

CRYO METER MBS-C

Instruction Manual

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 Consideration

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

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

We will offer you Material Safety Data Sheet (called MSDS) of our products upon your request. If you have any questions, please contact our Service Engineering Division or the nearest customer support center.

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SHIPPING LIST

Our product has been fully inspected before shipment. However, please make sure that there is no damage or shortage of delivered items by checking the shipping list below and the exterior of the products.

COMPONENTS	QUANTITY
CRYO METER MBS-C	1
I/O Connector-kit (*)	1
K(CA) plug	1
Instruction Manual	1

(*) Standard attachment in case of no option specified. Option cable and/or plugs shown in Table 1-2 are attached instead of the kit by your specifying of the option.

Note to Users

ULVAC CRYOGENICS INC. ships the products that have been passed the inspection and adjustment procedure. Please contact our customer support if you have any problem. Any modification and/or adjustment should not be performed without our permission. Otherwise, it will cost on the verification, inspection, adjustment, and repair even in the warranty period.

1. General

1.1 Features

CRYO METER MBS-C is the successor to MBS.

MBS-C is installed on CRYO-U[®] cryopump manufactured by ULVAC CRYOGENICS, INC. and measures temperature inside cryopump from 10K to 350K.

The MBS-C measures temperature of 2nd stage of cryopump utilizing cryogenic thermocouple (Chromel-AuFe thermocouple), and outputs handling no-voltage dry contacts and analog signals.

With two dry contacts, MBS-C displays three different temperature levels of 2nd stage such as below 20K, 20K to 280K, and 280K and above. The temperature is displayed on front panel of MBS-C with LED indicator which has three different colors.

The analog output signal indicates 2nd stage temperature with 5 – 0 Vdc corresponding to 10K – 350K range. Also, the analog line is isolated from the power line.

Moreover, MBS-C has K(CA) thermocouple for 1st stage of cryopump or for detecting baffle temperature, it therefore outputs the thermocouple electromotive force directly.

The input power for MBS-C is DC24V. When operating MBS-C with CRYO METER MBD, manufactured by ULVAC CRYOGENICS, the input power can be supplied from MBD to MBS-C. MBD displays the numeric temperature value of 2nd stage.

Refer to Figure 1-1 and 1-2 for the appearances of MBS-C and MBD. Please refer to MBD instruction manual for details. We offer two types of MBD, MBD-S (100V type) and MBD-T (200V type).

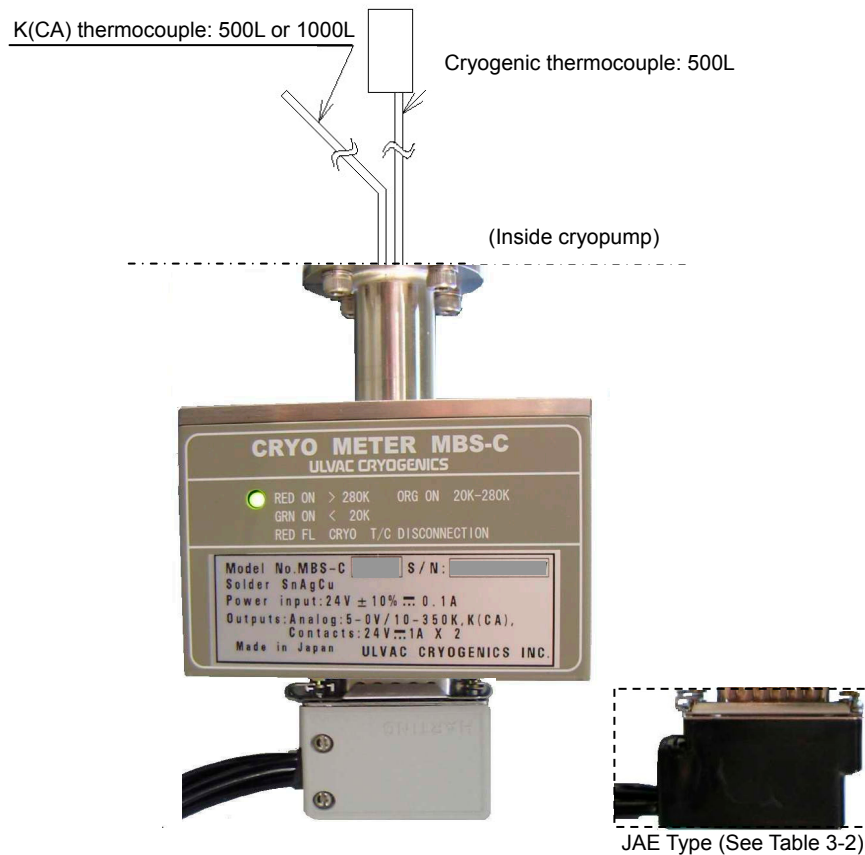


Figure 1-1 CRYO METER MBS-C



Figure 1-2 CRYO METER MBD-S, MBD-T

1.2 Models of MBS-C

We offer two models of MBS-C according to the length of K thermocouple. The models are chosen depending on the size of cryopump and its design. Refer to Appended Figure 3 for the dimensions.

Table 1-1 Models of MBS-C

Model	Cryogenic thermocouple [mm]	K thermocouple [mm]
MBS-C2, C2a	500	500
MBS-C3, C3a	500	1000

(*1)C2a and C3a are the types for the use with thermal anchors. They have been added mainly for cryopumps with caliber larger than 20 inches.

1.3 Attached Connectors and Option Cables

If no cable-option is specified, connector plugs shown in Table 3-2 will be attached. Wiring of the connectors should be done by customers in this case.

If you purchase our equipment that inputs MBS-C signal, you can choose the specified cable to connect MBS-C "I/O" connector as an option to avoid self-wiring job.

See Table 1-2 for the selection, and refer to "Supplement 2" to know the options in detail.

Table 1-2 Cable Options for MBS-C "I/O" connecting

Part Number	Cable Name	Length [m]	Application	Attachment
GP-HM30	MBS-compatible Cable	(0.3m only)	Same way as MBS on wiring and connecting	3 Plugs for wiring ^(**1)
MBD-HS30	MBD – MBS-C Cable	5,10,15,20	A cable for connecting MBD and MBS-C	
MBD-HS31	MBD - MBS-C Cable with Contact signals	5,10,15,20	Option cable of MBD MBS-C contacts available	

^(**1) The plugs are same type of MBS attachments. Note that it is easier for cabling MBD and MBS-C by using MBD-HS30 than using GP-HM30, because other cables are required in the latter case.

Please specify MBS compatible cable when you need to wire in the same way as previous models of MBS.

When purchased as a system, please contact us for appropriate cables.

2. General Specifications

Table 2-1 Ratings of MBS-C

	Item	Specifications
Ambient Conditions	Storage Temperature	-20 – 70°C(*1)
	Operating Temperature	10 – 35°C
	Ambient Humidity	40 – 85%RH (No Condensation)
	Installation Space	Indoors, Installation Height: Less 1000m Keep away from direct sunlight and corrosive gases.
Temperature of 2nd stage	Cryogenic Thermocouple	Cryogenic thermocouple (Chromel-AuFe0.07%) 10 - 350K(-263 – +77°C) Thermal anchors are used with C2a and C3a.
	LED Status Display	Green Light: 20K or less ^(*2) Orange Light: 20 - 280K ^(*2) Red Light: 280K and above
	Contact Output 1 (A contact x1)	No-voltage dry contact conduction: 20K or less ^(*1)
	Contact Output 2 (A contact x1)	No-voltage dry contact conduction: 280K and above
	Contact Rating (as above)	DC24V/1A or AC48V/0.5A
	Analog Output	5 – 0V/ 10 – 350K (Refer to Figure A-1.) Minimum Load 100kΩ or above
Temperature of Baffle or 1st stage	Cryogenic Thermocouple	K thermocouple (Chromel - Alumel) JIS C 1605-1995 class3
	Signal Output	Thermocouple Direct Output (Refer to Figure A-2.)
Power Source	Input Power Source	DC24V (+-10%), 0.1A or less, Rush Current 1A or less. With protection against reverse connection
(*1) Environment Resistance	Insulating Resistance	DC500V mega (10MΩ or over)
	Withstand Voltage	AC500V / min. (less than 4mA)
	Resistance to Noise	1kV / min. (First Transient Method)
	Resistance to Vibration	0.6G or less (10 – 20Hz)
Machine Specification	Dimensions	90Wx111Hx53D (Refer to Appended Figure 3.)
	Weight	Approx. 0.5kg
	Dust and Water-Proof	IP21
(*1) Substrates only		
(*2) AC2 settings: Threshold temperature is changed to 25K from 20K. Please equate 20K as 25K for this setting.		

3. Connector Specifications

Shown below are the locations of MBS-C connectors and signal names.

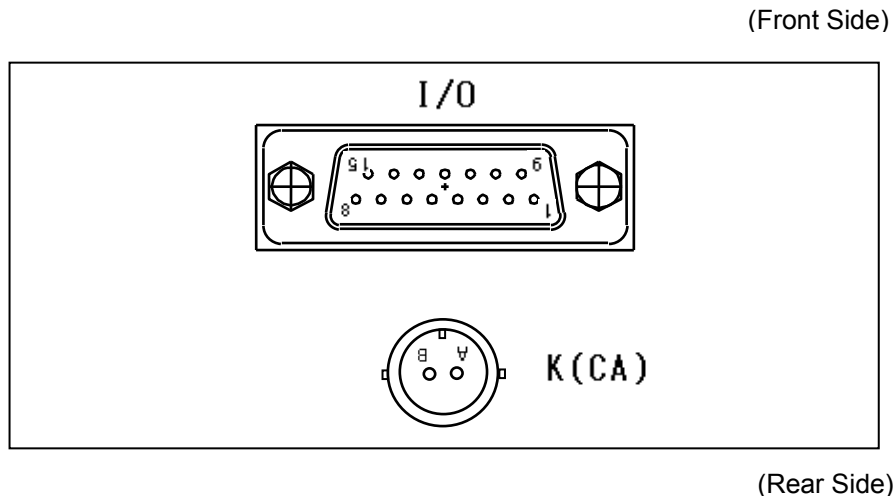


Figure 3-1 MBS-C Bottom View

Table 3-1 Pin assignments and signals

Symbol	Model	Pin No.	Signal Name	Pin No.	Signal Name
I/O	D-SUB 15 pins DA-15PAF-N (JAE) or equivalent	1	N.C.	9	N.C.
		2	Analog Output(+)	10	Analog Output (-)
		3	N.C.	11	N.C.
		4	Contact Output 1: 20K or less	12	Contact Output 1: 20K or less
		5	Contact Output 2: 280K and above	13	Contact Output 2: 280K and above
		6	Input Power (24V)	14	Input Power (0V)
		7	N.C.	15	N.C.
		8	FG(Frame Ground)		
K(CA)	R05-R2M (TAJIMI)	A	K thermocouple output (+)	B	K thermocouple output (-)

Listed below are appropriate connectors for cable wiring.

Table 3-2 Connectors for wiring

Symbol	Specification	(*)				
		Part Name	Part Number	Vendor	Original Number (*)	Vendor
I/O	Connector for IO signals (D-SUB 15pin plug, Female)	Plug	0967 015 4715	HARTING	(DA-15SF-N)	(JAE)
		Slide lock device	0967 015 0511		(DA51220-1)	
		Hood	0967 000 9915		(DA51211-J)	
		Part Number			Vendor	
K(CA)	K-thermocouple signal (Round-shaped plug)	R05-PB2F, or R05-P2F		TAJIMI		

(*) JAE "Hood" has gone into out of production. HARTING model is almost similar to JAE on hood size, and is similar on plug specifications

4. Installation

4.1 Thermocouple Installation



1.1 CAUTION

- ◆ Be sure to put the indium gasket on when installing the cryogenic thermocouple and the K thermocouple.
- ◆ Do not bend the sheath more than the diameter of the cylinder. (Be sure to bend with hands)
- ◆ Do not attempt to straighten bent sheath.
- ◆ Do not place stress on the joint part of sheath and copper block when putting on or taking off.
- ◆ Avoid the sheath from getting stuck when installing inner kits.

◆ CRYOGENIC THERMOCOUPLE (Chromel-AuFe 0.07%)

<Without Thermal Anchor>

Place indium gasket below the 2nd stage of coldhead unit and fix with countersunk head screw (M3x10L).

(Fix copper block on the edge with pliers before tightening screws.)

<With Thermal Anchor (For models of caliber larger than 20 inches)>

Following the above step, fold indium sheet (30x40mm) two times along the longer side and place it on sheath, and fix thermal anchor on the 2nd stage cylinder of coldhead with hexagon socket bolt M4x12L and cerate nut M4.

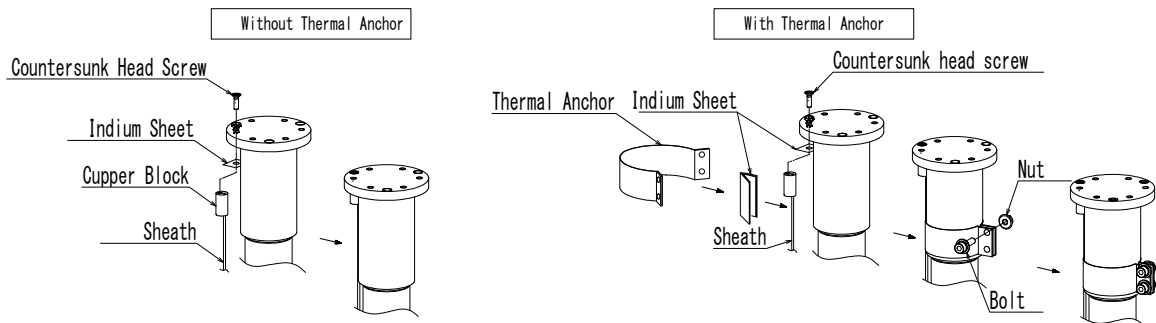


Figure 4-1 Cryogenic Thermocouple Installation

◆ K THERMOCOUPLE (Figure 4-2)

Place indium sheet where 80K baffle is fixed.

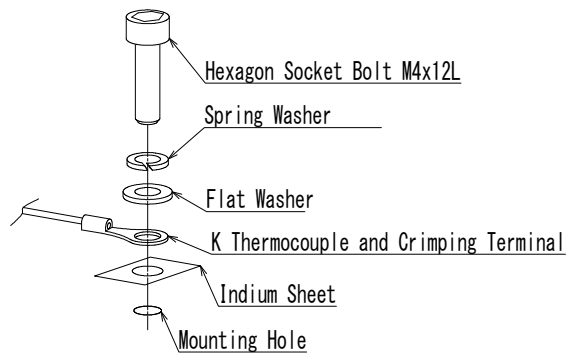


Figure 4-2 Thermocouple Installation

4.2 Cable Connection

The recommended cabling diagram for MBS-C INPUT/OUTPUT signal is shown in Figure 4-3. Please refer to Figure 4-4 and 4-5 as well.

In Figure 4-4, cabling using MBD is shown. In this example, MBS compatible cables that enables the similar wiring with existing models of MBS.

In Figure 4-5, the wiring using MBD-MBS-C connection cable (Option of MBD-HS30) that can connect MBD and MBS-C directly and is normally recommended.



2.2 WARNIN

Disconnect the power supply to MBS-C before connecting the cables to devices, there is a risk of electric shock when touching the connectors.

If you connect and disconnect the cable without turning off MBD or other connecting devices, MBS-C's factory default values may be overwritten and MBS-C function incorrectly.



1.3 CAUTION

- (*1) After all connections have been made, reconfirm that cables are connected correctly. Missed wiring may cause damage to MBS-C.
- (*2) The isolation between ANALOG IN and 24V P/S in the control panel is recommended to reduce noise problem.
- (*3) Also, isolation between DIGITAL IN and ANALOG IN is recommended for the same reason, and avoiding Ground-Loop problem.
- (*4) In case of connecting a measurement tool to the MBS-C analog output line, check the tool's input impedance before the connection. Lower impedance may cause a voltage drop of MBS-C analog line, and may damage the system operation.
- (*5) Always use compensating lead wires for K thermocouple (supplied by customers) for K thermocouple plug cables. The temperature will not be measured correctly with regular signal cables.
- (*6) Do not connect the compensating lead wires for K thermocouple to multiple devices in parallel. Use distributor instead.
- (*7) Make sure that external resistance of K thermocouple input lines are below 100 Ω .



1.2 CAUTION

When Wiring;

In order to prevent mutual interference during operation, signal lines, control lines, and AC power lines should be placed in separate conduits. Especially, do not route MBS-C analog line in ways as to place together with AC power lines or control lines of other equipments in a same conduit, or to bundle them together. It may cause interference with MBS-C operation.

In case that separated conduits are not possible, keep enough distance between the lines (300mm or more) to avoid the interference.

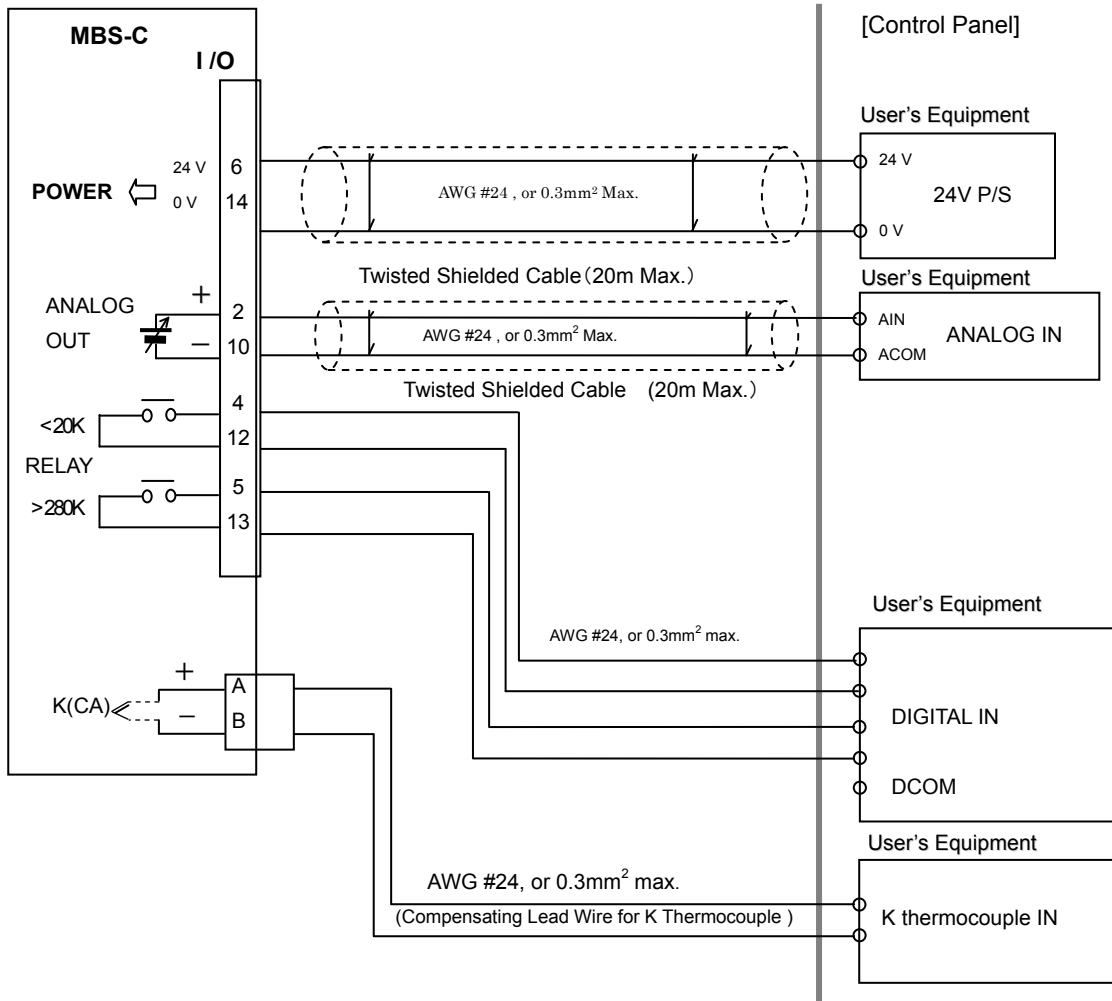


Figure 4-3 DC Power Line and Signal Line Diagram

<Wiring with MBS compatible cables>

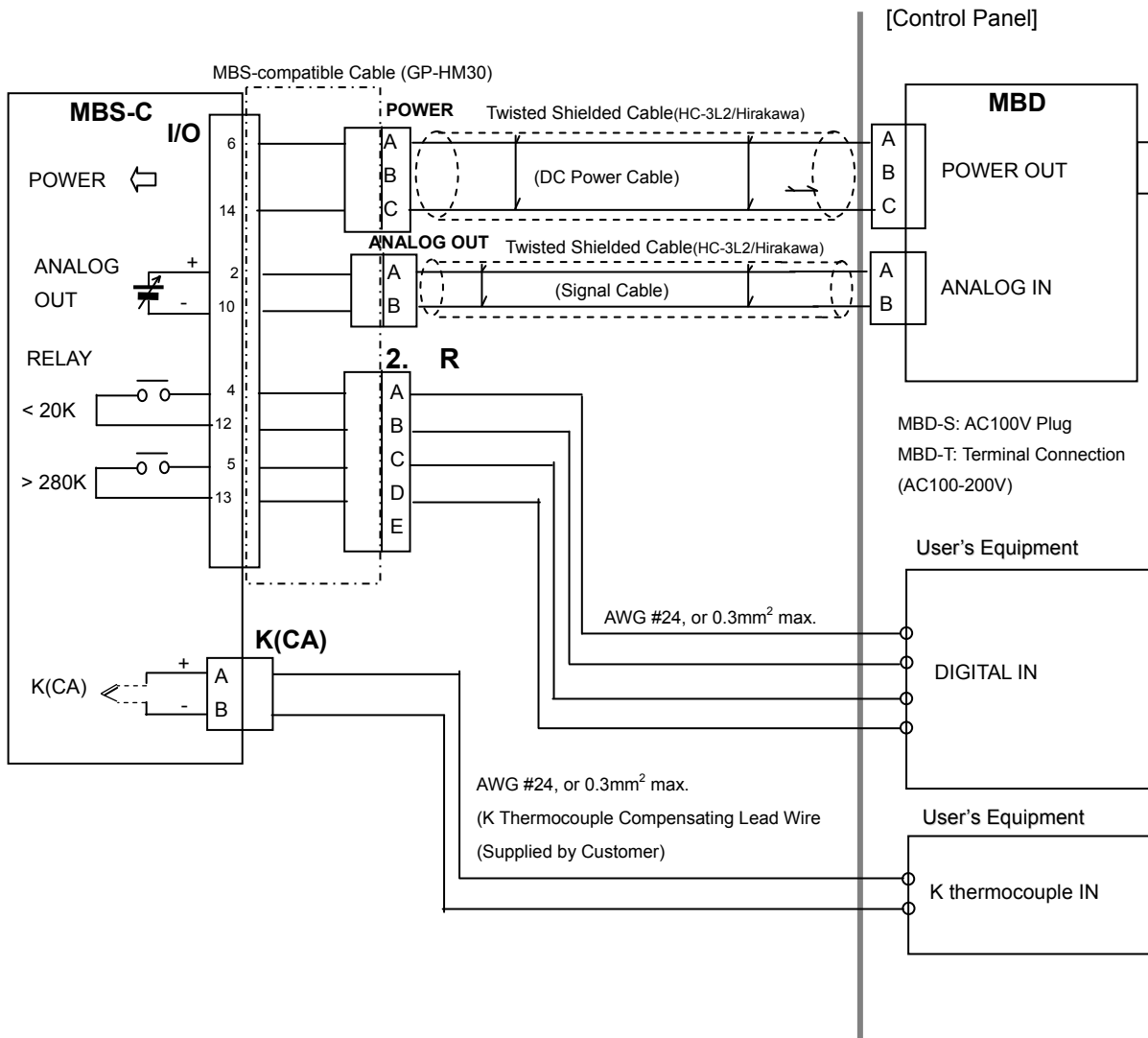


Figure 4-4 Cable Connection with MBD and Other Signal Line Diagram (1)

<Wiring with Optional cables>

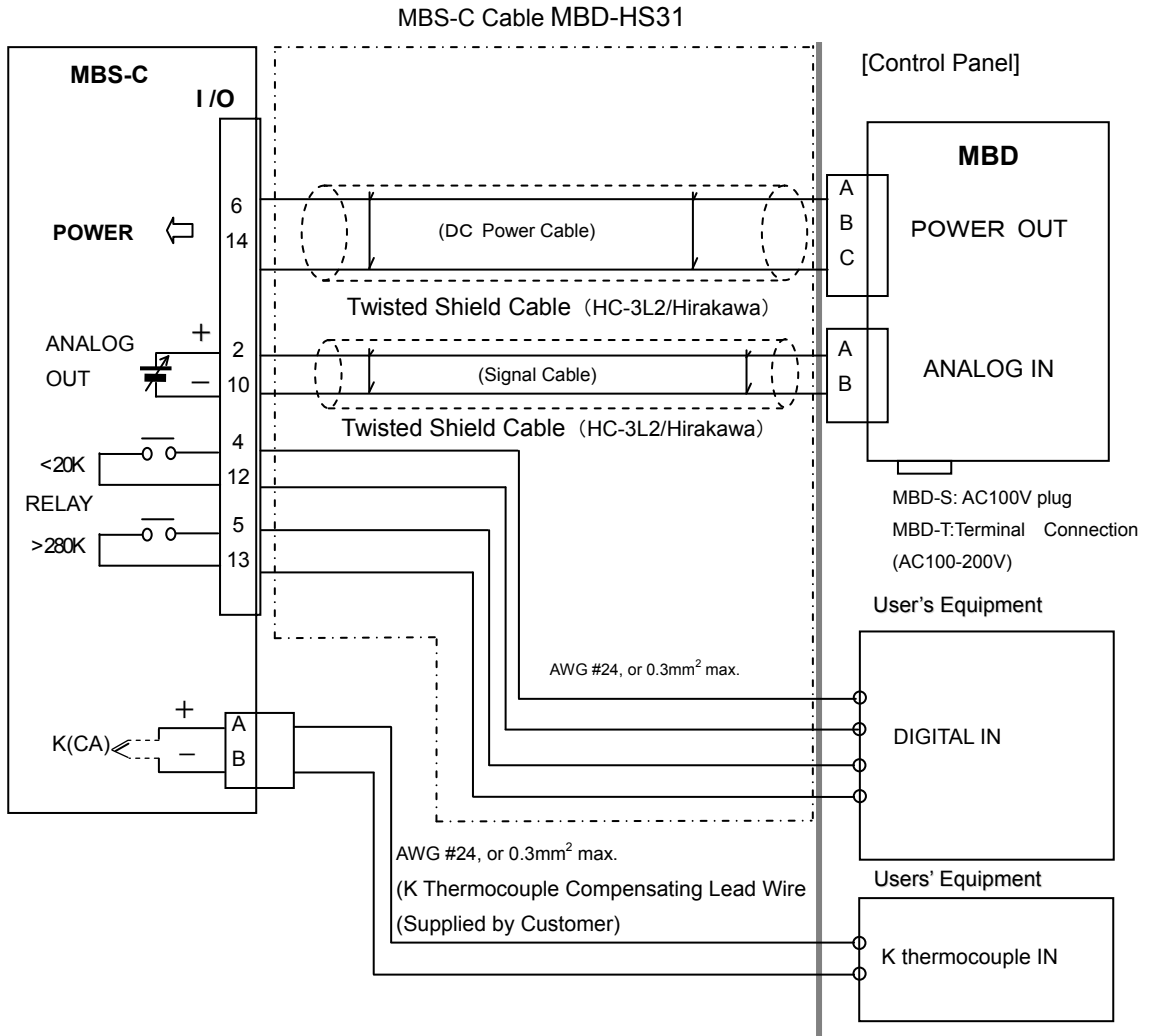


Figure 4-5 Cable Connection with MBD and Other Signal Line Diagram (2)

5. Status Display

Power ON MBD or MBS-C

Supply dc-power for MBS-C or power on MBD to supply the power for MBS-C.

If there is a defect or danger, shutoff the branch circuit power immediately. After that, check the cable connections referring to Section 6. Troubleshooting.

Check that the indicator lights up after power-on. MBS-C displays three different colors (red, orange and green) according to the temperature inside cryopump. The line indicator lights up for MBD.

Listed below are the descriptions for status displays in several conditions.

Status Display and Output Signal for MBS-C

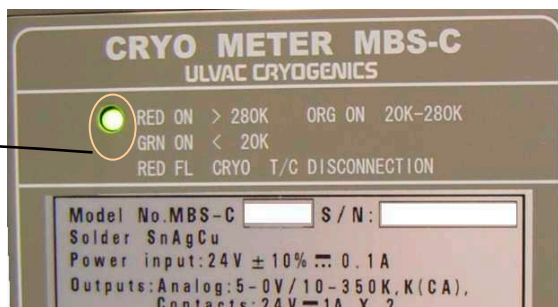


Figure 5-1 Front Panel of CRYO METER MBS-C

Table 5-1 Status Display of MBS-C

Color	Status	K(CA) (Appended Figure 2)	I/O ANALOG OUTPUT (Appended Figure 1)	I/O Contact Output (Pin-Pin)	
 Red	Lights up when temperature of 2nd stage is 280K and above. Temperature inside cryopump is at room temperature(20°C) and above.	Approx. 0mV or more	1.2V or less	(4-12)	Open
				(5-13)	Close
 Orange	Lights up when temperature of 2nd stage is between 20K and 280K. Cryopump is in cool-down or regeneration operation.	Refer to Appended Figure 2.	Refer to Appended Figure 1.	(4-12)	Open
				(5-13)	Open
 Green	Lights up when temperature of 2nd stage is below 20K. Cryopump is in steady operation.	Nominal -6.5mV or less	4.8V and above	(4-12)	Close
				(5-13)	Open

NOTE:

When the indicator does not light as shown in Table 5-1, there is a possibility of an error or defect. Please refer to Section 6. Troubleshooting for details.

6. Troubleshooting



	 2.1 WARNING
<p>In the troubleshooting procedure, confirm the fault status, turn off the power, and turn on the power again. After that, reconfirm the fault status. If the product goes into over-heat condition, turn off the power immediately.</p>	

Table 6-1 Troubleshooting Procedure

Problem	Possible Cause	Corrective Action
I. Red indicator flashes.	Disconnection of Cryogenic thermocouple	Please contact us.
II. The indicator does not light.	1) Miswiring	Reconnect the cables correctly. Refer to Table 3-1 and Figure 4-3 for details.
	2) Fault of electric circuit	Please contact us.
III. ANALOG and K output does not output anything.	1) Miswiring	Reconnect the cables correctly. Refer to Table 3-1 and Figure 4-3 for details.
	2) Disconnection of thermocouple	Please contact us.
IV. Contact output does not output anything.	1) Miswiring	Reconnect the cables correctly. Refer to Table 3-1 and Figure 4-3 for details.
	2) Fault of electric circuit	Please contact us.
V. ANALOG output value is not correct.	1) Attached part loosened	Install correctly placing indium sheet of high thermal conduction.
	2) Deterioration of thermocouple.	Re-calibration is needed.
	3) Internal circuit damaged	Please contact us.
IV. K thermocouple value is not correct.	1) Attached part loosened	Install correctly placing indium sheet of high thermal conduction.
	2) Defect in wiring	Use compensating lead wires.
	3) Deterioration of thermocouple	Please contact us.

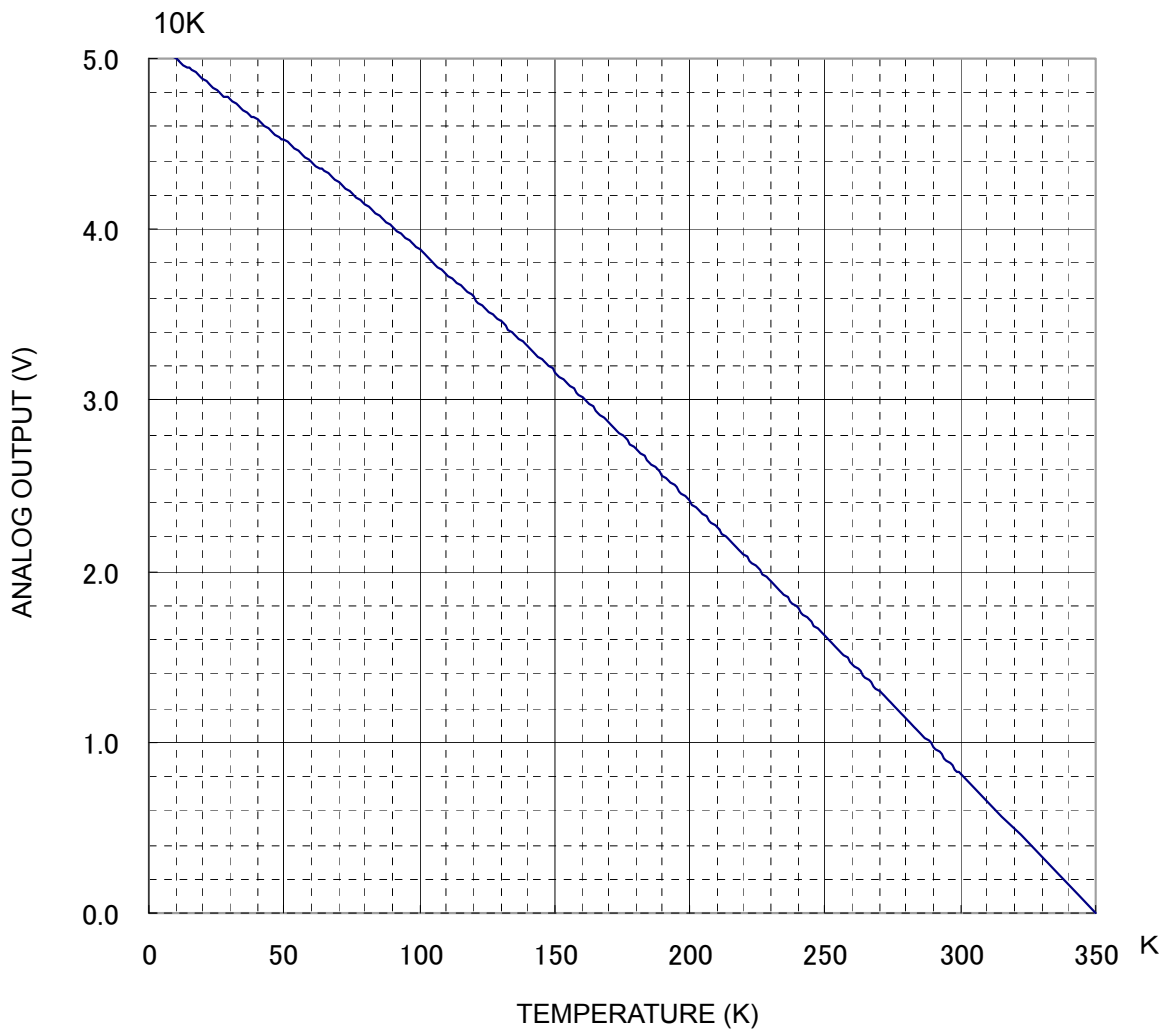
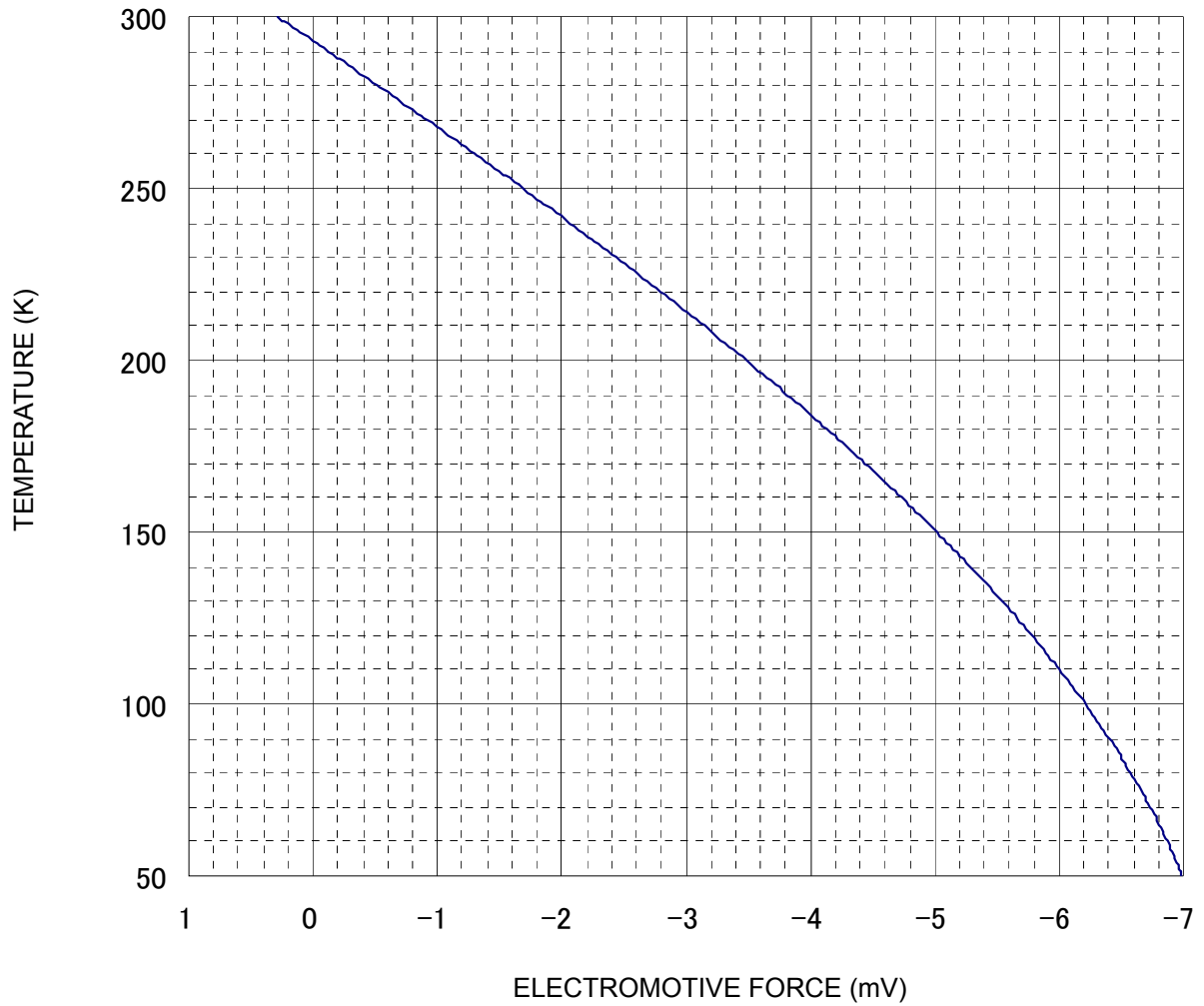


Figure A-1 Analog Output voltage (10K - 350K)



(Ambient Temperature : 20°C)

Figure A-2 K Thermocouple output voltage

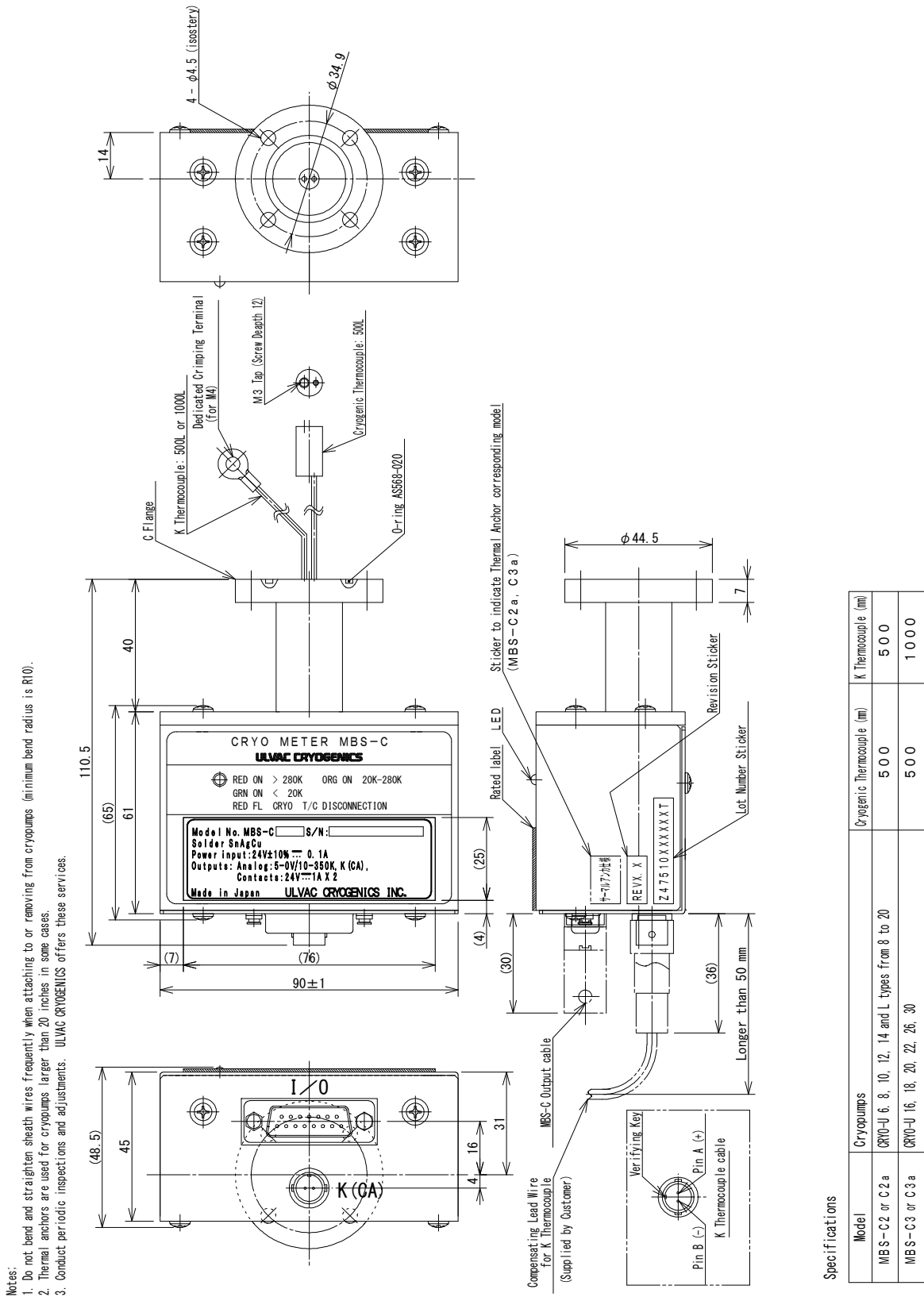


Figure A-3 Dimensions of MBS-C

Supplement 1. Assembling IO Connector and Connecting to MBS-C

1. The Connector-kit

If no cable-option is specified, the Connector-kit shall be attached to MBS-C for “I/O” connecting. Fig. 1-A shows the package view.

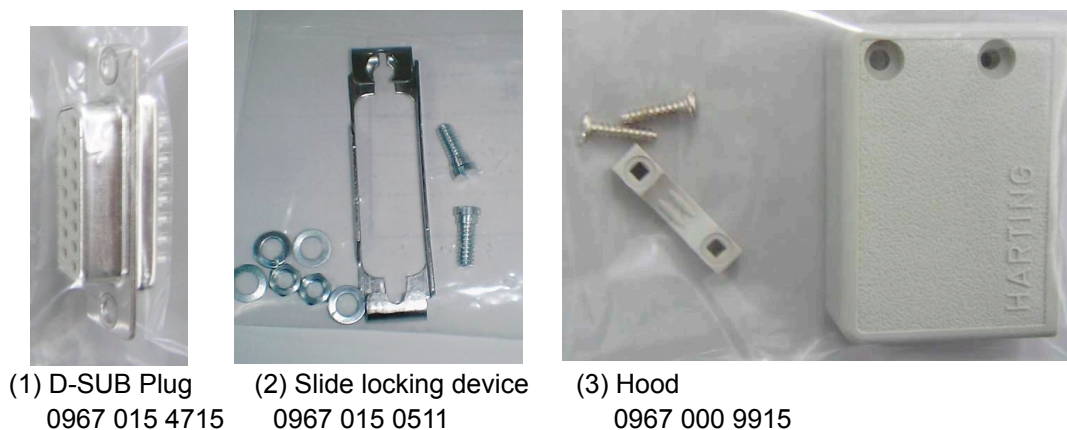
The package includes all the parts you need. Fig. 1-B displays the contents.

You will not use two tapping screws (size: 2.9) in the Hood package. ^{(*)1}

Also, you will not use nuts and washes in the Slide locking device package. ^{(*)2}



Fig. 1-A Connector-kit Package (Part No. 72D15F-S)



(1) D-SUB Plug
0967 015 4715

(2) Slide locking device
0967 015 0511

(3) Hood
0967 000 9915

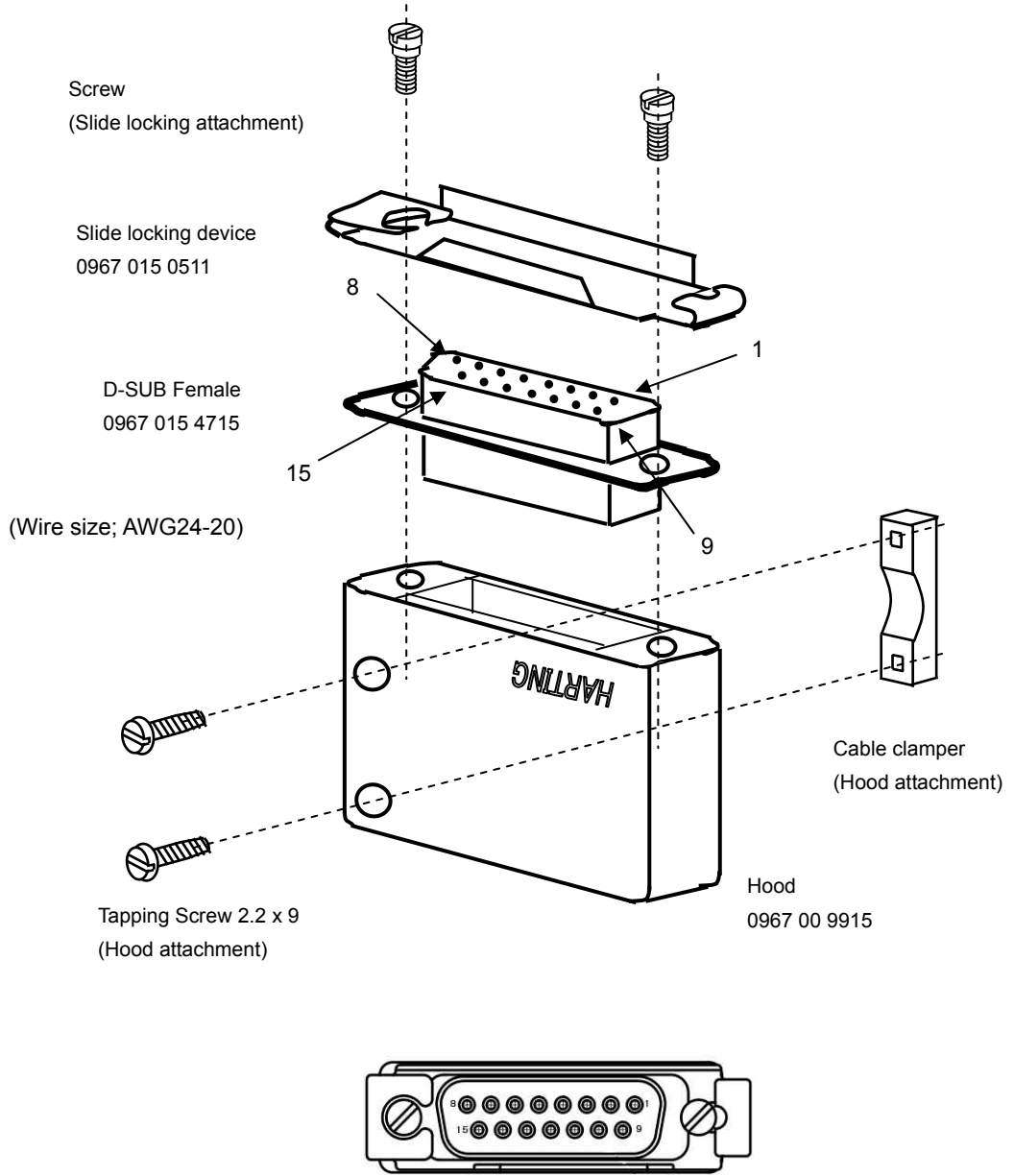
Fig. 1-B Parts in the Package

^{(*)1} The screws are to tap connector-holes of the hood. If the tapping is not enough, you can make taps by yourself with using these screws.

^{(*)2} Nuts and washes are for another connector-clamper.

2. Assembling the parts

Fig. 1-C shows how to assemble. You shall use a minus driver for tightening screws.



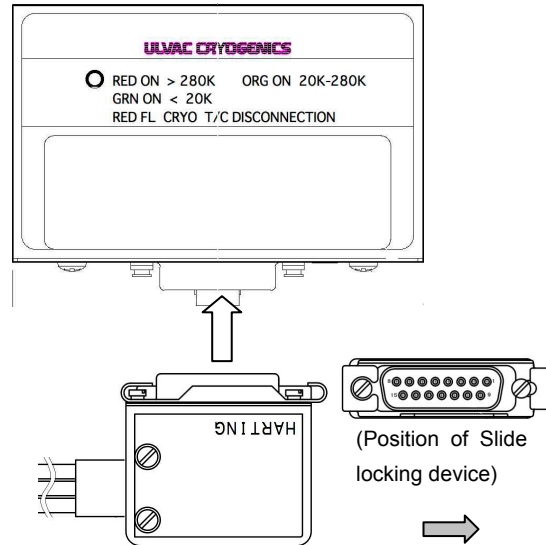
(Note) You do not use the following parts for the assembling.

- Tapping screws (size: 2.9) in the Hood package,
- Nuts and washers in the Slide locking device package

Fig. 1-C Assembling of Connector-kit

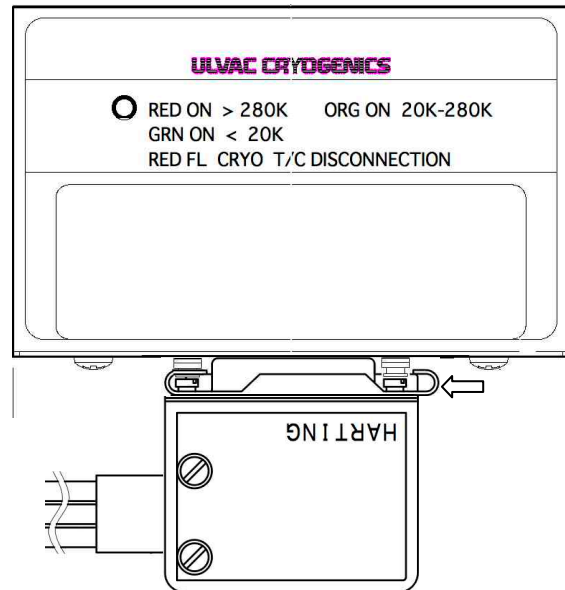
3. Connecting Procedure to MBS-C

Confirm location and name of the connector by referring to Figure 3-1.



Make sure that the Slide locking device is at correct position shown in the figure on the right side.

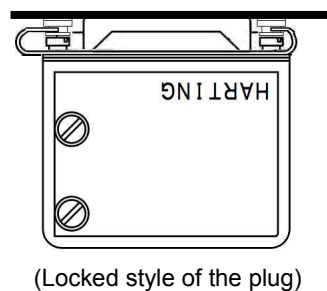
Then, insert the plug straightly to the end position.



According to the figure shown here, push the right side of the Slide locking device.

Check that the Slide locking device is positioned shown in the figure with light metallic sound. It means that the plug is locked to MBS-C.

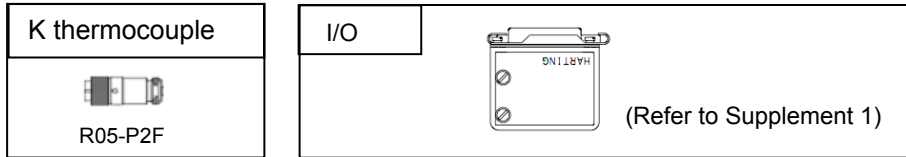
If you would remove the plug, push the left side of the Slide locking device for unlocking the plug. Then, pull the plug to remove it.



Supplement 2. Attachment, and Option cables

The following shows all the types that are available for connecting to MBS-C.

(Standard Attachments)








(Note) K-thermocouple plug for wiring is attached to MBS-C in any case

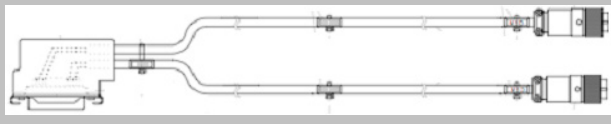
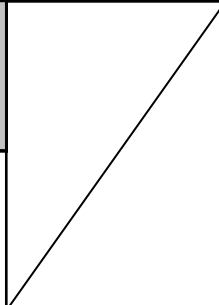
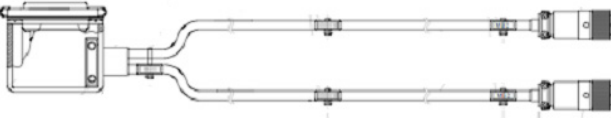
(Option cables)

Check and order the cable shown below if you need. The I/O plug shown above is not attached when you select any option cable.

(Note1) “(New)” means that it is different with the hood (cover). Another specifications are similar as before.

The change is caused that the vendor operated the parts to out of production.


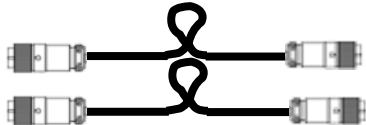



Type	GP-HM30	MBS-compatible Cable	Attached plug
Old			 R03-P5M  R03-P2F  R03-P3M Refer to Table 2-A
New			

Type	MBD-HS30	MBD - MBS-C Cable	Attached plug
Old			
New			

(Note2) Note that MBD-HS30 requires self-wiring of the connector for contact signals of MBS-C.

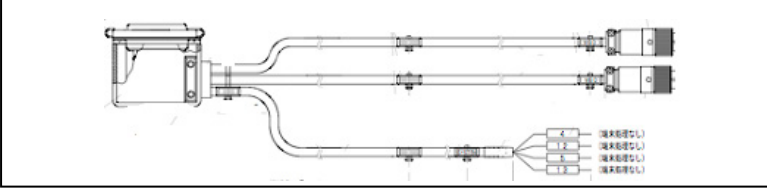
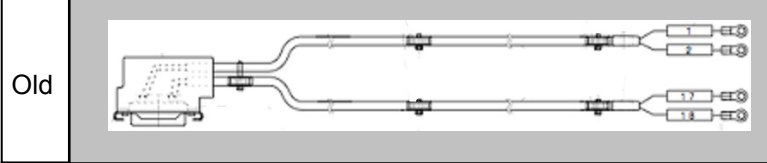
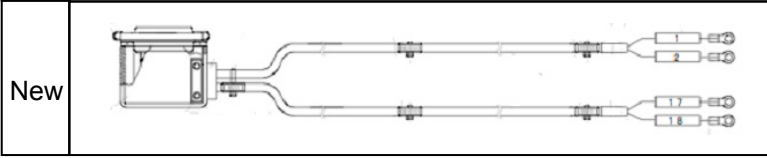
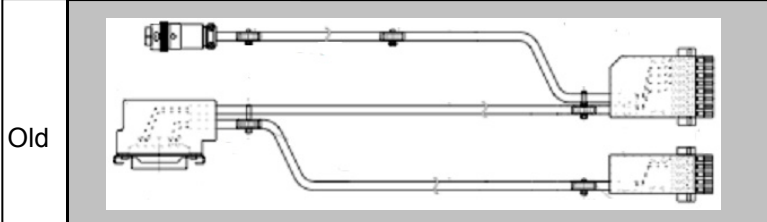
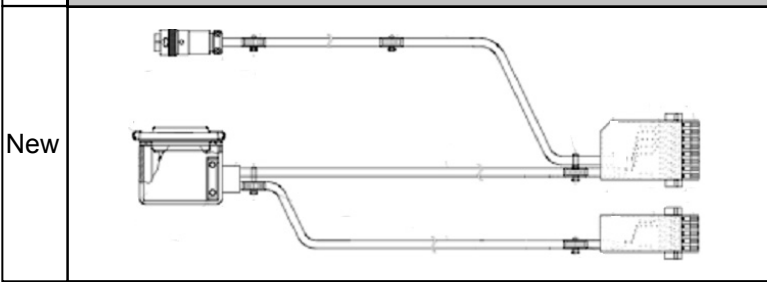
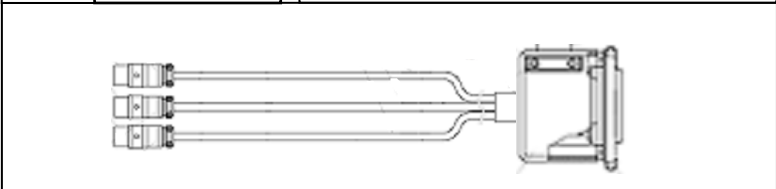
If you would not, you can choice MBD-HS31. It has already contact signal lines. See next page.

Table 2-A Example: Another combination of MBS-compatible Cable

MBS-compatible Cable	MBS-MBD Connecting Cable Set
	
 R03-P5M  (R03-P2F)  (R03-P3M)	

If you choose MBS-compatible Cable and MBD, the MBS-MBD connecting cable set is required. See Table 2-A. In this case, only R03-P5M plug for contact signals is used.

Table 2-B Specified Option Cables (Mainly Thermal Control): Ordered products

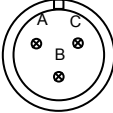
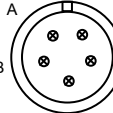
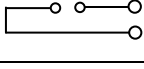
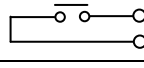
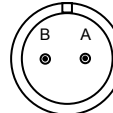
Type	MBD-HS31	MBD -MBS-C Cable with Contact signals
		
Type	CM-HS30	CM Cable
Old		
New		
Type	CR-HS30	CR Cable
Old		
New		
Type	GP-HM31	MBS adapting Cable
		

(Note 3) Refer to Note1 for the meaning of “Old” and “New” terms in Table 2-B.

(Note 4) MBS adapting cable is available for installing MBS that should be connected to MBS-C cables in case of replacing a pump with MBS-C to a reserved pump with MBS

Supplement 3. Pin assignments of MBS-compatible Cable

Table 3-A Pin assignments of MBS-compatible Cable connectors

Name	Receptacle Pin name	Available Plug Spec.	Pin assignment		Function
POWER		R03-PB3M, or R03-P3M	A	+24V DC	Input power
			B	(Reserved)	
			C	0V	
RELAY		R03-PB5M, or R03-P5M	A		2'nd stage: 20K or lower
			B		
			C		2'nd stage: Over 280K
			D		
			E	(Reserved)	
ANALOG OUT		R03-PB2F, or R03-P2F	A	+ OUTPUT	2'nd stage: +5 – 0V/ 10 – 350K
			B	- ACOM	

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Revision History

Date	Revision No.	Contents
2005-12-27	2005.12	First edition
2006-02-02	2006FY01	P.4, Correction of the model number of Angle 90° Clamp in Table 3-2.
2006-08-23	2006AT02	IO Connector has changed. Supplement 1, 2 and 3 have been added.(P.13-P.18)
2007-09-04	2007SR03	Addition of disposal consideration. (PIW-1)
2009-06-08	2009JE04	“Introduction” has revised. UCN address has changed. “SERVICE NETWORK” has revised.
2009-09-24	2009SR05	WARNING has added Section 4.2 Cable Connection.
2013-11-08	2013NR06	“Introduction” has revised. “SERVICE NETWORK” has revised.
2014-10-06	2014OR07	Figure 1-2 has been changed (MBD-S, MBD-T Added) Table 1-1 MBS-C2a and C3a have been added. 2. General Specifications Table 2-1 has been modified. 3. Connector Specifications Figure 3-1 has been changed. 4.1 Thermocouple Installation The process to attach thermal anchor has been added. 4.2 Cable Connection Cautions have been modified. Figure 4-5 has been added. Table 6-1 Items V and VI have been added.
2017-12-20	2017DR08	4.2 Cable Connection Figure4-5 has been modified. SERVICE NETWORK has been revised.

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