



User's Manual

LN2-VC2L

Pressurized LN2 Valve Box



INSTECH, Inc.

Warranty

December 23, 2025

INSTECH, Inc. guarantees the product will conform to the specifications outlined in this manual and will remain free of defects in workmanship and materials for one year from the date of delivery. Should a product, in *INSTECH's* opinion, malfunction during the warranty period because of a defect in workmanship or material, *INSTECH* will repair or replace it at no charge to the buyer, provided the product has not been subject to accidental damage, misuse, abuse, or unauthorized alteration, modification, and/or repair.

Examples of actions that will make this warranty null and void include, but are not limited to, the following:

- ◆ Storing or operating the device at any temperature outside the operating and storage temperature range.
- ◆ Performing or attempting to perform unauthorized service or repair.
- ◆ Resale -- except through an authorized dealer.

Products requiring service under this WARRANTY should be delivered to *INSTECH, Inc.* All portions of such systems, hardware, and software should be sent, along with proof of purchase if obtained from an authorized dealer. The buyer must ensure the product or assume the risk of damage or loss in transit. If unable to repair or replace the product, *INSTECH* will refund the purchase price paid by the original buyer.

DISCLAIMER

THE FOREGOING WARRANTY IS IN LIEU OF AND TO THE EXCLUSION OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. *INSTECH, INC.'S* LIABILITY AND THE BUYER'S EXCLUSIVE REMEDY FOR BREACH OF THE FOREGOING WARRANTY SHALL BE LIMITED TO THE REPAIR OR REPLACEMENT OF THE PRODUCT OR REFUND OF THE PURCHASE PRICE. UNDER NO CIRCUMSTANCES WILL *INSTECH* BE LIABLE TO THE BUYER IN ANY WAY FOR DAMAGES, INCLUDING ANY LOST PROFITS, LOST SAVINGS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR MISUSE OF THE PRODUCT, OR *INSTECH'S* BREACH OF THE FOREGOING WARRANTY

Safety Information



Within this manual, a set of symbols are used to call attention to Safety Warnings, Caution Notices, and Notes. The symbols are defined in

Figure 1:



		
Warning Symbol Indicates a safety guideline that should be followed at all times	Caution Symbol Indicates a caution notice that calls attention to a potential safety risk	Note Symbol Indicates an important notice which should be given careful consideration.

Figure 1: Symbol Legend



Documentation: The LN2-VC2L cooling system is just one component of your *INTEC* temperature control system. Be sure to carefully read, and follow the safety guidelines outlined for each component device in the system.



Electrical Connections: Always use the correct Input voltage and frequency according to the end-user's region. 110VAC 60Hz AC for North America, 220VAC 50Hz in Europe, etc. *INTEC* will configure each element of the *INTEC* temperature control system with an appropriate receptacle before delivery. NEVER use power plug adapters when using the LN2-VC1L, or any other part of your *INTEC* System.



Liquid Nitrogen Handling: It is strongly recommended that the user take the time needed to fully read and understand the Liquid Nitrogen safety warnings outlines in this section.

- ◆ Only use liquid nitrogen in areas with adequate ventilation. Liquid nitrogen boils at -196°C , changing state to nitrogen gas. Nitrogen gas (78% of the atmosphere) is colorless, odorless, nonflammable, and nontoxic. *However, it will not support life!* Nitrogen gas displaces ambient oxygen and could cause asphyxiation, possibly resulting in serious brain injury or death. Ambient air at STP typically contains 21% oxygen, and less than 19.5% oxygen is considered to be an oxygen deficient atmosphere. 1 cubic foot of liquid nitrogen will expand to 696 cubic feet of 100% nitrogen gas at 70°F . *Loss of consciousness from nitrogen asphyxiation can occur without any warning signs!* A victim will seldom recognize the signs of impending asphyxiation. Never fill liquid nitrogen containers in confined areas without adequate ventilation, and it is strongly advised to have another person present when conducting liquid nitrogen transfer operations.
- ◆ Cryogenic containers must always be stored in an upright position.
- ◆ Always wear appropriate safety equipment, including loose-fitting leather or cryogenic gloves and eye and face protection. Remove all metal jewelry such as rings, bracelets, and watches.
- ◆ Avoid rough handling of cryogenic containers. A cold exterior surface can indicate the loss of vacuum in the outer jacket. In this case contact the manufacturer or supplier immediately.
- ◆ Never attempt to change or remove any of the fittings on the cryogenic containers.
- ◆ Use only containers that are approved for use with liquid nitrogen, such as the containers supplied with *INTEC* liquid nitrogen pumps. Liquid nitrogen should never be handled in open pail type containers.
- ◆ Transfer of liquid nitrogen into warm lines or containers must be done slowly in order to prevent thermal shock and possible buildup of pressure.
- ◆ Liquid nitrogen transfer lines should extend to the mouth of the open container. Never allow a liquid nitrogen stream to fall a distance through the air to reach a container on the floor. Elevate the container on an appropriate stable platform, so that the liquid stream stays inside.
- ◆ When transporting the LN2 container from the cryogenic container to the work site, watch carefully for other people or obstacles. Never transport LN2 in a passenger elevator -- use the stairs instead.
- ◆ If liquid nitrogen is splashed in the eyes, flush with water for at least 15 minutes and seek immediate medical attention. For skin contact, soak the affected area in still ambient water and seek immediate medical attention.
- ◆ Be sure to use LN2-rated funnels when filling a low-pressure Dewar. Using a funnel not rated for LN2 can be dangerous!



Current Limiting Devices: Most devices used in your *INSTECH* System contain a replaceable fuse rated appropriately for each device. The fuse for the LN2-VC2L is located within the AC power receptacle (or in a standalone fuse holder) and can be accessed using a flathead screwdriver. **The fuse should only be accessed when the device is unplugged from the AC power supply.** Never replace the fuse with a fuse of a different current rating than what is indicated on the back panel of the controller.



Extreme Temperatures: While the LN2-VC2L case should never reach dangerous temperatures, special care should be taken concerning the Stage/Plate/Chuck/ probe station being controlled as well as the LN2 transfer lines. Both the chassis and sample temperature can exceed 60°C, or drop below -20°C depending on the configuration. Transfer lines may be extremely hot or cold depending on the current operating state. Always be aware of the operating temperature of your stage and avoid physical contact accordingly. Contact with extreme temperatures, hot or cold, may cause bodily harm.



Power Button: Power is supplied or interrupted on the LN2-VC2L via an illuminated push-button switch located on the front panel of the controller. This button can be identified by the power symbol below in **Figure 2**.

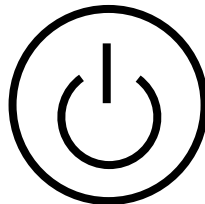


Figure 2. Primary power switch indicator



Part 1. Introduction

The LN2-VC2L is a precision instrument for cooling large thermal blocks via the flow of LN2/N2 gas. The LN2-VC2L uses a series of valves to control the flow of a pressurized LN2 source by controlling the flow of gas state LN2 only. It must be used in conjunction with a standalone temperature controller such as the mK2000, which calculates how the valve box must be enabled/ disabled to control the flow of LN2. Originally developed for use with hot and cold stages, the LN2-VC2L system can be used for a wide variety of applications.

The LN2-VC2L is a drop-in replacment for the LN2-VC1L, and offer increased maximum flow rates and cooling power.

Note that by default, the insulated LN2 supply line that connects the pressurized dewar to the plate/chuck is NOT included, and must be purchased seperatley.

1.1 Specifications

Table 1: Table of General Specifications

General Specifications	
Specification	Value
Input Power Requirments	100-240VAC 50/60 Hz Universal input [200W max power]
Temperature Range	-190°C to 400°C
Max Flow Rate	150L/min
Max LN2 Pressure	Pressure-release valve rating is indicated on the controller back panel. Configurations include: +1.5 Bar [1.5 BAR pressure release valve] +3.4 Bar [3.4 BAR pressure release valve]
Inlet Port Size	8mm OD Compression fitting
Outlet Port Size	¼” NPT
Chassis Dimensions	38.5cm x 36.5cm x 20cm
Environmental requirements	Ambient Temperature 0°C ~ 50°C, humidity < 85%RH

Part 2. System Setup/ Operation





2.1 Unpacking and Equipment List for LN2-VC1L

Please inspect the shipping carton for any signs of damage that may have occurred during shipment. If the shipping carton shows any signs of damage, please retain the shipping carton for insurance purposes. Open the shipping carton and remove and inspect the contents. Please report any occurrences of shipping damage to *INTEC* immediately.



Shipping Carton: It is highly recommended to retain the shipping carton for the duration of the 1-year factory warranty. Using the original packaging for manufacturer-approved return shipping greatly reduces instances of shipping damage.

Table 2: Standard Parts for the mk2000B

Standard Parts for the LN2-VC2L	
One (1) LN2-VC2L valve box	
One (1) Power cord (Region Specific)	
One (1) Cooling IO Cable	
One (1) Insulated Stainless Steel transfer Line (2m, 8mm compression fittings)	
OPTIONAL: One (1) insulated LN2 supply line (connects dewar to thermal plate) – CGA295	

2.2 System Connections



Figure 3. Front Panel of LN2-VC2L

Place the LN2-VC2L on a level, clean surface with ample ventilation. Because the valve box is equipped with radiator fans on the rear panel, make sure the airflow is unobstructed by nearby walls or objects. Connect the LN2-VC2L to an AC power source (200W) with the included AC power cable. Note that the AC power socket includes a 5A protective fuse – never replace this fuse with another with a rating other than 5A 250VAC.

For normal operation, the LN2-VC2L should be connected to the mK2000B temperature controller via the included Cooling I/O port (Item 3 in **Figure 3**) with the included PS/2 cable (PS/2 cable). If using the valve box with manual control only via the control knob, only the AC power cable connection. USB and Ethernet ports are used only for debugging/ configuration on the LN2-VC2L, and the GPIO/ Intake heater ports may be ignored unless the valve box has been pre-configured to utilize them.



Figure 4. Back Panel of LN2-VC1L/ LN2-VC2L

The rear panel of the LN2-VC2L is shown in **Figure 4**, and a system connection diagram is shown in **Figure 5**. The LN2 inlet marked “IN” connects to the stage/plate/chuck being controlled via a the included LN2 transfer line. The “Out” port can either be partially diverted for either gas-purge or convection cooling, or it can be safely vented to an exhaust duct. At all times when using the LN2-VC2L, be sure to consider where the N2 exhaust gas is going, and take appropriate measures to prevent nitrogen gas buildup in the work area. Nitrogen is non-toxic and odorless, but it can displace oxygen, which can cause asphyxiation, possibly resulting in serious brain injury or death. No workspace or experiment is the same, so it is the responsibility of the user to ensure a safe operating environment for the LN2-VC2L. LN2-VC2L exhaust gas may not be suitable for window defrosting since the gas is not pre-heated before being expelled.

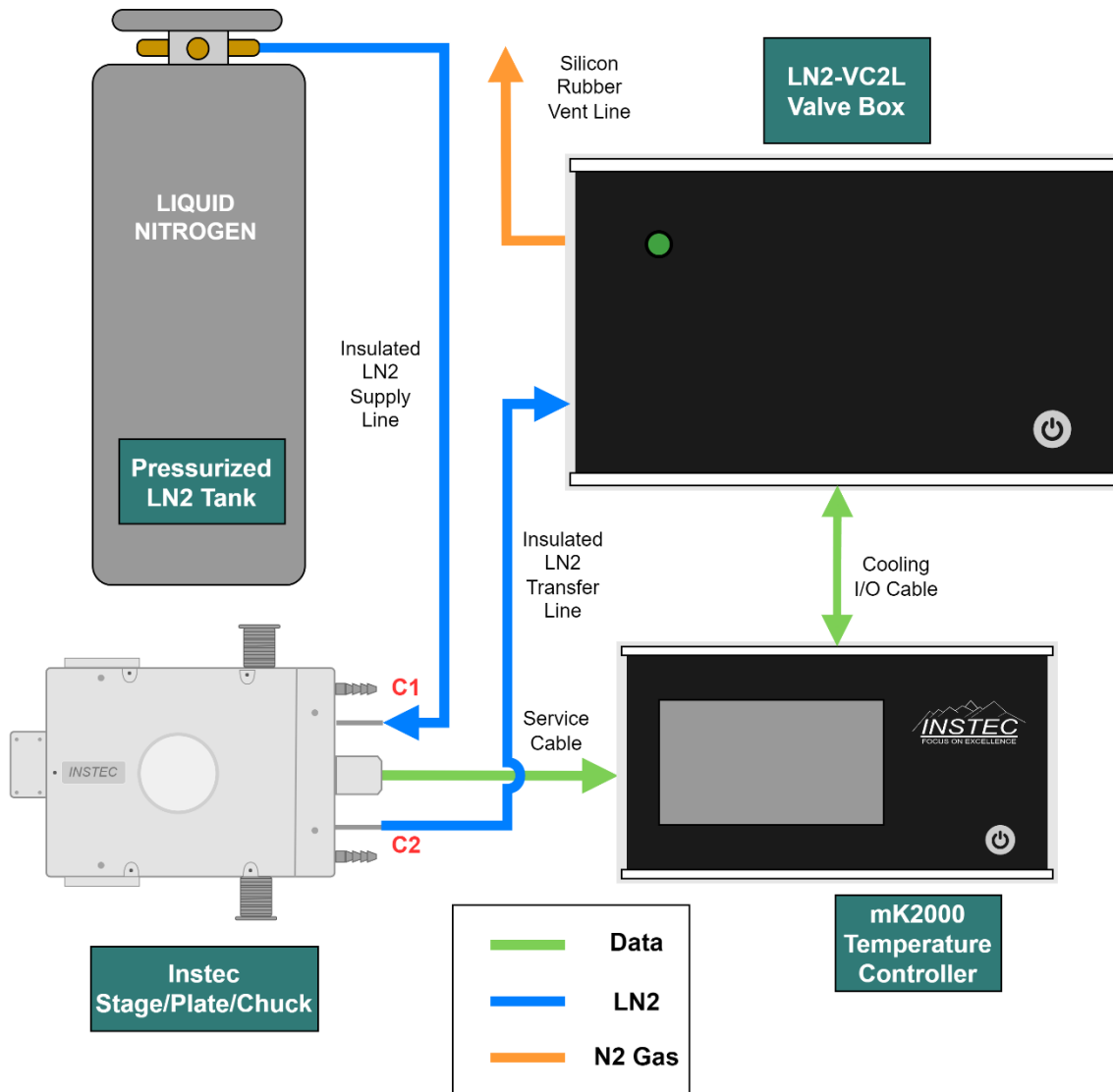


Figure 4. System Connection Diagram for LN2-VC1L/ LN2-VC2L and mK2000B



Installation Safety: Do not connect the power cable and turn on the mK2000B until all other connections being used have been made.



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2.3 Operation

Once connected to an appropriately configured mK2000B temperature controller, the LN2-VC2L is completely controlled via the mK2000 temperature controller. To apply a manual control signal, rotate the manual control knob on the front panel. At any time if the LN2 pressure exceeds the maximum pressure rating (Either 1.5Bar or 3.4Bar), the over-pressure relief inside the valve box will trip and vent the LN2 transfer line. If the valve box vents, immediately close the valve on the LN2 dewar to stop the flow of LN2 through the system.

During operation, the status LED on the front panel of the LN2-VC2L will blink according to the power output signal from the mK2000 or manual control knob. The duty cycle of the LED blinking corresponds to the power signal, ie. 50% output power corresponds to 50% duty cycle on the status LED. This signal is used to determine the open status of the valves inside the LN2-VC2L.

Special consideration should be made towards condensation prevention when operating the LN2-VC2L with large thermal plates/ chucks. Condensation will occur on the transfer lines, and the thermal area, when they are cooled for extended periods in an air environment. Condensation can be mitigated by ensuring a dry environment around the plate and transfer lines, using Vacuum-insulated transfer lines, or by adding insulation to the LN2 transfer lines. Over extended-duration experiments, condensation may build up on the plate or transfer lines, and this condensation will melt once the system is brought back to room temperature. Carefully consider where the system will be positioned in the work area, and don't place any delicate electronics or materials beneath the plate or transfer lines. Drip trays may be utilized to help direct condensate into safe collection areas.

For more information on the operation of the LN2-VC2L and mK2000 temperature controller, consult the user's manual for the mK2000 itself or contact [**support@instec.com**](mailto:support@instec.com).

Appendix I – User Replaceable fuses

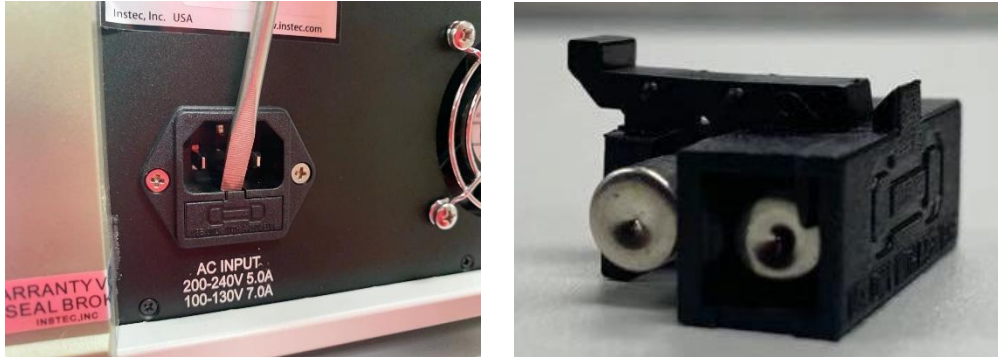


Figure A1: User replaceable AC Input Fuse Holder (left), and AC Input Fuse Drawer (right)

All LN2-VC2L units come standard with a user-replaceable fuse located on the AC input port, visible in **Figure A1**. The replacement fuse specification is always printed below the fuse holder in white text and is different depending on the input voltage. To access this fuse, first, disconnect the controller from AC Power. Next, it is recommended to use a small flathead screwdriver to pry open the fuse drawer. It may take some force to remove the fuse drawer. Once removed, inspect the fuse to visually verify that the fuse is intact, and use the continuity setting on a digital multimeter to verify continuity.