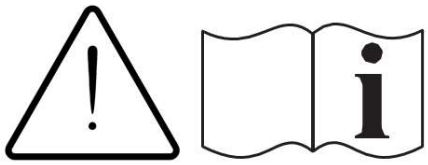
MVE Fusion Series

MVE FUSION Quick Reference Guide



Quick Reference Guide

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NOTE: MVE Fusion cryogen freezer should be installed by Chart Personal or an authorized MVE Distributor per the MVE Fusion Technical Manual, PN 20994124.

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Safety

READ BEFORE OPERATING THIS EQUIPMENT

Liquid nitrogen (LN2) is used in MVE Fusion 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 MVE Fusion should be done in accordance with the manufacturer / supplier instructions. It is important that all safety precautions recommended by the manufacturer be followed.

- **Nitrogen vapor is a potential asphyxiant as it displaces Oxygen (O_2) in confined spaces. Rapid suffocation can occur without warning in an Oxygen-deficient atmosphere (less than 19.5% O_2). Chart Cryogenic Freezers must be installed and operated in well-ventilated areas.**

- **DO NOT vent container in confined spaces.**
- **DO NOT enter confined spaces where excess nitrogen gas may be present.**

- **If exposure has occurred move to ventilated area or fresh air. If breathing is difficult, supplement oxygen may be required. If not breathing, give artificial respiration. SEEK IMMEDIATE MEDICAL ATTENTION.**

- **Contact with liquid nitrogen or uninsulated equipment containing nitrogen can result in cold contact burns or tissue damage. Nitrogen vapor can cause damage to skin or eyes.**

- **In case of frostbite, warm area with warm water not exceeding 105°F (40°C) and SEEK IMMEDIATE MEDICAL ATTENTION.**

- **Never place LN2 in a sealed container without a pressure relief device. The expansion ratio of liquid nitrogen to gaseous nitrogen is 1 to 700 (1 cubic foot of liquid nitrogen becomes 700 cubic feet of gaseous nitrogen 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:

- Cryogenic gloves (loose fitting)
- Full-face shield or chemical splash goggles
- Cryogenic apron

- Long sleeve shirt and cuffless pants
- Closed toe shoes (no sandals)

Equipment Usage

Cryogenic containers must be operated in accordance with the manufacturer/supplier instructions. 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.

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**.

This manual includes the following symbols.

Table 1: the symbols and their descriptions

Symbol	Title	Description
	**Caution**	Signifies a CAUTION of potentially hazardous situation when operating the device that may result in minor to moderate injury or property damage.
	**Warning**	Signifies a WARNING of a potentially hazardous situation when operating the device that may result in serious injury or property damage.
	**Warning; Low Temperature**	Indicates low temperature or freezing conditions. Take care to avoid exposure to skin, eyes, and clothing.
	**Warning; Asphyxiating Atmosphere**	Indicates the potential for an oxygen-depleted atmosphere due to nitrogen vapor. Take care to operate device in a well-ventilated area.
	**Warning; Electricity**	Indicates a potential electrical hazard. Take care to avoid contact with electricity.
	**Warning; Explosive**	Indicates a potential explosive hazard. The expansion ratio of liquid nitrogen to gas is 1:700 and can cause explosive conditions if placed into a sealed container.
	**Wear Protective Gloves**	Thermal gloves must be worn during indicated procedures.
	**Wear a Face Shield**	A face shield must be worn during indicated procedures.
	**ETL Listed Mark**	Chart Fusion Freezer is conformed to UL STD 61010-1 and certified to CSA STD C22.2#61010-1.

WARNING: Do not modify this equipment without authorization of the manufacturer.

Display / Control Panel

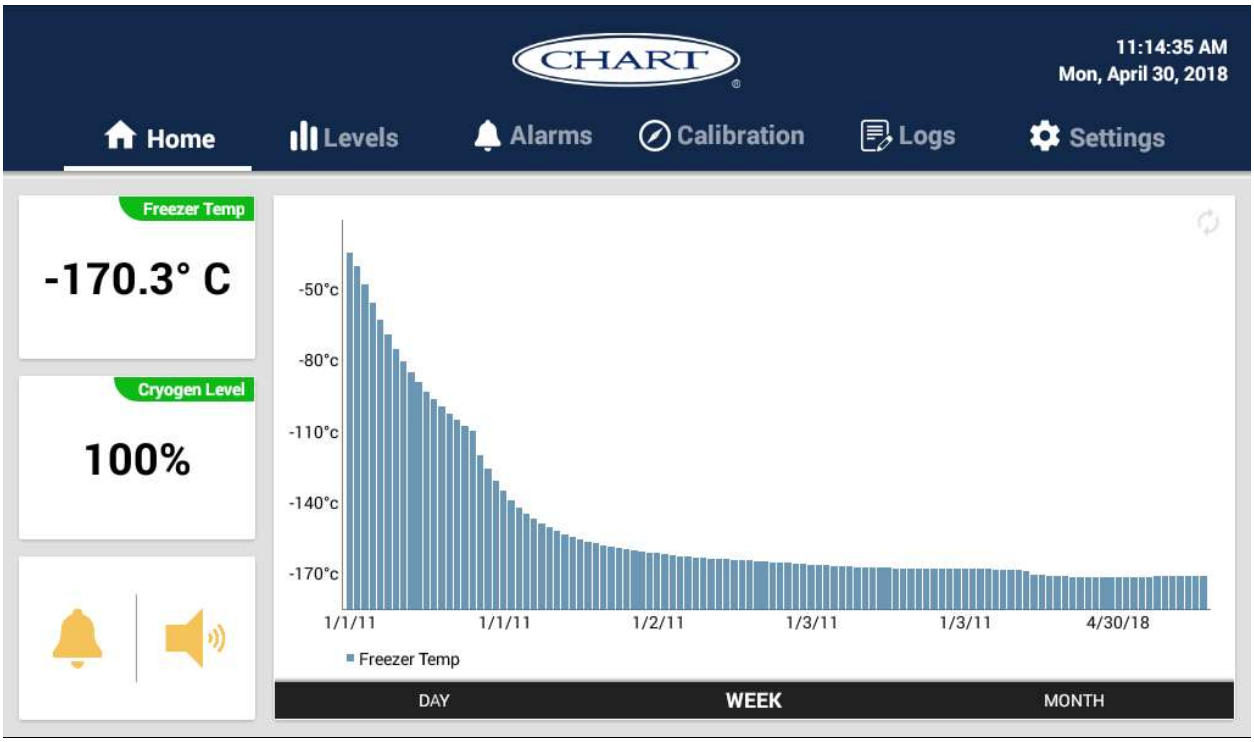
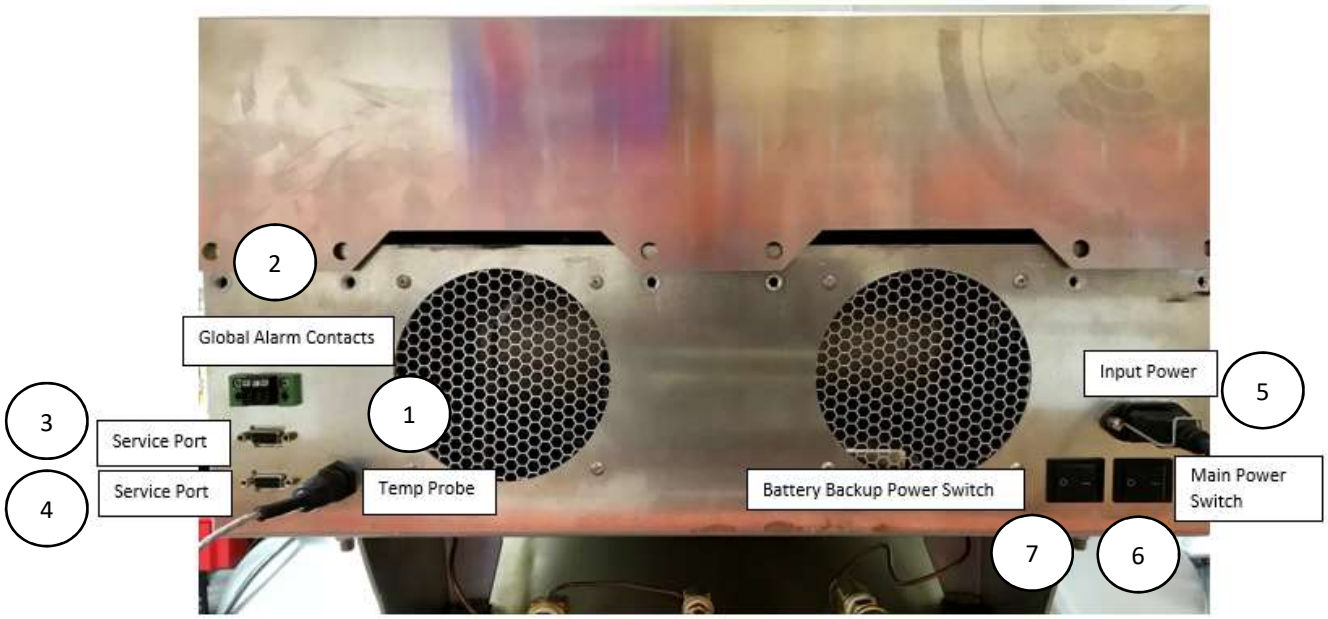


Table 1: Front Panel Identification

Front Panel	MVE FUSION Graphical User Interface (GUI) Displays Freezer Temperature and Cryogen (LN2) Level % on home screen.
Display	A Liquid Crystal Display (LCD) shows the value of all the current conditions including Freezer Temperature and LN2 level. The display also shows any current alarm conditions that may exist.
RTD Probe	Used to monitor the internal Fusion freezer temperature.
Alarm Visual and Audible Mutes	Used to silence the visual and audible alarms. Also used to reset the latching global alarm after the alarm condition is corrected.

Back Panel / Electrical / Physical Connections



1	RTD Temperature Probe Connection
2	Global Alarm Contacts (These connections monitor All Alarms)
3	Service Serial Port
4	Service Serial Port
5	Input Power
6	Main Power Switch
7	Battery Backup Power Switch

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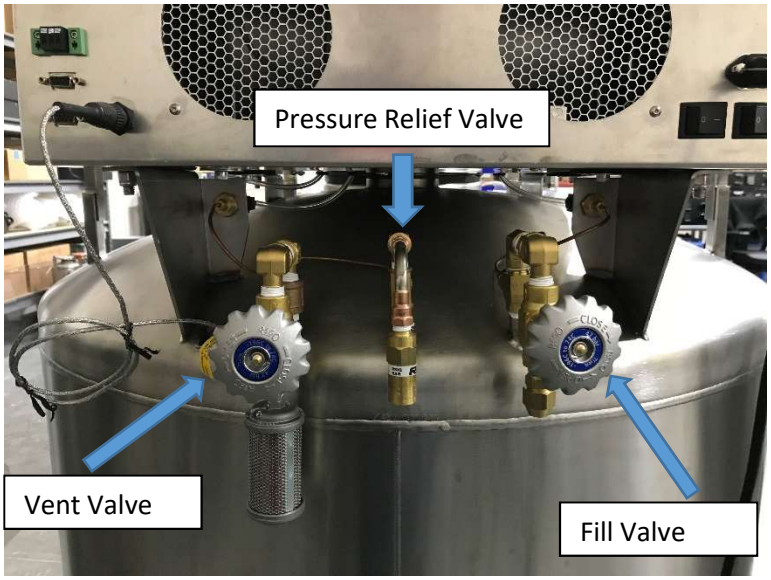
Fusion Dewar Plumbing Connections



Procedure for the First Fill

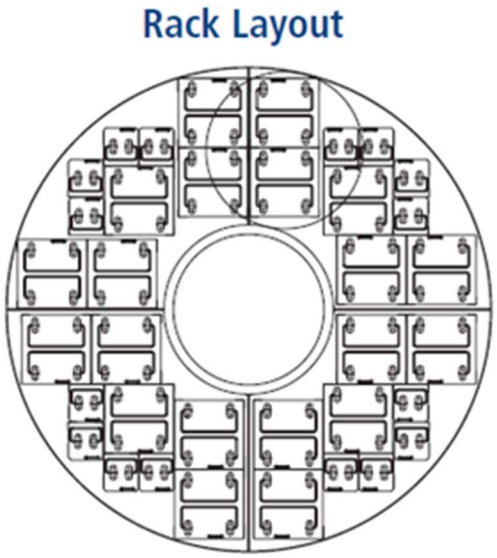
1. Do not power on the Fusion until all steps are followed.

2. Make sure to have two, 230-liter liquid nitrogen cylinders at 22-35PSI for the first fill.

3. Load racks and empty boxes or alternate inventory systems into the MVE Fusion.
   NOTE: VERY IMPORTANT TO ADD RACKS AND BOXES BEFORE FILLING.

⚠ **CAUTION: Venting may occur which will result in a loss of cryogen inside the pressure vessel if warm racks are installed after the Fusion's first fill and/or if more than 1, 2, or 3 warm racks are installed during its subsequent operation. Be prepared to have a 230-liter liquid nitrogen cylinder @ 22-35psi to refill pressure vessel if this occurs.**

See the rack Layout below for reference.



4. Connect one 230 cylinder full of cryogen (LN2) to the Fusions inlet valve using the supplied transfer hose with the cane oriented in the vertical position, so the pressure relief valve can vent downwards.

NOTE: One temperature probe will be factory installed in the backside of the Fusion Dewar. Another aftermarket temperature sensor can be installed in the secondary sensor tube.

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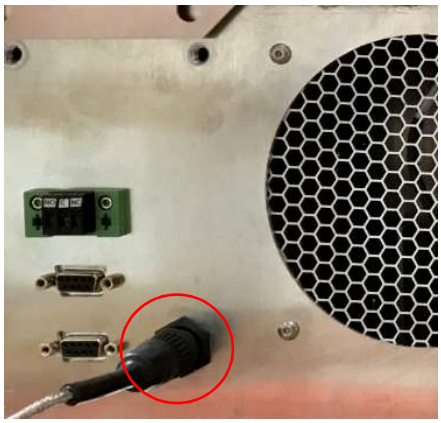
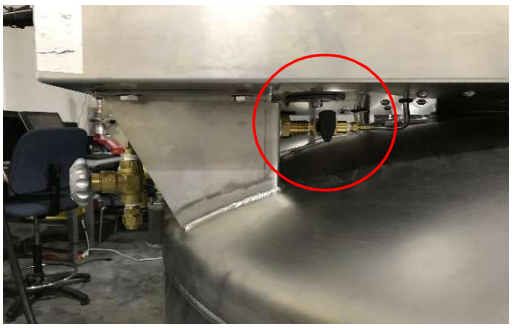
CAUTION: If an aftermarket temperature sensor is not installed in the secondary sensor tube, the tube should remain plugged with the factory installed plug.



5. Shut off the two isolation valves located underneath the shroud on both sides of the liquefier.

6. Open the supply tank liquid valve.



7. Open the fill valve on the back of the Fusion.

8. Open the vent valve on the back of the Fusion. This will create a pressure differential sufficient to push the LN2 from the supply tank into the freezer. The vent valve will remain open until the Fusion freezer is filled with LN2.

9. As the Fusion freezer and its contents are at room temperature for the first fill/charge, fill the internal sample storage area with 20-30 liters of LN2 through the neck of the tank using the second LN2 supply tank with another transfer hose having a phase separator **(Not supplied)**.

10. Connect A/C electrical power to MVE Fusion power receptacle at the rear.

11. After filling the sample storage area with 20-30 liters of LN2 through the neck, install the lid assuring that the lid lock thru hole located in the lid aligns with the lid lock tab located on the Dewar neck.

12. Once LN2 begins to flow steadily out of the vent valve muffler, first shut off the Fusions vent valve, then shut off its fill valve. Lastly, shut off the fill valve on the LN2 supply tank.

13. Open both Isolation valves.

    NOTE: The inner pressure should fill in about 35 to 45 minutes (using a supply source of 22-35PSIG)

14. The freezer's pressure relief valve will begin releasing gaseous nitrogen as the liquid boils off and the pressure builds (above 50 PSIG) inside of the storage tank. As the internal chamber and storage racks come down to temperature the "relief" events will decrease.

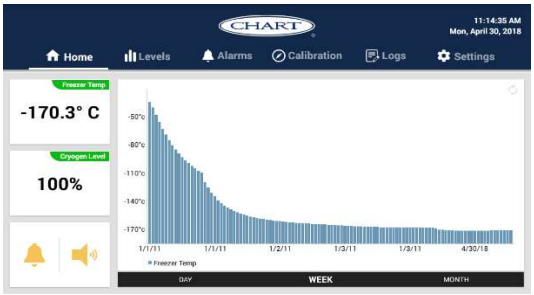
15. Once all the steps above have been completed the MVE Fusion can be powered on by flipping the main power switch to the on position followed by flipping the BB Enable/Disable (backup battery) switch to the on position. The Fusion's main screen will automatically turn on. Below shows the default LCD startup order. No programming is required for the first fill. MVE Fusion Default Password**: Fusion01**

1*

2*

3*

4*



16. To turn off the MVE Fusion freezer simply flip the main power and the backup battery switches located on the back of the Fusion to the off position.

Calibration of Temperature Probe

The factory installed RTD temperature probe used on the MVE Fusion has been calibrated at the factory using a two-point, low temperature range calibration method. This calibration method provides a level of accuracy of +/- 1.8°F (+/- 1°C) when operating at altitudes between 1000ft to 1500ft (305m to 457m). Further calibration should not be required unless desired by the end user. Refer to the MVE Fusion Technical Manual for information on calibration methods and procedures.

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Alarms and Descriptions

Alarm Display	Description
TIP TEMP FAULT	Issue with thermocouple located on the cryocoolers cold tip.
SYSTEM SHUTDOWN	Fusion freezer has shutdown
REJECT TEMP FAULT	Issue with thermocouple located on the cryocoolers heat rejector.
MOTOR TEMP L FAULT	Issue with thermocouple located on the cryocoolers left motor.
MOTOR TEMP R FAULT	Issue with thermocouple located on the cryocoolers right motor.
TEMP A OPEN	Issue with the RTD connection.
MOTOR R OUT OF RANGE	Cryocoolers right motor temperature is out of the allowable range.
MOTOR L OUT OF RANGE	Cryocoolers left motor temperature is out of the allowable range.
TIP TEMP OUT OF RANGE	Cryocoolers cold tip temperature is out of the allowable range.
REJECT T OUT OF RANGE	Cryocoolers reject temperature is out of the allowable range.
TEMP A OUT OF RANGE	RTD temperature out of the allowable range.
TEMP A SHORT	Issue with RTD.
VIBRATION FAULT	Cryocoolers vibration level is out of the allowable range.
LID OPEN	The Fusion lid has been off for more than 5 minutes.
BATTERY LOW	Backup battery voltage is low.
LN2 OUT OF RANGE	Cryogen (LN2) level within the storage vessel is out of the allowable range.
GAS PRESS OUT OF RANGE	Gas Pressure within the storage vessel is out of the allowable range.
VFD HARDWARE FAULT	Issue with the Fusion electronics.
VFD OVER CURRENT	Issue with the Fusion electronics.
VFD OVER TEMPERATURE	Fusion electronics temperature is out of the allowable range.

If any alarms occur please contact your authorized MVE Distributor or Customer / Technical Service

Chart Customer / Technical Service:

Phone: (800) 482-2473 Fax: (888) 932-2473

NOTES:

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