TECHNICAL MANUAL

MVE TEC 3000

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This manual covers use and maintenance of the TEC 3000. It is intended for use by experienced personnel only.

NOTE: All MVE models are a Class 1, externally powered, continuous operation medical device. They are not suitable for use with flammable anesthetics. This equipment has been tested and found to comply with the limits for medical devices to IEC 601-1-2: [or EN 60601010102:2001 or Medical Device Directive 93/42/EEC].

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Product Identification

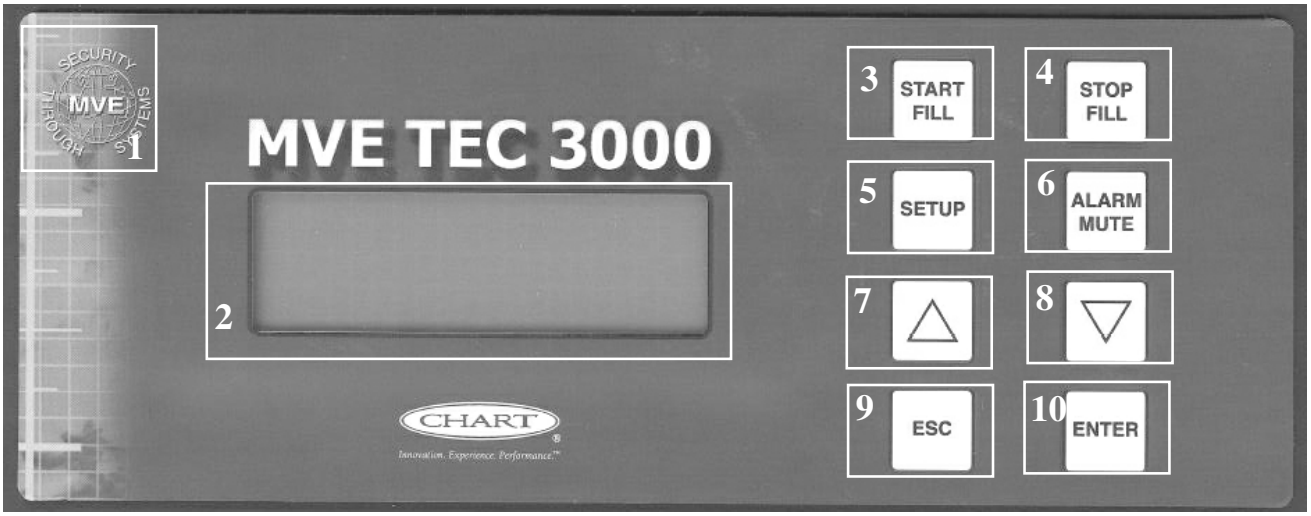


Table 1: Front Panel Identification

1	Front Panel	The front panel is the user interface for the TEC 3000. All displays and controls are located on the front panel
2	Display	A 4 x 20 Liquid Crystal Display (LCD) shows the value of all current conditions including Temperature and Liquid Nitrogen Level. The display also shows any current alarm conditions that may exist.
3	Start Fill	Used to manually fill the freezer with liquid nitrogen. This button may also be pressed to clear "fog" from the storage area to increase visibility.
4	Stop Fill	Used to manually end the filling cycle. After pressing this button, the unit will not resume filling until the low level setting is reached, or the "START FILL" button is pressed.
5	Setup	Used to adjust the value of all user adjustable functions including Level, Level Alarms, Temperature Alarms, Passwords, Etc.
6	Alarm Mute	Used to silence the audible alarm. Also used to reset the latching alarm after the alarm condition is corrected.
7	Up Arrow	Used to increase number values during "Setup" modes. Press once to decrease incrementally. Hold the button to scroll through values quickly. May also be used to toggle "YES/NO" or "ON/OFF" values.
8	Down Arrow	Used to decrease number values during "Setup" modes. Press once to decrease incrementally. Hold the button to scroll through values quickly. May also be used to toggle "YES/NO" or "ON/OFF" values.
9	Escape	Used to exit any menu or setup function.
10	Enter	Used to Select any menu for editing or save any user adjustable setting.

Product Identification

Bottom Panel / Electrical / Physical Connections

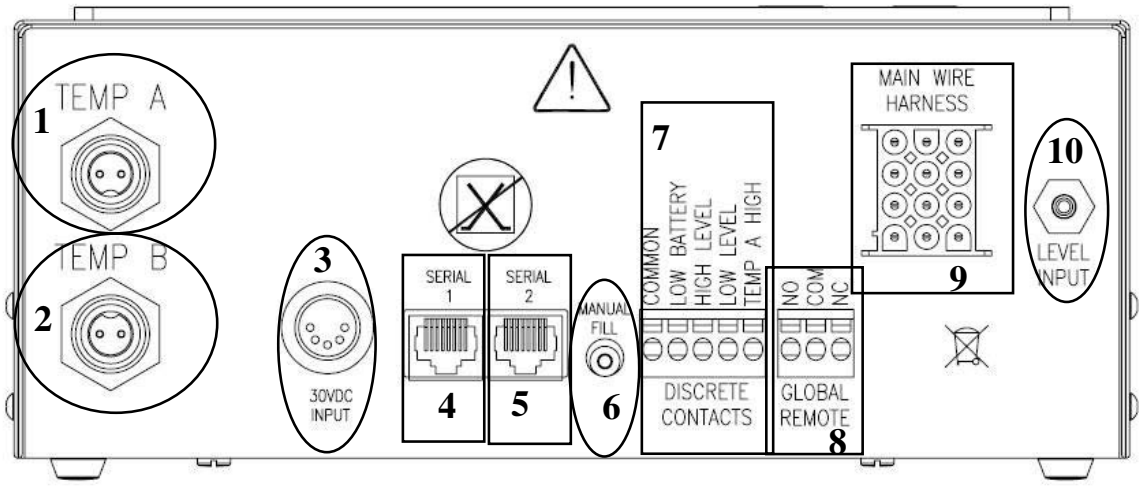


Table 2: Bottom Panel Identification

1	Temp A	Connection for Temperature A probe.
2	Temp B	Connection for Temperature B probe.
3	Power Connections	Connections for incoming power and output to solenoid valves.
4	COM 1	Connection for RS-485 communications interface.
5	COM 2	Redundant Connection for RS-485 communications interface.
6	Manual Fill	Manual Fill button used to override the TEC 3000 software and manually fill the freezer.
7	Discreet Alarm Connections	These connections monitor the alarms for High Temp A, Low Level, Low Battery, and LN2 Supply. They can be wired to any alarm system that uses Normally Open (NO)
8	Global Alarm Connections	These connections monitor ALL alarms. They can be wired to any alarm system that uses Normally Open (NO) or Normally Closed (NC) contacts.
9	Main Harness Connection	Connection for the main wiring harness. All of the connections for the solenoid valves, lid switch, bypass sensor, etc. are located here.
10	Level Connection	Connection for level sensing system. Level sensing is achieved via differential pressure sensor, located inside the TEC 3000. The tube from the level sensing line on the freezer connects here. The connection is a 1/8” (3.2mm) OD hose barb.

Functions and Features

The TEC 3000 employs a variety of high level features that enable the controller to monitor and control the environment inside a freezer with a high level of precision. Below is a list of features and the functions will be described in the following subsections.

- Liquid Nitrogen Level Measurement
- Automatic Liquid Nitrogen Level Control
- Two Channel Temperature Measurement
- Multi Function User Defined Alarms
- Hot Gas Bypass (Optional)
- Battery Backup (Optional)
- Adjustable Security / Password System

Liquid Nitrogen Level Measurement

The TEC 3000 utilizes a differential pressure sensor to determine the amount of liquid nitrogen in the storage vessel. The sensor operates on the physical principle of imposed head pressure. This principle states that the pressure generated by a column of fluid (or freezer, in the case of liquid nitrogen storage vessels) increases proportionally to the depth of the fluid. Figure 1 illustrates this principle. The gauges on the columns of fluid show that as the height of the fluid in the cylinder increases, the pressure shown on the gauge also increases.

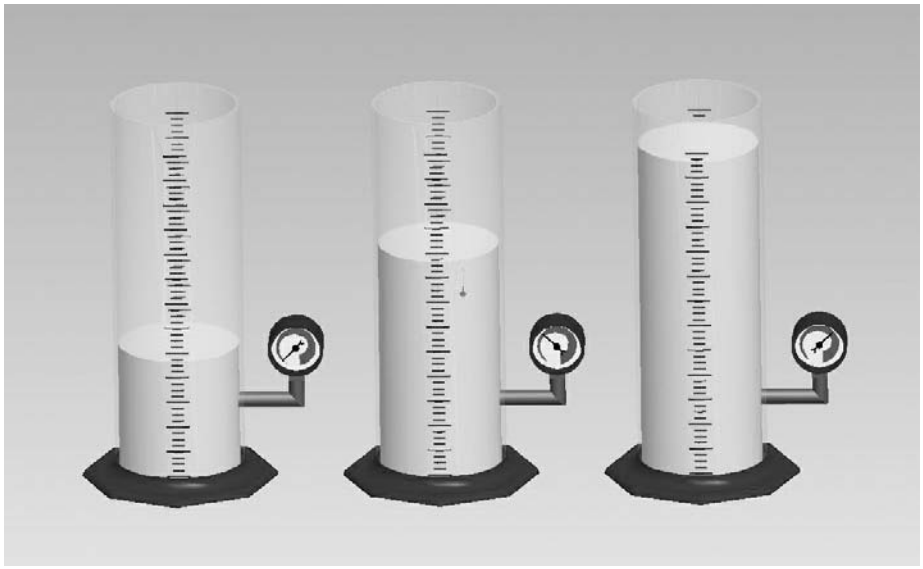


Figure 1: As the level of fluid in a cylinder increases, the pressure at the bottom of the cylinder increases proportionally.

Functions and Features

The TEC 3000 measures the pressure signal generated by liquid nitrogen inside the freezer to determine the depth of nitrogen. The pressure signal is transmitted through a tube that passes from the outside of the freezer, through the vacuum space and into the storage space of the freezer. This tube is known as an annular line, because it passes through the annular space (also known as vacuum space) between the inner and outer vessels of the freezer. The figure below shows a cutaway view of a freezer and the routing of the annular line.

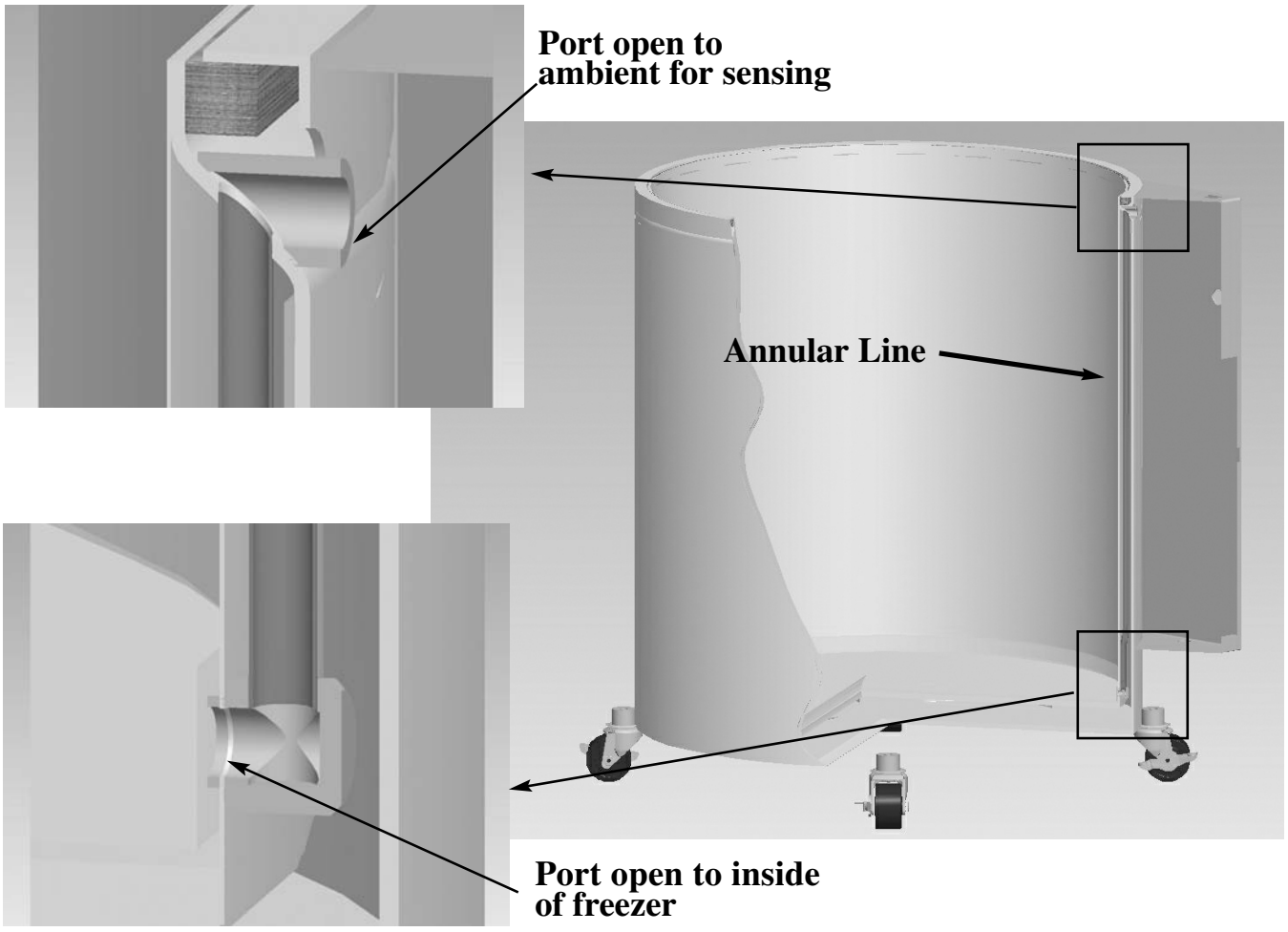


Figure 2: Typical Annular Line Configuration

As the level of liquid nitrogen inside the freezer increases, the pressure inside the annular line increases. The TEC 3000 detects the pressure on the annular line and relates this pressure to a level measurement in inches or millimeters. The completely enclosed system creates a reliable and accurate level measurement system that requires minimal maintenance and is not affected by humidity, moisture, etc. See Specifications for detailed information on the level measurement system.

Automatic Liquid Nitrogen Level Control

The TEC 3000 precisely controls the depth of liquid nitrogen inside the freezer using the Liquid Nitrogen Measurement System described above. Using this differential pressure system, the TEC 3000 can be adjusted by the end user to maintain a depth of liquid nitrogen inside the freezer over a range of 3" (76mm) up to 48" (1219mm). As the liquid nitrogen in the freezer evaporates, the depth of the LN_2 is reduced. When the depth of LN_2 drops below the user defined Low Level Setting, the TEC 3000 will signal for the solenoid valve(s) to open, allowing LN2 to flow from the supply source into the freezer, increasing the depth of LN_2. When the depth of LN_2 inside the freezer reaches the user defined High Level Setting, the TEC 3000 will turn off the signal to the solenoid valve(s), stopping the flow of LN_2 of the freezer. The TEC 3000 will continue to monitor the level, and the cycle repeats itself. Figure 3 shows a typical LN_2 depth interval.

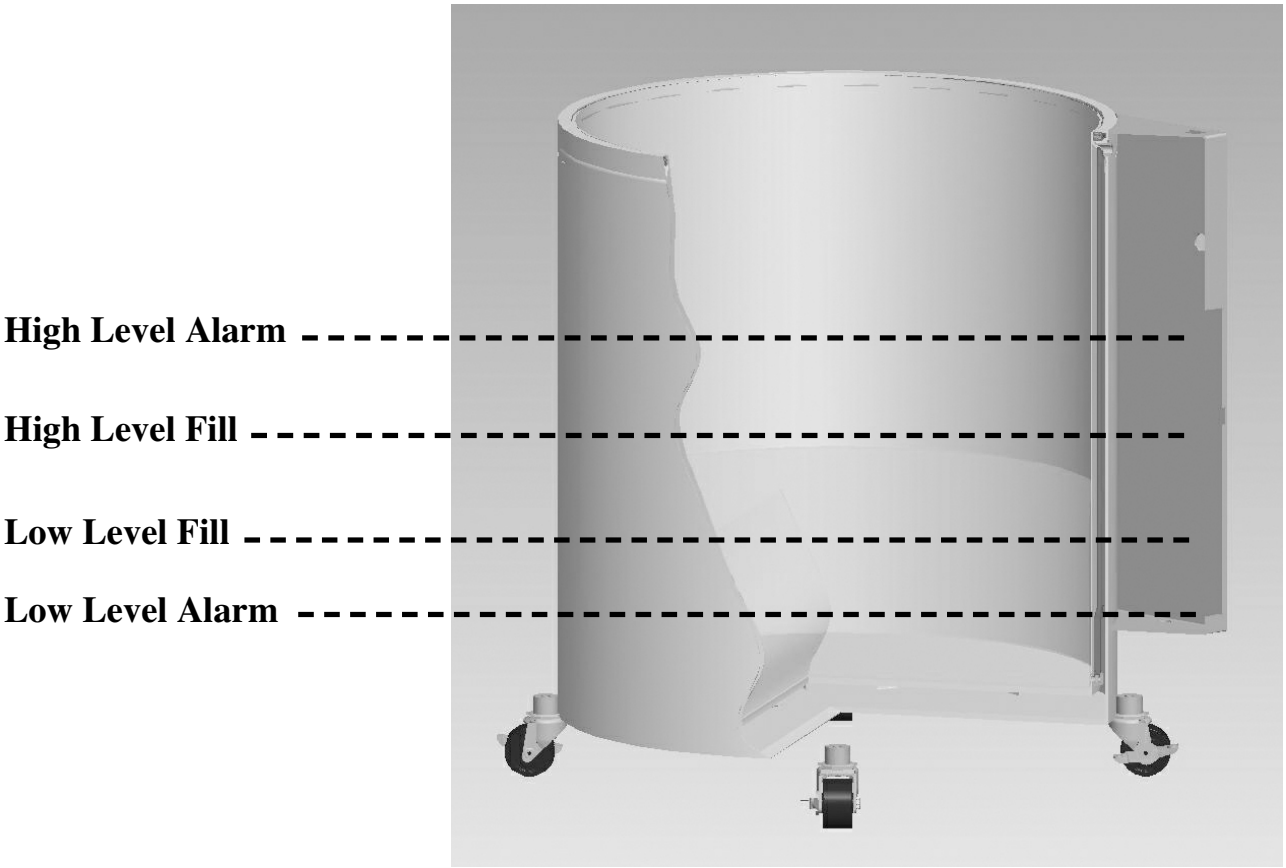


Figure 3: Typical LN2 Depth Intervals

Functions and Features

Temperature Measurement

The TEC 3000 is equipped with 2 channels for temperature measurement and is designed for use with 1000 ohm Platinum RTD temperature probes. These temperature probes use a very fine platinum wire that changes electrical resistance relative to temperature. Platinum RTD's exhibit a very linear increase in resistance when temperature increases. The behavior of platinum RTD probes makes them ideal for temperature measurement in cryogenic environments.

Multi Function User Defined Alarms

The TEC 3000 is equipped with 17 audible and visual alarms. These alarms monitor the environment in the freezer, liquid nitrogen supply (at the freezer), and the incoming power (at the freezer). In the event that a condition triggers any of the alarms, that particular alarm will be displayed on the LCD screen with an accompanied buzzer. If desired, an autonomous monitoring system may be connected to the TEC 3000 via 4 external alarm contacts located on the bottom panel. (See "Bottom Panel / Electrical / Physical Connections" section of this manual for details). The contacts may be configured as either Normally Open (NO) or Normally Closed (NC) switches. Of the four contact sets, one is a global alarm indicator (switches when ANY alarm condition exists) and the other contacts are discreet alarm indicators (switches when one SPECIFIC alarm condition exists) The drawing on page 4 shows the pin out locations of each contact set and which alarm is associated with which contact. Table 3 lists all the possible alarms and their descriptions.

Table 3: Alarms and their Descriptions

Alarm Display	Description
High Temp A	The temperature of Probe A is above the user defined High Temperature setting.
High Temp B	The temperature of Probe B is above the user defined High Temperature setting.
Low Temp A	The temperature of Probe A is below the user defined Low Temperature setting.
Low Temp B	The temperature of Probe B is below the user defined Low Temperature setting.
High Level	The depth of LN_2 inside the freezer is above the user defined High level setting.
Low Level	The depth of LN_2 inside the freezer is below the user defined Low level setting.
Usage Warning	The amount of LN_2 consumed by the freezer has doubled within a 24 hour time period.
Usage Alarm	The amount of LN_2 consumed by the freezer has increased by a factor of 5 within a 24 hour period.
Fill Time	The amount of time required to complete a fill cycle exceeds the user defined Fill Time setting.
Bypass Time	The amount of time required to complete a bypass cycle exceeds the user defined Bypass Time setting.
Temp A Calibration	The temperature of Probe A is lower than absolute zero (-273°C / -460°F).
Temp B Calibration	The temperature of Probe B is lower than absolute zero (-273°C / -460°F).
Bypass Calibration	The temperature of the bypass sensor is lower than absolute zero (-273°C/-460°F)
Low Battery	The voltage of the back up batteries has dropped below 21 volts.
Power Failure	The primary power has been disconnected for at least 60 minutes.
Lid Open	The lid on the freezer has been open longer than the user specified time limit.
Communication Loss	The controller has lost communication with the display

Functions and Features

Hot Gas Bypass (Optional)

Theory of operation:

The TEC 3000 has the capability of venting warm nitrogen gas before initiating a fill cycle. When the LN_2 inside the freezer evaporates down to the user defined Low Fill Setting, the TEC 3000 initiates a fill cycle. Freezers equipped with the Hot Gas Bypass option initially delay the fill cycle, and allow warm nitrogen gas to vent to the atmosphere before allowing LN_2 to enter the freezer. A temperature sensor in the plumbing system on the freezer senses the temperature of the incoming fluid (mixture of liquid and gaseous nitrogen). The plumbing system will not allow this fluid to enter the freezer until the temperature of the incoming fluid cools to the user defined Hot Gas Bypass Temperature setpoint (factory set at -100°C / -148°F). When this occurs, the plumbing system allows the cold LN_2 to enter the freezer, preventing excessive loss of LN_2 inside the freezer and keeping the temperature gradient of the freezer more consistent. The Hot Gas Bypass system works well on liquid nitrogen delivery systems that are moderate in length. The bypass system will allow the LN_2 delivery system to cool substantially before delivering fluid to the freezer.

Components:

The Hot Gas Bypass valve consists of the following components:

- Solenoid Valve
- Temperature Sensor
- Muffler
- Miscellaneous Plumbing and Electrical Components

Battery Backup (Optional)

Theory of operation:

The TEC 3000 is equipped to run seamlessly on power delivered from an external battery system when the primary power source is interrupted. Freezers equipped with the Battery Backup option can run 36 hours without primary power, preventing loss of environmental control of the freezer in the event of a power failure. During normal operation, the TEC 3000 continuously charges and maintains the backup batteries.

NOTE: The amount of time a freezer will operate on back-up batteries may vary with fill valve arrangement, fill intervals, and the size of the freezer.

Components:

The battery backup system consists of the following components:

- Two 12 VDC lead acid batteries
- A freezer mounted battery box
- An inline fuse
- Associated wiring

Functions and Features

Passwords / Security Features

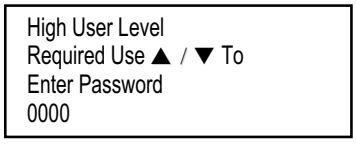
The TEC 3000 employs a multi level security system that can be used to control which functions and parameters of the controller may be adjusted. Three different levels of security may be assigned up to 10 passwords, allowing users to control who has the ability to alter settings, and to what extent they may be altered. For example, in a repository that employs many technicians, the manager of the repository may only want to allow technicians the ability to view alarm settings but no ability to adjust them. In this case, the technicians would be assigned a password with low level security privelages. Conversely, if the repository manager wants to have complete control over the freezer's parameters, they would assign a password with high levels of security privelages. Table 4 shows the different levels of security and what functions may be altered by each. For more information on setting up security levels and passwords, see "Password and Security Setup".

Adjusting Temperature Alarm Settings

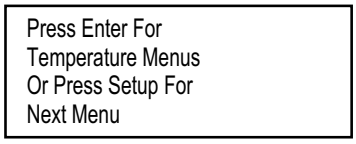
The following section describes how to adjust temperature alarm settings. At any time during the following procedure, the user may exit the level by pressing the "Escape" button repeatedly, until the display returns to the "monitor" display mode. After 30 seconds of inactivity, the controller will automatically return to the "monitor" display mode.

NOTE: Security Level 2 or higher is required to adjust temperature settings (see "Password and Security Setup" section for details).
To exit any menu screen and return to the previous menu, press "ESC" key.

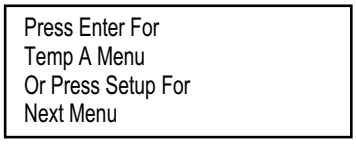
1. **PRESS "SETUP"**
   The controller will prompt for a password. Use the "▲ / ▼" keys to scroll to the appropriate number. Press "Enter" to move cursor to the next position in the password.



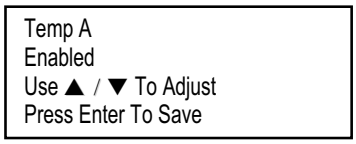
2. **PRESS "ENTER"**
   The display will read "Temperature Menus".



3. **PRESS "ENTER"**
   The display will read "Temp A Menu".
   NOTE: To adjust Temp B settings, press "Setup" instead of "Enter".

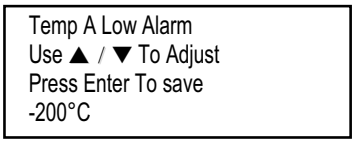


4. **PRESS "ENTER"**
   The display will read "Temp A Enabled".
   NOTE: Probe A may be disabled now by pressing the "▲ / ▼" keys. Press "Enter" to save settings.



5. **PRESS "SETUP"**
   Until Display Reads "Temp A High Alarm". Use the "▲ / ▼" keys to adjust the temperature. Hold either button to scroll quickly. Press "Enter" to save settings.

6. **PRESS "SETUP"**
   The display will read "Temp A Low Alarm". Use the "▲ / ▼" keys to adjust the temperature. Hold either button to scroll quickly. Press "Enter" to save settings



After all adjustments are complete, wait 30 seconds, and the TEC 3000 will return to the Main Display screen, and new settings will take effect.

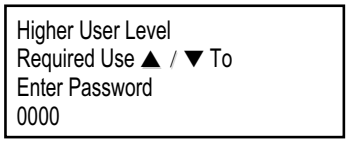
Adjusting Level and Level Alarm Settings

The following section describes how to adjust liquid nitrogen level settings and the high/low level alarms. NOTE: Security Level 2 or higher is required to adjust the Level and Level Alarm settings (See "Password and Security Setup" section for details).

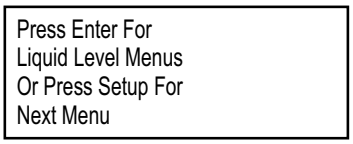
NOTE: To exit any menu screen and return to the previous menu press "ESC" key.

HIGH LEVEL ALARM SETTING:

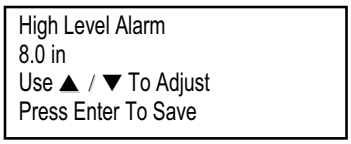
1. **PRESS "SETUP"**
   The controller will prompt for a password. Use the "▲ / ▼" keys to scroll to the appropriate number. Press "Enter" to move the cursor to the next position in the password.



2. **PRESS "SETUP"**
   Until the display reads "Liquid Level Menus".



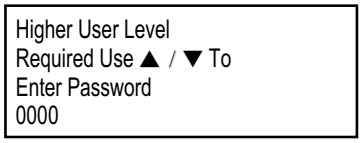
3. PRESS "ENTER"
   The display will read "High Level Alarm". Use the "▲ / ▼" keys to adjust the setting. Press "Enter" to save the settings. NOTE: No level settings can be adjusted to less than .5" (14 mm) within each other.



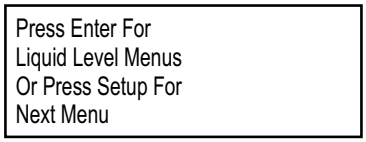
After all adjustments are complete, wait 30 seconds, and the TEC 3000 will return to the Main Display screen, and new settings will take effect.

HIGH LEVEL SETTING:

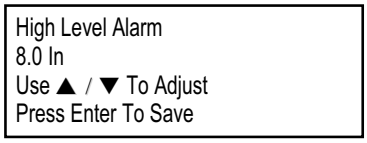
1. **PRESS "SETUP"**
   The controller will prompt for a password. Use the "▲ / ▼" keys to scroll to the appropriate number. Press "Enter" to move cursor to the next position in the password.



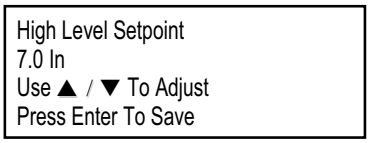
2. **PRESS "SETUP"**
   Until the display reads "Liquid Level Menu".



3. **PRESS "ENTER"**
   The display will read "High Level Alarm Setpoint".



4. **PRESS "SETUP"**
   The display will read "High Level Setpoint". Use the "▲ / ▼" keys to adjust the setting. Press "Enter" to save settings.



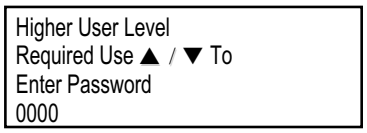
After all adjustments are complete, wait 30 seconds, and the TEC 3000 will return to the Main Display screen, and new settings will take effect.

Adjusting Level and Level Alarm Settings

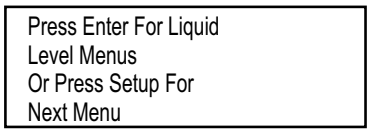
NOTE: To exit any menu screen and return to the previous menu, press "ESC" key.

LOW LEVEL SETTING

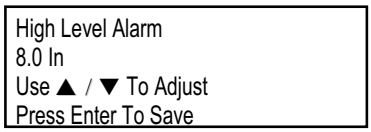
1. **PRESS "SETUP"**
   The controller will prompt for a password. Use the "▲ / ▼" arrow keys to scroll to the appropriate number. Press "Enter" to move the cursor to the next position in the password.



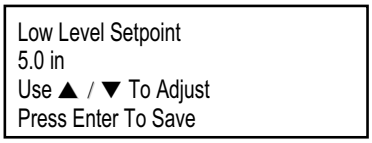
2. **PRESS "SETUP"**
   Until the display reads "Liquid Level Menus".



3. **PRESS "ENTER"**
   The display will read "High Level Alarm".

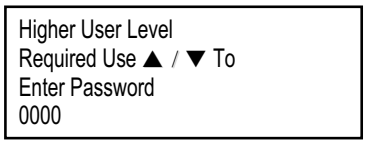


4. **PRESS "SETUP"**
   Until the display reads "Low Level Setpoint". Use the "▲ / ▼" keys to adjust the setting. Press "Enter" to save settings.

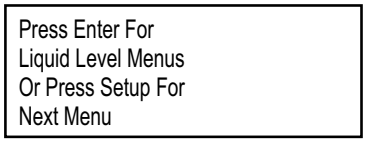


LOW LEVEL ALARM SETTING:

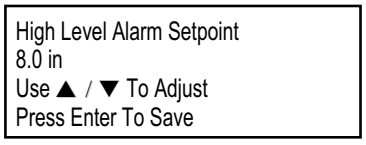
1. **PRESS "SETUP"**
   The controller will prompt for a password. Use the "▲ / ▼" keys to scroll to the appropriate number. Press "Enter" to move cursor to the next position in the password.



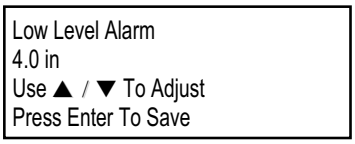
2. **PRESS "SETUP"**
   Until the display reads "Liquid Level Menus".



3. **PRESS "ENTER"**
   The display will read "High Level Alarm".



4. **PRESS "SETUP"**
   Until the display reads "Low Level Alarm". Use the "▲ / ▼" keys to adjust the setting. Press "Enter" to save settings.



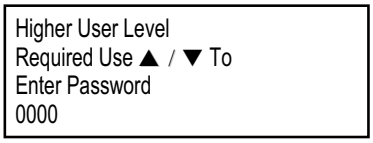
After all adjustments are complete, wait 30 seconds, and the TEC 3000 will return to the Main Display screen, and new settings will take effect.

Adjusting Display and Output Settings

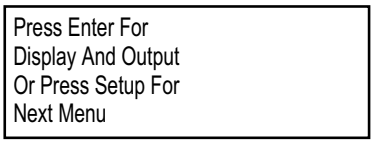
The units of measurement displayed by the TEC 3000 may be adjusted to accommodate the needs of the user. Temperature measurement may be displayed in degrees Kelvin (°K), degrees Celsius (°C), or degrees Fahrenheit (°F). The amount of liquid nitrogen in the freezer may be displayed in inches (in), millimeters (mm), or percentage full (%).

NOTE: Security Level 1 is required to adjust the display and output settings (See "Password and Security Setup)"

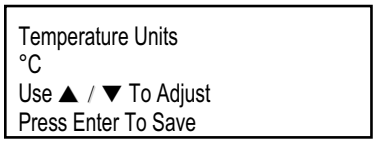
1. **PRESS "SETUP"**
   The controller will prompt for a password. Use the "▲ / ▼" keys to scroll to the appropriate number. Press "Enter" to move cursor to the next position in the password.



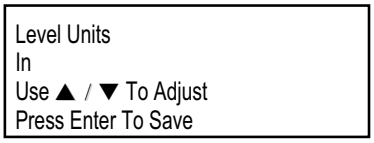
2. **PRESS "SETUP"**
   Until the display reads "Display and Output Setup".



3. **PRESS "ENTER"**
   The display will read "Temperature Units °C". Use the "▲ / ▼" keys to toggle between °C (Celsius), °F (Fahrenheit), or °K (Kelvin). Press "Enter" to save settings.



4. **PRESS "SETUP"**
   The display will read "Level Units". Use the "▲ / ▼" keys to toggle between "in" (inches) or "mm" (millimeters). Press "Enter" to save settings.



After all adjustments are complete, wait 30 seconds, and the TEC 3000 will return to the Main Display screen, and new settings will take effect.

Calibration of temperature Probes

Both temperature probes used by the TEC 3000 may be independently calibrated using two distinct calibration methods:

- The “Low Temperature Range” (single point) calibration method which provides accuracy of +/- 1.0°C from -150°C to -199°C.

- The “Full Temperature Range” (two point) calibration method which provides accuracy of +/-2.0°C from 0.0°C to -199°C.

The single point calibration method provides the greatest level of accuracy in the cryogenic temperature range. If temperatures greatly exceed -150°C, the accuracy of the single point method decreases. Calibrating using this method requires fewer steps than the two point method, and hence reduces the chances of improper calibration.

The two point calibration method provides the greatest temperature range measurement capability. This method is less accurate over the cryogenic temperature range, but does not lose accuracy as temperature approach 0°C. Calibrating using this method requires more steps than the single point method and hence increases the chances of improper calibration.

NOTE: Each of the temperature sensor probes (A & B) used with the TEC 3000 have been calibrated at the factory, using the “Low Temperature Range” method. This calibration method provides a level of accuracy of +/-1.8°F (+/-1°C) when operated in the altitude range of 1000 ft. to 1500 ft. (305m to 457m). Further calibration should not be required unless the installation altitude is significantly different than above, or if desired by the end user.

Calibration

Low Temperature Range Method:

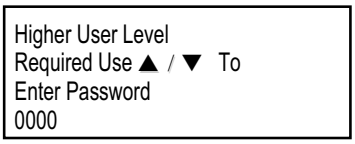
To complete the calibration process, the user will need a cryogenic freezer or other suitable container filled with liquid nitrogen and appropriate safety equipment.

The first step of calibration is to determine the appropriate saturation temperature of liquid nitrogen. The temperature of liquid nitrogen varies with altitude so the user must determine the altitude of the location of installation and select the corresponding temperature from Table XX at the end of this section. This value will be programmed into the TEC 3000 in the following procedure.

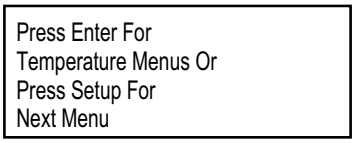
NOTE: Security Level 1 is required to adjust the display and Output settings (See "Password and Security Settings" section for details).

At any time during the following procedure, the user may exit the level by pressing the "Escape" button repeatedly, until the display returns to the "monitor" display mode. After 30 seconds of inactivity, the controller will automatically return to the "monitor" display mode.

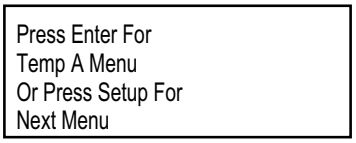
1. **PRESS "SETUP"**
   The controller will prompt for a password. Use the **"▲ / ▼"** keys to scroll to the appropriate number. Press "Enter" to move cursor to the next position in the password.



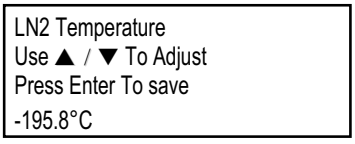
2. **PRESS "ENTER"**
   The display will read "Temp Menus".



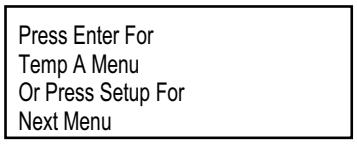
3. **PRESS "ENTER"**
   The display will read "Temperature A Menu".



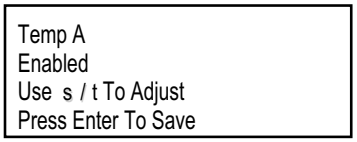
4. **PRESS "SETUP"**
   Until display reads "LN2 Temperature". Use the **"▲ / ▼"** keys to enter the saturation temperature of liquid nitrogen that approximates the altitude of the freezer location. Refer to Table XX. Press "Enter" to save the setting.



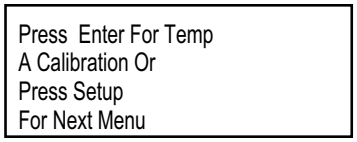
5. **PRESS "SETUP"**
   The display will read "Temp A Setup"
   NOTE: To calibrate Probe B, press "Setup" again until the display reads "Temp B Setup".



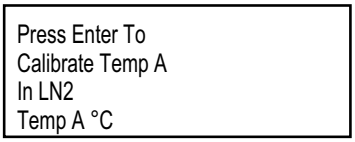
6. **PRESS "ENTER"**
   The display will read "Temp A Enabled".



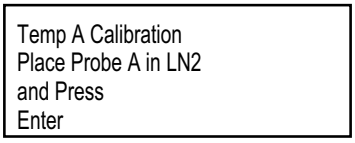
7. **PRESS "SETUP"**
   Until the display reads "Calibrate Temp A Probe".



8. **PRESS "ENTER"**
   The display will read "Calibration Type" Use "▲ / ▼" keys to select "SINGLE POINT".

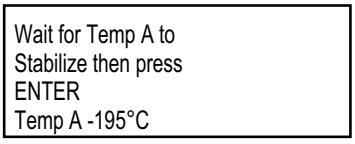


9. **Press "ENTER"**
   The display will read "Temp A Calibration".



At this time, place the Temp A probe into a suitable container filled with liquid nitrogen. If the freezer already contains liquid nitrogen, this may be used so long as the probe can be fully submerged in the liquid nitrogen.

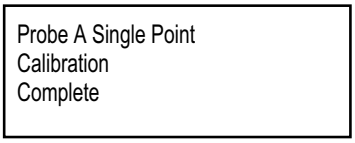
10. **PRESS "ENTER"**
    The display will read "Wait for Temp A to stabilize then press ENTER".



As the temperature probe cools, the value of Temp A displayed on the screen will decrease. When the value of this number becomes steady, the temperature of the probe has stabilized.

Calibration

10. **PRESS "ENTER"**
    The display will read "Probe A Single Point Calibration Complete".



Now the single point calibration of Probe A is complete. To calibrate Probe B, use the same method described above, selecting Probe B during step 6.

Full Range Calibration Method:

To complete the calibration process, the user will need a cryogenic freezer or another suitable container filled with liquid nitrogen, a well insulated cup filled with ice, water, and appropriate safety equipment.

The first step of calibration is to determine the appropriate saturation temperature of liquid nitrogen. The temperature of liquid nitrogen varies with altitude, so the user must determine the altitude of the location of installation, and select the corresponding temperature from Table XX at the end of this section. This value will be programmed into the TEC 3000 in the following procedure.

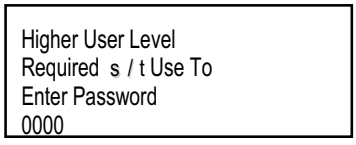
When preparing ice water, use a well insulated container such as a polystyrene cup. Allow sufficient time for the temperature of the ice water to stabilize, stirring occasionally to equalize the temperature of the water. It may be helpful to measure the temperature of the ice water with a thermometer to ensure that its temperature is 0°C.

NOTE: Improper preparation of ice water will result in inaccurate calibration. It is imperative that the temperature of the ice water has stabilized at 0°C before the calibration process begins.

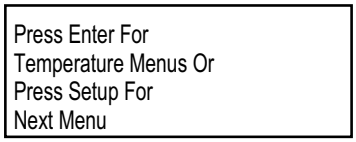
NOTE: Security Level 2 is required to calibrate the temperature probes (see Section 7 "Password and Security Setup" for details.

At any time during the following procedure, the user may exit the level by pressing the "Escape" button repeatedly, until the display returns to the "monitor" display mode. After 30 seconds of inactivity, the controller will automatically return to the "monitor" display mode.

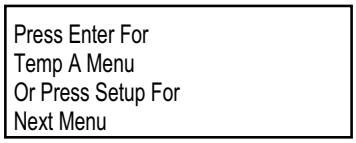
1. **PRESS "SETUP"**
   The controller will prompt for a password. Use the **"▲ / ▼"** keys to scroll to the appropriate number. Press "Enter" to move cursor to the next position in the password.



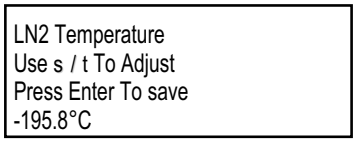
2. **PRESS "ENTER"**
   The display will read "Temp Menus".



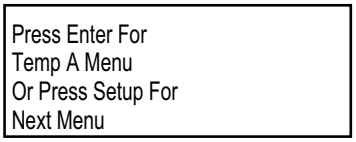
3. **PRESS "ENTER"**
   The display will read "Temperature A Menu".



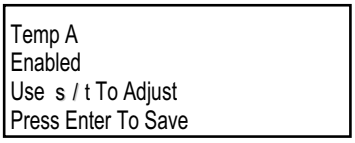
4. **PRESS "SETUP"**
   Until display reads "LN2 Temperature". Use the **"▲ / ▼"** keys to enter the saturation temperature of liquid nitrogen that approximates the altitude of the freezer location. Refer to Table XX. Press "Enter" to save the setting.



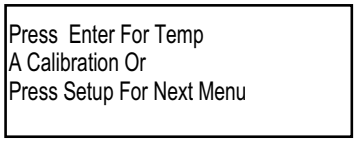
5. **PRESS "SETUP"**
   The display will read "Temp A Setup"
   NOTE: To calibrate Probe B, press "Setup" again until the display reads "Temp B Setup".



6. **PRESS "ENTER"**
   The display will read "Temp A Enabled".

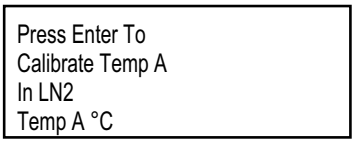


7. **PRESS "SETUP"**
   Until the display reads "Calibrate Temp A Probe".

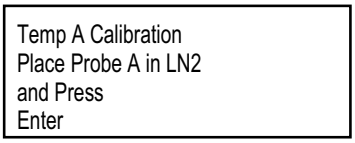


Calibration

8. **PRESS "ENTER"**
   The display will read "Calibration Type" Use ▲ / ▼ keys to select "TWO POINT".

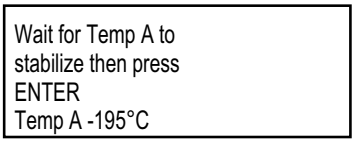


9. **Press "ENTER"**
   The display will read "Temp A Calibration".



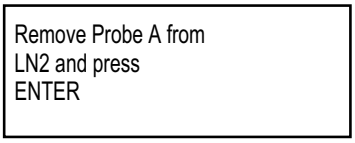
At this time, place the Temp A probe into a suitable container filled with liquid nitrogen. If the freezer already contains liquid nitrogen, this may be used so long as the probe can be fully submerged in the liquid nitrogen.

10. **PRESS "ENTER"**
    The display will read "Wait For Temp A to stabilize then press ENTER"



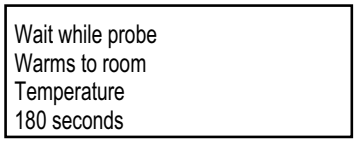
As the temperature probe cools, the value of Temp A displayed on the screen will decrease. When the value of this number becomes steady, the temperature of the probe has stabilized.

11. **PRESS "ENTER"**
    The display will read "Remove Probe A from LN2 and press ENTER".

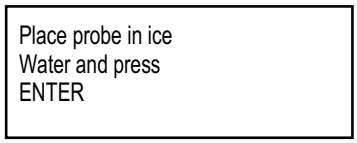


Remove the temperature probe from the liquid nitrogen. At this time, the first point of the two point calibration is complete. The next steps involve warming the probe to room temperature, then cooling it again in the ice water bath.

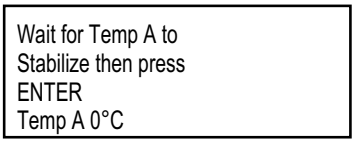
12. **PRESS "ENTER"**
The display will read "Wait while probe warms to room temperature". The timer will begin to count down from 180 seconds.



While the timer is counting down, it is important to allow the probe to warm to room temperature. Allow the probe to hang freely in a room temperature environment for the entire duration of the countdown. When the countdown is complete, place the temp probe in ice water

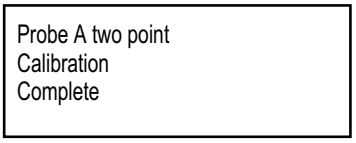


13. Press "ENTER"
The display will read "Wait for Temp A to stabilize then press "ENTER".



As the temperature probe cools, the value of Temp A displayed on the screen will decrease. When the value of this number becomes steady, the temperature of the probe has stabilized.

14. **PRESS "ENTER"**
The display will read "Probe A two point calibration complete"



Now the Two Point calibration of Probe A is complete. To calibrate Probe B, use the same method described above, selecting Probe B during step 6.

Table 5: LN2 Saturation Temp Vs. Altitude

ALTITUDE RANGE		SATURATION LIQUID NITROGEN TEMP		
Feet	**Meters**	**°C**	**°F**	**°K**
Sea Level to 500	Sea Level to 152	-196.8	-320.4	77.4
501 to 1000	153 to 304	-196.0	-320.7	77.2
1001 to 1500	305 to 457	-196.2	-321.1	77.0
1501 to 2000	457 to 610	-196.4	-321.5	76.8
2001 to 3000	610 to 915	-196.6	-321.9	76.6
3001 to 4000	915 to 1220	-196.6	-322.4	76.3
4001 to 5000	1220 to 1524	-197.2	-322.9	76.0
5001 to 6000	1525 to 1829	-197.5	-323.5	75.4
6001 to 7000	1829 to 2134	-197.8	-324.0	75.4
7001 to 8000	2134 to 2439	-198.1	-324.6	75.1
8001 to 9000	2439 to 2744	-198.4	-325.1	74.8
9001 to 10000	2744 to 3049	-198.7	-325.7	74.4

Password and Security Setup

Password and Security Setup

This section describes how to set up different security levels and passwords for the TEC 3000. The TEC 3000 is capable of storing up to 10 passwords. Each password may have a different level of security, allowing different users to have different permissions regarding setting adjustments. For example, users with a Security Level 1 can manually initiate a fill, manually stop a fill, temporarily mute alarms and change display settings. This user would not be able to adjust level settings, alarm settings, calibrate probes, etc. In contrast, a user with Security 4 may adjust all settings as well as set and maintain passwords. Table 6 below shows the levels of security available and the permissions associated with each security level.

To adjust any password or security level setting, a Level 4 password is required. The default (or "global") password for the TEC 3000 is "3456". All parameters may be adjusted by using this password. Use Table 6 to record password and security level settings.

NOTE: If the default password has been altered and the new password has been forgotten, contact MVE Customer Service for details on how to reset passwords.

Table 6: Security Levels and Definitions

FEATURE	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
Fill Start	X	X	X	X
Fill Stop	X	X	X	X
Alarm Mute	X	X	X	X
Change Display Units	X	X	X	X
Temp Settings		X	X	X
Level Settings		X	X	X
Time/Date		X	X	X
Calibration Probes		X	X	X
Change Languages		X	X	X
Hot Gas Bypass Settings		X	X	X
OFAF Setting			X	X
Communication Settings			X	X
Password Settings				X
Programming			X	X

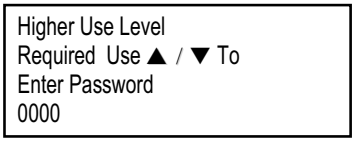
Password and Security Setup

Creating and Maintaining Passwords

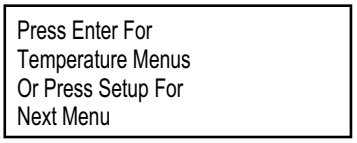
Use the following procedure to create new passwords and adjust security levels for each password.

NOTE: The default password for the TEC 3000 is “3456” and is located in Password 1. The default security setting for this password is Level 4. Altering the password in Password 1 will delete the default password of “3456”. Use the blank table at the end for this section to record password and security level settings.

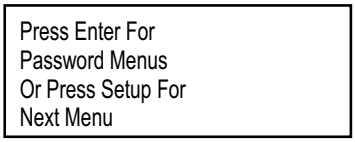
1. **PRESS “SETUP”**
   The controller will prompt for a password. Use the “▲ / ▼” keys to scroll to the appropriate number. If setting up passwords for the first time, use the default password of “3456”. Press “Enter” to move cursor to the next position in the password.



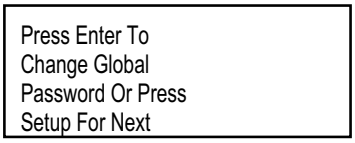
2. **PRESS “ENTER”**
   The display will read “Temperature Menus”.



3. **PRESS “SETUP”**
   Until the display reads “Password Menus”



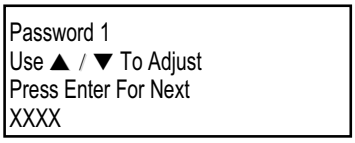
4. **PRESS “ENTER”**
   The display will read “Press Enter to change Global Password or press Setup for Next”.



5. **PRESS “SETUP”**
   To scroll to the desired password number.

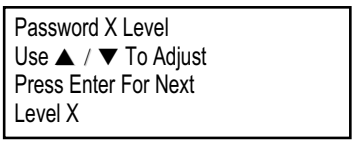
6. **Press “ENTER”** to select the desired password number.

7. **PRESS “ ▲”** or **“ ▼”**
   To scroll to the appropriate number. Press “Enter” to move cursor to the next position in the password.



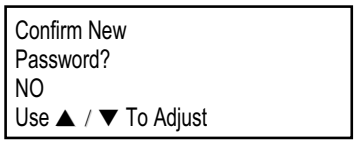
Password and Security Setup

8. **PRESS "ENTER"**
   After the desired password is selected. The display will now read "Password X Level".



9. **PRESS** "▲" or"▼"
   To adjust the security level.

10. **Press "ENTER"**
    Display will read "Confirm New Password".



11. *Press* "▲" or "▼"
    To select "YES" or "NO". Selecting "Yes" will save the new password and security setting. Selecting "NO" will abort all changes.

12. **Press "ENTER"** to save changes.

At this time, the selected password and security level has been set and saved. Follow steps 7 - 11 to set additional passwords and security levels, or press "Escape" repeatedly to return to the display screen. After 5 minutes of inactivity, the controller will automatically return to the "monitor" mode. Use Table 7 to record passwords for future reference.

Table 7: Password and Security Record

Location	Number	Security Level
Password 1		
Password 2		
Password 3		
Password 4		
Password 5		
Password 6		
Password 7		
Password 8		
Password 9		
Password 10		

Specifications

Table 6: TEC 3000 Specifications

Cabinet Dimensions:	
Length	9.125” / 232 mm
Width	3.5” / 89 mm
Height	8” / 20 mm
Weight	6.5 lbs / 2.95 kg
Display:	
Type	Liquid Crystal Display with Backlight
Size	4 x 20 Character
Resolution	8 x 5 Pixels Per Character
Keypad	8 Keys, Multi Function
Electrical Specifications (TEC 3000 Only):	
Input Voltage	30 VDC
Input Current (Max)	5A
Input Current (Continuous)	1A
Power Consumption (Max)	28 watts
Power Consumption (Continuous)	6 watts
Fill Valve Output Voltage	24 VDC
Purge Valve Output Voltage	24 VDC
Short Protections	Current Limiting, Automatic Reset
Electrical Specifications (Jerome WSL730M Only):	
Input Voltage	110 - 230
Input Frequency	50 - 60 Hz
Output Voltage	30 VDC
Max Current Capability	3A
Input Current:	.73A @ 110V
	.35A @ 230 V
Power Requirements (Power Supply +TEC 3000):	
Input Current (Max)	.3 A @ 110 VAC
Input Current (Continuous)	<.1A @ 110 VAC
Input Power (Max)	30 watts
Input Power (Continuous)	8 watts
Physical Connections (TEC 3000):	
Temperature Probes	2 pin twist lock (two)
Input Power / Output Power / Sensors	15 pin AMP

Specifications

Table 6: TEC 3000 Specifications Continued

Required Temperature Sensor Specifications:	
Type	Two Wire Platinum RTD
Quantity	Two
Resistance	1000Ω @ 0°C
Sensitivity	3.85Ω / °C
Temperature Measurements:	
Resolution	.2°F / .1°C
Accuracy	+/- 1.8°F/1°C (Single Point Calibration)*
	+/- 3.6°F/2°C (Dual Point Calibration)**
Range	-328°F to 158°F/-200°C to +70°C
Level Measurement System:	
Type	Differential Pressure Sensor
Accuracy	+/-.5” / 13mm LN2
Resolution	.1” / 2.5mm
Range	3” / 76mm to 48” / 1219 mm

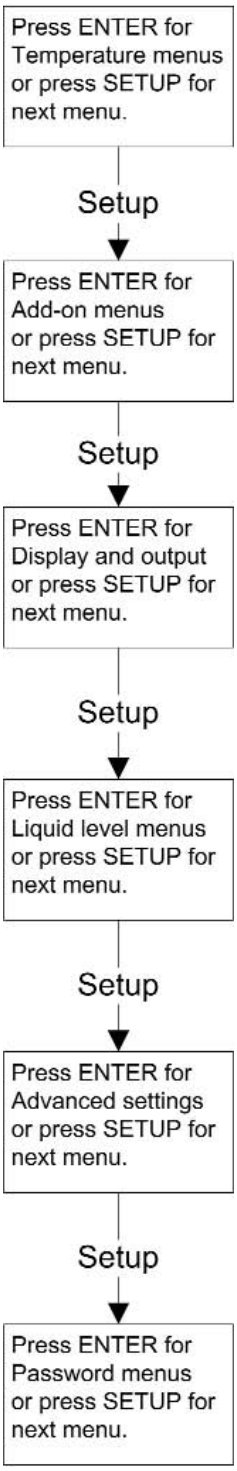
* Accuracy determined over range of -200°C to -135°C. Accuracy decreases slightly as range increases.

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

Setup Menu Maps

This section maps the menu trees of the TEC 3000 and defines the menu screen menus

Display and Setup Menus



Press ENTER here to adjust temperature alarm settings, calibrate temperature probes, initiate high temperature alarm tests, and input the saturation temperature of liquid nitrogen.

Press ENTER here to set up Hot Gas Bypass, lid switch settings, and to check battery status. (all of these features are optional).

Press ENTER here to specify units of measure (temperature and level), specify language, and adjust printer settings.

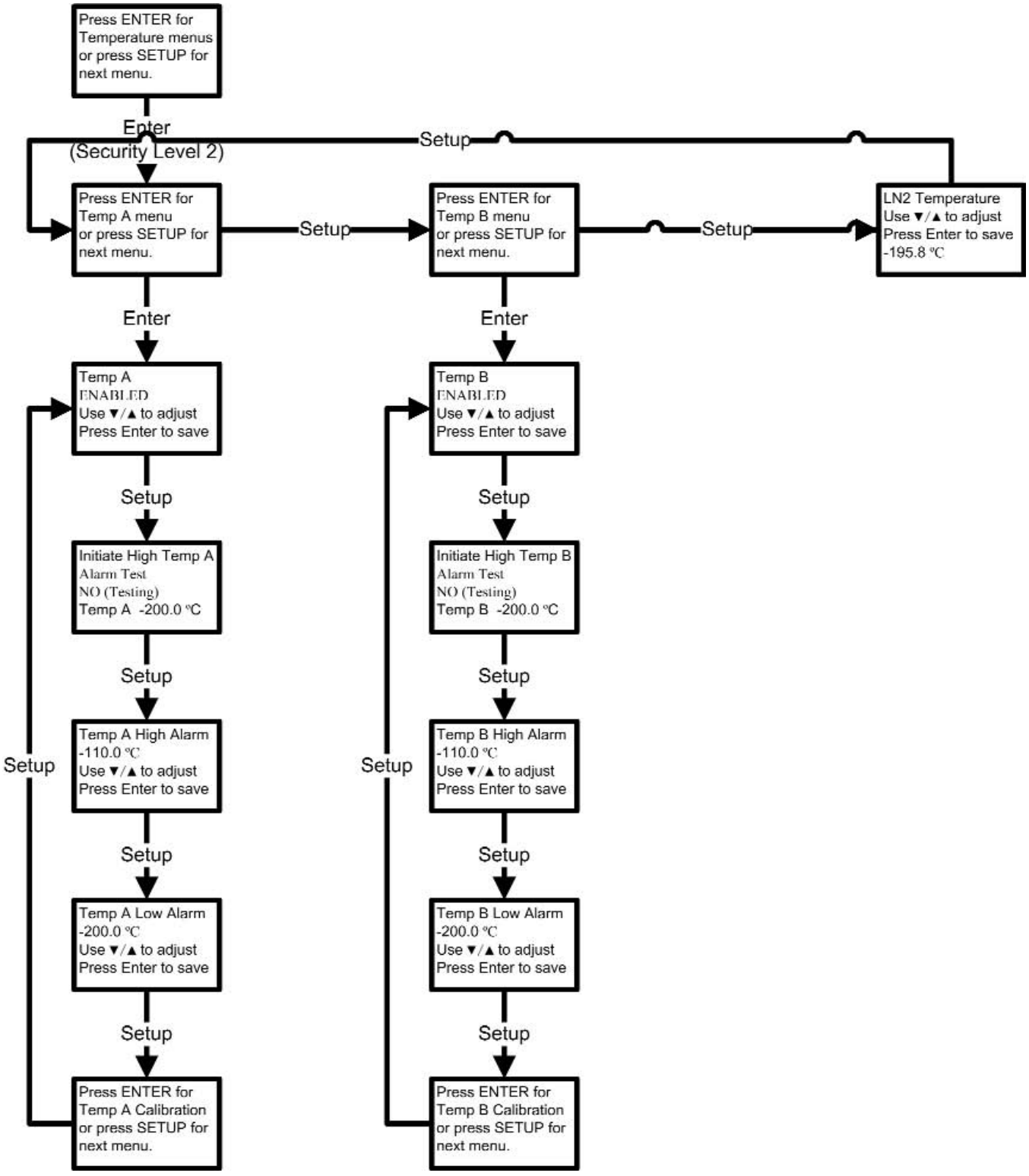
Press ENTER here to adjust high and low level alarms, high and low level fill fittings, and calibrate the level sensor.

Press ENTER here to set time and date, adjust communications settings, set up OFAF, timed and sequential filling, and update firmware.

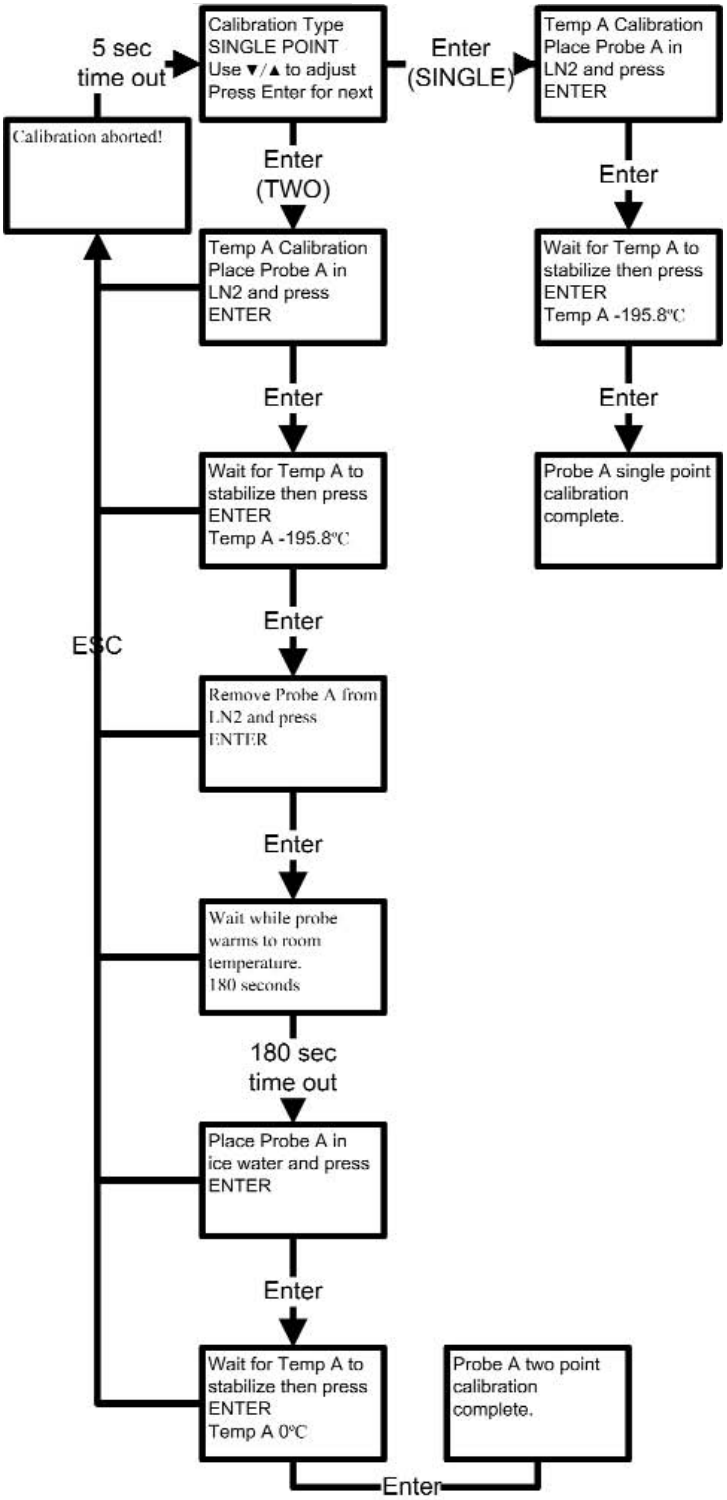
Press ENTER here to set up and maintain passwords and security settings.

Setup Menu Maps

Temperature Setup Menus

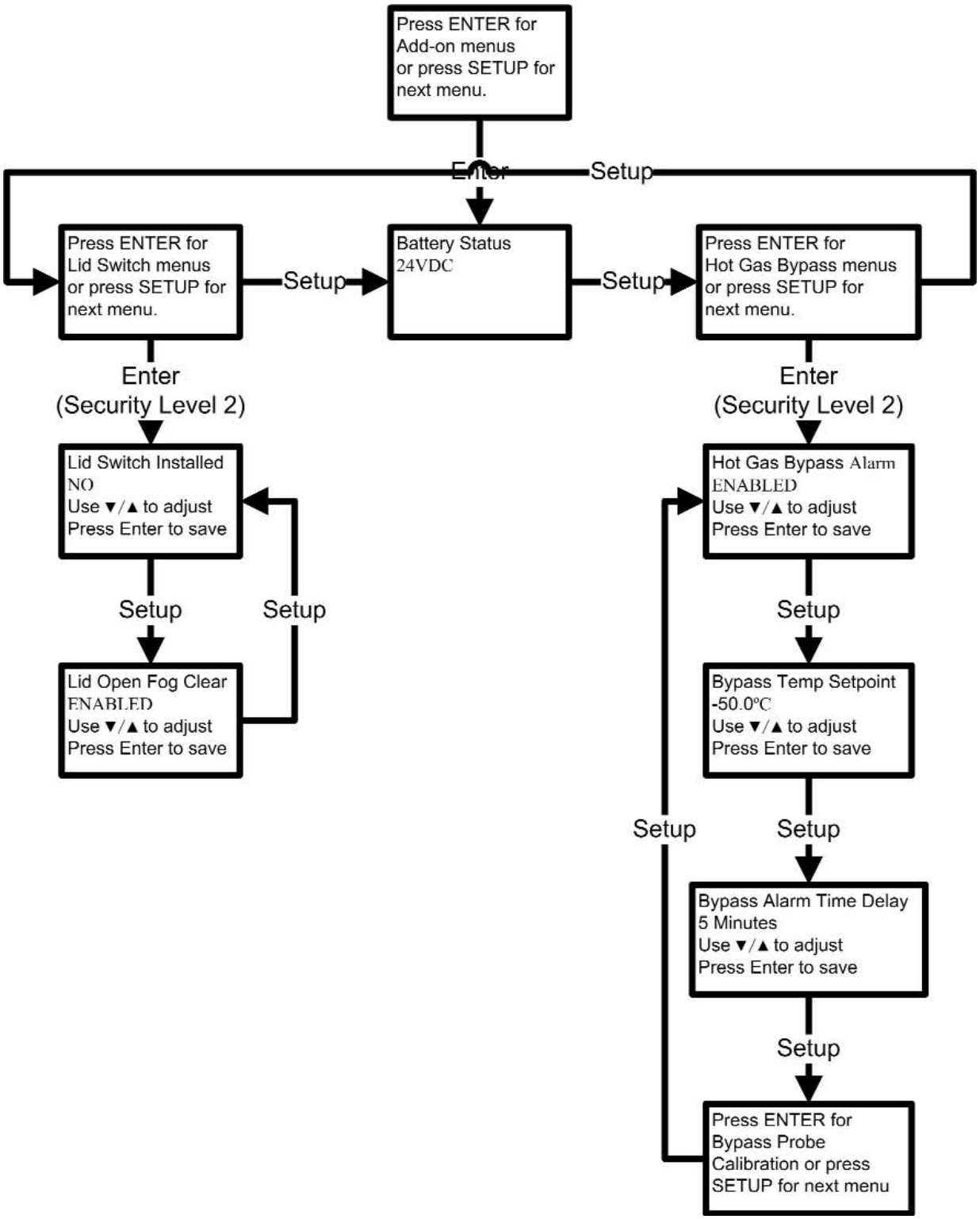


Temperature Calibration Menus



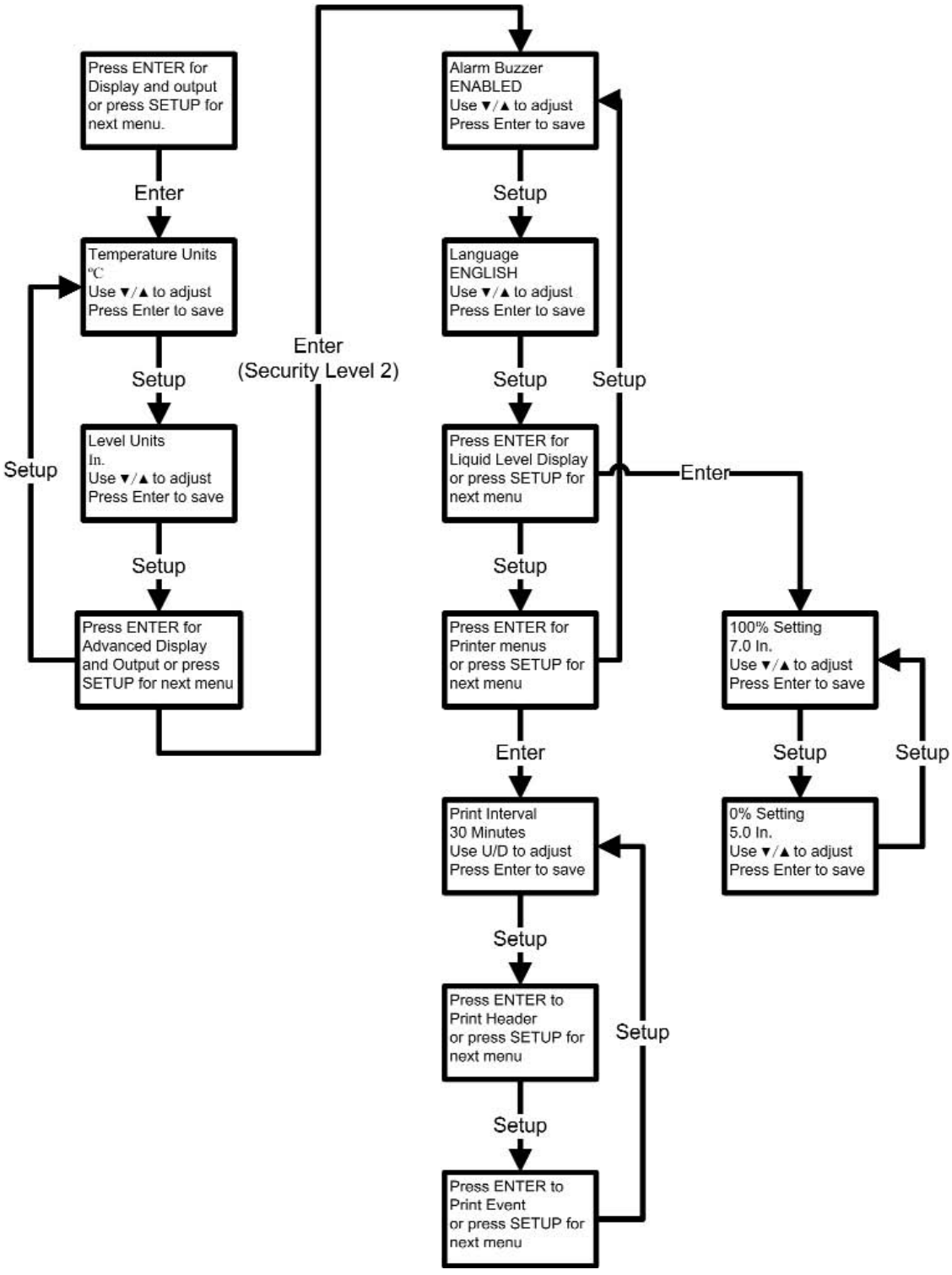
Setup Menu Maps

Add On Menus



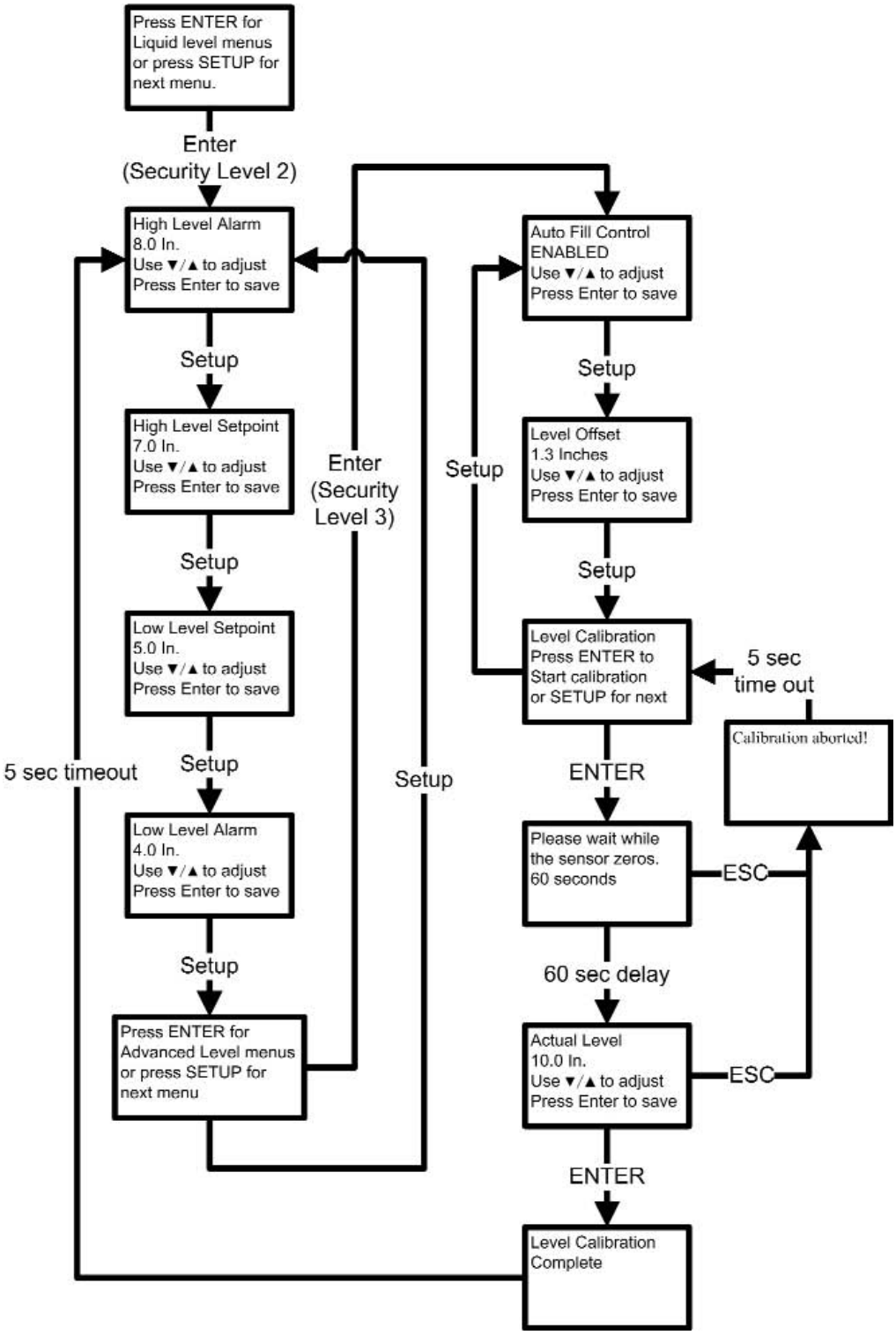
Setup Menu Maps

Display and Output Menus

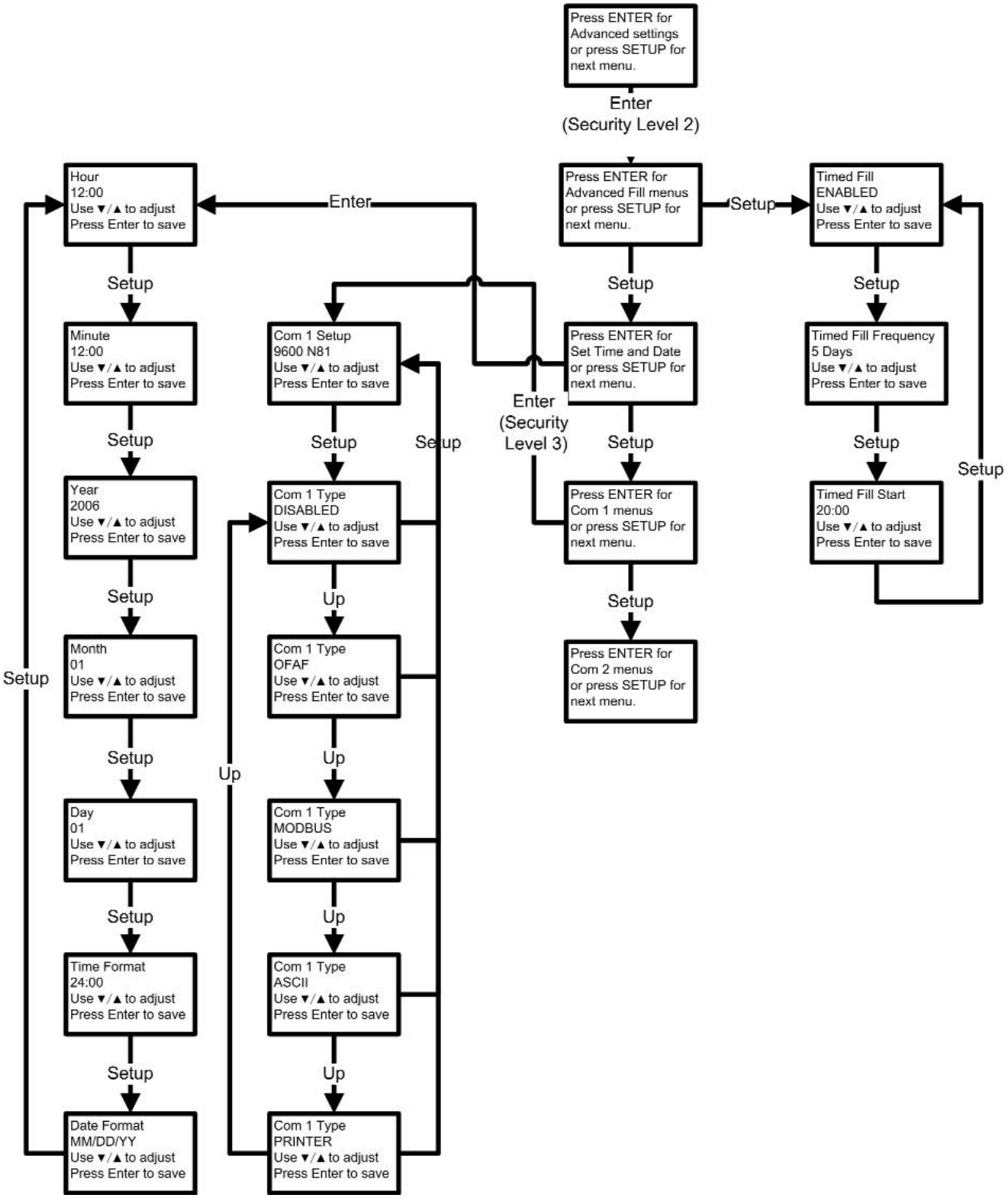


Setup Menu Maps

Liquid Level Menus

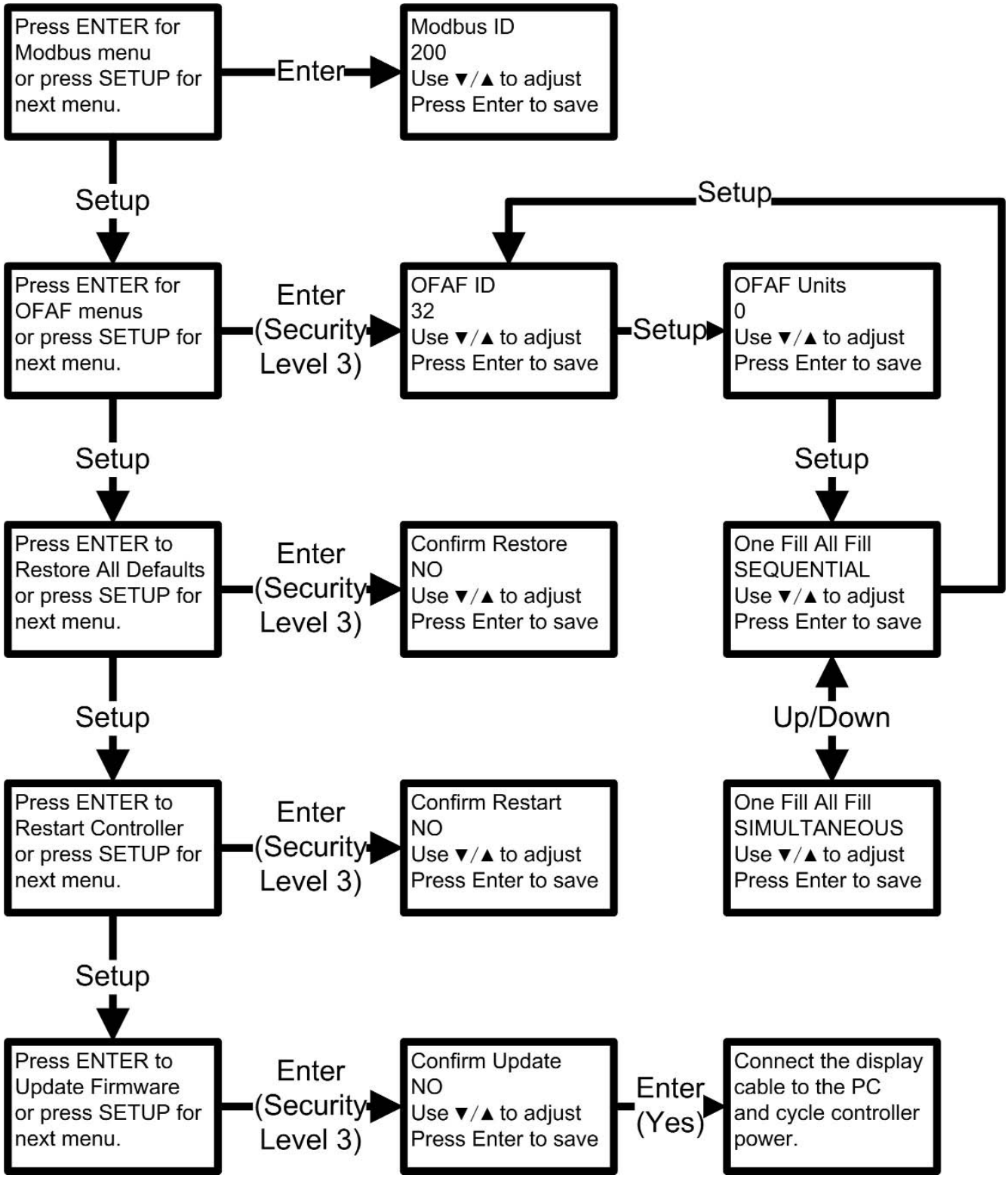


Advanced Setting Menu



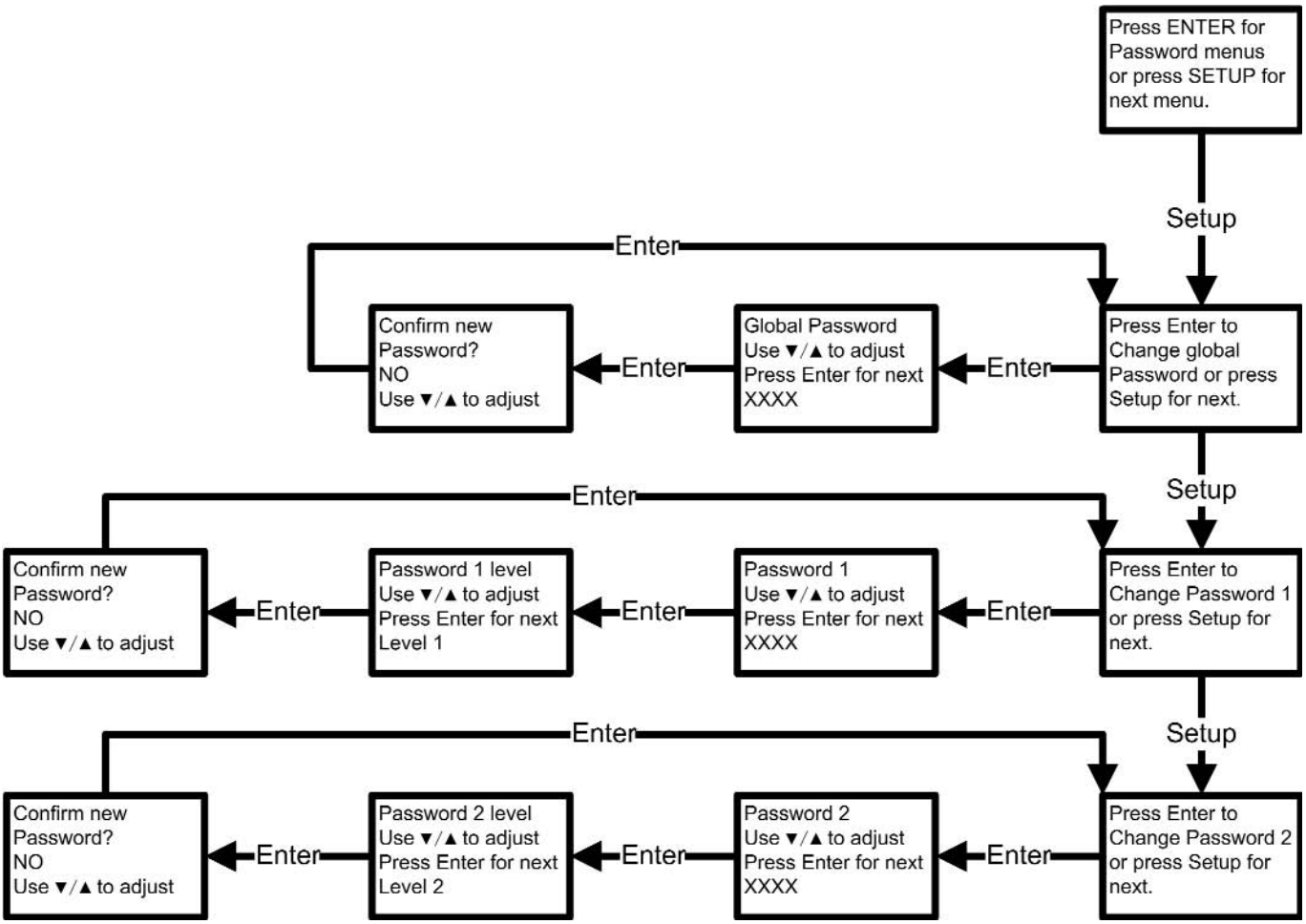
Setup Menu Maps

Advanced Settings Menu



Setup Menu Maps

Password and Security Menus



Applications and Safety Precautions

General

Liquid Nitrogen (LN2) is used in the operation of the CHART / MVE Freezer. Although not explosive, there are a number of safety considerations to keep in mind in the handling of LN2.

Properties

Nitrogen is a colorless, odorless, tasteless gas. Gaseous Nitrogen makes up about 78% of the earth's atmosphere. Once collected and isolated, Nitrogen will liquefy when cooled properly. The properties of LN2 are as follows:

PROPERTY	VALUE
Boiling Point @ 1 ATM	-195.9°C
Thermal Conductivity (gas)	24 mW/(m.K)
Latent Heat of Vaporization (liquid)	198.38 kJ/kg
Density (liquid)	808.607 kg/m^3

Table 8: Specifications of Nitrogen

Handling Cryogenic Containers

Cryogenic Supply containers (dewars) must be operated in accordance with the manufacturer instructions. Safety instructions will also be posted on the side of each dewar. Cryogenic dewars must be kept in a well-ventilated place where they are protected from the weather and away from any sources of heat.

Liquid Nitrogen Safety Precautions

Transferring LN2 and operating the storage Freezer controls should be done in accordance with the manufacturer / supplier instructions. During this transfer, it is important that all safety precautions written on the storage Freezer and recommended by the manufacturer be followed.

WARNING

- Nitrogen is a potential asphyxiate 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 not breathing, give artificial respiration. If breathing is difficult, supplemental Oxygen may be required. **SEEK MEDICAL ATTENTION IMMEDIATELY.**

WARNING CONTINUED:

- Liquid Nitrogen can cause severe frostbite to the eyes or skin. DO NOT touch frosted pipes or valves. In case of frostbite, consult a physician at once. If a physician is not readily available, warm the affected areas with water that is near body temperature.

- Never place LN2 in a sealed container without a pressure relief device. The expansion ratio of LN2 to N2 gas is approximately 700 to 1; ie, 1 liter of LN2 becomes 700 liters of N2 gas at 1 ATM 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 the Oxygen in a normal breathing atmosphere. Liquid products are of even greater threat since a small amount of liquid evaporates to create a large amount of gas. Therefore, it is imperative that cryogenic supply and storage freezers be stored and operated in open and well-ventilated areas. Persons transferring LN2 should make every effort to protect the eyes and skin from accidental contact with liquid or cold gas spilling from freezer. Protect the eyes with a full-face shield or chemical splash goggles. Safety glasses (even with side shields) are not adequate. Always wear cryogenic gloves or equivalent when handling anything that has been in contact with liquid (cold gas, cold pipes, or equipment). Long sleeve shirts and trousers without cuffs are recommended attire.

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. A typical summary of these instructions is provided as follows:

- If symptoms of asphyxia such as headache, drowsiness, dizziness, excitation, or excess salivation, vomiting, or unconsciousness are observed, individuals should move to fresh air. If breathing is difficult, administer oxygen. If breathing has stopped, administer artificial respiration. **CALL A PHYSICIAN AND EMERGENCY OFFICIALS IMMEDIATELY.**

- If exposure to cryogenic liquids or cold gases occurs, restore tissue to normal, body temperature (37°C) as rapidly as possible, and then protect the injured tissue from further damage and infection. **CALL A PHYSICIAN IMMEDIATELY**. 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. Keep warm and rest. Call a physician immediately.

Equipment Usage

The equipment with which this manual is included is a cryogenic freezer that uses LN2 as a refrigerant. It is intended to be used for the storage of biological samples that have been previously frozen in a controlled environment. It is not designed to be used for initial freezing of the biological samples.

for use with a refrigerant other than LN2. Usage for purposes other than those intended could present a hazard to the user. MVE cryogenic freezers that are not in use should be stored and/or transported in a dry environment.

All MVE models are a Class 1, externally powered, continuous operation medical device. They are not suitable for use with flammable anesthetics. This equipment has been tested and found to comply with the limits for medical devices to IEC 601-1-2: [or EN 60601-1-1-2:2001 or Medical Device Directive 93/42/EEC]. This testing shows the device provides reasonable protection against harmful interference in a typical medical installation. However, there is no guarantee that interference will not occur in a particular installation. The user should understand the following:

- 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.
- Portable and mobile RF communications equipment can affect Medical Electrical Equipment.
- Only Chart/MVE approved cables and accessories may be used on Chart/MVE equipment. For a list of approved equipment, consult Chart/MVE Technical Service through contact information provided in the Preface of this manual.
- The use of accessories, transducers and cables other than those specified may result in increased emissions or decreased immunity of the TEC 3000.
- The TEC 3000 should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the TEC 3000 should be observed to verify normal operation in the configuration in which it will be used.
- Units equipped with battery backup option will continue to operate when mains are disconnected.

If this equipment does cause harmful interference to other devices or is negatively impacted by other devices, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the devices.
- Increase the separation between the devices.
- Connect the equipment to an outlet on a different circuit
- Consult the manufacturer or field service technician for help

When the integrity of the external protective earth conductor arrangement is in doubt, the equipment must be relocated so external protective earth conductor arrangement is rectified. The equipment shall be operated from its internal battery only during this relocation

Applications and Safety Precautions

In applications that utilize a modular liquid cylinder as a source for LN2, the supply will need to be replenished at regular intervals to ensure proper operation of the freezer. When exchanging liquid cylinders, follow the procedure listed below to ensure proper safe performance.

1. All plumbing components should be allowed to warm to room temperature (20°C) before attempting to change supplies.
2. Close all valves associated with the liquid cylinder supply.
3. Relieve pressure in the plumbing supply by manually initiating a fill cycle (refer to operating instructions).
4. Loosen the plumbing connection for the transfer hose at the liquid cylinder.
5. Remove empty liquid cylinder and replace with full liquid cylinder.
6. Attach the transfer hose to the plumbing connection at the liquid cylinder - be sure that the hose is connected to the “LIQUID” connection and not the “GAS” or “VENT” connection. This connection will be labeled as such or colored blue.
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 fill cycle and observe proper operation.

Applications that utilize a stationary supply (bulk tank) require no special procedures when replenishing the LN2 supply. Refilling of stationary supply tanks may only be performed by a qualified industrial gas supplier. After the supply is replenished, the user should manually initiate a fill cycle on the freezer to observe proper operation.

Replacement Part and Accessories

Parts and Accessories

The table below lists parts and accessories that are approved replacements for MVE freezers. They may be obtained through MVE customer service - refer to contact information in the Preface Section of this manual.

WARNING: Use of any parts other than those listed will void the factory warranty and may cause improper or hazardous operation. Questions regarding compatible parts and accessories

Table 9: Replacement Parts and Accessories

Part Number	Description	Application
11795030	Replacement power supply	All Freezers
10718155	Replacement 12v Battery (2 required per freezer)	All Freezers
13223844	Stand alone Replacement TEC 3000 (no display)	All non-cabinet freezers (except European MDD)
13223836	Replacement Text Display	All freezers (except European MDD)
13223861	Replacement Symbolic Display	European MDD Freezers
10712925	Replacement Fill Valve	Contact Customer Service
11884614	Replacement Fill Valve	Contact Customer Service
10712933	Replacement Purge Valve	All Freezers
10713400	Replacement Hot Gas Bypass Sensor	All freezers equipped with Hot Gas Bypass Option
10713418	Replacement Temperature Probe 112cm	All MVE HE Series
10713354	Replacement Temperature Probe 244 cm	All MVE Series
11851467	Replacement Fuse For Battery Backup	All Freezers With Battery Backup Option
9713109	LN2 Transfer Hose	All Freezers
10883361	Measuring Stick	All Freezers
1810032	Replacement Relief Valve 3.4 Bar	All Freezers
10946596	Replacement Power Cable 110V	All Freezers
10995363	Replacement Power Cable 230V	All Freezers
10740053	Communications Cable	All Freezers
SEE NOTE	External Alarm Cable	All Freezers

NOTE: All external alarm cabling must be of adequate gauge for the external alarm system. This cabling must be shielded to ensure proper operation.

Preventative Maintenance

General

The following are maintenance and troubleshooting procedures for the MVE TEC 3000 System Monitor.

The following items of inspection should be part of your normal maintenance routine for your MVE Freezer.

- The LN2 transfer hose, which connects the freezer to the LN2 supply, should be inspected for broken outer casing, broken welds, or any indication of leakage. This service can be done by the user. Inspect hoses used on freezers connected to a permanent LN2 supply monthly. Inspection of hoses used on freezers supplied by a portable liquid cylinder is recommended each time the supply is replaced or refilled (monthly inspection as a minimum). If any breakage or leakage is found the hose should be replaced immediately.

- When exchanging liquid supply cylinders, tightening of the hose at the liquid cylinder causes rotation of the hose. This rotation can loosen the connection at the freezer. Whenever exchanging supplies, retighten the connection at the freezer. Avoid disconnecting the hose or exchanging supplies when the hose has frost or condensation on it. Moisture will condense inside the hose and be forced into the fill valve creating the potential for the valve to freeze open and cause an overfill condition. It is preferable to disconnect the hose only when it is dry and at room temperature. Preventative maintenance inspection of the LN2 supply plumbing should be conducted on an annual basis. This service should be performed by a technician qualified by the dealer/distributor through which the freezer was purchased.

Inspection of the LN2 supply plumbing should be performed as follows:

Remove the center rear cabinet panel on MVE Series Models and the plumbing shroud on units without cabinets equipped with the stand alone TEC 3000 control system

1. With the LN2 supply connected and the supply valve opened, use a soap solution to check for leaks (bubbles) on all pipe and tubing connections up to the fill solenoid valve and bypass solenoid valve if so equipped. Verify that the supply pressure is 1.5 to 2.4 bar.

2. If any leaks are detected, attempt to correct them by tightening the appropriate fitting.

NOTE: Compression connections to copper tubing should be tightened no more than an additional 1/4 turn. If tightening the fitting does not correct the leak, the fitting should be replaced.

NOTE: Before disassembling the plumbing assembly to make replacements shut off the LN2 supply valve, disconnect the LN2 supply hose to the freezer, and shut off the Main Power connection.

NOTE: The pipe fittings used in the plumbing assemblies on MVE freezers are National Pipe Thread standard an are not compatible with Metric Pipe Thread sizes. The tubing and associated compression connectors are standard inch OD size and are not compatible with metric tube sizes.

Preventative Maintenance

3. To leak test the plumbing connections down stream of the fill valve:

   A. Leave the LN2 supply connected and valve opened.

   B. Disable the gas bypass feature if so equipped, by disconnecting the associated connector from the controller.

   C. Soap all connections from the fill solenoid valve to the dewar.

   D. Initiate filling by pressing the fill start key on the display.

   E. Look for leakage at the soaped connections.

4. The level of the LN2 in the freezer should be checked with the provided level measurement meter stick and compared to the displayed level on a daily basis.

5. Calibrate temperature probes and perform a High Temperature alarm test every 6 months.

6. Periodically clean the exterior of the freezer. Cabinet freezers can be cleaned using a household type cleaner suitable for painted surfaces. Freezers with Stainless Steel finish should be cleaned using a cleaner designed for stainless steel.

7. Inspect the clear vinyl level sensor tubing every 6 to 12 months for cuts or cracking. Treat the tubing with a vinyl treatment (vinyl upholstery treatment) every 12 months.

8. Inspect the routing of the tubing to ensure that it does not come into contact or to close to the fill plumbing or any associated brackets which may become cold when the freezer is filling. Drastic changes in the temperature of the tubing will temporarily affect the level reading and could cause false level alarms. The tubing also becomes brittle when extremely cold and can break easily.

9. Periodically clean frost and ice from the lid or liner. When cleaning frost from a hinged lid, cover the dewar chamber with cardboard to prevent the ice from dropping into the freezer.

10. Remove any noticeable floating debris from the freezer.

11. MVE recommends that the freezer be taken out of service every three years for thorough cleaning and drying. If the freezer is operated in a high ambient humidity environment (60% RH or greater), this interval should be reduced to 2 years. The solenoid valve should be replaced at this time also.

12. Inspect all electrical connections for corrosion when the freezer is out of service and power is shut off. Clean if necessary. This service should be performed by a technician qualified by the dealer/distributor through which the freezer was purchased.

13. Cabinet style freezers should have the hinges inspected for cracking of metal components and obvious wear on a yearly basis.

14. Periodically inspect corks/lid liners and gaskets (where applicable) for wear or other damage.

15. When attempting to remove or reposition temperature probes in sensor tube assembly, do not pull leads if the probe seems to be stuck. Damage could occur to the leads or the probes. Remove the sensor assembly and allow it to thaw before moving probes.

Repackaging for Shipment

If it is necessary to return any part of the MVE System Monitor for repair or replacement, a Return Materials Authorization (RMA) number must be obtained from a Customer Service Representative before returning the instrument to our service department. When returning an instrument for service, the following information must be provided before MVE can attempt any repair.

- System model and serial number
- User's name, company, address, and phone number
- Malfunction symptoms
- Description of system
- Returned Materials Authorization (RMA) number

If possible, the original packaging material should be retained for shipment. If not available consult MVE for shipping and packing instructions.

Storage Conditions

If it is necessary to store MVE freezers, that are not in use, storage conditions must remain in the 0°C to 40°C temperature range, with humidity conditions in the 0% - 95% range. If it is necessary to transport any MVE freezer, the original packing material should be used. If not available, the freezer should be shipped on a suitable shipping skid or crate with dimensions that are at least 318mm wider than the base of the freezer. The freezer must be centered on this skid.

NOTE: MVE freezers may not be shipped while in service. Doing so will void all warranties and cause severe damage to the unit!

Replacing Backup Battery

Units that are equipped with the optional Battery Backup system may require battery replacement. The TEC 3000 continually charges the backup batteries when main power is connected to the unit. If the backup batteries are unable to sustain operation of the TEC 3000 for at least 24 hours from a full state of charge (battery voltage should be at least 24 VDC), the batteries need to be replaced. The battery replacement procedure is described below. See "Replacement Pats and Accessories" section for battery part numbers.

1. Disconnect main power
2. Disconnect battery backup from wire harness
3. Remove battery access cover
4. Remove fuse from fuse holder
5. Label and disconnect leads from batteries
6. Remove batteries by releasing catch on reusable tie straps
7. Install new batteries, securing with reusable tie straps
8. Re-install fuse in fuse holder
9. Re-install battery access cover
10. Re-connect main power
11. Re-connect battery backup to wire harness

TEC 3000 Display Installation Guide

Tools Needed

- Phillips head screw driver
- 3/8” ratchet
- 3” extension bar
- 9 mm socket or 11/32” socket
- 11/32” nut driver or 11/32” socket

Listed below are steps needed to safety remove and replace a TEC display.

1. Disconnect the Jerome power supply from TEC 3000. Locate the five pin din power supply receptacle on the bottom of the TEC 3000 (Fig 1). Gently pull on the receptacle housing until the five pin safely separates from the five pin din female power supply receptacle in the TEC 3000 enclosure.

2. Locate the TEC 3000 wiring harness on the bottom of the TEC 3000 enclosure. The harness is connected to the controller by a 12 pin connector. The 12 pin connector connection is secured by the incorporation of two locking arms on opposite sides of the connector. DO NOT hold and use the wiring harness to apply the pulling force needed to separate the wiring harness connector from the wiring harness receptacle in the TEC 3000 enclosure. Squeeze the locking arms and gently pull on the 12 pin connector until the connector separates from the wiring harness receptacle.

3. Locate the two TEC 3000 temperature probes on the bottom of the TEC 3000 enclosure. Remove the probes by turning the temperature probe locking mechanism counterclockwise until it cannot be turned any further. Gently pull the temperature probe until it separates from the Temperature probe housing in the controller enclosure.

4. Identify the clear nylon tube connected to the brass fitting on the bottom of the TEC 3000 enclosure. Grasp the tube tightly, as close to the brass fitting as possible. Pull on the tube until it separates from the brass fitting.

5. Locate any Cat 5 cables. These cables are used for data downloading and one fill all fill applications. If not used skip to next step. The Cat 5 cable is connected to the controller by a built in locking mechanism on the connector housing that plugs into a communications port in the TEC 3000 enclosure. Locate Cat 5 connector housing and squeeze the locking mechanism which will allow the connector to be removed from the communications port housing. Repeat this procedure if there are two Cat 5 cables connected to the TEC 3000.

6. Locate the mounting screws used to attach the TEC 3000 to the controller mounting bracket. WARNING: TEC 3000 can fall and cause injury during this process. Take proper precaution when removing mounting bracket screws. Once the TEC 3000 is no longer connected to the controller mounting bracket, the controller can fall and cause bodily injury. Use the Phillips head screw driver to remove the four Phillips head screws. Place screws in a safe location for reinstallation process.

7. Locate the six Phillips head screws on the side of the TEC 3000 controller used to secure the display mounting bracket to the TEC 3000 base bracket. Use a Phillips head screw driver to remove screws. Place screws in a safe location for reinstallation process.

8. Communications between the TEC 3000 display and the potted control board is achieved by a Cat 5 network cable. The Cat 5 network cable plugs into a communications port located on the display control board Locate the Cat 5 cable connector housing and squeeze he locking mechanism which will allow the connector to be removed from the communications port housing,. Apply enough pulling force to separate the Cat 5 cable from the display control board.

9. the TEC 3000 display is secured to the display mounting bracket by four hex head nuts and three lock washers. Use the 11/32” nut driver or a 3/8” ratchet with a 3” extension bar and a 9mm socket attached to it. Use the ratchet assembly or nut driver to remove the hex nuts by turning them in the counter clockwise direction. There is a metal ground strap secured to the display enclosure by one of the four hex nuts and two 7/16” washers. There is one washer between the display mounting bracket and the metal strap. The other washer is placed between the metal strap and the hex head nut. Place all hex nuts and washers in a safe location.

10. Gently remove the TEC 3000 display from the display mounting bracket. There are four mounted screws located in the corners of the TEC 3000 display. Gently pull on one of the corners of the display to remove the display from the mounting bracket.

11. The procedure for the installation of the display is the reverse of the removal procedure.

EN Compliance Tables

Table 201: Guidance and manufacturer's declaration – electromagnetic emissions for all TEC 3000s (see 6.8.3.201 a) 3)).

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 202: Guidance and manufacturer's declaration – electromagnetic immunity – for all TEC 3000s (see 6.8.3.201 a) 6)).

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 610000-4-4	±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
Electrical fast transient/burst IEC 610000-4-5	±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 61000-4-11	<5 % U_T (>95 % dip in U_T) For 0,5 cycle 40 % U_T (60 % dip in U_T) For 5 cycles 70 % U_T (30 % dip in U_T) For 25 cycles <5 % U_T (>95 % dip in U_T) For 5 sec.	<5 % U_T (>95 % dip in U_T) For 0,5 cycle 40 % U_T (60 % dip in U_T) For 5 cycles 70 % U_T (30 % dip in U_T) For 25 cycles <5 % U_T (>95 % dip in U_T) For 5 sec.	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: UT is the AC mains voltage prior to application of the test level			

EN Compliance Tables

Table 202: Guidance and manufacturer's declaration – electromagnetic immunity – for all TEC 3000s that are not life supporting (see 6.8.3.201 b)).

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	3V	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 $d = [3,5/V1]\sqrt{P}$
Radiated RF IEC 61000-4-3	3V/m 80 MHz to 2,5 GHz	3V/m	$d = [3,5/E1]\sqrt{P}$ 80 MHz to 800 MHz $d = [7/E1]\sqrt{P}$ 800 MHz to 2,5 GHz 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 the structures, objects and people.

[a] Field strengths from fixed transmitters such as 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, and 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 measure may be necessary, such as reorienting or relocating the TEC 3000.

[b] Over the frequency range 150kHz to 80 Mhz, field strengths should be less that [V1] V/m.

Table 206: Recommended separation distances between portable and mobile RF communications equipment and the TEC 3000 – for TEC 3000 systems that are not life supporting (see 6.8.3.201 b)

Recommended separation distances between portable and mobile FR communications equipment and the TEC 3000

The TEC 3000 is intended for use in an 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.

	Separation distance according to frequency of transmitter (m)		
Rated maximum output power of transmitter (W)	150 kHz to 80 MHz $d = [3,5/V1]\sqrt{P}$	80 MHz to 800 MHz $d = [3,5/E1]\sqrt{P}$	800 MHz to 2,5 GHz $d = [7/E1]\sqrt{P}$
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 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.