

Liquid Nitrogen Generator Instruction Manual

EMP-14A

Export Control Policy

When applying a refrigerator to a cryocooler for optical sensors, the cryocooler falls under row 6.A.2.d.2 of the control list established by The Wassenaar Arrangement, which is equal to row 10(2) of appended table 1 of Japan's Export Trade Control Order.

Customers must follow all related rules and regulations such as Foreign Exchange and Foreign Trade Act and take appropriate procedures when exporting or re-exporting our refrigerators.

Introduction

Thank you for choosing our products. This instruction manual gives information and precautions on handling, installation, operation, and maintenance of the product.

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. To ensure proper use of this product, read this instruction manual carefully and keep this manual close at hand so that you can use for reference during operation.

If you purchased our other products and/or optional devices with this product, read relevant instruction manuals carefully.

- (1) It is strictly prohibited to duplicate or distribute this instruction manual or any of its parts to a third party without written permission from ULVAC CRYOGENICS.
- (2) Information in this document is subject to change without notice due to specification change or the improvement of the product.
- (3) If you have any questions or comments on this document, please do not hesitate to contact us. The phone numbers of local customer support centers are listed at the end of this manual.

Safety Conventions

Our products have been designed to provide extremely safe and reliable operation when properly used. Following safety precautions must be observed during normal operation and when servicing them.



WARNING

A warning describes safety hazards or unsafe practices which could result in severe injury or loss of life.



CAUTION

A caution describes safety hazards or unsafe practices which could result in personal injury or equipment damage.



Toxic gas or chemicals used.

There is a risk of severe injury upon contact.



Corrosive chemicals used.

There is a risk of severe injury upon contact.



Flammable gas used.

There is a danger of fire or burn injury.



Explosive gas used.

There is a risk of fire or explosion.



Hazardous voltage .

Electric shock may cause severe injury or loss of life.



Hot heating part present.

There is a risk of burn injury.



Low-temperature area present.

There is a risk of frostbite. Do not touch.

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Safety Instructions

1. Danger of electric shock: Do not touch live part.

To this unit, voltage that would cause electrocution or serious injuries is applied. It is extremely dangerous to touch the live part inside the unit. Make sure to turn OFF the main power source before performing installation, maintenance or repair. Contacting the internal parts that are not insulated may damage human body or equipments such as electrical shock.

Connect the earth wire to D type grounding.

**2. Danger of oxygen deficiency:
Ventilate well.**

Nitrogen gas itself is not toxic to human bodies but it reduces the oxygen concentration in the atmosphere (the oxygen concentration of 18% or below is defined as an oxygen-depleted state). Choose a well-ventilated and good-air-circulated location to install the present unit, and install a ventilator with a capacity of at least 1000m³/hour airflow. In addition, do not stay together with a dewar containing liquid nitrogen in a sealed space, such as an elevator or a car.

3. Danger of explosion: Do not seal LN2.

The volume of nitrogen gas is 700 times of liquid nitrogen. Containing liquid nitrogen of atmospheric pressure in an airtight space makes it into high-pressure gas as high as 700atm, possibly resulting in explosion. Use liquid nitrogen in the condition constantly open to air.

**4. Danger of burns or frostbites:
Never touch high temperature and
ultra-low temperature parts.**



Liquid nitrogen provides temperature as low as -196°C . If liquid nitrogen is handled without protective wear, frostbites, loss of sight, and other risks are anticipated. Be sure to wear leather gloves, goggles, trousers without turnips, etc. to handle liquid nitrogen. In addition, take care of liquid nitrogen transport piping, too. In this unit, there is a part with danger of burns if it is touched directly. Carry out maintenance, repair, etc. at least 30 minutes after the unit is stopped.





**5. Danger of Explosion: DO NOT expose to
corrosive gases.**



In this unit, high-pressure Helium gas is filled. To disassemble or dispose of the unit, parts, and others, be sure to discharge gas (under regular maintenance, there is no need to discharge gas). In addition, never attempt to install the apparatus under the atmosphere of hydrochloric acid-based, chlorine gas-based, and other corrosive gases.

Disposal Considerations

Disposal of industrial waste is regulated by national or local governments. Follow all applicable local or national laws, regulations or guidelines when disposing of our products.

				WARNING
When the refrigerator unit may have pumped toxic or dangerous gases, you must contact your safety supervisor at the time of disposal, and follow the instructions to remove hazardous substances before disposing.				

We provide Safety Data Sheet (SDS) of our products upon your request.

Please contact us when necessary.

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1. General Description of the System

1.1 Liquid nitrogen generator (EMP-14A)

EMP-14A Liquid Nitrogen Generator provides liquid nitrogen by cooling down, condensing and liquefying nitrogen gas with the cold head (Model:S050).

Liquid nitrogen is stored in the dewar, and can be dispensed to another container with easy operation. With the optional automatic transfer system, liquid nitrogen can be automatically transferred to the dewars of customers' equipments.

Nitrogen gas source can be selected from two types; (1) PSA nitrogen generator, (2) Membrane nitrogen generator.

Liquid nitrogen generator is hereafter referred to as "EMP-14A" in this manual.

1.2 Helium gas compressor (model:SA115-C)

This unit is mounted in the lower part of EMP-14A, compress Helium gas and supply to the cold head to provide cryogenic temperatures. It is automatically turned on and off by the control circuit of EMP-14A.

Helium gas compressor is hereafter referred to as "SA115-C" in this manual.

For details of this equipment, please refer to the operation manual for "SA115-C".

1.3 PSA (Pressure Swing Adsorption) Nitrogen Generator (type GN-10i)

PSA Nitrogen Generator GN-10i generates highly concentrated nitrogen from air using adsorber and supply the gas to EMP-14A. The nitrogen generated here is used as the material for liquid nitrogen and is also used to take out liquid nitrogen. PSA nitrogen generator is hereafter called "GN-10i" in this manual. When we describe things that are in common with membrane nitrogen generators, they are collectively referred to as "nitrogen generators".

Please refer to the operation manual of GN-10i for details.

1.4 Membrane Nitrogen Generator (type IM-120)

Membrane Nitrogen Generator IM-120 takes in dry air from user's equipments and generates highly concentrated nitrogen with membrane separation technology. The nitrogen generated here is used as the material for liquid nitrogen, and is also used to dispense liquid nitrogen.

Membrane nitrogen generator is hereafter called "IM-120" in this manual. When we describe things that are in common with PSA nitrogen generators, they are collectively referred to as "nitrogen generators".

Please refer to the operation manual of IM-120 for details.

2. Component Description

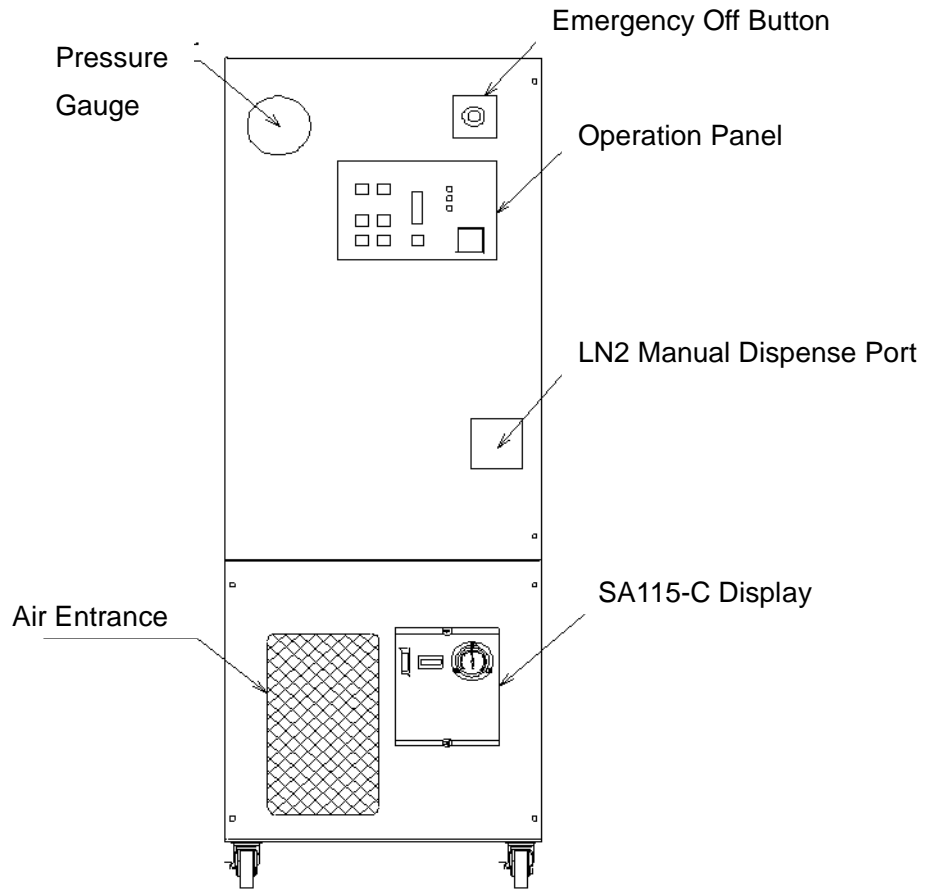


Figure 2-1 Front view of EMP-14A

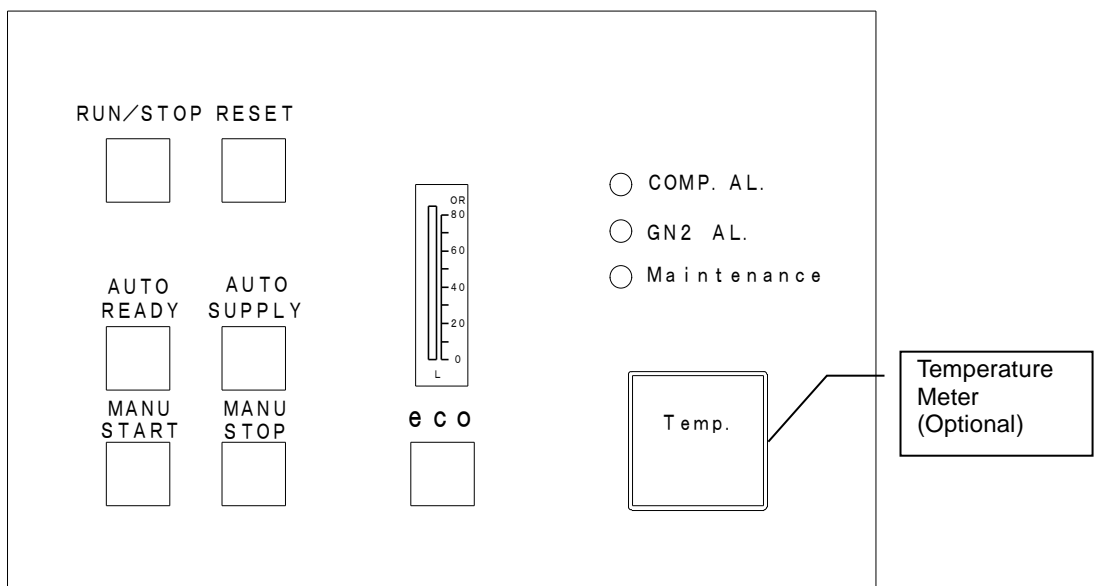


Figure 2-2 Operation panel of EMP-14A

2.1 Front view of EMP-14A (Figure 2-1)

Emergency off button	Press this button to interrupt power supply to the control circuit to stop such operations as dispensing liquid nitrogen. Do not use this button except for emergency.
Front door	Remove two screws to open this door. Inside the door, there are a liquid nitrogen dewar, a cold head and electric circuits. Open this door only for periodic inspection, maintenance and repair services.
LN2 manual dispense port	Press the panel to open. Inside the panel, there is a tube connector for liquid nitrogen flexible hose. Since the port may reach extremely low temperature, use cautions not to touch such port during or right after dispensing liquid nitrogen.
Pressure gauge	Displays the pressure inside the dewar.
SA115-C display	Displays the status of SA115-C. Reset with RUN/STOP button after the cause of an error condition of SA115-C is cleared.
Air entrance	This part is for taking air into SA115-C for air-cooling. Do not block, always leave space in front.

2.2 Operation panel of EMP-14A (Figure 2-2)

RUN/STOP	Use this button to start or stop the main unit. This button lights green during normal operation, and blinks when an error occurs. Note that the light is off when the device is in eco-mode standby.
RESET	This switch is used to clear the error state of EMP-14A.
AUTO READY	Use this button when you wish to use automatic

transfer function. While the AUTO READY is ON, the EMP is in stand-by mode for automatic transfer, and automatic transfer to the destination set by receiving the signal is possible. While standing by, the button lights green. When the level sensor in the transfer destination detects any trouble, green light blinks.

AUTO SUPPLY

While using the optional automatic transfer function with our level sensor, press this button to start transfer while in stand-by mode. When automatic transfer is activated, the button lights white.

MANU START

Press this button to manually dispense liquid nitrogen from LN2 manual dispense port. (To be referred to as "Manual supply") The manual supply is terminated automatically in 10 minutes. This button lights green during manual supply, and blinks from 30 seconds before the automatic termination. When you wish to supply more, press this button again while it is blinking to extend 10 more minutes.

MANU STOP

Press this button to interrupt the manual supply of liquid nitrogen supply operation.

Indicator

Displays the guideline amount of liquid nitrogen in the dewar.

eco

Press this button to switch to eco-mode operation. The button lights blue when in eco-mode. Refer to "11. eco mode " for more detail.

COMP. AL.

Lights red when the SA115-C encounters an error. The RUN/STOP button blinks at the same time.

GN2 AL.

The indicator lights red when the nitrogen gas generator stops due to faults. Then RUN/STOP switch blinks as well.

Maintenance

This light illuminates when the maintenance interval of GN-10i is approaching.

Temperature meter

Temperature meter is an optional. It displays the temperature inside the dewar.

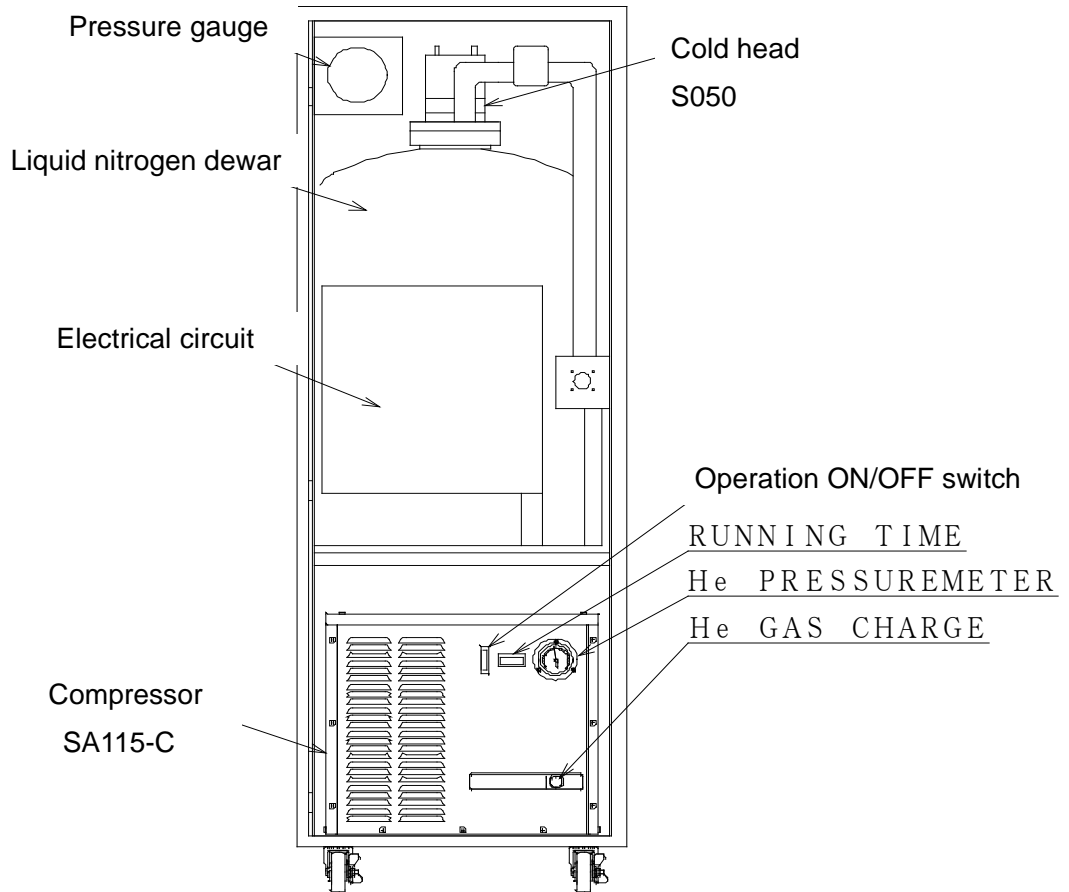


Figure 2-3 Inside of EMP-14A front door and lower panel

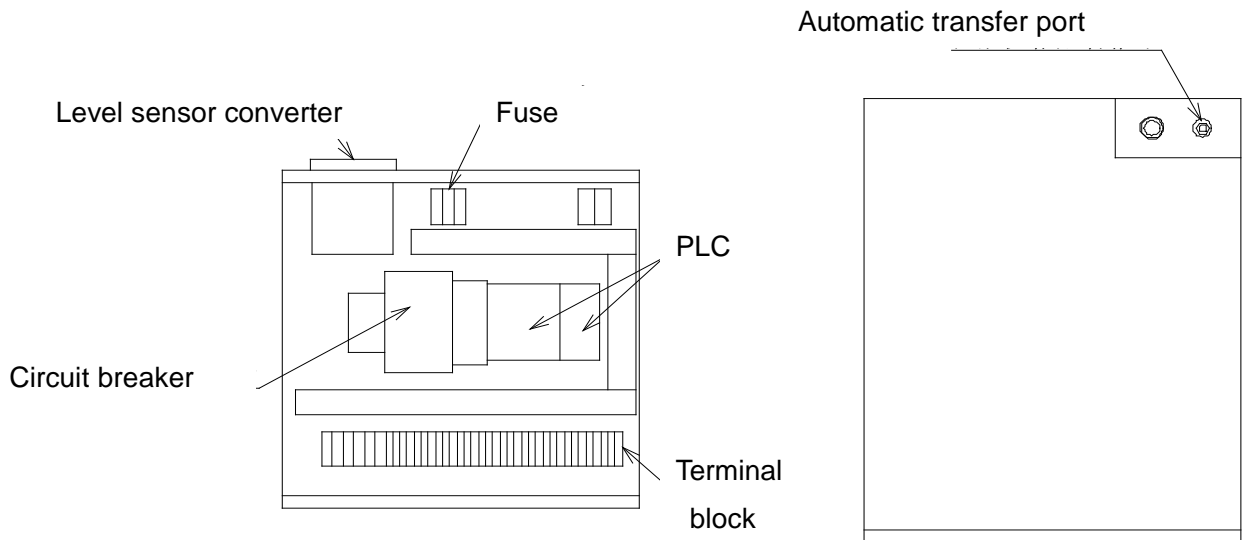


Figure 2-4 Electrical circuit

Figure 2-5 Top of EMP-14A

2.3 Inside of EMP-14A front door and lower panel (Figure 2-3)

Liquid nitrogen dewar	Stores liquid nitrogen up to 40 liters.
Cold head (S050)	The cold head works in conjunction with SA115-C compressor to achieve ultra-low temperature. The cold head requires maintenance services according to the time it operates.
Pressure gauge	Displays the pressure inside the dewar.
He PRESSURE METER	Displays the pressure of helium gas filled in SA115-C.
He Gas CHARGE	The port for charging helium gas. Do not touch except when needed, as touching it may result in helium leakage.
OPERATION switch	Use this lever to switch between start and stop of SA115-C. Normally, move the lever upward. This lever is also used to reset SA115-C in the event of a failure.
RUNNING TIME	Displays the total operation time of SA115-C. Use this information to perform maintenance properly.

2.4 Inside the lower panel on the back

L/R Switch (Back of SA115-C)	Use this lever to choose whether to switch start and stop of SA115-C from EMP-14A control circuit (REMOTE), or from RUN/STOP switch of SA115-C (LOCAL). The default setting is REMOTE. If it is changed to LOCAL, control of EMP-14A is disabled.
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2.5 EMP-14A Electrical circuit (Figure 2-4)

Power breaker	This is a protective breaker for control circuit of EMP-14A. It trips when an electric leak or short-circuit occurs.
Fuse	Protective fuses for AC circuit (F-1, 2: 3A) and protective fuses for DC circuit (F3: 2A).
Sequencer	A controller used to control the operation of EMP-14A system. This functions to operate the necessary devices upon reception of signal from each sensor. In the event of an error, please inform the status of input-and-output lights of the sequencer when contacting us.
Level sensor converter	An electric component for detecting the amount of liquid nitrogen in EMP-14A. Since it is adjusted precisely, do not touch any buttons.
Terminal block	Connected to the wiring of signal reception of the electric appliances and automatic transfer target dewar.

2.6 EMP-14A Top side (Figure 2-5)

Automatic transfer port (Optional)	Swagelok connector to connect liquid nitrogen auto-transfer line. Do not touch during and right after supplying liquid nitrogen as it is extremely cold.
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3. Flow Diagram

<Note> The configuration may differ depending on the customer specifications.

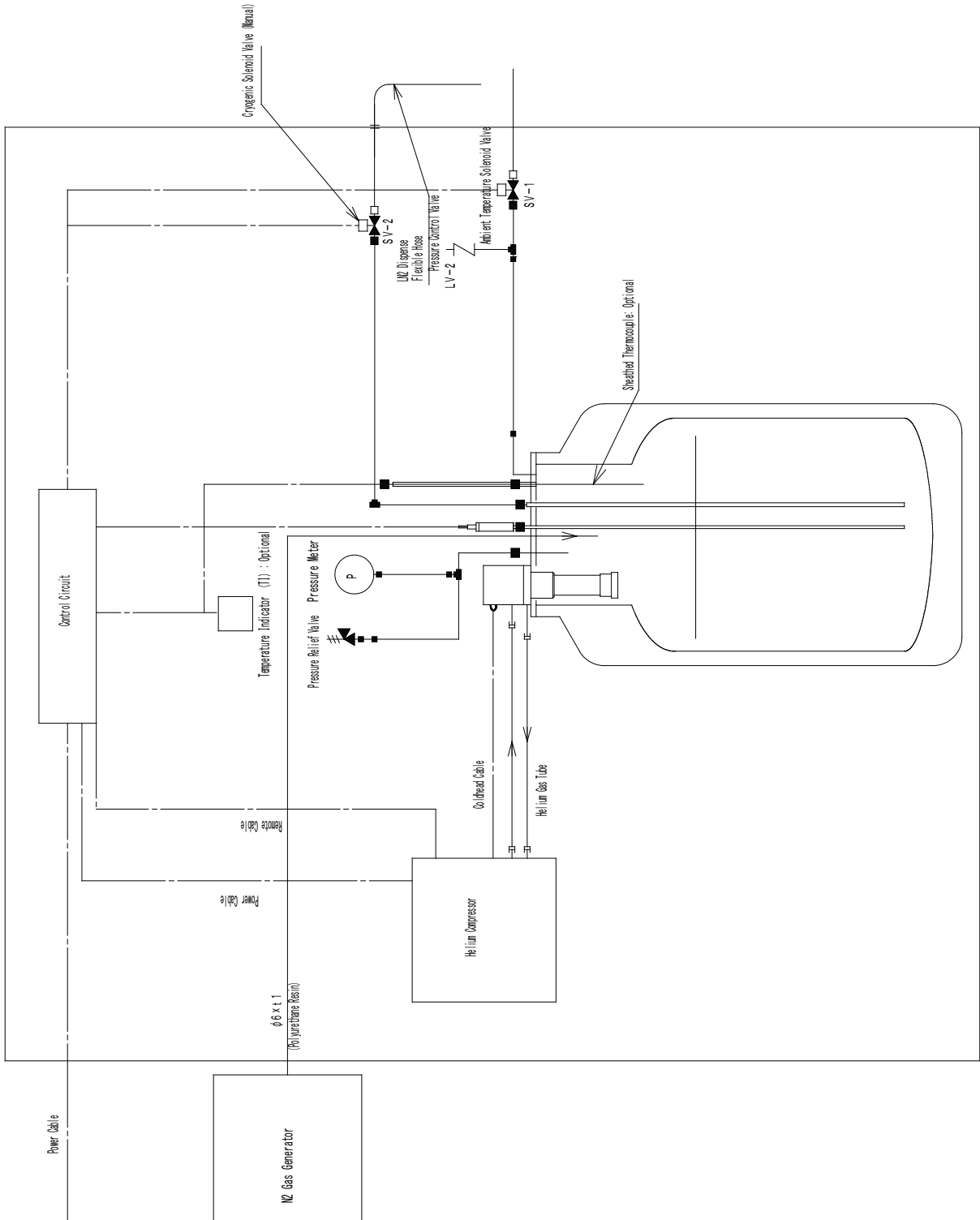


Figure 3-1 Flow Diagram

4. Specifications

4.1 Liquid nitrogen generator

Type	:EMP-14A
Liquid nitrogen production rate	:14L/day (50/60 Hz)
High pressure gas processing capacity	:9.1 m ³ /day
Dimensions	:600 [W] x 750 [D] x 1688 [H]
Weight	:Approx. 235 kg (excluding LN ₂)
Liquid nitrogen storage capacity	:Up to 40L
Cold head	:S050
Compressor	:SA115-C
Cooling method	:Air-cooled (Intake air from the front, exhaust from the back)
Ambient conditions	:Ambient temperature: 10 – 35°C Relative humidity: 80% or lower (Non-condensation other than LN ₂ manual dispense port)

- EMP-14A is for indoor use only.
- As EMP-14A is air-cooled, make sure that the air intake and exhaust ports are always open, not blocked.

4.2 PSA (Pressure Swing Adsorption) nitrogen gas generator

Type	:GN-10i
Dimensions	:400[W] x460[D] x900[H]
Weight	:Approx. 60kg
Cooling method	:Air-cooled (Inhale from the front, exhaust from the back)

- GN-10i must be installed indoors.
- The GN-10i are not usable under the atmosphere of organic solvent.
- Air entered from the front is discharged from the back. Do not block the ports.

4.3 Membrane nitrogen gas generator

Type	:IM-120
Dimensions	:150[W] x300[D] x800[H]
Weight	:Approx.20 kg

- IM-120 must be installed indoors.
- The IM-120 is unable in the atmosphere of organic solvent.

5. Utilities

5.1 Power source (for EMP-14A)

Voltage	: 200VAC±10%, three-phase
Power capacity	: 20A or more
Power consumption	: 1.7/2.0 kW (50/60 Hz)
Connection	: Round type crimping terminal for M5



CAUTION

Use D-type earth ground for safety.

5.2 Power source (for the use with GN-10i)

Voltage	: 100VAC±10%, single-phase
Power capacity	: 15A or more
Power consumption	: Approx.400W (50/60 Hz)
Connection	: 3 prong plug



CAUTION

Use D-type earth ground for safety.

5.3 Dry air for IM-120 (when using IM-120)

Pressure	: 0.5MPa – 1.0MPa
Flow rate	: 120L/min or more
Dew point	: -17 °C or below (at atmospheric pressure)
Air requirement	: Oil-free

Note1: Use compressors equipped with air dryer.

Note2: **Supply dry air continuously.**

6. Installation

6.1 Conditions of installation site

- (1) Install the equipment at a level and stabilized indoor place where direct sunshine can be avoided and well ventilated. Power supply or other utilities should be located nearby.
- (2) The ambient temperature should be from 10°C to 35°C and humidity is 80% or below.
- (3) Keep the following spaces for maintenance.
Spaces other than the back are required only at the time of maintenance and check.

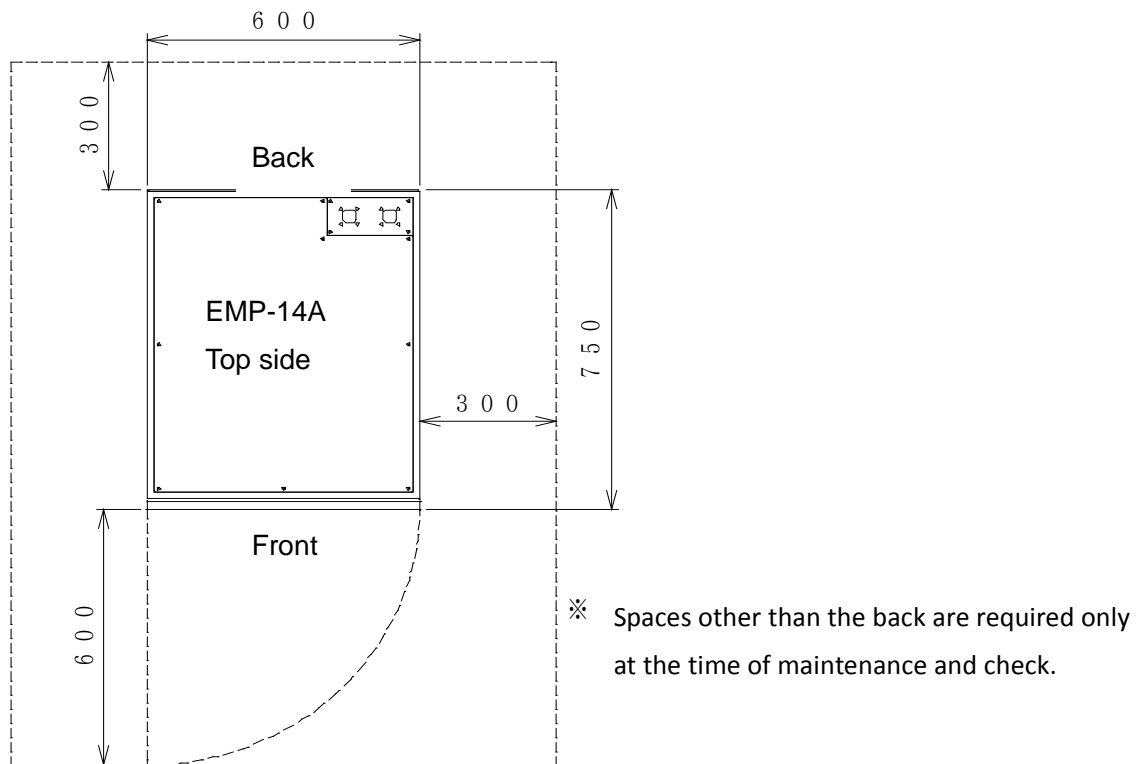


Figure 6-1 Maintenance space for EMP-14A

- (4) Lock the wheels to fix the equipment.

6.2 Connection of GN-10i to power source

	 WARNING
Ensure that main power source is disconnected before making the connection to power-supply.	

	 WARNING
Following procedure must be undertaken by an authorized electrician familiar with the structure and risk of the product. Failure to observe this warning may result in severe bodily injury or fatal accident.	

- (1) Use tools such as circuit tester to check that the supply voltage is within the appropriate range as described in "5. Utilities".
- (2) Plug the power-supply cable which comes out from the back of GN-10i
- (3) Turn on the power breaker on the back of the GN-10i.

6.3 Dry air connection to IM-120

- (1) Attach the connector for tubes to the dry air valve. Screw size is Rc1/4.
- (2) Onto the connector attached as in the step (1), attach the tube for dry air supply. Connect the other side of the tube to "AIR IN" connector on the back side of IM-120.



6.4 Utility connection of EMP-14A


Remove the back panel of EMP-14A and locate holes for utility connection on the bottom. Connect cables through these holes including power-supply, Nitrogen tube and remote cables of Nitrogen generation system, signal cables for automatic transfer destination.


6.4.1 Power-supply connection of EMP-14A

	 WARNING
Ensure that main power source is disconnected before making the connection to power-supply.	

- (1) Use tools such as circuit tester to check that the supply voltage is within the appropriate range as described in “5. Utilities”.
- (2) Connect the crimping terminal side of power cables to EMP-14A through the holes on the bottom. Connect the cables that have matching marks on the terminal block (R, S, T, E). If the connection is inadequate, it may result in incidents such as a fire while EMP-14A is in operation.
- (3) When the connection to the terminal board is made, attach the power cable to the circuit breaker and supply electricity by turning on the breaker in the electric circuit part of EMP-14A. Be sure to confirm that the power is supplied to the sequencers or other parts in the electric circuit of EMP-14A.

	 WARNING
Do not connect the earth ground wire to power lines. It may result in electric shock or electric leakage.	

 CAUTION
When you operate multiple devices with one power source, be aware of the total capacity. Lack of capacity invites overcurrent (voltage drop) and may result in the equipment failure.

 CAUTION
Only the personnel who have sufficient knowledge and skill on electric connections or cables can perform the work to extend power cables.

6.4.2 Connecting nitrogen tube

Connect the nitrogen gas tube to the nitrogen gas inlet connector located on the dewar of EMP-14A. Connect the opposite side of nitrogen gas tube to the nitrogen gas supply valve on the generator.

6.4.3 Connection of “Nitrogen gas generator” remote cable

Connect a remote cable to the remote connector located inside of EMP-14A and the signal connector from the back of GN-10i , or “PRESSURE SWITCH OUT” connector on the back of IM-120.

Fix the back panel of EMP-14A when all the connections are made.

7. Electric Wiring

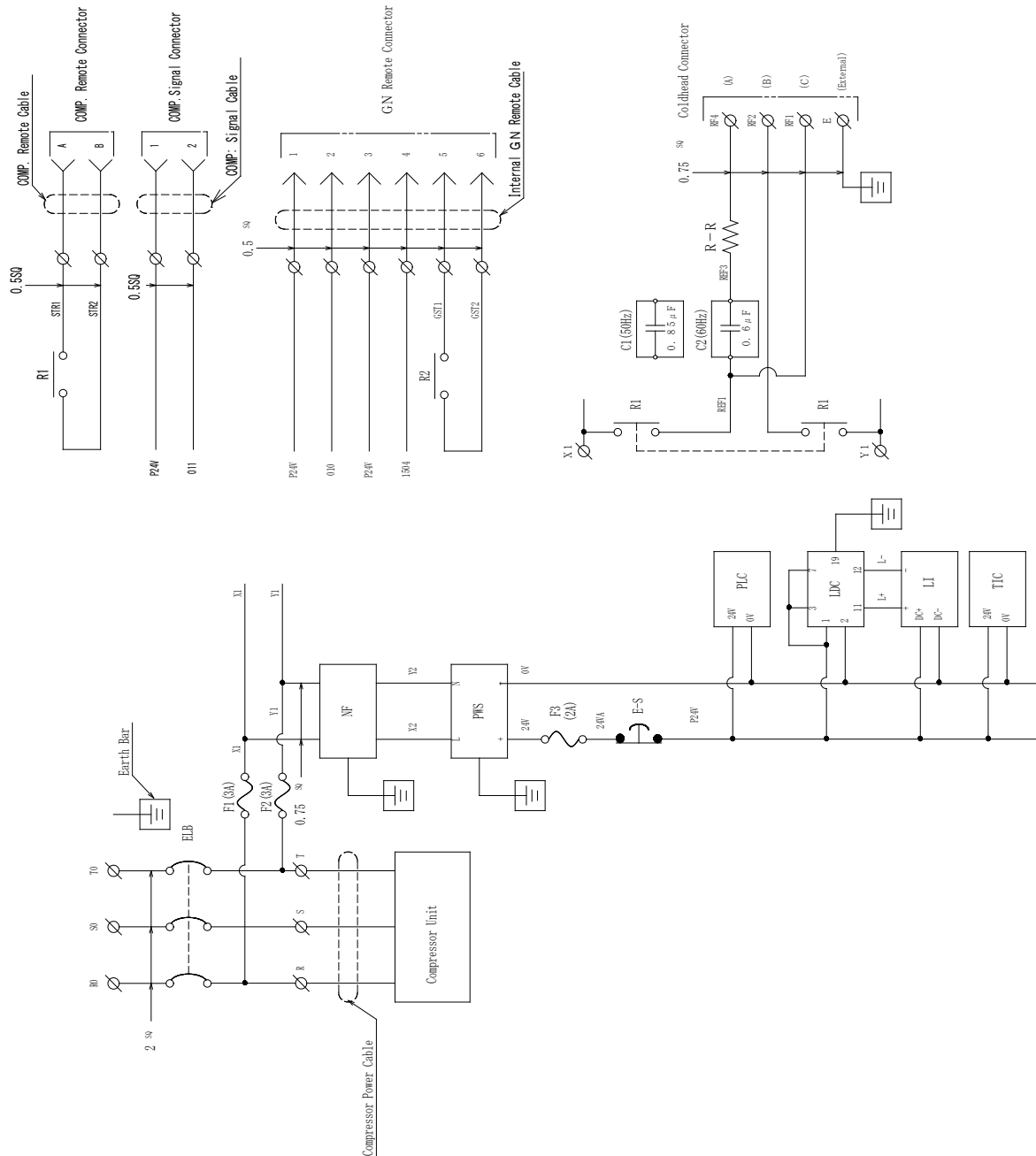


Figure 7-1 Electric wiring-1 EMP-14A

Symbol	Name
ELB	Earth Leakage Breaker
	Terminal Cover
NF	Noise Filter
PFS	Power Supply
PLC	Programmable Controller
LDC	Capacitance Level Meter Converter
LI	Level Indicator
TIC	Temperature Indicator
E-S	Emergency Off Switch
F-1, 2, 3	Fuse Holder
R1	Relay
R2	Relay
PBL1, 4	Lighting Button
PBL2	Lighting Button
PBL3	Lighting Button
PBL5	Lighting Button
PBL1, 3	Button Switch
PBL2	Button Switch
PL1, 2	Indicator Light
PL3	Indicator Light
C1	Condenser
C2	Condenser
R-R	Resistor
SV2	Cryogenic Solenoid Valve
SV1	Cryogenic Solenoid Valve

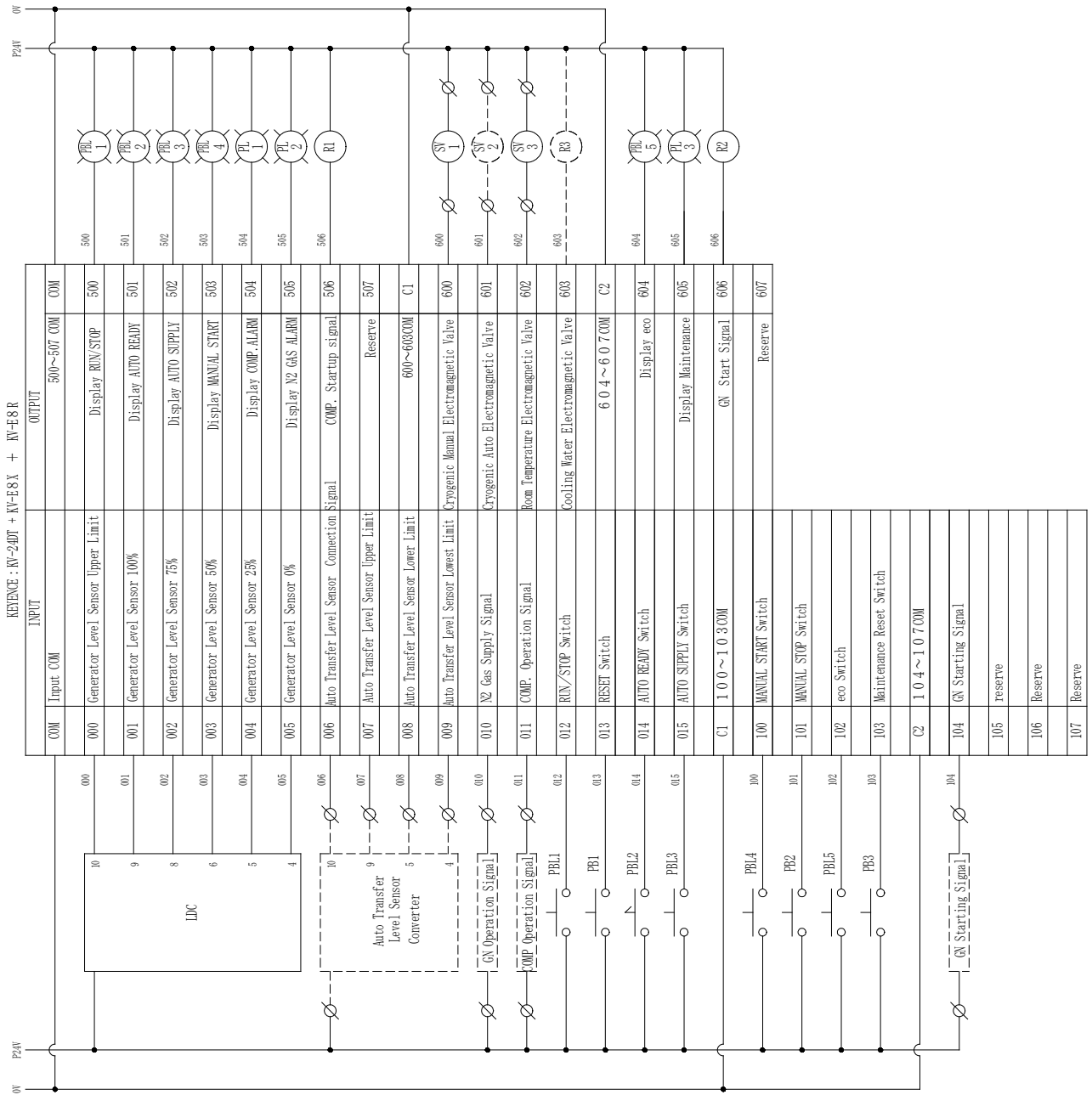


Figure 7-2 EMP-14A Electric wiring-2 (Sequencer)

8. Operation

8.1 Checks prior to operation

Check the following before starting the operation.

- (1) The power source of the EMP-14A and GN-10i is connected correctly.
- (2) The air inlet and outlet ports of EMP-14A and GN-10i are cleared.
- (3) The nitrogen gas tube is connected correctly between EMP-14A and the nitrogen generators.
- (4) The RUN/STOP switch of EMP-14A is turned off (lights off).
- (5) The main power source of EMP-14A and GN-10i are ON.
- (6) If IM-120 is used, a tube is properly connected between IM-120 and the dry air main valve
- (7) Nitrogen generator remote cables are properly connected between EMP-14A and the nitrogen generator.

8.2 Prepare for operation

8.2.1 Start supplying nitrogen gas

(When GN-10i is used)

- (1) Press RUN/STOP switch of EMP-14A. (Not GN-10i)
GN-10i starts up. When it starts operation normally, the POWER switch on EMP-14A flashes with long term light-on and short term light-off.
Note: Once operation starts, RUN/STOP switch does not work for the next six minutes. If you wish to shut down, press emergency off button.
- (2) 6 minutes later from the start of GN-10i, the ball in the front flow meter goes up, and nitrogen-gas supply starts. Check that the center of a ball is at the position of 10 N liter / min. When having shifted, please refer to the operation manual of GN-10i and adjust the flow rate by control valve.

(When IM-120 is used)

- (1) Open the dry air valve and supply dry air to IM-120.
The supply air pressure gauge "AIR INLET PRESSURE" shows dry air supply pressure.
- (2) At nitrogen gas pressure regulator, adjust the nitrogen gas pressure gauge "GN2 OUTLET PRESSURE" to 0.2 MPa. Nitrogen gas flow meter "GN2 OUTLET FLOW" is adjusted Nitrogen gas supply system.



CAUTION

Use nitrogen gas with recommended flow rate and pressure. Otherwise, liquid nitrogen generation may be hindered.

8.2.2 Start liquid nitrogen production

- (1) As nitrogen gas supply starts normally, the RUN/STOP switch lights green and SA115-C starts up, which means the start of liquid nitrogen production.
If the production does not start and the COMP.AL. illuminates, the power supply may be connected with reverse phase. In such a case, turn OFF the breakers of main power source and the electric circuit of EMP-14A, replace 2 cables out of 3 on the main power source, and turn on the power again.
- (2) At the time of initial startup, inside of the dewar is at room temperature and the time to cooldown is required. (It normally takes about half a day.) When the dewar is sufficiently cooled down, liquid nitrogen begins to be accumulated. The production continues until liquid nitrogen reaches 40 liters (100%). After that, production starts when the amount of liquid nitrogen in the dewar is below 30liters (75%), and stops when it reaches to 100%.

8.3 Shutdown

When EMP-14A is turned OFF with the RUN/STOP button, the RUN/STOP light flashes with shorter illumination and longer off for 10 seconds, and all the operations stop including LN₂ production, nitrogen gas supply. The RUN/STOP button lights off.

8.4 When resuming EMP-14A after suspending for 1 or 2 weeks



CAUTION

When the system is suspended operation for a long time, liquid nitrogen in the dewar will be replaced by the air. If the equipment is resumed with such condition, the LN₂ production efficiency deteriorates due to the moisture in the air. Follow the procedure below to resume.

(For the system with GN-10i)

- (1) Remove the remote cable from GN-10i before pressing the RUN/STOP switch of EMP-14A, and remove the panel on the right side of GN-10i.
- (2) Unplug the jumper connector located on the terminal block (1 and 2 of TB2) inside GN-10i.
- (3) Press the button on the front of GN-10i to startup and keep supplying nitrogen gas to EMP-14A for at least one hour.
- (4) Stop GN-10i, connect the jumper connector located on the terminal block (1 and 2 of TB2), and attach the remote cable for nitrogen gas generator and

close the right panel.

- (5) Press RUN/STOP button of EMP-14A to reboot the entire system.

(For the system with IM-120)

- (1) Open the dry air valve to supply dry air to IM-120.
- (2) Supply nitrogen gas to EMP-14A for at least one hour.
- (3) Press the RUN/STOP switch of EMP-14A to reboot the entire system.

NOTE: Please inform us in advance when the system is to be suspended for longer than two weeks.

8.5 Corrective action in the event of an error

In an event of an error, follow the procedure below and in "13.Trouble Shooting".

8.5.1 Corrective action when electric power failure occurs

EMP-14A and GN-10i will be automatically restored from electric power failure and they will be rebooted automatically when the electricity comes back. However, when the amount of liquid nitrogen inside is 75% or more, production may not be resumed at the time of rebooting. (This is the common precaution when rebooting).

8.5.2 Corrective action for COMP. AL.

- (1) Check the electric supply voltage and capacity.
- (2) Remove the acrylic panel of EMP-14A compressor display, turn down the lever of compressor OPERATION switch and return it to upward again.
- (3) Press RESET button of EMP-14A.
- (4) When a trouble is temporary, SA115-C re-starts. When the system stops due to abnormal temperature, it may unable to resume for about 30 minutes until the detection part is cooled down. When SA115-C does not start at all with COMP.ALARM illuminated, refer to "13.Trouble Shooting" and perform corrective actions.

8.5.3 Corrective action for GN2 AL.

(For the system with GN-10i)

- (1) Turn off the RUN/STOP switch of EMP-14A.
- (2) Reset the GN-10i.
- (3) Turn on the RUN/STOP switch to re-start EMP-14A.
- (4) When nitrogen gas begins to flow from GN-10i, GN2 AL. lights off.

(For the system with IM-120)

- (1) Turn off the RUN/STOP switch of EMP-14A.
- (2) Check that the supply pressure of dry air is 0.5 MPa or above.
- (3) When the nitrogen gas pressure is 0.2MPa and flow rate is 10NL/min, turn ON the EMP-14A RUN/STOP switch to restart.

8.6 Emergency off

In case of an emergency, press the emergency off button on the front panel to disconnect the control power supply and stop all the operation of EMP-14A.







CAUTION

An emergency shutdown might damage the equipment. Do not use this button except in emergency.

To restore, turn the emergency off button to the right.

9. Dispense Liquid Nitrogen Manually


			 WARNING
<ul style="list-style-type: none"> • When dispensing liquid nitrogen, make sure to keep the room well ventilated in order to prevent oxygen shortage. • Never attempt to seal liquid nitrogen. • When dispensing liquid nitrogen, be sure to put on protective fittings such as leather gloves. Also, use caution with handling liquid nitrogen supply flexible hose as it is in extremely low temperature right after dispensing. 			

9.1 Connecting liquid nitrogen flexible hose

Connect the coupler joint of the flexible hose to LN₂ manual dispense port on the front panel of EMP-14A. When connecting, do so while pushing down the outer ring part.

9.2 Dispense liquid nitrogen

To manually dispense liquid nitrogen, put the end of the flexible hose into the desired dewar, and press-and-hold MANU START button for 3 seconds. The supply stops automatically in 10 minutes. MANU START button starts to blink 30 seconds before the supply stops. To dispense more liquid nitrogen, press MANU START button while running to extend the supply for another 10 minutes. Press MANU STOP to stop dispensing.

 CAUTION
Never leave the place while manually dispensing liquid nitrogen. Keep the place well ventilated for prevention of lack of oxygen.





- ☆ Production of liquid nitrogen stops during manual supply operation.
- ☆ When nitrogen-gas supply is suspended, liquid nitrogen cannot be dispensed.
- ☆ When the EMP-14A is in standby for automatic transfer (when the AUTO READY is pressed), LN₂ manual dispense is limited to 25%. Manual dispense function is not available during automatic transfer is taking place. Perform manual dispense after automatic transfer finishes.

9.3 Disconnecting flexible hoses**CAUTION**

When disconnecting flexible hoses, make sure that they return to room temperature. Note that disconnecting hoses right after dispensing liquid nitrogen may result in damaging the O-ring inside the coupler joint.

Disconnect flexible hoses with the reverse procedure to connecting. Push down the outer ring of the EMP-14A side joint and pull out the flexible hose.

10. Automatic Transfer of Liquid Nitrogen

				WARNING
<ul style="list-style-type: none"> • While liquid nitrogen is being transferred, make sure to ventilate the room to prevent decrease in oxygen levels. • Never seal liquid nitrogen in the target devices. • Liquid nitrogen supply pipes reach extremely low temperature during and right after the transfer. Caution is also advised for the extremely cold gas released from the nitrogen gas release port in the target dewar. 				

10.1 Inspections before starting automatic transfer

Before starting automatic transfer, make sure of the following:

- (1) The level indicator cable is properly connected between EMP-14A and the level sensor of the target device.
- (2) Liquid nitrogen supply tube is properly connected between EMP-14A and the target dewar.
- (3) The nitrogen gas exhaust port of the target dewar is open to the atmosphere.

10.2 Automatic transfer

- (1) Turn ON the EMP-14A AUTO READY (Standby mode).
- (2) Automatic transfer will start when the level sensor detects the LN₂ level is 25% or lower. When our level sensor is used, automatic transfer can be started forcibly by pressing AUTO SUPPLY button. AUTO SUPPLY button lights white while transfer is taking place.
- (3) When the level sensor of the target device detects the LN₂ level reaches 100%, transfer will be terminated. Automatic transfer will also be terminated when the RUN/STOP or AUTO READY of EMP14A are turned OFF, the LN₂ level of EMP-14A is 0%, or supply of nitrogen gas stops.

✧ Liquid nitrogen cannot be dispensed manually during automatic transfer.

✧ When the EMP-14A is in standby for automatic transfer by pressing AUTO READY button, manual dispense of liquid nitrogen will be limited to 25%.

10.3 Time limit of automatic transfer

Automatic transfer is suspended when fixed time (defaulted to 10 minutes) passes from when the transfer begins, and the AUTO READY and the AUTO SUPPLY blink alternately. Blinking stops by pressing the AUTO READY button. Check the liquid nitrogen level in the target dewar, and contact us when any unusual conditions are found.

11. eco Mode

11.1 eco mode

The operation of EMP-14A will be turned to eco mode by pressing “eco” button on the operation panel. When in eco mode, EMP-14A is operated as follows.

- ✧ When EMP-14A does not receive any requests for LN2 production and transfer, EMP-0114A will be operated with the cycle of 22 hours' suspension and 2 hours production.
- ✧ When the signal to request automatic transfer is input while in eco mode, EMP-14A will start the transfer in six minutes.
- ✧ Manual dispense is not available during eco mode. To dispense manually, reset eco mode and wait for 6 minutes until the nitrogen gas generator resumes operation.
- ✧ When the liquid nitrogen level is lowered to 30L (75%) or less, EMP-14A resumes production automatically. It returns to eco-mode ten minutes later than the liquid nitrogen level reaches 40L (100%).



CAUTION

When resumed after long-term suspension or newly purchased, do not turn to “eco” mode immediately after starting operation. It may result in failure.

Set to eco mode after operating continuously for 2 weeks to 1 month. Operate for two weeks when it is suspended for about 6 months. If the suspended term is longer, operate for 1 month.

12. Maintenance and Inspections

12.1 Daily inspection

Check for the following as daily inspections.

- (1) The operating sound generated from each device is normal.
- (2) The pressure and flow rate of nitrogen gas are 0.2 MPa and 10 NL/min. respectively.
- (3) Helium gas pressure of SA115-C is within the appropriate range.
 - When suspended: 1.95 – 2.05 MPa
 - When in operation: 2.20 – 2.30 MPa
- (4) The alarm light of EMP-14A is not lit.

12.2 Periodical maintenance/inspection

Table 12-1 Maintenance interval



Parts	10,000 hours	30,000 hours	40,000 hours	8,000 hours or 2 years (Shorter)	20,000 hours *3
Coldhead *1	✓				
Oil adsorber		✓			
Helium pipe joint			✓		
GN-10i Air Compressor				✓	
GN-10i Filter *2				✓	
GN-10i Solenoid valve					✓



Parts	1year	2years	5years
IM-120 Membrane			✓
IM-120 Prefilter	✓		
IM-120 tube, joint		✓	
IM-120 Fixed throttle valve		✓	
IM-120 Check Valve		✓	

- ◇ Check the total operation time of EMP-14A with the hour meter on SA115-C.
- ◇ When the maintenance interval approaches, the Maintenance light blinks.
- *1... The coldhead should be replaced once every 10,000 hours of operation. However, replace with new ones once every 5 years as the built-in parts may become deteriorated even if 10,000 hours is not reached,
- *2... In addition to table 12-1, clean the filter of the air inlet of GN-10i once a month.
- *3... Maintenance intervals vary depending on the operating condition. For

example, when the system is in consecutive running, replacement should be done every two years.

NOTE: Coldhead cylinder and oil absorber are to be replaced with our stock. Customers are requested to return the set of parts to us after replacing.

	 WARNING
Be sure to turn off the main power source before performing maintenance.	


	 WARNING
Since helium is filled in this equipment as well as in the maintenance parts (cold head, oil adsorber), do not disassemble these parts. When you have to disassemble or dispose such parts, discharge helium using the optional charging adapter kit.	

12.3 Regular customer inspection

The EMP-14A is a high pressure manufacturing equipment. Please follow the applicable laws or regulations when operating and maintaining this equipment.

13. Troubleshooting

When any failure or unusual phenomenon occurs in the equipment, at first perform the fault diagnosis shown in the following table. When contacting us, it is requested to check the lighting status of PLC lamp arranged to the electrical circuit in advance.

	WARNING
<p>Ensure that main power is disconnected before inspecting the power source or inside of the equipment. Some parts of the equipment may remain in high temperature right after stopping operation. Use caution to avoid burn injury.</p>	

Problem	Possible Cause	Corrective Action
(1) Equipment fails to start by pressing the RUN/STOP switch. (The RUN/STOP switch does not light)	The main power source (breaker) is turned OFF.	Turn ON the main power source.
	The power cord is not connected.	Connect the power cord correctly.
	The circuit breaker is turned OFF.	Turn ON the circuit breaker.
	The fuse is blown.	Replace fuse with new one. If the fuse is blown repeatedly, please contact us.
	The emergency stop button is pressed.	Reset the emergency stop switch by turning it to the right, and restart.
(2) Equipment fails to start even if the RUN/STOP switch lights up.	LN ₂ level is not decreased to the re-starting level.	When LN ₂ level is decreased to 75% or less, the production starts automatically.
(3) Power breaker trips.	Short-circuit or electric leakages occur.	Please contact us.
(4) GN2 AL. lights on. The RUN/STOP lamp flickers at the same time.	GN10i is suspended.	Check the electric wiring of GN-10i, or Suspend and resume EMP and GN-10i.
	IM-120 is suspended.	Check the dry air supply pressure.
	Nitrogen gas supply decreases, or the pressure is lowered temporarily.	Refer to "9-5-3. Corrective action when GN2 AL. occurs" and restart EMP 14A.

Problem	Possible Cause	Corrective Action
(5) COMP.ALARM lights, LN ₂ production does not start. (The RUN/STOP switch flickers as well).	The voltage declines and power supply falls short as multiple devices run simultaneously on one power source.	Engage one power source per one device. Fix the power supply to meet the specified value when it is not sufficient.
	The ambient temperature is too high.	Ventilate well around EMP-14A.
		Keep the ambient temperature below 35 °C by installing fans or air conditioners.
	Electric parts of SA115-C break down.	Please contact us.
	SA115-C helium charge pressure is lower than specified.	Charge helium gas to the appropriate pressure. Contact us for more information on charging.
(6) RUN/STOP switch blinks and EMP does not start LN ₂ production (Alarm light is not lit).	RUN/STOP switch is pressed less than 6 minutes before.	Wait for 6 minutes until GN-10i starts N ₂ supply.
	Condensation occurs in the level sensor of EMP-14A.	Check the connection between EMP-14A and nitrogen generator, and flow rate of nitrogen gas. The level sensor needs to be dried. Please contact us.
	Level sensor of EMP-14A break down.	Please contact us.
(7) Liquid Nitrogen cannot be dispensed.	No liquid nitrogen such as at the time of initial start-up. (LN ₂ amount is displayed as 0 %)	Please wait until liquid nitrogen accumulates.
	Level sensor malfunctions due to ice or frost in the dewar.	Please contact us..
	Solenoid valve failure (Solenoid valve does not make operating sound.)	Please contact us.

Problem	Possible Cause	Corrective Action
	AUTO READY switch is turned OFF (When LN ₂ is not dispensed automatically.)	Turn ON the AUTO READY switch.
	eco mode is ON. (When LN ₂ cannot be dispensed manually.)	Cancel Eco mode and wait for 6 minutes.
(8) Liquid Nitrogen does not increase.	The equipment is in initial start-up.	Wait for about half a day until the dewar temperature is lowered enough to store liquid nitrogen.
	The helium gas piping and refrigerator cables are not connected correctly.	Connect the helium gas lines and refrigerator cables properly.
	The level sensor fails to detect correctly.	Please contact us.
(9) The rate of Liquid Nitrogen production declines.	Cold head and oil adsorber exceed the recommended maintenance interval.	Conduct the maintenance according to the time of operation.
	Helium charge pressure of SA115-C is lowered.	Add helium to the specified pressure. Please contact us when this trouble occurs frequently.
	Amount of evaporation from dewar increased.	Please contact us.
	EMP absorbs special gas such as helium.	Please contact us.
	Ice or frost adheres to inside the dewar or around the cold head.	Please contact us.
	The purity of Nitrogen gas is not sufficient.	Check the purity of nitrogen gas supplied.

Problem	Possible Cause	Corrective Action
(10) AUTO READY button blinks.	The level sensor cable of the target dewar is disconnected or not connected.	Check the level sensor cable of the target device.
	The level sensor of the target device breaks down.	Please contact us.
(11) MANU START button blinks.	Only 30 seconds left until the time limit of 10 minutes of manual dispense.	Press MANU START button again to continue dispensing manually.
(12) AUTO READY button and AUTO SUPPLY button blink alternately.	The time limit of automatic dispense is over, but the level sensor of the target device send the signal to supply.	Press AUTO READY button to cancel automatic transfer mode and check the liquid nitrogen level in the target device. Please contact us if any problem is found.
(13) Other failures		Please contact us.

14. Accessories

The accessories below are delivered along with the equipments.

EMP-14A

Flexible Hose for Dispensing LN2	1 (0.8m)
Nitrogen Gas Tube	1 (3m)
Single Head Wrench	1
Glass Fuse	3 (3A x 2, 2A x 1)
Instruction Manual	1 (This book)

GN-10i

Remote Cable for Nitrogen Generator	1 (5m)
Instruction Manual	1

IM-120

Remote Cable for Nitrogen Generator	1 (5m)
Connector for Tubes	1 (Screw size: R1/4)
Dry Air Supply Tube	1 (5m)
Instruction Manual	1

- The above accessories may vary depending on the directions by customers.

15. Warranty

1. Gratis warranty period and warranty coverage

Gratis warranty period

Gratis warranty period is one year starting from the date of delivery.

Coverage

(1) Failure diagnosis

As a general rule, diagnosis of failure should be done on site by customer.

However, ULVAC CRYOGENICS or our service network can perform this service for an agreed fee upon the customer's request. There will be no charge if the cause of the breakdown is found to be a fault of ULVAC CRYOGENICS.

(2) Damage during transportation

When damage by delivery/transportation is admitted, the product will be repaired free of charge within the range of the guarantee expressed in the sales contract.

(3) Breakdown repairs

There will be a charge for breakdown repairs, replacements and on-site visits for the following seven conditions. In those cases the cost shall be your own expense even though the product is within the warranty period.

- 1) Breakdowns due to improper storage or handling, careless accident, software or hardware design by the customer.
- 2) Breakdowns due to modifications of the product without consent of the manufacturer.
- 3) Breakdowns due to maintenance of the product without authentic parts or breakdowns resulting from using the product outside the specified specifications of the product.
- 4) Breakdowns due to contamination or corrosion caused by user's use conditions.
- 5) Breakdowns due to natural disasters (such as fire, earthquake, flood, lightning, salt damage, and so on) , environmental pollution, irregular voltage, and /or usage of undesignated power source.
- 6) Breakdowns that are outside the terms of warranty.
- 7) Consumables and/or replacement service.

Since the above services are limited to within Japan, diagnosis of failures, etc are not

performed abroad. If you desire the after service abroad, please contact ULVAC CRYOGENICS and consult us for details in advance.

2. Exclusion of opportunity loss from warranty liability

Regardless of the gratis warranty term, compensation to opportunity losses incurred to your company or your customers by failures of ULVAC CRYOGENICS products and compensation for damages to products other than ULVAC CRYOGENICS products and other services are not covered under warranty.

3. Repair period after production is discontinued

ULVAC CRYOGENICS shall accept product repairs for seven years after production of the product is discontinued.

Manufacturer: ULVAC CRYOGENICS INCORPORATED

Please refer to the SERVICE NETWORK at the end of this book for our contact information.

SERVICE NETWORK

- For technical support, servicing or additional contact information, visit us at www.ulvac-cryo.com.

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Revision History

Date	Revision No.	Contents
2014 / 09 / 30	2014.09	First edition
2015 / 08 / 04	2015AT01	The model of PSA nitrogen gas generator has been changed. The format for Warnings and Cautions has been changed.
2016 / 09 / 13	2016SR02	“Disposal Considerations” has been added. 15. Warranty Company address has been changed.
2017 / 02 / 22	2017FY03	“Safety Instructions” has been changed.
2019 / 10 / 07	2019OR04	The model name of the compressor unit has been changed. The temperature indicator has been modified as optional.

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