MVE Variō TS Controller (Touch Screen)

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The Americas

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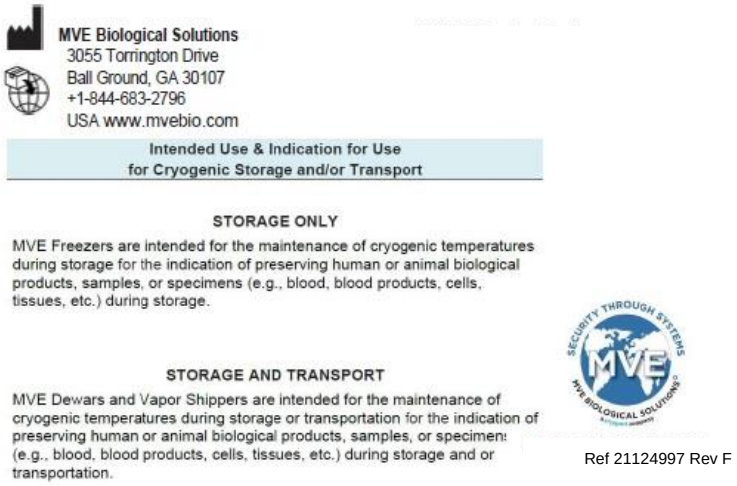
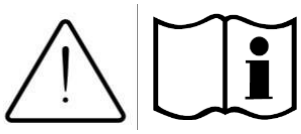


Ref 21124997 Rev F

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



NOTE: All MVE models are Class 1, externally powered, continuous operation medical devices. 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 60601-1:2005+A1(or EN 60601-1:2006+A1:2013 or Medical Device Directive 93/42/EEC]. EMC standard IEC 60601-1-2

1.0 TABLE OF CONTENTS

2.0 Safety

Symbols Used

The following symbols are used in this manual, on the device, and on device packaging:

Symbol	Title	Description
	**Operating Instructions**	The operating instructions should be considered for additional information when operating this device.
	**Serial Number**	Unique identifier for the device.
	**Model Number**	MVE Biological Solutions model number for the device.
	**Caution**	Signifies a CAUTION of a 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; Asphixiating 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.
	**Temperature Limit**	Indicates minimum and maximum temperature limits at which the freezer should be stored or transported.
	**Humidity Limit**	Indicates minimum and maximum humidity limits at which the freezer should be stored or transported.
	**UL Listed Mark**	MVE Biological Solutions Cryogenic Freezers conform to relevant UL safety standards.
	**CE Mark**	MVE Biological Solutions Cryogenic Freezers are assessed to meet safety, health, and environmental protection requirements for Europe.
	**Manufacturer**	Indicates manufacturer name and address.

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

Liquid Nitrogen Safety

Liquid nitrogen (LN2) is used in MVE Cryogenic Freezers as a refrigerant. Understanding and following certain safety precautions is extremely important when handling LN2 and these freezers.
Nitrogen is a colorless, odorless, tasteless gas. Gaseous nitrogen makes up about 78.1% of the Earth's atmosphere by volume. LN2 becomes vapor at temperatures greater than -320.8°F (-196°C). In Liquid state, nitrogen has a temperature range from -320.4°F to -346°F (-195°C to -210°C).

- Nitrogen vapor is 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). MVE Biological Solutions Cryogenic Freezers must be installed an 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 moved 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 expanions ratio of liquid nitrogen is 1 to 700 (1 cubic foot of liquid nitrogen becomes 700 cubic feet of gaseous nitrogen when evaporated)

Recommended Protective clothing

- Cryogenic gloves (loose fitting)
- Full-face shield or chemical splash goggles
- Long Sleeve Shirt and Cuffless pants
- Close toe shoes (no sandals)

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 and will specify the symptoms and treatment of over-exposure to liquid or gaseous nitrogen. A typical summary is shown below:

- If symptoms of asphyxia such as headache, drowsiness, dizziness, excitation, excess salivation, vomiting, or unconsciousness are observed, remove to fresh air. If breathing is difficult, supplemental oxygen maybe required. If breathing has stopped, CALL A PHYSICIAN IMMEDIATELY.

- If exposure to cryogenic liquids or cold vapor occurs, restore tissue to normal body temperature (98.6°F, 37°C) as quickly as possible and protect the injured tissue from further damage. Rapid warming of the affected area(s) is best achieved by bathing in warm water. The temperature of the water used should not exceed 140°F, 40°C. Under no circumstances should the affected area be rubbed or otherwise agitated in any way, either before or after warming. If the eyes are affected, flush them thoroughly with warm water for a minimum of 15 minutes. In the event of a massive exposure, remove clothing while showering with warm water. The affected individual should not drink alcohol or smoke. CALL A PHYSICIAN IMMEDIATELY.

EQUIPMENTUSAGE

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

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

3.0 CERTIFICATIONS & LISTINGS

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

Authorized Representative:
Medical Product Services GmbH
Borngasse 20
3519 Braunfels, Germany

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

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

4.0 PRODUCT INFORMATION

4.1 MVE VARIŌ SERIES MODELS & SPECIFICATIONS

MVE Biological Solutions MVE offers a wide range of fully automated LN2 freezers that can accommodate a variety of inventory systems designed to meet all of your cryogenic storage needs. Each MVE Variō Series freezer is a hand-made, double-walled, vacuum insulated stainless steel Dewar designed to maintain an internal temperature anywhere from -20°C to -150°C with minimal energy costs and environmental impact. There are no contraindications for this device
The physical dimensions and storage capabilities for each model are as follows:

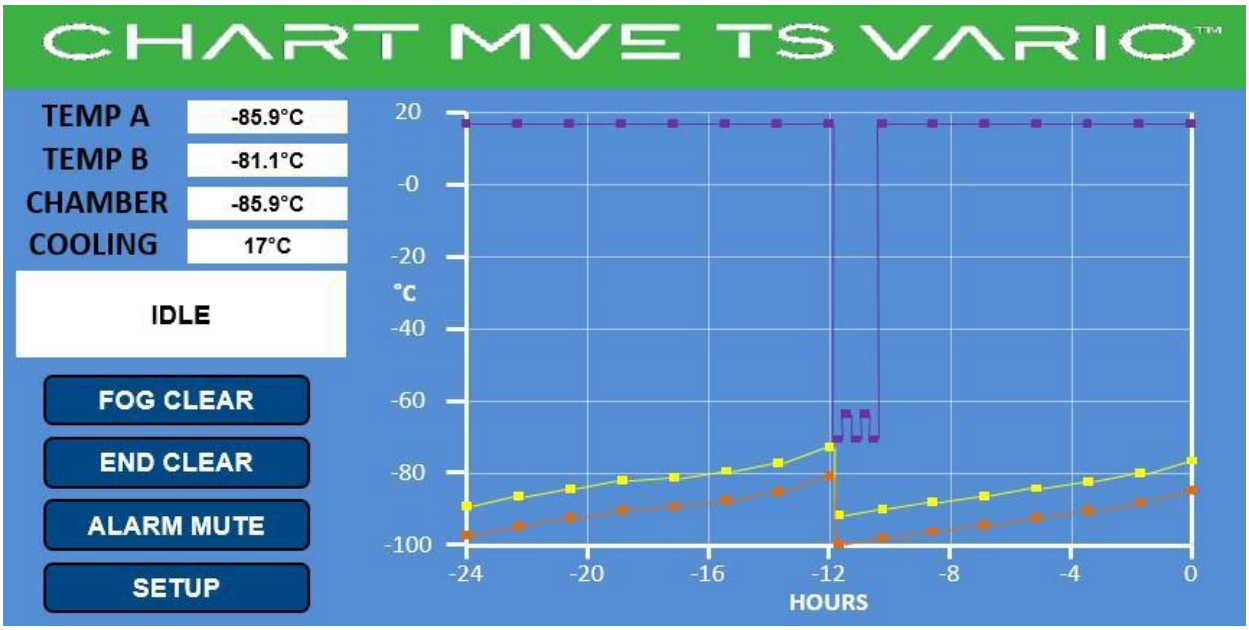
Physical Dimensions				
	MVE Varīō 1536P	**MVE Varīō 1539R**	**MVE Varīō 1879P**	**MVE Varīō 1881R**
Inner Diameter, in. (mm)	38.5 (978)	38.5 (978)	56.0 (1422)	54.8 (1391)
Lift-over Height, in. (mm)	37.1 (944)	37.1 (944)	40.2 (1021)	38.8 (985)
Max. Floor Loading Pressure, kPa (Caster base area)	15.50	15.50	25.22	29.67
ax. Point Pressure per Caster (kPa)	7760	7760	17465	18398
Minimum Ceiling Height, in. (mm)	83.2 (2115)	83.2 (2115)	90.3 (2294)	88.9 (2257)
Minimum Door Width, in. (mm)	42.0 (1067)	42.0 (1067)	60 (1524)	60 (1524)
Neck Opening, in. (mm)	17.5 (445)	17.5 (445)	25.0 (635)	25.0 (635)
Overall Height, in. (mm)	61.3 (1556)	63.3 (1607)	62.1 (1577)	61.3 (1556)
Usable Internal Height, in. (mm)	28.8 (732)	30.8 (782)	29.5 (749)	29.5 (749)
Weight Empty, lbs. (kg)	690 (313)	690 (313)	1606 (728)	1721 (781)

Maximum Storage Capacity

		MVE Varīō 1536P	MVE Varīō 1539R	MVE Varīō 1879P	MVE Varīō 1881R
1.2 & 2.0 ml Vials (Internally Threaded):					
Total Capacity		36400	39200	79950	81900
Number of 100 Cell Box Racks		24	24	54	60
Number of 25 Cell Box Racks		16	16	30	12
Number of Boxes Per Rack		13	14	13	13
Blood Bags:					
791 OS/U (25ml)	**Total Capacity**	3080	3064	5866	5628
	Bags / Frame	7	8	7	7
	No. of Frames	440	383	838	804
Compact *(25ml)*	**Total Capacity**	4338	4338	8622	9414
	Bags / Frame	9	9	9	9
	No. of Frames	482	482	958	1046
4R9951 *(50ml)*	**Total Capacity**	1488	1736	2952	2940
	Bags / Frame	6	7	6	6
	No. of Frames	248	248	492	490
DF200 *(200ml)*	**Total Capacity**	496	812	1584	1608
	Bags / Frame	4	4	4	4
	No. of Frames	124	203	396	402
4R9953 *(250ml)*	**Total Capacity**	812	608	1104	1240
	Bags / Frame	4	4	4	4
	No. of Frames	203	152	276	310
4R9955 *(500ml)*	**Total Capacity**	608	496	960	984
	Bags / Frame	4	4	4	4
	No. of Frames	152	124	240	246
DF700 *(700ml)*	**Total Capacity**	256	256	504	544
	Bags / Frame	4	4	4	4
	No. of Frames	64	64	126	136

4.2 VARIŌ TS CONTROLLER

4.2.1 Display Panel Identification



Front Panel Identification	
Display	7” touchscreen, backlight
Freezer Status	Displays “IDLE”, “BYPASSING”, or “COOLING” based on the current freezer status
FOF CLEAR Key	Used to manually clear the fog from the storage area to increase visibility
END CLEAR Key	Used to manually terminate the fog clearing process
ALARM MUTE Key	Used to silence the audible alarm. Will reset the latching alarm once it has been corrected
SETUP Key	Used to access Setup Menus and parameters
Trend Graph	Visual X,Y graph parameter adjustable days and cooling temperature

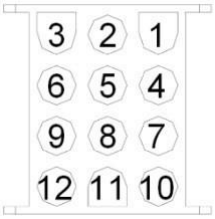
4.2.2 Connection Panel Identification

1	Temp A Port	Connection for Temp A probe
2	Temp B Port	Connection for Temp B probe
3	Serial Number Barcode	MVE Biological Solutions MVE TS serial number written below barcode
4	30 VDC Power Input	Main power supply connection
5	Serial Port	RJ-45 connection for Serial/COM
6	Ethernet Port	Ethernet connection for networking
7	Alarm Contacts	15 pin alarm output
8	Wire Harness Connection	12-pin wire harness connection to plumbing assembly, lid switch, and battery backup
9	Level Connection	Level signal input. Clear, vinyl tube connects to hose barb

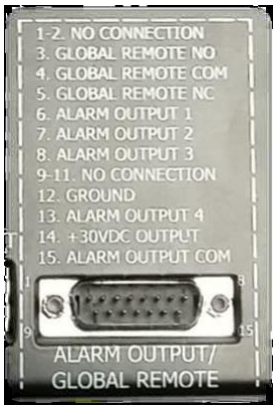
NOTE: The Vario TS Controller contains a Lithium Ion coin-cell battery. There is no recommendation to replace this battery. There are no user serviceable components internal to the controller.

4.2.3 Variō TS Specs, Outputs, & Connections

VARIO TS Dimensions (stand-alone)	
Length	9.2 in. (233 mm)
Width	3.6 in. (92 mm)
Height	8.0 in. (203 mm)
Weight	5.5 lbs. (2.5 kg)
Display	
Type	Color LCD touch panel
Size	7” diagonal
Resolution	800 x 480 pixels
Keypad	Resistive Touch Panel
Electrical – MVE Biological Solutions MVE TS Only	
Input Voltage	30 VDC
Input Current (max)	2 A
Input Current (continuous)	300 mA
Power Consumption (max)	60 W
Power Consumption (continuous)	9 W
Fill Valve Output Voltage	24 VDC
Short Protection	Current limiting, automatic reset
Electrical Jerome Power Supply (WSL530M)	
Input Voltage	100 – 240 VAC
Input Frequency	50 – 60 Hz
Output Voltage	30 VDC ± 5%
Max Current Capability	2 A
Input Current	1.27 A @ 110 VAC 0.61 A @ 230 VAC
VARIO TS Physical Connections	
Temperature Probes	2-pin mini-con-x, threaded coupling
Input Power	5-pin DIN
Output Power / Sensors / Battery Backup	12-pin Tyco MATE-N-Lock Receptacle with Pin contacts
Serial Port	RJ-45, 4-pin RS-485
Ethernet Port	RJ-45
Global/Discrete Alarm Output	15-pin D-sub
Temperature Sensor	
Type	2-wire Platinum RTD (Pt-1000)
Quantity	2
Resistance	1000 Ω @ 0°C
Sensitivity	3.85 Ω / °C
Temperature Measurement	
Resolution	0.1°C (0.2°F)
Accuracy – Single Point Calibration * – Double Point calibration **	± 1.0°C (1.8°F) ± 2.0°C (3.6°F)
Range	- 200°C to 70°C (- 328°C to 158°F)
Level Measurement	
Type	Differential Pressure Sensor
Accuracy	± 0.5 in. (13 mm) LN2
Resolution	0.1 in. (2.5 mm)
Range	3.0 in. to 48 in. (76 mm to 1219 mm)

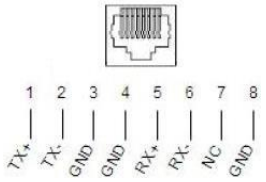


Main Wire Harness		
PIN	**Description**	**Function (I/O)**
1	Battery Backup 24VDC +	Input/Output
2	Battery Backup 24VDC -	Input/Output
3	Lid Switch 1	Input
4	Cooling Valves 24VDC +	Output
5	Cooling Valves 24VDC -	Output
6	Lid Switch 2	Input
7	Coil Outlet Temp Sensor +	Input
8	Coil Outlet Temp Sensor -	Input
9	Inlet Temp Sensor +	Input
10	Bypass 24VDC +	Output
11	Bypass 24VDC -	Output
12	Inlet Temp Sensor -	Input



DB15 Connection		
PIN	**Description**	**Function (I/O)**
1	Analog Temp +	Output
2	[1]Analog +	Output
3	Not Used	-
4	Not Used	-
5	Not Used	-
6	High/Low Temperature Alarms (NO)	Output
7	Lid Open Alarm (NO)	Output
8	Sensor Failure Alarm (NO)	Output
9	Analog Temp -	Output
10	[1]Analog -	Output
11	Not Used	-
12	Not Used	-
13	Stuck Valve Alarm (NO)	Output
14	+5VDC (Supplied)	-
15	Common	-
[1]Circuit is connected, but unassigned.		

Serial I/O Port		
PIN	**Description**	**Function (I/O)**
1	TXA (Transmit +)	Output
2	TXB (Transmit -)	Output
3	Ground	-
4	Ground	-
5	RXA (Receive +)	Input
6	RXB (Receive -)	Input
7	No Connection	-
8	Ground	-



Chamber Temp Sensors		
PIN	**Description**	**Function (I/O)**
1	Chamber Temp A +	Input
2	Chamber Temp A -	Input
1	Chamber Temp B +	Input
2	Chamber Temp B -	Input

Main Power Supply (30 VDC)		
PIN	**Description**	**Function (I/O)**
1	Ground	-
2	Chassis Ground	-
3	28VDC	Input
4	NC	-
5	NC	-

4.3 MVE VARIŌ OPERATING ENVIRONMENT

4.3.1. Ambient Temperature & Relative Humidity

MVE cryogenic freezers are designed to be operated in environments near room temperature (65°F – 80°F, 18°C – 27°C) and with a relative humidity below 50%. However, a small variance of a few degrees outside of this range will not have a significant impact on the performance of the freezer. The relative humidity should be maintained low enough to keep condensation build up to a minimum, as elevated humidity levels can lead to excessive condensation and frost on and around the lid. In situations where the relative humidity is high and uncontrollable, the lid should be routinely wiped dry to prevent the formation of ice. Should significant ice formation develop, refer to the Preventative Maintenance procedures included with this document for thawing instructions.

3.3.2 Thermal Load

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

5.0 INSTALLATION & STARTUP

This section will review the basic receiving, installation, and startup procedures for MVE Variō Series freezers. Always inspect the bill of lading for accuracy and external crate/packaging for damage before accepting the shipment.

Included with each MVE Variō Series unit:

- Literature Packet
- MVE Variō TS Quick Start Reference Guide – PN 21124996
- MVE Variō TS Controller (Packaged in a separate box) – PN 21079371
- 6' Transfer hose (Inside freezer) – PN 9713109
- Desiccant bag (Inside freezer. To be removed and discarded.)
- Liquid Nitrogen handling instructions
- MVE Checklist (Signed by shipping inspector)

Note: To avoid injury or damaging the equipment, do not apply power to the MVE Variō TS controller, connect a battery backup, or connect an LN2 supply to the freezer until setup is complete.

NOTE: Do not position the freezer in an orientation that makes it difficult to remove the power supply from the main power

Installation Procedure:

Following the careful uncrating and unpacking of the freezer, install using these basic instructions:

1. Ensure all of the plumbing assembly connections to the MVE Variō TS wire harness are secure.
2. Connect the 12-pin wire harness to the MVE Variō TS wire harness connection.

3. If the freezer is equipped with battery backup, the included battery fuse must be installed before connecting the battery to the main wire harness. Open the battery enclosure and unscrew the fuse harness. Install the fuse and close the fuse harness and the battery enclosure.

NOTE: Do not connect the battery backup to the main wire harness until setup is complete.

4. Connect Temp A & B temperature sensors to the corresponding twist-lock connection.

5. Plug in the power supply to an appropriate wall outlet with the proper AC voltage. Avoid wall outlets that are connected to emergency generator power if possible. Although an uninterruptible power supply (UPS) is ideal, a surge protector or power conditioner is recommended.
6. If applicable, connect the battery backup to the main wiring harness. While running on outlet power, the MVE Variō TS supplies a steady 27 VDC trickle charge to the battery backup. The battery backup may need to be charged for several hours before it is able to power the MVE Variō TS.

7. It is recommended that empty inventory system components such as racks, boxes, frames, or canisters be introduced prior to initiating the first cooling cycle. This will allow the racks, frames, etc. to cool with the freezer.
8. Remove the cap-plug from the fill tee on the plumbing assembly and connect the LN2 supply. If a modular LN2 cylinder is being utilized as the liquid supply, securely connect and tighten the transfer hose to both the fill tee connection and the supply connection labeled *LIQUID*. If a bulk

LN2 supply system is employed, securely connect and tighten the supply connection to the freezer fill tee connection.

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

9. Plug the power supply into the MVE Variō TS 30 VDC power input. The MVE Variō TS display should illuminate and begin the startup sequence.
   NOTE: Use only provided power supply with the unit.

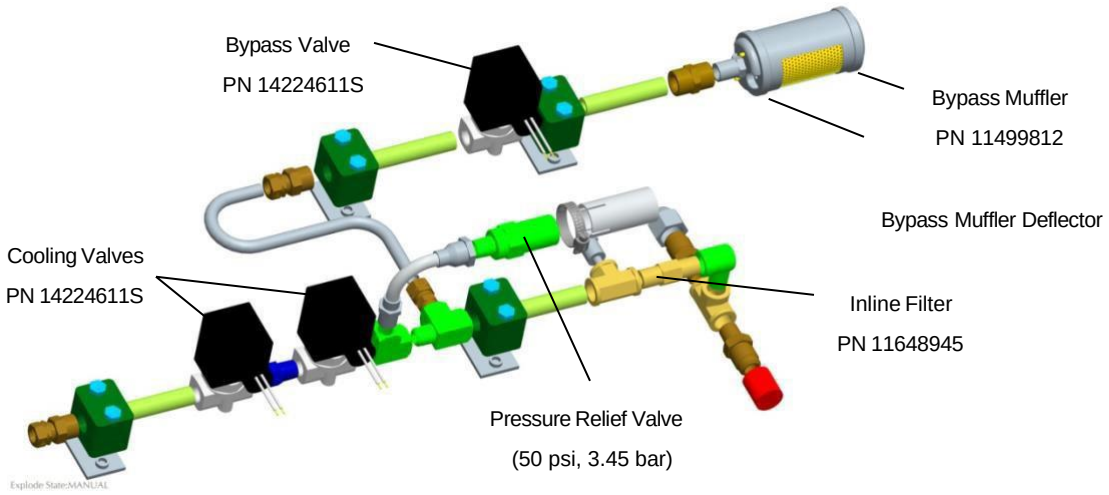
10. Following the startup sequence, the MVE Variō TS will start to alarm and initiate a cooling cycle. This is normal.
11. Press *ALARM MUTE* to silence the audible buzzer for 30 minutes. For installation and startup purposes, the alarm buzzer can be disabled; however, it is recommended that it be re-enabled when installation is complete.
12. Ensure that freezer lid is closed and open the LN2 supply valve.
13. The initial cool-down cycle will take significantly longer than subsequent cooling cycles, and excessive condensation / ice buildup on the lid and plumbing can be expected. However, it is important that the lid not be removed during this period.
14. When the freezer reaches the chamber temperature set point minus the chamber deadband, the Variō TS will terminate the cooling cycle. The frost and ice buildup will melt and evaporate soon thereafter, and normal operation will commence.

6.1 SYSTEM OPERATION

6.1 Introduction

MVE Variō™ Series freezers operate using an innovative, patent-pending refrigeration system utilizing liquid nitrogen (LN2) as the sole refrigerant. When a cooling cycle is initiated, LN2 flows from the supply source and through a heat exchanger located beneath the top head of the freezer, making use of the principle of *evaporative cooling* to maintain ultra-low to cryogenic storage temperatures.

This heat transfer system was developed by MVE to fully utilize the heat capacity of LN2 while simultaneously purging frost and moisture from the storage space. The MVE Variō TS controller monitors and meters the amount of LN2 flowing through the heat exchanger to maintain the completely dry storage space within ±5°C of the user-defined storage temperature, which can be set anywhere from -20°C to -150°C. The efficient offset neck design and double-walled, vacuum insulated, all-stainless steel construction provides a consistent temperature profile throughout the storage space – even with the lid open. While the lid is open, the MVE Variō™ automatically compensates by shortening the cooling cycle interval so that the storage space temperature does not increase above of the desired range. A schematic of the Variō TS plumbing is shown below, and may be used as reference for the sections that follow.


Bypass Valve
PN 14224611S
Bypass Muffler
PN 11499812
Bypass Muffler Deflector
Cooling Valves
PN 14224611S
Inline Filter
PN 11648945
Pressure Relief Valve
(50 psi, 3.45 bar)

6.2 The Hot Gas Bypass Cycle

The *Hot Gas Bypass Cycle*, or simply the *Bypass Cycle*, is the first process initiated when controller begins cooling the MVE Variō freezer, and is intended to purge, or bypass, all of the warm nitrogen gas sitting stagnate in the supply line to the freezer. The controller will open the bypass valve and allow the warm nitrogen gas to continue purging until the *inlet temperature sensor* reaches its user-defined setpoint, at which point the bypass valve will close, the cooling valves will open, and the *Cooling Cycle* will begin. The inlet temperature setpoint may be adjusted by the user in the Variō TS *Inlet Temp Menus*:

6.3 The Cooling Cycle

The *Cooling Cycle* is the process by which the MVE Variō system maintains an internal temperature within the range specified by the user. When the storage chamber warms above the *maximum chamber temperature*, the Variō TS will begin purging the warm nitrogen from the supply line and initiate a cooling cycle immediately thereafter. Note that this function is automatic and cannot be manually overridden by any process short of physically disconnecting the unit. As the cooling cycle continues, LN2 flows through the heat exchanger, sometimes referred to as the *cooling coil*, and evaporates into gaseous nitrogen. At that point, the nitrogen exits the cooling coil and passes by the *coil temperature sensor*, also called the *cooling sensor*, on its way into the freezer. The maximum chamber temperature may be adjusted by the user in the Variō TS *Cooling Menus*:

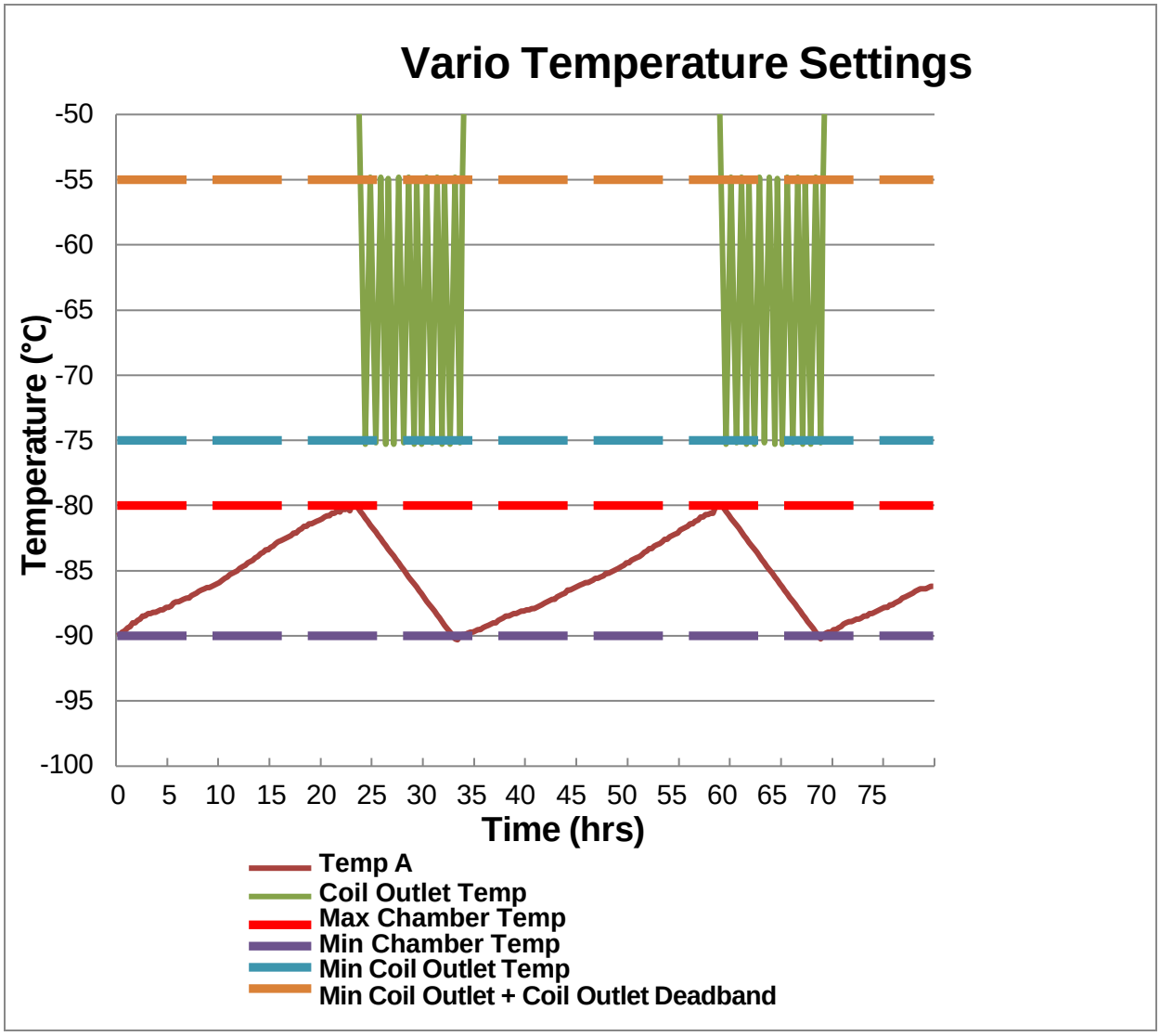
6.3.1 Coil Outlet Temperature

The *coil outlet temperature*, also called the *cooling temperature*, is the temperature of the gaseous nitrogen as it exits the heat exchanger and enters the freezer, and is measured by cooling sensor. What the cooling sensor does is ensure that the temperature of the nitrogen exiting the heat exchanger is not so cold that it causes the temperature of the storage area to fall below the user-defined range when it is purged through the chamber. If it is, the cooling valves will close and allow the nitrogen to warm to the temperature defined by the minimum coil outlet temperature plus the *coil outlet deadband*, at which point the cooling valves will open and the cooling cycle continue. Both the minimum coil outlet temperature and the coil outlet deadband may be set by the user in the Variō TS *Cooling Menus*:

6.4 Cooling Cycle Termination

The MVE Variō system will continue cooling the storage chamber until it reaches the minimum chamber temperature, which is defined by the maximum chamber temperature minus the *chamber temperature deadband*, at which point the cooling valves will close and the cooling cycle terminate. The chamber temperature deadband may be adjusted by the user in the Variō TS *Cooling Menus*:

The figure below shows the different temperature settings overlaid onto an example temperature graph of a Vario freezer.



Note: The above graph is for illustrative purposes. Actual performance will vary with atmospheric conditions and usage.

6.5 Varīō TS Recommended Temperature Settings

	Chamber Temperature -80°C to -90°C	Chamber Temperature -140°C to -150°C
Max Chamber Temp	-80°C	-140°C
ChamberDeadband	10°C	10°C
Min Coil Outlet Temp	-75°C	-135°C
Coil Outlet Deadband	20°C	20°C

High Temperature Setpoint	Max Chamber Temp
Low Temperature Setpoint	Max Chamber Temp - Chamber Deadband
Min Coil Outlet Temp	Max Chamber Temp + 5°C
Coil Outlet Deadband	20°C

6.6 Varīō TS Default Settings

Max Chamber Temp	-80°C
ChamberDeadband	10°C
Min Coil Outlet Temp	-75°C
Coil Outlet Deadband	20°C
Inlet Temp Setting (Gas Bypass)	-70°C
Gas Bypass / Supply Alarm Time Delay	5 minutes
Max Cooling Cycle Alarm Time Delay	120 minutes
High Temp Alarm	-75°C
Low Temp Alarm	-95°C
Temperature DisplayUnits	°C
Stuck Valve Open Alarm Delay	30 minutes
Stuck Valve Closed Alarm Delay	30 minutes
COM 1 Type	ASCII
Event Log Interval	240 minutes
Global Password	3 4 5 6

6.7 Varīō TS System Alarms

The MVE Varīō TS controller is equipped with a total of 15 system status alarms, all of which may be customized by the user to suit the needs of the application. The various alarm indication screens and the corresponding descriptions are shown below.

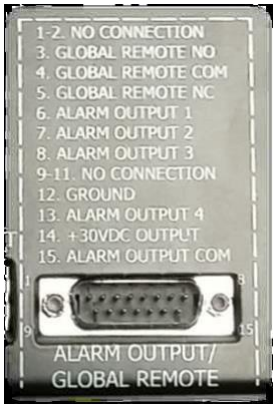
6.7.1 Alarm Definitions

Alarm Display	Description
ALARM High Temp A Started at: 01/01/2011 12:00 PM	The Temp A sensor is reading above the user defined high temperature alarm setting.
ALARM High Temp B Started at: 01/01/2011 12:00 PM	The Temp B sensor is reading above the user defined high temperature alarm setting.
ALARM Low Temp A Started at: 01/01/2011 12:00 PM	The Temp A sensor is reading below the user defined low temperature alarm setting.
ALARM Low Temp B Started at: 01/01/2011 12:00 PM	The Temp B sensor is reading below the user defined low temperature alarm setting.
ALARM Temp A Sensor Fail Started at: 01/01/2011 12:00 PM	The Varīō TS has lost communication with the Temp A sensor. The sensor has either been disconnected from the controller or has been damaged.
ALARM Temp B Sensor Fail Started at: 01/01/2011 12:00 PM	The Varīō TS has lost communication with the Temp B sensor. The sensor has either been disconnected from the controller or has been damaged.
ALARM Inlet Sensor Fail Started at: 01/01/2011 12:00 PM	The Varīō TS has lost communication with the inlet sensor. The sensor has either been disconnected from the controller or has been damaged.

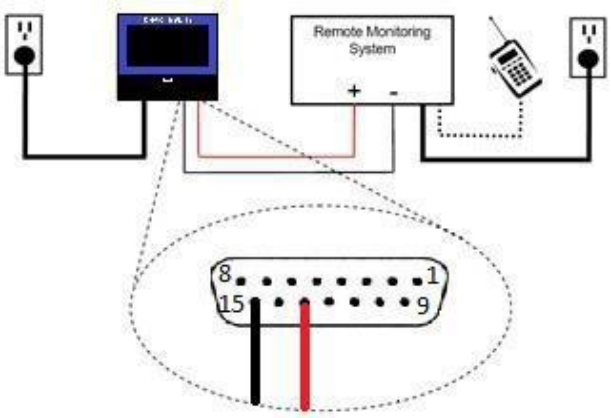
Alarm Display	Description
ALARM Cooling Sensor Fail Started at: 01/01/2011 12:00 PM	The Varīō TS has lost communication with the cooling sensor. The sensor has either been disconnected from the controller or has been damaged.
ALARM Supply Time *X* min Started at: 01/01/2011 12:00 PM	The Supply Time alarm is triggered when the temperature of the incoming nitrogen fails to reach the Inlet Temp Setpoint within the time specified by the Supply Alarm Delay. Once activated, the Varīō TS will terminate the Hot Gas Bypass cycle and begin supplying the freezer with N_2.
ALARM Valve Stuck Open Started at: 01/01/2011 12:00 PM	The Valve Stuck Open alarm is triggered when the Cooling Cycle has terminated and the Inlet Temp Sensor fails to warm above the Inlet Temp Setpoint within the time specified by the Stuck Open Delay time.
ALARM Valve Stuck Closed Started at: 01/01/2011 12:00 PM	The Valve Stuck Closed alarm is triggered when the Varīō TS has begun feeding N_2 to the freezer, and the Inlet Temp Sensor fails to cool to the Inlet Temp Setpoint in the time specified by the Stuck Closed Delay time. Note that although this alarm is similar to the Supply Time Alarm, it will remain active regardless of the *ENABLED/DISABLED* status of the Inlet Temp Sensor.
ALARM Lid Open *X* min Started at: 01/01/2011 12:00 PM	This alarm is triggered when the *Lid Switch Installed* setting is set to *YES* and the freezer lid remains open for the duration of the time specified by the Lid Open Alarm Delay. Note that by default, the *Lid Switch Installed* setting is set to *NO*.
ALARM Cooling Time *X* min Started at: 01/01/2011 12:00 PM	The Cooling Time Alarm is triggered when the Varīō TS has initiated a Cooling Cycle and the Chamber Temp fails to reach the Chamber Temp Setpoint in the amount of time specified by the Cooling Time Alarm Delay.
ALARM Power Failure Started at: 01/01/2011 12:00 PM	The Power Failure Alarm is triggered when the Varīō TS is equipped with battery backup and has been running on battery power for 30 minutes. With typical use, a battery backup equipped Varīō TS will retain functionality for 72 hours after the loss of its primary power source.
ALARM Low Battery Started at:	The Low Battery Alarm is triggered when the voltage of the battery backup powering the Varīō TS drops below 21VDC.
Communications Loss Unit 1 Started/Ended at: 01/1/11 12:00	The Communications Loss screen is displayed in the event that the Display Screen has been disconnected from the Varīō TS control board. This screen does not necessarily indicate a loss of system functionality, but it does impair the user's ability to monitor the

6.7.2 Remote Monitoring of System Alarms

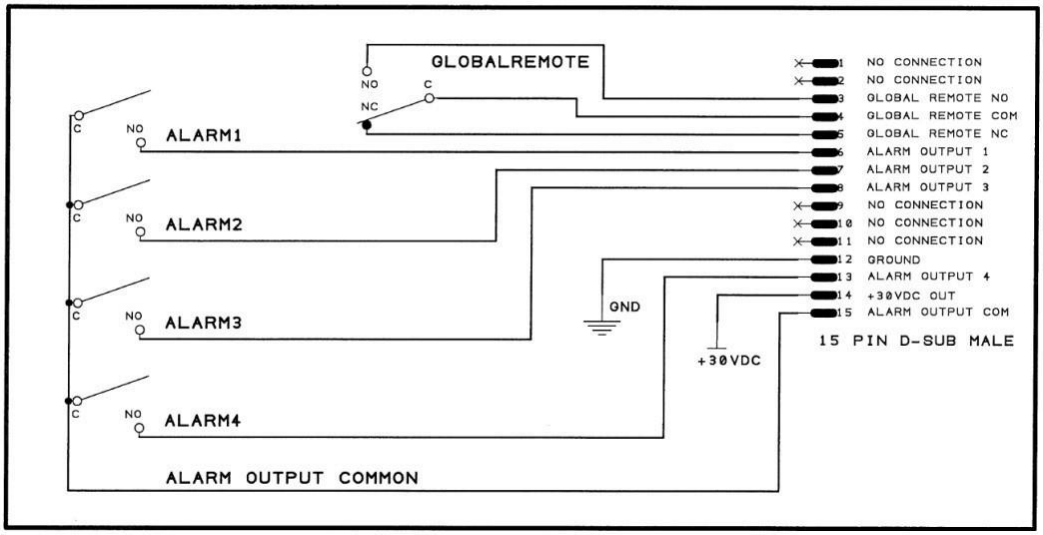
The Varīō TS is equipped with a DB15 connection port that provides, along with real-time temperature monitoring, 4 different normally closed alarm contacts for both high and low Temp A alarms, the Lid Open Alarm, Sensor Failure alarms for all four temperature sensors, and the Stuck Valve Alarms. As a catch-all, the Varīō TS also provides both a normally open and a normally closed latching alarm circuit monitoring the entire MVE Varīō system. Any alarm condition will cause these *Global Alarm* contacts to switch state.



Programmable Alarm Outputs	Global Remote
Normally Open or Normally Closed	Normally Open or Normally Closed
Dry Contact Relay	Dry Contact Relay
Latching	Latching
Non-Polarity Sensitive	Non-Polarity Sensitive
24 VDC max at 100 mA max per channel	24 VDC at 1 A max



NOTE: Shielded cables should be used and the shield should be grounded where it connects to remote monitoring equipment or
comm/networking equipment.



The Global Remote activates a signal when any alarm state is active, allowing the user to trigger an external device. It consists of three connections: Common (COM), Normally Open (NO), and Normally Closed (NC). The user may connect an external signal (0-24 VDC, < 100 mA) to the Common terminal. When there are no active alarms, the Common terminal is connected to the Normally Closed terminal. If any alarms are active, an internal relay switches to connect the Common terminal to the Normally Open terminal instead.

6.8 System Security

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

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

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

Security Access Levels			
LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**
Fog Clear ▪ End Clear ▪ Alarm Mute ▪ Change DisplayUnits	Level 1 + : ▪ Temp Settings ▪ Time & Date Settings ▪ Calibration Menus ▪ Language Selection ▪ Hot Gas Bypass Menus	Level 2 + : ▪ Communications Settings ▪ Programming	Level 3 + : ▪ Password Settings

NOTE: Forgot your password? Contact your authorized MVE Distributor or the MVE Biological Solutions-MVE Technical Service group.

6.9 BatteryBackup

The Battery Backup is an optional feature on all MVE Variō Series freezers. In the event that the primary power source is compromised, the Variō TS is able to maintain full functionality for approximately 48 hours while running on power from this external battery system. The MVE Variō Battery Backup is a fully automated, plug-and-play system with seamless power transfer.

Once the primary power source has been reconnected, the Variō TS will automatically provide a continuous 27V trickle-charge until the battery power has been fully restored. In the event battery voltage falls below 21V, a Low Battery Alarm will activate, and at 18V, the Variō TS will begin selectively disabling all non-critical systems to conserve power.

The Variō TS power status may be viewed at any time in the *Add-On Menus*. During typical, externally powered operation, the screen will read *On AC Power*. When running off of auxiliary power, the screen will show the current battery power in volts as well as the percent battery power remaining.

> **NOTE:** The amount of time that an MVE Variō System will operate on backup power will vary depending on the temperature status, the typical interval of cooling cycles, and the size of the system being used.

6.10 Lid Switch

Although the MVE Variō system will maintain temperature regardless of the open/closed status of the lid, the Variō TS controller has the built-in ability to support a lid switch monitoring circuit. This feature allows the user to take advantage of the automatic fog clear feature, and to activate the Lid Open Alarm if desired. Contact your MVE Authorized Distributor or the MVE Biological Solutions Biomedical Customer/Technical Services team for further information.

6.11 Communications & Networking

The Variō TS RS-485 serial interface offers several advanced communication capabilities. The MVE Biological Solutions MVE TS is equipped with one RJ-45 serial port for connection to another MVE controller, PC, serial printer, or other RS-485 device. Up to 100 MVE Biological Solutions MVE TS controllers can be successfully networked.

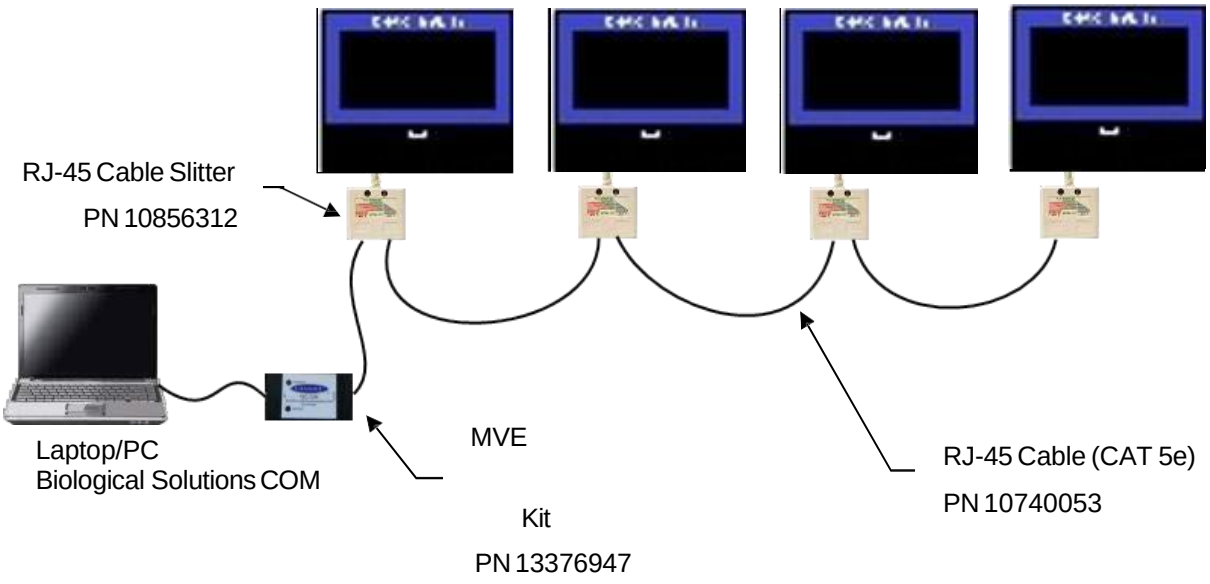
The Variō TS is equipped with an Ethernet port for connection to a local area network (LAN).

NOTE: The Variō TS should NEVER be connected directly to a LAN or public telecommunications network.

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

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

NOTE: Shielded cables should be used and the shield should be grounded where it connects to remote monitoring equipment or comm/networking equipment.

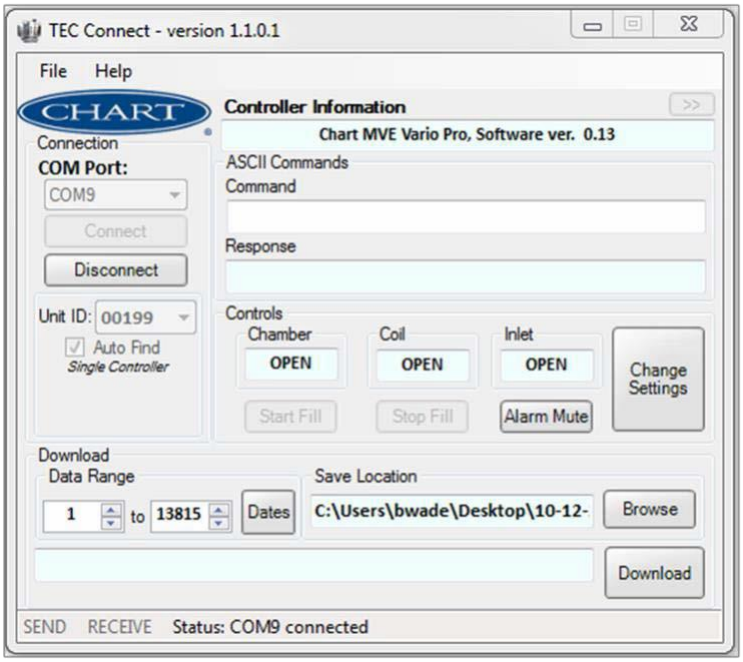


NOTE: Shielded cables should be used and the shield should be grounded where it connects to remote monitoring equipment or
comm/networking equipment.

6.11.1 TEC Connect

TEC Connect is a free, downloadable software program that enables the user to easily download the Variō TS event log and also monitor various controller parameters. Features include a user-friendly ASCII command window, real-time temperature monitoring, event log download button, and a quick parameter setup table. To download the TEC Connect software and the associated User's Manual, visit the MVE Biological Solutions Industries website.

For additional information, contact your authorized MVE Distributor or MVE Biological Solutions Technical Service.



Required Items

- Microsoft Windows (7, Vista, XP, 2000, 98)
- MVE TEC COM USB Kit (P/N 13376947)
- USB Port

Installing MVE TEC COM USB Kit

1. Insert the included USB to Serial Driver Disc into the PC CD-ROM (or download TEC COM kit drivers from www.MVE Biological Solutionsindustries.com)
2. Plug the MVE TEC COM USB Kit into an open USB port
3. Follow the automatic installation prompts

Downloading and Installing TEC Connect

1. Uninstall in any previous TEC Connect versions
2. The latest version is available online at the MVE Biological Solutions Industries website (contact MVE Biological Solutions Technical Service for details).
3. Click the link and open the compressed folder
4. Extract all files from the compressed folder to a location on your hard drive
5. Open the extracted SETUP file
6. Follow the prompts to complete installation
7. A TEC Connect icon should appear on your programs list when complete

6.11.2 Connecting to the Variō TS controller

Variō TS Settings

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

TEC Connect Settings

4. Connect Variō TS serial port to PC with MVE TEC COM USB Kit.
5. Open TEC Connect
6. The TEC Connect program Determine the Windows COM Port. This can be accomplished by navigating to the device manager and locating the COM port labeled “RS-485 Isolated Port”
7. Note the COM number listed beside “RS-485 Isolated Port” in the Device Manager window.
8. Close Device Manager and click “OK”
9. Select the appropriate Windows COM Port from the drop down menu
10. Connect to Variō TS

- For a single controller:

  Check the “Auto Find” box or enter the MODBUS ID of the controller and click “Connect”.

- For networked controllers:

  Uncheck the “Auto Find” box, enter the Unit ID of the desired controller, and click “Connect”. In order to connect to another controller on the network, click “Disconnect”, change the Unit ID, and then click “Connect”.

11. If the controller is successfully connected, the current temperature and level information from the controller will be displayed and “COMX connected” will be displayed under “Status”, where X is the COM port the TEC COM kit is connected to on the PC.

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

6.11.3 EVENT LOG

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

Downloading the event log via USB:

1. Insert a USB drive with sufficient space into the USB port on the front of the controller.
2. Press “Setup” form the main menu. The user may be prompted to enter a password to continue.
3. Navigate to the “Event Log” menu on the controller.
4. Press “Download to USB”. Saving the event log may take several minutes. Once the transfer is complete the USB can be removed. The first 6 digits of the filename will be the controller SN, followed by a two digit placeholder number.

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

NOTE: USB sticks being used with the MVE Biological Solutions MVE Touchscreen controllers need to be formatted as FAT32 filesystem to work correctly. The windows operating system can format USB sticks up to 32 GB in size, if you are trying to use a stick size larger than 32 GB then you may need to source software that will enable this.

Below is a sample event log and a list of event codes. The events are logged so that Record #1 is the most recent event logged. The event parameters are logged in the units and format of that respective category. For example, if the Varīō TS temperature units are set to be in degrees Celsius, then the temperature will be logged in degrees Celsius. If the time is set to a 24 hour clock, then the event log times will be in that format. Parameter changes will be logged as a string such as “Parameter number 126 changed from 60 to 180.” Contact your MVE Distributor or MVE Biological Solutions MVE Technical Service for information regarding these parameter changes.

Event	Unit ID	User	Date	Time	Temp A	Temp B	Level	Usage	Status
105	200	0	06/29/16	12:02 PM	-197.5°C	-197.5°C	3.8 in	1.1 in/day	BY
106	200	0	06/29/16	12:00 PM	-197.5°C	-197.5°C	5.5 in	1.1 in/day	
107	200	0	06/29/16	08:00 AM	-197.5°C	-197.5°C	5.7 in	1.3 in/day	
108	200	0	06/29/16	04:00 AM	-197.5°C	-197.6°C	6.0 in	1.3 in/day	
109	200	0	06/29/16	12:00 AM	-197.5°C	-197.5°C	6.2 in	1.3 in/day	
110	200	0	06/29/16	12:00 AM	-197.5°C	-197.5°C	6.1 in	1.3 in/day	ZO
111	200	0	06/29/16	12:00 AM	-197.5°C	-197.5°C	6.1 in	1.3 in/day	
112	200	0	06/28/16	08:00 PM	-197.5°C	-197.5°C	6.3 in	0.0 in/day	
113	200	0	06/28/16	04:00 PM	-197.5°C	-197.5°C	6.5 in	0.0 in/day	
114	200	0	06/28/16	12:41 PM	-197.5°C	-197.6°C	6.7 in	0.0 in/day	
115	200	0	06/28/16	12:36 PM	-197.5°C	-197.5°C	6.7 in	0.0 in/day	PF
116	200	0	06/28/16	10:11 AM	Parameter 40104 changed from 4 to 6				
117	200	0	04/28/16	10:11 AM	Parameter 40105 changed from 27 to 28				
118	200	0	04/27/16	10:11 AM	Parameter 40103 changed from 65 to 16				

6.11.4 Variō TS Event Codes

Code	Name	Description
CO	Cooling	Occurs when the current chamber temperature rises above the Max Chamber Temp setpoint and bypassing (if enabled) has been completed. “CO” is prevented from occurring if the Cooling Coil Temperature is below the Min Coil Outlet Temp setpoint or if Gas Bypass & Alarm is enabled and the Inlet Temperature is above the Inlet Temp Setpoint. “CO” is ended when the current Chamber Temperature drops below the Max Chamber Temp setpoint minus the Chamber Deadband setpoint or the Cooling Coil Temperature drops below the Min Coil Outlet Temp setpoint.
BY	Bypassing	Occurs when Gas Bypass & Alarm is enabled, the current Chamber Temperature is below the Max Chamber Temp setpoint and the current Inlet Temperature is above the Inlet Temp Setpoint. “BY” is prevented from occurring when Gas Bypass & Alarm is disabled, the current Inlet Temperature is below the Inlet Temp Setpoint or there is a Inlet Sensor Failure alarm. “BY” is ended when the current Inlet Temperature drops below the Inlet Temp Setpoint or the unit bypasses for the amount of time equal to the Supply Alarm Delay.
CF	Cooling Sensor Failure	Occurs when the Cooling Sensor returns an out of range value for the duration of the Cooling Sensor Alarm Time setpoint. “CF” ends when the sensor returns a valid value.
IF	Inlet Sensor Failure	Occurs when the Inlet Sensor returns an out of range value for the duration of the Inlet Sensor Alarm Time setpoint. “IF” ends when the sensor returns a valid value.
AF	Temp A Sensor Failure	Occurs when the Temp A Sensor returns an out of range value for the duration of the Temp A Sensor Alarm Time setpoint. “AF” ends when the sensor returns a valid value.
BF	Temp B Sensor Failure	Occurs when the Temp B Sensor returns an out of range value for the duration of the Temp B Sensor Alarm Time setpoint. “BF” ends when the sensor returns a valid value.
AL	Temp A Low Alarm	Occurs when the temperature read by probe A is enabled and less than the Temp A Low Alarm Setpoint for Temp A Low Alarm Time (Default 1 minute). “AL” is ended when the temperature rises above the Temp A Low Alarm Setpoint or probe A is disabled.
AH	Temp A High Alarm	Occurs when the temperature read by probe A is enabled and greater than the Temp A High Alarm Setpoint for Temp A High Alarm Time (Default 1 minute). “AH” is ended when the temperature falls below the Temp A High Alarm Setpoint or probe A is disabled.

BL	Temp B Low Alarm	Occurs when the temperature read by probe B is enabled and less than the Temp B Low Alarm Setpoint for Temp B Low Alarm Time (Default 1 minute). “BL” is ended when the temperature rises above the Temp B Low Alarm Setpoint or probe B is disabled.
Code	**Name**	**Description**
BH	Temp B High Alarm	Occurs when the temperature read by probe B is enabled and greater than the Temp B High Alarm Setpoint for Temp B High Alarm Time (Default 1 minute). “BH” is ended when the temperature falls below the Temp B High Alarm Setpoint or probe B is disabled.
CT	Cooling Time Alarm	Occurs when the unit has been cooling for the duration of the Cooling Alarm Time. The unit then switches to a cooling disabled state until the alarm is cleared.
SA	Supply Alarm	Occurs when the unit has been bypassing for the duration of the Supply Alarm Time (default is 5) and then it switches the unit from bypassing to cooling and ends the alarm immediately.
SO	Stuck Open Alarm	The Stuck Open Alarm occurs when the cooling and inlet valves should be closed, but the inlet temperatures have been below the inlet temperature setpoint for more than the stuck open alarm time.
SC	Stuck Closed Alarm	The Stuck Closed Alarm occurs when the cooling and inlet valves should be open, but the inlet temperature has been above the inlet temperature setpoint for more than the stuck closed alarm time.
LO	Lid Open	Occurs when the lid switch is installed and is open for longer than the Lid Open Alarm Time setpoint. Requires lid switch be installed.
PF	Power Failure Alarm	Occurs when the supplied power falls below 16 Volts or when the unit loses power entirely it is reported once at time of power down but printed and saved to the event log upon start up. “PF”, in the case of a complete loss of power, is prevented when Restart Controller or Update Firmware are selected in the menus before the power loss. “PF” is ended when the supplied power rises above 21 Volts.
BB	Running On Battery	Occurs when the unit is running on battery power. “BB” is ended when the unit is running on main power.
BV	Low Battery Alarm	Occurs when the unit is powered by the battery and the supplied power is below 21 Volts for the Low Battery Alarm Time (default 1 min). “BV” is ended when the supplied voltage is raised above 21 Volts.
AM	Alarm Muted	Occurs when the Alarm Mute button is pressed. “AM” is ended by pressing the Alarm Mute button again or after 30 minutes have passed.

6.11.5 Printer Setup

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

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

TEC 2000/3000/TS Printer Kit (PN 11544943)

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

Installation

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

7.0 SYSTEM SETUP & CUSTOMIZATION

7.1 TemperatureSettings

7.1.1 Temp Sensors A & B

The default setting for both Temp A and Temp B in *Enabled*, with Temp A functioning as the primary or *driving* sensor. Should Temp A be disabled or otherwise become inoperable for any reason, Temp B will assume the primary role. To adjust the Temp A/B settings, follow these instructions:

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”.
2. Press “Temperature Settings”
3. Press “Temperature A Settings”
4. To enable/disable the temperature A probe press “ENABLED” or “DISABLED” next to “Temperature Probe A”

   Pressing “ENABLED” will change the status to “DISABLED” and pressing “DISABLED” will change the status to “ENABLED”.
5. Press the value displayed next to “High Alarm Setpoint”

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the High Alarm Setpoint using the number pad that appears on screen and then press “Enter” to save the new value. Be sure to include “-“ when entering negative values.
6. To enable/disable the high temperature press “ENABLED” or “DISABLED” next to “High Alarm”

   Pressing “ENABLED” will change the status to “DISABLED” and pressing “DISABLED” will change the status to “ENABLED”.
7. Press the value displayed next to “Low Alarm Setpoint”

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the Low Alarm Setpoint using the number pad that appears on screen and then press “Enter” to save the new value. Be sure to include “-“ when entering negative values.
8. To enable/disable the low temperature alarm press “ENABLED” or “DISABLED” next to “Low Alarm”

   Pressing “ENABLED” will change the status to “DISABLED” and pressing “DISABLED” will change the status to “ENABLED”.
9. Press “Initiate High Temp. A Alarm Test”

   The display will read “Testing” while the temperature reading on the probe increases. Once the temperature probe passes the high alarm setpoint the display will read “Yes” to indicate the alarm has been triggered.

Note: If the temperature probe is open or no probe is connected the controller will not go into the high temperature alarm test mode.

7.1.2 Chamber Temperature / Coil Outlet Temperature & Deadband

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”.
2. Press “Temperature Settings”
3. Press “Cooling Temperature Settings”
4. The first value displayed is the current cooling temperature. This is the same as the coil outlet temperature.
5. To adjust the maximum (warmest) allowable chamber temperature press the value displayed next to “Max Chamber Temp”.

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the max chamber temperature using the number pad that appears on screen and then press “Enter” to save the new value. Be sure to include “-“ when entering negative values.

   Note: The Variō TS controller will not allow the user to select a maximum chamber temp greater than or equal to the high temperature alarm setpoint. As a result, it may be necessary to adjust the high temperature alarm prior to changing the maximum chamber temp.
6. To adjust the chamber temperature deadband press the value displayed next to “Chamber Deadband”. Note that the chamber deadband also defines the minimum (coldest) allowable chamber temperature.

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the chamber deadband using the number pad that appears on screen and then press “Enter” to save the new value. Be sure to include “-“ when entering negative values.

   Note: The Variō TS controller will not allow the user to select a maximum chamber temp / chamber deadband combination that results in a minimum chamber temp less than or equal to the low temperature setpoint. As a result, it may be necessary to adjust the low temp alarm prior to changing the chamber deadband.
7. To adjust the minimum coil outlet temperature press the value displayed next to “Min Coil Outlet Temperature”. The minimum coil outlet temperature defines the coldest allowable temperature of the N_2 as it exits the heat exchanger coil. The default value of -60.0°C is sufficient to maintain chamber temperatures as cold as -150.0°C.

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the minimum coil outlet temperature using the number pad that appears on screen and then press “Enter” to save the new value. Be sure to include “-“ when entering negative values.
8. To adjust the coil outlet deadband press the value displayed next to “Coil Outlet Deadband”. The coil outlet deadband, when added to the minimum coil outlet temp, defines the warmest allowable temperature of the N_2 before it is purged out of the heat exchanger coil and into the freezer. The default value of 20.0°C is sufficient to maintain chamber temperatures as cold as -150.0°C.

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the coil outlet deadband using the number pad that appears on screen and then press “Enter” to save the new value. Be sure to include “-“ when entering negative values.
9. To enable/disable the cooling time alarm press “ENABLED” or “DISABLED” next to “Cooling Time Alarm”.

   Pressing “ENABLED” will change the status to “DISABLED” and pressing “DISABLED” will change the status to “ENABLED”.
10. To adjust the cooling time alarm delay press the value displayed next to “Cooling Alarm Delay”

The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the cooling time alarm delay using the number pad that appears on screen and then press “Enter” to save the new value. Be sure to include “-“ when entering negative values.

11. In the event the cooling temperature sensor falls out of calibration, press “Cooling Temperature Calibration” and follow the prompts to recalibrate the sensor.

7.1.3 Inlet Temperature & Bypass Cycle

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”.
2. Press “Temperature Settings”
3. Press “Inlet Temperature Settings”
4. The first value displayed is the current inlet temperature.
5. To enable/disable the bypass cycle (and thus the supply alarm) press “ENABLED” or “DISABLED” next to “Hot Gas Bypass and Alarm”.

   Pressing “ENABLED” will change the status to “DISABLED” and pressing “DISABLED” will change the status to “ENABLED”.
6. To adjust the inlet temperature setpoint press the value displayed next to “Inlet Temperature Setpoint”. The inlet temperature setpoint defines the warmest allowable temperature at which N_2 will be introduced to the heat exchanger coils. The default value of -70°C is suitable for most applications but may require adjustment.

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the inlet temperature setpoint using the number pad that appears on screen and then press “Enter” to save the new value. Be sure to include “-“ when entering negative values.
7. To adjust the supply alarm delay press the value displayed next to “Supply Alarm Delay”. The supply alarm delay defines the maximum amount of time the bypass cycle will run before being terminated and a supply alarm being triggered.

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the supply alarm delay using the number pad that appears on screen and then press “Enter” to save the new value. Be sure to include “-“ when entering negative values.

   Note: The supply time will vary significantly from one application to another. It is recommended that the user observe and record several bypass cycles in order to establish a typical supply time for the application, and adjust the supply alarm delay accordingly.
8. To enable/disable the stuck valve alarms press “ENABLED” or “DISABLED” next to “Stuck Valve Alarm”.

   Pressing “ENABLED” will change the status to “DISABLED” and pressing “DISABLED” will change the status to “ENABLED”.
9. To adjust the stuck open valve time delay press the value displayed next to “Stuck Open Delay”.

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the stuck open valve time delay using the number pad that appears on screen and then press “Enter” to save the new value. Be sure to include “-“ when entering negative values.
10. To adjust the stuck closed valve time delay press the value displayed next to “Stuck Closed Delay”.

    The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the stuck closed valve time delay using the number pad that appears on screen and then press “Enter” to save the new value. Be sure to include “-“ when entering negative values.
12. In the event the inlet temperature sensor falls out of calibration, press “Inlet Temperature Calibration” and follow the prompts to recalibrate the sensor.

7.1.4 Setting Liquid Nitrogen Saturation Temperature

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”.
2. Press “Temperature Settings”
3. To adjust the liquid nitrogen saturation temperature press the value displayed next to “LN2 Saturation Temperature”

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the liquid nitrogen saturation temperature using the number pad that appears on screen and then press “Enter” to save the new value. Be sure to include “-“ when entering negative values.

Note: LN2 saturation temperatures at various altitudes are shown below.

LN2 Saturation Temp vs. Altitude				
Altitude				e
Meters	Feet	°C	°F	
0 – 152	0 – 500	-195.8	-320.4	77.4
152 – 305	501 – 1000	-196.0	-320.7	77.2
305 – 457	1000 – 1500	-196.2	-321.1	77.0
457 – 610	1501 – 2000	-196.4	-321.5	76.8
610 – 915	2001 – 3000	-196.6	-321.9	76.6
915 – 1220	3001 – 4000	-196.9	-322.4	76.3
1220 – 1524	4001 – 5000	-197.2	-322.9	76.0
1524 – 1829	5001 – 6000	-197.5	-323.5	75.7
1829 – 2134	6001 – 7000	-197.8	-324.0	75.4
2134 – 2439	7001 – 8000	-198.1	-324.6	75.1
2439 – 2744	8001 – 9000	-198.4	-325.1	74.8
2744 – 3049	9001 – 10000	-198.7	-325.7	74.4

7.2 BatteryBackup

Once the battery backup has been connected, the Variō TS controller will automatically detect its presence enable its use accordingly. There is no need to manually enable the battery backup, and the only way to disable its use is to physically remove it from the controller. To check the operating status of the battery backup, follow these instructions:

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”.
2. Press “Add-on Settings”
3. The first item displayed is the battery status. If the controller is being powered by the battery backup, the screen will display *On Battery Backup*, the current battery voltage, and the charge level as a percentage. Otherwise, the screen will display *On AC Power*.

7.3 Lid Switch

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”.
2. Press “Add-on Settings”
3. Press “Lid Switch Settings”
4. To enable/disable the lid switch press “ENABLED” or “DISABLED” next to “Lid Switch Installed”.

   Pressing “ENABLED” will change the status to “DISABLED” and pressing “DISABLED” will change the status to “ENABLED”.
5. To enable/disable the lid open fog clear press “ENABLED” or “DISABLED” next to “Lid Open Fog Clear”.

   Pressing “ENABLED” will change the status to “DISABLED” and pressing “DISABLED” will change the status to “ENABLED”.
6. To adjust the lid open alarm time press the value displayed next to “Lid Open Alarm Time”.

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the lid open alarm time using the number pad that appears on screen and then press “Enter” to save the new value. Be sure to include “-“ when entering negative values.

7.4 Display & Output Settings

7.4.1 Temperature Units

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”.
2. Press “Display and Output Settings”
3. To adjust the temperature units press the unit displayed next to “Temperature Units”

   Select the desired temperature units by pressing “°C”, “°F”, or “K” once the keypad appears and then “Enter”.

7.4.2 Alarm Buzzer

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Display and Output Settings”
3. Press “Advanced Display and Output Settings”
4. To enable/disable the alarm buzzer press “ENABLED” or “DISABLED” next to “Alarm Buzzer”

   Pressing “ENABLED” will change the status to “DISABLED” and pressing “DISABLED” will change the status to “ENABLED”.

7.4.3 Language Settings

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Display and Output Settings”
3. Press “Advanced Display and Output Settings”
4. To adjust the language setting press the language displayed next to “Language”

   Select the desired language by pressing “English”, “French”, “Italian”, “German” or “Spanish” once the keypad appears and then “Enter”.

7.4.4 Printer Settings

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Display and Output Settings”
3. Press “Advanced Display and Output Settings”
4. To adjust the print interval press the value displayed next to “Print Interval”

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the print interval using the number pad that appears on screen and then press “Enter” to save the new value.
5. To print a header (when a printer kit is attached) press “Print Header”
6. To manually print an event (when a printer kit is attached) press “Print Event”

7.5 SecuritySetup

7.5.1 Password Entry Mode

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Password Settings”
3. To enable/disable password entry mode press “ENABLED” or “DISABLED” next to “Password Entry Mode”

   Pressing “ENABLED” will change the status to “DISABLED” and pressing “DISABLED” will change the status to “ENABLED”.

7.5.2 GlobalPassword

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Password Settings”
3. Press “Set Global Password”

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the global password using the number pad that appears on screen and then press “Enter” to save the new value.

7.5.3 MultilevelPasswords

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Password Settings”
3. Press “Set Password X” where X is the desired password number.

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the selected password using the number pad that appears on screen and then press “Enter” to save the new value.
4. Once the new password is entered, set the password level

Options “1”, “2”, “3”, and “4” will be displayed for the password level. Select the desired password level and press “Enter”.

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

Feature	Not Password Protected	Level 1	Level 2	Level 3	Level 4
Fog Clear	X				
End Clear	X				
Alarm Mute	X				
Quick Reference Settings	X				
Temp Display Units		X	X	X	X
Enable / Disable Temp Sensors			X	X	X
Temp Alarm Settings			X	X	X
High Temp Alarm Test			X	X	X
Lid Switch Settings			X	X	X
Hot Gas Bypass Settings			X	X	X
Enable / Disable Alarm Buzzer			X	X	X
Alarm Settings			X	X	X
Date/Time			X	X	X
Language Settings			X	X	X
Printer Settings			X	X	X
Temp Calibration			X	X	X
Communication Settings				X	X
Reset to default settings				X	X
Password Settings					X

NOTE: Forgot your password? Contact your authorized MVE Distributor or the MVE Biological Solutions-MVE Technical Service group.

7.6 AdvancedSettings

7.6.1 Date & Time Adjustment

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Advanced Settings”
3. Press the first value displayed next to “Date”

   The number pad will be displayed once the value to be adjusted is selected. Type in the current month using the number pad that appears on screen and then press “Enter” to save the new value.
4. Press the second value displayed next to “Date”

   The number pad will be displayed once the value to be adjusted is selected. Type in the current day using the number pad that appears on screen and then press “Enter” to save the new value.
5. Press the third value displayed next to “Date”

   The number pad will be displayed once the value to be adjusted is selected. Type in the current year using the number pad that appears on screen and then press “Enter” to save the new value.
6. Press date format displayed next to “Format”

   Select the desired date format and press “Enter” to save the new setting.
7. Press the first value displayed next to “Time”

   The number pad will be displayed once the value to be adjusted is selected. Type in the current hour using the number pad that appears on screen and then press “Enter” to save the new value.
8. Press the second value displayed next to “Time”

   The number pad will be displayed once the value to be adjusted is selected. Type in the current minute using the number pad that appears on screen and then press “Enter” to save the new value.
9. Press the third value displayed next to “Time”

   Select “AM” or PM” and then press “Enter” to save the new value.
10. Press time format displayed next to “Time”

    Select the desired time format and press “Enter” to save the new setting.

7.6.2 Communications

7.6.2.1 COM Setup and COM Type

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Advanced Settings”
3. Press “Serial Port Settings”
4. Press the desired serial port setup

   The current setting will be highlighted.
5. Press the desired serial port type

   The current setting will be highlighted.

7.6.3 Unit ID / Modbus Menu

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Advanced Settings”
3. Press “Serial Port Settings”
4. Press the value displayed next to “MODBUS ID”

   The number pad will be displayed once the value to be adjusted is selected. Type in a new value for the MODBUS ID (if desired) using the number pad that appears on screen and then press “Enter” to save the new value

7.6.4 Restoring Manufacturer Defaults

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Advanced Settings”
3. Press “Firmware and Reset Settings”
4. Press “Restore All Defaults”

7.6.5 Restarting the Controller

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Advanced Settings”
3. Press “Firmware and Reset Settings”
4. Press “Restart Controller”

8.0 PREVENTATIVE MAINTENANCE & TROUBLESHOOTING

8.1 PreventativeMaintenanceSchedule

MVE Varīō System freezers are designed specifically for ease of use with minimal required maintenance, but as with any mechatronic device, preventative maintenance is the key to ensuring optimum operation and performance, as well as maximum service life.

NOTE: This is the recommended MVE preventative maintenance schedule. MVE Distributors may have a more rigorous/comprehensive plan which may be substituted for the below according to the needs of the application.

MVE Varīō Series Preventative Maintenance Schedule

	Weekly	Monthly	6 Months	1 Year	2 Years	5 Years
Verify Adequate Supply	X					
Plumbing Leak Check		X				
High Temp Alarm Test			X			
Thaw Freezer Lid			X			
Folding Step Inspection			X			
Lid Hinge Inspection			X			
Inline Filter Replacement				X		
Complete Function Test				X		
Solenoid Valve Replacement					X	
Relief Valve Replacement					X	
Lid gasket replacement					X	

Note: Check freezer at a 5 year interval and thaw only if ice builds up enough to impede the proper insertion, access and retrieval of samples. See the thaw and moisture removal procedure in section 8.2.14.

8.2 PreventativeMaintenanceProcedures

8.2.1 Calibrating the Pt1000 Temperature Sensors

This section describes how to calibrate the MVE Biological Solutions TS temperature sensors. There are two calibration procedures: single point and two point calibration.

For single point calibration, the reference point is LN2. For two point calibration, the reference points are LN2 and ice water. Unless regulations require a two point calibration, the single point calibration procedure is recommended. The benefit of two point calibration is more accurate temperature measurement in near room temperature environments. The drawback is a longer, more complex calibration procedure. The benefit of a single point calibration is a simple calibration procedure. The drawback of single point calibration is less accurate temperature measurement in near room temperature environments.

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

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

8.2.1.1 Single Point Calibration

The single point calibration procedure requires a small volume of liquid nitrogen – enough to completely submerge the end of the temperature sensor.

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

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Temperature Settings”
3. Press “Temperature A Settings”

   NOTE: To calibrate the Temperature B probe, Inlet Temperature probe, or Cooling Temperature probe enter the corresponding settings menu from the “Temperature Settings” menu and follow the remaining steps listed below for these probes.
4. Press “Temperature A Calibration”
5. Press “Single Point Calibration”
6. Submerge the temperature probe in LN2

   Place the temperature probe in LN2 and then press “Next”.
7. Wait for the temperature probe reading to stabilize and press “Next” to complete calibration

8.2.1.2 Double Point Calibration

The dual point calibration procedure requires a small volume of liquid nitrogen and ice water – enough to completely submerge the end of the temperature sensor. To ensure accuracy, proper ice water bath preparation is imperative. For the best results, add filtered water to a Styrofoam cup containing crushed ice. Allow the solution to stand at room temperature for five minutes prior to beginningprocedure.

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

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Temperature Settings”
3. Press “Temperature A Settings”

   NOTE: To calibrate the Temperature B probe, Inlet Temperature probe, or Cooling Temperature probe enter the corresponding settings menu from the “Temperature Settings” menu and follow the remaining steps listed below for these probes.
4. Press “Temperature A Calibration”
5. Press “Double Point Calibration”
6. Submerge the temperature probe in LN2

   Place the temperature probe in LN2 and then press “Next”.
7. Wait for the temperature probe reading to stabilize and press “Next”
8. Remove the probe from LN2 and press “Next”

   The controller may prompt to wait for the probe to reach room temperature before continuing the calibrationprocess.
9. Submerge the temperature probe in ice water.

   Place the temperature probe in ice water and press “Next”.
10. Wait for the sensor to stabilize and then press “Next”.

8.2.2 Testing the Remote Alarm Contacts

8.2.2.1 Testing Global Alarm Contacts

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

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

8.2.2.2 Testing the programmable Alarm Output Contacts

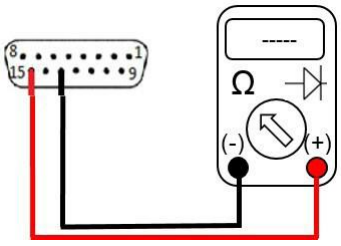
Each of the four programmable alarms may be set to either Active Open or Active Closed logic. See testing procedures below for the two different states.

ActiveOpen:
The alarm output is disconnected from the ALARM OUTPUT COMMON while the alarm is active.
The alarm output is connected to ALARM OUTPUT COMMON while the alarm is not active.

- Normal State (No Alarms)
  There should be continuity between the ALARM OUTPUT COMMON and the alarm output contact being tested
- Alarm State
  The circuit between the ALARM OUTPUT COMMON and the alarm contact to be tested should read open

ActiveClosed:
The alarm output is connected to ALARM OUTPUT COMMON while the alarm is active.
The alarm output is disconnected from the ALARM OUTPUT COMMON while the alarm is not active.

- Normal State (No Alarms)
  The circuit between the ALARM OUTPUT COMMON and the alarm contact to be tested should read open
- Alarm State
  There should be continuity between the ALARM OUTPUT COMMON and the alarm output contact being tested



Alarm PIN Assignments	
Alarm	**PIN**
High/Low Temp A Alarm	6
Lid Open Alarm	7
Sensor Failure Alarm	8
Stuck Valve Alarm	13
Common	15

8.2.3 Plumbing Leak Check

Leaky plumbing connections can create a host of problems including excessive cooling cycle times, nuisance alarms, and high nitrogen consumption. Leaky plumbing connections are especially common on liquid cylinder supply systems due to the frequent attachment/removal of fittings when changingcylinders.

To check the plumbing for leaks:

1. With the supply system at operating pressure, thoroughly spray all transfer hose connections and freezer plumbing connections with a leak detecting solution.
2. Allow solution to penetrate fittings for a minimum of 30 seconds. Large leaks will be immediately apparent with large bubble formations. Smaller leaks will take longer to detect, and cause the solution to adopt a foam-like appearance.
3. Tighten fittings as necessary.
4. If tightening the fitting does not fix the leak, check the fitting for cracks and or galling and replace as necessary.
5. Upon replacement, recheck the plumbing to ensure proper installation.

8.2.4 Variō TS Firmware Update

As with any electronic device, the Variō TS firmware, or the software that defines controller operation, may be modified from time to time in order to provide better performance, additional features, or patch known issues. A USB drive and the current firmware file(s) are required to perform a firmware upgrade.

NOTE: The Variō TS firmware should only be updated by an authorized MVE Distributor or under the direction of MVE Biological Solutions Technical Service. Improperly performed firmware updates may render the controller inoperable.

1. Place firmware updater file(s) on the root level of a USB drive (i.e. not contained in a subfolder within the USB drive).
2. Plug the USB into the USB port on the front of the controller.

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

3. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
4. Press “Advanced Settings”
5. Press “Firmware and Reset Settings”
6. Press “Firmware Update”

Wait for the controller to complete the firmware update. This may take several minutes. The controller may beep periodically during the firmware update.

8.2.5 Verifying Adequate LN2 Supply

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

Observe the pressure of the supply source. Ideally, pressure should be 22 – 35 psi (1.52 – 2.41 bar). It is common for the pressure gauge on an industrial liquid cylinder to be inoperative. If you suspect this to be the case, install a pressure gauge inline between the liquid cylinder and the freezer for pressure verification. Initiate a cooling cycle on at least one freezer on the network. The supply system should be able to maintain appropriate pressure throughout the duration of the cooling cycle.

Verify the amount of liquid in the supply source. Most bulk tanks have some method of digital or analog volume measurement. Liquid cylinders typically use a sight gauge. As with the pressure gauge on liquid cylinders, it is common for the sight gauge to be inoperative.

If the supply is determined to be inadequate, have your gas supplier replenish or replace the system.

8.2.6 High Temperature Alarm Test

The high temperature alarm test allows a user to simulate a high temperature alarm without having to remove the corresponding sensor from the freezer. Once initiated, the Variō TS will warm the sensor by applying a small voltage to the sensor leads. The Variō TS will continue to heat the sensor until it exceeds the High Temp Alarm setpoint, at which time it will remove the applied voltage and terminate the testing procedure.

> NOTE: The heat generated by the sensor during the high temperature alarm test is NOT enough to affect the actual temperature in the freezer storage space.

NOTE: Security Level 2 or higher is required to perform the high temperature alarm test.

1. From the home screen, press “Setup” to enter setup menus. Controller may prompt for a password. Type in the password using the number pad that appears and press “Enter”
2. Press “Temperature Settings”
3. Press “Temperature A Settings”

   Note: To test the Temperature B probe, enter the “Temperature B Settings” menu from the “Temperature Settings” menu and follow the remaining steps listed below.
4. Press “Initiate High Temp. A Alarm Test”

   The temperature probe reading will increase on the display once the test has initiated. Verify that the alarm occurs after the temperature probe reaches the high temperature setpoint. Once the test is initiated, pressing “<”, “Exit”, or “Setup” will not interrupt the test.

   Note: If the temperature probe is open or no probe is connected the controller will not initiate the high temperature alarm test.

8.2.7 Lid Thaw Procedure

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

8.2.8 Folding Step Inspection

When inspecting the step assembly, verify that the hinges are free of cracks and that all connections are secure. Verify the integrity of the anti-slip strips and replace if necessary (PN 4810179). Ensure the step locking strap is able to securely hold the steps in an upright, folded position. To prevent the pivot bolts from continuously loosening, apply thread locker (PN 11087674) to the bolt shaft and retighten.

8.2.9 Filter Replacement

CAUTION: Ensure that the LN2 supply valve is closed and the plumbing assembly is fully vented before attempting to remove the inline filter.

To remove and replace the inline filter:

1. Close the LN2 supply valve and disconnect the LN2 transfer hose from the plumbing assembly fill tee.
2. Loosen and remove the fill tee and inline filter from the plumbing assembly.
3. Replace the inline filter (PN 11648945) and reinstall the fill tee using new Teflon tape to wrap the threads. Ensure the filter is oriented correctly such that the imprinted arrow points in the direction of LN2 flow.
4. Reconnect the transfer hose, open the LN2 supply valve, and check fittings for leaks.

8.2.10 Relief Valve Replacement

CAUTION: Ensure that the LN2 supply valve is closed and the plumbing assembly is fully vented before attempting to remove the relief valve.

1. Remove plumbing shroud to gain access to plumbing system.
2. If the valve is equipped with a deflector, loosen the clamp and remove the deflector.
3. Loosen the relief valve and remove it from the plumbing assembly. Support the attachment tube with a wrench to prevent damage from torsion.
4. Install a replacement relief valve rated to 50 PSI (3.4 bar) (PN 1810032) using new Teflon tape to wrap the threads.

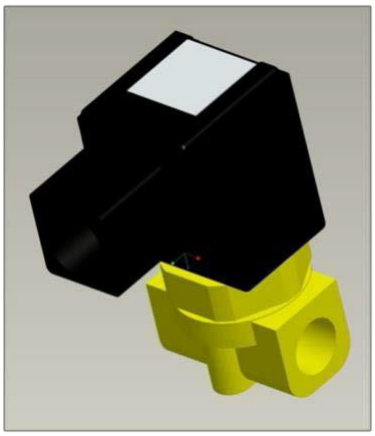
WARNING: In addition to voiding any warranty, installing a relief valve with a pressure rating other than 50 PSI (3.4 bar) may prevent proper operation and lead to a dangerous over-pressurized condition.

8.2.11 Complete MVE Variō TS Function Test

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

8.2.12 Solenoid Valve Replacement

MVE freezers will have two types of solenoid valves. The purge valve is a 3 port solenoid valve. The two fill valves and the one gas bypass valve are 2 port, normally closed, inline solenoid valves.



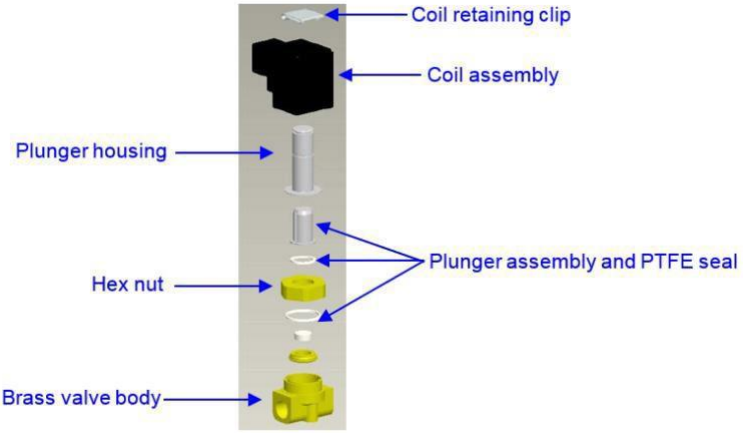
All MVE freezers are equipped with electromechanical solenoid valves that have been tested and approved by MVE for cryogenic use. These valves utilize a PTFE seal for optimal sealing in cryogenic environments. Over time, the normal thermal cycling that this seal is subject to will cause it to harden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

NOTE: Always use replacement solenoid valves from MVE. Substituting non MVE components may result in inoperable valves and even damage to the MVE Variō TS control system. Damage to the control system due to use of non MVE parts will not be covered by warranty.

CAUTION: Ensure that the LN2 supply valve is closed and the plumbing assembly is fully vented before attempting to remove the valve.

1. Remove plumbing shroud to gain access to plumbing system.
2. Disconnect the solenoid valve from the controller.
3. Remove coil retaining clip by inserting a flathead screwdriver between the clip and the edge of the coil body. Twist the screwdriver and allow the clip to slide off.
4. Remove and discard the coil assembly.
5. Using a crescent wrench, loosen the hex nut and remove the plunger housing and plunger assembly.
6. Remove any debris that may have collected in brass valve body.
7. Inspect the brass valve body for nicks or other damage. If the sealing surface appears to be in good condition, the valve body may be reused. Although uncommon, if the sealing surface is damaged, the plumbing will need to be disassembled and the entire valve body will need to be replaced. When installing a new valve body, verify correct orientation by ensuring the imprinted arrow points in the direction of LN2 flow.
8. Disassemble a new MVE supplied valve (PN 14224611S) using the above procedure.

9. Install the new plunger, plunger housing, and coil assembly onto the old valve body.
10. Assembly valve with new components in the reverse order.
11. Reconnect the valve to the Variō TS controller.
12. Verify that no leaks are present using leak detect solution.
13. Open the LN2 supply valve and manually initiate a cooling cycle. Allow the cooling cycle to complete and verify that flow stops at the termination of the cycle.



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

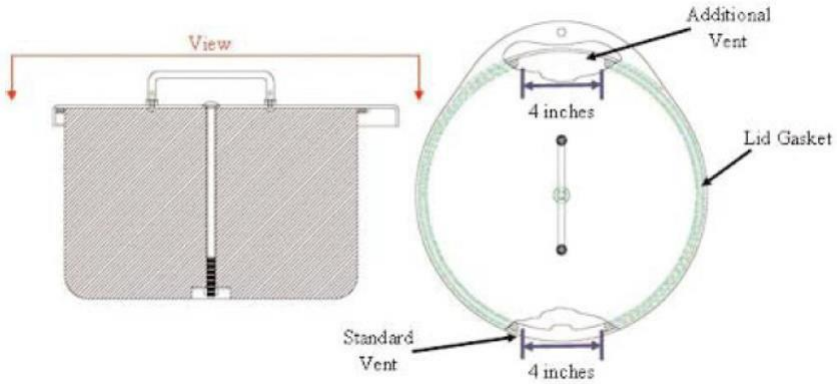
NOTE: When installing a complete new valve, ensure it is oriented correctly. An “N” is engraved on the side of the SMC brass valve body. The valve should be installed so that this “N” is on the inlet side of the valve.

8.2.13 Lid Gasket Replacement

8.2.13.1 MVE Variō 1500 Series

Depending on the condition of the current gasket, the gasket material may either be removed or more material may be added to the existing gasket. The replacement gasket material will be a neoprene tape.

1. Clean the attachment surface.
2. Remove the tape backing on the gasket material to expose adhesive strip.
3. Trim to size as needed and install onto lid.
4. Cut a 4 inch gap in the gasket material on either side of the lid as shown below to allow sufficient venting of the freezer space.



8.2.13.2 MVE Variō 1800 Series

The MVE Variō 1800 Series lid has a trim seal gasket that slides securely around the circumference of the lid without additional adhesive or rivets.

1. Remove the existing gasket by simply pulling off the trim seal gasket.
2. Install new gasket starting at the rear center of the lid. Insert trim seal around lid edge so that the trim lip secures to the lid. Install around the entire lid.
3. Cut a 8 inch gap in the gasket material at the rear center under the lid hinge to allow sufficient venting of the freezer space.

8.2.14 Complete Freezer Thaw & Moisture Removal

1. Close LN2 supply valve and remove LN2 supply.
2. Remove all power sources from the Variō TS controller.
3. Open or remove lid from freezer.
4. Allow the freezer storage space to warm to room temperature. A fan or similar device may be used to accelerate the warming process.
5. After the freezer has reached ambient temperature, thoroughly purge any moisture from the freezer space. This can be done with a wet/dry vacuum and towels. Open the hinged hatch on the bottom of the turn-tray to access the bottom of the freezer.
6. Once moisture has been removed from the freezer, purge the plumbing assembly with gaseous nitrogen at a pressure no greater than 50 PSI (3.4 bar) for 30 seconds. Repeat 30 second purging cycles until the plumbing assembly is completely dry.

8.3 Accessories & Replacement Parts

MVE Variō System Accessories		
Item Description		**Part Number**
COM Kit: RJ-45 to USB Convertor		13376947
Network Setup Kit: 1 RJ-45 network cable & 1 cable splitter		10856321
RJ-45 Network Cable		10740053
RJ-45 Cable Splitter		10856312
Supply T-Assembly: used to connect 2 freezers to one LN2 supply connection		10784443
Relief Valve Inline Adapter: 3/8” NPT		1611592
Relief Valve Inline Adapter: 1/2” inch NPT Outlet		1810092
Cool Reach: cryo-compatible squeeze-grip used to retrieve hard to reach items		13051579
LN2 Transfer Hose:	4 ft (1220 mm), ½ inch (12.7 mm) ODT	9713159
	6 ft (1829 mm), ½ inch (12.7 mm) ODT	9713109
LN2 Transfer Hose Coupler: used to connect two transfer hoses.		1110862
Printer Kit: includes printer and cables		11544943
Cryo Gloves:	Medium; Length: Mid-arm	9717119
	Large; Length: Mid-arm	9717129
	X-Large; Length: Mid-arm	9717139
	Medium; Length: Elbow	9717149
	Large; Length: Elbow	13376947
	X-Large; Length: Elbow	10856321
Cryo Apron		10740053
Automatic LN2 Supply Switcher		10856312

Replacement Parts	
Item Description	**Part Number**
Inline Filter: 40 micron mesh	11648945
Relief Valve: 50 PSI (3.4 bar)	1810032
SMC Solenoid Valve: cooling & bypass valves	14224611S
Inlet Temperature Sensor	10713400
Gas Bypass Muffler	11499812
Gas Bypass Muffler Deflector	11885449
Temperature Probe: 96 inch (2438 mm)	10713354
Temperature Probe: 44 inch (1118 mm)	10713418
3-Tube Temp Sensor Guide for 1500 Series: 39 inch (990 mm)	14248816
3-Tube Temp Sensor Guide for 1800 Series: 44 inch (1118 mm)	14248752
Jerome Power supply In:100-240 VAC,50/60Hz,140VA .Out: 30 VDC. 2A	20965617
Power Outlet Cord: 110 VAC (The Americas)	14010103
Power Outlet Cord: 230 VAC (Europe)	10995363
Battery Backup Replacement Battery: 12 VDC	10718155
Battery Backup Fuse: 4A 250V	11858467

9.0 EN COMPLIANCE TABLES

Table: Guidance and manufacturer's declaration – electromagnetic emissions for all MVE Variō TS.

Guidance and Manufacturer's Declaration - Electromagnetic Emissions		
The MVE Variō TS is intended for use in the electromagnetic environment specified below. The customer or the user of the MVE Variō TS should assure that it is used in such an environment.		
Emissions Test	Compliance	Electromagnetic Environment – Guidance
RF emissions CISPR 11	Group 1	The MVE Variō TS 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 MVE Variō TS 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: Guidance and manufacturer's declaration – electromagnetic immunity – for all MVE Variō TS.

Guidance and Manufacturer's Declaration – Immunity			
The MVE Vario TS is intended for use in the electromagnetic environment specified below. The customer or user of the MVE Vario TS should ensure that it is used in such an environment.			
Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment – Guidance
ESD IEC 61000-4-2	±8kV Contact ± 2 kV, ± 4 kV, ± 8 kV, ± 15 kV air	±8kV Contact ± 2 kV, ± 4 kV, ± 8 kV, ± 15 kV air	Floors should be wood, concrete or ceramic tile. If floors are synthetic, the r/h should be at least 30%
Electrical Fast Transient/Burst IEC 61000-4-4	±2 kV 100 kHz repetition frequency	±2 kV 100 kHz repetition frequency	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±0.5 kV, ±1 kV Line-to-line ±0.5 kV, ±1 kV, ± 2 kV Line-to-ground	±0.5 kV, ±1 kV Line-to-line ±0.5 kV, ±1 kV, ± 2 kV Line-to-ground	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	0 % UT; 0,5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0 % UT; 1 cycle 70 % UT; 25/30 cycles Single phase: at 0° 0 % UT; 250/300 cycle	0 % UT; 0,5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0 % UT; 1 cycle 70 % UT; 25/30 cycles Single phase: at 0° 0 % UT; 250/300 cycle	Mains power quality should be that of a typical commercial or hospital environment. If the user of the MVE Vario TS requires continued operation during power mains interruptions, it is recommended that the MVE Vario TS be powered by an uninterruptible power supply or battery.
Power frequency (50/60 Hz) Magnetic field IEC 61000-4-8	30A/M 50/60 Hz	30A/M 50/60 Hz	Power frequency magnetic fields should be that of a typical commercial or hospital environment.

Table: Guidance and manufacturer's declaration – electromagnetic immunity – for all MVE Varió TS.

Guidance and Manufacturer's Declaration – Immunity			
The MVE Varió TS is intended for use in the electromagnetic environment specified below. The customer or user of the MVE Varió TS should ensure 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 6Vrms (In ISM Bands) 150 kHz to 80 MHz	3Vrms 6Vrms (In ISM Bands) 150 kHz to 80 MHz	Portable and mobile RF communications equipment should be used no closer to any part of the MVE Varió TS including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1,2\sqrt{P}$ $d = 1,2\sqrt{P}$ $d = 2,3\sqrt{P}$ 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].
Radiated RF IEC 61000-4-3	80MHz to 2.7GHz	3 V/m 80 MHz – 2,7 GHz 80 % AM at 1 kHz	Interference may occur in the vicinity of equipment marked with the following symbol: 

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

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

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

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

Test frequency (MHz)	Band [a] (MHz)	Service [a]	Modulation [b]	Maximum power (W)	Distance (m)	IMMUNITY TEST LEVEL (V/m)
385	380 –390	TETRA 400	Pulse modulation [b] 18 Hz	1,8	0,3	27
450	430 – 470	GMRS 460, FRS 460	FM [c] ± 5 kHz deviation 1 kHz sine	2	0,3	28
710	704 – 787	LTE Band 13, 17	Pulse modulation [b] 217 Hz	0,2	0,3	9
745						
780						
810	800 – 960	GSM 800/900, TETRA 800, iDEN 820, CDMA 850, LTE Band 5	Pulse modulation [b] 18 Hz	2	0,3	28
870						
930						
1 720	1 700 – 1 990	GSM 1800; CDMA 1900; GSM 1900; DECT; LTE Band 1, 3, 4, 25; UMTS	Pulse modulation [b] 217 Hz	2	0,3	28
1 845						
1 970						
2 450	2 400 – 2 570	Bluetooth, WLAN, 802.11 b/g/n, RFID 2450, LTE Band 7	Pulse modulation [b] 217 Hz	2	0,3	28
5 240	5 100 – 5 800	WLAN 802.11 a/n	Pulse modulation [b] 217 Hz	0,2	0,3	9
5 500						
5 785						

Table: Recommended separation distances between portable and mobile RF communications equipment and the MVE Variō TS – for MVE Variō TS systems that are not life supporting.

Recommended separation distances between portable and mobile RF communications equipment and the MVE Variō TS

The MVE Variō TS is intended for use in the electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the MVE Variō TS can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the MVE Variō TS as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter (W)	**Separation distance according to frequency of transmitter (m)**		
	150 kHz to 80 MHz d = [3,5/V1]√P	80 MHz to 800 MHz d = [3,5/E1]√P	800 MHz to 2,5 GHz d = [7/E1] √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 I meters (m) can be estimated using the equation applicable to the frequency of the transmitter where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

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

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

NOTE : Use of MVE Vario TS adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, MVE Vario TS should be observed to verify that they are operating normally.

NOTE: Use of accessories, transducers and cables other than those specified or provided by the manufacturer of this equipment could result in increased electromagnetic emissions or decreased electromagnetic immunity MVE Vario TS and result in improper operation.

10.0 APPENDIX

10.1 ASCII Interface & Command Index

ControlCommands:
Controller ID Input: *IDN? Output: MVE Biological Solutions MVE Variō TS, Software ver. #.## Description: Returns the controller type & software revision.
Alarm Mute Input: ALMS 0 Output: None Description: Same effect as pressing *ALARM MUTE* button.
Alarms Active Input: ALMS? Output: # Output Range: 0, 1 Description: Displays “1” if an alarm is currently active and “0” if no alarms are currently active.
Calibrate Temp A Input: CALTA Output: None Description: Calibrates Temp A in LN2.
Calibrate Temp B Input: CALTB Output: None Description: Calibrates Temp B in LN2.
GlobalPassword Input: CODE? Output: #### Output Range: 0000 – 9999 Description: Displays Global Password.

ControlCommands:
Test High Temp A Alarm Input: HITSTA Output: None Description: Initiates High Temp A Alarm Test.
Test High Temp B Alarm Input: HITSTB Output: None Description: Initiates High Temp B Alarm Test.
Restore Manufacturer Defaults Input: INITEE Output: None Description: Restores all default settings.
Set LN2 Saturation Temperature Input: LNSATP ±###.# Input Range: See “Saturation Temperature Page” (Page 78). Output: None Description: Sets the Liquid Nitrogen Saturation temperature.
Get LN2 Saturation Temperature Input: LNSATP? Output: ±###.# Output Range: See “Saturation Temperature Page” (Page 78). Description: Displays the Liquid Nitrogen Saturation temperature.
Set Password Entry Mode Input: LOCK # Input Range: 0,1 Output: None Description: Setting to “0” disables Password Entry Mode. Setting to “1” enables Password Entry Mode.

ControlCommands:
Get Password Entry Mode Input: LOCK? Output: # Output Range: 0,1 Description: Returns “0” if Password Entry Mode is disabled. Returns “1” if Password Entry Mode is enabled.

Temperature Commands:
Get Inlet Temp Input: BPTMP? Output: ±###.#, or OPEN Description: Displays current inlet temperature.
Get Inlet Temp Setpoint Input: INSET? Output: ±###.# Description: Displays current Inlet Temperature set point.
Set Inlet Temp Setpoint Input: INSET ±###.# Input Range: See “Inlet Temp Setpoint Page” (Page 86). Output: None Description: Sets inlet temperature setpoint.
Get Chamber Deadband Input: CHDB? Output: ±###.# Description: Displays current chamber deadband value.
Set Chamber Deadband Input: CHDB ±###.# Output: None Description: Sets the chamber deadband value.

Temperature Commands:
Get Chamber Temp Input: CHTMP? Output: ±###.# or OPEN Description: Displays current Chamber Temperature.
Get Max Chamber Temp Input: CHSET? Output: ±###.# Description: Displays current Max Chamber Temperature setpoint.
Set Max Chamber Temp Input: CHSET ±###.# Output: None Description: Sets Max Chamber Temperature.
Get Cooling Coil Deadband Input: CODB? Output: ±##.# Description: Displays current Cooling Coil Deadband.
Set Cooling Coil Deadband Input: CODB ##.# Output: None Description: Sets Cooling Coil Deadband.
COSET? Input: COSET? Output: ±###.# Description: Displays current Minimum Cooling Temperature Setpoint.
COSET Input: COSET ±###.# Input Range: See “Min Coil Outlet Temp Page” (Page 115). Output: None Description: Sets current Minimum Cooling Temperature Setpoint.

Temperature Commands:
COTMP? Input: COTMP? Output: ±###.# or OPEN Description: Displays current Cooling Temperature.
HITA Input: HITA ±###.# Output: None Description: Sets Temp A High Alarm to entered value.
HITA? Input: HITA? Output: ±###.# Description: Displays current setting of Temp A High Alarm.
HITAS? Input: HITAS? Output: 0 or 1 Description: Displays “1” If there is currently a Temp A High Alarm and “0” if Temp A High Alarm is inactive.
HITAM Input: HITAM # Input Range: 0,1 Output: None Description: Disables the Temp A High Alarm if set to “0”. Enables the Temp A High Alarm if set to “1”.
HITAM? Input: HITAM? Output: 0 or 1 Description: Displays “1” If the Temp A High Alarm is enabled. Displays “0” If the Temp A High Alarm is disabled.
HITB Input: HITB ±###.# Output: None Description: Sets Temp B High Alarm to entered value.

Temperature Commands:
HITB? Input: HITB Output: ±###.# Description: Displays current setting of Temp B High Alarm.
HITBM Input: HITBM # Input Range: 0,1 Output: None Description: Disables Temp B High Alarm if set to “0”. Enables the Temp B High Alarm if set to “1”.
HITBM? Input: HITBM? Output: 0 or 1 Description: Displays “1” If the Temp B High Alarm is enabled. Displays “0” If the Temp B High Alarm is disabled.
HITBS? Input: HITBS? Output: 0 or 1 Description: Displays “1” If there is currently a Temp B High Alarm. Displays “0” If there is currently not a Temp B High Alarm.
LOTA Input: LOTA ±###.# Output: None Description: Sets Temp A Low Alarm to entered value.
LOTA? Input: LOTA? Output: ±###.# Description: Displays current Temp A Low Alarm setting.
LOTAM Input: LOTAM # Input Range: 0,1 Output: None Description: Disables the Temp A Low Alarm if set to “0”. Enables the Temp A Low Alarm if set to “1”.

Temperature Commands:
LOTAM? Input: LOTAM? Output: 0 or 1 Description: Displays “1” If the Temp A Low Alarm is enabled. Displays “0” If the Temp A Low Alarm is disabled.
LOTAS? Input: LOTAS? Output: 0 or 1 Description: Displays “1” If there is currently a Temp A Low Alarm. Displays “0” If there is currently not a Temp A Low Alarm.
LOTB Input: LOTB ±###.# Input Range: See “Temp B Low Alarm Setpoint Page” (Page 59). Output: None Description: Sets Temp B Low Alarm to entered value.
LOTB? Input: LOTB? Output: ±###.# Description: Displays current Temp B Low Alarm setting.
LOTBM Input: LOTBM # Input Range: 0,1 Output: None Description: Disables the Temp B Low Alarm if set to “0”. Enables the Temp B Low Alarm if set to “1”.
LOTBM? Input: LOTBM? Output: 0 or 1 Description: Displays “1” If the Temp B Low Alarm is enabled. Displays “0” If the Temp B Low Alarm is disabled.

Temperature Commands:
LOTBS? Input: LOTBS? Output: 0 or 1 Description: Displays “1” If there is currently a Temp B Low Alarm. Displays “0” If there is currently not a Temp B Low Alarm.
TEMPA? Input: TEMPA? Output: ±###.# or OPEN Description: Displays current Temp A value.
TEMPB? Input: TEMPB? Output: ±###.# or OPEN Description: Displays current Temp B value.
TUNI Input: TUNI X Input Range: C, F, or K Output: None Description: Sets temperature units of measurement based on entered character; ‘C’ for degrees Celsius, ‘F’ for degrees Fahrenheit and ‘K’ for Kelvin.
TUNI? Input: TUNI? Output: X Output Range: C, F, or K Description: Shows current units of measurement for temperature; ‘C’ for degrees Celsius, ‘F’ for degrees Fahrenheit and ‘K’ for Kelvin.

Cooling Cycle Commands
BPFIL? Input: BPFIL? Output: 0 or 1 Description: Displays “1” if currently Bypassing. Displays “0” if not Bypassing.
CFIL? Input: CFIL? Output: 0 or 1 Description: Displays “1” if cooling cycle is active. Displays “0” if not actively cooling.

Data Logging Commands:
CLEVLG Input: CLEVLG Output: None Description: Clears the data log. Variance: After using this command, the EVENT? Query will return PF (Power Failure) until there is at least one event in the data log.
DATE Input: DATE MM/DD/YY or DATE DD/MM/YY depending on Date Format setting. Output: None Description: Sets the current date.
DATE? Input: DATE? Output: MM/DD/YY or DD/MM/YY depending on Date Format setting. Description: Displays the current date.

Data Logging Commands:

EVENT?

Input: EVENT?

Output:

Normal Record:

[ID],[DATE],[TIME],[TEMPA],[TEMPB],[LEVEL],[RATE],[ALARMS/EVENTS]

Parameter Change

[ID],[DATE],[TIME],[TEMPA],[TEMPB],[LEVEL],[RATE],[ALARMS/EVENTS]

#####,MM/DD/YY,##:##,±###.#,±###.#,±###.#,±###.#,XX*

#####,MM/DD/YY,##:## XX,±###.#,±###.#, ±###.#,±###.#,XX*

#####,DD/MM/YY,##:## ,±###.#,±###.#,±###.#,±###.#,XX*

#####,DD/MM/YY,##:## XX,±###.#,±###.#, ±###.#,±###.#, XX*

#####,MM/DD/YY,##:##,Parameter number ### changed from #### to ####

#####,MM/DD/YY,##:## XX,Parameter number ### changed from #### to ####

#####,DD/MM/YY,##:##,Parameter number ### changed from #### to ####

#####,DD/MM/YY,##:## XX,Parameter number ### changed from #### to ####

Description: Returns the last event.

*XX can be multiple one or two character Alarm/Event codes where each code is separated by a space. If none are displayed there are no current alarms or events.

EVNCT?

Input: EVENCT?

Output: #####

Description: Returns the number of events stored.

Data Logging Commands:
EVNLOG? Input: EVNLOG? # Input Range: 1 – 30000 Output: #####,MM/DD/YY,##:##,±###.#,±###.#,±###.#,±###.#,XX* or #####,MM/DD/YY,##:## XX,±###.#,±###.#, ±###.#,±###.#,XX* or #####,DD/MM/YY,##:## ,±###.#,±###.#,±###.#,±###.#,XX* or #####,DD/MM/YY,##:## XX,±###.#,±###.#, ±###.#,±###.#, XX* or #####,MM/DD/YY,##:##,Parameter number ### changed from #### to #### or #####,MM/DD/YY,##:## XX,Parameter number ### changed from #### to #### or #####,DD/MM/YY,##:##,Parameter number ### changed from #### to #### or #####,DD/MM/YY,##:## XX,Parameter number ### changed from #### to #### Description: Returns the specified event.
LOGPER Input: LOGPER ### Input Range: 1 – 1440 Output: None Description: Sets the Log period in minutes.
LOGPER? Input: LOGPER? Output: ##### ##### Description: Returns the Modbus ID and Log period in minutes.
MEMO Input: MEMO # XXXX…. Input Range: 1 – 5 Output: None Description: Sets the specified memo, # can be 1-5, for each available memo. The memo section (XXXX…) can contain up to 50 alphanumeric characters.

Data Logging Commands:
MEMO? Input: MEMO? # Input Range: 1 – 5 Output:XXXX…. Description: Returns the specified memo.
TIME Input: TIME HH:MM:SS, in 24 hour format (:SS designation optional) Output: None Description: Sets time to entered value, use 24 hour format.
TIME? Input: TIME? Output: HH:MM:SS or HH:MM:SS XX depending on Time Format. Description: Displays the current time.
UNID Input: UNID ##### Input Range: 0 – 200 Output: None Description: Sets the Unit ID number.
UNID? Input: UNID? Output: ##### Description: Displays Unit ID number.
CDATE? Input: CDATE? Output: XXX ## #### ##:##:## Description: Displays compile date and time.

11. 0 Santizing and Decontaminating MVE Biological Solutions Alumninum and Stainless Steel Products

MVE aluminum dewars are constructed with an aluminum inner, which utilizes a fiberglass neck support. The stainless units are constructed with an inner entirely fabricated from stainless steel sheets. Any cleaning solution that does not react with aluminum or stainless can be used in the sanitation process of these dewars. In most cases, any household detergent or mild soap solution is suitable. The U.S. Custom Service uses a solution called EXPOR for incoming shipments from abroad. This is mixed 9 parts water mixed with sodium chloride & lactic acid. As mentioned above, however, any household cleaning solution can be used. These include bleach, detergents, and mild soaps. Other cleaners and disinfectants that can be safely used include hydrogen peroxide, chlorine/water and denatured alcohol. NOTE: ***DO NOT USE ANY PETROLEUM BASED CLEANING SOLUTION***. It is important that the inner vessel is thoroughly rinsed with water and all cleaner residues have been removed. Spraying the solution into the inner vessel is preferred, although agitation of the solution inside the inner will suffice. Vapor shippers and Doble units will require filling the inner to its full capacity with cleaning mixture and then rinsing. Allow the unit to dry thoroughly before putting into service. With vapor shippers, we suggest setting dewar inverted to drain and dry. The process is not intended for use in older vapor shipper models manufactured prior to 1994. The generally accepted practice of using 10% chlorine bleach with 90% water solution still holds as the best method for decontamination. However, with some of the bovine and swine virus strains showing up today, it is the conclusion of the agricultural professors at the University of Minnesota and Texas A & M that an increased mixture of chlorine bleach to 30% and 70% water will kill all known viruses except BSE. To perform this sanitizing procedure, cover all inner surfaces with the solution, let stand for 30 minutes and remove. Rinse the decontaminated surfaces with clean water and remove rinse water. Allow dewar to dry before putting into service. For vapor shippers and Doble units, this means to place dewar on end (inverted) and allow drying. Note: Vapor dewars can be used immediately after rinsing but may take longer to recharge to 100% capacity If you have any questions concerning decontaminating dewar please contact Bio-Medical Technical Service.

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