

If no control keys are pressed, the freezer will automatically return to RUN mode after 5 minutes.

**Note** The low alarm set point must be set at least 5°C from the control set point. ▲

## Run Mode

Run mode is the default mode for the freezer. This mode will display the cabinet temperature on the temperature display under normal operating conditions. In addition, Run mode allows display of the high stage heat exchange temperature.

This information is scrolled by pressing the up or down arrow keys. The display will return to the operating temperature in 10 seconds if no keys are pressed.

## Section 2 Calibrate

Once the freezer has stabilized, the control probe may need to be calibrated. Calibration frequency is dependent on use, ambient conditions and accuracy required. A good laboratory practice would require at least an annual calibration check. On new installations, all parameters should be checked after the stabilization period.

**Caution** Before making any calibration or adjustments to the unit, it is imperative that all reference instruments be properly calibrated. ▲

### Calibrate the Control Probe

Plug a type T thermocouple reader into the receptacle located inside the lower door (Figure 1-5). Compare the control temperature set point to the temperature of the measuring device.

1. Press the Mode key until the Calibrate indicator lights.
2. Press up/down arrow to match the display to calibrated instrument.
3. Press Enter to store calibration.
4. Press the Mode key to return to Run mode.

#### Temperature Stabilization Periods

**Startup** - Allow 12 hours for the temperature in the cabinet to stabilize before proceeding.

**Already Operating** - Allow at least 2 hours after the display reaches set point for temperature to stabilize before proceeding.

**Note** During calibration, the temperature display is not available. ▲

If no keys are pressed for approximately five minutes while in Calibrate mode, the system will reset to Run mode.





## Section 3 Alarms

The Isotemp Basic freezer alarms are displayed on the freezer control panel. When an alarm is active, the indicator next to the alarm description lights and an audible alarm sounds. Press the Silence key to disable the audible alarm for the ringback period. The visual alarm will continue until the freezer returns to a normal condition. The alarms are momentary alarms only. When an alarm condition occurs and then returns to normal, the freezer automatically clears the alarm condition.

Description	Delay	Ringback	Relay
Power Failure	1 min.	15 min.	Yes
High Temperature Alarm	1 min.	15 min.	Yes
Low Temperature Alarm	1 min.	15 min.	Yes
Probe Failure	1 min.	15 min.	No
Door Open	1 min.	15 min.	No
Wrong Power	0 min.	none	Yes
Low Battery*	1 min.	12 hours	No
Low BUS Battery (optional)	1 min.	15 min.	No
Hot Condenser	1 min.	none	No
High Stage Failure	0 min.	15 min.	Yes
Micro Board Failure	0 min.	15 min.	Yes

*All alarm delays and ringback times are  $\pm 30$  seconds.*

*\* The automatic battery test runs immediately on initial start-up, then every 8 hours thereafter.*

## High Stage System Failure

The "high stage system failure" condition is created when the high stage compressor and fans run for 30 minutes and are not capable of cooling the interstage heat exchanger to the proper temperature. Under this condition, the high stage compressor and fans turn off after 30 minutes and an audible and visual alarm occur. The audible alarm can be silenced and will ringback every 15 minutes.

## Probe Failure Alarm

The microprocessor in Isotemp Basic freezers continually scans all probes including the control probe, heat exchanger probe and condenser probe to ensure that they are operating properly. Should an error be detected, the "Probe Failure" alarm will occur as shown in the table above. If an error is detected with the control probe, the high and low stage compressors will run continuously. As a result, the cabinet temperature will decrease until it reaches the lowest temperature that the refrigeration system can maintain. If an error is detected with the heat exchanger probe, the freezer will cycle properly at its temperature set point using a 5 minute step start between the high and low stage compressors. If an error is detected with the condenser probe, there is no impact on the performance of the freezer; however, the hot condenser alarm may also occur. Contact the Technical Services department or your local distributor.

Error	Notes
Er00	<p><b>Name:</b> Improper model selected.</p> <p><b>Description:</b> Indicates that DIP SW3 has not selected a proper model or can't be accessed properly.</p> <p><b>Response:</b> Display shows "Er00" and will not start-up until a proper model is selected. Contact Technical Services.</p>
ErA1	<p>This error condition will prevent peripherals (fans, compressors, etc.) from powering up with the incorrect voltage.</p> <p><b>Name:</b> Voltage/Frequency failure</p>
ErC1	<p><b>Description:</b> Indicates the measured RMS line voltage did not agree with the logic level sensed by the micros provided by the installed high voltage PCB; or the measured RMS voltage is not within a tolerable range (&lt;180 VAC &lt; 270 for 230VAC unit / &lt;85VAC &lt; 160 for 115VAC unit); or the frequency measured over 10 cycles was not within a tolerable range (55 Hz &lt; Freq &lt; 70 Hz for 60 Hz units / 40 Hz &lt; Freq &lt; 55 Hz for 50 Hz units)</p>
ErD1	<p><b>Response:</b> This condition is checked at power on reset and if it is active, the unit will NOT power up. The unit will indefinitely display "Er_1" in the display and continue to monitor the frequency and voltage. Furthermore, the audible alarm will sound. Other startup error messages may be displayed prior to this message; however, the system will stop the startup sequence for this condition.</p>
ErE1	
ErA1	<p>ErA1 .. No pulses (zero crossings) detected to determine frequency (50 / 60 Hz)</p>
ErF1	<p>ErC1 .. Frequency detected is below 50 Hz</p>
ErD1	<p>ErD1 .. Frequency detected is above 60 Hz (Possible noise spikes on supply voltage)</p>
ErE1	<p>ErE1 .. Unit is 230V and the voltage detected is below the low limit (180VRMS)</p>
ErF1	<p>ErF1 .. Unit is 230V and the voltage detected is above the high limit (260VRMS)</p>
Erg1	<p>Erg1 .. Unit is 115V and the voltage detected is below the low limit (85VRMS)</p>
ErH1	<p>ErH1 .. Unit is 115V and the voltage detected is above the high limit (160VRMS)</p>
Er02	<p><b>Name:</b> Control (Cabinet) Sensor Failure</p> <p><b>Description:</b> This condition indicates that the control sensor has failed to produce a valid reading for <math>\geq 12</math> consecutive reads (~60 seconds).</p> <p><b>Response:</b> The unit will stage both compressors on (if necessary) and the unit will attempt to head to bottom out. If the sensor recovers, the system will begin to operate normally and respond to the temperature feedback. The remote alarm contacts will become active. 'Er02' will be added to the main display queue and the last valid cabinet temperature value will not be displayed.</p>
Er03	<p><b>Name:</b> Heat Exchange Sensor Failure</p> <p><b>Description:</b> This condition indicates that the heat exchange sensor has failed to produce a valid reading for <math>\geq 12</math> consecutive reads (~60 seconds).</p> <p><b>Response:</b> The display will show "Er03" only when the button sequence to read the heat exchange sensor is depressed.</p>

### Section 3

#### Alarms

Error (cont.)	Notes
Er05	<p><b>Name:</b> Display Firmware Integrity Failure</p> <p><b>Description:</b> The display firmware has failed to pass its CRC CCITT checksum integrity test.</p> <p><b>Response:</b> The display performs this check at startup and the display board will fail to startup without any error indication if it does not pass this at power on.</p>
Er06	<p><b>Name:</b> Micro Firmware Integrity Failure</p> <p><b>Description:</b> The micro firmware has failed to pass its CRC CCITT checksum integrity test.</p> <p><b>Response:</b> This is checked at power on reset and the "Er06" will be displayed for ~10 seconds at startup if this condition exists.</p>
Er07	<p><b>Name:</b> Micro Fail - CS5521 SPI Failure / UISR Failure</p> <p><b>Description:</b> This condition indicates a micro board failure due to either the SPI bus is unable to communicate with the ADC device or a UISR event caused the microcontroller to be in an unstable state.</p> <p><b>Response:</b> The unit will try to recover from this fault three times by a hardware reset of the micro board. In the event that the system couldn't rectify the issue, the following sequence of events will occur:</p> <ol style="list-style-type: none"> <li>1. Remote alarm contacts will become active.</li> <li>2. Buzzer will annunciate audibly and will have a ringback of 15 minutes.</li> <li>3. "Seven segment" display will show "Er07".</li> <li>4. The system will have 10 minute staging between the high stage compressor and the low stage compressor activation.</li> <li>5. The system will go to bottom out temperatures.</li> </ol>
Er09	<p><b>Name:</b> Stuck Button</p> <p><b>Description:</b> This condition indicates that the display board has a stuck button.</p> <p><b>Response:</b> The Er09 will show on the display periodically.</p>
Er11	<p><b>Name:</b> Condenser Probe Sensor Failure</p> <p><b>Description:</b> This condition indicates that the condenser probe sensor has failed to produce a valid reading for <math>\geq 12</math> consecutive reads (~60 seconds).</p> <p><b>Response:</b> The display shows "Er11".</p>
dErr	<p><b>This is a general display error in which value being displayed can not be represented within characters provided.</b></p>
(four dashes) ---- in display	<p><b>Name:</b> Lost Communication</p> <p><b>Description:</b> Communication between the micro board and the display board has been lost. Under this condition, the visual alarm flashes along with dashes in the temperature display (----). Contact Technical Services.</p>

## Section 4 Maintenance

**Warning** If the unit has been in service, turn it off and disconnect the power cord connector before proceeding with any maintenance. ▲

**Warning** Avoid the excessive use of water around the control area due to the risk of electrical shock. Damage to the controls may also result. ▲

Wipe down the freezer exterior using soap and water and a general use laboratory disinfectant. Rinse thoroughly with clean water and dry with a soft cloth.

### Clean the Air Filter (minimum 4 x per year)

1. Open the front lower door by grasping the bottom left corner.
2. Locate the grille on the door. See Figure 1-5. Grasp the middle of the grille material and gently pull out to remove.
3. Wash the filter material using water and a mild detergent.
4. Dry by pressing between two towels.
5. Install the filter back into the grille and attach the grille.

Depending upon environmental conditions, the filter may need to be cleaned or replaced more frequently. If the filter becomes torn or excessively dirty, a replacement can be purchased from Fisher. See the exploded parts drawings for filter part number. A filter kit (set of 5) is also available.

### Clean the Condenser (minimum yearly)

1. Open the front lower door by grasping the bottom left corner. See Figure 1-5.
2. Using a vacuum cleaner and being very careful not to damage the condenser fins, clean the condenser.

Depending upon environmental conditions, the condenser may need to be cleaned more frequently.

## Clean Water-cooled Condenser

The water-cooled condenser can be cleaned-in-place by using the CIP procedure. Cleaning solutions can be used, depending on type of deposits or build-up to be removed.

**Caution** Do not use liquids that are corrosive to stainless steel or the brazing material (copper or nickel). ▲

### CIP (Clean-In-Place) Procedure

1. Disconnect the unit from the water supply.
2. Drain the unit.
3. Rinse with fresh water and drain the unit again.
4. Fill with fresh water.
5. Add cleaning agent (solution and concentration dependent on deposits or build-up).
6. Circulate cleaning solution (if feasible).
7. Drain the cleaning solution.
8. Add and circulate a passivating liquid for corrosion inhibition of plate surfaces.
9. Drain this liquid.
10. Rinse with fresh water and drain.
11. Reconnect the water supply and fill the unit.
12. Return to service.

## **Defrost the Chamber**

1. Remove all product and place it in another freezer.
2. Turn the unit off and disconnect it from the power source.
3. Turn off the battery switch (O). See Figure 1-5.
4. Open all of the doors and place towels on the chamber floor.
5. Allow the frost to melt and become loose.
6. Remove the frost with a soft cloth.
7. After defrosting is complete, clean the interior with a non-chloride detergent. Rinse thoroughly with clean water and dry with a soft cloth.
8. Plug unit in and turn power switch on.
9. Turn the battery power switch to Standby mode (⏻).
10. Allow the freezer to operate empty overnight before reloading the product.

## **Clean the Door Gasket (minimum monthly)**

Using a soft cloth, remove any frost build-up from the gasket and door(s). The door gasket may need to be cleaned more frequently if dirt or excessive frost build-up prevents the door from closing properly.

## **Clean Vacuum Relief Port (min. monthly)**

The exterior door gasket provides an excellent seal that protects product, provides an energy efficient thermal barrier to keep cold air in and room temperature air out and reduces frost build up on the inner doors.

Because the door gasket seals so well, a vacuum can be created after a door opening. Warm air enters the cabinet, cools and contracts, creating a vacuum that pulls the door in tightly against the seal.

To equalize the pressure inside the cabinet after a door opening requires 1.5-3.0 cu.ft. of ambient air to be drawn into the cabinet. The amount of air required to equalize the pressure varies depending on the cabinet size, cabinet temperature, duration of door opening, inventory volume and the temperature/humidity of the ambient air. The unit is designed with a “vacuum relief port” that allows the pressure to be equalized.



## Clean Vacuum Relief Port (continued)

The time required to draw 1.5-3.0 cu.ft. of air into the cabinet depends on two factors,

- a) the size and number of paths available for the air to enter the cabinet, and
- b) the pressure difference between the internal cabinet and the ambient room.

Cabinets with the vacuum relief port operating normally, (i.e. vacuum relief port is not iced over) will require a minimum of 30 seconds up to a maximum of 120 seconds for the cabinet to equalize. This is also a good indication that the exterior door is well sealed.

The vacuum relief port requires routine maintenance. It will ice over unless preventive measures are taken. If the vacuum relief port becomes iced over, the freezer will take several hours to equalize pressure.

**Caution** Do not leave the freezer unattended with the door unlatched. The vacuum could release, resulting in a door opening and the potential for product loss. ▲

### Vacuum Relief Port Maintenance

Monitor the inner port opening on each door opening for frost and ice build-up. Remove any frost with a soft dry cloth. If the tube should become clogged with ice, it must be cleaned. Clear the vacuum relief tube completely free of ice to prevent rapid ice formation.

Factors that can affect the performance of the vacuum relief port include: high ambient temperature, high humidity conditions and frequent door openings. Maintenance should be performed weekly, or as needed.

**Caution** Failure to maintain the vacuum relief port may result in excessive ice build-up inside the tube, clogging of the port, and the inability to open the door. The vacuum relief port may need to be cleaned more often with frequent door openings and high humidity environments. ▲

## Replace the Battery(s)

1. Grasp the bottom left corner of the lower door to access the battery. The battery is rectangular in shape, located on the front left corner of the compressor compartment and is secured in place by a mounting bracket.
2. Directly above the battery(s) is the battery power switch. Turn the battery power switch to the off position (O).
3. Disconnect the battery connections.
4. Remove the old battery and install the new battery.
6. Reconnect the battery (red to positive and black to negative).
7. Turn the battery power switch to Standby mode (⏻).
8. Close lower panel door.

**Caution** The % of charge can vary depending on the age, usage and condition of the battery. For a consistent and dependable charge, replace the battery every 2 years. Replacement batteries must be rechargeable and are available from Fisher. Refer to the parts list for stock number and description of the replacement batteries. Dispose of the used batteries in a safe manner and in accordance with good environmental practices. ▲

## Prepare the Unit for Storage

Defrost the unit as described previously. This prepares the unit for storage. Turn off the battery power switch (O). Turn off the freezer power switch. Disconnect power to the battery(s) and to the freezer.

# PREVENTIVE MAINTENANCE

## Freezers

Your equipment has been thoroughly tested and calibrated before shipment. Regular preventive maintenance is important to keep your unit functioning properly. The operator should perform routine cleaning and maintenance on a regular basis. For maximum performance and efficiency, it is recommended that the unit be checked and calibrated periodically by a qualified service technician.

The following is a condensed list of preventive maintenance requirements. See the specified section of the instruction manual for further details.

We have qualified service technicians, using NIST traceable instruments, available in many areas. For more information on Preventive Maintenance or Extended Warranties, please contact us at the number below.

Cleaning and calibration adjustment intervals are dependent upon use, environmental conditions and accuracy required.

### Tips:

- Fill an upright by starting at the bottom near the probe and add racks to one shelf at a time. Allow freezer to recover to set point between shelves.
- Fill a chest by starting at the left side near the probe. Filling with room temperature racks will result in a long pull-down time.
- Fill unit with frozen product to help overall performance; frozen water jugs, for example.
- Always make certain the vacuum relief port is free of frost and ice, to allow for timely re-entry into the freezer after a door opening.

- 401 Millcreek Road, Box 649 • Marietta, Ohio 45750 USA • 740-373-4763
- USA and Canada 888-213-1790 • Telefax: 740-373-4189 • email: [services.controlenv@thermo.com](mailto:services.controlenv@thermo.com)

## Preventive Maintenance for Freezers

Refer to Manual Section	Action	Monthly	Yearly	Every 2 Years
--	Verify ambient temperature, <90°F	<input checked="" type="checkbox"/>		
--	* Adjust door handle for firm latching, as needed	<input checked="" type="checkbox"/>		
Figure 1-4 4	Check and clean probe cover, gaskets, hinges, inner doors and vacuum relief port of ice and snow	<input checked="" type="checkbox"/>		
		<i>More frequent cleaning may be required, depending on use and environmental conditions.</i>		
4.2	Check air filter. Clean or replace as needed	<input checked="" type="checkbox"/>		
1, 4	Check alarm back-up battery	<input checked="" type="checkbox"/>		** Replace
--	Check condenser fan motor for unusual motor noise or vibration		<input checked="" type="checkbox"/>	
2	* Verify and document calibration, at the minimum, annually		<input checked="" type="checkbox"/>	
4	* Clean condenser compartment and wipe off condenser		<input checked="" type="checkbox"/>	

\* Qualified service technicians only

\*\* Dispose of properly, according to all state and federal regulations

### To minimize ice build-up inside of freezer:

- Locate the freezer away from drafts or heating/cooling vents
- Keep the number of door openings to a minimum
- Minimize the length of time door is open
- Make sure door latches securely after opening



## Section 5 Factory Installed Options

Described below are the factory installed options which are available, or may be already installed, on your unit.

### Back-Up System (BUS) - P/N 1950533, 1950535

**Warning** Before installation of BUS components, make sure the power to the freezer is disconnected, the battery switch is turned off (O) and the freezer has warmed to ambient temperature. ▲

The built-in BUS (back up system) will keep the freezer chamber temperature below the critical level in the event of a power or equipment failure. If power to the freezer fails, or temperature increases to the back up alarm set point, the BUS injects liquefied gas into the chamber to keep the chamber temperature within the specified range.

The BUS operates on an internal 12-volt, rechargeable battery which is kept charged during normal operation by the integral battery charger.

### Install Injection Assembly, Vent Stack and Solenoid

1. Install the injection assembly (Figure 5-1) through the 1/2" pre-punched hole, directly behind the 2" vent stack hole in the center of the chamber ceiling.

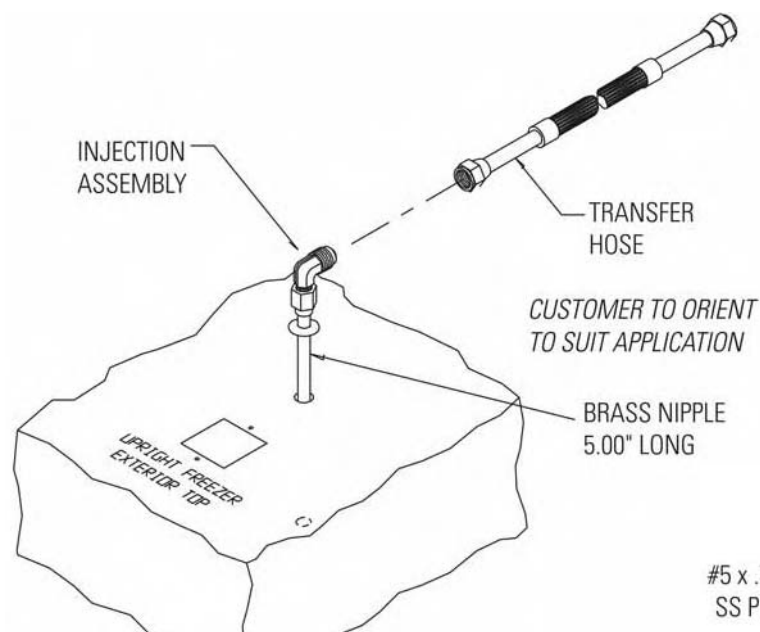
**Note** Cover the open end of injection assembly with tape to keep insulation from entering the nipple. ▲

2. Slide 3/8" flatwasher over open end of nipple.
3. Insert the covered end of the injection assembly through the exterior hole.
4. Remove the tape covering from the end of the nipple and install the 1/8" NPT brass tee on the open end of the nipple. Place Permagum sealant between the brass tee and the interior top.
5. Remove the two Phillips head screws securing the metal bracket on the vent stack assembly.

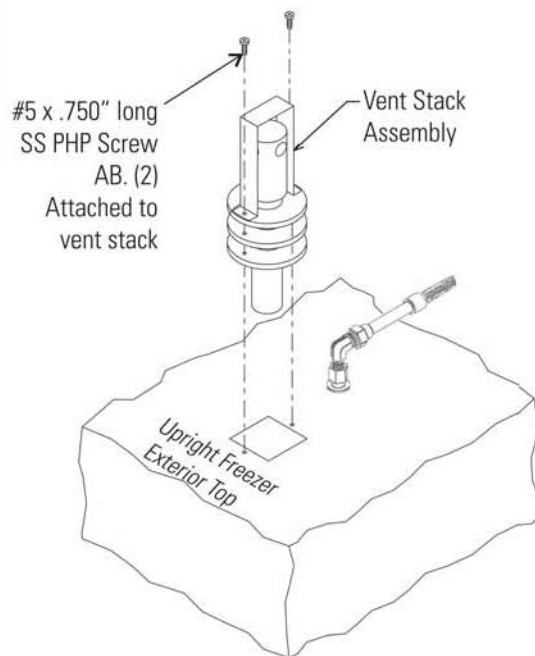
## Install Inj. Assembly, Vent Stack and Solenoid (cont.)

6. Install the vent stack (Figure 5-2) through the opening and secure it to the top of the freezer, using screws.
7. On the cabinet interior, seal around the end of the vent stack with Permagum.
8. Install the transfer hose connecting one end to the injection assembly, the other end to the solenoid valve. Install the solenoid valve to the supply source. The solenoid mounting bracket is not required and may be discarded.

**Caution** When selecting a CO<sub>2</sub> supply cylinder, it must be equipped with a siphon tube. ▲



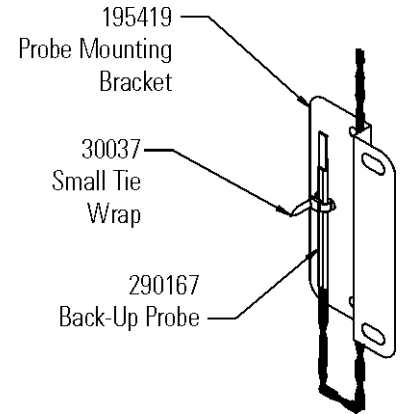
**Figure 5-1.** Injection Assembly



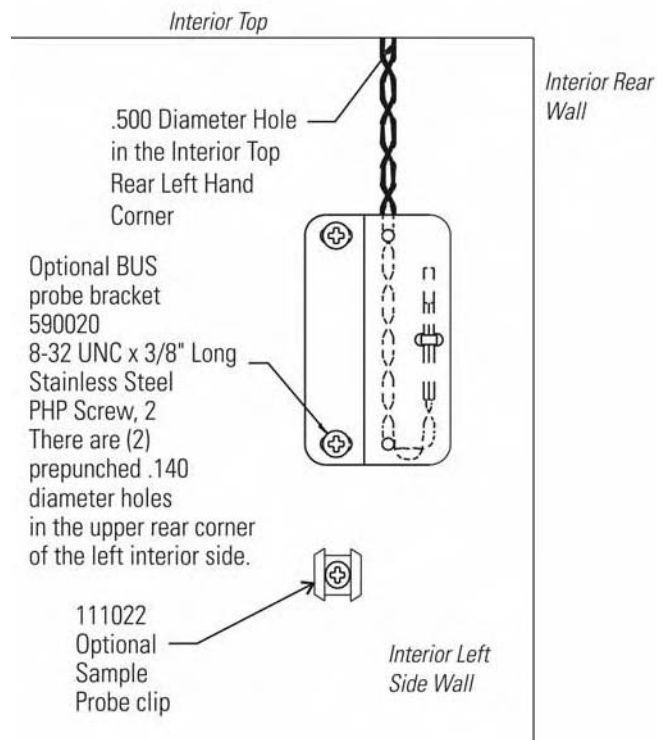
**Figure 5-2.** Vent Stack

## Install the Temperature Probe

1. Locate the 0.500" pre-punched hole in the upper left hand back corner of the chamber ceiling. Remove the tie wrap securing the coiled probe/solenoid harness. Uncoil the probe lead and run the probe tip (approximately 12") down through 0.500" porthole (Figure 5-4).
2. As shown in Figure 5-3, thread the small tie wrap through the openings in the front of the bracket. Secure the probe on the back of the bracket with the tie wrap.
3. Tap #8-32 the two pre-punched holes located on the interior left wall of the freezer. Mount the bracket. Figure 5-4 shows the Back-Up probe mounted on the interior left side wall of the freezer.



**Figure 5-3.** Probe

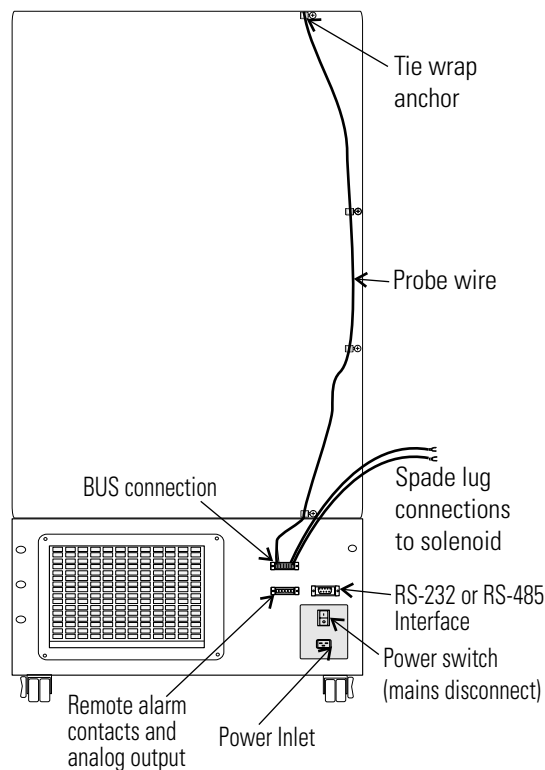


**Figure 5-4.** Probe Bracket Location



## Connect the Probe/Solenoid Harness

1. Remove the four screws on the freezer back panel and use them to mount the tie wrap anchors as shown in Figure 5-5. Secure the probe wire with tie wraps.
2. Plug the solenoid/probe connector into the BUS connection and secure with a screw on the right and left side. The connector is keyed.
3. Loosen the terminal screws on the solenoid. Slide the spade lug connectors under the screws and tighten to secure.
4. Connect power to the freezer. Turn the freezer On, with battery switch Off (O).
  - a. The Solenoid Engaged light on the BUS control panel will illuminate (no injection occurs). This light stays on until the unit is below BUS setpoint.
  - b. The Low Battery indicator may also illuminate.
5. Turn the battery switch to Standby mode (Ⓢ) to charge both batteries.



**Figure 5-5.** Routing

## BUS Operation and Maintenance

**Warning** When activated, this unit injects liquid nitrogen or carbon dioxide. Liquid nitrogen can cause serious freezing (frostbite) if it comes in contact with unprotected skin or eyes. Nitrogen suppresses oxygen levels and may cause suffocation if area is not well ventilated. Refer to Appendix A for the proper handling of liquid LN<sub>2</sub>. ▲

**Caution** Make sure the pressure relief valve on any LN<sub>2</sub> tank is adjusted to 30 PSI maximum blow-off. ▲

**Warning** Carbon dioxide gas suppresses oxygen levels and may cause suffocation if area is not well ventilated. Refer to “Handling Liquid CO<sub>2</sub>” in Appendix B of this manual. ▲

### BUS Control Panel



**Figure 5-6.** BUS Control Panel

Power - indicates the unit has AC power.

Low Battery - battery charge is low. The battery needs replaced or recharged.

Solenoid Engaged - BUS has opened the solenoid so it can inject gas (CO<sub>2</sub> or LN<sub>2</sub>).

Press-To-Test - Activates the solenoid and injects LN<sub>2</sub> or CO<sub>2</sub> into the freezer chamber as long as the button is depressed. The solenoid engaged indicator should light. If the Low Battery indicator lights during the test, replace the BUS battery.

**Note** Solenoid will not engage if door is open. ▲

### Configure the Optional BUS (Back-Up System)

The optional BUS can be configured for LN<sub>2</sub> or CO<sub>2</sub> supply. To select the supply type:

1. Press the Mode key until the Backup indicator lights.
2. Press the up or down arrow key. The display will show ‘cO2’ for CO<sub>2</sub> selection and ‘Ln2’ for LN<sub>2</sub> selection.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode.

If no control keys are pressed, the freezer will automatically return to Run mode after 5 minutes.

## Set Optional BUS Set Point

The optional back up system is designed to inject CO<sub>2</sub> or LN<sub>2</sub> into the freezer compartment if the temperature rises above back up system set point. To set the BUS set point:

1. Press the Mode key until the Set Temperature and Backup indicators light.
2. Press the up or down arrow key until the desired BUS set point is displayed.
3. Press Enter to save the setting.
4. Press the Mode key until the Run indicator lights for Run mode.

If no control keys are pressed, the freezer will automatically return to Run mode after 5 minutes.

**Caution** Changing the operating temperature set point can affect the BUS set point. The BUS set point will self adjust to maintain a temperature of at least 10°C above the operating temperature set point. ▲

**Caution** The BUS set point cannot be set any colder than the high temperature alarm set point (see Section 1). If the back-up system is installed with CO<sub>2</sub>, then -65°C is the coldest BUS set point that can be used (if the cabinet set point is -75°C or colder). ▲

## Test BUS Operation

After the freezer has stabilized and both batteries are fully charged, the BUS can be tested to verify proper operation.

1. Disconnect the AC power to the freezer by turning the power switch off.
2. As the freezer warms up, verify the BUS injects at the desired temperature. Displayed temperature may vary by a few degrees from inject temperature due to the differences in probe locations.

## Clean the Vent Stack

Routinely check the vent stack for frost or ice build-up. The type of frost that forms in the vent stack is generally very soft and may be easily removed with a bristle brush or soft cloth. If ice build-up has occurred, a complete defrost may occasionally be required. See Section 4 for freezer defrost instructions.

## Disconnect the Fitting Asm./Transfer Hose

To disconnect the freezer back-up from the gas supply:

1. Close the supply valve.
2. Depress the test button on the BUS control box to remove the gas from the line.
3. Slowly disconnect the fitting assembly from the supply (in the event that any gas remains in the line).

## Chart Recorder

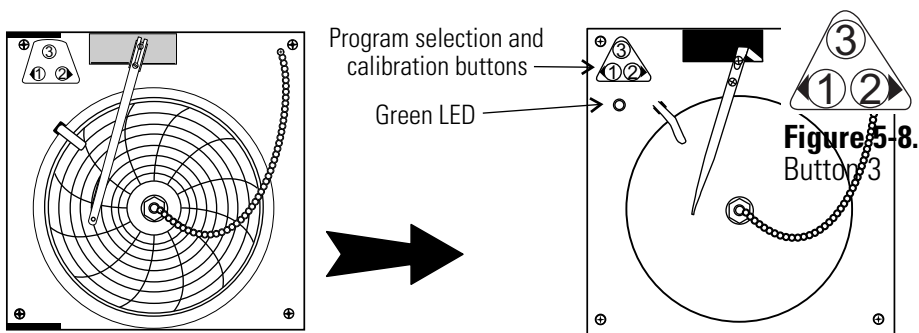


Figure 5-7. Recorder Details

## Install the Chart Paper

1. Open the glass door of the recorder and press button #3 until the pen begins to move outward.
2. Unscrew the knob at the center of the chart and remove the paper.
3. Install the new chart paper, position the paper to the correct time line and replace the knob.
4. Remove the cap from the felt pen and press button #3.

## Change the Recorder Temperature Range

The chart recorder contains eight temperature ranges and is factory-programmed for the freezer.

Program	From	To
1	-40	30°C
2	0	60°C
3	-100	38°C
4	-5	50°C
5	0	100°C
6	-100	200°C
7	-115	50°C
8	-10	70°C

1. Press and hold button #3 for one second, then let the pen move off the chart paper.
2. Press and hold for five seconds either button #1 or button #2.
3. Release the button and the green LED will begin to flash. Count the number of flashes to determine the present program setting.
4. To change the program setting, press the left or right arrows to increase or decrease the count.
5. When the desired program number is flashing, press button #3 to bring the pen arm back onto the chart. Recording will begin in the new program.

## Calibrate the Chart Recorder

**Caution** The recorder must be in service for 24 hours before performing the following calibration procedure. ▲

1. Place an accurate thermometer in the chamber next to the recorder probe.
2. Temperature probes for the recorder are located in the left front corner of the freezer chamber (Figure 1-4).
3. After about three minutes, compare the thermometer reading with the chart recorder reading.
4. If an adjustment is necessary, press the #1 button to move the pen to the left or the #2 to move the pen to the right. The button must be held about five seconds before the pen begins to move. Release the button when the pen position matches the thermometer.

**Note** The felt-tip pen on the recorder requires periodic replacement. Usually the ink will appear to fade before replacement becomes necessary. Additional pen tips may be purchased from Fisher. ▲

## Section 6 Specifications

Catalog No. (Model)	IE1386V (8953)	IE1386D (8954)	IE1386A (8955)
<b>Temperature Range</b>	-50C to -86C (-58F to -123F) in an 18C to 32C* (64.4F to 89.6F) ambient		
<b>Exterior Dimensions</b>	33.3"W x 77.9"H x 32.9" 84.6 x 197.9 x 78.7cm	33.3"W x 77.9"H x 32.9" 84.6 x 197.9 x 78.7cm	33.3"W x 77.9"H x 32.9" 84.6 x 197.9 x 78.7cm
<b>Interior Dimensions</b>	23.0"W x 51.5"H x 19.3" 58.4 x 130.8 x 49.0cm	23.0"W x 51.5"H x 19.3" 58.4 x 130.8 x 49.0cm	23.0"W x 51.5"H x 19.3" 58.4 x 130.8 x 49.0cm
<b>Capacity</b>	13.0 cu. ft. (368.1 liters)	13.0 cu. ft. (368.1 liters)	13.0 cu. ft. (368.1 liters)
<b>Refrigeration</b>	Two 1 HP (2545 BTUH each)		
<b>Insulation</b>	Non-CFC, foamed-in-place urethane: 5.0" (12.7 cm) cabinet; 4.5" (11.4 cm) door		
<b>Electrical-</b> nominal voltage $\pm 10\%$	230V, 50 Hz, 12.0FLA Operating Range: 208VAC-240VAC	230V, 60 Hz, 12.0FLA Operating Range: 208VAC-240VAC	120V, 60 Hz, 16.0 FLA Operating Range: 108VAC-130VAC
<b>Breaker Requirements</b>	15 amp Dedicated Circuit, 15 Amp Time Delay Breaker	15 amp Dedicated Circuit, 15 Amp Time Delay Breaker	20 amp Dedicated Circuit, 20 amp Time Delay Breaker
<b>Shipping Weight: Motor</b>	711 lbs. (323 kg)	711 lbs. (323 kg)	711 lbs. (323 kg)

*\*Compressors may not cycle off with cabinet running at -86C in a 32C ambient.*

**Section 6**  
Specifications

Catalog No. (Model)	IE1786A (8956)	IE1786D (8957)	IE1786V (8958)
<b>Temperature Range</b>	-50C to -86C (-58F to -123F) in an 18C to 32C* (64.4F to 89.6F) ambient		
<b>Exterior Dimensions</b>	33.3"W x 77.9"H x 38.9" 84.6 x 197.9 x 94.0cm	33.3"W x 77.9"H x 38.9" 84.6 x 197.9 x 94.0cm	33.3"W x 77.9"H x 38.9" 84.6 x 197.9 x 94.0cm
<b>Interior Dimensions</b>	23.0"W x 51.5"H x 25.3" 58.4 x 130.8 x 64.3cm	23.0"W x 51.5"H x 25.3" 58.4 x 130.8 x 64.3cm	23.0"W x 51.5"H x 25.3" 58.4 x 130.8 x 64.3cm
<b>Capacity</b>	17.3 cu. ft. (489.9 liters)	17.3 cu. ft. (489.9 liters)	17.3 cu. ft. (489.9 liters)
<b>Refrigeration</b>	Two 1 HP (2545 BTUH each)		
<b>Insulation</b>	Non-CFC, foamed-in-place urethane: 5.0" (12.7 cm) cabinet; 4.5" (11.4 cm) door		
<b>Electrical - nominal voltage ±10%</b>	120V, 60 Hz, 16.0 FLA Operating Range: 108-130V	230V, 60 Hz, 12.0FLA Operating Range: 208-240V	230V, 50 Hz, 12.0FLA Operating Range: 208-240V
<b>Breaker Requirements</b>	20 amp Dedicated Circuit, 20 amp Time Delay Breaker	15 amp Dedicated Circuit, 15 Amp Time Delay Breaker	15 amp Dedicated Circuit, 15 Amp Time Delay Breaker
<b>Shipping Weight: Motor</b>	830 lbs. (376 kg)	830 lbs. (376 kg)	830 lbs. (376 kg)

Catalog No. (Model)	IE2386V (8959)	IE2386D (8963)	IE2386 A (8964)
<b>Temperature Range</b>	-50C to -86C (-58F to -123F) in an 18C to 32C* (64.4F to 89.6F) ambient		
<b>Exterior Dimensions</b>	40.8"W x 77.9"H x 38.9" 103.6 x 197.9 x 94.0cm	40.8"W x 77.9"H x 38.9" 103.6 x 197.9 x 94.0cm	40.8"W x 77.9"H x 38.9" 103.6 x 197.9 x 94.0cm
<b>Interior Dimensions</b>	30.6"W x 51.5"H x 25.3" 77.7 x 130.8 x 64.3cm	30.6"W x 51.5"H x 25.3" 77.7 x 130.8 x 64.3cm	30.6"W x 51.5"H x 25.3" 77.7 x 130.8 x 64.3cm
<b>Capacity</b>	23.0 cu. ft. (651.3 liters)	23.0 cu. ft. (651.3 liters)	23.0 cu. ft. (651.3 liters)
<b>Refrigeration</b>	Two 1 HP (2545 BTUH each)		
<b>Insulation</b>	Non-CFC, foamed-in-place urethane: 5.0" (12.7 cm) cabinet; 4.5" (11.4 cm) door		
<b>Electrical- nominal voltage ±10%</b>	230V, 50 Hz, 12.0FLA Operating Range: 208-240V	230V, 60 Hz, 12.0FLA Operating Range: 208-240V	120V, 60 Hz, 16.0 FLA Operating Range: 108-130V
<b>Breaker Requirements</b>	15 amp Dedicated Circuit, 15 Amp Time Delay Breaker	15 amp Dedicated Circuit, 15 Amp Time Delay Breaker	20 amp Dedicated Circuit, 20 amp Time Delay Breaker
<b>Shipping Weight: Motor</b>	900 lbs. (408 kg)	900 lbs. (408 kg)	900 lbs. (408 kg)

\*Compressors may not cycle off with cabinet running at -86C in a 32C ambient.

## **Certifications**

Declaration of Conformity is available from the factory

## **Safety Specifications**

Indoor Use Only

Altitude - up to 2,000 meters

Temperature - 5°C to 43°C

Humidity - Maximum RH 80% for temperatures up to 31°C, decreasing linearly to 50% RH at 40°C

Mains Supply Fluctuations - Mains supply voltage fluctuations not to exceed  $\pm 10\%$  of the nominal voltage

Installation Category II <sup>1</sup>

Pollution Degree 2 <sup>2</sup>

Class of Equipment I

## **Intended Use**

This product is intended for use as a General Purpose Laboratory Freezer for storing samples or inventory between -40 and -86C.

This unit is not intended for use in an explosive environment, nor to be used for the storage of flammable inventory. This unit is not intended for use in a Class II medical application as defined by Title 21 of the Federal Code of Regulations.

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<sup>1</sup> Installation category (overvoltage category) defines the level of transient overvoltage which the instrument is designed to withstand safely. It depends on the nature of the electricity supply and its overvoltage protection means. For example, in CAT II which is the category used for instruments in installations supplied from a supply comparable to public mains such as hospital and research laboratories and most industrial laboratories, the expected transient overvoltage is 2500V for a 230V supply and 1500V for a 120V supply.

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<sup>2</sup> Pollution degree describes the amount of conductive pollution present in the operating environment. Pollution degree 2 assumes that normally only non-conductive pollution such as dust occurs with the exception of occasional conductivity caused by condensation.





## THERMO FISHER SCIENTIFIC FREEZER WARRANTY

The Warranty Period starts two weeks from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the warranty period.

During the first two years of the warranty period, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, labor included. The ULT Freezers include an additional two year warranty on the compressors, parts only, F.O.B. factory. Installation and calibration is not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to any work being performed. Expendable items, i.e., glass, filters, pilot lights, light bulbs and door gaskets are excluded from this warranty.

In addition to the standard warranty, the foamed-in-place cabinet design carries a unit production lifetime warranty (foamed-in-place cabinet, evaporator and foamed-in-place door; parts only). Please contact your sales representative or Thermo for additional information.

Replacement or repair of component parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original two year warranty period. The Technical Services Department must give prior approval for the return of any components or equipment.

**THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY.**

Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation, and preventive maintenance.

If equipment service is required, please call your Technical Services Department at 1-800-438-4851 (USA and Canada) or 1-740-373-4763. We're ready to answer your questions on equipment warranty, operation, maintenance, service, and special applications. Outside the USA, contact your local distributor for warranty information.



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## THERMO FISHER SCIENTIFIC FREEZER INTERNATIONAL DEALER WARRANTY

The Warranty Period starts two months from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the warranty period. Dealers who stock our equipment are allowed an additional four months for delivery and installation, providing the warranty card is completed and returned to the Technical Services Department.

During the first two years of the warranty period, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, labor excluded. The ULT Freezers include an additional two year warranty on the compressors, parts only, F.O.B. factory. Installation and calibration is not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to any work being performed. Expendable items, i.e., glass, filters, pilot lights, light bulbs and door gaskets are excluded from this warranty.

In addition to the standard warranty, the foamed-in-place cabinet design carries a unit production lifetime warranty (foamed-in-place cabinet, evaporator and foamed-in-place door; parts only). Please contact your sales representative or Thermo for additional information.

Replacement or repair of component parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original two year warranty period. The Technical Services Department must give prior approval for the return of any components or equipment.

**THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY.**

Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation, and preventive maintenance.

If equipment service is required, please contact your local distributor or Thermo (1-800-438-4851 in USA and Canada, or 1-740-373-4763). We're ready to answer your questions on equipment warranty, operation, maintenance, service, and special applications. Outside the USA, contact your local distributor for warranty information.



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# Appendix A Handling Liquid Nitrogen

**Warning** Contact of liquid nitrogen or cold gas with skin or eyes may cause serious freezing (frostbite) injury. ▲

## Handle liquid nitrogen carefully.

The extremely low temperature can freeze human flesh very rapidly. When spilled on a surface the liquid tends to cover it completely and intimately, cooling a large area. The gas issuing from the liquid is also extremely cold. Delicate tissue, such as that of the eyes, can be damaged by an exposure to the cold gas which would be too brief to affect the skin of the hands or face.

## Never allow any unprotected part of your body to touch objects cooled by liquid nitrogen.

Such objects may stick fast to the skin and tear the flesh when you attempt to free yourself. Use tongs to withdraw objects immersed in the liquid, and handle the object carefully.

## Wear protective clothing.

Protect your eyes with a face shield or safety goggles (safety glasses without side shields do not give adequate protection). Always wear gloves when handling anything that is, or may have been, in immediate contact with liquid nitrogen. Insulated gloves are recommended, but heavy leather gloves may also be used. The gloves should fit loosely, so that they can be thrown off quickly if liquid should splash into them. When handling liquid in open containers, it is advisable to wear high-top shoes. Trousers (which should be cuffless if possible) should be worn outside the shoes.

The safe handling and use of liquid nitrogen in cryogenic refrigerators and dewar flasks is largely a matter of knowing the potential hazards and using common-sense procedures based on that knowledge. There are two important properties of liquid nitrogen that present potential hazards:

1. It is extremely cold. At atmospheric pressure, liquid nitrogen boils at  $-320^{\circ}\text{F}$  ( $-196^{\circ}\text{C}$ ).
2. Very small amounts of liquid vaporize into large amounts of gas. One liter of liquid nitrogen becomes 24.6 cu. ft. (700l) of gas.

The safety precautions in this booklet must be followed to avoid potential injury or damage which could result from these two characteristics. Do not attempt to handle liquid nitrogen until you read and fully understand the potential hazards, their consequences, and the related safety precautions. Keep this booklet handy for ready reference and review.

**Note** Because argon is an inert gas whose physical properties are very similar to those of nitrogen, the precautions and safe practices for the handling and use of liquid argon are the same as those for liquid nitrogen. ▲

## Use only containers designed for low temperature liquids.

Cryogenic containers are specifically designed and made of materials that can withstand the rapid changes and extreme temperature differences encountered in working with liquid nitrogen. Even these special containers should be filled SLOWLY to minimize the internal stresses that occur when any material is cooled. Excessive internal stresses can damage the container.

**Do not cover or plug the entrance opening of any liquid nitrogen refrigerator or dewar. Do not use any stopper or other device that would interfere with venting of gas.**

These cryogenic liquid containers are generally designed to operate with little or no internal pressure. Inadequate venting can result in excessive gas pressure which could damage or burst the container. Use only the loose-fitting necktube core supplied or one of the approved accessories for closing the necktube. Check the unit periodically to be sure that venting is not restricted by accumulated ice or frost.

**Use proper transfer equipment.**

Use a phase separator or special filling funnel to prevent splashing and spilling when transferring liquid nitrogen into or from a dewar or refrigerator. The top of the funnel should be partly covered to reduce splashing. Use only small, easily-handled dewars for pouring liquid. For the larger, heavier containers, use a cryogenic liquid withdrawal device to transfer liquid from one container to another. Be sure to follow instructions supplied with the withdrawal device. When liquid cylinders or other large storage containers are used for filling, follow the instructions supplied with those units and their accessories.

**Do not overfill containers.**

Filling above the bottom of the necktube (or specified maximum level) can result in overflow and spillage of liquid when the necktube core or cover is placed in the opening.

**Never use hollow rods or tubes as dipsticks.**

When a warm tube is inserted into liquid nitrogen, liquid will spout from the top of the tube due to gasification and rapid expansion of liquid inside the tube.

**Warning** Nitrogen Gas Can Cause Suffocation Without Warning! ▲

**Store and use liquid nitrogen only in a well-ventilated place.**

As the liquid evaporates, the resulting gas tends to displace the normal air from the area. In closed areas, excessive amounts of nitrogen gas reduce the concentration of oxygen and can result in asphyxiation. Because nitrogen gas is colorless, odorless and tasteless, it cannot be detected by the human senses and will be breathed as if it were air. Breathing an atmosphere that contains less than 18% oxygen can cause dizziness and quickly result in unconsciousness and death.

**Note** The cloudy vapor that appears when liquid nitrogen is exposed to the air is condensed moisture; not the gas itself. The issuing gas is invisible. ▲

**Never dispose of liquid nitrogen in confined areas or places where others may enter.**

Disposal of liquid nitrogen should be done outdoors in a safe place. Pour the liquid slowly on gravel or bare earth where it can evaporate without causing damage. Do not pour the liquid on pavement.

# Appendix B Handling Liquid CO<sub>2</sub>

**Warning** High concentrations of CO<sub>2</sub> gas can cause asphyxiation! OSHA Standards specify that employee exposure to carbon dioxide in any eight-hour shift of a 40-hour work week shall not exceed the eight-hour time weighted average of 5000 PPM (0.5% CO<sub>2</sub>). The short term exposure limit for 15 minutes or less is 30,000 PPM (3% CO<sub>2</sub>). Carbon dioxide monitors are recommended for confined areas where concentrations of carbon dioxide gas can accumulate. ▲

**Store and use liquid CO<sub>2</sub> only in a well-ventilated place.**

As the liquid evaporates, the resulting gas tends to displace the normal air from the area. In closed areas, excessive amounts of CO<sub>2</sub> gas reduce the concentration of oxygen and can result in asphyxiation. Because CO<sub>2</sub> gas is colorless, odorless and tasteless, it cannot be detected by the human senses and will be breathed as if it were air. Breathing an atmosphere that contains less than 18% oxygen can cause dizziness and quickly result in unconsciousness and death.

**Note** The cloudy vapor that appears when liquid CO<sub>2</sub> is exposed to the air is condensed moisture; not the gas itself. The issuing gas is invisible. ▲

**Never dispose of liquid CO<sub>2</sub> in confined areas or places where others may enter.**

Disposal of liquid CO<sub>2</sub> should be done outdoors in a safe place. Pour the liquid slowly on gravel or bare earth where it can evaporate without causing damage. Do not pour the liquid on pavement.

# Appendix C First Aid

If a person seems to become dizzy or loses consciousness while working with liquid nitrogen or carbon dioxide, move to a well-ventilated area immediately. If breathing has stopped, apply artificial respiration. If breathing is difficult, give oxygen. Call a physician. Keep warm and at rest.

If exposed to liquid or cold gas, restore tissue to normal body temperature (98.6° F) as rapidly as possible, followed by protection of the injured tissue from further damage and infection. Remove or loosen clothing that may constrict blood circulation to the frozen area. Call a physician. Rapid warming of the affected part is best achieved by using water at 108° F. Under no circumstance should the water be over 112° F, nor should the frozen part be rubbed either before or after rewarming. The patient should neither smoke nor drink alcohol.

# Declaration of Conformity

**Manufacturer's Name:** Thermo Fisher Scientific (Asheville) LLC

**Manufacturer's Address:** 401 Millcreek Road  
Marietta, Ohio 45750  
U.S.A.

**Product Description:** ISOTEMP® ULT -86°C General Purpose Freezer

**Product Designations:** 8953 / IE1386V 8954 / IE1386D 8955 / IE1386A  
8956 / IE1786A 8957 / IE1786D 8958 / IE1786V  
8959 / IE2386V 8963 / IE2386D 8964 / IE2386A  
8965 / IU1386V 8966 / IU1386D 8967 / IU1386A  
8968 / IU1786A 8969 / IU1786D 8970 / IU1786V  
8971 / IU2386V 8972 / IU2386D 8973 / IU2386A  
8974 / IU2886D 8975 / IU2886V 943 / FB67700  
945 / FB67701 946 / FB67702

**Year of Initial CE Marking:** 2011

**Affected Serial Numbers:** Release 6  
(Release Level [REL#] shown on Serial Tag)

This product conforms to the following European Union Directive(s):

**EMC:** 2004/108/EC  
**LVD:** 2006/95/EC

This product conforms to the following Harmonized, International and National Standards:

<b>EMC:</b>	<b>LVD:</b>
EN 61326-1:2006	EN 61010-1 2 <sup>nd</sup> Edition
EN 61000-3-2	EN 60335-2-34 (applicable sections)
EN 61000-3-3	CSA C22.2 No. 61010-1 2 <sup>nd</sup> Edition
	UL 61010-1 2 <sup>nd</sup> Edition



7 July 2011

Eric Pickrell  
Regulatory Compliance Specialist

**ThermoFisher**  
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