No.99MBA119A4
SERIES No.378

# Power Revolver
## (Bright Field)

For
Microscope Unit
WIDE 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:

**DANGER**

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

**WARNING**

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

**CAUTION**

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.

# Labels on Product

### Product Safety Labels

This measuring instrument has been designed and manufactured with human safety taken as a major consideration. Additionally, in order to use it more safely, Product Safety Labels have been applied to the main unit and all peripheral devices. This section describes the label application places and warning information at each place.

Before operating the measuring instrument, be sure to carefully read this section to use it safely for an extended period of service life.

**<Product Safety Labels>**

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

※ For details about where this product safety label is stuck, see Section 2.5.

# 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
    Overvoltege 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 it's 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. For detailed information, please contact Mitutoyo in advance.

# Disposal of Products outside the European Union and Other 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.

# Contents

Service Network

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# 1 Overview

This chapter describes the configuration of the bright-field power revolver that is adapted to Mitutoyo video microscope unit “WIDE VMU Series”. This chapter also describes component names and functions of the revolver.

## 1.1 Outline

The bright-field power revolve is a unit for electrically switching the objectives by installing in the microscope unit WIDE VMU series which has been incorporated in machine equipment.

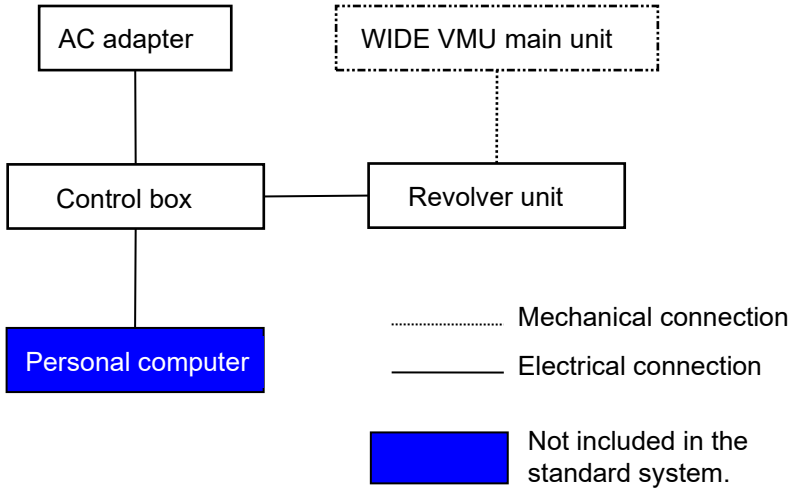
This revolver allows the objectives to be switched without touching directly by hand, and thus makes them free from contamination.

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

**NOTE** **To use this product safely, be sure to first read “Safety Precautions” and “Precautions for Use” described before, and observe those precautions.**

## 1.2 System Configuration

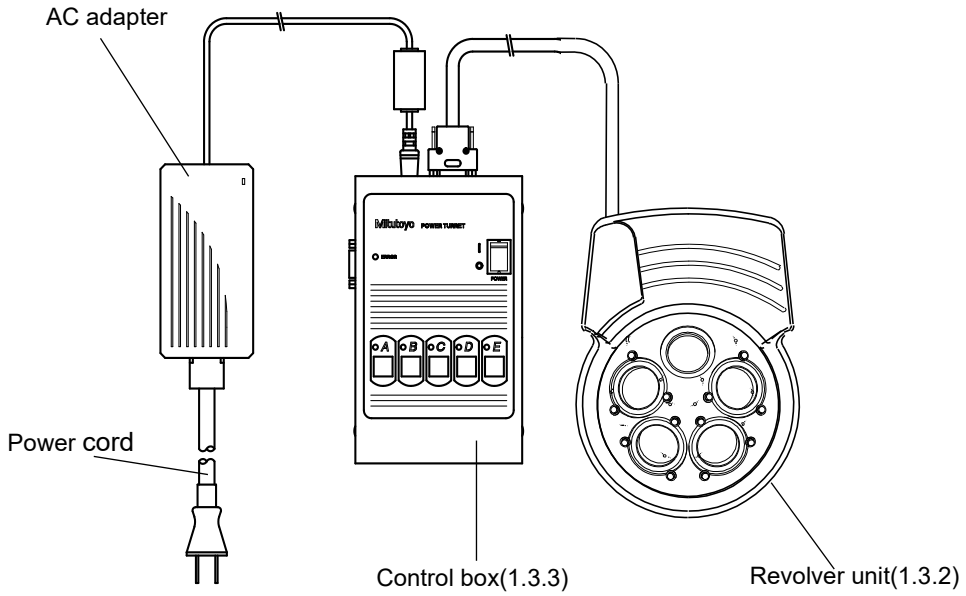
The Power Revolver consists of the revolver unit, control box, and AC adapter.



# 1.3 Name and Function of Each Part

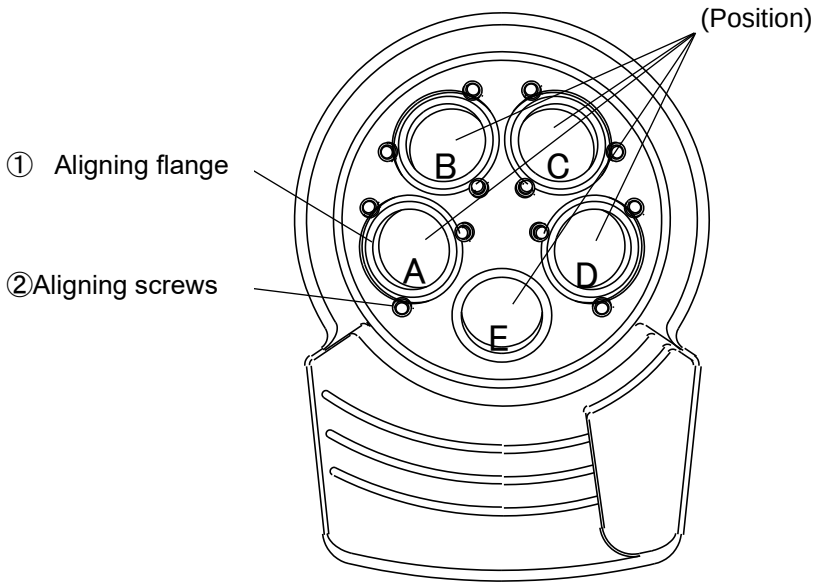
This section gives the name and function of each part of the Power Revolver.

## 1.3.1 System appearance



## 1.3.2 Revolver unit

This unit is mounted on the microscope unit and allows a maximum of 5 objectives to be attached to. A desired objective is selected with the Position Select buttons (see § 1.3.3) on the control box. Revolver units have objective centering mechanisms that can adjust the field of view by slightly moving an objective.




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

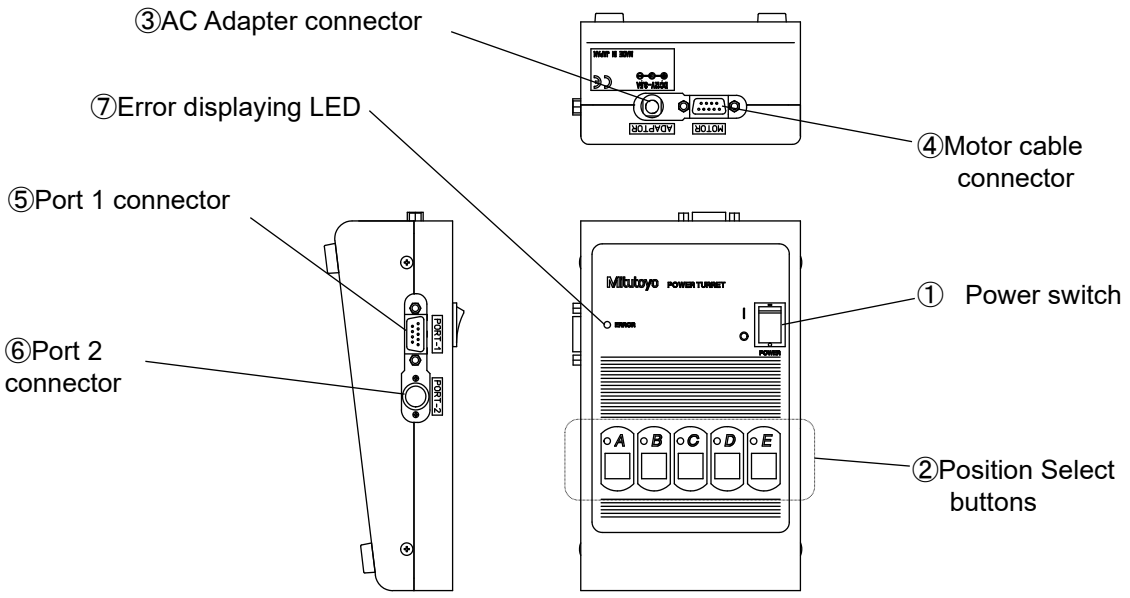
These screws are to align the objective by slightly moving the aligning flange within the horizontal plane.

**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 Control box




① Power switch
Turns on and off the power to the control box.

② Position Select buttons
Either of the buttons is pressed to switch to a desired objective.
The green LED corresponding to the selected objective is lit.

③ AC adapter connector
Connects the AC adapter.

④ Motor cable connector
Connects the revolver unit.

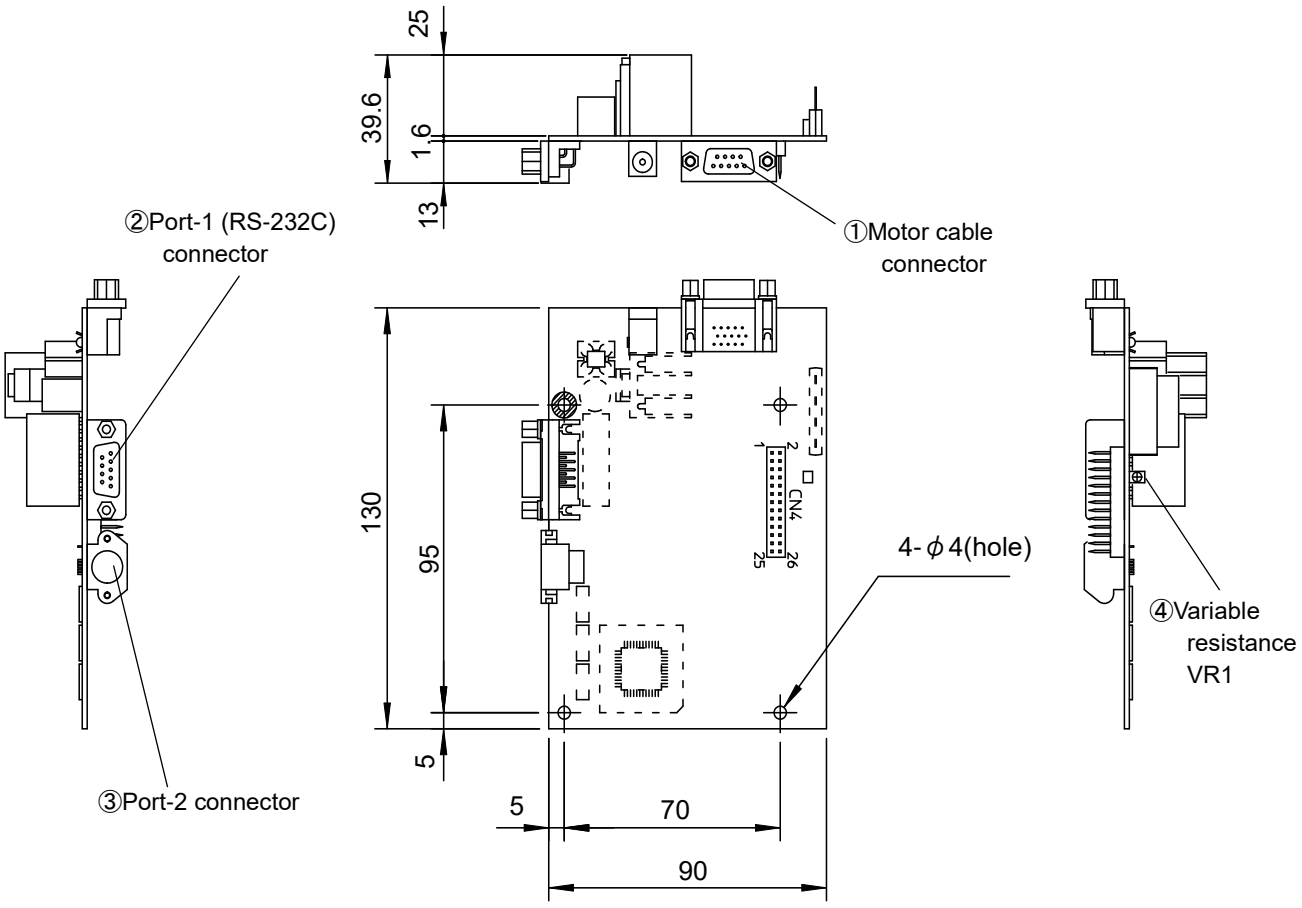
⑤ Port 1 connector (RS-232C)
Connects to the personal computer with the dedicated cable.

⑥ Port 2 connector
Connects to the control box for the Power Focus Unit (option) with the dedicated cable.

⑦ LED Error displaying LED
This red LED is lit when an error has occurred.

## 1.3.4 Control Board

The control board is arranged in the console box. When it is necessary to use the variable resistance “VR1” for performing maintenance, disassemble the console box by seeing Section 5.6.4.




① Motor cable connector
Connects the revolver unit.

② Port-1 (RS-232C) connector
Connects the PC via the dedicated cable.

③ Port-2 connector
Connects the motorized focusing unit’s control box (optional) via the dedicated cable

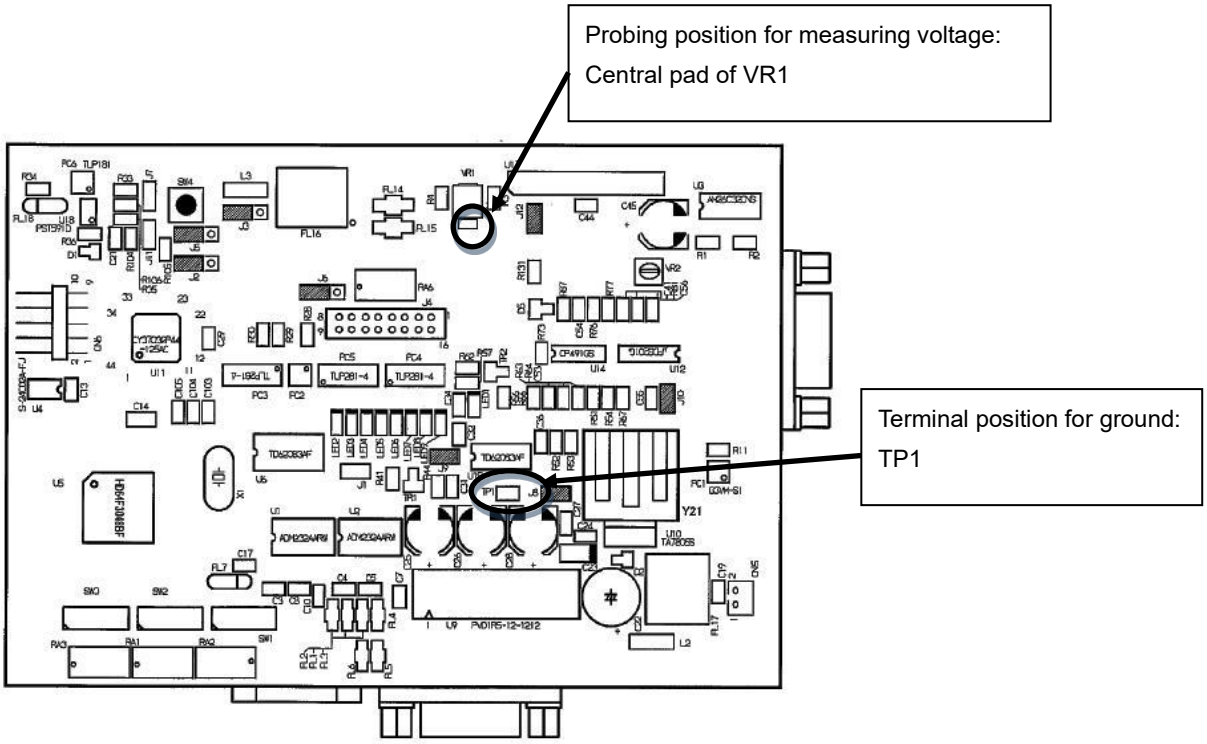
④ Variable resistance VR1
Adjusts the torque around each objective’s stop position finely.

**TIP** When the objective arrangement includes unbalance, or when the power revolver has been used for a long period, the rotational resistance of the revolver becomes large so that overrun or short-run may occur. Such phenomena may be adjusted by using this variable resistance “VR1”.

Probing position for measuring voltage and adjustment method

When you would like to increase the torque for 20 %, rotate the variable resistance “VR1” in such a manner that the measured voltage increases for 20 %.

(Default value of “VR1” at plant shipment: About 3 V)



# 2 Installation

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

## 2.1 Unpacking and Checking

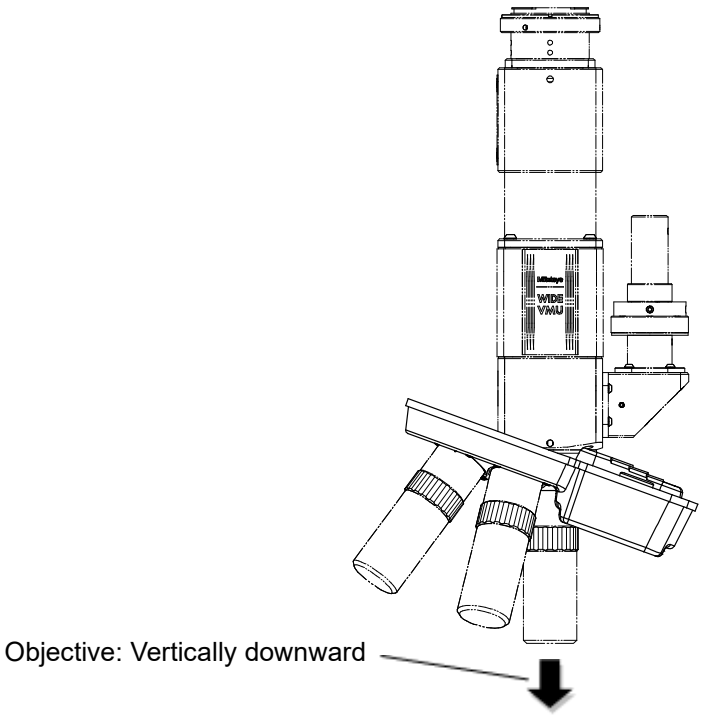
Prior to shipment from the factory, the Power Revolver is thoroughly inspected and its mechanical, optical, and electrical operation are fully guaranteed.

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 Notes on mounting the revolver to instrument

When mounting the power revolver to Mitutoyo video microscope unit or your instrument, pay attention so as to mount the power revolver in the correct orientation.

Namely, mount the revolver unit in such a manner that the objective to be used for observation and measurement is oriented downward in the vertical direction.
Otherwise, the normal rotational motion is not guaranteed.



## 2.3 Mounting the Revolver

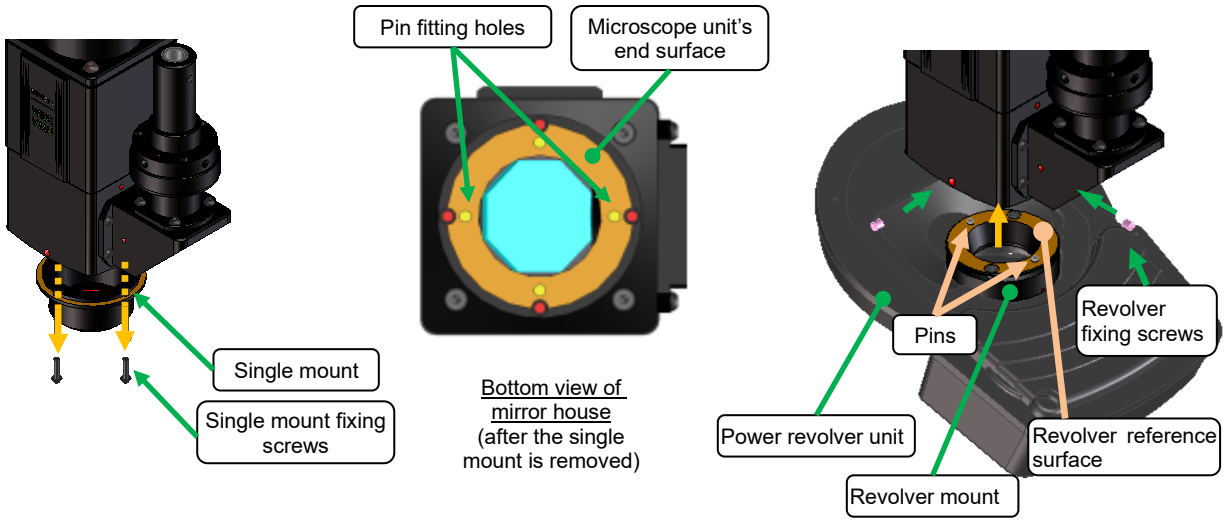
Mount the power revolver unit to the video microscope unit according to the following procedure:

① Loosen the single mount fixing screws (4 pieces of hexagon socket button head cap screws M3) to remove the single mount.

② At the bottom of the mirror house, the microscope unit's end surface and the pin fitting holes can be seen.

③ Insert the revolver mount in such a manner the peripheral surface of the revolver mount is guided by the inner surface of the mirror house's bottom portion. Then in the state that the pins of the revolver mount is fitted into the pin fitting holes of the mirror house, press the revolver's reference surface on the microscope unit's end surface.

④ By using the revolver fixing screws (2 pieces of hexagon socket set screws M4) supplied with the revolver, fix the revolver mount. (Use 2 threaded holes among the 3 threaded holes of the mirror house.)




**CAUTION**

**When loosening the revolver fixing screws, be sure to hold the revolver with your hand. Otherwise, the revolver may drop so that the workpiece or the instrument may be damaged.**

**IMPORTANT**

**Be sure to mount the revolver in the orientation shown in the above figure.**

**NOTE** **When the single mount is removed, the mirror is exposed. Accordingly, pay attention on handling.**

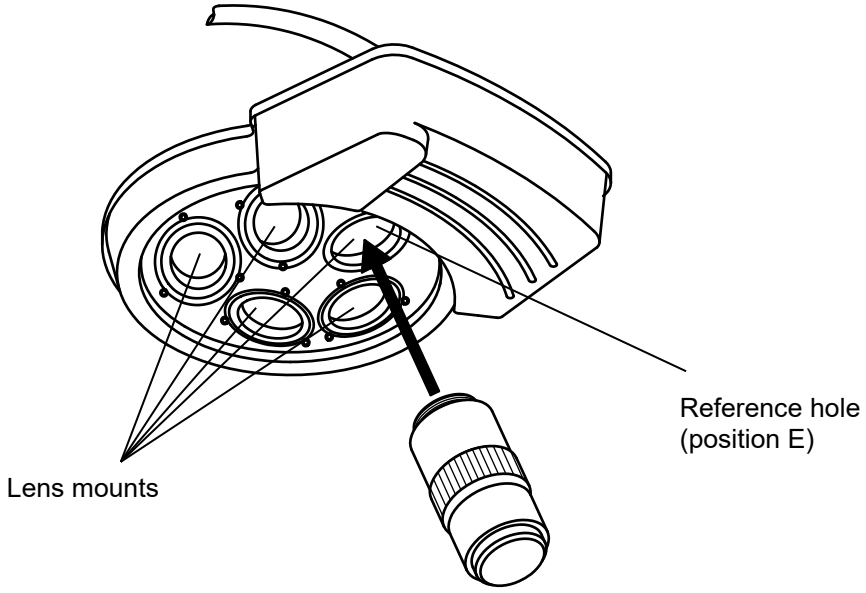
**TIP** **In Mitutoyo WIDE VMU, the position of the objective seat is not changed between when the single mount is attached and when the various revolvers are attached. Consequently, the compatibility of the attached position is guaranteed.**

# 2.4 Mounting the objective

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 4 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 4 objectives or less for use, make sure that the highest magnification lens is attached to the reference hole.




**CAUTION**

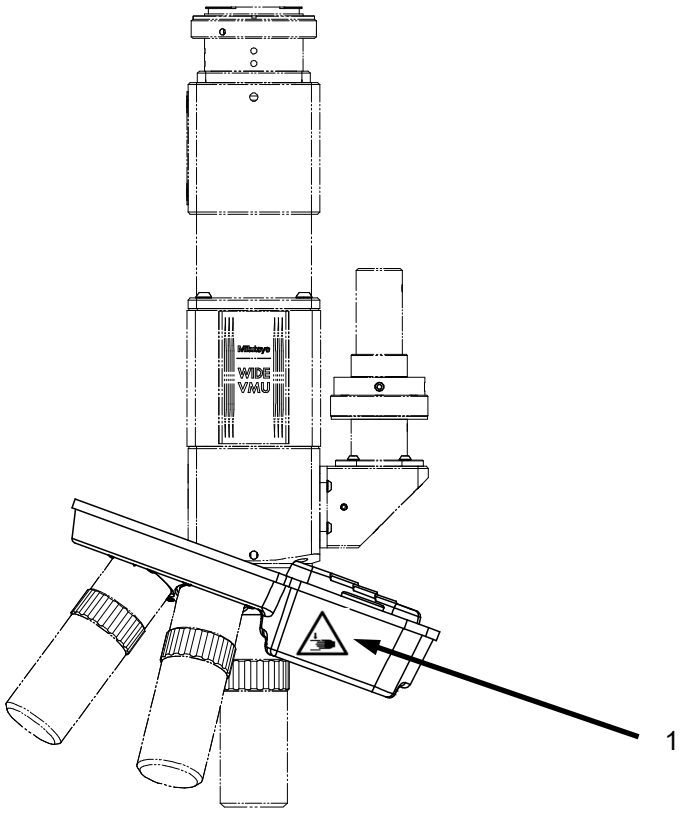
**Before mounting the objective to the power revolver unit, turn off the power of the instrument.**
**In addition, do not insert your finger in the objective mount.**
**Otherwise, personal injury may occur by rotational movement of the revolver.**

**NOTE**

1. **Do not touch the lens surface of the objective.**
2. **Pay attention so as not to drop the objective.**
3. **Do not tighten the objective with an excessive force.**
4. **Store the removed objective in the supplied objective case.**

## 2.5 Sticking Precaution Labels

When mounting the power revolver to the WIDE VMU (Video Microscope Unit), be sure to stick the supplied precaution seal as shown in the figure below.




Example of location where the precaution seal should be stuck

**【Product Safety Labels】**

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

**CAUTION**

**Stick the precaution labels at locations easy to watch, and pay enough attention when handling the power revolver. According to the orientation of mounting the revolver to VMU, stich the precaution labels to locations each to watch.**

# 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 100V and 240VAC ± 10% and have a frequency of 50/60Hz.

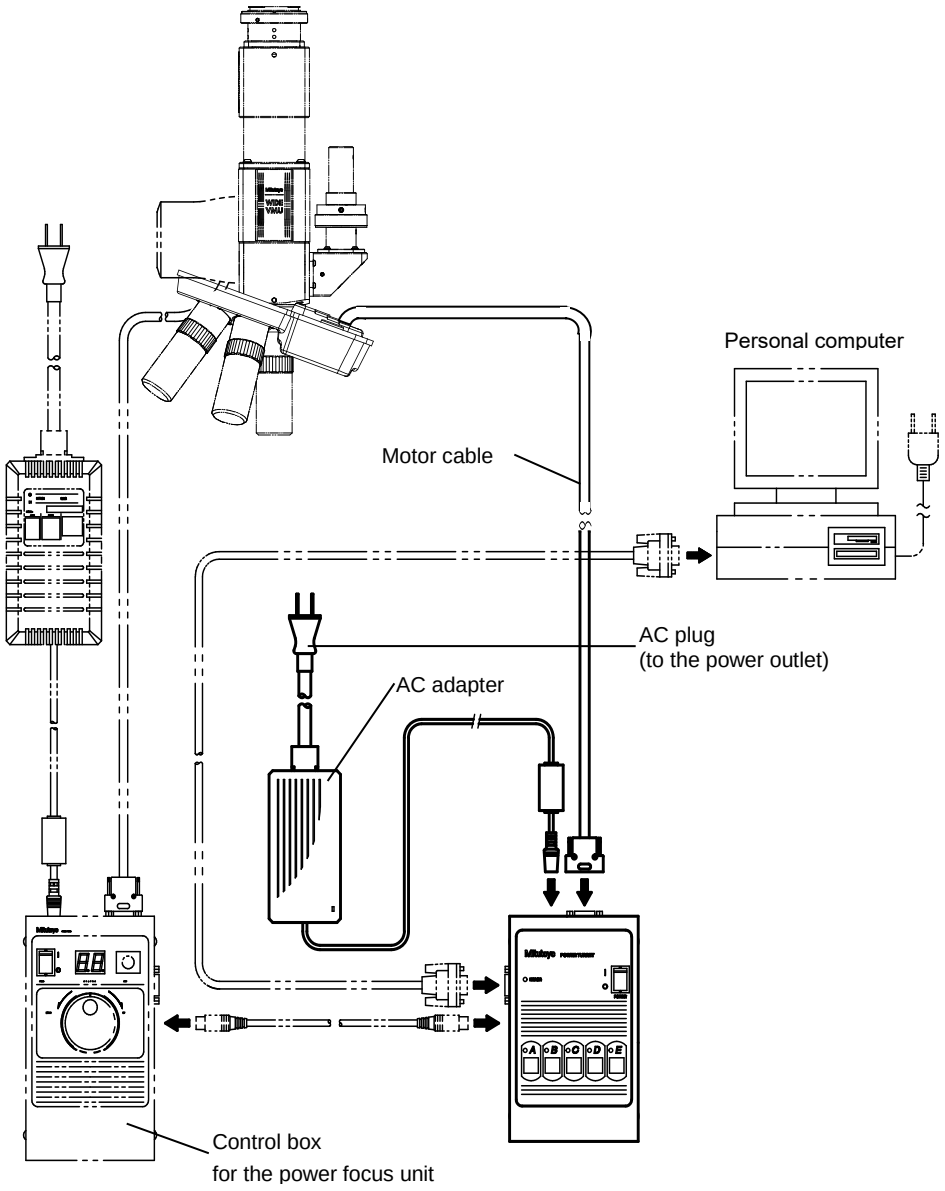
A two-pole outlet or a two-pole outlet with a ground terminal is required as the AC power outlet. Make allowance for the power output capacity in consideration of the total consumption of the system.

**NOTE** **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.**

**TIP** **The system may require a power regulator if power fluctuation is not within ±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.**

## 2.7 Connecting Each Part

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 and the power focus unit are used, connect them using the dedicated cables (optional accessories)



# 2.8 Labeling the Position ID Seals

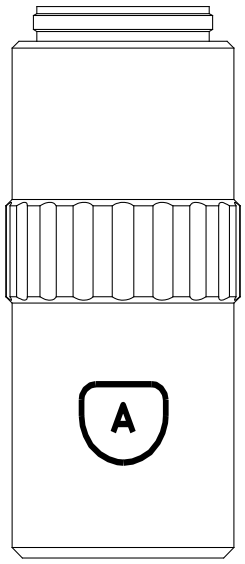
To identify in which position of A, B, C, D and E the individual objectives are attached, label the ID seal around each objective tube.

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 observation position.

③ Label the seal [A] around the tube of the objective that has come in the observation position.

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 2mm), 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.

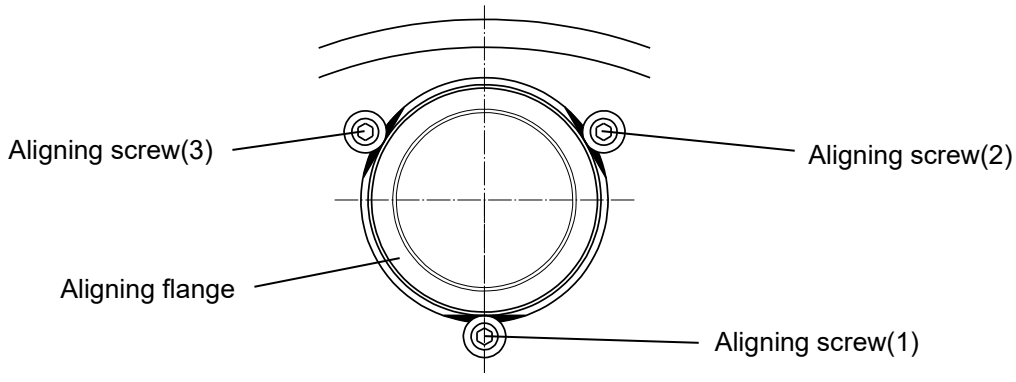
⑩ Repeat steps ⑧ and ⑨ to gradually approach the black circle to the center. Finally tighten the aligning screws to correctly align the black circle with the center.

⑪ After performing the aligning process, confirm that 3 aligning screws for each objective are tightened securely.

**CAUTION**

**On the damage which originates from the handling, Mitutoyo assumes no responsibility.**

⑫ Similarly align the other objectives (3 pieces at most).



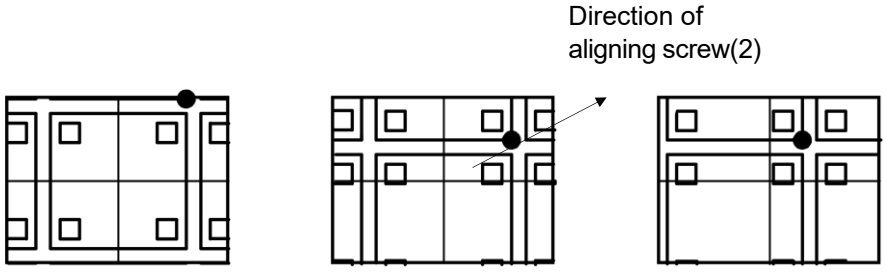




Fig 1 Fig 2 Fig 3

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# 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 the Position Select button corresponding to the current revolver position is lit.)

② Select a desired objective.
Press the Position Select button of the desired objective. Depending on the selected position, the revolver rotates clockwise or counterclockwise so that the rotation angle is smaller..

## 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.

When turning off the power, turn off the control box 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.

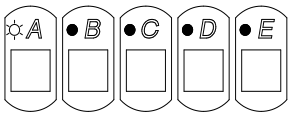
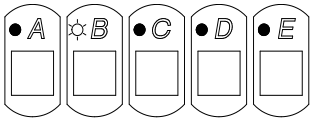
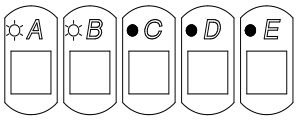
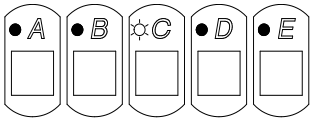
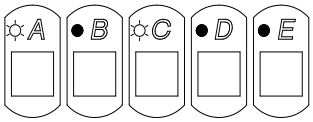
## 4.1 Troubleshooting and Remedies

| Symptoms | Check points | Remedies | Ref. |
|---|---|---|---|
| **The Power Revolver will not rotate when a Position Select button is pressed.** | 1) Check if power is on. | 1) Plug the power cord plug into the power outlet. | |
| | 2) Check if the Position Select button's LED light up. | 2) Turn on the power switch. | 1.3.3 |
| | 3) Check if the Position Select button that has already been selected is pressed. | 3) Press another Position Select button except the button that has been selected. | 1.3.3 |
| | 4) Is the setting of dip switches correct? | 4) Set the dip switch correctly. | 5.6.4 |
| | 5) In addition to the supplied cable between the revolver unit and the console box, is an extension cable used? | 5) Adopt the predetermined connection. (This system cannot use any extension cable.) | |
| **The revolver does not operate by commands from the PC.** | 1) Is the sequence of turning on the power incorrect? | 1) Turn on the power in the sequence of the PC, and then the console box. | 3.2 |
| | 2) Are the commands from the PC single-byte and capital? | 2) Use single-byte and capital letters for the commands. | 5.6.5 |
| | 3) Has the RS232C communication error occurred? | 3) In some models of PC, when the PC is started up, incorrect data is output. Accordingly, when starting up the PC, transmit the error clear command to resume the RS232C communication. | |

| | | | |
|---|---|---|---|
| **The stopping accuracy is not good.** | 1) Are the aligning screws loosened? | 1) Tighten the aligning screws again. | 1.3.2 |
| | 2) Are the revolver fixing screws loosened? | 2) Tighten the revolver fixing screws securely. | 2.3 |
| | 3) Is there backlash and play in the gear system, or are the screws in the gear system loosened? | 3) Contact your dealer or the nearest Mitutoyo sales office (Do not disassemble). Adjustment in Mitutoyo plant is required. | |
| | 4) Is the revolver orientation oblique or horizontal? | 4) Mount the revolver in such a manner that the objective is oriented downward in the vertical direction. In the other orientations, the correct motion and accuracy are not guaranteed. | |
| **The stop position of the revolver cannot be recognized.** | 1) In addition to the supplied cable between the revolver unit and the console cable used? | 1) Adopt the predetermined connection. (This system cannot use any extension cable.) | |
| **Short-run of the revolver occurs.** | 1) Is the setting of dip switches correct? | 1) Set the dip switches correctly. | 5.6.4 |
| | 2) The mass is too large. Is anything other than Mitutoyo objectives mounted to the revolver unit? | 2) Remove anything other than Mitutoyo objectives. | |
| | 3) Is the setting of VR1 too small? (Section 1.3.4) | 3) Rotate the VR1 clockwise to increase the setting. | 1.3.4 |
| | 4) Is there backlash and play in the gear system, or are the screws in the gear system loosened? | 4) Contact your dealer or the nearest Mitutoyo sales office (Do not disassemble). | |
| | 5) In addition to the supplied cable between the revolver unit and the console box, is an extension cable used? | 5) Adopt the predetermined connection. (This system cannot use any extension cable.) | |

| | | | |
|---|---|---|---|
| **Over-run of the revolver occurs.** | 1) Is the setting of dip switches correct? | 1) Set the dip switches correctly. | 5.6.4 |
| | 2) The mass is too large. Is anything other than Mitutoyo objectives mounted to the revolver unit? | 2) Remove anything other than Mitutoyo objectives. | |
| | 3) Is the setting of VR1 too large? (Section 1.3.4) | 3) Rotate the VR1 counterclockwise to decrease the setting. | 1.3.4 |
| | 4) Is there backlash and play in the gear system, or are the screws in the gear system loosened? | 4) Contact your dealer or the nearest Mitutoyo sales office (Do not disassemble). | |
| | 5) In addition to the supplied cable between the revolver unit and the console box, is an extension cable used? | 5) Adopt the predetermined connection. (This system cannot use any extension cable.) | |

## 4.2 Error Messages and Remedies

| Error displaying LED(red) status | Position Select button LED(green) status | Meaning and remedy |
|---|---|---|
| 1. ☼ ERROR |  | RS-232C parity error<br>Slide the dip switch to ON and OFF so as to check the phenomenon again.<br>…Restart the system power |
| 2. ☼ ERROR |  | RS-232C over-run error<br>Slide the dip switch to ON and OFF so as to check the phenomenon again.<br>…Restart the system power |
| 3. ☼ ERROR |  | RS-232C framing error<br>Slide the dip switch to ON and OFF so as to check the phenomenon again.<br>…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.)<br>…Restart the system power |
| 5. ☼ ERROR |  | Sensor detection failure error (occurs if no sensor input comes from anywhere during motor stop.)<br>…Press a Position select button to rotate the revolver. |

**NOTE** Depending on the sequence and timing of turning on or off the power to the console box, the PC and the video microscope unit, an error message may appear.

Be sure to turn on the power in the correct sequence

# 5 Specifications

This chapter describes about the specification on Power Revolver system.

## 5.1 Total Specification

| | |
|---|---|
| Observation | Bright-field observation |
| Maximum number of mountable objectives | 5 |
| Objective aligning mechanism | Provided (For one objective, the aligning mechanism is not provided.) |
| Positioning accuracy<br>(Repeatability of stopping accuracy) | 3 μm (2σ) |
| Life | 1 million positionings |
| Maximum power consumption | 10 W |
| Input voltage | AC 100 ~ 240 V |
| External input/output interface | RS-232C |

## 5.2 Revolver unit

| | |
|---|---|
| Number of mounting holes for the objective | 5 (fixed hole 1, aligning hole 4) |
| Visual field aligning range | ±0.5mm |
| Drive method | Gear drive with a DC motor |
| External dimensions | 130(W) x 186(D) x 47(H) mm<br>5.12”(W) x 7.32”(D) x 1.87”(H) |
| Mass | Approx. 1800 g |

## 5.3 Control Box

| | |
|---|---|
| LED display | 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<br>4.25'(W) x 6.93"(D) x 2.48"(H) |
| Mass | Approx. 800 g |

## 5.4 Accessories

| Part name | Part No. | Quantity | Remark(※1) |
|---|---|---|---|
| Hexagon socket button head cap Screws M4x6 | A162-3221U | 2 pcs | ○ |
| Warning seal ; Crushing of Hands | 42ZAA203A | 3 pcs | ○ |
| Position ID seal | 12BAC011 | 4 sets | ○ |
| 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 | 99MBA119A | 1 copy | ○ |
| RS-232C cable（2m） | 12AAA807 | — | △ |
| Link cable（0.6m） (※2) | 12AAB283 | — | △ |

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

2）Used for linking the power revolver with the power focus unit.

## 5.5 CE marking / UKCA marking

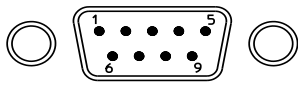
| | |
|---|---|
| EMC Directive / Electromagnetic Compatibility Regulations | EN61326-1<br>Immunity test requirements Clause 6.2Table2<br>Emission class:ClassA |
| RoHS Directive / The Restriction of the Use of Certain HazardousSubstances in Electrical and Electronic EquipmentRegulations: | EN IEC 63000 |

## 5.6 Specification for Connecting a Personal Computer

### 5.6.1 RS-232C communication protocol

| | | |
|---|---|---|
| Communication method | : | Half duplex |
| Synchronizing method | : | Asynchronous (start/stop method) |
| Baud rate | : | 1200, 2400, 4800, or 9600(*1) bps |
| | | (*1 factory setting, selectable with DIP switch） |
| Data bit | : | 8 bits (ASCII code) |
| Parity bit | : | None/even/odd |
| Stop bit | : | 1 bit |
| Flow control | : | None |

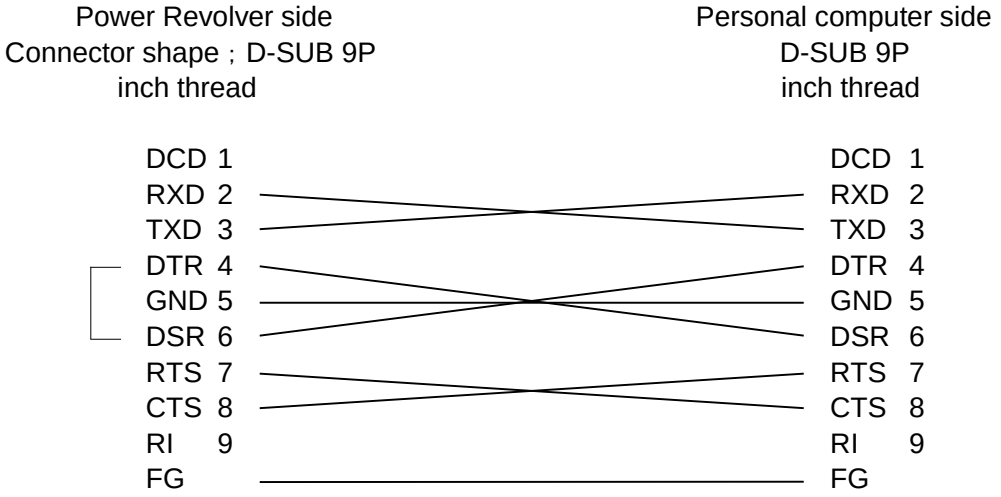
## 5.6.2 RS-232C connector

| Connector shape | Pin No. | Signal name | I/O（※） | 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 |

※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).

## 5.6.3 Connection of RS−232C cable

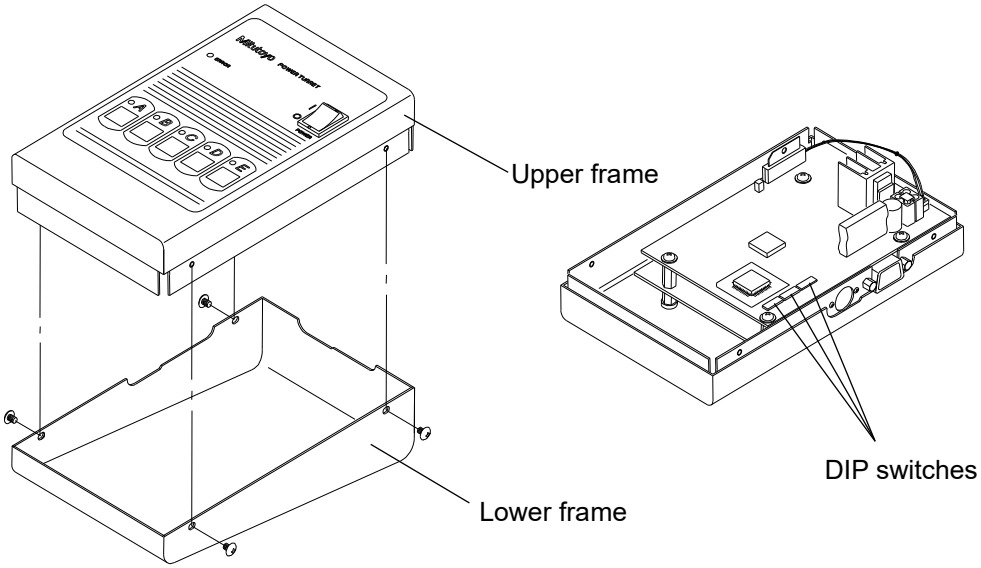


### 5.6.4 Setup of DIP switches

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.

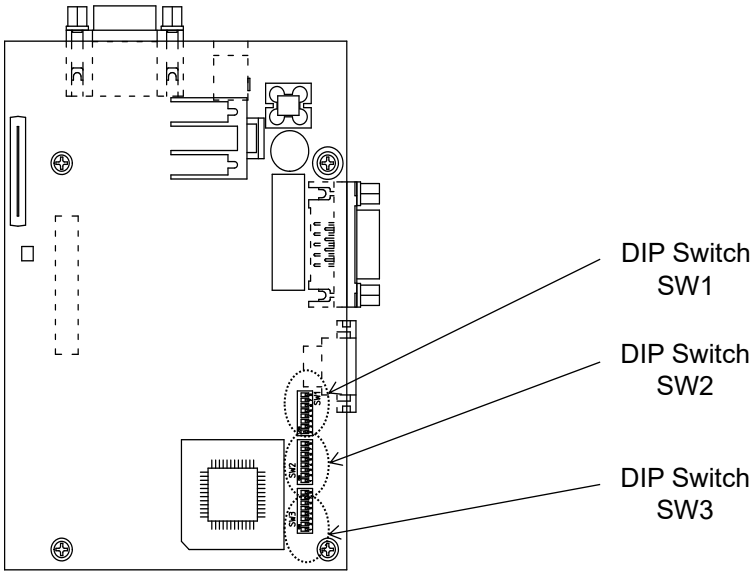
① Disassembling the control box

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 DIP switch position

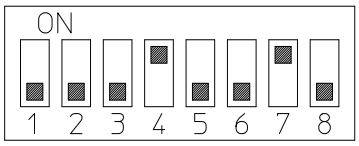
Confirm the position of the DIP switch to be changed.

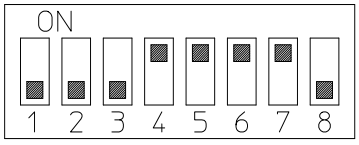
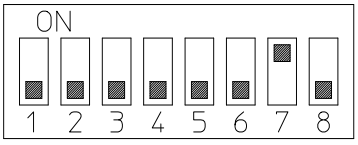



**CAUTION**

**Before performing this operation, be sure to turn off the power.**

③ Setting DIP switches

| DIP switch No. | SW3 | | |
|---|---|---|---|
| Factory setting |  | | |
| **Operation** | **Switch No.** | **setting** | **Description** |
| RS-232C Baud rate | **1** | **※1** | ※1 SW No. 1: 1200 ON, 2400 ON, 4800 OFF, 9600 OFF<br>※2 SW No. 2: 1200 ON, 2400 OFF, 4800 ON, 9600 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 |
| Fixed | **5** | **OFF** | Don't change |
| | **6** | **OFF** | |
| | **7** | **ON** | |
| | **8** | **OFF** | |

| DIP switch No. | | SW1 | SW2 |
|---|---|---|---|
| Factory setting | |  |  |
| **Operation** | **SW No.** | **Setting** | |
| Fixed | **1** | **OFF** | **OFF** |
| | **2** | **OFF** | **OFF** |
| | **3** | **OFF** | **OFF** |
| | **4** | **ON** | **OFF** |
| | **5** | **ON** | **OFF** |
| | **6** | **ON** | **OFF** |
| | **7** | **ON** | **ON** |
| | **8** | **OFF** | **OFF** |

## 5.6.5 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 from A, to 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: Error clear command to be used when RS232C communication error has occurred. It is recommended to transmit this command to the revolver after the PC has been started up. Note that while RS232C communication error is continued, this command from the PC may not be received by 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 |
|---|---|
| 0 5 | RS232C　parity error |
| 0 7 | RS232C　over-run error |
| 0 8 | RS232C　framing error |
| 0 9 | An undefined command was received. |
| 1 0 | Another command is being executed. |
| 1 1 | The power supply of power focus unit is not turned on. |
| 1 2 | 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 | Description |
|---|---|---|
| ①Operation status of the Power Revolver | 1 | 0 : Ready status<br>1 : The revolver is rotating. |
| ② Not assigned | 1 | 0 : Fixed value |
| ③ Not assigned | 1 | 0 : Fixed value |
| ④ Not assigned | 1 | 0 : Fixed value |
| ⑤Communication | 1 | 0 : Normal<br>1 : Parity error<br>2 : Over-run error<br>3 : Framing error |
| ⑥Connection status | 1 | 0 : The power focus unit is connected.<br>1 : The power revolver is connected.<br>2 : The power focus unit and power revolver are connected. |
| ⑦Version of the program | 1 | 1 : Ver. 1.00 |
| ⑧Position sensor detection status | 1 | 0 : No sensor detects the position.<br>1 : Sensor A detects the position.<br>2 : Sensor B detects the position.<br>3 : Sensor C detects the position.<br>4 : Sensor D detects the position.<br>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.

(About contents of response)

New numerical values may be added to the response.

**NOTE**

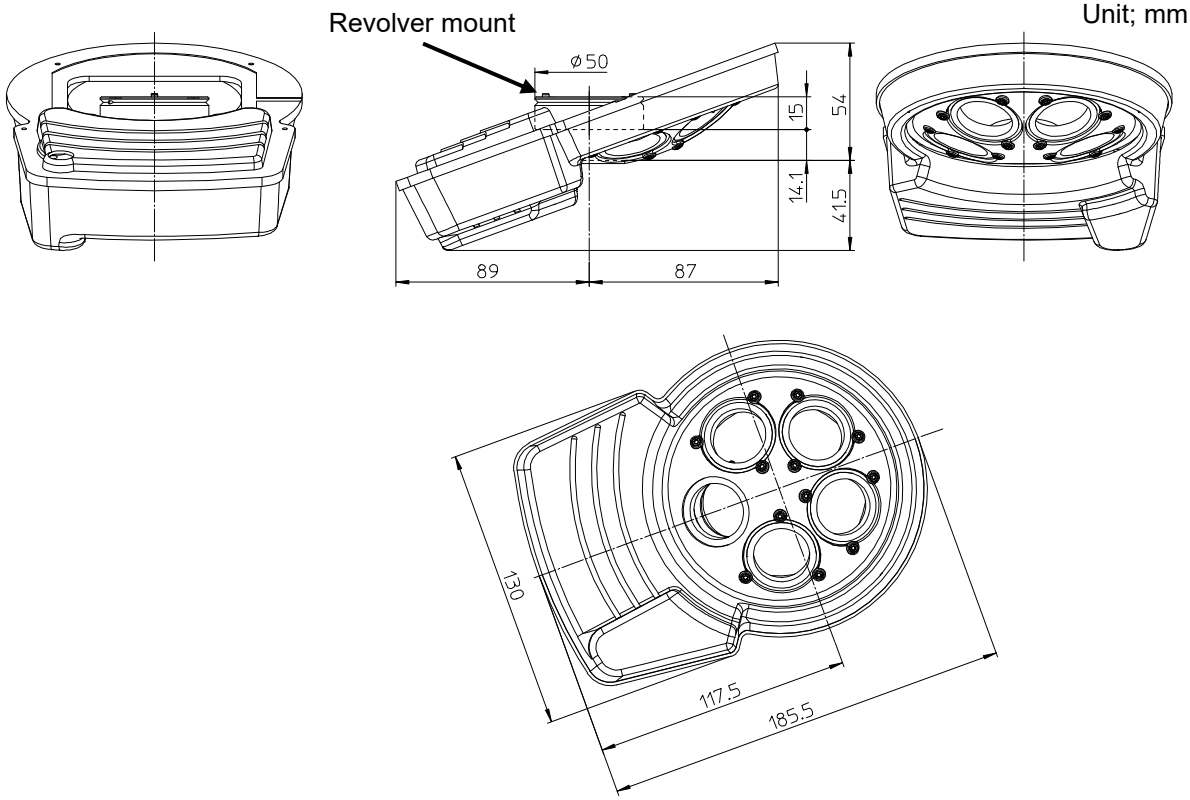
1. **When the communication error indication is lit on the console box, the revolver cannot receive communication from the PC. Turn off the power switches of the console box and PC, and then turn on those power switches again to resolve the error.**

2. **When a communication error has occurred, commands from the PC to the revolver, or responses from the revolver to the PC are not correctly communicated. Resolve the error, and then transmit the command again.**

# 5.7 External Dimensions

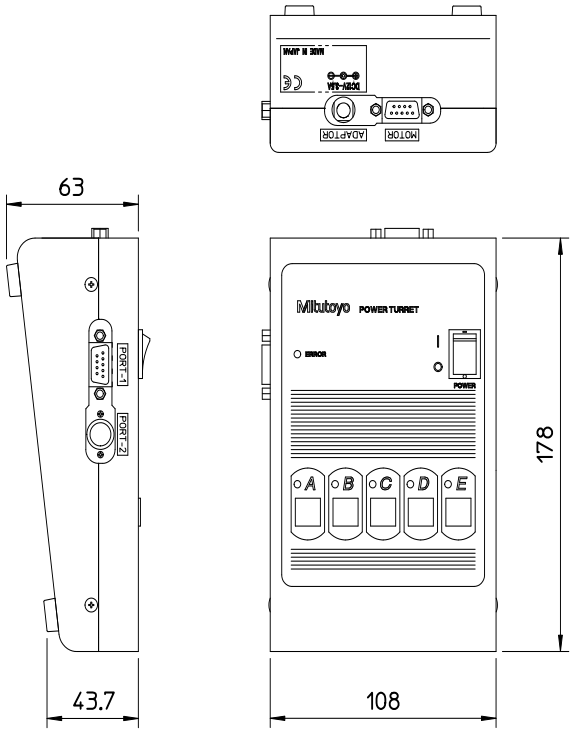
## 5.7.1 Revolver unit

Unit; mm




## 5.7.2 Console box

Unit; mm



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*As of October 2020

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