

No. 99MBA112A8
SERIES No. 378

Power Revolver with 5Lens mounts

**For Microscope Unit
VMU**

User's Manual

Read this User's Manual thoroughly
before operating the instrument. After reading,
retain it close at hand for future reference.

Mitutoyo

CONVENTIONS USED IN THIS MANUAL

Safety Precautions

To ensure that instruments are operated correctly and safely, Mitutoyo manuals use various safety symbols (Signal Words and Safety Alert Symbols) to identify and warn against hazards and potential accidents.

The following symbols indicate **general** warnings:



Indicates an imminently hazardous situation which, if not avoided, will result in serious injury or death.



Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.



Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.

The following safety signs indicate **specific** warnings or prohibited actions, or indicate a mandatory action:



Alerts the user to a specific hazardous situation. The given example means “To warn of electricity”.



Prohibits a specific action. The given example means “Do not touch”.



Specifies a mandatory action. The given example means “Connect an earth to the ground”.

CONVENTIONS USED IN THIS MANUAL

Types of Notes

The following types of **notes** are used in this manual to help the operator obtain reliable measurement data through correct instrument operation.

IMPORTANT An important note provides information essential to use the product. You cannot disregard this note.

An important note is a type of precaution, which if neglected could result in degraded performance or accuracy, or instrument malfunction/failure.

NOTE A note provides information to be especially noted or supplemented to use the product. A note also supplies information to be noted for specific operations (e.g., memory limitation, instrument configuration, or details that apply to specific versions of a program).

TIP A tip is a type of note that helps the user to apply the operation method and procedures to his or her specific conditions.

A tip also indicates the reference destination if there is information to be referred to.

The specifications and information in this manual are subject to change without notice.

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Electromagnetic Compatibility (EMC)

This product complies with the EMC Directive and the UK Electromagnetic Compatibility Regulations; however, if this receives electromagnetic interference that exceeds these requirements, it will be out of warranty and require appropriate measures.

This product is an industrial product, and is not intended to be used in residential environment. If this product is used in residential environment, this product may cause electromagnetic interference with other instruments. In such a case, it is required to take appropriate measures for preventing such electromagnetic interference.

Precautions for Use

- **This system is a precision machine.**

Exercise great care when handling this system. Never bump or apply excessive force to all of its system components during operation.

- **Rectify installation environments.**

- Close to 20°C in ambient temperature.
- Free of extreme humidity.
- Free of dust and dirt.
- Free of vibration.

- **Turn off the power before connection and maintenance works.**

To prevent accidents or electric shock caused by system malfunction during connection or maintenance works, be sure to turn off the power before conducting connection or maintenance works.

- **Power supply**

Observe the following precautions regarding the power supply.

- The power supply specification of this machine

Pollution Degree : 2

Overvoltage Category : II

Class of equipment : Class I equipment

- If the system is subjected to a short-term power interruption, the system may restore itself to the power-on state. Before operating the system again, confirm the safety of the system and its surroundings.

- **Confirm the input voltage before turning the power switch on**

For the input voltage of this system of “100V~240V” is applied to this system. Connect the power plug with the plug socket after checking that the rated voltage of the system corresponds to the voltage of the plug socket.

- **Power cord**

Use only the power cord supplied for this system.

- **Disassembly prohibition**

Disassembling any of the components / parts of this unit will damage its performance and may result in electric shock, injury or malfunction.

Never disassemble any of the components / parts of this unit other than components / parts specifically forgeted for adjustment.

Important

This instrument consists of precision components, and its performance cannot be guaranteed, even within the warranty period, if it is disassembled by the user.

All equipment failures that occur after user disassembly will be repaired on a fee-for-service basis.

- **Danger prevention**

For danger prevention, do not use the system in any place where volatile gases could be generated.

- **Maintenance**

Gently wipe the system components on lint-free and soft cloth. If it is still dirtied, wipe it on cloth containing neutral detergent and then wipe it lightly on dry cloth or cloth well-wrung after soaked in water. Do not use organic solvent such as thinner or benzine.

- **Take special shielding measures when using the machine in the following locations:**

- Where noise caused by static electricity is generated.
- Near strong electric fields.
- Where power source lines pass nearby.
- Where there is a risk of radioactivity.
- Where the system components could be subject to corrosive gas.

Installation Environments

Temperature

This measuring system has been assembled and adjusted in the temperature-controlled room at 20°C. To use the measuring system at the rated measuring accuracy in the specification, the temperature at the installation site should be close to 20°C with minimum temperature fluctuation. (The ideal temperature is standard temperature condition level 1, 20°C ± 1°C, that is specified as “Standard Condition of Precision Measurement Environments” in JMAS5011.) Also, the temperature gradient should be 2°C as reference for 8 hours. If this temperature environment is worse than the above condition, the measuring system may not meet the specified measuring accuracy. Even if the specified accuracy is temporarily obtained by adjustment, uncertain measurements will be displayed at 20°C.

Humidity

Humidity does not affect the accuracy of the measuring system directly. High environmental humidity may corrode important machined surfaces and may adversely affect electronic parts. The environmental humidity should be maintained within a range of 55 % to 65%.

Dust and dirt

The measuring system consists of high-precision parts including guide ways, linear scale units and optical units that must be kept free of dust and dirt. Use the system in a site free of dust and dirt.

System Environments

Place	The indoor use
Operating altitude	2000m or less
Operating temperature range	5 to 40°C
Operating humidity range	20 to 80%RH (with no condensation)

Preservation environments

Storage temperature range	-10 to 50°C
Storage humidity range	5 to 80%RH (with no condensation)

Warranty

In the event that this product should prove defective in workmanship or material, within one year from the date of original purchase for use, it will be repaired or replaced, at Mitutoyo's option, free of charge upon its prepaid return to Mitutoyo, without prejudice to the provisions of the Mitutoyo Software End User License Agreement.

If this product fails or is damaged for any of the following reasons, it will be subject to a repair charge, even if it is still under warranty.

- (a) Failure or damage owing to fair wear and tear.
- (b) Failure or damage owing to inappropriate handling, maintenance or repair, or to unauthorized modification.
- (c) Failure or damage owing to transport, dropping, or relocation of the instrument after purchase.
- (d) Failure or damage owing to fire, salt, gas, abnormal voltage, lightning surge, or natural disaster.
- (e) Failure or damage owing to use in combination with hardware or software other than those designated or permitted by Mitutoyo.
- (f) Failure or damage owing to use in ultra-hazardous activities.

This warranty is effective only where the instrument is properly installed and operated in conformance with the instructions in this manual within the original country of the installation.

EXCEPT AS SPECIFIED IN THIS WARRANTY, ALL EXPRESS OR IMPLIED CONDITIONS, REPRESENTATIONS, AND WARRANTIES OF ANY NATURE WHATSOEVER INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NONINFRINGEMENT OR WARRANTY ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE, ARE HEREBY EXCLUDED TO THE MAXIMUM EXTENT ALLOWED BY APPLICABLE LAW.

You assume all responsibility for all results arising out of its selection of this product to achieve its intended results.

Disclaimer

IN NO EVENT WILL MITUTOYO, ITS AFFILIATED AND RELATED COMPANIES AND SUPPLIERS BE LIABLE FOR ANY LOST REVENUE, PROFIT, OR DATA, OR FOR SPECIAL, DIRECT, INDIRECT, CONSEQUENTIAL, INCIDENTAL, OR PUNITIVE DAMAGES HOWEVER CAUSED AND REGARDLESS OF THE THEORY OF LIABILITY ARISING OUT OF THE USE OF OR INABILITY TO USE THIS PRODUCT EVEN IF MITUTOYO OR ITS AFFILIATED AND RELATED COMPANIES AND/OR SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

If, notwithstanding the foregoing, Mitutoyo is found to be liable to you for any damage or loss which arises out of or is in any way connected with use of this product by you, in no event shall Mitutoyo's and/or its affiliated and related companies' and suppliers' liability to you, whether in contract, tort (including negligence), or otherwise, exceed the price paid by you for the product only.

The foregoing limitations shall apply even if the above-stated warranty fails of its essential purpose.

BECAUSE SOME COUNTRIES, STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR THE LIMITATION OF LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, IN SUCH COUNTRIES, STATES OR JURISDICTIONS, MITUTOYO'S LIABILITY SHALL BE LIMITED TO THE EXTENT PERMITTED BY LAW.

Export Control Compliance

This product falls into the Catch-All-Controlled Goods and/or Catch-All-Controlled Technologies (including Programs) under Category 16 of Appended Table 1 of Export Trade Control Order or under Category 16 of Appended Table of Foreign Exchange Control Order, based on Foreign Exchange and Foreign Trade Act of Japan.

If you intend re-export of the product from a country other than Japan, re-sale of the product in a country other than Japan, or re-providing of the technology (including Programs), you shall observe the regulations of your country.

Also, if an option is added or modified to add a function to this product, this product may fall under the category of List-Control Goods, List-Control Technology (including Programs) under Category 1 - 15 of Appended Table 1 of Export Trade Control Order or under Category 1 - 15 of Appended Table of Foreign Exchange Control Order, based on Foreign Exchange and Foreign Trade Act of Japan. In that case, if you intend re-export of the product from a country other than Japan, re-sale of the product in a country other than Japan, or re-providing of the technology (including Programs), you shall observe the regulations of your country. Please contact Mitutoyo in advance.

Notes on Export to European Countries

When you intend exporting of this product to any of the European countries, it may be required to provide User's Manual(s) in English and Declaration of Conformity in English (in some cases, the official language of the country to be exported). For detailed information, please contact Mitutoyo in advance.

Disposal of Products outside the European Countries

Please follow the official instruction in each community and country.

Disposal of Old Electrical & Electronic Equipment (Applicable in the European Countries with Separate Collection Systems)



This symbol on the product or on its packaging is based on WEEE Directive (Directive on Waste Electrical and Electronic Equipment), and this symbol indicates that this product shall not be treated as household waste.

To reduce the environmental impact and minimize the volume of landfills, please cooperate in reuse and recycle.

For how to dispose of the product, please contact your dealer or the nearest Mitutoyo sales office.

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China RoHS Compliance Information
SERVICE NETWORK

1

Overview

This chapter describes the configuration of the Power Revolver, which is designed for the Microscope Unit VMU.

The name and function of each part are also given here.

1.1 Outline

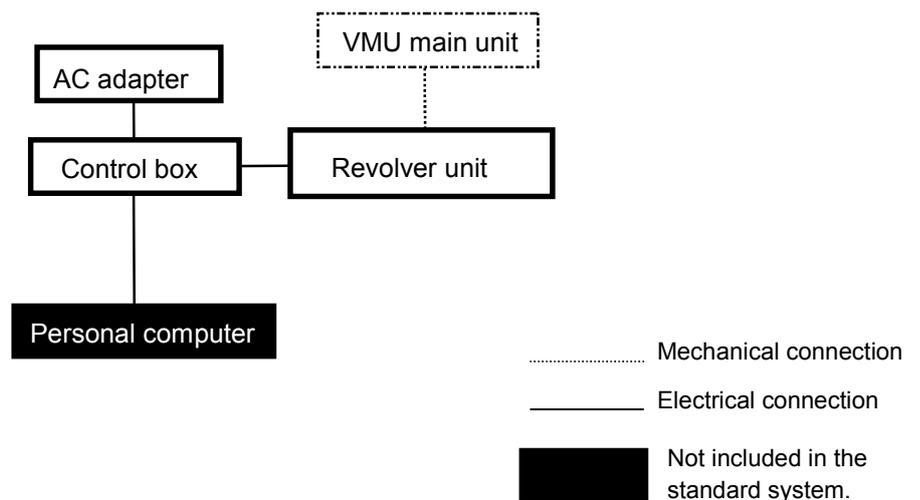
The Power Revolver is a unit for electrically switching the objectives by installing in the microscope unit VMU which has been incorporated in machine equipment.

This revolver allows the objectives to be switched without touching directly by hand, and thus makes them free from contamination.

Also, if a personal computer is connected to the VMU system, the computer can switch the objectives externally. This enables automation of observing and laser-machining a workpiece.

1.2 System Configuration

A system consists of the revolver unit, control box, and AC adapter.

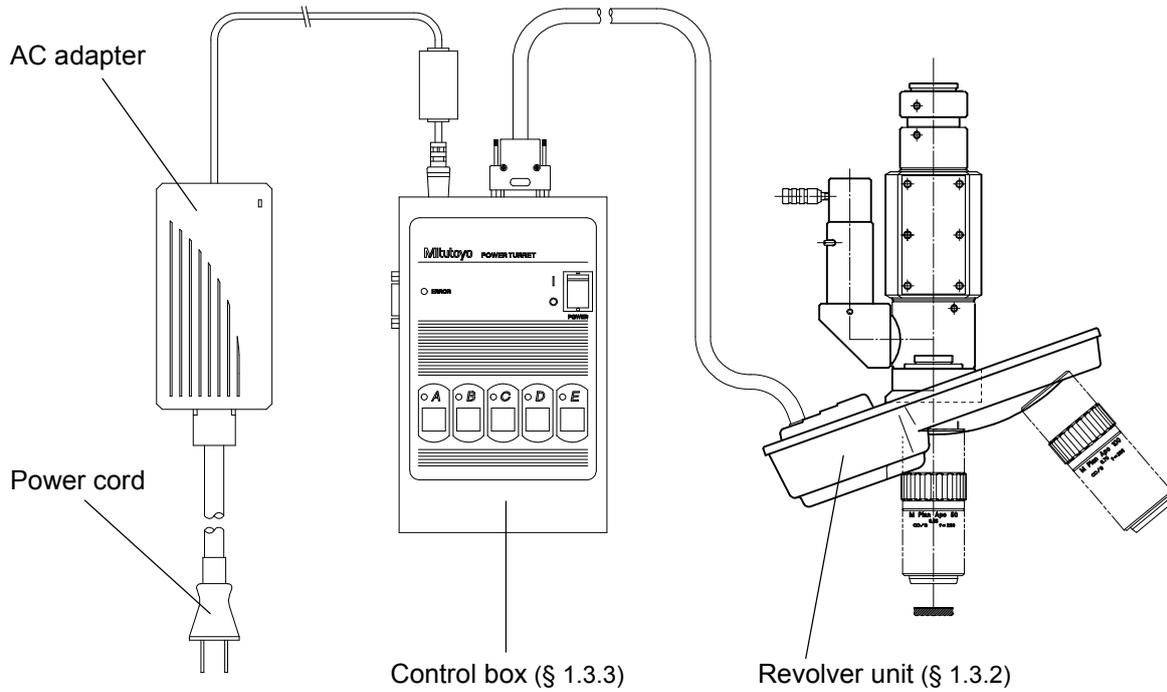


1.3 Name and Function of Each Part

This section gives the name and function of each part of the Power Revolver.

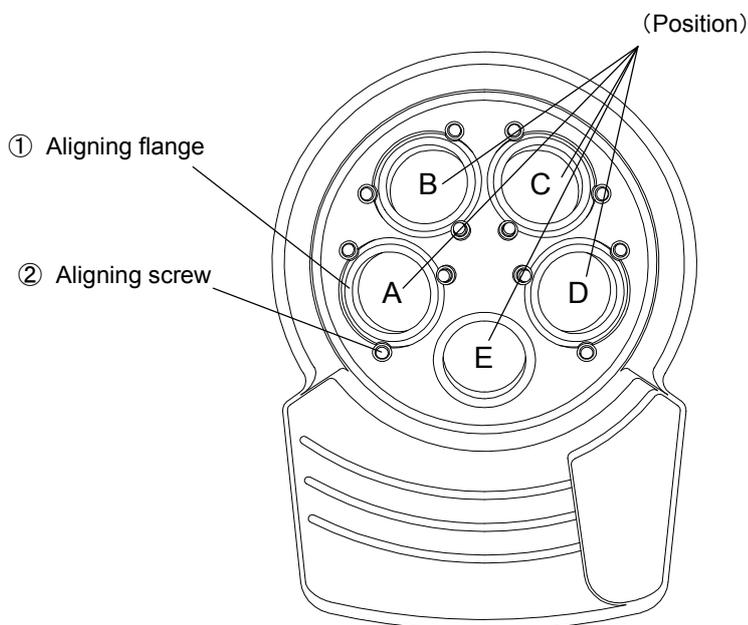
1.3.1 System appearance

(1) Control box type (Order No. 378-713)



1.3.2 Revolver unit

This unit is mounted on the microscope unit and allows a maximum of five objectives to be attached to. A desired objective is selected with the Position Select buttons (see § 1.3.3) on the control box. The tapped holes attached with an objective have objective centering mechanisms except for one hole.



① Aligning flange

This flange, in which an objective is screwed, allows the objective to be aligned by being slightly moved within the horizontal plane with the aligning screws.

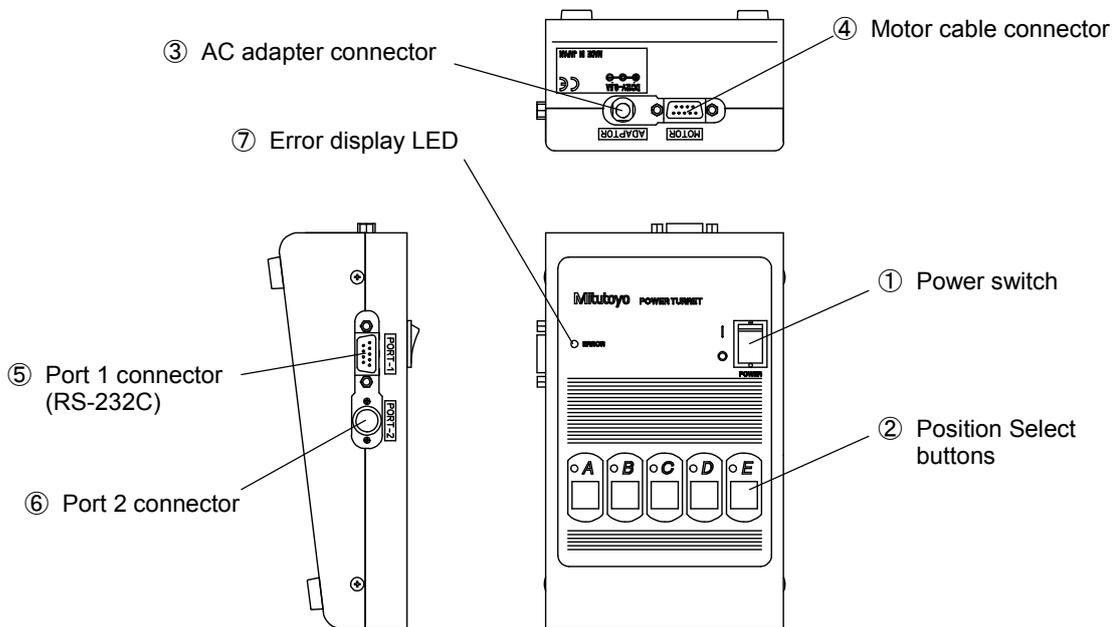
② Aligning screws

These screws are to align the objective by slightly moving the aligning flange within the horizontal plane.

TIP What is Aligning? : Positioning an objective by moving slightly within the horizontal plane so that any objective can observe the same position of a specimen even if the objective is switched with the revolver.

What is the position? : Five tapped hole positions where the objectives are mounted.

1.3.3 Counter box



- ① Power switch
Turns on and off the power to the control box.
- ② Position Select buttons
Presses either of the buttons to switch to a desired objective.
A LED (green) which shows the selected objective lights up.
- ③ AC adapter connector
Connects the AC adapter.
- ④ Motor cable connector
Connects the revolver unit.
- ⑤ Port 1 connector (RS-232C)
Connects to the personal computer with the dedicated cable.
- ⑥ Port 2 connector
This connector is not used.
- ⑦ Error display LED
When an error occurs, the LED (red) lights up.

2

Installation / Adjustment

This chapter explains how to install the Power Revolver in the microscope unit and adjust each of the parts.

2.1 Unpacking and Checking

Prior to shipment from the factory, the Power Revolver is thoroughly inspected and its mechanical, optical, and electrical operation are fully guaranteed.

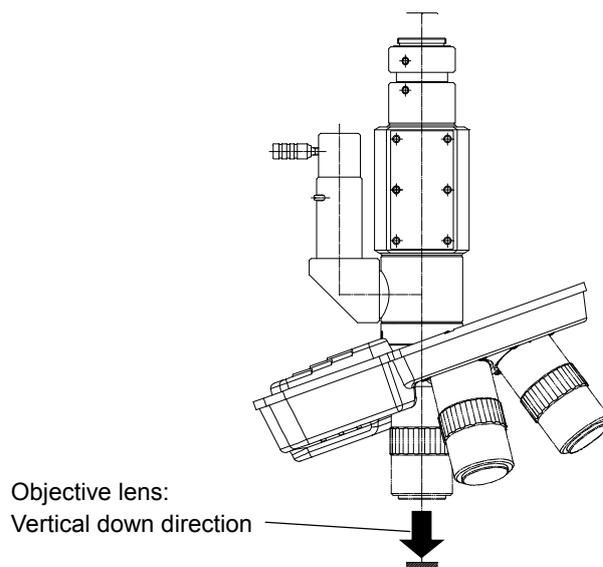
Unpack the Power Revolver, and make sure that all accessories and components are present, and that the Power Revolver was not damaged during shipment. If you have any questions, contact your dealer or nearest Mitutoyo Service Center.

2.2 Precautions in Mounting the Revolver

When mounting the power revolver on a microscope unit or a user's instrument, pay attention to its orientation.

Make sure that one of the objective lenses to be used for observation and measurement faces the vertical down direction.

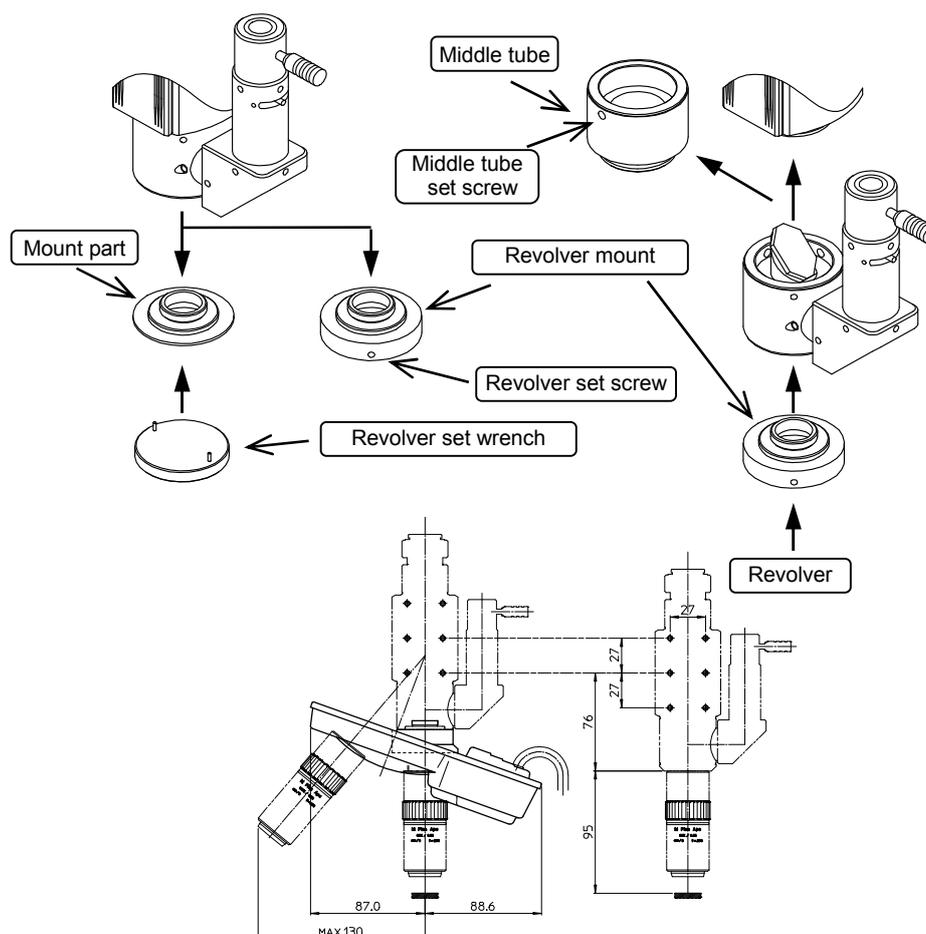
If the objective lens faces a direction (such as the horizontal direction) other than the vertical down direction, the normal revolution of the power revolver is not guaranteed.



2.3 Mounting the Revolver

Mount the Power Revolver unit on the microscope unit according to the following procedure.

- ① Use the revolver set wrench provided to remove the mount part.
(L·L4 series) Loosen the middle tube set screw and remove the middle tube.
- ② Screw the revolver mount onto the main unit illumination.
- ③ Mount the power revolver on the revolver mount and tighten the revolver set screw to fix the revolver in place.



IMPORTANT When mounting the Power Revolver, refer to the items of Important and Tip in VMU User's Manual 「3.1 Mounting a Bright-field revolver (BF)」.

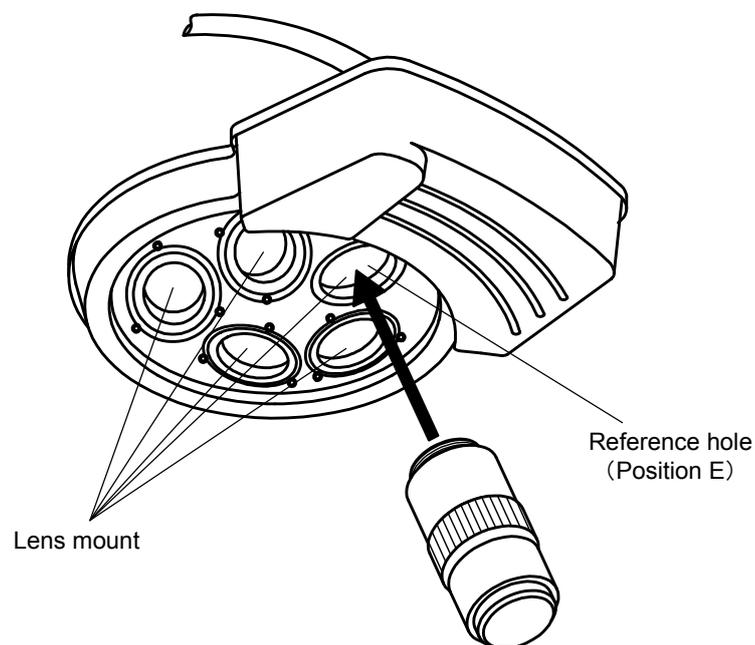
NOTE Using the Power Revolver with Focusing Unit B is impossible.
Use Focusing Unit A with the column stand so that the optical axis is aligned with the center of the column stand stage.

2.4 Attaching Objectives to the Revolver

Unscrew the caps mounted on the Power Revolver unit and screw objectives to attach to the revolver. It is possible to attach a maximum of five objectives.

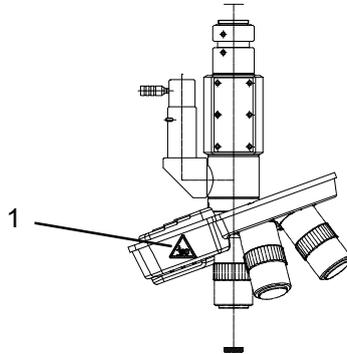
Among the five objective holes one tapping hole, that is fixed with no aligning mechanism provided, is assigned as position [E]. This objective hole is called the reference hole and becomes the reference for aligning.

Be sure to attach the highest magnification lens of the objectives to be used to the reference hole. Even if there are four objectives or less for use, make sure that the highest magnification lens is attached to the reference hole.



2.5 Labeling the Caution Seal

Label the caution seal as shown in the figure below, in the case where the revolver is fixed in the VMU series.



Example of the seal position to be labeled

<Product Safety Labels>

1		<p>Warning; Crushing of Hands (Prevents the operator from the risk of injury due to pinched fingers.)</p> <p>Do not insert your fingers or hand between the rotating revolver and the WIDE VMU (Video Microscope Unit).</p> <p>Otherwise, a personal injury may result.</p>
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CAUTION

A position to label a caution seal depends on a mounting orientation of the revolver. Label a caution seal at a position clearly visible to an operator so that the operator will be able to exercise great care in operating the revolver.

2.6 Setting-up the Power Supply

Use the dedicated AC adapter for the power supply to this unit. The AC power voltage for the Power Revolver must be between AC100V and AC240V and have a frequency of 50/60Hz.

A two-pole outlet with a ground terminal is required as the AC power outlet. Make allowance for the power output capacity in consideration of the total consumption of the system.

TIP The system may require a power regulator if power fluctuation is not within $\pm 10\%$ of the specified voltage. An uninterruptible power system is required if there is the potential for power failure.

For more information, contact your dealer or the nearest Mitutoyo sales office.

Only allow the power outlet at the installation site to be used for the machinery including the Power Revolver. Do not plug other electric equipment into the outlet.

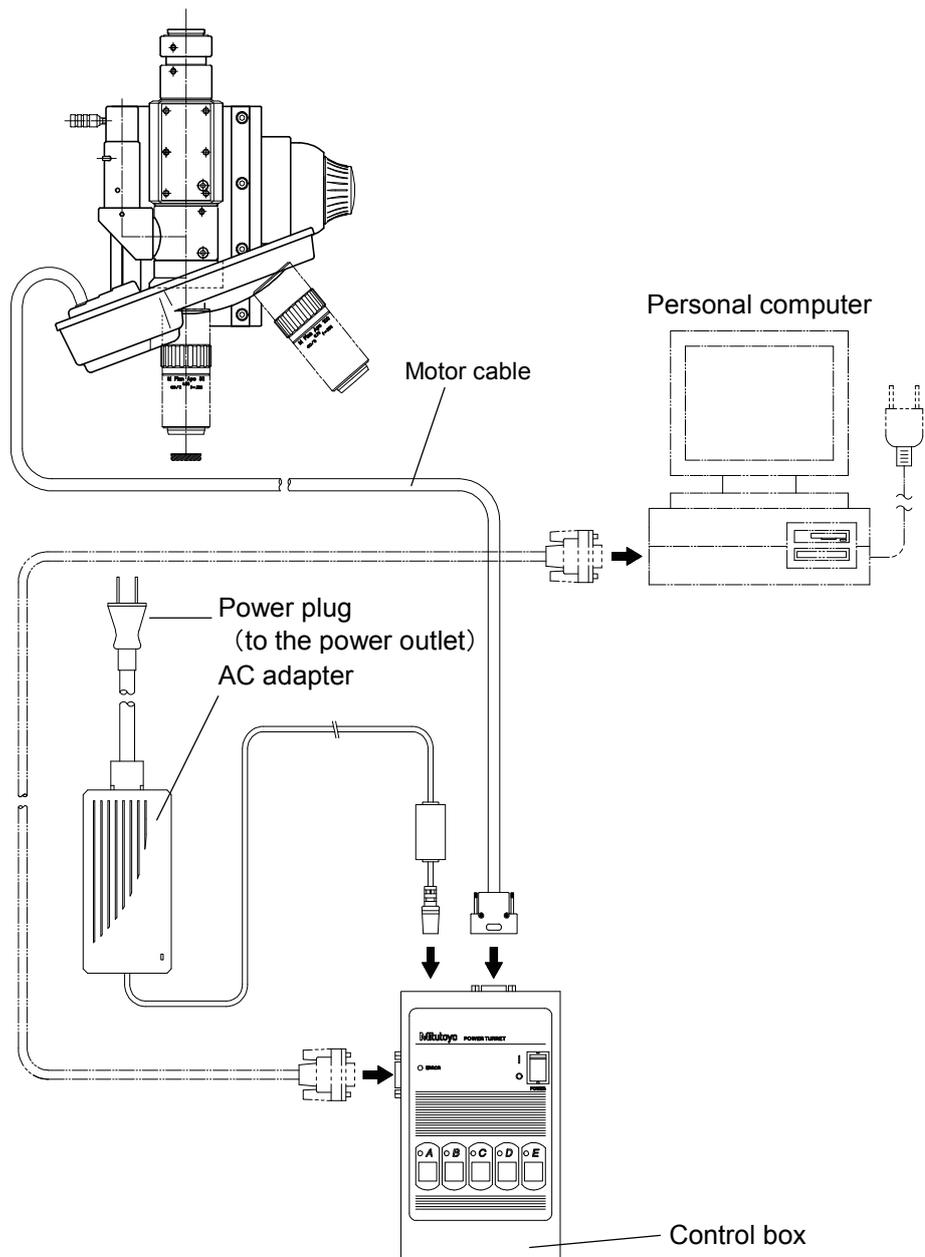
2.7 Connecting Each Part

2.7.1 Connection

Connect the cables of each part according to the following figure

Connect the motor cable connector and the AC adapter plug to the control box, and finally connect the power plug to the AC outlet.

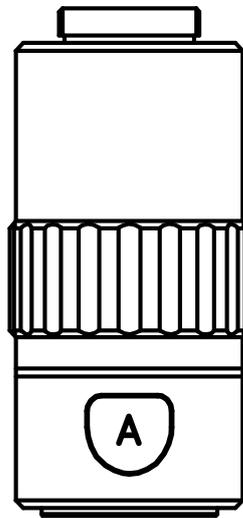
If a personal computer is used, connect them using the RS-232C cables (optional accessories).



2.8 Labeling the Position ID Seals

To identify in which position of A, B, C, D, and E the individual objectives are attached, label the ID seal around each objective tube.

- ① Turn on the power switch on the control box.
- ② Press the Position Select button A.
The revolver rotates the objective attached in position A to the front of the FS70.
- ③ Label the seal [A] around the tube of the objective that has come in the front.
- ④ Similarly label the seal corresponding to the position on other objectives.



2.9 Aligning the Visual Field Center

Aligning is performed to position objectives so as not to deviate the visual field center when an objective is switched to.

- ① Press the Position Select button [E] to rotate the revolver and select the highest magnification objective that was attached to the reference hole.
- ② Set a specimen on the stage as an index of observation and focus on it. Decide a marker position such as a corner or a character on the specimen to be observed. Move the stage so as to align the marker position with the CCD center.
- ③ Press a Position Select button to rotate the revolver and select a desired objective to be aligned.
- ④ Bring the specimen into focus, and check where the marker position on the specimen is in the field of view. If the marker is at the center, the objective does not need to be aligned.
- ⑤ If the marker is deviated from the center, it is necessary to align the objective. Loosen once the three aligning screws that secure the aligning flange with the Allen wrench (nominal 1.5mm), then lightly tighten them.

The following explains the procedure for aligning the black circle in Fig.1 as a marker with the center.

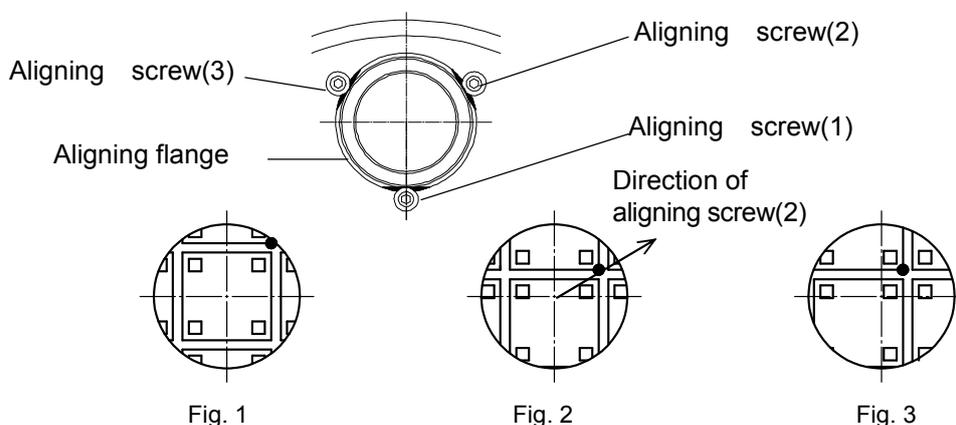
- ⑥ Tighten gently the aligning screw (1) so that the black circle comes on the line passing through the aligning screw (2) and the center. (See Fig.2.)
- ⑦ Loosen the aligning screw (2) to be able to move the black circle toward the center. (See Fig.3.)
- ⑧ Select the aligning screw that can approach the black circle to the center by tightening the screw, and then adjust it.
- ⑨ Select the aligning screw that can approach the black circle to the center by loosening the screw, and then adjust it.
- ⑩ Repeat steps ⑧ and ⑨ to gradually approach the black circle to the center. Finally tighten the aligning screws to correctly align the black circle with the center.
- ⑪ After the aligning check that there is no slack in each aligning screw(each three place).



CAUTION

If the aligning screws are not tighten certainly, the aligning flange falls with an objective and there is a possibility of damaging a sample, other equipments, etc. On the damage which originates from the handling, Mitutoyo assumes no responsibility.

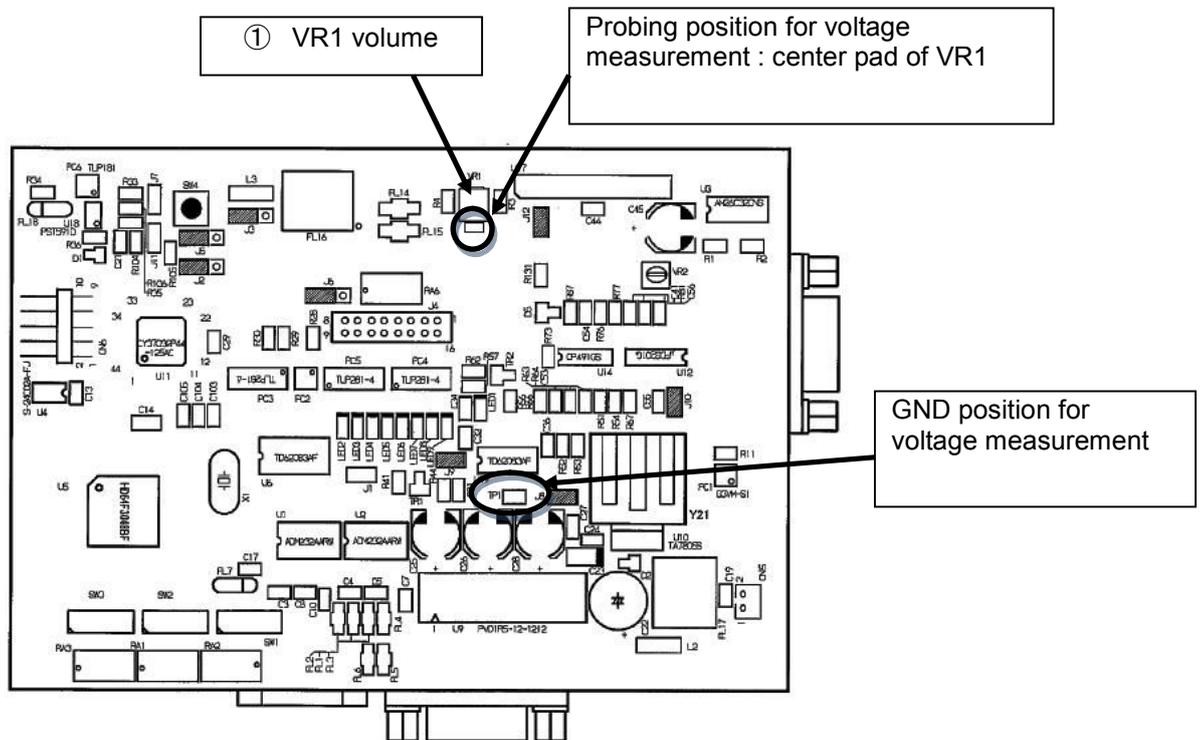
- ⑫ Similarly align the other objectives (three pieces at most).



2.10 Adjustment of the motor torque

2.10.1 Adjustment of the probing position for voltage measurement

If you want to raise the torque by 20%, rotate the VR1 to the position where the value is plused by 20% compared with the current one.
(Factory default of VR1: approx. 3V)



① VR1 volume

This volume is used to adjust the rotation torque at around the stop position of each lens.

Adjust the volume with measuring the voltage with using a voltage meter.

The probing position of the voltage meter during adjustment is described on the next page.

TIP If the lens allocation is not balanced or the revolver has been used for a long period, since smoothness of rotation sliding of the revolver deteriorates, it is easy to cause overrun or shortage of running. In those cases, it can be solved occasionally by adjusting this volume.

3

Operating Procedure

This chapter explains the procedure for operating the Power Revolver when using the microscope.

3.1 Operation from the Control Box

- ① Turn on the power switch. (The LED of one of the Position Select buttons which shows the current position of revolver lights up.)
- ② Select a desired objective.
Check the position ID of the seal labeled on the desired objective, then press the Position Select button of the same ID. The revolver will select the shortest distance and rotate depending on the selected objective position.

3.2 Operation from a Personal Computer

When using a personal computer, turn on the power according to the following procedure.

- ① Turn on the power to the personal computer.
- ② Turn on the power to the control box (or the control board).

When turning off the power, turn off the control box (or the control board) first then turn off the personal computer.

For information about the communication command specification, refer to "5.6 Specification for Connecting a Personal Computer".



CAUTION

Operate prudently so that the objective may not contact a workpiece when switching the objective. On the damage which originates from the handling, Mitutoyo assumes no responsibility.

MEMO

4

Troubleshooting

Although a problem may occur when this unit is being used, this does not necessarily indicate a failure. Determine the nature of the problem, and then take corrective action according to the following table.

If the problem is not corrected after taking corrective action, contact your dealer or the nearest Mitutoyo sales office.

4.1 Troubleshooting and Remedies

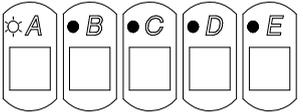
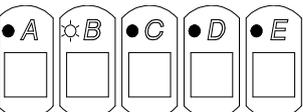
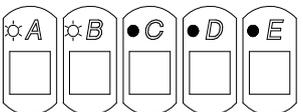
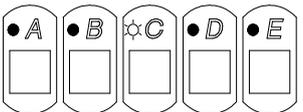
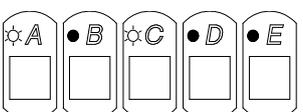
Symptoms	Check points	Remedies	Ref.
The Power Revolver will not rotate when a Position Select button is pressed.	<ol style="list-style-type: none"> 1) Check if the power is on. 2) Check if the display LED of Position Select button is lit. 3) Check if the Position Select button that has already been selected is not pressed. 4) Check if a DIP switch is set up correctly. 5) Check if an extended cable except the supplied cable between the revolver and a control box is not added. 	<ol style="list-style-type: none"> 1) Plug the power cord plug into the power outlet. 2) Turn on the power switch. 3) Press another Position Select button except the button that has been selected. 4) Correct the setup of DIP switch. 5) Return to the connection defined regularly (this system is not designed assuming the use of extended cable). 	<p>§1.3.3</p> <p>§1.3.3</p> <p>§5.5.4</p>
The Power Revolver will not rotate by the command from the personal computer.	<ol style="list-style-type: none"> 1) Check if the procedure to turn on the power supply is correct. 2) Check if the command from the personal computer is transmitted in the format of 1-byte capital letter. 3) Check if the RS232C communication error has not occurred. 	<ol style="list-style-type: none"> 1) First turn on the power supply of the personal computer, then the control box . 2) Transmit the command in the format of 1-byte capital letter. 3) On start-up, improper data are output from a PC by the model. After turning the power on, restart the RS232C communication by the Error Clear command. 	<p>§3.2</p> <p>§5.5.5</p>
The stop accuracy is not good.	<ol style="list-style-type: none"> 1) Check if the screw of centering mechanism is not loosened. 2) Check if the screw of revolver attaching mount is not loosened. 3) Check if the gear or its screws are not loosened. 4) Check if the revolver is not mounted obliquely or horizontally. 	<ol style="list-style-type: none"> 1) Tighten the screw of centering mechanism again. 2) Tighten the screw of revolver attaching mount again. 3) Contact the nearest Mitutoyo sales office. (Do not assemble it on your own)In this case, it must be adjusted by our manufacturing factory. 4) Both operation and accuracy of the instrument are not warranted unless the revolver is mounted with the lens facing downward or in the vertical direction. 	<p>§1.3.2</p>

Symptoms	Check points	Remedies	Ref.
The stopping position of the revolver can not be recognized.	1) Check if an extended cable other than the supplied cable is not added between the revolver and a control board.	1) Return to the connection at the normal state (this system is not considering the use of extended cable).	
The revolver stops before the desired position.	1) Check if a DIP switch is set up correctly. 2) The weight is heavy. Check if anything other than a lens is not attached to the revolver. 3) Check if an extended cable except the supplied cable between the revolver and a control box is not added. 4) Check if the setup of VR1 is not small. 5) Check if an extended cable other than the supplied cable is not added between the revolver and a control board.	1) Correct the setup of DIP switch. 2) Remove the attached things other than lens of our company. 3) Return to the connection defined regularly (this system is not designed assuming the use of extended cable). 4) Turn VR1 clockwise to increase the setup. 5) Return to the connection at the normal state (this system is not considering the use of extended cable).	§5.54 §2.72
The revolver overruns the desired position.	1) Check if a DIP switch is set up correctly. 2) The inertial force is big. Check if anything other than a lens is not attached to the revolver. 3) Check if the setup of VR1 is not large. 4) Check if there are not the backlash and looseness of screw in the gear part. 5) Check if an extended cable other than the supplied cable is not added between the revolver and a control board.	1) Correct the setup of DIP switch. 2) Remove the attached things other than lens of our company. 3) Turn VR1 counterclockwise to decrease the setup. 4) Contact the nearest our sales office (do not disassemble). 5) Return to the connection at the normal state (this system is not considering the use of extended cable).	§5.54 §2.72
During operation, the power has been interrupted.	1) Is the power cord disconnected? 2) Is not power supply voltage falling to less than 90V ? (voltage dips, short interruptions or voltage variations of power supply are included)	1) Connect the power cord correctly. 2) An electric supply source is investigated. When other equipment was supplied from the same power outlet, change other equipment to another power outlet.	

4.2 Error Messages and Remedies

(Applied only to the control box type (order No. 378-713))

 Lighting ● Not lighting

Lighting state of the error display LED (red)	Lighting state of the Position Select button LED (green)	Meaning and remedy
1.  ERROR		RS-232C parity error Slide the DIP switch to turn it ON/OFF and reconfirm the status. ...Restart the system power.
2.  ERROR		RS-232C over-run error Slide the DIP switch to turn it ON/OFF and reconfirm the status. ...Restart the system power.
3.  ERROR		RS-232C framing error Slide the DIP switch to turn it ON/OFF and reconfirm the status. ...Restart the system power.
4.  ERROR		Timeout error (occurs if the time between the rotation instruction reception and the rotation completion exceeds the specified time.) ...Restart the system power.
5.  ERROR		Sensor detection failure error (occurs if no sensor input comes from anywhere during motor stop.) ...Press a Position Select button to rotate the revolver.

MEMO

5

Specifications

This chapter describes the specification of the whole system.

5.1 Comprehensive Specification

Order No.	378-713
Observation	Bright field
Maximum mounting number of objective	5
Centering mechanism of objective	Valid (except for one hole)
Positioning accuracy (repeated stop accuracy)	3 μ m (2 σ)
Drive life (durability)	One million positions
Power consumption	10 W
Input voltage	100V to 240 VAC
External input-output interface	RS-232C

5.2 Revolver Unit

Number of mounting holes for objective	5 (fixed hole: 1, aligning hole: 4)
Adjustable range of visual field	\pm 0.5mm
Drive method	Gear drive with a DC motor
External dimensions	130(W) x 186(D) x 47(H) mm 5.12"(W) x 7.32"(D) x 1.85"(H)
Mass	Approx. 1800 g (4.0lb)

5.3 Control Box

LED Display (message)	Error, Position A,B,C,D,E
Control switch	Power switch, Position Select buttons
Input voltage	12 VDC (AC adapter output voltage)
External dimensions	108(W) x 176(D) x 63(H) mm 4.25"(W) x 6.93"(D) x 2.48"(H)
Mass	Approx. 800 g (1.8lb)

5.4 Accessories

Part name	Part No.	Quantity	378-713
Position ID seal	12BAF554	4 sets	○
Allen wrench, nominal 1.5	12BAF795	1 pc.	○
Revolver set wrench	02AKF420	1 pc.	○
AC adapter (Input voltage: 100V to 240VAC, 50/60Hz)	357651	1 pc.	○
Power cord	Differs depending on the destination country	1 pc.	○
User's Manual	99MBA112A	1 copy	○
RS-232C cable (2m)	12AAA807	1 pc.	△

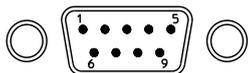
※1) ○ ; Standard accessory △ ; Optional accessory (User option)

5.5 Specification for Connecting a Personal Computer

5.5.1 Counter and concerned matters

Communication method :	Half duplex	
Synchronizing method :	Asynchronous (start/stop method)	
Baud rate :	1200, 2400, 4800, or 9600 ^(※1) bps (selectable with DIP switch)	
Bit configuration :	Data bit	8 bits (ASCII code)
	Parity bit	None/even ^(※1) /odd
	Stop bit	1 bit
Flow control :	None	(※1) Setup in the factory shipping

5.5.2 RS-232C connector

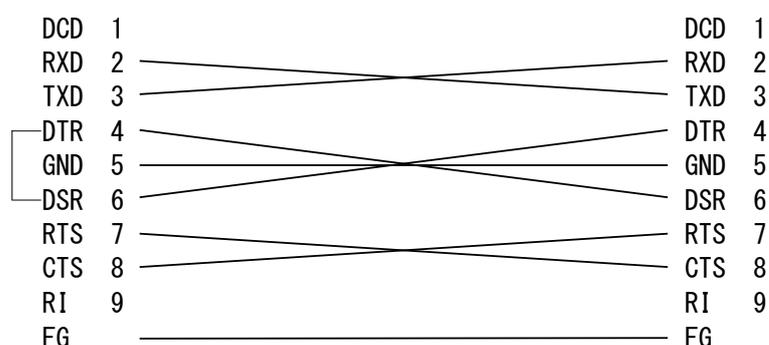
Connector shape	Pin No.	Signal name	I/O (※2)	Description
 D-sub, 9 pins, male, inch thread	1			
	2	RD	IN	Receive data
	3	TD	OUT	Transmit data
	4	DTR	OUT	Data terminal ready
	5	SG	—	Signal ground
	6	DSR	IN	Data set ready
	7	RTS	OUT	Request to send
	8	CTS	IN	Clear to send
	9			
	FG	—	—	Frame ground

(※2) Each signal input/output depends on the direction viewed from the control box of the Power Revolver.

The input/output circuits used are equivalent to MAX232 (MAXIM Corporation).

5.5.3 Connection of RS-232C cable

Power Revolver side	Personal computer side
Connector shape ; D-SUB 9P	D-SUB 9P
inch thread	inch thread



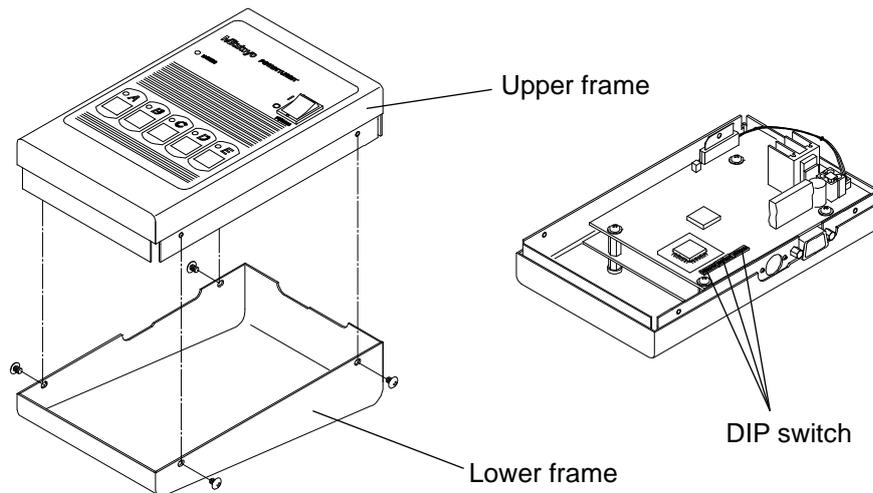
5.5.4 Setup of DIP switches

If it is necessary to change factory settings, set the DIP switches again according to each conditions. The procedure for setting the DIP switches is described below.

① Disassembling the control box

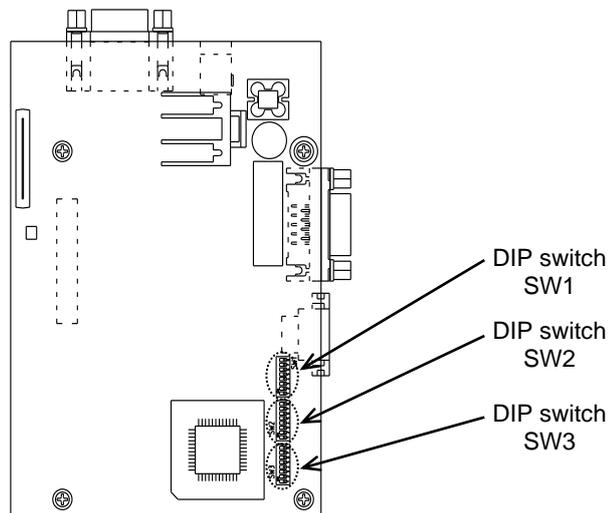
Turn off the power switch on the control box, and then disconnect the cables.

Unscrew the four screws with a screwdriver, then remove the lower frame from the upper frame in which switches are built in. Turn the upper frame over, and set the DIP switches again.



② Location of DIP switches

Confirm the location of the DIP switch to be changed.

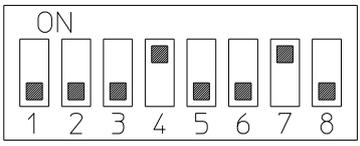


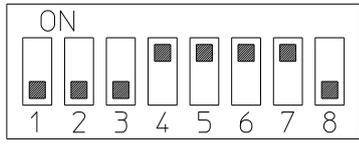
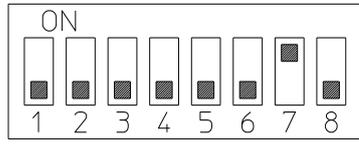
CAUTION

Be sure to turn off the power before starting this procedure.

③ Setting DIP switches

Set the DIP switches according to the tables below.

DIP switch No.	SW3																	
Factory settings																		
Operation	Switch No.	Setting switches	Description															
RS-232C baud rate	1	※1	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Switch No. \ bps</td> <td style="text-align: center;">1200</td> <td style="text-align: center;">2400</td> <td style="text-align: center;">4800</td> <td style="text-align: center;">9600</td> </tr> <tr> <td style="text-align: center;">※1 1</td> <td style="text-align: center;">ON</td> <td style="text-align: center;">ON</td> <td style="text-align: center;">OFF</td> <td style="text-align: center;">OFF</td> </tr> <tr> <td style="text-align: center;">※2 2</td> <td style="text-align: center;">ON</td> <td style="text-align: center;">OFF</td> <td style="text-align: center;">ON</td> <td style="text-align: center;">OFF</td> </tr> </table>	Switch No. \ bps	1200	2400	4800	9600	※1 1	ON	ON	OFF	OFF	※2 2	ON	OFF	ON	OFF
	Switch No. \ bps	1200		2400	4800	9600												
※1 1	ON	ON	OFF	OFF														
※2 2	ON	OFF	ON	OFF														
	2	※2																
Parity check: used/none	3	ON	Parity check: None															
		OFF	Parity check: Used															
Parity check: even/odd	4	ON	Even parity check															
		OFF	Odd parity check															
Do not change (Fixed)	5	OFF	Inhibition of operation															
	6	OFF																
	7	ON																
	8	OFF																

DIP switch No.	SW1	SW2
Factory settings		
Operation	Switch No.	Setting switches
Do not change (Inhibition of operation) (Fixed)	1	OFF
	2	OFF
	3	OFF
	4	ON
	5	ON
	6	ON
	7	ON
	8	OFF

5.5.5 RS-232C communication specification

"EM" and "CRLF" described in tables are defined as the following meaning.

「EM」 : End mark

「CRLF」 : Carriage return, line feed

Control command (Use a 1-byte capital letter for the command.)

These commands are used for the case in which the rotation of the Power Revolver is controlled from the personal computer.

(1)Rotation to position A

Header			Sub-field			EM	
R	W	R	M	V	A	CR	LF

(2)Rotation to position B

Header			Sub-field			EM	
R	W	R	M	V	B	CR	LF

(3)Rotation to position C

Header			Sub-field			EM	
R	W	R	M	V	C	CR	LF

(4)Rotation to position D

Header			Sub-field			EM	
R	W	R	M	V	D	CR	LF

(5)Rotation to position E

Header			Sub-field			EM	
R	W	R	M	V	E	CR	LF

(6)Stop

Header			Sub-field			EM	
R	W	R	S	T	P	CR	LF

This command is used for the case in which the rotation of the revolver is stopped in the position except for position A, B, C, D, and E.

Note)In this case, the positioning accuracy is not guaranteed.

(7)Error Clear

Header			Sub-field			EM	
R	W	R	R	S	T	CR	LF

NOTE)

This command is used for the case in which the RS232C communication error has occurred.

It is recommended to send this command to the revolver after starting up a PC.

If the RS232C communication error has occurred, however, this command is not always passed between a PC and the revolver.

Answer data

(The data from the Power Revolver is returned in the format of 1-byte capital letter.)

The Power Revolver sends one of the following responses, when the control command from the personal computer is accepted.

Normal response

Header			EM	
R	O	K	CR	LF

Abnormal response

Header			Status		EM	
R	N	G	*	*	CR	LF

Status	Description
05	RS232C parity error
07	RS232C over-run error
08	RS232C framing error
09	An undefined command was received.
10	Another command is being executed.
11	The power supply of power focus unit is not turned on.
12	Though the command for the power focus unit was received, the power focus unit is not connected.

(Response timing to commands)

In response to the control command from the personal computer, the Power Revolver sends its status at the time of accepting the command.

Read command (Use a 1-byte capital letter for the command.)

These commands are sent by the personal computer to know the current status of the Power Revolver.

Basic command

Header			Sub-field			EM	
R	R	D	S	T	U	CR	LF

Reads the status of the Power Revolver from the personal computer.

The response of the Power Revolver to the basic commands above from the personal computer is as below.

Header			Data								EM	
R	O	K	①	②	③	④	⑤	⑥	⑦	⑧	CR	LF

Data	Number of bytes	Response contents
① Operation status of the Power Revolver	1	0 : Ready status 1 : The revolver is rotating.
② Rotation error	1	0 : Normal 4 : Timeout error 5 : Sensor detection failure error
③ Not assigned	1	0 : Normal
④ Not assigned	1	0 : Normal
⑤ Communication	1	0 : Normal 1 : Parity error 2 : Over-run error 3 : Framing error
⑥ Connection status	1	0 : The power focus unit is connected. 1 : The power revolver is connected. 2 : The power focus unit and power revolver are connected.
⑦ Version of the program	1	1 : Ver. 1.00
⑧ Position sensor detection status	1	0 : No sensor detects the position. 1 : Sensor A detects the position. 2 : Sensor B detects the position. 3 : Sensor C detects the position. 4 : Sensor D detects the position. 5 : Sensor E detects the position.

(Response timing to commands)

The Power Revolver sends the response to the personal computer after completion of the processing for the read command.

(Response contents)

Other response contents may be added in the future.

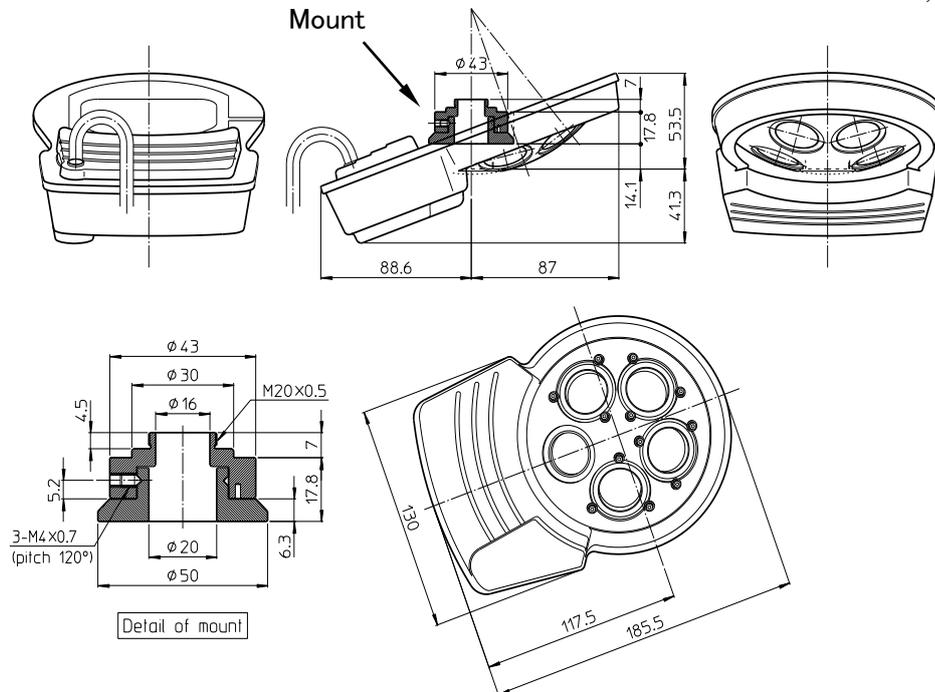
NOTE

1. When one of the communication errors lights up in the control box, the commands (signals) from the personal computer are not accepted. Initiate the control box and personal computer to cancel the error.
2. When a communication error occurs, the command to the power revolver from the personal computer or the response to the personal computer from the power revolver is not transmitted correctly. Cancel the error to transmit a command again.

5.6 External Dimensions

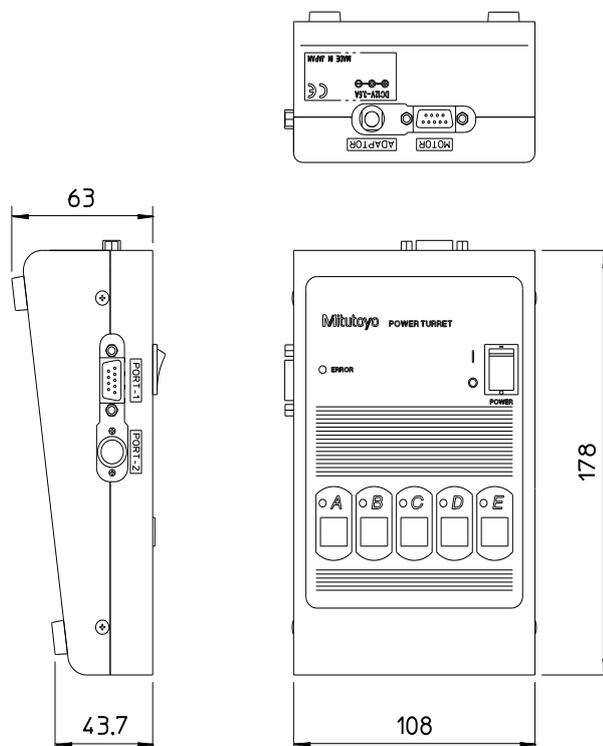
5.6.1 Revolver unit

Unit ; mm



5.6.2 Control box

Unit ; mm



5.7 CE marking / UKCA marking

EMC Directive / Electromagnetic Compatibility Regulations	EN 61326-1 Immunity test requirement: Clause 6.2 Table 2 Emission limit: Class A
RoHS Directive / The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations	EN IEC 63000

China RoHS Compliance Information

This product meets China RoHS requirements. See the table below.

产品中有害物质的名称及含量

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
本体	×	○	○	○	○	○
配件	×	○	○	○	○	○

本表格依据 SJ/T 11364 的规定编制。

○：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。

×：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。



环保使用期限标识是根据《电器电子产品有害物质限制使用管理办法》以及《电子电气产品有害物质限制使用标识要求(SJ/T11364-2014)》制定的,适用于中国境内销售的电子电气产品的标识。

电器电子产品只要按照安全及使用说明内容在正常使用情况下,从生产日期算起,在此期限内产品中含有的有毒有害物质不致发生外泄或突变,不致对环境造成严重污染或对其人身、财产造成严重损害。

产品使用后,要废弃在环保使用年限内或者刚到年限的产品,请根据国家标准采取适当的方法进行处置。

另外,此期限不同于质量/功能的保证期限。

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