

**CRYO-METER MBD series
MBD-S / MBD-T
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.

This page intentionally left blank

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.

This page intentionally left blank.

TABLE OF CONTENTS

1. Features and types	1
2. Specifications	2
3. Connector Specifications.....	3
4. Installation	4
5. Operation	8
6. Troubleshooting	8
CRYO METER MBD-S / MBD-T Dimensions.....	11

FIGURES

Figure 1-1 MBD-S Appearance	1
Figure 1-2 MBD-T Appearance	1
Figure 1-3 Types of MBD series	1
Figure 2-1 MBD Front Panel	3
Figure 3-1 MBD Rear Panel.....	3
Figure 4-1 Wiring of MBD-S/MBD-T and MBS-C	5
Figure 4-2 Wiring of MBD-S/MBD-T and MBS.....	6
Figure 4-3 MBD-S/MBD-T Power Supply Circuit	7
Figure 5-1 CRYO METER MBD Display.....	8

TABLES

Table 2-1 Specifications	2
Table 3-1 Connectors Input/Output Pins.....	3
Table 6-1 Troubleshooting List	9

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 external view of the products.

ITEM	QUANTITY
CRYO METER MBD-S/MBD-T (with power cable) ^(*)	1
Clamp kit (Holder & Set Screw × 2)	1
Connector set (R03-PB3M, R03-PB2F) (See table.3-1) ^(**)	1
Instruction Manual	1

^(*) The length of the power cable is 3m fixed.

^(**) Types of cables for connecting MBD-S/MBD-T to MBS-C or MBS are listed on page 2 (Table 1-2) in MBS-C instruction manual. Please refer the table and order appropriate one. These cables are not included in MBD series.

Note: A connector set will be provided with MBD-S/MBD-T, not with those cables.

Inspection and Adjustment of CRYO METER MBD series

Please contact our technical service department when inspection and/or adjustment of CRYO METER MBD 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 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 .

1. Features and types

CRYO METER MBD series is an accessory device for cryogenic thermal display. It can be used in combination with CRYO METER MBS-C or MBS, cryogenic thermocouple thermometer connected to UCI cryopump. The MBD inputs the analog output signal from MBS-C/MBS and displays cryopump 2nd stage temperature numerically. The display range is from 10K to 350K.

Existing MBD has enhanced in application and has become two different CRYO METER, MBD-S and MBD-T. The main difference between them is the power cables. MBD-S is the equivalent product of existing MBD and has AC100V plug as a power cable terminal whereas MBD-T has round terminals at the end of power cable and can be used when input power source is AC200V.

Figure 1-1 and 1-2 show the appearances of MBD-S and MBD-T.



Figure 1-1 MBD-S



Figure 1-2 MBD-T

(Types)

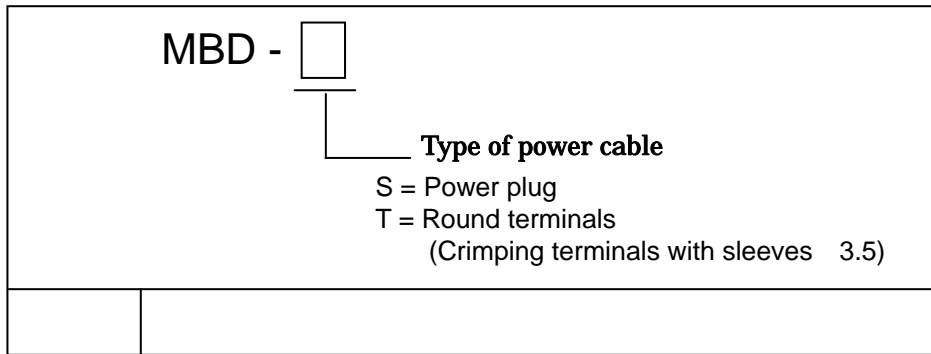


Figure 1-3 Types of MBD series

(Names for ordering)

These products can be ordered by names as shown the table below.
 Note that ordering “MBD” will be considered as ordering “MBD-S”

Names for ordering	Product types
“MBD-S”, “MBD”, or “MBD (AC100V)”	MBD-S
“MBD-T”, or “MBD (AC200V)”	MBD-T

< Note >

Although just “MBD” means “MBD-S” at ordering, MBD is used as the name for both MBD-S and MBD-T when there is no need to distinguish between them in this instruction manual.

2. Specifications

Table 2-1 Specifications

Model	MBD-S	MBD-T
Dimensions	90(W) × 43(H) × 119(D) (mm) (Refer dimension drawing for details)	
Temperature Display	Cryopump second stage temperature (3 digit number)	
Measure Range	10K ~ 350K (-263 ~ +77)	
Accuracy	± 2.0% (Full Scale) (± 1K at temperature between 10K and 30K)	
ANALOG Input	5V ~ 0V (10K ~ 350K) Input impedance: Approx. 100K	
Input Power Source	Voltage: 100 - 115VAC ± 15% Current: 0.15A typ.	Voltage: 100 - 220VAC ± 15% Current: 0.15A typ.
Input power source cable	Two-pole plug with earth ^(*) 3m	Round terminal ends 3m (Crimping terminals with sleeves 3.5)
24V Output (Power out)	Dedicated power source for CRYO METER MBS / MBS-C ^(*) Voltage: 23 - 25VDC Current: 120mA max.	
Operating Environment	Ambient Temperature: 0 - 40 (typ. 25°C) Storage Temperature: -20 - 70 (No freezing) Ambient Humidity: 40% ~ 85% RH (No condensing)	
Dielectric resistance	AC Input - FG: >50M (at DC500M)	
Dielectric Strength Voltage	AC Input - FG: AC2000V/1 min 24V Output - FG: AC500V/1 min	
Noise Immunity (Impulse method)	Power line: (50nS/1uS) Common mode/Normal mode: 2000V Input/Output line: (50nS/1uS) Common mode/Normal mode: 500V	
Weight	Approx. 500g	
Note	<p>(*) This power cable is according to Electrical Appliance and Material Safety Law of Japan and for domestic use only. Do not use AC200V</p> <p>(*) The power source cannot be used for more than one CRYO METER or any other equipment.</p>	

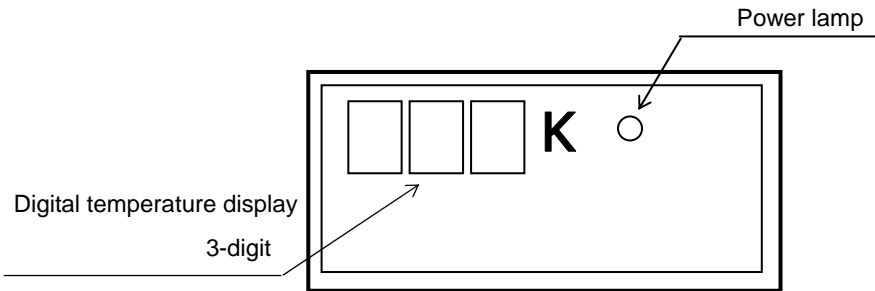



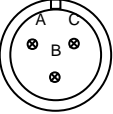
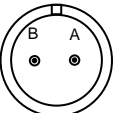
Figure 2-1 MBD Front Panel

3. Connector Specifications



Figure 3-1 MBD Rear Panel

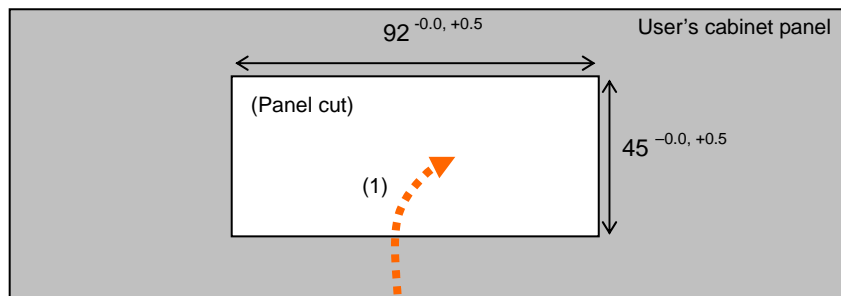
Table 3-1 Connectors Input/Output Pins

Names	Receptacle Pins	Connectable plug types	Assignments		Functions
POWER OUT 24V 		R03-PB3M or R03-P3M (Cable attached)	A	+24V	For MBS/MBS-C 24V Power supply output
			B	No Connection	
			C	0V	
ANALOG IN		R03-PB2F or R03-P2F (Cable attached)	A	+ INPUT	ANALOG Signal Input from MBS/MBS-C +5 – 0V / 10 – 350K
			B	- ACOM	

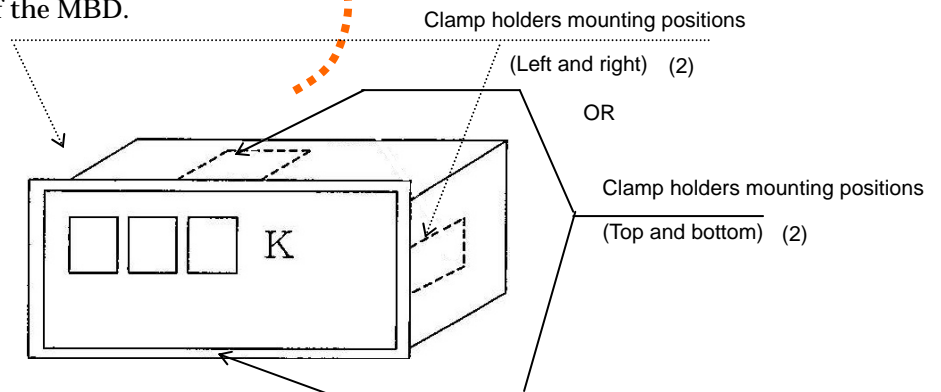
4. Installation

Follow the instruction below to install the MBD on your display panel with a clamp kit. After installing the MBD, connect cables to the MBD. A clamp kit and cables are provided with the MBD.

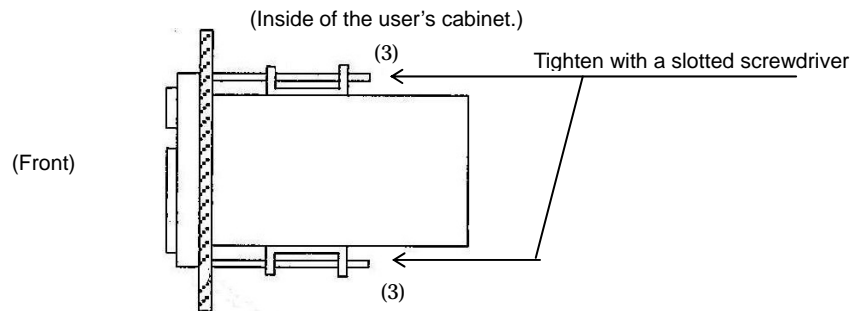
(1) Insert the MBD from the front through the rectangle hole of your panel as shown below.



(2) Fix the clamp holders on top and bottom or left and right sides of the MBD.



(3) Tighten the set screws to mount the MBD firmly.



Wiring

After the MBD has been installed to the panel, connect the MBD to the MBS-C. [MBD - MBS-C connecting cable (MBD-HS30)] can be used for connecting MBD to MBS-C POWER and ANALOG OUT (I/O connectors). In this case, wiring of MBS-C RELAY and K(CA) needs to be done by users. (Refer to the dotted lines in the diagram below.)

To choose other cables, please refer to the Table 1-2 or appendix 2 in MBS-C instruction manual. The [MBS-MBD connecting cable] will be required to connect the MBD-S/MBD-T to existing MBS. Please specify the cable at time of order. The wiring of MBS and MBD-S/MBD-T is shown in Figure 4-2.

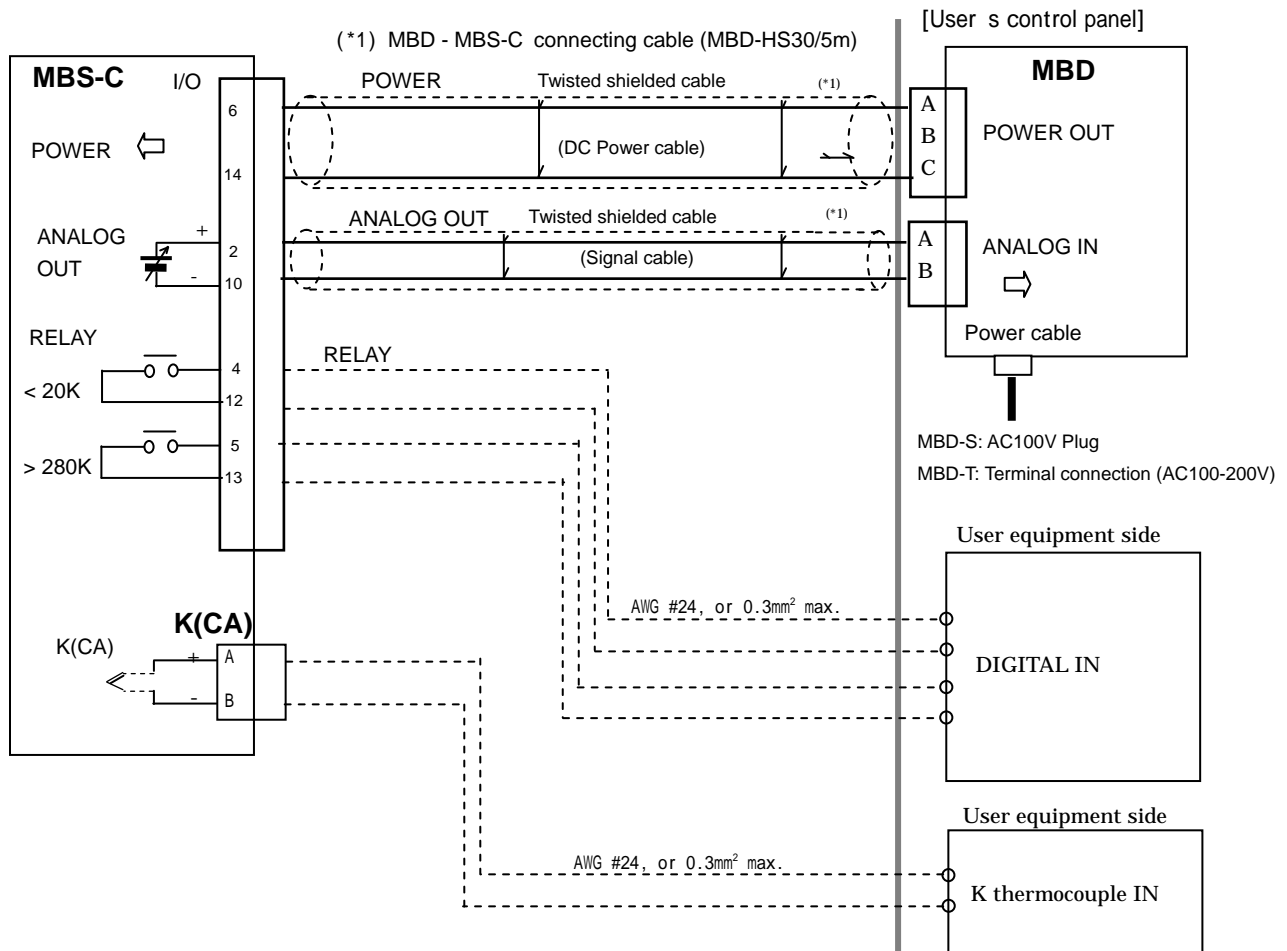



Figure 4-1 Wiring of MBD-S/MBD-T and MBS-C

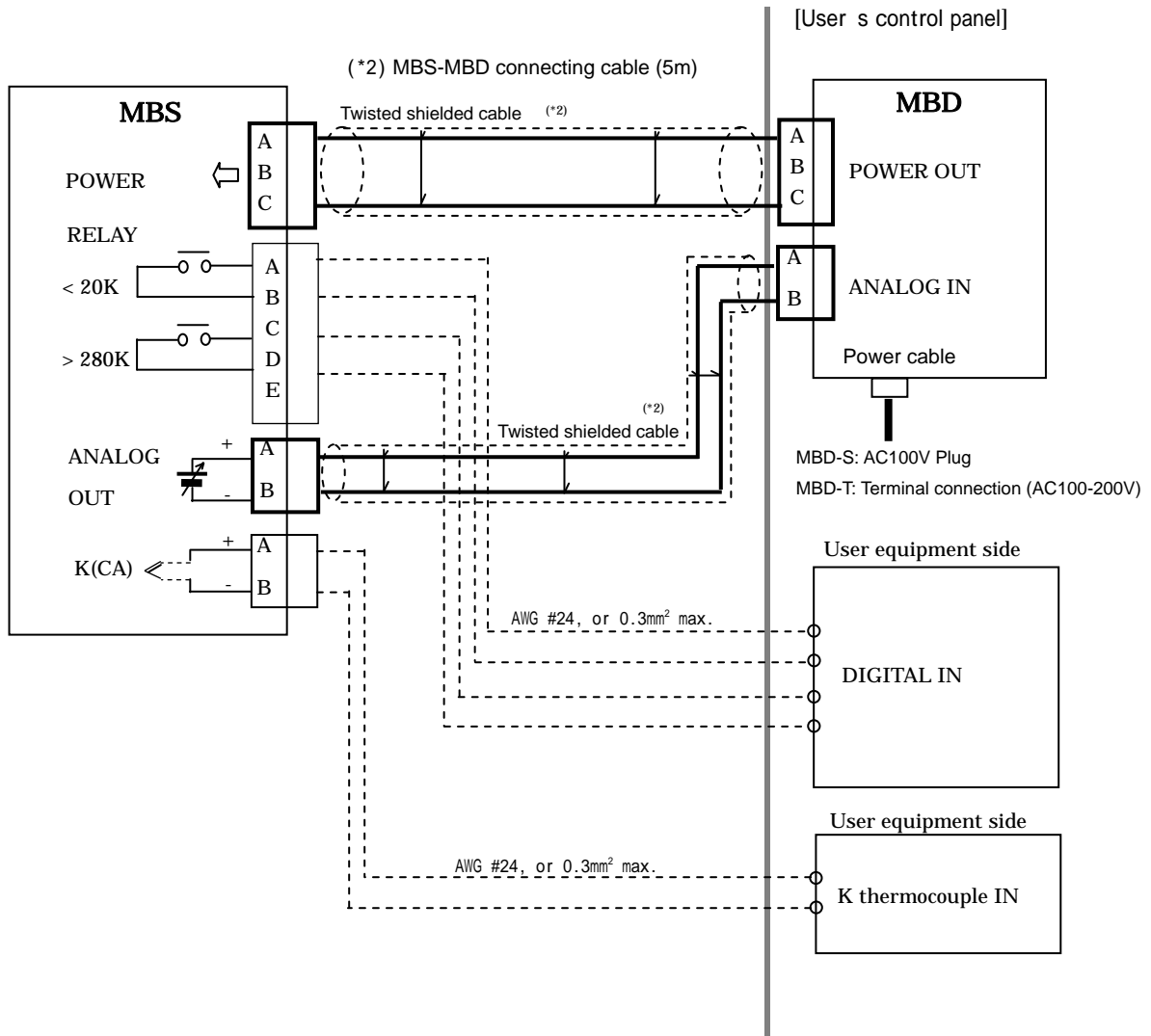


CAUTION

Conduit Requirements for MBD 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, MBS-C 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.



(Note: Wirings indicated with dotted line needs to be done by users.)

Figure 4-2 Wiring of MBD-S/MBD-T and MBS



CAUTION

Conduit Requirements for MBD 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 must be in separate conduit from other equipments or AC power lines or control lines for other equipments. Otherwise, MBS 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.

Power connection and protection

Figure 4-3 is a MBD-S/MBD-T power supply examples and its connection.

It is recommended to calculate the capacities of the step-down transformer and of branch circuit protector/fuse by formulas below.

(*1) Step-down transformer: Number of MBDs x 15 x 3 [VA]

(*2) Branch circuit protector/fuse: Number of MBDs x 0.15 x 4 [A]

For example, when using four MBDs, the capacity of the step-down transformer can be calculated as 180[VA] by the formula, 4 x 15 x 3. Also the capacity of a protector/fuse should be more than 2.4[A], 4 x 0.15 x 4. Thus, it is appropriate to choose a trans that capacity of 200VA and a protector/fuse of 3A.

(Note: MBD-S and MBD-T need less consumption current compared to that of existing MBD.)

When 200V power supply is used, such as MBD-T, the power line surge will be larger. It is recommended to install varistor near the terminal block.

(*3) Recommended varistor type: ERZV10D471 Matsushita

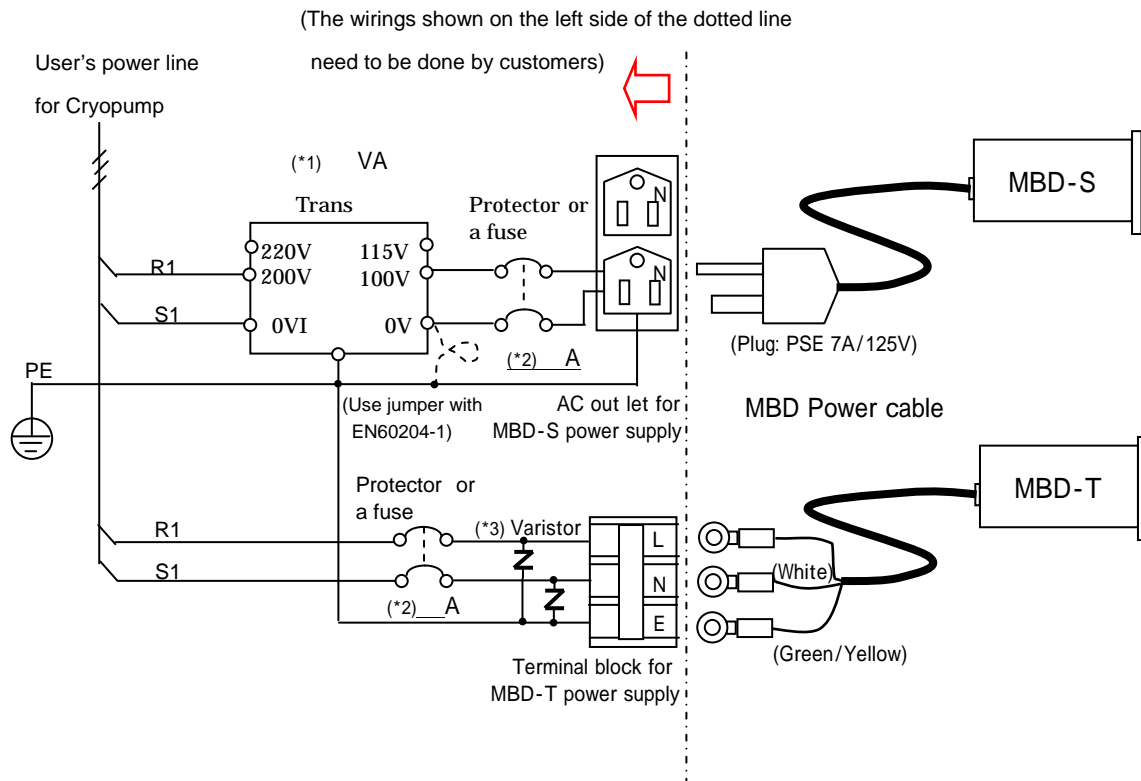


Figure 4-3 MBD-S/MBD-T Power Supply Circuit

5. Operation

Turn on the power

Turn on the input power of the MBD. If there is any sign of abnormal behavior and/or hazard of the MBD, cut off the branch circuit power for MBD immediately. Then check the wiring referring to “6. Troubleshooting” in this instruction manual.

After turning on the power, ensure that the POWER lamp on the display panel lights on.

Temperature monitoring

MBD displays the second stage temperature of cryopump with numeric numbers so that the temperature can be checked with eyes easily.



Figure 5-1 CRYO METER MBD Display

6. Troubleshooting

Preventive maintenance and inspection

Following points should be ensured at periodic inspections.

No damage on the housing and/or the cables.

No stress or force on the cables.

All plugs of the cables are tightened.

If any problem is found at an inspection, follow the troubleshooting procedures in the troubleshooting lists on page 13 and 14 or contact our customer support.

Trouble shooting procedure

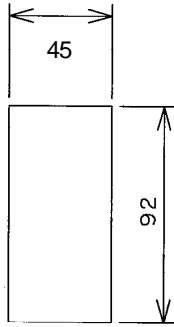
Table 6-1 Troubleshooting List (1/2)

Problem	Check Point	Possible causes	Action
Power lamp does not light on, when turn on the MBD.	AC main supply Power supply cord Fuse	1. Supply power is low or none. 2. Wiring problem 3. MBD failure	Check the AC main supply voltage for the MBD. If there is no problem with the voltage, then check the Power supply cord and the connection (UCI supplied cable should be used). Also ensure the regular voltage comes in to MBD through the cable. If no problem is found with the points above, there is a possibility of MBD failure. Please contact our customer support for replacement of the product.
Power lamp is lighted but no lamps of the MBS-C on.	DC power cable MBD POWER OUT	1. Wiring problem 2. MBD failure 3. MBS - C failure	Check the connections and damages of the DC power cable between MBD and MBS-C. (UCI supplied cable should be used.) Also check that the regular DC voltage comes out at MBD POWER OUT. If no problem is found with the points above, there is a possibility of MBD failure. Please contact our customer support for replacement of the product or refer to MBS-C manual to proceed troubleshooting.
Power lamp is lighted but the temperature value is not displayed.	Signal cable Inside of MBD	1. Wiring problem 2. MBD failure	Check if there is any damage on the Signal cable. Also check that the wiring and conduit are done properly. If no problem is found with the points above, there is a possibility of MBD failure. Please contact our customer support for replacement of the product.
The displayed temperature on the MBD does not correspond with the Displayed status on the MBS-C.	Signal cable	1. Wiring problem 2. MBD failure 3. MBS - C failure	Check the connections and damages of the Signal cable between MBD and MBS-C. (UCI supplied cable should be used.) If no fault is found, check the voltage at the cable plug and refer to MBS – C manual to find the corresponding temperature. If the temperature and displayed number on MBD don't match, there is a possibility of MBD failure. please contact our customer support for replacement of the product or refer to MBS - C manual to proceed troubleshooting.

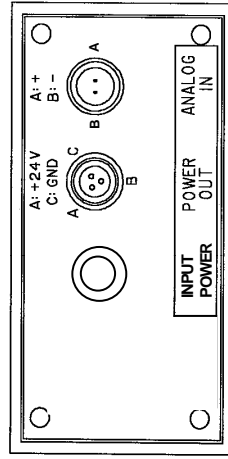
Table 6-2 Troubleshooting List (2/2)

Problem	Point	Possible causes	Action
The displayed temperature does not change even when the cryopump is in operation.	Signal cable	1.Cryopump operational problem 2.Wiring problem 3.MBD failure 4.MBS - C failure	Check that the cryopump is operated properly. Also check that the change of status display on MBS-C corresponds with the change of temperature display on the MBD. If so, the problem might be caused by an operational problem, not by a failure of MBD. However, if no fault is found with the operation, follow the same inspection procedure shown in upper column.
The displayed temperature is unstable.	Signal cable DC power cable Power supply cord	1.Wiring and conduit problem (Noise and/or surge)	Check the connections and damages of the Signal cable and the DC power cable between MBD and MBS-C. (UCI supplied cables should be used.) If no fault is found, check the wirings and conduits of those cables. The cables are sensitive and they should not be placed near power source and/or drive output line. Earth conductor of power lines should not be placed near the cables of MBD either. Also MBD Power supply cord should not be near the main power lines connected to power switching equipment. Refer to "Conduit Requirements for MBD wiring" on page 5 and 6. Also consult our customer support to solve the problem.
Not numerical character(s) is/are displayed.	Signal cable DC power cable Power supply cord	1.Wiring and conduit problem (Noise and / or surge) 2.MBD failure	Check the wirings and conduits first.. If there is no problem, there is a possibility of MBD failure. Please contact our customer support for replacement of the product.

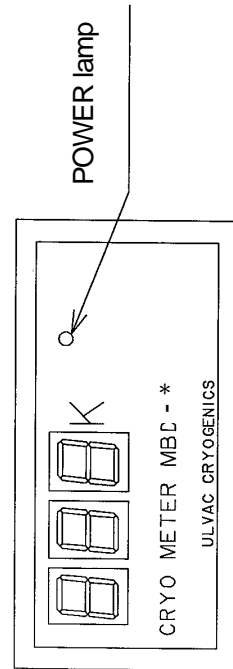
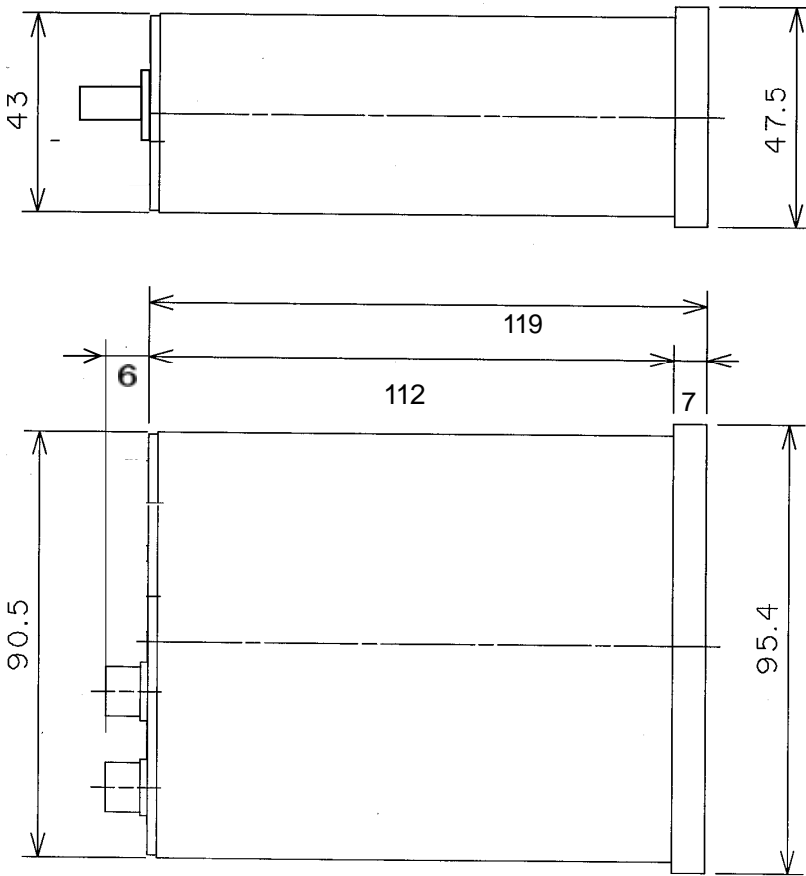
Panel cut dimensions (1 / 2)



Pin connector detail drawing (part) (1 / 1)



(Note: Names and descriptions of pins above are not incused on the back.)



*: S or T

CRYO METER MBD - S / MBD - T dimensional outline drawing

This page intentionally left blank.

SERVICE NETWORK

- Please call us or our customer support centers if you have any questions or need servicing.

ULVAC CRYOGENICS INC.

www.ulvac-cryo.com

<Inquiries about cryopumps, compressors, accessories, etc.>

Headquarters

1222-1 Yabata, Chigasaki, Kanagawa 253-0085, Japan

<Sales>

Tel: +81-467-85-8884

<Service Engineering Division>

Tel: +81-467-85-9366

Fax: +81-467-83-4838

Osaka Branch Office

3-3-31 Uemura Nissei bldg., Miyahara, Yodogawa-ku, Osaka

532-0003, Japan

Tel: +81-6-6397-0112

Fax: +81-6-6397-0126

<Inquiries about cryostats or LN₂ generators>

Kyoto Factory

140-1, Megawa, Makishima-cho, Uji, Kyoto, 611-0041, Japan

Tel: +81-774-28-5595

Fax: +81-774-20-2201

ULVAC CRYOGENICS KOREA INC.

www.ulvac-cryo.co.kr

107, Hyeongoksandan-ro, Cheongbuk-Myeon, Pyeongtaek-si,

Gyeonggi-Do, Korea, 451-831

Tel: +82-31-683-2926

Fax: +82-31-683-2956

ULVAC CRYOGENICS (NINGBO) INC.

www.ulvac-cryo.com

1-2 Floor, Shuguang Building, No.6 Jingyua Road,

Ningbo National Hi-Tech Zone, Ningbo, 315040, China

Tel: +86-574-879-03322

Fax: +86-574-879-10707

- For additional contact information, please visit our website at www.ulvac-cryo.com.

Customer Support Information in English: Select [English] from the list in the upper right corner and click on [Support].

This page intentionally left blank.

Revision History

Date	Revision No.	Contents
2007-12-10	2007.12	First edition
2008-04-11	2008AL01	Addition of the connector set in shipping list.
2009-06-08	2009JE02	“Introduction” has revised. UCN address has changed. “SERVICE NETWORK” has revised.
2013-11-08	2013NR03	“Introduction” has revised. “SERVICE NETWORK” has revised.
2018-06-14	2018JE04	“SERVICE NETWORK” has revised.

This page intentionally left blank