BS-04xxxTRS Series

ROTARY SENSOR

BS-04430TRH

BS-04440TRH

ROTARY SENSOR HEAD

BS-04160KIT

BS-04170KIT

ELECTROMAGNETIC VALVE KIT

For the proper use of the instrument, be sure to read this instruction manual. Even after you read it, please keep the manual on hand so that you can consult it whenever necessary.

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Please be sure to read this instruction manual carefully, and fully understand its contents prior to the operation or maintenance for the proper use of the instrument.

NOTICE

- This instrument generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to the environment, especially radio communications.
- The following actions must be avoided without prior written permission from JEOL Ltd. or its subsidiary company responsible for the subject (hereinafter referred to as "JEOL"): modifying the instrument; attaching products other than those supplied by JEOL; repairing the instrument, components and parts that have failed, such as replacing pipes in the cooling water system, without consulting your JEOL service office; and adjusting the specified parts that only field service technicians employed or authorized by JEOL are allowed to adjust, such as bolts or regulators which need to be tightened with appropriate torque. Doing any of the above might result in instrument failure and/or a serious accident. If any such modification, attachment, replacement or adjustment is made, all the stipulated warranties and preventative maintenances and/or services contracted by JEOL or its affiliated company or authorized representative will be void.
- Replacement parts for maintenance of the instrument functionality and performance are retained and available for five years from the date of installation. Thereafter, some of those parts may be available for a certain period of time, and in this case, an extra service charge may be applied for servicing with those parts. Please contact your JEOL service office for details before the period of retention has passed.
- In order to ensure safety in the use of this instrument, the customer is advised to attend to daily maintenance and inspection. In addition, JEOL strongly recommends that the customer have the instrument thoroughly checked up by field service technicians employed or authorized by JEOL, on the occasion of replacement of expendable parts, or at the proper time and interval for preventative maintenance of the instrument. Please note that JEOL will not be held responsible for any instrument failure and/or serious accident occurred with the instrument inappropriately controlled or managed for the maintenance.
- After installation or delivery of the instrument, if the instrument is required for the relocation whether it is within the facility, transportation, resale whether it is involved with the relocation, or disposition, please be sure to contact your JEOL service office. If the instrument is disassembled, moved or transported without the supervision of the personnel authorized by JEOL, JEOL will not be held responsible for any loss, damage, accident or problem with the instrument. Operating the improperly installed instrument might cause accidents such as water leakage, fire, and electric shock.
- The information described in this manual, and the specifications and contents of the software described in this manual are subject to change without prior notice due to the ongoing improvements made in the instrument.
- Every effort has been made to ensure that the contents of this instruction manual provide all necessary information on the basic operation of the instrument and are correct. However, if you find any missing information or errors on the information described in this manual, please advise it to your JEOL service office.
- In no event shall JEOL be liable for any direct, indirect, special, incidental or consequential damages, or any other damages of any kind, including but not limited to loss of use, loss of profits, or loss of data arising out of or in any way connected with the use of the information contained in this manual. Some countries do not allow the exclusion or limitation of incidental or consequential damages, so the above may not apply to you.
- This manual are copyrighted, all rights reserved by JEOL and/or third-party licensors. Except as stated herein, none of the materials may be copied, reproduced, distributed, republished, displayed, posted or transmitted in any form or by any means, including, but not limited to, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of JEOL or the respective copyright owner.
- When this manual is furnished under a license agreement, it may only be used or copied in accordance with the terms of such license agreement.

- In some cases, this instrument, the software, and the instruction manual are controlled under the “Foreign Exchange and Foreign Trade Control Law” of Japan in compliance with international security export control. If you intend to export any of these items, please consult JEOL. Procedures are required to obtain the export license from Japan’s government.

TRADEMARK

- All company and product names are trademarks or registered trademarks of their respective companies.

MANUFACTURER

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Telephone: 81-42-543-1111 Facsimile: 81-42-546-3353 URL: http://www.jeol.co.jp

Note: For servicing and inquiries, please contact your JEOL service office.

WARRANTY INFORMATION

1 Limited Warranty

Products manufactured by JEOL Ltd. (hereafter “JEOL products”) that fail under normal use by the customer during the warranty period will be repaired or replaced, at JEOL’s discretion, without charge.
The components, modules and devices that are provided as replacements will be new parts or refurbished parts that provide the same performance as new parts. All components, modules and devices removed under this warranty become the property of JEOL.

1.1 Applicable Products

- This warranty applies only to hardware and software products manufactured by JEOL Ltd.
- For components that are not JEOL products, such as the computer, HDD, memory device, and the like, the warranty provisions of the respective manufacturers shall apply.

1.2 Warranty Period

- In the case of products for which the warranty period is recorded in the contract documentation, the recorded warranty period shall take precedence.
- If not specifically stated elsewhere, the warranty period is a period of 12 months from the date on which the acceptance test is completed after delivery to the customer; or, in the case of parts that must be periodically replaced, the warranty period is the length of the specified replacement period.
- For components that are not JEOL products, like the computer, HDD, memory device, and the like, the warranty start date shall be the date on which the acceptance test is completed after delivery to the customer and the warranty periods established by the respective makers shall apply.
- In the event that parts are replaced or repaired free of charge during the warranty period, there is no change to the warranty start date or the warranty period for the product.

1.3 Scope of the Warranty

■ Failure diagnosis

If a problem occurs, contact your JEOL service office and describe the conditions and content of the problem. JEOL will assess the problem based on the situation and content of the problem.

■ Repair method

If it is determined that the problem is caused by a fault or defect of a JEOL product, repair or replacement will be performed free of charge. The choice of whether to repair or replace a component is entirely at the discretion of JEOL.

■ Warranty exclusions

This limited warranty does not extend to products for which any of the following situations apply. Even within the warranty period, in the situations listed below, a fee will be charged to repair the product.

- Product is operated or stored in an environment or under conditions that do not satisfy the specified installation requirements.
- The installation environment has changed (temperature, humidity, magnetic fields, etc.) since the time of installation.
- There is significantly accelerated deterioration of components and/or corrosion of electrical circuitry as a result of exposure to extreme temperature, humidity, or an environment containing highly-corrosive gases or excessive dust.
- The quality of the utilities (including electricity, water, gas, air quality) has worsened.
- The customer has relocated an installed instrument.

- Even in the case of a portable or movable instrument designed to be transported to a remote location or moved around for use by the user, damage or failures caused during the instrument relocation by the customer.
- Product has not been properly maintained.
- Consumable items or parts with the specified replacement period have not been replaced as specified.
- Corrupted operating system or application software, or damaged computer used with the instrument, caused by shutting down the main power to the computer without performing the proper shutdown sequence.
- Products that have been disassembled, modified or repaired by the customer in ways other than those specified in the instruction manuals provided with the instrument.
- Products with damage or failure caused by using them in combination with hardware, software, peripheral devices, and accessories that have not been provided or approved by JEOL.
- Damage or failure resulting from a situation caused by the customer, such as failing to properly manage the instrument, for which JEOL cannot be held responsible.
- Corruption of the operating system or application software, or damage to a computer used with the instrument, caused by fluctuations in the electricity or power failure.
- Product damaged as a result of fire, earthquake, flooding, lightning or other natural disaster, or due to local conflict or war.
- Damage or malfunction of operating system, application software, or the instrument itself as a result of infection by a computer virus.
- Instruments that have been restored after being disposed of or re-sold without prior written notice to and agreement from JEOL.

1.4 Items Not Covered by Warranty

- Regardless of whether a product is still within the warranty period, this warranty does not cover losses or damage to devices made by any other manufacturer at the customer site even if they are damaged by a malfunction of the JEOL product.
- JEOL is not responsible for any loss or damage to data recorded onto storage media, or to storage units. The customer is responsible for making back-up copies of their own data.
- Replacement parts for maintenance of the instrument functionality and performance are retained and available for five years from the date of installation. Thereafter, some of those parts may be available for a certain period of time. Please contact your JEOL service office for details before the period of retention has passed.
- For items that are frequently updated, remodeled, or disappear from the market, like the computers used with the JEOL products, it may not be possible to obtain an exact replacement.

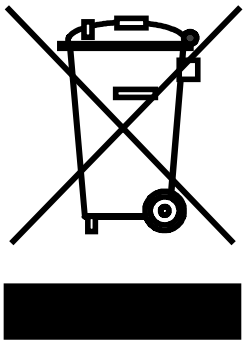
2 Repairs for a Fee

Repairs of JEOL products are available with charges after the end of the warranty period, or at anytime a customer requests. The components, modules and devices that are provided as replacements during the paid repair work will be new parts or refurbished parts that provide the same performance as new parts. All components, modules and devices removed during such repairs will become the property of JEOL.

- The warranty period for parts replaced and the service during paid repair work is a period of 3 months after the completion of the repairs; or, in the case of parts that must be periodically replaced, the warranty period is the length of the specified replacement period.
- In the event that repairs are performed again during the warranty period, there is no change to the warranty start date or the warranty period.

Notes on Disposal for Business Users

Attention:
Your product is marked with this symbol. It means that used electrical and electronic products should not be mixed with general household waste. There is a separate collection system for these products.



■ In the European Union

This symbol means that electrical and electronic equipment, at the end of its life, should be disposed of correctly.

In the European Union there is a separate collection system for used electrical and electronic products. Please help us to conserve the environment we live in!

Electrical and electronic appliances and machines often contain materials which, if handled or disposed of incorrectly, are potentially hazardous to human health and to the environment. They are, however, essential for the correct functioning of your appliance or machine. Therefore, please do not dispose of your old machine or appliance together with your household waste.

Your JEOL product is designed and manufactured with high-quality materials and components which can be recycled and reused. If the product is used for business purposes and you want to discard it, please contact your JEOL dealer, who will advise you about the end-of-life disposal arrangements.

■ Outside the European Union

If you wish to discard this product, please contact your local authorities and ask for the correct method of disposal.

CONTENTS

SAFETY PRECAUTIONS

Although this instrument is protected with safety device which prevents the occurrence of accident that could result in an injury, harm, and damage to the users or instrument itself, the safety feature may not work properly if you use the instrument for the purpose of use not intended or in an improper usage. For the proper use of the instrument, please be sure to read all of the instructions, descriptions, notices, and precautions contained in this manual carefully to understand them fully prior to the operation or maintenance. This section, "Safety Precautions," contains important information related to safety for using of the instrument.

The safety indications and their meanings are as follows:

⚠ **DANGER:**	An imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ **WARNING:**	A potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ **CAUTION:**	A potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or a situation that could result in serious damage to facilities or acquired data.

Labels bearing the following symbols are attached to dangerous locations on the instrument. Do not touch any of these locations with your hands or anything else.

Examples of symbols

- **Use the instrument properly within the scope of the purpose and usage described in its brochures and manuals. Before using the instrument , read the manual carefully and understand the correct method and procedure for use.**
- **Never open/remove protective parts (exterior panels) and parts that can't be opened/removed without use of tool (including key), or disconnect/ connect the cables/connectors that are not described in this manual.**
- **Never attempt to do any works of disassembling / assembling the instrument other than those described in this manual.**
- **Never make modifications that include installing substitute parts and disabling safety devices or other safety features.**
- **Never disconnect the grounding wire or move it from the prescribed position. Failure to follow this instruction could result in electric shock.**
- **When you dispose of the instrument or liquid or other waste, follow all applicable laws and regulations, and dispose of it in a proper manner without polluting the environment.**
- **After going through the manual and the leaflets attached to component units, keep them at hand for immediate reference.**
- **Be sure to read the "Safety Precautions" section of the manuals for the accessories attached to or built into the instrument.**
- **If anything is unclear, please contact your JEOL service office.**

⚠ WARNING for Installation

- **Do not attempt to install the instruments by yourself.**

Installation work requires professional expertise and JEOL is responsible for the installation of the instruments and related attachments purchased from JEOL.
Consult your JEOL service office.

- **During energizing instrument, do not attempt to touch the terminal or internal parts directly by hand and to keep the cover of instrument open.**

Direct touch to the parts may cause the electric shock or the injury.

- **Confirm the grounding of the user's chamber.**

This instrument BS-04xxxTRS series has no grounding terminal so fix it with bolts tightly to the user's chamber. Then confirm the grounding condition of the user's chamber.

⚠ CAUTION

■ Check contents of instrument before installation

Upon receipt of an instrument or a part, make sure that it is the correct one you ordered.

■ Location of installation for instrument

Do not install the instrument the following place and condition to avoid the failure of the instrument, electric shock, fire or explosion.

- ◆ The instrument should be installed and operated at an ambient temperature of 5 degree C to 40 degree C and an ambient humidity of 90% or less.
- ◆ Do not install the instrument in a place bathed with direct sunlight or radiation heat.
- ◆ Never use the instrument in a place where the temperature and/or humidity is high, where an atmosphere of corrosive or combustible gas or in the vicinity of inflammable gas or where dust, metal particles, oil mist, cutting fluid, water contents, salt contents or organic solvent are present.
- ◆ Do not install the instrument in a place where high intensity electric field or magnetic field is generated or a place where the instrument may be subject to electromagnetic interference, electrostatic discharge or radio frequency interference.
- ◆ Do not install the instrument in a place where mechanical vibration or impact is transmitted to the instrument.
- ◆ The floor should be rigid enough to withstand the instrument weight and be free from vibration from outside. Maximum permissible level is 0.5G.

■ Wiring and tubing of instrument

Arrange all cables and water tubes, air tubes correctly and connect them securely under the following conditions.

- ◆ Install a noise filter as close to the instrument as possible.
- ◆ Install surge-absorbing circuits for relays, electromagnetic contactors, solenoids and coils.

- Lay the power lines (AC power line, motor line and etc.) and signal lines more than 30 cm away from each other. Do not pass them in the same duct nor bind them together. Keep high voltage cables and other wirings more than 50 cm away from each other (except when accommodating them in a shielded duct). Do not accommodate them in the same duct or bind them together.
- If the instrument is connected to the same AC distributor or AC line as that for an electric welding machine, electric discharge machine or other or if there is a high frequency noise generating source nearby, though the same power is not used, install noise filters in the power supply and input circuit.
- When a load (electron beam gun for deposition) is connected to the instrument, arc discharge may be produced depending on the operating conditions on the load side and may generate high frequency spike noise. This may cause malfunction of and damage to components of the user's system. Check the entire system for earth wiring arrangement to make the instrument immune from them. Also install a surge absorbing circuit and insulation amplifier on parts that may be affected by such noise.
- Confirm that all cables and tubes are free from bend or tension.

■ Operation of instrument

- Do not run the instrument under full load to avoid unforeseen accidents in the initial stage of test run.
- Provide an interlock and emergency stop switch to eliminate the risk of danger if instrument is used as a component of a system. Otherwise, you may get injured.

■ Incorporating the instrument into user's system

When installing the instrument in system, following condition should be confirmed before incorporating it.

- Confirm the grounding of the user's chamber. This instrument BS-04xxxTRS series has no grounding terminal so fix it with bolts tightly to the user's chamber. Then confirm the grounding condition of the user's chamber.
- Make sure that the temperature nearby the instrument does not exceed 5 degree C to 40 degree C with the cooling components in the system and others.
- If there is a source of vibration near the instrument, install a shock absorber or other to hold the vibration transmitted to instrument below the specified level of 0.5G.

■ Inspection and Maintenance

Do not change the wiring and/or tubing to this instrument and the user's equipment energized with power. You may get electric shock or injured or the instrument may be damaged.

PRECAUTIONS FOR USE

Important precautions, which may result in damage to the device itself if not followed, are described below.

- **If you do not use this device for a long time, shut down the power.**
- **If you find problems with the device, shut down the power immediately, and contact your nearest JEOL service office**.

■ System maintenance

- **Do not change the wiring and/or tubing of the unit and user's equipment energized with AC power.**
- **Regular maintenance for system is required.**
- **Check the propery functionality of the device when restarting the device after shut down long time.**

■ Prohibited matters

- **Do not apply any modifications on this unit.**

NOTATIONAL CONVENTIONS AND GLOSSARY

■ Examples for general notations

⚠ WARNING:	A potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTIONS:	A potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or a situation that could result in serious damage to facilities or acquired data.
– CAUTION – :	Important precautions for use, which, if not followed, may result in damage to or problems with the device itself.
■ :	A squire indicates a series of the explanation
✍ :	Additional points to remember regarding the operation.
☞ :	A reference to another section, chapter or manual.
1, 2, 3 :	Numbers indicate a series of items that achieve a task.
◆ :	A diamond indicates a single items that achieves a task.

1 GENERAL

This Rotary Sensor is of the quartz crystal type, and functions as a sensor for deposition-rate control and monitoring. It utilizes the principle that when quartz crystal deposited on the surface, then it's natural frequency decreases. It incorporates with the twelve quartz crystals, and can be moved from a quartz crystal to next in sequence. With the optional electro-magnetic valve kit, the quartz crystal sensors move around step by step.

When this sensor is installed with the IC/6 Thickness Controller, it automatically moves one quartz crystal to next when a quartz crystal failure takes place, thus enabling an evaporation or sputtering process to extend over a long period of time for continuous film formation.
The detecting hole is in a fixed position, so there is no need to change the value of the factor for the thickness controller at each time the quartz crystal is moved.

This instruction manual is for BS-04xxxTRS series Rotary Sensor, BS-04430TRH / BS-04440TRH Rotary Sensor Heads, and BS-04160KIT / BS-04170KIT Electromabnetic Valve Kit.

2 SPECIFICATIONS

2.1 Rotary Sensor Txxx(BS-04xxxTRS)

The BS-04xxxTRS Rotary Sensor Txxx is the main body for the rotary sensor as a quartz rate control monitor that incorporates twelve quartz crystals. It is necessary to combine this rotary sensor with BS-044x0TRH Rotary Sensor Head xxx, and with BS-041x0KIT Electromagnetic Valve Kit or own equivalent kit. And also it is necessary to choose the suitable length of it for the chamber.

2.1.1 Specifications

Quartz crystal	12 (INFICON 6 MHz)
Torerable temperature for quartz	100 degree C or less
Drive method	Air drive (0.4 to 0.7 MPa)
Connection-bore size	6 mm in diameter for drive air
Main body outer diameter	50 mm in diameter
Hole size for chamber	2 inches (Chamber)
Sensor nominal length	See Table 1 of 'Models of Rotary Sensor'
Cooling method	Water-cooling jacket (About 2 to 3 L/min., Differential pressure 0.2 MPa or more)
Connection-bore size	6 mm in diameter for cooling water
Cooling water temperature	10 to 25 degree C

Table 1 Models of Rotary Sensor

Model	Name	Nominal length (L)
BS-04300TRS	Rotary sensor T200	200mm
BS-04310TRS	Rotary sensor T300	300mm
BS-04320TRS	Rotary sensor T350	350mm
BS-04330TRS	Rotary sensor T400	400mm
BS-04340TRS	Rotary sensor T450	450mm
BS-04350TRS	Rotary sensor T480	480mm
BS-04360TRS	Rotary sensor T500	500mm
BS-04370TRS	Rotary sensor T540	540mm
BS-04380TRS	Rotary sensor T545	545mm
BS-04390TRS	Rotary sensor T580	580mm
BS-04400TRS	Rotary sensor T650	650mm
BS-04410TRS	Rotary sensor T700	700mm
BS-04420TRS	Rotary sensor T750	750mm

✍ The outer diameter of the head fitting (Stopper and Guide) of the rotary sensor is 80mm, and the outer diameter of rotary sensor main body is 50mm. The head fitting should be fitted to main body after installing the rotary sensor main body through the 2-inch hole of a vacuum chamber.

☞ See 3. Installing procedure

⚠ CAUTIONS

Keep the temperature of quartz crystal below 100 degree C as specified. If not, provide the additional action to meet the specification. If the quartz crystals are used over the specified temperature, it may cause malfunction in deposition-rate measurement, or damage to the instrument.

⚠ CAUTIONS

Attention of the quality of the cooling water

If the instrument is operated with poor quality cooling water, it may cause the trouble of instrument by clogging or corrosion in the cooling waterway. It is desirable to inspect the water quality regularly, and if it is poor, improve it. The recommendable water quality is as below.

1. Specific resistance of water: more than 5k-ohm･cm
2. Hardness of water: 100mg/litter as calcium carbonate or less
3. pH: 6.5～8

2.1.2 Configuration

Rotary sensor main body	1 set

2.1.3 Note

It is necessary to provide the Rotary Sensor Head xxx (BS-044x0TRH), and the Electromagnetic Valve Kit (BS-041x0KIT) or equivalent.

2.2 Rotary Sensor Head xxx (BS-044x0TRH)

The BS-044x0TRH Rotary Sensor Head xxx is the head for the rotary sensor T series as a quartz rate control monitor that incorporates twelve quartz crystals. It is possible to combine two kinds (45 degree and 180 degree) of the rotary sensor head with a specific length of the rotary sensor main body, and to attach them in the chamber.

2.2.1 Specifications

Quartz crystal	12 (INFICON corp., 6MHz)
Head angle	45 Degree or 180 Degree See Table 2 of 'Models of Rotary Sensor Head'
Tolerable temperature for quartz	100 degree C or less

Table 2 Models of Rotary Sensor Head

Model	Name	Head angle
BS-04430TRH	Rotary Sensor Head 180	180°
BS-04440TRH	Rotary Sensor Head 45	45°

2.2.2 Configuration

Rotary sensor head 1 set

2.2.3 Note

It is necessary to provide a Rotary Sensor (BS-04xxxTRS), and a Electromagnetic Valve Kit (BS-041x0KIT) or equivalent.

2.3 Electromagnetic Valve Kit (BS-041x0KIT)

The electromagnetic valve kit is a solenoid valve air control kit to exchange the quartz crystals.

2.3.1 Specifications

Operating voltage 5V or 24V
See 'Models of Electromagnetic Valve Kit'

Table 3 Models of Electromagnetic Valve Kit

Model	Name	Operating voltage
BS-04160KIT	Electromagnetic Valve Kit 5	5V DC
BS-04170KIT	Electromagnetic Valve Kit 24	24V DC

2.3.2 Configuration

Electromagnetic valve kit 1 set

2.3.3 Note

It is necessary to provide a Rotary Sensor (BS-04xxxTRS) and a Rotary Sensor Head xxx (BS-044x0TRH).
It is possible to apply the equivalent valve control kit which is prepared by user.

2.4 Outer view

Total over view of the rotary sensor with the main body, the rotary sensor head and the electromagnetic valve kit are shown below. Fig 1 is the case to apply the rotary sensor head 180 (BS-04430TRH) and Fig 2 is the case to apply the rotary sensor head 45 (BS-04440TRH).

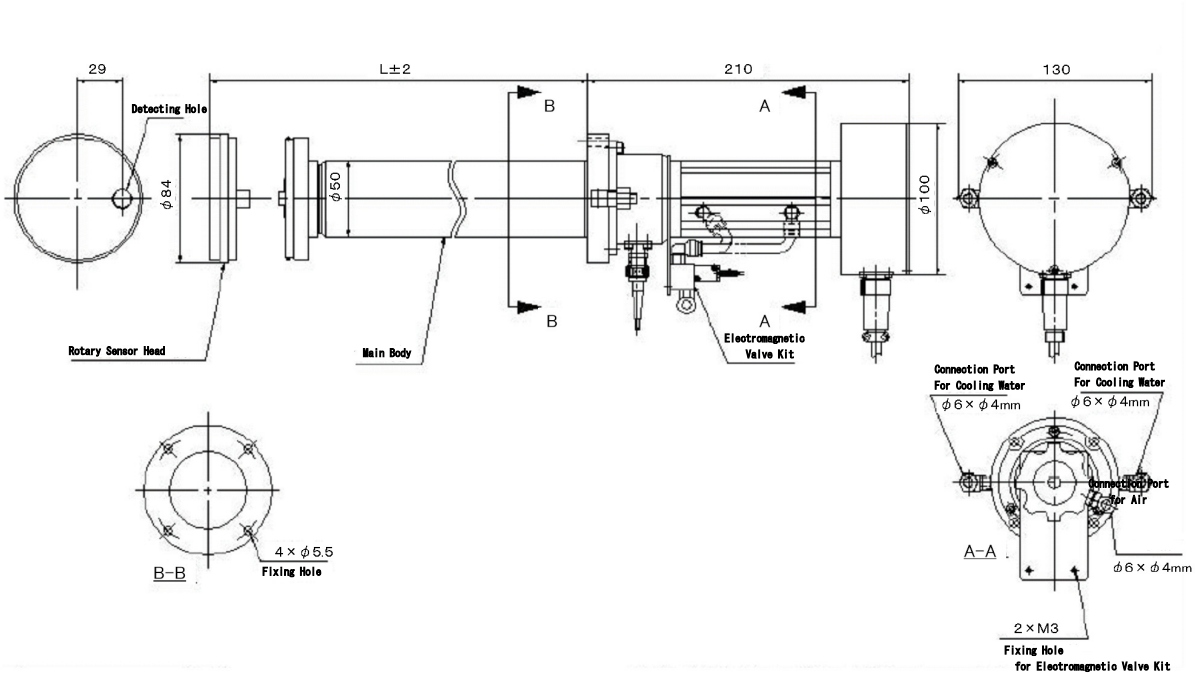


Fig 1 Rotary Sensor with Rotary Sensor Head 180 and Electromagnetic Valve Kit

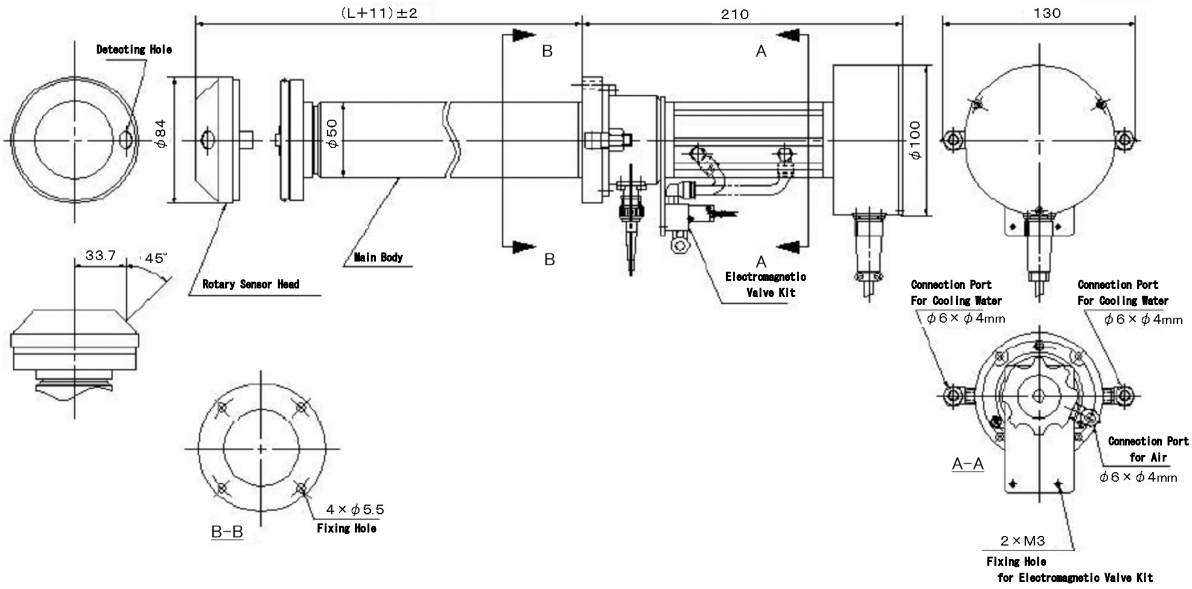


Fig 2 Rotary Sensor with Rotary Sensor Head 45 and Electromagnetic Valve Kit

3 INSTALLING PROCEDURE

The procedures of installing a rotary sensor to a chamber, arrangement of outer tubing and wiring at the initial setting are described here after. It is for the re-installation after removing it in case of such as repairing, also same procedure is possible to apply.

1. When a rotary sensor head is attatched to a rotary sensor, dismount a head-cover and a head first.

☞ 5 Exchange method of quartz crystal

✍ After that, install the rotary sensor main body through the 2-inch hole of a vacuum chamber. But the outer diameter of the head fittings of rotary sensor is 80mm, they can not go through. So remove the head fittings of rotary sensor once as below mentioned process 2, 3.

✍ The process 2, 3 below need when installing or removing the rotary sensor into or from chamber. They need not when mounting or dismounting the rotary sensor head to exchange the quartz crystals.

☞ Fig 3 Illustration of installing and removing the head fittings

2. Unscrew two M3*4 screws, and remove the contact unit (864353286).

– CAUTION – :

Do not remove springs and others on the contact unit.

☞ Fig 3 Illustration of installing and removing the head fittings

3. Unscrew four M3*6 screws, and remove the guide (821272055).

– CAUTION – :

Do not remove stopper (820456951) from the guide.

Do not remove insulator unit (864353278) from the rotary sensor main body.

☞ Fig 3 Illustration of installing and removing the head fittings

4. Install the rotary sensor main body through the chamber and fasten it to the chamber port, and attach the head fittings of rotary sensor in a reverse procedure which removed before.

5. Mount the rotary sensor head 180 or 45.

☞ 5 Exchange method of quartz crystal

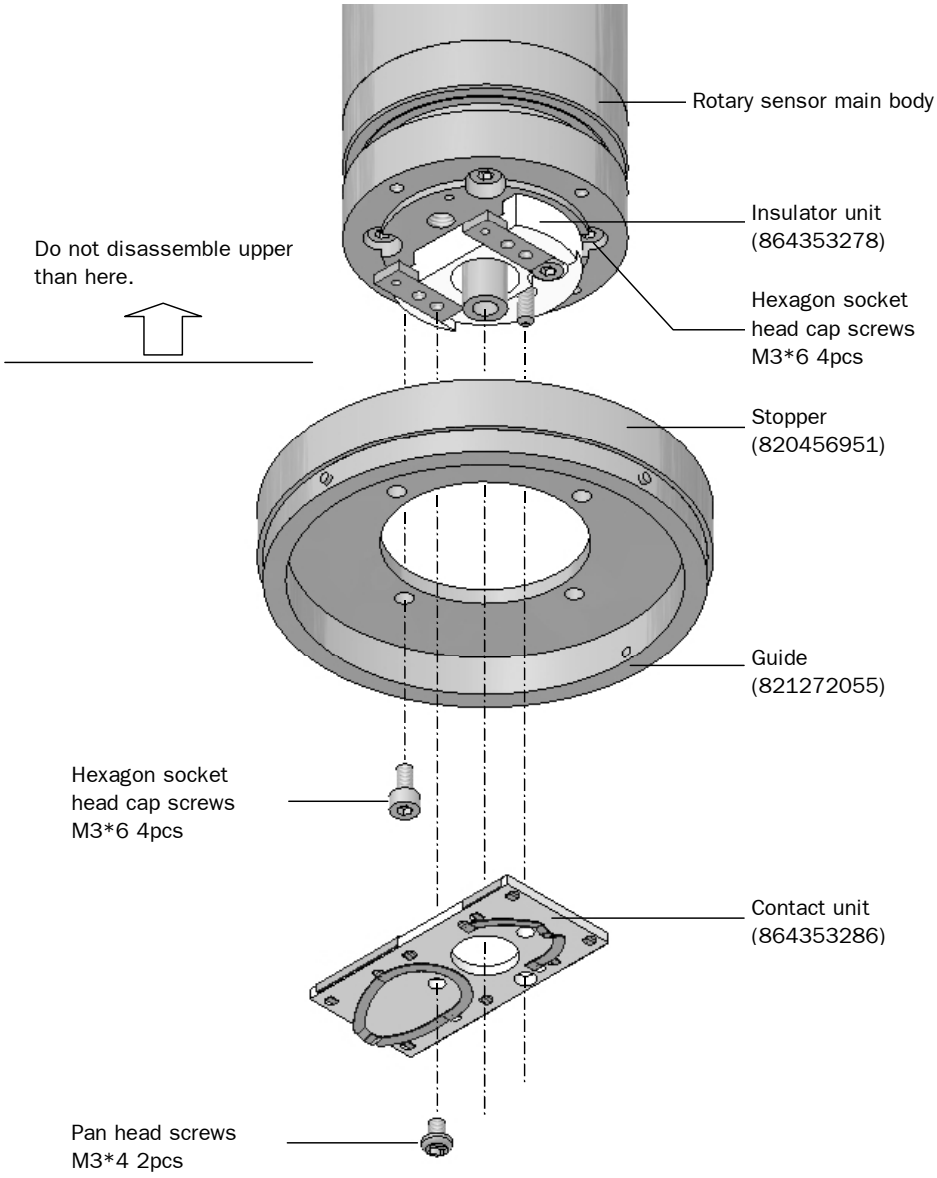


Fig 3　Illustration of installing and removing the head fittings

⚠ CAUTIONS

The electric terminals of the head fittings are precisely made, handle with special care of them. These parts must be fastened surely. But fastened with excessive power will cause deformation or damage, and with under-power will cause a poor contact, as a result, it may occur instability or performance deterioration in the instrument.

6. Carry out the inlet/outlet piping for cooling water.

– CAUTION – :

Do not bend the hose too small because it may choke the water flow.

7. When you use the electromagnetic valve kit, connect the drive circuit to the electromagnetic valve.

☞ Outer connecting circuit of electromagnetic valve kit

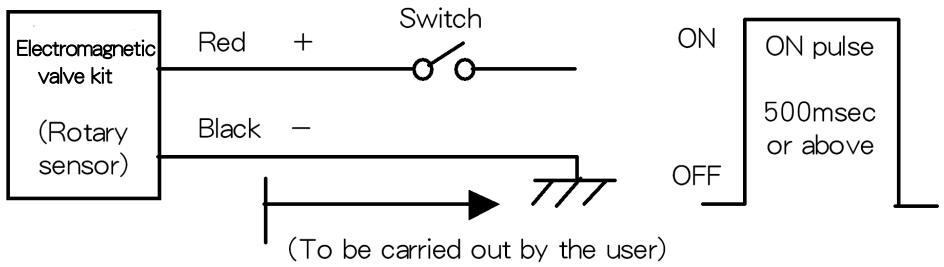


Fig 4 Outer connecting circuit of electromagnetic valve kit

– CAUTION – :

Check the model of the electromagnetic valve kit because it has two models (5V and 24V).

8. Carry out the air piping .

– CAUTION – :

Do not bend the hose too small because it may choke the air flow.

9. Connect between the BNC connector of rotary sensor and the 6MHz oscillator of the quartz-type film thickness controller or of the film thickness monitor with coaxal cable.

10. If user utilizes the quartz crystal position sensing data of the rotary sensor, carry out the wiring to the drive control circuit of user's system refering to the following information as shown Fig. 5 and Fig. 6.

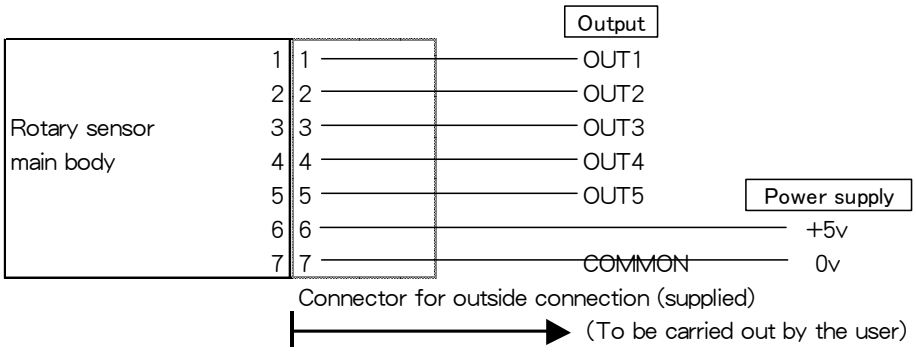
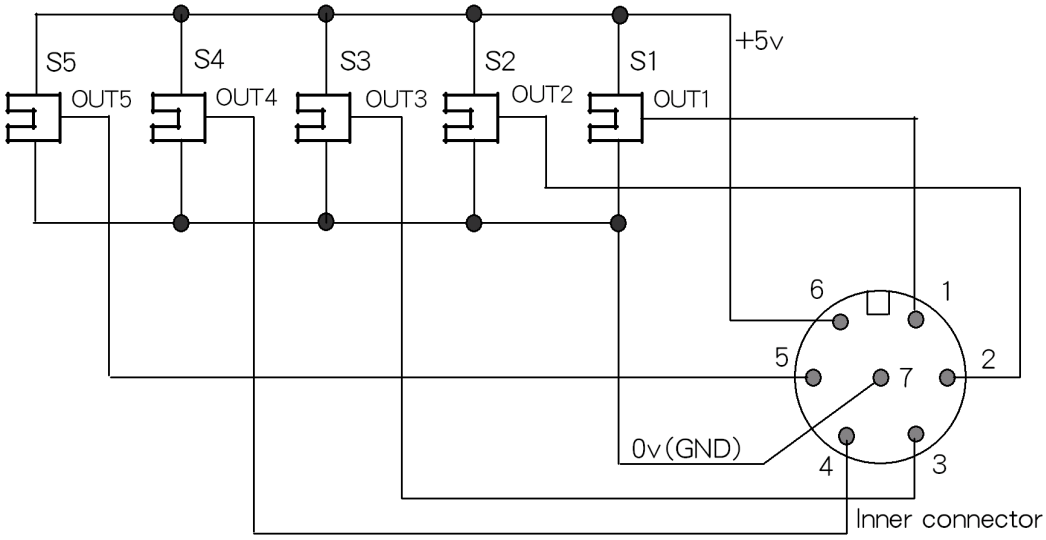
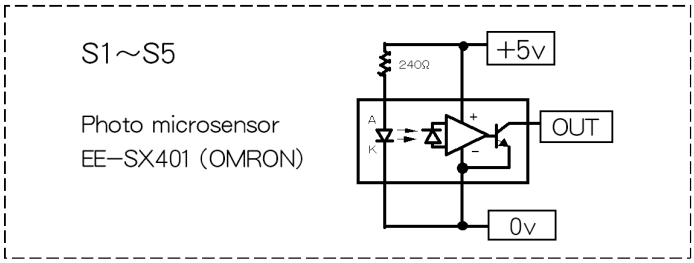


Fig 5 Connection of quartz crystal position sensing circuit

【Rotary sensor crystal position sensing circuit】





【Output table】

Crystal / Output		1	2	3	4	5	6	7	8	9	10	11	12
OUT1	(2^0)	1	0	1	0	1	0	1	0	1	0	1	0
OUT2	(2^1)	0	1	1	0	0	1	1	0	0	1	1	0
OUT3	(2^2)	0	0	0	1	1	1	1	0	0	0	0	1
OUT4	(2^3)	0	0	0	0	0	0	0	1	1	1	1	1
OUT5		1	1	1	1	1	1	1	1	1	1	1	1

(Explanation)
1. "1" indicates light incident/output transistor ON state in photo microsensor.
2. "0" indicates light interrupted/output transister OFF state in photo microsensor.
3. The crystal positions 1～12 are identified by output signals OUT1～4 binary.
4. Output signal OUT5 is "1" at the fixed positions, and "0" while indexing.

Fig 6 Quartz crystal position sensing circuit and data table

⚠ CAUTIONS

1. Power input to No6 (+), No7 (-) terminals of inside connector, should be 5vDC, and current capacity is 0.5A or more. Do not use another voltage of DC power supply, or reverse polarity, or AC power supply.
2. Connect the output signals OUT1～5 to the sequence controller with logical operations (programmable controller). The voltage of this circuit can be used 5 to 24vDC.
   The absolute maximum ratings of output transistor of photo micro-sensor are output voltage: 28v, output current: 16mA, output power loss: 250mW.
   ☞ Fig 7 Quartz crystal position indicating circuit (for reference)
   Take into consideration the outputs are different from the output table while indexing.

User should prepare the position indicator for quartz crystal. The following circuit diagram is given as example of it. Connecting this circuit to TRS-series rotary sensors, you can display the quartz crystal position numbers with LED. These numbers are same to mechanically displayed number of the rotary sensor main body.

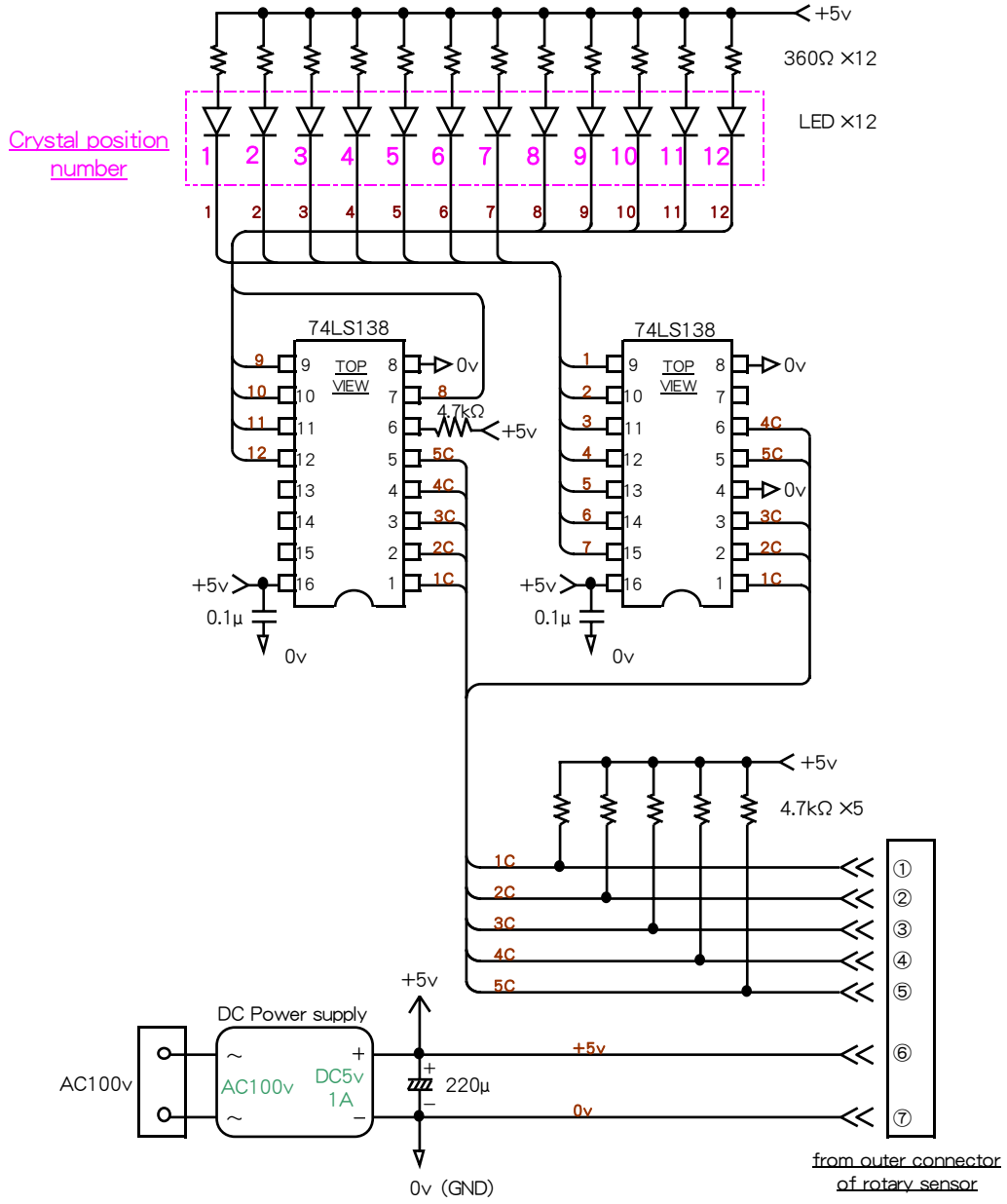


Fig 7　Quartz crystal position indicating circuit (for reference)

－CAUTION－:

This circuit can not adapt to SSR-series rotary sensors.

4 CHECK OF OPERATION

This is a procedure of mechanical movement check of rotary sensor after installing to chamber and outer tubing and wiring are completed. The functions as a sensor for deposition-rate control and monitoring are not described here.

1. Supply cooling water and air. Confirm no leakage exist at tubing.

> ⚠ CAUTIONS
>
> Confirm quality and quantity of cooling water meet the specifications.
> If the instrument is operated with poor quality, lack of water flow, it may cause abnormal movement or trouble in instrument.

2. Drive the electromagnetic valve kit or own equivalent kit prepared, and confirm that the quartz crystal sensors move around step by step.

3. Confirm that the numbers of the quartz crystal position indicator which is prepared by user, go up step by step at the same time, and that these numbers are same to mechanically displayed number of rotary sensor main body.

> ⚠ CAUTIONS
>
> The air tube fittings on index cylinder are with air speed controller. Adjust them moderately to restrain the mechanical shock of rotation. At the time of shipment, these controllers are squeezed at the 2-turns rewinding position from the end of turning clockwise.
> If the air tube fittings without speed controller are used here, or with speed controller but squeezed insufficiently, it may cause a trouble by the mechanical shock.

5 EXCHANGE METHOD OF QUARTZ CRYSTAL

The exchange methods for the rotary sensor head 180 and 45 are discribed as below.

5.1 Rotary Sensor Head 180 (BS-04430TRH)

☞ Fig 8 Assembling drawing of rotary sensor 180

1. Dismount the head-cover.

✍ Turn the stopper (820456951) several times clockwise seeing from head-side, then the head cover is loosen, and remove it.

2. Loosen the screw (820456926) at the center of the holder (820456918) , then can be pull off the head from rotary sensor main body.

3. Unscrew six M3x6 hexagon socket head cap screws, and remove the holder (820450529) from the holder (820456918).

4. Remove the worn-out quartz crystals from the sensor holder (820456918), and replace them with new quartz crystals.

5. The completion of quartz crystal replacement, assemble the head again with a reverse steps from 1 to 4.

✍ To set the head to rotary sensor main body, fit the ditch of holder (820456918) to pin of rotation drive shaft.

> ⚠ CAUTIONS
>
> The parts of head fittings and head are precisely made, handle with special care of them. These parts must be fastened surely. But fastened with excessive power will cause deformation or damage, and with under-power will cause a poor contact, as a result, it may occur instability or performance deterioration in the instrument.

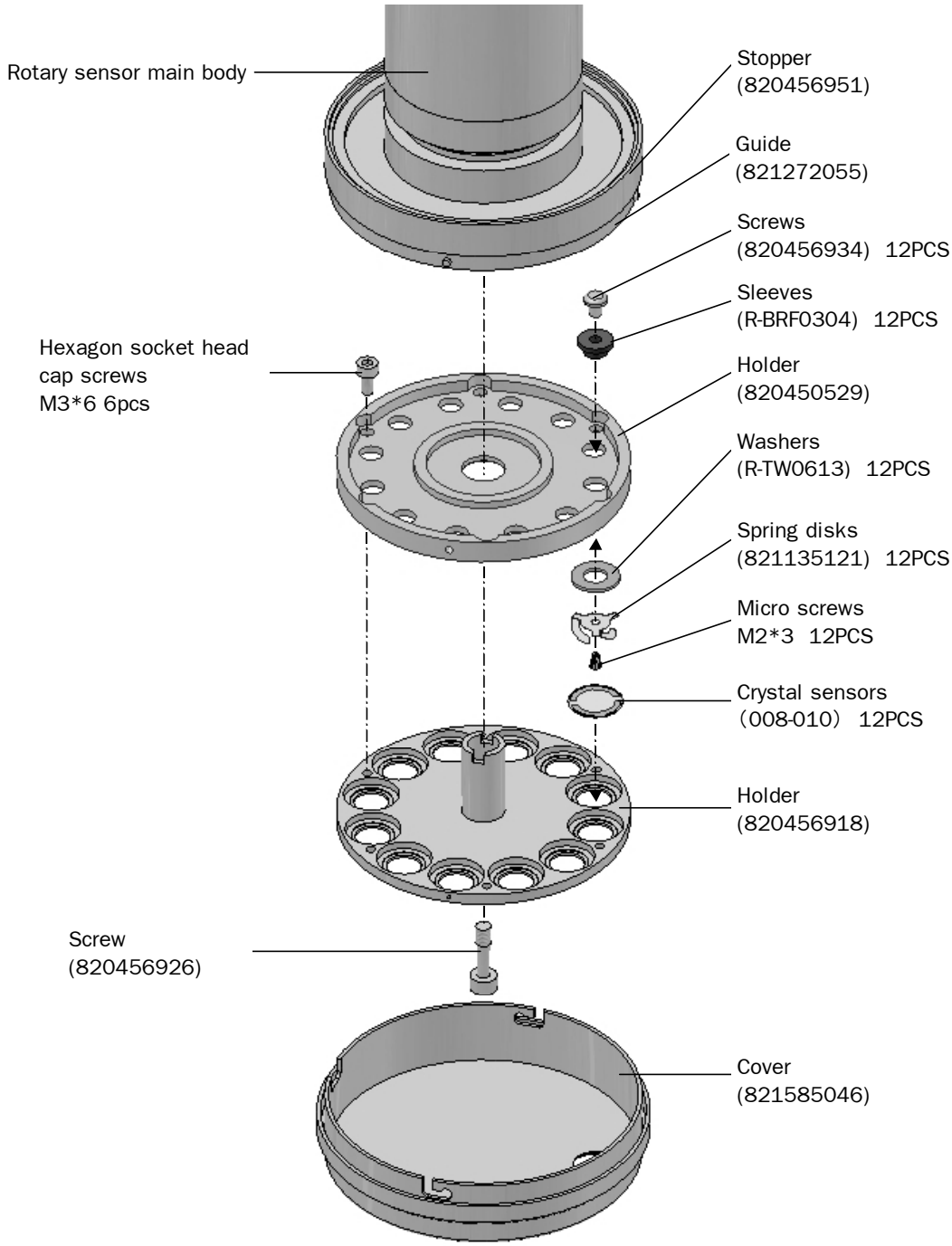


Fig 8 Assembling drawing of rotary sensor head 180

5.2 Rotary Sensor Head 45

☞ Fig 9 Assembling drawing of rotary sensor 45

1. Dismount a head-cover.

✍ Turn the stopper (820456951) several times clockwise seeing from head-side, then the head cover is loosen, and remove it.

2. Loosen the screw (821255053) at the center of the holder (821271164) , then can be pull off the head from rotary sensor main body.

3. Unscrew three M3x8 hexagon socket head cap screws, and remove the holder (812674707) from the holder (812674715).

4. Remove the worn-out quarts quartz crystals from the sensor holder (812674715), and replace them with new quartz crystals.

5. The completion of quartz crystal replacement, assemble the head again with a reverse steps from 1 to 4.

✍ To set the head to rotary sensor main body, fit the ditch of holder (821271164) to pin of rotation drive shaft.

> ⚠ CAUTIONS
>
> The parts of head fittings and head are precisely made, handle with special care of them. These parts must be fastened surely. But fastened with excessive power will cause deformation or damage, and with under-power will cause a poor contact, as a result, it may occur instability or performance deterioration in the instrument.

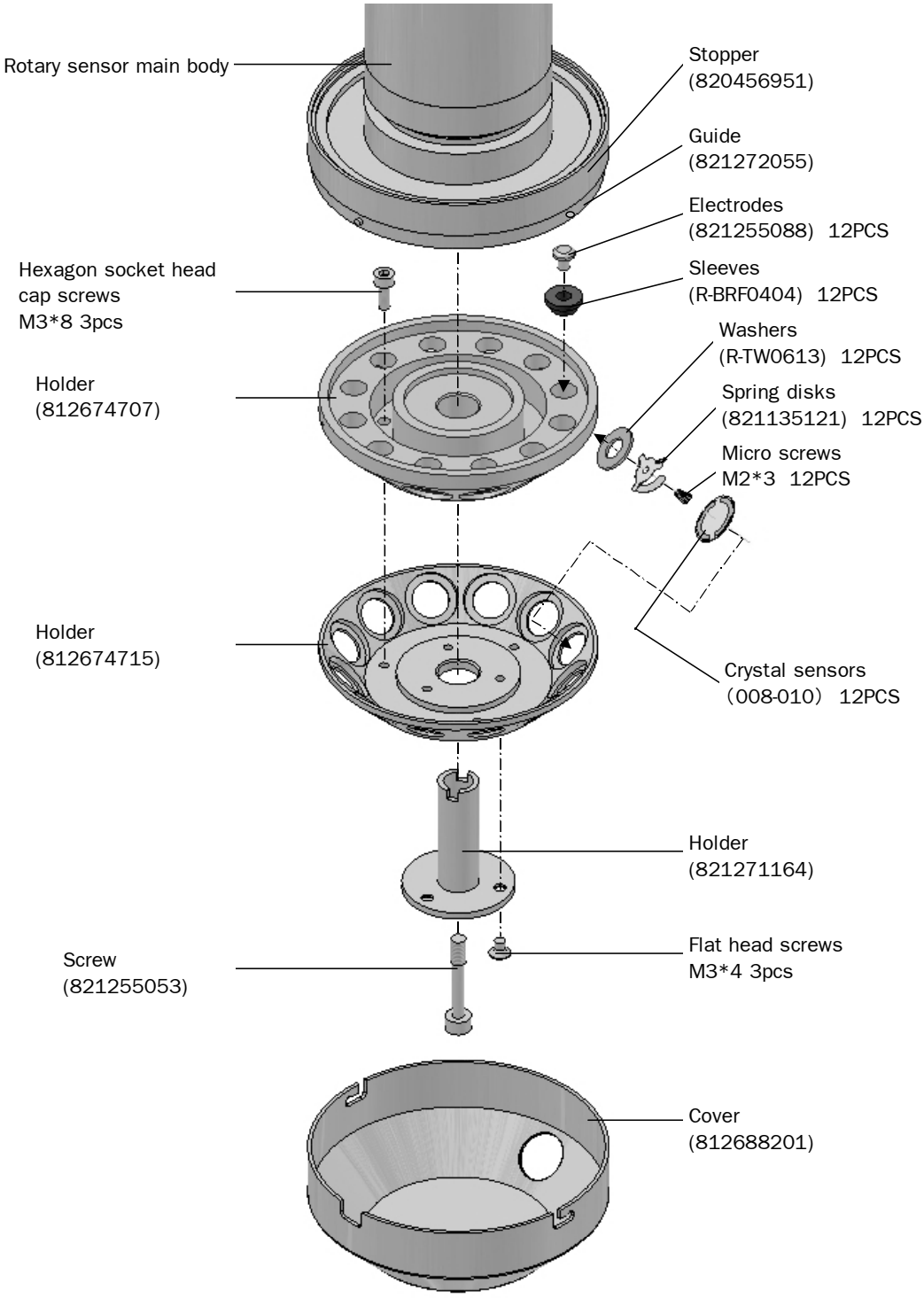


Fig 9 Assembling drawing of rotary sensor head 45

6 REFERENCE

The reference datas and materials for use are here.

6.1 The temperature of the rotary sensor

The temperature of quartz crystals must be used below as specified (100 degree C), and it is best in the 30−50 degree C temperature range of the sensor holder.

1. Cover and cap for cooling

When the sensor holder temperature is estimated to exceed 100 degree C due to the ambient temperature conditions, fit an adiabatic cover around the sensor head (it is best if the cover is water cooled), or fit a JEOL made Cu-cap (optional).

☞ Fig. 10 shows the rough drawing of the heat blocking for the rotary sensor head.

✍ If the quartz crystals are used over the specified temperature, it may cause malfunction in deposition-rate measurement, or damage to the instrument.

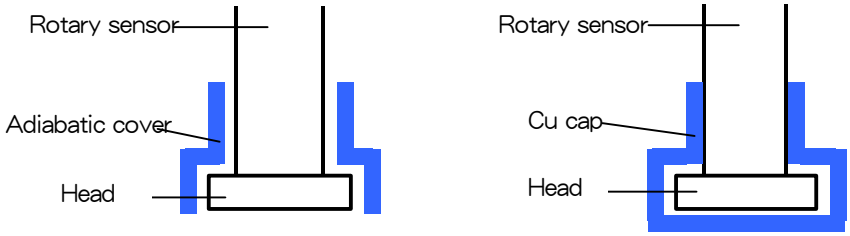


Fig 10 Rough drawing of heat blocking for rotary sensor head

2. Temperature test result on vacuum chamber at JEOL

The apparatus layout for temperature measuring test of the rotary sensor head in the vacuum chamber is shown in Fig.11. And the temperature test results of the rotary sensor head is shown in Fig.12.

As the temperature test results may vary largely with the installation location of the sensor in the vacuum chamber, just use the following data for your reference.

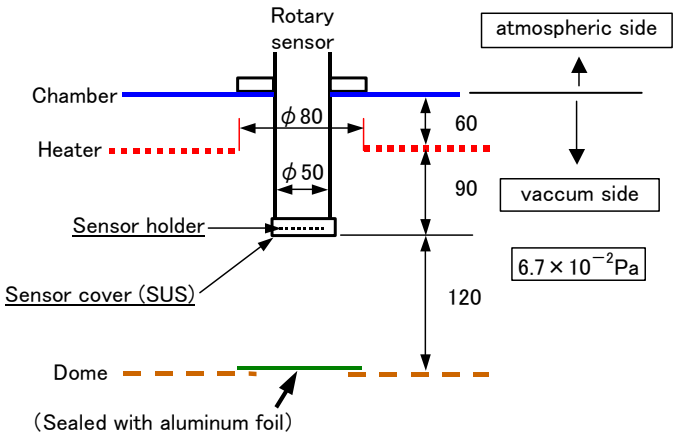


Fig 11 Apparatus layout for temperature measuring test

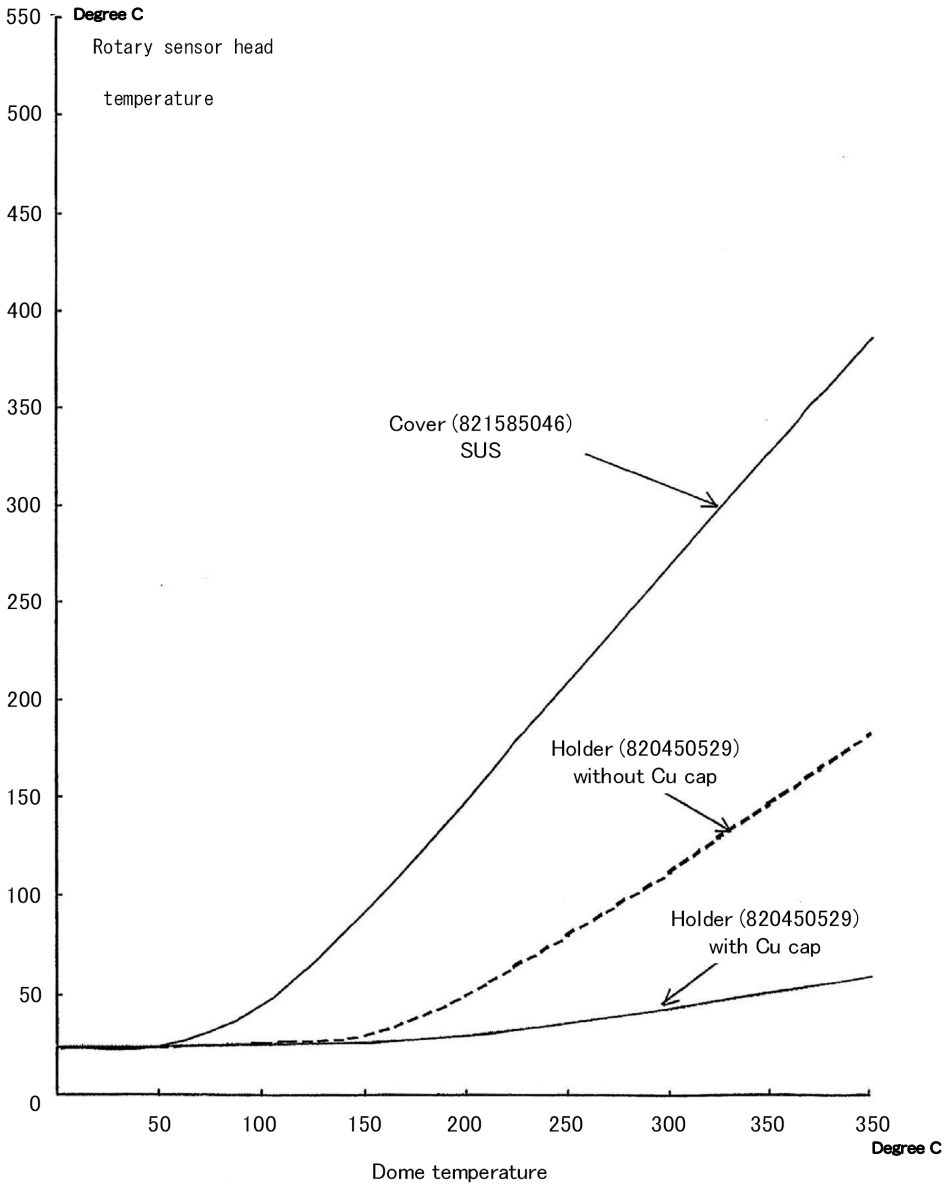


Fig 12 Temperature results of sensor head vs. dome temperature