

# MODEL *LR-Series/HR-Series* 60/90/180/300/600/1200/1800

# TYPE DRY VACUUM PUMP INSTRUCTION MANUAL

Read this manual before using this pump and keep it hand for immediate reference.

Components Division, ULVAC, Inc

#### Before Use

This instruction manual provides methods for proper handling and maintenance of LR/HR products. This manual consists of specification, installation, operation and maintenance, and each of section includes important information with which potential hazards can be avoided. It is essential to understand these methods described in this manual concerning the Specification, Operation and Maintenance.

Before to use this device, you are expected to receive a general safety-training course regarded as effective by the government of your country. Also, personnel who will involve these products should have licensed concerning electricity, mechanics, cargo handling and vacuum.

This manual might change for the improvement, the specification change of the product, and the improvement of easiness to use.

When you have some ambiguities concerning the operation, please contact with your local ULVAC service center and ask for the matter. Refer to 5.3 Servicing.

## ULVAC

For Safety Use

-This LR/HR series models are maintenance free except when to connect with the host equipment, or disconnect from it, and to regulate N2 gas flow at the time of operation. Overhaul or repair work is performed at ULVAC. When any trouble occurs, please contact with your local ULVAC service center (please refer to the ULVAC address list at the end of this manual).

- The interlock system and control system of the LR/HR series pumps are expected to be connected with the host equipment.
- The LR/HR series pumps are integrated into a host machine or are located close to the host machine (not more than 3m of travel to the next EMO button).
- Connect the power line of the LR/HR series with the EMO system of the host equipment.
- The gas which can be exhausted with this LR/HR series pump, it provides for inert gas(Air,N2,Ar).
- Do not exhaust other gases (toxicity gas, combustion gas, corrosion gas, and explosiveness gas).
- Set up this LR/HR series pump at ventilated room.
- These products are manufactured to conform with laws applied at the time of the preparation of this manual. When the applied laws are revised in the future, the legality of these products will not be ensured.
- If the host equipment of these products does not conform to the same laws, or if the products are modified, then the performance and safety of these products should not be insured. ULVAC should not have a responsibility in such a case.
- Personnel who have no record of formal safety training course regarded by your government (safety for electricity, cargo handling, etc) should not operate these products. Operator should have finished these-safety training course.
- Installation and operation of these products should be performed according to the applicable local safety codes and laws (e.g. fire fighting law, electric installation code, etc).
- Before starting installation or removal work of this products, shut off all the energy sources (electricity, compressed air, cooling water, etc.).

#### Safety Denotation

For this manual and for warning denotation of LR/HR series models, technical terms are defined according to the hazardous levels, with which workers should understand the rules to be followed.

- Articles attached with these denotations, describe countermeasures for potential hazards.



: Failure to comply with this instruction involves the possibility of impending death or serious personal injury.



: Failure to comply with this instruction involves the possibility of death or serious personal injury.



: Failure to comply with this instruction involves the possibility of a medium degree of personal injury or serious damage to the equipment.



: Matter for which attention is necessary for using pump.





: Because this work has the danger of the burn, it is necessary to confirm the temperature of the pump has fallen.

# Warning Label

Warning labels are attached on the warning locations in this system. Be sure to check them before starting operation of the Pump.

1		Before use, read through the instruction manual and fully understand its contents.
2	4	<ul> <li>You may get an electric shock in the area around a portion with this warning label. Before maintenance or wiring, be sure to turn off the primary power supply.</li> <li>Be sure to close the lid of the terminal box before operating this unit. Never open it during operation.</li> </ul>
3		During operation or for a while after operation stops, do not touch the unit as each portion is at a very high temperature. - If a human body touches the unit, it may get burned.
4		Long term storage of the Vacuum pump without operation might possibly cause trouble in operation caused by rust if you kept the Pump long time without operating it, ask a closest Service Center for the check. Indoor Use Only
5		<ul> <li>There is a serious risk of injury due to suction.</li> <li>Sufficient purging gas system</li> <li>Wear appropriate protective equipment and clothing</li> </ul>



#### ULVAC

The method for the evasion of danger according to the work item is shown.

And the dangerous action, which should not be done, is shown.

#### Installation and Storage Requirements



- This product is packed in the wooden crate. Please request dismantlement to a special trader.
- Please guide equipment with the glove made of the skin, and the use of an appropriate dismantlement tool to those who dismantle it.
- When taking out the pump from wood frame, or lift it, instruct workers that the product should be hung by a crane at the pump top hook, then move it.
- Only licensed worker can perform cargo handling or operate the lording machines.
- When handling is performed improperly or unpack tools are improperly maintained, there will be possibilities of falling down or topple of the pump, so no person should be underside of the pump.

#### Transit



- Although this pump is provided with casters, do not move it a long distance using these casters.
  - If you move this pump in such a way, the load exceeds the safety criterion. You could hurt your waist.

#### Earthquake Resistant Measures



- To provide earthquake resistance, the pump should be tightly fixed according to the diagram below. If it is loosely installed, then the pump could topple or move and will produce damages for peripheral devices.
- Piping for vacuum, cooling water, nitrogen, and wiring, should be constructed so that they can absorb vibration and should not produce damages on piping or run off within defined vibration level.

#### Piping for inlet-outlet ports <Installation>



• Before start work, ensure that all hazardous energies are shut off. Refer to 2.1 For Safety Use.

#### Nitrogen Gas Piping <Installation>



• Before start work, ensure that all hazardous energies are shut off. Refer to 2.1 For Safety Use.

Use the supplied nuts and ferrule for piping work.

#### Cooling Water Piping <Installation>

WARNIN

Before start work, ensure that all hazardous energies are shut off. Refer to 2.1 For Safety Use.

#### Power wiring <Installation>

WARNIN

• Before start work, ensure that all hazardous energies are shut off. Refer to 2.1 For Safety Use.

WARNIN

- Wiring work should be performed by licensed workers.
- Use the supplied connectors only. If other connectors are used, the first ground contact may fail, and raise the possibility of electrical shocks.

#### Stop

- The pump is very hot during operation and for some time after it stops. Contact with it may cause burn. Feed cooling water for about one hour after the pump is shut down. Never remove the external panel until the pump cools down.
- Contact with electric parts, wiring or others in the panel may cause electric shock. Never run the pump with the external panel removed.
- Suction and the exhaust pipe are 70°C or more. Remove the protection cover after about one hour after the pump is shut down.

#### Power wiring < Detaching>

• There is danger of the electric shock when the breaker (MCB1) is turning on (SEMI S2-0200 type4). Please cut off the power supply surely before it detaches it.

WARNIN

#### Cooling water < Detaching >



- Because cooling water in the pump boils when the collaboration of cooling water is removed immediately after the stop of the pump and pressure rises the sensor and piping might be damaged. Please supply cooling water until the temperature of the pump falls.
- The pump is very hot during operation and for some time after it stops. Contact with it may cause burn. Feed cooling water for about one hour after the pump shut down.
- Close the cooling water supply valve (HWSV). After the valve is closed, tag 「CLOSE」 sign on the grip.
- Through visual flow gauge (HWFM: e.g. flow sight) on the host equipment ensure that flow is shutoff.
- When compress air is supplied from cooling water inlet, the measurement part of the sensor might be damaged. Please supply compress air from cooling water outlet.

#### Nitrogen Gas <Detaching>

WARNIN

- Close the nitrogen gas supply valve (HPSV) on the host equipment. After the valve is closed, tag [CLOSE] sign on the grip.
- Gas will still remain in the host equipment piping. Place pressure gauge on the host equipment nitrogen supply source (halfway of the piping to the pump), and ensure that the pressure has already down within atmospheric pressure.

#### Suction and exhaust gases <Detaching>

- Remove the piping according to the manual provided for the host equipment.
- Suction and exhaust pipe is very hot for some time after pump stop. Remove the protection cover after about one hour after the pump is shut down.

WARNIN

• Completely close the inlet and outlet ports with using closing flange.

#### Shipping

	WARNIN
•	Although this pump is provided with casters, do not move it a long distance using these casters.
ullet	If you move this pump in such a way, the load to move the pump exceeds the safety criterion. You
	could hurt your waist.

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# 1. Specification

#### Design concept

This LR/HR series models are designed to perform vacuum pumping for electronic devices (such as semiconductor and LCD) manufacturing equipment. Consequently, the interlocking system and control system of this LR/HR series are assumed to be built-in to the host equipment.

LR/HR series can be used generally in the following processes:

- Chamber vacuum pumping in spattering or vapor deposit processes in which only inert gases (nitrogen or argon) are used.

- Vacuum pumping for chambers where devices are set or taking out (air pumping).

- Other general vacuum pumping (low hazardous level gases: gases no toxicity, no inflammable, no corrosive and no explosive).

Performance and Configuration

LR/HR series have a performance of vacuum pumping in pressure regions from atmospheric pressure through medium vacuum pressure (about 5Pa). And LR/HR series have nine variations of speed to support various equipment.

LR/HR60, LR/HR90 and LR/HR180 are composed of the primary dry vacuum pump unit.

LR/HR300, LR/HR600, LR/HR1200 and LR/HR1800 are a composition in which the booster pump is added to the upside of LR/HR60, LR/HR90, and LR/HR180.

As for this manual, important information to use these products safely has been described.



### Please read before it uses it.

#### 1.1 Overall Configuration

#### 1.1.1 Pump Structure

As for a primary pump, the root rotor of six pairs queues up in the series. Casing space is gradually reduced toward the outlet. The booster pump is composed of the root rotor of big capacity by one stage.

The two rotors are positioned with a small allowance gap and rotate in opposite directions without contact with each other. Gases is introduced from the top of casing and pass through toward the bottom of it, then spew out from the outlet port.

The aluminum alloy casting is used for the main parts which compose the pump. And the aluminum surface is treated with a special process.

Canned motor is used to drive the rotors. This can eliminate the shaft seal construction, this improved the reliability of the device.



The pump is completely clad with panels.

The main body of the pump and electrical equipment, the sensor, the N2 adjustment equipment, and the cooling water piping, etc. which drive it are laid out in the package.



# 1.1.2 System Flow

N2, cooling water and power supply is required.

#### Nitrogen gas system

Nitrogen gas flows in two lines in the pump, one for the shaft seal and the other for gas ballast (attenuation).

The shaft seal prevents lubricating oil from entering the pump casing.

Gas ballast gas is fed to the pump casing to reduce corrosion by corrosive gas and accumulation of reactive products, or to reduce liquefaction during the compression and pressurization process of the pump after sucking the condensable gas. If you do not exhaust these gases, you do not need to run gas ballast gas.

#### Cooling water system

Cooling water flows from the cooling water inlet port to the flow meter, motor, pump body, and cooling water outlet port in that order to cool the pump.







HR60, HR90, HR180



ULVAC

HR300, HR600, HR1200, HR1800



#### Electrical system has two lines of power line and control line.

A sensor is mounted in the system, which is constantly monitoring operation.

When the sensor detected abnormal situation, it will activates buzzer, LED and remote control to output warning signal.

You can operate the pump using pendant controller for local operation (LOCAL), or using electric signal through the remote controller for remote control (LEMOTE).

#### Electrical system

#### • Power line

Wiring is arranged from the power connector to the motor through the breaker (with thermal relay), allowing the motor to be protected by the pump alone.

#### • Control line

The pump monitors the cooling water flow rate, nitrogen gas flow rate, electric current value, and pump temperature at all times and gives alarm in two steps if any trouble occurs.

#### • When WARNING is displayed

In case of WARNING alarm, pump operation is continued.

If the pump is stopped when the WARNING alarm is given, the alarm is held. The alarm can be reset by pressing the RESET switch. (The buzzer sound can be stopped with the BZ MUTE switch.)

#### • When ALARM is displayed

If the cause of WARNING alarm is not eliminated, the pump will be shut down automatically. The ALARM is held even when the pump is shut down. The alarm can be reset with the RESET switch. (The buzzer sound can be stopped with the BZ MUTE switch).

# 1.2 Specifications for utilities

#### Specification

Spec		Model	LR/HR60	LR/HR90	LR/HR180	
Maximum pumpir	ng speed	50 Hz	62(1030)	112(1860)	183(3100)	
m3/hr (L/mi	n)	60Hz	80(1333)	126(2100)	237(3950)	
Maximum inle	t pressure (	Pa)		Atmospheric pressure		
Ultimate pr	ressure (Pa)			$5.0^{2)}$		
Maximum exhaust pressure		ıre	Atmospheric pressure			
Tulat diamatan	Standard		VG50	VG80	VG80	
Inlet diameter	CE		NW40	NW50	NW50	
Outlet diameter			NW40			
Lubrico	tingoil		BARRIERTA J100F, J100FE			
Lubricating oil			0.5L	0.9L	1.5L	
Grease		BARIERTA JFE552HV				
			23.8g	30.0g	37.4g	
Weight (kg)		180kg	245 kg	335 kg		

Spec Model			LR/HR300	LR/HR600	LR/HR1200	LR/HR1800		
Booster Pump			PRC-003A	PRC-006A	PRC-012A	PRC-018A		
Primary	Pump		LR/HR60	LR/HR90	LR/HR90	LR/HR180		
Maximum pumping	speed	50 Hz	359(5980)	653(10900)	1012(16900)	1701(28350)		
m3/hr (L/min)	)	60 Hz	365(6080)	701(11700)	1051(17500)	1784(29700)		
Maximum inlet	pressur	e (Pa)		Atmospheric pre	ssure or 200Pa <sup>1)</sup>			
Ultimate pre	ssure (F	Pa)		0.6	7 2)			
Maximum exha	ust pres	ssure	Atmospheric pressure					
Inlat diamatan	Sta	ndard	VG80	VG80	VG100	VG150		
iniet diameter		CE	NW80	NW80	NW100	NW100		
Outlet dia	ameter		NW40					
		DDC	BARRIERTA J60F					
				ГКС	0.7L	1.5L	1.9L	1.9L
Lubricating oil			BARIERTA J100F, J100FE					
Grease	Grease HR	IID	0.5L	0.9L	0.9L	1.5L		
		BARIERTA JFE552HV						
			23.8g	30.0g	30.0g	37.4g		
Weight	(kg)		275kg	370kg	420kg	545kg		

1) Maximum inlet pressure of HR300, HR600, HR1200, and HR1800 is 200Pa. Other models are atmospheric pressure.

2) The ultimate pressure is a value when the seal gas is 5SLM and the gas ballast gas is 0SLM.

#### Utility Requirements

Power			3 phase : 200 VAC, 50/60 Hz : 220 VAC, 60 Hz				
	Model name		LR/HR60	LR/HR90	LR/HR180		
Current <sup>3)</sup>	At max. load (A) LR/HR (60Hz)		7.0/7.3	11.8/11.8	20.6/21.1		
	At ultimate pressure (A) LR/HR(60Hz)		6.9/7.1	11.2/11.2	18.9/19.6		
	Supply pres	ssure (MPa)	0.1 to 0.3				
Cooling	In/out difference pressure (MPa)		0.1				
water	Flow rate (	L/min)	5.0				
	Supply wat	er temperature (°C)	$10 \text{ to } 30^{4)}$				
	Supply pres (MPa: gaug	ssure ge pressure)	0.1 to 0.5				
Purge	Regulated pressure		0.05				
gas	(MPa: gauge pressure)		(Regulated pressure in pump)				
		Shaft seal (SLM)	5				
	Flow rate	Gas ballast (SLM)	0 to 45				

Power			3 phase : 200 VAC, 50/60 Hz : 220 VAC, 60 Hz				
	Model name		LR/HR300	LR/HR600	LR/HR1200	LR/HR1800	
Current <sup>3)</sup>	At max. load (A) LR/HR (60Hz)		9.6/8.1	19.0/13.8	24.2/18.9	39.8/29.7	
	At ultimate pressure (A) LR/HR(60Hz)		7.0/7.8	12.3/12.9	13.7/15.4	21.4/24.0	
	Supply pressure (MPa)		0.1 to 0.3				
Cooling	In/out difference pressure (MPa)		0.1				
water	Flow rate (L/min)		5.0				
	Supply wat	er temperature (°C)	10 to 304)				
	Supply pressure (MPa: gauge pressure)		0.1 to 0.5				
Purge	Regulated pressure		0.05				
gas	(MPa: gauge pressure)		(Regulated pressure in pump)				
		Shaft seal (SLM)	$5^{5)}$				
	Flow rate	Gas ballast (SLM)	0 to 45				

3) The current at the maximum load of HR300/600/1200/1800 has described the maximum current in the use-pressure range(Atmospheric pressure to 200 Pa).

4) Not condensing.

5) The flow rate of shaft seal gas is 5SLM fixation.

Chemical matters used in this pump



Primary pump

- Pump oil BARRIERTA J100 FLUIDE, J100 FLUIDE E (NOK KLUBER)
- Bearing grease BARRIERTA JFE552HV (NOK KLUBER)
- Booster pump (LR/HR300, LR/HR600, LR/HR1200, LR/HR1800)
  - Pump oil BARRIERTA J60 FLUIDE (NOK KLUBER)

Above oils are used for bearing lubrication. LR/HR series requires no oil supply for maintenance. We will replace the oil at the time of in-house overhaul. The reclaimed oil is legally dumped by qualified traders.

These oils are chemically stable, but when it is heated (burned), it will generate toxic gases. Do not burn these oils. The oils should be reclaimed and legally dumped by qualified traders.

Make sure to keep in compliance with the laws and regulations established by the local governments to dispose the Vacuum pump. You should ask the dedicated disposal agency for the disposal particularly if the Pump has exhausted any toxic gas.

Note that you are requested to bear the cost and charges relating to the disposal.

# 1.3 Dimensional Drawings

#### Standard type





























### 1.4 Description of Controller



No.	Control	Sign	Function
1	START switch	START	Starts the pump.
2	STOP switch	STOP	Stops the pump.
3	MODE switch	MODE	Selects a setting item.
4	Input change switch	$\bigtriangledown$	Changes over the set value. Changes the selected content of setting.
5	ENTER switch	ENTER	Determines the selected item and setting.
6	RESET switch	RESET	Resets the alarm.
7	BZ MUTE switch	BZ MUTE	Stops buzzer sound.
8	REMOTE/LOCAL switch	REMOTE / LOCAL	Changes over the REMOTE/LOCAL mode.
9	Display	LCD	Displays the current status with characters.
10	RUN lamp	LED1 (green)	The lamp lights when the pump starts.
11	REMOTE lamp	LED2 (green)	The lamp lights when the pump is running in the REMOTE mode.
12	WARNING lamp	LED3 (orange)	The lamp lights when WARNING is given.
13	ALARM lamp	LED4 (red)	The lamp lights when ALARM is given.
14	Buzzer	BZ	The buzzer sounds in case of WARNING or ALARM.

When any trouble occurs, LED3 (orange : No12) and LED4 (red : No13) on the controller will light and warning buzzer sounds. Detailed information will be indicated on the LCD



\* Refer to the System chart

#### 1.6 Performance Curve





2. Installation

# 2.1 For Safety Use



-This LR/HR series models are maintenance free except when to connect with the host equipment, or disconnect from it, and to regulate N2 gas flow at the time of operation. Overhaul or repair work is performed at ULVAC. When any trouble occurs, please contact with your local ULVAC service center (please refer to the ULVAC address list at the end of this manual).

- The interlock system and control system of the LR/HR series pumps are expected to be connected with the host equipment.
- The LR/HR series pumps are integrated into a host machine or are located close to the host machine (not more than 3m of travel to the next EMO button).
- Connect the power line of the LR/HR series with the EMO system of the host equipment.
- The gas which can be exhausted with this LR/HR series pump, it provides for inert gas(Air,N2,Ar).
- Do not exhaust other gases (toxicity gas, combustion gas, corrosion gas, and explosiveness gas).
- Set up this LR/HR series pump at ventilated room.
- These products are manufactured to conform with laws applied at the time of the preparation of this manual. When the applied laws are revised in the future, the legality of these products will not be ensured.
- If the host equipment of these products does not conform to the same laws, or if the products are modified, then the performance and safety of these products should not be insured. ULVAC should not have a responsibility in such a case.
- Personnel who have no record of formal safety training course regarded by your government (safety for electricity, cargo handling, etc) should not operate these products. Operator should have finished these-safety training course.
- Installation and operation of these products should be performed according to the applicable local safety codes and laws (e.g. fire fighting law, electric installation code, etc).
- Before starting installation or removal work of this products, shut off all the energy sources (electricity, compressed air, cooling water, etc.).

Following are description concerning with potential hazards and the method to avoid these hazards:

Location of vacuum pump in host device



It is assumed that the pump stops suddenly when the interlock of the host device does not synchronize with the interlock of the facility. It is necessary to manage utility to give preventive measures. Do not use the utility not managed.

#### Power Wiring

- This LR/HR series pump is locked out in intercepting cooling water, the N2 gas, and the power line. Give the system which can lock out on the host equipment.
- Material selection, installation and operation of wiring should be done according to the rules and codes applied in your country (e.g. fire fighting law, electric installation code, etc).
- For serious situations such as abnormal current or voltage, the products are provided with safety devices (e.g. noise filter) with which these abnormal situation can be avoided. To release the leaking current securely, the power wiring (cable terminal of the host equipment) should be directly connected to the terminal board (breaker).
- Though these products are provided with breaker (MCB1, MCB2 (LR/HR300, LR/HR600, LR/HR1200, LR/HR1800, LR3600)), inner wiring from power connector through the breaker (MCB1, MCB2) is keeping hot. To completely shutoff the electricity, provide a breaker (M/D: AIC 10kAV or above) to the host equipment.
- Heater (AC200V) is installed in the exhaust pipe. Obtain the protection cover according to "finger safe" which are the rule and the law concerning safety in the country.
- When to perform installation or removal of these products, the power should be shutoff completely according to the following diagram.



Current value at the maximum load and inverter and driver's INPUT current are shown in the following (current which flows to inverter and driver immediately after turning on of power supply).

Please select the electric wire, which the electric wire specification can be allowed referring to current at the maximum load.

Please confirm that the size of the electric wire is a size of the electric wire, which the connector can be allowed.

#### LR/HR60, LR/HR90, LR/HR180

Power		3 phase : 200 VAC, 50/60 Hz : 220 VAC, 60 Hz			
	Model name	LR/HR60	LR/HR60 LR/HR90		
Current	At maximum load LR/HR (60Hz)	7.0⁄7.3	11.8/11.8	20.6/21.1	
(A)	Inverter and driver's INPUT current				
Size of recommended electric wire		14AWG	10AWG	10AWG	

#### LR/HR300, LR/HR600, LR/HR1200, LR/HR1800

Power		3 phase : 200 VAC, 50/60 Hz : 220 VAC, 60 Hz			
	Model name	LR/HR300	LR/HR600	LR/HR1200	LR/HR1800
Current	At maximum load LR/HR (60Hz)	9.6⁄8.1	19.0/13.8	24.2⁄18.9	39.8⁄29.7
(A)	Inverter and driver's INPUT current	6.4	15.1	24.0	33.0
Size of recommended electric wire		10AWG	10AWG	10AWG	6AWG


#### << Possible electric shock hazard>>

If you have no record of electrical safety training course you should not perform the operation.

1. Shut off the breaker (MCB1, MCB2 (LR/HR300, LR/HR600, LR/HR1200, LR/HR1800)) of the pump.

2. Ensure that LCD of the controller (PCTL) is off.

3. Shutoff the breaker (M/D) of the host equipment.

4. Make lockout and tag-out according to the host equipment instruction manual.

5.Through current indication lamp, which may be provided in the host equipment, ensure that wire is not alive.

6. Remove power connector.



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- The noise filters etc. are used to maintain the tolerance to the electrical noise to these products. The electrical noise (current) is leaked from the noise filter to the ground line. Therefore, a certain earth of the ground line is necessary.

- These products are classified with the "High Leakage Current" product, and the plug connections etc. are prohibited.

- Please fix the power line wiring directly to the terminal or the breaker, etc.



#### << Possible electric shock hazard>>

If you have no record of electrical safety training course you should not perform the operation.





The noise filter is used to maintain the tolerance to an electric noise to this product. Therefore, a high Leakage current flows to do Leakage from the noise filter to the ground line.

The model and the Leakage current of the noise filter used for the CE specification of each model are shown.

The model and the Leakage current of the noise filter

Model name	LR/HR60		LR/H	IR90	LR/HR180	
Noise filter (SCHAFFNER)	FN 258-16/29 FN 258		8-30/33		FN 258-30/33	
Leakage current (200V/50Hz) mA	50.0		65.0		65.0	
Model name	LR/HR300	LR/HR600		LR/HR12	200	LR/HR1800
Noise filter (SCHAFFNER)	FS 5559-35/33	FS 5559-60/33		FS 5559-6	0/33	FS 5559-60/33
Leakage current (200V/50Hz) mA	8.2		8.2	8.2		8.2

#### Cooling water

- LR/HR series models use cooling water. The products are designed and tested as leakage free for the conditions defined. Nevertheless, for conditions which departed from the criteria (e.g. abnormal high water pressure), may produce leakage. In that case, the leakage will continue unless water supply from the host equipment is shut off. Electric devices or wiring should not be arranged at the bottom of the pump or on the floor around it.

- When the leakage occurs at the position of supply side from the pump mounted flow sensor (WFM), the sensor will warn the leakage. But, if the decrease of the cooling water head level does not reach the warning level, the sensor cannot detect the leakage.

- Place water leakage sensor on the floor at the pump bottom, and connect it to the host equipment interlock system. When a water leakage is detected, close the cooling water valve (HWSV) at once. After the valve is closed, tag a **CLOSED** sign on the grip.

- Fix a flow gage (HWFM: e.g. flow sight) on the host equipment and make it possible to check if the cooling water is flowing.

- A drain port is provided at the bottom of base. This port should be connected with reliable drain outlet in case of a water leakage. The drainage requires adequate level difference.

- When to perform a work, there will be possibility of water leakage. Fix valves which compatible with the host equipment piping connector at the cooling water inlet-outlet.

## Nitrogen gas

- LR/HR series models use nitrogen gas. The products are designed as leakage proof devices and tested under the conditions defined. Nevertheless, for conditions departed from the criteria (e.g. abnormal high gas pressure), there may be gas leakage.
- Set up this LR/HR series pump at ventilated room.
- Fix valve (HPSV) to shut off nitrogen gas supply.
- When to remove this products from the host equipment, close the nitrogen gas supply valve (HPSV) on the host equipment. After the valve is close, tag a **CLOSED** sign on the grip.
- There will be remaining gas in the host equipment piping. Fix a pressure gauge on the host equipment nitrogen supply source (midpoint of the piping to the pump), and then ensure that the pressure is reduced to the atmospheric pressure. When to perform work, if the internal gas pressure is high, the piping will be abruptly removed and injury could occur.

# Suction and exhaust gases.

- ULVAC specifies gases which can be exhausted by the pump. When the pump is used to exhaust other gases (e.g. toxic gas, combustible gas, corrosive gas and explosive gas), there could be serious accidents. These gases should not be applied to the pump.

# High temperature surfaces

- The temperature of the intake pipe and the exhaust pipe becomes  $70^{\circ}$ C or more. Set up the protection cover when the connection of the piping of the intake and the exhaust ends.
- Moreover, the protection cover is preparatory by the option.
- LR/HR series models are designed to prevent any hazard which caused by heat. However, when the temperature of the gas is extremely high, then the surface of the device could be high temperature. Warning labels are attached at the positions where the temperature could result a serious injury.



<< High temperature surface >>

Be careful of the high temperature surface near this label (intake and exhaust outlet...).

# Controlling wiring (power supply group units included)

- Be careful not to insert things into the fan louver.
- A protection circuit should be mounted in the host equipment so that the connector pins of the remote connector not receive voltage higher than 24Vdc.

# EMC

- EMC performance of these products can be obtained under the conditions prescribed by the EMC instruction. The performance does not be guaranteed under unstable environment exceeding this standard level. To keep the EMC performance, use sealed cable and separate the products from components which generate noises (e.g. power switch, inverter, etc.), then check the noise level (conduction and emission) coming from host equipment is within criterion.

## EMO

- EMO should be established as a total system including the host equipment with which this LR/HR series models will be installed (if only a pump unit suspends it's operation, the total system could be hazardous). Pump suspension matter should be incorporated with the host equipment EMO sequence of the total system, to shut off the power.

#### 2.2 Installation and Storage Requirements

#### 2.2.1 Unpack

LR/HR series models are packed in wood frames. Unpack work should be performed by expert trades.

• This product is packed in the wooden crate. Please request dismantlement to a special trader.

- Please guide equipment with the glove made of the skin, and the use of an appropriate dismantlement tool to those who dismantle it.
- When taking out the pump from wood frame, or lift it, instruct workers that the product should be hung by a crane at the pump top hook, then move it.
- Only licensed worker can perform cargo handling or operate the lording machines.
- When handling is performed improperly or unpack tools are improperly maintained, there will be possibilities of falling down or topple of the pump, so no person should be underside of the pump.



- Instruct the workers to wear leather gloves and use proper tool to avoid injuries caused wood frame debris and nails.
- Do not tilt the pump by more than  $10^\circ\,$  .

Upon receipt of this products, make sure that the products is the correct model you ordered and that it is free from damage in transit.

#### List of Accessories

Description	Q'ty
Nitrogen inlet joint	1 pc.
Power connector	1 pc.
Remote operation connector	1 pc.
RS-232C/RS-485 communication connector	1 pc.
Quick Manual	1 copy



: If there are some problems, please contact with our office within one-week period.



: Although this pump is provided with casters, do not move it a long distance using these casters. If you move this pump in such a way, the load exceeds the safety criterion. You could hurt your waist.

When to transit the pump, you should use loading machines (e.g. moving crane) and hang it, or load and fix the pump on a pallet, then transit it by pallet truck.



- Do not tilt the pump by more than  $10^\circ\,$  .

- Pallet truck should not directly be placed under the pump base bottom. This could topple the pump.



### 2.2.3 Environmental Requirements for Installation

Following installation and storage requirements should be met.

Storage and installation requirements

Description	Requirement
Temperature and humidity (for storage)	- 30 - $60^{\circ}~$ C, less than 95%RH
Temperature and humidity (for operation)	$5$ - $40^{\circ}$ C, less than $95\% RH$
Above sea level	Not exceeding 1000m
Outside vibration	Not exceeding 0.5G

\* Not condensing

#### 2.2.4 Other Requirements

CAUTION

- Set up and keep this LR/HR series pump at ventilated room.

- Before storage, drain the pump. If water is remaining in the pump, it will be freezing at a low temperature (below 0°C) and may damage the components.

- Do not lay two pumps one on the other nor lay the pump on its side during storage.

- After moving the pump to the place of installation, adjust the jack to set it in a horizontal position (adjustable range is + 10 mm).

- Do not tilt the pump by more than 10° when moving it.



WARNING

#### 2.2.5 Earthquake Resistant Measures

- To provide earthquake resistance, the pump should be tightly fixed according to the diagram below. If it is loosely installed, then the pump could topple or move and will produce damages for peripheral devices.

- Piping for vacuum, cooling water, nitrogen, and wiring, should be constructed so that they can absorb vibration and should not produce damages on piping or run off within defined vibration level.



Earthquake-proof strength was examined based on the demands postulated of 1997 version United States union construction standard (UBC).

Please refer to the next table for a fall moment, the horizontal load, and the center of gravity position.

ULVAC, Inc. Components Div. Date : November 25, 2002

#### Antiearthquake procedures

		unit	LR/HR60	LR/HR90	LR/HR180	LR/HR300	LR/HR600	LR/HR1200	LR/HR1800
The maximum width on surface of projection which falls easily	L1	mm	370	420	520	378	470	470	520
Short distance from fulcrum on surface of projection which falls easily to center of gravity position	L2	mm	161	180	222	161	205	200	223
The distance from rear panel to center of gravity position	L3	mm	383	403	465	491	529	517	661
Height from floor side to center of gravity position	h	mm	242	258	307	445	488	580	606
Weight of device	Wp	kg	180	245	335	275	370	420	545
Horizontal pressure(Adjuster) Fp=0.94*Wp	Fp/4	kg	42.3	57.6	78.7	64.6	87.0	98.7	128.1
0.94*h>=0.85*L2			OK	OK	OK	OK	OK	OK	OK
Fall power R=(Wp*(0.94h-0.85L2))/(2*L1)	R	kg	22.0	26.1	32.2	102.4	111.9	167.6	199.3
Shearing power of anchor bolt (M10)	τ		1537	1537	1537	1537	1537	1537	1537
Fp< τ			OK	OK	OK	OK	OK	OK	OK
Tensility of anchor bolt(M10)	σ		2300	2300	2300	2300	2300	2300	2300
R< σ			OK	OK	OK	OK	OK	OK	OK
Jack interval	J1	mm	378	428	528	378	428	428	528
Earthquake-proof Bracket interval	J3	mm	556	610	655	556	610	610	655
Fall angle	α1	deg	38.0	39.7	40.7	23.0	23.7	20.3	23.5
Earthquake-proof Bracket interval	J2	mm	440	490	590	440	540	540	590
Fall angle	α2	deg	42.3	43.5	43.9	26.3	29.0	25.0	25.9
$\alpha > 15 \deg$			OK	OK	OK	OK	OK	OK	OK



#### 2.3 Piping

2.3.1 Piping for inlet-outlet ports



: Before start work, ensure that all hazardous energies are shut off. Refer to **2.1 For Safety Use**.



- LR series has installed flange for keeping and the suction entrance mesh on the suction entrance flange.

- HR series has installed flange for keeping on the suction entrance flange. The suction entrance mesh has not been installed. Please do not remove flange for keeping until the time of connected work of piping to prevent the foreign body fall in the pump.

- When connecting piping, be careful not to drop foreign matter (e.g. bolt) into the inlet/outlet port of the pump. If something was dropped into these port, then the pump should be disassembled to removed the matter from the pump, so contact with the your local service center.

- The pump flange should not be loaded directly (refer to 2.4.5 Earthquake Resistance Measures).

- Be careful not to damage the gasket surface. After the completion of the piping work, perform gas leak test for the whole system.

- If thin metal piping, bellows or the likes are used, the pulsing stream of gas in piping may produce pipe resonance, and the sound could exceed the work environment sound criteria if the piping, bellows or the like are made with thin metal wall. Provide material of adequate thickness.

- The temperature of the intake pipe and the exhaust pipe becomes  $70^{\circ}$ C or more. Set up the protection cover when the connection of the piping of the intake and the exhaust ends.

- When the pump is driven, AC200V is energized to the exhaust pipe heater. Obtain the protection cover so that the hand should not touch the heater part after connecting the exhaust pipe.

- Moreover, the protection cover is preparatory by the option.



- - Installation protection cover to the exhaust heating element.
- ■- Specification for Connection : refer to **1.3 Dimensional Drawings**.
- - Compatible Piping : Use pipe materials which compatible with your local rules and laws concerning to safety.

Piping should not produce rust. Heat resistance performance should be more than  $100^\circ\,$  C.

#### 2.3.2 Nitrogen Gas Piping



: Before start work, ensure that all hazardous energies are shut off. Refer to  ${\bf 2.1}$  For Safety Use.

: Use the supplied nuts and ferrule for piping work.

■ Connection Requirements : Swage-lock for 6.35mm-diameter pipe

■ - Proper Piping : Use SUS pipe of outside diameter of 6.35mm-diameter with more than 0.9mPa pressure proof joints.

Nitrogen	Supply gas j	pressure MPa: reading on gauge)	0.1 to 0.5		
	Regulated p	ressure	0.05		
gas	(	MPa: reading on gauge)	(Regulated pressure in pump)		
-	Flow rate	Shaft seal (SLM)	0 to 5		
		Gas ballast (SLM)	0 to 45		

#### 2.3.3 Cooling Water Piping



: Before start work, ensure that all hazardous energies are shut off. Refer to **2.1 For Safety Use**.



- If two or more pumps are used, connect them in parallel, if connected serial, then the cooling performance will be reduced and resulted a failure.

- Do not mistake the cooling water inlet and outlet.

- If cooling water contains much scale or impurities, filter it with a filter in the fore stage.

- It is difficult to accomplish an adequate flow rate when water supply source is far distant from drain outlet, or piping level is uneven (the drain outlet level is higher than that of the pump).

In this case, improve the piping arrangement, or use larger sized pipe, or increase the water pressure within specified pressure scope.

- Only stainless steel pipe is used for cooling water piping of the dry pumps. Please note that troubles because of following causes shall be paid service, due to choked pipe and drop of cooling efficiency by deposition and accumulation of impurities (water stain, microorganism, metal powder and metal ion).

- Do not use any metal pipe other than stainless steel pipe in the cooling water system (including host side). Ions could be merged into water, if metal pipe such as copper and zinc are included is used. Cooling water flow rate could be decreased because merged ion accumulates and adheres to the inner wall of the pipe.

- It is recommended to use water which does not include any impurities (e.g. industrial water. See table below). Keep in mind not to use poor quality of water because metal ion could be included in cooling water even inlet side of cooling water is clean. Water stain such as calcium carbonate could be accumulated in cooling water system depending on water quality and it could made cooling efficiency low. In addition, there could be cooling water leakage because of corrosion from the inner wall of water pipe by chlorine ion.

- The pump could be damaged if it continuously runs with cooling water flow rate lower than specified amount. Make sure to keep specified flow rate.

#### [Reference]Standard Water Quality of Industrial Water

Turbidity	рН	Alkalinity CaCO3	Hardness Mg, CaCO <sub>3</sub>	Evaporation residue	Chlorine ion Cl <sup>−</sup>	Iron Fe	Manganese Mn
mg/L	-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
20 max.	6.5-8.0	75 max.	120 max.	250 max.	80 max.	0.3 max.	0.2 max.

Established by: Japan Industrial Water Association ■ - Connector Requirement : Connector port Rc3/8 female

■- Compatible piping : Joint and pipe should have water pressure resistance of more than 0.9Mpa, and heat resistance of more than 100°C.

	Supply pressure (MPa)	0.1 to 0.3
Cooling	Inlet-outlet pressure difference (MPa)	0.1
water	Flow rate (L/min)	5.0
	Supply temperature	10 to 30 1)

1) Not condensing

# 2.4 Wiring

2.4.1 Power wiring

Object model: LR/HR60, LR/HR90, LR/HR180

: LR/HR300, LR/HR600, LR/HR1200, LR/HR1800



: Before start work, ensure that all hazardous energies are shut off. Refer to **2.1 For Safety Use**.

Wiring work should be performed by licensed workers.

$\frown$	Pin assig	gnment
DA	Pin No.	Specification
	А	R phase
	В	S phase
	С	T phase
	D	PE/GND

#### Specifications

Pump model (LR/HR Series commonness)	LR/HR60	LR/HR90	LR/HR 180	LR/HR 300	LR/HR 600	LR/HR 1200	LR/HR 1800
Connector regulation							
Receptacle Insert array / Contact type			32-17 / Male				
Compatible plug Insert array / Contact type				32-17/ Female			
Compatible wire size	Maximum 10AWG/4 Conductors Outside diameter of insulation coating $\phi$ 4.5mm					Maximum 6AWG/4 Conductors Outside diameter of insulation coating $\phi$ 7.0mm	
Rated current (50/60 Hz)			46	BA			80 A



 $\cdot$  Use wire compatible with your local safety codes (e.g. UL, TUV compatible).

- Wiring work should be performed according to your local wiring codes (rules). To ensure safety from direct contact, cable should be fixed firmly, or cable rack should be provided.

- Wire for the cable according to regulations of NEC Article 400.

# 2.4.2 Wiring for remote control

Pin a	Pin assignment							
Pin	I/O	Itom	Specifications					
INO.	IN	Futomal interlash	CLOSE: Normal					
1	11N	External Interlock	CLOSE: Normai	OPEN: External interlock stop				
2	IN	Pump start	CLOSE: Pup	ODEN: Stop				
3 4	IN	Pump start	CLOSE: Normal	OPEN: Stop				
4	IN	Alarm usset	CLOSE: Normal	OPEN. Emergency shutdown				
C C	IN	Alarm reset	CLOSE: Reset					
6	IN	WATING MODE	* It dose not use it in the	LR/HR Series.				
7	IN	Seal gas valve	CLOSE: Valve open	OPEN: Valve close				
8	0117							
9	OUT	DRP start check	CLOSE: Running	OPEN: At stop				
10	OUT	MBP start check	CLOSE: Running	OPEN: At stop				
11	OUT	REMOTE/LOCAL status check	CLOSE: Remote	OPEN: Local				
12	OUT	Emergency shutdown status check	CLOSE: Normal	OPEN: At emergency stop				
13	OUT	WATING MODE check	* It dose not use it in the	LR/HR Series.				
14	OUT	Ready check	CLOSE: Ready	OPEN: Under preparation				
15	OUT	Alarms in a batch	CLOSE: Normal	OPEN: Alarm				
16	OUT	Warnings in a batch	CLOSE: Normal	OPEN: Warning				
17								
18								
19	OUT	OUT 9 - 16 COM						
20	IN	IN 1 COM						
21								
22	IN	IN 3-7 COM						
23								
24	OUT	Purge gas warning	CLOSE: Normal	OPEN: Warning				
25	OUT	Cooling water warning	CLOSE: Normal	OPEN: Warning				
26	OUT	DRP temperature warning	CLOSE: Normal	OPEN: Warning				
27	OUT	MBP temperature warning <sup>1)</sup>	CLOSE: Normal	OPEN: Warning				
28	OUT	DRP current value alarm	CLOSE: Normal	OPEN: Alarm				
29	OUT	DRP current value warning	CLOSE: Normal	OPEN: Warning				
30	OUT	MBP current value alarm	CLOSE: Normal	OPEN: Alarm				
31	OUT	MBP current value warning	CLOSE: Normal	OPEN: Warning				
32	OUT	Pumping pressure alarm <sup>1)</sup>	CLOSE: Normal	OPEN: Alarm				
33	OUT	Pumping pressure warning <sup>1)</sup>	CLOSE: Normal	OPEN: Warning				
34	OUT	System error	CLOSE: Normal	OPEN: Alarm				
35		<b>~</b>						
36								
37	OUT	OUT 24 - 34 COM						

1) Do not use it in the LR series.

2) Do not connect to PIN No. 2, 8, 17, 18, 21, 23, 35, 36.

# . Specifications

Pump side connector	D-sub 37pin female
Compatible connector	D-sub 37pin male
Compatible wire size	AWG #22 Use the shielded cable.

- Before start the work, ensure that all hazardous energies are shutoff. Refer to the Section **2.1 For safety Use**.

- Wiring work should be performed by licensed worker.

- If the external interlock function is not used (used when an interlock with equipment other than a system in which the pump is installed is activated), connect 1 and 20 by a jumper wire or if the remote emergency stops function (only AC line is shut down) is not used, connect 4 and 22 by a jumper wire. If this wiring is not connected between these pins, the pump will recognize it as an external interlock command or an emergency shutdown command and will not start. (Refer to Fig.1)

- A voltage of 24VDC is applied to the input system on the pump side. Prepare a no-voltage contact.

The pump side of the output is a no-voltage contact. Use the pump within the following specified range.

Operable voltage: Less than 24 VDC, contact capacity: 50mA (per one contact)

OUT-COM is commonly using the N-COM; hence connect the same power of 0Vdc. If positive electric potential is put, the contact point will be open and may result a failure. (Refer to Fig.2)





Fig.1 Example of short-circuit line.

Fig.2 Circuit in base

-When the current between a signal pin and GND terminal flows more than 0.1mA, It may cause the circuit the malfunction. Ensure that it flows equal or less than 0.1mA.

### Pin No.7 Seal gas valve (SEAL GAS VALVE)

Only the seal gas valve can be opened/closed in the run mode 1 (mode in which nitrogen gas is not used). When a large amount of water content is pumped for a specific time in a CRYO pump regenerating process, give a command that feeds seal gas from this terminal only in the process time zone to suppress rusting due to water content permeating to the bearing.

#### Pin No.9, 10 DRP start check , MBP start check

No.9 and No.10 is terminal that gives notice that each pump is ready for pumping. Can change the timing that sends this signal.

#### Pin No.14 Ready status check (READY)

Terminal that gives notice that the pump is ready for pumping. This signal is issued by confirming that the pump is rotating at the specified revolution and that the temperature of each part being measured reaches the preset temperature. LR series issues this signal as soon as receiving the signal of pump start, because LR series is not set a temperature. Temperature is not set as standard, but can be set, as and if required. To set a temperature other than the pump temperature, it is necessary to add a sensor.

For the run mode, refer to "3.3 How to Confirm Pump Run Status". If the pump is used to pump only air or inert gas, seal gas is not always necessary, but it is to be noted that air contains moisture that induces corrosion. ULVAC recommends use of seal gas. (In standard is set in run mode 3.)



#### Case 1. 『SET-UP 1』⇒『start up mode』⇒『1』

# Case 2. 『SET-UP 1』⇒『start up mode』⇒『2』



#### 2.4.3 Communication

Used when operating the pump using a personal computer or checking the operation history. Contact your local ULVAC service center for the communication functions.

	Р	in assignment	Communication specifications			
	No.	Item	Signal format	RS-232C/RS485		
	1	FG (Frame GND)	Baud rate	9600 bps		
	2	RS-232C RxD	Bit	Start	1 bit	
9 0 0 5	3	RS-232C TxD	Configuration	Data	8 bits	
	4	RS-485 B(-)		Parity	EVN	
	5	GND		Stop	1 bit	
6 1	6	RS-485 A(+)	Data		BCD code	
	7		Configuration	Terminator	CR code	
	8	RS-485 Terminator				
	9	RS-485 Terminator				

#### Specifications

Pump side connector	D-sub 9pin female			
Compatible connector	D-sub 9pin male			
Compatible wire size	AWG #22 Use the shielded cable.			

 $List of \ communication \ commands: Please \ refer \ to \ attached \ material \ in \ the \ end \ of \ a \ book \ for \ the \ communication \ command \ and \ the \ communication \ of \ the \ communication \ connector. (c. \ Supplementation \ of \ the \ communication \ system ).$ 

Command	I/O	Contents	Supplement
A0	out	System status read-out	Microcomputer status
A1	in	Stop command	
A2	in	Start command	
A3	out	Status read-out	Pump status (normal or abnormal)
A5	Out	Valve status read-out	Seal gas valve. Gas ballast gas valve. Option valve.
A8	In	Remote/local selection	
A9	In	Alarm reset	
B1	OUT	Display read-out at start	Pump status by item
B2	OUT	Alarm log read-out	Alarm log up to 30 cases in the $past^{1)}$
B3	OUT	Warning read-out	
B4	OUT	Alarm read-out	
B8	OUT	Run log read-out	Run status at every 30 seconds for the past one week
B9	OUT	Current status read-out	Loads current run status in a batch
C5	IN	Baud rate setting	
C6	IN	RS485 address setting	
D0	OUT	Model read-out	
D2	OUT	Serial No. Read-out	
D4	OUT	Clock read-out	

#### 1) Run log

It records every minute between 30 minutes after the pump starts. And after the pump stops, run log of one minute is recorded.

Run log is recorded every minute when warning occurs.

When alarm occurs after 30 minutes pass by starting the pump, run log is recorded 16 minutes from 15 minutes before alarm occurs to 1 minute after alarm occurs.



Noting when communicating by RS-485.

 $\bullet$  Please input the 3 digits of ": n n" before the command when you order the command from the host side.

• The response code from the pump side is the same as the RS-232C communication.

3. Operation Procedure

3.1 Flowchart for operation



# **3.2 Prior Operation**

- 1. Ensure that all the piping and wiring works are completed.
- 2. Open the cooling water valve, and ensure that no water leakage is observed.
- 3. Turn the nitrogen regulator fully counterclockwise, and open supply valve, and ensure that no nitrogen gas leakage is observed.
- 4. Turn ON the host equipment breaker (M/D).
- 5. Turn ON the breaker (MCB1, MCB2 (LR/HR300, LR/UR600, LR/HR1200, LR/HR1800)) on the pump.



- "Initialize" is displayed for initialization and operation cannot be performed immediately after the breaker is turned ON. Perform the following operation after verifying that "Waiting" appears about 30 seconds later.



# 3.3 Selecting LOCAL (manual)/REMOTE

(a)	Local (manual) operation	Switch to use
	Mode for manual start and stop of the pump	REMOTE /LOCAL
(b)	Remote operation	$\square$
	Mode for starting and stopping the pump by switch operation on the system.	
	The run mode is selected with the REMOTE/LOCAL switch on the controller.	

# 3.4 Start and Stop

LOCAL operation						
	1. [CONDITION /STAND-BY] or status is	Switch to use				
	displayed on the controller display.					
	2. Press the [START] switch on the controller.	START				
Run	3. The pump starts and the [RUN] lamp on the					
	controller lights.					
	4. [CONDITION / RUNNING] or status is					
	displayed on the controller display.					
	1. Press the [STOP] switch on the controller.					
	2. The pump stops and the [RUN] lamp on the	STOP				
Stop	controller goes off.					
	3. CONDITION /STAND-BY] or status is					
	displayed on the controller display.					

REMOTE operation				
Run	Turn on Pump start signal. The pump starts.			
Stop	Turn off Pump start signal. The pump stops.			

## 3.5 Checking the Pump Run Status

This pump is equipped with multiple sensors, allowing the pump status to be checked on LCD.

#### <Operation>

(example)

	Operation	Controller display		
1.	Turn ON the breaker.	CONDITION / STAND-BY		
2.	Start the pump.	CONDITION / Running		
3.	Display an item to check using $[\nabla]$ or $[\Delta]$ switch.	N2 Purge Flow $4.3$ SLM $\downarrow$		
	$\bigcirc \ \bigtriangleup$	Water Flow 3.0 L/min ↓ DRP Pump TEMP 55℃		

If an item selected last is left as it is for one minute or more, the subsequent display during pump start will be that item.

### List of monitor items (standard specification)

Display item	Display content	Unit of display
CONDITION	Displays the numerun status	-
N2 Purge Gas	Displays the N <sup>2</sup> purge gas (seal, ballast) flow rate.	SLM
WATER FLOW	Displays cooling water flow rate.	L/min
EX. PRESS.	Displays the pressure of exhaust pipe.	M Pa
MBP revolution	Displays the booster pump run frequency	rpm
DRP CURRENT	Displays the motor input current of primary pump.	A
MBP CURRENT	Displays the motor input current of booster pump.	А
DRP PUMP TEMP	Displays primary pump temperature.	°C
MBP PUMP TEMP	Displays booster pump temperature.	°C
EX. PIPE TEMP	Displays exhaust pipe temperature.	°C
MODE	Displays the pump run mode.	-
OPTION VALVE	Displays the state of the option valve.	-
Auto Purge Time	Displays the setting time of the auto purge-function.	Sec
CONTACT	CONTACT Displays the setting-output of the contact function.	
	(A or B contact)	_
Running Time	Displays integrated pump run hours.	Hr
Time	Displays the current time and date.	yy/mm/dd /time
LANGUAGE	Displays the selected language.(Japanese or English)	-

### 3.6 Set item change.

- There are two kinds of set items when you change the set item with the pump of UR sires.
- **[**SET-UP 1] is not protected by the password, and set value can be changed according to the specification.
- **[**SET-UP 2] is protected by the password, and set value can not be changed because it is related to the performance of the pump.

# Method of changing set value.

- (1) A set item of the table below is managed by [SET-UP 1]. [SET-UP 1] is displayed in LCD by pressing [MODE]. [SET-UP 1] can be selected by pressing [ENTER].
- (2) The change item is displayed in LCD by pressing  $[\Delta], [\nabla]$ . The change item can be selected by pressing [ENTER].
- ③ A set value is changed pressing  $[\Delta], [\nabla]$ . The change of a set value ends when fixing it pressing [ENTER].
- ④ Display the Pump Run Status in LCD by pressing [MODE] when the change of a set value ends.

	Set item managed by <b>[</b> SET-UP 1 <b>]</b>
1	[CONTACT]
2	[Time]
3	[LANGUAGE]
4	[RS BAUD]
5	[RS485 ADDRESS]
6	[START CHECK]



Set item managed by  $\llbracket$  SET-UP 2  $\rrbracket$  is protected by the password. The customer cannot change the setting. When you want to change these set values after purchase the product, please contact with your local service center.

	Set item managed by <b>[</b> SET-UP 2 <b>]</b>						
1	『N2 Purge Gas』	13	[MBP CURRENT ALM]				
2	<b>『</b> OP N2 Purge Gas <b>』</b>	14	[BOX option 1]				
3	[WATER FLOW]	15	<b>『</b> BOX option 2 <b>』</b>				
4	『EX.PRESS. WARN』	16	<b>『</b> DRP PUMP TEMP. <b>』</b>				
5	[EX.PRESS. ALM]	17	『MBP PUMP TEMP.』				
6	[DRP revolution]	18	『EX.PIPE TEMP.』				
7	[MBP revolution]	19	<b>FOPTION TEMP.</b>				
8	[option 1]	20	<b>『</b> BOX OP. SWITCH <b>』</b>				
9	[option 2]	21	[MODE]				
10	<b>『</b> DRP CURRENT WARN <b>』</b>	22	<b>[OPTION VALVE]</b>				
11	[DRP CURRENT ALM]	23	[Auto Purge Time]				
12	『MBP CURRENT WARN』	24	[Running Time]				

#### $\mathbf{Run}\;\mathbf{Mode}$

The pump can be run in the following modes.

Mode 1	Both seal gas and gas ballast gas are	e not used.			
Mode 2	Seal gas is used, but gas ballast gas is not used. (The solenoid valve opens when the pump starts.)				
Mode 3	Both seal gas and gas ballast gas ar valve opens when the pump starts.)	e used. (The solenoid			
Mode M	Manually controls the seal gas valv valve.	e and gas ballast gas			
In the Mode M, th follows.	ie seal gas valve and gas ballast valv	e can be controlled as			
The gas ballast g by pressing [∇] controller simulta	BZ MUTE				
The seal gas val pressing [∆] and [] simultaneously.					

About optional specifications

\* The personal computer used for this pump permits control of multiple functions to cope with a variety of applications. Items displayed differ depending on the additional functions. Refer to the list of set items for individual functions.

#### 3.7 List of set items



: **WARNING** indicates that the pump is approaching the limit of operation. But at this moment, the pump is still running. "ALARM" tells that the pump has exceeded the limit of operation and, simultaneously with it, the pump will stop automatically.

Pump temperature and motor power settings differ from model to model.

# MODEL No.6 LR60

setsetimit alarm valuetimetimetime1N2 purge gas0.5 SLMLowerlimit5 sec fixed180 sec5 sec after run to run stop2OP, N2 purge gas0.0 SLMLowerlimit5 sec fixed180 sec5 sec after run to run stop3Cooling water4.0 LowerLowerlimit5 sec fixed180 sec5 sec after run to run stop4Pumping pressure0.000Higherlimit0 sec5 sec after run to run stop5Pumping pressure0.000Higherlimit0 sec5 sec after run to run stop6DRP_INV frequencyIntermediate revolution0000 rpm, rated revolution0000 rpm7MBP_lNV frequencyIntermediate revolution0000 rpm, rated revolution0000 rpm8Analog input spare 10 VLowerlimit5 sec fixed0 sec5 sec after run to run stop10DRP current9.0AHigherlimit10 sec5 sec after run to run stop11DRP current0.0AHigherlimit10 sec5 sec after run to run stop12MBP current0.0AHigherlimit alarm fixed10 sec5 sec after run to run stop13MBP current0.0AHigherlimit alarm fixed10 sec5 sec after run to run stop14BOX analog input spare 1(10 V)0.VLowerlimit alarm fixed10 sec5 sec after run to run		Name	Alarm	Higher/lower	Warning	Alarm	Monitor range
vectorvaluevectorvectorvector1N2 purge gas0.5Lower limit5 sec fixed180 sec5 sec after run to run2OP_N2 purge gas0.0Lower limit5 sec fixed0 sec5 sec after run to run3Cooling water4.0Lower limit5 sec fixed180 sec5 sec after run to run4Pumping pressure0.000Higher limit0 sec5 sec after run to run5Pumping pressure0.000Higher limit0 sec5 sec after run to run6DRP INV frequencyIntermediate revolution0000 rpm, rated revolution0000 rpm8Analog input spare 10 VLower limit5 sec fixed0 sec5 sec after run to run10 VVValarm10 sec1 sec after run to runstop9Analog input spare 20 VLower limit5 sec fixed0 sec5 sec after run to run11DRP current0.0 AHigher limit10 sec5 sec after run to run12MBP current0.0 AHigher limit10 sec5 sec after run to run13MBP current0.0 AHigher limit10 sec5 sec after run to run14BOX analog input0 VLower1 sec fixed1 sec15Stan after fimit 60°CHigher limit 60°C5 sec after run to run16DRP temperatureHigher limit 60°C5 sec fixed0 sec5 sec after run to run17MBP temperatureHigher li			set	limit alarm	time	time	Ū
1   N2 purge gas   0.5   Lower   limit   5 sec fixed   180 sec   5 sec after run to run stop     2   OP_N2 purge gas   0.0   Lower   limit   5 sec fixed   0 sec   5 sec after run to run stop     3   Cooling water   4.0   Lower   Lower   limit   5 sec after run to run stop     4   Pumping pressure   0.00   Higher   limit   0 sec   5 sec after run to run stop     5   Pumping pressure   0.000   Higher   limit   0 sec   5 sec after run to run stop     6   DRP INV frequency   Intermediate revolution 0000 rpm, rated revolution 0000 rpm   stop   stop     7   MBP INV frequency   Intermediate revolution 0000 rpm, rated revolution 0000 rpm   stop   stop     9   Analog input spare 1   0 V   Lower   limit 5 sec fixed   0 sec   5 sec after run to run stop     10   DRP current   9.0A   Higher alarm   10 sec   3 min after run to run stop     11   DRP current   0.0A   Higher limit   10 sec   3 min after run to run stop     12   MBP current   0.0A			value				
SLMalarmstop2 $OP_N2$ purge gas0.0Lower limit5 sec fixed0 sec5 sec after run to run stop3Cooling water4.0Lowerlimit5 sec fixed180 sec5 sec after run to run stop4Pumping pressure0.000Higherlimit0 sec5 sec after run to run stop5Pumping pressure0.000Higherlimit0 sec5 sec after run to run stop6DRP INV frequencyIntermediate revolution0000 rpm, rated revolution0000 rpm7MBP INV frequencyIntermediate revolution0000 rpm, rated revolution0000 rpm8Analog input spare 10 VLowerlimit5 sec fixed0 sec5 sec after run to run stop9Analog input spare 20 VLowerlimit10 sec5 sec after run to run stop10DRP current9.0AHigher alarm10 sec3 min after run to run stop11DRP current0.0AHigher limit10 sec5 sec after run to run stop12MBP current0.0AHigher limit10 sec5 sec after run to run stop13MBP current0.0AHigher limit10 sec5 sec after run to run stop14BOX analog input spare 2 (10 V)0 VLower limit 5 sec fixed0 sec5 sec after run to run stop15BOX analog input stap0 VLower limit 5 sec fixed0 sec5 sec after run to run stop15BOX analog input stap0 VL	1	N2 purge gas	0.5	Lower limit	5 sec fixed	180 sec	5 sec after run to run
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $			SLM	alarm			stop
Image: Star in the star i	2	OP_N2 purge gas	0.0	Lower limit	5 sec fixed	0 sec	5 sec after run to run
3   Cooling water   4.0   Lower limit			SLM	alarm			stop
	3	Cooling water	4.0	Lower limit	5 sec fixed	180 sec	5 sec after run to run
4   Pumping pressure WARNING   0.000 MPa   Higher limit alarm fixed   0 sec   5 sec after run to run stop     5   Pumping pressure ALARM   0.000 MPa   Higher limit alarm fixed   0 sec   5 sec after run to run stop     6   DRP INV frequency   Intermediate revolution 0000 rpm, rated revolution 0000 rpm   6 sec   5 sec after run to run stop     7   MBP INV frequency   Intermediate revolution 0000 rpm, rated revolution 0000 rpm   6 sec   5 sec after run to run stop     9   Analog input spare 2   0 V   Lower limit   5 sec fixed   0 sec   5 sec after run to run stop     9   Analog input spare 2   0 V   Lower limit   10 sec   11 5 min after run to run stop     10   DRP current   0.0A   Higher limit   10 sec   3 min after run to run stop     11   DRe current   0.0 A   Higher limit alarm fixed   10 sec   5 sec after run to run stop     13   MBP current   0.0 A   Higher limit alarm fixed   10 sec   5 sec after run to run stop     14   BOX analog input spare 1 (10 V)   0 V   Lower limit sec fixed   0 sec   5 sec after run to run stop     15   BOX analog input			L/min	alarm			stop
WARNINGMPaalarm fixedstop5Pumping pressure0.000Higherlimit0 sec5 sec after run to run stop6DRP_INV frequencyIntermediate revolution0000 rpm, rated revolution0000 rpm, rated revolution0000 rpm7MBP_INV frequencyIntermediate revolution0000 rpm, rated revolution0000 rpmrun7MBP_INV frequencyIntermediate revolution000 rpm, rated revolution0000 rpm9Analog input spare 10 VLowerlimit5 sec fixed0 sec5 sec after run to run stop10DRP current9.0AHigher limit10 sec15 min after run to run stop11DRP current9.0AHigher limit alarm fixed10 sec3 min after run to run stop12MBP current0.0AHigher limit alarm fixed10 sec5 sec after run to run stop13MBP current0.0AHigher limit alarm fixed10 sec5 sec after run to run stop14BOX analog input spare 1 (10 V)0 VLower limit alarm5 sec fixed0 sec5 sec after run to run stop15BOX analog input spare 2 (10 V)0 VLower limit alarm5 sec fixed0 sec5 sec after run to run stop16DRP temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed0 sec5 sec after run to run stop17MBP temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed0 sec	4	Pumping pressure	0.000	Higher limit	0 sec		5 sec after run to run
5Pumping pressure ALARM0.000 MPaHigher limit alarm fixed0 sec5 sec after run to run stop6DRP_INV frequencyIntermediate revolution0000 rpm, rated revolution0000 rpm7MBP_INV frequencyIntermediate revolution0000 rpm, rated revolution0000 rpm8Analog input spare 10 VLower15 sec fixed0 sec5 sec after run to run stop9Analog input spare 20 VLowerlimit5 sec fixed0 sec5 sec after run to run stop10DRP current9.0AHigher alarm10 sec15 min after run to run stop11DRP current9.0AHigher limit10 sec3 min after run to run stop12MBP current0.0AHigher limit alarm fixed10 sec3 sin after run to run stop13MBP current0.0AHigher limit alarm fixed10 sec5 sec after run to run stop14BOX analog input spare 1 (10 V)0 VLower limit alarm5 sec fixed0 sec5 sec after run to run stop15BOX analog input spare 2 (10 V)0 VLower limit alarm5 sec fixed0 sec5 sec after run to run stop16DRP temperature meatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed0 sec5 sec after run to run stop17MBP temperature temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed0 sec5 sec after run to run stop		WARNING	MPa	alarm fixed			stop
ALARMMPaa larm fixedstop6DRP_INV frequencyIntermediate revolution 0000 rpm, rated revolution 0000 rpm7MBP_INV frequencyIntermediate revolution 0000 rpm, rated revolution 0000 rpm8Analog input spare 10 VLower limit5 sec fixed0 sec5 sec after run to run stop9Analog input spare 20 VLower limit5 sec fixed0 sec5 sec after run to run stop10DRP current9.0AHigher alarm10 sec15 min after run to run stop11DRP current10.0AHigher limit10 sec3 min after run to run stop12MBP current0.0 AHigher limit10 sec5 sec after run to run stop13MBP current0.0 AHigher limit10 sec5 sec after run to run stop14BOX analog input0 VLower limit5 sec fixed0 sec5 sec after run to run stop15BOX analog input0 VLower limit5 sec fixed0 sec5 sec after run to run stop16DRP temperatureHigher limit 0°C5 sec fixed0 sec5 sec after run to run stop17MBP temperatureHigher limit 0°C6 sec fixed0 sec5 sec after run to run stop18Exhaust pipeHigher limit 0°C7 sec fixed0 sec5 sec after run to run stop19Option temperatureHigher limit 0°C6 sec fixed0 sec5 sec after run to run stop21Auto purge time60 sec5 sec fixed0 sec	<b>5</b>	Pumping pressure	0.000	Higher limit		0 sec	5 sec after run to run
6   DRP_INV frequency   Intermediate revolution 0000 rpm, rated revolution 0000 rpm     7   MBP_INV frequency   Intermediate revolution 0000 rpm, rated revolution 0000 rpm     8   Analog input spare 1   0 V   Lower   limit   5 sec fixed   0 sec   5 sec after run to run stop     9   Analog input spare 2   0 V   Lower   limit   5 sec fixed   0 sec   5 sec after run to run stop     10   DRP current   9.0A   Higher alarm   10 sec   15 min after run to run stop     11   DRP current   10.0A   Higher limit   10 sec   3 min after run to run stop     12   MBP current   0.0A   Higher limit   10 sec   3 min after run to run stop     13   MBP current   0.0A   Higher limit   10 sec   5 sec after run to run stop     14   BOX analog input   0.V   Lower   limit   5 sec fixed   0 sec   5 sec after run to run stop     15   BOX analog input   0.V   Lower   limit   5 sec fixed   0 sec   5 sec after run to run stop     16   DRP temperature   Higher limit 0°C   6 sec fixed   0 sec <t< td=""><td></td><td>ALARM</td><td>MPa</td><td>alarm fixed</td><td></td><td></td><td>stop</td></t<>		ALARM	MPa	alarm fixed			stop
7   MBP INV frequency (10V)   Intermediate revolution 0000 rpm, rated revolution 0000 rpm alarm   Cose of the sec of	6	DRP_INV frequency	Interme	ediate revolution	0000 rpm, ra	ted revolu	tion 0000 rpm
8   Analog input spare 1   0 V   Lower limit alarm   5 sec fixed 0 sec stop   5 sec after run to run stop     10   DRP current   9.0A   Higher alarm   10 sec run to run stop   15 min after run to run stop     11   DRP current   9.0A   Higher limit alarm fixed   10 sec   3 min after run to run stop     12   MBP current   0.0A   Higher limit alarm fixed   10 sec   5 sec after run to run stop     13   MBP current   0.0A   Higher limit alarm fixed   10 sec   5 sec after run to run stop     14   BOX analog input spare 1 (10 V)   0.0 A   Higher limit alarm fixed   10 sec   5 sec after run to run stop     15   BOX analog input spare 1 (10 V)   0.V   Lower limit sec fixed   0 sec   5 sec after run to run stop     16   DRP temperature   Higher limit 60°C Ready 0°C   5 sec fixed   0 sec   5 sec after run to run stop     17   MBP temperature   Higher limit 0°C Ready 0°C   5 sec fixed   0 sec   5 sec after run to run stop     18   Exhaust pipe Higher limit 0°C Ready 0°C   5 sec fixed   0 sec   5 sec after run to run stop     19   Option temperature   <	7	MBP_INV frequency	Interme	diate revolution	0000 rpm, ra	ted revolu	tion 0000 rpm
(10V)alarmstop9Analog input spare 20 VLower limit5 sec fixed0 sec5 sec after run to run stop10DRP current9.0AHigher alarm10 sec15 min after run to run stop11DRP current10.0AHigher limit10 sec3 min after run to run stop12MBP current0.0AHigher limit10 sec3 min after run to run stop13MBP current0.0AHigher limit alarm fixed10 sec5 sec after run to run stop14BOX analog input 	8	Analog input spare 1	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run to run
9   Analog input spare 2   0 V   Lower limit arm   5 sec fixed or construction of the sec fixed or constened or construction of the sec fixed or co		(10V)		alarm			stop
(10 V)alarmstop10DRP current9.0AHigher alarm10 sec15 min after run to run stop11DRP current10.0AHigher limit10 sec3 min after run to run stop11DRP current0.0 AHigher limit10 sec3 min after run to run stop12MBP current0.0 AHigher limit10 sec5 sec after run to run stop13MBP current0.0 AHigher limit10 sec5 sec after run to run stop14BOX analog input spare 1 (10 V)0 VLower limit alarm5 sec fixed0 sec5 sec after run to run stop15BOX analog input spare 2 (10 V)0 VLower limit alarm5 sec fixed0 sec5 sec after run to run stop16DRP temperatureHigher limit 0°C5 sec fixed0 sec5 sec after run to run stop17MBP temperatureHigher limit 0°C5 sec fixed0 sec5 sec after run to run stop18Exhaust pipeHigher limit 0°C5 sec fixed0 sec5 sec after run to run stop19Option temperatureHigher limit 0°C5 sec fixed0 sec5 sec after run to run stop12Run mode31010101021Run mode31010101022Option temperatureB contact open alarm5 sec fixed0 sec5 sec after run to run stop19Option temperatureB contact open alarm5 sec fixed0 sec5 sec after run to run st	9	Analog input spare 2	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run to run
10   DRP current WARNING   9.0A   Higher alarm fixed   10 sec   15 min after run to run stop     11   DRP current ALARM   10.0A   Higher limit alarm fixed   10 sec   3 min after run to run stop     12   MBP current MARNING   0.0 A   Higher limit alarm fixed   10 sec   5 sec after run to run stop     13   MBP current ALARM   0.0 A   Higher limit alarm fixed   10 sec   5 sec after run to run stop     14   BOX analog input spare 1 (10 V)   0 V   Lower limit alarm   5 sec fixed   0 sec   5 sec after run to run stop     15   BOX analog input spare 2 (10 V)   0 V   Lower limit alarm   5 sec fixed   0 sec   5 sec after run to run stop     16   DRP temperature Higher limit 0°C Heater control 0°C   5 sec fixed   0 sec   5 sec after run to run stop     17   MBP temperature Higher limit 0°C Heater control 0°C   5 sec fixed   0 sec   5 sec after run to run stop     19   Option temperature Higher limit 0°C Heater control 0°C   5 sec fixed   0 sec   5 sec after run to run stop     21   Run mode   3   1   1   1   1     22   Option temperature fixed <td></td> <td>(10 V)</td> <td></td> <td>alarm</td> <td></td> <td></td> <td>stop</td>		(10 V)		alarm			stop
WARNING   fixed   run stop     11   DRP current   10.0A   Higher limit alarm fixed   10 sec   3 min after run to run stop     12   MBP current WARNING   0.0 A   Higher limit alarm fixed   10 sec   5 sec after run to run stop     13   MBP current ALARM   0.0 A   Higher limit alarm fixed   10 sec   5 sec after run to run stop     14   BOX analog input spare 1 (10 V)   0.V   Lower limit alarm   5 sec fixed   0 sec   5 sec after run to run stop     15   BOX analog input spare 2 (10 V)   0.V   Lower limit alarm   5 sec fixed   0 sec   5 sec after run to run stop     16   DRP temperature   Higher limit 60°C Heater control 0°C   5 sec fixed   180 sec   5 sec after run to run stop     17   MBP temperature   Higher limit 0°C Heater control 0°C   5 sec fixed   0 sec   5 sec after run to run stop     19   Option temperature   Higher limit 0°C Heater control 0°C   5 sec fixed   0 sec   5 sec after run to run stop     21   Run mode   3	10	DRP current	9.0A	Higher alarm	10  sec		15 min after run to
11DRP current ALARM10.0AHigher limit alarm fixed10 sec3 min after run to run stop12MBP current WARNING0.0 AHigher limit alarm fixed10 sec5 sec after run to run stop13MBP current ALARM0.0 AHigher limit alarm fixed10 sec5 sec after run to run stop14BOX analog input spare 1 (10 V)0 VLower limit alarm5 sec fixed alarm0 sec5 sec after run to run stop15BOX analog input spare 2 (10 V)0 VLower limit alarm5 sec fixed alarm0 sec5 sec after run to run stop16DRP temperature Heater control 0°CHigher limit 0°C Heater control 0°C5 sec fixed top0 sec5 sec after run to run stop17MBP temperature temperatureHigher limit 0°C Heater control 0°C5 sec fixed top0 sec5 sec after run to run stop18Exhaust pipe temperatureHigher limit 0°C Heater control 0°C5 sec fixed top0 sec5 sec after run to run stop19Option temperature Heater control 0°CB contact open alarm fixed5 sec fixed scop0 sec5 sec after run to run stop21Run mode3		WARNING		fixed			run stop
ALARMalarm fixedstop12MBP current WARNING0.0 AHigher limit alarm fixed10 sec5 sec after run to run stop13MBP current ALARM0.0 AHigher limit alarm fixed10 sec5 sec after run to run stop14BOX analog input spare 1 (10 V)0 VLower limit alarm5 sec fixed alarm0 sec5 sec after run to run stop15BOX analog input spare 2 (10 V)0 VLower limit alarm5 sec fixed alarm0 sec5 sec after run to run stop16DRP temperature Heater control 0°CHigher limit 60°C Heater control 0°C5 sec fixed stop180 sec5 sec after run to run stop17MBP temperature temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed stop0 sec5 sec after run to run stop18Exhaust pipe temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed stop0 sec5 sec after run to run stop19Option temperature MunceB contact open alarm fixed5 sec fixed stop0 sec5 sec after run to run stop21Run mode Auto purge time 600 secB contact0 sec5 sec after run to run stop22Optional valve NoneNoneIII23Auto purge time 600 secEnglishII24Alb contact B contactIII25English/Japanese EnglishG00 bpsII<	11	DRP current	10.0A	Higher limit		10  sec	3 min after run to run
12MBP current WARNING0.0 A alarm fixedHigher limit alarm fixed10 sec stop5 sec after run to run stop13MBP current ALARM0.0 A alarm fixedHigher limit alarm fixed10 sec stop5 sec after run to run stop14BOX analog input spare 1 (10 V)0 V alarmLower limit alarm5 sec fixed stop0 sec stop5 sec after run to run stop15BOX analog input spare 2 (10 V)0 V alarmLower limit alarm5 sec fixed stop0 sec stop5 sec after run to run stop16DRP temperature Heater control 0°CHigher limit 60°C Heater control 0°C5 sec fixed Heater control 0°C0 sec stop5 sec after run to run stop17MBP temperature Heater control 0°CHigher limit 0°C Heater control 0°C5 sec fixed Heater control 0°C0 sec stop5 sec after run to run stop18Exhaust pipe temperatureHigher limit 0°C Heater control 0°C5 sec fixed Heater control 0°C0 sec sec after run to run stop19Option temperature Heater control 0°CB contact open alarm fixed5 sec fixed sec fixed0 sec sec after run to run stop21Run mode A3IIII22Optional valve MoneNoneIII23Auto purge time Auto purge time600 secIII24A/B contactB contactIII25English/Japanese B		ALARM		alarm fixed			stop
WARNINGalarm fixedstop13MBP current ALARM0.0 AHigher limit alarm fixed10 sec5 sec after run to run stop14BOX analog input spare 1 (10 V)0 VLower limit alarm5 sec fixed alarm0 sec5 sec after run to run stop15BOX analog input spare 2 (10 V)0 VLower limit alarm5 sec fixed alarm0 sec5 sec after run to run stop16DRP temperatureHigher limit 60°C Heater control 0°C5 sec fixed Heater control 0°C180 sec5 sec after run to run stop17MBP temperatureHigher limit 0°C Heater control 0°C5 sec fixed Heater control 0°C0 sec5 sec after run to run stop18Exhaust pipe Heater control 0°CHigher limit 0°C Heater control 0°C5 sec fixed Heater control 0°C0 sec5 sec after run to run stop19Option temperatureB contact open alarm fixed5 sec fixed Heater control 0°C0 sec5 sec after run to run stop21Run mode3I contact B contactI contact0 sec5 sec after run to run stop22Optional valveNoneI contactI contactI contact23Auto purge time600 secI contactI contactI contact24A/B contactB contactI contactI contactI contact25English/JapaneseEnglishI contactI contactI contact26Baud rate setting9600 bpsI cont	12	MBP current	0.0 A	Higher limit	10 sec		5 sec after run to run
13   MBP current ALARM   0.0 A   Higher limit alarm fixed   10 sec   5 sec after run to run stop     14   BOX analog input spare 1 (10 V)   0 V   Lower limit alarm   5 sec fixed   0 sec   5 sec after run to run stop     15   BOX analog input spare 2 (10 V)   0 V   Lower limit alarm   5 sec fixed   0 sec   5 sec after run to run stop     16   DRP temperature   Higher limit 60°C Heater control 0°C   5 sec fixed   180 sec   5 sec after run to run stop     17   MBP temperature   Higher limit 0°C Heater control 0°C   5 sec fixed   0 sec   5 sec after run to run stop     18   Exhaust pipe temperature   Higher limit 0°C Heater control 0°C   5 sec fixed   0 sec   5 sec after run to run stop     19   Option temperature   Higher limit 0°C Heater control 0°C   5 sec fixed   0 sec   5 sec after run to run stop     20   Spare switch on box   B contact open alarm fixed   5 sec fixed   0 sec   5 sec after run to run stop     21   Run mode   3   I   I   I   I     22   Optional valve   None   I   I   I     23   Aut	1.0	WARNING	0.0.1	alarm fixed		10	stop
ALARMalarm fixedstop14BOX analog input spare 1 (10 V)0 VLower limit alarm5 sec fixed alarm0 sec5 sec after run to run stop15BOX analog input spare 2 (10 V)0 VLower limit alarm5 sec fixed alarm0 sec5 sec after run to run stop16DRP temperatureHigher limit 60°C Heater control 0°C5 sec fixed Heater control 0°C180 sec5 sec after run to run stop17MBP temperatureHigher limit 0°C Heater control 0°C5 sec fixed Heater control 0°C0 sec5 sec after run to run stop18Exhaust pipe temperatureHigher limit 0°C Heater control 0°C5 sec fixed Heater control 0°C0 sec5 sec after run to run stop19Option temperatureHigher limit 0°C Heater control 0°C5 sec fixed Heater control 0°C0 sec5 sec after run to run stop20Spare switch on boxB contact open alarm fixed5 sec fixed Heater0 sec5 sec after run to run stop21Run mode3IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	13	MBP current	0.0 A	Higher limit		10  sec	5 sec after run to run
14   BOX analog input spare 1 (10 V)   0 V   Lower limit b sec fixed alarm   0 sec   5 sec after run to run stop     15   BOX analog input spare 2 (10 V)   0 V   Lower limit 60°C   5 sec fixed alarm   0 sec   5 sec after run to run stop     16   DRP temperature   Higher limit 60°C   5 sec fixed Ready 0°C   180 sec   5 sec after run to run stop     17   MBP temperature   Higher limit 0°C   5 sec fixed Ready 0°C   0 sec   5 sec after run to run stop     18   Exhaust pipe temperature   Higher limit 0°C   5 sec fixed Ready 0°C   0 sec   5 sec after run to run stop     19   Option temperature   Higher limit 0°C   5 sec fixed Ready 0°C   0 sec   5 sec after run to run stop     20   Spare switch on box   B contact open alarm fixed   5 sec fixed   0 sec   5 sec after run to run stop     21   Run mode   3	1.4	ALARM	0.17	alarm fixed	<b>~</b> (* 1	0	stop
15BOX analog input spare 2 (10 V)0 VLower limit alarm5 sec fixed0 sec5 sec after run to run stop16DRP temperatureHigher limit $60^{\circ}$ C Ready $0^{\circ}$ C Heater control $0^{\circ}$ C5 sec fixed180 sec5 sec after run to run stop17MBP temperatureHigher limit $0^{\circ}$ C Ready $0^{\circ}$ C Heater control $0^{\circ}$ C5 sec fixed0 sec5 sec after run to run stop18Exhaust pipe temperatureHigher limit $0^{\circ}$ C Heater control $0^{\circ}$ C5 sec fixed0 sec5 sec after run to run stop19Option temperatureHigher limit $0^{\circ}$ C Heater control $0^{\circ}$ C Heater control $0^{\circ}$ C5 sec fixed0 sec5 sec after run to run stop19Option temperatureHigher limit $0^{\circ}$ C Heater control $0^{\circ}$ C Heater control $0^{\circ}$ C5 sec fixed0 sec5 sec after run to run stop20Spare switch on box fixedB contact open alarm fixed5 sec fixed0 sec5 sec after run to run stop21Run mode3222212223Auto purge time600 sec2222224A/B contactB contact222225English/JapaneseEnglish22226Baud rate setting9600 bps222227RS485 address setting0012228Stat chack1122<	14	BUX analog input $(10 \text{ V})$	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run to run
13   BOX analog input of alarm   1 See fixed of sec is see after run to run stop     16   DRP temperature   Higher limit 60°C Ready 0°C Heater control 0°C   5 sec fixed of sec is see after run to run stop     17   MBP temperature   Higher limit 0°C Ready 0°C Heater control 0°C   5 sec fixed of sec is see after run to run stop     18   Exhaust pipe temperature   Higher limit 0°C Ready 0°C Heater control 0°C   5 sec fixed of sec is see after run to run stop     18   Exhaust pipe temperature   Higher limit 0°C Ready 0°C Heater control 0°C   5 sec fixed of sec is sec after run to run stop     19   Option temperature   Higher limit 0°C Ready 0°C Heater control 0°C   5 sec fixed of sec is sec after run to run stop     20   Spare switch on box   B contact open alarm fixed   5 sec fixed of sec is stop   0 sec is sec after run to run stop     21   Run mode   3   Implementer control 0°C   5 sec fixed of sec is stop   0 sec is stop     22   Optional valve   None   Implementer control 0°C   Implementer control 0°C   Implementer control 0°C     23   Auto purge time   600 sec   Implementer control 0°C   Implementer control 0°C   Implementer control 0°C     23   Auto purge time   600 sec   Implementer co	15	Spare 1 (10 V)	οV	alarm	E and fined	0	stop
Spare 2 (10 V)Higher limit 60°C Ready 0°C Heater control 0°C5 sec fixed ready 0°C Heater control 0°C180 sec stop5 sec after run to run stop17MBP temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed ready 0°C Heater control 0°C0 sec5 sec after run to run stop18Exhaust pipe temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed ready 0°C Heater control 0°C0 sec5 sec after run to run stop19Option temperatureHigher limit 0°C Heater control 0°C5 sec fixed ready 0°C Heater control 0°C0 sec5 sec after run to run stop20Spare switch on boxB contact open alarm fixed5 sec fixed run other run of run stop0 sec5 sec after run to run stop21Run mode3Image: run to run stop122Optional valveNoneImage: run to run stop123Auto purge time600 secImage: run to run stop124A/B contactB contactImage: run to run stop25English/JapaneseEnglishImage: run to run stop26Baud rate setting9600 bpsImage: run to run stop27RS485 address setting00Image: run to run stop28State abadeImage: run to run stop	19	BOX analog input	υv	Lower limit	5 sec fixed	0 sec	o sec after run to run
16Diff temperatureHigher limit 60 C Ready 0°C Heater control 0°C5 sec fixed stop100 sec5 sec after run to run stop17MBP temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed Person0 sec5 sec after run to run stop18Exhaust pipe temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed Person0 sec5 sec after run to run stop19Option temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed Person0 sec5 sec after run to run stop19Option temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed Person0 sec5 sec after run to run stop20Spare switch on box PersonB contact open alarm fixed5 sec fixed Person0 sec5 sec after run to run stop21Run mode3Image: Person PersonImage: Person PersonImage: Person PersonImage: Person Person23Auto purge time600 secImage: Person PersonImage: Person PersonImage: Person PersonImage: Person Person24A/B contactB contactImage: Person PersonImage: Person PersonImage: Person PersonImage: Person PersonImage: Person Person25English/JapaneseEnglishImage: Person PersonImage: Person PersonImage: Person PersonImage: Person PersonImage: Person Person26Baud rate setting Person960	16	DRP tomporature	Uighon	limit 60°C	5 coe fived	180 000	5 oog ofter run to run
Iteraty of C Heater control 0°CStop17MBP temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed Sec fixed0 sec Sec after run to run stop18Exhaust pipe temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed Sec fixed0 sec5 sec after run to run stop19Option temperature Heater control 0°CHigher limit 0°C Heater control 0°C5 sec fixed Sec fixed0 sec5 sec after run to run stop19Option temperature Heater control 0°CHigher limit 0°C Heater control 0°C5 sec fixed Sec fixed0 sec5 sec after run to run stop20Spare switch on box TixedB contact open alarm fixed5 sec fixed Sec fixed0 sec5 sec after run to run stop21Run mode S3Image: Sec fixed Heater control 0°C0 sec5 sec after run to run stop23Auto purge time Auto purge time600 secImage: Sec fixed HeaterImage: Sec fixed HeaterImage: Sec fixed HeaterImage: Sec fixed Heater24A/B contactB contactImage: Sec fixed HeaterImage: Sec fixed HeaterImage: Sec fixed HeaterImage: Sec fixed HeaterImage: Sec fixed Heater25English/Japanese B address setting9600 bpsImage: Sec fixed HeaterImage: Sec fixed HeaterImage: Sec fixed Heater26Baud rate setting B address setting00Image: Sec fixed HeaterImage: Sec fixed HeaterImage: Sec fixed 	10	Diti temperature	Roody (		5 sec lixeu	100 sec	ston
17MBP temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed sec fixed0 sec sec after run to run stop18Exhaust pipe temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed sec fixed0 sec sec after run to run stop19Option temperatureHigher limit 0°C Heater control 0°C5 sec fixed sec after run to run stop0 sec sec after run to run stop19Option temperatureHigher limit 0°C Heater control 0°C5 sec fixed sec fixed0 sec sec after run to run stop20Spare switch on box fixedB contact open alarm fixed5 sec fixed sec fixed0 sec sec after run to run stop21Run mode3Image: sec after stopImage: sec after stop23Auto purge time600 secImage: sec after sec afterImage: sec after stop24A/B contactB contactImage: sec after sec afterImage: sec after stop25English/JapaneseEnglishImage: sec after sec afterImage: sec after sec after26Baud rate setting setting9600 bpsImage: sec after sec afterImage: sec after sec after27RS485 address setting sec afterImage: sec after sec afterImage: sec after sec afterImage: sec after sec after29Stap advectImage: sec afterImage: sec afterImage: sec afterImage: sec after sec after29StapImage: sec afterImage: sec afterImage: s			Heater	control 0°C			stop
11   MBT temperature   Higher limit 0°C   5 sec fixed   5 sec after run to run     18   Exhaust pipe   Higher limit 0°C   5 sec fixed   0 sec   5 sec after run to run     19   Option temperature   Higher limit 0°C   5 sec fixed   0 sec   5 sec after run to run     19   Option temperature   Higher limit 0°C   5 sec fixed   0 sec   5 sec after run to run     20   Spare switch on box   B contact open alarm fixed   5 sec fixed   0 sec   5 sec after run to run stop     21   Run mode   3   2   2   0ptional valve   None   2     23   Auto purge time   600 sec   2   2   2   1   1     24   A/B contact   B contact   2   2   1   1   2     25   English/Japanese   English   2   2   1   1   2     26   Baud rate setting   9600 bps   2   2   2   2   2     26   Baud rate setting   9600 bps   2   2   2   2   2     26   Ba	17	MBP tomporature	Highor	limit 0°C	5 see fixed	0 500	5 sec after run to run
Iteraty of C Heater control 0°CHeater control 0°CStop18Exhaust pipe temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed Sec fixed0 sec over Sec after run to run stop19Option temperature PersonHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed Needy 0°C Heater control 0°C0 sec Sec after run to run stop20Spare switch on box FixedB contact open alarm fixed5 sec fixed Sec fixed0 sec Sec after run to run stop21Run mode3Image: Sec fixed Sec fixed0 sec Sec after run to run stop21Run mode3Image: Sec fixed Sec fixed0 sec23Auto purge time B contact600 secImage: Sec fixed Sec fixedImage: Sec fixed Sec fixedImage: Sec fixed Sec fixed24A/B contactB contactImage: Sec fixed Sec fixedImage: Sec fixed Sec fixedImage: Sec fixed Sec fixedImage: Sec fixed Sec fixed25English/JapaneseEnglishImage: Sec fixed Sec fixedImage: Sec fixed Sec fixedImage: Sec fixed Sec fixedImage: Sec fixed Sec fixed26Baud rate setting Sec fixed9600 bpsImage: Sec fixed Sec fixedImage: Sec fixed Sec fixedImage: Sec fixed Sec fixedImage: Sec fixed Sec fixed27RS485 address setting Sec fixedImage: Sec fixed Sec fixedImage: Sec fixed Sec fixedImage: Sec fixed Sec fixedImage: Sec fixed Sec fixed28Sta	11	MDI temperature	Roady (		5 Sec lixeu	U BEC	ston
18Exhaust pipe temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed sec fixed0 sec sec fixed5 sec after run to run stop19Option temperature Heater control 0°CHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed sec fixed0 sec sec fixed5 sec after run to run stop20Spare switch on box Heater control 0°CB contact open alarm fixed5 sec fixed sec fixed0 sec sec fixed5 sec after run to run stop21Run mode3Image: Sec fixed fixed0 sec sec fixed5 sec after run to run stop23Auto purge time Auto purge time600 secImage: Sec fixed fixedImage: Sec fixed fixedImage: Sec fixed fixedImage: Sec fixed fixed24A/B contact B contactB contact fixedImage: Sec fixed fixedImage: Sec fixed fixedImage: Sec fixed fixedImage: Sec fixed fixed25English/JapaneseEnglishImage: Sec fixed fixedImage: Sec fixed fixedImage: Sec fixed fixedImage: Sec fixed fixed26Baud rate setting fixed9600 bpsImage: Sec fixed fixedImage: Sec fixed fixedImage: Sec fixed fixedImage: Sec fixed fixed27RS485 address setting fixedImage: Sec fixed fixedImage: Sec fixed fixedImage: Sec fixed fixedImage: Sec fixed fixed28Start absolvImage: Sec fixed fixedImage: Sec fixed fixedImage: Sec fixed fixedImage: Sec fixed <td></td> <td></td> <td>Heater</td> <td>control 0°C</td> <td></td> <td></td> <td>stop</td>			Heater	control 0°C			stop
10DistributionInight frimit of C Ready 0°C Heater control 0°C5 sec fixed c6 sec5 sec after run to run 	18	Exhaust ning	Highor	limit 0°C	5 see fixed	0 500	5 sec after run to run
IterativeIteraty of C Heater control 0°CStop19Option temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed Feedy 0°C Heater control 0°C0 sec5 sec after run to run stop20Spare switch on boxB contact open alarm fixed5 sec fixed Sec fixed0 sec5 sec after run to run stop21Run mode3Image: Contact open alarm fixed5 sec fixed Sec fixed0 sec5 sec after run to run stop21Run mode3Image: Contact open alarm fixed5 sec fixed Sec fixed0 sec5 sec after run to run stop21Run mode3Image: Contact open alarm fixed5 sec fixed Sec fixed0 sec5 sec after run to run stop23Auto purge time600 secImage: ContactImage: ContactImage: Contact24A/B contactB contactImage: ContactImage: ContactImage: Contact25English/JapaneseEnglishImage: ContactImage: ContactImage: Contact26Baud rate setting9600 bpsImage: ContactImage: ContactImage: Contact27RS485 address setting00Image: ContactImage: ContactImage: Contact28Start abadeImage: ContactImage: ContactImage: ContactImage: Contact29Start abadeImage: ContactImage: ContactImage: ContactImage: Contact29Start abadeImage: ContactImage: ContactImage: ContactIm	10	temperature	Roady (		5 Sec lixeu	U BEC	ston
19Option temperatureHigher limit 0°C Ready 0°C Heater control 0°C5 sec fixed S sec fixed0 sec S sec after run to run stop20Spare switch on boxB contact open alarm fixed5 sec fixed S sec fixed0 sec5 sec after run to run stop21Run mode3Image: StopImage: StopImage: Stop23Auto purge time600 secImage: StopImage: Stop24A/B contactB contactImage: StopImage: Stop25English/JapaneseEnglishImage: StopImage: Stop26Baud rate setting9600 bpsImage: StopImage: Stop27RS485 address setting00Image: StopImage: Stop		temperature	Heater	control 0°C			Stop
15Option temperatureHigher limit of C Ready 0°C Heater control 0°C5 sec lixed6 sec5 sec after run to run stop20Spare switch on boxB contact open alarm fixed5 sec fixed0 sec5 sec after run to run stop21Run mode3	19	Ontion temperature	Highor	limit 0°C	5 sec fixed	0 500	5 sec after run to run
Includy of C Heater control 0°CIncludy of C Heater control 0°CStop20Spare switch on box fixedB contact open alarm fixed5 sec fixed o0 sec5 sec after run to run stop21Run mode3Includy of C fixedIncludy of C oIncludy of C method122Optional valveNoneIncludy of C fixedIncludy of C oIncludy of C method23Auto purge time600 secIncludy of C fixedIncludy of C fixed24A/B contactB contactIncludy of C fixedIncludy of C fixed25English/JapaneseEnglishIncludy of C fixedIncludy of C fixed26Baud rate setting9600 bpsIncludy of C fixedIncludy of C fixed27RS485 address setting00Includy of C fixedIncludy of C fixed28Start shockIncludy of C fixedIncludy of C fixedIncludy of C fixed	10	Option temperature	Ready (	PC	o see lixeu	0 800	ston
20Spare switch on boxB contact open alarm fixed5 sec fixed0 sec5 sec after run to run stop21Run mode3			Heater	control 0°C			Stop
20Space switch of boxD contact open atallo see fixedo see ater full to full21Run mode3	20	Snare switch on hov	B conte	act open alarm	5 sec fixed	0 sec	5 sec after run to run
21Run mode3Stop22Optional valveNone23Auto purge time600 sec24A/B contactB contact25English/JapaneseEnglish26Baud rate setting9600 bps27RS485 address setting00	20	Spare switch on box	fixed	ict open alarm	o see lixeu	0 800	ston
21Induct022Optional valveNone23Auto purge time600 sec24A/B contactB contact25English/JapaneseEnglish26Baud rate setting9600 bps27RS485 address setting0028Start shock1	21	Run mode	3				
23   Auto purge time   600 sec     24   A/B contact   B contact     25   English/Japanese   English     26   Baud rate setting   9600 bps     27   RS485 address setting   00     28   Start shock   1	22	Ontional valve	None				
24 A/B contact B contact   25 English/Japanese English   26 Baud rate setting 9600 bps   27 RS485 address setting 00	23	Auto nurge time	600 800				
25 English/Japanese English   26 Baud rate setting 9600 bps   27 RS485 address setting 00   28 Start shock 1	24	A/B contact	B conta	et			
26 Baud rate setting 9600 bps   27 RS485 address setting 00	25	English/Jananese	English	~~			
27 RS485 address setting 00   28 Start shock 1	26	Baud rate setting	9600 hr	s			
28 Start sheat 1	27	RS485 address setting	00	~			
	28	Start check	1				

# MODEL No.7 LR90

	Name	Alarm	Higher/lower	Warning	Alarm	Monitor range
		set limit alarm		time	time	
		value				
1	N2 purge gas	0.5	Lower limit	5 sec fixed	180 sec	5 sec after run to run
-		SLM	alarm		-	stop
2	OP_N2 purge gas	0.0 SLM	Lower limit alarm	5 sec fixed	0 sec	5 sec after run to run stop
3	Cooling water	4.0	Lower limit	5 sec fixed	180 sec	5 sec after run to run
	0	L/min	alarm			stop
4	Pumping pressure	0.000	Higher limit	0 sec		5 sec after run to run
	WARNING	MPa	alarm fixed			stop
<b>5</b>	Pumping pressure	0.000	Higher limit		$0 \sec$	5 sec after run to run
	ALARM	MPa	alarm fixed			stop
6	DRP_INV frequency	Interme	ediate revolution	0000 rpm, ra	ted revolu	tion 0000 rpm
7	MBP_INV frequency	Interme	ediate revolution	0000 rpm, ra	ted revolu	tion 0000 rpm
8	Analog input spare 1	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run to run
	(10V)		alarm			stop
9	Analog input spare 2	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run to run
	(10 V)		alarm			stop
10	DRP current	13.6A	Higher alarm	10  sec		15 min after run to
	WARNING		fixed			run stop
11	DRP current	15.6A	Higher limit		10  sec	3 min after run to run
	ALARM		alarm fixed			stop
12	MBP current	0.0 A	Higher limit	10 sec		5 sec after run to run
	WARNING		alarm fixed			stop
13	MBP current	0.0 A	Higher limit		10 sec	5 sec after run to run
1.4	ALARM	0.17	alarm fixed	<b>-</b> 0: 1	0	stop
14	BOX analog input $1(10 \text{ V})$	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run to run
1 5	spare I (IU V)	0.17	alarm		0	stop
19	BUX analog input $(10 \text{ V})$	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run to run
16	DPD tomporature	Uichon	limit 75°C	5 coo fived	180 000	5 ago often run to run
10	Dur temperature	Poodu (		5 sec fixed	100 sec	stop
		Hostor	control 0°C			stop
17	MPD tomporature	Lighon	limit 0°C	5 coo fived	0 000	5 and often with to with
11	MDF temperature	Deader (		5 sec fixed	0 sec	o sec after run to run
		Hostor	control 0°C			stop
10	Exhaust nine	Lighon	limit 0°C	5 coo fived	0 000	5 and often with to with
10	tomporature	Roody (		5 sec fixed	0 sec	ston
	temperature	Heater	control 0°C			stop
10	Ontion tomporaturo	Highor	limit 0°C	5 see fixed	0 000	5 cos ofter run to run
15	Option temperature	Roady (		5 sec fixed	0 sec	ston
		Hostor	control 0°C			stop
20	Spare switch on hov	B conte	et open alarm	5 sec fixed	0 500	5 sec after run to run
20	Spare Switch Off DOX	fixed	act open alarin	o sec nixeu	0 800	ston
91	Run mode	11Xeu 2				stop
22	Ontional valvo	None				
23	Auto nurge time	600 800				
20	A/R contact	Beonte	et			
24 95	English/Jananoso	English				
20	Baud rate setting	9600 hr	e e e e e e e e e e e e e e e e e e e			
$\frac{20}{97}$	RS485 address setting	00	бi			
21	Start check	1				
40	NULL UNITON	1		1	L	

	Name	Alarm	Higher/low	ver	Warning	Alarm	Monitor range
		set	limit alarm	1	time	time	
		value		-			
1	N2 purge gas	0.5	Lower li	imit	5 sec fixed	180 sec	5 sec after run to
_	F 8 - 8	SLM	alarm				run stop
2	OP N2 nurge gas	0.0	Lower li	imit	5 sec fixed	0 sec	5 sec after run to
_	or _r.= pargo gas	SLM	alarm		3 500 micu	0.000	run stop
3	Cooling water	4.0	Lower li	imit	5 sec fixed	180 sec	5 sec after run to
0	cooling water	L/min	alarm		3 500 micu	100.000	run stop
4	Pumping pressure	0.000	Higher li	imit	0 sec		5 sec after run to
	WARNING	MPa	alarm fixed	d			run stop
5	Pumping pressure	0.000	Higher li	imit		0 sec	5 sec after run to
	ALARM	MPa	alarm fixed	d			run stop
6	DRP_INV frequency	Interme	diate revolu	ition	0000 rpm, ra	ted revolut	ion 0000 rpm
7	MBP INV frequency	Interme	diate revolu	ition	0000 rpm, ra	ted revolut	tion 0000 rpm
8	Analog input spare 1	0 V	Lower li	imit	5 sec fixed	0 sec	5 sec after run to
	(10V)		alarm	-			run stop
9	Analog input spare 2	0 V	Lower li	imit	5 sec fixed	0 sec	5 sec after run to
-	(10 V)		alarm	-			run stop
10	DRP current	23.0A	Higher li	imit	10 sec		15 min after run
	WARNING		alarm fixed	d			to run stop
11	DRP current	24.0A	Higher li	imit		10 sec	3 min after run to
	ALARM		alarm fixed	d			run stop
12	MBP current	0.0 A	Higher li	imit	10 sec		5 sec after run to
	WARNING		alarm fixed	d			run stop
13	MBP current alarm	0.0 A	Higher li	imit		10 sec	5 sec after run to
			alarm fixed	d			run stop
14	BOX analog input	0 V	Lower li	imit	5 sec fixed	0 sec	5 sec after run to
	spare 1 (10 V)		alarm				run stop
15	BOX analog input	0 V	Lower li	imit	5 sec fixed	$0 \sec$	5 sec after run to
	spare 2 (10 V)		alarm				run stop
16	DRP temperature	Higher	limit $85^{\circ}\mathrm{C}$		5 sec fixed	180 sec	5 sec after run to
		Ready 0	°C				run stop
		Heater	control 0°C				
17	MBP temperature	Higher	limit 0°C		5 sec fixed	$0 \sec$	5 sec after run to
		Ready 0	°C				run stop
		Heater	control 0°C				
18	Exhaust pipe	Higher	limit 0°C		5 sec fixed	$0 \sec$	5 sec after run to
	temperature	Ready 0	°C				run stop
		Heater	control 0°C				
19	Option temperature	Higher	limit 0°C		5 sec fixed	$0 \sec$	5 sec after run to
		Ready 0	°C				run stop
		Heater	control 0°C				
20	Spare switch on box	B conta	ict open ala	arm	5 sec fixed	$0 \sec$	5 sec after run to
		fixed					run stop
21	Run mode	3					
22	Optional valve	None					
23	Auto purge time	600 sec					
24	A/B contact	B conta	et				
25	English/Japanese	English					
26	Baud rate setting	9600 bp	s				
27	RS485 address setting	00					
28	Start check	1					

Model	No.	9	LR300
Model	No.	9	LR300

	Name	Alarm	Higher/lower	Warning	Alarm	Monitor range
		set	limit alarm	time	time	U
		value				
1	N2 purge gas	0.5	Lower limit	5 sec fixed	180 sec	5 sec after run
		SLM	alarm			to run stop
2	OP_N2 purge gas	0.0	Lower limit	5 sec fixed	0 sec	5 sec after run
		SLM	alarm			to run stop
3	Cooling water	4.0	Lower limit	5 sec fixed	180 sec	5 sec after run
		L/min	alarm			to run stop
4	Pumping pressure	0.000	Higher limit	0 sec		5 sec after run
	WARNING	MPa	alarm fixed			to run stop
5	Pumping pressure	0.000	Higher limit		$0 \sec$	5 sec after run
	ALARM	MPa	alarm fixed			to run stop
6	DRP_INV frequency	Interme	diate revolution	0000 rpm, ra	ted revolut	ion 0000 rpm
7	MBP_INV frequency	Interme	diate revolution	3599 rpm, ra	ted revolut	ion 3600 rpm
8	Analog input spare 1	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	(10V)		alarm			to run stop
9	Analog input spare 2	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	(10 V)		alarm			to run stop
10	DRP current	9.0A	Higher alarm	10  sec		15 min after
	WARNING		fixed			run to run stop
11	DRP current	10.0A	Higher limit		10 sec	3 min after run
	ALARM		alarm fixed			to run stop
12	MBP current	$3.5 \mathrm{A}$	Higher limit	10 sec		5 sec after run
10	WARNING		alarm fixed		10	to run stop
13	MBP current	4.5 A	Higher limit		10 sec	5 sec after run
1.4	ALARM	0.17	alarm fixed	<b>F</b> (* 1	0	to run stop
14	BOX analog input $(10 \text{ V})$	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
15	BOX angler input	0.17	alarm	E and fined	0	to run stop
19	BOA analog input	0 V	Lower limit	o sec fixed	0 sec	5 sec after run
16	DRP tomporature	Highon	limit 60°C	5 and fixed	180 000	5 soo ofter run
10	Diti temperature	Roady 0		5 sec lixeu	100 Sec	to run ston
		Heater (	control 0°C			to run stop
17	MBP temperature	Highor	limit 0°C	5 sec fixed	180 800	5 sec after run
11	MDI temperature	Roady 0	PC	o see fixed	100 800	to run ston
		Heater of	control 0°C			to run stop
18	Exhaust ning	Highor	limit 0°C	5 sec fixed	0.500	5 see ofter run
10	temperature	Roady 0		5 Sec lixeu	U SEC	to run ston
	temperature	Heater (	control 0°C			to run stop
19	Ontion temperature	Highor	limit 0°C	5 sec fixed	0 sec	5 sec after run
10	option temperature	Roady 0	eC	o see fixed	0 Sec	to run ston
		Heater (	control 0°C			to run stop
20	Spare switch on box	B conto	et opon alarm	5 sec fixed	0.500	5 see ofter run
20	Spare switch off DOX	fixed	or open atarill	o sec nixeu	0 800	to run ston
21	Bun mode	11xeu 3				to run stop
22	Optional valve	o None				
23	Auto purge time	foo soc				
24	A/B contact	B conta	et.			
25	English/Jananese	English				
26	Baud rate setting	9600 hn	s			
27	RS485 address setting	00	~			
28	Start check	1				

Model No. 10 LR600
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	Name	Alarm	Higher/lower	Warning	Alarm	Monitor range
		set	limit alarm	time	time	
		value				
1	N2 purge gas	0.5	Lower limit	5 sec fixed	180 sec	5 sec after run
		SLM	alarm			to run stop
<b>2</b>	OP_N2 purge gas	0.0	Lower limit	5 sec fixed	0 sec	5 sec after run
		SLM	alarm			to run stop
3	Cooling water	4.0	Lower limit	5 sec fixed	180 sec	5 sec after run
		L/min	alarm			to run stop
4	Pumping pressure	0.000	Higher limit	$0 \sec$		5 sec after run
	WARNING	MPa	alarm fixed			to run stop
<b>5</b>	Pumping pressure	0.000	Higher limit		0 sec	5 sec after run
	ALARM	MPa	alarm fixed			to run stop
6	DRP_INV frequency	Interme	diate revolution	0000 rpm, ra	ted revolut	tion 0000 rpm
7	MBP_INV frequency	Interme	diate revolution	3599 rpm, ra	ted revolut	tion 3600 rpm
8	Analog input spare 1	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	(10V)		alarm			to run stop
9	Analog input spare 2	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	(10 V)		alarm			to run stop
10	DRP current	13.6A	Higher alarm	10  sec		15 min after
	WARNING		fixed			run to run stop
11	DRP current	15.6A	Higher limit		10  sec	3 min after run
	ALARM		alarm fixed			to run stop
12	MBP current	9.0 A	Higher limit	10  sec		5 sec after run
	WARNING		alarm fixed			to run stop
13	MBP current	$10.0 \mathrm{A}$	Higher limit		10  sec	5 sec after run
	ALARM		alarm fixed			to run stop
14	BOX analog input	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	spare 1 (10 V)	0 T.I	alarm			to run stop
15	BOX analog input	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
10	spare 2 (10 V)	TT· 1	alarm	<b>x</b> (° 1	100	to run stop
16	DRP temperature	Higher	limit 75°C	5 sec fixed	180 sec	5 sec after run
		Ready 0	°C			to run stop
	MDD	Heater	control 0 C	<b>-</b> (* 1	100	<b>-</b> 0.
17	MBP temperature	Higher	limit 0°C	5 sec fixed	180 sec	5 sec after run
		Ready 0	°C			to run stop
10		Heater	control 0 C	<b>-</b> (* 1	0	<b>-</b> 0.
18	Exhaust pipe	Higher	limit 0°C	5 sec fixed	0 sec	5 sec after run
	temperature	Ready 0	°C			to run stop
		Heater of	control 0°C		-	
19	Option temperature	Higher	limit 0°C	5 sec fixed	0 sec	5 sec after run
		Ready 0	°C			to run stop
		Heater of	control 0°C			
20	Spare switch on box	B conta	ict open alarm	5 sec fixed	0 sec	5 sec after run
		fixed				to run stop
21	Kun mode	3				
22	Optional valve	None	None			
23	Auto purge time	600 sec				
24	A/B contact	B conta	et			
25	English/Japanese	English				
26	Baud rate setting	9600 bp	s			
27	RS485 address setting	00				
28	Start check	1				

Model No. 11	LR1200
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	Name	Alarm	Higher/lower	Warning	Alarm	Monitor range
		set	limit alarm	time	time	_
		value				
1	N2 purge gas	0.5	Lower limit	5 sec fixed	180 sec	5 sec after run
		SLM	alarm			to run stop
2	OP_N2 purge gas	0.0	Lower limit	5 sec fixed	0 sec	5 sec after run
		SLM	alarm			to run stop
3	Cooling water	4.0	Lower limit	5 sec fixed	180 sec	5 sec after run
		L/min	alarm			to run stop
4	Pumping pressure	0.000	Higher limit	0 sec		5 sec after run
	WARNING	MPa	alarm fixed			to run stop
5	Pumping pressure	0.000	Higher limit		0 sec	5 sec after run
	ALARM	MPa	alarm fixed			to run stop
6	DRP_INV frequency	Interme	diate revolution	0000 rpm, ra	ted revolut	ion 0000 rpm
7	MBP_INV frequency	Interme	diate revolution	3599 rpm, ra	ted revolut	ion 3600 rpm
8	Analog input spare 1	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	(10V)		alarm			to run stop
9	Analog input spare 2	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	(10 V)		alarm			to run stop
10	DRP current	13.6A	Higher alarm	10  sec		15 min after
	WARNING		fixed			run to run stop
11	DRP current	15.6A	Higher limit		10  sec	3 min after run
	ALARM		alarm fixed			to run stop
12	MBP current	13.6 A	Higher limit	10  sec		5 sec after run
	WARNING		alarm fixed			to run stop
13	MBP current alarm	$15.6\mathrm{A}$	Higher limit		10  sec	5 sec after run
			alarm fixed			to run stop
14	BOX analog input	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run
	spare 1 (10 V)		alarm		-	to run stop
15	BOX analog input	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
10	spare 2 (10 V)		alarm		100	to run stop
16	DRP temperature	Higher	limit 75°C	5 sec fixed	180 sec	5 sec after run
		Ready 0	°C			to run stop
		Heater	control 0 C		100	<b>-</b> 0.
17	MBP temperature	Higher	limit 0°C	5 sec fixed	180 sec	5 sec after run
		Ready 0	°C			to run stop
		Heater of	control 0°C		-	
18	Exhaust pipe	Higher	limit 0°C	5 sec fixed	0 sec	5 sec after run
	temperature	Ready 0	°C			to run stop
		Heater of	control 0°C			
19	Option temperature	Higher	limit 0°C	5 sec fixed	$0 \sec$	5 sec after run
		Ready 0	P°C			to run stop
		Heater of	control 0°C			
20	Spare switch on box	B conta	ict open alarm	5 sec fixed	$0 \sec$	5 sec after run
		fixed				to run stop
21	Run mode	3				
22	Optional valve	None				
23	Auto purge time	600 sec	600 sec			
24	A/B contact	B conta	et			
25	English/Japanese	English				
26	Baud rate setting	9600 bp	s			
27	RS485 address setting	00				
28	Start check	1				

Model No. 12	LR1800
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	Name	Alarm	Higher/lower	Warning	Alarm	Monitor range
		set	limit alarm	time	time	
		value				
1	N2 purge gas	0.5	Lower limit	5 sec fixed	180 sec	5 sec after run
		SLM	alarm			to run stop
2	OP_N2 purge gas	0.0	Lower limit	5 sec fixed	$0 \sec$	5 sec after run
		SLM	alarm			to run stop
3	Cooling water	4.0	Lower limit	5 sec fixed	180 sec	5 sec after run
		L/min	alarm			to run stop
4	Pumping pressure	0.000	Higher limit	0 sec		5 sec after run
	WARNING	MPa	alarm fixed			to run stop
<b>5</b>	Pumping pressure	0.000	Higher limit		$0 \sec$	5 sec after run
	ALARM	MPa	alarm fixed			to run stop
6	DRP_INV frequency	Interme	diate revolution	0000 rpm, ra	ted revolut	ion 0000 rpm
7	MBP_INV frequency	Interme	diate revolution	3599 rpm, ra	ted revolut	ion 3600 rpm
8	Analog input spare 1	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	(10V)		alarm			to run stop
9	Analog input spare 2	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run
	(10 V)		alarm			to run stop
10	DRP current	23.0A	Higher alarm	10 sec		15 min after
	WARNING		fixed			run to run stop
11	DRP current	24.0A	Higher limit		10  sec	3 min after run
	ALARM		alarm fixed			to run stop
12	MBP current	21.0A	Higher limit	10 sec		5 sec after run
	WARNING		alarm fixed			to run stop
13	MBP current	22.0A	Higher limit		10  sec	5 sec after run
	ALARM		alarm fixed			to run stop
14	BOX analog input	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run
	spare 1 (10 V)		alarm			to run stop
15	BOX analog input	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	spare 2 (10 V)		alarm			to run stop
16	DRP temperature	Higher	limit $85^{\circ}\mathrm{C}$	5 sec fixed	180  sec	5 sec after run
		Ready 0	°C			to run stop
		Heater	control 0°C			
17	MBP temperature	Higher	limit 0°C	5 sec fixed	180 sec	5 sec after run
		Ready 0	°C			to run stop
		Heater	control 0°C			
18	Exhaust pipe	Higher	limit 0°C	5 sec fixed	$0 \sec$	5 sec after run
	temperature	Ready 0	°C			to run stop
		Heater of	control 0°C			
19	Option temperature	Higher	limit 0°C	5 sec fixed	$0 \sec$	5 sec after run
		Ready 0	°C			to run stop
		Heater of	control 0°C			
20	Spare switch on box	B conta	ict open alarm	5 sec fixed	0 sec	5 sec after run
		fixed				to run stop
21	Run mode	3				
22	Optional valve	None				
23	Auto purge time	600 sec				
24	A/B contact	B contac	et			
25	English/Japanese	English				
26	Baud rate setting	9600 bp	s			
27	RS485 address setting	00				
28	Start check	1				

# MODEL No.13 HR60

	Name	Alarm	Higher/lower	Warning	Alarm	Monitor range
		set	limit alarm	time	time	
		value				
1	N2 purge gas	0.5	Lower limit	5 sec fixed	180 sec	5 sec after run to run
		SLM	alarm			stop
2	OP_N2 purge gas	0.0	Lower limit	5 sec fixed	0 sec	5 sec after run to run
		SLM	alarm			stop
3	Cooling water	4.0	Lower limit	5 sec fixed	180 sec	5 sec after run to run
		L/min	alarm			stop
4	Pumping pressure	0.120	Higher limit	10 sec		5 sec after run to run
	WARNING	MPa	alarm fixed			stop
<b>5</b>	Pumping pressure	0.130	Higher limit		$2 \sec$	5 sec after run to run
	ALARM	MPa	alarm fixed			stop
6	DRP_INV frequency	Interme	ediate revolution	0000 rpm, ra	ited revolu	ition 0000 rpm
7	MBP_INV frequency	Interme	diate revolution	0000 rpm, ra	ted revolu	tion 0000 rpm
8	Analog input spare 1	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run to run
	(10V)		alarm			stop
9	Analog input spare 2	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run to run
	(10 V)		alarm			stop
10	DRP current	9.0A	Higher alarm	$10 \sec$		15 min after run to
	WARNING		fixed			run stop
11	DRP current	10.0A	Higher limit		10 sec	3 min after run to run
10	ALARM	0.0.1	alarm fixed	10		stop
12	MBP current	0.0 A	Higher limit	10 sec		5 sec after run to run
10	WARNING	0.0.4	alarm fixed		10	stop
13	MBP current	0.0 A	Higher limit		10 sec	5 sec after run to run
14	ALANM POV analag input	οV	I amarin nxeu	5 and fired	0 200	stop
14	BOA analog input	υv	Lower minit	5 sec fixed	0 sec	stop
15	BOX analog input	0 V	Lower limit	5 sec fixed	0 800	5 sec after run to run
10	snare $2(10 \text{ V})$	0 .	alarm	5 Sec lixed	0 800	ston
16	DRP temperature	Higher	limit 115°C	5 sec fixed	180 sec	5 sec after run to run
10	Divi temperature	Ready 8	SO°C	o see inteu	100 500	stop
		Heater	control 0°C			
17	MBP temperature	Higher	limit 0°C	5 sec fixed	0 sec	5 sec after run to run
	••••• ••••• •••••	Ready (	°C			stop
		Heater	control 0°C			1
18	Exhaust pipe	Higher	limit 120°C	5 sec fixed	180 sec	5 sec after run to run
	temperature	Ready (	)°C			stop
	-	Heater	control 100°C			-
19	Option temperature	Higher	limit 0°C	5 sec fixed	0 sec	5 sec after run to run
	1 1	Ready (	0°C			stop
		Heater	control 0°C			-
20	Spare switch on box	B conta	act open alarm	5 sec fixed	0 sec	5 sec after run to run
	1	fixed	Ĩ			stop
21	Run mode	3				
22	Optional valve	None				
23	Auto purge time	600 sec				
24	A/B contact	B conta	et			
25	English/Japanese	English				
26	Baud rate setting	9600 bp	s			
27	RS485 address setting	00				
28	Start check	1				

# MODEL No.14 HR90

	Name	Alarm	Higher/lower	Warning	Alarm	Monitor range
		set	limit alarm	time	time	
		value				
1	N2 purge gas	0.5 SLM	Lower limit alarm	5 sec fixed	180 sec	5 sec after run to run stop
2	OP_N2 purge gas	0.0 SLM	Lower limit alarm	5 sec fixed	0 sec	5 sec after run to run stop
3	Cooling water	4.0	Lower limit	5 sec fixed	180 sec	5 sec after run to run
4	D	L/min	alarm	10		stop
4	WARNING	MPa	alarm fixed	10 sec		stop
<b>5</b>	Pumping pressure	0.130	Higher limit		$2 \sec$	5 sec after run to run
	ALARM	MPa	alarm fixed			stop
6	DRP_INV frequency	Interme	ediate revolution	0000 rpm, ra	ted revolu	tion 0000 rpm
7	MBP_INV frequency	Interme	ediate revolution	0000 rpm, ra	ted revolu	tion 0000 rpm
8	Analog input spare 1 (10V)	0 V	Lower limit alarm	5 sec fixed	0 sec	5 sec after run to run stop
9	Analog input spare 2 (10 V)	0 V	Lower limit alarm	5 sec fixed	0 sec	5 sec after run to run stop
10	DRP current WARNING	13.6A	Higher alarm fixed	10 sec		15 min after run to run stop
11	DRP current ALARM	15.6A	Higher limit alarm fixed		10 sec	3 min after run to run stop
12	MBP current WARNING	0.0 A	Higher limit alarm fixed	10 sec		5 sec after run to run stop
13	MBP current	0.0 A	Higher limit		10 sec	5 sec after run to run
14	ALANM BOX analog input	ΟV	Lower limit	5 coo fived	0 000	stop
14	spare 1 (10 V)	0 V	alarm	5 sec fixed	0 sec	stop
15	BOX analog input spare 2 (10 V)	0 V	Lower limit alarm	5 sec fixed	0 sec	5 sec after run to run stop
16	DRP temperature	Higher Ready 7 Heater	limit 120°C 70°C control 0°C	5 sec fixed	180 sec	5 sec after run to run stop
17	MBP temperature	Higher Ready ( Heater	limit 0°C )°C control 0°C	5 sec fixed	0 sec	5 sec after run to run stop
18	Exhaust pipe temperature	Higher Ready ( Heater	limit 120°C )°C control 100°C	5 sec fixed	180 sec	5 sec after run to run stop
19	Option temperature	Higher Ready ( Heater	limit 0°C 0°C control 0°C	5 sec fixed	0 sec	5 sec after run to run stop
20	Spare switch on box	B conta fixed	act open alarm	5 sec fixed	0 sec	5 sec after run to run stop
21	Run mode	3				-
22	Optional valve	None				
23	Auto purge time	600 sec				
24	A/B contact	B conta	ct			
25	English/Japanese	English				
26	Baud rate setting	9600 bp	s			
27	RS485 address setting	00				
28	Start check	1				

# Model No. 15 HR180

	Name	Alarm	Higher/lower	Warning	Alarm	Monitor range
		set	limit alarm	time	time	
		value				
1	N2 purge gas	0.5	Lower limit	5 sec fixed	180 sec	5 sec after run to
		SLM	alarm			run stop
2	OP_N2 purge gas	0.0	Lower limit	5 sec fixed	$0 \sec$	5 sec after run to
		SLM	alarm			run stop
3	Cooling water	4.0	Lower limit	5 sec fixed	180 sec	5 sec after run to
		L/min	alarm			run stop
4	Pumping pressure	0.120	Higher limit	10 sec		5 sec after run to
	WARNING	MPa	alarm fixed			run stop
<b>5</b>	Pumping pressure	0.130	Higher limit		$2 \sec$	5 sec after run to
	ALARM	MPa	alarm fixed			run stop
6	DRP_INV frequency	Intermediate revolution 0000 rpm, rated revolution 0000 rpm				
7	MBP_INV frequency	Intermediate revolution 0000 rpm, rated revolution 0000 rpm				
8	Analog input spare 1	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run to
	(10V)		alarm			run stop
9	Analog input spare 2	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run to
	(10 V)		alarm			run stop
10	DRP current	21.0A	Higher alarm	10  sec		15 min after run
	WARNING		fixed			to run stop
11	DRP current	22.0A	Higher limit		10  sec	3 min after run to
	ALARM		alarm fixed			run stop
12	MBP current	0.0 A	Higher limit	10  sec		5 sec after run to
	WARNING		alarm fixed			run stop
13	MBP current alarm	0.0 A	Higher limit		10  sec	5 sec after run to
			alarm fixed			run stop
14	BOX analog input	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run to
	spare 1 (10 V)	0.17	alarm		-	run stop
15	BOX analog input	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run to
10	spare 2 (10 V)	TT· 1	alarm	<b>x</b> (* 1	100	run stop
16	DRP temperature	Higher limit 85°C		5 sec fixed	180 sec	5 sec after run to
		Ready 45°C				run stop
	MDD	Heater control 0°C		<b>-</b> (* 1	0	<b>-</b> 0:
17	MBP temperature	Higher limit 0°C		5 sec fixed	0 sec	5 sec after run to
		Ready 0°C				run stop
10		Heater control 0°C			100	
18	Exhaust pipe	Higher limit 120°C		5 sec fixed	180 sec	5 sec after run to
	temperature	Keady 0°C				run stop
		Heater control 100°C				
19	Option temperature	Higher limit 0°C		5 sec fixed	$0 \sec$	5 sec after run to
		Ready 0	P°C			run stop
		Heater control 0°C				
20	Spare switch on box	B contact open alarm fixed		5 sec fixed	$0 \sec$	5 sec after run to
						run stop
21	Kun mode	3 N				
22	Optional valve	None				
23	Auto purge time	600 sec				
24	A/B contact	B contact				
25	English/Japanese	English				
26	Baud rate setting	9600 bps				
27	RS485 address setting	00				
28	Start check	1				
Model No. 16	HR300					
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	Name	Alarm	Higher/lower	Warning	Alarm	Monitor range
		set	limit alarm	time	time	
		value				
1	N2 purge gas	0.5	Lower limit	5 sec fixed	180 sec	5 sec after run
		SLM	alarm			to run stop
2	OP_N2 purge gas	0.0	Lower limit	5 sec fixed	$0 \sec$	5 sec after run
		SLM	alarm			to run stop
3	Cooling water	4.0	Lower limit	5 sec fixed	180 sec	5 sec after run
		L/min	alarm			to run stop
4	Pumping pressure	0.120	Higher limit	10  sec		5 sec after run
	WARNING	MPa	alarm fixed			to run stop
<b>5</b>	Pumping pressure	0.130	Higher limit		$2 \sec$	5 sec after run
	ALARM	MPa	alarm fixed			to run stop
6	DRP_INV frequency	Interme	diate revolution	0000 rpm, ra	ted revolut	ion 0000 rpm
7	MBP_INV frequency	Interme	diate revolution	3599 rpm, ra	ted revolut	10n 3600 rpm
8	Analog input spare 1	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
0	(10V)	0 II	alarm	~ ~ 1	-	to run stop
9	Analog input spare 2	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run
10	(10 V)	0.01	alarm	10		to run stop
10	DRP current	9.0A	Higher alarm	10 sec		15 min after
	WARNING	10.04	fixed		10	run to run stop
11	DRP current	10.0A	Higher limit		10 sec	3 min after run
10	ALARM	0 7 4	alarm fixed	10		to run stop
12	MBP current	3.5 A	Higher limit	10 sec		5 sec after run
10	WARNING MDD	4 5 4	alarm fixed		10	to run stop
13	MBP current	4.5 A	Higner limit		10 sec	5 sec after run
14	ALANM BOX analog input	0 V	I owor limit	5 and fixed	0 000	5 ago ofter run
14	DOX allalog input	υv	alarm	5 sec fixed	0 sec	to run ston
15	BOX analog input	0 V	Lower limit	5 sec fixed	() sec	5 sec after run
10	spare $2(10 \text{ V})$	0 1	alarm	o see lixeu	0 800	to run stop
16	DRP temperature	Higher	limit 115°C	5 sec fixed	180 sec	5 sec after run
10	Divi temperature	Ready 80°C		o see intea	100 500	to run stop
		Heater	control 0°C			··· - ···· ···· P
17	MBP temperature	Higher	limit 140°C	5 sec fixed	180 sec	5 sec after run
	mer comperature	Ready 6	0°C	o see inica	100.000	to run stop
		Heater	control 70°C			
18	Exhaust pipe	Higher	limit 120°C	5 sec fixed	180 sec	5 sec after run
10	temperature	Ready 0	°C	o see inica	100.000	to run stop
	I. I.	Heater	control 100°C			
19	Option temperature	Higher	limit 0°C	5 sec fixed	0 sec	5 sec after run
	- p p	Ready 0	°C			to run stop
		Heater	control 0°C			1
20	Spare switch on box	B conts	ict open alarm	5 sec fixed	0 sec	5 sec after run
	T	fixed				to run stop
21	Run mode	3				
22	Optional valve	None				
23	Auto purge time	600 sec				
24	A/B contact	B conta	et			
25	English/Japanese	English				
26	Baud rate setting	9600 bp	s			
27	RS485 address setting	00				
28	Start check	1		1		

Model No. 17	HR600
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	Name	Alarm	Higher/lower	Warning	Alarm	Monitor range
		set	limit alarm	time	time	0
		value				
1	N2 purge gas	0.5	Lower limit	5 sec fixed	180 sec	5 sec after run
		SLM	alarm			to run stop
2	OP_N2 purge gas	0.0	Lower limit	5 sec fixed	0 sec	5 sec after run
		SLM	alarm			to run stop
3	Cooling water	4.0	Lower limit	5 sec fixed	180 sec	5 sec after run
		L/min	alarm			to run stop
4	Pumping pressure	0.120	Higher limit	10 sec		5 sec after run
	WARNING	MPa	alarm fixed			to run stop
<b>5</b>	Pumping pressure	0.130	Higher limit		$2 \sec$	5 sec after run
	ALARM	MPa	alarm fixed			to run stop
6	DRP_INV frequency	Interme	diate revolution	0000 rpm, ra	ted revolut	ion 0000 rpm
7	MBP_INV frequency	Interme	diate revolution	3599 rpm, ra	ted revolut	ion 3600 rpm
8	Analog input spare 1	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	(10V)		alarm			to run stop
9	Analog input spare 2	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	(10 V)		alarm			to run stop
10	DRP current	13.6A	Higher alarm	10 sec		15 min after
	WARNING		fixed			run to run stop
11	DRP current	15.6A	Higher limit		10  sec	3 min after run
	ALARM		alarm fixed			to run stop
12	MBP current	9.0 A	Higher limit	10  sec		5 sec after run
	WARNING		alarm fixed			to run stop
13	MBP current	10.0 A	Higher limit		10  sec	5 sec after run
	ALARM		alarm fixed			to run stop
14	BOX analog input	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	spare 1 (10 V)		alarm			to run stop
15	BOX analog input	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	spare 2 (10 V)		alarm			to run stop
16	DRP temperature	Higher limit 120°C		5 sec fixed	180 sec	5 sec after run
		Ready 7	0°C			to run stop
		Heater of	control 0°C			
17	MBP temperature	Higher	limit 140°C	5 sec fixed	180 sec	5 sec after run
		Ready 8	5°C			to run stop
		Heater	control 90°C			
18	Exhaust pipe	Higher	limit 120°C	5 sec fixed	180 sec	5 sec after run
	temperature	Ready 0	°C			to run stop
		Heater	control 100°C			
19	Option temperature	Higher	limit 0°C	5 sec fixed	0 sec	5 sec after run
		Ready 0	°C			to run stop
		Heater of	control 0°C			
20	Spare switch on box	B conta	ict open alarm	5 sec fixed	0 sec	5 sec after run
		fixed				to run stop
21	Run mode	3				
22	Optional valve	None				
23	Auto purge time	600 sec				
24	A/B contact	B conta	et			
25	English/Japanese	English				
26	Baud rate setting	9600 bp	s			
27	RS485 address setting	00				
28	Start check	1				

Model No. 18 HR	1200
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	Name	Alarm	Higher/lower	Warning	Alarm	Monitor range
		$\operatorname{set}$	limit alarm	time	time	
		value				
1	N2 purge gas	0.5	Lower limit	5 sec fixed	180 sec	5 sec after run
		SLM	alarm			to run stop
2	OP_N2 purge gas	0.0	Lower limit	5 sec fixed	0 sec	5 sec after run
		SLM	alarm			to run stop
3	Cooling water	4.0	Lower limit	5 sec fixed	180 sec	5 sec after run
		L/min	alarm	1.0		to run stop
4	Pumping pressure	0.120	Higher limit	10  sec		5 sec after run
~	WARNING	MPa	alarm fixed		0	to run stop
5	Pumping pressure	0.130 MD-	Higher limit		2 sec	5 sec after run
C	ALARM	MPa	alarm fixed	0000	· · · · · · · · · · · · · · · · · · ·	to run stop
6	DRP_INV frequency	Interme	diate revolution	0000 rpm, ra	ted revolut	ion 0000 rpm
1	MBP_INV frequency	Interme	diate revolution	3599 rpm, ra	tea revolut	10n 3600 rpm
8	Analog input spare 1	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
0	(10V)	0.17	alarm	<b>F</b> (* 1	0	to run stop
9	Analog input spare 2 $(10 \text{ V})$	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
10	(10 V)	13.64	Highor olorm	10 000		15 min ofter
10	WARNING	13.0A	fixed	10 sec		run to run ston
11	DRP current	15.64	Highor limit		10 800	3 min after run
11	ALARM	10.04	alarm fixed		10 860	to run ston
12	MBP current	136A	Higher limit	10 sec		5 sec after run
14	WARNING	10.011	alarm fixed	10 500		to run stop
13	MBP current alarm	15.6 A	Higher limit		10 sec	5 sec after run
			alarm fixed			to run stop
14	BOX analog input	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	spare 1 (10 V)		alarm			to run stop
15	BOX analog input	0 V	Lower limit	5 sec fixed	0 sec	5 sec after run
	spare 2 (10 V)		alarm			to run stop
16	DRP temperature	Higher limit 120°C		5 sec fixed	180 sec	5 sec after run
		Ready 7	0°C			to run stop
		Heater	control 0°C			
17	MBP temperature	Higher	limit 140°C	5 sec fixed	180 sec	5 sec after run
		Ready 8	5°C			to run stop
		Heater	control 90°C			
18	Exhaust pipe	Higher	limit 120°C	5 sec fixed	180 sec	5 sec after run
	temperature	Ready 0	°C			to run stop
	_	Heater	control 100°C			
19	Option temperature	Higher	limit 0°C	5 sec fixed	$0 \sec$	5 sec after run
		Ready 0	°C			to run stop
~ ~	~	Heater of	control 0°C		-	
20	Spare switch on box	B conta	ict open alarm	5 sec fixed	0 sec	5 sec after run
01		fixed				to run stop
21	Kun mode	3 N.				
22	Optional valve	INONE				
23	Auto purge time	DUU SEC	-+			
24	A/D contact	E conta	jt			
20 96	Boud rate cotting	Denglish	2			
$\frac{20}{97}$	BS485 address setting	9000 ap	8			
41 90	Start check	1				
40	DIALI CHECK	1		1		

Model No. 20	HR1800
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	Name	Alarm	Higher/lower	Warning	Alarm	Monitor range
		set	limit alarm	time	time	
		value				
1	N2 purge gas	0.5	Lower limit	5 sec fixed	180 sec	5 sec after run
		SLM	alarm			to run stop
2	OP_N2 purge gas	0.0	Lower limit	5 sec fixed	0 sec	5 sec after run
		SLM	alarm			to run stop
3	Cooling water	4.0	Lower limit	5 sec fixed	180 sec	5 sec after run
		L/min	alarm			to run stop
4	Pumping pressure	0.120	Higher limit	10 sec		5 sec after run
	WARNING	MPa	alarm fixed			to run stop
<b>5</b>	Pumping pressure	0.130	Higher limit		$2 \sec$	5 sec after run
	ALARM	MPa	alarm fixed			to run stop
6	DRP_INV frequency	Interme	diate revolution	0000 rpm, ra	ted revolut	ion 0000 rpm
7	MBP_INV frequency	Interme	diate revolution	3599 rpm, ra	ted revolut	ion 3600 rpm
8	Analog input spare 1	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run
	(10V)		alarm			to run stop
9	Analog input spare 2	0 V	Lower limit	5 sec fixed	$0 \sec$	5 sec after run
	(10 V)		alarm			to run stop
10	DRP current	21.0A	Higher alarm	10  sec		15 min after
	WARNING		fixed			run to run stop
11	DRP current	22.0A	Higher limit		10 sec	3 min after run
10	ALARM	21.24	alarm fixed			to run stop
12	MBP current	21.0A	Higher limit	10 sec		5 sec after run
10	WARNING	00.04	alarm fixed		10	to run stop
13	MBP current	22.0A	Higher limit		10 sec	5 sec after run
14	ALARM POV analag input	0 V	I amon limit	5 and fired	0 222	to run stop
14	BOX analog input	0 V	Lower limit	5 sec fixed	0 sec	b sec after run
15	BOX analog input	0 V	Lowor limit	5 see fixed	0 800	5 soc after run
10	snare $2(10 \text{ V})$	U V	alarm	5 Sec lizeu	U SEC	to run ston
16	DRP temperature	Higher	imit 85°C	5 sec fixed	180 sec	5 sec after run
10	Divi temperature	Ready 45°C		0.000 11100	100.000	to run stop
		Heater	control 0°C			1
17	MBP temperature	Higher	limit 140°C	5 sec fixed	180 sec	5 sec after run
		Ready 8	5°C			to run stop
		Heater	control 90°C			1
18	Exhaust pipe	Higher	limit 120°C	5 sec fixed	180 sec	5 sec after run
	temperature	Ready 0	°C			to run stop
	-	Heater	control 100°C			-
19	Option temperature	Higher	limit 0°C	5 sec fixed	0 sec	5 sec after run
	1 1	Ready 0	°C			to run stop
		Heater of	control 0°C			_
20	Spare switch on box	B conta	ict open alarm	5 sec fixed	0 sec	5 sec after run
	-	fixed	1			to run stop
21	Run mode	3				_
22	Optional valve	None				
23	Auto purge time	600 sec				
24	A/B contact	B conta	et			
25	English/Japanese	English				
26	Baud rate setting	9600 bp	s			
27	RS485 address setting	00				
28	Start check	1	1			

#### Explanation of Set Items

- (1) The list above shows the default values of standard settings.
- (2) This pump gives the following two types of WARNING and ALARM signal.
  - (a) When the number of set value is one and the pump is to be stopped at a certain time

The pump displays "N<sub>2</sub> Purge Gas" if DRP N2 purges gas becomes lower than the WARNING set value of 0.5L/min and this condition continues for more than the WARNING set time of 5.0 sec. If the purge gas flow rate is not corrected and the ALARM set time has passed 180 seconds, ALARM will be given and the pump will stop automatically. The same applies to "N<sub>2</sub> FLOW OPTION", "WATER FLOW" and "DRP PUMP TEMP".

Also set items include flow rate set value and set time.

- (b) When values can be set individually to WARNING and ALARM The pump gives "DRP CURRENT" WARNING if the motor power has exceeded the WARNING set value of 13.5A (HR90) and this condition continues for more than WARNING set time of 10 sec. If the ALARM set value of 15.5A (HR90) is exceeded for the ALARM set time of 10 seconds, ALARM will be given and the pump will stop automatically. Set items include four: WARNING set value and set time and ALARM set value and set time.
- (3) If the alarm set value is 0, the item will not be monitored.
- (4) In the item of temperature, the initial set value (H) is the alarm set value. The next set value (R) is the READY signal set value when temperature rise is completed. The third set value is used when controlling the heater using this input. Temperature is controlled within the range of set temperature  $\pm 3^{\circ}$ C.
- (5) Auto purge delays the time of closing the N2 purge gas valve when stopping the pump. Enter delay time.
- (6) Set the baud rate according to the equipment connected when RS485/232C is used. The baud rate is 9600bps as standard, but it can be changed to 2400bps or 4800bps if required.
- (7) The address is the No. of the branch-wired pump when RS485/232C is used. Up to maximum 16 can be branched.
- (8) Start check sets a timing to issue the signal of start check. In the case of 1, the signal of start check is issued by confirming that the pump is rotating at the specified revolution. In the case of 2, the signal of start check is issued one second later when start switch of the controller is pushed. In addition, when intermediate revolution and rated revolution are same (DRP\_INV frequency / MBP\_INV frequency), the signal of start check is issued one second later when start switch of the controller is pushed regardless of start check = 1 or 2.



When the temperature of the pump is low, and the process is done, the process gas is cooled in the pump.
Driving the pump because a sublime material adheres in the pump according to the kind of the gas might become impossible. Please confirm Ready signal of the temperature of the pump to avoid such trouble.

Ready signal is Pin.14 of (2.4.2 Wiring for remote control)

- If the temperature of the pump rises up to the preset temperature, Pin.No14 and No19 close.

- The temperature of Ready signal of each model of has been decided. However, the object model becomes only HR series.

Example of using Ready signal. HR s

CAUTION

# 3.8 Preliminary Operation (Setting of Utilities)

Setting of secondary utilities (pump side) should be done after starting the pump.

- The maximum exhaust pressure is <u>0.10 MPa (absolute pressure)</u>. In excess of this, the seal members may be damaged or overheated, resulting in trouble. Installation of a pressure gauge that can monitor the exhaust pressure is recommended.

- Always use the pump with the check valve installed. Otherwise, exhaust-side gas may back-stream abruptly when the pump is stopped and may damage the drive control system of the pump.

- Before starting the pump, check the primary utility setting. Until all the utility setting is fulfilled, the pump cannot start because the safety circuit activates.

- If valve is fixed at the downstream of the outlet port, then check the valve is opened.

Start the pump

# 3.8.1 Setting of Nitrogen Gas Pressure

Open the valve on the supply side to apply nitrogen gas pressure.

The regulator is factory locked. Pull the knob until it clicks to unlock it and regulate the pressure on the pump side to 0.05 to 0.10 MPa (gauge pressure).



If pressure is increased to above 0.9 MPa, the solenoid value in the pump will be disabled. Regulate the flow rate after the pump has started. Refer to [1.2 Specifications for utilities] for the flow rate and pressure setting conditions.

Nitrogen gas pressure varies with consumption. Re-regulate the secondary pressure to the specified value of 0.05 - 0.10MPa after regulate it for consumption.



# 3.8.2 Setting the seal gas flow rate

The seal gas flow rate is controlled by a fixed orifice. Gas flows at a rate of 5.0 SLM within the range of 0.05 to 0.1 MPa. Regulation is not required.

# 3.8.3 Setting the gas ballast gas flow rate (in mode 3)

After the pump has started, set the gas ballast gas flow rate according to the process.



- If gas ballast gas is fed, the ultimate pressure will higher (about 10 Pa at 45 SLM).

For the adjustment, use the gas ballast gas-regulating valve on the front panel.



# 3.8.4 Setting the cooling water flow rate



- If the pump is operated for a long time with insufficient cooling water, the pump may fail. Always feed cooling water at the prescribed flow rate.

- Regulate the cooling water flow rate to <u>5.0 L/min</u> or more using the primary pressure or cooling water flow rate control valve in the system.

# 3.9 Operation

Please contact with your nearest service center in order to avoid occurring an alarm or a failure, if the pump can be used under following conditions.



- Don't use the pump under a continuous heavy load (e.g. a slow pumping) for a long time in a tact operation. In this case, the pump may be broken down due to a heavy load. The pump was designed in order to evacuate a closed vacuum chamber without a leak.

- Don't use the pump under a continuous heavy load for more than one minute at a start-up. If the pump cannot reach the stationary rotational frequency within one minute at a startup, the pump will be stopped due to working a protection circuit of an inverter. An alarm of "MBP Power E alarm" is displayed in the controller, and the pump will be stopped.

# **3.10 stop** Stop the pump.



- The pump is very hot during operation and for some time after it stops. Contact with it may cause burn. Feed cooling water for about one hour after the pump is shut down. Never remove the external panel until the pump cools down.

- Contact with electric parts, wiring or others in the panel may cause electric shock. Never run the pump with the external panel removed.

- Suction and the exhaust pipe are  $70^\circ\!{\rm C}$  or more. Remove the protection cover after about one hour after the pump is shut down.

# 3.11 Self-Diagnostic Function

The operating state is always monitored for the monitor items mentioned earlier. When abnormality occurs

Operation	Controller display		
0. Normal Operation	CONDITION/Running		
1. If pump operation is continued without meeting the requirements, WARNING will be given on LCD and as remote signal.	Pump temperature High – WARNING		
2. If the condition in (1) continues for a certain length of time or if the operation limit value is reached, ALARM will be given on LCD and as remote signal. Pump automatically stops.	Pump temperature High – ALARM		

The WARNING LED on the controller will light and the buzzer will sound if any trouble occurs. (The pump is running in this state.)

- If the pump is stopped when the WARNING signal is given, the signal will be held even after stop.
- When the pump stops automatically, the ALARM signal will be held even after the stop.
- To reset these signals, press the RESET switch after the pump has stopped.
- ALARM signal will not be given when the pump is at stop.
- If two or more troubles occur during operation, \* will be displayed at extreme end of the item. In this case, other items can be checked by pressing  $[\Delta]$  or  $[\nabla]$  key.
- The absolute value of the item for which alarm is given can be checked by pressing the [MODE] key when the item is displayed on the alarm display screen.

# 3.12 Logging Function

- Records the time items of ALARMS and WARNINGS were given up to maximum 100 events.
- When the [MODE] switch is pressed, **SITUATION RECORD DATA** is displayed.
- Pressing the  $[\nabla]$  or  $[\triangle]$  switch displays the items in occurrence order.
- Can be checked during run.

Display example	Cooling water low <alm>0101071435</alm>
Display content	Stopped due to low cooling water flow rate at 2:35 pm on January 7, 2001.

# 4. Inspection And Maintenance

#### 4.1 Inspection

- Periodically check (it is recommended to check once a day) the controller or the remote operation output to see if any alarming signal is output.

Also check the log data to see if any alarming data is reported.

If alarming signal is displayed, take steps according to the **TROBLE SHOOTING**.

- When the pump is contaminated, wipe out it with a dry rag.

#### 4.2 Maintenance

- These LR/HR products are maintenance free except when to connect with the host equipment, or disconnect from it, and to regulate N2 gas flow at the time of operation. Overhaul or repair work is performed at ULVAC. When any trouble occurs, please contact with your local ULVAC service center (please refer to the ULVAC address list at the end of this manual).

#### < Maintenance period >

It is recommended to overhaul the pump once a year.

The bearing on the vacuum side uses grease for lubrication. Replace the bearing once a year, as rule, though the frequency changes with use and application of the pump. It is important to maintain the performance (safety is included) and keep the programmed production. (However, the exchange period is different depending on use conditions)

Part name	Model name	Part name	Model name
Bearing	All models	Power lock	All models
O-ring	All models	Coupling spider	All models
Teflon seal	All models	Bearing of motor	All models
Axis receiving turn stop	All models	Vacuum pump oil	All models
Labyrinth ring	All models		

When overhauling it, parts for which the exchange is necessary.

#### Parts for which exchange is necessary every two years.

Part name	Model name	Part name	Model name
Pressure sensor	HR series	Bearing case	All models

Parts for which exchange is necessary every three years.

Part name	Model name	Part name	Model name		
Solid-state relay	HR series	Pressure diameter for purge gas		All models	
Cooling fan	All models	Inverter LR/HR30		00, 600,1200,1800	
Ball	All models	Seal sleeve		All models	
Compression spring	All models				

Parts for which exchange is necessary every five years.

Part name Model name		Part name	Model name		
Breaker	HR series	Switching power supply		All models	
Magnetic contact	All models	Controller		All models	
Cooling water sensor	All models	Exhaust piping heater		HR series	
Flow sensor for purge gas	All models	Mantle heater HR300, 6		600,1200,1800	
Current sensor	All models	Cylinder <sup>1)</sup>		All models	
Solenoid-controlled valve	All models	Rotor shaft <sup>1)</sup>		All models	
Thermo-couple	All models	Rubber vibration isolator		All models	
Control base	All models				

1)When the size is measured, and the warp is confirmed, they are the exchanges. When overhaul is required, please contact with your local ULVAC service center. All overhaul will be performed at the ULVAC.

# ULVAC

< Removal procedure >

Power wiring



: Shutoff the power securely according to the diagram below before starting installation or removal work.



<< Electric shock is possible >>

You should not operate this system unless you have electrical safety training course record.

1. Shut off the breaker (MCB1, MCB2 (LR/HR300, LR/HR600, LR/HR1200, LR/HR1800)) of the pump.

2. Ensure that LCD of the controller (PCTL) is off.

3. Shutoff the breaker (M/D) of the host equipment.

4. Make lockout and tag-out according to the host equipment instruction manual.

5. Through current indication lamp which may be provided in the host equipment, ensure that wire is not alive.

6. Remove power connector.



Cooling water



- Because cooling water in the pump boils when the collaboration of cooling water is removed immediately after the stop of the pump and pressure rises the sensor and piping might be damaged. Please supply cooling water until the temperature of the pump falls.

- The pump is very hot during operation and for some time after it stop. Contact with it may cause burn. Feed cooling water for about one hour after the pump shut down.

- Close the cooling water supply valve (HWSV). After the valve is closed, tag **CLOSE** sign on the grip.

- Through visual flow gauge (HWFM: e.g. flow sight) on the host equipment ensure that flow is shutoff.

# Remove piping

Please do the following work when you drain cooling water from the pump.

- 1) Compress air is introduced from [Cooling water outlet] of the pump.
- 2) Work ends if compress air is exhausted from  $[\![ Cooling water inlet ]\!]$  .



When compress air is introduced from  $\llbracket$  Cooling water inlet, the cooling water sensor might be damaged by the load of compress air. Therefore, please introduce compress air from  $\llbracket$  Cooling water outlet.

# Nitrogen Gas



-Close the nitrogen gas supply valve(HPSV) on the host equipment. After the valve is closed, tag **CLOSE** sign on the grip.

- Gas will still remain in the host equipment piping. Place pressure gauge on the host equipment nitrogen supply source (halfway of the piping to the pump), and ensure that the pressure has already down within atmospheric pressure.

Remove piping.

# Suction and exhaust gases



<< High temperature surface >>

Be careful of the high temperature surface near this label (intake and exhaust outlet...).

- Remove the piping according to the manual provided for the host equipment.

- Suction and exhaust pipe is very hot for some time after pump stop. Remove the protection cover after about one hour after the pump is shut down.

-Completely close the inlet and outlet ports with using closing flange

#### Shipping



: Although this pump is provided with casters, do not move it a long distance using these casters. If you move this pump in such a way, the load to move the pump exceeds the safety criterion. You could hurt your waist.



When to transit the pump, you should use loading machines (e.g. moving crane) and hang it, or load and fix the pump on a pallet, then transit it by pallet truck.



: Do not tilt the pump by more than  $10^{\circ}$  .

Pallet truck should not directly be placed under the pump base bottom. This could topple the pump.

# 4.3 TROUBLESHOOTING

# 4.3.1 Major Troubles

Symptom	Cause	Corrective action
Power cannot be applied.	Power is not supplied.	Supply power.
	Incorrect wiring of connector	Correctly make wiring connection.
		(Refer to 2.6.1 Power wiring)
	Leak in pump	Disassemble and repair pump.
No indication on display	Breaker is not turned on.	Turn on breaker.
	Failure of instrumentation	Replace instrumentation.
Controller can not activates the	LOCAL mode is not selected.	Press REMOTE/LOCAL switch on controller.
Pump.	STOP SWITCH is turned on.	Turn off STOP SWITCH.
	"EMERGEMCY STOP" is displayed.	Emergency stop pin of remote operation connector is not
		shorted.
		(Refer to 2.6.2 Wiring for remote control)
	"INTERLOCK" is displayed.	External interlock pin of remote operation connector is
		not shorted.
	Failure of instrumentation	Replace instrumentation.
Pump does not start by remote	REMOTE mode is not selected.	Press REMOTE/LOCAL selector switch on controller.
operation.	Failure of instrumentation	Replace instrumentation.
Unusual sound is heard from	Panel is vibrating	Contact with service center
pump.		Check by ULVAC personnel
	Exhaust sound	Sound may be high due to resonance in the piping when
		gas is being fed. Use a pipe with a thicker wall to
		suppress the sound.
	Failure of the pump	Contact with service center
		Check by ULVAC personnel
	Backing pressure rise	Check the exhaust piping.
	Leakage at inlet port	Check the piping. Repair the trouble.
Pressure does not lower.	Intake port wire netting is clogged.	Check the piping at the upstream of the PUMP.
	Pump operating temperature is not	Measure again one hour later.
	static.	The ultimate pressure in the "Specifications" is the value
		directly above the pump.
The temperature does not	Booster pump operating temperature	Operating for one hour.
increase. (only HR series)	is not static.	Turn on the bimetal switch because the bimetal switch
		has been turned off when the temperature does not
		increase after of the temperature error.
	Exhaust pipe operating temperature	Operating for one house.
	is not static.	Exchange the mantle heater because the temperature
		fuse has been cut when the temperature does not
		increase after of the temperature error.

# 4.3.2 In Case of Alarm Signal

Display	Symptom	Cause	Corrective action
$N_2$ PURGE	Purge gas flow	Flow rate regulating valve	Open the flow rate-
GAS LOW	rate low	is closed.	regulating valve.
ALARM		Insufficient difference	Increase supply pressure
		pressure at inlet/outlet	from host equipment.
		ports	
		Insufficient supply of gas	Increase supply of gas.
		Clogged piping	If the trouble is in the
		Leak in joint	pump, contact with service
			center. Repair by ULVAC
		Failure of instrument	Contact with service center,
			repair by ULVAC,
WATER	Cooling water	Flow rate regulating valve	Open the flow rate-
FLOW LOW	flow rate low	is closed.	regulating valve.
ALARM		Insufficient difference	Increase supply pressure
		pressure at inlet/outlet	from host equipment.
		ports	
		Insufficient supply of gas	Increase supply of gas from
			host equipment.
		Clogged piping	If the trouble is in the
		Leak in joint	pump, contact with service
			center. Repair by ULVAC
		Failure of instrument	Contact with service center.
	Alter course al	E	Repair by ULVAC
DRF/MDF DIIMD	Abhorman	is high	tomporature
TEMP	tomporaturo	Is high.	Open the flow rotes
HIGH	temperature	insumcient cooling water	open the now rate
ALARM		Failure of instrument	Contact with convice contor
		Fandre of mstrument	Benair by IILVAC
		Increase of backing	Clean and wash the
		pressure	exhaust nine
		The inlet pressure is high	Usual pressure is operating
		(only booster pump units	the range that is from the
		of HR series.)	ultimate pressure to 200Pa.
Exhaust	Abnormal	Environment temperature	Lower the environment
TEMP	increase of	is high.	temperature.
HIGH	exhaust pipe	Exhaust pressure is high.	Clean and wash the
ALARM	temperature	(>0.13Mpa)	exhaust pipe.
			(Reverse-valve)
DRP/MBP	Failure of	Disconnection of the	Contact with service center.
PUMP,	temperature	sensor wiring, contact of	Repair by ULVAC
Exhaust,	sensor	the connector, PC board	
Option		portion bad connection.	
TEMP			
E ALARM			

Display	Symptom	Cause	Corrective action
DRP/MBP	Overload of motor	Increase of backing	Clean and wash piping at
CURRENT		pressure	downstream of pump
HIGH		Failure of instrument	Contact with service
ALARM		Rotation disabled by	center. Repair by ULVAC
		foreign substance	1
		Rotation disabled by low	
		flow rate	
		Rotation disabled by	
		damaged bearing	
DRP	Cut-off of the	Malfunction of the	Contact with service
CURRENT	electromagnetic	electromagnetic switch	center. Repair by ULVAC
E ALARM	switch	Failure of disconnection	concert respan of electro
	~	and instrumentation	
		products	
MBP	Inverter alarm	Breaker not turned.	Turn on the breaker.
CURRENT	activation	By the high load	Avoid exhaust
E ALARM		operation at startup, does	immediately after start-
		not reach the steady	up.
		rotation within the	I
		specified time.	
		Failure of disconnection	Contact with service
		and instrumentation	center. Repair by ULVAC
		products	1 0
RS232C	Communication	Disturbance of the	Improvement of the
ERROR	error between	transmitted signal due to	device side noise
	controller and main	noise, etc.	environment
	PC		Strengthening of the
			grounding line
		ROM/RAM data	Contact with service
		destroyed by static	center. Repair by ULVAC
		electricity, etc.	
		Failure of instrument	
		Controllers and PC	
		software version is not	
		compatible.	
SYSTEM	PC program out of	Watch dog circuit	Turn off power and turn
ERROR	control	actuated	it on again.
	Control power	Low output of control	Contact with service
	output low	power in pump	center. Repair by ULVAC
		Short-circuit of 24VDC	
		line	
		Short terminal of program	
		down-load JP1	
		misconnection	
OPPOSITE	Abnormally of the	Failure of the PC board	Contact with service
TURN	main PC	program.	center. Repair by ULVAC

# 5.WARRANTY TERMS

This product is shipped after strict internal inspection. If you find any manufacturing defects, accidents during the transportation, or other defects attributed to our responsibility, please contact our Components Division at headquarters or the nearest sales office or agency. The repair/replacement is free of charge.

# 5.1 Warranty Product

(1) Dry Vacuum Pump LR-Series/HR-Series 60/90/180/300/600/1200/1800

# 5.2 Warranty Period

- (1) Domestic: 1 year from the date of delivery
- (2) Direct export: 1 year from the date of B/L

# 5.3 Warranty Coverage

(1) Warranty coverage and disclaimer

The warranty covers the pump only. In the event of failures and accidents related to exhaust of air or nitrogen which are attributed to our defects in design or manufacturing, the product is repaired free of charge within 1 year from the date of delivery.

Any failures attributed to the following cause are not covered by the warranty and charged even within the warranty period.

• Failures and defects due to exhaust of gas other than air or nitrogen, or materials

- Failures and defects attributed to consumables
- If the product is used with a power supply other than that with power supply voltage and frequency you ordered.
- Failures and defects caused by natural disasters including fire, wind and flood, earthquake and thunderbolt, and unavoidable disasters including war
- Failures and defects caused by careless handling or misuse
- Products modified/disassembled/repaired without our permission
- Failures and defects under an abnormal environment (strong electromagnetic field, radiation environment, high temperature, high humidity, inflammable gas atmosphere, corrosive gas atmosphere, dust)
- Failures and defects due to noise
- Product failure or indirect damage to your company in the event of a claim by a third party to us on violation of patents
- When our engineers judge that the failures or defects are caused under the conditions of use inappropriate to this product

#### 5.4 How to Respond

(1) Domestic:

An alternative is delivered or the product is sent back to us or the nearest our service center for repair. If it is necessary to respond on site, contact our Components Division, or the nearest sales office or agency for assistance.

(2) Direct export:

An alternative is delivered or the product is sent back to us or the nearest our service center for repair. The return cost shall be borne by the customer.

#### 5.5 Others

- (1) If there are individual contracts and memorandum related to specifications in addition to this document, the contents in those documents prevail.
- (2) Please let us know if you export this product from Japan and take necessary procedures according to the provisions of export-related laws and regulations, such as foreign exchange laws and foreign trade laws.
- (3) For any questions and consultation on this product, check the model/serial number and then contact the nearest sales office or agency, or our Components Division.

https://www.ulvac.co.jp/support\_info/

(4) Note that the contents in this document is subject to change without prior notice.

# Attached material

b. About the exchange of FUSE (CE Type)

These fuses are set up for the protection of EMI filter (NF31, NF32). The necessity for changing this fuse is not caused usually. Controller's LCD disappears when this fuse cuts, and the pump stops.

The replacement procedure of the fuse has been described based on the demand item in UL3101. Please never do the clearing work independently. Please contact the nearby service center when the exchange is necessary.



<< Electric shock is possible >>

Never exchange it.

0. Please sever the pump from the power supply surely. Reference"4.2 maintenance: Power Wiring



PUMP	Use Fuse							
Model	Capacity of fuse	Number	Maker	Model				
LR/HR60	15	3	Little Fuse	CCMR 015.				
LR/HR90	30	3	Little Fuse	CCMR 030.				
LR/HR180	35	3	Little Fuse	CCMR 035.				
LR/HR300	30	3	Little Fuse	CCMR 030.				
LR/HR600	50	3	Little Fuse	CCMR 050.				
LR/HR1200	50	3	Little Fuse	CCMR 050.				
LR/HR1800	60	3	Little Fuse	CCMR 060.				

#### c. Communication system supplementation.

#### c-1 Communication connector connection chart.



CAUTION

Noting when communicating by RS-485.

• For the pump connected at the end, RS-485 terminator (between 8-9) is short-circuited.

- It is necessary to set the address to the pump when communicating by RS-485.
  - Please contact the service center when it is not set.
- Please input the 3 digits of ": n n" before the command when you order the command from the host side.

<u>: n n</u> [Command name] \* The command is the same as the RS-232C communication.

#### c-2 Communication command.



Command name: Display data read-out at start.           1         2         3         5         7         9         10         11	Command name: Baud rate setting         Command name: Baud rate setting         1 2 3 4 5 6 7 8 10 11 12 13 415 617 1619 20 22 23 45 55 71 26 30 33 2 33 45 55 71 30 30 45 45 45 45 45 45 45 45 45 45 45 45 45
Sensor number table.     No     Sensor name       0     Sensor name     0     Sensor name       01     NL purge gas.     10     MEP current.       02     0P NL purge gas.     11     Spare 1 in BOX.       03     Cooling water.     12     Spare 2 in BOX.       04     Exhaust pressure.     13     DRP temperature.       05     DRP INV frequency.     14     MEP temperature.       07     Option spare 2     17     Spare tipe temperature.       08     Option spare 2     17     Spare tipe temperature.       09     DRP Current.     17     Spare switch in BOX.	Command name: RS-455 address setting. 1 2 3 4 5 6 7 8 9 10 11 21 34 15 16 11 38 11 18 12 22 73 4 25 82 178 29 93 93 95 93 93 95 94 46 46 Host side CS/4 B5/hh/Rf 11 11 21 41 15 16 11 21 21 25 4 25 82 178 29 93 93 93 93 93 94 41 42 44 46 46 1 2 3 4 5 6 7 8 9 10 11 21 34 15 16 17 18 19 20 22 23 45 86 71 78 29 93 93 93 93 93 94 41 42 44 46 46 Pump side OK/K7 1 1 1 1 2 3 4 5 7 8 9 10 11 21 34 15 16 17 22 25 45 86 71 78 29 93 93 93 93 93 93 93 94 44 46 46 Pump side OK/K7 1 1 1 0 0 ~ 0 9
Command name: SV1 reversing instruction.           1 2 3 4 5 6 7 8 9 10 11 213 4 15 16 7 18 N20 2 2 2 2 3 4 5 6 7 8 3 9 3 13 2 3 3 4 5 4 5 4 4 4 4           Host side           1 2 3 4 5 6 7 8 9 10 11 213 4 15 16 7 18 N20 1 2 2 3 4 5 6 7 8 3 9 3 13 2 3 3 4 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 4 4 5 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Command name: Reset at running time.         1 2 3 4 5 6 7 8 9 1011 12 13 415 // 11 18 120 12 25 34 55 36 17 36 97 33 35 35 73 35 40 44 45 4         Host side         1 2 3 4 5 6 7 8 9 1011 12 13 415 // 11 18 19 20 12 25 34 55 36 17 36 40 33 45 35 35 35 45 44 45 45         Host side         1 2 3 4 5 6 7 8 9 1011 12 13 415 // 11 18 14 18 // 11 18 14 18 // 11 18 14 18 // 11 18 14 18 // 11 18 14 18 // 11 18 14 18 // 11 18 14 18 // 11
Command name:SV reversing instruction. 1 2 3 4 5 6 7 8 9 10 11 213 4 15 6 7 8 10 11 213 4 15 6 7 8 10 11 213 21 213 21 213 21 213 21 213 21 21 21 21 21 21 21 21 21 21 21 21 21	
Command name: Alarm log clearness.         1 2 3 4 5 6 7 8 9 10 11 12 13 44 16 // 10 // 02 02 03 45 66 27 86 93 01 22 34 46 46         Host side         Cutom of the second s	
	▲ 認 検 図 設 計 製 図 ULXXAAC 717LE New PDR-C commands State : Part 2 -
	MFG DWG No.

	Nb         Set content.           0.9 C         Run mode (1, 2, 3, M(4)).           0.9 T         A / B context (A context = 0, B context = 1).           0.9 C         Mucro-purge time (unit = second ).           0.9 C         Option value (0 = 1 is not 1 = 1 t is ).           1         0.9 Option value (0 = 1 is not 1 = 1 t is ).           1         1.0 Japanie / Endiah (0 = Japanie 1 = Endiah).           1         1.0 Japanie / Endiah (0 = Japanie 1 = Endiah).           1         1.0 Japanie / Endiah (0 = Japanie 1 = Endiah).           1         1.0 Japanie / Endiah (0 = Japanie 1 = Endiah).           1         1.0 Japanie / Endiah (0 = Japanie 1 = Endiah).           1         1.0 Japanie / Endiah (0 = Japanie 1 = Endiah).           1         1.0 Japanie / Endiah (0 = Japanie 1 = Endiah).           1         1.0 Japanie / Endiah (0 = Japanie 1 = Endiah).           1         1.0 Japanie / Endiah (0 = Japanie 1 = Endiah).           1         1.1 Z         Diff habater temperature.           1         1.1 S         Extense habater temperature.           1         1.1 S         Endiah babater temperature.		Image: State of the state o
83 年 5 後 31 8 3 9 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Set content.       No       Set content.         OR[20mere real bound pair value comparison reative.       0.7       No       No       Set content.         OR[20mere real bound pair value comparison reative.       0.7       No       No       Set content.         OR[20mere real bound pair value comparison reative.       0.7       No       No       No       No         Cooling water bound pair value comparison reative.       0.7       DFP INV reted frequency.       0.7       Def Mink       No       <	ole. eed internally.	e is written , the operation is not guaranteed. er supply because DATA is recorded in 承認 検 図 設 計 製 MFG MFG No.
Command name:Read-out of set content         1 2 3 4 5 6 7 8 9 10 11 21 14 15 16 17 18 18 27 18 19 28 28 28 28 28 28 28 28 28 28 28 28 28	set content.         Not purge gas warring value.         0.3       Confire water varring value.       0.5         0.3       Option spare 2 varring value.       0.5         0.4       DFR UN intermediate frequency.       0.5         0.4       DFR current sam value.       0.5         0.4       DFR cu	[Attention] Please use only the number which exists in the set tab The number which dose not exist in the set table is use	When the number which does not exist in the set table Moreover , it does not return in ON / OFF of the powe EEP-ROM when written.

Command name: Alarm log read-out           1         2         4         5         6         7         <
Postore Estimates in the firm of the firm
xx is a sensor number (When the sensor number is 35 or more, data from the 19th byte becomes irregular data). $\widehat{\Delta}$ ee shows warning by 01 and the alarm is shown by 02. We shows the low alarm by 00, the high alarm is shown by 01, and other warning is shown by 02. In the absence of data, signal is sert back with "O" entered at the 5th byte, "OR" entered at the 6th byte. The adsence of data, signal is sert back with "O" entered at the 5th byte, "OR" entered at the 6th byte. Please distancing the from 37th to 68th byte is CPU intermal data. $\widehat{\Delta}$
Sensor number table.       No.       Sensor name       No.       Sensor name         0       Nest Sor name       No.       Sensor name       No.       Sensor name         0       No.       Sensor name       No.       Sensor name       No.         0       No.       Sensor name       No.       Sensor name       No.         0       Opling water.       1       Same 1 in BOX       35       Pump stort.         0       Soling water.       1       Same 2 in BOX       36       Pump stort.         0       Exhaust pressure.       1       Same 2 in BOX       36       Pump stort.         0       MSP INV frequency.       39       Pump stort.       A         0       Option spare 1.       1       Same stort.       40       Pum storb witehold.         0       Option spare 1.       1       Same stort.       40       Pum storb witehold.       A         0       Option spare 1.       1       Same stort.       1       A       Pum storb.       A         0       Option spare 1.       1       Same stort.       1       A       Pum storb.       A         0       Option spare 1.       1       Same storb.
Command name: Warring read-out 1 2 3 4 5 1 2 9 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1
Command name: Alarm read-out          1 2 3 4 1 4 7 8 9 10 11 21 34 15 10 7 11 21 415 11 13 14 15 11 13 415 11 13 415 11 13 415 11 13 415 11 13 415 11 13 415 11 13 415 11 13 415 11 13 415 11 13 415 11 13 415 11 13 415 11 11 11 11 11 11 11 11 11 11 11 11 1
▲ 認 検 図 設 計 製 図 本 図 設 計 製 図 New PDR-C commands ScALE New PDR-C commands ScALE DATE New DR-C commands ScALE DATE New DR-C commands New PDR-C commands

Command name: Model read-out         1 2 3 4 5 6 7 8 9 10 11 23 14 15 16 71 16 12 20 24 25 04 25 04 26 04 44 64         Host side         DDDT         DDT         1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 71 18 15 20 24 25 04 25 04 26 04 44 64         Lost side         DDT         1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 11 18 11 20 24 25 04 25 04 26 04 26 04 45 04         Pump side         DDT/DT/R         (Restores)	Command name: Clock writing ( Correction ). 1 2 3 4 5 4 7 8 9 10 11 20 14 15 10 11 20 14 15 10 11 20 14 15 10 10 10 10 10 10 10 10 10 10 10 10 10
Command name: Model writing.         1 2 3 4 5 7 1 8 10 11 2 13 4 15 16 7 18 19 20 12 22 23 42 56 27 28 39 90 11 26 44 64 4         Hoet side         Dump side         Dump side         Miles only while stopping. ).	Originand name:         1 2 3 4 5 6 7 8 9 NUL2 IS 44 IS NU IR 12 14 4 15 NU IR 12 13 4 5 6 7 1 8 9 NU IR 12 14 15 NU IR 12
Command name: Production number read-out. 1 2 3 4 5 6 7 8 9 10 11 21 31 415 16 7 18 18 20 21 22 20 24 25 92 78 26 30 31 22 23 35 55 31 78 30 41 42 44 45 45 Host side D2Erd 11 11 11 11 11 11 11 11 11 11 11 11 11	Command name: 1 2 3 4 5 6 7 8 9 10 11 2 10 4 15 16 1 10 10 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
Command name:State read-out. 1 2 3 4 5 6 7 8 9 10 11 2 13 4 15 16 7 18 19 20 12 22 22 22 22 22 22 22 22 22 22 22 22	
Command name:Clock read-out. 1 2 3 4 5 6 7 8 9 10 11 21 31 415 16 71 18 92 11 22 23 42 56 26 36 39 31 26 36 36 36 36 36 36 36 44 6 46 Host side D42 from 11 12 13 415 16 11 18 18 19 21 22 36 26 36 27 36 39 31 27 33 45 36 41 6 46 1 2 3 4 5 6 7 8 3 10 11 11 11 18 18 18 12 26 32 56 36 37 36 39 31 28 36 34 44 6 46 1 2 3 4 5 6 7 8 3 10 11 11 11 18 18 18 12 28 34 56 46 1 2 3 4 5 6 7 8 3 10 11 11 11 18 18 18 12 28 24 56 46 1 2 3 4 5 6 7 8 3 10 11 11 11 18 18 18 12 28 24 56 46 1 2 3 4 5 6 7 8 3 30 14 42 44 46 46 1 2 3 4 5 6 7 8 3 10 11 11 11 18 18 18 12 28 24 56 46 1 2 3 4 5 6 7 8 3 10 11 11 11 18 18 18 12 28 24 56 46 1 2 3 4 5 6 7 8 3 10 11 11 11 18 18 18 18 18 18 18 18 18 18	
	A 28 I A 20 A
	MFG DWG No.



This mark is applied to the electronic information product sold in the People's Republic of China. The figure at the center of the mark is the validity date of environmental protection. This product does not influence the environment, the human body and the property during the period reckoning the manufacturing date as long as the caution for safe use regarding the products are observed. \*The environmental protection validity date is not the product warranty period.

Table1.	Making	format fo	r names a	and	contents	of	hazardous	substances	or	elements
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Name of parts	Hazardous substances or elements						
	Pb	Hg	Cd	Cr <sup>6+</sup>	PBB	PBDE	
Body	0	0	0	0	0	0	
Panel	0	0	0	0	0	0	
Base	0	0	0	0	0	0	
Electrical Parts	0	0	0	0	0	0	

O: indicating that content of the hazardous substance or element in all homogeneous materials of the part does not exceed the requirements for concentration limits specified by SJ/T11363-2006.

×: indicating that content of the hazardous substance or element in, at least one kind of, homogeneous materials of the part exceeds the requirements for concentration limits specified by SJ/T11363-2006. Producer may further explain the technical excuse to the items marked with "X" perspecific conditions here.



Form: A00315268-02-00

#### ULVAC Components / Certificate of Decontamination

This is a certificate of decontamination for repair and inspection request of ULVAC Components. All material must be certified as decontaminated and this certificate must be submitted to your closest local ULVAC service center or sales office prior to shipment.

Please consult with your closest local ULVAC service center or sales office if our components are used with toxic gases or contaminated with reactive products or substances produced by reaction.

Product model: Model: Serial No.: Application: Remarks:

Contaminant (Check an applicable box.)

I guarantee that above returned item(s) is not contaminated with harmful substances.

Above returned item(s) is contaminated with the following harmful substances.

	Name of contaminant (molecular formula)	Characteristics
1		
2		
3		
4		
5		

To: ULVAC

Attn:

	Date:	/	/	(YYYY/MM/DD)
Your company				
Division				
Contact				
Phone				
Fax				
E-mail				

Please pack returned item(s) carefully before shipment. Any accident occurred during transportation to us and during disassembly caused by contaminant is under your responsibility. It is also to be understood that ULVAC may decline to repair returned item(s) depending on the type of contaminant and degree of contamination, and return it to you.

To be filled in by ULVAC Request for SDS: Yes/No	Received by	
ULVAC job No.		

# ULVAC

