

## Liquid Nitrogen Generator Instruction Manual

MP-300K

### 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 provides 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.

### General Precautions

- (1) It is strictly prohibited to duplicate or reproduce this manual either partially or entirely, or disclose or transfer to a third party without written permission from ULVAC CRYOGENICS.
- (2) Information in this document is subject to change without notice, along with the specification change or improvement of the product.
- (3) If you have any questions or comments on this document, please contact us. The contact details are listed at the end of this book.

## 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.

## Table of Contents

Safety Instructions .....	1
Disposal Considerations.....	2
1. General Description of the System .....	5
1.1 Liquid nitrogen generator (MP-300K) .....	5
1.2 Helium gas compressor (UW701N) .....	5
1.3 PSA (Pressure Swing Adsorption) system nitrogen gas generator (GN-20i) .....	5
2. Component Description .....	6
2.1 Front panel of MP-300K (Figure 2-1) .....	7
2.2 Operation panel of MP-300K (Figure 2-2) .....	7
2.3 Inside MP-300K front door (Figure 2-3) .....	10
2.4 MP-300K Electrical circuit (Figure 2-4) .....	10
2.5 MP-300K Top (Figure 2-5) .....	11
2.6 UW701N Front (Figure 2-6) .....	13
2.7 UW701N Status display (Figure 2-7).....	13
3. Flow Sheet .....	14
4. Specifications.....	15
4.1 Liquid nitrogen generator .....	15
4.2 PSA system nitrogen gas generator.....	15
5. Utilities .....	16
5.1 Power source (for MP-300K).....	16
5.2 Cooling water (for MP-300K).....	16
5.3 Power supply for GN-20i .....	17
5.4 Nitrogen gas for MP-300K (for systems with N <sub>2</sub> gas supply) .....	18
6. Installation.....	19
6.1 Conditions for installation place .....	19
6.2 GN-20i Power-supply connection .....	20
6.3 MP-300K utility connection .....	20
7. Electric Wiring.....	23
7.1 MP-300K .....	23
7.2 MP-300K(PLC) .....	24

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8.	Operation .....	25
8.1	Checks prior to operation .....	25
8.2	Operation preparation.....	25
8.3	Shutdown .....	26
8.4	Corrective action in the event of an error .....	27
8.5	Emergency off .....	28
9.	Manual Dispense of Liquid Nitrogen.....	29
9.1	Connecting liquid nitrogen supply port .....	29
9.2	Dispense liquid nitrogen.....	29
9.3	Disconnecting Manual Dispense Flexible Hoses .....	30
10.	Automatic Supply of Liquid Nitrogen .....	31
10.1	Inspections before automatic transfer .....	31
10.2	Automatic transfer .....	31
10.3	Time limit of automatic transfer.....	31
11.	Maintenance and Inspection.....	32
11.1	Daily inspection.....	32
11.2	Maintenance/inspection intervals .....	32
12.	Troubleshooting.....	34
13.	Accessories .....	38
14.	Warranty .....	39

## Safety Instructions

### 1. Danger of electric shock: Do not touch the 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, or install a ventilator with a capacity of at least 2000 m<sup>3</sup>/Hr 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 LN<sub>2</sub>.



The volume of nitrogen gas is 700 times of liquid nitrogen. Confining atmospheric pressure liquid nitrogen in an airtight space produces high-pressure gas as high as 700 Atm, 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  $-196^{\circ}\text{C}$ . If liquid nitrogen is directly handled, there may be dangers of frostbites, loss of sight, and others. Be sure to wear protective clothes such as leather gloves, goggles, trousers without turnips, etc. to handle liquid nitrogen. In addition, liquid nitrogen transport piping must be carefully checked. In this unit, there is a part with danger of burns if it is touched directly. When performing maintenance or repair work, etc. wait for at least 30 minutes after the unit is shutdown.

**5. Danger of Explosion:  
Do not expose to corrosive gases.**









In this system, high-pressure helium gas is filled. When disassembling or disposing the system or parts, be sure to discharge gas (under regular maintenance, there is no need to discharge gas). In addition, never attempt to install the system under the atmosphere of hydrochloric acid, chlorine gas, or other corrosive gases.



## Disposal Considerations

Regulations and the ordinance concerning industrial waste treatment are provided in the country and region to discard. When disposing our products, please process abandonment according to relevant regulations and ordinance, etc.

				<b>WARNING</b>
<p>When it seems that the cryopump and the refrigerator have been used to evacuate a toxic or dangerous material, you must contact a safety supervisor before discarding, and discard it after removing the poisonous material according to directions of the safety supervisor.</p>				

		<b>WARNING</b>
<p>Do not disassemble, pressurize, heat, and/or throw into fire. The adsorber may explode.</p> <p>For safe disposal of an adsorber, follow the procedures below.</p> <p>(1) Depressurize the high pressure helium gas in the adsorber to an ambient atmospheric pressure. To do so safely, connect the proper tools such as our charging adaptor (for refrigerator maintenance).</p> <p>(2) Before proceeding with disposal work, remove the couplings of the adsorber to visually confirm that it has been depressurized.</p>		

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

If you have any questions, please contact our Service Engineering Division or the nearest customer support center.

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# 1. General Description of the System

## 1.1 Liquid nitrogen generator (MP-300K)

MP-300K Liquid Nitrogen Generator provides liquid nitrogen by cooling down, condensing and liquefying nitrogen gas with the cold head (Model:S050).

Liquid nitrogen is stored inside 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' system.

Supply of nitrogen gas can be selected from (1)PSA nitrogen gas generator (2)Nitrogen gas supply (supplied directly from the customers' nitrogen gas line).

Liquid nitrogen generator is hereafter referred to as "MP-300K" in this manual.

## 1.2 Helium gas compressor (UW701N)

This unit is in the right side of MP-300K, compress Helium gas to supply to the cold head to provide cryogenic temperatures. It is automatically turned on and off by the control circuit of MP-300K.

Helium gas compressor is hereafter referred to as "UW701N" in this manual.

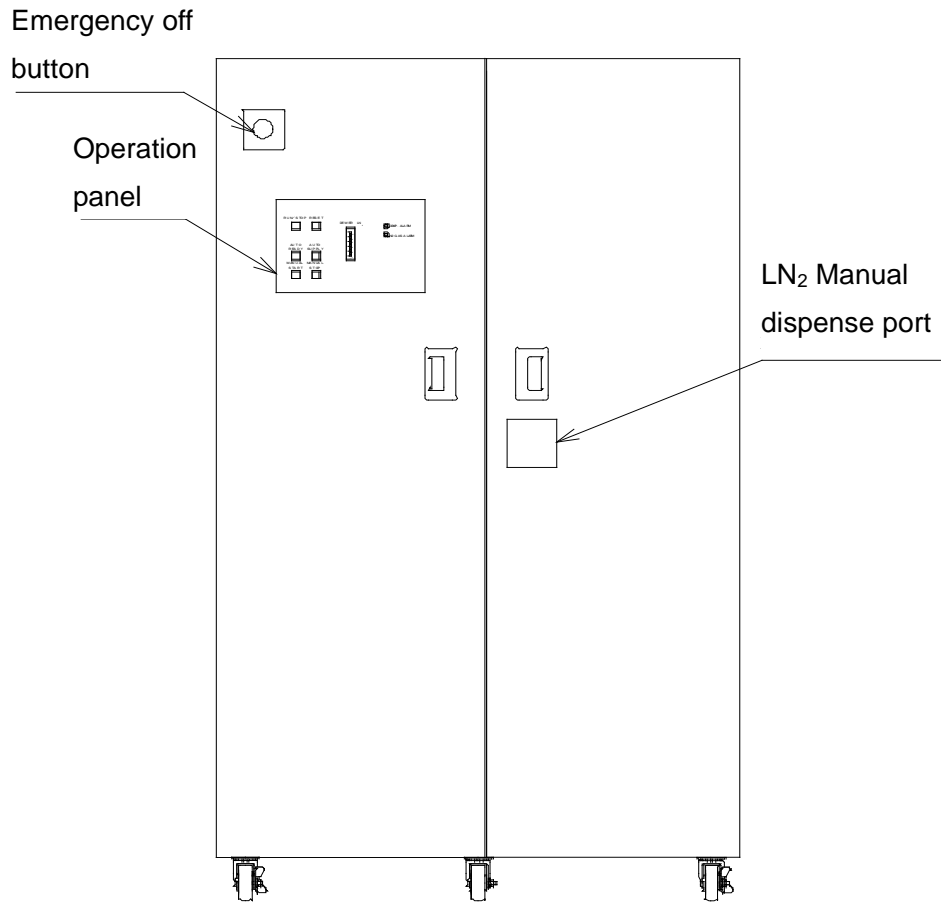
Please refer to the operation manual of "UW701N" for details.

## 1.3 PSA (Pressure Swing Adsorption) system nitrogen gas generator (GN-20i)

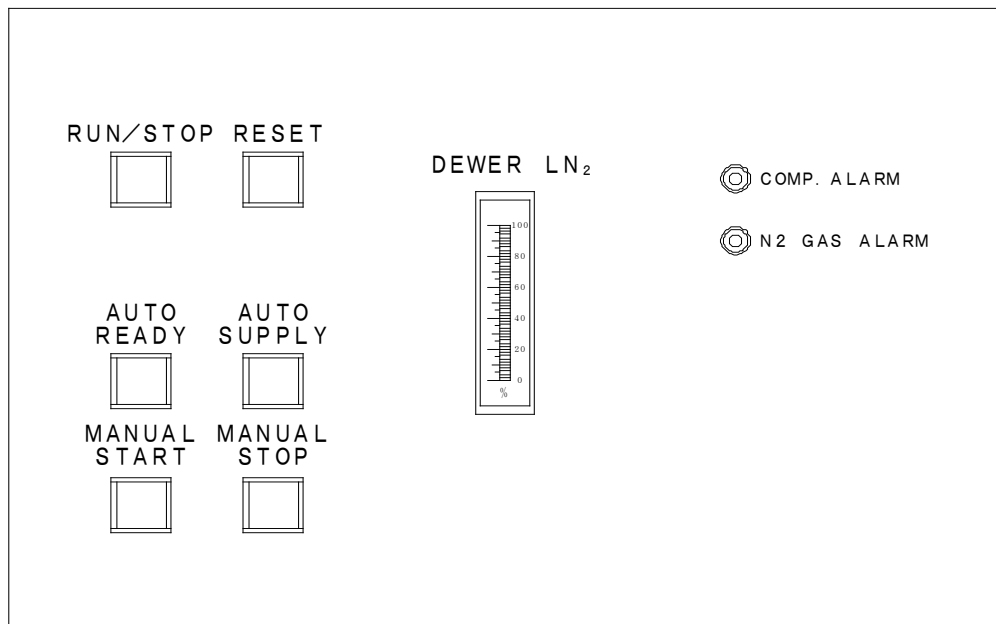
This equipment separates nitrogen gas from air using activated carbon and supplies to MP-300K. The nitrogen gas is cooled down to liquid nitrogen, and is also used for dispensing liquefied nitrogen.

PSA system nitrogen gas generator is hereafter referred to as "GN-20i". When we refer to items which are in common with membrane nitrogen generator, they are called "nitrogen gas generator" collectively. Please refer to the operation manual of GN-20i about the details of this equipment.

## 2. Component Description



**Figure 2-1 MP-300K Front**



**Figure 2-2 MP-300K Operation panel**

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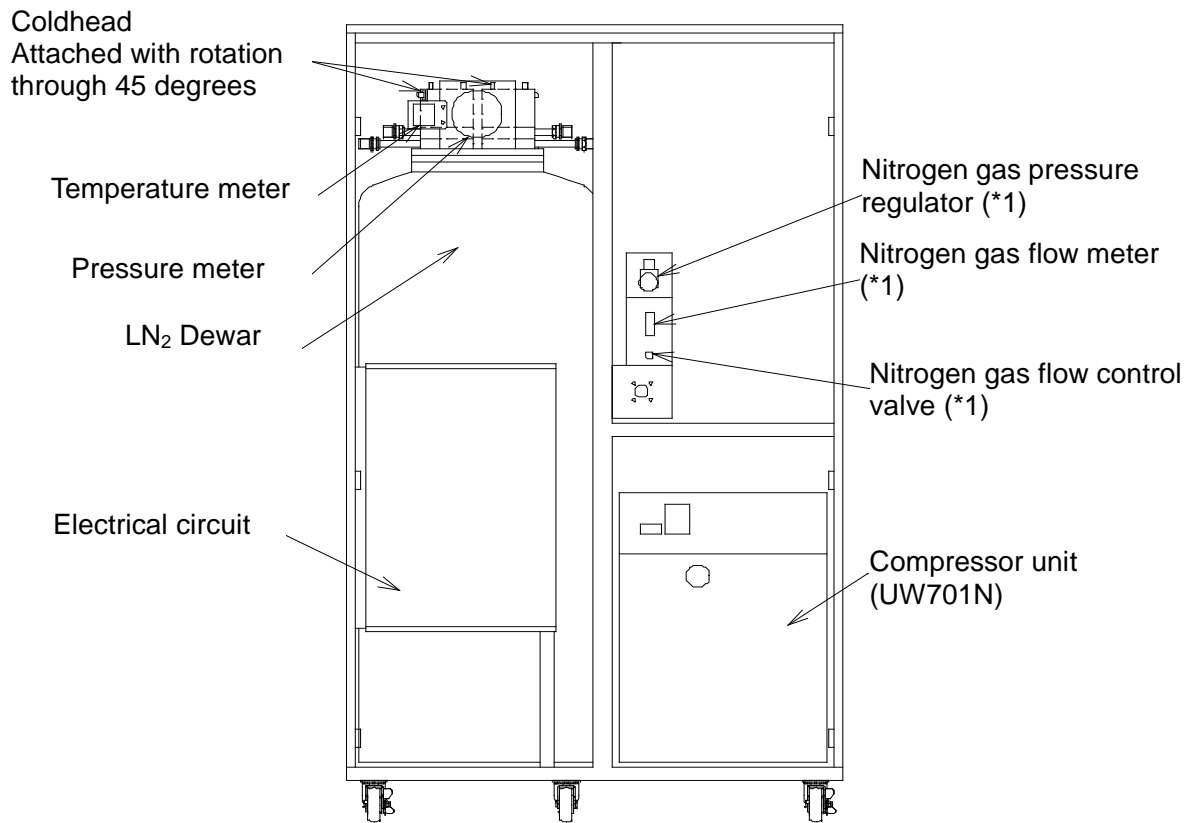
## 2.1 Front panel of MP-300K (Figure 2-1)

- Emergency off button : Press this button to interrupt power supply to the control circuit to stop such operations as LN<sub>2</sub> production or transfer. Do not use this button except for emergency.
- Front panel : Inside this panel, LN<sub>2</sub> dewar, coldhead, or electrical wiring are located. Do not open except for regular inspections, maintenance or repair works.
- LN<sub>2</sub> manual dispense port : The coupling to connect liquefied nitrogen supply piping. Note that the port reaches to extremely low temperature during and immediately after dispensing. Do not touch it directly while in low temperature.

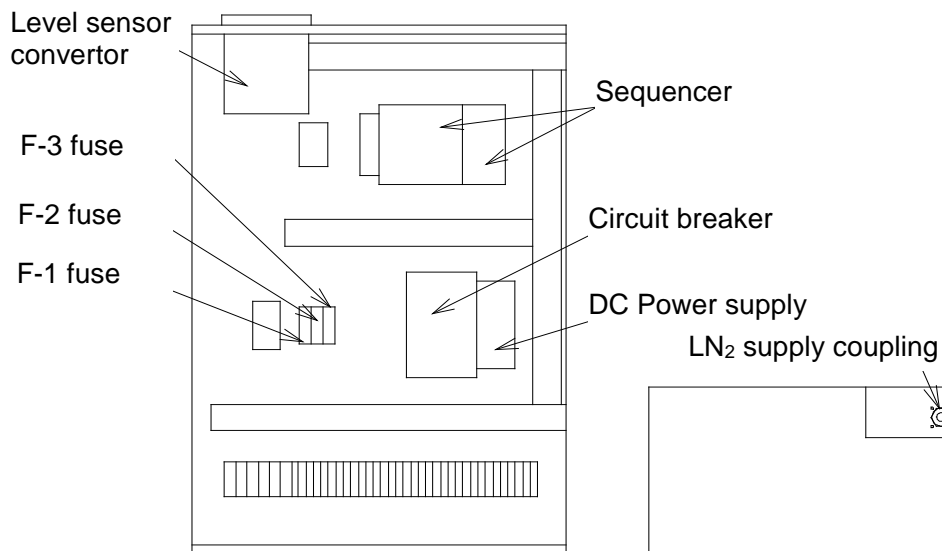
## 2.2 Operation panel of MP-300K (Figure 2-2)

- RUN/STOP : Use this button to start or stop the main unit. This button lights green during normal operation, and flickers when in error state.
- RESET : This switch is used to reset the MP-300K error.
- AUTO READY : Press this button to use optional auto supply function. When you wish to auto-supply, turn this ON. The button lights green while on standby, and blinks when an error condition is encountered at the level sensor of the auto supply destination.
- AUTO SUPPLY : Press this button to start supplying liquefied nitrogen at a desired moment while using optional auto supply function. The button lights white while in auto supply state.
- MANUAL START : Press this button to manually dispense liquid nitrogen from LN<sub>2</sub> supply ports. (To be referred to as "Manual supply") Manual supply is terminated automatically in 10 minutes. This button lights green while liquid nitrogen is manually supplied and blinks from pressing 30 seconds in advance to automatic termination. When you wish to supply more, press this button once again while it is blinking to extend 10 minutes.

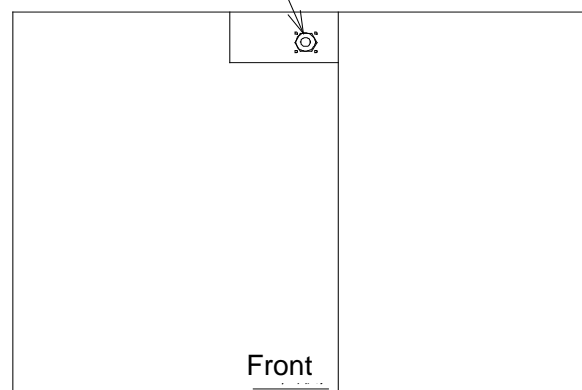
MANUAL STOP	: Press these buttons to interrupt the manual dispense of liquid nitrogen.
DEWAER LN <sub>2</sub>	: Displays liquid nitrogen level in the dewar.
COMP. ALARM.	: Turns on red when the UW701N stops due to an error. The RUN/STOP button blinks at the same time.
N <sub>2</sub> GAS ALARM.	: Red light illuminates when the nitrogen gas generator stops due to faults, or when the supply pressure of nitrogen gas declines. The RUN/STOP switch blinks at the same time.



**Figure 2-3** Inside MP-300K front panel



**Figure 2-4** MP-300K Electrical circuit



**Figure 2-5** MP-300K Top

### 2.3 Inside MP-300K front door (Figure 2-3)

LN <sub>2</sub> dewar	:Container that stores 100 liters of LN <sub>2</sub> .
Cold head	:The cold head works in conjunction with the compressor to generate ultra-low temperature. The cold head needs maintenance services according to the time in operation.
N <sub>2</sub> Pressure regulator (*1):	:Adjusts and displays the pressure of nitrogen gas supplied. Adjust the pressure to 0.2MPa when using the equipment.
N <sub>2</sub> Flow meter (*1)	:Displays and adjusts the flow rate of nitrogen gas. Adjust the flow rate at the center of the ball inside to 20 NL/min.
Pressure meter	:Displays the pressure inside the dewar.
Temperature meter	:Displays the temperature inside the dewar. (Temperature meter is not equipped depending on the condition of installation.)

(\*1) Nitrogen gas pressure regulator, flow meter, and flow control valve are mounted only on the models with nitrogen gas supply (without nitrogen gas generator).

### 2.4 MP-300K Electrical circuit (Figure 2-4)

Circuit breaker	:Circuit breaker to protect the control circuit of MP-300K. This trips when an electric leakage or short circuit occurs.
Fuse	:AC protective fuse (F-1,2 : 2A) and DC protective fuse (F-3 : 2A).
Sequencer	:Controller of the system. It receives signals from the sensors and activates functions as needed. When you contact us in case of an error, provide the state of sequencer input-output light such as illuminating, blinking or off.
Level sensor converter	:Electric component to detect the LN <sub>2</sub> level. Never strip the protective sticker or touch adjusting trimmer since it is precisely adjusted.



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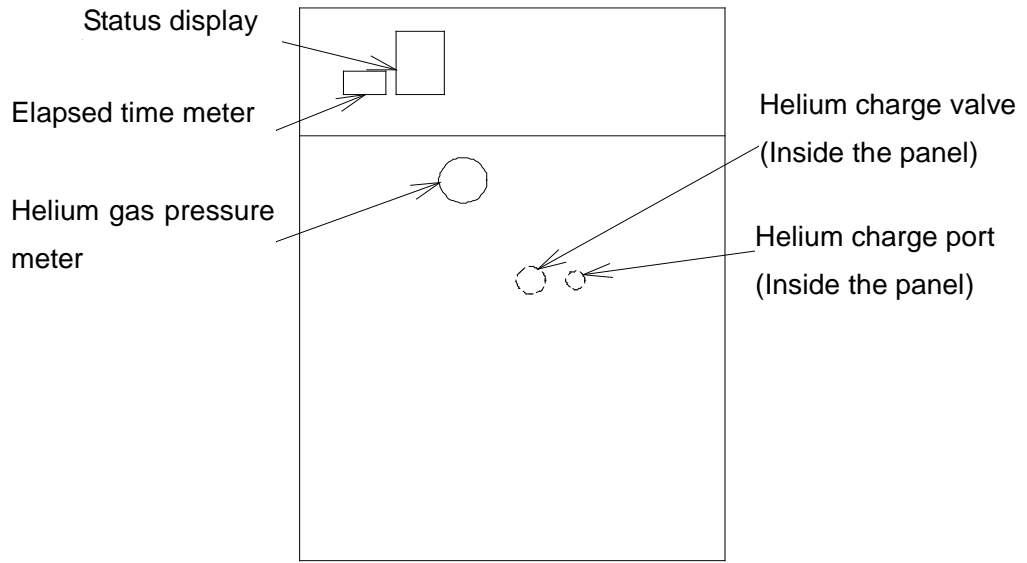
## 2.5 MP-300K Top (Figure 2-5)

Auto LN<sub>2</sub> supply coupling  
(Optional)

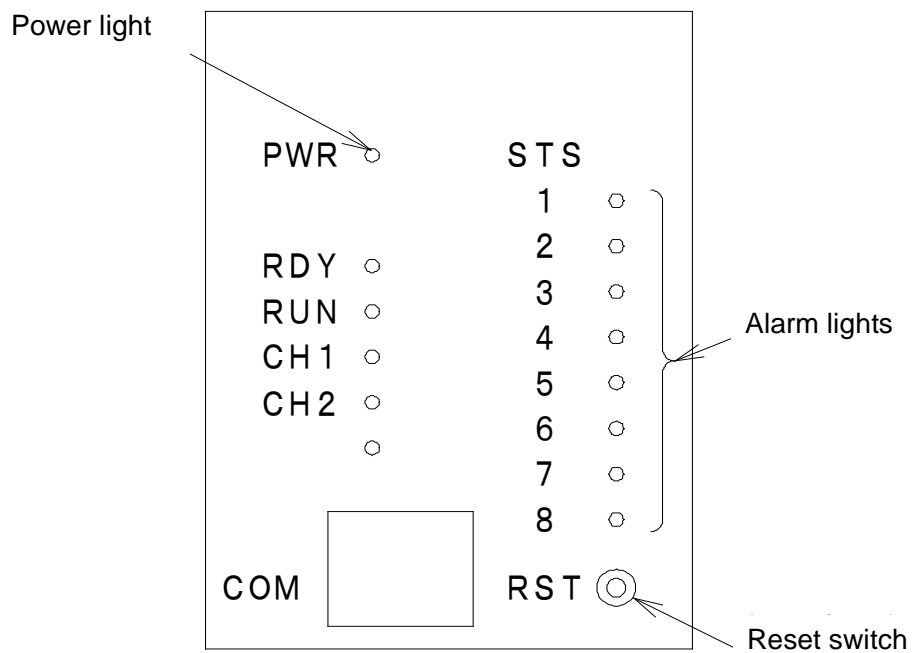
:Swagelok coupling to connect the line for LN<sub>2</sub> auto supply. Note that the coupling is in extremely low temperature during and immediately after dispensing LN<sub>2</sub>.

Supply signal connector  
(Optional)

:Port to connect to auto supply level indicator with dedicated cable to input and output the signal.



**Figure 2-6 UW701N Front**



**Figure 2-7 UN701N Status display**

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## 2.6 UW701N Front (Figure 2-6)

Helium gas pressure meter	: Displays the helium pressure of UW701. In operation 1.90 – 2.30MPa
Helium charge port	: Connect a hose to charge helium gas. Do not remove the cap while it is not in use.
Helium charge valve	: This valve is used to charge helium gas. Do not touch except when necessary to prevent helium leakage.
Elapsed time meter	: The meter records the number of hours the UW701N compressor has been operating. Use the record to determine when to perform maintenance works.

## 2.7 UW701N Status display (Figure 2-7)

Power light	: When the power is supplied to UW701N, this indicator illuminates red.
Alarm lights	: Eight display lights to display error states.
RESET switch	: Press this button to reset when an error of UW701N.

### 3. Flow Sheet

The figure below shows the flow diagram of MP-300K (fixed automatic type 2)

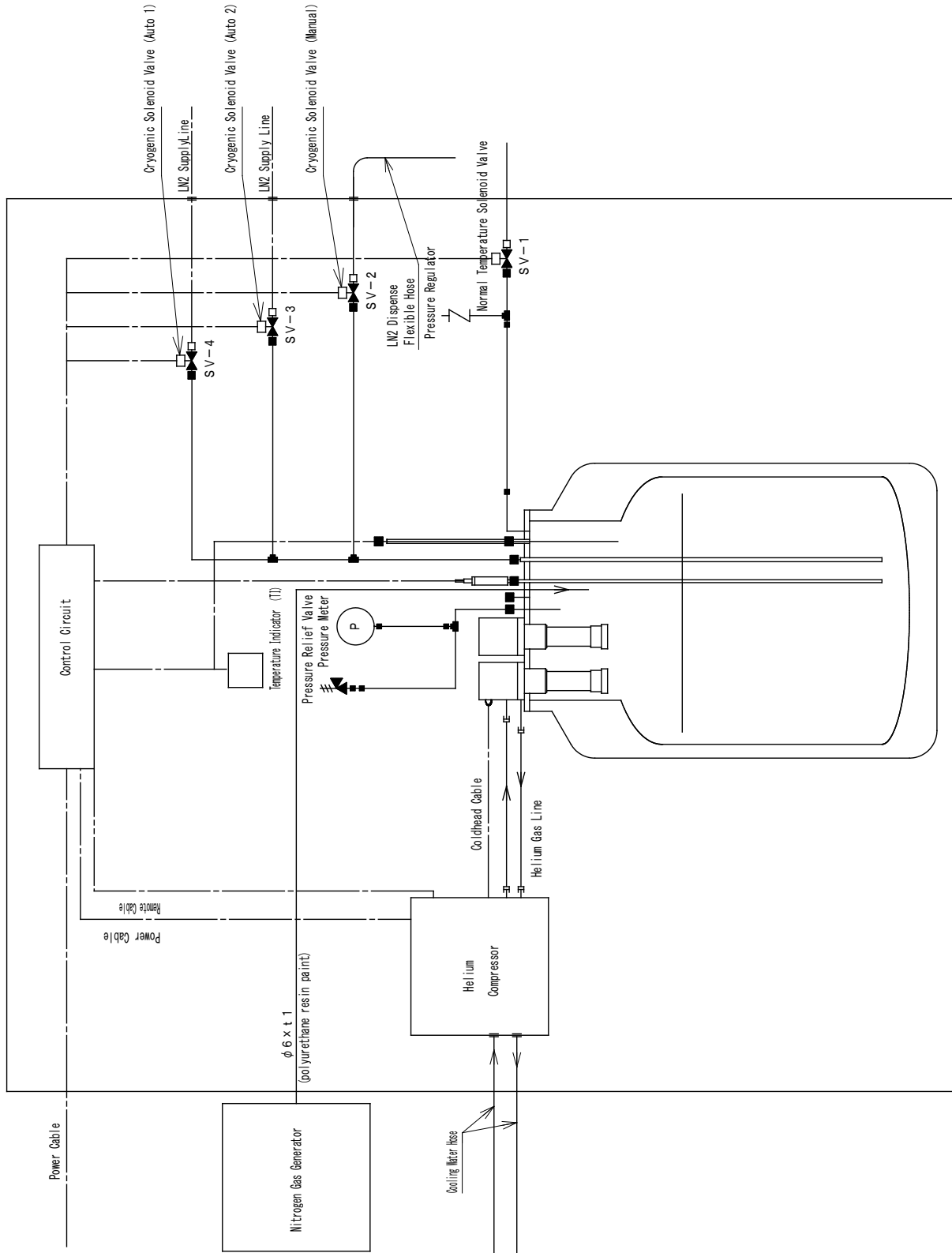


Figure 3-1 Flow diagram

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## 4. Specifications

### 4.1 Liquid nitrogen generator

Type	: MP-300K
LN <sub>2</sub> production	: 28L/day (50Hz), 30L/day (60Hz)
Dimensions	: 1050[W] x 750[D] x 1795[H]
Weight	: Approx. 430 kg (without LN <sub>2</sub> )
LN <sub>2</sub> Storage	:100L (maximum)
Cold head type	: S050 (2 units)
Compressor type	: UW701N
Cooling method	: Water-cooled
Ambient conditions	: Ambient temperature: 10 – 35°C Relative humidity: 80% or less (Non-condensation other than LN <sub>2</sub> dispense port)

- MP-300K is intended for indoor use only.
- Do not use the equipment in the atmosphere with organic solvents or corrosive gases.

### 4.2 PSA system nitrogen gas generator

Type	: GN-20i
Dimensions	: 470[W] x 620[D] x 1225[H]
Weight	: Approx. 140 kg
Cooling method	:Air-cooled (inhale from front, exhaust from back)

- PSA nitrogen generator is intended for indoor use only.
- This equipment must not be used in the atmosphere with organic solvents or corrosive gases.
- PSA nitrogen generator is air-cooled. Clear the air inhale and exhaust ports and do not block.

## 5. Utilities

### 5.1 Power source (for MP-300K)

Voltage	: 190-220 VAC , three-phase (50Hz) 200-230 VAC, three-phase (60Hz)
Power capacity	: 30 A or above
Power consumption	: 4.3/5.2 kW ( 50/60 Hz )
Connection	: Round type crimping terminal for M6



### CAUTION

Use D-type earth ground for safety.

### 5.2 Cooling water (for MP-300K)

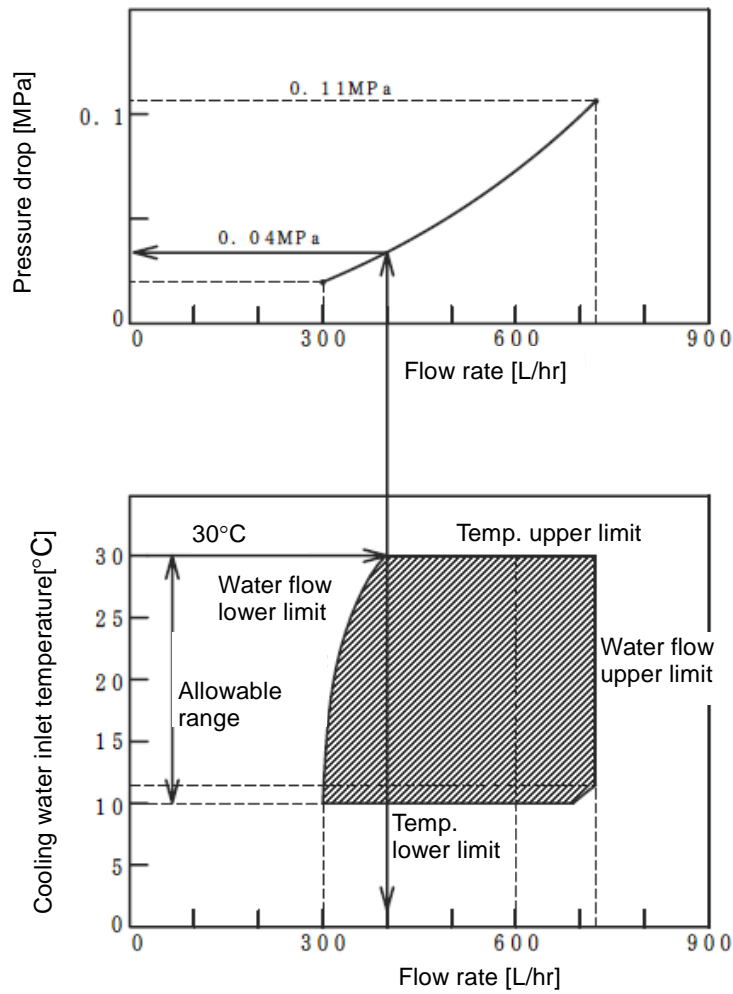
Recommended flow rate	: 6.7 L/min (400L/hr)
Recommended pressure	: 0.04 MPa
Recommended temperature:	20°C
Water quality	: Tap water equivalent

\* Check the water quality on a regular basis.



### CAUTION

The flow rate of cooling water should be within the following allowable range. When the flow rate or pressure is too low, it may result in abnormal suspension, failure, or damaging cooling water pipes due to the temperature rise.



**Figure 5-1 Allowable range of cooling water for MP-300K**

5.3 Power supply for GN-20i

- Voltage : AC100V±10% (50/60Hz) single-phase
- Power capacity : 15A or above
- Power consumption : 0.7 / 0.8kW (50/60Hz)
- Connection : Grounded outlet



**CAUTION**

Use D-type earth ground for safety.

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5.4 Nitrogen gas for MP-300K (for systems with N<sub>2</sub> gas supply)

Supply pressure	: 0.3 – 0.99 MPa
Flow rate	: 20NL/min or more
Purity	: 99% or above
Dew point	: -60°C or below

<NOTE> Supply N<sub>2</sub> gas continuously.

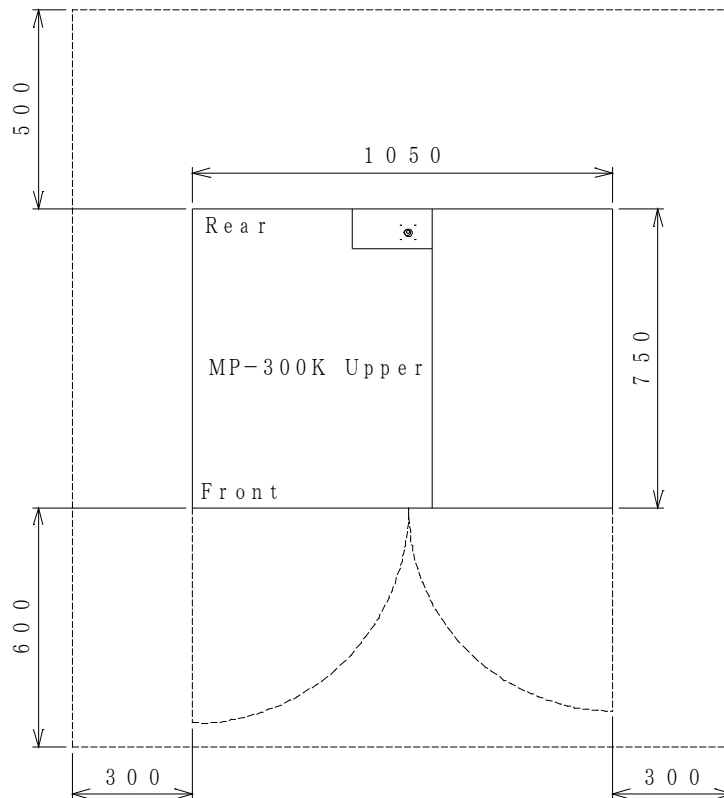


## 6. Installation

### 6.1 Conditions for installation place

- (1) Install the equipment at a level and stabilized indoor place. Power supply or other utilities should be located nearby.
- (2) Install the equipment at a well-ventilated place where the ambient temperature is 10 – 35°C and humidity is 80% or less.
- (3) Secure the following spaces for maintenance.

<NOTE> Spaces other than the back are required only at the time of maintenance and check, and do not always need to be secured.



**Figure 6-1 Maintenance space for MP-300K**

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

## 6.2 GN-20i Power-supply connection



### WARNING

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

- Supply Voltage : 100VAC±10% (50/60Hz)
- Power capacity :15 A or more
- Power consumption :0.7kW / 0.8kW (50/60 Hz )

- (1) Confirm that the power-supply voltage is within the above scope by using testers or other devices.
- (2) Connect the power cable on the back of GN-20i to power outlet.
- (3) Turn ON the circuit breaker on the back of GN-20i.

## 6.3 MP-300K utility connection

Remove the back panel of MP-300K and locate a hole for utility connection at the bottom. Connect power cable, cooling water hose, nitrogen gas tube, and nitrogen gas generator remote cable through this hole.

### 6.3.1 MP-300K power supply connection





### WARNING


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

- Supply Voltage : 190-220 VAC (50Hz) three-phase,  
200-230VAC (60Hz) three-phase
- Power capacity :30 A or more
- Power consumption :4.3kW / 5.2kW (50/60 Hz )

- (1) Check that the power supply voltage is within the range shown above.
- (2) Connect the power cable through the hole on the bottom and check that the connection to the power supply breaker is correct. If the connection is inappropriate, an accident such as burn might occur during operation.
- (3) When the connection is completed, turn ON the breakers on the power supply side and MP-300K circuit breaker to start power supply. Then, open the MP-300K left side door to check that alarm light of UW701N is off. When the

alarm light is on, the connection is in reversed-phase. Disconnect the power supply and exchange the two lines out of three on the power supply side.

	 <b>WARNING</b>
Do not connect the earth wire to the power supply line. It may lead to electric shock or electric leakage.	

 <b>CAUTION</b>
When multiple devices run on one power source, total capacity must be observed carefully. Overcurrent (voltage drop) by lack of capacity may damage the equipments.

 <b>CAUTION</b>
When extension of power cable is needed, the work must be performed by a personnel who has sufficient knowledge and skill on power connection or cable selection.

### 6.3.2 Connect cooling water tube to MP-300K

**NOTE:** Depending on water quality, scale might accumulate inside cooling water tube, or the tube might be corroded. It is recommended to use water circulation system when there is such concern.

- 1) Connect the attached cooling water joint to the cooling water IN and OUT connectors. The screw size of the connector is R3/8. Place seal tape on the screw part.
- 2) Connect the cooling water joint to the cooling water supply side.
- 3) Connect the cooling water hose to the water supply side and the MP-300K water IN connector, and water discharge side and MP-300K water OUT connector.
- 4) When the connections are made, open the main valve of cooling water supply to check that the water flow is correct and no leak is seen in the coupling or hoses in the joint part of couplings or hose.
- 5) When you use cooling water circulation system, set the water temperature at 20°C.



## CAUTION

Water may leak if the connection between cooling water joint and hose is loose.



## CAUTION

Be sure to connect the hose to the correct port. Wrong connection may result in breakage of cooling water tube and leakage of water.

(\*)Refer to UW701N instruction manual for the detail of allowable range of cooling water.

### 6.3.3 Connection of Nitrogen gas tube

Place Nitrogen gas tube from the bottom hole and connect it to the gas connector of the nitrogen gas pressure regulator. Connect the other side to the nitrogen gas supply valve of customers' preparation.

### 6.3.4 Connection of nitrogen gas generator remote cable

Connect the nitrogen gas generator remote cable to the remote connector located inside the MP-300K, and the signal connector on the back of the GN-20i.

Attach the MP-300K back panel when all the connections are completed.

# 7. Electric Wiring

## 7.1 MP-300K

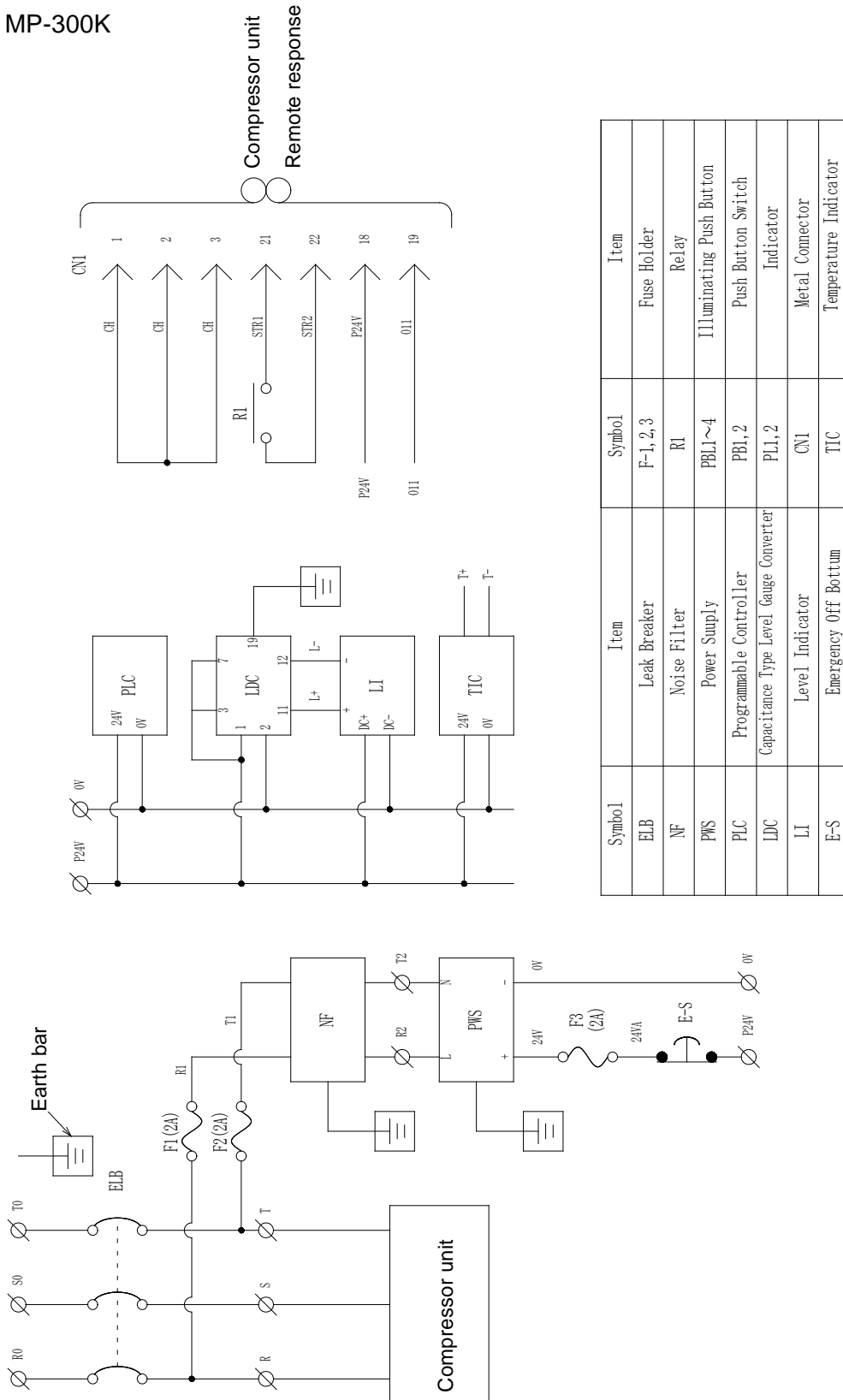


Figure 7-1 MP-300K Electric wiring-1

Symbol	Item	Symbol	Item
ELB	Leak Breaker	F-1, 2, 3	Fuse Holder
NF	Noise Filter	RI	Relay
PWS	Power Supply	PBL1~4	Illuminating Push Button
PLC	Programmable Controller	PBL, 2	Push Button Switch
LDC	Capacitance Type Level Gauge Converter	PL1, 2	Indicator
LI	Level Indicator	CNI	Metal Connector
E-S	Emergency Off Button	TIC	Temperature Indicator

7.2 MP-300K(PLC)

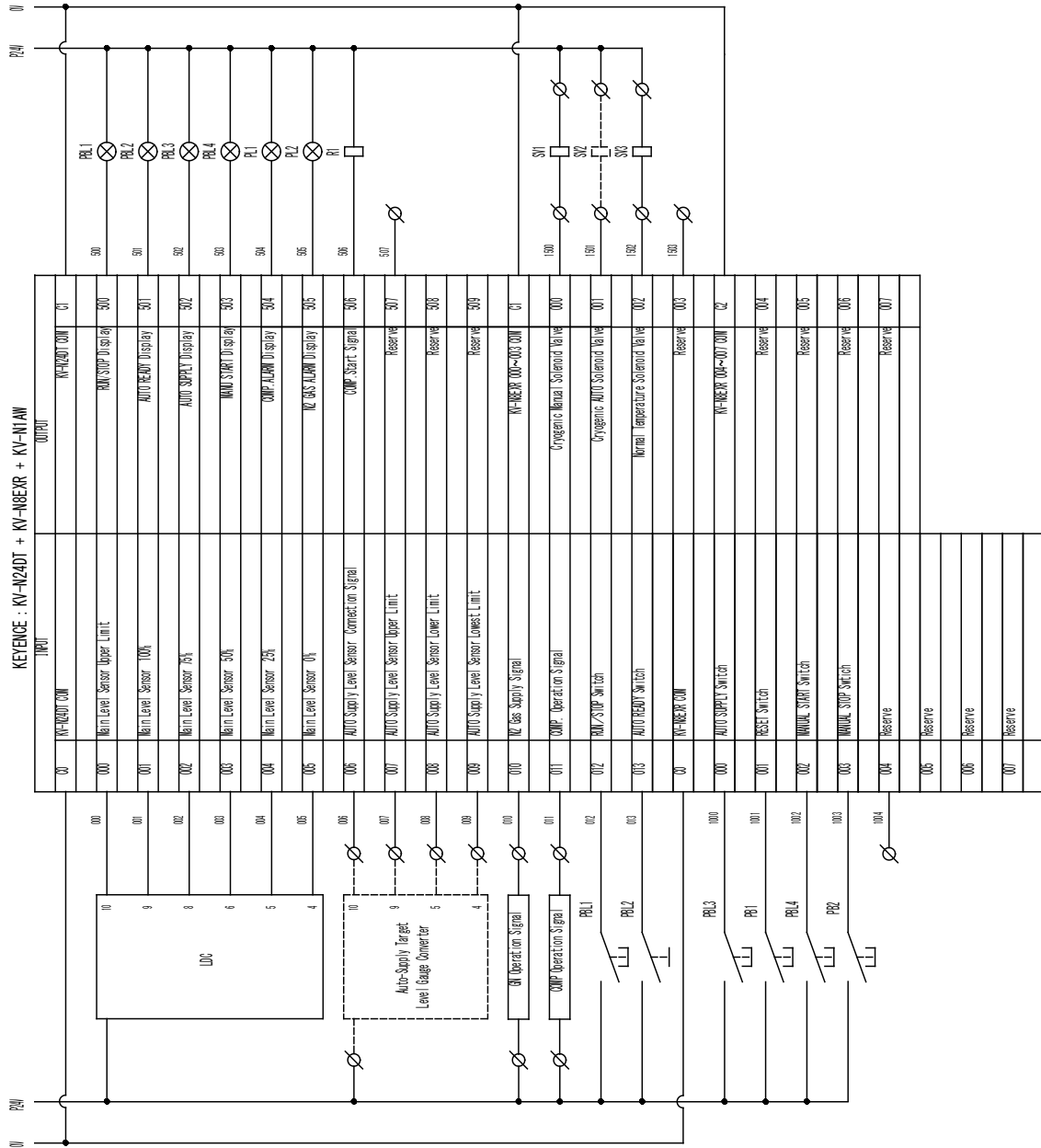


Figure 7-2 MP-300K Electric wiring-2 (PLC)

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## 8. Operation

### 8.1 Checks prior to operation

Check the following before starting the operation.

- (1) The power source of MP-300K and GN-20 are connected properly.
- (2) There is sufficient space in front of the air inhale and exhaust areas of GN-20.
- (3) Cooling water hose is connected correctly between MP-300K and water supply.
- (4) Nitrogen gas tube is connected correctly between MP-300K and the nitrogen gas source.
- (5) The RUN/STOP button of MP-300K is turned OFF (light off).
- (6) The main power source of MP-300K and GN-20 are ON.
- (7) Nitrogen gas generator remote cable is connected properly between MP-300K and the nitrogen gas generator.

### 8.2 Operation preparation

#### 8.2.1 Start supplying nitrogen gas

(When using GN-20i)

- (1) Press the GN-20i POWER button to startup GN-20i. The POWER button lights green when it starts up normally.
- (2) Nitrogen gas supply starts after six minutes of GN-20i startup along with the rise of the ball in flow meter in the center. When nitrogen gas supply starts, N<sub>2</sub> GAS ALARM light of MP-300K is turned off. Check that the center of the ball is at 20NL/min. When it is not at the right position, adjust with the flow rate control valve. Refer to the GN-20i instruction manual for the procedure.

(For the system with nitrogen gas supply)

- (1) Open the nitrogen-gas supply valve, supply nitrogen gas to MP-300K.
- (2) Open the front door of MP-300K, adjust the pressure to 0.25MPa with pressure regulator. A click sound is heard (sound of a pressure switch), and N<sub>2</sub> GAS ALARM lamp turns off. Then, adjust the pressure to 0.2MPa. After that, check that the ball center of a flow meter is on the position of 20 NL/min. When shifted, adjust the flow rate by the control valve.



### CAUTION

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

## 8.2.2 Start-up

- (1) Press the RUN/STOP button on the operation panel to turn ON (lights green). UW701N starts up and LN<sub>2</sub> production starts.
- (2) Since inside of liquid nitrogen dewar is at room temperature at initial start-up, it is necessary to take the time to cool inside of the dewar. (It normally requires about half a day.) When the dewar is sufficiently cooled, production of liquid nitrogen starts. The production continues until liquid nitrogen in the dewar reaches 100 liters (100%). After that, production starts when the amount of remaining liquid nitrogen is below 75L (75%), and stops at 100L (100%). This cycle goes on repeatedly.

## 8.3 Shutdown

When the RUN/STOP button is turned OFF (lights off), all the operation of MP-300K including LN<sub>2</sub> production or supply stops. Caution is advised for items as follows.

- (1) Do not attempt to interrupt the nitrogen gas supply.

When nitrogen-gas supply stops, LN<sub>2</sub> production also stops. The cold head right after stopping the operation is at extremely low temperature and likely to cause water condensation or freezing. Therefore, when moisture in the atmosphere enters, ice or frost might be generated. Do not stop nitrogen gas supply for ten minutes after the system is shutdown.

- \* Note that allowing ice or frost may bring about the drawbacks shown below.

- ◆ Decrease of liquefied nitrogen production
- ◆ Liquefied nitrogen supply failure
- ◆ Level sensor failure

- (2) Shutdown procedure

Follow the steps below when shutting down MP-300K for reasons such as utility stop.

1. Turn OFF RUN/STOP switch of MP-300K. After the LN<sub>2</sub> production (UW701N) stops, turn OFF the breaker.

↓ Wait for 10 minutes or more.

2. Turn OFF the GN-20i POWER to shutdown, and turn OFF the GN-20i breaker. Or, close the nitrogen-gas source valve to stop supply. Or, stop cooling-water supply.

**NOTE:** By waiting for longer than 10 minutes after shutting down LN<sub>2</sub> production, the edge of the coldhead is warmed up, reducing the air intake. When stopping cooling-water supply, turn OFF the MP-300K RUN/STOP



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switch first, and wait for longer than 10 minutes after LN<sub>2</sub> production stops to allow UW701N to cool down.

## 8.4 Corrective action in the event of an error

When errors occur in the equipments, please follow the procedure below and in “12. Trouble Shooting”.

### 8.4.1 Corrective action when electric power failure occurs

MP-300K and GN-20i will be automatically restored in the event of a power-failure and they will be rebooted automatically when the electricity comes back. However, when the amount of LN<sub>2</sub> is 75% or more, LN<sub>2</sub> production may not be resumed at the time of rebooting.

### 8.4.2 Corrective action when COMP. ALARM occurs

(1) Open the front right door and check the alarm light of UW701N.

STS 1-8 light up: The power supply error of UW701N has occurred. Check whether the power supply is reverse-phased or power-supply voltage is not low.

STS 2-8 light up: The internal temperature error of UW701N has occurred. Please contact us.

STS 3-8 light up: The internal temperature error of UW701N has occurred. Contact us.

STS 4-8 light up: The cooling water system error of UW701N has occurred. Check the cooling water pressure and flow rate. Wait about 30 minutes after adjusting to the normal range.

STS 5-8 light up: Helium gas pressure of UW701N is declining. Adjust the Helium gas pressure to the normal range.

STS 6-8 light up: The cold head protection circuit is operating. The circuit protector (CP2) of UW701N is turned on.

STS 7-8 light up: The protection circuit of the main part of a compressor is operating. Check power-supply voltage and Helium gas pressure. A power supply is re-switched on after intercepting a power supply for several minutes after adjusting to the normal range.

STS 8 light up: The controller error of UW701N has occurred. Turn off the power supply for several minutes, and turn on the power again.

(2) Open the front right door, and press the RESET switch of UW701N with a thin stick. If the UW701N is ready to be restarted, alarm light turns off and an alarm buzzer also stops.

(3) Press RESET button on the MP-300K operation panel.

(4) When the fault is cleared, UW701N re-starts. When UW701N does not start

and COMP.ALARM lights up again, please contact us.

### 8.4.3 Corrective action for GN2 AL. State

<System with GN-20i>

- (1) Turn OFF the RUN/STOP switch of MP-300K.
- (2) Reset and restart the GN-20i. When N<sub>2</sub> gas starts to be supplied from GN-20i, N<sub>2</sub> GAS ALARM light turns off.
- (3) Turn ON the RUN/STOP switch of MP-300K to restart.

<System with N<sub>2</sub> gas supply>

- (1) Turn OFF the RUN/STOP switch of MP-300K.
- (2) Check that the N<sub>2</sub> pressure is above 0.3MPa.
- (3) Adjust the pressure regulator inside the MP-300L front door to 0.25MPa or above, turn off the N<sub>2</sub> GAS ALARM light, and then adjust to 0.2MPa. Check that the flow rate is 20NL/min.
- (4) Turn ON the RUN/STOP switch of MP-300K to restart.

### 8.5 Emergency off

In case of an emergency, press the emergency off button on the front to disconnect the control power supply and stop all the operation of MP-300K.

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








## CAUTION

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

Turn the emergency OFF switch to the right to clear.

## 9. Manual Dispense of Liquid Nitrogen

					WARNING
<ul style="list-style-type: none"> <li>• When dispensing liquid nitrogen, make sure to keep the room well ventilated in order to prevent oxygen shortage.</li> <li>• Never attempt to seal liquid nitrogen.</li> <li>• 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 at the lowest temperature right after dispensing.</li> </ul>					


### 9.1 Connecting liquid nitrogen supply port

Connect the joint (coupler joint) of attached flexible hose to LN<sub>2</sub> supply port located at the front of MP-300K. When connecting to the coupler joint, do so while pushing down the outer ring part of the MP-300K side.

### 9.2 Dispense liquid nitrogen

To manually dispense liquid nitrogen, insert the head end of flexible hose in liquid nitrogen dewar, and keep pressing the MANUAL START buttons for 3 seconds. With the above steps, the MANUAL START buttons are lit in green, and liquid nitrogen flows out of head end of flexible hose or pipe.

The dispense operation stops automatically 10 minutes later from the start-up of supply. The MANUAL START flickers 30 seconds in advance of the automatic termination. When more liquid nitrogen is needed, press MANUAL START buttons again to extend the operation for another 10 minutes. Press MANUAL STOP buttons to stop dispensing.

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

- ◇ LN<sub>2</sub> production stops during the manual dispense operation.
- ◇ When nitrogen-gas supply stops, liquid nitrogen cannot be dispensed.
- ◇ When AUTO READY is pressed and MP-300K is waiting for automatic supply, the amount of LN<sub>2</sub> that can be dispensed manually is limited to 25%. Manual dispense cannot be performed while automatically supplied. Manual dispense should be started after the automatic supply is completed.

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### 9.3 Disconnecting Manual Dispense 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 in the opposite way of connecting. Push down the outer ring of the MP-300K side joint and pull out the flexible hose to disconnect.

## 10. Automatic Supply of Liquid Nitrogen

					WARNING
<ul style="list-style-type: none"> <li>• When dispensing liquid nitrogen, make sure to keep the room well ventilated in order to prevent oxygen shortage.</li> <li>• Never attempt to seal liquid nitrogen.</li> <li>• 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 at the lowest temperature right after dispensing.</li> </ul>					

### 10.1 Inspections before automatic transfer

Check the following before starting automatic transfer.

- (1) Level indicator cable is connected properly between the MP-300K and the level sensor on the auto transfer destination.
- (2) LN<sub>2</sub> transfer piping is properly connected between MP-300K and the dewar in auto transfer destination.
- (3) Nitrogen gas release port is exposed to the air.

### 10.2 Automatic transfer

- (1) Turn ON the MP-300K AUTO READY switch (Standby for automatic transfer)
- (2) When the level sensor detects the remaining LN<sub>2</sub> is less than 25%, automatic transfer starts. Automatic transfer can be initiated by pressing AUTO SUPPLY button. AUTO SUPPLY button lights white during automatic transfer.
- (3) When the level sensor in the auto supply destination detects 100%, automatic transfer is terminated. Automatic transfer also stops by the following conditions;
  1. The MP-300K RUN/STOP or AUTO READY is turned OFF,
  2. The remaining LN<sub>2</sub> in MP-300K is 0%,
  3. Nitrogen gas supply stops
  - ◇ Manual dispense cannot be started while automatic transfer is taking place.
  - ◇ When the AUTO READY is pressed and the MP-300K is in standby for automatic transfer, manual dispense is limited to 25%.

### 10.3 Time limit of automatic transfer

When certain time (typically 10 minutes) passes from the start of automatic transfer, MP-300K stops supplying, and AUTO READY and AUTO SUPPLY buttons blink alternately. The blink can be cleared by pressing AUTO READY button.

Check the remaining volume of LN<sub>2</sub> in the target dewar and contact us if any error is observed.

## 11. Maintenance and Inspection

### 11.1 Daily inspection

Check for the following items for daily inspection.

- Pressure gauge reading record; below the pressure of 0.028MPa.
  - Level gauge record
- The operation sound generated from each unit is normal.
- The pressure and flow rate of nitrogen gas are 0.2 MPa and 20NL/min. respectively.
- He gas pressure of UW701N is within appropriate range.
 

When in operation:            1.90 – 2.30 MPa
- The alarm light of MP-300K is off.

### 11.2 Maintenance/inspection intervals

Parts	10,000Hr	30,000Hr	40,000Hr	1 year	2 years	5 years
Coldhead cylinder (2 units) *1	✓					
Adsorber (Compressor)		✓				
Helium line coupling			✓			
GN-20i air compressor				✓		
GN-20i filter *2				✓		
GN-20i solenoid valve *3					✓	

◇ Check the total operation time of the system with the hour meter on UW701N.

\*1... Maintenance interval is normally 10,000 hours, however, even if 10,000 hours is not reached, replace them once every 5 years as the internal parts may become deteriorated.

NOTE: When replacing the oil adsorber, it is requested to return the used set to us after replacement.

\*2 Clean the filter on the air intake port of GN-20i every month.

\*3 Maintenance cycle differs depending on the frequency of operation.  
In case GN-20i is operated continuously, the solenoid valve should be replaced every two years.



## WARNING

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



## 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

## 12. Troubleshooting

When any failure or unusual state is found, perform the fault diagnosis shown in the following table. When contacting us, check the status lights of sequencer on the electrical circuit in advance.

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

Problem	Possible Cause	Corrective Action
(1) The unit fails to start even if the RUN/STOP switch is turned on” (The RUN/STOP button fails to light.)	The main power source (breaker) is turned off.	Turn on the main power source.
	The main power cable is not connected.	Connect the main power cable correctly.
	The fuse of MP-300K electrical circuit is blown.	Replace the fuse with a new one. If the fuse is blown repeatedly, contact us.
	The power (breaker) of MP-300K is turned off	Turn on the power breaker of MP-300K
	The emergency stop switch is pressed.	Reset the emergency stop switch by turning it to the right, and restart.
(2) LN <sub>2</sub> production fails to start even if the RUN/STOP switch is turned on” (The RUN/STOP switch lamp comes on.)	The LN <sub>2</sub> level does not reach the re-starting level.	When LN <sub>2</sub> level is decreased to lower than 75%, LN <sub>2</sub> production resumes automatically.
(3) Power breaker is tripped	Short circuit or leak current occurs.	Contact us.
(4) N <sub>2</sub> GAS ALARM lights. The RUN/STOP switch lamp of MP-300K flickers at the same time	GN-20i is suspended.	Restart GN-20.
	N <sub>2</sub> supply is declined, or the pressure goes down temporarily.	Refer to the 8.4.3 Corrective action when N <sub>2</sub> GAS ALARM occurs” and re-start the system.



Problem	Possible Cause	Corrective Action
	The power source is connected with phase reversed, or the voltage drops (STS 1-8 of UW701N lights up.)	In case of reversed phase, replace 2 lines in 3 lines. When power supply voltage is falling, check the main power supply.
	Internal temperature of UW701N abnormally goes up. (STS 2-8 of UW701N lights up.) (STS 3-8 of UW701N lights up.)	Contact us.
	The cooling water is not supplied, or the cooling water flow rate drops. (STS 4-8 of UW701N lights up.)	Supply the cooling water sufficiently. Then, reset UW701N, and next, press RESET of MP-300K.
	Helium gas pressure is declining. (STS5-8 of UW701N lights up)	Check helium gas pressure. Add helium gas and reset the system. When it occurs again, contact us.
	Cold head motor protection worked. (STS6-8 of UW701N lights up)	Turn ON the circuit protector (CP2) of the UW701N back. Carry out reset operation after that. When it generate again, make contact with us.
	Compressor motor protection worked. (STS7-8 of UW701N lights up)	Check the power supply voltage and helium pressure. When they are within the normal range, shutdown the power source for a few minutes and then restart. Contact us when this occurs again.
	UW701N controller is in error state. (STS8 of UW701N lights up)	Shutdown the power source for a few minutes, and then restart. Contact us when this occurs again.

Problem	Possible Cause	Corrective Action
(6) RUN/STOP button flickers, and LN <sub>2</sub> production does not start. (Alarm light is off)	Dew condensation occurred in the level sensor of MP-300K.	Check tube connection and nitrogen-gas flow rate of MP-300K and a nitrogen-gas source of supply. The level sensor needs to be dried. Contact us.
	MP-300K level sensor has dew.	Contact us.
(7) LN <sub>2</sub> cannot be dispensed	There is no liquefied nitrogen due to initial start-up, etc. (Liquefied nitrogen level display is 0%.)	Wait until the liquefied nitrogen is accumulated.
	The level sensor is incorrect-operating under the influence of ice and frost generated inside the container.	Contact us.
	Solenoid valve failure (Working sound of solenoid valve is not heard.)	Contact us.
	AUTO READY is turned OFF. (When automatic transfer fails)	Turn ON the AUTO READY.
(8) LN <sub>2</sub> does not increase	The system is in initial start-up process.	Wait about half a day until the dewar is sufficiently cooled to store LN <sub>2</sub> .
	Helium gas tube and refrigerator cable are not connected correctly after maintenance.	Connect the Helium gas tube and refrigerator cable correctly.
	The level sensor fails to detect correctly.	Contact us.

Problem	Possible Cause	Corrective Action
(9) LN <sub>2</sub> accumulation declines	Ice or frost appears around the cold head.	Contact us.
	The maintenance interval for cold head and oil absorber is reached.	Perform the maintenance works, depending on operation hours.
	Helium gas pressure of UW701N is decreased.	Fill the Helium gas additionally until the specified pressure is reached. When the trouble occurs repeatedly, contact us.
	Evaporation in the dewar increases.	Contact us.
	MP-300K inhales gases such as helium.	Contact us.
	The purity of nitrogen gas is not sufficient.	Check the purity of the nitrogen gas.
(10) AUTO READY button flickers	The level sensor in the supply destination is in error state.	Contact us.
	The level sensor cable in the supply destination is not connected or broken.	Check the level sensor cable,
(11) MANUAL START button flickers	30 seconds before the manual dispense time limit (10 minutes) is reached.	If you wish to continue dispensing, press MANUAL START button again.
(12) AUTO READY and AUTO SUPPLY flickers alternately	Supply signal continues from the level sensor in the supply destination although automatic transfer time limitation is reached.	Press AUTO READY to release the automatic supply state, and check the LN <sub>2</sub> level in the supply destination. Contact us if any error is found.
(13) Other failures		Contact us.

## 13. Accessories

The accessories below are delivered along with the equipments.

### MP-300K

Flexible hose for dispensing LN <sub>2</sub>	1 (0.8m)
Cooling water hose	2 (5m)
Cooling water joint	2 (Screw size R1/2)
Nitrogen gas tube	1 (5m)
Wrench	1
Glass fuse	3 (2A x 3)
Instruction manual	1 (This book)

### GN-20i

N <sub>2</sub> generator remote cable	1 (5m)
Instruction manual	1

For systems with nitrogen gas supply

N <sub>2</sub> gas tube connector	1 (Screw size R1/4)
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NOTE: The carton content may vary depending on the customer specification.

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## 14. Warranty

### 14.1 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.

#### 14.2 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.

#### 14.3 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**

Refer to the "SERVICE NETWORK" at the end of this book for our contact information.

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## SERVICE NETWORK

- For technical support, servicing or additional contact information, visit us at [www.ulvac-cryo.com](http://www.ulvac-cryo.com).

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**Revision History**

Date	Revision No.	Contents
2017 / 1 / 25	2017.01	First edition
2019 / 3 / 14	2019MH01	Full-fledged revision

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