



SICERA CRYOPUMP **SYSTEM OPERATION MANUAL**

(Cryopump System)
SKV

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INSTRUCTION PRIOR TO INSTALLATION & MAINTENANCE

- (1) This user's manual provides the information required to install and maintain the cryopump (including the cold trap or cold head; the same shall apply hereinafter in this section except the particular function and component) system.
- (2) Sumitomo Heavy Industries (SHI) requires all users to read this manual prior to the installation and operation of the system.
- (3) Using the system without following the directions in this user's manual may result in malfunction of the system or may be hazardous to the human body of the operator. SHI shall provide no warranty in case the system is used without following the directions recommended in this manual.
- (4) Copying or duplicating this user's manual in part or in whole is prohibited without expressed or written permission from SHI.
- (5) SHI reserves the right to change any or all information contained herein without prior written notice. Revisions may be issued at the time of such changes and/or deletions.
- (6) If you have any questions, please contact SHI.

PRECAUTIONS

This manual uses the following signs and expressions to describe items requiring strict observance to prevent injury to the operator and other persons, damage to the system, the mother system or property, etc.

<p>WARNING</p> 	<p>< WARNING > Indicates a potentially hazardous situation that may cause injury to the operator or people around the system in the event of improper handling without any account of this description. When using the system, be sure to adhere to this description.</p>
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<p>CAUTION</p> 	<p>< CAUTION > Indicates a potentially hazardous situation that may result in troubles such as malfunction and damage of the mother system in the event of improper handling without any account of this description. When using the system, be sure to adhere to this description.</p>
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WARNINGS

This cryopump accumulates and stores gases and reactive substances from the mother system at ultra low temperatures. These gases and substances can be toxic, corrosive, flammable (combustion promoting, combustible, hypergolic, explosive) or reactive.

Inhaling or swallowing toxic gases can be fatal or cause permanent disabilities. It is very important to know all the potential dangers involved.



< Warning of Toxic Substances >

This cryopump handles toxic gases, vapors and substances. Also, the substances formed by the mother system as well as gases or vapors made by chemical reaction can be toxic.

Inhaling or accidentally swallowing these substances can cause serious injury or even death.

Should the gas leak, safely and effectively ventilate the room. Until the danger passes, have all persons not sufficiently knowledgeable of emergency procedures or fully covered in proper protective gear leave the danger area.

Also, transport anyone who possibly inhaled a toxic gas out of the dangerous area before applying first-aid. See a physician as soon as possible.

When scrapping the cryopump, handle it as industrial waste and pass it over to legally qualified disposer. (Lead is included in the cold head of the cryopump.)



< Warning of Oxygen Deficiency >

If breathing air which contain less than 18% oxygen, humans succumb to oxygen deficiency. A lack of oxygen required by the body can lead to lost mental capacity, fainting, blackout and even permanent disabilities and death.

Inert gases such as N₂ are generally innocuous, but they can provoke an oxygen deficiency. Be aware and cautious of such conditions.

If gas leaks, it is important to ensure that oxygen concentration is 18% or higher.

Safely and effectively ventilate the room. Until the danger passes, have all persons not sufficiently knowledgeable of emergency procedures or fully covered in proper protective gear leave the danger area.

Also, transport anyone who is possibly suffering from an oxygen deficiency out of the dangerous area before applying first-aid. See a physician as soon as possible.



< Warning of Corrosive Substances >

When the cryopump exhausts corrosive substances, these substances can adhere to it and cause corrosion. Corrosion can lead to damage. Also, because the cold head contains high pressure helium gas, corroded parts can rupture under high pressure, which is extremely dangerous.

Contact SHI before using this cryopump in processes which use corrosive gases or from corrosive substances.

The cryopump cylinder is made of stainless steel and copper. Special attention is needed when cryopumping the gases and the substances which are corrosive to these materials. (Corrosive substances can form even inside vacuum chambers because of plasma reactions and ion implantation.)



< Warnings of Flammable Substances >

Flammable substances are categorized by their properties as combustion promoting, combustible, hypergolic, explosive, and so forth. Familiarize yourself with properties of the gases used before cryopumping them.



This cryopump accumulates and stores gases and reactive substances at ultra low temperatures. Hence, there is the danger of substances already accumulated inside becoming dangerously reactive if additional gases or substances are cryopumped through the cryopump. Always regenerate the cryopump before introducing new gases or reactive substances.



Keep flames away from this product.

Keep this product away from sources of heat.

During regeneration, switch off power to any equipment or sensors, which might possibly ignite regenerative gas upon contact.

If reacted with, flammable substances can cause fire or explosion.

Fire or flying fragments can injure or kill a person.

Gases or reactive substances can contain substances that burn or explode upon contact with air. Fire or flying fragments can injure or kill a person. Always check for leaks before use.

Example: Oxygen (O₂)

Make note of the fact that O₂ promotes combustion. Sometimes when substance burn in air, combustion can become rampant and cause explosions if O₂ concentration is high.

Example: Hydrogen (H₂)

H₂ is odorless, colorless, tasteless and readily flammable. It can catch fire, if ignited, when its concentration is 4 to 75% in air or 4.0 to 94% in oxygen. It can also explode upon ignition at a concentration of 18 to 59% in air or 15.5 to 92.6% in oxygen. When H₂ burns, most of the flames do not emit a visible light, so it is extremely hard to confirm fires visually. Therefore, use due caution to prevent fires from occurring. Dilute H₂ concentration levels to prevent combustion and explosion.

Example: Ozone (O₃)

Inhaling a large quantity of ozone (O₃) causes headaches, coughing, pulmonary edema or other disorders. An atmospheric concentration over 0.1 ppm can harm or kill a person. It is extremely dangerous. Should O₃ leak, have all persons not sufficiently knowledgeable of emergency procedures or fully covered in proper protective gear leave the dangerous area. Also, transport anyone who is possibly suffering from O₃ inhalation out of the dangerous area before applying first-aid. See a physician as soon as possible.

When releasing internally accumulated O₃ by regeneration, there is the possibility of liquefied O₃ exploding if it drips on the first-stage radiation shield panel. Keep O₃ from accumulating in large quantities inside the cryopump.

Example: Phosphorus (P)

The phosphorous oxides formed from the combustion of phosphorus (P) are highly corrosive when dissolved in water. There is a danger of burn injury upon contact or serious handicap if inhaled. In case P-started fire break out, have all persons leave the dangerous area who are not sufficiently knowledgeable of emergency procedures and not fully covered in proper protective gear. Also, transport anyone is possibly suffering from phosphorus burns out of the dangerous area before applying first-aid. See a physician as soon as possible.

If possibly cryopumping hyperbolic substances such as P through the cryopump, prepare a cap that isolates internal gases from the atmosphere (oxygen) whenever the cryopump is detached from the vacuum chamber. If fire breaks out when the cryopump is detached, put the fire out by shutting off air supply with the prepared cover. Do not leave the gas to naturally burn out. The cryopump uses high-pressure gas to generate ultra low temperatures. Combustion can rupture the pressure vessel, which would be extremely dangerous.

Here, only a few of the potentially dangerous gases and substances pumped with this cryopump have been explained, but these have other properties also. In fact, the cryopump can be used with many more substances depending on the objective or

process. Familiarize yourself with the properties of gases and substances, which may be present in the cryopump before installing, operation or performing maintenance on it.

< Combustion Range of Combustible Gases >

If exhausting combustible gases, set regeneration purge gas rate so that the concentration of the combustible gas is not within the combustion range even if the gas is revaporized. The gas can be revaporized by regeneration or rise of a cryopanel temperature.

*The cryopanel temperature rises, when the cryopump remains stopped for long periods of time due to power failures and so forth.

Table 1 Combustion Range of Major Gases

Stable Combustion Range of Combustible Gases

Range name of gas	Stable Combustion Range in the air		Stable Combustion Range in oxygen		Detonation Range in the air		Detonation Range in oxygen	
	lower point Vol%	upper point Vol%	lower point Vol%	upper point Vol%	lower point Vol%	upper point Vol%	lower point Vol%	upper point Vol%
hydrogen	4.0	75	4.0	94	18	59	15.5	92.6
carbon monoxide	12.5	74	12.5	94	15	70	38	90
acetylene	2.5	81	2.5	93	4.2	50	3.5	92
metane	5.0	15	5.1	59	6.5	12	6.3	53
propane	2.1	9.5	2.3	55			2.5	42.5
n-butane	1.8	8.4	1.8	49			2.1	38
propylene	2.4	11	2.1	53			2.5	50
ammonia	15.0	28	15.0	79			25.4	75
ethylene	2.7	36	2.7	80				

Depending on the conditions, acetylene, and ethylene oxide burn even in 100% concentration.

Table 2 Properties of Some Toxic Gases

Physical & Chemical Properties of Some Toxic Gases

material	chemical formula	boiling point °C 1atm	fusing point °C 1atm	gravity air=1	gas density gl,0°C 1atm	stable combustion zone Vol %	color scent	property	solubility for water	succus density g/ml(b.p.)	causticity	
											Cu	SUS
monosilane	SiH ₄	-112	-186	1.12	1.44	0.8~98		naturalness toxicity	react	0.711 (m.p.)	○	○
silicon dichloride	SiH ₂ Cl ₂	8.2	-122	3.94	4.94 (8.4°C)	4.1~98.8			react	1.261	×	○
silane trichloride	SiHCl ₃	31.8	-126.5	4.7			pungent odor	combustibilit y	react	1.347 (20°C)		D
silicon tetrachloride	SiCl ₄	59	-70	5.9			pungent odor	combustibilit y	react	1.52 (0°C)		D
silicon tetrafluoride	SiF ₄	65	-90.2	3.61			suffocating	toxicity	react	1.59 (-80°C)		
arshin	AsH ₄	-62.48	-113.5	2.695	3.48	0.8~98	garlic odor colorless	combustibilit y toxicity	20ml/100 ml (20°C)	1.604 (-64.3°C)		
arsenic chloride(III)	AsCl ₃	130.21	-16	6.29				toxicity	react	2.1497 (25°C)		
phosphine	PH ₃	-87.74	-133	1.146 (20°C)	1.38 (20°C)	1.3~98	garlic odor colorless	combustibilit y toxicity	20ml/100 ml (20°C)	0.746 (-90°C)	×	
fluophosphorou s(III)	PF ₃	-101.2	-151.3	3.05			pungent odor colorless	toxicity	progressively disassembly			
fluophosphorou s(V)	PF ₅	-84.6	-93.8	4.37			pungent odor colorless	toxicity	react	1.636 (-84.5°C)		
phosphorous trichloride(III)	PCl ₃	76	-112	4.77			pungent odor colorless	toxicity	react	1.574 (21°C)		
phosphorous oxychloride	POCl ₃	105.8	1.25	5.32			pungent odor colorless	toxicity	react			
diborane	B ₂ H ₆	-92.8	-164.9	0.95	1.22	0.8~98	unpreasen t odor colorless	combustibilit y toxicity	react	0.470 (-120°C)		
boron trifluoride	BF ₃	-99.8	-128.1	2.37	3.077	—	pungent odor colorless	incombustibili ty toxicity	react	1.589	D	D
hydrogen selenide	H ₂ Se	-41.2	-64	2.81	3.615	—	garlic odor colorless	combustibilit y toxicity	377ml/10 0ml (4°C)	2.004		
monogermanium	GeH ₄	-90	-165	2.66	3.43	0.8~98	pungent odor colorless	naturalness toxicity	small reactivity	1.523 (-142°C)		
hydrogen telluride	H ₂ Te	-1.8	-49	4.5			garlic odor colorless		well dissolved	2.57 (20°C)		
stibine	SbH ₃	-17	-88	4.33			garlic odor colorless		500ml/ 100ml	2.26 (-25°C)		

○:usable X :nonusable D:usable if in a dry form
(Reference: The safety data of the special material gas /The High Pressure Gas Safety Institute of Japan)



< Warning of Voltage and Electric Current >

Electric dangers exist when power to the system is turned on. They include electric shock or combustion by contact with live parts, or fire from leakage current.

The cryopump contains internal high voltage parts. Contact with them can result in electric shock.

Always set the ON/OFF switch and main breaker at the OFF position before installation or maintenance.

Use only a power supply of the specified voltage rating. Unspecified voltages can result in fire, electric shock, and/or system damage.

If cooling water or other liquid infiltrates the electrical system, shut power off immediately and wipe up all liquid.

Before detaching the outside panels of the compressor unit, always set the ON/OFF switch and the main breaker at the OFF position. In any case, do not detach panels unless specified herein. Contact with live parts can result in electric shock, burns, and/or equipment damage.

Be sure to turn off the customer's main power and lock the compressor breaker with OFF position before maintenance work. It may result in electric shock to fail to obey this precaution.



< Warning of High Pressure Gas >

This system uses high pressure gas, 2.30-2.35 MPaG. Strike at a sharp edge or contact with the pointed tool can result in gas leak and/or explosion. Pay special attention to handling the system.

The following table shows the minimum bending radius of the flexible hoses. Bending them at smaller angle can result in gas leak and/or explosion.

Do not disassemble anything not so specified in this manual. Disassembling the system can result in electric shock, explosion or gas leak.

The cryopump, compressor, flexible hoses, and compressor adsorber are pressurized with helium gas. Purge the helium gas from all pressurized components before disposing them. Open the purge valve gradually. Quick operation of the valve can cause serious injury or even death.

When scrapping the cryopump system, handle it as industrial waste and pass it over to legally qualified disposer. (Lead is included in the cold head of the cryopump.)

Table 3 Minimum Bending Radius of Flexible Hose

Size (for TM series compressor)	Minimum bending radius	
	Middle point	End point
15A	150 mm (5.91 inch)	300 mm (11.8 inch)
20A	200 mm (7.87 inch)	400 mm (15.7 inch)
25A	225 mm (8.86 inch)	450 mm (17.7 inch)

CAUTIONS



< Caution about Heavy Unit >

The cryopump unit is heavy, therefore one person alone should not carry or install the cryopump.

Installing or carrying the cryopump unit by one person alone may cause back injury. Use a lifter or some other lifting tools properly.



< Caution about Cold Surface >

There is a risk of frostbite due to low temperature of a cold surface in the cryopump unit.

Do not touch the cryopump vessel during regeneration.



< Cautions of Malfunction >

Do not touch or meddle with the inverter for the main power source of the compressor unit. Meddling with the inverter can result in damage or bungle of the compressor electric circuit.

When the cryopumps and the compressors are running, do not touch any of the RS-485 communication cable connectors (D-sub9) on the CP controller, the cryopump IO module, or the compressor, by hand or any tools such as a screwdriver.

Accidental disconnection of the communication cable connectors will result in unexpected stoppage of the compressors, or the whole cryopump system.

Do not connect any cables to the maintenance port of D-sub9, mini USB, or D-sub25 on both of the compressor and the CP controller. Connecting any cables to these maintenance ports may cause unexpected stoppage of the compressor or the cryopumps. These maintenance ports are meant to be handled by SHI authorized personnel only.

Do not put any objects on the surface of the compressor unit. It may disturb the unit operation and may cause hazard.

Enough space is required around the compressor unit for heat radiation and maintenance.

Failure to take this precaution can result in performance down or breakdown.

Do not damage the cryopumps in installing it to the customer tool. Damaged cryopumps can cause malfunction.

Before connecting the flexible lines, ensure that surface of the self-seal coupling is free from dust and dirt, and then check attachment with the flat rubber gasket. Incorrect attachment can cause gas leak.

The return side of the flexible line should be connected to the cold head first. Connecting the supply side flexible gas hose to the cold head prior to connecting the return side flexible gas hose to the cold head can result in improper.

The system is shipped with helium gas at 2.30-2.35 MPaG under static conditions. Degradation of cooling power or cryopump malfunction can result if the system helium gas pressure is not in the specified pressure range.

Avoid to the contamination when helium gas is charged. Contamination can result in noisy operation of the cryopump and also a reduction in the cooling capacity of the cold head.

1 INTRODUCTION

1-1 CRYOPUMP SYSTEM

The cryopump is a vacuum pump that traps gases and vapor by condensing or adsorbing them on a cold surface. The cryopump uses helium gas as refrigerant. Helium is supplied from a compressor. SICERA system is composed of one or two compressors, multiple numbers of cryopumps, and one CP controller. SICERA system can be mounted to a customer tool and be operated from the tool.

All electric power to compressor and the individual cryopump is supplied from the customer tool. The power source for the CP controller is supplied from the customer UPS.

(See INSTALLATION/MAINTENANCE MANUAL POWER CABLE CONNECTION about the detail.)

Operation commands are communicated to the CP controller via RS-232C cable from the customer controller. The compressor and the cryopumps are controlled by the CP controller.

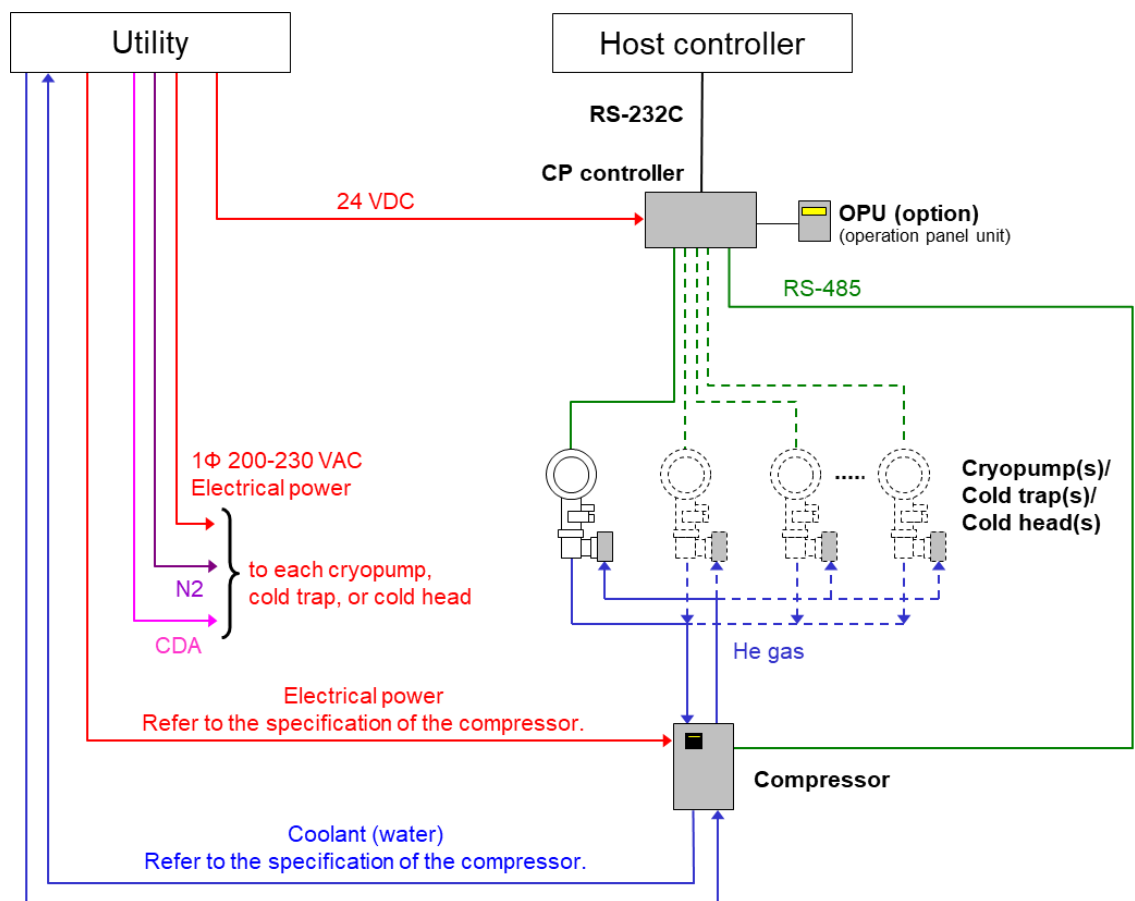


Figure 1 Cryopump System Flow

(Please refer to

Table 4 Cryopump Model and Maximum Number of Cryopumps Connected to One Compressor.)

2 SPECIFICATION

Table 4 Cryopump Model and Maximum Number of Cryopumps Connected to One Compressor.

Size	Low profile	Max. number (TM-30 series)	Max. number (TM-50 series)
	ICF		
8 inch	KV-08FCL0A0D4	4 ^{*1} - 5 ^{*2}	8 ^{*1} - 11 ^{*2}
	KV-08FSL0A0D4		

*1 Average operating inverter frequency of cryopump system is assumed to be 60Hz.

*2 Average operating inverter frequency of cryopump system is assumed to be 45Hz.

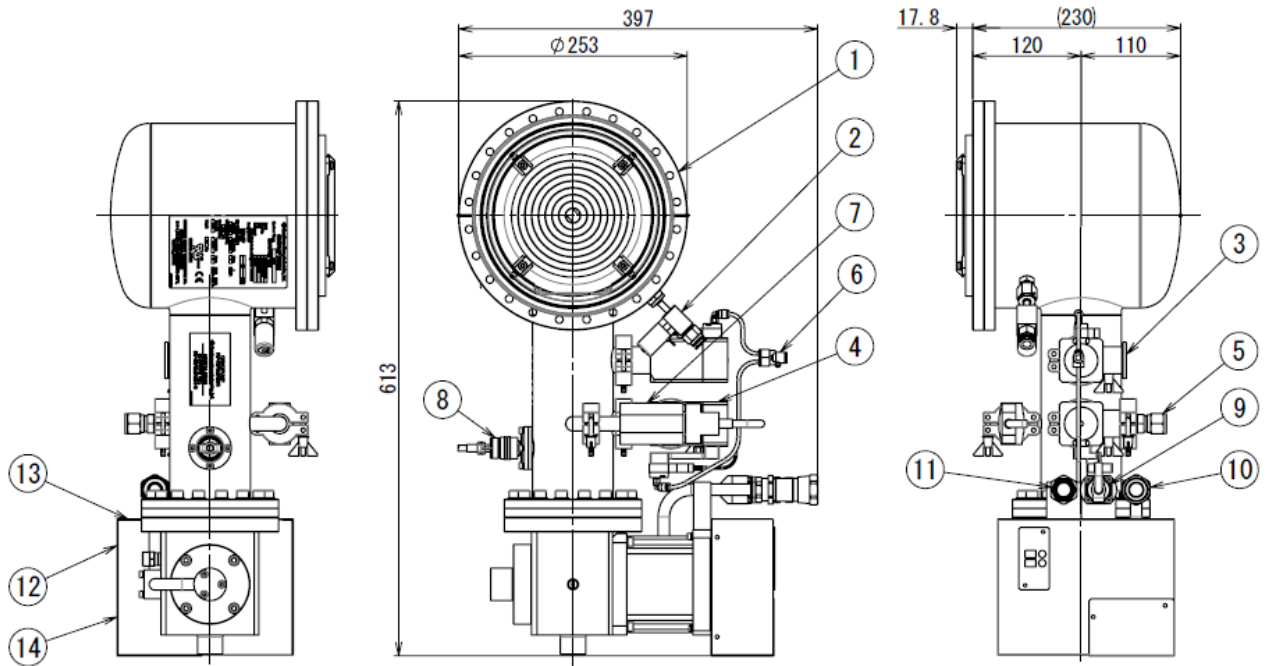
2-1 CRYOPUMP UNIT

2-1-1 CRYOPUMP UNIT (KV-08FCL0A0D4)

Table 5 Cryopump (KV-08FCL0A0D4) Specification

Item		Specification		
Model		KV-08FCL0A0D4		
Gauge		8 inch (metal seal)		
Shape		Low profile		
Environmental condition		<ul style="list-style-type: none"> - Indoor use - Altitude up to 1000 m - Temperature 5 to 40 degrees C (28 to 40 degrees C with 5% cooling capacity loss) - Humidity: 20 – 80% (without dew) - Transient over voltage: Category 2 (IEC60664-1) - Applicable rated pollution degree: Category 1 (IEC60664-1) 		
Storage environmental condition		<ul style="list-style-type: none"> - Indoor - Temperature: 0 to 40 degrees C - Humidity: 20 – 80% (without dew) 		
Performance specification	Pumping speed	Water	4,000 L/s	
		Argon	1,200 L/s	
		Nitrogen	1,500 L/s	
		Hydrogen	2,200 L/s	
	Argon through put	1.2 Pa·m ³ /s (700 sccm)		
	Capacity	Argon	160,000 Pa·m ³ (1,600 Std L)	
		Nitrogen	100,000 Pa·m ³ (1,000 Std L)	
		Hydrogen	1,200 Pa·m ³ (12 Std L)	
		Argon and nitrogen gas capacities are measured under the following condition; Pressure recovery after 30 seconds from stopping the intermittent gas introduction every 25 L. (Attained pressure is 6.7E-5 Pa (5E-7 Torr)) Gas flow rate: Argon only: 100 sccm Nitrogen only: 100 sccm		
	Crossover	20.0 Pa·m ³ (150 Torr·L)		
Base pressure	< 5E-7 Pa (4E-9 Torr)			
Cool down time	75 min or less (T2: 290K→20K, regardless of number of operation cryopumps)			
Warm up time	45 min or less (T2: 20K→290K, regardless of number of operation cryopumps)			
Outside dimension		613 mm L x 397 mm W x 230 mm H		
Weight		28 kg		
Sound pressure		less than 85 dBA		
Mechanical interface		Pump flange:	ICF253	
		Roughing port flange:	ISO KF25	
		Purge line fitting:	3/8" tube connection Supply pressure 0.4 – 0.6 MPaG (60 – 80 psiG)	
		Vent line port flange:	1/2" Swagelok®	
		Pneumatic valve supply fitting:	1/4" tube connection Supply pressure 0.4 – 0.7 MPaG (60 – 100 psiG)	
		Helium line fitting:	Supply Aeroquip – 8 (female) Return Aeroquip – 8 (male)	
Electrical interface		Rated demand power:	1 ϕ 200-230 VAC (±10%) 50/60Hz	
		Rating current:	0.6 A	
		Power consumption:	125 W	
		Cryopump unit built-in fuse setting value:	1.25 A (200 kAIC)	
		SCCR:	5 kA	
		Ground system:	TN	
		Terminal size:	L1, L2, GND: M3.5	
		Wire size:	AWG16 or more	
		Cable clamp type:	ST13.5-B (LAPP)	
		Communication interface		Communication form:
Connector type:	D-sub 9 pins (male)			
SEMI F47		Compliant		
Standards		UL	Recognized	
		CE	Compliant	

Cryopump: KV-08FCL0A0D4



- 1 : Main flange
- 2 : Purge valve
- 3 : Rough valve
- 4 : Vent valve
- 5 : Vent line
- 6 : Rough valve & vent valve pneumatic connection
- 7 : Pressure sensor
- 8 : Temperature sensor connector
- 9 : Motor connector
- 10 : Supply helium connection
- 11 : Return helium connection
- 12 : IO module
- 13 : Communication network interface
- 14 : Electrical interface

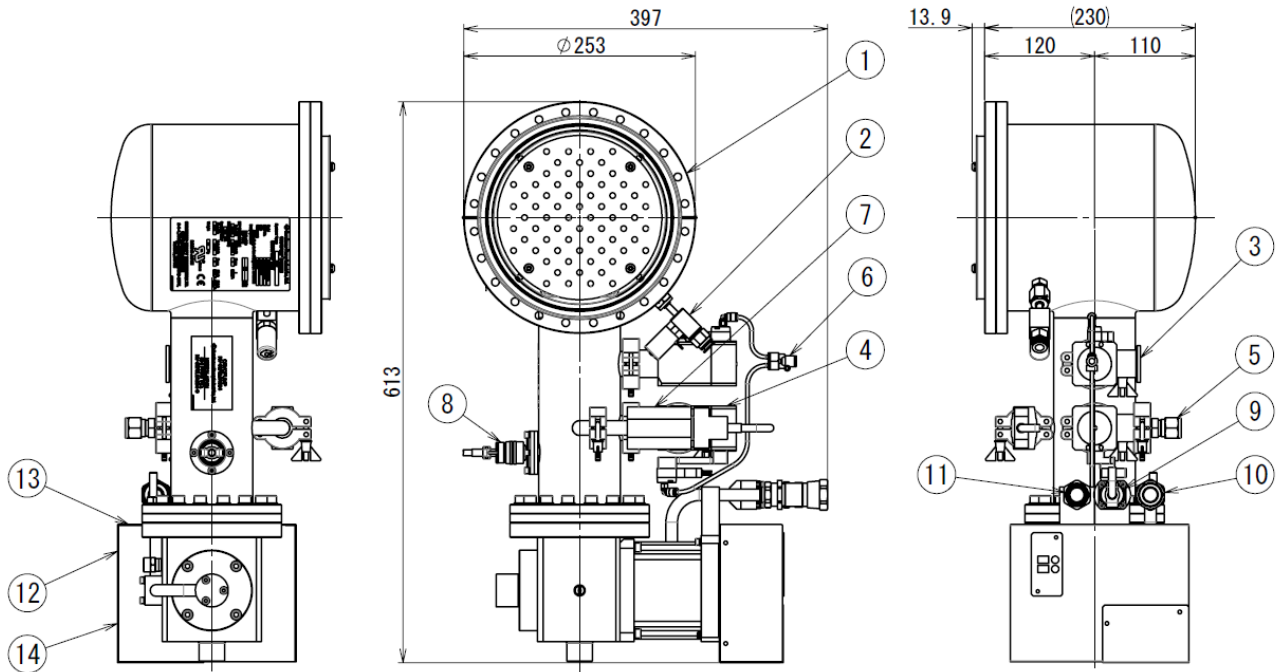
Figure 2 Cryopump (KV-08FCL0A0D4)

2-1-2 CRYOPUMP UNIT (KV-08FSL0A0D4)

Table 6 Cryopump (KV-08FSL0A0D4) Specification

Item		Specification		
Model		KV-08FSL0A0D4		
Gauge		8 inch (metal seal)		
Shape		Low profile		
Environmental condition		<ul style="list-style-type: none"> - Indoor use - Altitude up to 1000 m - Temperature 5 to 40 degrees C (28 to 40 degrees C with 5% cooling capacity loss) - Humidity: 20 – 80% (without dew) - Transient over voltage: Category 2 (IEC60664-1) - Applicable rated pollution degree: Category 1 (IEC60664-1) 		
Storage environmental condition		<ul style="list-style-type: none"> - Indoor - Temperature: 0 to 40 degrees C - Humidity: 20 – 80% (without dew) 		
Performance specification	Pumping speed	Water	4,000 L/s	
		Argon	230 L/s	
		Nitrogen	270 L/s	
		Hydrogen	900 L/s	
	Argon through put	1.2 Pa·m ³ /s (700 sccm)		
	Capacity	Argon	200,000 Pa·m ³ (2,000 Std L)	
		Nitrogen	160,000 Pa·m ³ (1,600 Std L)	
		Hydrogen	1,200 Pa·m ³ (12 Std L)	
	Argon and nitrogen gas capacities are measured under the following condition; Pressure recovery after 30 seconds from stopping the intermittent gas introduction every 25 L. (Attained pressure is 6.7E-5 Pa (5E-7 Torr) Gas flow rate: Argon only: 250 sccm Nitrogen only: 100 sccm			
	Crossover	20.0 Pa·m ³ (150 Torr·L)		
Base pressure	< 5E-7 Pa (4E-9 Torr)			
Cool down time	75 min or less (T2: 290K→20K, regardless of number of operation cryopumps)			
Warm up time	45 min or less (T2: 20K→290K, regardless of number of operation cryopumps)			
Outside dimension		613 mm L x 397 mm W x 230 mm H		
Weight		28 kg		
Sound pressure		less than 85 dBA		
Mechanical interface		Pump flange:	ICF253	
		Roughing port flange:	ISO KF25	
		Purge line fitting:	3/8" tube connection Supply pressure 0.4 – 0.6 MPaG (60 – 80 psiG)	
		Vent line port flange:	1/2" Swagelok®	
		Pneumatic valve supply fitting:	1/4" tube connection Supply pressure 0.4 – 0.7 MPaG (60 – 100 psiG)	
		Helium line fitting:	Supply Aeroquip – 8 (female) Return Aeroquip – 8 (male)	
Electrical interface		Rated demand power:	1 φ 200-230 VAC (±10%) 50/60Hz	
		Rating current:	0.6 A	
		Power consumption:	125 W	
		Cryopump unit built-in fuse setting value:	1.25 A (200 kAIC)	
		SCCR:	5 kA	
		Ground system:	TN	
		Terminal size:	L1, L2, GND: M3.5	
		Wire size:	AWG16 or more	
		Cable clamp type:	ST13.5-B (LAPP)	
		Communication interface		Communication form:
Connector type:	D-sub 9 pins (male)			
SEMI F47		Compliant		
Standards		UL	Recognized	
		CE	Compliant	

Cryopump: KV-08FSL0A0D4



- 1 : Main flange
- 2 : Purge valve
- 3 : Rough valve
- 4 : Vent valve
- 5 : Vent line
- 6 : Rough valve & vent valve pneumatic connection
- 7 : Pressure sensor
- 8 : Temperature sensor connector
- 9 : Motor connector
- 10 : Supply helium connection
- 11 : Return helium connection
- 12 : IO module
- 13 : Communication network interface
- 14 : Electrical interface

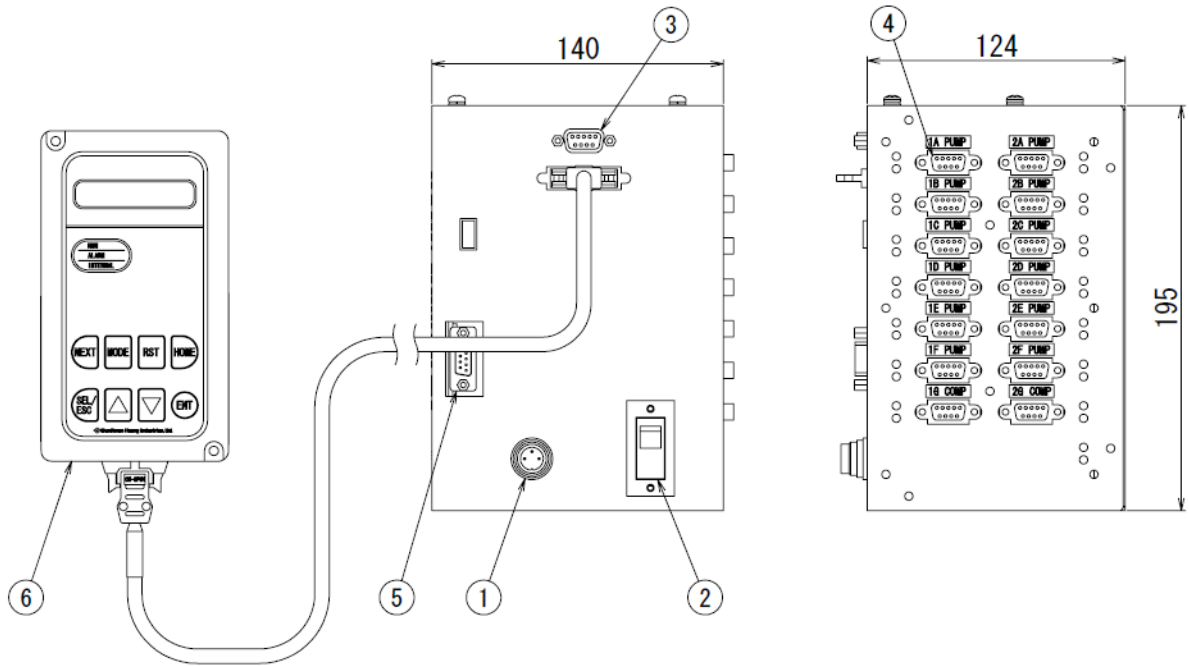
Figure 3 Cryopump (KV-08FSL0A0D4)

2-2 CP CONTROLLER

2-2-1 CPC-DN14NP0

Table 7 CP Controller (CPC-DN14NP0) Specification

Item	Specification	
Model	CPC-DN14NP0	
Environmental condition	<ul style="list-style-type: none"> - Indoor use - Altitude up to 1000 m - Temperature 5 to 40 degrees C - Humidity: 20 – 80% (without dew) - Transient over voltage: Category 2 (IEC60664-1) - Applicable rated pollution degree: Category 2 (IEC60664-1) 	
Storage environmental condition	<ul style="list-style-type: none"> - Indoor - Temperature: 0 to 40 degrees C - Humidity: 20 – 80% (without dew) 	
Max possible connections to a single controller	12 cryopumps and 2 compressors	
Outside dimension	140 mm L x 124 mm W x 195 mm H	
Weight	3 kg	
Electrical interface	Rated demand power:	24 VDC (to be powered by Class 2 (UL1310) power supply)
	Rating current:	0.2 A
	Power consumption:	5 W
	CP controller built-in circuit protector setting value:	1 A
	(Please supply UPS power from the customer tool)	
	Electrical power connector model:	Unit side connector: Amphenol T3262 100 (Pin number 1: P24, 2: N24, 3: GND) Power cable side connector (range provided by the customers): Amphenol T3261 001
Communication interface	Communication form	
	With the customer tool:	RS-232C serial communication (D-sub 9pin female #4-40 screw) DEU-9S-FO, D20418-2R(JAE) Pin No. 2: RXD Pin No. 3: TXD Pin No. 5: GND
	With the cryopump system: (cryopump, cold trap & compressor)	RS-485 serial communication (D-sub 9pin female)
Other interfaces	Maintenance PC connection	RS-232C serial communication (D-sub 9pin male)
SEMI F47	Not intended (because of DC power)	
Standards	UL	Recognized
	CE	Compliant



- 1 : Power connector
- 2 : Power switch
- 3 : Communication network interface (customer)
- 4 : Communication network interface (cryopump system)
- 5 : Maintenance connection
- 6 : OPU (operation panel unit): (option)

Figure 4 CP Controller (CPC-DN14NP0)

2-3 OPU (OPERATION PANEL UNIT) (OPTION)

2-3-1 K448810H01

Table 8 OPU (K448810H01) Specification

Item	Specification
Model	K448810H01
Environmental condition	<ul style="list-style-type: none"> - Indoor use - Altitude up to 1000 m - Temperature 0 to 50 degrees C - Humidity: 20 – 90%RH (without dew) - Vibration: Up to 0.5G - Impact shock: Up to 1.0G - Protective structure: IP00
Storage environmental condition	<ul style="list-style-type: none"> - Indoor - Temperature: -20 to 65 degrees C - Humidity: 20 – 90% (without dew)
Outside dimension	90 mm W x 159 mm H x 25 mm D
Weight	190 g (without cable)
Setup	Connect with a CP controller by the provided communication cable
Electrical power supply	5 VDC (supplied from a CP controller)

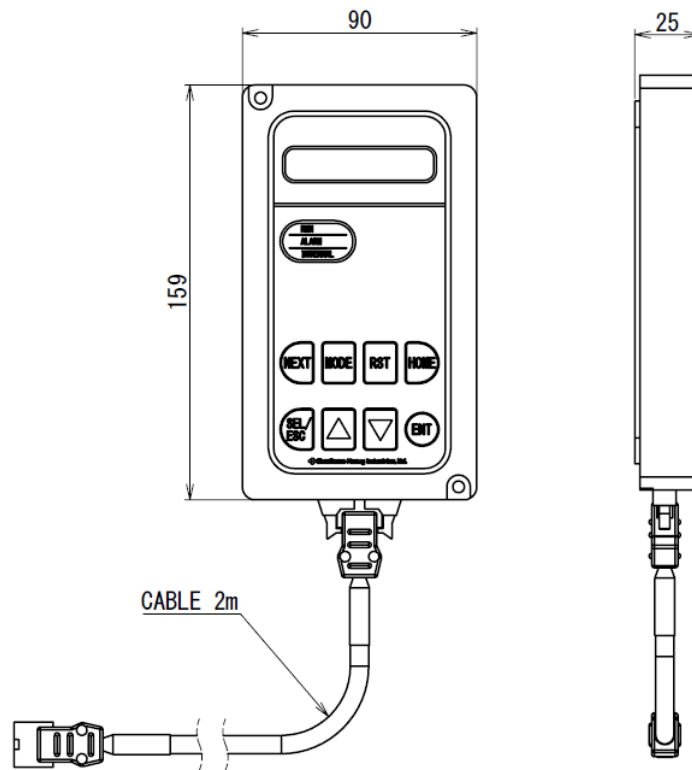


Figure 5 OPU (K448810H01)

2-4 COMPRESSOR UNIT

2-4-1 TM-50L-AA

Table 9 Compressor Unit (TM-50L-AA) Specification

Item	Specification	
Model	TM-50L-AA	
Cooling system	Water cooling	
Environmental condition	<ul style="list-style-type: none"> - Indoor use - Altitude up to 1000 m - Temperature 5 to 35 degrees C (28 to 35 degrees C with 5% cooling capacity loss) - Humidity: 20 – 80% (without dew) - Transient over voltage: Category 2 (IEC60664-1) - Applicable rated pollution degree: Category 2 (IEC60664-1) 	
Storage environmental condition	<ul style="list-style-type: none"> - Indoor - Temperature: 0 to 40 degrees C - Humidity: 20 – 80% (without dew) 	
Outside dimension	593 mm L x 451 mm W x 1177 mm H	
Weight	170 kg	
Sound pressure	less than 70 dBA	
Mechanical interface	Helium line fitting:	Supply Aeroquip – 8 (male) Return Aeroquip – 8 (female)
	Helium charge fitting:	45 degrees flare (male) and 7/16" x 20 threads/inch
	Cooling water fitting: (supply and return)	NPT 1/2 (female, Material: Stainless steel)
Electrical interface	Rated demand power:	3 ϕ 200 – 230 VAC ($\pm 10\%$) 50/60 Hz (The minimum voltage is 180 V and the maximum voltage is 253 V with zero tolerance)
	Rating current:	44 A
	Compressor unit built-in circuit breaker setting value (ELB):	50 A (interrupting rating 35 kAIC)/30mA
	SCCR:	5 kA
	Ground system:	TN
	Terminal size:	L1, L2, L3: M5, GND: M8
	Wire size:	AWG4 or more
	Cable clamp type:	ST-M50 (LAPP)
Communication interface	Communication form:	RS-485 serial communication (between compressor and CP controller)
	Connector type:	D-sub 9pin (male)
Other Interfaces	Communication form:	RS-232C serial communication (between compressor and maintenance PC)
	Connector type:	D-sub 9pin (male)
	Communication form:	AI, DI/O signal
	Connector type:	D-sub 25pin (female)
	Communication form:	Unused connector (J1)
	Connector type:	206430-1 (AMP)
	Communication form:	Unused connector (P2)
Connector type:	206061-1 (AMP)	
Helium gas pressure	Static:	2.30 – 2.35 MPaG (at 20 degrees C)
	Operating:	2.9 – 3.1 MPaG (supply pressure) *
Cooling water requirement	Maximum pressure:	0.70 MPaG
	Min. flow rate:	4 – 10 L/min
	Temperature range:	4 – 32 degrees C
	Water quality:	Refer to the cooling water specification
SEMI F47	Compliant	
Standards	UL	Recognized
	CE	Compliant

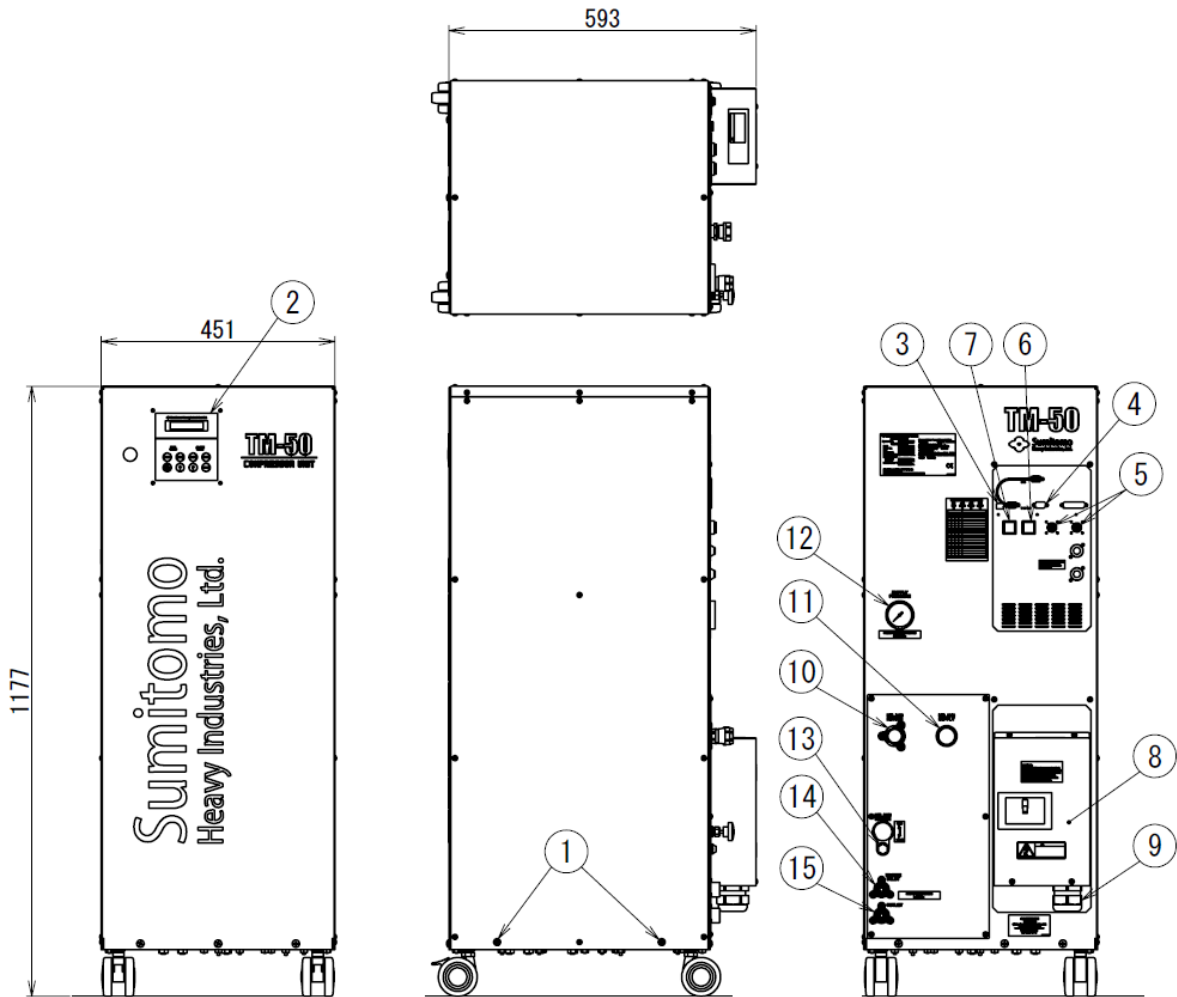
*This is recommendation value. It is no problem to go out of the range temporarily.

2-4-2 TM-50H-AA

Table 10 Compressor Unit (TM-50H-AA) Specification

Item	Specification		
Model	TM-50H-AA		
Cooling system	Water cooling		
Environmental condition	<ul style="list-style-type: none"> - Indoor use - Altitude up to 1000 m - Temperature 5 to 35 degrees C (28 to 35 degrees C with 5% cooling capacity loss) - Humidity: 20 – 80% (without dew) - Transient over voltage: Category 2 (IEC60664-1) - Applicable rated pollution degree: Category 2 (IEC60664-1) 		
Storage environmental condition	<ul style="list-style-type: none"> - Indoor - Temperature: 0 to 40 degrees C - Humidity: 20 – 80% (without dew) 		
Outside dimension	593 mm L x 451 mm W x 1177 mm H		
Weight	170 kg		
Sound pressure	less than 70 dBA		
Mechanical interface	Helium line fitting:	Supply Aeroquip – 8 (male) Return Aeroquip – 8 (female)	
	Helium charge fitting:	45 degrees flare (male) and 7/16" x 20 threads/inch	
	Cooling water fitting: (supply and return)	NPT 1/2 (female, Material: Stainless steel)	
Electrical interface	Rated demand power:	3 ϕ 380 – 480 VAC ($\pm 10\%$) 50/60Hz In the case of 342 – 380 V, the maximum number of loading cryopumps will be reduced to 90% of the cryopumps specification. (e.g. when the maximum number of loading cryopumps is 6 on the cryopump specification, the maximum number of loading cryopumps (342 – 380 V) will be reduced to 5 cryopumps. (6 x 0.9 = 5.4. The largest integer below 5.4 is 5. Therefore, the maximum number of the loading cryopumps will be 5 cryopumps.))	
	Rating current:	22 A	
	Compressor unit built-in circuit breaker setting value (MCCB):	30 A (interrupting rating 30kAIC)	
	SCCR:	5 kA	
	Ground system:	TN	
	Terminal size:	L1, L2, L3: M8, GND: M8	
	Wire size:	AWG8 or more	
	Cable clamp type:	ST-M40 (LAPP)	
	Communication interface	Communication form:	RS-485 serial communication (between compressor and CP controller)
		Connector type:	D-sub 9pin (male)
Other Interfaces	Communication form:	RS-232C serial communication (between compressor and maintenance PC)	
	Connector type:	D-sub 9pin (male)	
	Communication form:	AI, DI/O signal	
	Connector type:	D-sub 25pin (female)	
	Communication form:	Unused connector (J1)	
	Connector type:	206430-1 (AMP)	
	Communication form:	Unused connector (P2)	
Helium gas pressure	Static:	2.30 – 2.35 MPaG (at 20 degrees C)	
	Operating:	2.9 – 3.1 MPaG (supply pressure)*	
Cooling water requirement	Maximum pressure:	0.70 MPaG	
	Min. flow rate:	4 – 10 L/min	
	Temperature range:	4 – 32 degrees C	
	Water quality:	Refer to the cooling water specification	
SEMI F47	Compliant		
Standards	UL	Recognized	
	CE	Compliant	

*This is recommendation value. It is no problem to go out of the range temporarily.



- 1: M10 for L bracket (accessory)
- 2: Operation panel
- 3: DIP switch
- 4: Communication network interface (RS-485)
- 5: Unused connector (J1, P2)
- 6: Inverter power indicator
- 7: Main power indicator
- 8: Electrical power interface
- 9: Cable clamp
- 10: Helium return connection
- 11: Helium supply connection
- 12: Pressure gauge
- 13: Helium charge port
- 14: Cooling water supply connection
- 15: Cooling water return connection

Figure 6 Compressor Unit (TM-50*-AA)

2-4-3 TM-50L-CA

Table 11 Compressor Unit (TM-50L-CA) Specification

Item	Specification	
Model	TM-50L-CA	
Cooling system	Water cooling	
Environmental condition	<ul style="list-style-type: none"> - Indoor use - Altitude up to 1000 m - Temperature 5 to 35 degrees C (28 to 35 degrees C with 5% cooling capacity loss) - Humidity: 20 – 80% (without dew) - Transient over voltage: Category 2 (IEC60664-1) - Applicable rated pollution degree: Category 2 (IEC60664-1) 	
Storage environmental condition	<ul style="list-style-type: none"> - Indoor - Temperature: 0 to 40 degrees C - Humidity: 20 – 80% (without dew) 	
Outside dimension	628 mm L x 451 mm W x 1177 mm H	
Weight	170 kg	
Sound pressure	less than 70 dBA	
Mechanical interface	Helium line fitting:	Supply Aeroquip – 8 (male) Return Aeroquip – 8 (female)
	Helium charge fitting:	45 degrees flare (male) and 7/16" x 20 threads/inch
	Cooling water fitting: (supply and return)	NPT 1/2 (female, Material: Stainless steel)
Electrical interface	Rated demand power:	3 φ 200 – 230 VAC (±10%) 50/60 Hz (The minimum voltage is 180 V and the maximum voltage is 253 V with zero tolerance)
	Rating current:	44 A
	Compressor unit built-in circuit breaker setting value (ELB):	50 A (interrupting rating 35 kAIC)/30mA
	SCCR:	5 kA
	Ground system:	TN
	Terminal size:	L1, L2, L3: M5, GND: M8
	Wire size:	AWG4 or more
	Cable clamp type:	ST-M50 (LAPP)
Communication interface	Communication form:	RS-485 serial communication (between compressor and CP controller)
	Connector type:	D-sub 9pin (male)
Other Interfaces	Communication form:	RS-232C serial communication (between compressor and maintenance PC)
	Connector type:	D-sub 9pin (male)
	Communication form:	AI, DI/O signal
	Connector type:	D-sub 25pin (female)
	Communication form:	Unused connector (J1)
	Connector type:	206430-1 (AMP)
	Communication form:	Unused connector (P2)
Helium gas pressure	Static:	2.30 – 2.35 MPaG (at 20 degrees C)
	Operating:	2.9 – 3.1 MPaG (supply pressure) *
Cooling water requirement	Maximum pressure:	0.70 MPaG
	Min. flow rate:	4 – 10 L/min
	Temperature range:	4 – 32 degrees C
	Water quality:	Refer to the cooling water specification
SEMI F47	Compliant	
Standards	UL	Recognized
	CE	Compliant

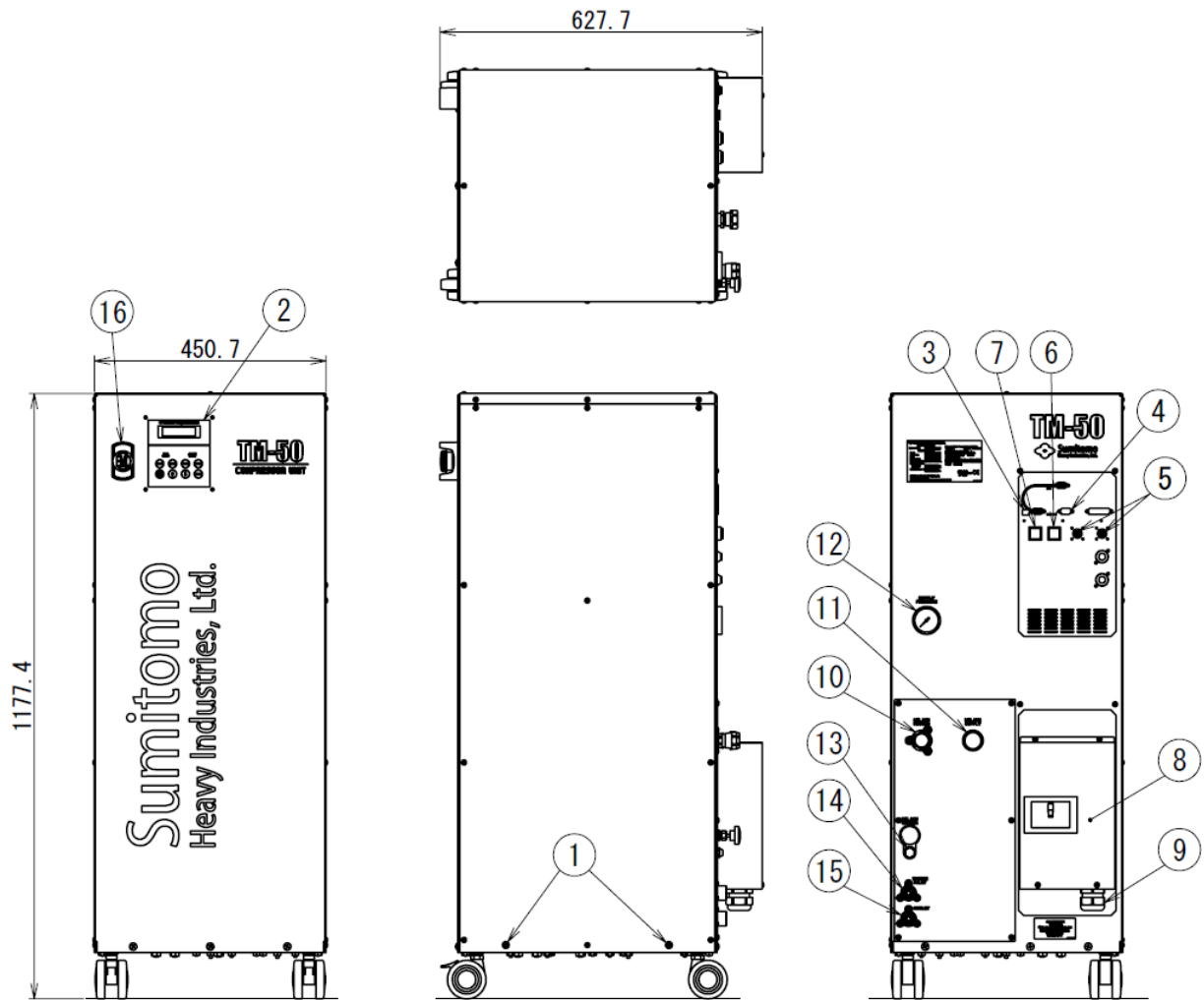
*This is recommendation value. It is no problem to go out of the range temporarily.

2-4-4 TM-50H-CA

Table 12 Compressor Unit (TM-50H-CA) Specification

Item	Specification		
Model	TM-50H-CA		
Cooling system	Water cooling		
Environmental condition	<ul style="list-style-type: none"> - Indoor use - Altitude up to 1000 m - Temperature 5 to 35 degrees C (28 to 35 degrees C with 5% cooling capacity loss) - Humidity: 20 – 80% (without dew) - Transient over voltage: Category 2 (IEC60664-1) - Applicable rated pollution degree: Category 2 (IEC60664-1) 		
Storage environmental condition	<ul style="list-style-type: none"> - Indoor - Temperature: 0 to 40 degrees C - Humidity: 20 – 80% (without dew) 		
Outside dimension	628 mm L x 451 mm W x 1177 mm H		
Weight	170 kg		
Sound pressure	less than 70 dBA		
Mechanical interface	Helium line fitting:	Supply Aeroquip – 8 (male) Return Aeroquip – 8 (female)	
	Helium charge fitting:	45 degrees flare (male) and 7/16" x 20 threads/inch	
	Cooling water fitting: (supply and return)	NPT 1/2 (female, Material: Stainless steel)	
Electrical interface	Rated demand power:	3 ϕ 380 – 480 VAC ($\pm 10\%$) 50/60Hz In the case of 342 – 380 V, the maximum number of loading cryopumps will be reduced to 90% of the cryopumps specification. (e.g. when the maximum number of loading cryopumps is 6 on the cryopump specification, the maximum number of loading cryopumps (342 – 380 V) will be reduced to 5 cryopumps. (6 x 0.9 = 5.4. The largest integer below 5.4 is 5. Therefore, the maximum number of the loading cryopumps will be 5 cryopumps.))	
	Rating current:	22 A	
	Compressor unit built-in circuit breaker setting value (MCCB):	30 A (interrupting rating 30kAIC)	
	SCCR:	5 kA	
	Ground system:	TN	
	Terminal size:	L1, L2, L3: M8, GND: M8	
	Wire size:	AWG8 or more	
	Cable clamp type:	ST-M40 (LAPP)	
	Communication interface	Communication form:	RS-485 serial communication (between compressor and CP controller)
		Connector type:	D-sub 9pin (male)
Other Interfaces	Communication form:	RS-232C serial communication (between compressor and maintenance PC)	
	Connector type:	D-sub 9pin (male)	
	Communication form:	AI, DI/O signal	
	Connector type:	D-sub 25pin (female)	
	Communication form:	Unused connector (J1)	
	Connector type:	206430-1 (AMP)	
	Communication form:	Unused connector (P2)	
Helium gas pressure	Static:	2.30 – 2.35 MPaG (at 20 degrees C)	
	Operating:	2.9 – 3.1 MPaG (supply pressure)*	
Cooling water requirement	Maximum pressure:	0.70 MPaG	
	Min. flow rate:	4 – 10 L/min	
	Temperature range:	4 – 32 degrees C	
	Water quality:	Refer to the cooling water specification	
SEMI F47	Compliant		
Standards	UL	Recognized	
	CE	Compliant	

*This is recommendation value. It is no problem to go out of the range temporarily.



- 1: M10 for L bracket (accessory)
- 2: Operation panel
- 3: DIP switch
- 4: Communication network interface (RS-485)
- 5: Unused connector (J1, P2)
- 6: Inverter power indicator
- 7: Main power indicator
- 8: Electrical power interface
- 9: Cable clamp
- 10: Helium return connection
- 11: Helium supply connection
- 12: Pressure gauge
- 13: Helium charge port
- 14: Cooling water supply connection
- 15: Cooling water return connection
- 16: EMO switch

Figure 7 Compressor Unit (TM-50*-CA)

Cooling Water Specification

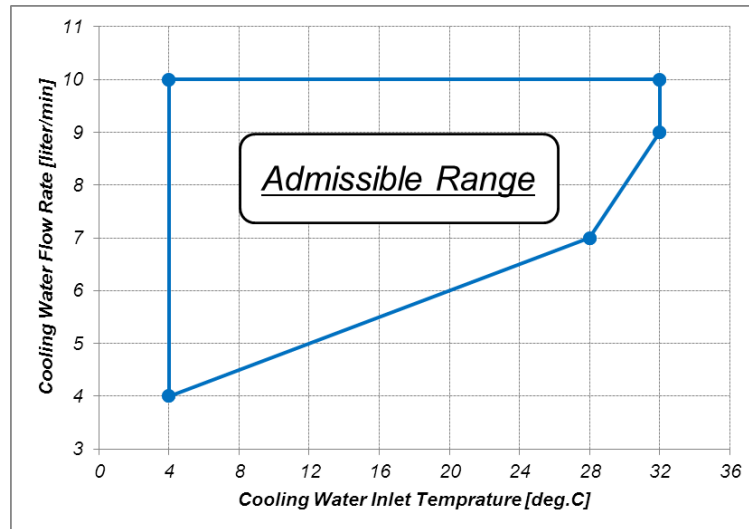


Figure 8 Cooling Water Specification (Water Temperature and Demand Flow) (TM-50)

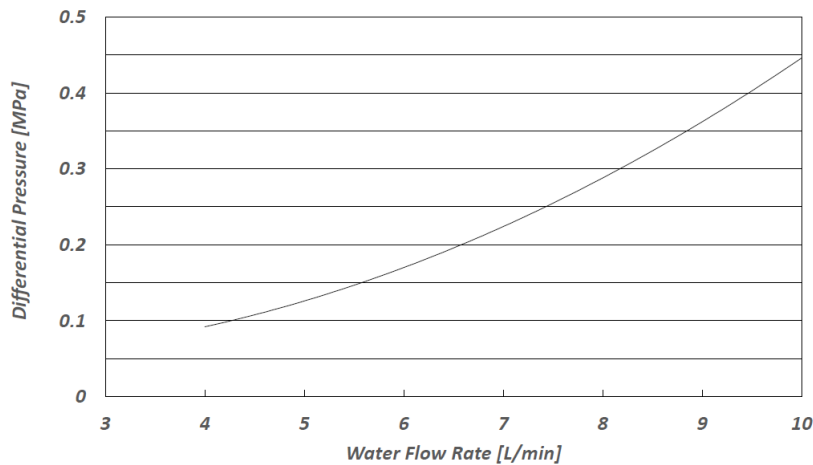


Figure 9 Differential Pressure and Water Flow Rates (TM-50)

Table 13 Cooling Water Specification (Water Quality) (TM-50)

Item	Specification
pH value	6.5 to 8.2 at 25 degrees C
Electrical conductivity	< 80 mS/m
Chloride ion	< 200 mg/L
Sulfate ion	< 200 mg/L
M-Alkalinity	< 100 mg/L
Total hardness	< 200 mg/L
Calcium hardness	< 150 mg/L
Ionic silica	< 50 mg/L
Iron	< 1.0 mg/L
Copper	< 0.3 mg/L
Sulfide ion	None, not detectable
Ammonium ion	< 1.0 mg/L
Residual chlorine	< 0.3 mg/L
Free carbon dioxide	< 4.0 mg/L
Stability index	6.0 to 7.0
Suspended matter	< 10 mg/L
Particle size	< 100 μm

2-4-5 TM-30L-AA

Table 14 Compressor (TM-30L-AA) Specification

Item	Specification		
Model	TM-30L-AA		
Cooling system	Water cooling		
Environmental condition	<ul style="list-style-type: none"> - Indoor use - Altitude up to 1000 m - Temperature 5 to 35 degrees C (28 to 35 degrees C with 5% cooling capacity loss) - Humidity: 20 – 80% (without dew) - Transient over voltage: Category 2 (IEC60664-1) - Applicable rated pollution degree: Category 2 (IEC60664-1) 		
Storage environmental condition	<ul style="list-style-type: none"> - Indoor - Temperature: 0 to 40 degrees C - Humidity: 20 – 80% (without dew) 		
Outside dimension	596 mm L x 451 mm W x 747 mm H		
Weight	140 kg		
Sound pressure	less than 70 dBA		
Mechanical interface	Helium line fitting:	Supply Aeroquip – 8 (male) Return Aeroquip – 8 (female)	
	Helium charge fitting:	45 degrees flare (male) and 7/16" x 20 threads/inch	
	Cooling water fitting: (supply and return)	NPT 1/2 (female, Material: Stainless steel)	
Electrical interface	Rated demand power:	3 ϕ 200/230 VAC ($\pm 10\%$) 50/60Hz In the case of 180 – 200V, the maximum number of loading cryopumps will be reduced to 80% of the cryopumps specification. (e.g. When the maximum number of loading cryopumps is 6 on the cryopump specification, the maximum number of loading cryopumps (180 - 200V) will be reduced to 4 cryopumps. (6 x 0.8 = 4.8. The largest integer below 4.8 is 4. Therefore, the maximum number of the loading cryopumps will be 4 cryopumps.))	
	Rating current:	25 A	
	Compressor unit built-in circuit breakersetting value (ELB):	40 A (Interrupting rating 14 kAIC)/30 mA	
	SCCR:	5 kA	
	Ground system:	TN	
	Terminal size:	L1, L2, L3: M5, GND:M5	
	Wire size:	AWG10 or more	
	Cable clamp type:	ST36-B (LAPP)	
	Communication interface	Communication form:	RS-485 serial communication (between compressor and CP controller)
		Connector type:	D-sub 9pin (male)
Other Interfaces	Communication form:	USB serial communication (between compressor and maintenance PC)	
	Connector type:	mini USB	
	Communication form:	DI/O signal	
	Connector type:	D-sub 25pin (female)	
	Communication form:	Unused connector (J1)	
	Connector type:	206430-1 (AMP)	
	Communication form:	Unused connector (P2)	
Helium gas pressure	- Static:	2.30 – 2.35 MPaG (at 20 degrees C)	
	- Operating:	2.9 – 3.1 MPaG (supply pressure) *	
Cooling water requirement	Maximum pressure:	0.70 MPaG	
	Min. flow rate:	4 – 10 L/min	
	Temperature range:	4 – 32 degrees C	
	Water quality:	Refer to the cooling water specification	
SEMI F47	Compliant		
Standards	UL/cUL	Recognized	
	CE	Compliant	

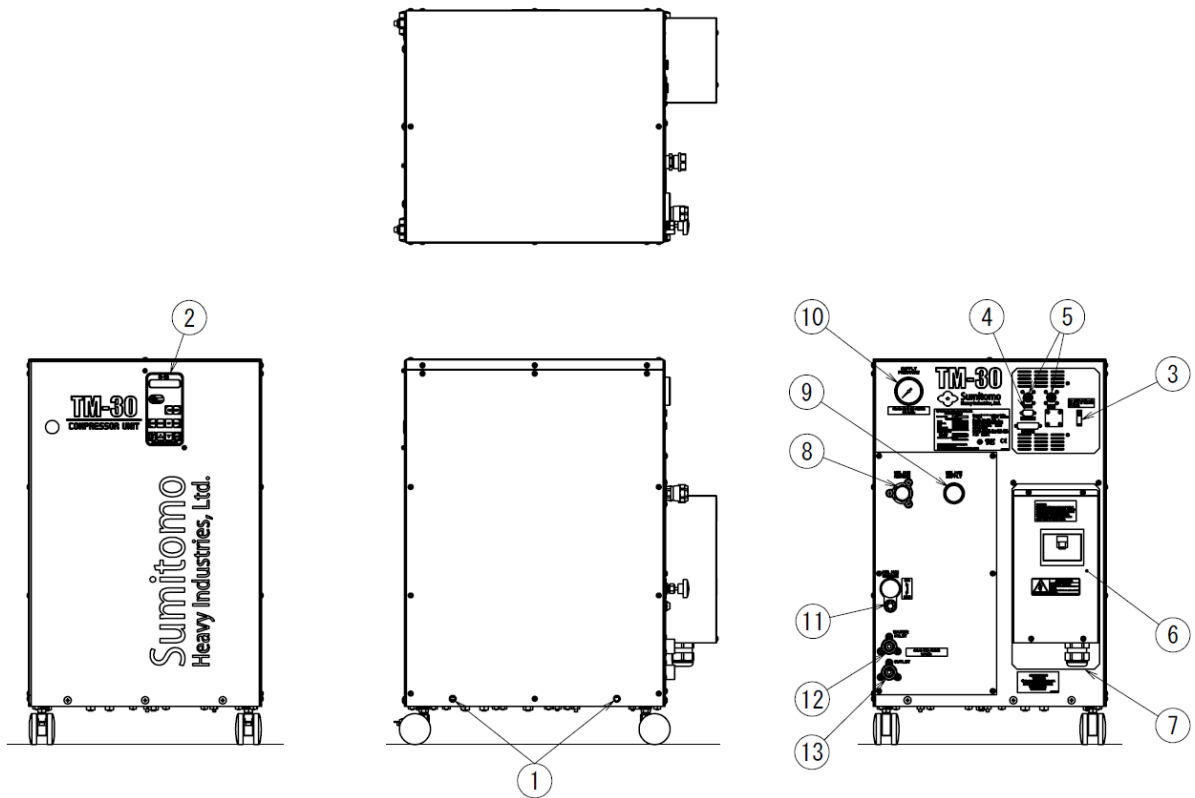
*This is recommendation value. It is no problem to go out of the range temporarily.

2-4-6 TM-30H-AA

Table 15 Compressor (TM-30H-AA) Specification

Item	Specification		
Model	TM-30H-AA		
Cooling system	Water cooling		
Environmental condition	<ul style="list-style-type: none"> - Indoor use - Altitude up to 1000 m - Temperature 5 to 35 degrees C (28 to 35 degrees C with 5% cooling capacity loss) - Humidity: 20 – 80% (without dew) - Transient over voltage: Category 2 (IEC60664-1) - Applicable rated pollution degree: Category 2 (IEC60664-1) 		
Storage environmental condition	<ul style="list-style-type: none"> - Indoor - Temperature: 0 to 40 degrees C - Humidity: 20 – 80% (without dew) 		
Outside dimension	604 mm L x 451 mm W x 747 mm H		
Weight	140 kg		
Sound pressure	less than 70 dBA		
Mechanical interface	Helium line fitting:	Supply Aeroquip – 8 (male) Return Aeroquip – 8 (female)	
	Helium charge fitting:	45 degrees flare (male) and 7/16" x 20 threads/inch	
	Cooling water fitting: (supply and return)	NPT 1/2 (female, Material: Stainless steel)	
Electrical interface	Rated demand power:	3 ϕ 380/400/415 VAC ($\pm 10\%$), 50Hz 3 ϕ 460/480 VAC ($\pm 10\%$), 60Hz In the case of 342 - 380V, the maximum number of loading cryopumps will be reduced to 80% of the cryopumps specification. (e.g. When the maximum number of loading cryopumps is 6 on the cryopump specification, the maximum number of loading cryopumps (342 - 380V) will be reduced to 4 cryopumps. (6 x 0.8 = 4.8. The largest integer below 4.8 is 4. Therefore, the maximum number of the loading cryopumps will be 4 cryopumps.))	
	Rating current:	14 A	
	Compressor unit built-in circuit breaker setting value (MCCB):	20 A (Interrupting rating 18 kAIC)	
	SCCR:	5 kA	
	Ground system:	TN	
	Terminal size:	L1, L2, L3: M5, GND: M5	
	Wire size:	AWG12 or more	
	Cable clamp type:	ST29-B (LAPP)	
	Communication interface	Communication form:	RS-485 serial communication (between compressor and CP controller)
		Connector type:	D-sub 9pin (male)
Other Interfaces	Communication form:	USB serial communication (between compressor and maintenance PC)	
	Connector type:	mini USB	
	Communication form:	DI/O signal	
	Connector type:	D-sub 25pin (female)	
	Communication form:	Unused connector (J1)	
	Connector type:	206430-1 (AMP)	
	Communication form:	Unused connector (P2)	
Helium gas pressure	- Static:	2.30 – 2.35 MPaG (at 20 degrees C)	
	- Operating:	2.9 – 3.1 MPaG (supply pressure) *	
Cooling water requirement	Maximum pressure:	0.70 MPaG	
	Min. flow rate:	4 – 10 L/min	
	Temperature range:	4 – 32 degrees C	
	Water quality:	Refer to the cooling water specification	
SEMI F47	Compliant		
Standards	UL/cUL	Recognized	
	CE	Compliant	

*This is recommendation value. It is no problem to go out of the range temporarily.



- 1: M10 for L bracket (accessory)
- 2: Operation panel
- 3: Maintenance USB port
- 4: Communication network interface (RS-485)
- 5: Unused connector (J1, P2)
- 6: Electrical power interface
- 7: Cable clamp
- 8: Helium return connection
- 9: Helium supply connection
- 10: Pressure gauge
- 11: Helium charge port
- 12: Cooling water supply connection
- 13: Cooling water return connection

Figure 10 Compressor Unit (TM-30*-AA)

2-4-7 TM-30L-CA

Table 16 Compressor (TM-30L-CA) Specification

Item	Specification		
Model	TM-30L-CA		
Cooling system	Water cooling		
Environmental condition	<ul style="list-style-type: none"> - Indoor use - Altitude up to 1000 m - Temperature 5 to 35 degrees C (28 to 35 degrees C with 5% cooling capacity loss) - Humidity: 20 – 80% (without dew) - Transient over voltage: Category 2 (IEC60664-1) - Applicable rated pollution degree: Category 2 (IEC60664-1) 		
Storage environmental condition	<ul style="list-style-type: none"> - Indoor - Temperature: 0 to 40 degrees C - Humidity: 20 – 80% (without dew) 		
Outside dimension	631 mm L x 451 mm W x 747 mm H		
Weight	140 kg		
Sound pressure	less than 70 dBA		
Mechanical interface	Helium line fitting:	Supply Aeroquip – 8 (male) Return Aeroquip – 8 (female)	
	Helium charge fitting:	45 degrees flare (male) and 7/16" x 20 threads/inch	
	Cooling water fitting: (supply and return)	NPT 1/2 (female, Material: Stainless steel)	
Electrical interface	Rated demand power:	3 ϕ 200/230 VAC ($\pm 10\%$) 50/60Hz In the case of 180 – 200V, the maximum number of loading cryopumps will be reduced to 80% of the cryopumps specification. (e.g. When the maximum number of loading cryopumps is 6 on the cryopump specification, the maximum number of loading cryopumps (180 - 200V) will be reduced to 4 cryopumps. (6 x 0.8 = 4.8. The largest integer below 4.8 is 4. Therefore, the maximum number of the loading cryopumps will be 4 cryopumps.))	
	Rating current:	25 A	
	Compressor unit built-in circuit breakersetting value (ELB):	40 A (Interrupting rating 14 kAIC)/30 mA	
	SCCR:	5 kA	
	Ground system:	TN	
	Terminal size:	L1, L2, L3: M5, GND:M5	
	Wire size:	AWG10 or more	
	Cable clamp type:	ST36-B (LAPP)	
	Communication interface	Communication form:	RS-485 serial communication (between compressor and CP controller)
		Connector type:	D-sub 9pin (male)
Other Interfaces	Communication form:	USB serial communication (between compressor and maintenance PC)	
	Connector type:	mini USB	
	Communication form:	DI/O signal	
	Connector type:	D-sub 25pin (female)	
	Communication form:	Unused connector (J1)	
	Connector type:	206430-1 (AMP)	
	Communication form:	Unused connector (P2)	
Helium gas pressure	- Static:	2.30 – 2.35 MPaG (at 20 degrees C)	
	- Operating:	2.9 – 3.1 MPaG (supply pressure) *	
Cooling water requirement	Maximum pressure:	0.70 MPaG	
	Min. flow rate:	4 – 10 L/min	
	Temperature range:	4 – 32 degrees C	
	Water quality:	Refer to the cooling water specification	
SEMI F47	Compliant		
Standards	UL/cUL	Recognized	
	CE	Compliant	

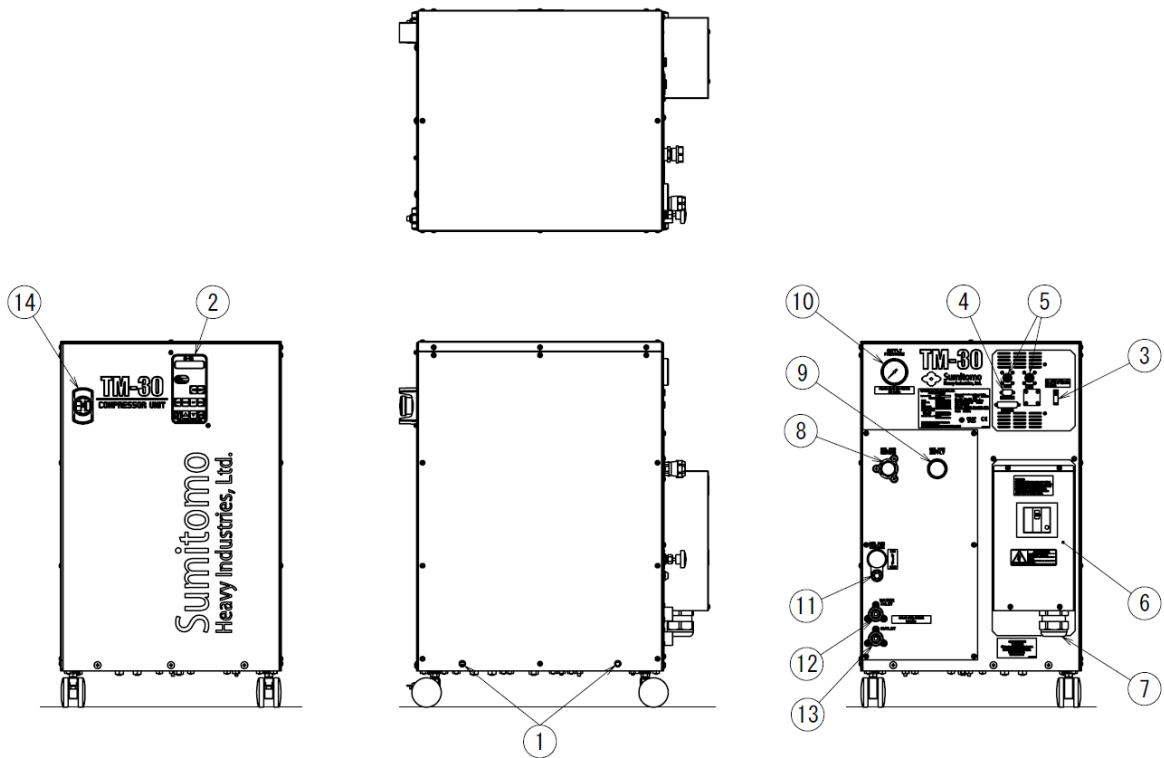
*This is recommendation value. It is no problem to go out of the range temporarily.

2-4-8 TM-30H-CA

Table 17 Compressor (TM-30H-CA) Specification

Item	Specification		
Model	TM-30H-CA		
Cooling system	Water cooling		
Environmental condition	<ul style="list-style-type: none"> - Indoor use - Altitude up to 1000 m - Temperature 5 to 35 degrees C (28 to 35 degrees C with 5% cooling capacity loss) - Humidity: 20 – 80% (without dew) - Transient over voltage: Category 2 (IEC60664-1) - Applicable rated pollution degree: Category 2 (IEC60664-1) 		
Storage environmental condition	<ul style="list-style-type: none"> - Indoor - Temperature: 0 to 40 degrees C - Humidity: 20 – 80% (without dew) 		
Outside dimension	639 mm L x 451 mm W x 747 mm H		
Weight	140 kg		
Sound pressure	less than 70 dBA		
Mechanical interface	Helium line fitting:	Supply Aeroquip – 8 (male) Return Aeroquip – 8 (female)	
	Helium charge fitting:	45 degrees flare (male) and 7/16" x 20 threads/inch	
	Cooling water fitting: (supply and return)	NPT 1/2 (female, Material: Stainless steel)	
Electrical interface	Rated demand power:	3 ϕ 380/400/415 VAC (±10%), 50Hz 3 ϕ 460/480 VAC (±10%), 60Hz In the case of 342 - 380V, the maximum number of loading cryopumps will be reduced to 80% of the cryopumps specification. (e.g. When the maximum number of loading cryopumps is 6 on the cryopump specification, the maximum number of loading cryopumps (342 - 380V) will be reduced to 4 cryopumps. (6 x 0.8 = 4.8. The largest integer below 4.8 is 4. Therefore, the maximum number of the loading cryopumps will be 4 cryopumps.))	
	Rating current:	14 A	
	Compressor unit built-in circuit breaker setting value (MCCB):	20 A (Interrupting rating 18 kAIC)	
	SCCR:	5 kA	
	Ground system:	TN	
	Terminal size:	L1, L2, L3: M5, GND: M5	
	Wire size:	AWG12 or more	
	Cable clamp type:	ST29-B (LAPP)	
	Communication interface	Communication form:	RS-485 serial communication (between compressor and CP controller)
		Connector type:	D-sub 9pin (male)
Other Interfaces	Communication form:	USB serial communication (between compressor and maintenance PC)	
	Connector type:	mini USB	
	Communication form:	DI/O signal	
	Connector type:	D-sub 25pin (female)	
	Communication form:	Unused connector (J1)	
	Connector type:	206430-1 (AMP)	
	Communication form:	Unused connector (P2)	
Helium gas pressure	- Static:	2.30 – 2.35 MPaG (at 20 degrees C)	
	- Operating:	2.9 – 3.1 MPaG (supply pressure) *	
Cooling water requirement	Maximum pressure:	0.70 MPaG	
	Min. flow rate:	4 – 10 L/min	
	Temperature range:	4 – 32 degrees C	
	Water quality:	Refer to the cooling water specification	
SEMI F47	Compliant		
Standards	UL/cUL	Recognized	
	CE	Compliant	

*This is recommendation value. It is no problem to go out of the range temporarily.



- 1: M10 for L bracket (accessory)
- 2: Operation panel
- 3: Maintenance USB port
- 4: Communication network interface (RS-485)
- 5: Unused connector (J1, P2)
- 6: Electrical power interface
- 7: Cable clamp
- 8: Helium return connection
- 9: Helium supply connection
- 10: Pressure gauge
- 11: Helium charge port
- 12: Cooling water supply connection
- 13: Cooling water return connection
- 14: EMO switch

Figure 11 Compressor Unit (TM-30*-CA)

Cooling Water Specification

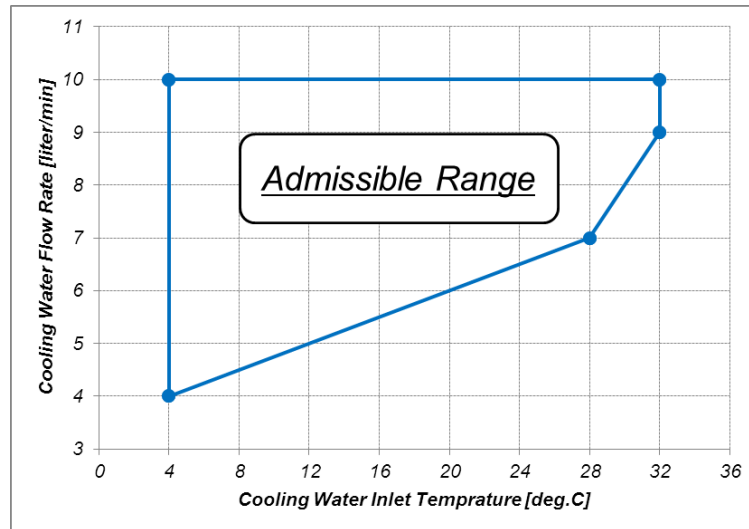


Figure 12 Cooling Water Specification (Water Temperature and Demand Flow) (TM-30)

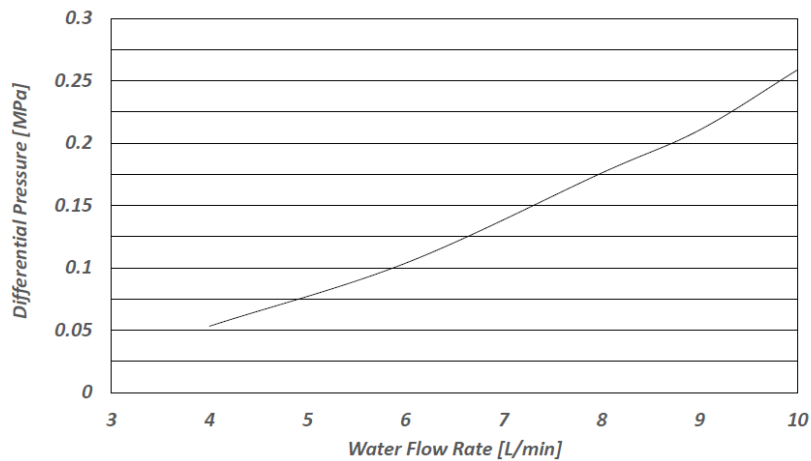


Figure 13 Differential Pressure and Water Flow Rates (TM-30)

Table 18 Cooling Water Specification (Water Quality) (TM-30)

Item	Specification
pH value	6.5 to 8.2 at 25 degrees C
Electrical conductivity	< 80 mS/m
Chloride ion	< 200 mg/L
Sulfate ion	< 200 mg/L
M-Alkalinity	< 100 mg/L
Total hardness	< 200 mg/L
Calcium hardness	< 150 mg/L
Ionic silica	< 50 mg/L
Iron	< 1.0 mg/L
Copper	< 0.3 mg/L
Sulfide ion	None, not detectable
Ammonium ion	< 1.0 mg/L
Residual chlorine	< 0.3 mg/L
Free carbon dioxide	< 4.0 mg/L
Stability index	6.0 to 7.0
Suspended matter	< 10 mg/L
Particle size	< 100 μm

3 HARDWARE INTERLOCK

In order to minimize expansion of damage caused by any abnormality that occurred in the system, various hardware interlocks have been installed in the system.

Do not attempt to disable or tamper these interlocks.

When any interlocks are being activated due to an abnormality in the system, the system may not function in part or in whole. (Operation status at the time of detecting the abnormality varies with the relevant interlock.)

Eliminate causes of the interlock activation and take appropriate action for recovery.

3-1 CRYOPUMP HARDWARE INTERLOCK

Table 19 Cryopump Hardware Interlock

No.	Item	Hazards protected, Detection method	Equipment condition after the interlock is activated
1	Refrigerator relief valve	Over-pressure protection of the charged helium This relief valve opens when the low side helium pressure is 2.7 MPaG (390 psiG) or more.	The cryopump does not stop. But helium charged pressure will decrease. There is a possibility that the cryopump system cannot operate correctly.
2	Cryopump relief valve (vent valve)	Over-pressure protection of the cryopump inside This relief valve opens when the cryopump inside pressure is 20 kPaG (3.2 psiG) or more.	The cryopump does not stop. But there is a possibility that the leaking is occurred by dust on the seat ring of the relief valve.
3	Fuse	Over-current protection of the IO module This fuse blows out when the IO module input current is 1.25 A or more by the short circuit, the earth fault etc.	The cryopump stops.

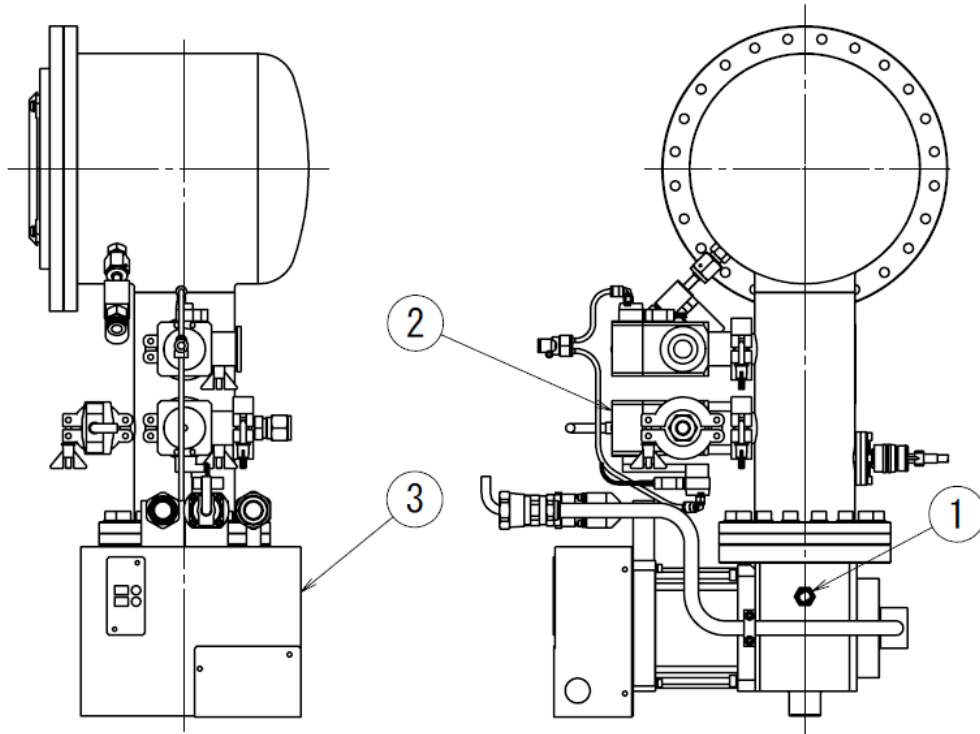


Figure 14 Cryopump (KV-08F*LOA0D4) Hardware Interlock

3-2 COMPRESSOR UNIT HARDWARE INTERLOCK

TM-50

Table 20 Compressor Unit Hardware Interlock

No.	Item	Hazards protected, Detection method	Equipment condition after the interlock is activated
1	Thermistor (TH1-1)	Over-temperature protection of the discharged Helium The compressor unit stops when the discharged helium temperature is 80 degrees C or more on this thermistor.	The compressor unit stops.
2	Thermistor (TH1-2)	Over-temperature protection of the Helium after cooling The compressor unit stops when the helium temperature after cooling is 60 degrees C or more on this thermistor.	The compressor unit stops.
3	Thermistor (TH1-3)	Over-temperature protection of the cooling water at outlet The compressor unit stops when the cooling water temperature at outlet is 60 degrees C or more on this thermistor.	The compressor unit stops.
4	Compressor relief valve	Over-pressure protection of the compressor This relief valve opens when the high side helium pressure is 3.55 MPaG (515 psiG) or more.	Exhaust extra gas to prevent the compressor unit from damage*
5	Main power switch	Over-current protection of the compressor (TM-50L) This main power switch turns off when the compressor input current is 50 A or more by the short circuit, the earth fault etc. Or, this main power switch turns off when the compressor leakage current is 30 mA or more by the earth fault etc. (TM-50H) This main power switch turns off when the compressor input current is 30 A or more by the short circuit, the earth fault etc.	The compressor unit stops.
6	Fuse	Over-current protection of the primary transformer This fuse blows out when the secondary current is 2.0A (TM-50L) /1.5A (TM-50H) or more by the short circuit, the earth fault etc.	The compressor unit stops.

*The compressor unit stops due to the supply pressure high alarm before the compressor relief valve is opened.

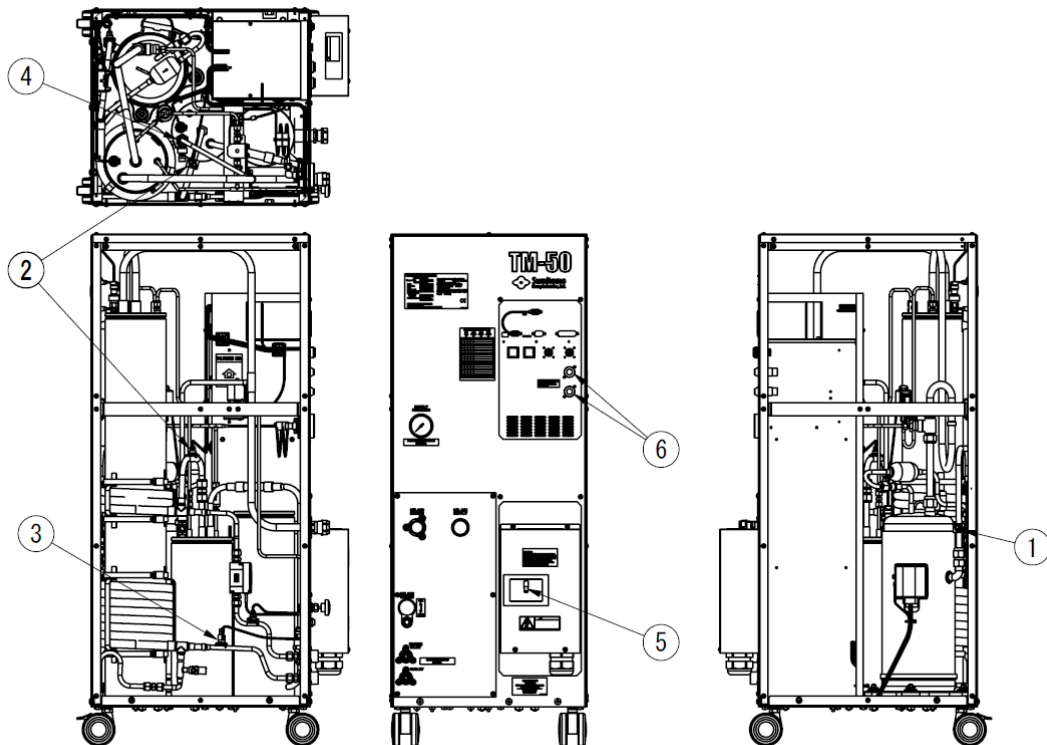


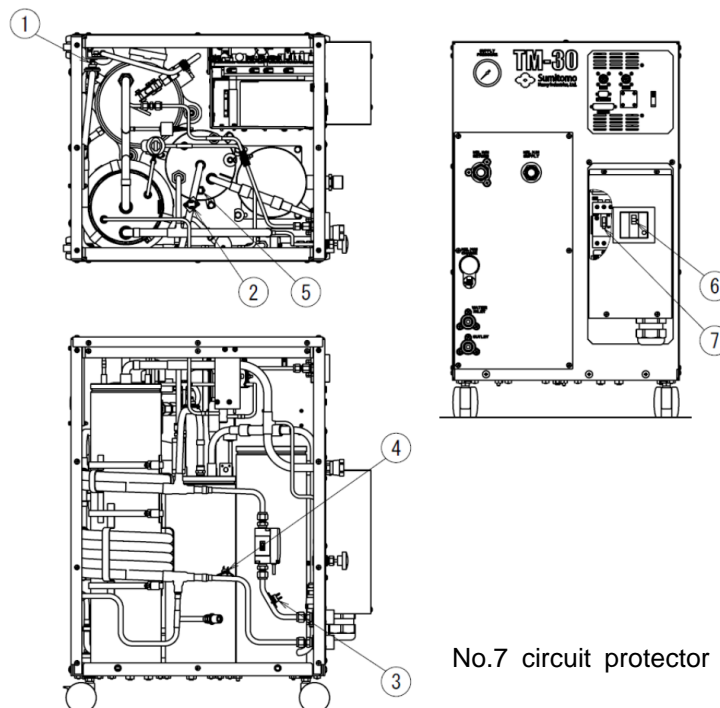
Figure 15 Compressor Unit Hardware Interlock (TM-50)

TM-30

Table 21 Compressor Unit Hardware Interlock (TM-30)

No.	Item	Hazards protected, Detection method	Equipment condition after the interlock is activated
1	Thermistor (T1)	Over-temperature protection of the discharged Helium The compressor unit stops when the discharged helium temperature is 75 degrees C or more on this thermistor.	The compressor unit stops.
2	Thermistor (T2)	Over-temperature protection of the Helium after cooling The compressor unit stops when the helium temperature after cooling is 60 degrees C or more on this thermistor.	The compressor unit stops.
3	Thermistor (T3)	Temperature protection of the cooling water at inlet The compressor unit shows warning when the cooling water temperature at inlet is 75 degrees C or more.	The compressor unit stops.
4	Thermistor (T4)	Over-temperature protection of the cooling water at outlet The compressor unit stops when the cooling water temperature at outlet is 60 degrees C or more on this thermistor.	The compressor unit stops.
5	Compressor relief valve	The safety valve functions when there is no high pressure alarm (threshold: 3.33 MPa) generated by the pressure sensor at the time of pressure abnormality such as excessive charging pressure or abnormal operation. Over-pressure protection of the compressor This relief valve open when the high side helium pressure is 3.55 MPaG (515 psiG) or more.	Exhaust extra gas to prevent the compressor unit from damage*
6	Main power switch	Over-current protection of the compressor (TM-30L) This main power switch turns off when the compressor input current is 40 A or more by the short circuit, the earth fault etc. Or, this main power switch turns off when the compressor leakage current is 30 mA or more by the earth fault etc. (TM-30H) This main power switch turns off when the compressor input current is 20 A or more by the short circuit, the earth fault etc.	The compressor unit stops.
7	Circuit protector	Over-current protection of the primary transformer This circuit protector is turned off when the secondary current is 2.0 A (TM-30L) /1.0 A (TM-30H) or more by the short circuit, the earth fault etc.	The compressor unit stops.

*The compressor unit stops due to the supply pressure high alarm before the compressor relief valve is opened.




No.7 circuit protector is within a breaker cover.

Figure 16 Compressor Unit Hardware Interlock (TM-30)

3-3 EMO INTERLOCK

CAUTION



< Caution about EMO Circuit >

This cryopump system is designed to be powered by a host system that has an EMO circuit. The compressor unit is provided with an EMO switch and a connection point where the host system EMO circuit is to be connected to. The cryopump is designed to be bolted or clamped to the host system and the controller is intended to be located internal to the host system.

Connect the components of this cryopump system to a host system that has an EMO circuit.

The EMO circuit of the customer's system must be closed at the end unit.

The EMO (emergency off) switch is a red and mushroom-shaped rotary lock switch installed in the host system and the SICERA compressor. Press this switch when an abnormality occurred in the system or when the operator wants to stop the system in emergency.

Power supply from the host system to the component is shut off when any EMO switch is pressed.

(Please refer to the Operation Manual for the use of the EMO switch.)

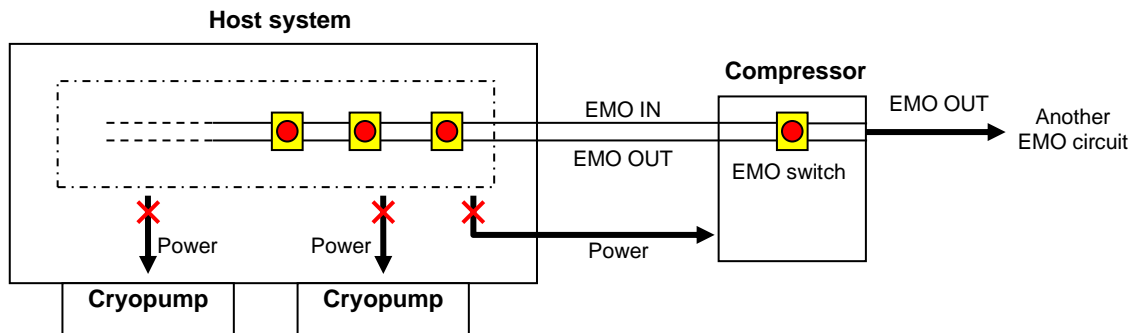


Figure 17 EMO Circuit System

To restart energization, turn the EMO (emergency off) switch to the right to reset it. The EMO switch will protrude and energization will become possible.

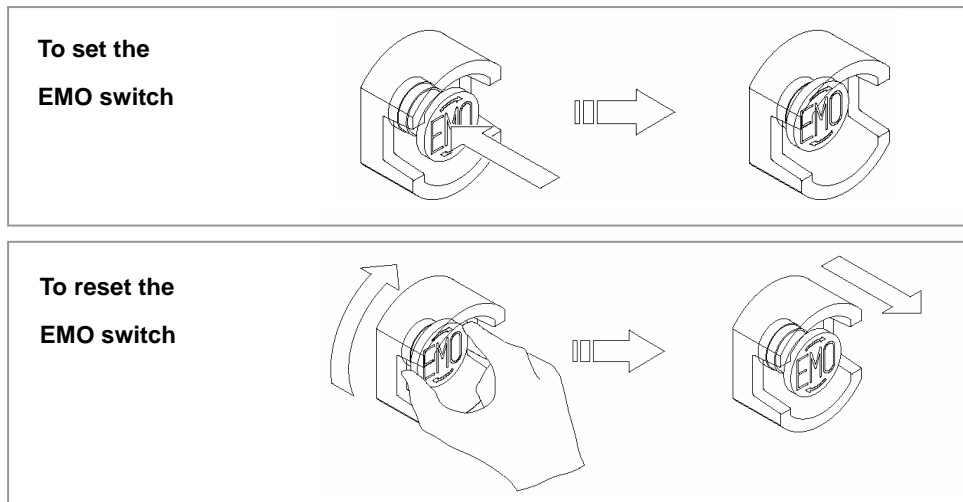


Figure 18 EMO Switch Set and Reset Procedure

The EMO (emergency off) switch is installed on the front of the compressor body.
 Refer to the following about the location, the model of connectors, and the electrical schematic.

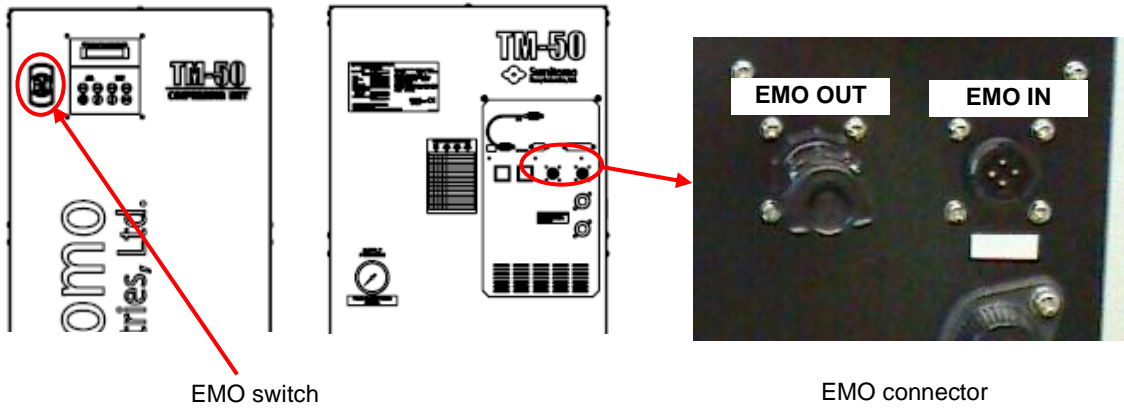


Figure 19 EMO Interface Location of the Compressor Unit (TM-50)

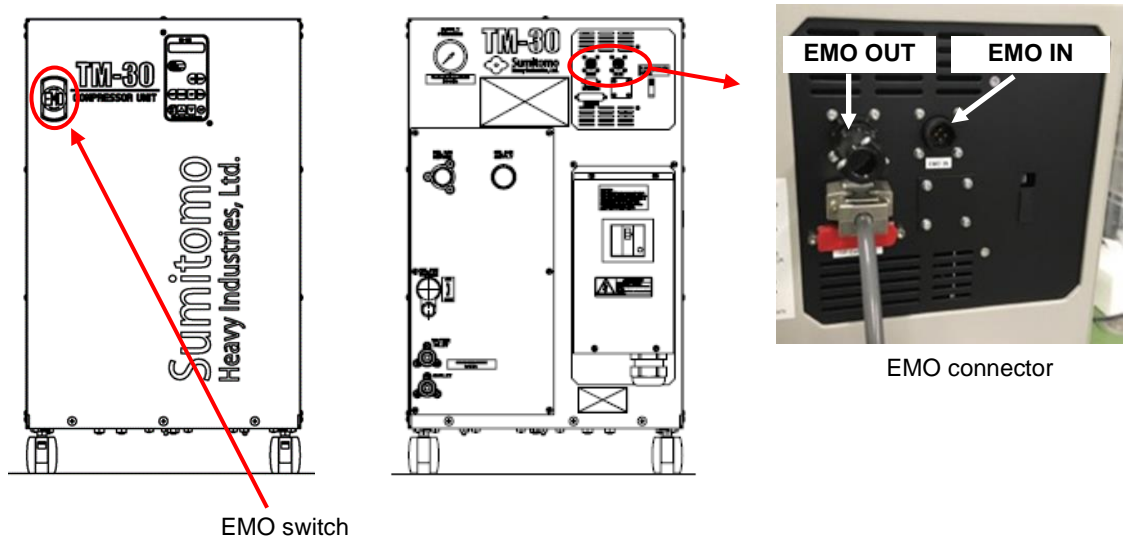


Figure 20 EMO Interface Location of the Compressor Unit (TM-30)

Table 22 EMO Connector Model

Item	Model (manufacture)
EMO OUT (J1)	206430-1 (AMP)
EMO IN (P2)	206061-1 (AMP)

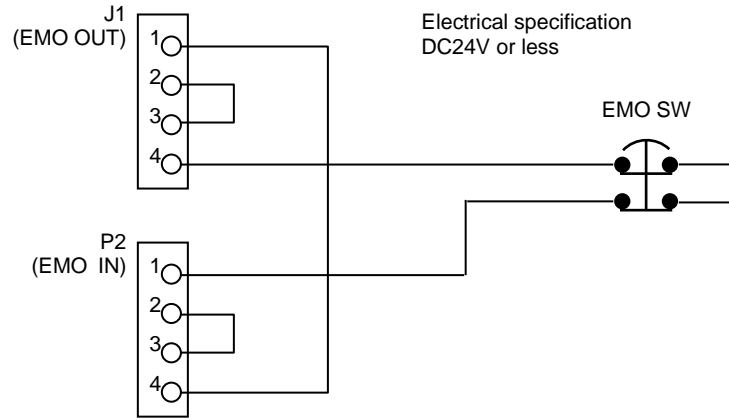


Figure 21 Compressor EMO Circuit Drawing

4 OPERATION

WARNING



< Warning about Explosion and Gas Leak >

The cryopump system (including the cryopump unit, compressor unit, adsorber, flexible gas lines, etc.) contains high-pressure helium gas (about 2.30-2.35 MPaG). Do not strike the system at a sharp edge or contact it with the pointed tool may cause gas leak or explosion.

Failure to adhere to this precaution could result in death or sever injury to worker. Pay special attention to handling the system.

WARNING



< Warning about Electric Shock >

This cryopump system includes a high-voltage power supply. Touching at wrong place will result in electric shock. Handle it with extreme care.

Make sure to switch off power supply to each unit before commencing any maintenance work. Failing to observe this precaution may result in electric shock.

Be sure to turn off the customer's main power and lock the compressor breaker with OFF position before maintenance work. It may result in electric shock to fail to obey this precaution.

CAUTION



< Caution about Cold Surface >

There is a risk of frostbite due to low temperature of a cold surface in the cryopump unit.

Do not touch the cryopump vessel during regeneration.

CAUTION



< Caution about Start the Cool Down >

The cryopump is only used when it is in vacuum condition.

The cryopump should be roughed out by the roughing pump before stating the cool down.

The cryopump cannot work correctly when it is in atmosphere condition.

CAUTION



< Caution about Malfunction >

When the cryopumps and the compressors are running, do not touch any of the RS-485 communication cable connectors (D-sub9) on the CP controller, the cryopump IO module, or the compressor, by hand or any tools such as a screwdriver.

Accidental disconnection of the communication cable connectors will result in unexpected stoppage of the compressors, or the whole cryopump system.

Do not connect any cables to the Maintenance port of D-sub9, mini USB, or D-sub25 on both of the compressor and the CP controller. Connecting any cables to these maintenance ports may cause unexpected stoppage of the compressor or the cryopumps. These maintenance ports are meant to be handled by Sumitomo Heavy Industries (SHI) authorized personnel only.

4-1 PRE-USE CHECK

Make the following checks before use.

- (1) Review the installation and maintenance manual and confirm that the installation of each unit and connection of cables have been done completely.
- (2) Make sure to switch off power supply to the compressor unit.
- (3) In terms of the flexible lines, check the supply and the return sides are connected correctly.
- (4) Look the pressure gauge of the compressor indicates 2.30-2.35 MPaG.
- (5) Check cooling water is being supplied to the compressor quantitatively.
- (6) Confirm that circuit protector of the compressor unit is ON. (Placed the left side of circuit breaker) (TM-50 not applicable)
- (7) Check the switching tap is selected properly. (TM-50 not applicable)
- (8) Make sure that all DIP switches inside the control panel are turned off (shifted to right side).
Do not handle the DIP switch after this operation. (TM-50 not applicable)
- (9) Confirm pneumatic gas for valves is being supplied correctly.
- (10) Look N2 purge gas is being supplied correctly.
- (11) Check all power supply to the cryopump system is turned off.

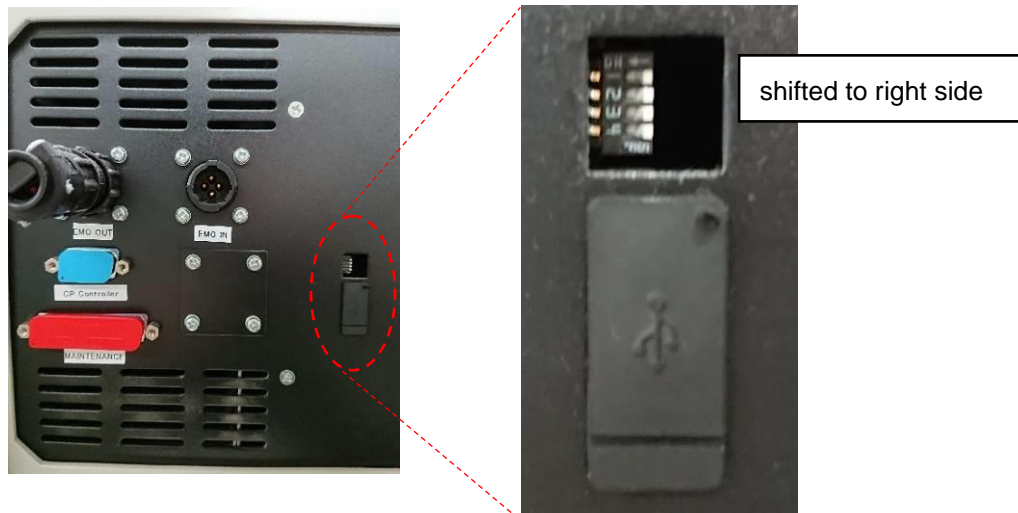


Figure 22 Compressor DIP Switch Setting (TM-30)

4-2 COMMUNICATION ID

SICERA is multi cryopump system. Therefore, each cryopump and compressor should have an individual ID for independent operation. If wrong number setting, the cryopump and compressor cannot work correctly.

4-2-1 CRYOPUMP ID SETTING

The cryopump ID is set by 2 rotary switches on the IO module.

The default ID numbers are "00" without special specification.

Change the ID number to proper value as follows:

- (1) Make sure the IO module is turned off and its 7 segment LED goes out.
The ID number change shall not be activated if the IO module power is supplied.
(The 7 segment LED should be turned off.)

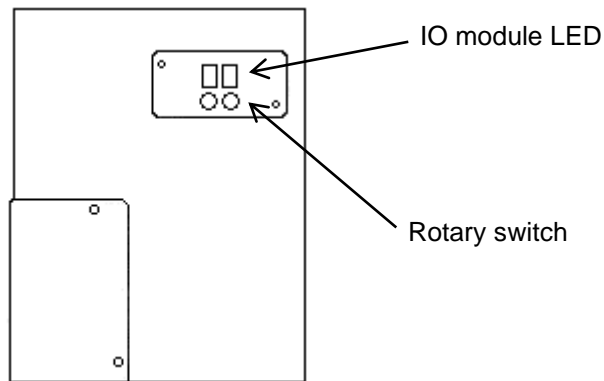


Figure 23 IO Module LED and Rotary Switch

- (2) Set the rotary switch numbers with a flat head screwdriver.

The ID number is 2 digits.

If the ID number is wrong, the cryopump does not work.

Default ID numbers of setting possible are 00-11.

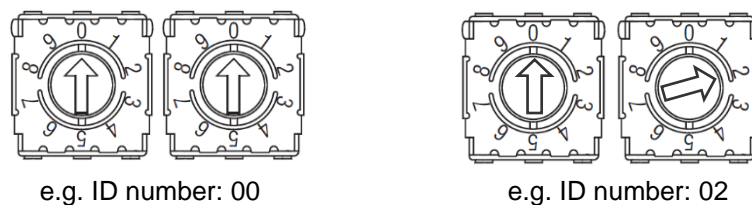


Figure 24 IO Module Rotary Switches for Cryopump ID

- (3) Turn on the IO module, and the number is displayed on the 7 segment LED.

4-2-2 CP CONTROLLER ID SETTING

Serial communication (RS-232C) between a host controller and SICERA CP controller has ID numbers for each cryopump and compressor. (cryopump max: 12, compressor max: 2)

Each ID number is set as a following table initially.

If you want to use ID number other than the following table, you need to change the ID number setting.

Refer to the Operation manual to change the setting.


Table 23 CP Controller Default ID Number Setting

Cryopump, Compressor (SICERA internal ID number)	Communication ID setting (Communication ID with host controller)
Cryopump 00	00
Cryopump 01	01
Cryopump 02	02
Cryopump 03	03
Cryopump 04	04
Cryopump 05	05
Cryopump 06	06
Cryopump 07	07
Cryopump 08	08
Cryopump 09	09
Cryopump 10	10
Cryopump 11	11
Compressor 00	20
Compressor 01	21

4-2-3 COMPRESSOR ID SETTING

TM-50

CAUTION



< Caution about Malfunction >
 There are two compressors in a cryopump system in the maximum.
All of the compressor communication ID is set to No.20 at first.
Therefore, one of two compressors should be set to another ID number (No.21)
if you operate two compressors by one system.

Two compressors cannot run correctly if communication ID of these compressors are same ID number.

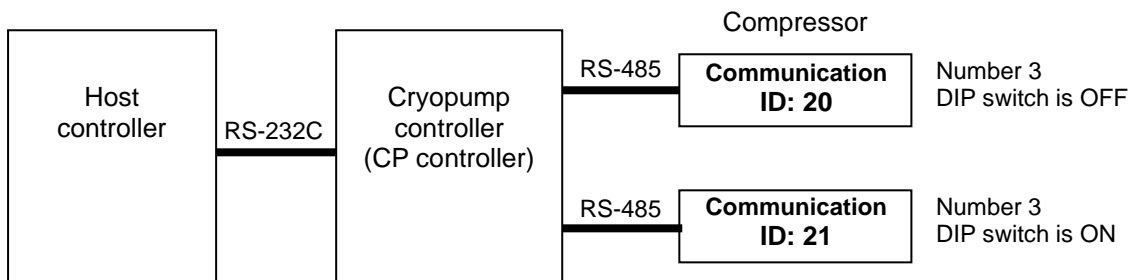


Figure 25 Compressor Communication ID Number Setting (TM-50)

In case that ID is incorrect, change the compressor ID according to the procedure below.

- (1) Make sure that the compressor is turned off and its LED goes out.
- (2) Remove D-sub connector from the front panel.
- (3) The number 3 DIP switch is turned on.

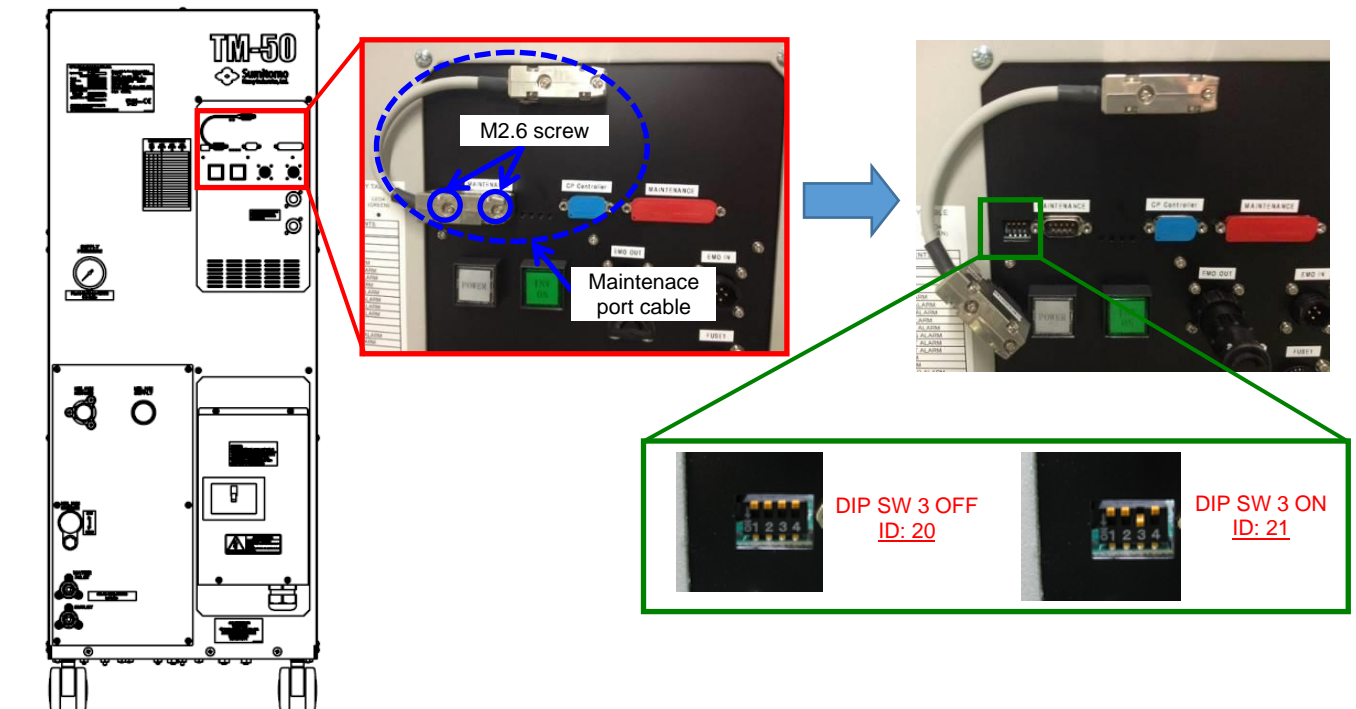



Figure 26 Compressor Number 3 DIP Switch Setting (TM-50)

- (4) Connect D-sub connector to the front panel.
- (5) Turn on the compressor and check the compressor ID number by the host controller.

TM-30

CAUTION




< Caution about Malfunction >
 There are two compressors in a cryopump system in the maximum.
All of the compressor communication ID is set to No.20 (PP121: 0) at first. Therefore, one of two compressors should be set to another ID number (No.21 (PP121: 1)) if you operate two compressors by one system.

Two compressors cannot run correctly if communication ID of these compressors are the same ID number.

Set the value of PP121 to be 0 or 1. Do not set 2-9 which are unrecognized on the host controller.
 After setting the ID number, check the status of ID recognition on the host controller.

CAUTION



< Caution about Malfunction >
 Do not handle DIP switch on control box without any special reason.
 In case that DIP switch is set incorrectly, TM-30 cannot be turned on or run normally. ID setting of TM-30 differs from CSW-61 and TM-50, the conventional model of SICERA compressor, so make sure to confirm the following procedure before setting the compressor ID.

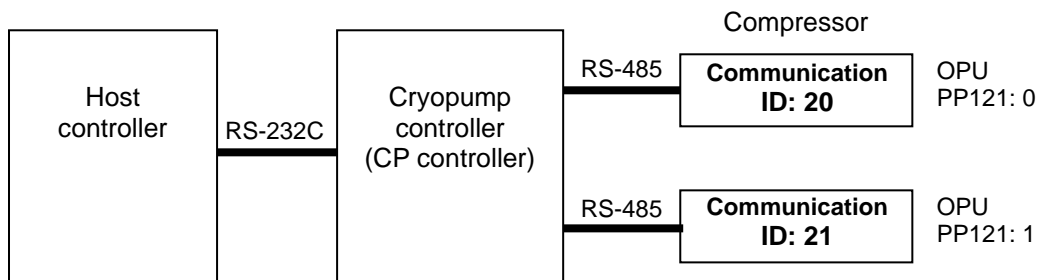


Figure 27 Compressor Communication ID Number Setting (TM-30)

In case that the ID is incorrect, change the compressor ID according to the procedure below.

- (1) Turn on the breaker on the rear panel of compressor.
- (2) Make sure the operation panel window is lighting and the compressor unit is powered on.
- (3) Make sure "RUN" LED on the operation panel is off and the compressor unit is stopped.
- (4) Change the parameter of "PP121" to set the compressor ID for RS485 communication.

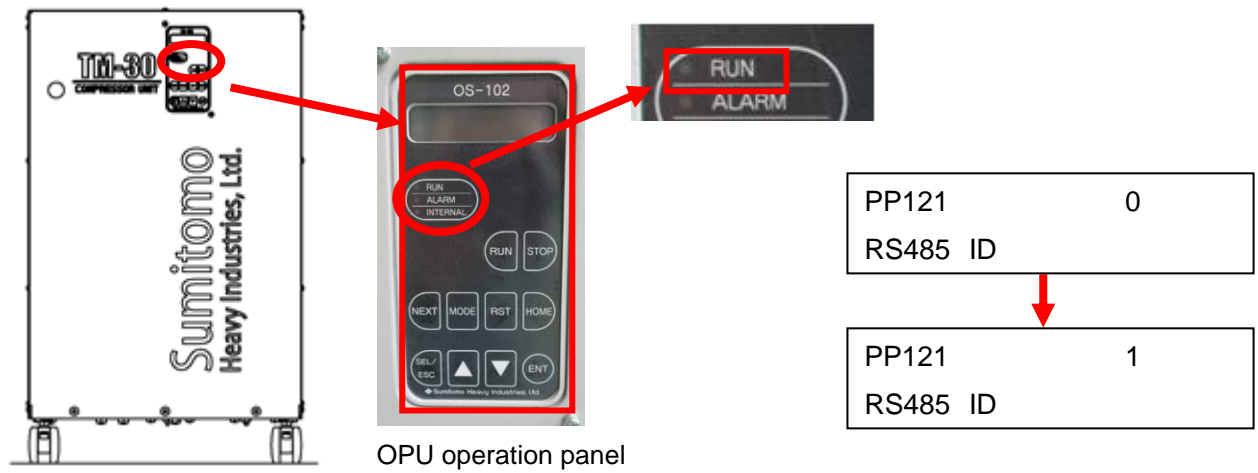
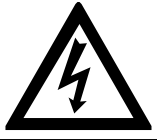


Figure 28 Compressor ID Setting by OPU (TM-30)

- (5) Once turn off the unit breaker in order to reflect the setting change. After the restart of unit, confirm the compressor ID with the host controller.

4-3 POWER ON SYSTEM

WARNING



< Warning about Electric Shock >

This cryopump system includes a high-voltage power supply. Touching at wrong place will result in electric shock. Handle it with extreme care.

Make sure to switch off power supply to each unit before commencing any maintenance work. Failing to observe this precaution may result in electric shock.

Be sure to turn off the customer's main power and lock the compressor breaker with OFF position before maintenance work. It may result in electric shock to fail to obey this precaution.

CAUTION



< Caution about Malfunction >

When the cryopumps and the compressors are running, do not touch any of the RS-485 communication cable connectors (D-sub9) on the CP controller, the cryopump IO module, or the compressor, by hand or any tools such as a screwdriver.

Accidental disconnection of the communication cable connectors will result in unexpected stoppage of the compressors, or the whole cryopump system.

Do not connect any cables to the maintenance port of D-sub9, mini USB, or D-sub25 on both of the compressor and the CP controller. Connecting any cables to these maintenance ports may cause unexpected stoppage of the compressor or the cryopumps. These maintenance ports are meant to be handled by Sumitomo Heavy Industries (SHI) authorized personnel only.

4-3-1 CRYOPUMP (IO MODULE)

- (1) Turn on the primary energy isolating device of each cryopump in the host system.
- (2) Check that the LED of the IO module is turned on.

4-3-2 CP CONTROLLER

- (1) Turn on the power switch on the front of the CP controller.
- (2) The 7 segment LED of the CP controller indicates the network status as the following table.

Table 24 CP Controller 7 Segments LED in Direction *1

LED	Meaning
Communication status	
0	No communication
1	Communicate with cryopump(s) only
2	Communicate with compressor(s) only
3	Communicate with cryopump(s) and 1 compressor
4	Communicate with cryopump(s) and 2 compressors
Additional indication of LED	
H	Some warnings happen in this system (cryopump or compressor) *2
J	Some warnings happen in this system (compressor) *2
A	Some alarms happen in this system (cryopump or compressor) *2*

*1 If warning or alarm happens in this system, then the CP controller LED indicates "Communication status" and "Additional indication" in alternate shifts.

*2 If warning happens in this system, this system is not stopped. But alarm happens, this system is stopped. Check the LED indicator in this system.

As for details, refer to TROUBLE SHOOTING section.

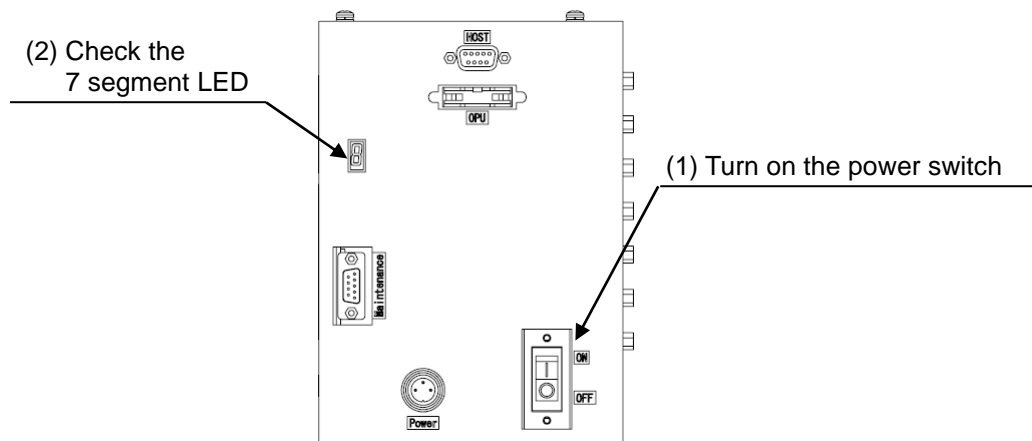


Figure 29 CP Controller Power On Procedure

4-3-3 COMPRESSOR

TM-50

Turn on the primary breaker of the compressor (user's breaker).

- (1) Turn on the breaker on the compressor rear panel.
- (2) Check that the 2 lamps (main power indicator, inverter power indicator) on the compressor rear panel are lighting.

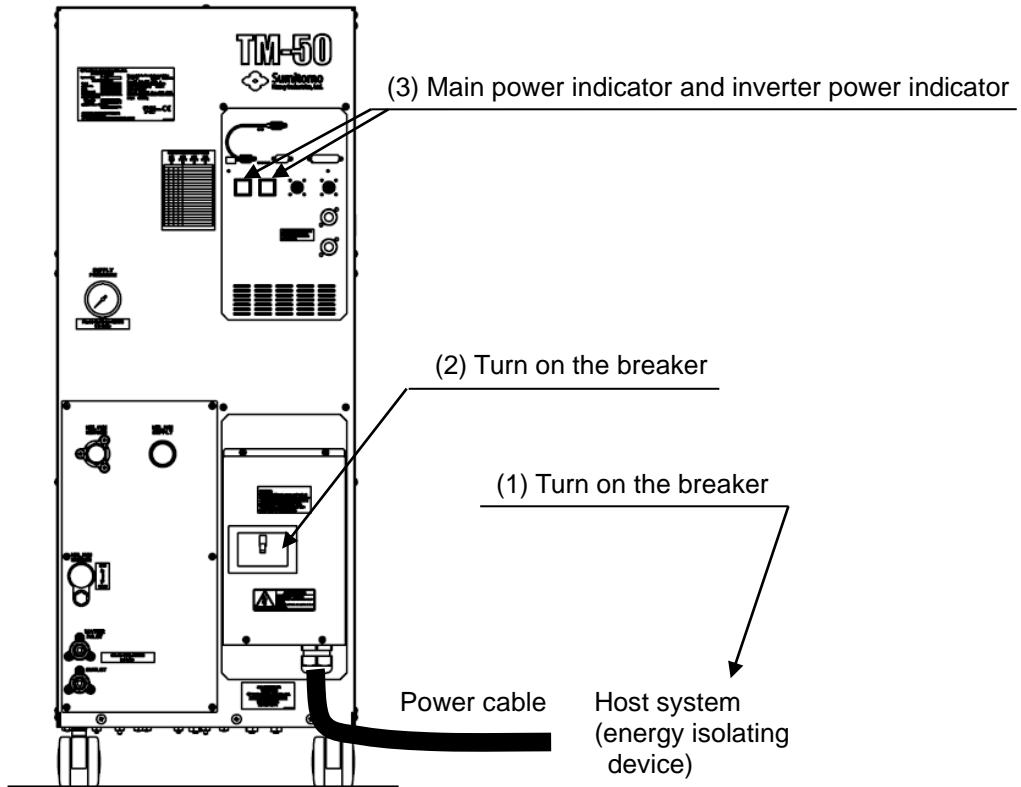


Figure 30 Compressor Power On Procedure (TM-50)

TM-30

- (1) Turn on the primary breaker of the compressor (user's breaker).
- (2) Turn on the breaker on the compressor rear panel.
- (3) Make sure the operation panel window is lighting and the compressor unit is powered on.

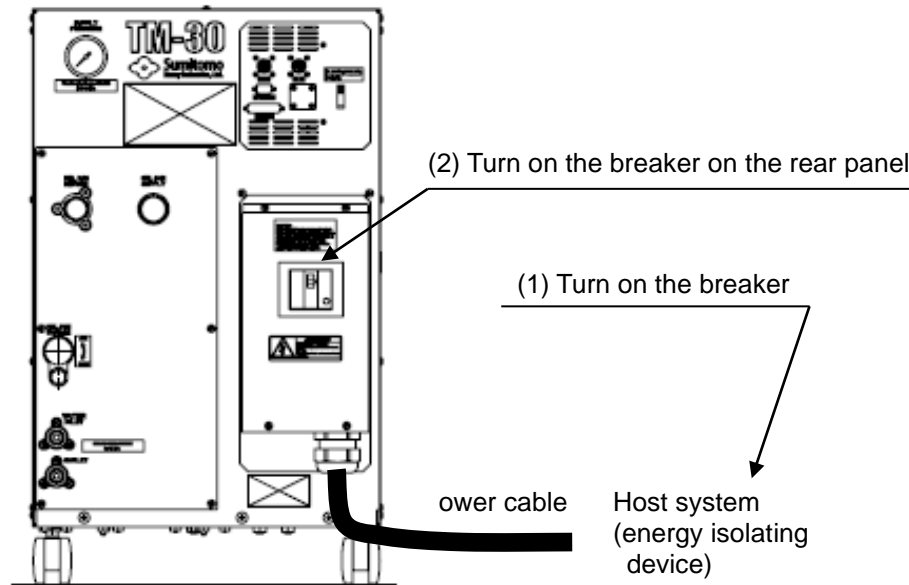




Figure 31 Compressor Power On Procedure (TM-30)

4-4 START RUNNING

 <p>CAUTION</p>	<p>< Caution about Cold Surface > There is a risk of frostbite due to low temperature of a cold surface in the cryopump unit. Do not touch the cryopump vessel during regeneration.</p>
---	--

 <p>CAUTION</p>	<p>< Caution about Start the Cool Down > The cryopump is only used when it is in vacuum condition. The cryopump should be roughed out by the roughing pump before stating the cool down. The cryopump cannot work correctly when it is in atmosphere condition.</p>
---	---

SICERA cryopump system is operated by the host tool communication commands.

As for details of communication command, refer to the software specification in APPENDIX.

Operate the cryopump system per the host tool procedures.





Typical Flow of Starting the Cryopump from Room Temperature

- (1) Purge the nitrogen into the cryopump enclosure through the purge valve for decontaminate the vapor, meanwhile warm up the 1st and 2nd temperature to normal temperature.
- (2) Continue to purge the nitrogen for setting time, in order to defrost left ice through warm up process and to warm the cryopump panel, when 00P003 extended purge time is set except for 0.
- (3) Rough out the inside of the cryopump enclosure through the rough valve for pumping the vapor and the gas.
- (4) The cryopump starts cooling down when inside pressure of the cryopump is lower than base pressure. Sumitomo Heavy Industries (SHI) recommended base pressure value is 10 Pa (75mTorr). The compressor starts running automatically when the cryopump motor starts running.
- (5) The cryopump can work as the vacuum pump when the cryopump temperature is enough low. The cooling down is completed when $T_2 < 17K$.
 Then SICERA cryopump begins to control T_1 temperature with the values in the following table.

Table 25 Cooling Down Completion Condition and T_1 Control Target

Completed cooling down temperature	$T_2 < 17K$
T_1 target temperature after completed cooling down	100K

4-5 ABORT RUNNING

<p>WARNING</p> 	<p><u>< Warning about Hazardous Materials ></u></p>
<p>WARNING</p> 	<p><u>Gases Pumped May Be Toxic, Corrosive, or Flammable Can Cause Injury or Death.</u></p> <p>The cryopump may be connected to a process chamber utilizing hazardous materials.</p> <p>The cryopump vent process chamber chemistry through the vent line manifold to the work environment. The vent line of the cryopump must be connected to exhaust line which is capable to detoxifying apparatus.</p>
<p>WARNING</p> 	<p><u>The cryopump must be purged before uninstalled from the host tool.</u></p> <p>Purge the cryopump by N2 gas until hazardous gas is diluted to safety concentration. Discharge static electricity to prevent explosion of flammable gas.</p>
<p>CAUTION</p> 	<p><u>< Caution about Cold Surface ></u></p> <p>There is a risk of frostbite due to low temperature of a cold surface in the cryopump unit.</p> <p>Do not touch the cryopump vessel during regeneration.</p>

SICERA cryopump system is operated by the host tool communication commands.

Abort the cryopump system per the host tool procedures.

Typical Flow of Abort the Cryopump

- (1) Warm up the cryopump to the room temperature with N2 purging by the host system instruction.
- (2) Abort the cryopump warming up operation by the host system instruction.

Purge with nitrogen to dilute the hazardous chemicals to below their TLV's during the N2 purge process for decommissioning the hazardous chemicals.

(TLV: threshold limit value)

- (3) Stop the N2 purging.

Refer to the INSTALLATION/MAINTENANCE MANUAL about REPLACEMENT OF CRYOPUMP.

5 CP CONTROLLER OPU (OPERATION PANEL UNIT: OPTION)

You can see the status of the cryopump and the compressor, and can change the parameter of regeneration sequence and so on. Basic use is as follows.

* As for communication cable for the OPU and CP controller (option), both sides are the same terminal, therefore there is no functional problem even if any terminal is connected to the OPU or CP controller.

5-1 OPU OUTLINE

The OPU is the following drawing.

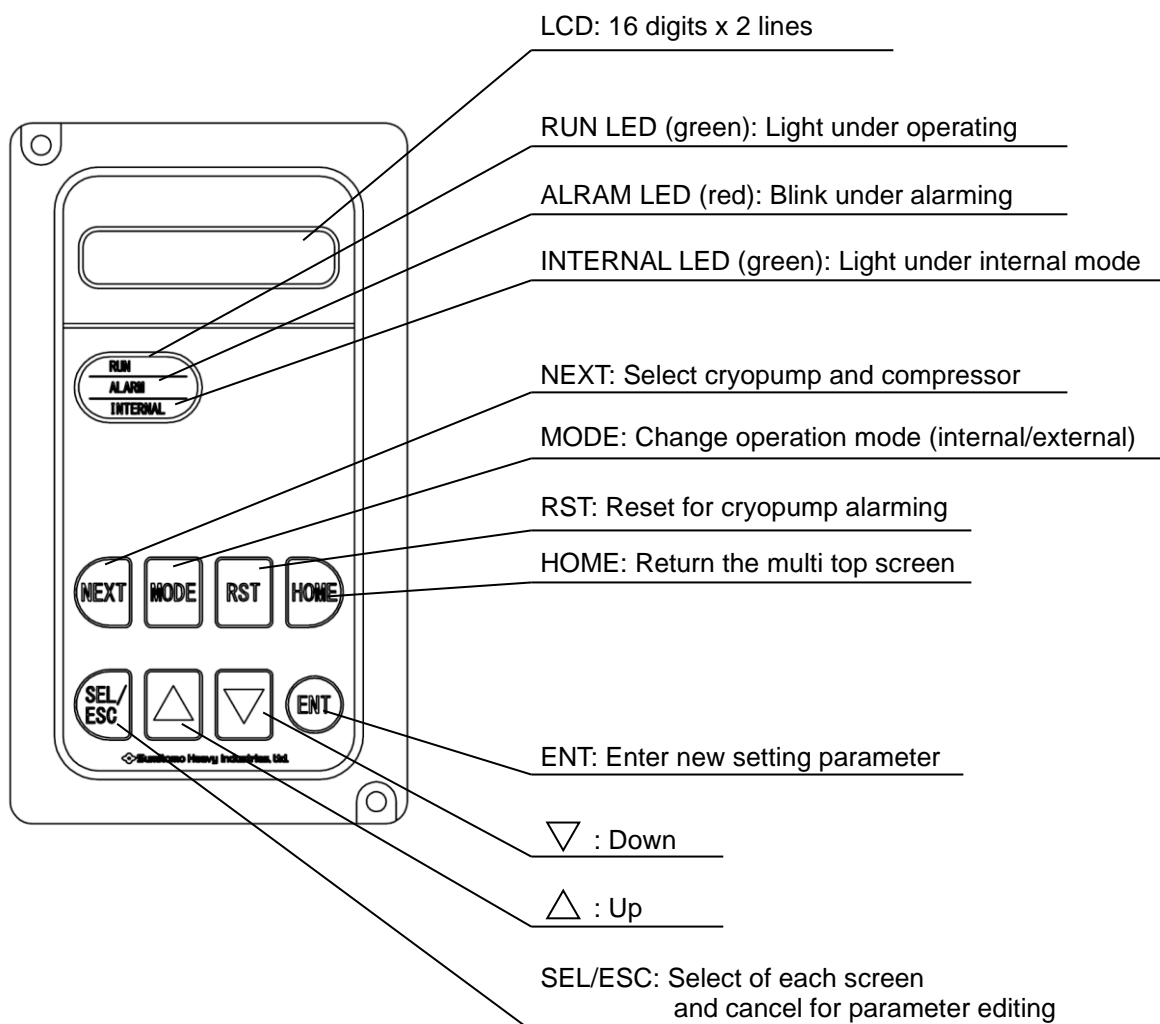


Figure 32 OPU (Operation Panel Unit)

5-2 CONFIGURATION OF THE OPU SCREEN

Display panels, LCD (16 digits×2 lines), show states and values of each function.

The LCD displays some information (Monitor, Alarm, Warning, Parameter, Regeneration, and so on).

They are divided into 8 parts as follows.

A	B			C		
D			E	F	G	H

Upper line

A : Item code

B : Data

C : Data unit

Lower line

D : Data name

E : (Blank)

F : Warning (normal: no display, warning: blinking "W")

G : Alarming (normal: no display, alarming: blinking "A")

H : (Blank)

* This display configuration is not applied to each top screen.

Figure 33 OPU Screen Configuration

5-3 KIND OF MENU ON THE SCREEN

The OPU of the CP controller has various menus on the LCD display. The followings are all kind of menu.

5-3-1 OPU MULTI SCREEN

MULTI ACTIVE 0x00000000	TOP <u>Communication ID number of all the cryopumps and compressors which communicate on the local network</u>
MM00 0x00000000 ACTIVE PUMP	MONITOR (MM00-MM16) <u>Group setting information of the cryopumps</u>
MA00 0x00000000 NO ALARM	ALARM <u>Communication ID number of the alarming cryopumps and compressors</u>
MW00 NO WARNING	WARNING <u>Communication ID number of the warning cryopumps and compressors</u>
MP00 0 P/W	PARAMETER(MP00-MP22) <u>Setting the communication ID number of the cryopumps and compressors. (This is locked by password.)</u>
MS00 1 SD-ON/OFF	SELF DIAGNOSTICS PARAMETER <u>Setting the parameter for self-diagnostics function (This is not locked by password)</u>

* Each ID number of the cyopump and compressor is indicated by hexadecimal.

Figure 34 OPU Multi Screen

5-3-2 OPU CRYOPUMP SCREEN

<p>PMP00 OFF T: 290K/290K</p>	<p>TOP <u>Communication ID number of the cryopump and temperature of T1/T2, and cryopump status</u></p>
<p>00M00 0 CRYOPUMP</p>	<p>MONITOR (M00-M24) <u>Status information of the cryopump</u></p>
<p>00A00 0 Hr NO ALARM</p>	<p>ALARM HISTORY <u>Cause of alarm and history</u></p>
<p>00W00 0 Hr NO WARNING</p>	<p>WARNING <u>Cause of warning</u></p>
<p>00P00 0 P/W</p>	<p>PARAMETER (P00-P34) <u>Parameter of the cryopump</u></p>
<p>00S00 30 min SD-MS TM</p>	<p>SELF DIAGNOSTICS PARAMETER (S00-S18) <u>Self diagnostics parameter of the cryopump</u></p>
<p>00V00 0 P/W</p>	<p>INVERTER PARAMETER (unused) <u>Parameter of the cryopump inverter</u> (This is locked by password.)</p>
<p>00E00 0 P/W</p>	<p>EEPROM CLEAR (unused) <u>Clear memory of EEPROM</u> (This is locked by password)</p>
<p>00H00 0 REGEN TYPE</p>	<p>REGENERATION HISTORY (H01-H10) <u>Last 10 regeneration histories</u></p>
<p>00D00 0 RUN MODE</p>	<p>LOCAL OPERATION (D00-D06) <u>Local operation of the cryopump</u> (Local operation mode only)</p>

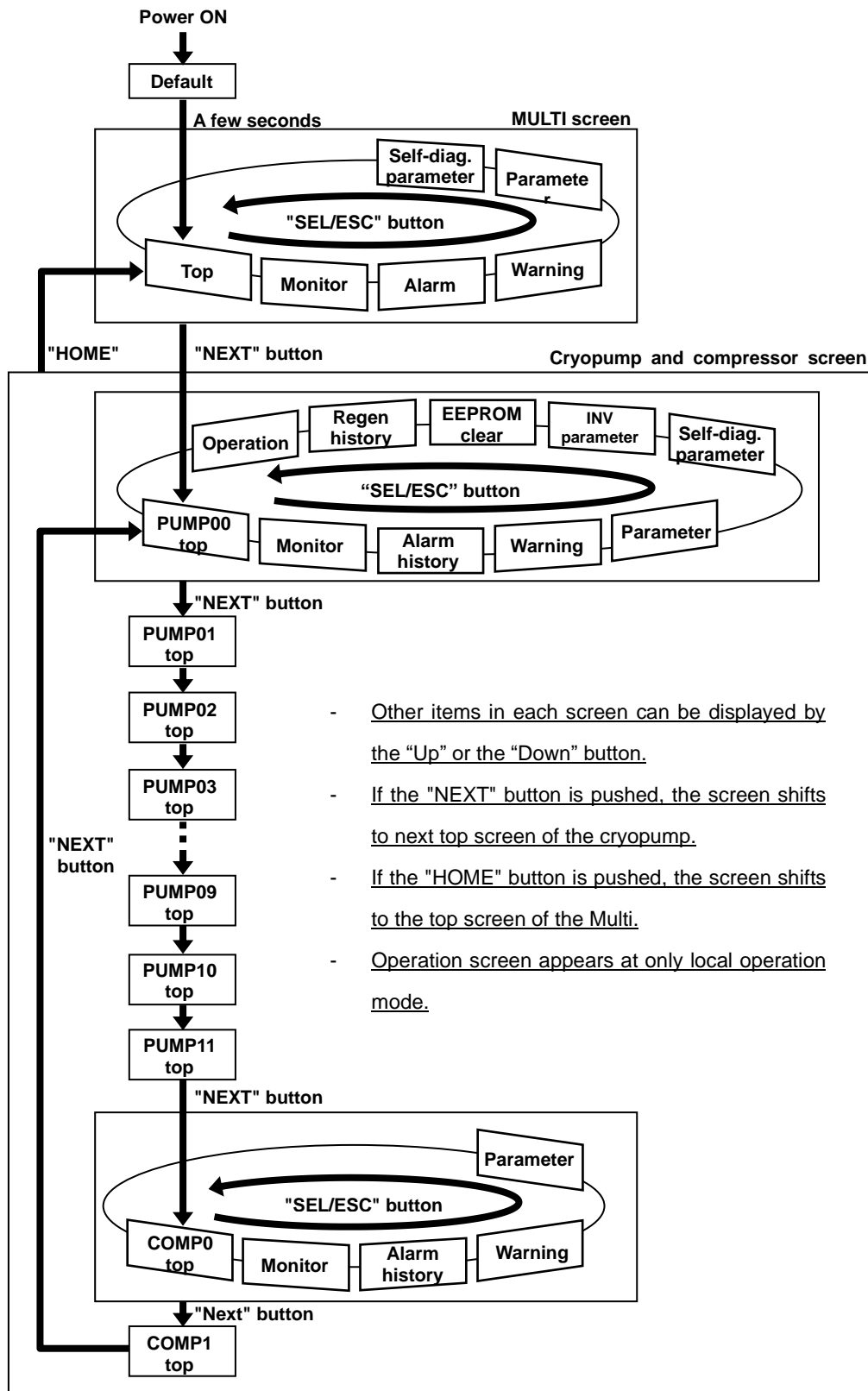
Figure 35 OPU Cryopump Screen

5-3-3 OPU COMPRESSOR SCREEN

<p>COMP0 STOP TIME: 0Hr</p>	<p>TOP <u>Communication ID number of the compressor and run time, and compressor status</u></p>
<p>COM00 0 Hr RUN TIME</p>	<p>MONITOR (M00-M09) <u>Status information of the compressor</u></p>
<p>COA00 0 Hr NO ALARM</p>	<p>ALARM HISTORY <u>Cause of alarm and history</u></p>
<p>COW00 0 Hr NO WARNING</p>	<p>WARNING <u>Cause of warning</u></p>
<p>COP00 0 P/W</p>	<p>PARAMETER (P00-P03) <u>Parameter of the compressor</u></p>

Figure 36 OPU Compressor Screen


5-4 OPU SCREEN HANDLING



- Other items in each screen can be displayed by the "Up" or the "Down" button.
- If the "NEXT" button is pushed, the screen shifts to next top screen of the cryopump.
- If the "HOME" button is pushed, the screen shifts to the top screen of the Multi.
- Operation screen appears at only local operation mode.

Figure 37 OPU Display Screen Handling

5-5 CHANGE PARAMETER

 <p>CAUTION</p>	<p>< Caution for Parameter Setting > Each parameter default value is Sumitomo Heavy Industries (SHI) recommended value. Don't change the parameter setting value basically. Please contact to Sumitomo Heavy Industries (SHI) if it is necessary to change the parameter.</p>
---	---

- (1) Display the parameter setting screen with the "SEL/ESC" button.
- (2) Display the target parameter with the "Up" and "Down" button.
- (3) Push the "ENT" button, and the item code is flashing to suggest edit mode.
- (4) Push the "Up" and "Down" button to change parameter.
(You can change it in succession by pushing the "Up" and "Down" button over a second.)
- (5) After changing data, push the "ENT" button to fix it and finish edit mode. The flashing of item code is stopped.
- (6) Before fixing, you can cancel your work by pushing the "SEL/ESC" button. The flashing of item code is stopped and the edit mode is completed.
(The data line displays the value before editing.)

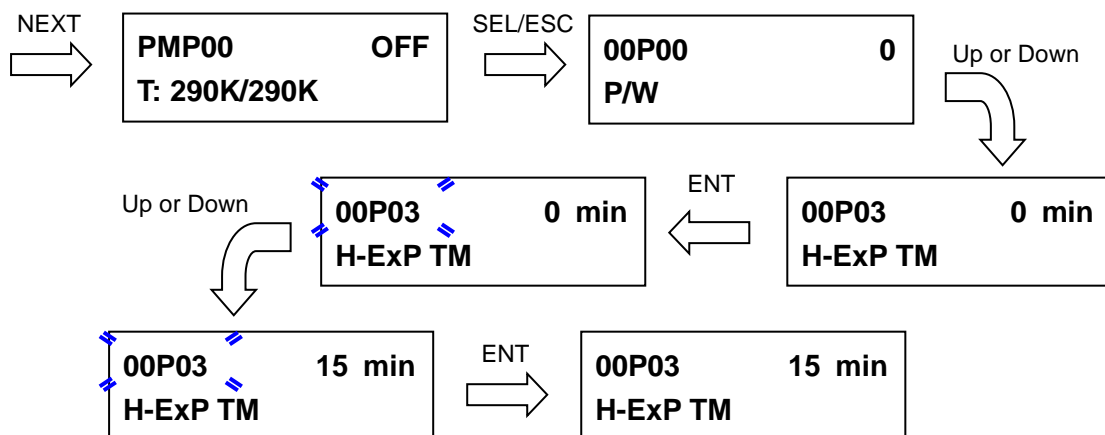


Figure 38 OPU Operation Screen (Pump00 Parameter Change)
 (Sample: Parameter No. P03 (Extend N2 Purge Time))

5-6 LOCAL OPERATION



< Caution about Cold Surface >

There is a risk of frostbite due to low temperature of a cold surface in the cryopump unit.

Do not touch the cryopump vessel during regeneration.



< Caution for Local Operation >

Indemnification

When the local operation mode is ON, the cryopumps always accept the OPU operation irrespective of the host tool (user tool) status. Sumitomo Heavy Industries (SHI) shall not be responsible for the following damage caused by the OPU operation of the user irrespective of the causes or reasons for the claims made by the user.

1. Any losses of profits and operation opportunity and other consequential or indirect loss or damage of any kind incurred by the user in connection with the OPU operation.
2. Any damage to the machines caused by any special circumstance on the part of the user which is attributable to the user irrespective of whether such damage is foreseeable or not by Sumitomo Heavy Industries (SHI).

SICERA cryopump system can be operated in local operation mode by the OPU of the CP controller.

When the power source for the CP controller is supplied (or the power source is reset), the default status of the CP controller is the external mode (local operation mode is OFF). Turning on the local operation mode is available any time. And the CP controller always accepts RS-232C communication commands from the customer tool even if the local operation mode is ON. If there is not the OPU, SICERA can be operated in only RS-232C communication commands.

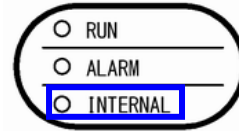
If you would like to prohibit local operation mode for user, SICERA can set the mode flag from the multi parameter screen "MP22".

5-6-1 SETTING LOCAL OPERATON MODE

(1) Push the "HOME" button once, then show the multi top screen.

(2) Check "INTERNAL" LED is OFF.

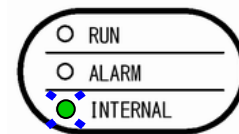
It means that the operation mode is the external mode.



(3) Push the "MODE" button. "INTERNAL" LED starts blink.

If "INTERNAL" LED starts blink, this status set the local operation mode.

"INTERNAL" LED: OFF = External mode / Blinking = Local operation mode



[Remarks]

During the local operation mode is ON, the operation mode is changeable by the "MODE" button in any time, on any screen.

When the power source for the CP controller is reset, the CP controller status starts from the external mode (local operation mode is OFF). Turning on the local operation mode is available any time.

5-6-2 LOCAL OPERATON

(1) Select the cryopump for local operation. (for example: Pump ID=00)

If the "NEXT" button is pushed, the screen shifts to the next top screen of the cryopump and the compressor.

(2) Select the local operation screen in the specified cryopump.

If the "SEL/ESC" button is pushed, the screen shifts to the next menu of the cryopump.

The top of the local operation screen indicates "RUN MODE".

(3) Push the "ENT" button, then "00D00" is blink.

(4) Change the parameter to 1,2,3 or 4.

Cryopump 0=Abort, 1=Full regeneration, 2=Fast regeneration, (3,4=unused)

(5) Push the "ENT" button.

- (6) The parameter is fixed and the cryopump starts the regeneration sequence.
As in external mode, the compressor will start to run automatically when at least one cryopump starts to run.
- (7) If you change this parameter to 0, the cryopump is aborted.

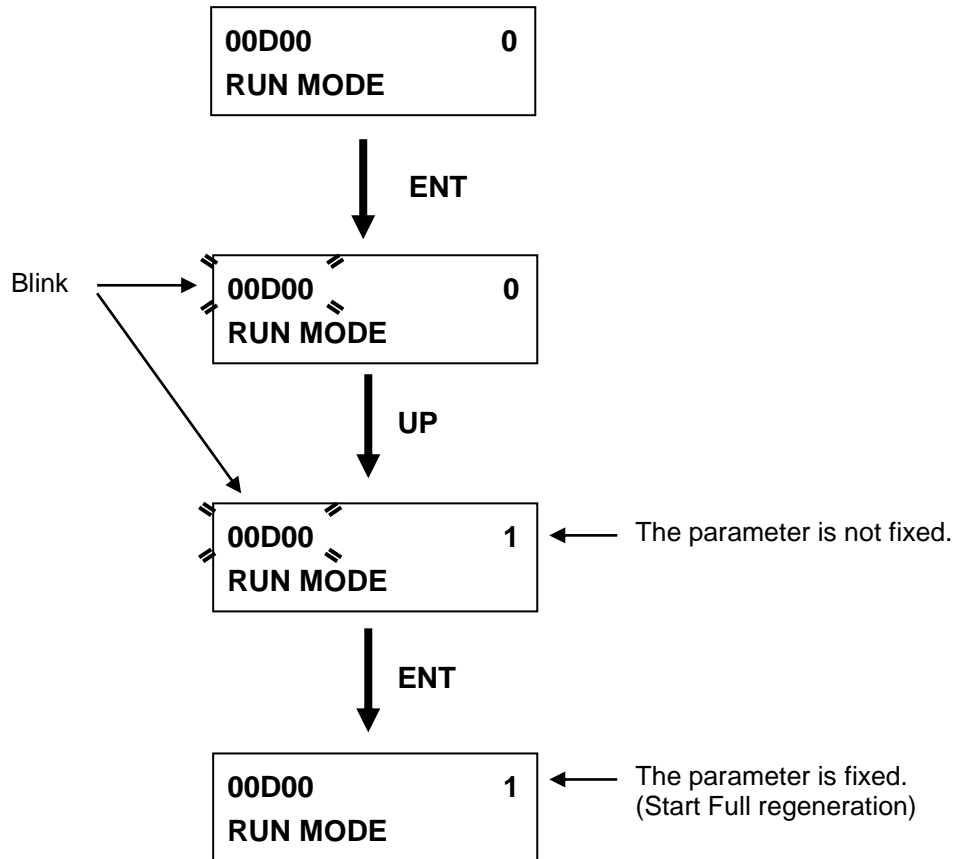


Figure 39 OPU Operation Screen (Pump00 Starts the Full Regeneration)

* If you start the regeneration again after 1st regeneration by the OPU, “00D00” status is 0 or 1. → Please set the parameter from 0 to 1 (or from 1 to 1). → The cryopump will start regeneration.
The following case is RUN MODE value 1.

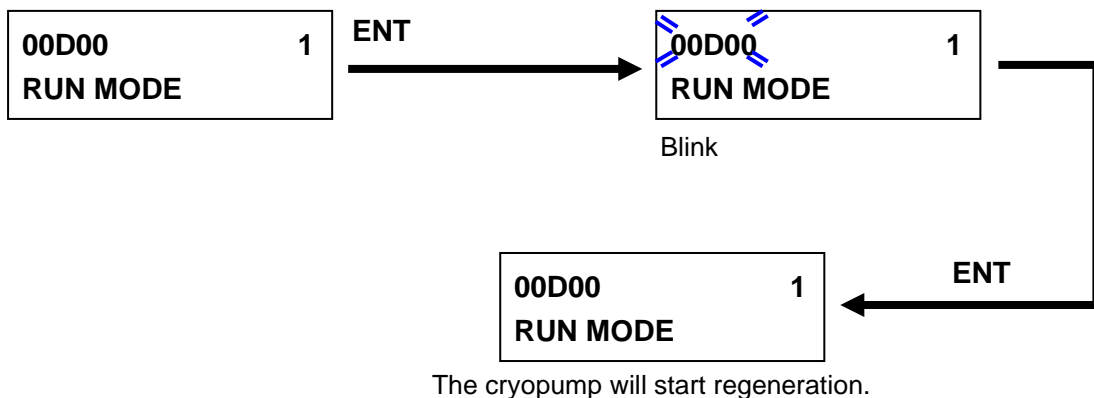


Figure 40 OPU Operation Screen (Pump00 Starts the Full Regeneration Again)

5-6-3 SETTING LOCAL OPERATON MODE FLAG

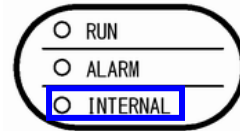
When you prohibit the local operation mode for user, please operate as follows.

The multi parameter "MP22" is saved in non-volatile memory. Therefore, if the power source for the CP controller is reset, the "MP22" value doesn't change from the last setting value.

(1) Push the "HOME" button once, then show the multi top screen.

(2) Check the "INTERNAL" LED is OFF.

It means that the operation mode is the external mode.



(3) Push the "SEL/ESC" button 4 times. Then Multi parameter screen (MP00) is displayed. "MP00" screen is locked by password.

(If you push 5 times, Multi top screen is displayed again.)

(4) Push the "ENT" button. "MP00" starts blink.

(5) Push the "Up" and "Down" buttons, and then set to "511".

(6) Push the "ENT" button, 511 will back to 0.

(7) Push the "Up" and "Down" buttons till "MP22" screen is appeared.

If "MP22" screen is not appeared, retry the step (4) - (6).

(8) Push the "ENT" button. "MP22" starts blink.

(9) Push the "Up" and "Down" buttons, and then set "0".

MP22=0: MODE button is not available (local operation is not available)

MP22=1: MODE button is available (local operation is available)

(10) Push the "ENT" button, and the parameter value will be fixed and the blink will stop.

Local operation mode ON/OFF flag is OFF (external mode only).

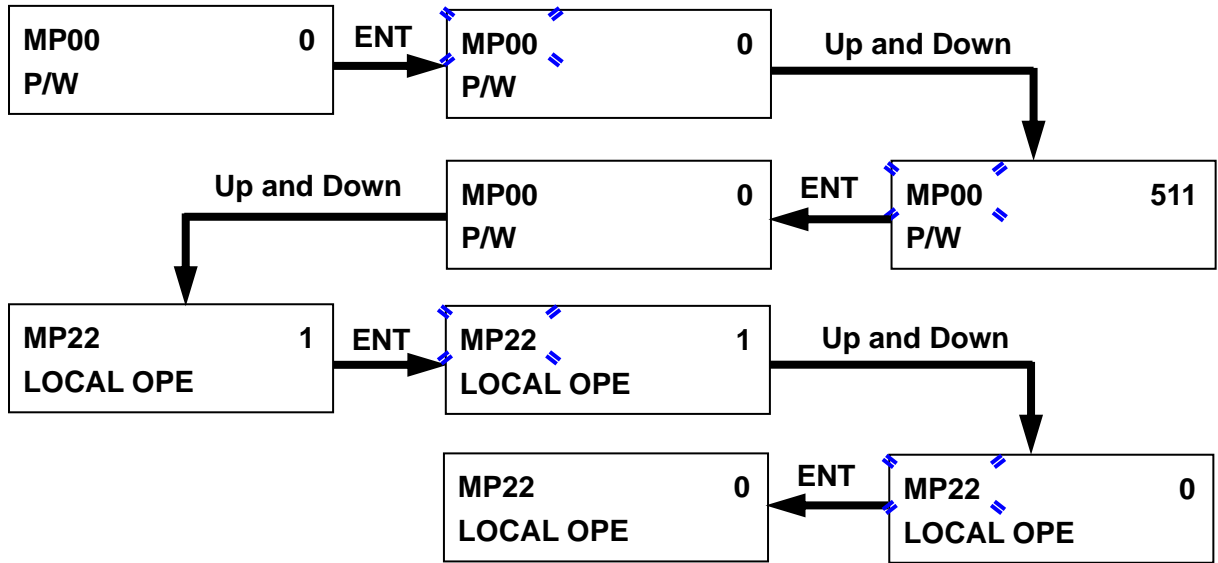


Figure 41 OPU Operation Screen (Multi Parameter Screen Local Operation Mode Flag Change)

5-7 CONTENTS OF OPU SCREEN

5-7-1 OPU SCREEN (INITIAL)

(1) Initial screen

Table 26 OPU Initial Screen (at Power On)

Upper	Lower		Remarks
Indication	Indication	Software version	
SHI Cryogenics	VER	**.**	After several seconds, the next screen is indicated.

5-7-2 OPU SCREEN (MULTI)

The Multi screen has 5 screens. (Top, Monitor, Alarm, Warning, and Parameter)

(1) Top screen

This screen shows the communication status of the cryopumps.

Table 27 OPU Screen (Multi Top)

Upper	Lower	Remarks
Indication	Indication	
MULTI ACTIVE	Showing 3FFFFFFF (max.) (hexadecimal) Sum of ID number of the cryopump and the compressor	Active cryopump and compressor

*Top screen has only one screen. The “Up” and “Down” buttons do not work.

(2) Monitor screen

This screen shows allocation of the cryopumps and the compressor related to the group setting.

Table 28 OPU Screen (Multi Monitor)

Upper			Lower	Remarks
Item	Data	Unit	Data name	
MM00	Showing 3FFFFFFF (max) (hexadecimal) Sum of ID number of the cryopump and the compressor		ACTIVE PUMP	Active cryopump and compressor (same with multi top screen)
MM01			RV GROUP A	Cryopump of roughing valve map A
MM02			RV GROUP B	Cryopump of roughing valve map B
MM03			RV GROUP C	Cryopump of roughing valve map C
MM04			RV GROUP D	Cryopump of roughing valve map D
MM05			RV GROUP E	Cryopump of roughing valve map E
MM06			ALL RV GRPS	Cryopump set to either roughing valve map
MM07			RP DEMAND	Cryopump requiring rough pump use
MM08			LOCKOUT GRP	Locked out roughing valve map
MM09			M-REGEN 1	Cryopump of multi regeneration group 1
MM10			M-REGEN 2	Cryopump of multi regeneration group 2
MM11			M-REGEN 3	Cryopump of multi regeneration group 3
MM12			M-REGEN 4	Cryopump of multi regeneration group 4
MM13			M-REGEN 5	Cryopump of multi regeneration group 5
MM14	Operating hours	Hr	RUN TIME	Measured if any cryopump is performed
MM15	**.**	-	S/W VER	Software version of the CP controller
MM16	*****		SERIAL NO	CP controller serial number (not displayed)

(3) Alarm screen

This screen shows the communication ID number of the cryopump or compressor in alarm condition.

(The cryopumps or compressors halt their operation.)

"NO ALARM" message is displayed at MA00, if no alarm.

Table 29 OPU Screen (Multi Alarm)

Upper			Lower	Remarks
Item	Data	Unit	Data name	
MA**	Showing FFFFF (max) (hexadecimal) Sum of ID number of the cryopump		ALARM PUMPS	The cryopump in alarm condition is shown.
MA**	Showing 3FF00000 (max) (hexadecimal) Sum of ID number of the compressor		ALARM COMPS	The compressor in alarm condition is shown.
MA**	None		NO ALARM	No alarm

(4) Warning screen

This screen shows the communication ID number of the cryopump or compressor in warning condition.

(The cryopumps or compressors continue their operation.)

"NO WARNING" message is displayed at MW00, if no warning.

Table 30 OPU Screen (Multi Warning)

Upper		Lower		Remarks
Item	Data	Unit	Data name	
MW**	Same as the alarm table		WARNING ON	The cryopump in warning condition is shown.
MW**	Same as the alarm table		WARNING C	The compressor in warning condition is shown.
MW**	None		NO WARNING	No warning

(5) Parameter screen

This screen shows the communication ID setting of the cryopump and the compressor.

This screen also shows RS-232C communication format setting between the CP controller and host controller.

This screen is locked by password.

Table 31 OPU Screen (Multi Parameter)

Upper		Lower		Remarks	Default
Item	Data	Unit	Data name		
MP00	*****	-	P/W	Input screen for user password (511)	
MP01	*****	-	SET P/W	User password	511
MP02	**	-	PUMP No.00	Cryopump No.00 ID setting	0
MP03	**	-	PUMP No.01	Cryopump No.01 ID setting	1
MP04	**	-	PUMP No.02	Cryopump No.02 ID setting	2
MP05	**	-	PUMP No.03	Cryopump No.03 ID setting	3
MP06	**	-	PUMP No.04	Cryopump No.04 ID setting	4
MP07	**	-	PUMP No.05	Cryopump No.05 ID setting	5
MP08	**	-	PUMP No.06	Cryopump No.06 ID setting	6
MP09	**	-	PUMP No.07	Cryopump No.07 ID setting	7
MP10	**	-	PUMP No.08	Cryopump No.08 ID setting	8
MP11	**	-	PUMP No.09	Cryopump No.09 ID setting	9
MP12	**	-	PUMP No.10	Cryopump No.10 ID setting	10
MP13	**	-	PUMP No.11	Cryopump No.11 ID setting	11
MP14	**	-	COMP No.00	Compressor No.00 ID setting	20
MP15	**	-	COMP No.01	Compressor No.01 ID setting	21
MP16	0 or 1	-	CDP-ON/OFF	Compressor differential pressure control (CDP) monitor ON/OFF.	1
MP17	***	Hr	CDP-SP TM	CDP sampling timer setting	1
MP18	*.**	MPa	CDP-BASE	CDP base differential pressure setting	1.45
MP19	*.**	MPa	CDP-SV LL	CDP differential pressure set value lower limit	0.03
MP20	**	Hz	CDP-JD Hz	CDP judgment of delta frequency	10
MP21	*	-	RS232 SET	RS232 communication format setting	0
MP22	*	-	LOCAL OPE	Local operation mode ON/OFF flag	1

Table 32 RS-232C Communication Format

Item	Value	Remarks
Baud rate	9600 or 19200 or 38400 bps	
Start bit	1 bit	Constant
Data length	7 bit	Constant
Parity bit	Even	Constant
Stop bit	1 bit or 2 bit	

Table 33 RS-232C Communication Format Setting (MP21)

MP21 setting value	Baud rate bps	Stop bit
0	9600	1
1	19200	
2	38400	
3	9600	2
4	19200	
5	38400	

Table 34 MP21 Default Setting

Item	Data name	Default value	Unit	Range	
				LL	UL
MP21	RS232 SET	0	-	0	5

If you change the setting value of MP21, please refresh the power source of the CP controller.

As a result, the communication format is updated.

(6) Self-diagnostics parameter screen

This screen shows self-diagnostics function parameter for Multi screen.

Table 35 OPU Screen (Multi Self-diagnostics Parameter)

Item	Upper		Lower		Remarks	Default
	Data	Unit	Data name			
MS00	0 or 1	-	SD-ON/OFF		Select the start or stop of the self-diagnostics function (0: Stop, 1: Start)	1
MS01	****	min	SD-CM STM		The compressor status monitoring starts after this setting time (MS01) is elapsed from completing all cryopump's regeneration.	30
MS02	***	MPa	SD-CM PH		Compressor supply pressure warning value. Set the value 2.75 when using TM-50L/H or TM-30L/H.	1.95
MS03	****	min	SD-CM TM1		Compressor supply pressure warning detect delay time	60

5-7-3 OPU SCREEN (CRYOPUMP)

The Cryopump screen has 10 screens. (Top, Monitor, Alarm history, Warning, Parameter, Self-diagnostics parameter, Inverter parameter, EEPROM clear, Regeneration history, and Operation)

(1) Top screen

This screen shows the 1st temperature, 2nd temperature, and cryopump status.

Table 36 OPU Screen (Cryopump Top)

Indication	Upper		Lower Data	Remarks
	Pump condition			
PMP00	PUMP ON/OFF/REG/ALM/INIT (displayed right-aligned)		T:***K/***K	Upper: Pump status PUMP ON: Run OFF: Stop REG: Regeneration, or Cool down ALM: Alarm stop INIT: (not connected or initializing) Lower: Data 1st temperature/2nd temperature

The above item code is the case that the cryopump's communication ID number is 00.

(2) Monitor screen

This screen shows the status of the cryopump.

Table 37 OPU Screen (Cryopump Monitor)

Item	Upper		Lower Data name	Remarks
	Data	Unit		
00M00	0 or 1	-	CRYOPUMP	Cryopump ON/OFF monitor
00M01	*****.	K	1ST TEMP	1st stage temperature
00M02	*****.	K	2ND TEMP	2nd stage temperature
00M03	*****	Pa	CG PRE	Pirani gauge (PG) pressure value
00M04	*****.	mTr	CG PRE	Pirani gauge (PG) pressure value [mTorr]
00M05	0 or 1	-	ROUGH VALVE	Roughing valve (RV) ON/OFF monitor (order value)
00M06	0 or 1	-	PURGE VALVE	Purge valve (PV) ON/OFF monitor (order value)
00M07	0 or 1	-	VENT VALVE	Vent valve (VV) ON/OFF monitor (order value)
00M08	*****.	Hz	INV Hz	Inverter frequency value
00M09	*****.	Hr	P. ON TM	Cryopump active hours
00M10	*****.	Hr	RUN TM	Operating hours
00M11	*****.	Hr	FWD TM	Inverter normal rotation hours
00M12	*****.	Hr	FL REGEN ET	Transit time after Full regeneration
00M13	*****.	Hr	FS REGEN ET	Transit time after Fast regeneration
00M14	*****.	Hr	DELAY ST TM	Delay time of regeneration start
00M15	*****.	Hr	RST TM	Delay time of regeneration restart
00M16	*****	-	REGEN TMS	Number of times of regeneration completed
00M17	****.	-	S/W VER	IO module software version
00M18	*****	-	SERIAL NO	Cryopump serial number (unused)
00M19	*****.	K	INITIAL T2	
00M20	*****.	Hr	INI T2 TIME	
00M21	*****.	K	WARNING T2	
00M22	*****.	Hr	WRN T2 TIME	
00M23	*****.	K	CURRENT T2	
00M24	*****.	Hr	CUR T2 TIME	

*The leading two numbers ("00") show the pump ID number.

(3) Alarm history screen

This screen shows alarm history. The data line shows the time of the alarm caused.

The latest 10 alarms are displayed chronologically and the first alarm will be erased when the alarms come to more than 10.

Table 38 OPU Screen (Cryopump Alarm History)

Upper			Lower	Remarks
Item	Data	Unit	Data name	
00A**	*****.	Hr	1ST BURNOUT	Burn out of 1st temperature line
00A**	*****.	Hr	2ND BURNOUT	Burn out of 2nd temperature line
00A**	*****.	Hr	CG BURNOUT	Burn out of Pirani gauge line
00A**	*****.	Hr	INV ALM	Inverter trouble
00A**	*****.	Hr	CK SUM ALM	Checksum trouble
00A**	*****.	Hr	CK SUM ALMB	Checksum trouble (inverter)
00A**	None		NO ALARM	No alarm

*The leading two numbers ("00") show the pump ID number.

(4) Warning screen

This screen shows occurring warnings. The data line shows the event time of warning.

The screen shows nothing when warning disappears, different from alarm history.

Table 39 OPU Screen (Cryopump Warning)

Upper			Lower	Remarks
Item	Data	Unit	Data name	
00W**	*****.	Hr	T1_INV_PEF	Monitor performance degradation frequency for 1st
00W**	*****.	Hr	T1_TMP_PEF	Monitor performance degradation temperature for 1st
00W**	*****.	Hr	T2_TMP_PEF	Monitoring performance degradation for 2nd
00W**	*****.	Hr	MT2_TMP_PEF	Monitor reaching temperature performance degradation for 2nd
00W**	*****.	Hr	COOLER_PEF	Monitor drive unit performance degradation for cold head
00W**	*****.	Hr	CMP_PH_LOW	Monitor operation pressure for compressor
00W**	*****.	Hr	CMP1_FAIL	Compressor 1 communication error or alarm stop
00W**	*****.	Hr	CMP2_FAIL	Compressor 2 communication error or alarm stop
00W**	*****.	Hr	CS RGN HSt	Check sum error of regeneration history data
00W**	*****.	Hr	CS TM DATA	Check sum error of elapsed time data
00W**	*****.	Hr	1ST HIGH	High temperature error of 1st stage
00W**	*****.	Hr	2ND HIGH	High temperature error of 2nd stage
00W**	None		NO WARNING	No warning

*The leading two numbers ("00") show the pump ID number.

(5) Parameter screen


 <p>CAUTION</p>	<p>< Caution for Parameter Setting > Each parameter default value is Sumitomo Heavy Industries (SHI) recommended value. Don't change the parameter setting value basically. Please contact to Sumitomo Heavy Industries (SHI) if it is necessary to change the parameter.</p>
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Table 40 OPU Screen (Cryopump Parameter)

Item	Upper		Lower	Remarks	Default
	Data	Unit	Data name		
00P00	****	-	P/W	Input screen for user password (123)	
00P01	***	K	Tgt T1	1st cooling control temperature	100K**
00P02	**	K	Tgt T2	2nd cooling target temperature	17K
00P03	****	min	H-Exp TM	Extended purge time for FULL regeneration	0min***
00P04	**	-	H-RP ReP UL	Repurge cycle upper limit	3
00P05	***	mTr	H-BU Rgh P	ROR base pressure	75mTr
00P06	***	m/m	H-ROR	ROR threshold value	38m/m
00P07	**	-	H-ROR UL	ROR cycle upper limit	10
00P08	***	sec	H-RP ReP TM	Repurge time	60sec
00P09	***	K	H-ExRgh T1	1st temperature for extended roughing during Full regeneration	295K
00P10	***	sec	L-Rgh TstTM	Fast rough test (unused)	150sec
00P11	***	K	L-Ena T2	2nd temperature in which Fast regeneration can start	100K
00P12	****	min	Rst DelayTM	Restart delay time	0min
00P13	****	min	St DelayTM	Start delay time	0min
00P14	0 or 1	-	RV LOCK	Roughing valve interlock Do not change the parameter from 0 to 1. You will not be able to open the rough valve.	0
00P15	**	K	PFR T2 UL	Recooling upper limit of 2nd temperature after blackout recovery	25K
00P16	0 or 1 or 2	-	PFR	PFR operation setting (0: No action, 1 and 2: recooling)	1
00P17	***	K	ReC T2 UL	Recooling upper limit of 2nd temperature by manual operation	360K
00P30	*****	-	SET PW	Password setting screen	123
00P31	*****	min	WARM TMOUT	Warm up time out value	90min
00P32	*****	min	COOL TMOUT	Cool down time out value	300min
00P33	*****	min	RV TMOUT	Rough valve open time out value	60min
00P34	*****	K	COLD FOR RV	2nd temperature lower limit for opening the rough valve	140K

*The leading two numbers ("00") show the pump ID number

*See CRYOPUMP PARAMTER section in APPENDIX about details.

** 00P01: The value is reference. It depends on heat load.

*** See the next table for setting "00P03".

Table 41 Recommended Parameter of Extended Purge Time

Model	Default extended purge time[min]	Recommend extended purge time [min] in case that some water accumulation is estimated
KV-08FCL0A0D4	0	30
KV-08FSL0A0D4	0	30

(6) Self-diagnostics parameter screen

Table 42 OPU Screen (Cryopump Self-diagnostics Parameter)

Upper		Lower		Remarks	Default
Item	Data	Unit	Data name		
00S00	****	min	SD-MS TM	S-D start delay time after regeneration complete	30min
00S01	**	Hz	SD-T1 WTF	Monitor start frequency for T1W1 warning	75Hz
00S02	**	Hz	SD-T1 FUL	Monitor start frequency for T1W2 warning	95Hz
00S03	**	Hz	SD-T1 FLL	Reset frequency for T1W1 warning	60Hz
00S04	***	K	SD-T1 T1	T1 temperature for T1W2 warning	101K
00S05	****	min	SD-T1 TM1	Delay time for T1W1 warning	1500min
00S06	****	min	SD-T1 TM2	Delay time for T1W2 warning	2500min
00S07	**	K	SD-T2 T2UL	T2 temperature for T2W1 warning	18K
00S08	**	K	SD-T2 T2LL	T2 temperature for T2W2 warning	13K
00S09	****	min	SD-T2 TM1	Delay time for T2W1 warning	60min
00S10	****	min	SD-MT2 TM2	Delay time for T2W2 warning	180min
00S11	**	K	SD-MT2 DIF	T2 differential temperature for T2W2 warning	3K
00S12	**	Hz	SD-MT2 FUL	Stable frequency for monitor initial T2 temperature	45Hz
00S13	****	Hr	SD-MT2 WTT1	Initial T2 temperature record start time	100Hr
00S14	****	Hr	SD-MT2 WTT1	Initial T2 temperature record finish time	200Hr
00S15	**	Hz	SD-DR WTF	Monitor start frequency for cryocooler warning	75Hz
00S16	***	K	SD-DR WTT1	Monitor start T1 temperature for cryocooler warning	101K
00S17	**	K	SD-DR WTT2	Monitor start T2 temperature for cryocooler warning	13K
00S18	****	min	SD-DR TM1	Delay time for cryocooler warning	60min

*The leading two numbers ("00") show the pump ID number.

Warning name of host screen and OPU screen

T1W1 warning = T1_INV_PEF

T1W2 warning = T1_TMP_PEF

T2W1 warning = T2_TMP_PEF

T2W2 warning = MT2_TMP_PEF

Cryocooler warning = COOLER_PEF

(7) Inverter parameter screend

The user should not use this screen. This screen is locked by password.

(8) EEPROM clear screen

The user should not use this screen. This screen is locked by password.

(9) Regeneration history screen

This screen shows regeneration historical data of the last 10 times.

Table 43 OPU Screen (Cryopump Regeneration History)

Upper		Lower		Remarks	History
Item	Data	Unit	Data name		
00H01	0 or 1or 2	-	Regen Type	Performed regeneration type 0: None 1: Full regeneration 2: Fast regeneration	The latest regeneration
00H01	*****.*	Hr	TM Btwn Reg	Operation hours from the last regeneration	
00H01	*****.*	min	Purge Time	Total minutes of purge valve opening during regeneration (except warm up time)	
00H01	*****	-	ROR Cycle	Total times of buildup roughing during regeneration	
00H01	*****	m/m	ROR Limit	Setting value of buildup pressure check	
00H01	*****.*	min	T1Warmup TM	Arrival time of the 1st temperature from regeneration start to 300K	
00H01	*****.*	min	T2Warmup TM	Arrival time of the 2nd temperature from regeneration start to 290K	
00H01	*****.*	min	Rough TM	Total hours of roughing valve opening during regeneration	
00H01	*****.*	min	Cooldown TM	Cooldown time during regeneration	
00H01	*****	Pa	Base Pre	Setting value of buildup roughing pressure	
00H01	*****	-	Re-P Cycle	Retry times of purge during regeneration	
00H01	*****.*	min	Regen Time	Regeneration minutes from start to finish	
00H02	Showing 12 regeneration data as well as H01				The 2nd last regeneration
~	~				~
00H09	Showing 12 regeneration data as well as H01				The 9th last regeneration
00H10	Showing 12 regeneration data as well as H01				The 10th last regeneration

*The leading two numbers ("00") show the pump ID number.

(10)Operation screen

You can operate the cryopump on this screen at the local operation mode only.

Table 44 OPU Screen (Cryopump Operation)

Upper			Lower	Remarks
Item	Data	Unit	Data name	
00D00	0, 1, 2, 3 or 4	-	RUN MODE	Start the regeneration 0: Abort 1: Full regeneration 2: Fast regeneration
00D01	0 or 1	-	COLD HEAD	Cold head operation 0: Stop 1: Run
00D02	0 or 1	-	ROUGH VALVE	Rough valve (RV) open 0: Close 1: Open
00D03	0 or 1	-	PURGE VALVE	Purge valve (PV) open 0: Close 1: Open
00D04	0 or 1	-	VENT VALVE	Vent valve (VV) open 0: Close 1: Open
00D05	0 or 1	-	ATM CG	Pressure gauge adjust atmosphere 1: Done (the 1 value return to 0 automatically) Available only when the pressure is in the provided range and the cryopump stops.
00D06	0 or 1	-	ZERO CG	Pressure gauge adjust zero 1: Done (the 1 value return to 0 automatically) Available only when the pressure is in the provided range and the cryopump stops.

*The leading two numbers ("00") show the pump ID number.

5-7-4 OPU SCREEN (COMPRESSOR)

The OPU Compressor screen has 5 screens. (Top, Monitor, Alarm history, Warning, and Parameter)

Some part of parameters of the compressor unit can be monitored from the OPU. The available screens are below.

(See 9-5 COMPRESSOR PARAMETER about detail.)

(1) Top screen

This screen shows the status and operation time of the compressor.

Table 45 OPU Screen (Compressor Top)

Upper		Lower	Upper
Indication	Comp condition	Indication	
COMP0	RUN/STOP/ALM/INIT (displayed right-aligned)	TIME: *****H	Upper: Compressor condition RUN: Run STOP: Stop ALM: Alarm stop INIT: (not connected or initializing) Lower: Compressor operating hours

* The above item code is the case that the compressor's communication ID number is 20.

("COMP0" shows the ID number 20, "COMP1" shows the ID number 21.)

(2) Monitor screen (CP controller)

This screen shows the status of the compressor.

Table 46 OPU Screen (Compressor Monitor)

Upper			Lower	Remarks
Item	Data	Unit	Data name	
C0M00	*****.*	Hr	RUN TIME	Compressor operating hours
C0M01	*.**	MPa	DP SET VAL	Setting value of differential pressure
C0M02	*.**	MPa	DP(DELTA)	Measured value of differential pressure
C0M03	*.**	MPa	PH(SUPPLY)	Measured pressure value of supply line
C0M04	*.**	MPa	PL(RETURN)	Measured pressure value of return line
C0M05	***.*	Hz	INV Hz	Inverter frequency
C0M06	***.*	%	RLF VALVE	Discrete opening ratio of relief valve
C0M07	**.*	L/m	CW FLOW	Flow rate of cooling water
C0M08	*****.**	Hr	ADS OPE TM	Adsorber operating time
C0M09	**.**	-	S/W VER	S/W version (not displayed)

The leading two characters ("C0") show the compressor ID number.

("C0" shows the ID number 20, "C1" shows the ID number 21.)

(3) Alarm history screen (CP controller)

This screen shows alarm history. The data line shows the event time of alarm.

The latest 10 alarms are displayed chronologically and the first alarm will be erased when the alarms come to more than 10.

Table 47 OPU Screen (Compressor Alarm History)

Upper			Lower	Remarks
Item	Data	Unit	Data name	
C0A**	*****.	Hr	TS1 HI	High temperature of the discharged helium (TM-50: 80 degrees C, TM-30: 75 degrees C)
C0A**	*****.	Hr	TS2 HI	High temperature of the helium after cooling (60 degrees C)
C0A**	*****.	Hr	TS3 HI	High temperature of cooling water at outlet (60 degrees C)
C0A**	*****.	Hr	PH BURNOUT	Burn out of supply pressure gauge
C0A**	*****.	Hr	PL BURNOUT	Burn out of return pressure gauge
C0A**	*****.	Hr	PH HI	High pressure of supply line
C0A**	*****.	Hr	PL LO	Low pressure of return line
C0A**	*****.	Hr	START DP LO	Low differential pressure on startup
C0A**	*****.	Hr	RUN DP LO	Low differential pressure in operation
C0A**	*****.	Hr	INV ALM	Inverter trouble
C0A**	*****.	Hr	CK SUM ALM	Checksum trouble
C0A**	None		NO ALARM	No alarm

The leading two characters ("C0") show the compressor ID number.

("C0" shows the ID number 20, "C1" shows the ID number 21.)

(4) Warning screen (CP controller)

This screen shows warning information.

The data line shows the event time of warning.

Table 48 OPU Screen (Compressor Warning)

Upper			Lower	Remarks
Item	Data	Unit	Data name	
C0W**	*****.	Hr	ADS REPLACE	Adsorber operating hours
C0W**	*****.	Hr	INSTANT PF (*)	Detecting the instantaneous abort of operation
C0W**	*****.	Hr	CW FLOW LOW (*)	The flow of cooling water is low.
C0W**	None		NO WARNINNG	No warning

The leading two characters ("C0") show the compressor ID number.

("C0" shows the ID number 20, "C1" shows the ID number 21.)

(*) These are only applied to TM-50.

(5) Parameter screen

The listed parameter is controllable from the OPU.

Other parameters should be set with the compressor operation panel.

Table 49 OPU Screen (Compressor Parameter)

Upper			Lower	Remarks	Default
Item	Data	Unit	Data name		
C0P00	*****	-	P/W	Input password (password: 123) After inputting password, the particular parameters (C0P01-C0P03) are appeared.	
C0P01	****. **	MPa	DP SV0	Targeted differential pressure 0 (1.45 MPa)	1.45 MPa
C0P02	****. **	MPa	DP SV1	Targeted differential pressure 1 (unused)	1.70 MPa
C0P03	****. **	MPa	DP SV2	Targeted differential pressure 2 (unused)	1.20 MPa

The leading two characters ("C0") show the compressor ID number.

("C0" shows the ID number 20, "C1" shows the ID number 21.)

6 COMPRESSOR SCREEN

The compressor unit has an operation screen by itself.

The operation screen of the compressor unit is explained in the following sections.

6-1 COMPRESSOR UNIT MANUAL OPERATION (TM-50)

The compressor unit has two operation mode; internal (local) and external (remote).

In the external (remote) mode, the compressor unit can receive only RS-485 serial communication or analog digital signal from the host controller.

In the internal (local) mode, the compressor unit operates as a stand-alone.

6-1-1 OPERATION PANEL OUTLINE (TM-50)



LED: RUN (green) lighting during operation
: ALARM (red) lighting in case of alarm

RUN : Operating the compressor in the internal mode
MODE : Switch to the internal/external mode
RST : Reset the alarm
STOP : Stopping the compressor in the internal mode
SEL/ESC : Switchover the LCD display or
cancel of editing parameter
UP : Up
DOWN : Down
ENT : Enter new setting parameter

Figure 42 Compressor Operation Panel (TM-50)

6-1-2 COMPRESSOR SCREEN HANDLING (TM-50)

The structure of the compressor operation screens is illustrated below.

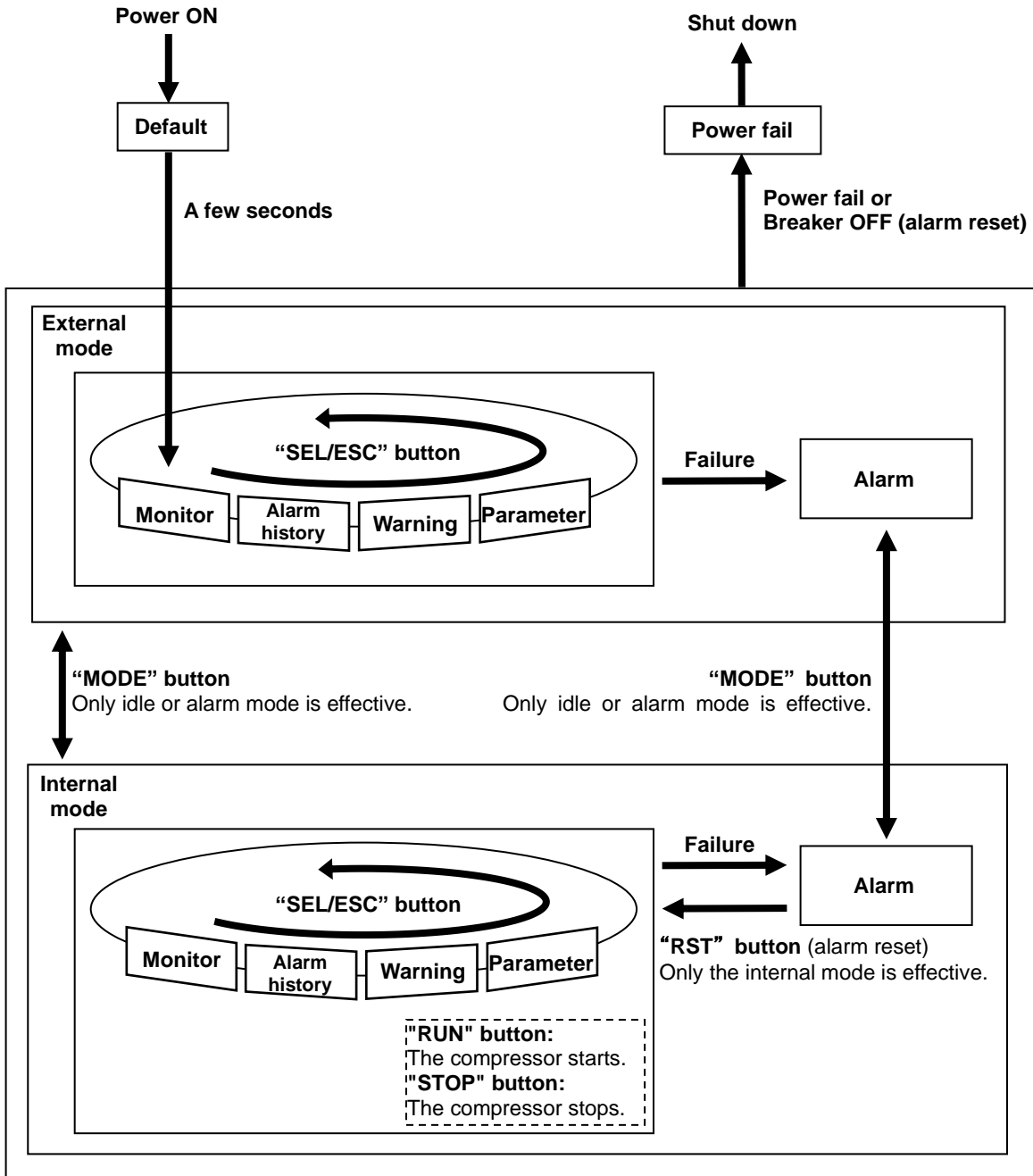


Figure 43 Compressor Operation Panel Screen Handling (TM-50)

6-1-3 CONTENTS OF COMPRESSOR SCREEN (TM-50)

(1) Initial screen

Table 50 Compressor Initial Screen (at Power On)

Upper		Lower		Remarks
Indication		Indication	Software version	
SHI*	Cryogenics	VER	**.**	After several seconds, the next screen is indicated.

*Sumitomo Heavy Industries (SHI)

(2) Monitor screen

This screen shows the status of compressor.

Table 51 Compressor Screen (Monitor)

Upper			Lower	Remarks
Item	Data	Unit	Data name	
M00	*****.	Hr	RUN TIME	Operating hours
M01	***.	MPa	DP SET VAL	Setting value of differential pressure
M02	**.	MPa	DP(DELTA)	Discrete value of differential pressure
M03	**.	MPa	PH(SUPPLY)	Discrete value of high pressure (supply) line
M04	**.	MPa	PL(RETURN)	Discrete value of low pressure (return) line
M05	***.	Hz	INV Hz	Inverter frequency
M06	***.	%	RLF VALVE	Discrete opening ratio of relief valve
M07	**.	L/m	CW FLOW	Flow of cooling water
M08	*****.	Hr	ADS OPE TM	Adsorber operating hours
M09	**.	-	S/W VER	Software version
M10	***.	°C	HE IN TEMP	Temperature of the discharged helium
M11	***.	°C	HE OUT TEMP	Temperature of the helium after cooling
M12	***.	°C	CW OUT TEMP	Temperature of cooling water at outlet
M13	***.	°C	CW IN TEMP	Temperature of cooling water at inlet
M18	**0	%	CW VALVE	Discrete opening ratio of cooling water valve (unused)
M19	**.	kW	INV IN PW	Inverter input power
M20	**.	kW	INV OUT PW	Inverter output power

(3) Alarm history screen

This screen shows alarm history. The data line shows the event time of alarm.

The latest 10 alarms are displayed chronologically and the first alarm will be erased when the alarms come to more than 10.

Table 52 Compressor Screen (Alarm History)

Item	Upper		Lower	Remarks
	Data	Unit	Data name	
AH**	***** .*	Hr	HE IN T HI	High temperature of the discharged helium (80 degrees C)
AH**	***** .*	Hr	HE OUT T HI	High temperature of the helium after cooling (60 degrees C)
AH**	***** .*	Hr	CW OUT T HI	High temperature of cooling water at outlet (60 degrees C)
AH**	***** .*	Hr	HE IN T NG	Measurement abnormality of thermistor of the discharged helium
AH**	***** .*	Hr	HE OUT T NG	Measurement abnormality of thermistor of the helium after cooling
AH**	***** .*	Hr	CW OUT T NG	Measurement abnormality of thermistor of cooling water at outlet
AH**	***** .*	Hr	PH BURNOUT	Burn out of supply pressure gauge
AH**	***** .*	Hr	PL BURNOUT	Burn out of return pressure gauge
AH**	***** .*	Hr	PH HI	High pressure of supply line
AH**	***** .*	Hr	PL LO	Low pressure of return line
AH**	***** .*	Hr	START DP LO	Low differential pressure on startup
AH**	***** .*	Hr	RUN DP LO	Low differential pressure in operation
AH**	***** .*	Hr	INV ALM	Inverter trouble
AH**	***** .*	Hr	CK SUM ALM	Checksum alarm
AH**	***** .*	Hr	PS DC5V LO	Low voltage of DC 5 V power supply
AH**	none		NO ALARM	No alarm

(4) Warning screen

This screen shows warning information.

The data line shows the event time of warning.

Table 53 Compressor Screen (Warning)

Item	Upper		Lower	Remarks
	Data	Unit	Data name	
WH**	***** .*	Hr	ADS REPLACE	Adsorber operating hours
WH**	***** .*	Hr	INSTANT PF	Instantaneous stop detection (monitoring blackout within 1 second)
WH**	***** .*	Hr	CW FLOW LOW	The flow of cooling water is low
WH**	***** .*	Hr	CW IN T NG	Measurement abnormality of thermistor of cooling water at inlet
WH**	***** .*	-	NO WARNINNG	No warning

(5) Parameter setting screen


 <p>CAUTION</p>	<p>< Caution for Parameter Setting > Each parameter default value is Sumitomo Heavy Industries (SHI) recommended value. Don't change the parameter setting value basically. Please contact to Sumitomo Heavy Industries (SHI) if it is necessary to change the parameter.</p>
---	---

Table 54 Compressor Screen (Parameter)

Item	Upper		Lower		Remarks	Default
	Data	Unit	Data name			
CP00	****	-	P/W		Input password (password:123) After inputting password, the particular parameters (CP10-CP13) are appeared	
CP01	*. **	MPa	DP SV0		Targeted differential pressure 0 (1.45 MPa) (The change from the compressor screen is reflected when the compressor is powered on.)	1.45 MPa
CP02	*. **	MPa	DP SV1		Targeted differential pressure 1 (unused)	1.70 MPa
CP03	*. **	MPa	DP SV2		Targeted differential pressure 2 (unused)	1.20 MPa
CP10	****	-	SET P/W		Set user password	123
CP11	0 or 1	-	ADS TM CLR		Clearing switch of adsorber operating hours	0
CP12	**.*	Hz	INV vL		Inverter base frequency	TM-50L: 60.0Hz TM-50H: 71.0Hz
CP13	***.*	V	INV vLv		Inverter base frequency voltage	TM-50L: 200.0V TM-50H: 480.0V

(6) Alarm screen

The present alarm message is indicated when an alarm happens.

The alarm is reset by the "RST" button, but it is necessary that the cause of alarm is recovered.

If the cause of alarm is not recovered, the alarm message will be indicated again.

(Some alarms are not reset immediately after pushing the "RST" button, for example, temperature alarm.)


 <p>CAUTION</p>	<p>< Caution for "RST" Button > The "RST" button is effective in the internal mode only. Therefore, it is necessary to change the operation mode from the external to the Internal when you use the "RST" button. After recovering, change the operation mode to the external mode, and compressor can run again in accordance with the CP controller.</p>
---	--

Table 55 Compressor Screen (Alarm)

Item	Upper		Lower		Remarks
	Data	Unit	Data name		
ALM	*****.*	Hr	It is the same as the alarm history screen.		It is the same as the alarm history screen.

6-2 COMPRESSOR UNIT MANUAL OPERATION (TM-30)

The compressor unit has two operation mode of internal (local) and external (remote).

In the external (remote) mode, the compressor unit can receive only RS-485 serial communication or analog digital signal from the host controller.

In the internal (local) mode, the compressor unit operates as a stand-alone.

6-2-1 COMPRESSOR OPERATION PANEL OUTLINE (TM-30)

Operation Mode

The compressor unit has two operation mode of internal (local) and external (remote).

External (remote) mode	Receive operation command from the host controller.
Internal (local) mode	Set operation command at operation panel.

Compressor starts in external mode when the power is turned on.

Operation mode can be changed by pushing 'MODE' button when the compressor unit is stopping.

Operation mode of internal/external is indicated by the lamp below the monitor of OPU.

The compressor starts to drive by pushing 'RUN' button, and stops running by pushing 'STOP' button, when it is in external mode.

Operation mode cannot be changed when the compressor unit is running.



LED	: RUN lightning during operation
	: ALARM lightning in case of alarm
	: ALARM blinking in case of warning
	: INTERNAL lightning when in the internal mode
RUN	: Compressor starts to run (internal mode)
MODE	: Switch to the internal/external mode
RST	: Reset of alarm status
STOP	: Compressor stops to run (internal mode)
SEL/ESC	: Scroll of parameter table or cancel of parameter edit
↑	: Up
↓	: Down
ENT	: Enter new setting of parameter
NEXT	: Scroll of parameter table
HOME	: Return to the initial screen

Figure 44 Compressor Operation Panel (TM-30)

6-2-2 COMPRESSOR SCREEN HANDLING (TM-30)

The structure of the compressor operation screens is illustrated below.

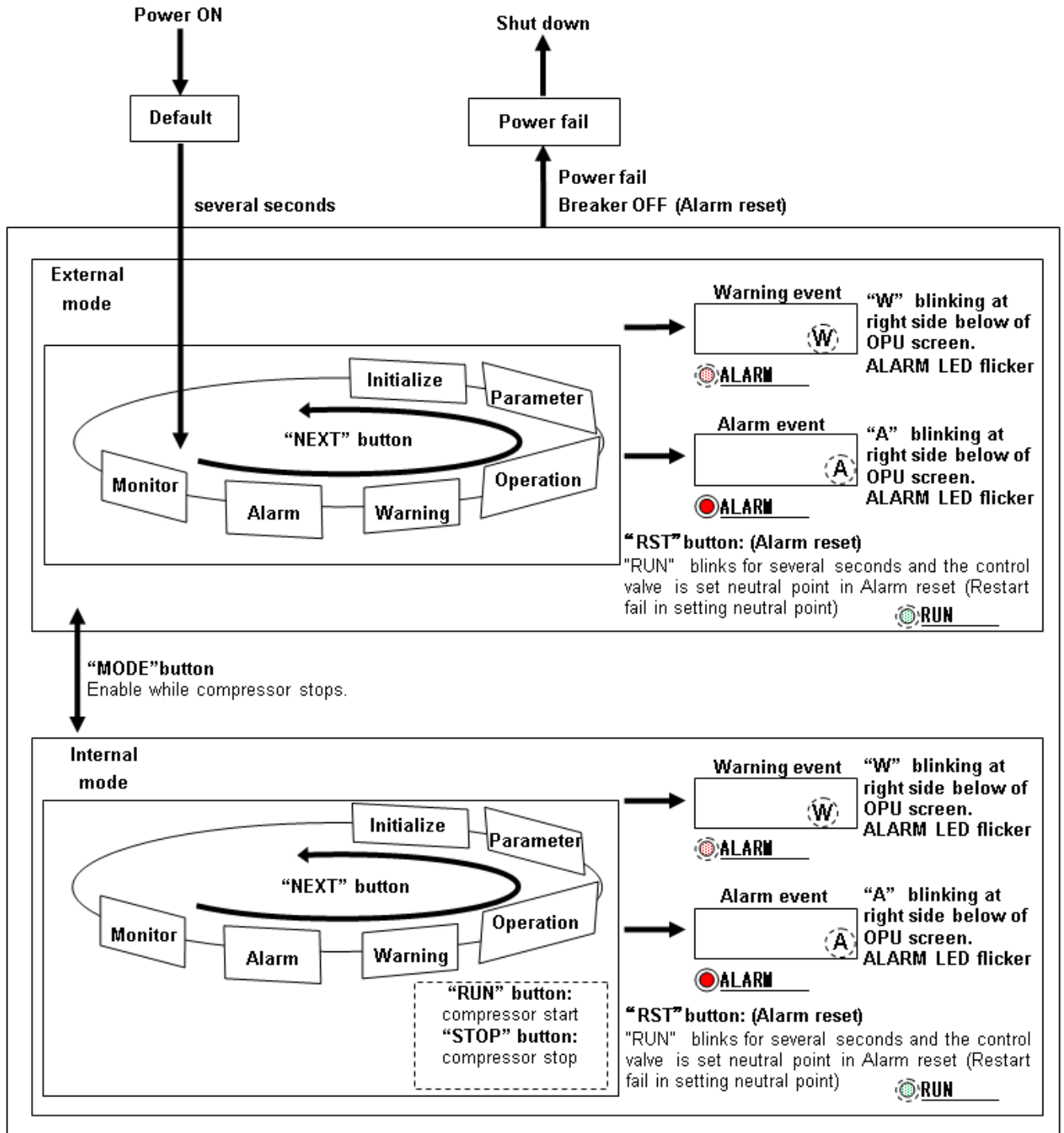


Figure 45 Compressor Operation Panel Screen Handling (TM-30)

6-2-3 CONTENTS OF COMPRESSOR SCREEN (TM-30)

(1) Initial screen

Table 56 Compressor Initial Screen (at Power On)

Upper		Lower		Remarks
Indication	Indication	Software version		
SHI Cryogenics	AZCOMP	003.010		After several seconds, the next screen is indicated.

(2) Monitor screen

This screen shows compressor unit status.

Push “SEL/ESC” button several times, monitor item is changed to MS***, MP***, MI***, MI***, MC*** and ME ***.

Table 57 Compressor Screen (Monitor)

*The colored items in the table are displayed only when the user has the authority of the vendor after entering the password (see section (7)).

Upper			Lower		Remarks
Item	Data	Unit	Data name		
MS000	**.**	MPa	PH(SUPPLY)		Measured pressure value of supply line
MS001	**.**	MPa	PL(RETURN)		Measured pressure value of return line
MS002	**.**	MPa	DP(DELTA)		Measured value of differential pressure
MS003	***	°C	TEMP01		Temperature of 01
MS004	***	°C	TEMP02		Temperature of 02
MS005	***	°C	TEMP03		Temperature of 03
MS006	***	°C	TEMP04		Temperature of 04
MS009	**.	L/m	CW_FLOW		Flow rate of cooling water
MS013	***	%	VOLT_R		Input voltage (R phase) for control card
MS014	***	%	VOLT_S		Input voltage (S phase) for control card
MS015	***	%	VOLT_T		Input voltage (T phase) for control card
MS016	**.**	V	PS 12V		Onboard voltage of DC 12 V
MS017	**.**	V	PS +15V		Onboard voltage of DC +15 V
MS018	**.**	V	PS 24V		Onboard voltage of DC 24 V
MS019	**.**	V	PS 5V		Onboard voltage of DC 5 V
MP002	***.	Hz	INV_Hz_C/P01		Inverter frequency compressor 01
MP004	*****.	Hr	RUN_TIME		Operating hours
MP005	*****.	Hr	ADS_OPE_TM		Adsorber operating hours (“-“ may appear.)
MP006	*****.	Hr	ADS_REM_TM		Adsorber remain hours (“-“ may appear.)
MP007	*****.	Hr	SERVICE_TIME		Service hours
MP008	**.	kW	PW_C/P01		Power consumption compressor 01
MI000	*		DRIVE_COMP		Drive compressor
MI001	*		SOL_VALVE		Solenoid valve (open (0)/close (1))
MI002	***	%	RLF_VALVE		Open rate of relief valve (close (0%)/full open (100%))
MI007	****		EXT_D_INPUT		External digital input bit0 (LSB) – 3 (MSB)
MI008	****		EXT_D_OUTPUT		External digital output bit0 (LSB) – 3 (MSB)

MI013	*	□ □ □	COMM □ STATUS	Communication status (RS-232C/RS485/CAN)
MI014	*****	□ □ □	COMM □ ERROR	Communication error
MC000	*** .***	□ □ □	S/W □ VER	Software version
ME---	*	□ □ □	NO AUTHORITY	No authority

(3) Alarm screen

This screen shows alarm of the compressor unit.

Push “SEL/ESC” button several times, the monitor item is changed to AR** and AH**.

AR** shows alarm event at the present stage.

Table 58 Compressor Screen (Alarm)

Upper			Remarks
Item	Data	Unit	Data name
AR**	***** .*	Hr	*** (Alarm event)

AH** shows alarm history. Data line shows the event time of alarm.

100 alarms are displayed chronologically and the first alarm will be erased when the alarms come to more than 100.

Table 59 Compressor Screen (Alarm History)

Upper			Remarks
Item	Data	Unit	Data name
AH**	***** .*	Hr	*** (Alarm history)

(4) Warning screen

This screen shows warning information.

Push “SEL/ESC” button several times, monitor item is changed to WR** and WH**.

WR** shows warning event at the present stage.

Table 60 Compressor Screen (Warning)

Upper			Lower
Item	Data	Unit	Data name
WR**	*****.*	Hr	*** (Warning event)

WH** shows warning history. Data line shows the event time of alarm.

100 warnings are displayed chronologically and the first warning will be erased when the alarms come to more than 100.

Table 61 Compressor Screen (Warning History)

Upper			Lower
Item	Data	Unit	Data name
WH**	*****.*	Hr	*** (Warning history)

(5) Operation screen


Manual operation may be set and changed with this screen.

Accessible datum are changed in accordance with authority.

Table 62 Compressor Screen (Operation)

Upper			Lower	Remarks
Item	Data	Unit	Data name	
OP---	*	□□□	NO_□_AUTHORITY	No authority to access parameter category

(6) Parameter setting screen

	<p>< Caution for Parameter Setting > Each parameter default value is Sumitomo Heavy Industries (SHI) recommended value. Don't change the parameter setting value basically. Please contact to SHI if it is necessary to change the parameter.</p>
---	---

Parameter settings can be confirmed and changed on this screen.

Table 63 Compressor Screen (Parameter)

*The colored items in the table are displayed only when the user has the authority of the vendor after entering the password (see section (7))

Upper			Lower	Remarks
Item	Data	Unit	Data name	
PP---	*	---	NO_AUTHORITY	No authority to access parameter category
PP111	*	---	D-SUB/RS-232C	Communication port select of external mode 0:D-SUB/1:RS-232C, RS485
PP121	*	---	RS485_ID	Compressor ID for RS485 (0 or 1)
PM---	*	---	NO_AUTHORITY	No authority to access parameter category

(7) Initialize screen

Table 64 Compressor Screen (Initialize)

Upper		Lower	Remarks
Item	Data	Data name	
IN---	*****	PASSWORD	Input screen for user password (123) After inputting password, the unit switches to the vendor mode. In the vendor mode, the colored items in the table are displayed.
IN000	*	ADS_OPE_TM	Adsorber operating time
IN001	*	ALARM/WARNING	Clear Alarm/Warning history data
IN002	*	DEFAULT	Set default parameter

7 TROUBLE SHOOTING

Refer to the following table when the customer tool cannot recognize the cryopump (including the cold trap; the same shall apply hereinafter in this section except the particular function and component) or when the cryopump and compressor cannot run correctly.

7-1 CUSTOMER TOOL CANNOT RECOGNIZE THE CRYOPUMP

Cause		CPC LED	Action
No power for the CP controller	The power connector is disconnected.	OFF	Connect the power connector correctly.
	The power switch is turned off.	OFF	Turn on the power switch.
	No power	OFF	Confirm that power is supplied.
	The power supply voltage is low.	OFF	Check the power supply voltage.
Malfunction of the host communication cable	The host communication cable (RS-232C) is disconnected.	0, 1, 2, 3, or 4	Connect the host communication cable correctly.
CP controller alarm	Checksum alarm (EEPROM alarm) It is necessary to rewrite the default parameter value.	A	<ol style="list-style-type: none"> 1. Turn off the CP controller. 2. Open the enclosure of the CP controller. 3. Turn on the No.1 switch of the DIP switch. 4. Turn on the CP controller. 5. After a few seconds, the LED will indicate "0", "1", "2", "3", "4", "H", "J", or "A". Then, turn off the CP controller. 6. Turn off the No.1 switch of the DIP switch and close the enclosure. 7. Turn on the CP controller.
	CPU watchdog alarm	0, 1, 2, 3, or 4	A CPU is reset automatically. Therefore, the cryopump and compressor will be stopped. Operate the cryopump again according to the condition.
	CPU address access alarm	0, 1, 2, 3, or 4	A CPU is reset automatically. Therefore, the cryopump and compressor will be stopped. Operate the cryopump again according to the condition.
Cause		IOM LED	Action
No power for the power distribution box	The circuit breaker is turned off.	OFF	Turn on the circuit breaker.
	No power	OFF	Confirm that power is supplied.
	The power supply voltage is low.	OFF	Check the power supply voltage.
No power for the cryopump (IO module)	No power	OFF	Confirm that power is supplied from the power distribution box.
	The power supply voltage is low.	OFF	Check the power supply voltage.
	The power connector is disconnected.	OFF	Connect the power connector correctly.
	The IO module fuse is blown.	OFF	<ol style="list-style-type: none"> 1. Confirm that power is supplied. 2. Turn off the power supply. 3. Replace the cryopump unit or IO module.
Malfunction of the local communication cable	Local communication cable (RS-485) is disconnected.	ID No.	Connect the local communication cable correctly.
IO module CPU alarm	CPU watchdog alarm	C0	Reset the cryopump power supply.
	CPU address access alarm	C1	Reset the cryopump power supply.

7-2 CRYOPUMP CANNOT START TO RUN

Cause		IOM LED	Action
Cryopump system alarm "e" command response is "H"	The 1st temperature sensor (T1) is breaking	A0	1. Check whether the temperature sensor cable connector is disconnected. 2. Reset the cryopump power supply after checking.
	The 2nd temperature sensor (T2) is breaking	A1	1. Check whether the temperature sensor cable connector is disconnected. 2. Reset the cryopump power supply after checking.
	The pressure sensor (Pirani gauge) is breaking	A2	1. Check whether the pressure sensor cable connector is disconnected. 2. Reset the cryopump power supply after checking.
	Checksum alarm	A3	1. Reset the cryopump power supply. 2. Enter password "511" at ##E00 screen by OPU, if alarm is not cleared. 3. Execute ##E04 screen (Def Param). 4. Reset the cryopump power supply again after 3.
Inverter alarm	Checksum alarm	A6	1. Reset the cryopump power supply. 2. Enter password "511" at ##E00 screen by OPU, if alarm is not cleared. 3. Execute ##E04 screen (Def Param). 4. Reset the cryopump power supply again after 3.
	Reset alarm	b0	Reset the cryopump power supply.
	Low voltage	b1	Reset the cryopump power supply.
	Over voltage	b2	Reset the cryopump power supply.
	Over DC current	b3	Reset the cryopump power supply.
	Over AC current	b4	Reset the cryopump power supply.
	Overheat	b9	Reset the cryopump power supply.
	Watch dog timer alarm	bb	Reset the cryopump power supply.
Communication alarm	bF	Reset the cryopump power supply.	

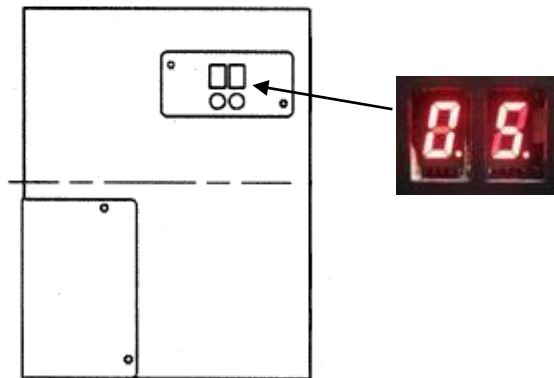


Figure 46 IO Module 7 Segment LED

7-3 REGENERATION IS NOT COMPLETED

Cause		Action	
Warm up time out "e" command response is "B". (cannot warm up)	The cold head motor cannot run.	The motor cable connector is disconnected.	1. Connect the motor connector correctly 2. Execute the regeneration again.
		Motor failure	Contact to SHI*.
	The purge valve cannot open.	The N2 purge pressure is too high.	Adjust the N2 purge pressure correctly. (Refer to the cryopump specification.)
		The purge valve connector is disconnected.	1. Connect the purge valve connector correctly 2. Execute the regeneration again.
		The purge valve solenoid is failure.	Contact to SHI.
	The N2 purge pressure is too low.		Adjust the N2 purge pressure correctly. (Refer to the cryopump specification.)
	The compressor does not run.		Refer to the compressor trouble shoot.
The compressor differential pressure is too low.		Refer to the compressor trouble shoot.	
Cool down time out "e" command response is "C". Fast regeneration cool down time out "e" command response is "C." (cannot cool down)	The cold head motor cannot run.	The motor cable connector is disconnected	1. Connect the motor connector correctly. 2. Execute the regeneration again.
		Motor failure	Contact to SHI.
	The compressor does not run.		Refer to the compressor trouble shoot.
	The compressor differential pressure is too low.		Refer to the compressor trouble shoot.
There is the leak.		1. Check the leak. 2. Execute the regeneration again after the leak check is completed.	
Roughing time out "e" command response is "G". (Rough evacuation does not work.)	The rough valve cannot open.	Pneumatic gas pressure is low.	Adjust the pneumatic pressure correctly. (Recommended value: 0.40 – 0.70 MPaG)
		The rough valve connector is disconnected.	1. Connect the rough valve connector correctly. 2. Execute the regeneration again.
		The rough valve solenoid is failure.	Contact to SHI.
	There is the leak.		1. Check the leak. 2. Execute the regeneration again after the leak check is completed.
The 2nd temperature (T2) is too high for the fast regeneration. "e" command response is "I".	The 2nd temperature is too high for starting the fast regeneration.		1. Check the cryopump temperature. 2. Execute the Full regeneration after checking.
The 2nd temperature (T2) is too low for roughing. "e" command response is "J".	The 2nd temperature is too low for roughing in the auto regeneration sequence.		1. Check the cryopump temperature. 2. Execute the Full regeneration after checking.
Electric power failure "e" command response is "K".	The regeneration is interrupted by the electric power failure.		Execute the regeneration again after the power failure recovery.
Manual abort "e" command response is "F".	The regeneration is interrupted by the abort instruction from the customer tool.		Operate the cryopump again according to the condition.

*Sumitomo Heavy Industries (SHI)

7-4 CHAMBER PRESSURE DOES NOT FALL

Cause		Action
The cryopump temperature goes up even though the cryopump was control to the low temperature. (cannot cool down)	The cold head motor cannot run.	The motor cable connector is disconnected. Motor failure
		1. Connect the motor connector correctly. 2. Execute the regeneration again.
		Contact to SHI.
	The compressor does not run.	Refer to the compressor trouble shoot.
	The compressor differential pressure is too low.	Refer to the compressor trouble shoot.
	There is the leak.	1. Check the leak 2. Execute the regeneration again after the leak check is completed
	Catching gas is over than the cryopump gas capacity.	Execute the regeneration.

7-5 CRYOPUMP PERFORMANCE DETERIORATION

Cause	IOM LED	Action
Cryopump system warning "SD1?" command response is the following. Warning status 01H = T1 warning 1 02H = T1 warning 2 04H = T2 warning 1 08H = T2 warning 2 10H = Cryocooler warning 20H = Auxiliary 40H = Header (always on) "SD1?" command is the cryopump warning only. J0, J1, J2 warnings are only the LED information.	T1 warning 1	H0
		The cryopump T1 performance warning 1 is happened. Check the cryopump status and contact to SHI.
	T1 warning 2	H1
		The cryopump T1 performance warning 2 is happened. Check the cryopump status and contact to SHI.
	T2 warning 1	H2
		The cryopump T2 performance warning 1 is happened. Check the cryopump status and contact to SHI.
	T2 warning 2	H3
	The cryopump T2 performance warning 2 is happened. Check the cryopump status and contact to SHI.	
Cryocooler warning	H4	The cryocooler of cryopump performance warning is happened. Check the cryopump status and contact to SHI.
Compressor supply pressure low warning	J0	1. The compressor supply pressure is lower than MS02. Charge the helium pressure and check the leakage part. 2. Contact to SHI.
The compressor 1 is communication error or stopped due to alarm.	J1	1. Check the compressor alarm on the compressor 1 screen. 2. Contact to SHI.
The compressor 2 is communication error or stopped due to alarm.	J2	1. Check the compressor alarm on the compressor 2 screen. 2. Contact to SHI.

7-6 COMPRESSOR HELIUM DIFFERENTIAL PRESSURE IS LOW

TM-50

Cause					Action	
The helium charged pressure is low.	-	-	-	-	There is a leak in the helium line.	<ol style="list-style-type: none"> 1. Execute the regeneration of all the cryopumps. 2. Abort the regeneration at room temperature. 3. Check the helium charged pressure by the helium pressure gauge on the compressor rear panel. 4. Charge the helium gas if the helium pressure is lower than the correct pressure range. 5. Check whether there is any helium leak. 6. Reconnect the helium hose when the leak is found. (Contact to SHI when it is impossible to correct the leak.)
Alarm item	L1 R	L2 G	L3 G	L4 G	Compressor LED	

TM-30

Cause	Action
The helium charged pressure is low.	<p>There is a leak in the helium line.</p> <ol style="list-style-type: none"> 1. Execute the regeneration of all the cryopumps. 2. Abort the regeneration at room temperature. 3. Check the helium charged pressure by the helium pressure gauge on the compressor rear panel. 4. Charge the helium gas if the helium pressure is lower than the correct pressure range. 5. Check whether there is any helium leak. 6. Reconnect the helium hose when the leak is found. (Contact to SHI when it is impossible to correct the leak.)

7-7 COMPRESSOR CANNOT RUN

TM-50

Cause					Action	
Compressor electric power failure	OFF	OFF	OFF	OFF	The earth leakage breaker is turned off.	1. Turn on the earth leakage breaker. 2. Turn on the Inverter power ON switch.
					No power	Confirm that power is supplied.
					The power supply voltage is low.	Check the power supply voltage.
					The compressor fuse is blown.	1. Confirm that power is supplied. 2. Turn off the power supply. 3. Check that the fuse is blown. 4. Change the fuse.
					There is the earth leakage. (TM-50L-AA)	1. Push the reset button of the earth leakage breaker. 2. Turn off the earth leakage breaker. 3. Turn on the earth leakage breaker.
Malfunction of the local communication cable	-	-	-	-	The local communication cable (RS-485) is disconnected.	Connect the local communication cable connector correctly.
Alarm item	L1 R	L2 G	L3 G	L4 G	Compressor LED	

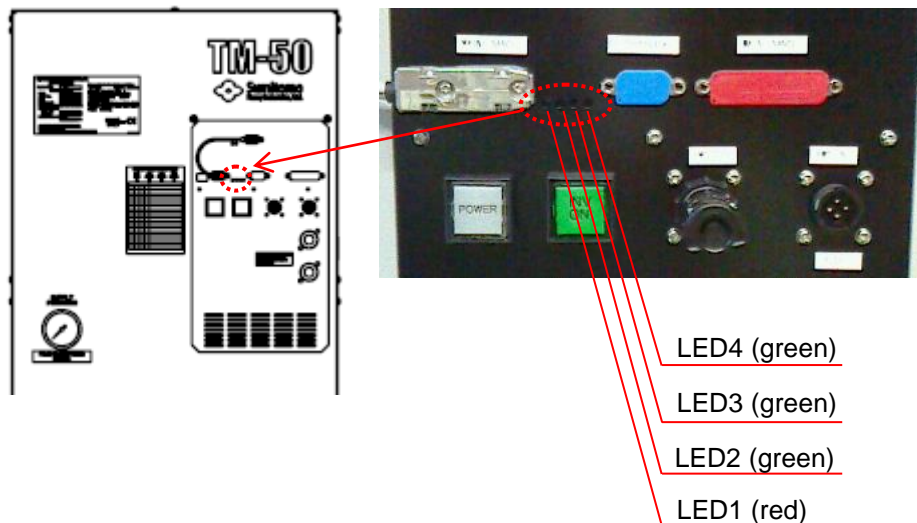


Figure 47 Compressor LED (TM-50)

TM-30

Cause		Action
Compressor electric power failure	The circuit breaker is turned off.	Turn on the circuit breaker.
	No power	Confirm that power is supplied.
	The power supply voltage is low.	Check the power supply voltage.
	The circuit protector is turned off.	1. Remove the protection cover from the circuit breaker box. 2. Turn on the circuit protector on left side.
	There is the earth leakage. (TM-30L-AA)	1. Turn off the circuit breaker. 2. Turn on the circuit breaker.
Malfunction of the local communication cable	The local communication cable (RS-485) is disconnected.	Connect the local communication cable connector correctly.
Error setting of DIP switch	The compressor is turned ON with a DIP switch ON (shifted to left side)	1. Turn off the circuit breaker. 2. Turn off the all DIP switches (shifted to right side).

7-8 COMPRESSOR CANNOT RUN (COMPRESSOR UNIT ALARM)

TM-50

Cause					Action	
Compressor in initializing		L	L		During initialize	-
Compressor is stopped		L	L	L	During stop	-
Compressor in operation		B	B	B	During operation	-
Temperature of helium on the primary of heat exchanger (TH1-1) is high	L	L			Lack of cooling water	Adjust the cooling water flow according to the cooling water specification in this manual.
					Blocking of cooling water pipe	Check whether the cooling water flow is enough.
Temperature of the helium after heat exchanger (TH1-2) is high	L		L		Lack of cooling water	Adjust the cooling water flow according to the cooling water specification in this manual.
					Blocking of cooling water pipe	Check whether the cooling water flow is enough.
Temperature of the cooling water at outlet (TH1-3) is high	L			L	Lack of cooling water	Adjust the cooling water flow according to the cooling water specification in this manual.
					Blocking of cooling water pipe	Check whether the cooling water flow is enough.
Measurement abnormality of thermistor of TH1-1	L	B	L	L	Thermistor failure	Contact to SHI.
Measurement abnormality of thermistor of TH1-2	L	L	B	L	Thermistor failure	Contact to SHI.
Measurement abnormality of thermistor of TH1-3	L	L	L	B	Thermistor failure	Contact to SHI.
Supply pressure sensor breaking	L	L	L		Supply pressure sensor failure	Contact to SHI.
Return pressure sensor breaking	L	L		L	Return pressure sensor failure	Contact to SHI.
Power supply DC5V low	L	B		B	The power supply output voltage is low for pressure sensor.	Contact to SHI.
Supply pressure high	L		L	L	The helium charged pressure is too high.	<ol style="list-style-type: none"> 1. Execute the regeneration of all the cryopumps. 2. Abort the regeneration at room temperature. 3. Check the helium charged pressure by the helium pressure gauge on the compressor rear panel. 4. Charge the helium gas if the helium pressure is lower than the correct pressure range. 5. Check whether there is any helium leak. 6. Reconnect the helium hose when the leak is found. (Contact to SHI when it is impossible to correct the leak.)
Return pressure low	L	B			The helium charged pressure is too low.	
Differential pressure is low at starting	L		B		The helium charged pressure is too low.	
					Bypass solenoid failure	
Differential pressure is low at running	L			B	There is the leak.	
Alarm item	L1 R	L2 G	L3 G	L4 G	Compressor LED	

<Alarm reset>
1. After remove the cause of some alarms, push the reset button on the OPU. Then the alarm lamp is turned off and the compressor is recovered.
2. If the alarm lamp is still lighting, turn off the compressor power supply for 10 sec or more. Turn on the compressor power supply again.

Compressor LED (L: Lighting, B: Blinking)

Cause					Action	
Inverter alarm	L	B	B		Input power open-phase	Check whether the input power is open-phase.
					Compressor capsule failure	Contact to SHI if the input power is normal.
					Inverter failure	Contact to SHI if the input power is normal.
Checksum alarm	L	B	B	B	Checksum alarm (EEPROM alarm) It is necessary to rewrite the default parameter value.	<ol style="list-style-type: none"> 1. Turn off the compressor and disconnect a RS-485 communication cable with CP controller. 2. Turn on the No.1 switch of the DIP switch. 3. Turn on the compressor. 4. Turn off the compressor after 5 sec. 5. Turn off the No.1 switch of the DIP switch, and return the DIP switch cover. 6. Turn on the compressor. 7. Check a compressor parameter ("P01" DP SV0 value). 8. Input 1.45 MPa if the "P01" value is another value. 9. Turn off the compressor, and connect the RS-485 communication cable. 10. Turn on the compressor.
Inverter communication alarm	B	B	B	B	Internal communication cable is disconnected.	<ol style="list-style-type: none"> 1. Connect the internal communication cable connector correctly. 2. Reset the power supply to compressor.
Alarm item	L1	L2	L3	L4		
	R	G	G	G	Compressor LED	

<Alarm reset>
 1. After remove the cause of some alarms, push the reset button on the OPU. Then the alarm lamp is turned off and the compressor is recovered.
 2. If the alarm lamp is still lighting, turn off the compressor power supply for 10 sec or more, turn on the compressor power supply again.

Compressor LED (L: Lighting, B: Blinking)

TM-30

Cause		Action	
The temperature of the discharged helium is high.	101T_ HXI_ H_ ULA	Lack of cooling water	Adjust the cooling water flow according to the cooling water specification in this manual.
		Blocking of cooling water pipe	Check whether the cooling water flow is enough.
		Thermal switch failure	When this alarm remains in spite of the unit reset after the compressor unit cooled to ambient temperature (stopped for 20 minutes or more), contact to SHI.
The temperature of the helium after cooling is high.	106T_ HXO_ H_ ULA	Lack of cooling water	Adjust the cooling water flow according to the cooling water specification in this manual.
		Blocking of cooling water pipe	Check whether the cooling water flow is enough.
		Thermal switch failure	When this alarm remains in spite of the unit reset after the compressor unit cooled to ambient temperature (stopped for 20 minutes or more), contact to SHI.
The temperature of the cooling water at inlet is too high.	116T_ HXI_ W_ ULA	Thermal error of cooling water	To prevent overheat, compressor unit shows warning when the cooling water temperature at inlet is 75 degrees C or more.
The temperature of the cooling water at outlet is high.	121T_ HXO_ H_ ULA	Lack of cooling water	Adjust the cooling water flow according to the cooling water specification in this manual.
		Blocking of cooling water pipe	Check whether the cooling water flow is enough.
		Thermal switch failure	When this alarm remains in spite of the unit reset after the compressor unit cooled to ambient temperature (stopped for 20 minutes or more), contact to SHI.
Thermal sensor breaking	104T_ HXI_ H_ B.O 109T_ HXO_ H_ B.O 119T_ HXI_ W_ B.O 124T_ HXO_ W_ B.O	Thermal sensor failure	Contact to SHI.
Thermal sensor earth fault	103T_ HXI_ H_ S.E 108T_ HXO_ H_ S.E 118T_ HXI_ W_ S.E 123T_ HXO_ W_ S.E	Thermal sensor failure	Contact to SHI.
Supply pressure high	001P_ Hi_ ULA	The helium charged pressure is too high.	<ol style="list-style-type: none"> 1. Execute the regeneration of all cryopumps. 2. Abort the regeneration at room temperature. 3. Check the helium charged pressure by the helium pressure gauge on the compressor rear panel. 4. Charge the helium gas if the helium pressure is lower than the correct pressure range. (Recommended value: 2.30 – 2.35 MPaG, displayed on LCD monitor on front panel) 5. Check whether there is any helium leak. 6. Reconnect the helium hose when the leak is found. (Contact to SHI when it is impossible to correct the leak.)
Return pressure low	007P_ Lo_ LLA	The helium charged pressure is too low.	

<Alarm reset>
 1. After remove cause of some alarms, push the reset button on the OPU. Then alarm lamp is turned off and compressor is recovered.
 2. If alarm lamp is still lighting, turn off the compressor power supply for 10 sec or more. Turn on the compressor power supply again.

Cause			Action	
Supply pressure sensor breaking	004P_ Hi_ B.O 003P_ Hi_ S.E	Supply pressure sensor failure	Contact to SHI.	
Return pressure sensor breaking	009P_ Lo_ B.O 008P_ Lo_ S.E	Return pressure sensor failure	Contact to SHI.	
Inverter alarm	605I_ CH_ * _**** 606I_ FCO_ * _****	Inverter failure	Contact to SHI.	
Checksum alarm	800E_ EPROM_ ALM	Checksum alarm (EEPROM alarm) It is necessary to rewrite the default parameter value.	Initialize the control card with OPU on the front panel. 1. Push "SEL/ESC" button 5 times. Then initialize screen (IN---) is displayed. 2. Push the "ENT" button. "IN---" starts blink. 3. Push the "Up" and "Down" buttons and set to "123". 4. Push the "ENT" button, 123 will back to 1. 5. Push the "Up" and "Down" buttons till "IN002" screen is appeared.1 will back to 0. 6. If "IN002" screen is not appeared, retry the step (2) - (4). 7. Push the "ENT" button. "IN002" starts blink. 8. Push the "Up" and "Down" buttons and set "1". 9. Push the "ENT" button. "IN002" blink will stop. 10. Turn off the compressor. 11. Turn on the compressor.	
Misconnection of switching tap	310E_ DC12V_ ULW 311E_ DC12V_ LLW 312E_ DC15V_ ULW 313E_ DC15V_ LLW 314E_ DC24V_ ULW 315E_ DC24V_ LLW	Tap setting is not suitable for commercial power supply voltage	1. Turn off the host breaker, and make sure that the power supply to the compressor unit stopped. 2. Remove the breaker box cover of compressor unit, and confirm the connection of switching tap. 3. If the tap is misconnected, select the tap suitable for commercial power supply voltage. 4. Restore the breaker cover, and turn on the host breaker to restart the compressor unit. 5. If commercial power supply voltage in the customer's country is no entry on the switching tap, check the supply voltage to the compressor is within $\pm 10\%$ of the commercial power supply voltage.	
OPU communication error	OPU Serial Err	Communication error between control board and OPU	1. Turn off the circuit breaker. 2. Make sure that all DIP switches inside the control panel are turned off (shifted to right side).	

<Alarm reset>
 1. After remove cause of some alarms, push the reset button on the OPU. Then alarm lamp is turned off and compressor is recovered.
 2. If alarm lamp is still lighting, turn off the compressor power supply for 10 sec or more. Turn on the compressor power supply again.

8 REFERENCE

8-1 ALARM AND WARNING CODE (COMPRESSOR)

8-1-1 ALARM CODE (TM-30)

Table 65 Alarm Code (Ver. 003.010)

Code	Abbreviation	Error	Trigger condition		
001	P_Hi_ULA	High Pressure Upper Limit Alarm	Helium supply pressure	>= 3.33	MPa
003	P_Hi_S.E	High Pressure Sensor Error	Helium supply pressure	>= 5.00	MPa
004	P_Hi_B.O	High Pressure Burn Out	Helium supply pressure	<= 0.10	MPa
007	P_Lo_LLA	Low Pressure Lower Limit Alarm	Helium return pressure	<= 0.20	MPa
008	P_Lo_S.E	Low Pressure Sensor Error	Helium return pressure	>= 5.00	MPa
009	P_Lo_B.O	Low Pressure Burn Out	Helium return pressure	<= 0.10	MPa
015	P_DELTA_LLA	Differential Helium Pressure Lower	Differential helium pressure	<= 0.5	MPa
101	T_HXI_H_ULA	Heat Exchanger Input, Helium Temperature Upper Limit Alarm	Helium discharge temperature	>= 75	°C
103	T_HXI_H_S.E	Heat Exchanger Input, Helium Temperature Sensor Error	Helium discharge temperature	>= 200	°C
104	T_HXI_H_B.O	Heat Exchanger Input, Helium Temperature Burn Out	Helium discharge temperature	<= -30	°C
106	T_HXO_H_ULA	Heat Exchanger Output, Helium Temperature Upper Limit Alarm	Helium discharge temperature	>= 60	°C
108	T_HXO_H_S.E	Heat Exchanger Output, Helium Temperature Sensor Error	Helium discharge temperature	>= 200	°C
109	T_HXO_H_B.O	Heat Exchanger Output, Helium Temperature Burn Out	Helium discharge temperature	<= -30	°C
116	T_HXI_W_ULA	Heat Exchanger Input, Water Temperature Upper Limit Alarm	Cooling water inlet temperature	>= 75	°C
118	T_HXI_W_S.E	Heat Exchanger Input, Water Temperature Sensor Error	Cooling water inlet temperature	>= 200	°C
119	T_HXI_W_B.O	Heat Exchanger Input, Water Temperature Burn Out	Cooling water inlet temperature	<= -30	°C
121	T_HXO_W_ULA	Heat Exchanger Output, Water Temperature Upper Limit Alarm	Cooling water outlet temperature	>= 60	°C
123	T_HXO_W_S.E	Heat Exchanger Output, Water Temperature Sensor Error	Cooling water outlet temperature	>= 200	°C
124	T_HXO_W_B.O	Heat Exchanger Output, Water Temperature Burn Out	Cooling water outlet temperature	<= -30	°C
301	E_Ph_Loss	Open Phase Alarm	Input power		
604	I_CO_COM_ER	COMP. Inverter COM Alarm	Communication error between the control board and inverter		
605	I_CH*_**** (*: any letters and numbers)	COMP. Inverter Alarm	Inverter failure		
606	I_FCO*_**** (*: any letters and numbers)	COMP. Inverter Alarm	Inverter failure		
800	E_EPROM_ALM	EEPROM Checksum Alarm	Parameter data broken		

8-1-2 WARNING CODE (TM-30)

Table 66 Warning Code (Ver. 003.010)

Code	Abbreviation	Error	Trigger condition		
001	P_Hi_ULW	High Pressure Upper Limit Warning	Helium supply pressure	≥ 3.25	MPa
007	P_Lo_LLW	Low Pressure Lower Limit Warning	Helium return pressure	≤ 0.60	MPa
202	F_WT_Fw_LLW	Flow Water Lower Limit Warning	Cooling water flow rate	≤ 4.0	L/m
101	T_HXI_H_ULW	Heat Exchanger Input, Helium Temperature Upper Limit Warning	Helium discharge temperature	≥ 70	°C
106	T_HXO_H_ULW	Heat Exchanger Output, Helium Temperature Upper Limit Warning	Helium after cooling temperature	≥ 55	°C
116	T_HXI_W_ULW	Heat Exchanger Input, Water Temperature Upper Limit Warning	Cooling water inlet temperature	≥ 32	°C
121	T_HXO_W_ULW	Heat Exchanger Output, Water Temperature Upper Limit Warning	Cooling water outlet temperature	≥ 55	°C
310	E_DC12V_ULW	DC12 V Upper Limit Warning	Control board power (12 V)	≥ 13.2	V
311	E_DC12V_LLW	DC12 V Lower Limit Warning	Control board power (12 V)	≤ 10.8	V
312	E_DC15V_ULW	DC15 V Upper Limit Warning	Control board power (15 V)	≥ 16.5	V
313	E_DC15V_LLW	DC15 V Lower Limit Warning	Control board power (15 V)	≤ 13.5	V
314	E_DC24V_ULW	DC24 V Upper Limit Warning	Control board power (24 V)	≥ 31.2	V
315	E_DC24V_LLW	DC24 V Lower Limit Warning	Control board power (24 V)	≤ 16.8	V
402	O_ADS_LIFE	Adsorber Lifetime Limited	Adsorber operation time	≥ 30000	Hr

9 APPENDIX

9-1 FULL REGENERATION SEQUENCE

8" or 10" CRYOPUMP FULL REGEN Sequence (1/3)

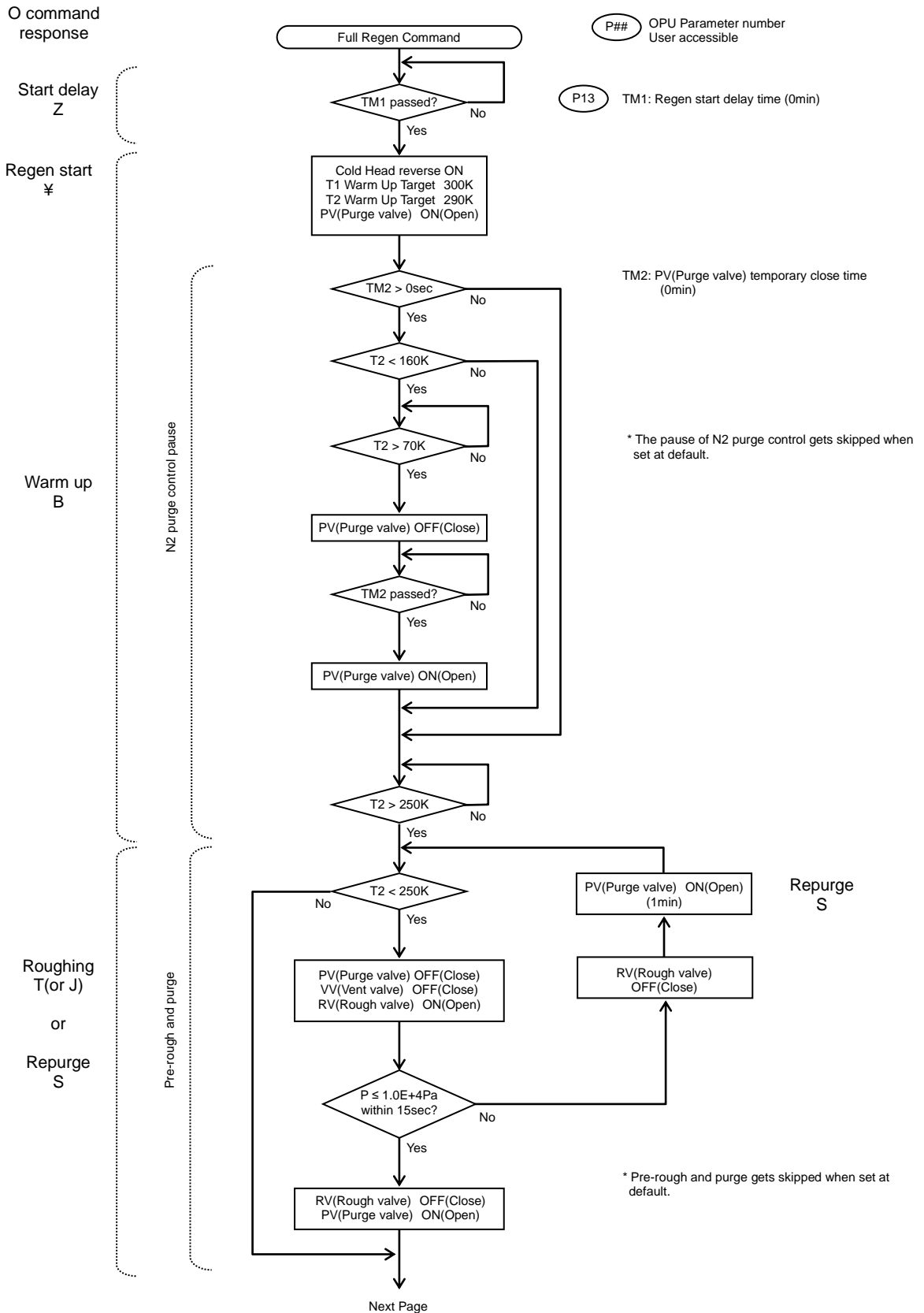


Figure 48 Full Regeneration Sequence (1/3)

8" or 10" CRYOPUMP FULL REGEN Sequence (2/3)

O command response

P## OPU Parameter number
User accessible

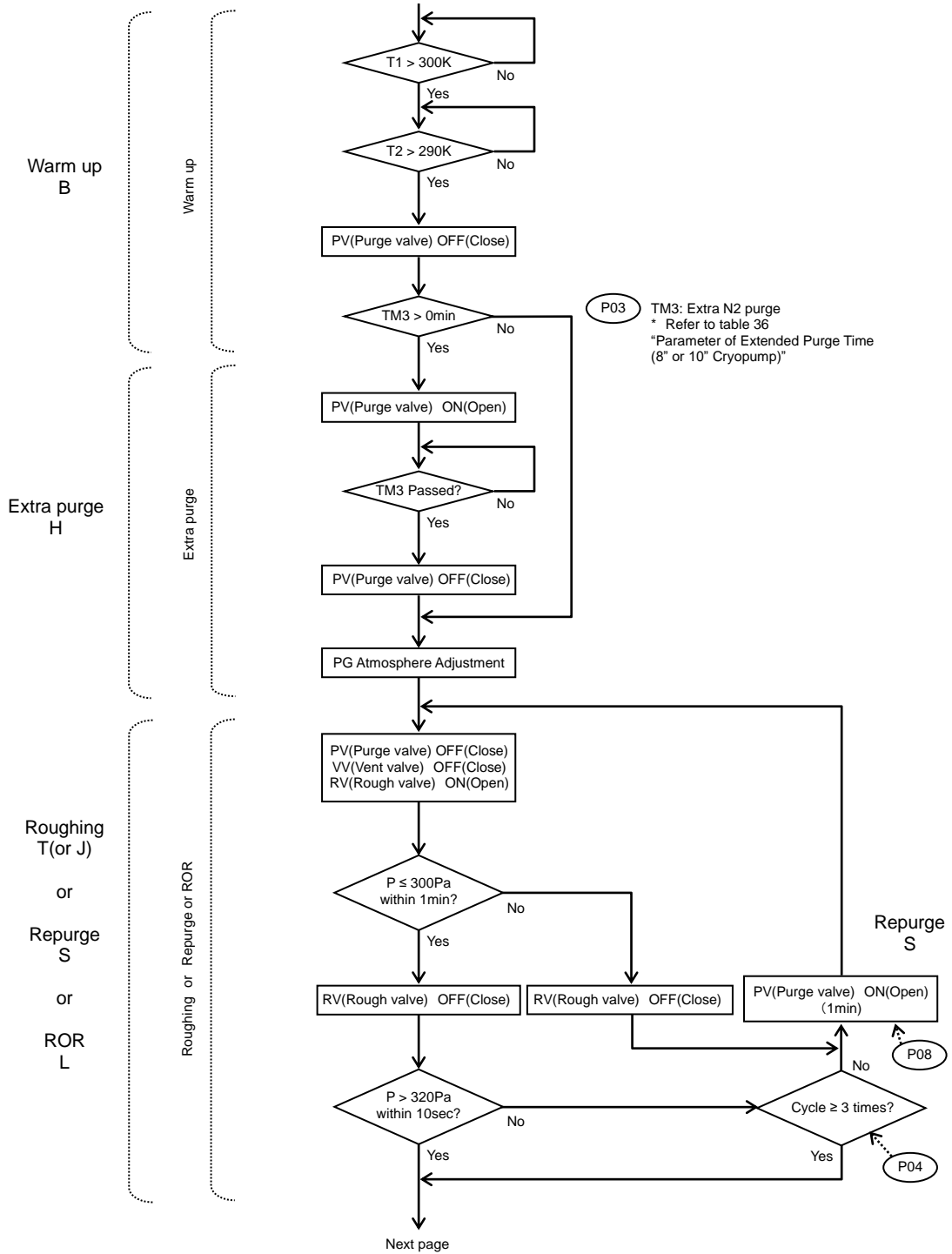


Figure 49 Full Regeneration Sequence (2/3)

8" or 10" CRYOPUMP FULL REGEN Sequence (3/3)

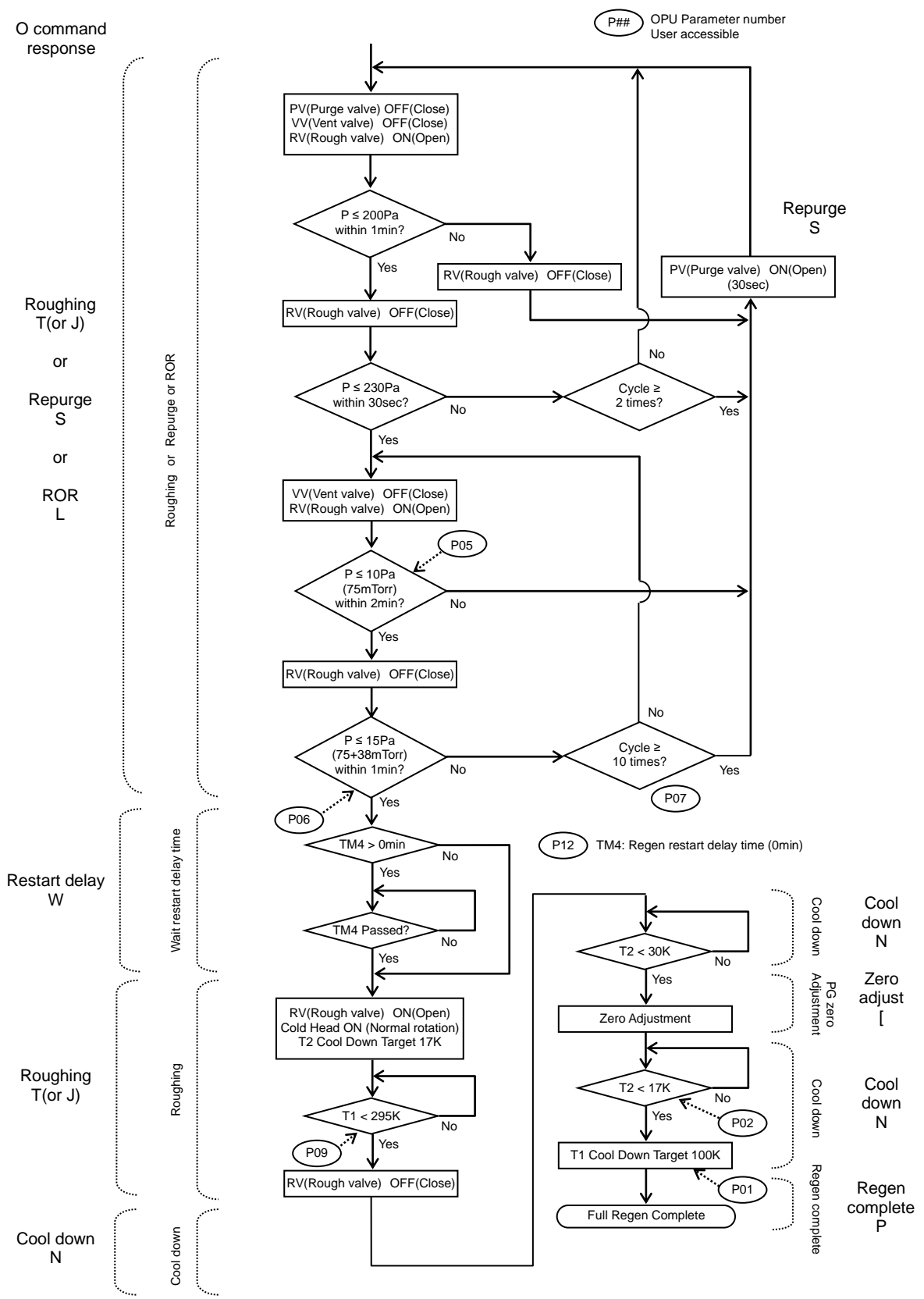


Figure 50 Full Regeneration Sequence (3/3)

9-2 FAST REGENERATION SEQUENCE

8" or 10" CRYOPUMP FAST REGEN Sequence (1/3)

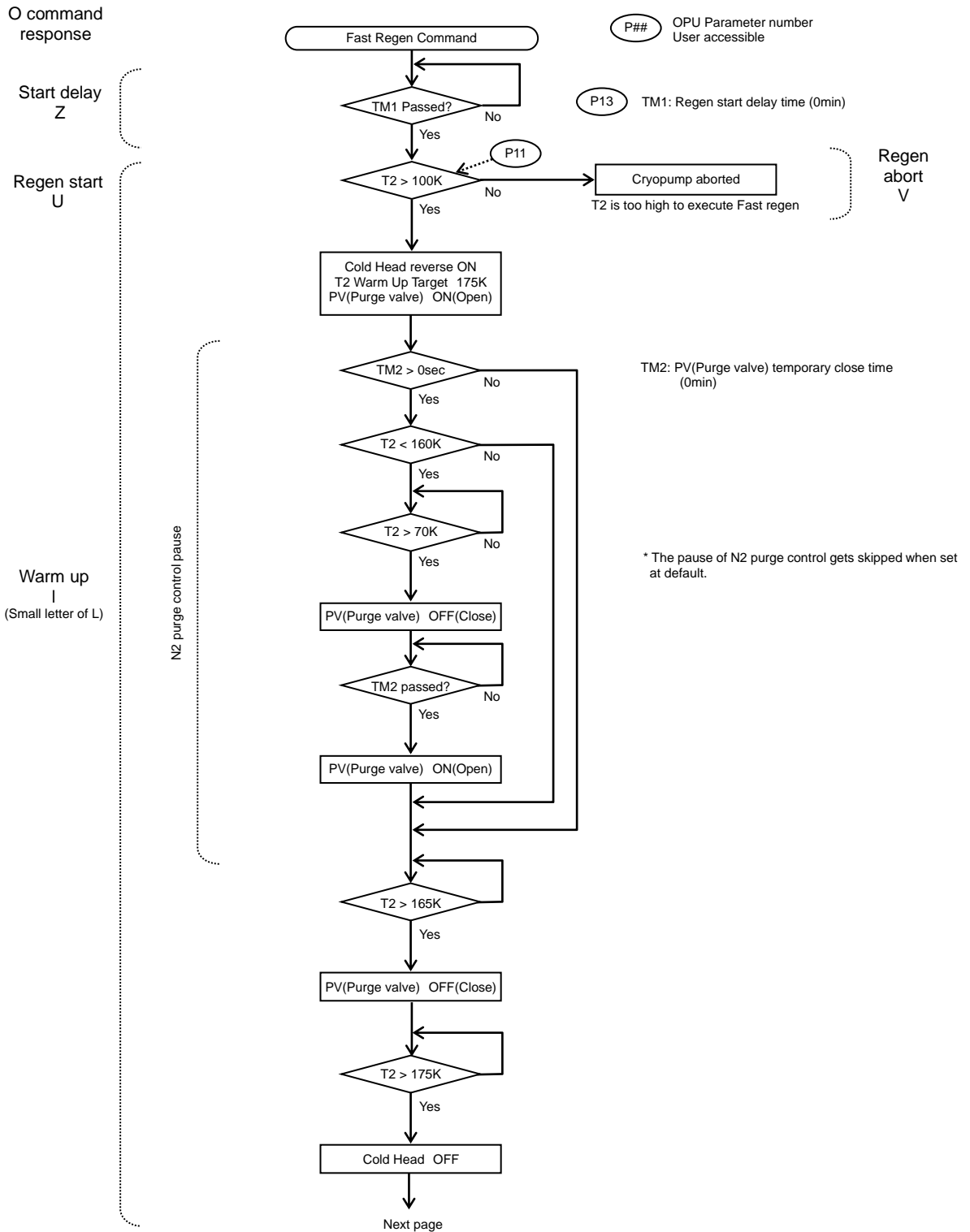


Figure 51 Fast Regeneration Sequence (1/3)

8" or 10" CRYOPUMP FAST REGEN Sequence (2/3)

O command response

P## OPU Parameter number User accessible

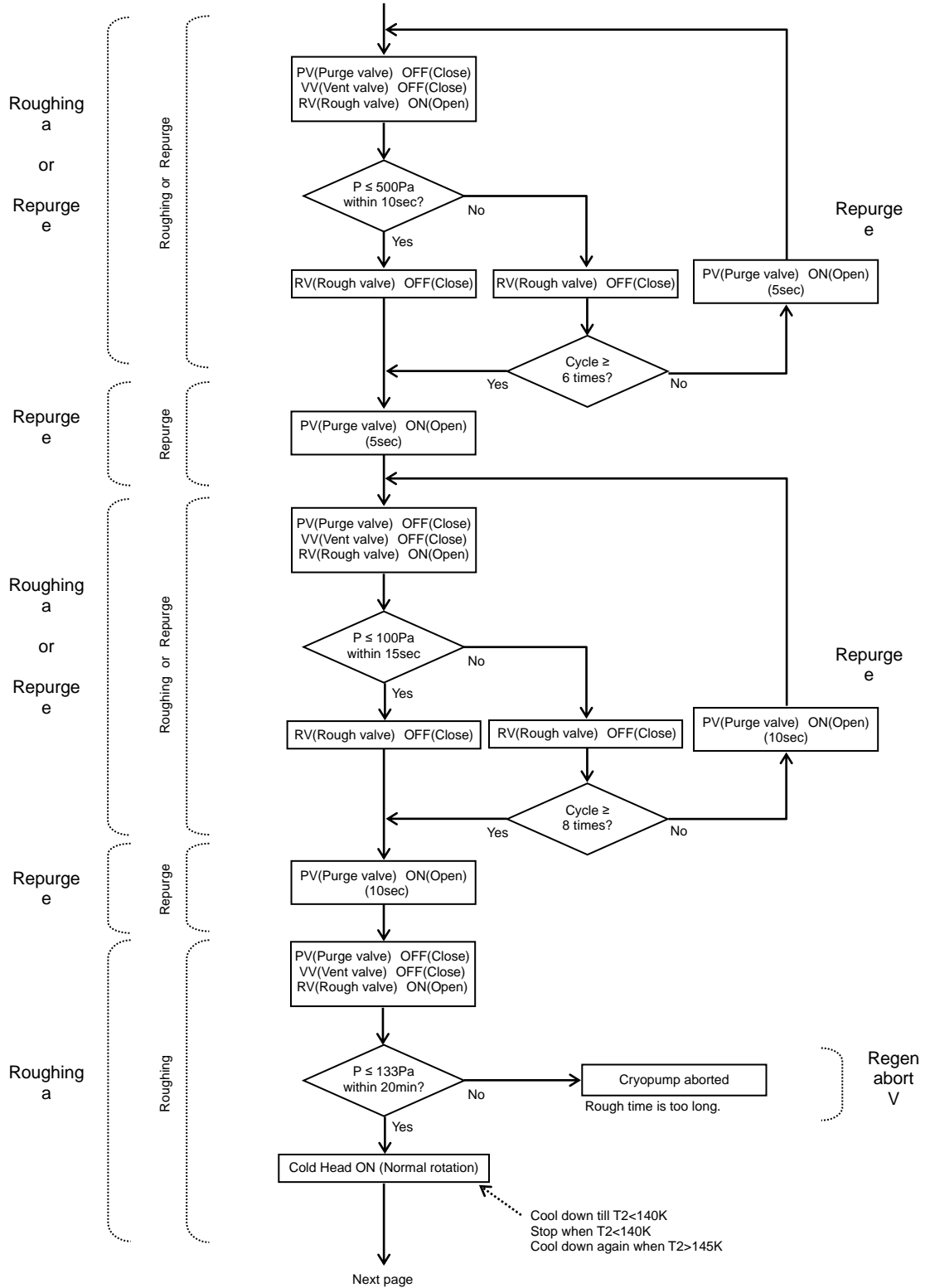


Figure 52 Fast Regeneration Sequence (2/3)

8" or 10" CRYOPUMP FAST REGEN Sequence (3/3)

O command response

P## OPU Parameter number
User accessible

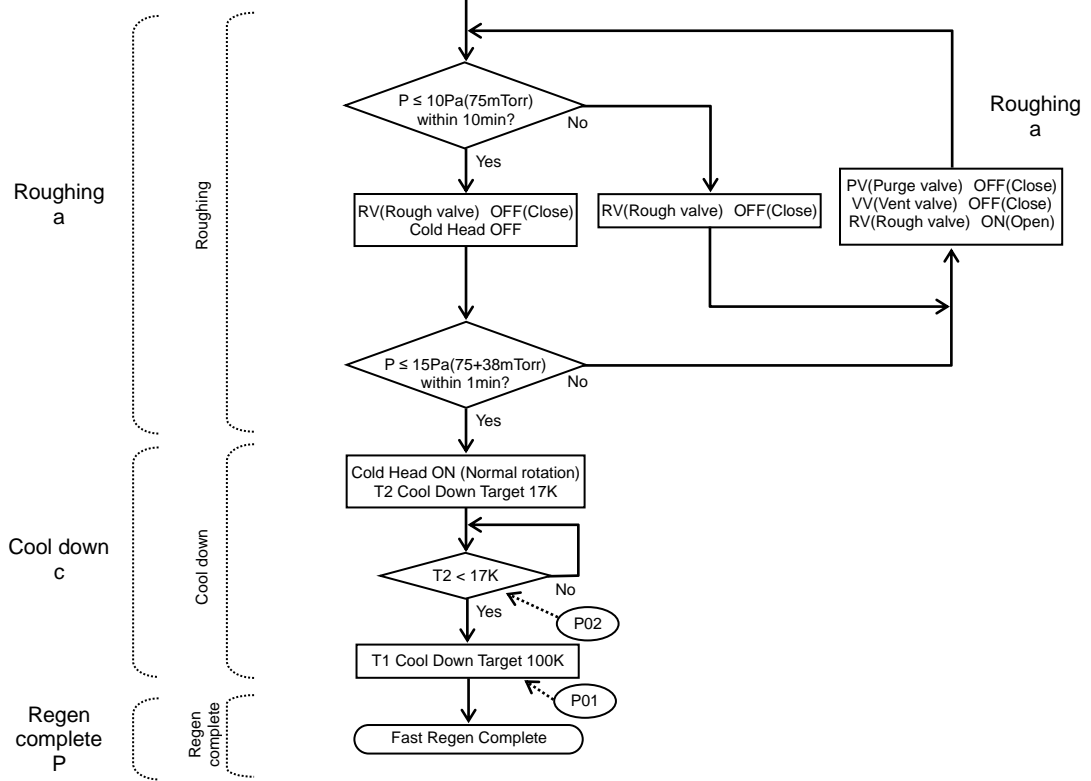


Figure 53 Fast Regeneration Sequence (3/3)

9-3 CRYOPUMP POWER RESTORED SEQUENCE

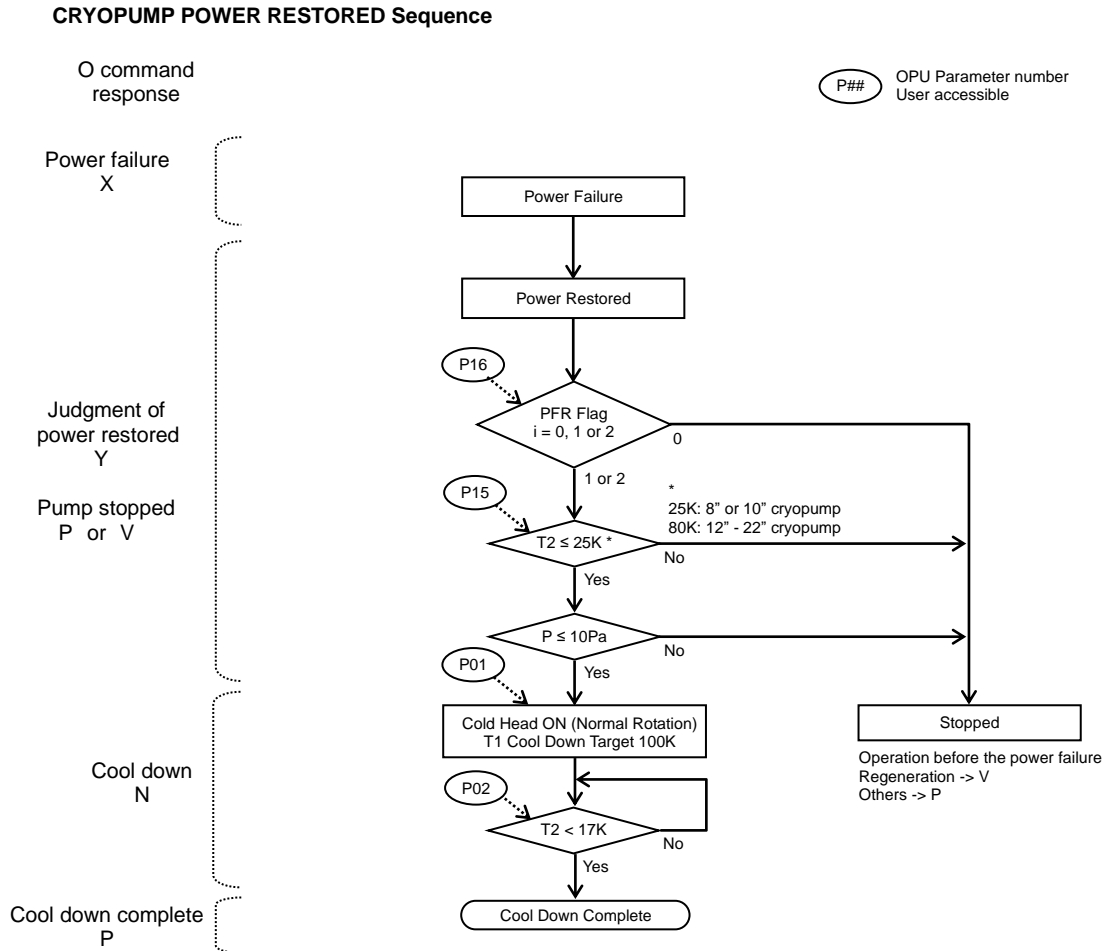


Figure 54 Cryopump Power Restored Sequence (1/1)

9-4 CRYOPUMP PARAMETER

Table 67 Cryopump Parameter

Item	Item name	Default	Note	Description
00P00	P/W		Password	Password for open user screen (User: 123)
00P01	Tgt T1	100 K*	T1 target temperature	1st cooling control temperature
00P02	Tgt T2	17 K	T2 target temperature	2nd cooling target temperature
00P03	H-Exp TM	0 min**	Extended purge time	(Full) extended purge time
00P04	H-RP ReP UL	3	Repurge cycle	(Full) repurge cycle upper limit
00P05	H-BU Rgh P	75 mTr	ROR base pressure	(Full) ROR base pressure
00P06	H-ROR	38 m/m	ROR threshold value	(Full) ROR threshold value
00P07	H-ROR UL	10	ROR cycle upper limit	(Full) ROR cycle upper limit
00P08	H-RP ReP TM	60 sec	Repurge time	(Full) repurge time
00P09	H-ExRgh T1	295 K	Extended roughing T1 limit	(Full) After start cooling, the cryopump keep roughing until 1st temperature become this temperature.
00P10	L-Rgh TstTM	150 sec	Fast rough test	(unused)
00P11	L-Ena T2	100 K	Fast regeneration enable T2	(Fast) 2nd temperature in which Fast regeneration can start
00P12	Rst DelayTM	0 min	Restart delay time	(Full) restart delay time
00P13	St DelayTM	0 min	Start delay time	(Full/Fast) start delay time
00P14	RV LOCK	0	Roughing valve interlock	0: Released 1: Active Do not change the parameter from 0 to 1. You will not be able to open the rough valve.
00P15	PFR T2 UL	25 K	T2 recool upper limit after PFR	Recooling upper limit of the 2nd temperature after power fail recovery (Only available when P0P16 is set to 1.)
00P16	PFR	1	PFR operation setting (0: no action, 1 and 2: recooling)	Power fail recovery operation setting (0: no action, 1 and 2: recooling; only available when 2nd temperature is below "P15")
00P17	ReC T2 UL	360 K	T2 recool upper limit by manual operation	Recooling upper limit of the 2nd temperature by manual operation Pump ON command (P##A1) is available when 2nd temperature is below this value.
00P30	SET PW	123	User password setting	Password setting for user screen
00P31	WARM TMOUT	90 min	Warm up time out value	Regeneration shall be aborted when the cryopump stays T1<300 K and T2<290 K for this period.
00P32	COOL TMOUT	300 min	Cool down time out value	After start cooling, regeneration shall be aborted when the cryopump stays T2>17 K for this period.
00P33	RV TMOUT	60 min	Rough valve open time out value	Regeneration shall be aborted when accumulative rough valve opening time excess this value.
00P34	COLD FOR RV	140 K	T2 lower limit for opening rough valve	Regeneration shall be aborted when the cryopump try to open the rough valve and the 2nd temperature is below this value.

* 00P01: The value is reference. It depends on the heat load.

** 00P03: Refer to Table 36 Recommended Parameter of Extended Purge Time.

9-5 COMPRESSOR PARAMETER

Table 68 Compressor Parameter

Item	Item name	Default	Note	Description
CP00	P/W	-	Password entry	Password entry to open user screen.
CP01	DP SV0	1.45 MPa	Differential pressure target 0	Targeted differential pressure 0 (1.45 MPa) (The change in the set point is reflected when the compressor is powered on.)
CP02	DP SV1	1.70 MPa	Differential pressure target 1	(unused)
CP03	DP SV2	1.20 MPa	Differential pressure target 2	(unused)
CP10	SET P/W	123	User password setting	Password setting for user screen
CP11	ADS TM CLR	0	Clear adsorber time	The adsorber operating hours is cleared to 0 when this parameter is set to 1. This parameter moves to 0 after clearing the adsorber operating time.
CP12	Inv vL	TM-50L: 60.0Hz TM-50H: 71.0Hz	Inverter base frequency	Inverter base frequency (read from the inverter)
CP13	Inv vLv	TM-50L: 200.0V TM-50H: 480.0V	Inverter base frequency voltage	Inverter base frequency voltage (read from the inverter)

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