

**Cryo Heater Controller
MBDI-H1 Series
Instruction Manual**

MBDI-H1N

MBDI-H1S

Export Control Policy

We recommend that ALL customers be sure to follow all rules and regulations such as Foreign Exchange and Foreign Trade Law when exporting or reexporting our products.

Introduction

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

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

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

1. About the personnel who are involved in handling our products

All personnel involved in handling our products should take a general safety education and training that is officially accepted in the country where our product is used. The personnel are also required to have specialized knowledge/skills and qualification on the electricity, the machinery, the cargo handling, and the vacuum. Especially, the personnel should be familiar with handling a cryopump in order to use it safely. Since we offer a training session (which is subject to fees) as needed for people who use cryopumps for the first time, please do not hesitate to contact our Service Engineering Division to join the training session.

2. Warranty

2.1 Gratis warranty period and Warranty coverage

【Gratis warranty period】

Note that an installation period of less than one year after installation in your company or your customer's premises or a period of less than 18 months (counted from the date of production) after shipment from our company, which is shorter, is selected.

【Coverage】

(1) Failure diagnosis

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

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

of the breakdown is found to be a fault of ULVAC CRYOGENICS.

(2) Damage during transportation

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

(3) Breakdown repairs

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

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

Since the above services are limited to within Japan, diagnosis of failures, etc are not performed abroad. If you desire the after service abroad, please contact ULVAC CRYOGENICS and consult us for details in advance.

2.2 Exclusion of opportunity loss from warranty liability

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

2.3 Repair period after production is discontinued

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

3. Service Form

After the products are delivered, please fill out the following information in the blanks. If you have any questions or technical problems, please feel free to contact the nearest Customer Support Center or headquarters. Please refer to "Service Network".

Cryopump/Super trap Model	:	_____
Cryopump/Super trap Serial No.	:	_____
Refrigerator Model	:	_____
Refrigerator Serial No.	:	_____
Compressor Model	:	_____
Compressor Serial No.	:	_____
Temperature controller/Thermal display Model	:	_____
Temperature controller/Thermal display Serial No.	:	_____
Option Part Model	:	_____
Optional Part Serial No.	:	_____

4. Notes for repair and maintenance requests

We may decline your request for the repair or the maintenance of our products if you refuse to give us information about the presence of the hazardous substance and/or contaminant.

Also, please be aware that we do not accept liability for damages by the contaminant, which might be caused during transportation to our office or the nearest customer support center. To avoid such accident, please pay careful attention to packing of the product

5. In case of breakdown and accident

When breakdown or accident occurs, we may ask for keeping the product on site as it is or retrieving the product to investigate its cause. Also we may ask for reporting the detailed process and/or the operating condition. When unidentified malfunction was generated, please contact our Service Engineering Division or

the nearest customer support center with reference to the chapter of Service Network. We ask for cooperation about the above.

6. General Precautions

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

Safety Considerations

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

**WARNING**

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

**CAUTION**

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

**Toxic gas or chemicals used.**

There is a risk of severe injury upon contact.

**Corrosive chemicals used.**

There is a risk of severe injury upon contact.

**Flammable gas used.**

There is a danger of fire or burn injury.

**Explosive gas used.**

There is a risk of fire or explosion.

**Hazardous voltage .**

Electric shock may cause severe injury or loss of life.

**Hot heating part present.**

There is a risk of burn injury.

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Disposal Considerations

Disposal of our products must be done in accordance with applicable national and local laws and regulations.

				WARNING
<p>The cryopumps or cryocoolers may contain residue of hazardous substances resulting from actual use. Contact your safety supervisor and follow the instructions to remove such toxic substances before disposing.</p>				

We provide Safety Data Sheet (SDS) of our products upon your request.
Please contact us if necessary.

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SHIPPING LIST

Our product has been fully inspected before shipment. However, please make sure that there is no shortage of delivered items by checking the table below, product name, and there is no damage by checking the external view of the product.

MBDI-H1 series has product name on the front of its body. Be sure that the product is exact specifications of your order. Please inform us product name and serial number when you inquire us about the product.

Item	Quantity
Cryo Heater Controller MBDI-H1 series	1
Power Cable (see chapter 5, Table 5-1)	1
Connectors(see chapter 5, Table 5-1)	1 set
Optional Cables (see chapter 5, Table 5-2)	1 set
Instruction Manual	1



Inspection and Adjustment of MBDI-H1 series

Please contact our technical service department when inspection and/or adjustment of MBDI-H1 series are needed. No circuit or any other parts of this product may be changed and/or adjusted in any shape or form in any circumstances. Note that the any inspection, check, adjustment and repair caused by such change and/or adjustment will be only accepted at your expense even if it is within the warranty period .

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1. Features and Types

1. 1 Features

Cryo Heater Controller MBDI-H1 series can be connected with Cryo Meter MBS-C and inner heater for room temperature quick regeneration, which are mounted to UCI (ULVAC CRYOGENICS INCORPORATED) Cryopump. Therefore, MBDI-H1 series can display temperature at 1st stage (80K shield) and 2nd stage (15K cryopanel) of cryopump, and control the heater to make them room temperature(300K) in cryopump regeneration. The appearance of MBDI-H1 series is shown in figure 1-1 below.

MBDI-H1 series has two difference types: MBDI-H1N and MBDI-H1S. The main difference between them is whether it has Power output (DC24V) for Cryo Meter MBS-C. The types of MBDI-H1 series are shown in figure 1-2. If Cryopump has sensor for over heat protection (optional), it is able to connect MBDI-H1 series to Cryo Meter MBS-C and UCI Cryopump with DIPswitches.

The functions in the following table can also be added by the DIP switches inside.

Functions	Descriptions
1 st Overcool protection	Adjust the 1 st stage temperature at the set value (default 80K) by preventing excess cooling with the heater. See 4.2 DIP switch specifications and 8. Operations (Table 8-2) for detail.
1st HEATER overheat protection	By setting the optional overheat protective thermocouple in addition to the originally mounted ones on 1 st and 2 nd stages for temperature control, the heater is disconnected to prevent excess heating when the temperature reading of this optional thermocouple reaches 60 ° C, even when the thermocouple for temperature control is out of order.
2nd HEATER overheat protection	



Figure 1-1 MBDI-H1 series appearance

1. 2 Types

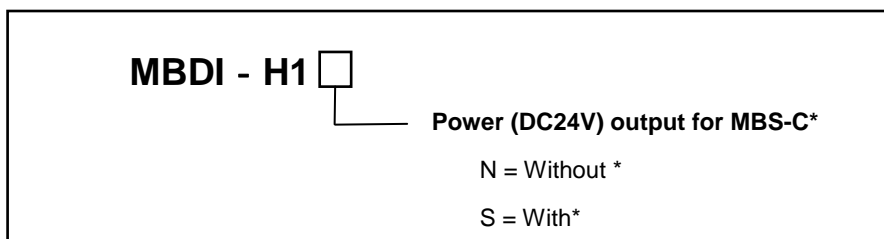


Figure 1-2 MBDI-H1 series types

2. Specifications

- Dimensions 240mm(W) × 100mm(H) × 300mm(D)
(Refer to the external dimensions for the details)
- Weight Approx. 3.0kg
- Power Source Shingle-phase AC100V±10% 50Hz/60Hz
Capacity of circuit protector : 5A
(Note: including power consumption)
- Inner power consumption MAX. 110W (Except for the power consumption of heater)
- Operation Environment Ambient temperature : -10 ~ 40°C (no freezing)
Ambient humidity : Less than 80%RH (no condensing)
Ambient Altitude : Below 1000m
- Input..... TC-IN
MBS-C K (CA) input : K Thermocouple
ANA-IN
MBS-C ANALOG input : 0~5V
OH-IN
Sensor for 1st Heater overheat protection : K Thermocouple
Sensor for 2nd Heater overheat protection : K Thermocouple
(Available to select Use/Non use with dip switch(See Section 4.2))
SYSTEM I/F
Photocoupler input (no-voltage contact input) : MAX 4mA
- Output..... POWER OUT
Power to MBS-C : DC24V MAX 300mA
HEATER
2nd HEATER : AC100V MAX 3A
1st HEATER : AC100V MAX 3A
Note: Total MAX 5A (Including inner power consumption)
SYSTEM I/F
Photocoupler output : MAX 8mA
TC-OUT
TC-IN parallel output (Not insulated with TC-IN)
ANA-OUT
ANA-IN parallel output (Not insulated with ANA-IN)
- Insulation resistance..... DC 500V 20MΩ or more
- Withstand voltage AC 1000V/1min between power terminal and earth terminal.

○ Display 1st TEMP 4 digits

Display range : 45K~350K

Display accuracy : 350K~123K $\pm 0.5\%FS$

123K~73K $\pm 3\%FS$

<73K Out of K Thermocouple accuracy range

Note: excluding reference junction compensation accuracy

Reference junction compensation accuracy : $\pm 2.0^{\circ}C$ ($23^{\circ}C \pm 5^{\circ}C$)

The range that can keep display accuracy : $23 \pm 5^{\circ}C$

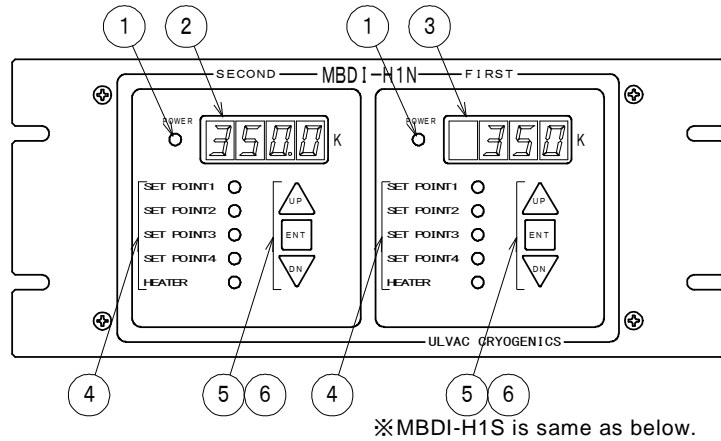
2nd TEMP 4 digits

Display range : 10.0K~350.0K

Display accuracy : $\pm 0.5\%FS$

The range that can keep display accuracy : $23 \pm 5^{\circ}C$

3. Part names and Descriptions



※MBDI-H1S is same as below.

Table 3-1 MBDI-H1 series Part names and Functions

Name		Function	
①	POWER	It lights when Power (AC100V) activated.	
②	7 -segment display SECOND	Normal mode	It displays the temperature at second stage of Cryopump.
		Parameter setting mode	It displays the set value. (See section 9.1)
③	7 -segment display FIRST	Normal mode	It displays the temperature at first stage of Cryopump.
		Parameter setting mode	It displays set value. (See section 9.1)
④	Conditions of LED • SETOPOINT 1 • SETOPOINT 2 • SETOPOINT 3 • SETOPOINT 4 • HEATER	It lights On/Off according to set value. Refer to Section 9.2 for the factory default value.	
⑤	[UP]/[DN]	<ul style="list-style-type: none"> • Used to change parameter. Reeper to section 9.1 "Parameter setting method" for the details.	
⑥	ENT	<ul style="list-style-type: none"> • used to release the alarm with pressing it for 5 seconds. • used to change parameter. Refer to section 9.1 "Parameter setting method" for the details.	

4. Connector specification and DIP switch specifications

4. 1 Connector specifications

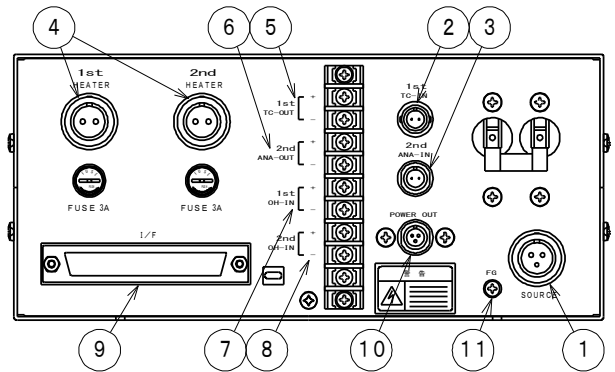


Table 4-1 Connectable plug types and descriptions of pins

No.	Name	Connectable plug type	Pin No.	Description
①	SOURCE	PRC03-12A10-3AF10.5 (TAJIMI)	A	L: Power source input (100V±10%)
			B	N: power source input (100V±10%)
			C	E: Earth
②	TC-IN	R05-PB2F Or R05-P2F (TAJIMI)	A	MBS-C K Thermocouple input (+)
			B	MBS-C K Thermocouple input (-)
③	ANA-IN	R03-PB2F Or R03-P2F (TAJIMI)	A	MBS-C Analog input (+)
			B	MBS-C Analog input (-)
④	HEATER	PRC03-12A10-2AM10.5 (TAJIMI)	A	Heater output/each: AC100V MAX3A
			B	(TOTAL MAX5A)
⑤	1st TC-OUT	Round type crimping terminal φ 3	+	K Thermocouple output (+)
			-	K Thermocouple output (-)
⑥	2nd ANA-OUT	Same as above	+	MBS-C Analog output (+)
			-	MBS-C Analog output (-)
⑦	1st OH-IN	Same as above	+	K Thermocouple for overheat protection input (+)
			-	K Thermocouple for overheat protection input (-)
⑧	2nd OH-IN	Same as above	+	K Thermocouple for overheat protection input (+)
			-	K Thermocouple for overheat protection input (-)
⑨	I/F	17JE-23370-02(D8B) (DDK)	See table 4-2	
⑩	POWER OUT ※1	R03-PB3M or R03-P3M (TAJIMI)	A	Power output (24V) for MBS-C
			B	N. C.
			C	Power output (0V) for MBS-C
⑪	FG	Round type crimping terminal φ 3	Frame grand	

※1 A POWER OUT Connector comes only with MBDI-H1S, not with MBDI-H1N.

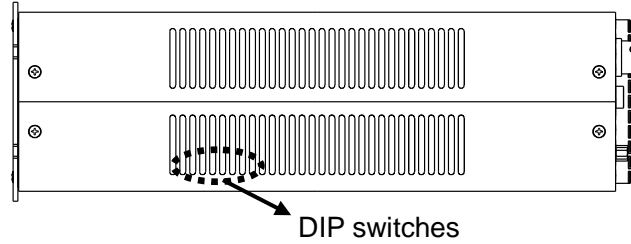
Table 4-2 Descriptions of I/F connector pin

Signal	Pin No.	Signal Name	Description
Input signal	1	COM	Contact Input Common (N24)
	2~5	N. C.	Keep these connector pins unconnected.
	6	HEATER ON 1st	Inner heater at 1 st stage is ON when the signal is ON.
	7	HEATER ON 2nd	Inner heater at 2 nd stage is ON when the signal is ON.
	8	N. C.	Keep this connector pin unconnected.
	9	ALARM RESET	It is used to release the condition that keeps alarm activating. After 0.1second or more for being ON, turn it OFF.
Output signal (Open collector)	10	GND_EX	Open Collector Output Common
	11	SETPOINT1 1st	It turns to L level above 1st SETPOINT1 (factory default: 300K). ※ ¹
	12	SETPOINT2 1st	It turns to L level above 1st SETPOINT2 (factory default: 150K). ※ ¹
	13	SETPOINT3 1st	It turns to L level below 1st SETPOINT3 (factory default: 130K). ※ ¹
	14	SETPOINT4 1st	It turns to L level below 1st SETPOINT4 (factory default: 130K). ※ ¹
	15	SETPOINT1 2nd	It turns to L level above 2nd SETPOINT1 (factory default: 300K). ※ ¹
	16	SETPOINT2 2nd	It turns to L level above 2nd SETPOINT2 (factory default: 150K). ※ ¹
	17	SETPOINT3 2nd	It turns to L level below 2nd SETPOINT3 (factory default: 25K). ※ ¹
	18	SETPOINT4 2nd	It turns to L level below 2nd SETPOINT4 (factory default: 20K). ※ ¹
	19-23	N. C.	Keep these connector pins unconnected.
	24	ALARM	It turns to L level when an alarm is activated. ※ ¹ See chapter 10 for a variety of alarms.
	25	HEATER ON ANS 1st	It turns to L level when each inner heater is ON. ※ ¹
	26	HEATER ON ANS 2nd	
	27	N. C.	Keep this connector pin unconnected.
	28	GND_EX	Open Collector Output Common
	29	GND_EX	Open Collector Output Common
30	N. C.	Keep these connector pins unconnected.	
-35			
36	DC24V_EX	Input DC24V (P24) for output signal circuit protection.	
37	FG	Frame Grand	

※¹ L level shows that transistor for open collector output is ON (conduction state).

H level shows that transistor for open collector output is OFF (non-conduction state).

4. 2 DIP switch specifications



There are two types of MBDI-H1 series DIP switch: Previous Model and New Model.

Previous Model: Push a lever UP to turn ON. The color of the levers is yellow.

(Previous models were sold until April, 2011.)

New Model: Push a lever DOWN to turn ON. The color of the levers is white.

(New model has been sold from May, 2011.)

Example: When No.9 and No.10 are ON.

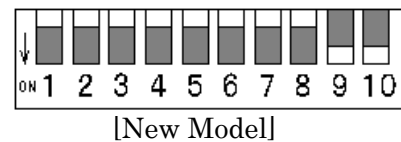
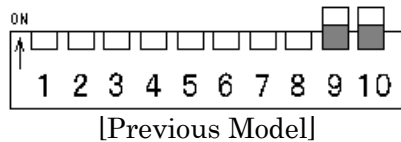


Table 4-3 Descriptions of DIP switches

No.	Item	Setting
1	The function that protects 1st stage from overcooling. (*1)	OFF : without ON : with
2 to 8	Not in use	OFF
9	The function that protects 1st HEATER from overheating. (*2)	OFF : with ON : without
10	The function that protects 2nd HEATER from overheating. (*3)	OFF : with ON : without

(*1) This function prevents the 1st stage from overcooling by the heater and adjusts the temperature at the set value (default 80K) by switching on and off the heater.

This function is available with the software version 1.11 or later (S/N: 1310657R or later) but not available with V 1.01, v1.00 (S/N: 1307656R or older).

(*2) Set the optional overheat protective thermocouple which is different from the originally mounted ones on 1st and 2nd stages for temperature control, and the heater will be disconnected to prevent excess heating when the temperature reading of this optional thermocouple reaches 60 °C, even when the thermocouple for temperature control is out of order.

(*3) The sticker “Overheat Protection for Heater” is placed on the bottom left of the front panel, if DIP switches No.9 and 10 are OFF (with the function that protects heaters from overheating). (See figure 4-1)



Figure 4-1 Photograph: Overheat protection for HEATER

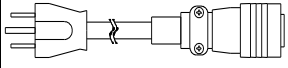
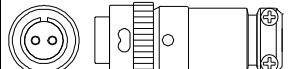
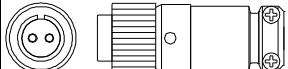

CAUTION

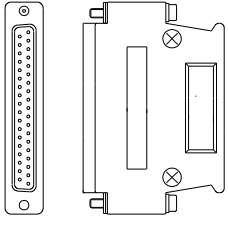
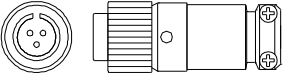
When the specifications of compressor which will be connected to MBDI-H1 series has been decided, DIP switch will be set before shipment. Do not make unnecessary change. Please contact us when the setting needs to be changed.

5. Accessories or Optional cables

Table 5-1 below shows accessories if no optional cables are specified. In this case, connection of connectors and wiring need to be done by customer.

Table 5-1 MBDI-H1 series accessories

Item	Type	Appearance	Manufacture	Usage	Quantity
① Power cable	GP-HS01	 3pin, Female	ULVAC CRYOGENICS	For SOURCE	1
② Connector	R05-PB2F	 Female	TAJIMI	For TC-IN	1
③ Connector	R03-PB2F	 Female	TAJIMI	For ANA-IN	1
④ Connector	PRC03-12A10-2AM10.5	 Male	TAJIMI	For HEATER	2

⑤	Connector	17JE-23370-02(D8B) or XM2S-3712(Hood) XM3A-3721(Plug)	 Male	DDK or OMRON	For I/F	1
⑥	Connector	R03-PB3M	 Male	TAJIMI	For POWER OUT	1※ ¹

※¹ A Connector for POWER OUT comes only with MBDI-H1S, does Not comes with MBDI-H1N.

If you purchase MBDI-H1 series as UCI System, you can specify optional cables. Optional cables are shown in table 5-2. Refer to chapter 7 for wiring operation. Note that the accessories in table 5-1 will be subjects to be changed if you specify optional cables.

Table 5-2 Optional cables


	Item	Type	Appearance	Remark
①	K Thermocouple cable	MH-HS10		The connector ② in table 5-1 is not provided.
②	MBS-C connection cable	MH-HS30	For MBDI-H1N 	The connector ③ in table 5-1 is not provided.
		MBD-HS30	For MBDI-H1S 	The Connectors ③ and ⑥ in table 5-1 are not provided.
③	Heater cable	MH-HS50		The connector ④ in table 5-1 is not provided.
④	Compensation lead wire for 1st OH	MH-HS11		
⑤	Compensation lead wire for 2nd OH	MH-HS12		

If you need same wiring of existing MBS regarding to Input and Output, please specify the cable for MBS. At the time of purchasing MBDI-H1 series as UCI System, please contact our customer service for cables can be used.

6. Installation

6. 1 Installation site

- Install MBDI-H1 series in the site under proper usage environment.



CAUTION

Avoid using MBDI-H1 series in these places.

- Where flammable gas, corrosive gas, oil mist and particles that can deteriorate electrical insulation are generated, or are abundant.
- Where the temperature is below -10°C or above 50°C .
- Where the relative humidity is 80%RH or below dew point.
- Where highly intense vibration or impact is generated or transferred.
- Near high voltage power lines or where inductive interference can affect the operation of the product.

6. 2 Installation method

Please see panel cut dimensions of figure 6-1 below, and machine the mounting hole on your cabinet panel. Insert MBDI-H1 series from the front panel into the interior of the mounting hole completely, and fix it with four M4 screws.

Note that if you will cut taps from the panel, locking screw sites need to be M4 or if you fix this product with nuts on back side without cutting taps, locking screw sites need to be $\phi 5$.

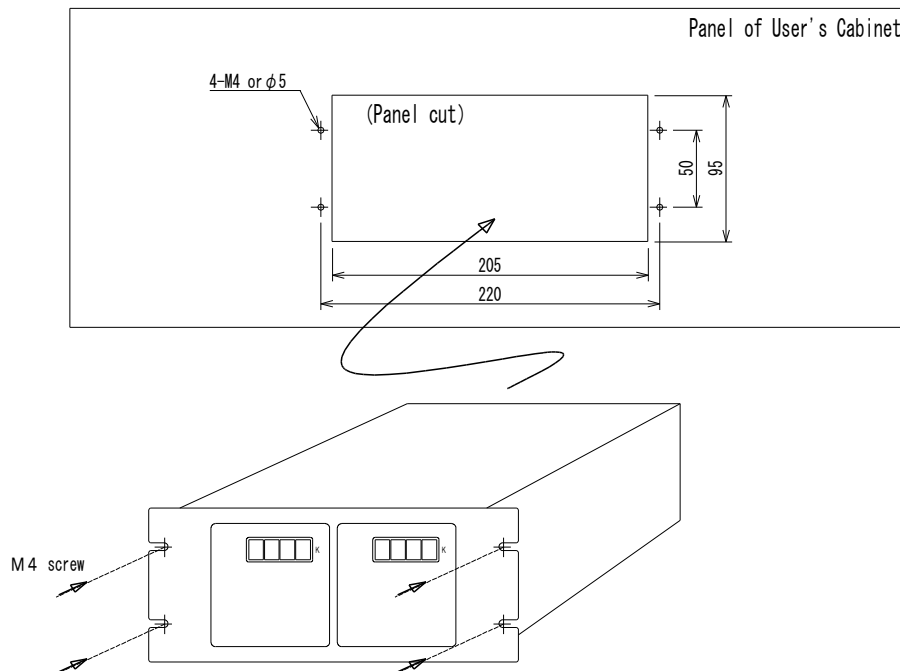



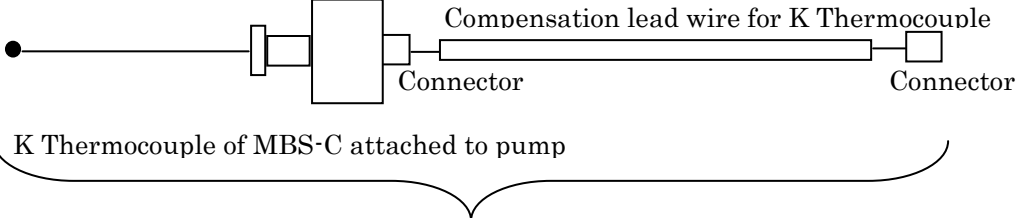
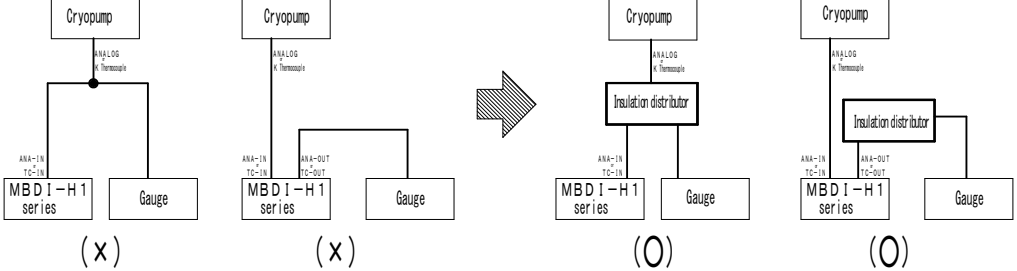


Figure 6-1 Panel cut dimensions and installation method

7. Wiring

After installing MBDI-H1 series into the panel, wiring should be done referring to figure 7-1, 7-2 for MBDI-H1N, figure 7-3, 7-2 for MBDI-H1S. The customer who purchased optional cables should operate wiring referring to figure 7-4, 7-5. Note that wiring must be done in accordance with following instructions.

		WARNING
<ul style="list-style-type: none"> ● Always disconnect this product from any power source during wiring operation. ● Avoid touching wired terminals and charged devices while supplying power to prevent electrical shock. 		

	CAUTION
<p>● ANALOG Signal, K Thermocouple</p> <p>① For ANALOG signal and K Thermocouple input, use the compensation lead wire with shield which effective for electric noise. Especially K Thermocouple input signal requires compensation lead wire for K Thermocouple.</p> <p>② The range of external resistance value of K thermocouple input line should be less than 100 Ω .</p>	
 <p style="text-align: center;">External resistance value between terminals <math>< 100 \Omega</math></p>	
<p>③ Miswiring of MBS-C POWER may result in damage to MBS-C.</p> <p>④ If you connect several gauges for an analog signal or K Thermocouple in parallel, or connect gauges to ANA-OUT, TC-OUT of MBDI-H1 series, MBDI-H1 series may display inaccurate temperature. In this case, be sure to install an insulation distributor in proper place as shown below.</p>	
	

**CAUTION**

● Conduit Requirements for MBDI-H1 series wiring

To prevent interference during the operation, there should be a separate conduit for each signal line, control line and AC power line. Especially analog signal line of MBS-C must be in separate conduit from other equipments or AC power lines or control lines for other equipments. Otherwise, MBDI-H1 series operation will be interfered.

If separate conduits cannot be supplied, keep enough distance (generally 300mm or more) between different wirings. It is effective to prevent interference.

**CAUTION**

- After wiring, make sure that wiring has been done correctly. If difference signal has been connected, damage to MBS-C may result. Also, make sure that the input power is within the allowable range.

**CAUTION**

For lead-free soldering, be sure to use soldering iron and tip that are lead-free use ONLY.

Also, Do NOT mix the lead-free solder with the lead eutectic solder.

It may decrease the lifetime of soldering connection.

**CAUTION**

It is recommended to indicate the type of soldering for appropriate maintenance.

The character strings listed below are recommended indication for each soldering.

Lead eutectic solder	SnPb	or	SP
Lead-free solder (Sn-Ag)	SnAgCu	or	SAC
Lead-free solder (Sn-Cu)	SnCuNi	or	SCN

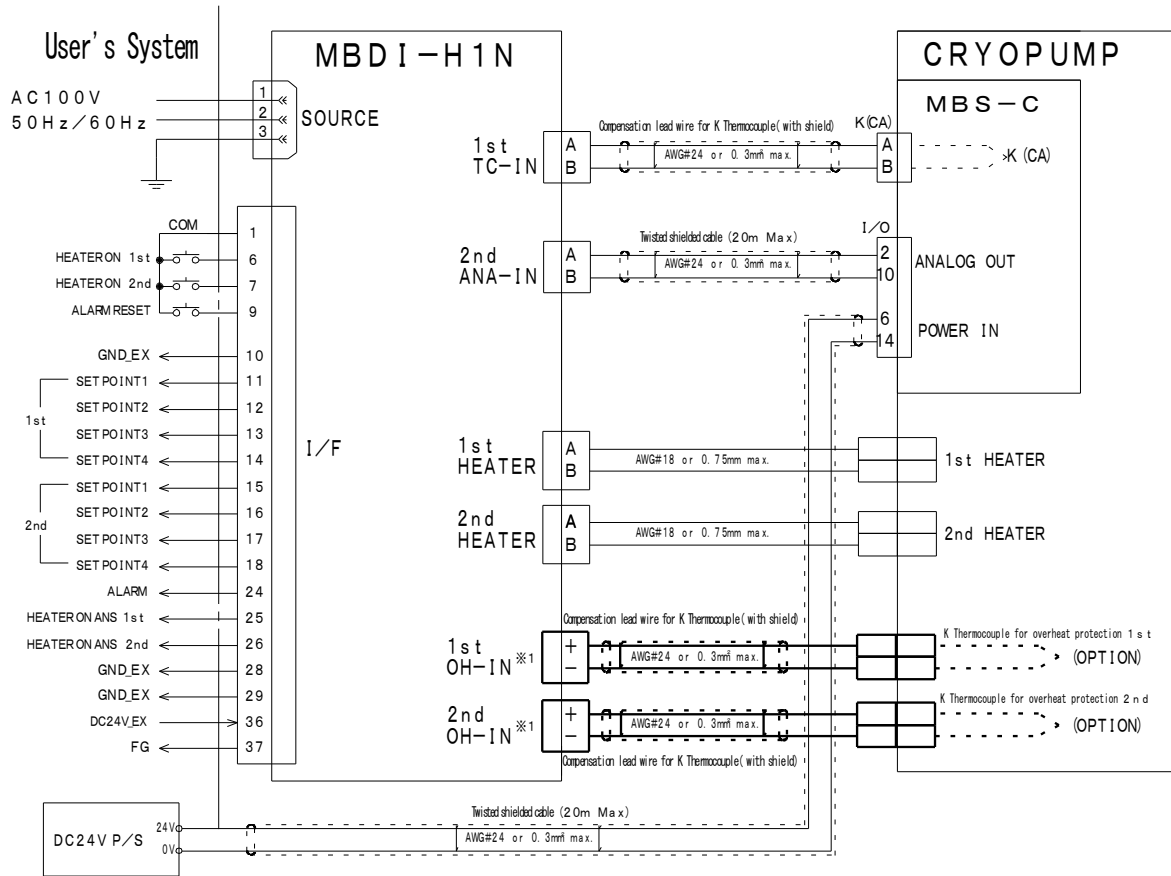


Figure 7-1 MBDI-H1N Wiring

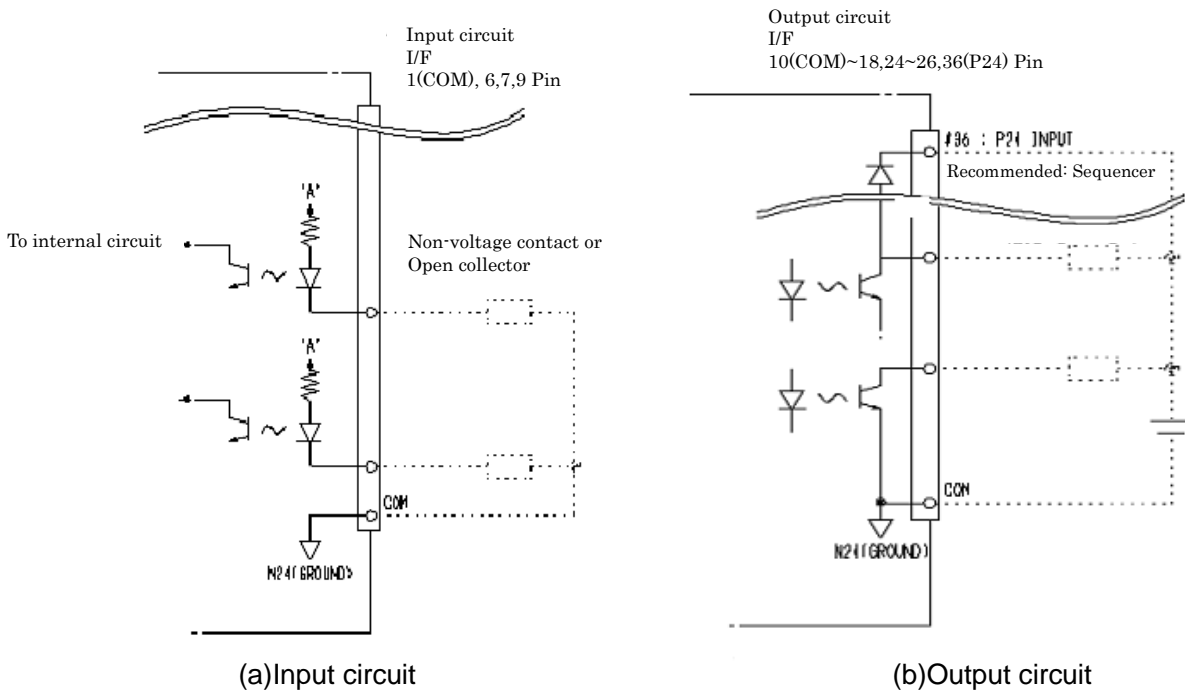


Figure 7-2 Wiring for I/F input and output signal

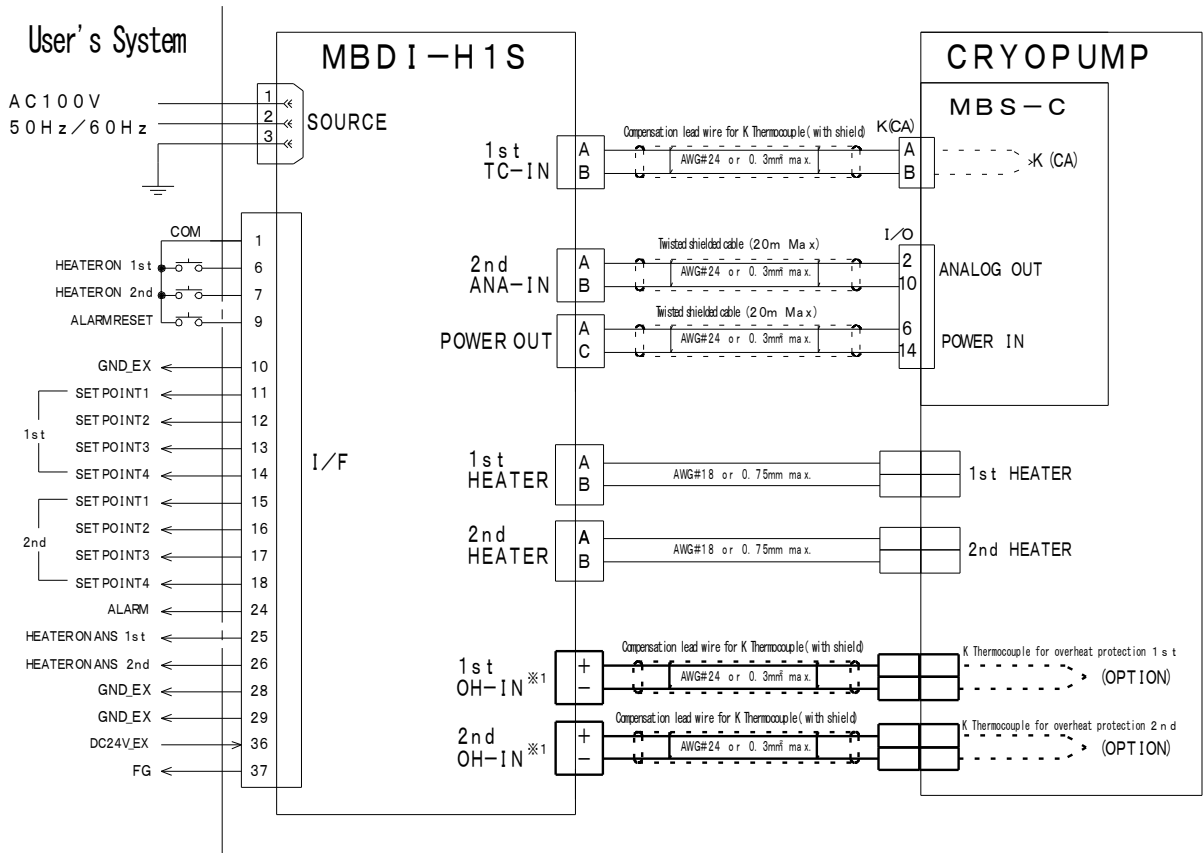
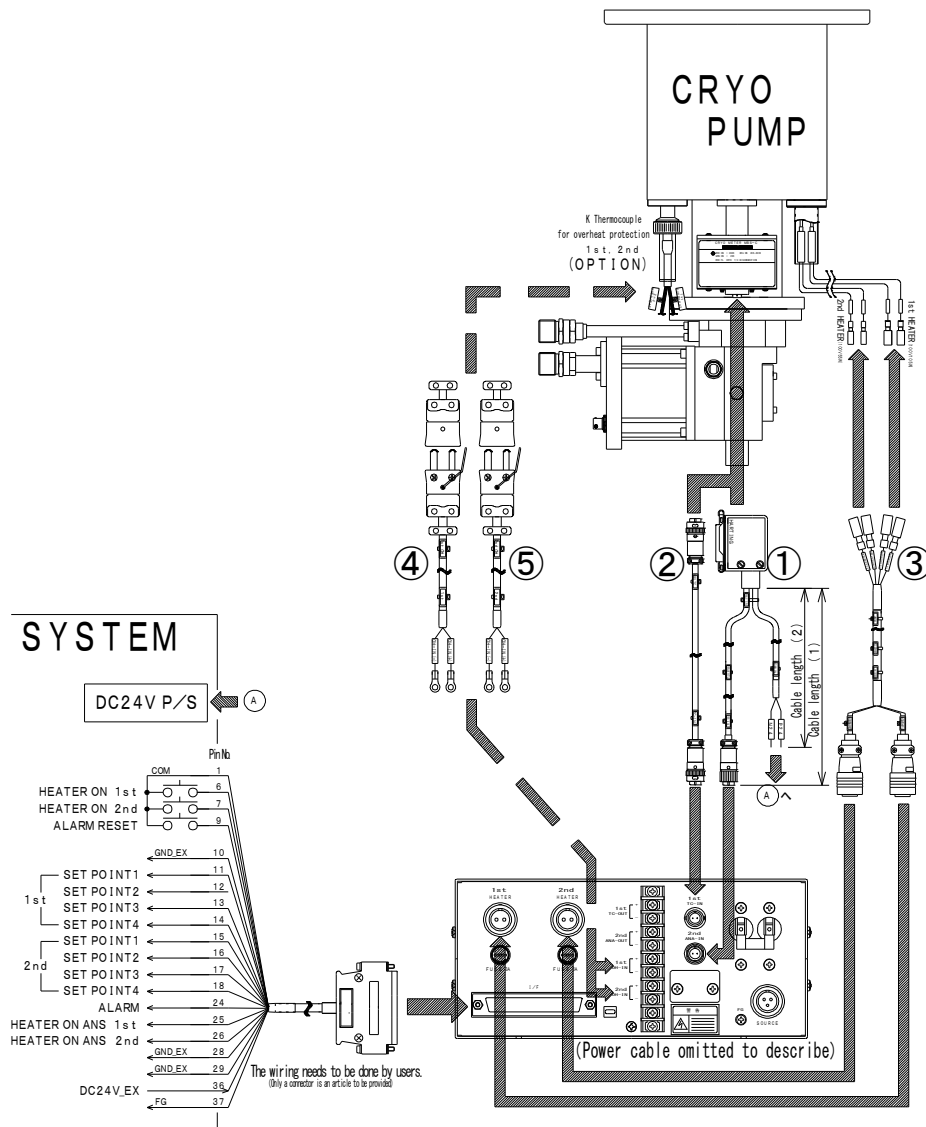
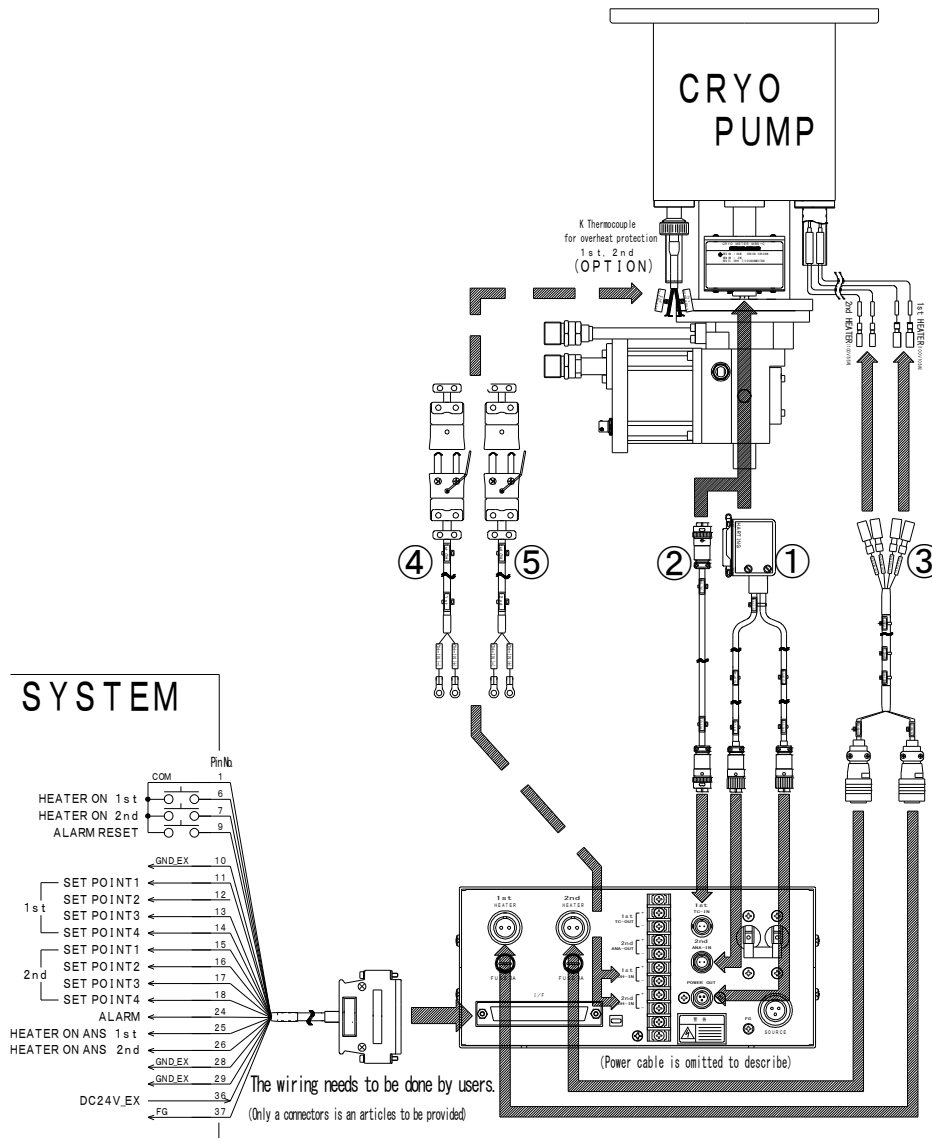


Figure 7-3 MBDI-H1S wiring



	Name	Type	Remark
①	MBS-C connection cable	MH-HS30	
②	K Thermocouple cable	MH-HS10	
③	2nd Heater cable	MH-HS50	
④	Compensation lead wire for 1st OH	MH-HS11	Only in the case of the pump with overheat protection sensor, the wiring will be required to be operated.
⑤	Compensation lead wire for 2nd OH	MH-HS12	

Figure 7-4 MBDI-H1N optional cable wiring



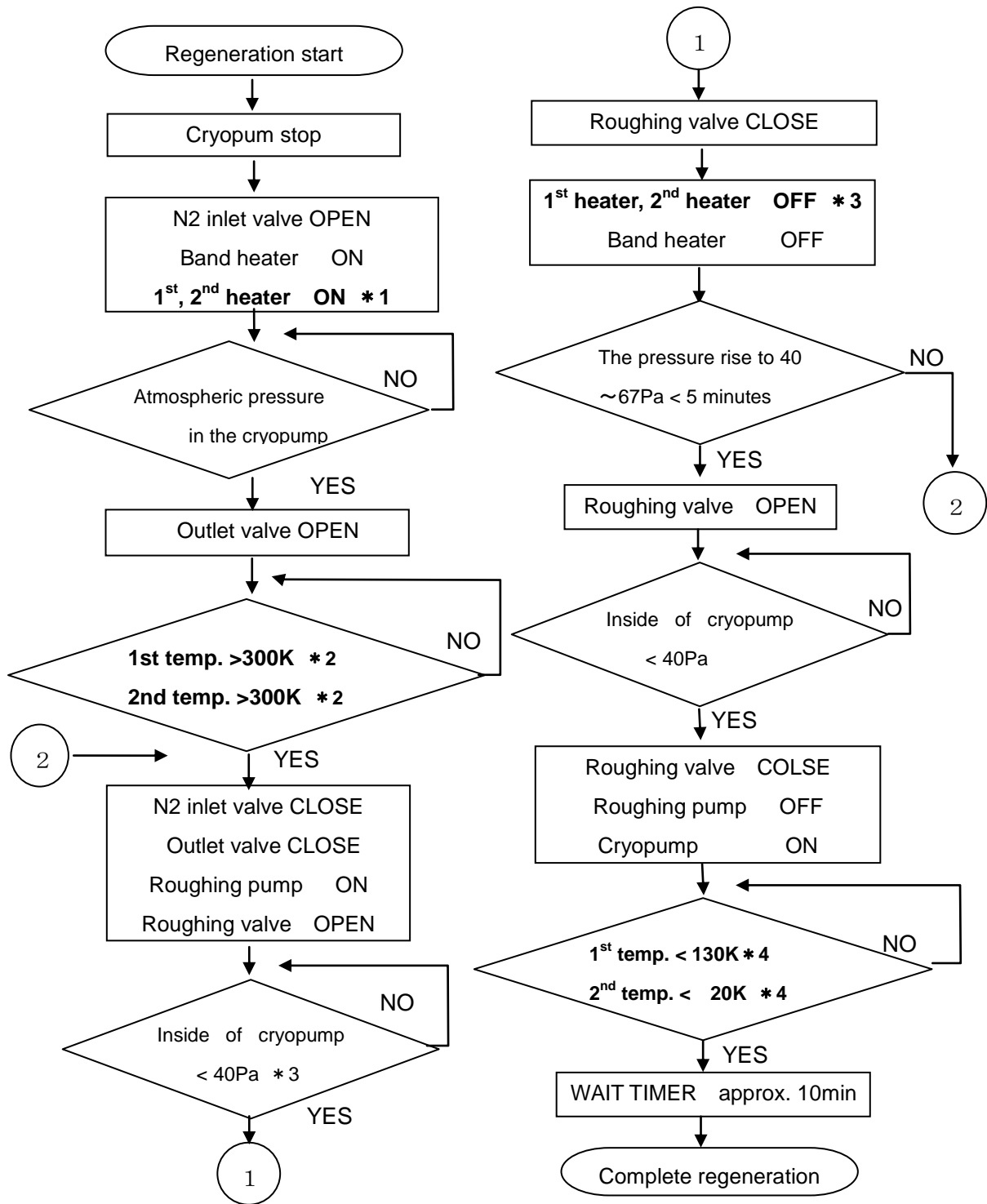
	Name	Type	Remark
①	MBS-C connection cable	MBD-HS30	
②	K Thermocouple cable	MH-HS10	
③	Heater cable	MH-HS50	
④	Compensation lead wire for 1st OH	MH-HS11	Only in the case of the pump with overheat protection sensor, the wiring will be required to be operated.
⑤	Compensation lead wire for 2nd OH	MH-HS12	

Figure 7-5 MBDI-H1S optional cable wiring

8. Operations

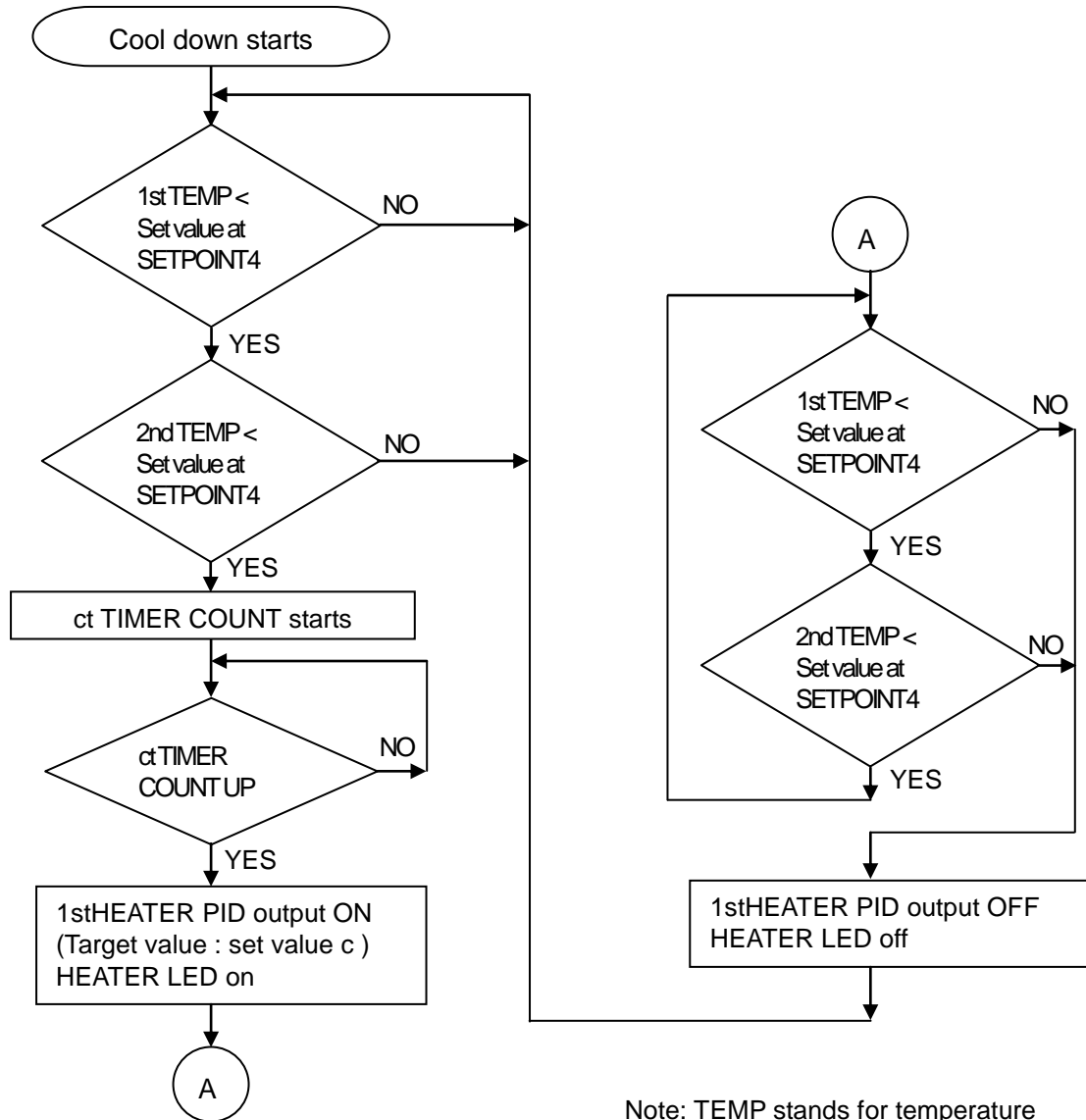
Table 8-1 Operations

Step	Operation	Status of MBDI-H1 series
1	Turn on the power of MBDI-H1 series.	POWER LED will light up. And 7 segments display will show 2 nd temperature on the left side, 1 st temperature on the right side.
2	Turn on I/F input of this product: [HEATER ON 1st] signal and [HEATER ON 2nd] signal. (Alternate Signal)	Cryopump's inner heater at 1 st and 2 nd stages will be ON, and then start to be controlled by PID control at R-T setting value (factory default value: 300K). And HEATER LED will light up.
3	When finishing heater control, turn OFF I/F input: [HEATER ON 1st] signal and [HEATER ON 2nd] signal.	Each inner heater at 1 st and 2 nd stage will be OFF. And HEATER LED will light off.



- * 1 : Turn ON this product's I/F input: [HEATER ON 1st] signal, [HEATER ON 2nd] signal.
- * 2 : This product's I/F output: [SETPOINT1 1st], [SETPOINT1 2nd] signals will be ON.
- * 3 : Turn OFF this product's I/F input: [HEATER ON 1st] signal, [HEATER ON 2nd] signal.
- * 4 : This product's I/F output: [SETPOINT4 1st], [SETPOINT4 2nd] signal will be ON.

Figure 8-1 An example flowchart of cryopump room temperature quick regeneration






Note: TEMP stands for temperature

When [HEATER ON 1st] or [HEATER ON 2st] signal is ON, the overcooling prevention flow stops.

Figure 8-2 Flowchart of overcooling prevention function

9. Parameter setting

9. 1 Parameter setting method

Key	Description
	In the setting mode, it is used to increase the set value.
	It is used to move to the parameter setting mode and to fix the value in the setting mode.
	In the setting mode, it is used to decrease the set value.






Parameter setting mode

Mode 1 : Basic setting mode (See section 9.2 for parameter list)

Mode 2 : Special setting mode (See section 9.2 for parameter list)

◎Parameter setting method






Mode 1

- ① Keep pressing  key for 1 second
- ② Press  key to select parameter to be set (SETPOINT1~4)
 - LED : The LED of the selected parameter will flash (SETPOINT1~4)
 - Cell : The cell will display the parameter (The cell will flash)
- ③ Press   keys to change the setting value.
- ④ Keep pressing  key till returning to the initial screen, then parameter setting mode will be completed.

SETPOINT1 → SETPOINT 2 → SETPOINT 3



→ SETPOINT4 → Returning to the initial screen.

Mode2



- ① Keep Pressing  key for 2 seconds
- ② Press  key to select parameter to be set (P, I, D, t)
 - Cell : The cell will display the parameter (The cell will flash)
- ③ Press   Keys to change the setting value
- ④ Keep pressing  key till returning to the initial screen, then parameter setting mode will be completed.

P → I → D → t → Retuning to the initial screen.

◎The function to inhibit the parameter setting (Key operation lock)

Keep pressing  and  keys at the same time for 5 seconds to prohibit the parameter changing.

→ In 7 segment, “on” will be displayed for 2 seconds.

Keep pressing   keys again for 5 seconds to unlock the function

→ In 7 segments, “oFF” will be displayed for 2 seconds.

9. 2 Initial set value

Initial factory default value is as follow.

Table 9-1 Parameter set value at factory default (Basic setting mode)

	Set command	Description	Initial Value	Setting range
1st	SETPOINT1	ROOM TEMP (Target value of 1 st inner heater control) It outputs signal above setting value (See table3-1)	300K	273~300K
	SETPOINT2	It outputs signal above setting value (See table 3-1)	150K	45~350K
	SETPOINT3	It outputs signal below setting value (See table3-1)	130K	45~350K
	SETPOINT4	It outputs signal below setting value (See table 3-1)	130K	45~130K
2nd	SETPOINT1	ROOM TEMP (Target value of 2 nd inner heater control) It outputs signal above setting value (See table 3-1)	300K	273~300K
	SETPOINT2	It outputs signal above setting value (See table3-1)	150K	45~350K
	SETPOINT3	It outputs signal below setting value (See table 3-1)	25K	45~350K
	SETPOINT4	It outputs signal below setting value (See table3-1)	20K	10~20K

Table 9-2 Parameter set value at factory default (Special setting mode)

	Set command	Description	Initial Value	Setting range
1st	P	Proportional band of 1 st inner heater control	2 K	—
	I	Integral time of 1 st inner heater control	150 sec	—
	D	Derivative time of 1 st inner heater control	24 sec	—
	t	Heater ON Time of 1 st inner heater control ^{*1}	240 min	See table 9-3
	c	Target temperature for overcooling protection	80K	10-150K
	ct	Timer for overcooling protection	30 min	0-30 min
2nd	P	Proportional band of 2 nd inner heater control	2 K	—
	I	Integral time of 2 nd inner heater control	150 sec	—
	D	Derivative time of 2 nd inner heater control	24 sec	—
	t	Heater ON Time of 2 nd inner heater control ^{*1}	240 min	See table 9-3

*1 An ALARM will be output if the heater is turned on electricity over set value. Note that this set value varies with pump size. Please refer to table 9-3 for further details.



WARNING

Do NOT change the set value of special setting mode. It may result in damage to cryopump. Note if you need to change Heater On Time of inner heater considering usage environment or another reason, please refer to section 9.1 “Parameter setting method”

Table 9-3 Inner Heater ON Time Recommended Set Value

Pump Size	Set Time
8 inch	45 min
10 inch, 12 inch	80 min
16 inch (U16P)	150 min
16 inch, or more (U16HSP, U16HSPL)	240 min

Initial set time is 240 min in case of purchasing only MBDI-H1 series. Therefore, set time value needs to be changed according to your pump. Also note that time for regeneration differs based on the condition of use for your pump. Please change Heater ON Time Set Value in accordance with Heater On Time of your pump. (See figure 9-1)

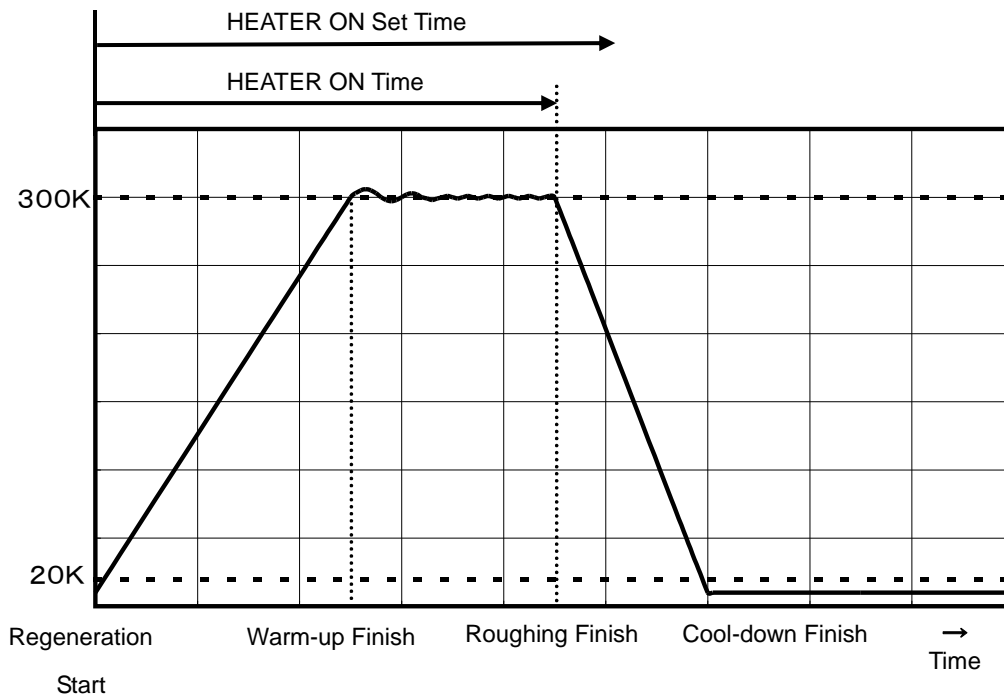
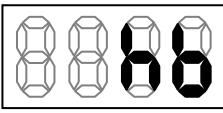
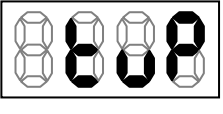
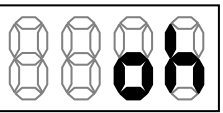


Figure 9-1 Inner Heater ON Time

10. Troubleshooting

Table 10-1 Troubleshooting list (descriptions of error indications)

Display	Description	Possible causes	Action
	It outputs due to a disconnecting of heater line.	Miswiring of heater cable	Make sure that the wiring has been done correctly.
		Disconnecting or breaking of heater line.	The heater needs to be replaced. Please contact our customer service.
	It outputs when Heater On Time goes OVER setting time "t" (See section 9.2) .	Disconnecting or improper grounding of K Thermocouple for TC IN and OVERHEAT.	There is a possibility that the cold head (refrigerator) has been damaged. Please contact our customer service.
		The heater is not grounded properly.	There is a possibility that the heater has been damaged. Please contact our customer service.
		Heater ON time "t" is short considering size and usage of pump. ※1	Change Heater ON time "t" in accordance with your pump. ※1
	It outputs when The temperature of K Thermocouple for OVERHEAT is above following temperature. 1st : Approx. 400°C 2nd : Approx. 70°C	Interference of heat sources except inner heater.	Cut off all heat sources immediately.
		Miswiring of K Thermocouple for OVERHEAT.	Make sure that the wiring has been done correctly.
		Breaking of K Thermocouple for OVERHEAT.	K Thermocouple needs to be replaced. Please contact our customer service.
		Disconnecting or improper grounding of K Thermocouple for TC IN.	There is a possibility that the cold head (refrigerator) has been damaged. Please contact our customer service.
		Improper grounding of the heater.	Please contact our customer service.

※1 "Heater ON Time" varies with conditions of use for your pump.

Therefore the setting value needs to be changed according to your device.

(Conditions of use : quantity of captured gas, types of captured gas.)

Table 10-2 Troubleshooting list (Other)

Problems	Possible causes	Action
1 st temperature indicator keeps showing “350K” and does not move.	K Thermocouple and/or K Thermocouple cable line are not connected.	Connect K Thermocouple and its line correctly referring to chapter 7.
	Disconnection of K Thermocouple	Replace K Thermocouple.
2 nd temperature indicator keeps showing “350K” and does not move.	2nd ANA-IN and/or ANALOG cable line are not connected.	Connect 2nd ANA-IN and/or ANALOG cable line correctly referring to chapter 7.
	Disconnection of Thermocouple for MBS-C 2 nd stage.	Replace MBS-C.
The indicated temperature is far more than room temperature (around 340K).	[+] and [-] of K Thermocouple are wired wrong way.	Wire [+] and [-] of K Thermocouple correctly.
	Interference of heater or other heater sources.	Cut off all heater sources immediately.
Unable to change the parameter setting (Out of key operation)	The function to inhibit the parameter setting is “on”.	Press [UP] and [DN] keys at the same time for 5 seconds to release the function. (See chapter 9)
Heater does not work at regeneration.	Power cable is not connected. The power switch has not been turned on.	Make sure the power source has been activated.
	No communication of [HEATER ON] signal.	Make sure [HEATER ON] signal has been activated.
Regarding failure of Compressor Unit alone and Refrigerator Unit alone, see instruction manuals attached with each product.		

**CAUTION**

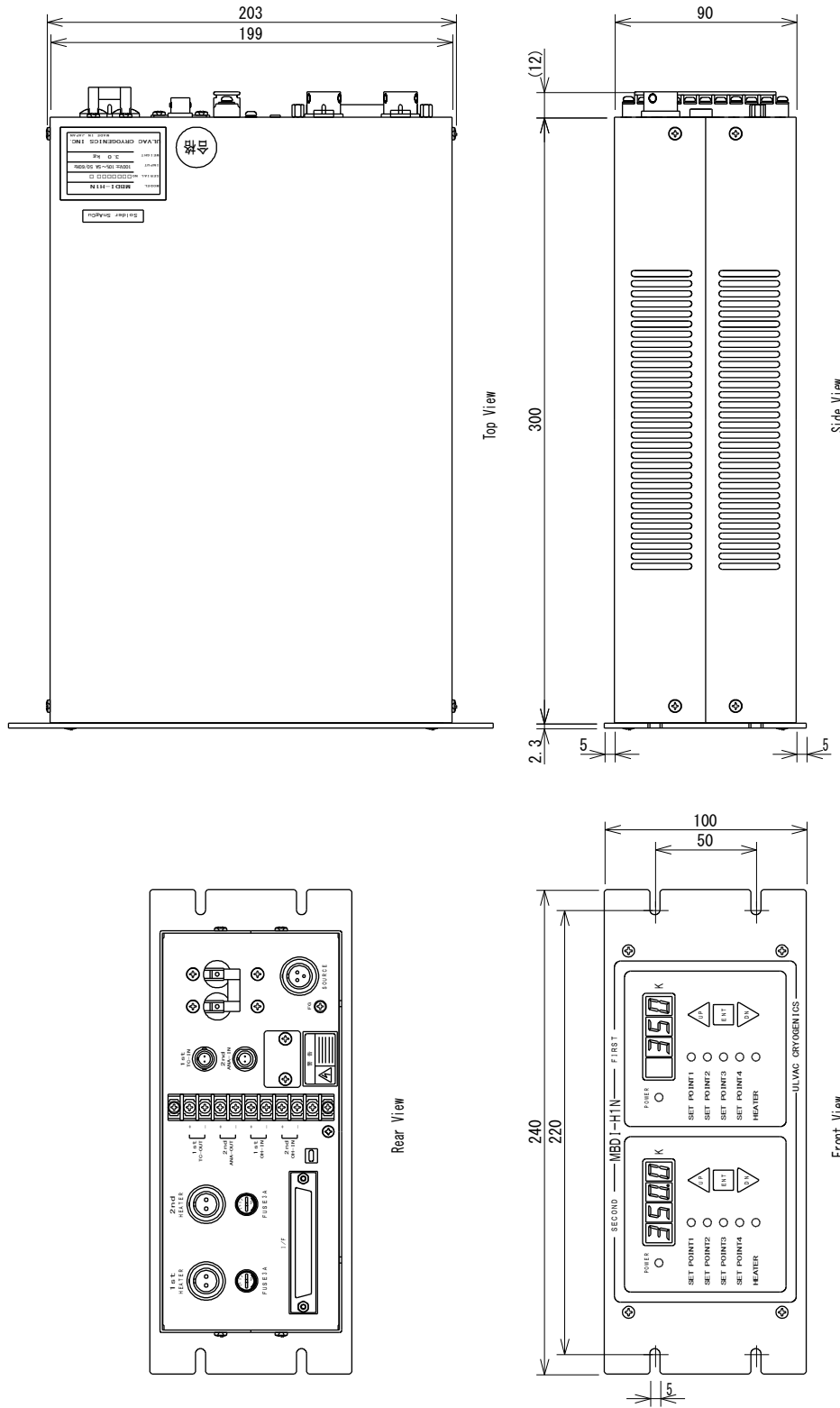
Do NOT remove the cover from MBDI-H1 series.
ONLY qualified maintenance personnel can remove the cover from MBDI-H1 series.

1 1 . Disposing of the product and parts

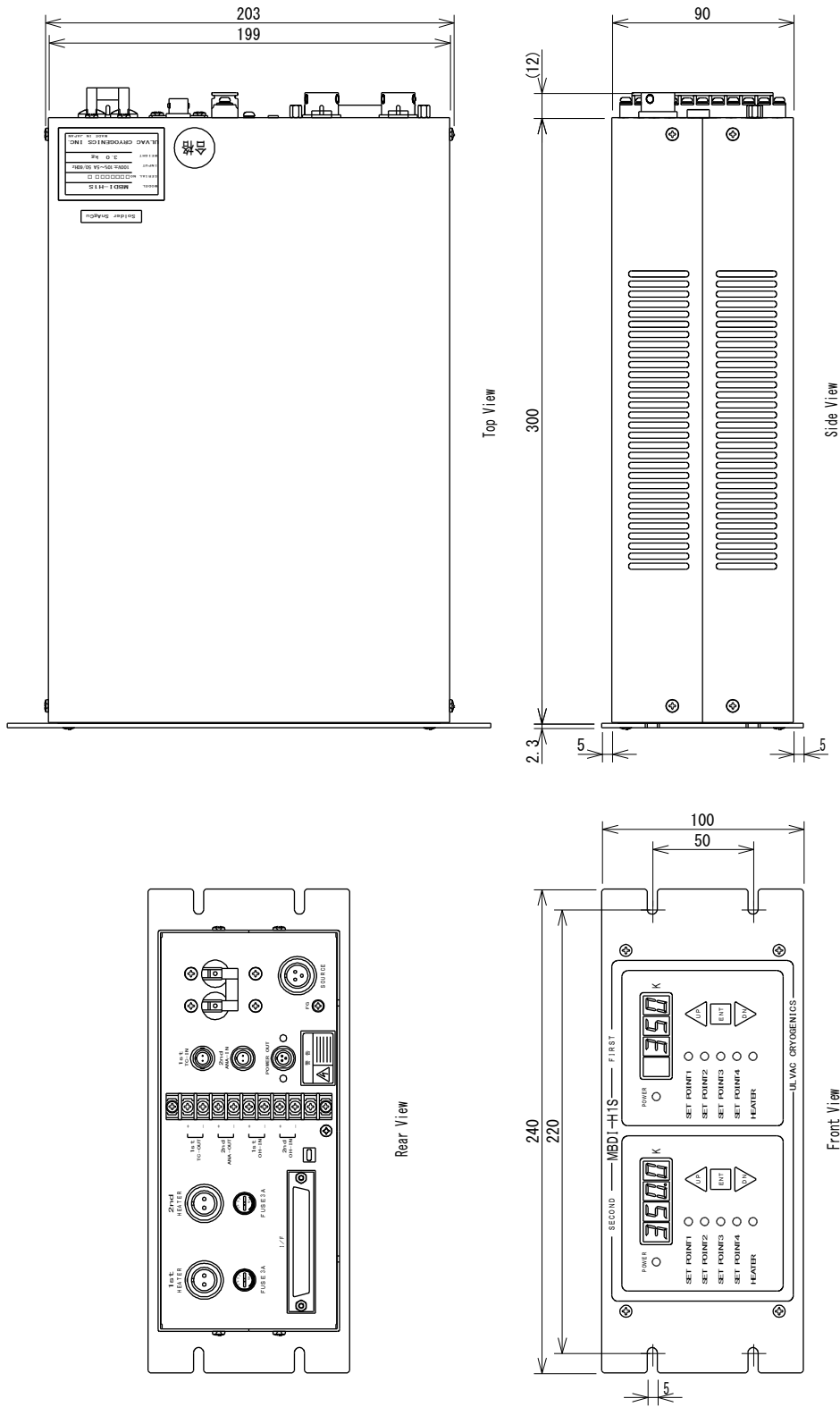


CAUTION

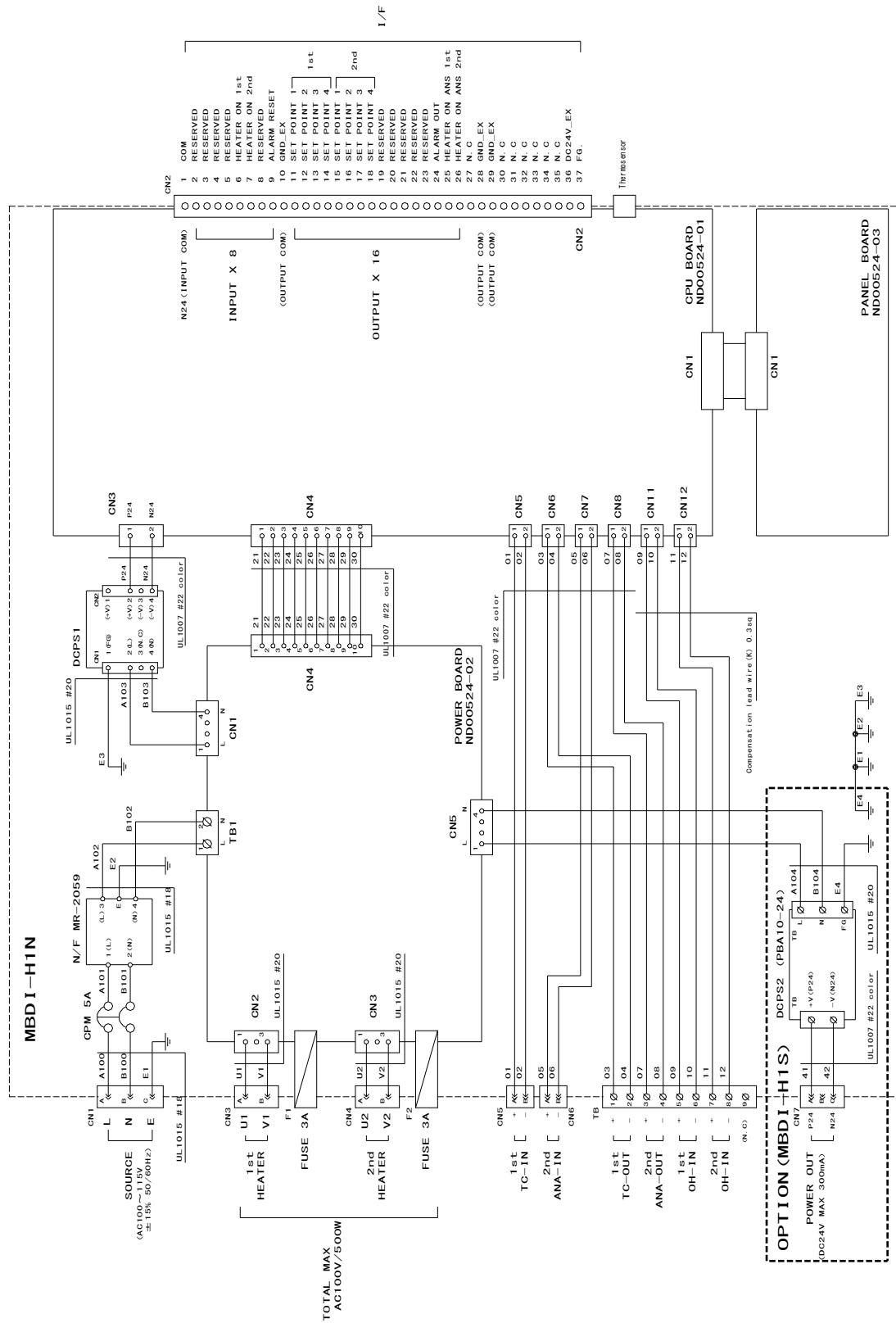
Ask duly-authorized agent for disposing of industrial waste, and dispose used products at your own risk in accordance with your local Waste Management Law and the PRTR (Pollutant Release and Transfer Resister). Or, you may return the product to the manufacture. In that case, please consult with your local customer service for further information.



Appended Figure.1 MBDI-H1N external dimensions drawing



Appended Figure.2 MBDI-H1S external dimensions drawing



Appended Figure.3 MBDI-H1N, MBDI-H1S electric wiring diagram

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Revision History

Date	Revision No.	Contents
2008-07-22	2008.07	First edition
2009-06-08	2009JE01	“Introduction” has been revised. UCN address has been changed. “SERVICE NETWORK” has been revised.
2012-01-30	2012JA02	P.7 4.2 DIP switch specifications Descriptions and figures of old and new types of DIP switch have been added. “Introduction”, “Disposal Consideration”, and “SERVICE NETWORK” have been revised.
2013-07-02	2013JU03	“SERVICE NETWORK” has been revised. P.8 Table5-1 MBDI-H1 series accessories ⑤ has been revised.
2013-11-21	2013NR04	Cover: Title has been changed, “Introduction” and “SERVICE NETWORK” has been revised. P.1 The table that contains the descriptions of additional functions has been added. P.8 Table4-3 The contents of the table has been changed. P.21 Chart 8-2 has been added. P.23 Table 9-2 The content of the table has been changed.
2018-12-13	2018DR05	“SERVICE NETWORK” has been modified.

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