

Nikon

Measuring Microscope MM-200

Instructions

MICROSCOPY  METROLOGY SERVICES
Suisse made.



RYF AG
Bettlachstrasse 2 · CH-2540 Grenchen
Tel. +41 32 654 21 00
ryfag@ryfag.ch · www.ryfag.ch

Thank you for purchasing this Nikon product.

This instruction manual, which describes basic microscope operations, is intended for users of the Nikon measuring microscope MM-200.



To ensure correct use, please read this manual carefully before operating the product.

- This manual may not be reproduced or transmitted in whole or in part without Nikon's express consent.
- The contents of this manual are subject to change without notice.
- Although every effort has been made to ensure the accuracy of this manual, errors or inconsistencies may remain. If you note any points that are unclear or incorrect, please contact your nearest Nikon representative.
- Some of the products described in this manual may not be included in the set you have purchased.
- Make sure you have read the manuals for any other products attached to or to be used with this product.

● Warning/Caution symbols used in this manual

Although Nikon products are designed to provide the utmost safety, ignoring safety precautions or improper use may result in personal injury or property damage, as well as voiding the terms of the warranty. To ensure safe use, please read the instruction manual carefully and thoroughly before trying to operate the instrument. Do not discard this manual. Store in a convenient location near the product for ready reference.

In this manual, safety precautions are indicated by the following symbols. For safe, correct use of the product, always follow the instructions indicated by these symbols.

Symbol	Meaning
 WARNING	Disregarding instructions indicated by this symbol may result in death or serious injury.
 CAUTION	Disregarding instructions indicated by this symbol may result in injury or property damage.

Safety Precautions

WARNING

1. Intended use of the product

This product is a precision measuring instrument. Use only for measurements and observations.

2. Do not disassemble.

Disassembly may result in malfunctions and/or electric shock and will void the terms of the warranty.

Never attempt to disassemble any part other than the parts described in this manual. If you experience problems with the product, contact your nearest Nikon representative.

3. Read the instruction manual carefully.

To ensure safety, carefully read this manual and the manual provided with any other equipment used with this product. Observe all warnings and cautions given at the beginning of each manual.

4. Use only the specified power cord and AC adapter.

Always use the specified power cord and AC adapter. (Refer to Section 8.14 for the specific power cord and Section 8.10 for the specific AC adapter.)

Use of a cord or AC adapter other than the specified type may lead to malfunction, overheating, or fire.

This product is classified as subject to Class I protection against electrical shock. Make sure it is connected to an appropriate ground terminal.

5. Turn off the power switch before plugging in the power cord and connecting the AC adapter.

Always turn off the microscope power switch (turn it to the "O" position) before plugging in the power cord and connecting the AC adapter.

Plugging in the power cord or connecting the AC adapter with the power switch turned on may result in electric shock or malfunction.

6. Handling the AC adapter

Keep the AC adapter in a well-ventilated place.

Covering or placing an object on top of the adapter will block heat radiation and may result in overheating.

7. Weight of the workpiece

The maximum weight that may be placed on the stage is 5 kg. Never exceed the maximum permissible weight, taking into consideration not only the weight of the workpiece but also the weight of the clamps, etc.

Exceeding the maximum permissible weight could cause the stage glass to break, which could result in serious injury or a major accident.

8. LEDs

This product uses LEDs, and is designated a Class 1 LED product.

⚠ CAUTION

1. Isolate the product from the power source during assembly, connection/disconnection of cords, and maintenance.

Always turn off the power switch(es) of the product (turn it (them) to the "O" position) and unplug the power cord from the wall outlet before assembly, connecting or disconnecting of cords, and cleaning of the product.

Attempting those work with the microscope connected to a power source may result in electric shock or malfunction.

2. Use the specified illuminator.

Always use the specified illuminator. (Refer to Section 8.13 for the specific illuminator.)

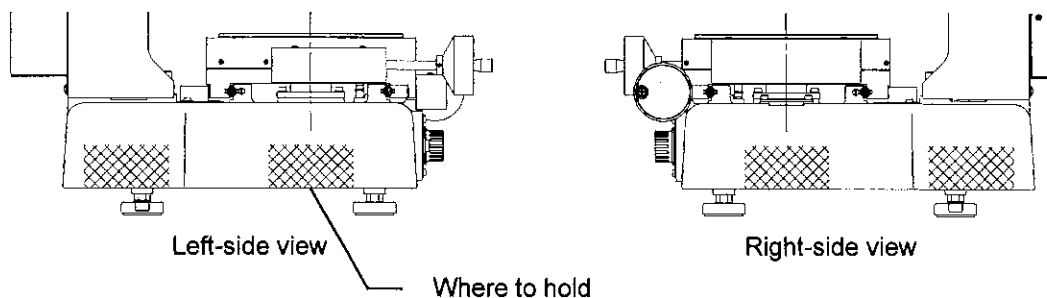
Use of an illuminator other than the specified type may lead to malfunction, overheating, or fire.

3. Cautions on installing and transferring the microscope

The MM-200 main unit by itself weighs approximately 40 kg.

When installing or moving the microscope, note the following to avoid injury or malfunction if the microscope falls or is knocked over:

- Remove the optical head and counter display when transporting the microscope.
- Use the provided retaining fixtures to secure the stage and green filter slider in place when transporting the microscope.
- For transporting, the microscope must be carried by at least two people.
- When lifting the microscope, hold the both sides of the microscope base with hands and avoid letting it fall.
- Do not lift the microscope by the focusing mount, stage, or controller on the back of the pillar. Doing so may damage the microscope.
- Install the microscope on a surface plate or sturdy work bench.
- Do not use the microscope installed on an uneven surface or sagging table.
- When installing the microscope, be careful to avoid catching your fingers or hands.



 **CAUTION**

4. Avoid contact with water.

Never allow water to come into contact with the product, and keep the product away from liquids.

Splashing water onto the product may cause a short, resulting in malfunction or abnormal heating.

If water is splashed onto the product, immediately turn off the power switch (turn it to the "O" position) and remove the power cord from the receptacle. Then wipe off moisture with a dry cloth or something similar.

If water enters the product, do not use; in this case, contact your nearest Nikon representative.

5. Cautions on assembling the product

- Take care to avoid pinching your fingers or hands during product assembly.
- Scratches or fouling such as fingerprints on optical components (such as lens and filters) will degrade microscope images. Be careful to avoid scratches or direct contact with the lens and filters.
- Connect the specified power cord to the AC adapter and plug the power cord into a 2-prong outlet with a ground terminal.
- When it starts thundering, immediately turn off the power of the product and unplug the power cord from the wall outlet to prevent malfunction.

6. Remove all covers from the product before switching on.

Do not use the product while covered with a cloth, etc., as this will give rise to abnormal heat, which could cause a fire.

7. Caution concerning long, sustained observations

To relieve fatigue resulting from long observation sessions, limit continuous observations to one hour.

Take at least 10- to 15-minute breaks between observation sessions. Adjust the layout of other equipment and the height of your chair.

Notes on handling the product

1. Handle the product gently.

This product is a precision optical instrument and requires gentle handling. Avoid subjecting it to sudden impact and shocks.

Even relatively minor impacts are capable of affecting the precision of the objective.

2. Weak electromagnetic waves

The product emits weak electromagnetic waves. Do not place precision electronic devices near the product to avoid degrading their performance. If TV or radio reception is affected, move the TV or radio farther away from the product.

3. Scratches, dirt, and foreign particles on the lens

Scratches or fouling such as fingerprints on optical components (such as lens and filters) will degrade microscope images. If these parts become dirty, clean them as described in chapter "7. Care and Maintenance" at the end of this manual.

4. Installation location

This product is a precision instrument. Use or storage in inappropriate environments may result in malfunctions or poor performance. Consider the following factors when selecting an installation location:

- If at all possible, install in a location with a constant temperature and humidity or in a dry location. Installing the product in hot, humid locations may result in mildew formation or condensation, impairing performance or generating malfunction.
- Install in a vibration-free place.
- Install on a surface plate or work bench.
- Do not use the microscope installed on an uneven surface or sagging table.
- Before installing the microscope, make sure that the upper surface of the table is level and free of dust and dirt.
- Install the product at least 10 cm away from walls.
- Choose a location less exposed to hazards in the event of collisions, earthquakes, or other potential disasters. To keep the product from falling, use strong rope or other means if necessary to secure it to the working desk or to another heavy, stable item.
- Avoid locations exposed to direct sunlight, locations immediately under room lights, and other bright locations.
- Avoid locations with excessive dust. Keep the microscope covered when not in use (for example, with a cover to avoid dust accumulation).
- To avoid splashes, do not use the product near water.
- Select a layout that allows easy removal of the power cord from the AC inlet of the AC adapter in the event of an emergency.
- Room lights just above the product may enter the objective as extraneous light. If possible, switch off room lights directly above the product when making observations.

5. Z-axis knob

- Never turn the Z-axis knobs on the left and right sides of the product in opposite directions at the same time. Doing so may damage the product.
- Turning the Z-axis knobs past its farthest point will damage the product. Never use undue force when turning the knobs.
- Avoid excessive loosening of the rotation torque for the Z-axis knob. Excessive loosening may cause the optical head to drop down on its own weight, damaging the workpiece or the objective.

6. For high-magnification objectives, adjust focus by moving the optical head away from the workpiece.

When objectives that have shorter working distances (W.D.: distance between the tip of objective and the focal plane) are used, the tip of the lens may come into contact with the workpiece during focusing. To avoid this, lower the objective end to the position slightly within the working distance, then focus by raising the optical head.

Note: Objectives in a range from 1x to 10x are best recommended.

If any of the objectives of 20x, 50x or 100x is used, failures such as difficulty focusing or the dia-illumination is not bright enough might occur.

7. Disposal

Before disposing of the microscope, contact a waste contractor for disposal as industrial waste, or dispose in accordance with applicable ordinances and rules.

8. Sequence in which equipment is turned on

If you plan to use the measuring microscope with peripherals (e.g., DP console or printer), turn on the peripheral(s) first. The measuring microscope should be the last device turned on.

Turning on peripherals after the microscope may prevent the microscope from detecting them and may lead to malfunctions.

If you do not plan to turn on peripherals connected via E-BUS, disconnect the E-BUS connecting cable. Leaving unused peripherals connected may lead to malfunctions.



9. After turning on the power

It takes about eight seconds to display counting values on the counter display, then become ready state for the measurement when you turn on the power.

Do not turn the brightness control dial during this period.

Turning the brightness control dial before counting values appear on the counter display may lead to malfunctions.

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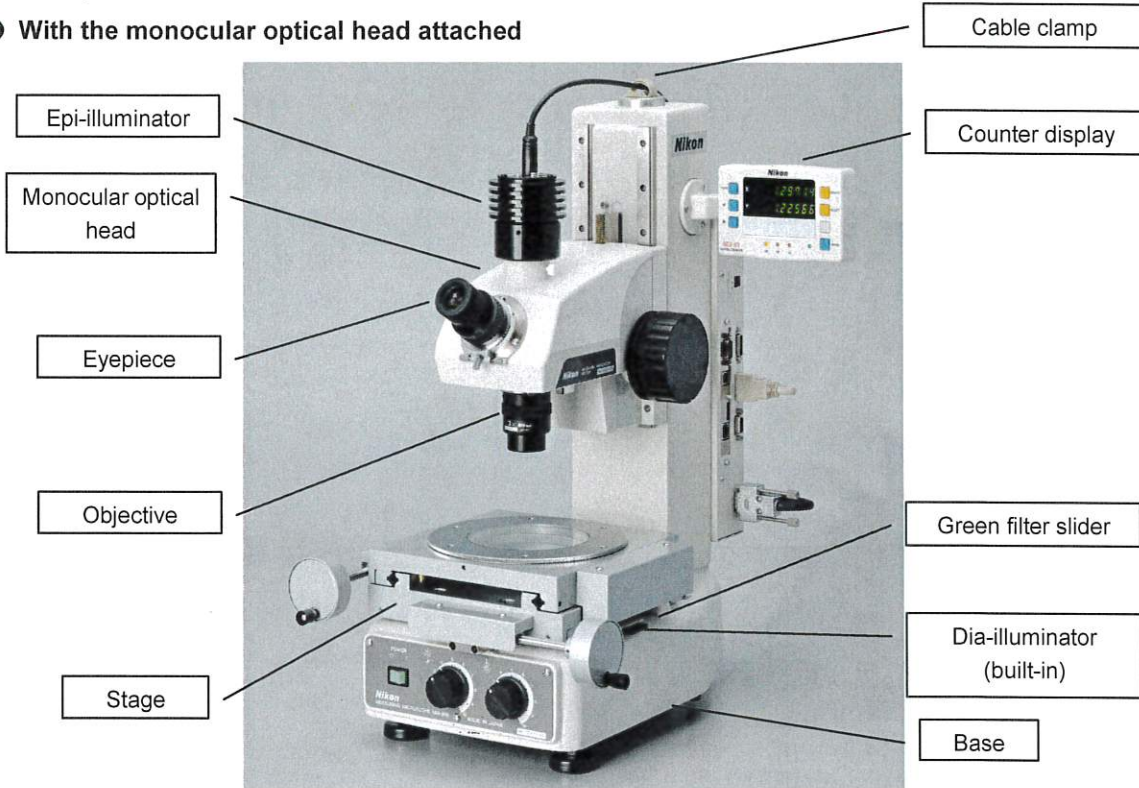
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1. Overall Configuration

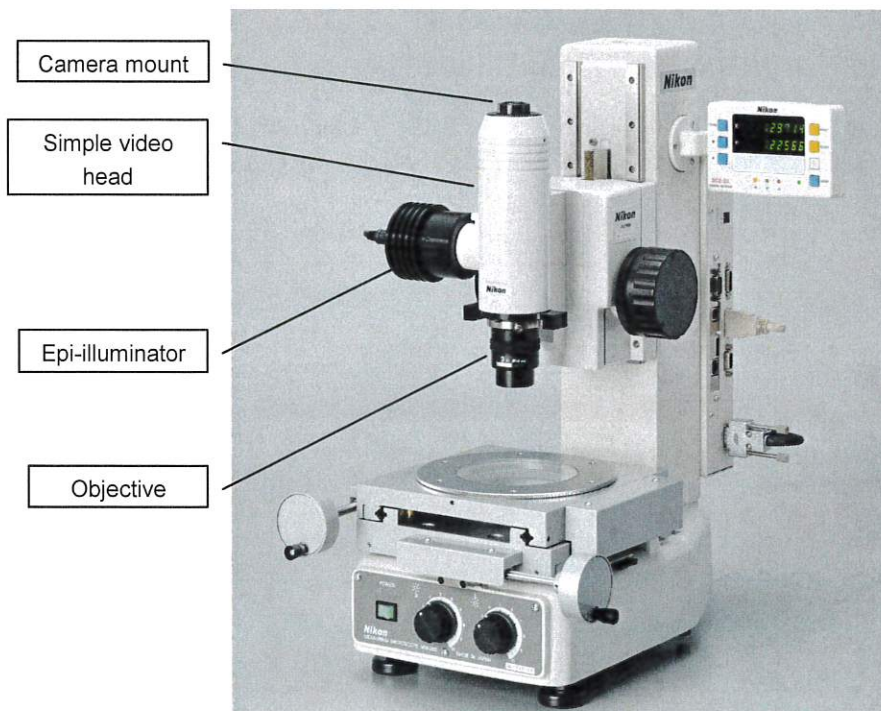
The measuring microscope MM-200 is a system product that allows selection of optical heads based on the measurement needs.

From the illustration and table shown below, confirm the parts combinations of your measuring microscope.

● **With the monocular optical head attached**



● **With the simple video head attached**



1.1 Monocular optical head and simple video head

The monocular optical head or simple video head can be attached to the measuring microscope MM-200.

The binocular eyepiece tube or camera cannot be attached to the monocular optical head.

The monocular eyepiece or binocular eyepiece cannot be attached to the simple video head.

1.2 Camera

The C-mount camera is attached to the simple video head. (Nikon DS-2M series is recommended.)

Refer to the instruction manual provided with the camera to connect the camera head and CCU (camera control unit.)

1.3 Concentric circle reticle and protractor eyepiece

Besides the standard crosshairs reticle, the concentric circle reticle for measuring and protractor eyepiece can be attached to the monocular optical head.

For detail, refer to "4.4 Connecting/setting optional accessories."

1.4 Illuminator

Use the specified LED illuminator for epi-illumination.

Dia-illuminator is built in the microscope base.

You cannot use other illuminator for epi-illumination and dia-illumination.

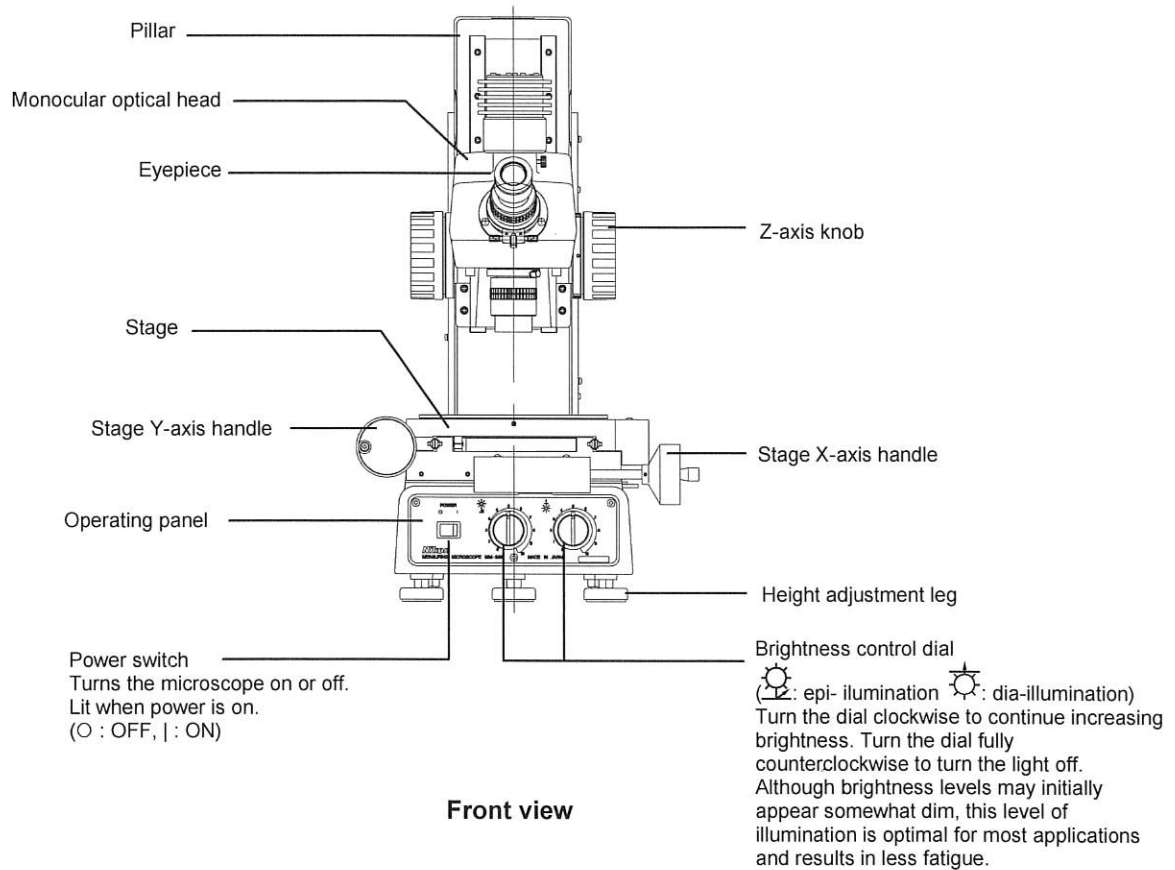
1.5 Stage

The stage is fixed to the microscope base.

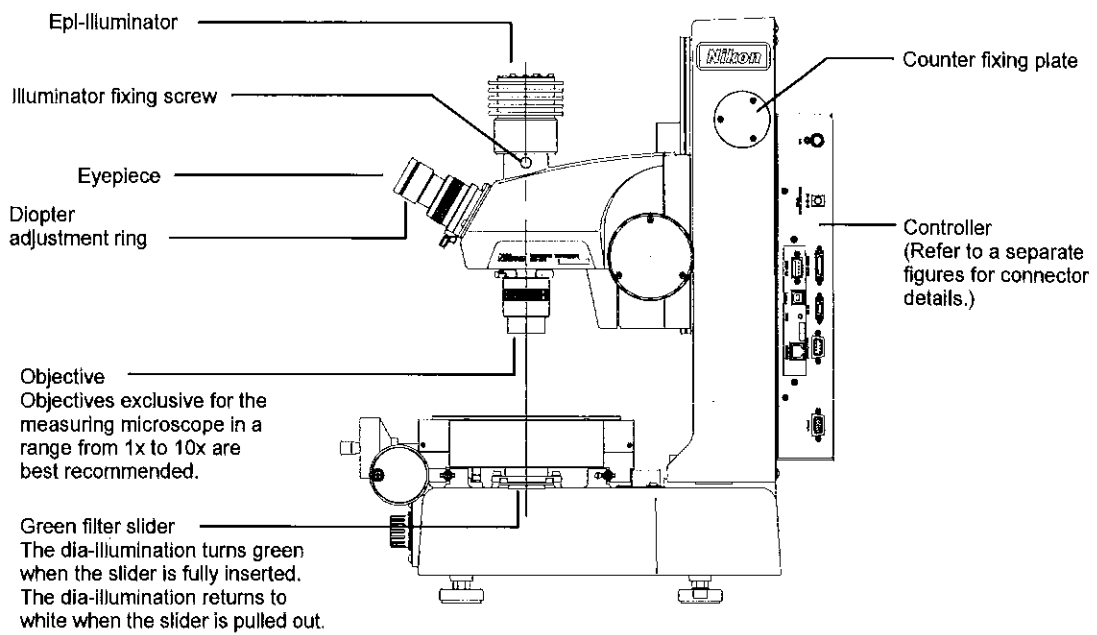
Other stages cannot be mounted.

2. Part Names and Functions

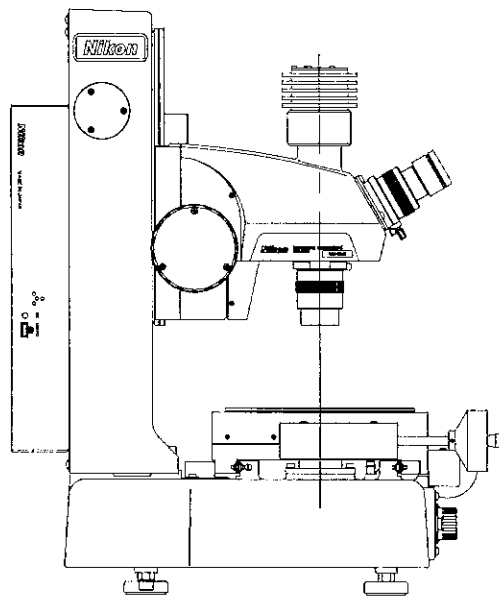
2.1 When the monocular optical head is attached (For the visual observation)



2. Part Names and Functions

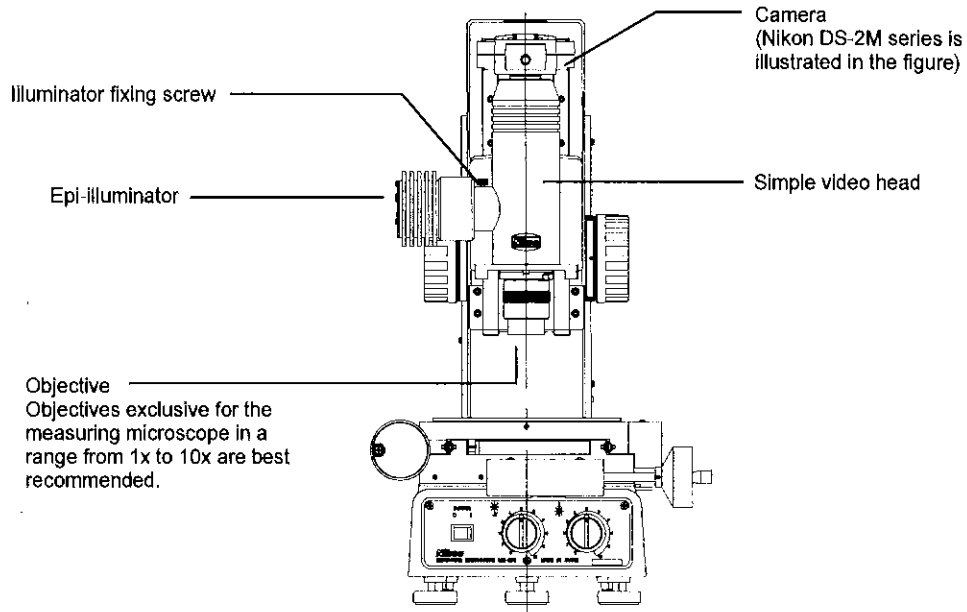


Right-side view



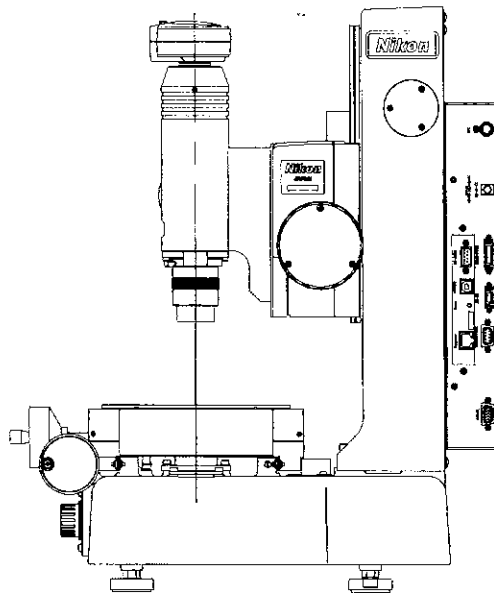
Left-side view

2.2 When the simple video head is attached (For the camera observation)



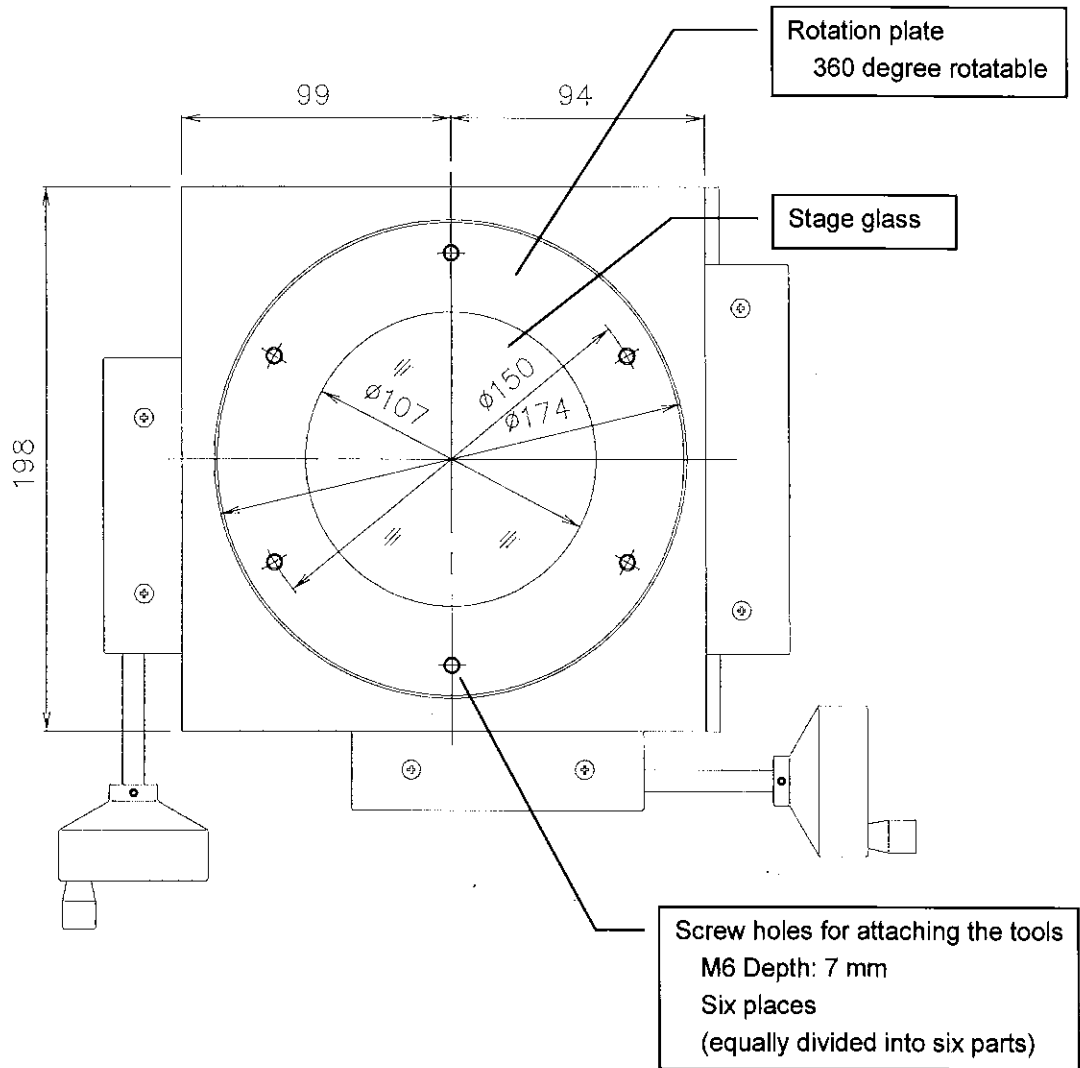
Objective
Objectives exclusive for the measuring microscope in a range from 1x to 10x are best recommended.

Front view



Right-side view

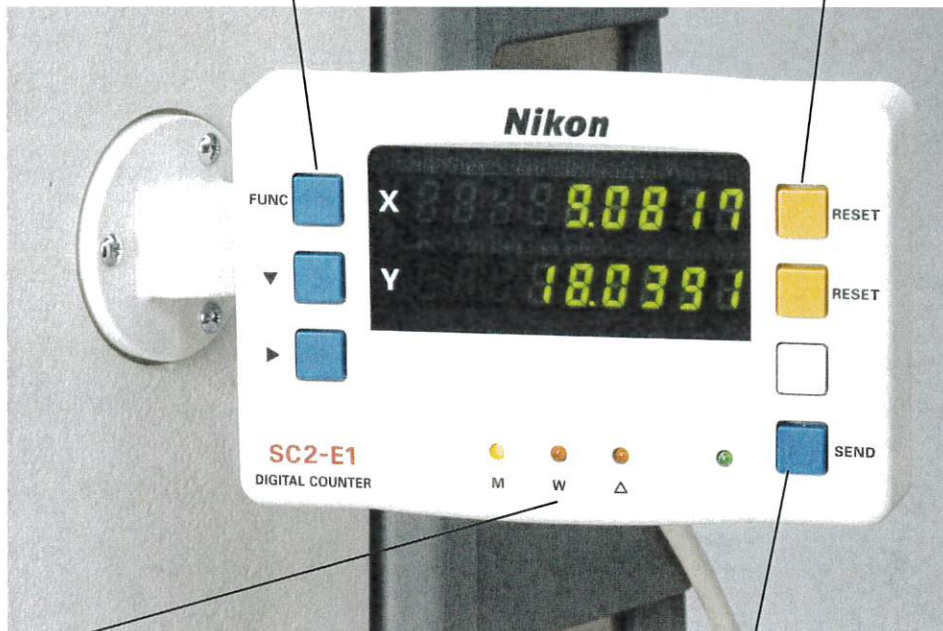
2.3 Top view of the stage



2.4 Counter display SC2-E1

FUNC key (Function key)
For details, refer to "5. System Setup."

RESET key
Resets the counter display value next to the key to zero.



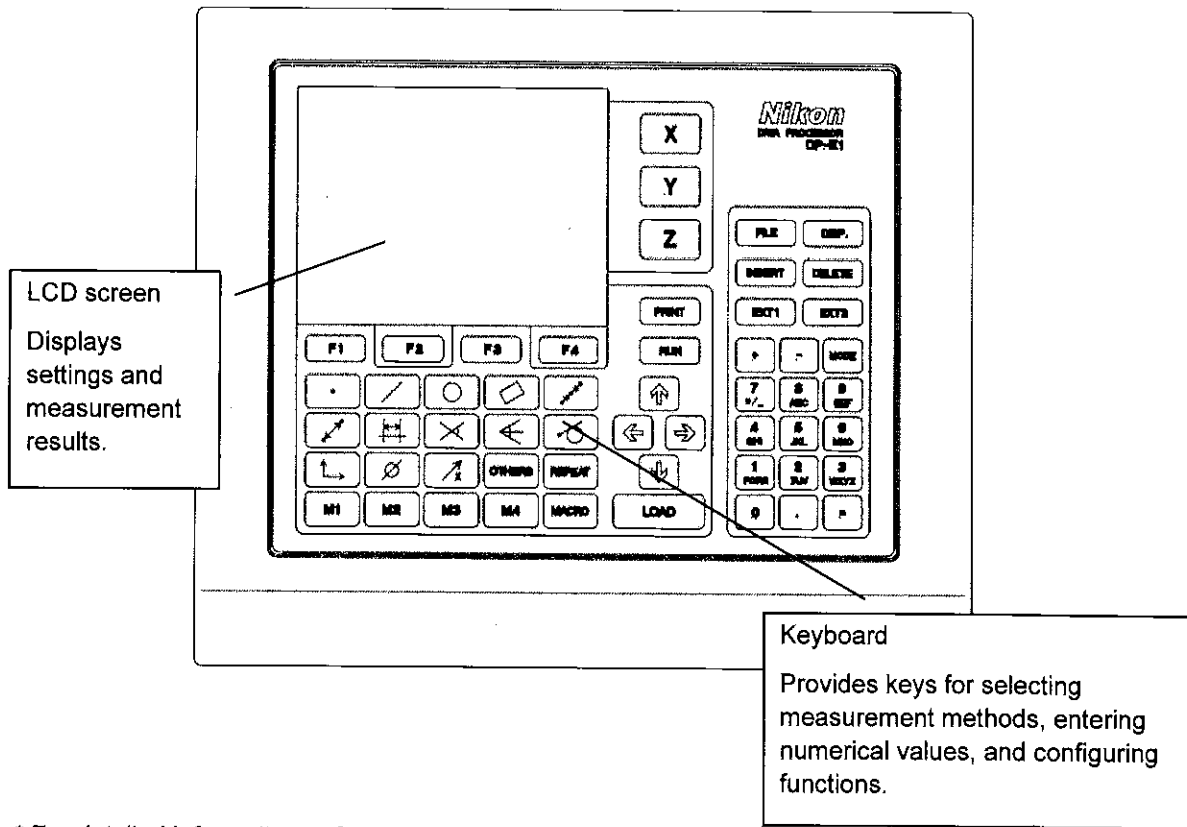
Status display
Displays current coordinate system when connected to the DP-E1

- When M is lit: Mechanical coordinate system mode
- When W is lit: Work coordinate system mode
- When Δ is lit: Displays the difference between coordinates

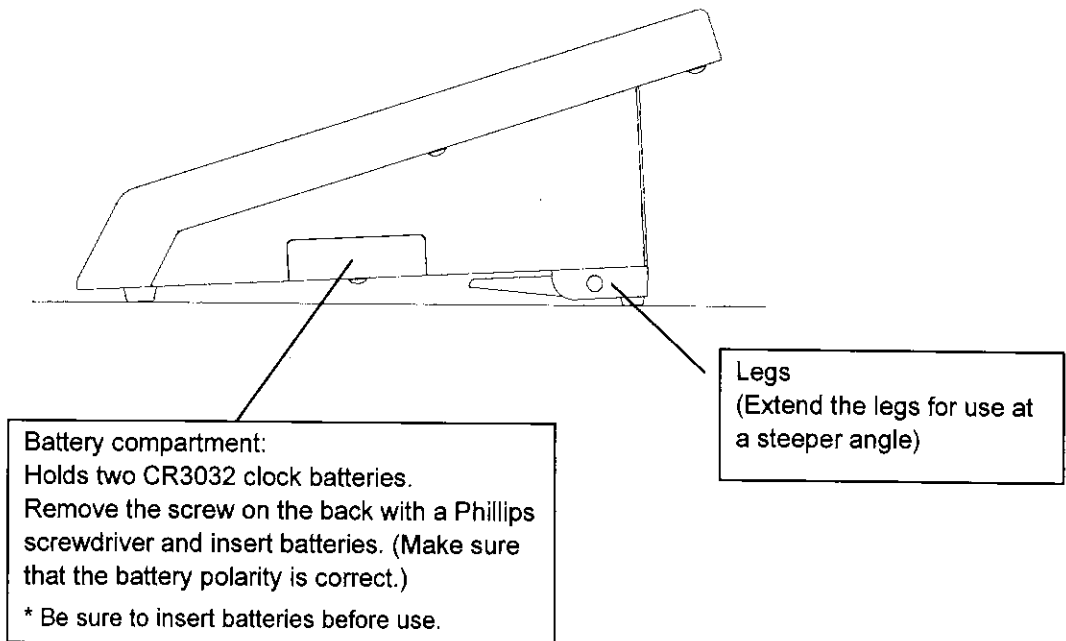
SEND key

- When a printer is connected
Prints each time the key is pressed.
- When the DP-E1 or E-MAX is connected
The current coordinates are entered as a point.

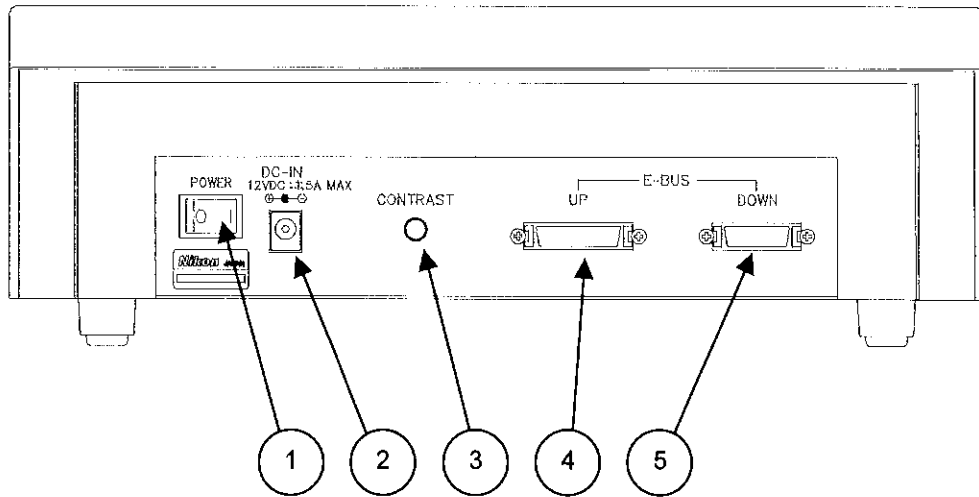
2.5 Data processor console DP-E1



* For detailed information, refer to the DP-E1 user's manual.



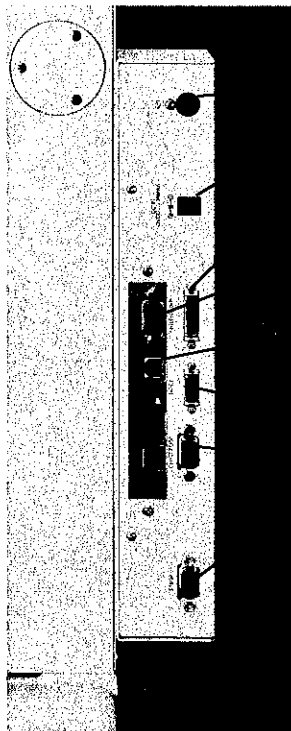
2. Part Names and Functions



- ① **POWER** On: Press toward the | side. Off: Press toward the ○ side.
- ② **DC-IN** Power inlet. Always use the specified AC adapter.
- ③ **CONTRAST** Dial for contrast adjustment of the LCD screen.
- ④⑤ **E-BUS** UP/DOWN interfaces
Interfaces for use when the unit is daisy-chained with other E-BUS equipment.
Connect a measuring microscope MM-200 to the highest position on the UP side.
If this system is the final addition, leave the DOWN connector OPEN.

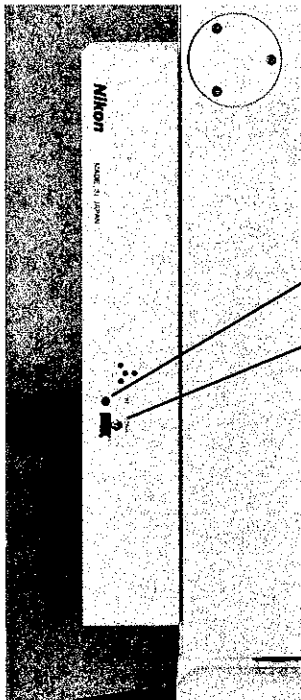
2.6 Controller interfaces

Right-side view



- 1: EPI Connected to an LED epi-illuminator.
- 2: DC-IN Connected to the AC adapter.
- 3: E-BUS (D) Connected to the DP-E1 Data Processor Console or similar equipment
- 4: RS-232C Connected to peripherals (such as printers) when using an RS-232C connection.
- 5: USB (D) Connected to peripherals (such as computers) when using a USB connection.
- 6: SC-E1 Connected to the SC2-E1 2-axis counter.
- 7: EXRST/FOOT Connected to a remote switch or foot switch.
- 8: STAGE Connected to the stage.

Left-side view



- 9: BZ Volume control for the buzzer.
- 10: USB (H) Connected to a USB memory device, as needed. (Use FAT-formatted USB memory.)

3. Measurement



Before starting measurement, be sure to read the **Warning** and **Caution**, and **Notes on handling the product** sections at the beginning of this manual. Carefully observe all of the instructions provided therein. Read the instruction manuals supplied with other instruments you intend to use with this measuring microscope.

To ensure accurate measurement, follow the procedures described in Section 3.4, "Checking parallel positioning of the crosshairs of the eyepiece," and Chapter 5, "System Setup."

3.1 Illumination

Press the power switch on the front of the microscope base toward ON (toward the | side). Turn the brightness control dial on the front of the microscope base clockwise to activate the dia-illuminator or epi-illuminator. Keep turning the dial clockwise to continue increasing the brightness. To turn off the light, turn the dial fully counterclockwise. (Note 1)

The following illumination methods are supported. Use the appropriate illumination for the workpiece being examined.

- Diascopic (DIA) illumination  Enables observation of the contours of the workpiece, which appear in outline.
- Vertical episcopic (EPI) illumination  Enables observation of the surface of non-transparent workpiece.
- Simultaneous dia/epi-illumination Enables simultaneous observation of the contours and surface of the workpiece.

The dia-illumination turns green when the green filter slider located right side of the main unit is fully inserted and returns to white when it is pulled out.

Note 1: It takes about eight seconds to display counting values on the counter display and become ready state for the measurement when you turn on the power.

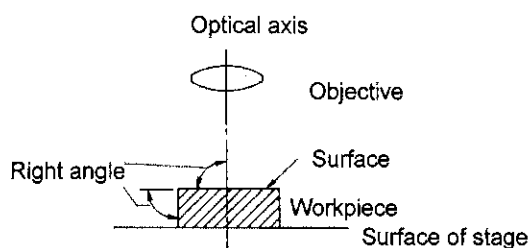
Do not turn the brightness control dial during that period.

Turning the brightness control dial before counting values appear on the counter display may lead to malfunctions.

3.2 Positioning the workpiece

Position the workpiece so that the contours (cross-sectional details) or surface for measurement are perpendicular to the optical axis of the objective. Failure to do this will prevent uniform focus throughout the field of view.

The top of the stage is perpendicular to the optical axis. Workpieces with two parallel surfaces or in other shapes that present surfaces perpendicular to the optical axis can be just placed on the stage.



3.3 Focusing

- For instructions on using the z-axis knob, refer to Section 3.5, "Z-axis knob."

When the monocular optical head is attached

- 1 Turn the diopter adjustment ring on the eyepiece to focus on the template (that is, the lines visible through the eyepiece).
 - 2 Turn the z-axis knob to raise or lower the optical head. Adjust so that the workpiece surface is about 126 mm from the thrusting end of the objective, based on a visual estimate. (That is, the focal plane is 126 mm from the thrusting end of the objective, regardless of magnification.)
 - 3 While looking through the eyepiece, turn the z-axis knob to bring the workpiece into sharp focus. (See Note 1.)
 - 4 Confirm that the workpiece is in focus.
 - 4-1 While looking through the eyepiece, carefully examine the lines of the template while moving your head up, down, left, and right. If the position of the workpiece image changes relative to the lines of the template, the workpiece is still out of focus. (This phenomenon is known as *parallax*.)
 - 4-2 Adjust the focus to correct parallax as follows.

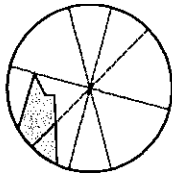
Again, carefully examine the lines of the template while moving your head left and right. If the workpiece image moves in the same direction as your head, bring the optical head closer to the workpiece.

If the workpiece image moves in the direction opposite the direction you move your head, move the optical head farther from the workpiece.
- Note 1: High-magnified objectives have shorter working distances. (Also called "W.D." this is the distance from the tip of the objective to the focal plane.) For this reason, during focusing, the tip of the lens may sometimes come into contact with the workpiece. To avoid this, initially lower the tip of the objective to a point just beyond the W.D., then adjust the focus by raising the optical head.
- Objectives in a range from 1x to 10x are best recommended.

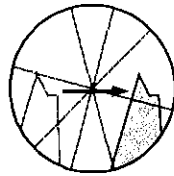
3.4 Checking parallel positioning of the crosshairs of the eyepiece

Activate the dia-illuminator or epi-illuminator and look through the eyepiece. The lines of the template are visible. To ensure accurate measurement, the crosshairs of the eyepiece must be aligned with the direction of the stage movement.

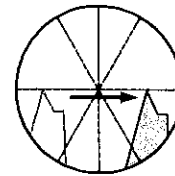
- 1 Attach the 3x objective to the optical head and position the workpiece on the mounting glass of the stage.
- 2 Turn on the measuring microscope. (Press the power switch toward the | side.) Turn the brightness control dial clockwise and activate dia-illumination or epi-illumination.
- 3 Adjust focus.
- 4 Move the stage along the X and Y axes to align a clear portion of the workpiece (the corner of the image, for example) with the template crosshairs.
- 5 Move the stage along the X-axis to make sure the image moves without going out of alignment with the crosshairs. If the image moves away from the crosshairs, turn the eyepiece until the crosshairs is aligned with the image movement by loosening the eyepiece fixing screw and turning the eyepiece angle adjustment knobs.



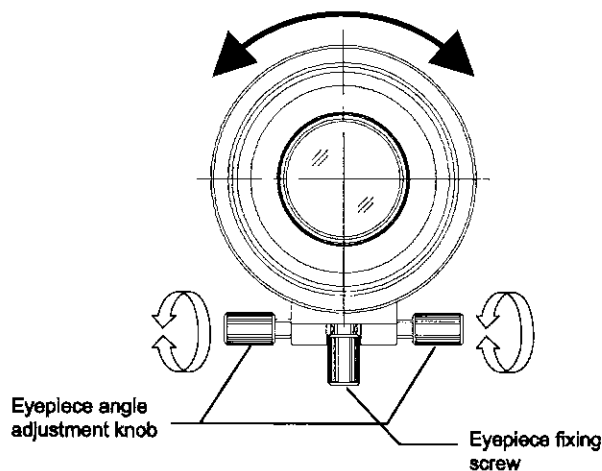
Align one point of the image with the crosshairs.



When stage is moved in X direction, the image moved away from the crosshairs.



Turn the eyepiece until the image moves along with the crosshairs.



6. Repeat steps 4 and 5 until you can move the stage without the image drifting from the crosshairs. When using a 3x objective, complete this adjustment so that the offset amount is 0.01 mm or less relative to the template (equivalent to two line widths or less of the dotted line on the template).
Tighten the fixing screw of eyepiece after the adjustment.

3.5 Z-axis knob

When adjusting the torque of the Z-axis knob, be careful to avoid loosening it to the point that the optical head begins to drop under its own weight.

Distance the optical head moves per knob revolution

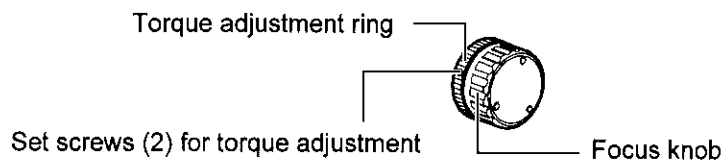
Approx. 38.3 mm/rev.

Adjusting the rotation torque of the Z-axis knob

Loosen the two set screws of the torque adjustment ring. As you turn the ring, notice how the resistance of the Z-axis knob changes. Adjust the torque in a range that ensures that the optical head does not begin dropping under its own weight. (The rotation torque of the Z-axis knob is factory-set so that the optical heads will not drop under their own weight.)

Tighten the two set screws after the adjustment.

Note: Use the knob on the right side to adjust the torque.



3.6 Measurement examples

Instructions for measurement using the counter display are given below.

3.6.1 Measurement using the DP-E1

For the measurement with the data processor console DP-E1, refer to the instruction manual provided with the DP-E1.

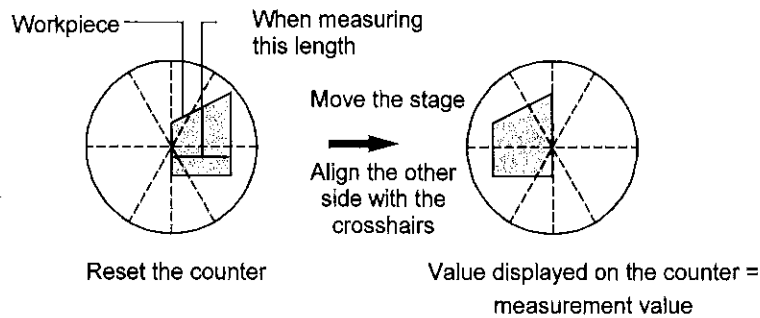
3.6.2 Length measurement (distance between two parallel sides)

This microscope is equipped with a stage for which the amount of movement is expressed digitally and displayed on the counter. Monitor this display to measure the distance between two parallel sides of a workpiece. Before measurement, always check parallel positioning of the stage and complete system setup.

- 1 Align one side of the workpiece with the crosshairs. Reposition the workpiece so that the side is parallel to one of the template crosshairs.
- 2 Reset the counter display by pressing the counter RESET key for both the X-axis and Y-axis.
- 3 Move the stage to align the other side of the workpiece with the crosshairs.

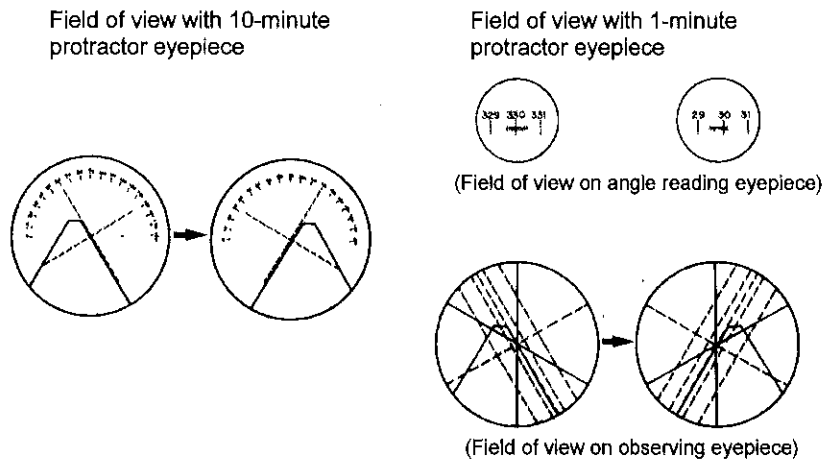
- 4 The value displayed on the counter is the measurement value (i.e., the distance between the two sides).

Measurement value = value displayed on the counter



3.6.3 Angle measurement



You can perform angle measurement using the 10-minute or 1-minute reading protractor eyepieces.



- 1 Remove the eyepiece and attach the protractor eyepiece.
- 2 Align one side of the image for measurement with a crosshair or the 60° line of the protractor eyepiece. Read the angle.
- 3 Next, align another side with the same crosshair or 60° line. Read that angle.
- 4 The difference between the values read in steps 2 and 3 is the measurement value.
 - To measure large oblique angles, it is easier to use the crosshairs of the protractor eyepiece as a reference right angle when reading the difference. (Similarly, for the 1-minute reading protractor eyepiece, you can use the lines at 30°, 60°, and 120° as reference lines.)
 - When the stage is used with protractor eyepieces, you do not need to center the vertical angle of the image in the crosshairs. This allows faster measurement.
 - When one side of the image for measurement is aligned with the crosshairs, leave a slight gap parallel to the side to improve alignment accuracy.
 - When you perform both angle and length measurements, the workpiece must be parallel positioned.
- 5 After angle measurement is complete, reattach the eyepiece.

4. Assembly

4.1 Assembly precautions

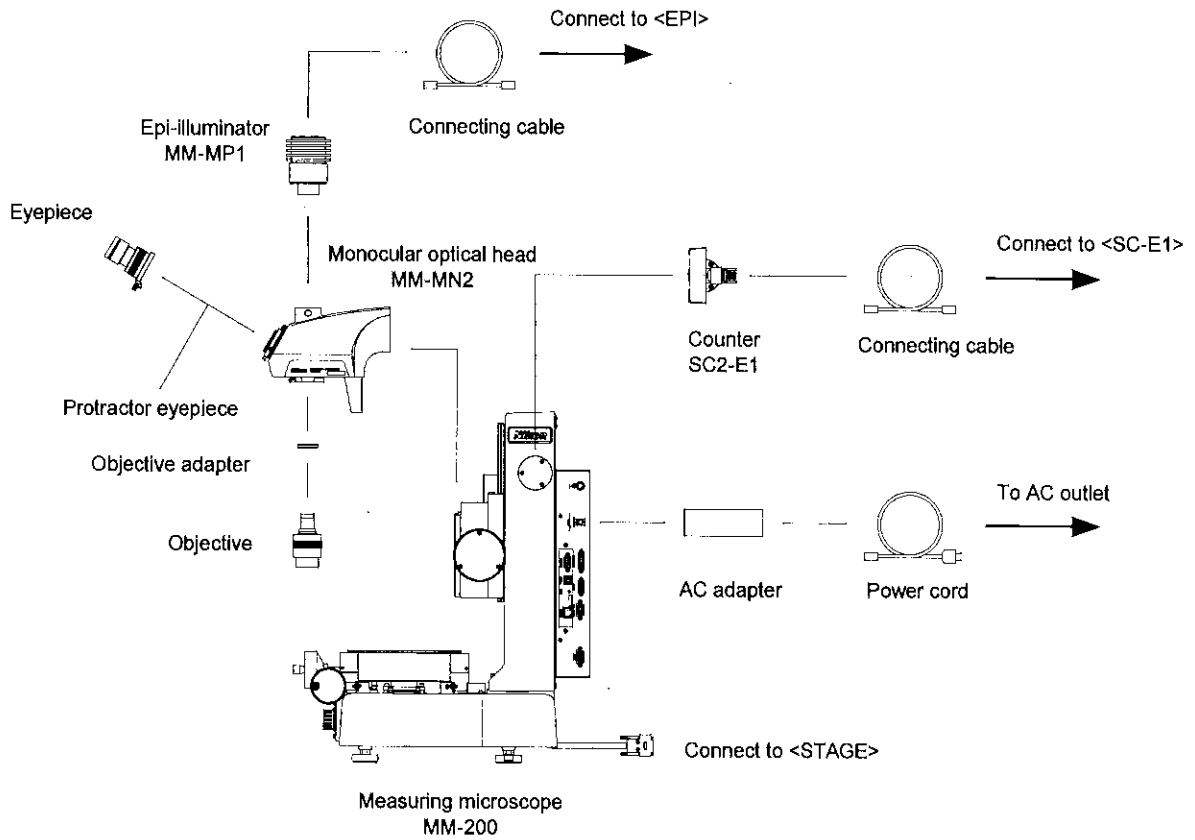
- Before assembling the instrument, be sure to read the “ WARNING”, “ CAUTION” and “Notes on handling the product” at the beginning of this manual and heed all the instructions written therein.
- Be also sure to read the instruction manuals supplied with other instruments to be used together with this measuring microscope.
- Install the instrument at a suitable location meeting the installation requirements. (Refer to p. 5 for requirements.)

<Tools>

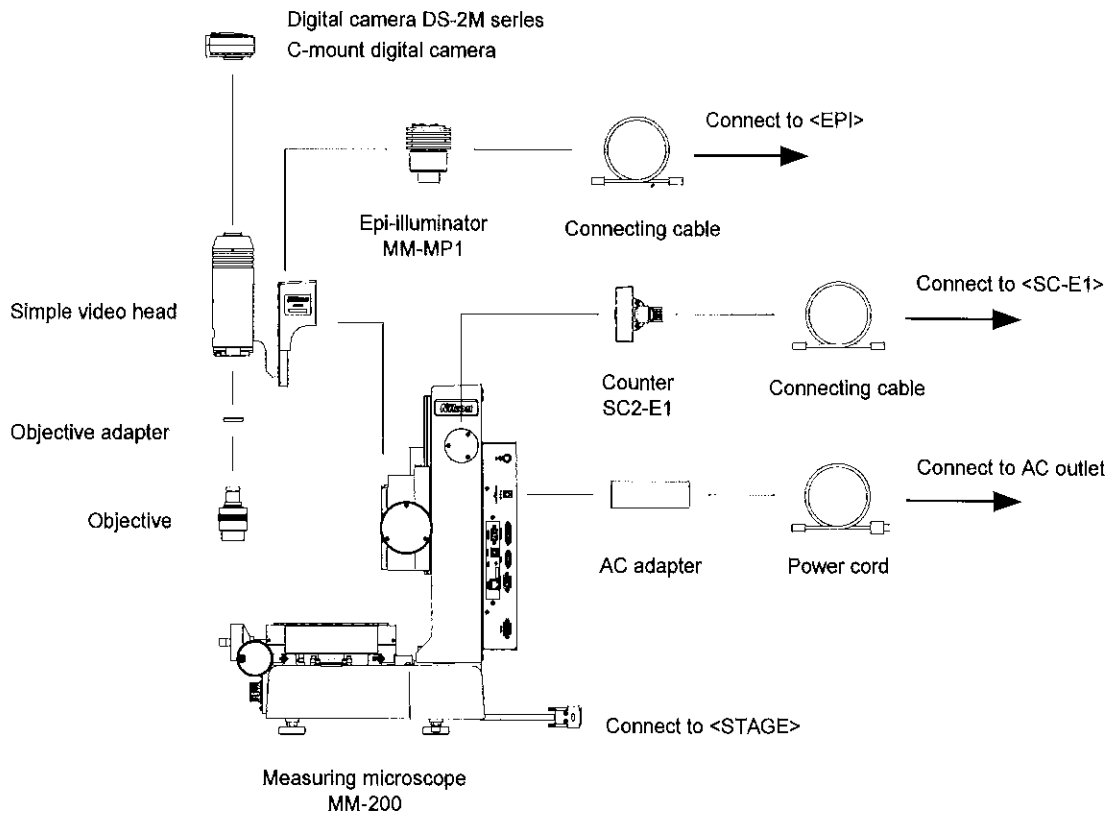
Phillips-head screwdriver
Hexagonal wrenches (2, 3 mm)
Spanner (13 mm)
Level

4.2 Connection examples

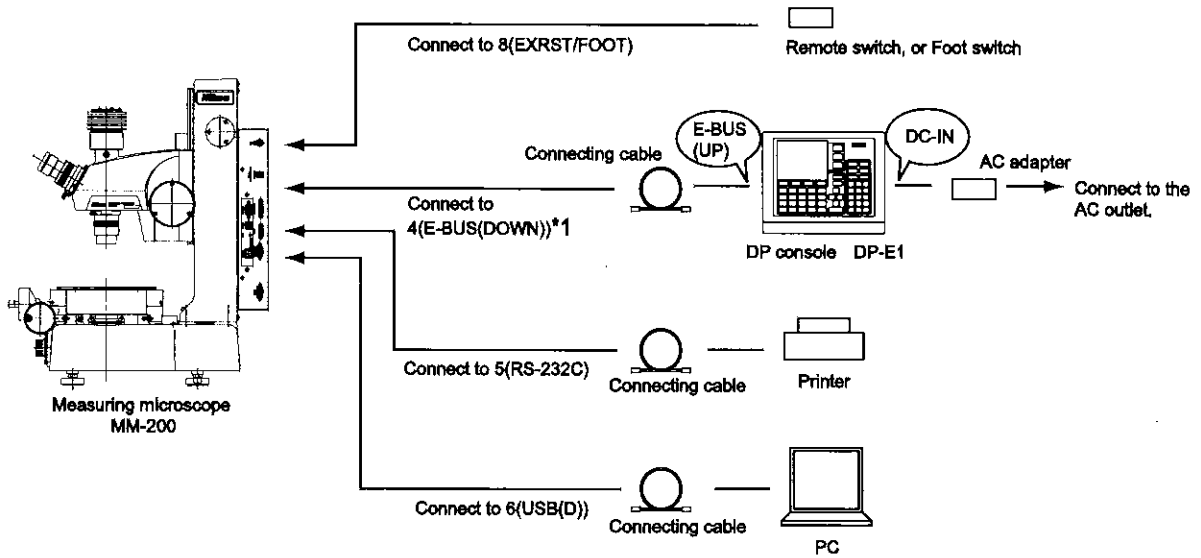
4.2.1 Basic assembly (For the visual observation)



4.2.2 Basic assembly (For the camera observation)



4.2.3 Connecting the data processor console DP-E1, remote switch, foot switch, computer, or printer



*1: When E-BUS(DOWN) connector on the controller is already occupied by another device, connect to the E-BUS(DOWN) connector on that device.

4.3 Assembly procedure

1. MM-200 main unit

Position the microscope on a solid table.

The MM-200 main unit by itself weighs approximately 40 kg. When installing the microscope, work with utmost care referring to the "Safety Precautions."

Connect the connection cable at the rear bottom of the microscope base to the STAGE connector of the controller.

2. Monocular optical head MM-MN2

* When the camera observation is performed, the simple video head is to be attached.

Attach the monocular optical head MM-MN2 to the focusing mount by sliding it down along the dovetail on the mount.

When the optical head is fully inserted, secure it in place by evenly tightening the two hexagonal socket head screws on the left side with the hexagonal wrench (2 mm.)

3. Eyepiece

* This procedure is not necessary when the camera observation is performed.

Attach the eyepiece to the circular dovetail mount on the monocular optical head. Secure it with clamp screws.

If you use a protractor, refer to "4.4 Connecting/setting optional accessories."

- Perform "Checking parallel positioning of the crosshairs of the eyepiece" after the assembly.

4. Objective

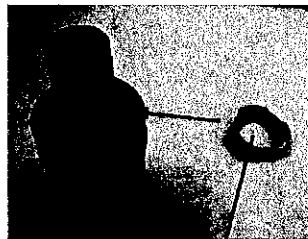
Attach to the objective mount at the bottom of the optical head or simple video head.

Attach an objective adapter to the objective.

Insert the objective into the objective mount so that the marking on the objective adapter appear on the front.

After insertion, screw in the objective counterclockwise (as viewed from above) as far as possible. Tighten the objective clamp screw to secure it in place.

- Objectives in a range from 1x to 10 x are best recommended.



Objective adapter



Objective clamp screw

Marking

5. Digital camera

* This procedure is not necessary if the visual observation is performed.

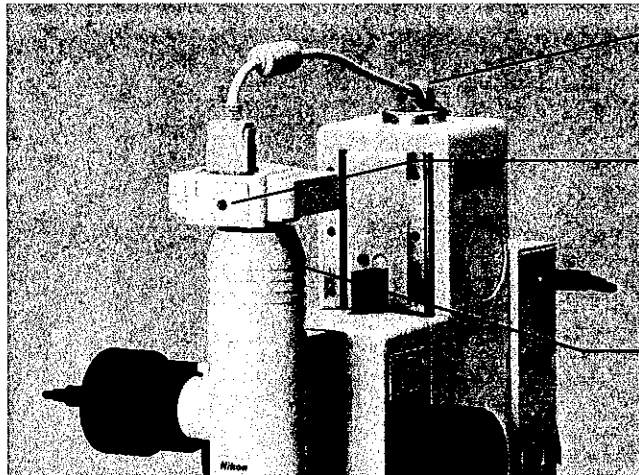
Attach to the camera mount on the top of the simple video head.

Use a camera that weighs less than 1 kg.

When mounting Nikon DS-2M series, pay attention to the orientation of the camera. (See the following figure.)

When mounting a digital camera other than Nikon DS-2M series, adjust the orientation of the camera by watching the movement of the image and the stage.

After adjusting the orientation of the camera, tighten the clamp screw with the 2 mm-hexagonal wrench.



Secure the cable with the supplied cable clamp.

Mount the camera with its tripod screw hole showing on the front side. (For Nikon DS-2M series)

Clamp screw

Refer to the instruction manual provided with the camera to connect the camera head and CCU (camera control unit).

6. Epi-illuminator MM-MP1

Attach to the top of the monocular optical head (if attached to the simple video head, attach to the left side of the simple video head) and secure with clamp screws.

Connect to the EPI connector of the controller with the connection cable supplied with the illuminator.

Secure the connection cable with the supplied cable clamp.

7. Counter display SC2-E1

The counter display can be attached to either the right or left side of the pillar.

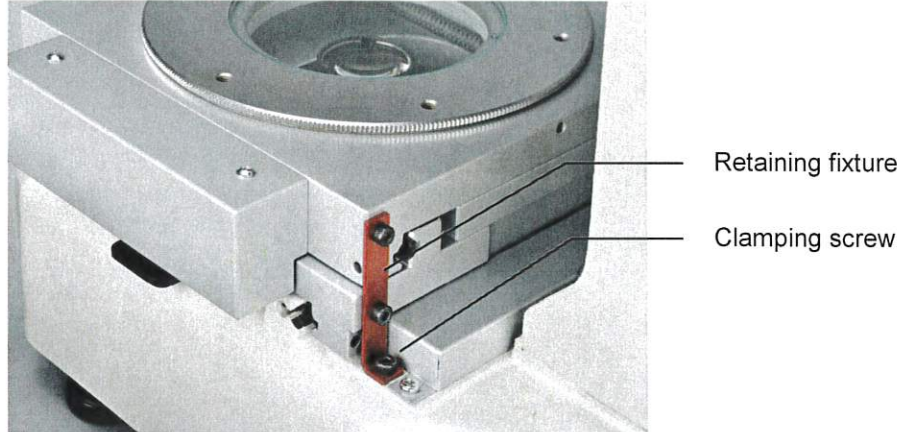
Remove the cover on the side of the pillar with the phillips-head screwdriver and secure the counter display with three screws supplied with the counter display.

Connect to the SC-E1 connector of the controller with the connection cable supplied with the counter display unit.

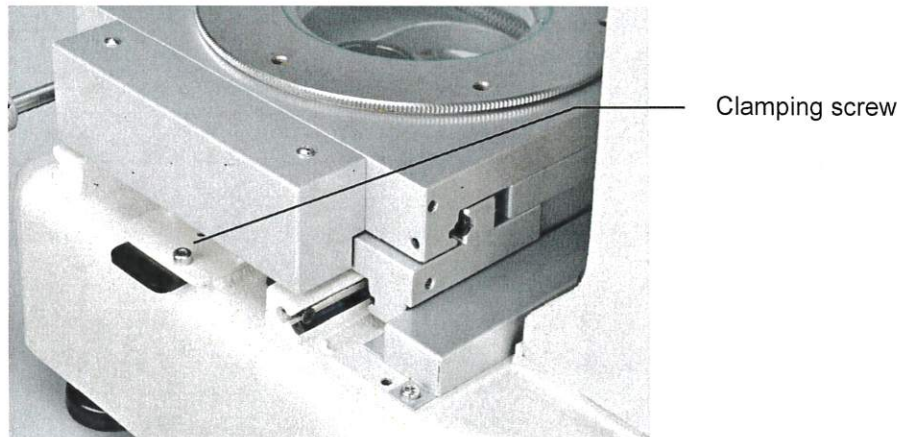
8. Retaining fixture

When the steps of assembly mentioned above have completed, remove the retaining fixtures from the stage and green filter slider referring the following procedures.

- (1) Using the hexagonal wrench (3 mm), loosen the three hexagon socket head cap screws securing the L-shaped retaining fixture located right rear of the stage and remove them together.

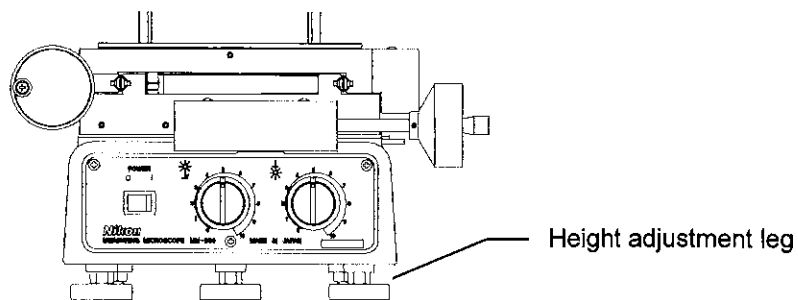


- (2) Turn the stage X-axis handle to move the stage to the left. Loosen the red hexagon socket head cap screw securing the green filter slider with the hexagonal wrench (3 mm.)



9. Level adjustment

Place a level on the stage glass and adjust three height adjustment legs (two front legs, one rear leg) of the base with the spanner (13 mm) until the stage glass is level.
(Keep the auxiliary leg at the rear of the base slightly off the table surface.)



10. AC adapter and power cord

Plug the AC adapter into the DC-IN connector of the MM-200 main unit controller.
Connect the specified power cord to the AC adapter and plug the power cord into a 2-prong outlet with a ground terminal.

Basic assembly is now complete.

4.4 Attaching/connecting optional accessories

4.4.1 Data processing console DP-E1

Connect to the E-BUS (DOWN) connector of the controller with the connection cable supplied with the DP-E1.

Connect the AC adapter to the DP-E1. Connect the specified power cord to the AC adapter and plug the power cord into a 2-prong outlet with a ground terminal.

- Multiple devices with the E-BUS connector can be connected in a row to the E-BUS (DOWN) connector of the controller using UP and DOWN. Keep in mind that any powered-down devices must be left unconnected. The presence of any powered-down device among the connected devices may result in malfunction.

4.4.2 Printer

A printer can be connected to the RS-232C interface of the controller.

The TSP651-24 thermal printer (Nikon specifications, Star Micronics) or the DPU-414 thermal printer (Seiko Instruments) is recommended.

When connecting the TSP651-24 thermal printer, refer to the setup manual supplied with the printer.

Always use the dedicated cable (the DPU-414 cable) to connect the DPU-414 to the counter.

- Turn on the printer before turning on the measuring microscope.
Startup sequence: Printer → DP-E1 → Measuring microscope

<Printer software DIP SW (dip switch) settings>

After referring to the DPU-414 instruction manual, configure the software DIP SW as follows. (For other software DIP SW settings, you may use the default settings.)

Input method	→	Serial
Carriage return	→	Carriage return
Printing mode	→	Normal
International characters	→	Japan
Data bit length	→	8 bits
Parity	→	None
Baud rate	→	9600 bps

<Sample printout>

Counting starts from "1."	001	X=	25.418	Y=-	17.830
	002	X=	25.418	Y=-	17.830
	003	X=	25.418	Y=-	17.830
	004	X=	25.427	Y=-	17.794
	005	X=	25.444	Y=-	17.769
	006	X=	25.399	Y=-	17.783
	007	X=	25.399	Y=-	17.783
	008	X=	25.399	Y=-	17.783
	009	X=	50.010	Y=-	20.035
		Z=	13.852		
	010	X=	---		

4.4.3 Computer

You can connect a computer to the RS-232C connector of the controller.

However, when using a computer running Nikon E-MAX data processing software, connect the computer via the USB (D) connector.

4.4.4. 10' reading protractor eyepiece

Remove the eyepiece and attach the 10' reading protractor eyepiece to the circular dovetail mount on the monocular optical head. Secure it with clamp screws.

This eyepiece has crosshairs and a protractor in its viewfield. Turning the protractor ring will rotate the crosshairs together with the vernier by 180°, permitting measurement of angles with the crosshairs as its standard.

- After attaching, perform "Checking parallel positioning of the crosshairs of the eyepiece."

4.4.5. 1' reading protractor eyepiece

Remove the eyepiece and attach 1' reading protractor eyepiece to the circular dovetail mount on the monocular optical head. Secure it with clamp screws.

This eyepiece has a small angle reading eyepiece in addition to the observing eyepiece. Turning the micrometer knob on the back will rotate the vernier together with the crosshairs in the viewfield of the observing eyepiece. This permits measurement of angles with the crosshairs as its standard in the same way as with the 10' reading protractor eyepiece. (The angle can be read through the angle reading eyepiece.) There is an illuminating mirror on the back of the angle reading eyepiece. Adjust the direction and inclination of the mirror to obtain the brightest viewfield.

- After attaching, perform "Checking parallel positioning of the crosshairs of the eyepiece."

4.4.6. Concentric circle reticle

The optional reticle is to be mounted instead of the standard crosshairs reticle.

The concentric circles reticle is be used in combination with the 3x objective. It can be used to measure the diameters of small circles as well as their center coordinates.

1. Remove the eyepiece from the monocular optical head.
2. Remove the eyepiece part (black) screwing counterclockwise against the foundation part (silver), then the standard crosshairs reticle appears.
3. Remove the standard crosshairs reticle with its metal frame. Attach the concentric circle reticle instead.
4. Reattach the eyepiece part.
5. Reattach the eyepiece to the monocular optical head.
6. Check parallel positioning of the crosshairs of the eyepiece.
 - Keep the reticles free of dust, etc., while the replacement.

4.4.7 Ring Illumination

An eight-direction LED ring illuminator can be attached at the bottom of the monocular optical head or the simple video head.

An illumination source such as fluorescent, ring fiber illuminator or LED ring illuminator can also be attached if the external illumination adapter is attached to the bottom of the monocular optical head or the simple video head.

For connecting the illumination source, refer to the instruction manuals supplied with the illuminators.

5. System Setup

When you are finished with assembly, proceed with system setup.

System setup is performed from the 2-axis counter display SC2-E1, the DP-E1 data processing console or the E-MAX measurement support system.

This manual provides a description of the setup procedure from the 2-axis counter display.

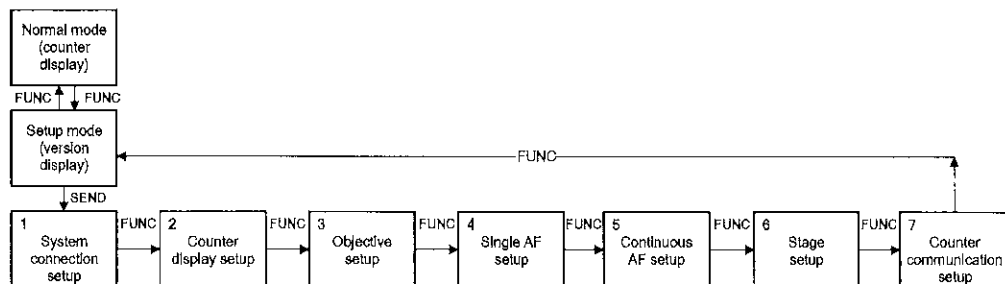
To proceed with setup from the data processing console or the E-MAX measurement support system, refer to the instruction manual supplied with the product.

The following parameters can be set:

Table 1

No.	Category	Item
1	System connection setup	Not used for this product.
2	Counter display setup	Number of displayed digits, averaging, counting direction
3	Objective setup (*1)	Not used for this product.
4	Single AF setup	Not used for this product.
5	Continuous AF setup	Not used for this product.
6	Stage setup	Linear correction for the XY axes
7	Counter communication setup	Baud rate, destination

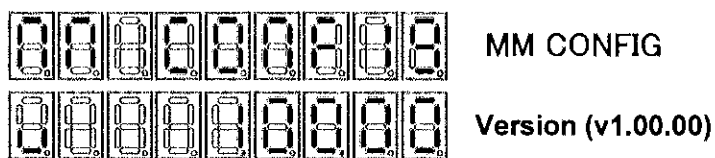
<Invoking Setup Mode>



When you turn on the power, the counter starts in the Normal mode. (In the Normal mode count values are shown.)

To enter the Setup mode, press the FUNC key with the counter in the Setup mode.

The firmware version appears on the counter display.



At this point, press the SEND key to display "1: System connection setup."

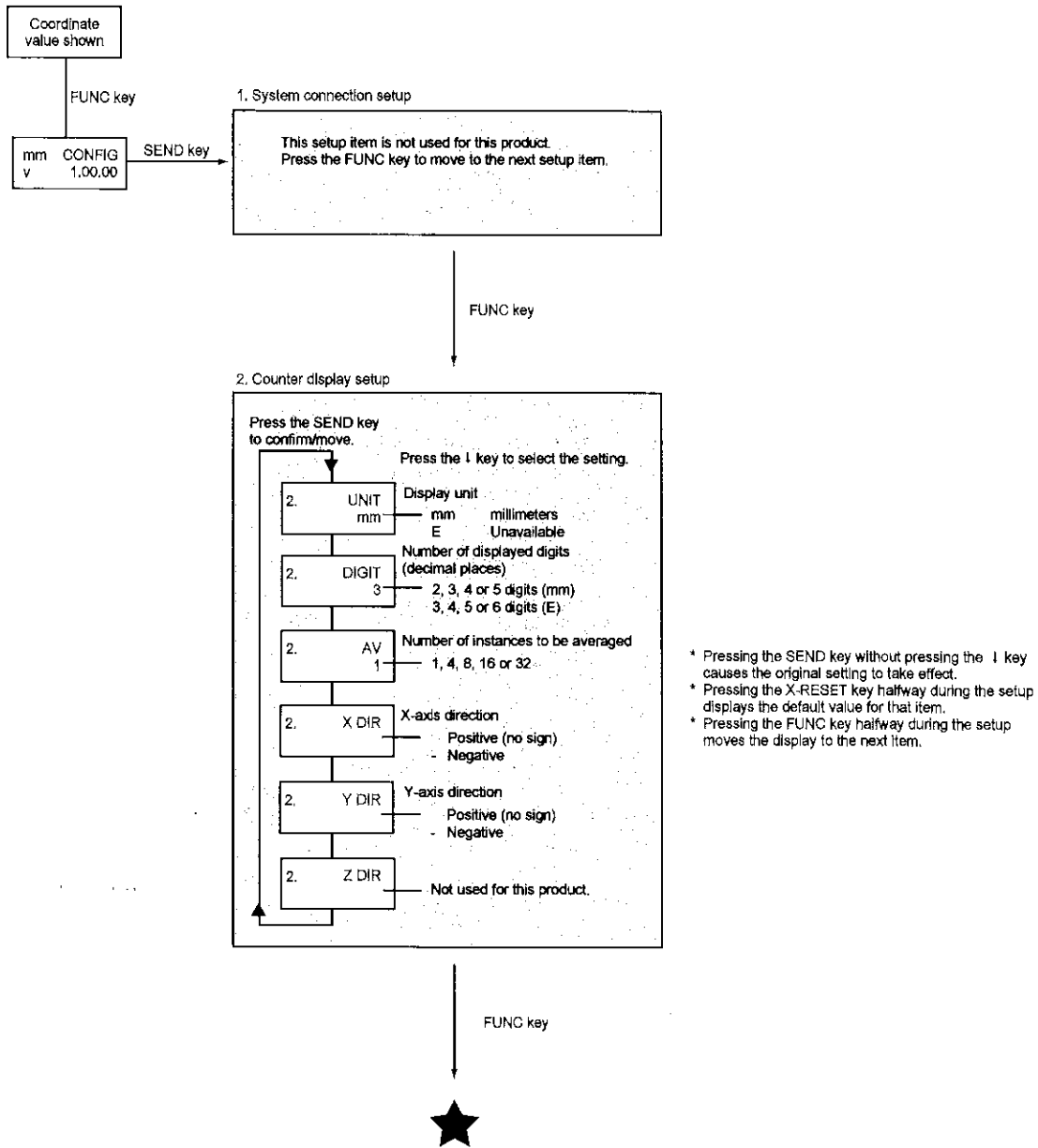
(No status change takes place if you press keys other than the SEND and FUNC keys.)

With "1: System connection setup" displayed, press the FUNC key to move to "2: Counter display setup." Pressing the FUNC key again will move the display to "3: Objective setup."

As described above, press the FUNC key repeatedly until the desired item number appears at the top left of the counter.

Press the FUNC key twice when "7: Counter communication setup" is shown to return to the Normal mode.

5. System Setup



- * Pressing the SEND key without pressing the I key causes the original setting to take effect.
- * Pressing the X-RESET key halfway during the setup displays the default value for that item.
- * Pressing the FUNC key halfway during the setup moves the display to the next item.

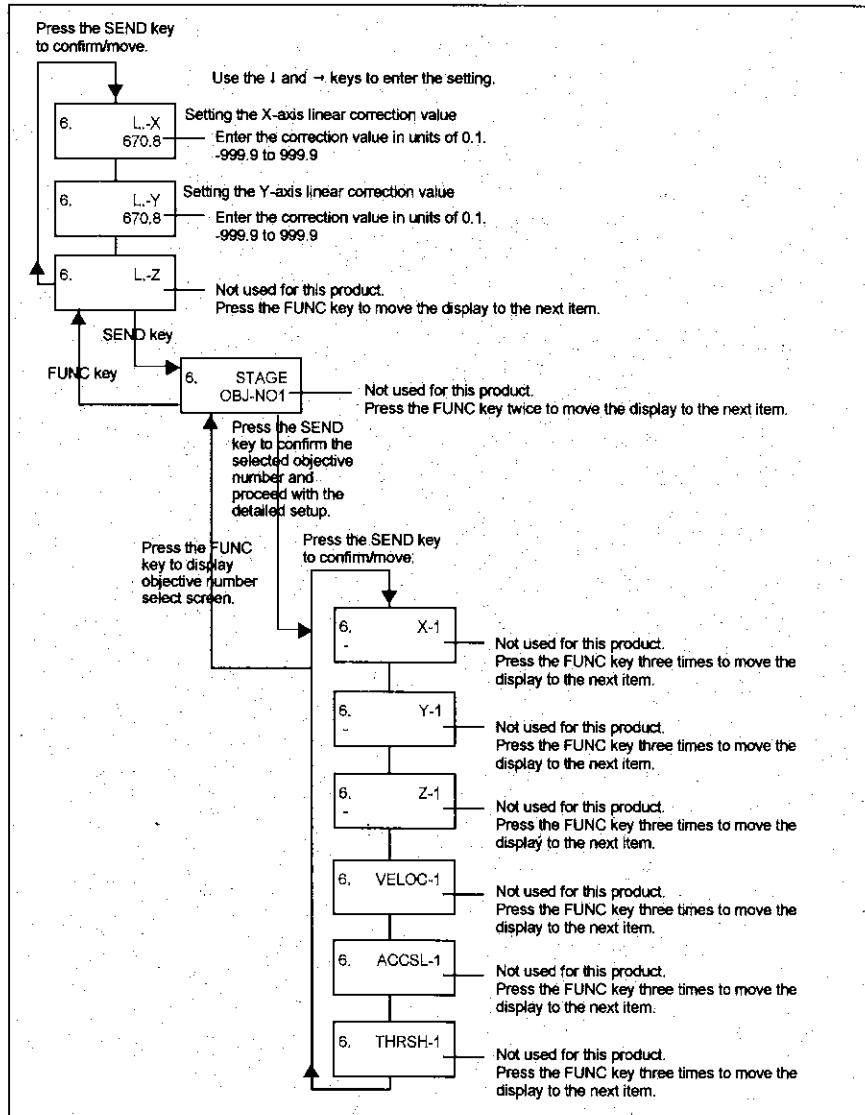
Note) "3: Objective setup," "4: Single AF setup" and "5: Continuous AF setup" are not the items used for this product. Press the FUNC key to move to the next setup item.

5. System Setup



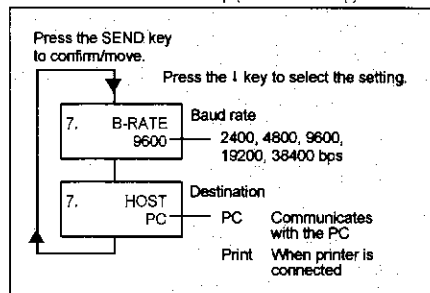
FUNC key

6. Stage setup



FUNC key

7. Counter communication setup (COM Port Setup)



FUNC key

Back to "1. System connection setup"

- “1: System connection setup,” “3: Objective setup,” “4: Single AF setup” and “5: Continuous AF setup” are not the items used for this product.
- “2: Counter display setup,” “6: Stage setup” and “7: Counter communication setup” are described in this section.

5.1 Counter display setup

This item allows you set the information shown on the MM system's counter display. “2” appears at the top left of the counter (most significant digit on X-axis).

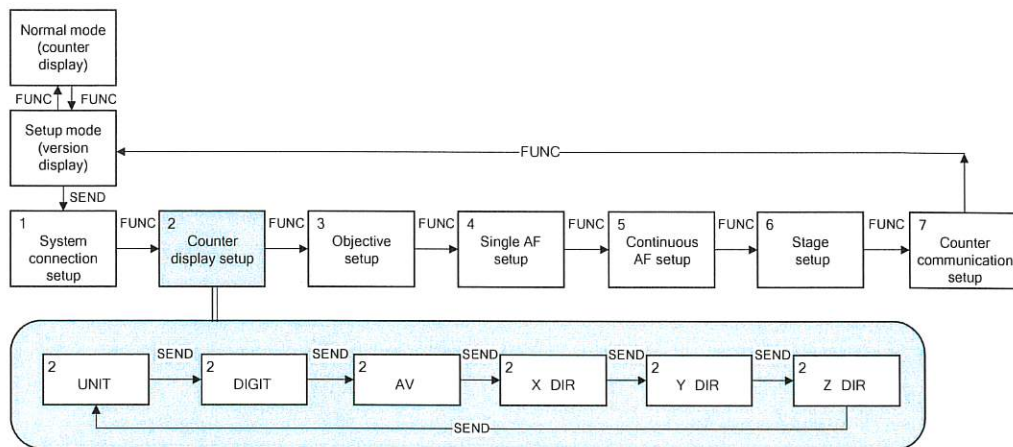
The following six setup screens are available:

- UNIT: Display units (mm or E)
- DIGIT: Number of displayed digits (decimal places: 2, 3, 4, 5 in mm/3, 4, 5, 6 in E)
- AV: Number of instances to be averaged (1, 4, 8, 16, or 32)
- X DIR: Counting direction of the X-axis (- or no sign)
- Y DIR: Counting direction of the Y-axis (- or no sign)
- Z DIR: This setup screen is not used for this product.

Press the FUNC key to move to the next setup item (“3: Objective setup”).

Pressing the FUNC key during setup restores the settings to their original status and switches the display to the next setup item.

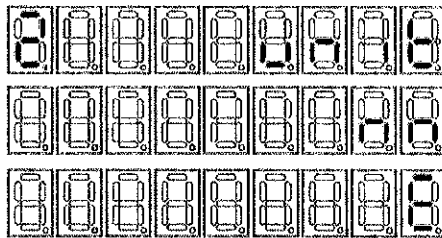
The six setup screens will be displayed in series until you press the FUNC key.



- 1) From the Normal mode, press the FUNC key, the SEND key, then the FUNC key again to enter "2: Counter display setup."
(You are in the "2: Counter display setup" screen when "2" appears at the top left of the counter.)
- 2) The **UNIT** screen allows you set the counter display unit. The display shows "mm" and "E" alternately at the bottom each time you press the ↓ key. When "mm" is shown, press the SEND key to confirm the selection.

mm: Values indicated in mm

E: (Not used)



2. UNIT

mm Values indicated in mm

E Not used

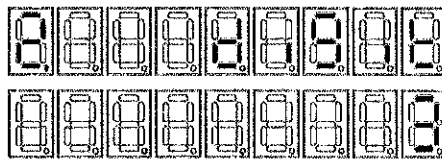
- 3) The **DIGIT** screen allows you set the number of displayed digits of decimal places. The display will show the options "2," "3," "4," and "5" at the bottom in series each time you press the ↓ key. When the desired option is shown, press the SEND key to confirm the selection. ("3," "4," "5," and "6" appear when "E" is selected.)

2: Two decimal places are shown.

3: Three decimal places are shown.

4: Four decimal places are shown.

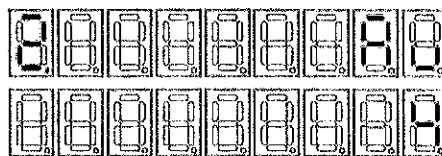
5: Five decimal places are shown.



2. DIGIT

3

- 4) The **AV** screen allows you set the number of instances to be averaged. The display will show the options "1," "4," "8," "16," and "32" at the bottom in series each time you press the ↓ key. When the desired option is shown, press the SEND key to confirm the selection. Normally select "4."



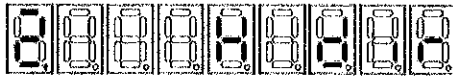
2. AV

Number of instances to be averaged
(possible settings are "4," "8," "16" or "32")
(Select "4" normally)

- 5) The **X DIR** screen allows you set the counting direction of the X-axis.
The display shows "-" and " " (no sign) alternately at the bottom each time you press the ↓ key.
When the desired option is shown, press the SEND key to confirm the selection.

-: Negative

: Positive (no sign)



2. X DIR X-axis direction setting

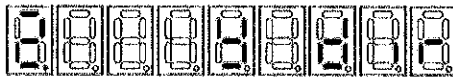


- Negative



Positive (no sign)

- 6) The **Y DIR** screen allows you set the counting direction of the Y-axis.
Set the direction in the same manner as in the **X DIR** screen.



2. Y DIR Y-axis direction setting

- 7) The **Z DIR** screen allows you set the counting direction of the Z-axis.
This setup screen is not used for this product.
Leave this screen as it is (the default setting).

- 8) The **UNIT** screen appears.
Press the FUNC key to move to the next setup item ("3: Objective setup").

Notes:

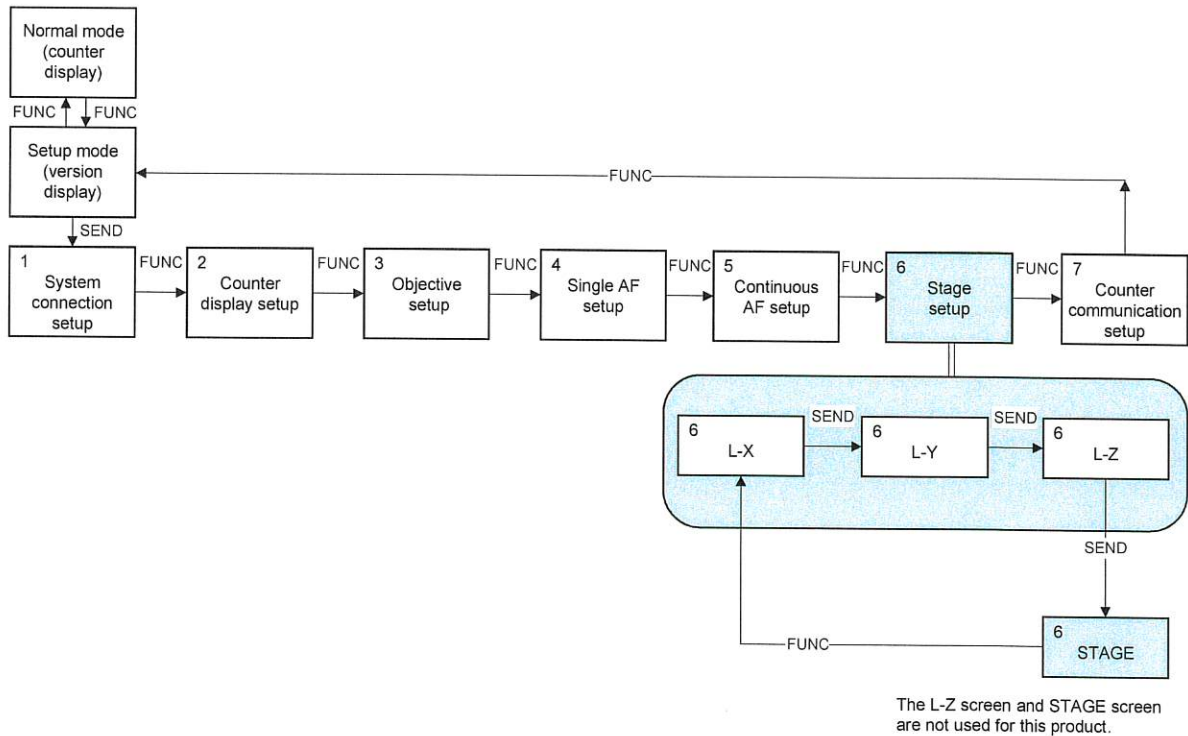
1. Pressing the SEND key without pressing the ↓ key in each of the screens restores the setting to its original status and switches the display to the next screen.
2. Pressing the FUNC key during setup restores the settings to their original status and switches the display to the next setup item.

5.2 Stage setup

This item allows you set stage information for the MM system.

"6" appears at the top left of the counter (most significant X axis digit place).

Set the linear correction values for the XY axes.



- 1) From the Normal mode, press the FUNC and SEND keys once each, then press the FUNC key five times to enter "6: Stage setup."
(You are in the "6: Stage setup" screen when "6" appears at the top left of the counter.)
- 2) The L-X screen allows you set the X linear correction value.
Use the ↓ and → keys to enter the correction value and press the SEND key to confirm the selection.
The correction value can be entered in increments of 0.1 and in a range from -999.9 to 999.9. (±)
If you enter 10.0, the correction value is 1.0 μm when moving the stage by 100 mm.

↓ **key:** Increments the value of the flashing digit each time it is pressed.

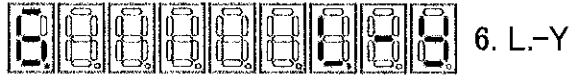
→ **key:** Moves the flashing cursor to the next digit each time it is pressed. Use this key to cause the desired digit to flash.

(Pressing the FUNC key without pressing the SEND key will switch the display to the next setup item; i.e., the objective number selection screen.)



[Example display]

- 3) The **L-Y** screen allows you set the Y linear correction value.
Set the correction value in the same manner as in the L-X screen.



- 4) The **L-Z** screen allows you set the Z linear correction value.
This setup screen is not used for this product.
Leave this screen as it is (the default setting).
- 5) The **STAGE** screen allows you specify the desired objective number.
This setup screen is not used for this product.
Leave this screen as it is (the default setting).
- 6) Press the FUNC key twice from the **STAGE** screen to move to the next setup item ("7: Counter communication setup").

Allowable range

Item	Increment	Range	Default
Linear X	0.1	-999.9 to 999.9	0.0
Linear Y	0.1	-999.9 to 999.9	0.0

Notes:

- Linear correction
Assuming ABC is the setting, calculate the correction value as follows:
Correction value = $1 + ABC \times 10^{-6}$
- Pressing the X-RESET key during setup displays the default value for that item.
- Pressing the SEND key without pressing the ↓ key restores the setting to its original status and switches the display to the next item.

5.3 Counter communication setup

This item allows you set up the MM system COM port.

"7" appears at the top left of the counter (most significant X axis digit place).

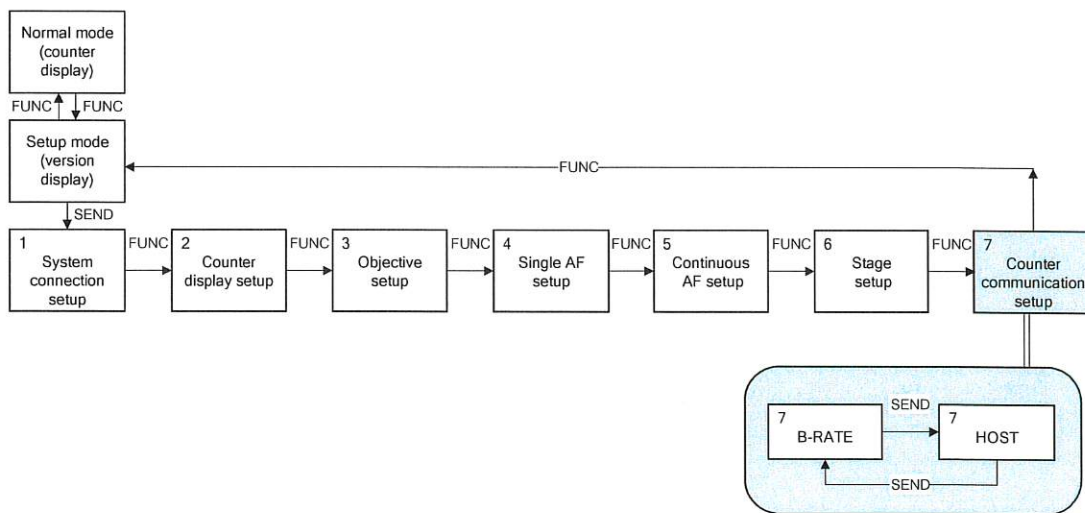
The following two setup screens are available:

- B-RATE: Baud rate (2400, 4800, 9600, 19200, 38400)
- HOST: Destination (PC, printer)

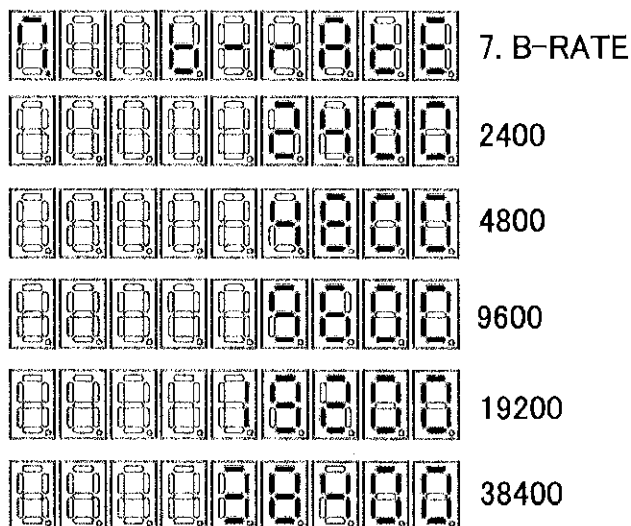
Press the FUNC key twice to return to the Normal mode.

Pressing the FUNC key during setup restores the setting to its original status and switches the display to the Setup mode.

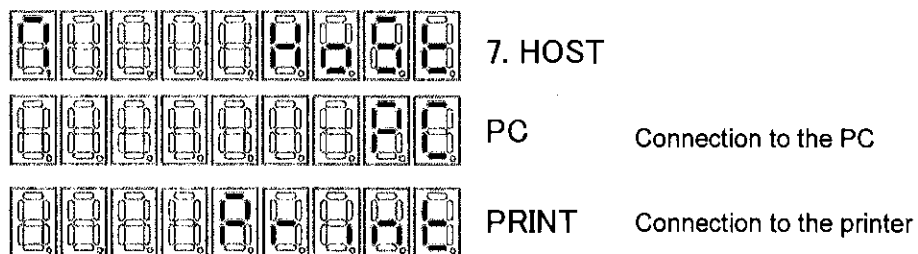
The two setup screens will be displayed alternately until the FUNC key is pressed.



- 1) From the Normal mode, press the FUNC and SEND keys once each, then press the FUNC key six times to enter "7: Counter communication setup." (You are in the "7: Counter communication setup" screen when "7" appears at the top left of the counter.)
- 2) The **B-RATE** screen allows you set the baud rate.
The display will show the options "2400," "4800," "9600," "19200," and "38400" at the bottom in series each time you press the ↓ key. With the desired option shown, press the SEND key to confirm the selection.
Normally, select "9600."



- 3) The **HOST** screen allows you set the destination.
 The display will show the options "PC" and "PRINT" at the bottom alternately each time you press the ↓ key.
 With the desired option shown, press the SEND key to confirm the selection.



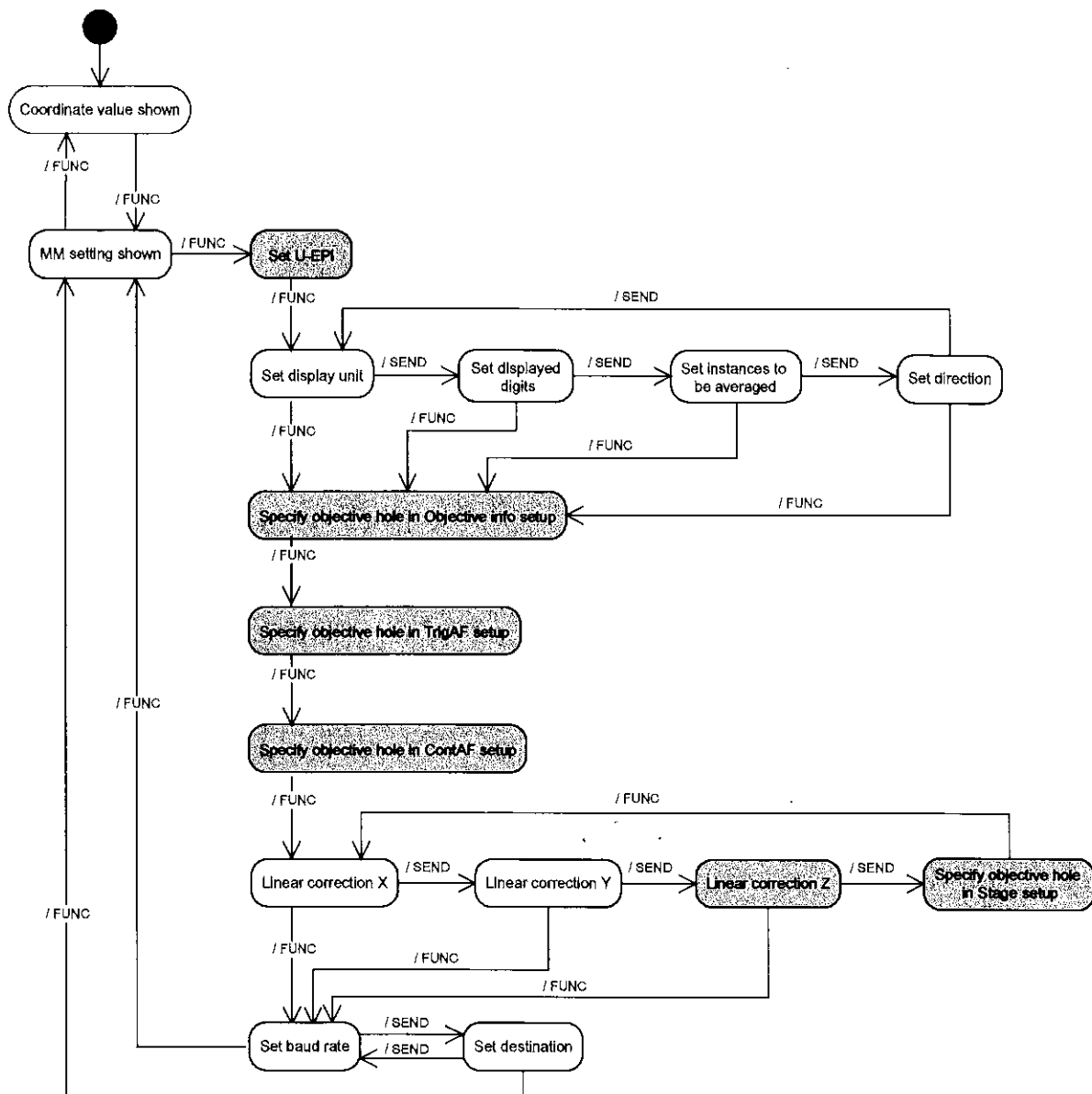
- 4) The **B-RATE** screen appears. Press the FUNC key twice to return to the Normal mode.
- Allowable range

Item	Unit	Range
Baud rate	bps	2400, 4800, 9600, 19200, 38400
Destination	None	PC or printer

Note:

- Pressing the SEND key without pressing the ↓ key restores the setting to its original status and switches the display to the next item.

5.4 Setup flow



Note) Items marked with the shaded box are not used for this product.

6. Troubleshooting

If the microscope does not function correctly, perform the inspections described below. If the problem persists, contact your nearest Nikon representative.

6.1 Measuring microscope main unit (Viewing)

1. Incomplete field of view. Uneven brightness across field of view.

- Parts are not attached correctly.
 - ⇒ Make sure all parts are attached correctly.
- Movable parts were switched improperly.
 - ⇒ Make sure you correctly switch moveable part such as the green filter slider.
- The specified illuminator is not used.
 - ⇒ Use the specified illuminator.

2. Noticeable dirt and dust in the field of view

- Dust is deposited on the lens, filter, or specimen surface.
 - ⇒ Clean off dust.

3. Some parts of the image are out of focus.

- The specimen is not properly positioned on the stage surface.
 - ⇒ Make sure the specimen is attached correctly.

4. Excessive brightness

- Excessive illumination voltage
 - ⇒ Adjust with the brightness control knob.

5. Unable to achieve focus with high-magnification lens.

- Not diopter-adjusted.
 - ⇒ Perform diopter adjustment.

Note: Objectives for the measuring microscope in a range from 1x to 10x are best recommended.

6.2 Measuring microscope main unit (Operation and control)

1. **The power will not turn on, even when the power switch is switched on.**
 - The power cord is either not connected or connected improperly.
 - ⇒ Make sure the cord is properly connected.
2. **The lamp fails to light.**
 - The power is off.
 - ⇒ Switch to ON.
 - The lamp cord is either not connected or improperly connected.
 - ⇒ Make sure the cord is properly connected.
3. **The workpiece will not move straight.**
 - Parallel positioning of the crosshairs of the eyepiece has not been checked.
 - ⇒ Check parallel positioning of the crosshairs of the eyepiece.
 - The microscope base is not level.
 - ⇒ Adjust the height adjustment legs until the microscope base is level.
4. **No reading or an incorrect reading is displayed on the counter display unit.**
 - The counter cables are either not connected or improperly connected.
 - ⇒ Make sure the cables are properly connected.
5. **No counting reading or an incorrect reading is displayed on the data processor console DP-E1.**
 - The cables are either not connected or improperly connected.
 - ⇒ Make sure the cables are properly connected.

Turning on the equipment in improper sequence may result in malfunctions.

Turn on the equipment in proper sequence in accordance with the instructions given in "Sequence in which equipment is turned on" on p.6.

6.3 Counter display

First check the following items if you suspect the unit is broken.

Symptom	Check
No power	<ul style="list-style-type: none"> • Are you using the correct power cable?
Does not count	<ul style="list-style-type: none"> • Is there a problem with the input connector or cable? • Turn the unit off, wait three seconds, then turn back on.
Miscounts	<ul style="list-style-type: none"> • Are the display units set to "mm"? • Is there a problem with the input connector or cable? • Is a significant noise source positioned nearby? • Is the unit fully grounded?
Odd display	<ul style="list-style-type: none"> • Is the voltage correct?
Measurement is inaccurate	<ul style="list-style-type: none"> • Is there any mechanical bending or excess play? • Has the temperature risen to abnormal levels? • Has the correction coefficient been set correctly?
RS-232C communication problem	<ul style="list-style-type: none"> • Are you using the RS-232C cross-cable? • Is the baud rate set to 9600 bps?
Unable to send data to printer	<ul style="list-style-type: none"> • Are the communication specifications met (i.e., criteria such as data bit length)? • Are you using the required RS-232C cable (dedicated cable for the DPU-414)? • Is the baud rate set to 9600 bps?
"Ec Error" appears. Encoder connection error	<ul style="list-style-type: none"> • Is the cable connected to the STAGE port faulty? • The cable connection may be loose. Turn off the microscope and check the connection.
"E-----11" Undefined RS-232C communication command error	<ul style="list-style-type: none"> • Have you entered an undefined command for RS-232C communication? • Press the SEND key and enter a correct command.

If you cannot resolve the problem after checking the preceding items, contact your dealer or nearest Nikon representative.

7. Care and Maintenance

7.1 Lens cleaning

Keep the lens free of dust, fingerprints, etc. Dirt on the lenses or filters will affect image quality. If any of the lenses become dirty, clean them by the procedure given below.

To clean other areas, such as inside the eyepiece tube, please contact your nearest Nikon representative.

- Brush away dust with a soft brush or wipe away gently with gauze.
- If fingerprints or grease gets on a lens, moisten a piece of soft, clean cotton cloth, lens tissue, or gauze with absolute alcohol (ethyl or methyl alcohol) and wipe.
- Absolute alcohol is highly flammable. Be careful when handling it, particularly around open flames or when turning the power switch on or off.
- Follow the instructions provided by the manufacturer when using absolute alcohol.

7.2 Cleaning the product

- It is recommended to use a silicon cloth to clean the product.
- For stubborn dirt, dampen a piece of gauze with dilute neutral detergent and wipe gently.
- Use of organic solvents on plastic parts or coated parts may result in discoloration.

7.3 Protection against dust

- Always take care to protect the measuring microscope from dust, particularly the sliding surfaces of the stage and the focusing mount guide. Cover the microscope with a cover or similar article when the microscope is not in use.

7.4 Lubrication

- Under normal use, the focusing mount guide and rack should require no lubrication for extended periods. If lubrication is required, use an approved lubricant/grease such as Epinoc Grease AP-O from Nippon Oil Corporation.

7.5 Storage

- Store the product in a dry location where mold is unlikely to form.
- Store the objectives and eyepieces in a dry box or similar container with a drying agent.
- Place the plastic cover over the product to protect it from dust.
- Cover the product with the plastic cover after switching off the product (press the switch to the "O" position).

7.6 Periodic inspections (fee charged)

To maintain peak performance of the microscope, it is recommended that periodic inspections are carried out. Contact your nearest Nikon representative for more information. (Parts and service charges apply for this service.)

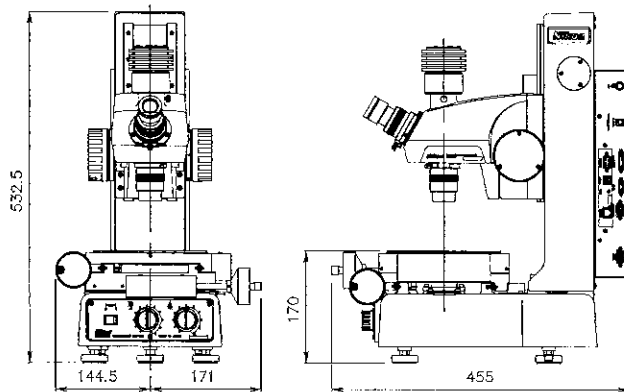
8. Specifications

8.1 System configuration

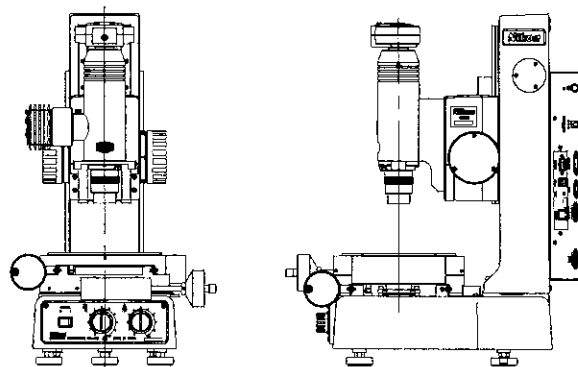
Main unit:	MM-200 (including the XY stage)
Power supply:	AC adapter, power cord
Optical head:	Use the monocular optical head MM-MN2 when the visual observation is performed. Use the simple video head when the camera observation is performed.
Eyepiece:	Monocular eyepiece (when used for the visual observation)
Objective:	Objectives exclusive for the measuring microscope
Illuminator:	Epi-illuminator MM-MP1
Counter display:	2-axis digital counter SC2-E1

8.2 Style

Type:	Single-column X-Y stage type
Dimensions (W × D × H):	315.5 × 532.5 × 455 mm (in clamped condition)
Weight:	approx. 40 kg



With the monocular optical head attached



With the simple video head attached

8.3 Monocular optical head when used for the visual observation

Model: MM-MN2

Image: Upright, erect image

Eyepiece tube: Monocular optical head: 30° inclination

8.4 Simple video head when used for the camera observation

Camera mount: C-mount

8.5 Eyepiece when used for the visual observation

Magnification: 10×

Diopter adjustment range: -8 to +5 m⁻¹**8.6 Objectives**

Magnifying power	Real viewfield mm	N.A.	Depth of focus μm	Working distance (W.D.) mm	Weight g	Accuracy of magnification %
1×	φ 20	0.03	782	79	120	±0.1
3×	φ 6.6	0.09	87	75.5	150	±0.1
5×	φ 4	0.13	38	64	150	±0.1
10×	φ 2	0.2	14	48	200	±0.1
20×	φ 1	0.4	3.5	20.3	650	±0.15
50×	φ 0.4	0.55	1.4	15.1	600	±0.3
100×	φ 0.2	0.75	0.7	4.1	550	±0.5

Mounting screw: M26 × 0.75

Distance from objective thrusting end to the image: 200 mm

Distance from objective thrusting end to the workpiece: 126 mm

Note: Objectives exclusive for the measuring microscope in a range from 1x to 10x are best recommended.

8.7 Overall magnification accuracy when used for the visual observation

Same as that of the objectives in the center 1/2 of viewfield

8.8 Focusing mount

Travel: 110 mm

Travel per rotation of Z-axis knob: approx. 38.3 mm/rev

8.9 Stage

Travel (X × Y axes): 50 × 50 mm

Size of stage: ϕ 174 mm

Size of stage glass: ϕ 107 mm

Workpiece weight for which precision is guaranteed: 2 kg

Workpiece weight for which load bearing capacity is guaranteed: 5 kg

Positioning accuracy for each axis ("L" represents measured length in mm):

2.5+L/50 μ m (submicron calibration in the environment in which accuracy is guaranteed)

3+L/50 μ m (standard in the environment in which accuracy is guaranteed)

Travel per rotation of Z-axis knob: approx. 1.25 mm/rev

Rotation range of the rotation plate: 360 degree

8.10 Power supply

Specified AC adapter

Manufacturer: EDACPOWER Electronics Co.,Ltd

Model: EA1050A-120

Input ratings: 100-240 V AC (\pm 10%), 50/60 Hz, 1.8 A max.

Output ratings: 12 V DC, 5 A max. (The inner terminal is the negative pole.)

Protection class: Class I

Others: PSE-approved, UL-approved, CE-compatible

8.11 Counter display

Model: SC2-E1

Display: Both X and Y axes

\pm 9,999.99 mm (resolution: 10 μ m)

\pm 9,999.999 mm (resolution: 1 μ m)

\pm 9,999.9999 mm (resolution: 0.1 μ m)

Display when reset: Both X and Y axes

0.00 mm (resolution: 10 μ m)

0.000 mm (resolution: 1 μ m)

0.0000 mm (resolution: 0.1 μ m)

Outer dimensions: 130 (W) × 85 (H) × 26.5 (D) mm

Weight: approx. 0.5 kg (including supplied cable)

8.12 Data processing console

Model:	DP-E1
Display device:	5.7" monochrome liquid crystal device
Power supply:	Specified AC adapter
	Manufacturer: EDACPOWER Electronics Co.,Ltd
	Model: EA1050A-120
	Input ratings: 100-240 V AC ($\pm 10\%$), 50/60 Hz, 1.8 A max.
	Output ratings: 12 V DC, 5 A max. (The inner terminal is the negative pole.)
	Protection class: Class I
	Others: PSE-approved, UL-approved, CE-compatible
Input voltage:	+12 V DC
Power consumption:	approx. 50 VA
Backup battery:	CR2032, 2 pcs, (service life: 3 years)
Outer dimensions:	300 (W) \times 99 (H, with legs folded) \times 240 (D) mm
Weight:	approx. 4 kg

8.13 Epi-illuminator

Model:	LED monocular illuminator MM-MP1
Light source:	White LED
Power consumption:	3 W
	Class 1 LED product

8.14 Power cord

Use the following power supply cord.

In Japan:

Labeled with PSE mark. Detachable three-prong power cord.
125V AC, 7A min

In the 100-120V regions (except for Japan):

UL-listed detachable power cord set, three-conductor grounding type SVT No18AWG,
3-m long max., rated at 125V, 7A min.

In the 230V regions:

Approved by EU/EN-standards, three-conductor grounding type H05VV-F, 3-m long max.,
rated at 250V, AC min.

8.15 Operating conditions

Temperature: 0 to 40°C
Relative humidity: 70% or less (no condensation)
Altitude: 2,000 m max.
Degree of contamination: Degree 2
Installation category: Category II
Restricted to indoor use only

8.16 Environment in which accuracy is guaranteed

Temperature: 20 °C ± 1 K

8.17 Storage conditions

Temperature: -20 to +60°C
Relative humidity: 90% or less (no condensation)

Conforming standards

CE Marking

This product meets EU LV Directive (Low Voltage Directive) requirements.

This product meets EU EMC Directive requirements.



This product meets FCC 15B Class A requirements.

This equipment has been tested and found to comply with the specifications for a Class A digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area may cause harmful interference, in which case the user will be required to correct the interference at his own expense.

This product conforms to Canadian EMI regulations.

This class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

MICROSCOPY + METROLOGY SERVICES

Suisse made.



RYF AG
Bettlachstrasse 2
CH-2540 Grenchen
Tel. +41 32 654 21 00
ryfag@ryfag.ch · www.ryfag.ch

RYF SA Succursale
Route de Genève 9c
CH-1291 Commugny
Tel +41 22 776 82 28
ryfag@ryfag.ch · www.ryfag.ch

RYF AG (Zürich)
Bahnhofplatz 17
CH-8400 Winterthur
Tel +41 52 560 22 25
ryfag@ryfag.ch · www.ryfag.ch