

Nitrogen Generator Instruction Manual

GN-15i

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 product. This instruction manual provides information and precautions on handling, installation, operation, and maintenance of the product.

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 as well.

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

Following precautions contain information regarding the safety of handling this system. Read them carefully to learn the ways of safe use.

1. Install the nitrogen generator in a safe place.



It may result in explosion or fire if there is explosive, flammable gas organic solvent close to the equipment. Place the equipment in a place free from flammable objects.

2. Do not place outdoors.



This equipment is not waterproof. If water invades into the electrical system, it may result in electric shock or fire. This system must be installed indoors.

3. Disconnect power supply before conducting inspections or servicing.



Make sure that the main power supply is turned off before starting inspections or wiring. Failure to follow this procedure could cause electric shock or severe injury.

4. Electric wiring must be done by qualified personnel.



Only qualified personnel can conduct electric wiring. If this caution is not observed, it may result in electric shock or fire.

5. Connect the ground wire.



Make sure to ground the equipment. Failure to follow this procedure could cause electric shock or fire.

6. Do not attempt to compress gas other than the air.



Never attempt to compress gases other than the air. Otherwise, it may result in explosion, fire or damage to the equipment.

7. Do not inhale nitrogen gas.

Inhaling nitrogen gas may bring serious damage to human bodies.

8. Do not use the nitrogen generator in a closed room.

Do not use the nitrogen generator in a place where closed or without insufficient ventilation as it may severely damage human bodies. Use the equipment in a place where sufficient air flow is available.

9. Do not touch the compressor while running.

Do not touch the compressor while it is supplied power. It may result in burn injury.

10. Release the tank pressure before inspection or maintenance.

Follow the maintenance standard for inspections and maintenance. Make sure to release tank pressure and confirm that there is no pressure before starting such works. If pressure remains, it may blow off parts, resulting in body injury.

11. Use the device at the specified temperature range.

Operate the nitrogen generator in a place where the temperature is from 5 to 40°C. The drain freezes when the ambient temperature is below 5°C, resulting in equipment failure. When it is above 40°C, it could cause equipment failure or shorten the life.

12. Install the nitrogen generator in a clean place

Installation site should be free from dirt or dust as they may cause equipment failure.

13. Repair work should be done by appropriate service providers.

It may result in failure or deterioration of life if the repair work is done by personnel who do not have adequate knowledge on the structure or risk.

14. Use our genuine parts.

When replacing parts for maintenance, our genuine parts should be used. Parts that are not genuine could cause equipment failure or shorten the life.

15. Do not remodel.





Never attempt to remodel the equipment as it may result in breakage or decrease of life.

16. Do not use in a place without sufficient ventilation.

Operation of this equipment must be done in a place where sufficient air flow is available. It will have harmful effects to the performance of the device or human bodies if it is operated in a place with poor ventilation.

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.

1. General

The GN-15i generates high density nitrogen gas with PSA(*) technology. The system consists of a compressor, adsorption tank, buffer tank, pressure regulator, flow rate meter, flow rate control valve, solenoid valve, piping or control equipments.

(*)P.S.A. (Pressure Swing Adsorption)

The air goes into the compressor to be pressurized, and passes through the adsorber tank to have impurities such as oxygen removed, and only high density nitrogen gas is sent to the buffer tank to make a product gas.

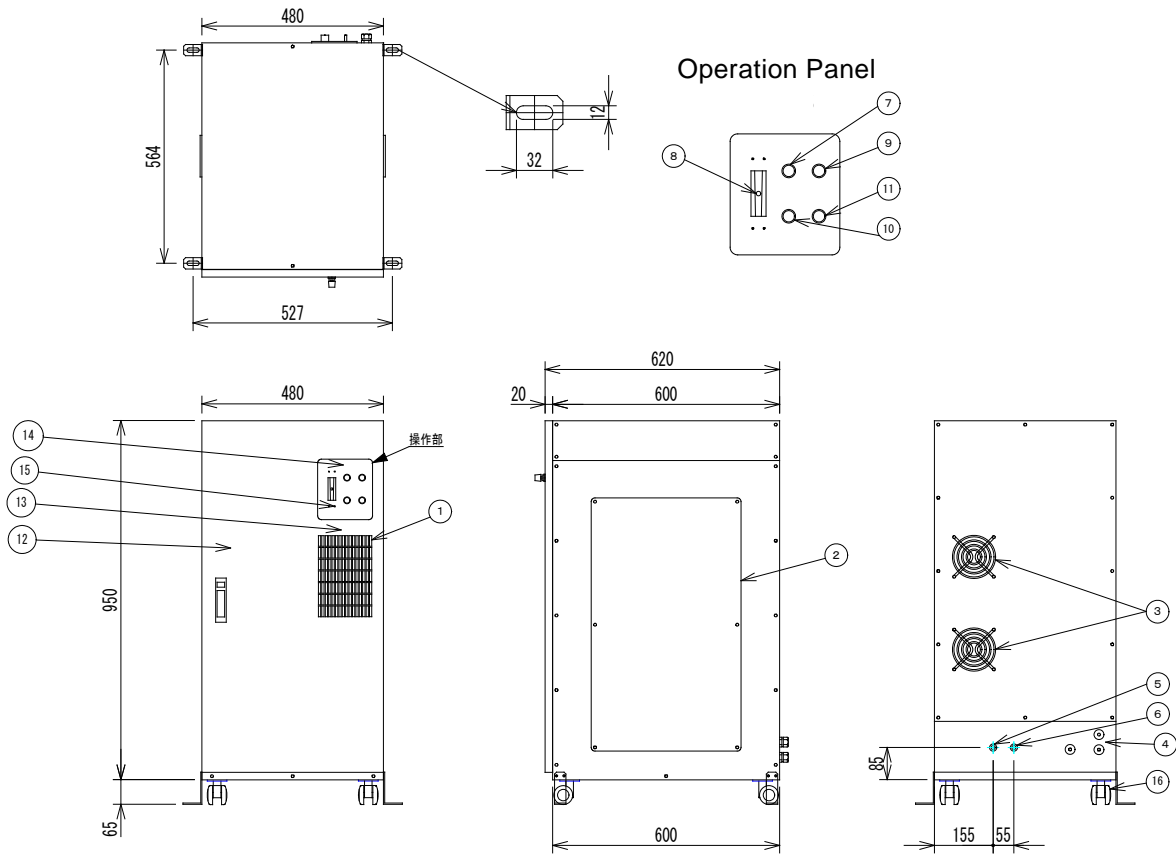
Moisture or oxygen gas that have been adsorbed in the pressurized state, P.S.A. is the technology to generate high density nitrogen by pressurizing or depressurizing (expose to the atmosphere from pressurized state) compressed air using the properties of adsorber (carbon molecular sieve) to adsorb and desorb oxygen.

2. Features

- Easy to perform maintenance work as the panels on top, both sides or back can be removed.
- Automatically switched between 50Hz and 60Hz.
- The state of operation can be monitored by the indicator lights on the operation panel. Operation starts simply by pressing Run/Stop button. Once started up, the equipment generates nitrogen gas automatically.
- To stop operation, simply press Run/Stop button.
- Tank pressure operation is possible with the switch.
- The compressor is long-life and low-noise type.
- Safety circuit is built inside to detect the compressor trouble. The generator stops automatically when a trouble occurs in the compressor.
- Drained water is evaporated by electric heater and PSA exhaust desorbed gas. There is no need of piping for drained water.

3. Component Descriptions

3.1 External Dimensions and Component Description



Unit: mm

Clear the spaces below for maintenance works.

Front: 600mm or more

Sides: 600mm or more

Back: 200mm or more

① Air inlet	⑨ Compressor alarm light
② Maintenance port	⑩ Alarm light / Reset button
③ Ventilation fan	⑪ Run/Stop button
④ Cable entrance	⑫ Circuit breaker (inside)
⑤ Nitrogen gas discharge port	⑬ Pressure sensor (inside)
⑥ Spare entrance port	⑭ Pressure regulator (inside)
⑦ Pressure alarm light	⑮ Nitrogen gas outlet meter (inside)
⑧ Nitrogen gas flow meter	⑯ Caster

3.2 Component Details

① Air inlet

Port to intake the atmosphere.

② Maintenance port

An opening to perform maintenance. Make sure to turn off the power supply before opening this port.

③ Ventilation fan

Do not block the air exit by placing the fan too close to walls or in other ways. Take space of more than 200mm from walls.

④ Cable entrance

Entrance for power cables

⑤ Nitrogen gas discharge port (ϕ 6 easy connecting)

⑥ Spare entrance port (Rc1/4)

⑦ Pressure alarm light

Illuminates when the pressure of nitrogen tank is below the set value.

⑧ Nitrogen gas flow meter

Displays the flow rate of nitrogen gas

⑨ Compressor alarm light

[Conditions that alarm light turns on]

(1) When an overcurrent by reasons such as overloading of the compressor unit is detected

(2) When the compressor wiring has any disconnection.

⑩ Alarm light / Reset button

When the compressor has some trouble, light turns on and the system stops operation. The condition is reset by pressing the button again.

⑪ Start / Stop button, light

Press this button to start or stop the equipment.. The light is turned on during

operation

⑫ Circuit breaker

The breaker for entire equipment. (Inside)

⑬ Pressure censor (Inside)

Displays the pressure of the nitrogen tank. The system will be shutdown for emergency if the pressure is lower than set value while dispensing nitrogen gas.

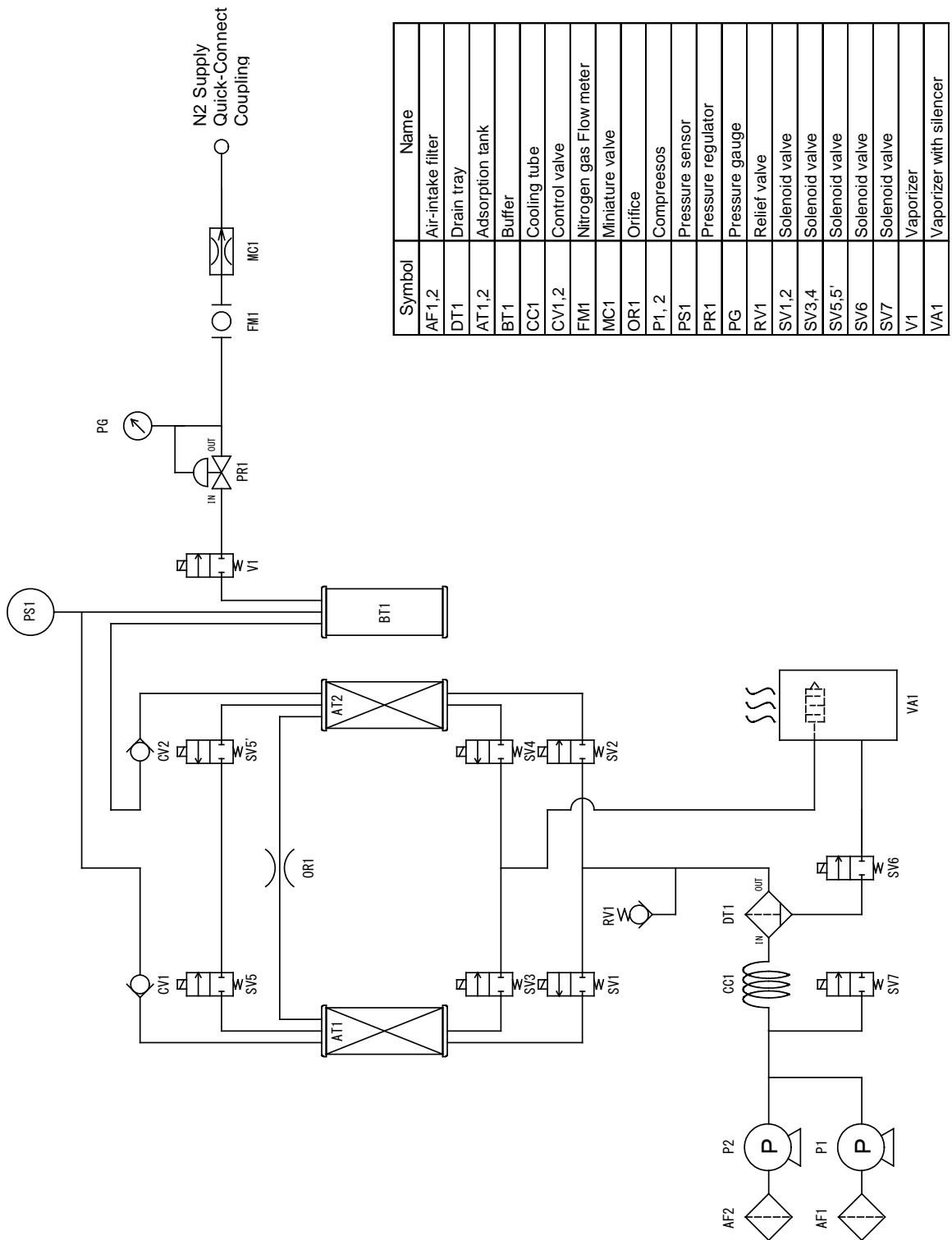
⑭ Pressure regulator (Inside)

Controls the discharge pressure of produced nitrogen gas. Refer to nitrogen gas supply pressure meter ⑮ to adjust at the desired pressure (within specification range)

⑮ Nitrogen gas supply pressure meter (Inside)

Displays the nitrogen gas supply pressure (set value).

4. Flow Diagram



Symbol	Name
AF1,2	Air-intake filter
DT1	Drain tray
AT1,2	Adsorption tank
BT1	Buffer
CC1	Cooling tube
CV1,2	Control valve
FM1	Nitrogen gas Flow meter
MC1	Miniature valve
OR1	Orifice
P1, 2	Compressors
PS1	Pressure sensor
PR1	Pressure regulator
PG	Pressure gauge
RV1	Relief valve
SV1,2	Solenoid valve
SV3,4	Solenoid valve
SV5,5'	Solenoid valve
SV6	Solenoid valve
SV7	Solenoid valve
V1	Vaporizer
VA1	Vaporizer with silencer

5. Specifications

5.1 Nitrogen generator specifications

Items	Specifications	
Model	GN-15i	
N2 production rate (*1)	15 NL/min	
Discharge pressure	0.2 MPa	
Purity	99 vol% (N2 + Ar)	
Dew point	Below -60°C	
Flow meter (*2)	25.0 NL/min	
Ambient temperature(*3)	5 - 40°C	
Ambient humidity(*3)	Relative humidity 10 - 80%	
Electrical rating Voltage and frequency	Main power source 100VAC single-phase, 50/60Hz	
Power consumption	800W	
Operating method	Input operation signals	
Input and output electrical signals	Input	Remote signal: CLOSE while in operation Contact capacity:DC30V 20mA required
	Output	Running signal: In operation (ON) N2 supply signal: While supplying (ON) Alarm signal: While in alarm state (ON) Relay contact output: Continuous load current 100VAC below 1A
Drained water processing	Evaporation inside the equipment	
Nitrogen gas exit	φ 6 quick-connect coupling	
Dimensions	480(W) x 620(D) x 950(H) (excluding casters)	
Weight	Approx. 90Kg	
Color	DIC 546 1/2	
Compressor	2688CS32-273 (made by Thomas) x 2	
Noise level	56dB(A) When measured from front 1m and height 1m	

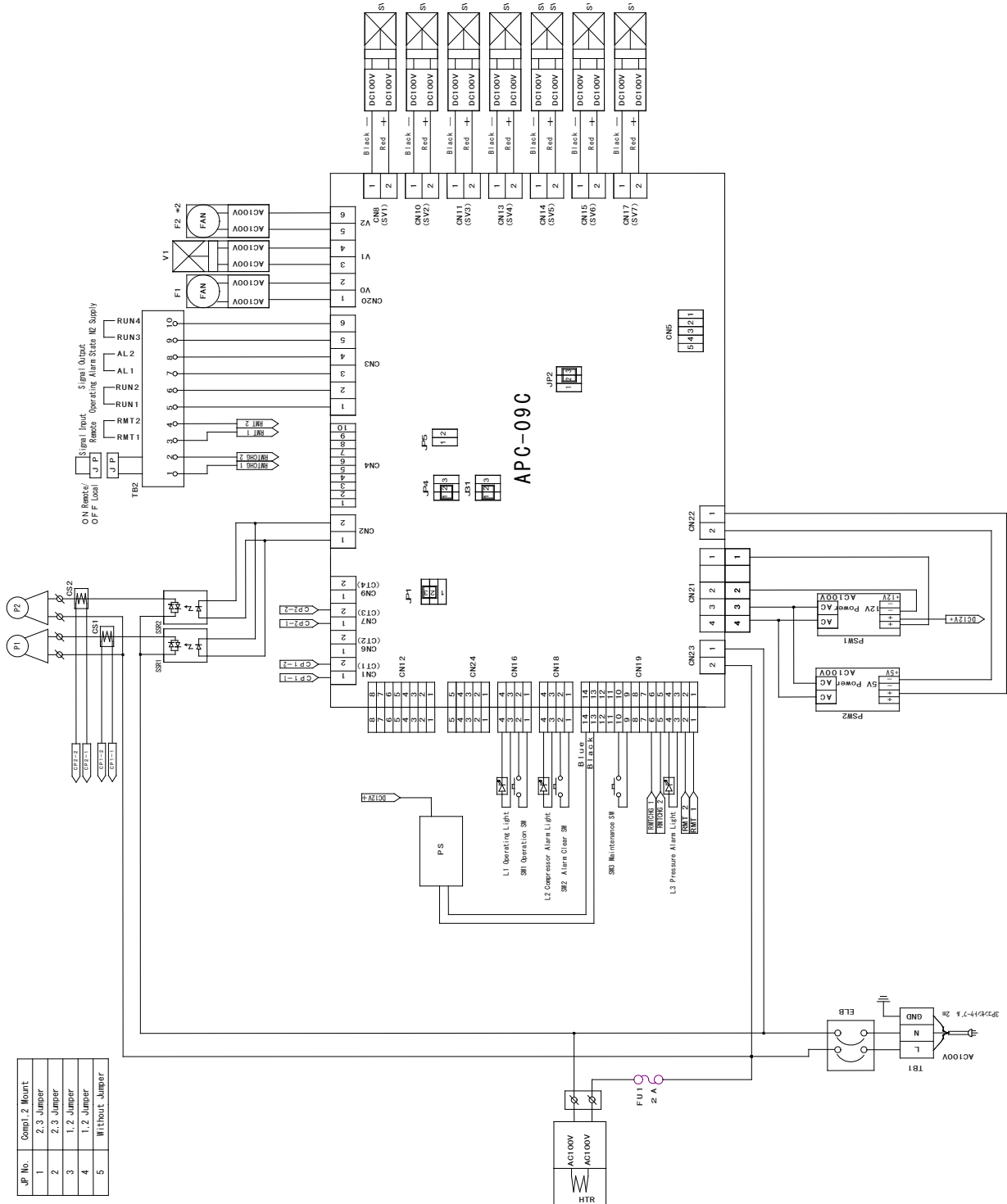
*1 This is the volume measured at the ambient conditions of temperature 20°C and humidity 60% RH and converted to 0°C and atmospheric pressure. The production volume above is the maximum under the conditions with temperature of 20°C, humidity of 60% RH and filters are cleared. The production rate may go down depending on the conditions such as temperature or humidity.

*2 Flow meter is made to fit the above discharge pressure. If it is used at the pressure other than the above, conversion is needed.

*3 This is not to guarantee the performance under these conditions.

6. Electric Wiring

Symbol	Name
APC-09C	Control board
TB1,2	Terminal board
SV1,2,3,4,5,6,7	Solenoid valve
V1	Solenoid valve
H1	Heater
PI,2	Air compressor
L1	Run/Stop indicator
L2	Compressor alarm light
L3	Pressure alarm light
F1	Cooling fan
F2	Ventilating fan
PSW1	12VDC Power supply
PSW2	5VDC Power supply
SW1	Local Run/Stop switch
SW2	Alarm cancel switch
SW3	Maintenance switch
ELB	Electric leakage breaker
CS1,2	Current sensor
SSR1,2	Solid state relay
LCD	LCD module
PS	Pressure sensor
FU1	Fuse (2A)



JP No.	Comp. 2 Mount
1	2.3 Jumper
2	2.3 Jumper
3	1.2 Jumper
4	1.2 Jumper
5	Without Jumper

7. Unpacking and Installation




7.1 Unpacking and Checking Contents

Unpack the Carton and confirm that it contains the following items.

- 1) GN-15i
- 2) Instruction Manual (This book)

7.2 Installation

- 1) Install the system indoors away from direct sunlight and well ventilated.

			Warning
<p>Ventilate well to prevent decline of oxygen level.</p> <p>Although nitrogen gas itself is not toxic to human bodies, it reduces the oxygen level in the air and may lead to suffocation. (It is defined that oxygen level of below 18% is the state of oxygen deficiency.) Install a ventilating fan that has airflow volume of 1000m³ /hr to circulate fresh air. It is recommended to use an oxygen meter.</p>			

- 2) Place the equipment on a stable and level floor.
- 3) Power outlet should be located within 1 meter distance from the equipment.
- 4) Clear the space in front of the air inlet or exhaust port.

NOTE: Clear the space of larger than 200mm in the back of the equipment for ventilation.

Environmental Requirements for Installing a Nitrogen Generator

- (1) Install in a clean place where free from dust.
 - (2) The GN-15i is air-cooled. It may not operate properly in extremely small space. In such a case, improve the air-permeability around the equipment, or ventilate or use an air conditioner for the entire room.
 - (3) Never use organic solvents (acetone, thinner, carbon tetrachloride, chloroform, ethyl acetate, nitric acid, aniline, kerosene, or gasoline) around the equipment.
- ◇ It may significantly deteriorates the life of the components such as filters or adsorbents.

7.3 Electric Wiring

<Input>

- Power source

Supply 100VAC outlet with earth lead exclusive to the equipment.

NOTE: Do not use cable reel or extension cable.

<Output>

- Operation signal output 5,6 [RUN1, RUN2]

This signal is sent out when the equipment starts running .

- Equipment alarm signal output 7,8 [AL1, AL2]

This alarm is activated when the computer is overloaded or motor disconnection.

It is also output when the pressure of produced nitrogen tank is lower than the set value.

(The GN-15i makes an emergency stop. Default setting is 0.3MPa.)

- Nitrogen supply signal output 9,10 [RUN3, RUN4]

Nitrogen is supplied in 6 minutes after the equipment starts up. Nitrogen supply signal is activated according to the timing.



WARNING

Danger of electrical shocks exists. Do not touch the live parts.

Voltage that can lead to electrocution or serious damage is added to the power supply of the equipment. It is extremely dangerous to touch the live part inside. Ensure to disconnect the power source before performing installation, maintenance or repairs. Connect to D type earth grounding as well.

8. Operation

8.1 Preparation before Operation

- 1) Take the right side plate off, and remove the red screws (two per compressor unit) that fix the compressor units for transportation.
- 2) Connect the piping to the nitrogen gas supply port (ϕ 6 quick-connect coupling) on the back of the equipment.
- 3) Wire the power cable, open the front door and turn the circuit breaker on.
- 4) Turn the toggle switch to LOCAL operation side, and press Run/Stop button.
- 5) Open the door to check that the pressure meter of the pressure regulator (located behind the operation panel) is set at appropriate value, and check nitrogen gas flow meter on the operation panel to confirm that the flow rate is appropriate.

8.2 Start-up and Stop (Tank pressure operation)*optional

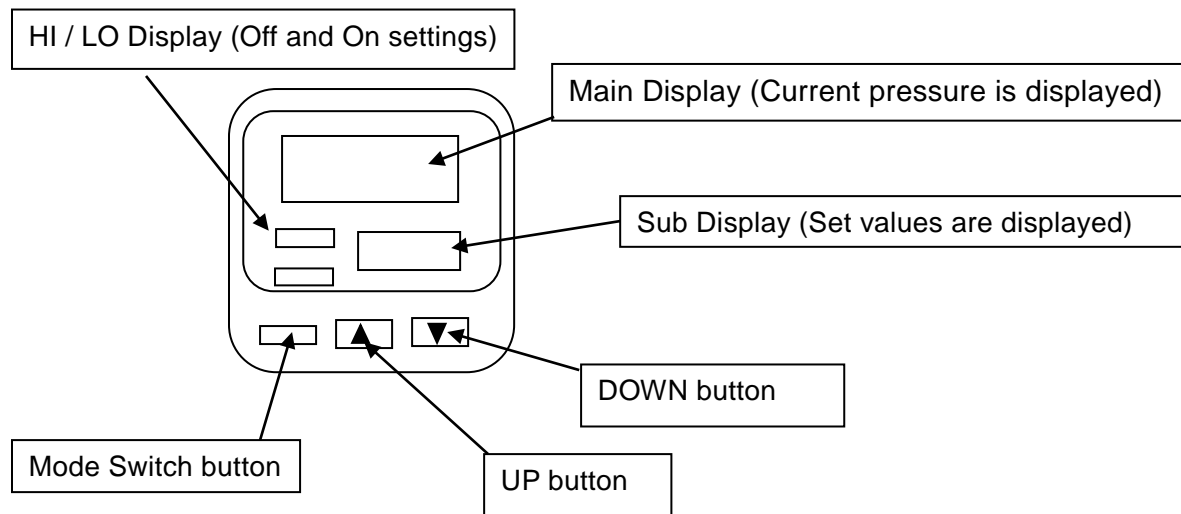
To use this function to turn ON and OFF by the internal pressure sensor, open the front panel and turn the toggle switch to "Tank Pressure Operation", and press Run/Stop button.

The equipment suspends operation when the back pressure of Nitrogen supply port reaches to the set upper limit of the pressure sensor, and resumes operation when the lower limit is reached. Refer to [How to change the set value of Digital Pressure Sensor (DP-100)] for the information on how to set the upper and lower limit.

Tank Pressure Operation settings [factory default settings]

Upper limit (OFF)	0.35MPa
Lower limit (ON)	0.20MPa

How to change the set value of digital pressure sensor (DP-100)



How to change the settings

- (1) Press Mode Switch button.

↳ LO-1 or HI-1 is displayed.

(LO-1: Pressure at which the equipment turns ON

HI-2: Pressure at which the equipment turns OFF)

- (2) Use <UP> or <DOWN> button to set the value.
- (3) The display of HI / LO display is changed by pressing the Mode Switch button.

9. Maintenance

9.1 Daily Inspections and Maintenance

Maintenance and inspections are very important in order to keep good performance for a long time. It is strongly recommended that the customers conduct daily inspections and maintenance.

For overall inspection, it is necessary to replace consumables such as compressor. Please contact us.

1) Abnormal sound and vibration

Every time the equipment is used, check if it has abnormally large noise, or large vibrations. If abnormal sound or vibration is observed, shut down the equipment immediately and contact us.

2) Cleaning and replacing intake air filter

It is extremely important to clean the intake air filter attached to the compressor. The compressor performance will be deteriorated if this filter is clogged. Frequent cleaning is encouraged especially in places where dust is observed. When the clog cannot be removed by cleaning, replace the filter. Please contact us for the necessary parts.

3) Others

When cleaning intake air filter, inspect with your eyes whether couplings, piping, bolts, nuts or screws are firm enough. Tighten when they are loose.

9.2 Overall Inspections

The life of the compressor is one year if it runs continuously. It is necessary to replace compressor, and inspect the adsorber deterioration, piping, couplings, or solenoid valves. Overall inspections should be done once a year although the running time is short.

10. Cautions before Use

1) Power capacity

At the time of start-up, large volume of electric current flows for a short while. If the capacity of power source is small, the operation might not proceed normally, such as the alarm light illuminates and the system stops while starting-up, or the circuit breaker inside is turned off. In such cases, use the power source with sufficient capacity as the exclusive power supply for the equipment.

2) When opening the side panels

When you remove the side panels to conduct the inspection of the equipment, make sure that the equipment is turned off before working.

If it is necessary to take the side panels off while in operation, use cautions never to place hands or bodies close to the compressor or cooling fans.

3) Devices inside

Never attempt to make alternations or remove the pipings, couplings or electric circuit as it may result in failure.

4) Power outage during operation

In case the power outage takes place while the equipment is in operation, the equipment may stop and the supply of produced nitrogen stops as well. After the power recovers, the equipment will restart the operation automatically. However, if pressure remain inside the adsorption chamber, the compressor does not rotate due to the pressure under load, the safety circuit work and the operation stops along with the attention light turned on.

In such a case, press the illuminating attention light to clear. The safety circuit is canceled and the equipment will start operation again.

11. Troubleshooting

Corrective actions when troubles occur are described below.

1) Circuit breaker works

If the circuit breaker works and the equipment stops although you turn ON the breaker once again, the possible cause may be the failure of electrical system or abnormal current. Disconnect the power supply and contact us.

2) Nitrogen gas is not supplied

The possible causes are as described below.

- Not sufficient time has passed since the start-up of the equipment.
- The pressure regulator inside the equipment is closed.->(6)
- The flow rate control valve on the front of the equipment is closed. ->(6)
- The piping outside the equipment is clogged.
- The pressure outside the equipment is larger than the discharge pressure.

If the produced gas is not supplied even after clearing the above problems, the possible causes may be the piping inside is disconnected, clogs of the couplings, or leaks. Please contact us.

3) Alarm light illuminates

When an alarm light illuminates and the equipment stops during operation, press Run/Stop button to clear the operating status, and then press attention light. The light is turned off and reset. Restart the equipment later. If the attention light illuminates and the equipment stops in a few seconds, the electric capacitance of the power source may not be sufficient.

Use the power outlet with sufficient capacitance and restart the equipment. If the equipment stops along with the alarm light again, the cause might be the equipment failure. Turn OFF the circuit breaker, unplug the power supply and contact us.

4) The operation light flashes

When the equipment has been running for longer than 8000 hours, the operation light flashes during operation to inform that the inspection will be necessary soon.

Press Maintenance Finish button on the left of inside the equipment for 5 seconds or so to reset.

The replacement interval of the compressor is about one year (10,000 hours) if it has been running continuously. It is also necessary to check the deterioration of adsorber, piping, couplings, or solenoid valves along with the replacement. Please contact us.

5) When abnormal sound is heard

If there is a sound different from the normal operating sound, the equipment may have trouble or failure. Unplug the power cable and contact us.

6) The supply pressure or flow rate is not in the range of specifications.

Adjust the pressure with the pressure regulator if the supply pressure of nitrogen gas is not within the range of specifications.

If the flow rate of supplied nitrogen gas is different from the necessary rate when nitrogen discharge pressure is within the range of specifications, adjust the flow rate at the flow rate adjustment valve on the front panel of the equipment. If the discharge pressure or flow rate does not return as intended, the possible cause may be the equipment failure. Shut down operation, turn OFF the circuit breaker, unplug the power supply and contact us.

Please contact us if there are other signs of failure than stated above.

12. 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.

- (i) Breakdowns due to improper storage or handling, careless accident, software or hardware design by the customer.
- (ii) Breakdowns due to modifications of the product without consent of the manufacturer.
- (iii) Breakdowns due to maintenance of the product without authentic parts or breakdowns resulting from using the product outside the specified specifications of the product.
- (iv) Breakdowns due to contamination or corrosion caused by user's use conditions.
- (v) 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.

(vi) Breakdowns that are outside the terms of warranty.

(vii) 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

For our contact information, refer to “**SERVICE NETWORK**” on the back of this document.

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- 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
2018 / 08 / 17	2018.08	First edition

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