A Chart Industries Company

MVE TEC 3000

TECHNICAL FREEZER MANUAL

MVE TEC 3000

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P/N 13289499 Rev F

Preface

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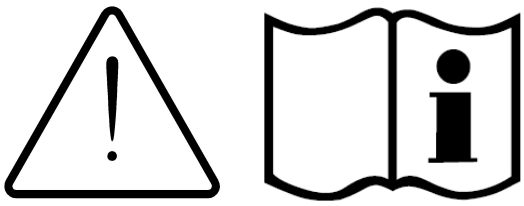
This manual covers the use and maintenance of MVE Cryogenic Freezers and the TEC 3000 control system. READ BEFORE USING THIS EQUIPMENT. It is intended for use by trained personnel only. All service and maintenance should be performed by an authorized MVE Distributor.



NOTE: All MVE models are Class I per IEC 61140, as the AC supply requires a protective earth ground. These devices are externally powered and intended for continuous operation. The general purpose cryogenic storage models are intended for professional use in research while the medical device versions are intended to be used in situations that directly support medical applications. They are not suitable for use with flammable anesthetics. These devices have been tested to, and are in compliance with, IEC 60601-1-2. The medical device versions of MVE models are Class IIa medical devices certified by a Notified Body and conform to Medical Device Directive 93/42/EEC.

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3. Safety

READ BEFORE OPERATING THIS EQUIPMENT

General

Liquid nitrogen (LN2) is used in MVE Cryogenic Freezers as a refrigerant. Understanding and following certain safety precautions is extremely important when handling LN2 and cryogenic containers (Dewars).

Liquid Nitrogen Properties

Nitrogen is a colorless, odorless, tasteless gas. Gaseous nitrogen makes up about 78% of the Earth's atmosphere by volume. Once collected and isolated, nitrogen can be liquefied.

Boiling Point @ 1 atm	-195.8°C , -320.3°F , 77.4 K
Thermal Conductivity (Gas)	25.83 mW/(m·K)
Heat of Vaporization (Liquid)	198.38 kJ/kg
Density @ 1 atm (Liquid)	1.782 lbs/L , 807.4 g/L , 808.6 kg/m^3

Liquid Nitrogen Safety

Transferring LN2 and operating the TEC 3000 should be done in accordance with the manufacturer/supplier instructions. It is important that all safety precautions written on the storage Dewar and recommended by the manufacturer be followed.

⚠WARNING⚠

- **Do not modify this equipment without authorization of the manufacturer.**
- **Nitrogen is a potential asphyxiant and can cause rapid suffocation without warning. Store and use in area with adequate ventilation. DO NOT vent container in confined spaces. DO NOT enter confined spaces where gas may be present unless area has been well ventilated. If inhaled, move to fresh air. If breathing is difficult, supplemental oxygen may be required. If not breathing, give artificial respiration. SEEK MEDICAL ATTENTION IMMEDIATELY!**

- **Liquid nitrogen can cause severe frostbite to the eyes or skin. DO NOT touch frosted pipes or valves. Cold nitrogen vapor can damage the eyes or skin. In case of frostbite, consult a physician at once. If a physician is not readily available, warm the affected area with water that is near body temperature.**
- **Never place LN2 in a sealed container without a pressure relief device. The expansion ratio of liquid nitrogen to gaseous nitrogen is approximately 1 to 700 (i.e. 1 cubic foot of LN2 becomes 700 cubic feet of gas when evaporated)**

The two most important safety aspects to consider when handling LN2 are adequate ventilation and eye and skin protection. Although nitrogen gas is non-toxic, it is dangerous in that the gas will displace oxygen in a normal breathing atmosphere. Liquid products are of even greater threat since a small amount of liquid evaporates into a large amount of gas. Therefore, it is imperative that cryogenic supply and storage Dewars be stored and operated in well-ventilated areas.
Persons transferring LN2 should make every effort to protect the eyes and skin from accidental contact with liquid or cold vapor. Chart MVE recommends the following protective clothing and accessories when transferring LN2 or handling hoses, valves, and plumbing components:

Recommended protective clothing

- Cryogenic gloves (loose fitting)
- Full-face shield or chemical splash goggles
- Cryogenic apron
- Long sleeve shirt and cuff less pants
- Closed toe shoes (no sandals)

Equipment Usage

Cryogenic containers must be operated in accordance with the manufacturer/supplier instructions. Safety instructions will also be posted on the side of each Dewar. Cryogenic Dewars must be kept in a well-ventilated area protected from weather and away from heat sources. In applications that use a modular liquid cylinder as a source of LN2, the supply will need to be replenished at regular intervals to ensure proper operation of the freezer. When exchanging liquid cylinders, follow the below procedure:

1. Allow all plumbing components to warm to room temperature before attempting to change supplies.
2. Close all valves associated with the liquid supply cylinder.
3. Relieve pressure in the plumbing assembly by initiating a brief fill by either pressing “Start Fill” or using the manual fill button.
4. Loosen the plumbing connection for the transfer hose at the liquid cylinder.
5. Remove empty liquid cylinder and replace with full liquid cylinder pressurized to 22 - 35 psig (1.52 - 2.41 bar).
6. Attach the transfer hose to the plumbing connection on the liquid cylinder. Ensure that the hose is connected to the connection labeled “LIQUID”.
7. Tighten the transfer hose plumbing connection at the liquid cylinder.
8. Open the liquid supply valve on the liquid cylinder.
9. Inspect plumbing for audible and visual leaks. Repair if necessary.
10. Manually initiate a fill to verify proper operation.

Recommended First Aid

Every site that stores and uses LN2 should have an appropriate Material Safety Data Sheet (MSDS) present. The MSDS may be obtained from the manufacturer/distributor. The MSDS will specify the symptoms of overexposure and first aid to be used. Here is a typical summary.

If symptoms of asphyxia such as headache, drowsiness, dizziness, excitation, excess salivation, vomiting, or unconsciousness are observed, remove to fresh air. If breathing has stopped, give artificial respiration. **CALL A PHSYICIAN IMMEDIATELY.** If breathing is difficult, supplemental oxygen maybe required. If exposure to cryogenic liquids or cold vapor occurs, restore tissue to normal, body temperature (37°C) as rapidly as possible, and then protect the injured tissue from further damage and infection.

Rapid warming of the affected areas is best achieved by bathing it in warm water. The temperature of the water used should not exceed 40°C. Under no circumstances should the frozen part be rubbed either before or after warming. If the eyes are involved, flush them thoroughly with warm water for at least 15 minutes. In case of massive exposure, remove clothing while showering with warm water. The patient should not drink alcohol or smoke. **CALL A PHYSICIAN IMMEDIATELY**.

4. Certifications and Listings

All fully automatic Chart MVE cryogenic freezer systems equipped with TEC 3000 controllers are UL / C-UL listed and CE marked to the Low Voltage Directive (LVD). Specially designated freezer models are also CE marked to the Medical Device Directive (MDD). The LVD is a European Union directive regulating the construction and operation of electrical equipment that is not considered a medical device. The MDD is a European Union directive regulating medical device construction and operation. These listings and certifications encompass the entire freezer system, and not just the electronic controller.

Authorized Representative:
Medical Product Services GmbH
Borngasse 20
35619 Braunfels, Germany

Chart MVE brand manufactured liquid nitrogen freezers covered in this manual are non-hazardous, open mouth vacuum insulated dewars. They are constructed of stainless steel and aluminum and specifically designed to hold liquid nitrogen. They are not subject to any pressure vessel codes as they are open to atmospheric pressure.

MVE liquid nitrogen containers are shipped empty without liquid nitrogen or any hazardous material from our factory. An MSDS is not available for the final formed and welded assembly. An MSDS on the stainless steel or aluminum alloys used is available but is not specific for the complete manufactured vessel.

5. Product Information

This section will give an overview of Chart MVE cryogenic freezers and components.

Chart MVE offers a wide range of LN2 freezers with TEC 3000 controllers that can accommodate a variety of inventory systems designed to meet all of your cryogenic storage needs. Each freezer is a hand-made, double-walled, vacuum insulated stainless steel Dewar designed to maintain temperature with minimal LN2 evaporation.

5.1. MVE Freezer Models

There are several series, or groups, of freezers, each of which offer specialized features and functionality. Each freezer has a descriptive name from which the highlighted features and performance specifications can be determined.

MVE (Series)(Capacity)(Turn-tray?)-(Temp?)(Cabinet?)(Full Auto?)-(Gas Bypass?)-(Battery Backup?)

Series	MVE Freezer Series (i.e. 800, 1500, 1800)
Capacity	Approximate 1.2 or 2.0 mL vial capacity in thousands
Turn-tray	Shape of turn-tray dividers, HE and HEco series only; P = pie-shaped, R = rectangular
Temp	“Top box” temperature rating, if applicable; -150°C or -190°C
Cabinet	C = cabinet model, if applicable
Full Auto	AF = Automatic Fill
Gas Bypass	GB = Hot Gas Bypass, if applicable
Battery Backup	BB = Battery Backup*
Medical Device Directive	MDD = European Union directive regulating medical device construction and operation.

*Battery Backup is standard ONLY for Medical Device Directive freezers.

Example: MVE 1536P-190F-GB-BB-MDD

MVE 1500 Series freezer with capacity for approximately 36,000 vials, pie-shaped turn-tray dividers, -190°C temperature rating, equipped with a TEC 3000, Hot Gas Bypass, and Battery Backup.

The Battery Backup can be added as an optional accessory for all other models.

Example: MVE 1536P-190AF-GB

MVE 1500 Series freezer with capacity for approximately 36,000 vials, pie-shaped turn-tray dividers, -190°C temperature rating, equipped with a TEC 3000, Hot Gas Bypass.

5.1.1. MVE High Efficiency / Vapor Series

The MVE High Efficiency / Vapor Series freezers will maintain a vapor storage temperature of either -150°C or -190°C with minimal LN2 evaporation while accommodating a wide variety of inventory systems.

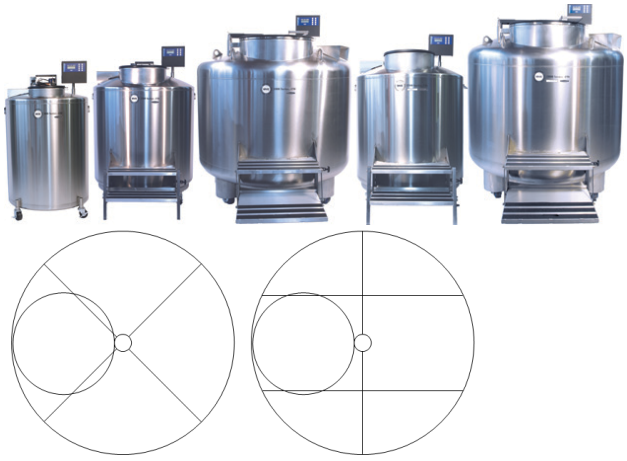


Figure 1: Top-view of HE Freezer showing offset neck and P and R turn-trays

Note: The values in the table for internal turn trays on the High Efficiency Freezers have a tolerance of +/- .25" (6mm).

Freezer Model	Minimum Door Width in. (mm)	Minimum Ceiling Height in. (mm)	Liftover Height in. (mm)	Turn-tray Platform Height In (mm)	Weight Empty lbs. (kg)	Weight Liquid Full lbs. (kg)	Qty of Casters	Direct Load per Caster (Full) lbs. (kg)
MVE 815P-150	32 (813)	75.1 (1908)	47.3 (1202)	6 (152)	475 (215)	1134 (514)	4	284 (129)
MVE 815P-190	32 (813)	75.1 (1908)	47.3 (1202)	6 (152)	475 (215)	1134 (514)	4	284 (129)
MVE 818P-190	32 (813)	84.2 (2138)	51.6 (1310)	6 (152)	495 (225)	1168 (530)	4	292 (133)
MVE 819P-190	32 (813)	90.1 (2289)	55.3 (1405)	6 (152)	515 (234)	1340 (608)	4	335 (152)
MVE 1536P-150	42 (1066)	83.2 (2115)	37.1 (944)	9 (228)	690 (313)	2037 (924)	4	509 (231)
MVE 1536P-190	42 (1066)	83.2 (2115)	37.1 (944)	9 (228)	690 (313)	2037 (924)	4	509 (231)
MVE 1539P-190	42 (1066)	87.8 (2230)	39.2 (995)	9 (228)	720 (327)	2140 (971)	4	535 (243)
MVE 1879P-150	60 (1524)	88.8 (2256)	38.7 (983)	9.5 (242)	1585 (719)	4458 (2022)	4	1115 (506)
MVE 1879P-190	60 (1524)	90.3 (2294)	40.2 (1021)	9.5 (242)	1721 (781)	4830 (2191)	4	1146 (520)
MVE 1892P-190	60 (1524)	100 (2540)	45.2 (1146)	9.5 (228)	1721 (781)	4875 (2211)	4	1219 (553)
MVE 1539R-150	42 (1066)	83.2 (2115)	37.1 (944)	9 (228)	690 (313)	2037 (924)	4	509 (231)
MVE 1542R-150	42 (1066)	87.8 (2230)	39.2 (995)	8 (203)	720 (327)	2140 (971)	4	535 (243)
MVE 1542R-190	42 (1066)	87.8 (2230)	39.2 (995)	9 (228)	720 (327)	2140 (971)	4	535 (243)
MVE 1881R-150	60 (1524)	88.8 (2256)	38.7 (983)	9.5 (242)	1606 (728)	4479 (2032)	4	1120 (508)
MVE 1881R-190	60 (1524)	88.9 (2257)	38.8 (985)	9.5 (242)	1721 (781)	4830 (2192)	4	1208 (548)
MVE 1894R-150	60 (1524)	98.6 (2504)	43.8 (1112)	9.5 (242)	1721 (781)	4875 (2211)	4	1219 (553)
MVE 1894R-190	60 (1524)	98.6 (2504)	43.8 (1112)	9.5 (242)	1721 (781)	4875 (2211)	4	1219 (553)

5.1.2. MVE Series

The MVE Series freezers are designed primarily for liquid phase storage, but can be used for vapor phase storage with the vapor storage accessory package. The wide neck opening allows easy access to stored samples. In vapor phase storage, these freezers will maintain a top box temperature of -90oC to -125°C.

Freezer Model	Minimum Door Width in. (mm)	Minimum Ceiling Height in. (mm)	Liftover Height in. (mm)	Weight Empty lbs. (kg)	Weight Liquid Full lbs. (kg)	Qty of Casters	Direct Load per Caster (Full) lbs. (kg)
MVE 205	20.4 (518)	71.1 (1806)	41 (1041)	195 (88)	365 (166)	4	91 (42)
MVE 510	23.9 (606)	71.7 (1822)	41.6 (1057)	281 (127)	577 (262)	4	144 (66)
MVE 616	27.4 (696)	71.5 (1816)	41.4 (1051)	310 (145)	748 (339)	4	187 (85)
MVE 1426	33.8 (858)	70.1 (1781)	40 (1016)	490 (222)	1181 (536)	4	295 (134)
MVE 1839	46.1 (1171)	92.3 (2345)	47.3 (1202)	750 (341)	1950 (885)	6	325 (148)

5.1.3. MVE Stock Series

The MVE Stock Series freezers are designed primarily for storage of either vials or straws on canes in liquid nitrogen, but can also be used for vapor phase storage with the vapor storage accessory package. Dual lids on the MVE 1318 and two-tier turn-trays in the MVE 816P-2T-190 and the MVE 1877P-2T-150 are example features of these freezers built for durability and ergonomic sample retrieval.

Freezer Model	Minimum Door Width in. (mm)	Minimum Ceiling Height in. (mm)	Liftover Height in. (mm)	Weight Empty lbs. (kg)	Weight Liquid Full lbs. (kg)	Qty of Casters	Direct Load per Caster (Full) lbs. (kg)
MVE 808	31 (787)	65.1 (1653)	39.1 (992)	250 (114)	660 (300)	3	220 (100)
MVE 816P-2T-190	32 (813)	59.5 (1512)	48.3 (1227)	475 (215)	1155 (524)	4	288.75 (131)
MVE 1318	42 (1067)	62.8 (1595)	43.6 (1107)	469 (213)	1328 (602)	3	332 (201)
MVE 1842P-150	60 (1524)	73 (1853)	42.5 (1078)	1167 (530)	2798 (1270)	4	699.5 (317.5)
MVE 1877P-2T-150	60 (1524)	67.5 (1716)	36.3 (923)	1600 (726)	4094 (1857)	4	1023.5 (464.25)

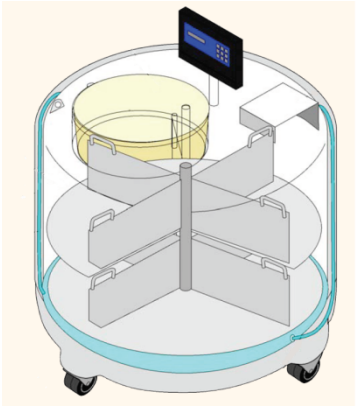


Figure 2: Diagram showing innovative two-tier turn-tray designed to maximize storage capacity while minimizing floor space.

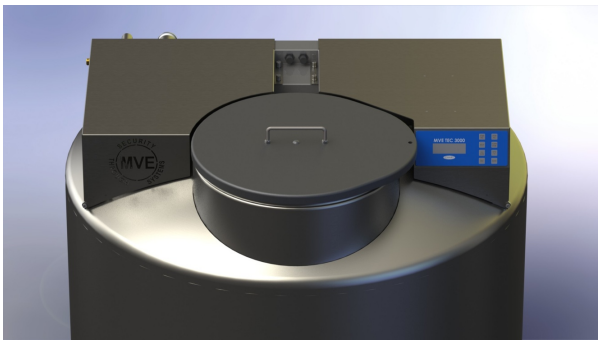
5.1.4. MVE Cabinet Series

The MVE Series freezers are designed primarily for liquid phase storage, but can be used for vapor phase storage with the vapor storage accessory package. The wide neck opening allows for ergonomic sample retrieval and the aesthetic square cabinet design fits snugly into tight corners.

Freezer Model	Minimum Door Width in. (mm)	Minimum Ceiling Height in. (mm)	Liftover Height in. (mm)	Weight Empty lbs. (kg)	Weight Liquid Full lbs. (kg)	Qty of Casters	Direct Load per Caster (Full) lbs. (kg)
MVE 616	28 (711)	71.5 (1816)	41.4 (1051)	352 (160)	785 (356)	4	196 (89)
MVE 1426	34.8 (883)	70.3 (1786)	40.2 (1021)	530 (240)	1198 (543)	4	300 (136)

5.1.5. MVE HEco Series

The MVE HEco Series freezers will maintain a vapor storage temperature of -190°C with minimal LN2 evaporation while accommodating a wide variety of inventory systems. This freezer is designed for easier access to the plumbing stack. This also allows for lower height clearance. The HEco is available only in the automatic fill version.
Model description example MVE HECO 1536P-190AF-GB

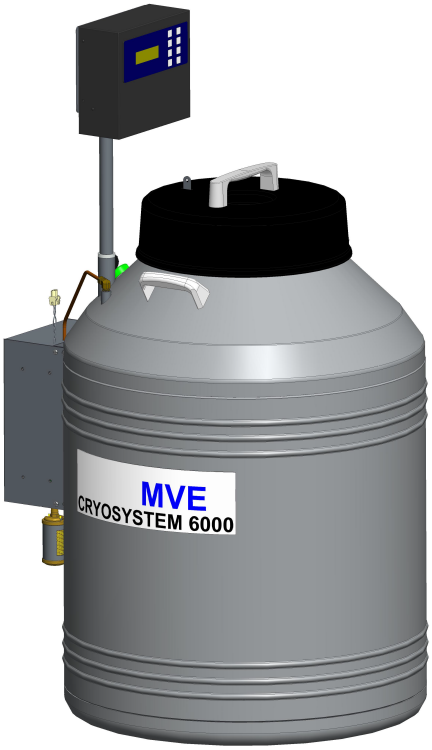


CAUTION: Pinch hazard, use caution when opening and closing the plumbing and electrical enclosures.

5.1.6. CryoSystem 6000 Full Auto

The MVE CryoSystem is designed primarily for liquid phase storage. The durable, tamper-proof lid design with its wide neck opening allows for ergonomic sample retrieval. The unique design is manufactured with the TEC3000 and plumbing system.

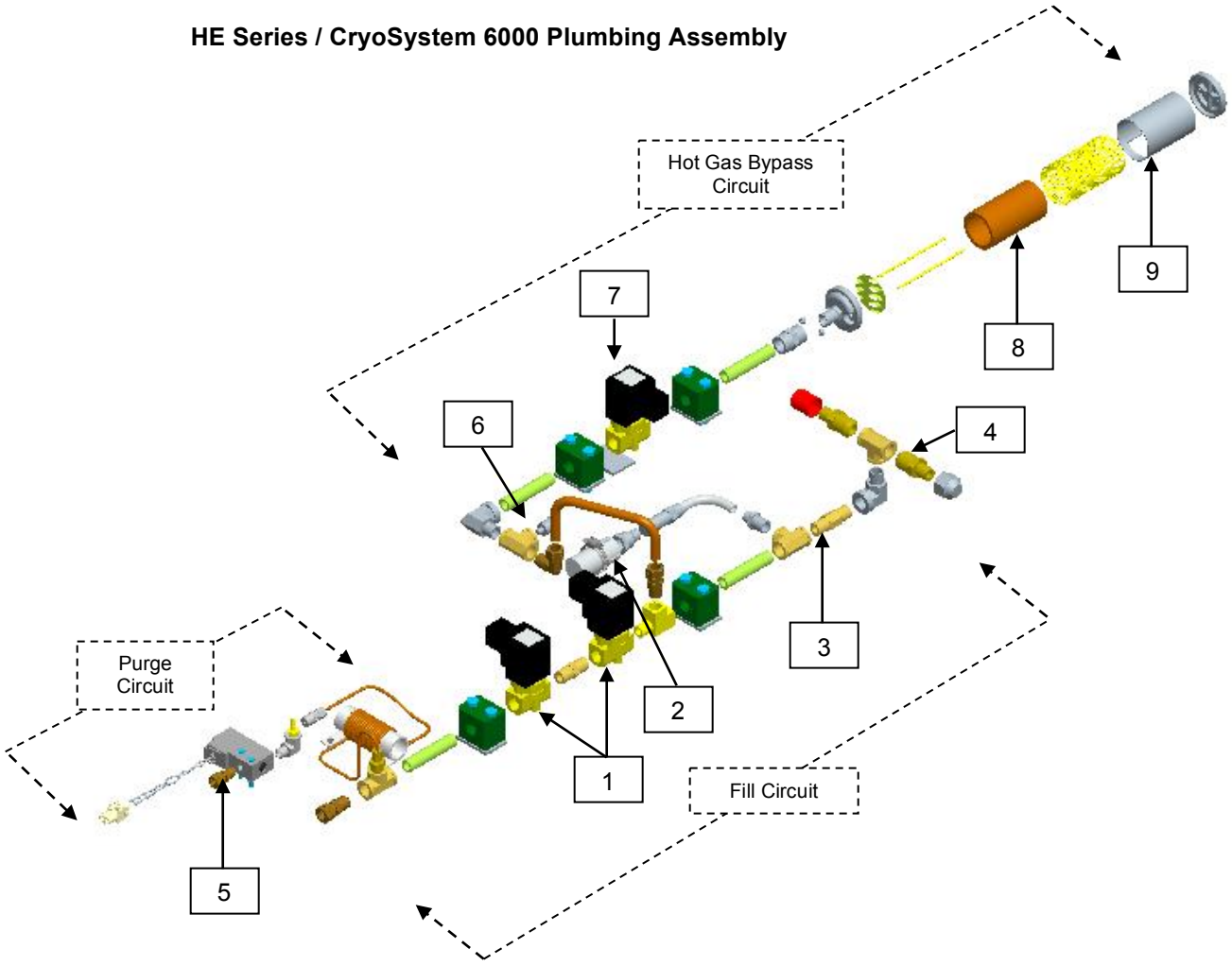
CryoSystem 6000 Full Auto with Gas bypass and TEC3000



5.2 Plumbing Assembly

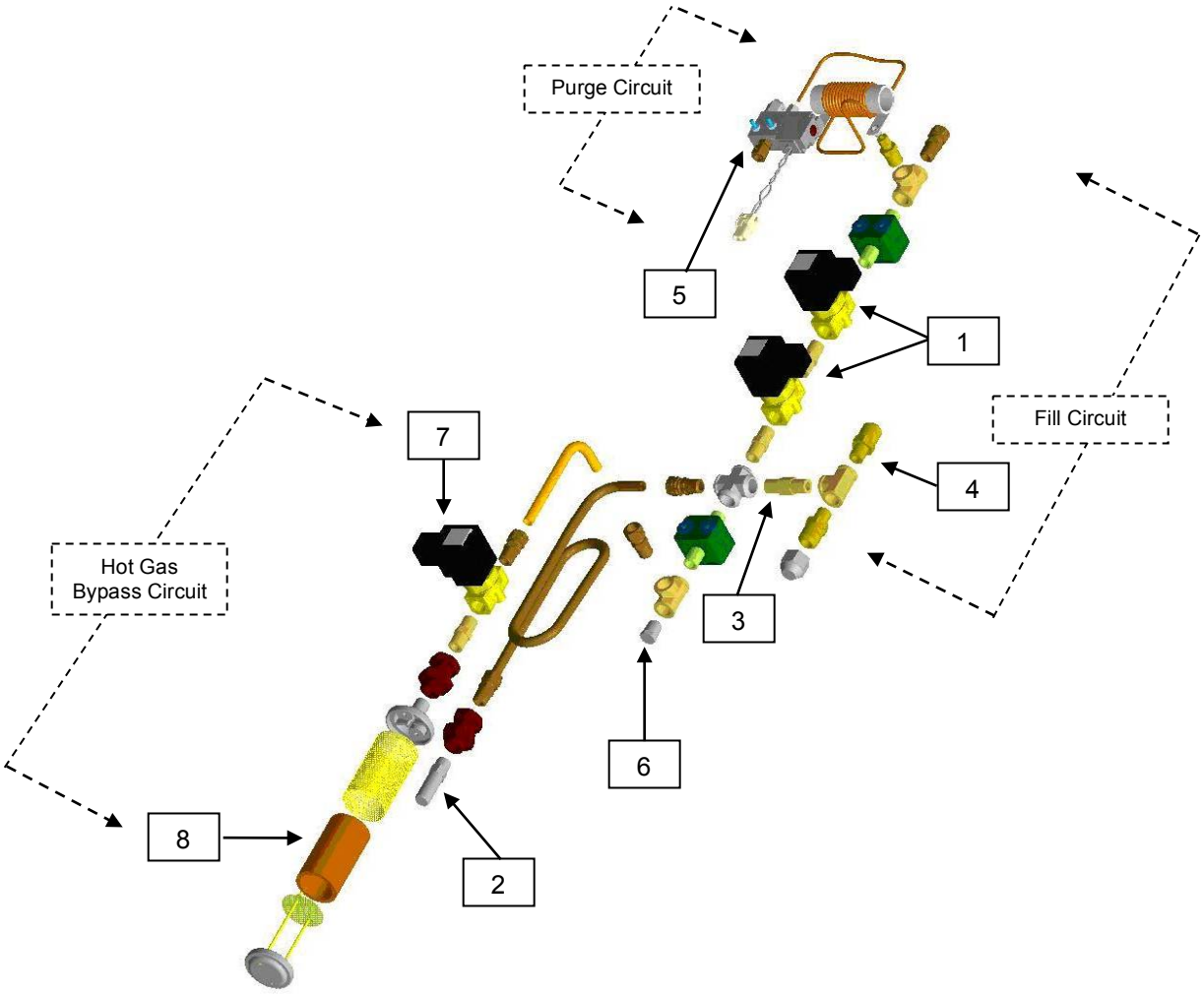
The plumbing assembly carries and regulates the flow of LN2 from the liquid supply through the annular fill line, and into the freezer. There are three plumbing assembly configurations; one for the HE/Stock Series, one for the HEco Series, and one for the MVE/Cabinet Series. Each one of these configurations are comprised of three main circuits: fill circuit, purge circuit, and optional gas bypass circuit.

HE Series / CryoSystem 6000 Plumbing Assembly



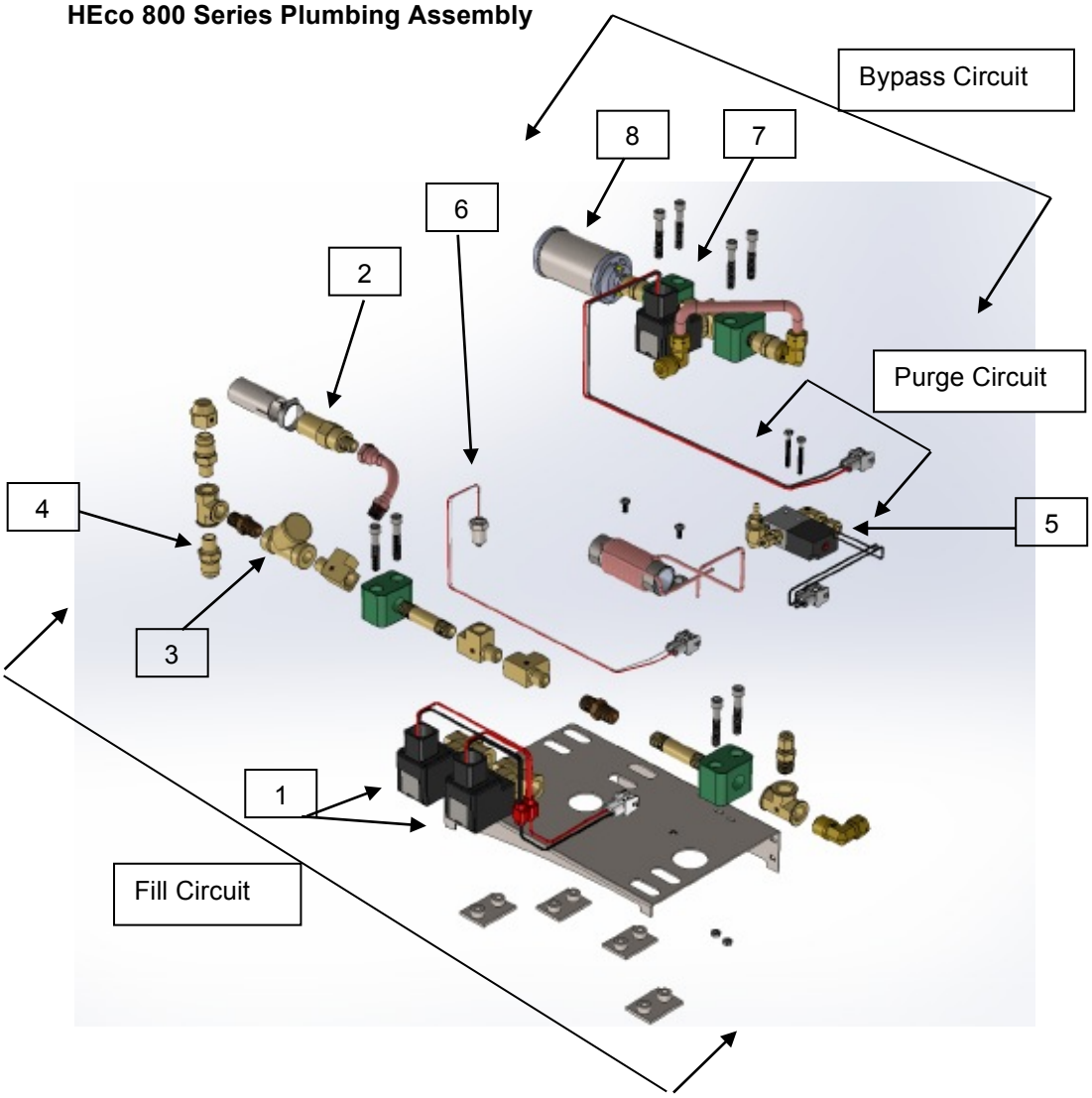
Key	Part Number	Component	Spec Details
1	14224611S	Fill Solenoid Valve	24 VDC, R ≈ 70 Ω (single), 35 Ω (dual)
2	1810032	Pressure Relief Valve	50 PSI (3.45 bar)
3	11648945	Inline Filter	40-micron
4	1110052	Fill Transfer Hose Connections	½ in. ODT, 45° flare, ¼ in. MPT
5	13284954S	Purge (3-way) Solenoid Valve	24 VDC, R ≈ 140 Ω
6	10713400	Gas Bypass Temp Sensor	Pt-1000 RTD
7	14224611S	Gas Bypass Solenoid Valve	24 VDC, R ≈ 70 Ω
8	11499812	Gas Bypass Muffler	-
9	11885449	Gas Bypass Muffler Deflector	-

MVE Series Plumbing Assembly



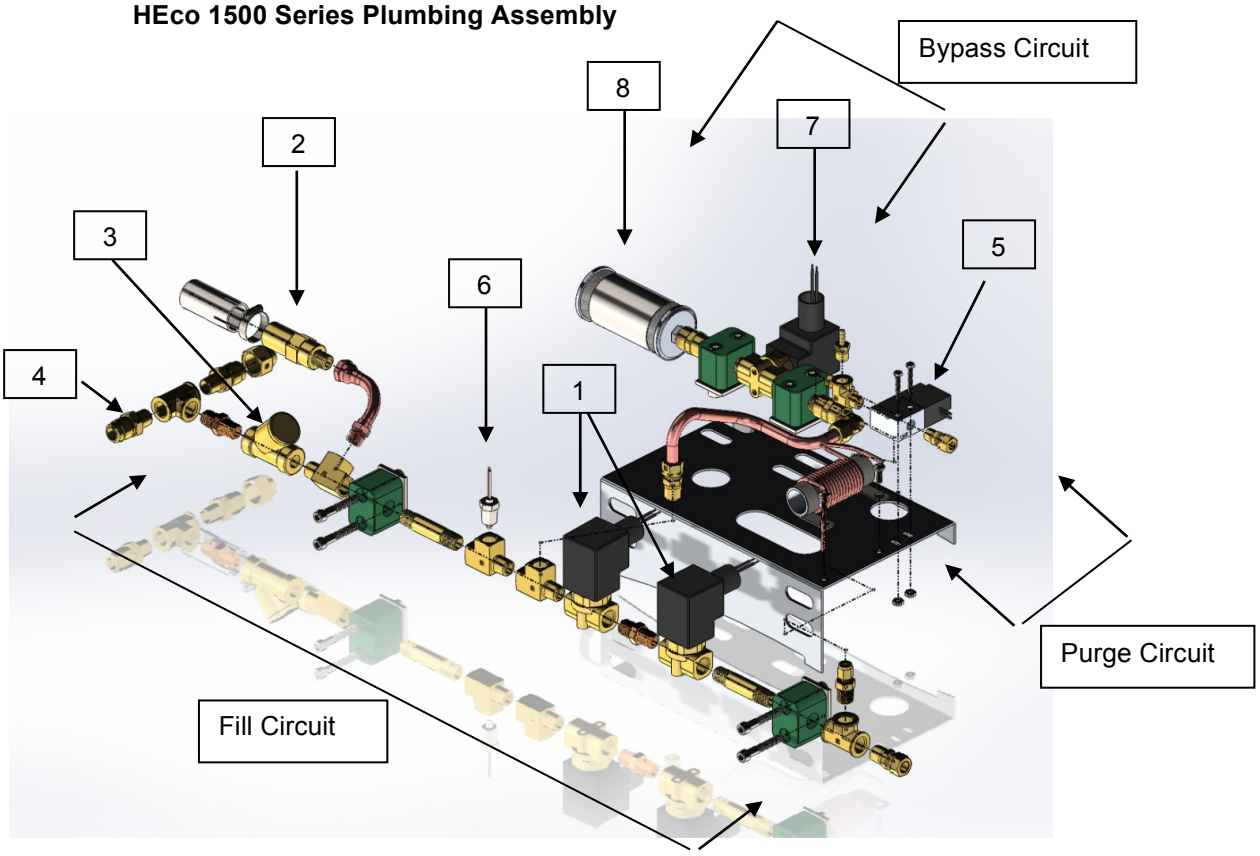
Key	Part Number	Component	Spec Details
1	14224611S	Fill Solenoid Valve	24 VDC, R ≈ 70 Ω (single), 35 Ω (dual)
2	1810032	Pressure Relief Valve	50 PSI (3.45 bar)
3	11648945	Inline Filter	40-micron
4	1110052	Fill Transfer Hose Connections	½ in. ODT, 45° flare, ¼ in. MPT
5	13284954S	Purge (3-way) Solenoid Valve	24 VDC, R ≈ 140 Ω
6	10713400	Gas Bypass Temp Sensor	Pt-1000 RTD
7	14224611S	Gas Bypass Solenoid Valve	24 VDC, R ≈ 70 Ω
8	11499812	Gas Bypass Muffler	-

HEco 800 Series Plumbing Assembly



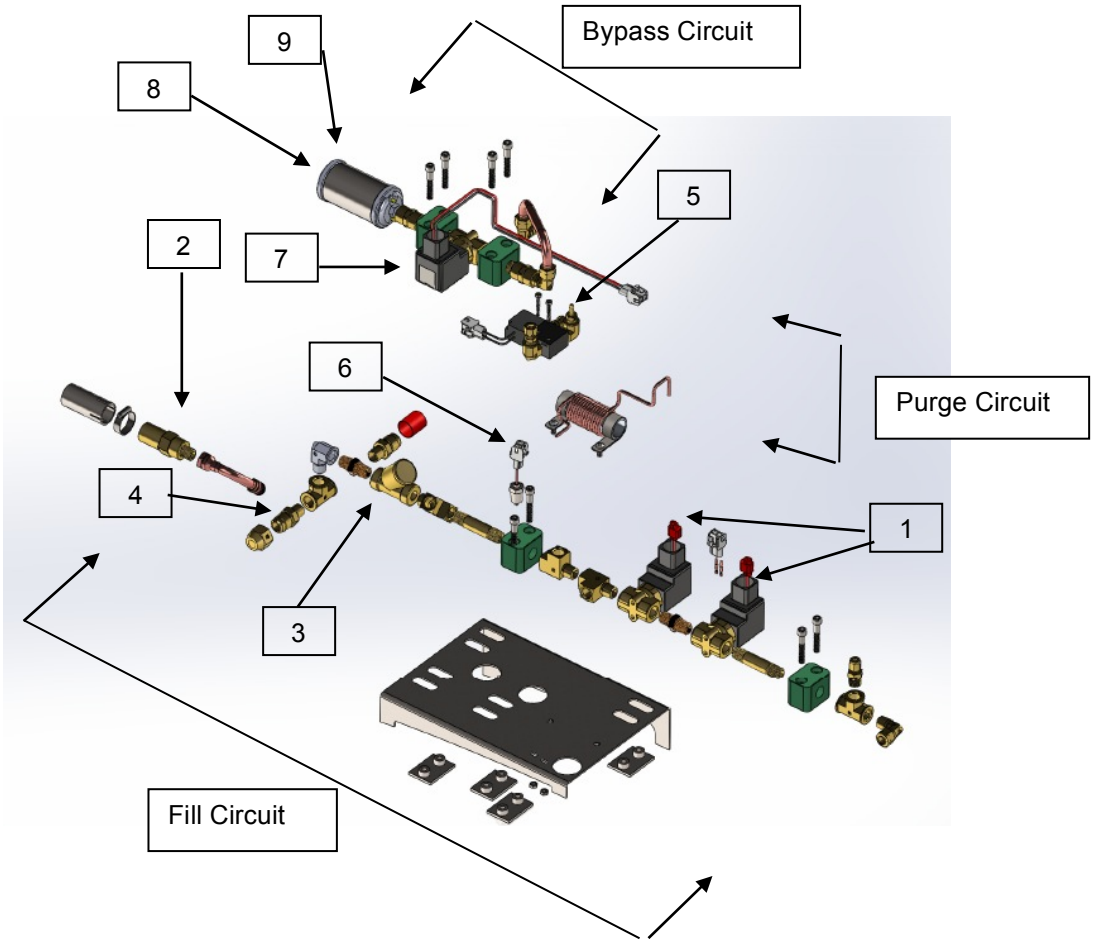
Key	Part Number	Component	Spec Details
1	14224611S	Fill Solenoid Valve	24 VDC, R ≈ 70 Ω (single), 35 Ω (dual)
2	1810032	Pressure Relief Valve	50 PSI (3.45 bar)
3	20669243	Y Strainer (Filter)	40-micron
4	1110052	Fill Transfer Hose Connections	½ in. ODT, 45° flare, ¼ in. MPT
5	13284954S	Purge (3-way) Solenoid Valve	24 VDC, R ≈ 140 Ω
6	10713400	Gas Bypass Temp Sensor	Pt-1000 RTD
7	14224611S	Gas Bypass Solenoid Valve	24 VDC, R ≈ 70 Ω
8	11499812	Gas Bypass Muffler	-
9	11885449	Gas Bypass Muffler Deflector	-

HEco 1500 Series Plumbing Assembly



Key	Part Number	Component	Spec Details
1	14224611S	Fill Solenoid Valve	24 VDC, R ≈ 70 Ω (single), 35 Ω (dual)
2	1810032	Pressure Relief Valve	50 PSI (3.45 bar)
3	20669243	Y Strainer (Filter)	40-micron
4	1110052	Fill Transfer Hose Connections	½ in. ODT, 45° flare, ¼ in. MPT
5	13284954S	Purge (3-way) Solenoid Valve	24 VDC, R ≈ 140 Ω
6	10713400	Gas Bypass Temp Sensor	Pt-1000 RTD
7	14224611S	Gas Bypass Solenoid Valve	24 VDC, R ≈ 70 Ω
8	11499812	Gas Bypass Muffler	-
9	11885449	Gas Bypass Muffler Deflector	-

HEco 1800 Series Plumbing Assembly

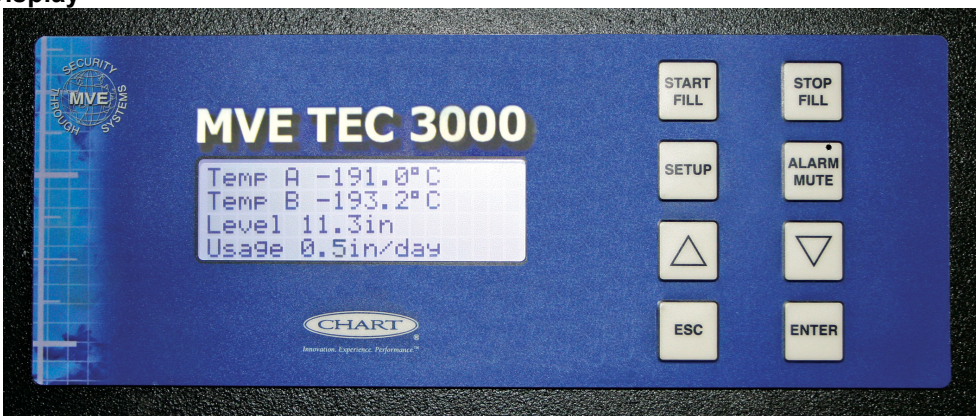


Key	Part Number	Component	Spec Details
1	14224611S	Fill Solenoid Valve	24 VDC, R ≈ 70 Ω (single), 35 Ω (dual)
2	1810032	Pressure Relief Valve	50 PSI (3.45 bar)
3	20669243	Y Strainer (Filter)	40-micron
4	1110052	Fill Transfer Hose Connections	½ in. ODT, 45° flare, ¼ in. MPT
5	13284954S	Purge (3-way) Solenoid Valve	24 VDC, R ≈ 140 Ω
6	10713400	Gas Bypass Temp Sensor	Pt-1000 RTD
7	14224611S	Gas Bypass Solenoid Valve	24 VDC, R ≈ 70 Ω
8	11499812	Gas Bypass Muffler	-
9	11885449	Gas Bypass Muffler Deflector	-

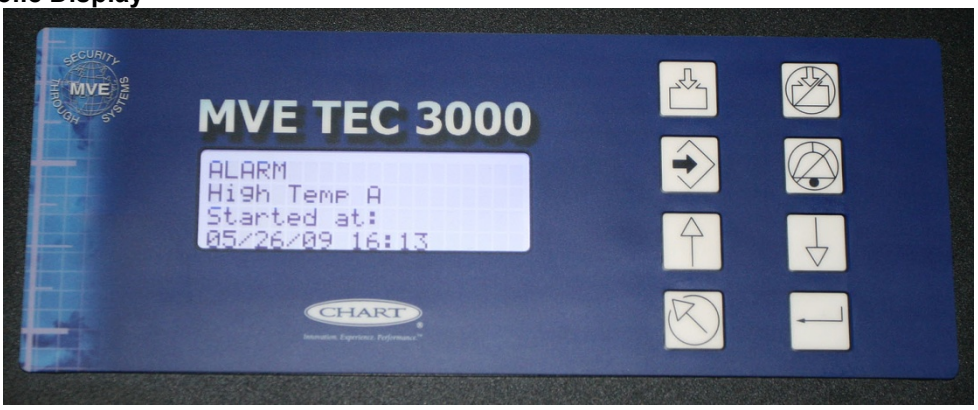
5.3 TEC 3000 Display

The TEC 3000 front panel display is the primary user interface for the TEC 3000. There are two display options: text or symbolic.

Text Display



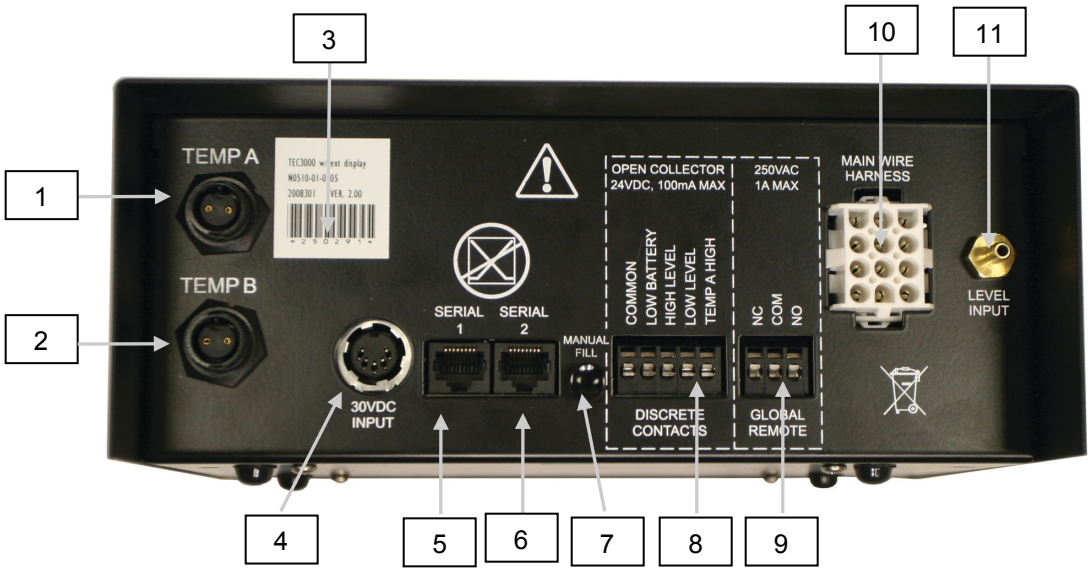
Symbolic Display



LDC Display	20 x 4 LCD with backlight
START FILL Key	Used to manually initiate a fill
STOP FILL Key	Used to manually terminate a fill – Disables Auto Fill for 30 minutes
SETUP Key	Used to access Setup Menus and parameters
ALARM MUTE Key	Used to silence the audible alarm for 30 minutes. Will reset the latching alarm once it has been corrected
▲ Key	Used to increase parameter values or to toggle “YES/NO” or “ON/OFF” values
▼ Key	Used to decrease parameter values or to toggle “YES/NO” or “ON/OFF” values
ESC Key	Used to escape or exit a menu or menu level
ENTER Key	Used to select a menu or value or save a setting change

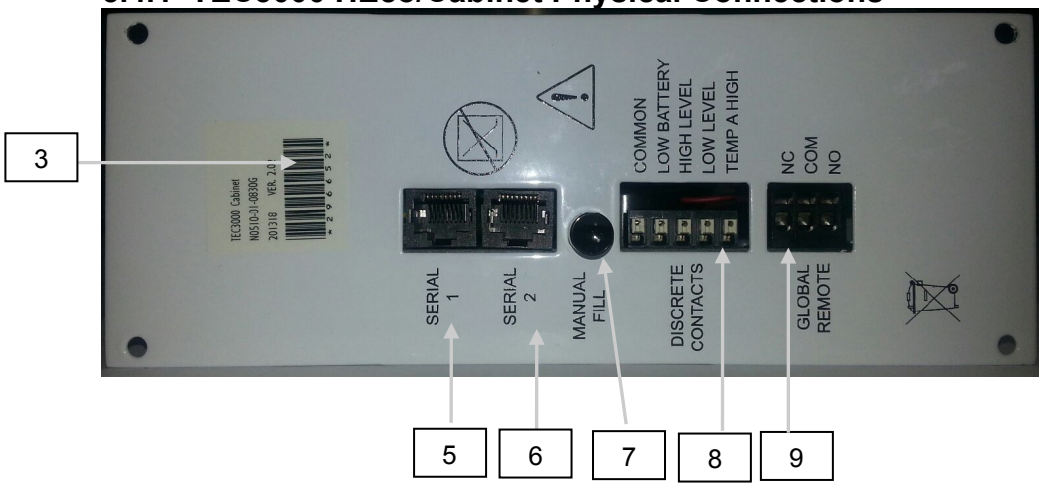
5.4 TEC 3000 Stand Alone Back Panel / Physical Connections

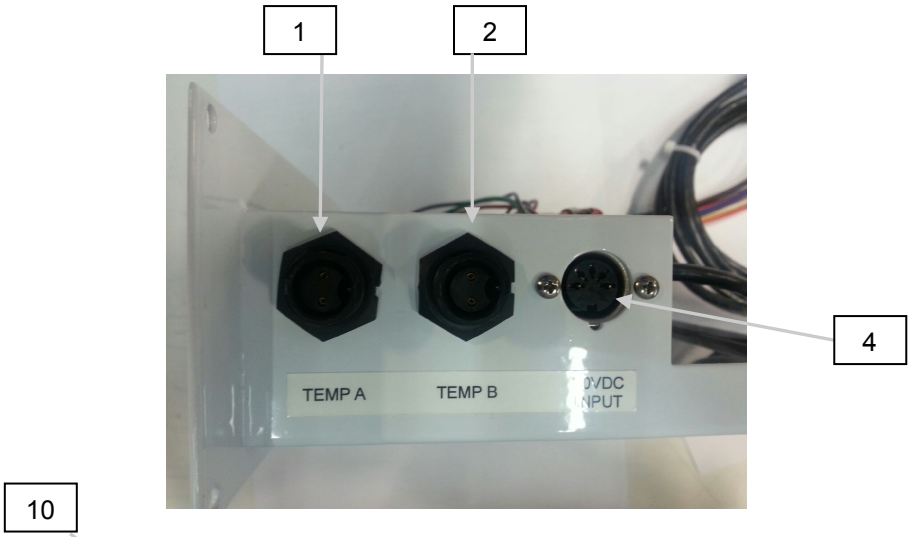
The TEC 3000 physical and electrical connections are located on the bottom of the stand-alone (non-cabinet) controller and on the back panel of the cabinet controller.



1	Temp A Port	Connection for Temp A probe
2	Temp B Port	Connection for Temp B probe
3	Serial Number Barcode	TEC 3000 serial number written below barcode
4	30 VDC Power Input	Main power supply connection
5	Serial 1 Port	RJ-45 connection for Serial/COM 1
6	Serial 2 Port	RJ-45 connection for Serial/COM 2
7	Manual Fill Button	Used to manually fill freezer. When depressed and held, the fill valves open. When released, the fill valves close.
8	Discrete Contacts	Open collector alarm terminals
9	Global Remote	Dry contact alarm terminals
10	Wire Harness Connection	12-pin wire harness connection to plumbing assembly, lid switch, and battery backup
11	Level Connection	Level signal input. Clear, vinyl tube connects to hose barb

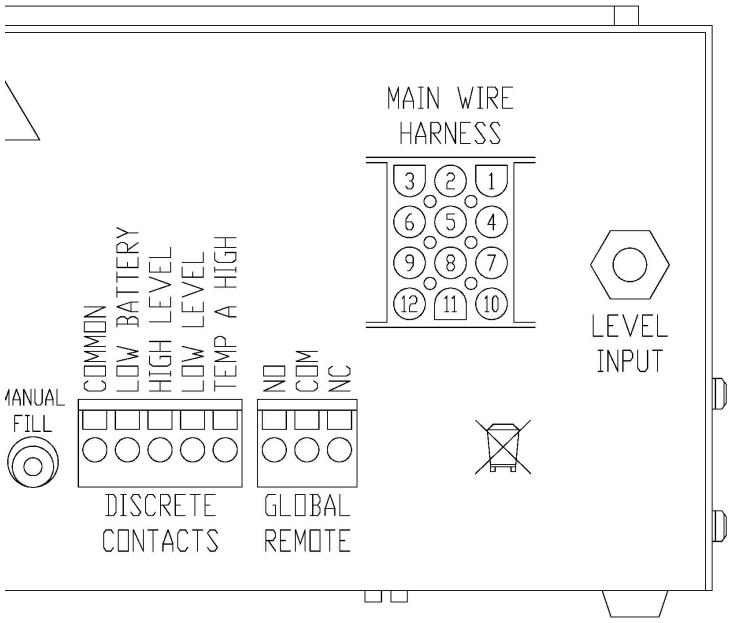
5.4.1 TEC3000 HEco/Cabinet Physical Connections




1
2
4
TEMP A
TEMP B


10
11

5.4.2 TEC3000 12-Pin Wiring Harness Connections



POSITION	DESCRIPTION	WIRE COLOR	WIRE GAUGE	LENGTH
1	+24VDC BATTERY BACKUP	DARK BLUE	18	50"
2	-24VDC BATTERY BACKUP	ORANGE	18	50"
3	+ LID SWITCH	BLACK WHITE STRIPE	22	96"
4	+ FILL VALVE	BROWN	18	82"
5	- FILL VALVE	PURPLE	18	82"
6	- LID SWITCH	RED GREEN STRIPES	22	96"
7	+ PURGE VALVE	YELLOW	20	48"
8	- PURGE VALVE	RED	20	48"
9	+ BYPASS SENSOR	RED	22	67"
10	+ BYPASS VALVE	BLACK	18	75"
11	- BYPASS VALVE	GRAY	18	75"
12	- BYPASS SENSOR	WHITE	22	67"

5.5 Specifications

TEC 3000 Dimensions (stand-alone)	
Length	9.1 in. (232 mm)
Width	3.5 in. (89 mm)
Height	8.0 in. (203 mm)
Weight	6.5 lbs. (2.95 kg)
Display	
Type	Liquid Crystal Display (LCD) with backlight
Size	20 x 4 Character
Resolution	8 x 5 Pixels per Character
Keypad	8 keys, Multi-function
Electrical – TEC 3000 Only	
Input Voltage	30 VDC
Input Current (max)	5 A
Input Current (continuous)	1 A
Power Consumption (max)	28 W
Power Consumption (continuous)	6 W
Fill Valve Output Voltage	24 VDC
Short Protection	Current limiting, automatic reset
Electrical – Jerome Power Supply (WSL730M V1)	
Input Voltage	110 – 230 VAC
Input Frequency	50 – 60 Hz
Output Voltage	30 VDC
Max Current Capability	3 A
Input Current	0.73 A @ 110 VAC 0.35 A @ 230 VAC
Power Requirements – TEC 3000 + Power Supply	
Input Voltage	110-230VAC/50-60Hz
Input Current (max)	.73A@110VAC
Input Current (continuous)	.35A@230VAC
Input Power (max)	30 Watts
Input Power (continuous)	8 Watts
TEC 3000 Physical Connections	
Temperature Probes	2-pin twist lock
Input Power	5-pin DIN
Output Power / Sensors / Battery Backup	15-pin AMP
Serial Ports	RJ-45, 4-pin RS-485
Temperature Sensor	
Type	2-wire Platinum RTD (Pt-1000)
Quantity	2
Resistance	1000 Ω @ 0°C
Sensitivity	3.85 Ω / °C
Temperature Measurement	
Resolution	0.1°C (0.2°F)
Accuracy – Single Point Calibration *	± 1.0°C (1.8°F)
– Two Point calibration **	± 2.0°C (3.6°F)
Range	- 200°C to 70°C (- 328°C to 158°F)
Level Measurement	
Type	Differential Pressure Sensor
Accuracy	± 0.5 in. (13 mm) LN2
Resolution	0.1 in. (2.5 mm)
Range	3.0 in. to 48 in. (76 mm to 1219 mm)

* Accuracy determined over range of -200°C to -135°C. Accuracy decreases slightly as range increases
** Accuracy determined over a range of -200°C to 0°C. Accuracy decreases slightly as range increase

5.6 Operating Environment

Ambient Temperature and Relative Humidity

MVE cryogenic freezers are designed to be operated in environments near room temperature (65°F – 80°F, 18°C – 27°C) and relative humidity below 50%. Due to the large gradient between LN2 and ambient temperatures, an additional change of a few degrees will not have a significant impact on the freezer performance. Although temperature changes will affect the open top MVE and MVE Stock series freezers to a greater degree, it again will not be a significant effect. The relative humidity should be maintained low enough so that condensation does not form on the TEC 3000. Elevated humidity levels can lead to excessive condensation and frost on and around the lid. In situations where the relative humidity is high and uncontrollable, the lid should be routinely wiped dry to prevent ice formation. Should significant ice formation develop, thaw as necessary. Refer to the Preventative Maintenance procedures for details.

Atmospheric Pressure

MVE cryogenic freezers are designed to be operated in environments with atmospheric pressure range of 8.2 psi (57.2 kPa) to 14.7 psi (101 kPa).

Thermal Load

Since MVE Freezers use LN2 as the refrigerant and do not employ any type of mechanical refrigeration, the thermal load will be negligible to negative.

6. Installation and Startup

This section will review the basic receiving, installation, and startup procedures for MVE Freezers. These instructions can also be applied to set up the CryoSystem 6000 Full Auto. Always inspect the bill of lading for accuracy and external crate/packaging for damage before accepting the shipment.

Included with each full auto freezer:

- Literature Packet
  - TEC 3000 Quick Start Reference Guide – PN 13289481
  - Manual Freezer Status Log – PN10936355
  - Warranty Statement / Registration / Certificate
- TEC 3000 – Packaged in box separately for HE/MVE Series models
- Transfer hose – 6 ft. – Inside freezer
- MVE Dipstick – Inside freezer
- Desiccant bag – To be removed and discarded – Inside freezer
- Liquid Nitrogen handling instructions
- MVE Checklist – Signed by shipping inspector



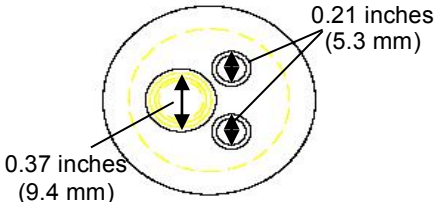
Installation

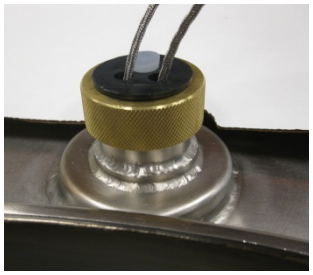
NOTE: Do not apply power to the TEC 3000 controller or connect an LN2 supply until later in this procedure to avoid injury or damaging the equipment.

Following the careful uncrating and unpacking of the freezer, install using these basic instructions. Cabinet Series freezers will be shipped with some of the connections described below already installed.

NOTE: Only install the freezer on a level surface. Never fill freezer and move to another location. Always fill the freezer where it is to be installed/used.

- Locate the temperature sensor tube assembly that will house the two temperature probes. For HE, HEco, and some Stock Series freezers, a three-tube temperature sensor assembly will be installed in the center of the top of the freezer. The two smaller tubes are designed to house the included temperature probes. The third, larger tube is designed to accommodate a third-party temperature probe. A silicone plug will be installed in this third tube. If the third tube is going to be used, simply remove the silicone plug. For the MVE Series (all open top freezers), a dual sensor tube will be installed along the inside wall of the freezer storage space. *The CryoSystem 6000 temperature probes are inserted into the neck area.*





- Insert the two temperature probes into the sensor tubes and position the sensors at the preferred height in the freezer space. Selecting probe A and B as well as the sensor placement is adjustable and completely up to the user. MVE does recommend placing sensor (Temp A) at the “top box” level. This refers to the level in the freezer space where the highest sample is being stored. If storing vials in boxes, then this would be at the level with the top box. This is recommended as it will be the warmest temperature experience by samples being stored in the freezer space.
- Connect the temperature probes to the TEC 3000 temperature ports using the twist lock connectors.

- For HEco models, once the temperature probes are in the desired position the freezer is ready to be filled. Connect transfer hose to its fill source and proceed to step 2 of the first fill start up procedure.
- For HE models, once the temperature probes are in the desired position, apply a small amount of the silicone sealant, included with the freezer, surrounding the temperature probes where they enter the sensor tubes. This will help maintain their position and help keep moisture from entering the freezer storage space. Proceed to the next step.

- Connect the clear vinyl tubing to the TEC 3000 Level Input hose barb and connect the other end of the tubing to the 3-way purge valve.
- Ensure all of the plumbing assembly connections to the TEC 3000 wire harness are secure.

NOTE: Do not connect the battery backup (if equipped) to the wire harness until later in the installation procedure.

- Connect the 12-pin wire harness to the TEC 3000 wire harness connection.

- If the freezer is equipped with battery backup measure the voltage at the end connector for approximately 24VDC to 27VDC; if no voltage is present, the included battery fuse must be installed before connecting the battery to the main wire harness. Open the battery enclosure and unscrew the fuse harness. Install the fuse; close the fuse harness and the battery enclosure. (This is done at the factory but should be verified at installation)

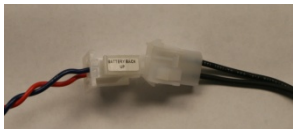
NOTE: Do not connect the battery backup to the main wire harness until the power supply has been verified to power up the controller

- Plug in the power supply to an appropriate wall outlet with the proper AC voltage. Avoid wall outlets that are connected to emergency generator power if possible. Although an uninterruptible power supply (UPS) is ideal to ensure continuous power, a surge protector or power conditioner is recommended.
- Plug the power supply into the TEC 3000 30 VDC power input. The TEC 3000 display should illuminate and begin the startup sequence.

⚠ WARNING ⚠

To avoid risk of electrical shock, this equipment must only be connected to a properly grounded power source or outlet.

- Following the startup sequence, the TEC 3000 may start to alarm. This is normal.
- Press “Alarm Mute” to silence the audible buzzer for 30 minutes. For installation and startup purposes, the alarm buzzer can be disabled; however, be sure to enable it when installation is complete. For instructions, see the Alarm Buzzer page in Section 6 of this manual.
- Connect the battery backup to the main wiring harness. While running on outlet power, the TEC 3000 supplies a steady 27 VDC trickle charge to the battery backup. The battery backup may need to be charged for several hours before it is able to power the TEC 3000.



- Remove a caplug from the fill tee on the plumbing assembly in order to connect the LN2 supply. If using an LN2 cylinder as the liquid supply, securely connect and tighten the transfer hose to both the fill tee connection and the supply connection labeled “LIQUID”. If using a bulk LN2 supply system, securely connect and tighten the supply connection to the freezer fill tee connection.

  NOTE: The recommended LN2 supply pressure is 22-35 psig (1.52 - 2.41 bar).

First Fill Startup procedure

1. Once the freezer has been properly installed, begin the first fill procedure. Fill freezer at the desired location where it is to be used. Do not fill to move freezer to another location.
2. Open or remove the lid for the first fill due to the accelerated LN2 evaporation rate when filling a warm freezer. If the freezer is equipped with a lid switch, engage the manual override (see the Lid Switch section of this manual for more info).
3. Verify supply pressure at 22-35 psig (1.52 – 2.41 bar) open valve and press “Start Fill” to begin filling the freezer.
4. The first fill will take significantly longer than subsequent fills due to a warm freezer.
5. It is recommended to place empty inventory system components such as racks, boxes, frames, or canisters in the freezer during the first fill. This will cool the inventory system as well as help the freezer reach its top box temperature rating faster.
6. It is normal for some condensation or frost to develop around the neck opening during the initial fill.
7. Once the TEC3000 reads a level; press stop fill; allow liquid to equalize and insert dipstick; verify level to the controller level display; change the offset value (+ or -) to match liquid level; press start fill to continue the fill process. When freezer has reached its high level set point wait 10 minutes for system to equalize then verify level with dipstick and calibrate if necessary.
8. Once the TEC3000 matches freezer LN2 level close or place the lid and allow the freezer to equilibrate and reach its temperature rating.
9. It is recommended that biological samples are not introduced into the freezer until several days after the top box temperature has stabilized at or below the freezer’s temperature rating. It is recommended to restart controller after 24 hours of initial install to reset the Liquid Usage.
10. Refer to the Operations section of this manual for further instructions.

Note: Pressing Stop Fill will disable TEC3000’s automatic fill function for 30 minutes.

7. Operation

This section of the manual will detail the functions and features of the TEC 3000 and demonstrate how to access and adjust the various user settings and options.

All MVE Freezers utilize LN2 as the means of refrigeration. Under atmospheric conditions, the temperature of LN2 is -196°C (-320°F, 77 K). Depending on the model, the LN2 resides either in or below the freezer storage space. Through normal usage and time, the LN2 will naturally boil off reducing the amount of refrigerant in the freezer. It is imperative that the LN2 level be properly maintained in order for the storage space temperature to be maintained. This, along with monitoring and recording temperature, is the main function of the TEC 3000.

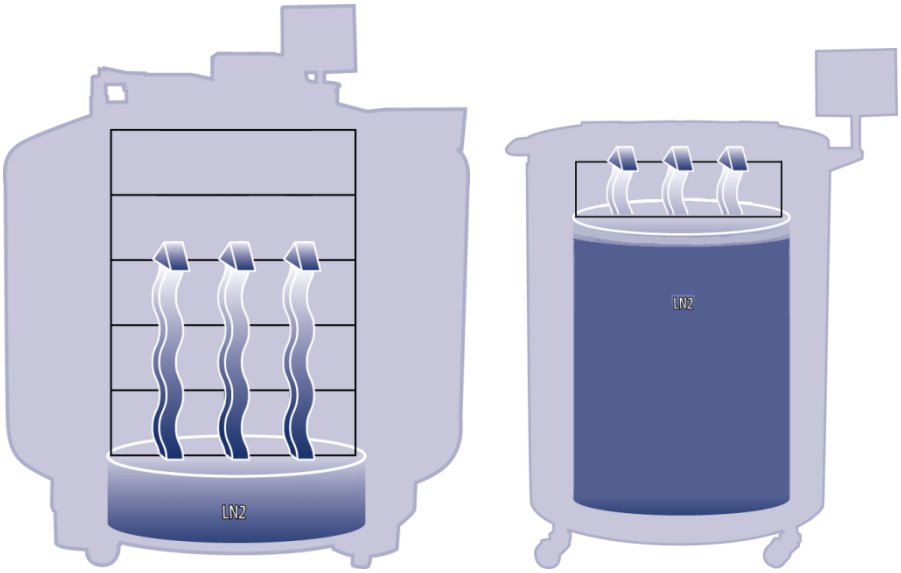


Figure 3: Illustration showing LN2 as the refrigerant. Left: LN2 below the storage space naturally boils off and cools the freezer. Right: LN2 resides in the freezer storage space.

7.1. Functions and Features

The TEC 3000 utilizes a variety of functions and features that enables it to closely monitor and control the environment inside a cryogenic freezer. This section will give an overview of the following features and their functionality:

- Liquid Nitrogen Level Measurement
- Automatic Liquid Nitrogen Level Control
- Liquid Nitrogen Usage
- Temperature Measurement
- User Defined Alarms
- Passwords/Security
- Communication Capabilities
- Lid Switch
- Hot Gas Bypass (Optional)
- Battery Backup (Optional)

7.1.1. Liquid Nitrogen Level Measurement

The LN2 level in the Dewar is determined through the use of a differential pressure sensor. This sensor operates on the physical principle of hydrostatic head pressure. The pressure generated by a column of fluid is proportional to the height, or depth, of the fluid column. In this application, the pressure generated by the LN2 at the bottom of the freezer will increase as the LN2 level increases. This differential pressure system allows the controller to measure the exact LN2 level accurately.

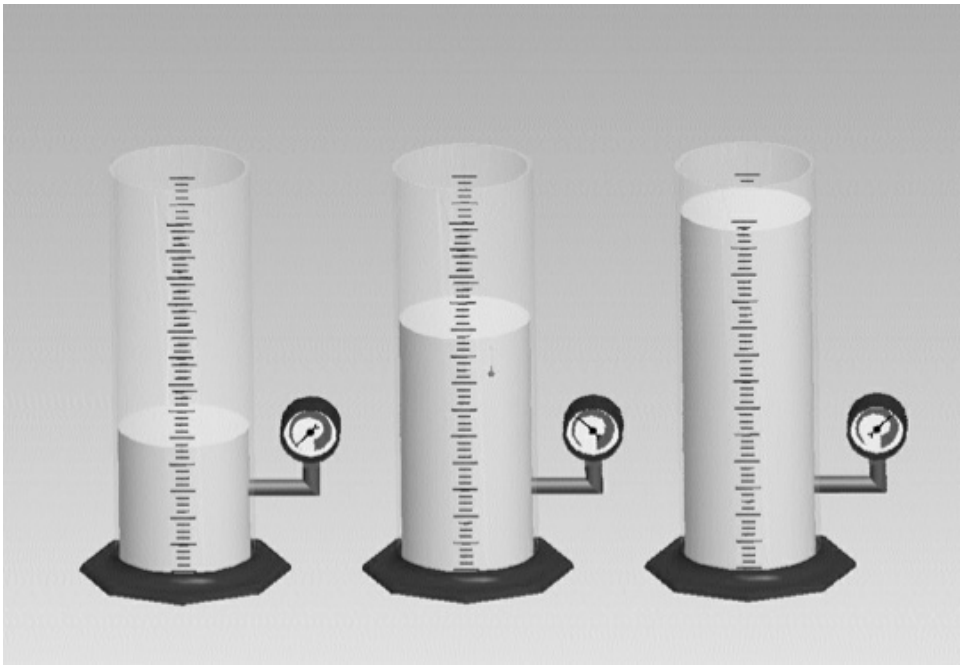


Figure 4: As the fluid level in the cylinder increases, the imposed head pressure at the bottom of the cylinder increases proportionally. The pressure gauges measure this increase in level.

This pressure signal generated by the LN2 is transmitted from the bottom of the inner vessel through the freezer's annular line to the differential pressure sensor inside the TEC 3000 controller. The TEC 3000 controller then compares this pressure signal to its atmospheric pressure readings and is then able to determine the exact LN2 level. The term "differential pressure" refers to the fact that the level is determined from the difference between the hydrostatic head pressure of the fluid column and atmospheric pressure. The measured LN2 level is displayed in inches, millimeters, or as percentage full.

Unlike alternative level sensing systems, such as thermistor based systems, differential pressure allows the exact level to be measured and displayed, not just a level range. This completely enclosed system requires minimal maintenance and is not affected by humidity, moisture, or other environmental variables. Also, the differential pressure system allows the automatic level settings and alarms to be set and adjusted electronically instead of having to physically move sensors.

7.1.2. Automatic Liquid Nitrogen Level Control

The TEC 3000 is equipped with a fully automated LN2 level control system. This level control system is based on user-defined parameters that can be adjusted to maintain a LN2 level in a freezer over a range of 3.0 inches (76 mm) up to 48.0 inches (1219 mm). Since this control system utilizes the differential pressure system described previously, these parameters can be adjusted electronically using the TEC 3000 keypad or remotely through a networked computer. This automatic fill control feature can be disabled. Below is a brief explanation of the four user-defined level control parameters. For instructions on accessing and adjusting the level control settings, see the Liquid Level Setpoints and Alarms section.

- **High Level Alarm** – If the LN2 level in a freezer reaches or exceeds this setting, a High Level Alarm will result. This audible/visual alarm will cause the High Level discrete contact and the global remote to switch to alarm state.
- **High Level Setpoint –** When the LN2 level in a freezer reaches this setting (with or without automatic fill enabled) the controller will close the fill valves and terminate the fill.
- **Low Level Setpoint** – When the LN2 level is at or below this setting (with automatic fill enabled) the controller will initiate a filling cycle.
- **Low Level Alarm** – If the LN2 level in a freezer is at or below this setting, a Low Level Alarm will result. This audible/visual alarm will cause the Low Level discrete contact and the global remote to switch to alarm state.

NOTE: Certain events can temporarily disable Auto Fill Control. Pressing “Stop Fill” will disable Auto Fill Control for 30 minutes. In the event of a Hot Gas Bypass Alarm or a Fill Time Alarm, Auto Fill Control will be disabled until the respective alarm is cleared by pressing “Alarm Mute” or restarting the controller.

Overfill Protection

The overfill protection (Software Version 2.03) will prevent an automatic fill if the LN2 level reading is 0 or if the level reading suddenly drops to 0. This prevents an overfill scenario in any situation where the TEC3000 loses its ability to measure the LN2 level.

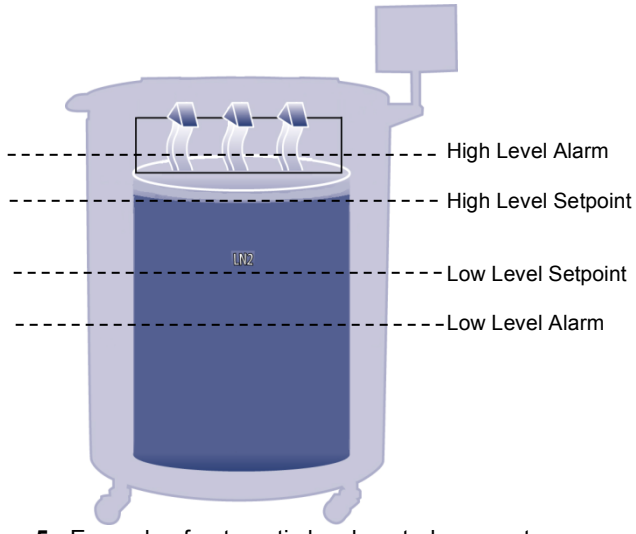


Figure 5: Example of automatic level control parameters

Note: Pressing Stop Fill will temporarily terminate TEC3000’s automatic fill function for 30 minutes.

7.1.3. Liquid Nitrogen Usage

The TEC 3000 controller is able to calculate and display an estimated rate of LN2 evaporation inside a freezer. This liquid usage is displayed in inches or millimeters per day. It takes time for the real-time data to accumulate in order for the liquid usage rate to be calculated.

The liquid usage is calculated by measuring the time it takes the LN2 level in a freezer to decrease 0.5 inches (12.7 mm) and then extrapolating that value out to a 24 hour period in order to obtain a per day liquid usage.

$$Liquid\ Usage = \left(\frac{L_1 - L_2}{Elapsed\ Time\ (hrs)}\right) \times 24\ hrs$$

For example:
If the LN2 level to decrease from 6.0 to 5.5 inches in 12 hours, then the displayed liquid usage will be 1.0 inch/day. See below.

$$Liquid\ Usage = \left(\frac{6.0" - 5.5"}{12\ hrs}\right) \times 24\ hrs = 1.0"/day$$

This calculation is suspended during fills and will resume 15 minutes after a fill to allow the LN2 level in the freezer to stabilize. The liquid usage calculation can be reset by restarting the controller or cycling the power. For liquid usage display options, refer to the Liquid Nitrogen Level Options section.

NOTE: Several scenarios can lead to a temporarily exaggerated liquid usage. If the level abruptly decreases 0.5 inches, then there will be a spike in the liquid usage. Having the freezer lid off for an extended period of time, adding or removing samples and racks, attempting to fill from an empty LN2 supply, or moving the freezer all can lead to an accelerated evaporation rate. Although the liquid usage is an accurate estimate of the daily evaporation rate, it can be temporarily skewed by certain events; however, because of method used to calculate the usage, it will recover as more data is acquired.

7.1.4. Temperature Measurement

The TEC 3000 is equipped with two independent temperature measurement channels. They are designed to be used with 1000 ohm platinum RTD temperature probes, also referred to as Pt-1000 RTDs. The electrical resistance of the very fine platinum wire in these probes changes linearly with temperature. Platinum's very linear relationship between resistance and temperature makes Pt-1000 RTDs ideal for temperature measurement in cryogenic environments. The temperatures displayed on the TEC 3000 LCD are not real-time readings, but rather a running average of the previous few measurements. The TEC 3000 takes temperature measurements several times a second and then averages the previous few measurements while updating the displayed temperature every second. The optional hot gas bypass temperature sensor is also a Pt-1000 RTD.

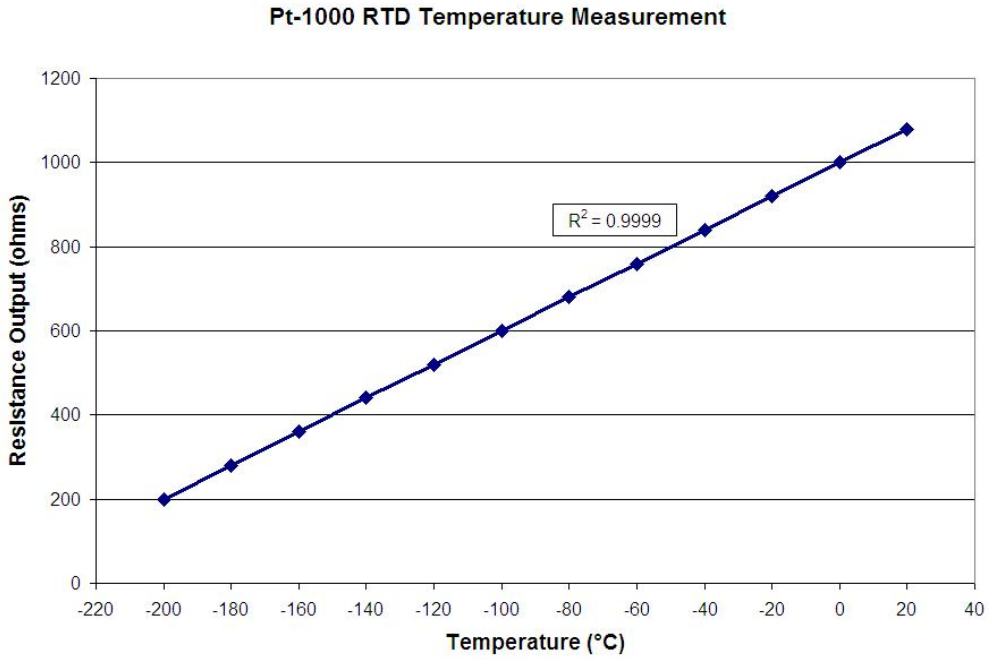


Figure 6: Platinum's linear relationship between temperature and resistance

7.1.5. User Defined Alarms

The TEC 3000 employs 18 different audible/visual alarms. These alarms are designed to alert the user to possible problems with the freezer temperature, LN2 level, controller power, and LN2 supply. In the event that a condition triggers an alarm, an audible buzzer will sound, that particular alarm will appear on the TEC 3000 LCD display, and the global remote alarm contacts will switch to alarm state. If the triggered alarm is one of the four specified discrete contacts, then that contact will also switch to alarm state. For more information on the global remote and discrete contacts, refer to the Remote Alarm Monitoring section.

To clear an alarm, first correct the condition and then press the “Alarm Mute” key or restart the controller. If the alarm condition is still present, then pressing the “Alarm Mute” key will only mute the audible buzzer for 30 minutes. The condition must be corrected in order to clear the alarm.

NOTE: Most TEC 3000 alarms have a one minute delay to avoid false positive or nuisance alarms. * denotes alarms that do not have a one minute time delay.

Table 1: TEC 3000 alarms and descriptions

Alarm Display	Description
High Temp A* Can be Enabled or Disabled	Temperature A is reading at or above the Temp A High Alarm setting When disabled, there will be no visible or audible alarm indication. The alarm event code will continue to be recorded in the internal data log.
High Temp B* Can be Enabled or Disabled	Temperature B is reading at or above the Temp B High Alarm setting When disabled, there will be no visible or audible alarm indication. The alarm event code will continue to be recorded in the internal data log.
Low Temp A Can be Enabled or Disabled	Temperature A is reading at or below the Temp A Low Alarm setting When disabled, there will be no visible or audible alarm indication. The alarm event code will continue to be recorded in the internal data log.
Low Temp B Can be Enabled or Disabled	Temperature B is reading at or below the Temp B Low Alarm setting When disabled, there will be no visible or audible alarm indication. The alarm event code will continue to be recorded in the internal data log.
High Level	LN2 level is at or above the High Level Alarm setting
Low Level	LN2 level is at or below the Low Level Alarm setting
Liquid Usage Warning	Liquid Usage rate doubles within a 24 hour period The liquid usage warning will not be indicated on the unit either audibly or visually. It will only be recorded in the internal data log.
Liquid Usage Alarm Can be Enabled or Disabled	Liquid Usage increases by a factor of 5 within a 24 hour period When this alarm is disabled, there will be no visual or audible indication at the controller, the event code continues to log
Fill Time	Fill cycle has not completed within the Maximum Fill Time setting (Auto fill is disabled until this alarm is cleared)
Bypass Time Alarm*	Hot Gas Bypass cycle has not completed within the Bypass Alarm Time Delay setting (Once the subsequent fill has ended, auto fill will be disabled until this alarm is cleared)
Temp A Calibration*	Temperature A is reading lower than absolute zero (-273°C / -460°F / 0 K)
Temp B Calibration*	Temperature B is reading lower than absolute zero (-273°C / -460°F / 0 K)
Bypass Calibration*	Bypass sensor is reading lower than absolute zero (-273°C / -460°F / 0 K)
Low Battery	Backup Battery voltage has dropped below 21 VDC
Power Failure Can be Enabled or Disabled	TEC 3000 main power has been disconnected and it has been running on battery power for 30 minutes

Lid Open	Freezer lid has been open longer than Lid Open Alarm Time setting
Communication Loss	TEC 3000 controller has lost communication with the LCD display
*Stuck Valve Alarms	When the freezer is supposed to be filling, if the controller does not see an appropriate decrease in temperature, within the delay time entered in the menu, a stuck closed valve alarm will be initiated. After the freezer is supposed to have stopped filling, if the controller does not see an appropriate increase in temperature, within the delay time entered in the menu, a stuck open valve alarm will be initiated. *(Feature is only available on HEco Models)

If any alarms occur, contact your authorized MVE Distributor or Technical Service.

7.1.6. Remote Alarm Monitoring

The TEC 3000 is equipped with a global remote alarm relay and four specific discrete dry contacts that allow remote monitoring of alarm conditions. Once activated, these latching contacts will retain their alarm state until the alarm condition is corrected and cleared. Although Chart MVE does not provide remote monitoring or programmable logic controller (PLC) systems, these devices can be easily connected to the TEC 3000. For example, it is possible to setup a TEC 3000 so that if a Low Level Alarm is triggered, the remote monitoring system will automatically send an email or place a call to alert the necessary individuals of the freezer's status. For proper discrete contact function, ensure the negative (low voltage) terminal of the remote monitoring system is connected to the COMMON discrete contact terminal and the positive (high voltage) terminal is connected to the respective discrete alarm terminal. Wires can be inserted and removed from the terminals by placing a small flathead screwdriver into the slot above the contact and prying down the latch until the clamp connector opens. Remove the flathead screwdriver to close the clamp connector. For alarm contact test procedures, refer to the Remote Alarm Tests section. Below are the remote alarm contact specifications and a typical remote monitoring setup schematic. If an alarm condition has been corrected, but it continues to register through the global or discrete contacts, remove the contacts and cycle the power on the controller. This will clear the alarm if it has latched in the system.

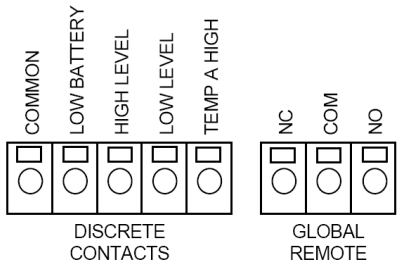


Figure 7: TEC 3000 remote alarm contacts

Table 2: TEC 3000 remote alarm contact specifications

Discrete Contacts	Global Remote
Normally Open	Normally Open or Normally Closed
Open Collector	Dry Contact Relay
Latching	Latching
Polarity Sensitive	Non-Polarity Sensitive
24 VDC at 100 mA max	230 VAC at 1 A max

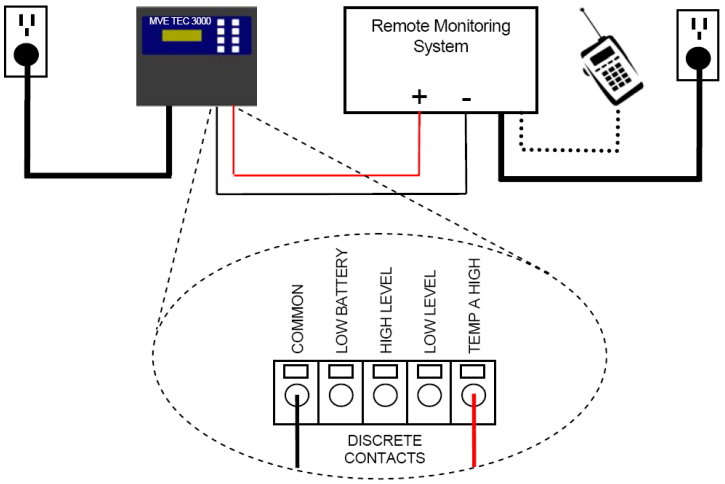


Figure 8: Typical remote alarm monitoring setup schematic. Temp A High monitoring shown

7.1.7. Passwords / Security

The TEC 3000 has a multilevel security system that can be customized to meet your security needs. Four different levels of security can be assigned up to 10 passwords allowing users to control who has the ability to change specific settings as well as to what extent these settings may be altered.

For example, in a tissue bank or repository that employs many technicians, the facility manager may want to restrict the technicians' access to allow them to view alarm settings, but not have the ability to adjust the settings. In this situation, the technicians would be assigned a password with low level security privileges. Conversely, if the shift manager wants to have complete access to all menus and settings, then he/she would be assigned a password with high level security privileges.

Password entry mode can be disabled in the Password Menu. For more information on passwords and security, refer to the Passwords / Security Setup section.

Table 3: Password security levels and descriptions. X denotes access to adjust setting.

Feature	Not Password Protected	Level 1	Level 2	Level 3	Level 4
Start Fill	X				
Stop Fill	X				
Alarm Mute	X				
Quick Reference Settings	X				
Temp and Level Display Units		X	X	X	X
Display Liquid Usage		X	X	X	X
Enable / Disable Temp Sensors			X	X	X
Temp Alarm Settings			X	X	X
High Temp Alarm Test			X	X	X
Lid Switch Settings			X	X	X
Hot Gas Bypass Settings			X	X	X
Enable / Disable Alarm Buzzer			X	X	X
Level Control / Alarm Settings			X	X	X
Date/Time			X	X	X
Language Settings			X	X	X
Printer Settings			X	X	X
Temp Calibration			X	X	X
Level Calibration				X	X
Enable / Disable Auto Fill				X	X
Timed Fill Settings				X	X
OFAF Settings				X	X
Communication Settings				X	X
Reset to default settings				X	X
Password Settings					X

Forgot your password? Contact your authorized MVE Distributor or Technical Service.

7.1.8. Communication / Networking Capabilities

The TEC 3000 RS-485 Serial interface offers several advanced communication capabilities. The TEC 3000 is equipped with two, independent RJ-45 serial ports. These ports are intended for connection to another MVE controller, PC, serial printer, or other RS-485 device. Up to 100 TEC 3000 controllers can be successfully networked.

NOTE: The TEC 3000 should never be connected directly to a LAN or public telecommunications network.

Below is a summary of the different communication / networking capabilities:

- **Host Computer –** The TEC 3000 can communicate with a computer via an RS-485 converter and ChartConnect 3000 or Windows HyperTerminal. Through the use of simple ASCII commands, all TEC 3000 settings and functions can be monitored and adjusted with these software programs. In addition to ASCII communication, ChartConnect 3000 also offers a user-friendly event log downloader. The event log is downloaded as a comma separated variable (.csv) file that can be opened in EXCEL. Either a single controller or a network of controllers may be connected to a host computer. For more information on computer communication capabilities, refer to the Communication / Networking section.
- **Serial Printer –** The TEC 3000 can be connected directly to a serial printer via an RS-485 converter. This allows controller events to be printed as they occur. This gives users the opportunity to keep hard-copy records of the freezer's status in addition to the standard event log saved in the controller's memory. This printed data bypasses the controller memory and is not given the opportunity to be altered electronically. For more information on the printer interface, refer to the Communication / Networking section.
- **MODBUS –** The TEC 3000 has RS-485 MODBUS communication capabilities. This will not be extensively covered in this manual. Please contact your MVE Distributor or Chart MVE Technical Service for more information.
- **One Fill All Fill (OFAF) –** A group of TEC 3000s can be networked in order to coordinate fill cycles and reduce LN2 transfer losses. For locations with multiple freezers, this function will increase the filling efficiency and drastically reduce LN2 consumption over time. A sequential or simultaneous OFAF network is possible. For more information on OFAF networking, refer to the Advanced Filling Options section.

7.1.9. Event Log And Event Codes

The TEC 3000 has a built-in data logging feature that automatically stores vital, time-stamped information including temperatures, LN2 level, liquid usage, and any alarms. Data is logged at a user-defined interval and anytime an event or alarm status changes. The default log interval is 4 hours. The TEC 3000 is able to store up to 30,000 events in its non-volatile memory. With a 4 hour log interval, the TEC 3000 is able to store approximately 10 years worth of data. This event log can be easily downloaded from the controller using ChartConnect 3000. This downloaded file is a .csv file that can be opened, analyzed, and plotted in EXCEL. Besides being a record of the freezer status, the event log is a vital tool for diagnosing problems or detecting potential problems with a freezer. For instructions on how to download the event log, refer to the Communication / Networking section of this manual or the ChartConnect 3000 User Manual (PN 13946348).

NOTE: Since the event log is stored in non-volatile memory, it will be retained and unaffected when the controller loses power, is restarted, if the firmware is updated, or when the event log is downloaded. However, resetting the controller to defaults will clear the event log. If the event log memory is exceeded, the oldest event will be deleted to make space for the most recent event.

Below is a sample event log and a list of event codes. The event log header displays the version of ChartConnect 3000 used to download the event log, the controller's unit ID, and the controller's firmware version. The events are logged so that Record #1 is the most recent event logged. The event parameters are logged in the units and format of that respective category. For example, if the TEC 3000 temperature units are set to be in degrees Celsius, then the temperature will be logged in degrees Celsius. If the time is set to a 24 hour clock, then the event log times will be in that format. Parameter changes will be logged as a string such as "Parameter number 126 changed from 60 to 180." Contact your MVE Distributor or Chart MVE Technical Service for information regarding these parameter changes.

ChartConnect 3000 v1.1.2
MVE TEC 3000 Software ver. 2.00

Record	Unit ID	Date	Time	TempA	TempB	LN2 Level	LN2 Usage	Event Codes
1	200	12/15/10	9:00	-186.7	-194.8	6.1	0.5	AH
2	200	12/15/10	5:00	-191.4	-195.8	6.3	0.5	
3	200	12/15/10	1:00	-191.4	-195.8	6.5	0.5	
4	200	12/15/10	00:00	-191.4	-195.8	6.6	0.5	ZO
5	200	12/14/10	21:00	-191.4	-195.8	6.6	0.5	
6	200	12/14/10	17:00	-191.4	-195.8	6.8	0.5	
7	200	12/14/10	9:00	-191.4	-195.8	6.8	0.5	
8	200	12/14/10	7:15	-191.5	-195.8	7.0	0.0	
9	200	12/14/10	6:32	-191.5	-195.8	5.0	0.0	F
10	200	12/14/10	5:00	-191.5	-195.8	5.3	0.0	

Figure 9: Sample event log download

Table 4: TEC 3000 Event Log Codes

Event Code	Description
AM	Alarm Mute
AH	Temp A High Alarm
AL	Temp A Low Alarm
BB	Running on battery power
BH	Temp B High Alarm
BL	Temp B Low Alarm
BP	Bypass Sensor Open
BV	Low Battery Voltage Alarm
BY	Hot Gas Bypassing
CA	Temp A Calibration Alarm
CB	Temp B Calibration Alarm
CG	Bypass Sensor Calibration Alarm
F	Filling
FD	Fill Disabled
FT	Fill Time Alarm
HG	Hot Gas Bypass Time Alarm
LH	High Level Alarm
LL	Low Level Alarm
LO	Lid Open Alarm
PF	Power Failure
SC	Stuck Closed Alarm
SO	Stuck Open Alarm
US	Liquid Usage Alarm
UW	Usage Warning
ZO	Level Zeroing

Once the event log has been downloaded, it can be plotted to facilitate analysis.

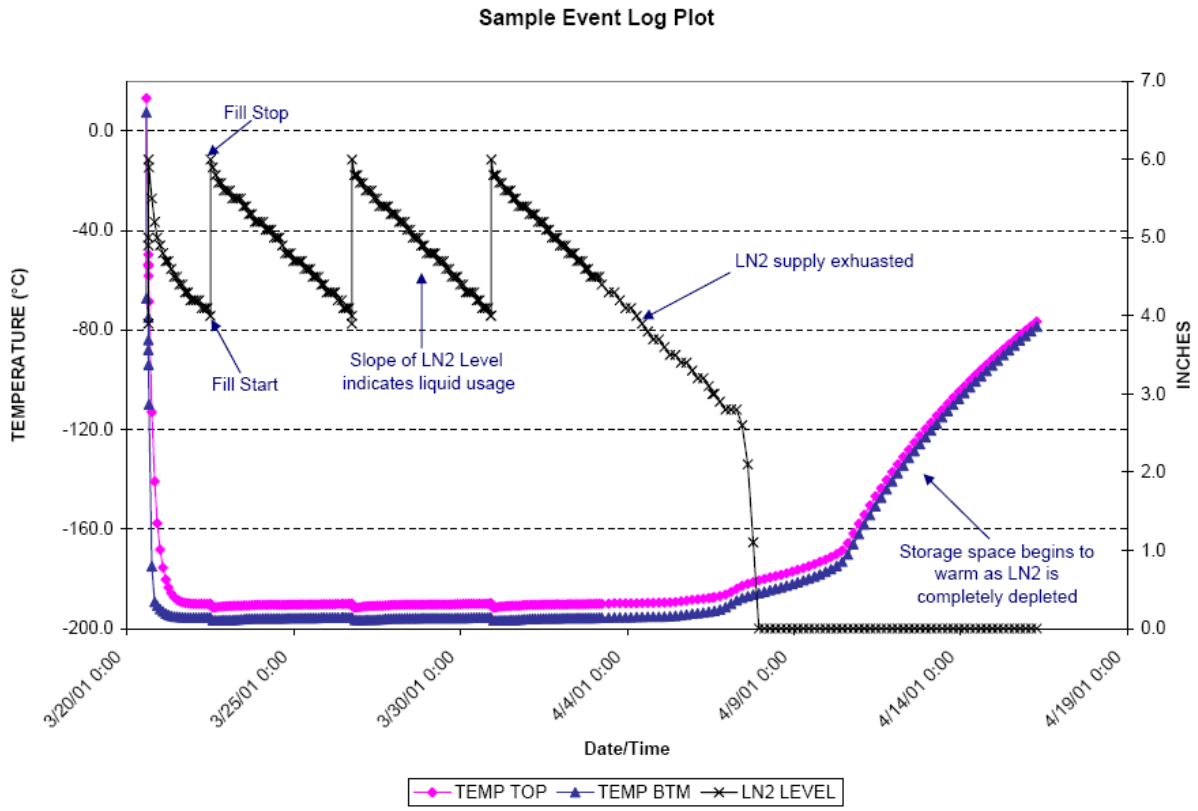


Figure 10: Sample Plotted Event Log

7.1.10. Lid Switch

The TEC 3000 has the ability to support a lid switch. This additional feature allows the user to disable filling while the lid is open, utilize the Lid Open Alarm, or initiate an automatic fog clear. A lid switch comes standard on all MVE Series and MVE Cabinet Series freezers. There are two configurations of the lid switch: the standard UL lid switch configuration and the optional fog clear lid switch configuration. The difference in their functionality is based on how they are wired to the TEC 3000.

- **Standard UL Lid Switch configuration –** The UL lid switch configuration, which is standard on MVE Series and MVE Cabinet Series freezers, is wired directly in series with the fill valves. With this configuration, when the lid is open and the lid switch is disengaged, the fill valves cannot be energized. When the lid is down and the lid switch is engaged, the fill valve circuit is closed and the valves can be energized. The functionality of the UL lid switch is independent of the settings in the lid switch menu of the TEC 3000 since it is hardwired into the fill valve circuit. MVE's UL listing stipulates that the models in these two series must have the lid switch hardwired in series with the fill valves when it leaves the factory to be compliant. The fog clear and lid open alarm features are not available with the UL lid switch configuration. It is available for users to easily adapt their UL lid switch configuration to a fog clear lid switch configuration and acquire these features. Contact your MVE Distributor or Chart MVE Technical Service for instructions.

  NOTE: The standard UL Lid Switch configuration is not controlled by the TEC 3000 Lid Switch Menus and the Lid Switch Installed option should be set to "NO".

- **Optional Fog Clear Lid Switch configuration –** The optional fog clear lid switch configuration is connected directly to the TEC 3000 wire harness lid switch connector and is not wired in series with the fill valves. This lid switch configuration is controlled by the settings in the lid switch menu of the TEC 3000, which include the fog clear feature and the Lid Open Alarm. With the fog clear feature enabled, the freezer will fill for 30 seconds each time the lid is opened, which clears the fog and improves visibility. The Lid Open Alarm feature allows the user to set a maximum time that the lid can remain open before an alarm is triggered. For instructions on adjusting the lid switch settings, refer to the Optional Features section.

  NOTE: Converting from the standard UL Lid Switch configuration to the optional Fog Clear Lid Switch configuration voids the UL compliance and requires that the UL mark be removed from the freezer.

NOTE: Both lid switch configurations do have an override feature. Simply pull up on the lid switch until it clicks to engage the manual override.

7.1.11. Hot Gas Bypass

The Hot Gas Bypass is a feature on HE/MVE/HEco freezer series equipped with a TEC 3000. The Hot Gas Bypass is able to vent the warm nitrogen gas from the supply line before initiating a fill cycle. This prevents warm gas from entering the freezer space. The bypass system helps to maintain a stable temperature gradient inside the freezer and increases the efficiency by preventing excess LN2 evaporation while filling. This feature is advantageous for any freezer setup and is especially ideal for sites where longer transfer hoses cannot be avoided.

The Hot Gas Bypass system consists of these components:

- Solenoid Valve (24 VDC)
- Temperature sensor (Pt-1000 RTD)
- Muffler
- Plumbing and electrical connections

Freezers with the Hot Gas Bypass installed and enabled will complete a bypass cycle prior to filling. When a fill is initiated, the bypass solenoid valve will open first and begin venting nitrogen gas from the supply line through the muffler and into the atmosphere. The TEC 3000 monitors and displays the temperature in the plumbing system throughout the bypass cycle. As LN2 begins flowing, the temperature in the plumbing system will decrease. Once the bypass temperature sensor readings reach the user-defined Bypass Temperature Setpoint, the bypass solenoid valve will close terminating the bypass cycle. The fill solenoid valves will then open and the freezer will begin filling. The default Bypass Temperature Setpoint is -70°C and can be adjusted based on the freezer setup.

The Bypass Alarm Time Delay is the maximum allowable bypass time. If the temperature in the plumbing system does not reach the Bypass Temperature Setpoint within the Bypass Alarm Time Delay setting, the TEC 3000 will terminate the bypass cycle, initiate the fill cycle, and trigger a Hot Gas Bypass Time Alarm. Once the immediate fill cycle is complete, auto fill will be disabled until the Hot Gas Bypass Time Alarm is acknowledged. This feature prevents a freezer from continuing to attempt to fill from an empty supply. A Hot Gas Bypass Time Alarm could be a sign of an empty supply, a supply with too low of pressure, or it could mean that the Bypass Alarm Time Delay needs to be increased in order to effectively purge the supply line of nitrogen gas. The default Bypass Alarm Time Delay is 5 minutes, but should be adjusted based on the freezer setup. It should be arranged so that the Bypass Temperature Setpoint is easily reached within the Bypass Alarm Time Delay setting.

NOTE: If a Hot Gas Bypass Time Alarm is triggered, once the immediate fill cycle is complete, auto fill will be disabled until the alarm is acknowledged.

7.1.12. Battery Backup (Optional)

The Battery Backup is an optional feature on all domestic HE/MVE/HEco freezers equipped with a TEC 3000 and comes standard on all MDD freezers. The TEC 3000 is able to run seamlessly on power from this external battery system when the primary power source is interrupted. The TEC 3000 is able to run fully functional on the Battery Backup for approximately 72 hours in the event of a power failure. While the TEC 3000 is running on its primary power source, it continuously provides a 27 volt trickle charge to keep the Battery Backup fully charged. A Low Battery Alarm will trigger if the TEC 3000 is running on Battery Backup and the voltage falls below 21 volts. The TEC 3000 will begin losing select functionality when its power source falls below 18 volts. Non-essential circuits are disabled first to conserve power.

The battery status can be viewed in the Add-on Menus. With a Battery Backup connected while the controller is running on main power, the battery status screen will read On AC Power. While running on Battery Backup, the battery status screen will display on battery backup 26VDC 80%-100%. With no Battery Backup connected, the battery status screen will display On AC Power. This feature is available with Firmware Version 2.02 or higher.

The Battery Backup system consists of these components:

- Two, 12 VDC lead acid batteries wired in series
- Inline fuse (4A 250V F)
- Battery housing
- Electrical connections

NOTE: The amount of time that a freezer will operate on power from the Battery Backup will vary depending on the fill status, the fill intervals, and the size of the freezer.

7.2. Adjusting Settings and Options

Password Entry
This section describes how to access the TEC 3000 menus and adjust the various settings and options. With password entry enabled, the controller will prompt for a password anytime a user attempts to access the setup menus. A flashing cursor on the password entry screen will make it clear which digit is being changed. Feature is available with Firmware Version 2.02.

These instructions will start from the main monitoring display screen, assume password entry mode is enabled, and the user has Security Level 4 clearance. Once in the setup menus, the user can press the “ESC” key to exit that menu level or press the “ESC” key repeatedly until the display returns to the main monitoring screen. After 30 seconds of inactivity, the display will automatically return to the main monitoring display screen.

TEC 3000 controllers with newer displays have the added functionality of a quick reference scroll menu. Pressing the up and down arrow keys simultaneously while on the main monitoring screen will display the controller’s serial number and firmware version. Pressing the up or down arrow keys will then scroll through the level, temperature, and gas bypass settings. The user can return to the main monitoring screen by pressing the “ESC” key or waiting 30 seconds.

Main Monitoring Display Screen

Temp A	-196.2°C
Temp B	-191.4°C
Level	10.0 in
Usage	0.5 in/day

7.2.1. Temperature Settings

This section describes how to access and adjust the various temperature settings on the TEC 3000.

NOTE: Security Level 2 or higher is required to adjust the Temperature Settings.

7.2.1.1. Enable / Disable Sensors

The default setting for both Temp A and Temp B sensors is enabled.

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level Required use ▲▼ to ENTER Password 0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for Temperature Menus or press SETUP for next menu

3. Press "ENTER"
The display will read "Temp A Menu".
NOTE: To access Temp B Menu, press "SETUP" instead of "ENTER".

Press ENTER for Temp A Menu or press SETUP for next menu

4. Press "ENTER"
The display will read "Temp A Enabled".
Use the "▲/▼" keys to change Temp A to DISABLED and press "ENTER" to save the setting change.

Temp A ENABLED Use ▲▼ to adjust Press ENTER to save

If a setting was changed, a confirmation display will read "New Setting Accepted".

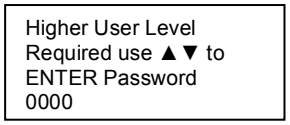
New Setting Accepted

7.2.1.2. High Temperature Alarm Test

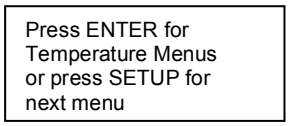
The high temperature alarm test allows a user to simulate a high temperature alarm without having to remove it from the freezer. Once initiated, the TEC 3000 will apply a small voltage to the sensor, which causes the sensor to heat up. The TEC 3000 will continue to heat the sensor until it exceeds the High Temp Alarm setting. Once surpassed, a High Temp Alarm will result and the sensor readings will begin to decrease. The alarm buzzer will sound and the remote alarm contacts will switch to alarm state until the simulated alarm is cleared. (Press Alarm Mute)

NOTE: The heat generated by the sensor during the High Temperature Alarm Test is NOT enough to affect the actual temperature in the freezer storage space. If the sensor is submerged in LN2, the heat generated by the sensor may not be sufficient to initiate a high temperature alarm.

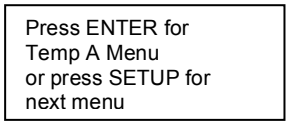
1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.



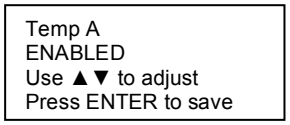
2. Press "ENTER"
The display will read "Temperature Menus".



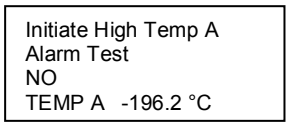
3. Press "ENTER"
The display will read "Temp A Menu".
NOTE: To access Temp B Menu, press "SETUP" instead of "ENTER".



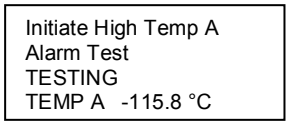
4. Press "ENTER"
The display will read "Temp A Enabled".



5. Press "SETUP"
The display will read "Initiate High Temp A Alarm Test". Use the "▲/▼" keys to change NO to YES and press "ENTER" to initiate the alarm test.



If High Temp Alarm Test is initiated, the display will read "Testing" and show the temp change throughout the test.
Note: If the temperature probe is open or no probe is connected the controller will not go into the high temperature alarm test mode.



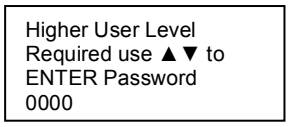
7.2.1.3. Temperature Alarm Settings

This section describes how to navigate and adjust the temperature alarm settings. The high temperature alarm is used to alert the user when the temperature in the freezer space has risen above the set threshold. The low temperature alarm can be used as a calibration error or redundant overfill indicator.

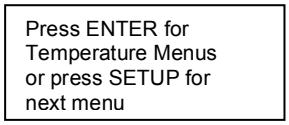
To be used as a calibration error indicator, the low temperature alarm would be set to a temperature slightly colder than the LN2 saturation temperature. Since the temperature in the freezer storage space can never be colder than LN2, if this alarm is triggered, it is an indication that the sensor requires recalibration.

To be used as a redundant overfill, or high level alarm, the low temperature alarm would be set to a temperature slightly warmer than the LN2 saturation temperature and the sensor placed higher than the desired liquid level in the freezer. If the low temperature alarm is triggered, then it is an indication that sensor is submerged in LN2 and the liquid level is higher than desired.

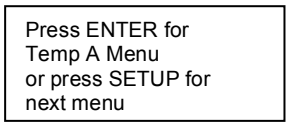
1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.



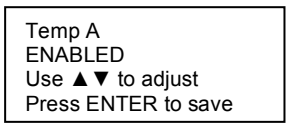
2. Press "ENTER"
The display will read "Temperature Menus".



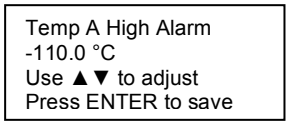
3. Press "ENTER"
The display will read "Temp A Menu".
NOTE: To access Temp B Menu, press "SETUP" instead of "ENTER".



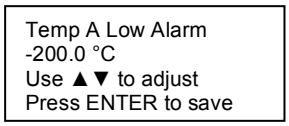
4. Press "ENTER"
The display will read "Temp A Enabled".



5. Press "SETUP"
Until the display reads "Temp A High Alarm".
Use the "▲/▼" keys to adjust setting and press "ENTER" to save the change.



6. Press "SETUP"
The display will read "Temp A Low Alarm".
Use the "▲/▼" keys to adjust setting and press "ENTER" to save the change.



Alarm masks added for Low and High Temperature alarms for both sensors A and B. This allows these alarms to be enabled or disabled by the user. Note these are called alarm masks because the alarms are not actually disabled. They are simply no longer indicated via audio/visual means. The text in the menu screens uses enable and disable since that is the more conventionally understood terminology. Feature is available with Firmware 2.03

7. Press "SETUP"
The display will read "Temp A High Alarm".
Use the "▲/▼" keys to adjust setting and press "ENTER" to save the change.

```
Temp A High Alarm
ENABLED
Use ▲▼ to adjust
Press ENTER to save
```

8. Press "SETUP"
The display will read "Temp A Low Alarm".
Use the "▲/▼" keys to adjust setting and press "ENTER" to save the change.

```
Temp A Low Alarm
ENABLED
Use ▲▼ to adjust
Press ENTER to save
```

7.2.1.4. Liquid Nitrogen Saturation Temperature

This section shows how to adjust the LN2 saturation temperature. This temperature is altitude dependent. The default LN2 saturation temperature is -195.8°C (-320.4°F, 77.4 K). This value is accurate for altitudes ranging form sea level to 500 feet (152 m). For the appropriate saturation temperature, refer to Table 5: LN2 Saturation Temperatures.

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level
Required use ▲▼ to
ENTER Password
0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for
Temperature Menus
or press SETUP for
next menu

3. Press "ENTER"
The display will read "Temp A Menu".

Press ENTER for
Temp A Menu
or press SETUP for
next menu

4. Press "SETUP"
Until the display reads "LN2 Temperature".
Use the "▲/▼" keys to adjust setting per Table 5 and press "ENTER" to save the change.

LN2 Temperature
Use ▲▼ to adjust
Press ENTER to save
-195.8 °C

Table 5: LN2 Saturation Temp vs. Altitude

Altitude		LN2 Saturation Temperature		
Feet	**Meters**	**°C**	**°F**	**K**
Sea Level – 500	Sea Level – 152	-195.8	-320.4	77.4
501 -1000	152 -305	-196.0	-320.7	77.2
1000 – 1500	305 – 457	-196.2	-321.1	77.0
1501 – 2000	457 – 610	-196.4	-321.5	76.8
2001 – 3000	610 – 915	-196.6	-321.9	76.6
3001 – 4000	915 – 1220	-196.9	-322.4	76.3
4001 – 5000	1220 – 1524	-197.2	-322.9	76.0
5001 – 6000	1524 – 1829	-197.5	-323.5	75.7
6001 – 7000	1829 – 2134	-197.8	-324.0	75.4
7001 – 8000	2134 – 2439	-198.1	-324.6	75.1
8001 – 9000	2439 – 2744	-198.4	-325.1	74.8
9001 – 10000	2744 – 3049	-198.7	-325.7	74.4

7.2.2. Liquid Level Settings

This section demonstrates how to adjust the LN2 level settings.

7.2.2.1. Level Setpoints and Alarms

The auto fill settings can be adjusted in the Liquid Level Menus. With auto fill enabled, the TEC 3000 will initiate an auto fill when the level is at or below the Low Level Setpoint and terminate a fill when the level reaches the High Level Setpoint. If the level is at or below the Low Level Alarm or at or above the High Level Alarm, the TEC 3000 will initiate that respective alarm.

NOTE: There must be a minimum of 0.5 inches between each of setpoint and alarm. For example, if the Low Level Alarm is set to be 4.0 inches, then the Low Level Setpoint would have to be set at least 4.5 inches. The Low Level Alarm can be set to a minimum value of 3.0 inches and the High Level Alarm can be set to a maximum value of 48.0 inches.

NOTE: Security Level 2 or higher is required to adjust the Liquid Level Settings.

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level Required use ▲▼ to ENTER Password 0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for Temperature Menus or press SETUP for next menu

3. Press "SETUP"
Until the display reads "Liquid Level Menus".

Press ENTER for Liquid Level menus or press SETUP for next menu

4. Press "ENTER"
The display will read "High Level Alarm". Use the "▲/▼" keys to adjust the High Level Alarm value and press "ENTER" to save the change.

High Level Alarm 8.0 in Use ▲▼ to adjust Press ENTER to save

5. Press "SETUP"
The display will read "High Level Setpoint". Use the "▲/▼" keys to adjust the High Level Setpoint value and press "ENTER" to save the change.

High Level Setpoint 7.0 in Use ▲▼ to adjust Press ENTER to save

6. Press "SETUP"
The display will read "Low Level Setpoint". Use the "▲/▼" keys to adjust the Low Level Setpoint value and press "ENTER" to save the change.

Low Level Setpoint 5.0 in Use ▲▼ to adjust Press ENTER to save

7. Press "SETUP"
The display will read "Low Level Alarm". Use the "▲/▼" keys to adjust the Low Level Alarm value and press "ENTER" to save the change.

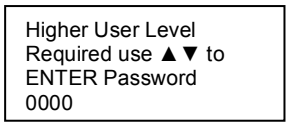
Low Level Alarm 4.0 in Use ▲▼ to adjust Press ENTER to save

7.2.2.2. Enable / Disable Auto Fill Control

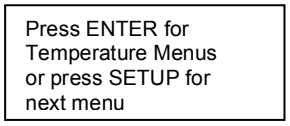
Auto Fill Control can be enabled or disabled in the Advanced Level Menus.

NOTE: Security Level 3 or higher is required to enable/disable Auto Fill.

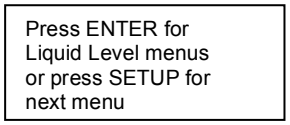
1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.



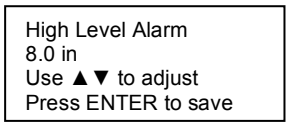
2. Press "ENTER"
The display will read "Temperature Menus".



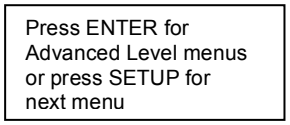
3. Press "SETUP"
Until the display reads "Liquid Level Menus".



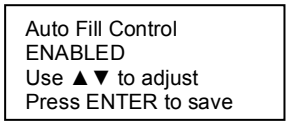
4. Press "ENTER"
The display will read "High Level Alarm".



5. Press "SETUP"
Until the display reads "Advanced Level Menus".



6. Press "ENTER"
The display will read Auto Fill Control". Use the "▲/▼" keys to adjust and press "ENTER" to save the change.

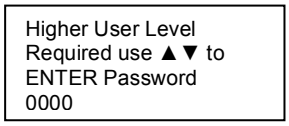


7.2.2.3. Level Offset

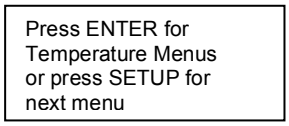
Since the annular line that carries the pressure level signal to the TEC 3000 is not located at the very bottom of the LN2 column, a Level Offset is needed. This value is determined and set at the factory and should not be adjusted to fix an inaccurate level reading unless setting up a freezer (see the First Fill Startup Procedure) or if instructed to do so by an authorized MVE Distributor or Technical Service. For liquid level calibration see section 7.3.2 page 84.

Note: Security Level 3 or higher is required to adjust the Level Offset.

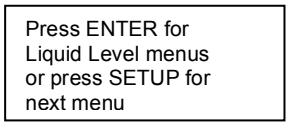
1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.



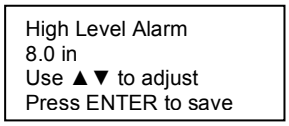
2. Press "ENTER"
The display will read "Temperature Menus".



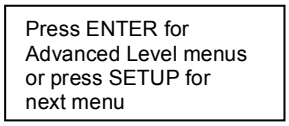
3. Press "SETUP"
Until the display reads "Liquid Level Menus".



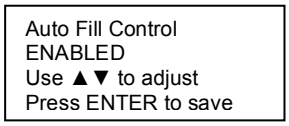
4. Press "ENTER"
The display will read "High Level Alarm".



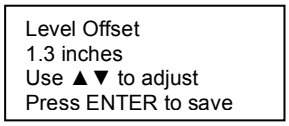
5. Press "SETUP"
Until the display reads "Advanced Level Menus".



6. Press "ENTER"
The display will read Auto Fill Control"



7. Press "SETUP"
The display will read "Level Offset". Use the "▲/▼" keys to adjust value and press "ENTER" to save the change.



7.2.3. Additional Feature Settings

This section details how to view and adjust the settings for the optional Battery Backup, Power Failure Alarm, Hot Gas Bypass, and Lid Switch.

NOTE: Security Level 2 or higher is required to adjust the Hot Gas Bypass and Lid Switch settings.

7.2.3.1. Battery Backup Status

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level
Required use ▲▼ to
ENTER Password
0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for
Temperature Menus
or press SETUP for
next menu

3. Press "SETUP"
The display will read "Add-on Menus".

Press ENTER for
Add-on menus
or press SETUP for
next menu

4. Press "ENTER"
The current battery status will be displayed. The display will read On AC Power if battery is connected or not connected and controller running on AC.

Battery Status
On AC Power

-OR-

The display will read On Battery Backup 26VDC or 80% or 100% if controller is running on battery backup (AC disconnected)

Battery Status
On Battery Backup
26VDC 80% or 100%

5. Press "SETUP"
The Power Failure Alarm status will display. Use the "▲/▼" keys to ENABLE or DISABLE and press "ENTER" to save the change.

Power Failure Alarm
ENABLED
Use ▲▼ to adjust
Press ENTER to save

7.2.3.2. Hot Gas Bypass Settings

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level
Required use ▲▼ to
ENTER Password
0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for
Temperature Menus
or press SETUP for
next menu

3. Press "SETUP"
The display will read "Add-on Menus".

Press ENTER for
Add-on menus
or press SETUP for
next menu

4. Press "ENTER"
The current battery status will be displayed.

Battery Status
On AC Power

5. Press "SETUP"
Until the display reads "Hot Gas Bypass Menus".

Press ENTER for
Hot Gas Bypass menus
or press SETUP for
next menu

6. Press "ENTER"
The display will read "Hot Gas Bypass". Use the "▲/▼" keys to adjust and press "ENTER" to save.

Hot Gas Bypass
DISABLED
Use ▲▼ to adjust
Press ENTER to save

7. Press "SETUP"
The current Bypass Temperature Sensor reading will be displayed.

Bypass Temperature
20.0 °C

8. Press "SETUP"
The display will read "Bypass Temp Setpoint". Use the "▲/▼" keys to adjust the value and press "ENTER" to save.

Bypass Temp Setpoint
-70.0 °C
Use ▲▼ to adjust
Press ENTER to save

9. Press "SETUP"
The display will read "Bypass Alarm Time Delay". Use the "▲/▼" keys to adjust the value and press "ENTER" to save.

Bypass Alarm Time Delay
5 min
Use ▲▼ to adjust
Press ENTER to save

10. Press "SETUP"
The display will read "Stuck Valve Alarms". Use the "▲/▼" keys to adjust the value and press "ENTER" to save.

Stuck Valve Alarms
DISABLED
Use ▲▼ to adjust
Press ENTER to save

11. Press "SETUP"
The display will read "Stuck Open Delay". Use the "▲/▼" keys to adjust the value, 1min to 90min and press "ENTER" to save.

Stuck Open Delay
1 min
Use ▲▼ to adjust
Press ENTER to save

12. Press "SETUP"
The display will read "Stuck Closed Delay". Use the "▲/▼" keys to adjust the value, 1min to 90min and press "ENTER" to save.

Stuck Closed Delay 1 min Use ▲▼ to adjust Press ENTER to save

7.2.3.2.1 Stuck Valve Alarm

NOTE: This feature requires that the bypass sensor be relocated into the main plumbing assembly instead of in the bypass plumbing branch so that it can monitor the temperature of the incoming supply stream when the bypass is not active. The controller will monitor the gas bypass sensor during and after filling.

When the freezer is supposed to be filling, if the controller does not see an appropriate decrease in temperature, within the delay time entered in the menu, a stuck closed valve alarm will be initiated. After the freezer is supposed to have stopped filling, if the controller does not see an appropriate increase in temperature, within the delay time entered in the menu, a stuck open valve alarm will be initiated.

The menu pages are in the hot gas bypass menu within the Add On menu. This will allow enabling and disabling of these alarms and setting the time delays. These alarms are enabled together. They cannot be selectively enabled / disabled.
The event code for the stuck closed alarm is "SC"
The event code for the stuck open alarm is "SO"
Refer to the Hot Gas Bypass Settings 7.2.3.2 (page 58) to change Stuck Valve Alarm settings.

7.2.3.3. Lid Switch Settings

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

```
Higher User Level
Required use ▲▼ to
ENTER Password
0000
```

2. Press "ENTER"
The display will read "Temperature Menus".

```
Press ENTER for
Temperature Menus
or press SETUP for
next menu
```

3. Press "SETUP"
The display will read "Add-on Menus".

```
Press ENTER for
Add-on menus
or press SETUP for
next menu
```

4. Press "ENTER"
The current battery status will be displayed.

```
Battery Status
On AC Power
```

5. Press "SETUP"
Until the display reads "Lid Switch Menus".

```
Press ENTER for
Lid Switch menus
or press SETUP for
next menu
```

6. Press "ENTER"
The display will read "Lid Switch Installed". Use the "▲/▼" keys to adjust and press "ENTER" to save.

```
Lid Switch Installed
NO
Use ▲▼ to adjust
Press ENTER to save
```

7. Press "SETUP"
The display will read "Lid Open Fog Clear". Use the "▲/▼" keys to adjust and press "ENTER" to save.

```
Lid Open Fog Clear
DISABLED
Use ▲▼ to adjust
Press ENTER to save
```

8. Press "SETUP"
The display will read "Lid Open Alarm Time". Use the "▲/▼" keys to adjust the value and press "ENTER" to save.

```
Lid Open Alarm Time
1 min
Use ▲▼ to adjust
Press ENTER to save
```

7.2.4. Display and Output Settings

This section demonstrates how to adjust the Display and Output Settings.

7.2.4.1. Temp and Level Display Units

NOTE: Security Level 1 or higher is required to change the display units.

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level
Required use ▲▼ to
ENTER Password
0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for
Temperature Menus
or press SETUP for
next menu

3. Press "SETUP"
Until the display reads "Display and Output".

Press ENTER for
Display and Output
or press SETUP for
next menu

4. Press "ENTER"
The display will read "Temperature Units". Use the "▲/▼" keys to adjust and press "ENTER" to save.

Temperature Units
°C
Use ▲▼ to adjust
Press ENTER to save

5. Press "SETUP"
The display will read "Level Display Menus".

Press ENTER for
Level Display Menus
or press SETUP for
next menu

6. Press "ENTER"
The display will read "Level Units". Use the "▲/▼" keys to adjust and press "ENTER" to save.

Level Units
in
Use ▲▼ to adjust
Press ENTER to save

7. Press "SETUP"
The display will read "Define 100%". If using the percentage level units, then use the "▲/▼" keys to adjust and press "ENTER" to save.

Define 100%
8.0 in
Use ▲▼ to adjust
Press ENTER to save

8. Press "SETUP"
The display will read "Define 0%". If using the percentage level units, then use the "▲/▼" keys to adjust and press "ENTER" to save.

Define 0%
0.0 in
Use ▲▼ to adjust
Press ENTER to save

Percentage Level Units Explanation

The defined 0% and 100% values are independent of the automatic level control parameters. The percentage level units are just an alternative to displaying the measured level in inches or millimeters. The percentage parameters can be set to match the high and low fill setpoints or they can be set to any other value that makes interpreting the liquid level easier for the user.

7.2.4.2. Liquid Usage Display

NOTE: Security Level 1 or higher is required to enable/disable the liquid usage display.

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level
Required use ▲▼ to
ENTER Password
0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for
Temperature Menus
or press SETUP for
next menu

3. Press "SETUP"
Until the display reads "Display and Output".

Press ENTER for
Display and Output
or press SETUP for
next menu

4. Press "ENTER"
The display will read "Temperature Units".

Temperature Units
°C
Use ▲▼ to adjust
Press ENTER to save

5. Press "SETUP"
Until the display reads "Display liquid usage". Use the "▲/▼" keys to adjust and press "ENTER" to save.

Display liquid usage
ENABLED
Use ▲▼ to adjust
Press ENTER to save

6. Press "SETUP"
Until the display reads "Liquid Usage Alarm". Use the "▲/▼" keys to adjust and press "ENTER" to save.

Liquid Usage Alarm
ENABLED
Use ▲▼ to adjust
Press ENTER to save

DISPLAY AND OUTPUT:
Liquid Usage Alarm can now be "Enabled or Disabled" on software versions starting with 2.03. When this alarm is disabled, there will be no visual or audible indication at the controller, but the event code for the alarm will continue to be recorded in the internal data log. Since this alarm is the early warning to potential vacuum failure, it is recommended that it not be disabled.

With software version 2.03 the liquid usage warning will no longer be indicated on the unit either audibly or visually. It will only be recorded in the internal data log. This is to minimize self-correcting nuisance warnings. A New menu page was added in the Display and Output menu, after the Enable Liquid Usage Display page, to allow enabling / disabling the liquid usage alarm.

7.2.4.3. Alarm Buzzer

The audible alarm buzzer can be disabled. This will not disable the alarms, only the audible buzzer. Alarms will still be displayed visually on the screen if the alarm buzzer is inactive.

NOTE: Security Level 2 or higher is required to enable/disable the alarm buzzer.

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level
Required use ▲▼ to
ENTER Password
0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for
Temperature Menus
or press SETUP for
next menu

3. Press "SETUP"
Until the display reads "Display and Output".

Press ENTER for
Display and Output
or press SETUP for
next menu

4. Press "ENTER"
The display will read "Temperature Units".

Temperature Units
°C
Use ▲▼ to adjust
Press ENTER to save

5. Press "SETUP"
Until the display reads "Advanced Display and Output".

Press ENTER for
Advanced Display
and Output or press
SETUP for next menu

6. Press "ENTER"
The display will read "Alarm Buzzer". Use the "▲/▼" keys to adjust and press "ENTER" to save.

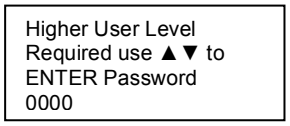
Alarm Buzzer
ENABLED
Use ▲▼ to adjust
Press ENTER to save

7.2.4.4. Languages

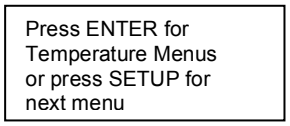
The TEC 3000 has five language options to choose from: English, Spanish, German, Italian, and French.

NOTE: Security Level 2 or higher is required to change the language setting.

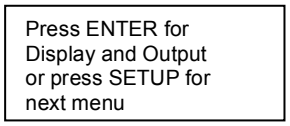
1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.



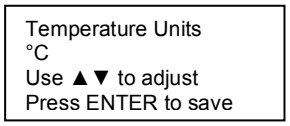
2. Press "ENTER"
The display will read "Temperature Menus".



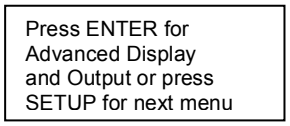
3. Press "SETUP"
Until the display reads "Display and Output".



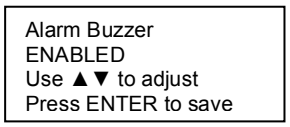
4. Press "ENTER"
The display will read "Temperature Units".



5. Press "SETUP"
Until the display reads "Advanced Display and Output".



6. Press "ENTER"
The display will read "Alarm Buzzer".



7. Press "SETUP"
The display will read "Language". Use the "▲/▼" keys to adjust and press "ENTER" to save.

7.2.4.5. Printer

This section describes how to adjust the Printer settings. For instructions on how to connect a printer, see the Communication / Networking section.

NOTE: Security Level 2 or higher is required to adjust the Printer settings.

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level Required use ▲▼ to ENTER Password 0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for Temperature Menus or press SETUP for next menu

3. Press "SETUP"
Until the display reads "Display and Output".

Press ENTER for Display and Output or press SETUP for next menu

4. Press "ENTER"
The display will read "Temperature Units".

Temperature Units °C Use ▲▼ to adjust Press ENTER to save

5. Press "SETUP"
Until the display reads "Advanced Display and Output".

Press ENTER for Advanced Display and Output or press SETUP for next menu

6. Press "ENTER"
The display will read "Alarm Buzzer".

Alarm Buzzer ENABLED Use ▲▼ to adjust Press ENTER to save

7. Press "SETUP"
Until the display reads "Printer Menu".

Press ENTER for Printer menus or press SETUP for next menu

8. Press "ENTER"
The display will read "Print Interval". Use the "▲/▼" keys to adjust and press "ENTER" to save.

Print Interval 30 min Use ▲▼ to adjust Press ENTER to save

9. Press "SETUP"
The display will read "Print Header". Press "ENTER" to print a new header.

Press ENTER to Print Header or press SETUP for next menu

10. Press "SETUP"
The display will read "Print Event". Press "ENTER" to print a new event.

Press ENTER to Print Event or press SETUP for next menu

7.2.5. Advanced Settings

This section describes how to change the various Advanced Settings.

7.2.5.1. Timed Filling

The TEC 3000 has several advanced filling options including Timed Filling. Timed Filling allows the user to set a regular filling schedule based on a fill start time and a fill frequency. If a facility staff would like the peace of mind of knowing that all the freezers are full of LN2 before leaving for the weekend, then they could set up a timed fill for every Friday afternoon. Even if the LN2 level in a freezer is above Low Level Setpoint, the TEC 3000 will initiate a fill and top off the freezer to its High Level Setpoint. If the liquid level is at or above the High Level Setpoint, then the TEC 3000 will skip that timed fill event and not initiate a fill.

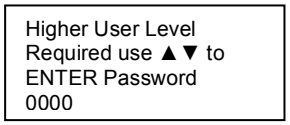
A TEC 3000 with a Timed Filling schedule will still maintain Auto Fill Control. If Timed Filling and Auto Fill Control are enabled, then the TEC 3000 will still initiate a fill anytime the liquid level reaches the Low Level Setpoint. Firmware Ver. 2.03 or higher will allow the Timed Fill Start to be set to any hour and minutes except midnight.

Timed Filling Setup

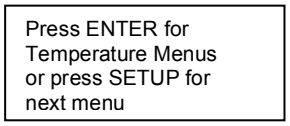
Enable Timed Filling and then select the number of days to elapse between timed fillings. Select a Timed Fill Start time that is later that same day. If Timed Filling is being enabled at 9:30 AM, then the Timed Fill Start should be set to 9:31 AM or later. This is recommended for simplicity. The TEC 3000 will initiate a fill when the Timed Fill Start is reached later that day. From then on, each time the Timed Fill Frequency elapses, the TEC 3000 will fill the freezer to its High Level Setpoint. The Timed Fill Frequency has a range of 1 to 28 days and the Timed Fill Start can be set to any hour and minutes except midnight. If midnight is selected controllers with Ver. 2.03 or higher will automatically change the hour and minutes to 01:00 hours.

NOTE: Security Level 3 or higher is required to setup or change Timed Filling.

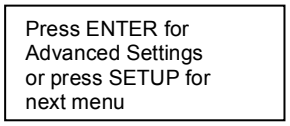
1. Press “SETUP”
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the “▲/▼” keys to scroll to the appropriate number. Press “ENTER” to advance the cursor to the next position.



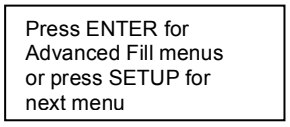
2. Press “ENTER”
The display will read “Temperature Menus”.



3. Press “SETUP”
Until the display reads “Advanced Settings”.



4. Press “ENTER”
The display will read “Advanced Fill Menus”.



5. Press "ENTER"
The display will read "Timed Fill". Use the "▲/▼" keys to adjust and press "ENTER" to save.

Timed Fill DISABLED Use ▲▼ to adjust Press ENTER to save

6. Press "SETUP"
The display will read "Timed Fill Frequency". Use the "▲/▼" keys to adjust and press "ENTER" to save. It can be set from 1 to 28 days.

Timed Fill Frequency 5 Days Use ▲▼ to adjust Press ENTER to save

7. Press "SETUP"
The display will read "Timed Fill Start Hour". Use the "▲/▼" keys to adjust and press "ENTER" to save.

Timed **Fill Start** Hour 20:00 Use ▲▼ to adjust Press ENTER to save

8. Press "SETUP"
The display will read "Timed Fill Start Minute" Use the "▲/▼" keys to adjust and press "ENTER" to save.

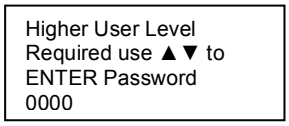
Timed **Fill Start** Minute 20:00 Use ▲▼ to adjust Press ENTER to save

7.2.5.2. Maximum Fill Time

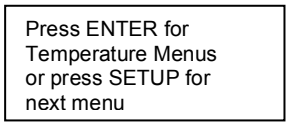
The maximum fill time can be adjusted in the Advanced Fill Menus. If a freezer begins filling but does not reach its High Level Setpoint within the maximum fill time, then the TEC 3000 will terminate the fill and trigger a Fill Time Alarm. Auto Fill Control will then be disabled until the Fill Time Alarm is cleared. The maximum fill time has a range of 30 to 240 minutes.

NOTE: Security Level 3 or higher is required to adjust the maximum fill time.

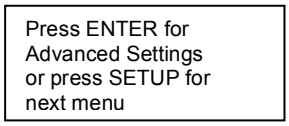
1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.



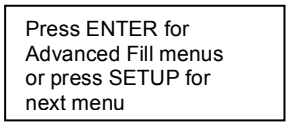
2. Press "ENTER"
The display will read "Temperature Menus".



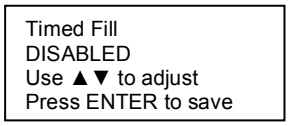
3. Press "SETUP"
Until the display reads "Advanced Settings".



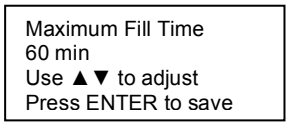
4. Press "ENTER"
The display will read "Advanced Fill Menus".



5. Press "ENTER"
The display will read "Timed Fill".



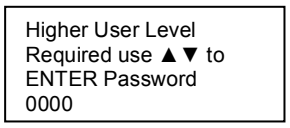
6. Press "SETUP"
Until the display reads "Maximum Fill Time". Use the "▲/▼" keys to adjust and press "ENTER" to save.



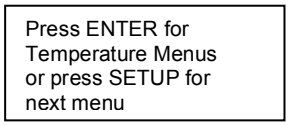
7.2.5.3. Time and Date

The time and date can be set in the Advanced Settings Menus. The user has the option of a 12 or 24 hour clock and a MM/DD/YY or DD/MM/YY date format.
NOTE: Security Level 2 or higher is required to change the time and date.

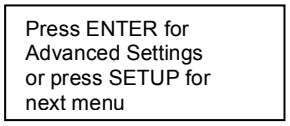
1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.



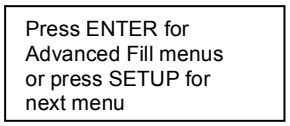
2. Press "ENTER"
The display will read "Temperature Menus".



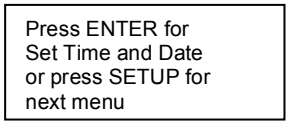
3. Press "SETUP"
Until the display reads "Advanced Settings".



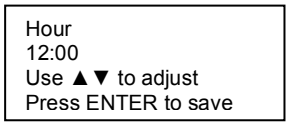
4. Press "ENTER"
The display will read "Advanced Fill Menus".



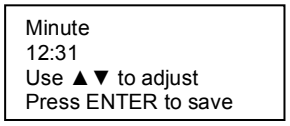
5. Press "SETUP"
The display will read "Set Time and Date".



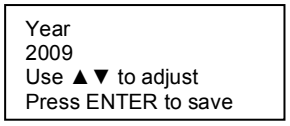
6. Press "ENTER"
The display will read "Hour". Use the "▲/▼" keys to adjust the hour and press "ENTER" to save.



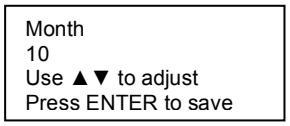
7. Press "SETUP"
The display will read "Minute". Use the "▲/▼" keys to adjust the minute and press "ENTER" to save.



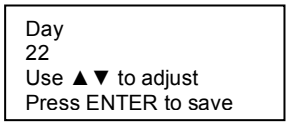
8. Press "SETUP"
The display will read "Year". Use the "▲/▼" keys to adjust the year and press "ENTER" to save.



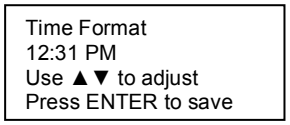
9. Press "SETUP"
The display will read "Month". Use the "▲/▼" keys to adjust the month and press "ENTER" to save.



10. Press "SETUP"
The display will read "Day". Use the "▲/▼" keys to adjust the day and press "ENTER" to save.



11. Press "SETUP"
The display will read "Time Format". Use the "▲/▼" keys to adjust and press "ENTER" to save.



12. Press “SETUP”

The display will read “Date Format”. Use the “▲/▼” keys to adjust and press “ENTER” to save.

Date Format MM/DD/YY Use ▲▼ to adjust Press ENTER to save

7.2.5.3.1. Communication Settings

7.2.5.3.2. COM Setup / Type

The settings for the two serial ports can be adjusted in the COM 1 and COM 2 Setup Menus. Since they are independent serial ports, only one serial port can be set to a given COM Type. If COM 1 is set to ASCII, then COM 2 cannot also be set to ASCII. Networked controllers must be daisy chained together with RJ-45 splitters in order to communicate using the same COM Type.

NOTE: Security Level 3 or higher is required to change the Communication Settings.

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level Required use ▲▼ to ENTER Password 0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for Temperature Menus or press SETUP for next menu

3. Press "SETUP"
Until the display reads "Advanced Settings".

Press ENTER for Advanced Settings or press SETUP for next menu

4. Press "ENTER"
The display will read "Advanced Fill Menus".

Press ENTER for Advanced Fill menus or press SETUP for next menu

5. Press "SETUP"
Until the display reads "COM 1 Menus". For COM 2 Menus, press "SETUP".

Press ENTER for COM 1 menus or press SETUP for next menu

6. Press "ENTER"
The display will read "COM 1 Setup". Use the "▲/▼" keys to adjust and press "ENTER" to save.

COM 1 Setup 9600 N81 Use ▲▼ to adjust Press ENTER to save

7. Press "SETUP"
The display will read "COM 1 Type". Use the "▲/▼" keys to adjust and press "ENTER" to save.

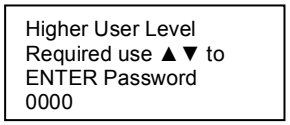
COM 1 Type ASCII Use ▲▼ to adjust Press ENTER to save

7.2.5.3.3. MODBUS ID

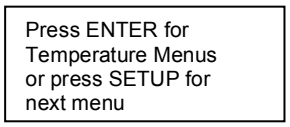
The TEC 3000 MODBUS ID also serves as the ASCII Unit ID. This address can be adjusted in the MODBUS Menu and has a range of 1 to 200.

NOTE: Security Level 2 or higher is required to change the MODBUS ID.

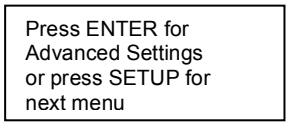
1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.



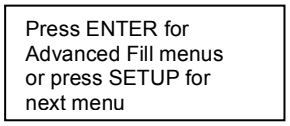
2. Press "ENTER"
The display will read "Temperature Menus".



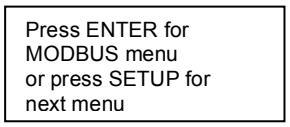
3. Press "SETUP"
Until the display reads "Advanced Settings".



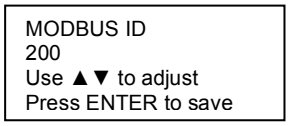
4. Press "ENTER"
The display will read "Advanced Fill Menus".



5. Press "SETUP"
Until the display reads "MODBUS Menu".



6. Press "ENTER"
The display will read "MODBUS ID". Use the "▲/▼" keys to adjust and press "ENTER" to save.

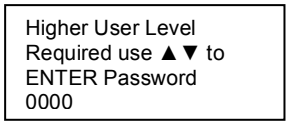


7.2.5.4. One Fill All Fill (OFAF)

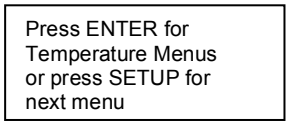
This section describes how to adjust the various OFAF settings. For more information and instructions on how to setup an OFAF network, refer to the OFAF Network Setup section of this manual.

NOTE: Security Level 3 or higher is required to adjust the OFAF settings.

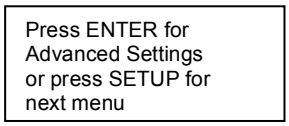
1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.



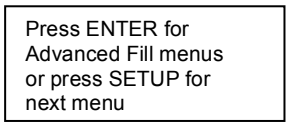
2. Press "ENTER"
The display will read "Temperature Menus".



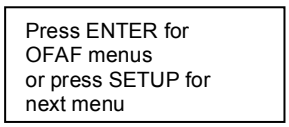
3. Press "SETUP"
Until the display reads "Advanced Settings".



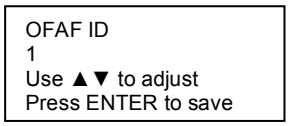
4. Press "ENTER"
The display will read "Advanced Fill Menus".



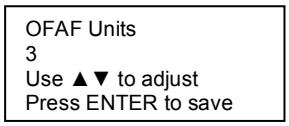
5. Press "SETUP"
Until the display reads "OFAF Menus".



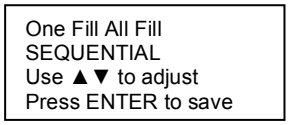
6. Press "ENTER"
The display will read "OFAF ID". Use the "▲/▼" keys to adjust the OFAF ID and press "ENTER" to save.



7. Press "SETUP"
The display will read "OFAF Units". Use the "▲/▼" keys to adjust the number of units and press "ENTER" to save.



8. Press "SETUP"
The display will read "One Fill All Fill". Use the "▲/▼" keys to adjust the type and press "ENTER" to save.



7.2.5.5. Restore Default Settings (Global Password)

The TEC 3000 can be reset to the factory defaults in the Advanced Settings Menu. This will also reset post-factory calibrations and ***global password to 3 4 5 6***. The accuracy of the level and temperature measurements should be confirmed after resetting.

Note: It is recommended to download complete data from the controller prior to performing a restore to defaults. Restoring to defaults will erase previous stored data and it cannot be retrieved once the restore function is performed.

NOTE: Security Level 3 or higher is required to reset to factory default settings.

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level Required use ▲▼ to ENTER Password 0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for Temperature Menus or press SETUP for next menu

3. Press "SETUP"
Until the display reads "Advanced Settings".

Press ENTER for Advanced Settings or press SETUP for next menu

4. Press "ENTER"
The display will read "Advanced Fill Menus".

Press ENTER for Advanced Fill menus or press SETUP for next menu

5. Press "SETUP"
Until the display reads "Restore All Defaults".

Press ENTER to Restore All Defaults or press SETUP for next menu

6. Press "ENTER"
The display will read "Confirm Restore". Use the "▲/▼" keys to change to "YES" and press "ENTER" to save.

Confirm Restore NO Use ▲▼ to adjust Press ENTER to save

TEC3000 Default Settings

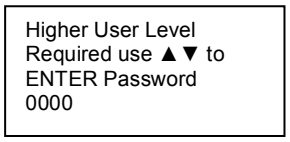
Parameter	Default Setting
High Temp Alarm	-110.0 °C / -166.0 °F / 163.2 K
Low Temp Alarm	-200.0 °C / -327.6 °F / 73.4 K
High Level Alarm	8.0 in / 205 mm
High Level Setpoint	7.0 in / 180 mm
Low Level Setpoint	5.0 in / 125 mm
Low Level Alarm	4.0 in / 100 mm
Defined 100%	8.0 in / 205 mm
Defined 0%	4.0 in / 100 mm
Level Offset	+1.3 in / +35 mm
Auto Fill	Enabled
Maximum Fill Time	60 minutes
Temperature Display Units	°C
Liquid Level Display Units	Inches
Hot Gas Bypass MENU	DISABLED
Hot Gas Bypass Temp Setpoint	-70 °C
Hot Gas Bypass Alarm Time Delay	5 minutes
COM 1 Type	ASCII
COM 2 Type	Disabled
Event Log Interval	240 minutes
GLOBAL PASSWORD	**3 4 5 6**

7.2.5.6. Restart Controller

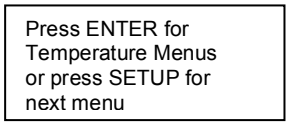
The TEC 3000 can be restarted in the Advanced Settings Menu. Restarting the controller and cycling the power are both safe ways to reboot the controller.

NOTE: Security Level 3 or higher is required to restart the controller from the Advanced Settings Menu

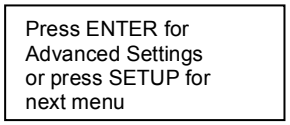
1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.



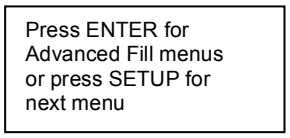
2. Press "ENTER"
The display will read "Temperature Menus".



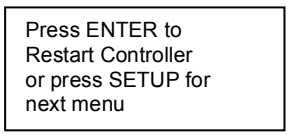
3. Press "SETUP"
Until the display reads "Advanced Settings".



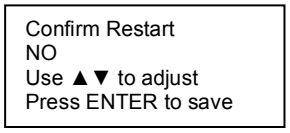
4. Press "ENTER"
The display will read "Advanced Fill Menus".



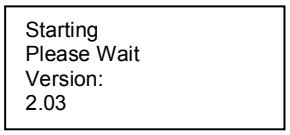
5. Press "SETUP"
Until the display reads "Restart Controller".



6. Press "ENTER"
The display will read "Confirm Restart". Use the "▲/▼" keys to change to "YES".



7. Press "ENTER"
The controller will restart and the display will read "Starting Please Wait". Following the startup sequence, the display will return to the main monitoring screen.



7.2.5.7. Firmware Update

NOTE: TEC 3000 firmware should only be updated by authorized MVE Distributors or under the direction of Technical Service. Improper firmware updates can render the controller inoperable.

The firmware, or controller software, can be updated in the event that a new revision is released. A personal computer, Chart/MVE TEC COM USB communications kit (PN 13376947), and the current firmware updater program are required to perform an upgrade. Contact your authorized MVE Distributor or Technical Service for more information.

1. Connect the TEC COM USB kit to serial port 1 on the TEC 3000 and a USB port on a computer.
2. Start the current firmware updater program.
3. When prompted, select “Update Firmware” in the TEC 3000 Advanced Settings Menu and cycle power to the controller.
4. The updater program should begin loading the new firmware.
5. Once complete, the controller may take several minutes to reboot. It is normal for an occasional beep to sound during this rebooting period.

NOTE: Security Level 3 or higher is required to update the firmware.

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level
Required use ▲▼ to
ENTER Password
0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for
Temperature Menus
or press SETUP for
next menu

3. Press "SETUP"
Until the display reads "Advanced Settings".

Press ENTER for
Advanced Settings
or press SETUP for
next menu

4. Press "ENTER"
The display will read "Advanced Fill Menus".

Press ENTER for
Advanced Fill menus
or press SETUP for
next menu

5. Press "SETUP"
Until the display reads "Update Firmware".

Press ENTER to
Update Firmware
or press SETUP for
next menu

6. Press "ENTER"
The display will read "Confirm Update". Use the "▲/▼" keys to change to "YES".

Confirm Update
NO
Use ▲▼ to adjust
Press ENTER to save

7. Press "ENTER"
The display will read "Connect COM 1 to a PC and cycle controller power". After cycling controller power, the updater program should begin loading the new firmware.

Connect COM 1
to a PC and
Cycle controller
power

8. During the firmware update, the display will read "Communications Loss Check Controller". This is normal. Upon completion, the startup sequence should begin within several minutes.

Communications Loss
Check Controller

7.2.6. Password / Security Setup

This section details how to enable / disable password entry mode as well as how to change and setup multilevel security passwords.

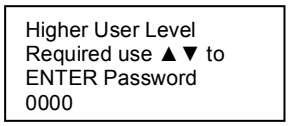
NOTE: Security Level 4 is required to setup or change passwords.

7.2.6.1. Password Entry Mode

This section details how to enable / disable password entry mode. Disabling the password entry mode will remove all TEC 3000 password protection.

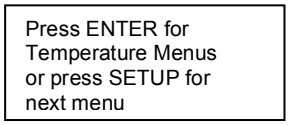
1. Press "SETUP"

Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.



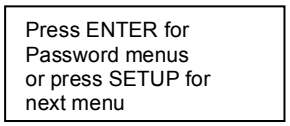
2. Press "ENTER"

The display will read "Temperature Menus".



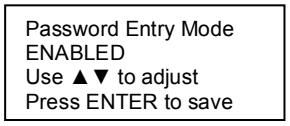
3. Press "SETUP"

Until the display reads "Password Menus".



4. Press "ENTER"

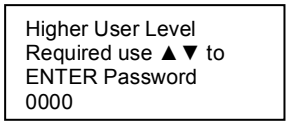
The display will read "Password Entry Mode". Use the "▲/▼" keys to change and press "ENTER" to save.



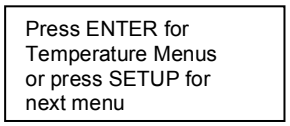
7.2.6.2. Global Password Change

This section describes how to change the **Global Password 3 4 5 6**. The Global Password has Security Level 4 clearance.

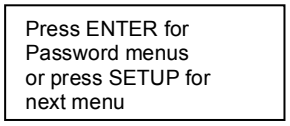
1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.



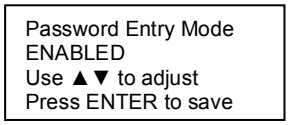
2. Press "ENTER"
The display will read "Temperature Menus".



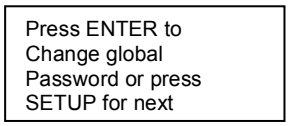
3. Press "SETUP"
Until the display reads "Password Menus".



4. Press "ENTER"
The display will read "Password Entry Mode".

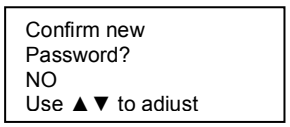


5. Press "SETUP"
The display will read "Change Global Password". The Global Password has Security Level 4 clearance.



6. Press "ENTER"
The display will read "Global Password". Use the "▲/▼" keys to input new Global Password and press "ENTER" to advance the cursor.

7. Press "ENTER"
The display will read "Confirm new Password?" To confirm new password, use the "▲/▼" keys to change from "NO" to "YES" and press "ENTER" to save.



7.2.6.3. Multilevel Passwords

This section describes how to setup and change the 9 multilevel passwords.

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor on the entry screen will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level
Required use ▲▼ to
ENTER Password
0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for
Temperature Menus
or press SETUP for
next menu

3. Press "SETUP"
Until the display reads "Password Menus".

Press ENTER for
Password menus
or press SETUP for
next menu

4. Press "ENTER"
The display will read "Password Entry Mode".

Password Entry Mode
ENABLED
Use ▲▼ to adjust
Press ENTER to save

5. Press "SETUP"
Until the display reads "Change Password 1".
Continue to press "SETUP" to access passwords 2-9.

Press ENTER to
Change Password 1
or press SETUP for
next

6. Press "ENTER"
The display will read "Password 1". Use the "▲/▼" keys to input Password 1 and press "ENTER" to advance the cursor.

Password 1
Use ▲▼ to adjust
Press ENTER for next
XXXX

7. Press "ENTER"
The display will read "Password 1 Level" Use the "▲/▼" keys to select the appropriate Security Level.

Password 1
Use ▲▼ to adjust
Press ENTER for next
Level 1

8. Press "ENTER"
The display will read "Confirm new Password?" Use the "▲/▼" keys to change "NO" to "YES" and press "ENTER" to save.

Confirm new
Password?
NO
Use ▲▼ to adjust

7.3. Calibration Procedures

7.3.1. Temperature Sensor Calibration

This section describes how to calibrate the TEC 3000 temperature sensors. There are two calibration procedures: single point and two point calibration.
For single point calibration, the reference point is LN2. For two point calibration, the reference points are LN2 and ice water. Unless regulations require a two point calibration, the single point calibration procedure is recommended. The benefit of two point calibration is more accurate temperature measurement in near room temperature environments. The drawback is a longer, more complex calibration procedure. The benefit of a single point calibration is a simple calibration procedure. The drawback of single point calibration is less accurate temperature measurement in near room temperature environments.

All new freezers equipped with TEC 3000 controllers have been calibrated at the factory. The temperature sensors should only be calibrated if faulty readings are suspected, a sensor or the TEC 3000 itself has been replaced, following a firmware update, or as a part of a preventative maintenance schedule.

For an accurate calibration, the LN2 Saturation Temperature (Section 7.2.1.4) needs to be correctly set based on the altitude of the freezer location.

NOTE: Security Level 2 or higher is required to calibrate temperature sensors.

CAUTION: Always wear protective gloves and face shield when handling LN2. Refer to the Safety section of this manual.

7.3.1.1. Single Point Calibration

The single point calibration procedure requires a small volume of LN2; enough to completely submerge the end of the temperature sensor. It may be possible to use the LN2 in the freezer space if the probe length permits.

1. Press "SETUP"
Controller will prompt for a password. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level
Required use ▲▼ to
ENTER Password
0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for
Temperature Menus
or press SETUP for
next menu

3. Press "ENTER"
The display will read "Temp A Menu".
Press "SETUP" for Temp B.

Press ENTER for
Temp A menu
or press SETUP for
next menu

4. Press "ENTER"
The display will read "Temp A".

Temp A
ENABLED
Use ▲▼ to adjust
Press ENTER to save

5. Press "SETUP"
Until the display reads "Temp A Calibration".

Press ENTER to
Temp A Calibration
or press SETUP for
next menu

6. Press "ENTER"
The display will read "Calibration Type". Use the "▲/▼" keys to adjust to "SINGLE POINT".

Calibration Type
SINGLE POINT
Use ▲▼ to adjust
Press ENTER for next

7. Press "ENTER"
The display will read "Temp A Calibration". Completely submerge the sensing end of Temp probe A in LN2.

Temp A Calibration
Place Probe A in
LN2 and press
ENTER

8. Press "ENTER"
The display will read "Wait for Temp A to stabilize". Wait for the displayed Temp A reading to stabilize while the probe is submerged in LN2 before pressing "ENTER".

Wait for Temp A to
stabilize then press
ENTER
Temp A -195.8 °C

9. Press "ENTER"
The display will read "Probe A single point calibration complete".

Probe A single point
calibration complete

7.3.1.2. Two Point Calibration

The two point calibration procedure requires a small volume of LN2 and an ice water bath; enough to completely submerge the end of the sensor. Proper ice water bath preparation is imperative to ensure accuracy. It is best to add filtered water to a Styrofoam cup containing crushed ice. Allow the solution to stand at room temperature for five minutes prior to beginning procedure.

1. Press "SETUP"
Controller will prompt for a password. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level
Required use ▲▼ to
ENTER Password
0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for
Temperature Menus
or press SETUP for
next menu

3. Press "ENTER"
The display will read "Temp A Menu".
Press "SETUP" for Temp B.

Press ENTER for
Temp A menu
or press SETUP for
next menu

4. Press "ENTER"
The display will read "Temp A".

Temp A
ENABLED
Use ▲▼ to adjust
Press ENTER to save

5. Press "SETUP"
Until the display reads "Temp A Calibration".

Press ENTER to
Temp A Calibration
or press SETUP for
next menu

6. Press "ENTER"
The display will read "Calibration Type". Use the "▲/▼" keys to adjust to "Two Point".

Calibration Type
TWO POINT
Use ▲▼ to adjust
Press ENTER for next

7. Press "ENTER"
The display will read "Temp A Calibration". Completely submerge the sensing end of Temp probe A in LN2.

Temp A Calibration
Place Probe A in
LN2 and press
ENTER

8. Press "ENTER"
The display will read "Wait for Temp A to stabilize". Wait for the displayed Temp A reading to stabilize while the probe is submerged in LN2.

Wait for Temp A to
stabilize then press
ENTER
Temp A -195.8 °C

9. Press "ENTER"
The display will read "Remove Probe A from LN2". Remove the temperature sensor from the LN2.

Remove Prove A from
LN2 and press
ENTER

10. Press "ENTER"
The display will read "Wait while probe warms to room temperature". Wait while the temperature sensor warms to room temperature and the controller counts down.

Wait while probe
warms to room
temperature
180 seconds

11. Wait 180 seconds

After the controller counts down, the display will read "Place Probe A in ice water". Completely submerge the sensing end of the probe in the ice water bath.

Place Probe A in
ice water and press
ENTER

12. Press "ENTER"

The display will read "Wait for Temp A to stabilize". Wait for the displayed Temp A reading to stabilize while the probe is submerged in the ice bath.

Wait for Temp A to
stabilize then press
ENTER
Temp A 0 °C

13. Press "ENTER"

The display will read "Probe A two point calibration complete".

Probe A two point
calibration complete

7.3.2. Liquid Nitrogen Level Calibration

This section describes the procedure to calibrate the LN2 level. This procedure requires the cryogenic meter dip stick supplied with each MVE freezer. This calibration method provides level measurements with a ±0.5” (±13 mm) accuracy.

All new freezers equipped with TEC 3000 controllers have been calibrated at the factory. The liquid level should only be calibrated if faulty readings are suspected, the TEC 3000 itself has been replaced, following a firmware update, or as a part of a preventative maintenance schedule.

CAUTION: Always wear protective gloves and face shield when handling LN2. Refer to the Safety section of this manual.

Dip Stick Procedure

1. Open or remove the freezer lid to access the interior storage space.
2. Hold the meter dip stick vertically with the 0.0 inch end pointed down.
3. Lower the meter dip stick into the LN2 at the bottom of the freezer. Ensure the meter dip stick is vertical and touching the bottom of the inner Dewar. Some LN2 boiling will occur around the meter dip stick.
    a. MVE High Efficiency / Vapor Series Freezers:
        Insert meter dip stick into the rectangular channel on the turn tray in order to access the liquid below the tray.
    b. MVE Series and MVE Cabinet Series Freezers:
        Lower the meter dip stick to the bottom of the freezer as close to the center as possible to obtain an accurate measurement.
4. Leave the meter dip stick in the LN2 for approximately 5 seconds.
5. Remove the meter dip stick from the liquid and immediately wave it back and forth in the air. A distinct frost line will begin to develop as moisture in the air condenses on the meter dip stick predominately where it was submerged.
6. Subtract 0.5 inches (13 mm) from the observed frost line to account for the LN2 boiling up around the meter dip stick while it was submerged. This resultant level measurement represents the actual liquid level inside the freezer. Once you have obtained the measured level, proceed to the liquid level calibration.

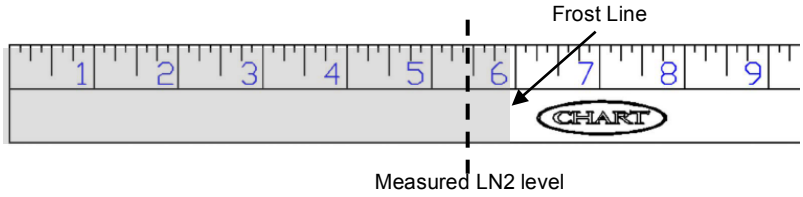
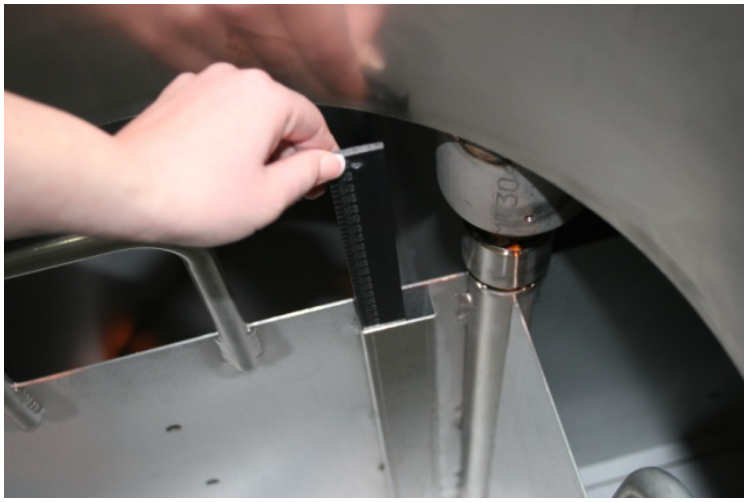


Figure 11: Meter dip stick showing example level frost line. The resultant measured level would be 5.5 inches after subtracting 0.5 inches from the frost line to account for the LN2 boiling.

Note: LN2 liquid at or above turn tray height will rise higher in the dip stick channel.



Level dip stick inserted to measure the physical liquid nitrogen level

Liquid Level Calibration

NOTE: Liquid level calibration cannot be performed while the TEC 3000 is filling. If TEC 3000 is filling, press “Stop Fill” and perform the calibration. Allow freezer plumbing to thaw 10 to 15 minutes before calibrating.

NOTE: Liquid level calibration is most accurate when calibrated at 10.0 inches (254 mm). Calibration must be performed above 3.0 inches (75 mm).

NOTE: Security Level 3 or higher is required to calibrate the liquid level.

1. Press “SETUP”

Controller will prompt for a password. A flashing cursor will make it clear which digit is being changed. Use the “▲/▼” keys to scroll to the appropriate number. Press “ENTER” to advance the cursor to the next position.

Higher User Level Required use ▲▼ to ENTER Password 0000

2. Press “ENTER”

The display will read “Temperature Menus”.

Press ENTER for Temperature Menus or press SETUP for next menu

3. Press “SETUP”

Until the display reads “Liquid Level Menus”.

Press ENTER for Liquid Level menus or press SETUP for next menu

4. Press “ENTER”

The display will read “High Level Alarm”.

High Level Alarm 8.0 in Use ▲▼ to adjust Press ENTER to save

5. Press “SETUP”

Until the display reads “Advanced Level Menus”.

Press ENTER to Advanced Level menus or press SETUP for next menu

6. Press “ENTER”

The display will read “Auto Fill Control”.

Auto Fill Control ENABLED Use ▲▼ to adjust Press ENTER for next

7. Press “SETUP”

Until the display reads “Level Calibration”.

Level Calibration Press ENTER to Start calibration or SETUP for next

8. Press “ENTER”

The display will read “Please wait while the sensor zeros”. Wait for the controller to count down from 60 seconds.

Please wait while the sensor zeros 60 seconds

9. Wait 60 seconds

After the controller counts down, the display will read “Actual Level”. Use the “▲/▼” keys to input the meter dip stick measured level.

Actual Level 10.0 in Use ▲▼ to adjust Press ENTER to save

10. Press "ENTER"
The display will read "Level Calibration Complete".

Level Calibration Complete

11) Verify that the home screen reads the liquid level value that was just entered. In some cases the controller should be restarted. Contact Technical support with any questions.

7.3.3. Hot Gas Bypass Sensor Calibration

This section describes how to calibrate the TEC 3000 hot gas bypass sensor. There are two calibration procedures: single point and two point calibration.
For single point calibration, the reference point is LN2. For two point calibration, the reference points are LN2 and ice water. Unless regulations require a two point calibration, the single point calibration procedure is recommended.

All new freezers equipped with TEC 3000 controllers and hot gas bypass have been calibrated at the factory. The hot gas bypass sensor should only be calibrated if faulty readings are suspected, bypass sensor has been replaced, or as a part of a preventative maintenance schedule.

For an accurate calibration, the LN2 Saturation Temperature (Section 6.2.1.4) needs to be correctly set based on the altitude of the freezer location.

Both the single and two point calibration procedures require a small volume of LN2; enough to completely submerge the bypass sensor. The two point calibration also requires an ice water bath. Proper ice water bath preparation is imperative to ensure accuracy. It is best to add filtered water to a Styrofoam cup containing crushed ice. Allow the solution to stand at room temperature for five minutes prior to beginning the calibration procedure.

NOTE: Security Level 2 or higher is required to calibrate the bypass sensor.

Hot Gas Bypass Sensor Removal

CAUTION: Removing the hot gas bypass sensor while a LN2 supply is connected to the freezer will cause the user to be exposed to LN2. Before beginning procedure, shut off and disconnect all LN2 supply sources. Always wear protective gloves and face shield when handling LN2. Refer to the Safety section of this manual.

1. Ensure all LN2 supply sources are shut off and disconnected.
2. Remove plumbing shroud or rear panel to access the plumbing assembly.
3. Locate the hot gas bypass sensor on the plumbing assembly.
4. Using a 9/16” or small adjustable wrench, remove the sensor from the plumbing assembly. It may be necessary to temporarily disconnect the sensor from the wire harness to avoid over twisting of the wires. Following removal of the sensor, reconnect the sensor wires.
5. Perform the hot gas bypass sensor calibration procedure.
6. Following calibration, reinstall the bypass sensor using new PTFE thread tape, ensure sensor wires are connected, reinstall plumbing shroud or rear panel, and reconnect the LN2 supply source.

7.3.3.1. Hot Gas Sensor Single Point Calibration

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level
Required use ▲▼ to
ENTER Password
0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for
Temperature Menus
or press SETUP for
next menu

3. Press "SETUP"
Until the display reads "Add-on Menus".

Press ENTER for
Add-on menus
or press SETUP for
next menu

4. Press "ENTER"
The display will read "Battery Status".

Battery Status
On AC Power

5. Press "SETUP"
Until the display reads "Hot Gas Bypass Menus".

Press ENTER to
Hot Gas Bypass menus
or press SETUP for
next menu

6. Press "ENTER"
The display will read "Hot Gas Bypass".

Hot Gas Bypass
ENABLED
Use ▲▼ to adjust
Press ENTER to save

7. Press "SETUP"
Until the display reads "Bypass Probe Calibration".

Press ENTER for
Bypass Probe
Calibration or press
SETUP for next menu

8. Press "ENTER"
The display will read "Calibration Type". Use the "▲/▼" keys to set as "SINGLE POINT".

Calibration Type
SINGLE POINT
Use ▲▼ to adjust
Press ENTER for next

9. Press "ENTER"
The display will read "Bypass Calibration". Submerge the sensing end of the bypass probe in LN2.

Bypass Calibration
Place Bypass Probe
in LN2 and press
ENTER

10. Press "ENTER"
The display will read "Wait for Bypass Temp to stabilize". Wait for the displayed temp reading to stabilize while the probe is submerged in liquid.

Wait for Bypass
Temp to stabilize
then press ENTER
Bypass Temp -195.8 °C

11. Press "ENTER"
The display will read "Bypass Probe single point calibration complete".

Bypass Probe
Single point
Calibration complete

7.3.3.2. Hot Gas Sensor Two Point Calibration

1. Press "SETUP"
Controller will prompt for a password. A flashing cursor will make it clear which digit is being changed. Use the "▲/▼" keys to scroll to the appropriate number. Press "ENTER" to advance the cursor to the next position.

Higher User Level
Required use ▲▼ to
ENTER Password
0000

2. Press "ENTER"
The display will read "Temperature Menus".

Press ENTER for
Temperature Menus
or press SETUP for
next menu

3. Press "SETUP"
Until the display reads "Add-on Menus".

Press ENTER for
Add-on menus
or press SETUP for
next menu

4. Press "ENTER"
The display will read "Battery Status".

Battery Status
On AC Power

5. Press "SETUP"
Until the display reads "Hot Gas Bypass Menus".

Press ENTER to
Hot Gas Bypass menus
or press SETUP for
next menu

6. Press "ENTER"
The display will read "Hot Gas Bypass".

Hot Gas Bypass
ENABLED
Use ▲▼ to adjust
Press ENTER to save

7. Press "SETUP"
Until the display reads "Bypass Probe Calibration".

Press ENTER for
Bypass Probe
Calibration or press
SETUP for next menu

8. Press "ENTER"
The display will read "Calibration Type". Use the "▲/▼" keys to set as "TWO POINT".

Calibration Type
TWO POINT
Use ▲▼ to adjust
Press ENTER for next

9. Press "ENTER"
The display will read "Bypass Calibration". Submerge the sensing end of the bypass probe in LN2.

Bypass Calibration
Place Bypass Probe
in LN2 and press
ENTER

10. Press "ENTER"
The display will read "Wait for Bypass Temp to stabilize". Wait for the temp reading to stabilize while the probe is submerged in LN2.

Wait for Bypass
Temp to stabilize
then press ENTER
Bypass Temp -195.8 °C

11. Press "ENTER"
The display will read "Remove Probe A from LN2". Remove the bypass sensor from the LN2.

Remove Bypass Probe
from LN2 and press
ENTER

10. Press "ENTER"
The display will read "Wait while probe warms to room temperature". Wait while the bypass sensor warms to room temperature and the controller counts down.

Wait while probe
warms to room
temperature
180 seconds

11. Wait 180 seconds
After the controller counts down, the display will read "Place Probe A in ice water". Completely submerge the sensing end of the probe in the ice water bath.

Place Bypass Probe
in ice water and
press ENTER

12. Press "ENTER"
The display will read "Wait for Temp A to stabilize". Wait for the displayed Temp A reading to stabilize while the probe is submerged in the ice bath.

Wait for Bypass
Temp to stabilize
then press ENTER
Bypass Temp 0.0 °C

13. Press "ENTER"
The display will read "Bypass Probe two point calibration complete".

Bypass Probe two
Point calibration
complete

7.4. Communication / Networking

The TEC 3000 is equipped with two independent RJ-45 serial ports. These ports are intended for connection to another MVE controller, PC, serial printer, or other RS-485 device. Up to 100 TEC 3000 controllers can be successfully networked.

NOTE: The TEC 3000 should never be connected directly to a LAN or public telecommunications network.

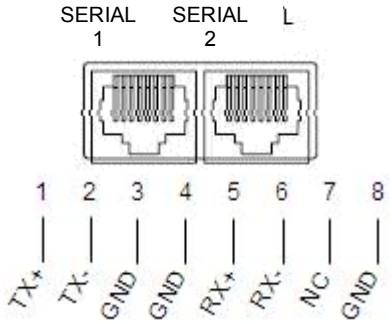


Figure 12: TEC 3000 serial ports and RS-485 4-wire pin diagram

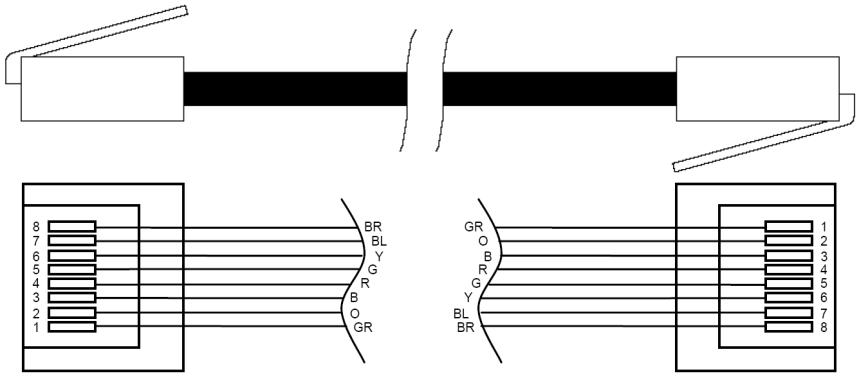


Figure 13: Standard RJ-45 cable assembly wiring details (PN 10740053). Wire colors may vary.

Table 6: RS-485 Interface Specifications

COM Setup	bits/sec	Parity	Data bits	Stop bits
9600 N81	9600	None	8	1
9600 N82	9600	None	8	2
19200 N81	19200	None	8	1
19200 N82	19200	None	8	2
COM Type				
ASCII	Printer	OFAF	MODBUS	Disabled
Transmission		**Mode**	**Terminator**	
4-wire		Asynchronous	CR, LF	

7.4.1. TEC Connect (Computer Interface)

TEC Connect is a free, downloadable software program that enables a user to download the event log and query and adjust controller parameters. This easy-to-use computer interface is fully compatible with TEC2000 and TEC3000 controllers. Features include a user-friendly ASCII command window, automatic COM Port selection, real-time temperature, level monitoring, and the event log download button that allows a date range selection. It will include the fill control buttons and a quick parameter setup table. For additional information refer to the TEC Connect user manual.

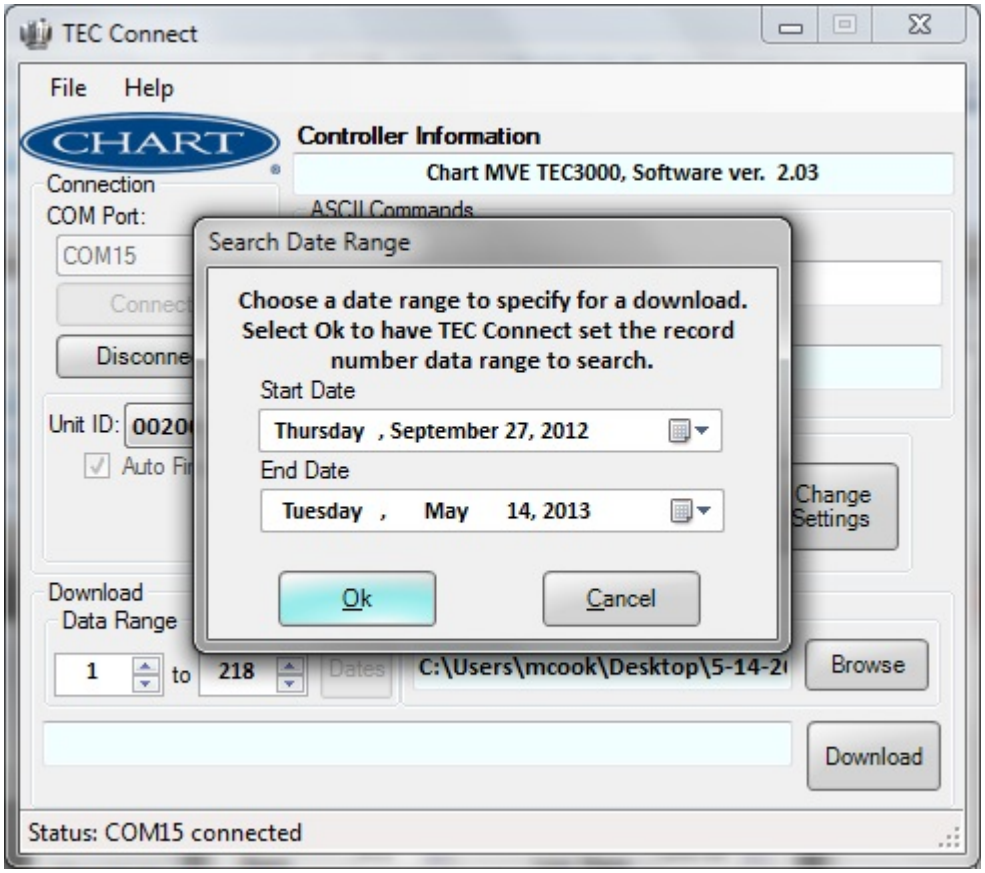


Figure 14: TEC Connect screen shot

Required Items

- Microsoft Windows (Vista, XP, WIN7)
- MVE TEC COM USB Kit (P/N 13376947)
- USB Port

Installing MVE TEC COM USB Kit

1. Insert the included USB to Serial Driver Disc into the PC CD-ROM
2. Plug the MVE TEC COM USB Kit into an open USB port
3. Follow the automatic installation prompts

Downloading TEC Connect and ChartConnect 3000

1. Uninstall in any previous ChartConnect 3000 versions
2. The latest version is available online under the Literature & Resources section; **http://www.chartbiomed.com/Literature_Resources/Software.aspx**
3. Click the link and open the compressed folder
4. Extract all files from the compressed folder to a location on your hard drive
5. Open the extracted SETUP file
6. Follow the prompts to complete installation
7. A ChartConnect 3000 icon should appear on your programs list when complete

Connecting to TEC 3000

TEC 3000 Settings

1. COM Setup: "9600 N81"
2. COM Type: "ASCII"
3. Select a unique MODBUS ID (Unit ID) for each controller involved

ChartConnect 3000 Settings

1. Connect TEC 3000 serial port to PC with MVE TEC COM USB Kit.
2. Open ChartConnect 3000
3. Determine the Windows COM Port by clicking "Find COM Port" on the ChartConnect 3000 main page
4. Note the COM number listed beside "RS-485 Isolated Port" in the Device Manager window.
5. Close Device Manager and click "OK"
6. Select the appropriate Windows COM Port from the drop down menu
7. Connect to TEC 3000
   - For a single controller: Select "Single Controller" and click "Connect". The Unit ID is automatically detected.
   - For networked controllers: Select "Networked Controller", enter the Unit ID of the desired controller, and click "Connect". In order to connect to another controller on the network, click "Disconnect", change the Unit ID, and then click "Connect".
8. If the controller is successfully connected, "COM Port Connected" and "Controller Detected" will be displayed in the status box

NOTE: Contact your MVE Distributor or Technical Service if you experience problems connecting to a controller.

Downloading the Event Log

1. Connect to controller using ChartConnect 3000
2. Select Event Download Range with Event 1 being the most recent logged event. The default download range includes all events
3. Designate a filename and save location. The default file name is the current date an time while the save location is the c:\ drive
4. Click “Download Event Log”.
5. Once the event log has finished downloading, select “Click to Open Downloaded Data File” or open the file from its saved location

Plotting the Event Log

1. Open downloaded event log with EXCEL
2. Before plotting be sure to delete any rows containing text; such as, “Parameter number…” refer to figure 15 for clean data
3. Insert new column between the Time and Temp A columns
4. Label this new column heading Date/Time
5. In cell E4, enter the formula “=C4+D4”
6. Fill down the rest of column E with this formula
7. Format the cells in column E so that the Number Category is Date and the Type is a date/time combination
8. Sort all the data by Descending Date, then by Descending Time, and then by Ascending Record #
9. Select the desired data to plot (Date/Time through LN2 Usage columns) and insert a scatter chart.
10. Once the chart has been created, select a secondary axis for the LN2 Level and LN2 Usage data sets
11. Format the chart and adjust the axis scales so that the data is easy to view and analyze.

	A	B	C	D	E	F	G	H	I	J
1	ChartConnect 3000 v1.1.2									
2	00200 Chart MVE TEC3000 Software ver. 2.00									
3	Record #	Unit ID	Date	Time	Date/Time	TempA	TempB	LN2 Level	LN2 Usage	Event Codes
4	1	200	2/4/2008	9:00 AM	2/4/08 9:00	-195.9	-190	6.5	0.3	
5	2	200	2/4/2008	5:00 AM	2/4/08 5:00	-195.9	-190	6.5	0.3	
6	3	200	2/4/2008	1:00 AM	2/4/08 1:00	-195.9	-190	6.6	0.3	
7	4	200	2/4/2008	12:00 AM	2/4/08 0:00	-195.9	-190.3	6.6	0.3	
8	5	200	2/4/2008	12:00 AM	2/4/08 0:00	-195.9	-190.3	6.6	0.3	ZO
9	6	200	2/3/2008	9:00 PM	2/3/08 21:00	-195.9	-190.3	6.6	0.3	
10	7	200	2/3/2008	5:00 PM	2/3/08 17:00	-195.9	-190.6	6.7	0.3	
11	8	200	2/3/2008	1:00 PM	2/3/08 13:00	-195.9	-190.9	6.7	0.3	
12	9	200	2/3/2008	9:00 AM	2/3/08 9:00	-195.9	-191.5	6.7	0.3	
13	10	200	2/3/2008	5:00 AM	2/3/08 5:00	-195.9	-192.8	6.8	0.3	
14	11	200	2/3/2008	4:19 AM	2/3/08 4:19	-195.9	-190.9	7	0.3	

Figure 15: Properly formatted event log for plotting

ASCII Command Interface

American Standard Code for Information Interchange (ASCII) commands can be used to query and adjust all TEC 3000 settings and parameters. Commands must be entered in all capital letters just as they appear in the below tables. For a complete list of proper syntax and responses, refer to Section 10.2 in the Appendix.

CONTROL COMMANDS

*IDN?	ID Query	CODE?	Global Password Query
ALMS	Set Alarm Status	HITSTA	Initiate Temp A High Alarm Test
ALMS?	Alarm Status Query	HITSTB	Initiate Temp B High Alarm Test
CALTA	Calibrate Temp A in LN2	INITEE	Restore All Defaults
CALTB	Calibrate Temp B in LN2	LNSATP	Set LN2 Saturation Temp
CALVL	Set Level Offset	LNSATP?	LN2 Saturation Temp Query
CALVL?	Level Offset Query		

TEMPERATURE COMMANDS

BPTMP?	Bypass Temp Query	LOTAS?	Temp A Low Alarm Status Query
HITA	Set Temp A High Alarm	LOTAM	Set Temp A Low Alarm Mask
HITA?	Temp A High Alarm Query	LOTAM?	Temp A Low Alarm Mask Query
HITAS?	Temp A High Alarm Status Query	LOTB	Set Temp B Low Alarm
HITAM	Set Temp A High Alarm Mask	LOTB?	Temp B Low Alarm Query
HITAM?	Temp A High Alarm Mask Query	LOTBS?	Temp B Low Alarm Status Query
HITB	Set Temp B High Alarm	LOTBM	Set Temp B Low Alarm Mask
HITB?	Temp B High Alarm Query	LOTBM?	Temp B Low Alarm Mask Query
HITBS?	Temp B High Alarm Status Query	TEMPA?	Current Temp A Query
HITBM	Set Temp B High Alarm Mask	TEMPB?	Current Temp B Query
HITBM?	Temp B High Alarm Mask Query	TUNI	Set Temp Units
LOTA	Set Temp A Low Alarm	TUNI?	Temp Units Query
LOTA?	Temp A Low Alarm Query		

LEVEL COMMANDS

BPFIL?	Bypass Status Query	HILM	Set High Level Alarm Mask
FILAS?	Fill Time Alarm Status Query	HILM?	High Level Alarm Mask Query
FILL	Set Fill Status	LEVL?	Current LN2 Level Query
FILL?	Fill Status Query	LFIL	Set Low Level Setpoint
FILLM?	Auto Fill Status Query	LFIL?	Low Level Setpoint Query
FILT	Set Max Fill Time	LOLA	Set Low Level Alarm
FILT?	Max Fill Time Query	LOLA?	Low Level Alarm Query
FILTIM?	Current Fill Duration Query	LOLS?	Low Level Alarm Status Query
HFIL	Set High Level Setpoint	LOLM	Set Low Level Alarm Mask
HFIL?	High Level Setpoint Query	LOLM?	Low Level Alarm Mask Query
HILA	Set High Level Alarm	LUNI	Set Level Units
HILA?	High Level Alarm Query	LUNI?	Level Units Query
HILS?	High Level Alarm Status Query	RATE?	Current Liquid Usage Query

LEVEL PERCENT COMMANDS

DSPN	Define 100% Point	DZER	Define 0% Point
DSPN?	100% Point Query	DZER?	0% Point Query
PCNT?	Current Percent Query		

EVENT LOG COMMANDS

CLEVLG	Clear Event Log	LOGPER	Set Event Log Interval
DATE	Set Date	LOGPER?	Event Log Interval Query
DATE?	Date Query	TIME	Set Time
EVENT?	Last Event Query	TIME?	Time Query
EVNCT?	Number of Events Query	UNID	Set Unit ID
EVNLOG? n	Event Log [n] Query	UNID?	Unit ID Query

7.4.2. OFAF Network Setup

OFAF networking allows multiple controllers to be linked together such that all of the freezers will fill whenever any networked controller calls for a fill. When multiple freezers are connected to a common supply source, it is advantageous to fill all freezers at the same time. LN2 transfer losses are significantly reduced by filling all networked freezers while the supply system is primed and cold. Using and OFAF network is more efficient than cooling the supply system every time an individual freezer fills. This approach is also more efficient than employing a keep full / keep cold system. Up to 100 TEC 3000 can be connected to an OFAF network.

An OFAF network can be configured in two modes: "Sequential" or "Simultaneous." For both modes, when any controller in the network initiates a fill, the Master controller (OFAF ID 1) recognizes this and triggers all other controller to initiate fills as well.

In Sequential OFAF mode, once the controller that initiated the first fill has reached its High Level Setpoint, the Master will trigger the freezer with the next sequential OFAF ID to fill until it reaches its High Level Setpoint. The Master will then trigger the freezer with the next sequential OFAF ID to fill and this process will continue until all freezers in the network including the Master have reached their High Level Setpoints.

In Simultaneous OFAF mode, when any controller initiates a fill and fills for at least 60 seconds, the Master will then broadcast a signal for all freezers, including itself, to begin filling. Each freezer will continue to fill until its High Level Setpoint is reached.

A user would select sequential OFAF over simultaneous if their supply system is not able to maintain the proper filling pressure while multiple freezers filling at the same time. Sequential OFAF allows freezers to fill one at a time with a primed and cold supply system so that it is easier for the system to maintain the proper filling pressure.

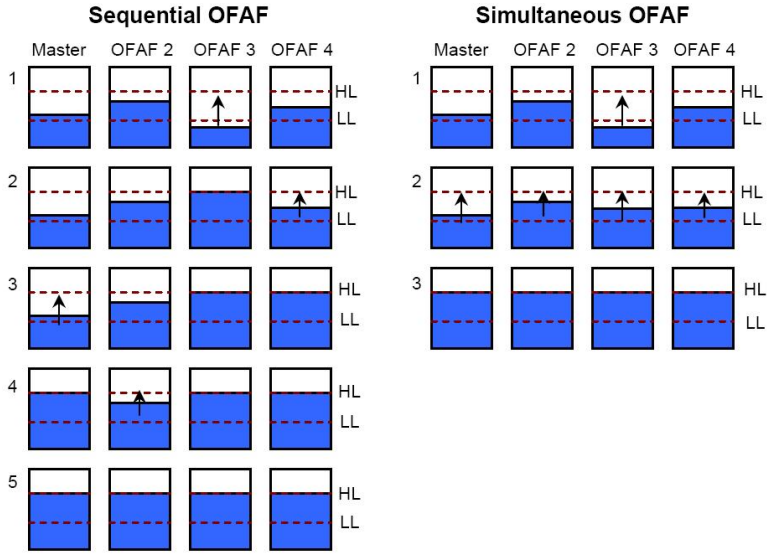


Figure 16: Diagram showing differences between Sequential and Simultaneous OFAF

Network Setup

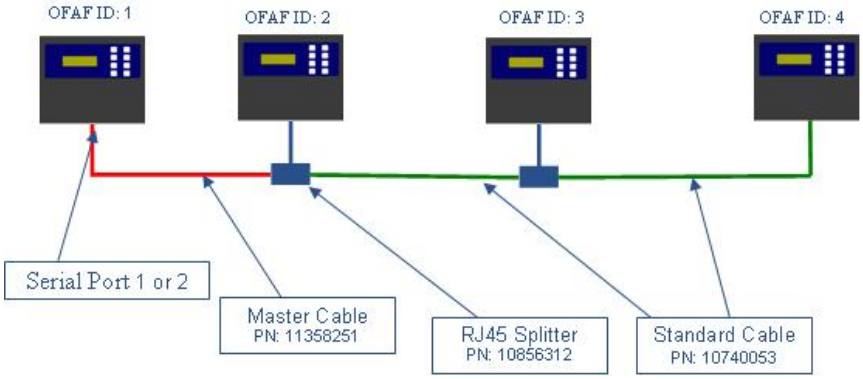


Figure 17: Diagram showing a typical OFAF network setup

Table 7: Required items for OFAF network

P/N	Description	Quantity needed
11358251	OFAF Master Cable	1
10740053	Standard CAT 5e Cable	# of controllers - 2
10856312	RJ-45 Splitter	# of controllers - 2

1. Designate the Master controller by setting its OFAF ID to “1”. Generally, this is the controller on the far end of the network from the LN2 supply.
2. Connect one end of the OFAF Master Cable to either Serial Port 1 or 2 of the Master controller.

NOTE: Either Serial Port 1 or 2 can be used for OFAF as long as the COM Types are in agreement.

3. Connect an RJ-45 splitter to the next controller in the network. Connect the free end of the OFAF Master Cable to this splitter.
4. Set the OFAF ID of this second controller to “2”.
5. Connect an RJ-45 splitter to the third controller in the network. Connect the splitters on the second and third controllers with a standard CAT 5e cable.
6. Set the OFAF ID of the third controller to “3”.
7. Continue this pattern until all controllers in the network are daisy chained and assigned sequential OFAF IDs.
8. Each controller in the network should also have the following settings:
    a. Auto Fill Control “Enabled”
    b. COM Setup “9600 N81”
    c. COM Type “OFAF”
    d. OFAF Type “Sequential” or “Simultaneous”. All controllers in a network must have the same OFAF Type.
    e. OFAF Units “# of controllers - 1”. The Master controller is not counted in the number of OFAF Units. All controllers in a network must have the same number of OFAF Units.

Cable Wiring

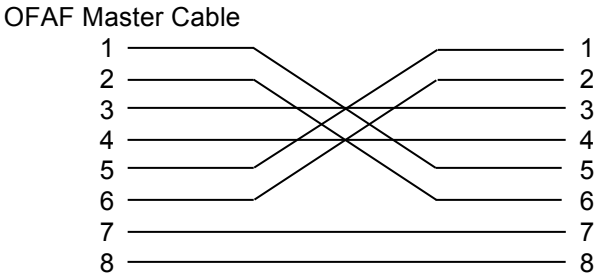


Figure 18: OFAF Master Cable wiring configuration. Numbering as viewed from side of RJ-45 connector opposite latch.

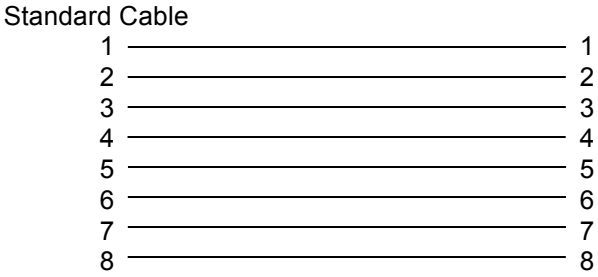


Figure 19: Standard reverse RJ-45 network cable configuration. Numbering as viewed from side of connector opposite latch.

Note: Pressing Stop Fill will delay the automatic fill circuit for 30 minutes. To initiate the Auto Fill Circuit restart the controller.

7.4.3. Printer Setup

The TEC 3000 compatible printer kit allows users to print a hard copy of the freezer's status at a set interval and as events occur. The TEC 3000 will print the current status of the freezer in the event log format. The default print interval is 30 minutes.

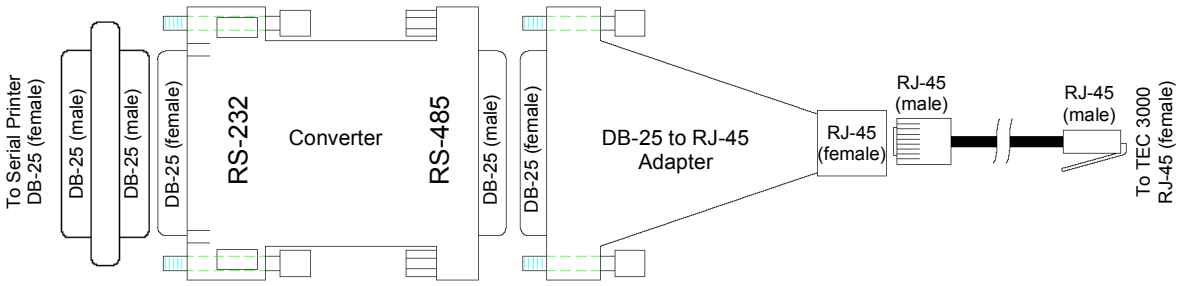
NOTE: Adjusting the print interval will not affect the event log interval. These two parameters are independent. The event log interval can be adjusted using ASCII commands. All printed events are not necessarily logged in the event log; however, all the events in the event log are printed.

TEC 3000 Printer Kit (P/N 11544943)

- Epson LX-300+II Serial Dot Matrix Printer
- RS-485 Converter and Adapters
- User's Guide

Installation

1. Setup printer as described in the included user's guide
2. Assemble and connect RS-485 converter and adapters as shown below
3. Connect the printer to TEC 3000 serial port 1 or 2 via the RS-485 converter assembly
4. Set the corresponding COM Setup to "9600 N81"
5. Set the corresponding COM Type to "Printer"
6. Adjust the Print Interval to the desired value
7. Test setup by forcing an event or printing a new header or event

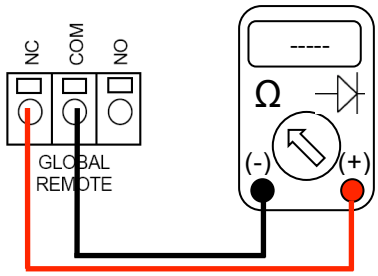


7.5. Remote Alarm Tests

7.5.1. Global Remote

The Global Remote contacts can be checked for continuity using a digital multimeter or ohm meter.

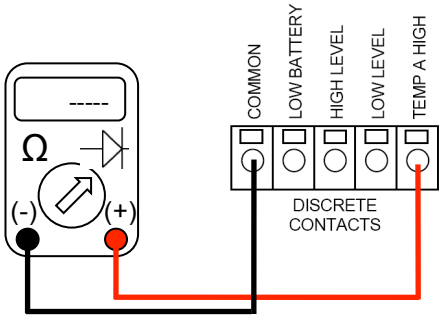
- Normal State (No Alarms)
  - There should be continuity between the COM and NC terminals
  - The COM – NO circuit should be open
- Alarm State
  - There should be continuity between the COM and NO terminals
  - The COM – NC circuit should be open



7.5.2. Discrete Contacts

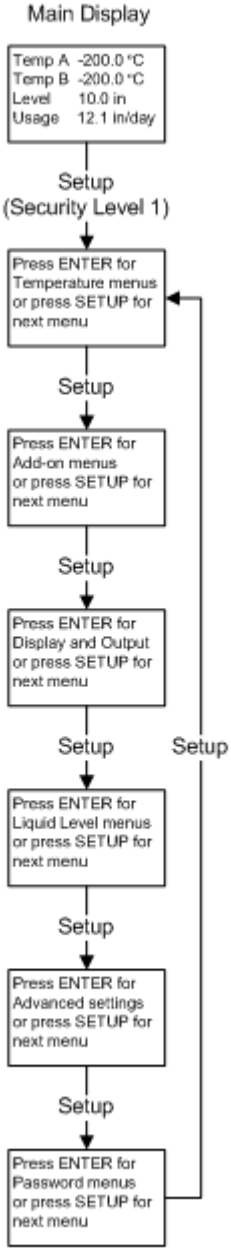
The Discrete Contacts can be tested for continuity using a digital multimeter with diode check. Since the Discrete Contacts are open collectors, the diode check function (⊣◁⊢) should be used.

- Normal State (No Alarms)
  - All Discrete Contact terminals should be open with respect to COMMON
- Alarm State
  - There should be continuity between the specific active alarm terminal and COMMON. Inactive alarms should remain open with respect to COMMON

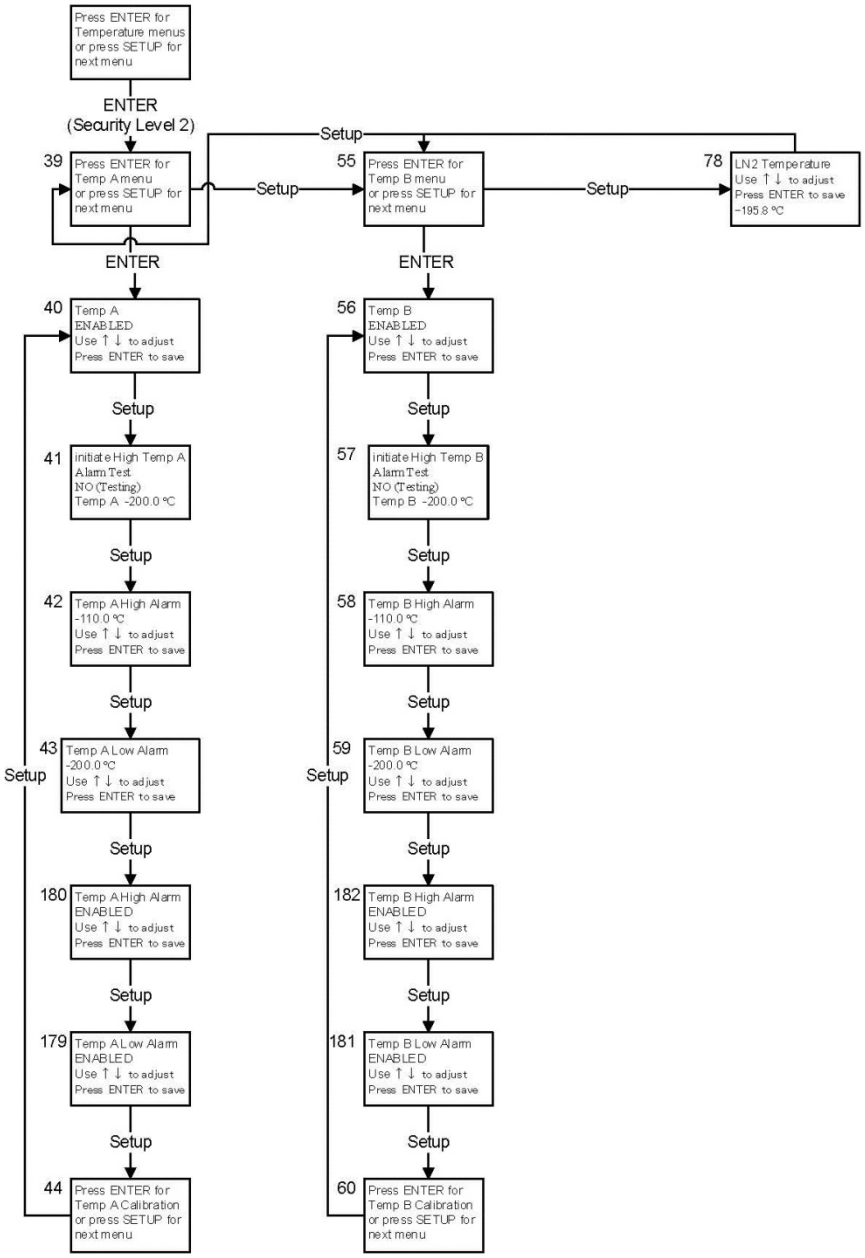


8. TEC 3000 Menu Maps

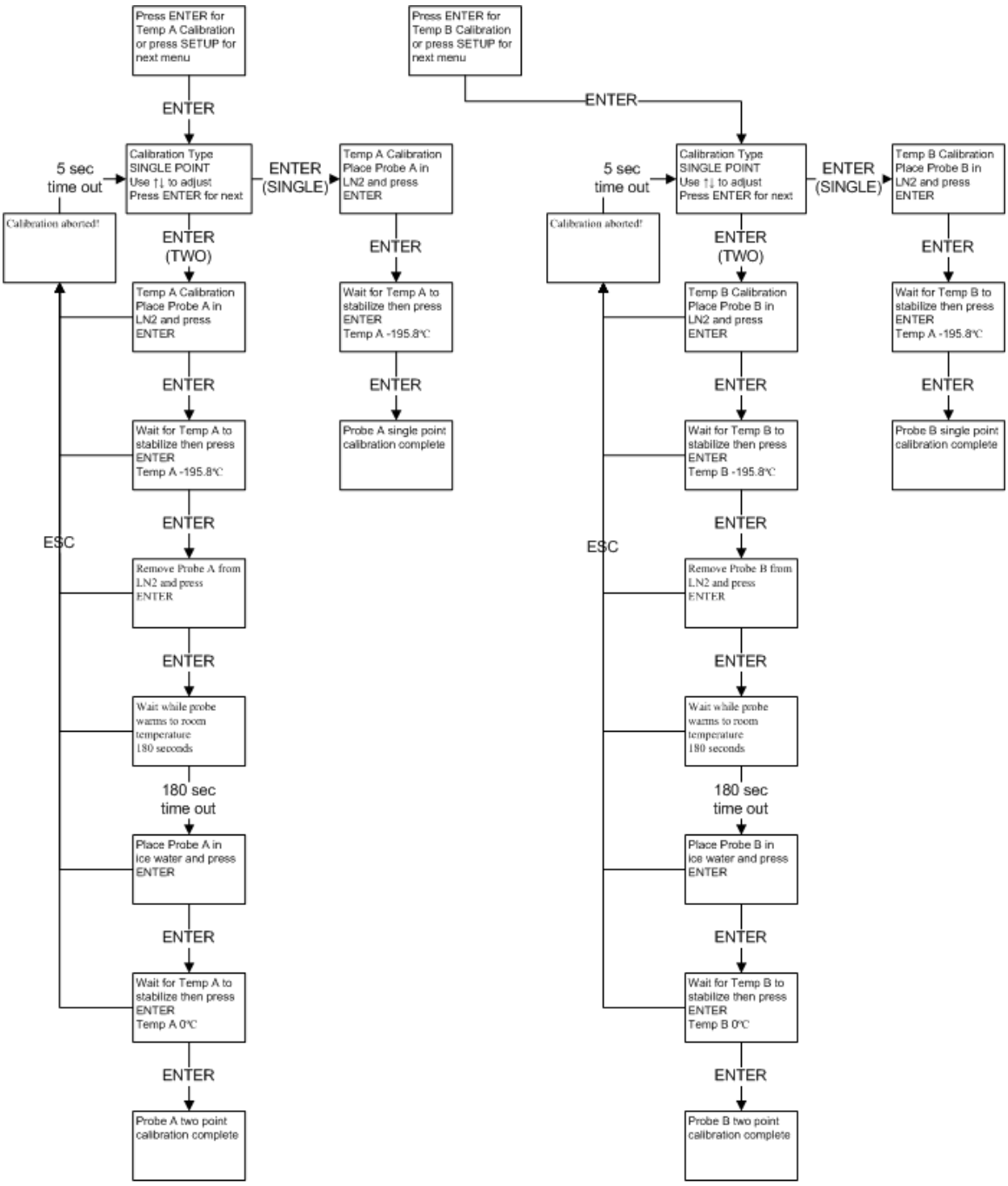
8.1. Main Setup Menus



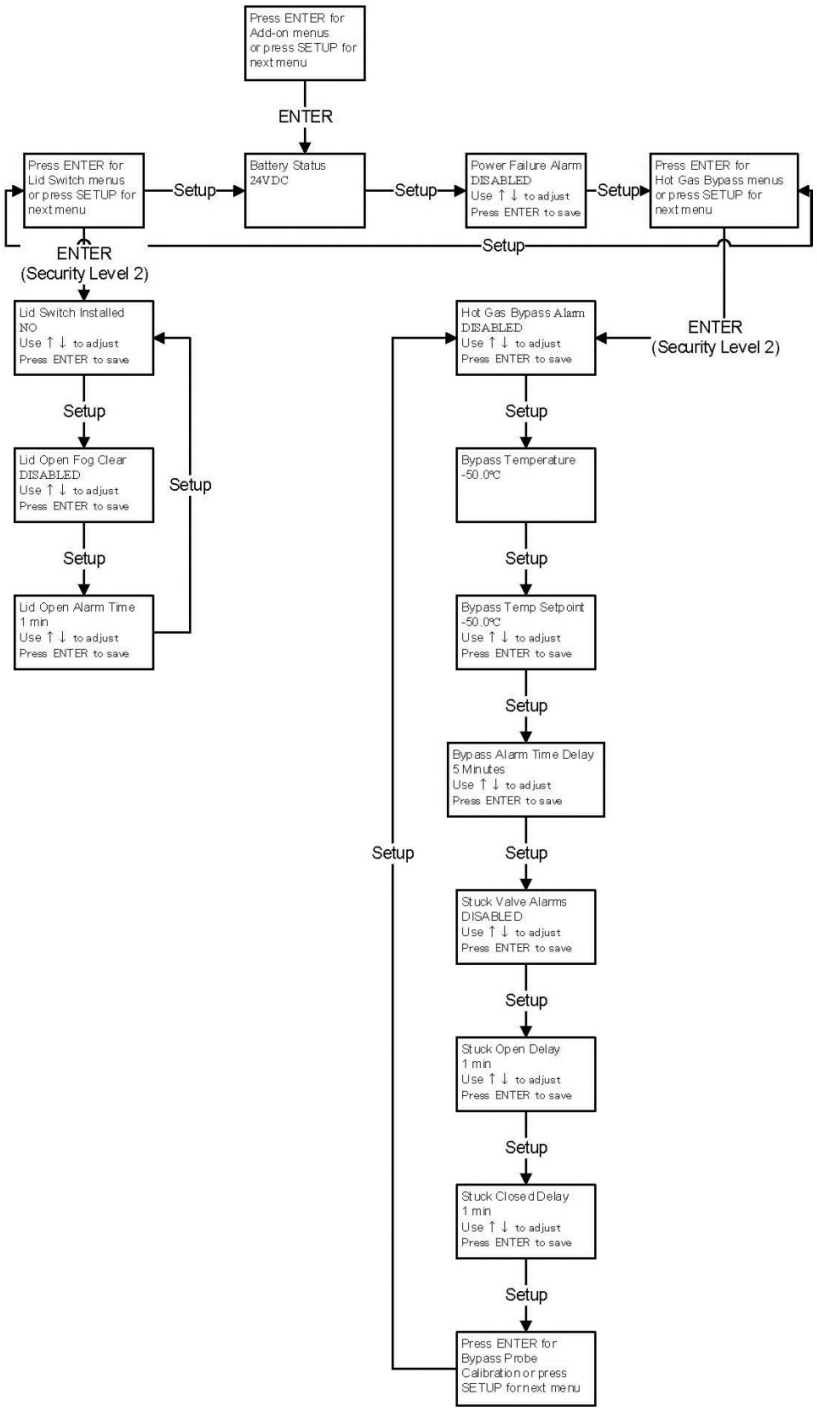
8.2. Temperature Setting Menus



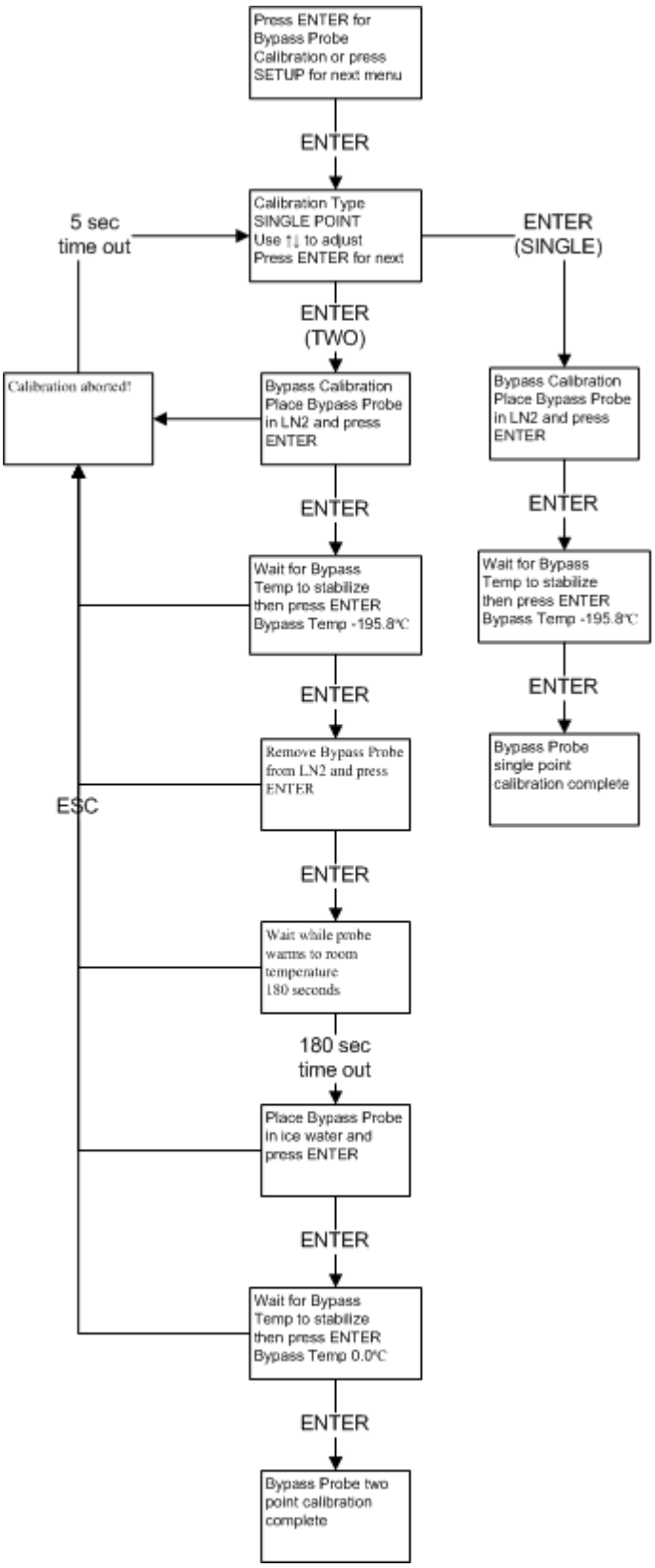
8.3. Temperature Calibration Menus



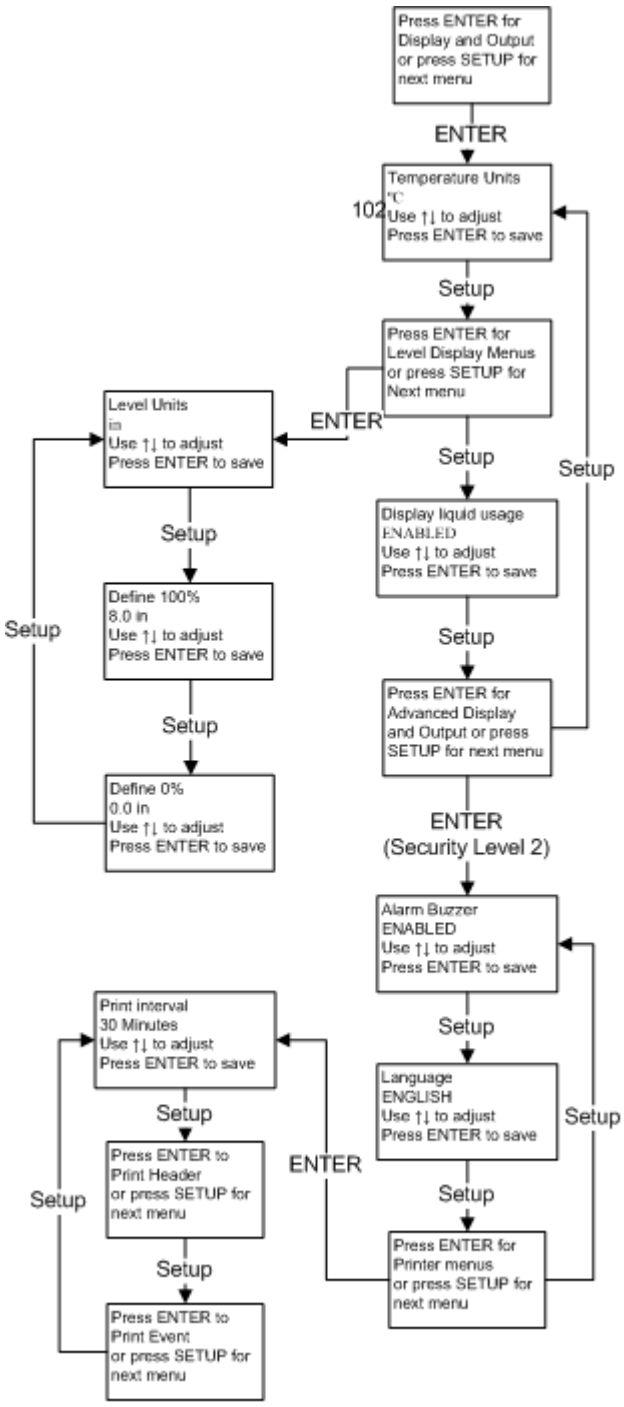
8.4. Add On Menus



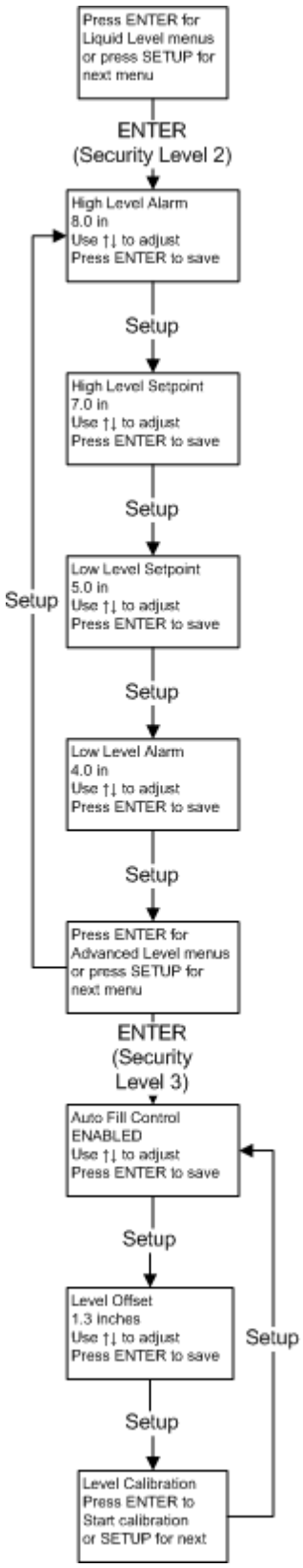
8.5. Hot Gas Bypass Sensor Calibration Menus



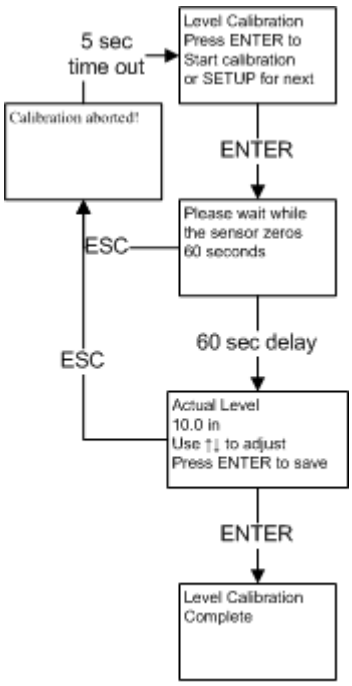
8.6. Display and Output Menus



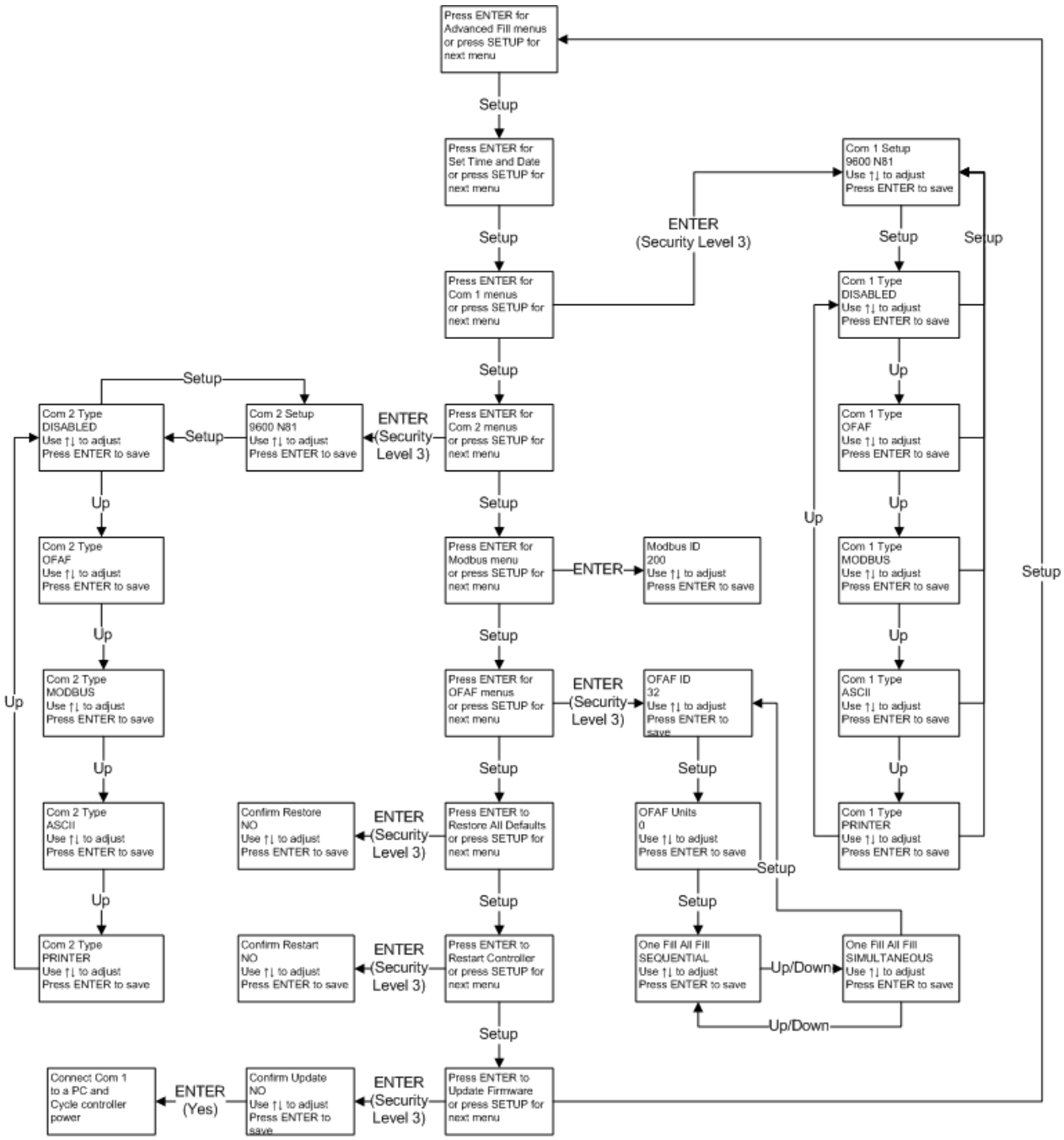
8.7. Liquid Level Menus



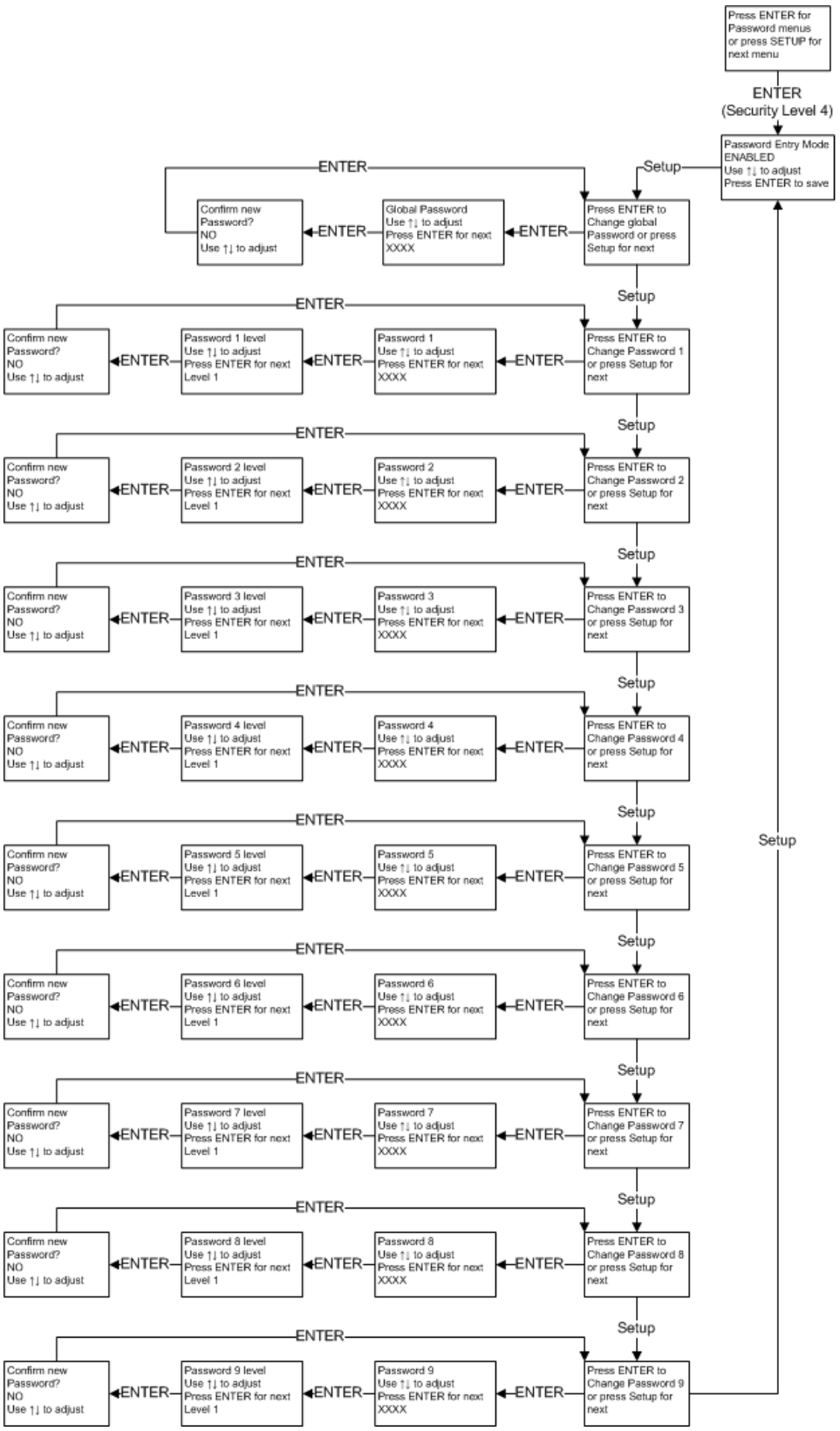
8.8. Liquid Level Calibration Menus



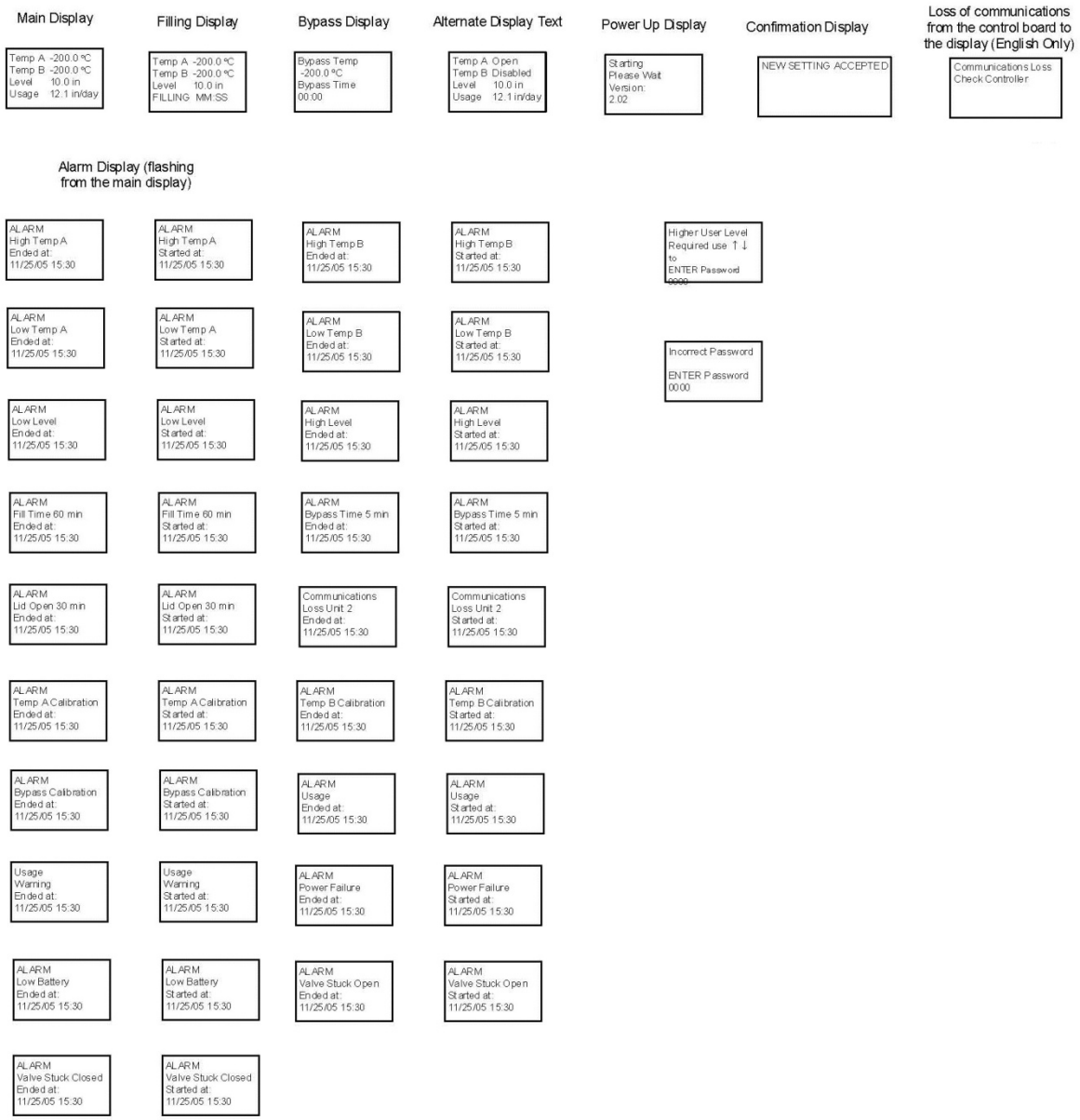
8.9. Advanced Settings Menus



8.10. Password Menus



8.11. TEC 3000 Display Screens



9. Preventative Maintenance

9.1. Preventative Maintenance Schedule

This section describes the preventative maintenance that should be performed on MVE freezers to ensure optimum operation and performance, as well as maximum service life. As with any technical piece of laboratory equipment, preventative maintenance is key to equipment success.

NOTE: This is the MVE recommended preventative maintenance. MVE Distributors may have a more comprehensive maintenance/service plan. At the minimum, the below schedule should be followed.

Table 8: Periodic Preventative Maintenance Schedule

	Weekly	Monthly	6 Months	12 Months	24 Months	60 Months
Level Verification	X					
Verify Adequate Supply	X					
Plumbing Leak Check		X				
High Temp Alarm Test			X			
Level Alarm Test			X			
Thaw Freezer Lid			X			
Folding Step Inspection			X			
Lid Hinge Inspection			X			
Inline Filter Replacement				X		
Complete Function Test				X		
Solenoid Valve Replacement					X	
Relief Valve Replacement					X	
Lid gasket replacement					X	
Complete Freezer Thaw and Moisture Removal						X

9.2. Preventative Maintenance Procedures

Level Verification

The differential pressure measurement system used on MVE freezers is nearly maintenance free. It provides a high level of accuracy and resolution to give the operator a precise indication of the exact amount of LN2 present in the freezer at all times. Despite its reliability, it is important that the accuracy of the level measurement system is verified on a weekly basis. This will prevent a control system malfunction from adversely affecting the temperature in the freezer storage space. Use the meter dipstick provided with every MVE freezer to manually measure the amount of LN2 in the freezer. Follow the “Dip Stick Procedure” listed in section 6.3.2 to properly measure the level. If the level is off by 1.0 inch (25mm) or more, follow the calibration procedure listed in the aforementioned section.

Verify Adequate Supply

Adequate LN2 supply pressure and flow is imperative to the proper operation of MVE freezers. Any LN2 supply whether from bulk tank or liquid cylinder must be able to maintain a pressure of 22-35 psi (1.52 – 2.41 bar) during a filling cycle, and must have enough liquid to ensure the completion of a fill cycle. The majority of nuisance alarms reported from MVE freezers are due to inadequate supply.

1. Observe the pressure of the supply source. Ideally, pressure should be 22 – 35 psi (1.52 – 2.41 bars).

   NOTE: It is very common for the pressure gauge on an industrial liquid cylinder to be inoperative. If you suspect this to be the case, install a pressure gauge inline between the liquid cylinder and the freezer for verification

2. Verify the amount of liquid in the supply source. Most bulk tanks have some method of digital or analog volume measurement. Liquid cylinders typically use a sight gauge. As with the pressure gauge on liquid cylinders, it is common for the sight gauge to be inoperative.
3. The minimum amount of liquid necessary in the supply should be enough to completely fill the number of freezers it is supplying. This amount can be determined from the LN2 inch to volume table in the Appendix.
4. Initiate a fill start on at least one freezer on the network. The supply system should be able to maintain appropriate pressure throughout the duration of the fill cycle.
5. If the supply is determined to be inadequate, have your gas supplier replenish/replace the supply.

Plumbing Leak Check

Leaky plumbing connections can create a host of problems including but not limited to:

- Slow fill times
- Nuisance Alarms
- High LN2 Consumption
- Inaccurate level readings
- Inaccurate liquid usage readings

Leaky plumbing connections are especially common on liquid cylinder supply systems, since the fittings are regularly loosened and tightened during liquid cylinder swap out.

1. With the supply system at operating pressure, thoroughly spray all transfer hose connections and freezer plumbing connections with leak detect solution
2. Allow leak detect solution to penetrate fittings for at least 30 seconds
3. large leaks will be immediately apparent with large bubble formations
4. Small leaks will take longer to detect, with small bubble formation in the appearance of “foam”
5. Most leaks can be repaired by tightening the suspect fitting with a crescent or appropriate sized wrench.
6. If tightening the fitting does not fix the leak, check the fitting for cracks and or galling. If the fitting is damaged, replace.
7. Recheck any replaced fittings for leaks.

High Temp Alarm Test

Please refer to **Section 7.2.1.2 page 48** for details and instructions on the High Temp Alarm Test.

Level Alarm Test

The TEC 3000 control system can trigger a high level or low level alarm if the LN2 level in the freezer exceeds the user defined parameters.

High Level Alarm Test:

1. Observe and record the current LN2 level
2. Record the current level settings. They may be accessed by pressing the "▲" and "▼" simultaneously to access the quick reference menu, or through the Liquid Level Menus. The current LN2 level should be between the High Level Alarm setting and Low Level Alarm setting. If not, allow the freezer to fill until it reaches the High Level Fill set point.
3. Adjust the level offset so that the current level is a value that is greater than the High Level Alarm setting. For example, if the High Level Alarm setting is currently 10.0 inches, increase the offset value by at least 1.0 inch. This will "fool" the controller into thinking that the level inside the freezer is higher than actual. Reference section 7.2.2.3 page 54 for level offset adjustment.
4. Observe the audible/visual alarm. Be aware that the level alarms have a one minute. This delay is intentional and is to prevent nuisance alarms.
5. If the alarm does not occur after one minute, verify that the audible alarm is turned on
6. Decrease the offset value to the original observed setting.

Low Level Alarm Test (Stand Alone TEC 3000 configuration):

1. Observe and record the current LN2 level.
2. Remove the vinyl tube from the hose barb on the bottom of the TEC 3000. Be careful not to damage the tube
3. The displayed level should drop to 0.0 inches.
4. After one minute, the audible alarm should sound
5. If the alarm does not sound, verify that the audible alarm is turned on.
6. Reconnect the vinyl tube. If the tube is deformed at the end, it may be necessary to trim off ¼" of the tube to ensure a good connection.
7. Press "Fill Start" to purge the level sensing line. After 30 seconds, the level should gradually increase to actual.
8. After the fill cycle is complete, manually measure the level using the dipstick

Low Level Alarm Test (Cabinet model freezers):

1. Observe and record the current LN2 Level
2. Adjust the High Level Alarm setting to a value that is at least 5.0 inches higher than the current LN2 level. For example, if the current LN2 level is 5.0 inches, adjust the High Level Alarm setting to at least 10.0 inches.
3. Adjust the High Level Fill setting to a value that is at least 4.0 inches higher than the current LN2 level.
4. Adjust the Low Level Fill setting to a value that is at least 3.0 inches higher than the current LN2 level. If auto fill is enabled, the freezer will begin filling automatically. Press "Fill Stop" to terminate the fill.
5. Adjust the Low Level Alarm setting to a value that is at least 2.0 inches higher than the current LN2 Level
6. After one minute, the Low Level Alarm should sound.
7. After alarm verification, return all level settings to their normal values.

Lid Thaw Procedure

1. Open or remove lid from freezer. Depending on the freezer model, it may be necessary to remove the lid from the hinges for it to completely warm to room temperature.
2. It is recommended that the freezer opening be covered with a spare lid or in another non-airtight manner to prevent moisture from entering the storage space and to minimize the top box temperature change while the lid is open.
3. Allow lid to sit at room temperature for approximately 30 minutes.
4. Once thawed, thoroughly dry lid, cork, and liner.
5. Inspect lid for damage and replace parts if necessary.

Folding Step Inspection

MVE 1500 and 1800 series freezers equipped with folding steps assemblies should be inspected for integrity at least every 6 months. Verify that hinges and free of cracks and all connections are secure. Check that the anti-slip strips on the steps are in good condition and replace if necessary (PN 4810179). Ensure the step locking strap is able to securely hold the steps in their folded position. If the pivot bolts continuously loosen, apply thread locker (PN 11087674) and retighten.

Lid Hinge Inspection

MVE freezers with hinged lids should be inspected for integrity at least every 6 months. Verify that the hinges are free of damage and securely attached to the freezer and lid. MVE hinged freezers are counterbalanced for easy opening and closing. Ensure the lid opens smoothly to a near 90° angle. The lid should remain completely open without assistance. Ensure lid closes smoothly and comes to rest centered on the freezer. Adjust hinges or replace as needed. For part numbers, contact Customer/Technical Service with the freezer serial number.

Inline Filter Replacement

CAUTION: Ensure that the LN2 supply valve is closed and the plumbing assembly is vented before removing the inline filter.

1. Close the LN2 supply valve and disconnect the LN2 transfer hose from the plumbing assembly fill tee.
2. Loosen and remove the fill tee and inline filter from the plumbing assembly.
3. Replace the inline filter (PN 11648945) and reassemble the fill tee and filter to the plumbing assembly using new Teflon tape if needed. Ensure the filter is oriented correctly so that the affixed arrow indicates the direction of LN2 flow.
4. Reconnect the LN2 transfer hose, open the LN2 supply valve and check fittings for any leaks.

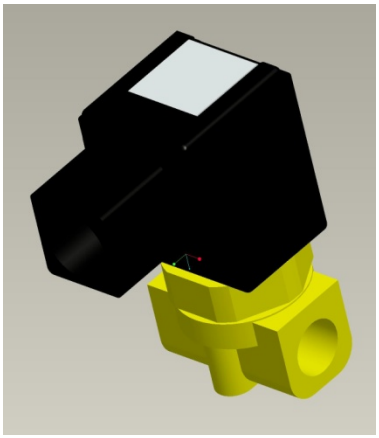
Complete Function Test

MVE recommends that freezers with TEC 3000 controllers undergo a complete function test every 12 months to ensure correct functionality and identify potential problems before symptoms develop. Function test documents can be written based on this manual or this manual itself can be used to verify the function of MVE freezers with TEC 3000 controllers.

Solenoid Valve Replacement

All MVE freezers are equipped with electromechanical solenoid valves that have been tested and approved by MVE for cryogenic use. These valves utilize a PTFE seal for optimal sealing in cryogenic environments. Over time, the normal thermal cycling that this seal is subject to will cause it to harden and lose its ability to seal completely. This will result in seepage past the sealing surface which can increase the LN2 consumption of the system, and in extreme cases result in an overfill situation. Thermal cycling through normal operation can also cause moisture ingress into the coil of the solenoid valve. Over time this may cause the connections and wiring in the coil to corrode and eventually fail. This will result in an inoperative solenoid valve.

NOTE: over the life of MVE freezer, several different interchangeable 24VDC solenoids have been used. The current model is pictured below. Always use replacement solenoid valves from MVE. Substituting non MVE components may result in inoperable valves and even damage to the TEC 3000 control system. Damage to the control system due to use of non MVE parts will not be covered by warranty.



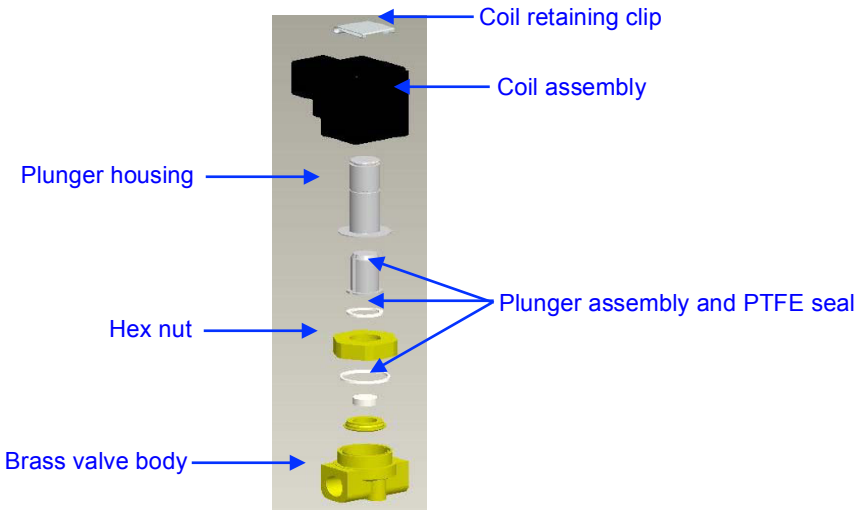
SMC Solenoid Valve
(Current production)

SMC (black) Solenoid Valve Replacement

CAUTION: Ensure that the LN2 supply valve is closed and the plumbing assembly is vented before removing the solenoid valves.

1. Remove plumbing shroud (on HE and HEco series) or rear access panel (on MVE series) to gain access to plumbing system
2. Remove coil retaining clip by inserting a flathead screwdriver between the clip and the edge of the coil body. Twist the screwdriver, and the clip should slide off
3. Remove and discard the coil assembly
4. Using a crescent wrench loosen hex nut and remove the plunger housing. Remove plunger housing and plunger assembly. Discard these parts

5. Remove any debris that may have collected in brass valve body
6. Inspect the brass valve body of the solenoid valve for nicks or damage. If the sealing surface appears to be in good condition, the valve body may be reused. If the sealing surface is damaged, the plumbing will need to be disassembled and the entire body will need to be replaced (this is not common).
7. Disassemble a new SMC valve (PN 14224611S) using the above procedure
8. Install the new plunger, plunger housing, and coil assembly onto the old valve body.
9. Assembly valve with new components in the reverse order.
10. Verify that no leaks are present using leak detect solution
11. Open the LN2 supply valve and initiate a fill cycle by pressing “Fill Start’. Allow the fill cycle to complete and verify that flow stops at the termination of the fill cycle.



NOTE: If the brass valve body requires replacing, the freezer plumbing will need to be disassembled and the entire valve replaced (PN 14224611S). It is typically easier to start disassembling the plumbing assembly beginning at the fill tee for fill valve replacement or the gas bypass muffler for gas bypass valve replacement.

NOTE: When installing a complete new valve, ensure it is oriented correctly. An “N” is engraved on the side of the SMC brass valve body. The valve should be installed so that this “N” is on the inlet side of the valve.

NOTE: If an older style solenoid requires replacing, the freezer plumbing will need to be disassembled and the entire valve replaced by the current production SMC solenoid valve (PN 14224611S). It is typically easier to start disassembling the plumbing assembly beginning at the fill tee for fill valve replacement or the gas bypass muffler for gas bypass valve replacement.

Relief Valve Replacement

CAUTION: Ensure that the LN2 supply valve is closed and the plumbing assembly is vented before removing the relief valve.

1. Remove plumbing shroud (on HE series) to gain access to plumbing system
2. If equipped with a relief valve deflector, loosen the deflector clamp and slide off the deflector.
3. Loosen the relief valve and remove it from the plumbing assembly. Be sure to support the attachment tube with wrench to prevent damage from twisting.
4. Install new relief valve (PN 1810032) applying new Teflon tape if needed. Ensure relief valve is rated to 50 PSI (3.4 bar).

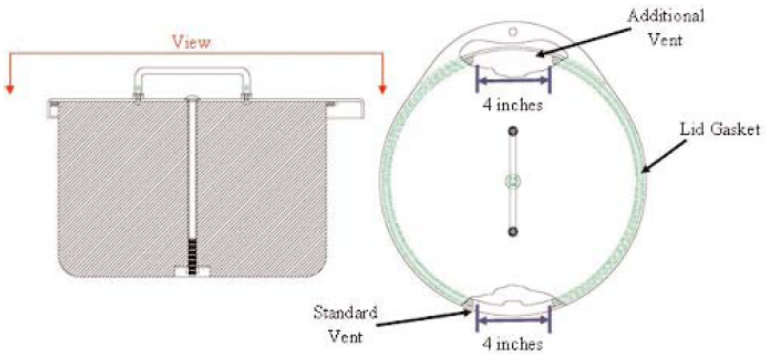
CAUTION: Installing a relief valve with a different pressure rating could prevent proper operation and lead to a dangerous over pressurized condition. Additionally, this will void any warranty.

Lid Gasket Replacement

The lid gasket configuration and material will vary depending on the freezer model and vintage. For the correct part numbers, contact Customer/Technical Service with the freezer serial number. There are three main types of lid gaskets and the replacement instructions for each are given below.

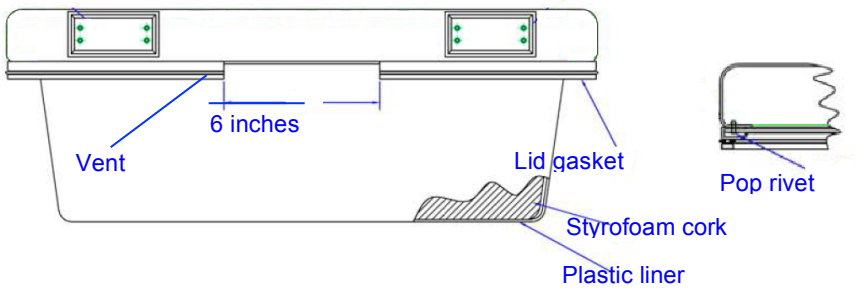
MVE High Efficiency/HEco Series

1. Depending on the condition of the current gasket, the gasket material can be removed and replaced or more material can simply be added to the existing gasket.
2. The replacement gasket material will be a neoprene tape.
3. Simply clean the surfaces, remove the tape back to expose the adhesive and install gasket material.
4. Trim to size as needed.
5. Cut a 4 inch gap in the gasket material on either side of the lid as shown below to allow sufficient venting of the freezer space



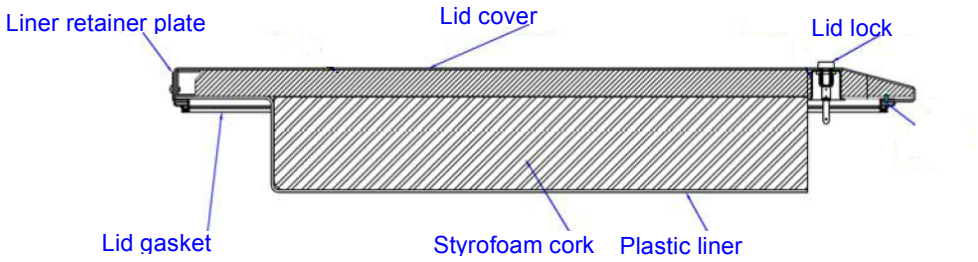
MVE and MVE Stock Series – Riveted gasket

1. Note how the current gasket is attached to the lid. The replacement gasket will be installed the same manner.
2. If applicable, remove lid from hinges.
    a. Place the lid in the closed position.
    b. Remove spring pressure from the hinge by loosening the ½ inch nut on the rod inside the hinge body.
    c. Remove screws securing the hinges to the freezer lid.
3. Remove lid assembly, and place it upside down either on top of the freezer opening or on flat surface.
4. Using a 1/8 inch drill bit, carefully drill off the heads of the existing rivets holding the gasket to the lid.
5. Remove gasket.
6. Inspect plastic lid liner and Styrofoam cork for damage and replace if necessary.
7. Install new gasket so that it lays flat and the flange is between the lid and the lid liner.
8. Properly align lid liner so that the existing rivet holes can be reused.
9. Insert 1/8 inch pop rivets into the existing liner holes, through the gasket, and then through the lid holes so that the fat part of the rivet is exposed. Sometimes it is easier to carefully drill through the gasket then inserting the rivets instead of attempting to puncture the gasket with the rivet.
10. Using a pop rivet gun, securely rivet the liner and gasket to the freezer lid.
11. Cut a 6 inch (150 mm) gap in the gasket at the rear of the freezer lid to allow the freezer space to vent.
12. Reinstall lid.
13. If applicable, reinstall lid hinges.
    a. With the lid closed, install and tighten screws securing hinges to the lid
    b. Using the ½ inch deep well socket, increase spring pressure until the hinges will hold the lid at approximately a 45° angle.



MVE Cabinet Series

1. Remove lid from freezer hinges.
    a. Place the lid in the closed position.
    b. Remove spring pressure from the hinge by loosening the ½ inch nut on the rod inside the hinge body.
    c. Remove screws securing the hinges to the freezer lid.
2. Remove liner retainer plate from the back of the lid.
3. Slide the plastic liner and plate assembly out through the back of the lid.
4. Note how the current gasket is installed. The replacement gasket will be installed in the same manner.
5. Separate the plastic liner from the plate.
6. Remove gasket.
7. Inspect plastic liner and Styrofoam cork for damage and replace if necessary.
8. Install new gasket in the same manner between the liner and plate.
9. Slide plastic liner and plate assembly back into the lid.
10. Cut a 6 inch (150 mm) gap in the gasket at the back of the lid to allow sufficient venting.
11. Reinstall lid hinges.
    a. With the lid closed, install and tighten screws securing hinges to the lid
    b. Using the ½ inch deep well socket, increase spring pressure until the hinges will hold the lid at approximately a 45° angle.



Complete Freezer Thaw and Moisture Removal

1. Remove freezer LN2 supply.
2. Unplug TEC 3000 main power and battery backup if equipped.
3. Open or remove lid from freezer.
4. Allow LN2 to completely evaporate and the freezer space to warm to room temperature. Placing a fan blowing into the freezer will accelerate this process.
5. After it has reached ambient temperature, thoroughly remove any moisture from the freezer space. This can be done with a wet/dry vacuum and towels. For High Efficiency models, open the hinged hatch on the bottom of the turn-tray to access the bottom of the freezer.
6. Once moisture has been removed from the freezer space, purge the plumbing assembly and annular lines with nitrogen gas. Compressed nitrogen or the gas use valve on a LN2 cylinder work best. The LN2 cylinder vent valve can also work, but will deplete the cylinder head pressure quickly. Ensure the nitrogen gas pressure does not exceed 50 PSI (3.4 bar).
7. Plug in the TEC 3000 main power and connect the freezer plumbing via transfer hose to a compressed nitrogen supply or the gas use valve on a LN2 cylinder. Ensure gas bypass is disabled if equipped.
8. Press “Start Fill” and allow the freezer to fill for 30 seconds.
9. Press “Stop Fill”
10. Press “Start Fill” and allow the freezer to fill for 30 seconds.
11. Continue cycling fills for 30 seconds until the plumbing assembly and annular lines are clear and completely dry.

In some cases, it may be necessary to purge the level sensing annular line separately. This can be done by connecting pressurized nitrogen gas directly to the freezer annular line fitting.

CAUTION: Ensure that the LN2 supply valve is closed and the plumbing assembly is vented before loosening the compression fittings and removing the annular line tube.

1. Loosen and remove the 1/4 inch compression fittings from the purge valve and the freezer annular line fitting.
2. Remove 1/4 inch copper tube and purge to clear any moisture.
3. Connect nitrogen gas source directly to the freezer’s 3/8 inch FPT annular line connection.
4. Purge annular line with nitrogen gas, maintaining a pressure below 50 PSI (3.4 bar), until the line in clear and completely free of any moisture.

NOTE: If moisture is not completely removed for the freezer space and annular lines, ice will form when LN2 is reintroduced into the freezer. Ice blockage in the freezer space or annular lines will interfere with proper function of the freezer and level sensing system.

ENSURE ALL MOISTURE IS COMPLETELY REMOVED PRIOR TO INTRODUCING LN2

9.3. Replacement Parts and Accessories

Replacement Parts	
Part Number	**Description**
11648945	Inline Filter – 40 micron mesh
1810032	Relief Valve – 50 PSI (3.4 bar)
14224611S	SMC Solenoid Valve – Fill and Gas Bypass
13284954S	Purge/3-way Solenoid Valve
10713400	Gas Bypass Temperature Sensor – Pt-1000 RTD
11499812	Gas Bypass Muffler
11885449	Gas Bypass Muffler Deflector
20570663	Temperature Probe – All Chart Freezer Series (65")
14248744	HE Series 3-Tube Temperature Sensor Assembly – 26 inch (660 mm)
14248816	HE Series 3-Tube Temperature Sensor Assembly – 39 inch (990 mm)
14248752	HE Series 3-Tube Temperature Sensor Assembly – 44 inch (1118 mm)
11795030	Jerome Power Supply – Input: 110-230 VAC; Output: 30 VDC (AC cord not included)
14010103	Power Outlet Cord – 110 VAC (The Americas)
10995363	Power Outlet Cord – 230 VAC (Europe)
10718155	Battery Backup Replacement Battery – 12 VDC
11858467	Battery Backup Fuse – 4A 250V
13319459S	TEC 3000 Controller – Stand-alone with text display
13319467S	TEC 3000 Controller – Stand-alone with symbolic display
13223908	TEC 3000 Cabinet Back Panel
13223836	TEC 3000 Cabinet Text Display Panel
13223861	TEC 3000 Cabinet Symbolic Display Panel
Accessories	
Part Number	**Description**
20561020	MVE LN2 Level Dip Stick, 47"
13376947	TEC COM USB Kit – TEC 2000/3000 – PC interface kit
10856321	Daisy Chain Kit – Network TEC 2000/3000s – One network cable and splitter
10740053	RJ-45 Network Cable
10856312	RJ-45 Jack Splitter
11358251	OFAF Master Cable
10784443*	Fill Valve Tee Assembly – Tee two freezer to one LN2 supply connection
1611592	Relief Valve Pipe Away Adapter – 3/8 inch NPT Outlet
1810092	Relief Valve Pipe Away Adapter – ½ inch NPT Outlet
13051579	Cool Reach Cryogenic Claw
9713159	LN2 Transfer Hose – 4 ft (1220 mm), ½ inch (12.7 mm) ODT
9713109	LN2 Transfer Hose – 6 ft (1829 mm), ½ inch (12.7 mm) ODT
1110862	LN2 Transfer Hose Coupler – Daisy chain two transfer hoses
11544943	Printer Kit – Includes serial printer and cables
9717119	Cryo Gloves – Size: Medium; Length: Mid-arm
9717129	Cryo Gloves – Size: Large; Length: Mid-arm
9717139	Cryo Gloves – Size: X-Large; Length: Mid-arm
9717149	Cryo Gloves – Size: Medium; Length: Elbow
9717159	Cryo Gloves – Size: Large; Length: Elbow
9717169	Cryo Gloves – Size: X-Large; Length: Elbow
10464394	Cryo Apron
13934911	Automatic LN2 Supply Switch
13319512	Stand-alone TEC 3000 Upgrade Kit – MDC TEC 2000 to TEC 3000 kit
13319504	Cabinet TEC 3000 Upgrade Kit – MDC TEC 2000 to TEC 3000 kit
13319491	Stand-alone TEC 3000 Upgrade Kit – Lakeshore TEC 2000 to TEC 3000 kit
13319475	Cabinet TEC 3000 Upgrade Kit – Lakeshore TEC 2000 to TEC 3000 kit

*Verify adequate pressure

10. Troubleshooting Quick Reference

Symptom	Possible Causes	Fixes	Instructions
Freezer not filling	Improperly connected LN2 supply	Verify LN2 connections	Equipment Usage Page 7
	Inadequate LN2 supply volume or pressure	Verify adequate supply	Verify Adequate LN2 Supply Page 115
	Fill solenoid valves not opening	Verify fill solenoid resistance	Solenoid Valve Replacement Page 119
		Check fill solenoid valves for debris	
	Lid switch not engaged	Verify lid switch settings and functionality	Lid Switch Settings Page 58
	Current LN2 level at or above the high level setpoint	Verify current LN2 level and level control settings	Liquid Level Settings Page 52
	Auto Fill disabled	Press Start Fill to verify manual operation. Confirm auto fill settings	Auto Fill Control Page 53
Slow fills or Long fill times	Inadequate LN2 supply	Verify adequate supply	Verify Adequate LN2 Supply Page 115
	Clogged inline filter	Clean/replace inline filter	Inline Filter Replacement Page 118
	Fill solenoid valves not opening all the way	Verify fill solenoid resistance	Solenoid Valve Replacement Page 119
		Check fill solenoid valves for debris	
	Leak in plumbing or LN2 supply connection	Check for leaks	Plumbing Leak Check Page 116
Incorrect temperature readings	Restore to defaults, improperly calibrated or requires recalibration	Recalibrate temperature sensor	Temperature Sensor Calibration Page 80
	Incorrect LN2 saturation temperature for altitude	Verify and adjust LN2 saturation temperature	LN2 Saturation Temperature Page 51
	Faulty temperature probe	Confirm resistance values and replace if necessary	Resistance Table Page 131
Incorrect LN2 level readings	Requires calibration	Perform LN2 level calibration	LN2 Level Calibration Page 84
	Disconnected clear vinyl tube	Check clear vinyl tube connections and integrity	Plumbing Leak Check Page 116
	Leak in level sensing line	Perform leak test on purge valve, vinyl tube, and fittings	
	Purge valve defective	Check resistance of purge valve (140 ohms)	Purge valve replacement
	Insufficient freezer venting	Increase lid gasket vent. Replace gasket/lid if necessary	Lid Gasket Replacement Page 121
	Obstruction in level sensing line	Purge level sensing annular line and clear any debris in the bottom of freezer. Complete freezer thaw and moisture removal may be necessary	Complete Freezer Thaw and Moisture Removal Page 124
Consistent power	Non-uniform AC voltage (dirty	Install uninterruptable power supply (UPS), Battery Backup,	

failure alarms	power) Transition to generator power	or quality surge protector	
Short cycle fills	Inaccurate level readings	See "Incorrect LN2 level readings" above.	
	Insufficient freezer venting	Increase lid gasket vent. Replace gasket/lid if necessary	Lid Gasket Replacement Page 121
	Obstruction in level sensing line	Purge level sensing annular line and clear any debris in the bottom of freezer. Complete freezer thaw and moisture removal may be necessary	Complete Freezer Thaw and Moisture Removal Page 124
High liquid usage	Inaccurate level readings	See "Incorrect LN2 level readings" above.	
	Insufficient venting	Increase lid gasket vent. Replace gasket/lid if necessary	Lid Gasket Replacement Page 121
	Introduction/retrieval of racks or samples Lid open for extended period of time	Liquid usage value should return to normal as more data is acquired	
	Inadequate LN2 supply	Verify adequate LN2 supply	Verify Adequate LN2 Supply Page 115
	Obstruction in level sensing line	Purge level sensing annular line and clear any debris in the bottom of freezer. Complete freezer thaw and moisture removal may be necessary	Complete Freezer Thaw and Moisture Removal Page 124
Consistently high and increasing liquid usage	Potential vacuum failure	Contact your authorized MVE Distributor or Technical Service	

11. EN Compliance Tables

Table 1: Guidance and manufacturer's declaration – electromagnetic emissions for all TEC 3000s (See 5.2.2.1 C).

Guidance and Manufacturer's Declaration - Electromagnetic Emissions		
The TEC 3000 is intended for use in the electromagnetic environment specified below. The customer or the user of the TEC 3000 should assure that it is used in such an environment.		
Emissions Test	Compliance	Electromagnetic Environment – Guidance
RF emissions CISPR 11	Group 1	The TEC 3000 uses RF energy only for its internal functions. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The TEC 3000 is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations / Flicker emissions IEC 61000-3-3	Complies	

Table 2: Guidance and manufacturer's declaration – electromagnetic immunity – for all TEC 3000s (See 5.2.2.1 F)

Guidance and Manufacturer's Declaration – Electromagnetic Immunity			
The TEC 3000 is intended for use in the electromagnetic environment specified below. The customer or the user of the TEC 3000 should assure that it is used in such an environment.			
Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment – guidance
Electromagnetic Discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV line(s) to line(s) ±2 kV line(s) to earth	±1 kV line(s) to line(s) ±2 kV line(s) to earth	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5% UT (>95% dip in UT) For 0,5 cycle 40% UT (60% dip in UT) For 5 cycles 70% UT (30% dip in UT) For 25 cycles <5% UT (>95% dip in UT) For 5 seconds	<5% UT (>95% dip in UT) For 0,5 cycle 40% UT (60% dip in UT) For 5 cycles 70% UT (30% dip in UT) For 25 cycles <5% UT (>95% dip in UT) For 5 seconds	Mains power quality should be that of a typical commercial or hospital environment. If the user of the TEC 3000 requires continued operation during power mains interruptions, it is recommended that the TEC 3000 be powered by an uninterruptible power supply or battery.
Power frequency (50/60 Hz) Magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: U_T is the AC mains voltage prior to application of the test level			

Table 4: Guidance and manufacturer's declaration – electromagnetic immunity – for all TEC 3000s (See 5.2.2.2)

Guidance and Manufacturer's Declaration – Electromagnetic Immunity			
The TEC 3000 is intended for use in the electromagnetic environment specified below. The customer or the user of the TEC 3000 should assure that it is used in such an environment.			
Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment – guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	Portable and mobile RF communications equipment should be used no closer to any part of the TEC 3000 including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1,2\sqrt{P}$ $d = 1,2\sqrt{P}$ $d = 2,3\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2,5 GHz	3 V/m	where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitter as determined by an electromagnetic site survey[a], should be less than the compliance level in each frequency range[b]. Interference may occur in the vicinity of equipment marked with the following symbol: 

NOTE 1: At 80 MHz and 800 MHz the higher frequency range applies

NOTE 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

[a] Field strengths from fixed transmitters such a s base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM, and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the TEC 3000 is used exceeds the applicable RF compliance level above, the TEC 3000 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the TEC 3000.

[b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Table 6: Recommended separation distances between portable and mobile RF communications equipment and the TEC 3000 – for TEC 3000 systems that are not life supporting (See 5.2.2.2)

Recommended separation distances between portable and mobile RF communications equipment and the TEC 3000			
The TEC 3000 is intended for use in the electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the TEC 3000 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the TEC 3000 as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter (W)	**Separation distance according to frequency of transmitter (m)**		
	150 kHz to 80 MHz $d = 1,2\sqrt{P}$	80 MHz to 800 MHz $d = 1,2\sqrt{P}$	800 MHz to 2,5 GHz $d = 2,3\sqrt{P}$
0,01	0,12	0,12	0,23
0,1	0,38	0,38	0,73
1	1,2	1,2	2,3
10	3,8	3,8	7,3
100	12	12	23
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer. NOTE 1: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies NOTE 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.			

NOTE: Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in this manual.

NOTE: Portable and mobile RF communications equipment can affect Medical Electrical Equipment.

NOTE: The use of accessories, transducers and cables other than those specified, with the exception of transducer and cables sold by the manufacturer of this device as replacement parts for internal components, may result in increased emissions or decreased immunity of the TEC 3000 Controller

NOTE: The TEC 3000 Controller should not be used adjacent or stacked with other equipment and that if adjacent or stacked use is necessary, the TEC 3000 Controller should be observed to verify normal operation in the configuration in which it will be used.

DISPOSAL OF PRODUCT:

Stainless Steel Freezer:

Freezers used to store biological materials require decontamination prior to disposal. Contact CHART MVE for decontamination information or reference page 147.

TEC 3000 Controller:

Local or national environmental laws and regulations may prohibit disposal of electrical and/or electronic equipment such as the TEC3000 controller. Contact the local city or town offices for instructions on proper disposal of electrical or electronic equipment. Alternately, CHART MVE may be contacted for disposal information.

12. Appendix

12.1. Reference Tables

Table 9: Temperature vs. Resistance Output (ohms) for Pt-1000 Temperature Sensors

Temp°C	-0	-1	-2	-3	-4	-5	-6	-7	-8	-9
-200	185.201									
-190	228.255	223.965	219.672	215.376	211.076	206.772	202.465	198.154	193.840	189.522
-180	270.964	266.708	262.449	258.186	253.920	249.651	245.379	241.103	236.824	232.541
-170	313.350	309.126	304.898	300.667	296.434	292.197	287.956	283.713	279.467	275.217
-160	355.433	351.238	347.040	342.839	338.635	334.429	330.219	326.006	321.791	317.572
-150	397.232	393.064	388.894	384.721	380.545	376.367	372.186	368.002	363.815	359.626
-140	438.764	434.622	430.478	426.331	422.182	418.030	413.876	409.719	405.559	401.397
-130	480.048	475.930	471.810	467.688	463.563	459.436	455.307	451.175	447.040	442.904
-120	521.098	517.003	512.906	508.806	504.705	500.601	496.495	492.386	488.276	484.163
-110	561.930	557.856	553.780	549.702	545.622	541.540	537.456	533.370	529.281	525.191
-100	602.558	598.504	594.448	590.391	586.331	582.269	578.205	574.139	570.072	566.002
-90	642.996	638.960	634.923	630.884	626.843	622.800	618.756	614.709	610.661	606.611
-80	683.254	679.236	675.217	671.195	667.172	663.147	659.120	655.092	651.062	647.030
-70	723.345	719.344	715.340	711.335	707.328	703.320	699.310	695.299	691.286	687.271
-60	763.278	759.292	755.304	751.315	747.324	743.331	739.337	735.341	731.344	727.346
-50	803.063	799.091	795.117	791.143	787.166	783.189	779.210	775.229	771.247	767.263
-40	842.707	838.748	834.789	830.828	826.865	822.902	818.937	814.970	811.003	807.033
-30	882.217	878.271	874.325	870.377	866.428	862.478	858.526	854.573	850.619	846.663
-20	921.599	917.666	913.732	909.797	905.861	901.923	897.985	894.044	890.103	886.160
-10	960.859	956.938	953.016	949.093	945.169	941.244	937.317	933.390	929.461	925.530
0	1000.00	996.091	992.181	988.270	984.358	980.444	976.529	972.613	968.696	964.778
	+0	**+1**	**+2**	**+3**	**+4**	**+5**	**+6**	**+7**	**+8**	**+9**
0	1000.00	1003.91	1007.81	1011.72	1015.62	1019.53	1023.43	1027.33	1031.23	1035.13
10	1039.03	1042.92	1046.82	1050.71	1054.60	1058.49	1062.38	1066.27	1070.16	1074.05
20	1077.94	1081.82	1085.70	1089.59	1093.47	1097.35	1101.23	1105.10	1108.98	1112.86
30	1116.73	1120.60	1124.47	1128.35	1132.21	1136.08	1139.95	1143.82	1147.68	1151.55
40	1155.41	1159.27	1163.13	1166.99	1170.85	1174.70	1178.56	1182.41	1186.27	1190.12
50	1193.97	1197.82	1201.67	1205.52	1209.36	1213.21	1217.05	1220.90	1224.74	1228.58
60	1232.42	1236.26	1240.09	1243.93	1247.77	1251.60	1255.43	1259.26	1263.09	1266.92
70	1270.75	1274.58	1278.40	1282.23	1286.05	1289.87	1293.70	1297.52	1301.33	1305.15
80	1308.97	1312.78	1316.60	1320.41	1324.22	1328.03	1331.84	1335.65	1339.46	1343.26
90	1347.07	1350.87	1354.68	1358.48	1362.28	1366.08	1369.87	1373.67	1377.47	1381.26

12.1.2. Table 10: LN2 Volume per Inch of Liquid in MVE Freezers

NOTE: The below values are accurate for the cylindrical portion of the freezer and do not take into account inventory components that will displace LN2.

Freezer Model	Inches	Liters
MVE 205	1	3.3
MVE 510	1	5.5
MVE 616 / 616C	1	8.1
MVE 1426 / 1426C	1	13.0
MVE 1839	1	20.0
MVE 808	1	10.3
MVE 816P-2T-190	1	10.1
MVE 1318	1	20.2
MVE 1842P-150	1	40.8
MVE 1877P-2T-150	1	40.8
MVE 815P-150	1	10.1
MVE 815P-190	1	10.1
MVE 818P-190	1	10.1
MVE 819P-190	1	10.1
MVE 1536P-150	1	19.3
MVE 1536P-190	1	19.3
MVE 1539P-190	1	19.3
MVE 1879P-150	1	40.8
MVE 1879P-190	1	40.8
MVE 1892P-190	1	40.8
MVE 1539R-150	1	19.3
MVE 1542R-150	1	19.3
MVE 1542R-190	1	19.3
MVE 1881R-150	1	38.9
MVE 1881R-190	1	38.9
MVE 1894R-150	1	38.9
MVE 1894R-190	1	38.9

Table 11: Conversion of inches of LN2 to various pressure units

NOTE: Conversion values do not take into account the TEC 3000 Level Offset

in. LN2	in. H2O	KPa	PSI	in. LN2	in. H2O	KPa	PSI	in. LN2	in. H2O	KPa	PSI
0.0	0.0	0.000	0.000	16.5	13.4	3.327	0.483	33.0	26.7	6.655	0.965
0.5	0.4	0.101	0.015	17.0	13.8	3.428	0.497	33.5	27.1	6.755	0.980
1.0	0.8	0.202	0.029	17.5	14.2	3.529	0.512	34.0	27.6	6.856	0.994
1.5	1.2	0.302	0.044	18.0	14.6	3.630	0.526	34.5	28.0	6.957	1.009
2.0	1.6	0.403	0.058	18.5	15.0	3.731	0.541	35.0	28.4	7.058	1.024
2.5	2.0	0.504	0.073	19.0	15.4	3.831	0.556	35.5	28.8	7.159	1.038
3.0	2.4	0.605	0.088	19.5	15.8	3.932	0.570	36.0	29.2	7.260	1.053
3.5	2.8	0.706	0.102	20.0	16.2	4.033	0.585	36.5	29.6	7.360	1.068
4.0	3.2	0.807	0.117	20.5	16.6	4.134	0.600	37.0	30.0	7.461	1.082
4.5	3.6	0.907	0.132	21.0	17.0	4.235	0.614	37.5	30.4	7.562	1.097
5.0	4.1	1.008	0.146	21.5	17.4	4.336	0.629	38.0	30.8	7.663	1.111
5.5	4.5	1.109	0.161	22.0	17.8	4.436	0.643	38.5	31.2	7.764	1.126
6.0	4.9	1.210	0.175	22.5	18.2	4.537	0.658	39.0	31.6	7.864	1.141
6.5	5.3	1.311	0.190	23.0	18.6	4.638	0.673	39.5	32.0	7.965	1.155
7.0	5.7	1.412	0.205	23.5	19.0	4.739	0.687	40.0	32.4	8.066	1.170
7.5	6.1	1.512	0.219	24.0	19.4	4.840	0.702	40.5	32.8	8.167	1.185
8.0	6.5	1.613	0.234	24.5	19.9	4.941	0.717	41.0	33.2	8.268	1.199
8.5	6.9	1.714	0.249	25.0	20.3	5.041	0.731	41.5	33.6	8.369	1.214
9.0	7.3	1.815	0.263	25.5	20.7	5.142	0.746	42.0	34.0	8.469	1.228
9.5	7.7	1.916	0.278	26.0	21.1	5.243	0.760	42.5	34.4	8.570	1.243
10.0	8.1	2.017	0.292	26.5	21.5	5.344	0.775	43.0	34.8	8.671	1.258
10.5	8.5	2.117	0.307	27.0	21.9	5.445	0.790	43.5	35.3	8.772	1.272
11.0	8.9	2.218	0.322	27.5	22.3	5.545	0.804	44.0	35.7	8.873	1.287
11.5	9.3	2.319	0.336	28.0	22.7	5.646	0.819	44.5	36.1	8.974	1.302
12.0	9.7	2.420	0.351	28.5	23.1	5.747	0.834	45.0	36.5	9.074	1.316
12.5	10.1	2.521	0.366	29.0	23.5	5.848	0.848	45.5	36.9	9.175	1.331
13.0	10.5	2.621	0.380	29.5	23.9	5.949	0.863	46.0	37.3	9.276	1.345
13.5	10.9	2.722	0.395	30.0	24.3	6.050	0.877	46.5	37.7	9.377	1.360
14.0	11.3	2.823	0.409	30.5	24.7	6.150	0.892	47.0	38.1	9.478	1.375
14.5	11.8	2.924	0.424	31.0	25.1	6.251	0.907	47.5	38.5	9.579	1.389
15.0	12.2	3.025	0.439	31.5	25.5	6.352	0.921	48.0	38.9	9.679	1.404
15.5	12.6	3.126	0.453	32.0	25.9	6.453	0.936				
16.0	13.0	3.226	0.468	32.5	26.3	6.554	0.951				

12.2. TEC 3000 ASCII Interface

American Standard Code for Information Interchange (ASCII) is a standard code used in data transmission, in which 128 numerals, letters, symbols, and special control codes are represented by a 7-bit binary number. Below is a chart for these binary codes.

USASCII code chart

Bits b_7 b_6 b_5 →	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b_4 ↓ b_3 ↓ b_2 ↓ b_1 ↓ Row ↓ Column →	0	1	2	3	4	5	6	7
0 0 0 0	0	NUL	DLE	SP	0	@	P	`	p
0 0 0 1	1	SOH	DC1	!	1	A	Q	a	q
0 0 1 0	2	STX	DC2	"	2	B	R	b	r
0 0 1 1	3	ETX	DC3	#	3	C	S	c	s
0 1 0 0	4	EOT	DC4	$	4	D	T	d	t
0 1 0 1	5	ENQ	NAK	%	5	E	U	e	u
0 1 1 0	6	ACK	SYN	&	6	F	V	f	v
0 1 1 1	7	BEL	ETB	'	7	G	W	g	w
1 0 0 0	8	BS	CAN	(	8	H	X	h	x
1 0 0 1	9	HT	EM	)	9	I	Y	i	y
1 0 1 0	10	LF	SUB	*	:	J	Z	j	z
1 0 1 1	11	VT	ESC	+	;	K	[	k	{
1 1 0 0	12	FF	FS	,	<	L	\	l	|
1 1 0 1	13	CR	GS	-	=	M	]	m	}
1 1 1 0	14	SO	RS	.	>	N	^	n	~
1 1 1 1	15	SI	US	/	?	O	_	o	DEL

TEC 3000 ASCII Command List

Control Commands

***IDN?** Identification Query
Input: *IDN?
Returned: MVE TEC 3000, Software ver. X.XX
Comments: Used to query the controller ID. Command must include "*****" preface. Returns controller model and firmware version.

ALMS Set Alarm Status
Input: ALMS 0 or ALMS 1
Returned: No response
Comments: Used to set the audible alarm status where 0 = Off and 1 = On. Has same function as the Alarm Mute key.

ALMS? Alarm Status Query
Input: ALMS?
Returned: 0 or 1
Comments: Used to query the current audible alarm status where 0 = Off and 1 = On.

CALTA Calibrate Temp A in LN2 (Single Point)
Input: CALTA
Returned: No response
Comments: Used to perform a single point calibration of Temp A. Temp A sensor must be submerged in LN2. See the Temperature Calibration section of this manual.

CALTB Calibrate Temp B in LN2 (Single Point)
Input: CALTB
Returned: No response
Comments: Used to perform a single point calibration of Temp B. Temp B sensor must be submerged in LN2. See the Temperature Calibration Section of this manual.

CALVL Set Level Offset
Input: CALVL ±XXX.X
Returned: No response
Comments: Used to set the liquid level offset.

CALVL? Level Offset Query
Input: CALVL?
Returned: ±XXX.X
Comments: Used to query the current level offset value.

CODE? Global Password Query
Input: CODE?
Returned: XXXX
Comments: Used to query the current global password.

HITSTA Temp A High Alarm Test
Input: HITSTA
Returned: No response
Comments: Used to initiate the High Temp A Alarm Test. See the High Temperature Alarm Test section for more information.

HITSTB Temp B High Alarm Test
Input: HITSTB
Returned: No response
Comments: Used to initiate the High Temp B Alarm Test. See the High Temperature Alarm Test section for more information.

INITEE Restore All Defaults
Input: INITEE
Returned: No response
Comments: Used to restore all factory default settings.

LNSATP Set LN2 Saturation Temperature
Input: LNSATP ±XXX.X
Returned: No response
Comments: Used to set the LN2 saturation temperature for single point calibration reference point.

Temperature Commands

BPTMP? Bypass Temp Query
Input: BPTMP?
Returned: ±XXX.X
Comments: Used to query the current bypass temp sensor reading.

HITA Set Temp A High Alarm
Input: HITA ±XXX.X
Returned: No response
Comments: Used to set the Temp A High Alarm value.

HITA? Temp A High Alarm Query
Input: HITA?
Returned: ±XXX.X
Comments: Used to query the current Temp A High Alarm value

HITAS? Temp A High Alarm Status Query
Input: HITAS?
Returned: 0 or 1
Comments: Used to query the Temp A High Alarm status where 0 = Off and 1 = On.

HITAM Set Temp A High Alarm Mask
Input: HITAM 0 or HITAM 1
Returned: No response
Comments: Used to enable or disable the Temp A High Alarm where 0 = disabled and 1 = enabled. Default setting is 1 = enabled.

HITAM? Temp A High Alarm Mask Query
Input: HITAM?
Returned: 0 or 1
Comments: Used to query the Temp A High Alarm Mask status where 0 = disabled and 1 = enabled. Default setting is 1 = enabled.

HITB Set Temp B High Alarm
Input: HITB ±XXX.X
Returned: No response
Comments: Used to set the Temp B High Alarm value.

HITB? Temp B High Alarm Query
Input: HITB?
Returned: ±XXX.X
Comments: Used to query the current Temp B High Alarm value

HITBS? Temp B High Alarm Status Query
Input: HITBS?
Returned: 0 or 1
Comments: Used to query the Temp B High Alarm status where 0 = Off and 1 = On.

HITBM Set Temp B High Alarm Mask
Input: HITBM 0 or HITBM 1
Returned: No response
Comments: Used to enable or disable the Temp B High Alarm where 0 = disabled and 1 = enabled. Default setting is 1 = enabled.

HITBM? Temp B High Alarm Mask Query
Input: HITBM?
Returned: 0 or 1
Comments: Used to query the Temp B High Alarm Mask status where 0 = disabled and 1 = enabled. Default setting is 1 = enabled.

LOTA Set Temp A Low Alarm
Input: LOTA ±XXX.X
Returned: No response
Comments: Used to set the Temp A Low Alarm value.

LOTA? Temp A Low Alarm Query
Input: LOTA?
Returned: ±XXX.X
Comments: Used to query the Temp A Low Alarm value.

LOTAS? Temp A Low Alarm Status Query
Input: LOTAS?
Returned: 0 or 1
Comments: Used to query the Temp A Low Alarm status where 0 = off and 1 = on.

LOTAM Set Temp A Low Alarm Mask
Input: LOTAM 0 or LOTAM 1
Returned: No response
Comments: Used to enable or disable the Temp A Low Alarm where 0 = disabled and 1 = enabled. Default setting is 1 = enabled.

LOTAM? Temp A Low Alarm Mask Query
Input: LOTAM?
Returned: 0 or 1
Comments: Used to query the Temp A Low Alarm Mask status where 0 = disabled and 1 = enabled. Default setting is 1 = enabled.

LOTB Set Temp B Low Alarm
Input: LOTB ±XXX.X
Returned: No response
Comments: Used to set the Temp B Low Alarm value.

LOTB? Temp B Low Alarm Query
Input: LOTB?
Returned: ±XXX.X
Comments: Used to query the Temp B Low Alarm value.

LOTBS? Temp B Low Alarm Status Query
Input: LOTBS?
Returned: 0 or 1
Comments: Used to query the Temp B Low Alarm status where 0 = off and 1 = on.

LOTBM Set Temp B Low Alarm Mask
Input: LOTBM 0 or LOTBM 1
Returned: No response
Comments: Used to enable or disable the Temp B Low Alarm where 0 = disabled and 1 = enabled. Default setting is 1 = enabled.

LOTBM? Temp B Low Alarm Mask Query
Input: LOTBM?
Returned: 0 or 1
Comments: Used to query the Temp B Low Alarm Mask status where 0 = disabled and 1 = enabled. Default setting is 1 = enabled.

TEMPA? Temp A Current Data Query
Input: TEMPA?
Returned: ±XXX.X
Comments: Used to query the current Temp A sensor reading.

TEMPB? Temp B Current Data Query
Input: TEMPB?
Returned: ±XXX.X
Comments: Used to query the current Temp B sensor reading.

TUNI Set Temp Units
Input: TUNI C, TUNI F, or TUNI K
Returned: No response
Comments: Used to set the Temp units where C = Celsius, F = Fahrenheit, and K = Kelvin. Default setting is degrees Celsius.

TUNI? Temp Units Query
Input: TUNI?
Returned: C, F, or K
Comments: Used to query the Temp units where C = Celsius, F = Fahrenheit, and K = Kelvin. Default setting is degrees Celsius.

Level Commands

BPFIL? Bypass Status Query
Input: BPFIL?
Returned: 0 or 1
Comments: Used to query the current hot gas bypass status where 0 = not bypassing and 1 = bypassing.

FILAS? Fill Time Alarm Status Query
Input: FILAS?
Returned: 0 or 1
Comments: Used to query the Fill Time Alarm Status where 0 = off and 1 = on.

FILL Set Fill Status
Input: FILL 0 or FILL 1
Returned: No response
Comments: Used to set the current Fill Status where 0 = Stop Fill and 1 = Start Fill

FILL? Fill Status Query
Input: FILL?
Returned: 0 or 1
Comments: Used to query the current Fill Status where 0 = not filling and 1 = filling.

FILLM? Auto Fill Status Query
Input: FILLM?
Returned: 0 or 1
Comments: Used to query the Auto Fill Status where 0 = disabled and 1 = enabled.

FILT Set Max Fill Time
Input: FILT XXX
Returned: No response
Comments: Used to set the maximum fill time in minutes from 30 to 240 minutes.

FILT? Max Fill Time Query
Input: FILT?
Returned: XXX
Comments: Used to query the maximum fill time. Value returned in minutes.

FILTIM? Fill Duration Query
Input: FILTIM?
Returned: XXX
Comments: Used to query the duration of the current fill. Value returned in seconds.

HFIL Set High Level Setpoint
Input: HFIL XXX.X
Returned: No response
Comments: Used to set the High Level Setpoint. Input value uses the current level units, either inches or millimeters. There must be at least a 0.5 inch interval between each level setting and alarm.

HFIL? High Level Setpoint Query
Input: HFIL?
Returned: XXX.X
Comments: Used to query the High Level Setpoint. Value returned in either inches or millimeters depending on the current level units. There must be at least a 0.5 inch interval between each level setting and alarm.

HILA Set High Level Alarm
Input: HILA XXX.X
Returned: No response
Comments: Used to set the High Level Alarm value. Input value uses the current level units, either inches or millimeters. There must be at least a 0.5 inch interval between each level setting and alarm.

HILA? High Level Alarm Query
Input: HILA?
Returned: XXX.X
Comments: Used to query the High Level Alarm value. Value returned in either inches or millimeters depending on the current level units. There must be at least a 0.5 inch interval between each level setting and alarm.

HILS? High Level Alarm Status Query
Input: HILS?
Returned: 0 or 1
Comments: Used to query the High Level Alarm Status where 0 = off and 1 = on.

HILM Set High Level Alarm Mask
Input: HILM 0 or HILM 1
Returned: No response
Comments: Used to enable or disable the High Level Alarm where 0 = disabled and 1 = enabled. Default setting is 1 = enabled.

HILM? High Level Alarm Mask Query
Input: HILM?
Returned: 0 or 1
Comments: Used to query the High Level Alarm Mask status where 0 = disabled and 1 = enabled. Default setting is 1 = enabled.

LEVL? Current LN2 Level Query
Input: LEVEL?
Returned: XXX.X
Comments: Used to query the current LN2 Level reading.

LFIL Set Low Level Setpoint
Input: LFIL XXX.X
Returned: No response
Comments: Used to set the Low Level Setpoint. Input value uses the current level units, either inches or millimeters. There must be at least a 0.5 inch interval between each level setting and alarm.

LFIL? Low Level Setpoint Query
Input: LFIL?
Returned: XXX.X
Comments: Used to query the Low Level Setpoint. Value returned in either inches or millimeters depending on the current level units. There must be at least a 0.5 inch interval between each level setting and alarm.

LOLA Set Low Level Alarm
Input: LOLA XXX.X
Returned: No response
Comments: Used to set the Low Level Alarm value. Input value uses the current level units, either inches or millimeters. There must be at least a 0.5 inch interval between each level setting and alarm.

LOLA? Low Level Alarm Query
Input: LOLA?
Returned: XXX.X
Comments: Used to query the Low Level Alarm value. Value returned in either inches or millimeters. There must be at least a 0.5 inch interval between each level setting and alarm.

LOLS? Low Level Alarm Status Query
Input: LOLS?
Returned: 0 or 1
Comments: Used to query the Low Level Alarm Status where 0 = off and 1 = on.

LOLM Set Low Level Alarm Mask
Input: LOLM 0 or LOLM 1
Returned: No response
Comments: Used to enable or disable the Low Level Alarm where 0 = disabled and 1 = enabled. Default setting is 1 = enabled.

LOLM? Low Level Alarm Mask Query
Input: LOLM?
Returned: 0 or 1
Comments: Used to query the Low Level Alarm Mask status where 0 = disabled and 1 = enabled. Default setting is 1 = enabled.

LUNI Set Level Units
Input: LUNI E, LUNI M, or LUNI %
Returned: No response
Comments: Used to set the LN2 level units where E = English (inches), M = Metric (millimeters), and % = Percent.

LUNI? Level Units Query
Input: LUNI?
Returned: E, M, or %
Comments: Used to query the current LN2 level units E = English (inches), M = Metric (millimeters), and % = Percent.

RATE? Current Liquid Usage Query
Input: RATE?
Returned: XXX.X
Comments: Used to query the current LN2 liquid usage rate.

Level Percent Commands

DSPN Define 100% Point
Input: DSPN XXX.X
Returned: No response
Comments: Used to set the 100% level setting in inches or millimeters.

DSPN? 100% Point Query
Input: DSPN?
Returned: XXX.X
Comments: Used to query the 100% level setting.

PCNT? Current Percent Query
Input: PCNT?
Returned: XXX.X
Comments: Used to query the current percent level reading.

DZER Define 0% Point
Input: DZER XXX.X
Returned: No response
Comments: Used to set the 0% level setting in inches or millimeters.

DZER? 0% Point Query
Input: DZER?
Returned: XXX.X
Comments: Used to query the 0% level setting.

Event Log Commands

CLEVLG Clear the Event Log
Input: CLEVLG
Returned: No response
Comments: Used to clear all data from the event log. Data will be permanently lost when the event log is cleared.

DATE Set the Date
Input: mm/dd/yy
Returned: No response
Comments: Used to set the current date in the format: mm/dd/yy (month/day/year).

DATE? Date Query
Input: DATE?
Returned: mm/dd/yy
Comments: Used to query the current date.

EVENT? Last Event Query
Input: EVENT?
Returned: XXXXX, MM/DD/YY, HH:MM, XXX.X, XXX.X, XXX.X, XXX.X
Comments: String returned: Date, Time, TempA, Temp B, LN2 Level, Liquid Usage, Event Codes

EVNCT? Event Log Count Query
Input: EVNCT?
Returned: XXXXX
Comments: Used to query the number of event log records.

EVNLOG? Event Log Record Query
Input: EVNLOG? N
Returned: XXXXX, MM/DD/YY, HH:MM, XXX.X, XXX.X, XXX.X, XXX.X
Comments: Used to query Event Record [n] where n = record number. String returned: Date, Time, TempA, Temp B, LN2 Level, Liquid Usage, Event Codes.

LOGPER Set Event Log Interval
Input: LOGPER XXX
Returned: No response
Comments: Used to set the event log interval between 1 and 240 minutes. Default setting is 240 minutes.

LOGPER? Event Log Interval Query
Input: LOGPER?
Returned: XXX
Comments: Used to query the current event log interval.

TIME Set the Time
Input: hh:mm:ss
Returned: No response
Comments: Used to set the controller Time in the format hh:mm:ss (hour:minute:second).

TIME? Time Query
Input: TIME?
Returned: hh:mm:ss
Comments: Used to query the current time.

UNID Set Unit ID
Input: UNID XXXXX
Returned: No response
Comments: Used to set the controller 5-digit Unit ID. TEC 3000 Unit ID should be between 1 and 200.

UNID? Unit ID Query
Input: UNID?
Returned: XXXXX
Comments: Used to query the controller Unit ID.

CHART BIO-MEDICAL DIVISION

CAIRE

MVE SECURITY THROUGH SYSTEMS

SANITIZING AND DECONTAMINATING CHART ALUMINUM AND MVE DEWARS

MVE aluminum dewars are constructed with an aluminum inner, which utilizes a fiberglass neck support. The stainless units are constructed with an inner entirely fabricated from stainless steel sheets. Any cleaning solution that does not react with aluminum or stainless can be used in the sanitation process of these dewars. In most cases, any household detergent or mild soap solution is suitable. The U.S. Custom Service uses a solution called EXPOR for incoming shipments from abroad. This is mixed 9 parts water mixed with sodium chloride & lactic acid. As mentioned above, however, any household cleaning solution can be used. These include bleach, detergents, and mild soaps. Other cleaners and disinfectants that can be safely used include hydrogen peroxide, chlorine/water and denatured alcohol. NOTE: ***DO NOT USE ANY PETROLEUM BASED CLEANING SOLUTION.*** It is important that the inner vessel is thoroughly rinsed with water and all cleaner residues have been removed. Spraying the solution into the inner vessel is preferred, although agitation of the solution inside the inner will suffice. Vapor shippers and Doble units will require filling the inner to its full capacity with cleaning mixture and then rinsing. Allow the unit to dry thoroughly before putting into service. With vapor shippers, we suggest setting dewar inverted to drain and dry. The process is not intended for use in older vapor shipper models manufactured prior to 1994.

The generally accepted practice of using 10% chlorine bleach with 90% water solution still holds as the best method for decontamination. However, with some of the bovine and swine virus strains showing up today, it is the conclusion of the agricultural professors at the University of Minnesota and Texas A & M that an increased mixture of chorine bleach to 30% and 70% water will kill all known viruses except BSE. This is still unknown to them and are not willing to offer a solution.

To perform this sanitizing procedure, cover all inner surfaces with the solution, let stand for 30 minutes and remove. Rinse the decontaminated surfaces with clean water and remove rinse water. Allow dewar to dry before putting into service. For vapor shippers and Doble units, this means to place dewar on end (inverted) and allow drying. Note: Vapor dewars can be used immediately after rinsing but may take longer to recharge to 100% capacity

Notes: