Nikon

CNC Video Measuring System NEXIV

model

VMR-3020

Instructions

(Hardware)

Thank you for purchasing the Nikon products.
This instruction manual is written for the users of the Nikon CNC Video Measuring System NEXIV "model VMR-3020".
To ensure correct usage, read this manual carefully before operating the instrument.

- The contents of this manual are subject to change without notice.
- Some of the products described in this manual may not be included in the set you have purchased.
- Although every effort has been made to ensure the accuracy of this manual, if you note any points that are unclear or incorrect, contact your nearest Nikon representative.
- Also refer to the instruction manuals for any other system that you may be using in conjunction with this product (such as a personal computer, display, etc.).

Warning/Caution Symbols Used in This Manual

Although Nikon products are designed to provide you with the utmost safety during use, incorrect usage or disregard of the instructions can cause personal injury or property damage. For your safety, read the instruction manual carefully and thoroughly before using the instrument. Do not discard this manual but keep it near the product for easy reference.
In this manual, safety instructions are indicated with the symbols shown below. Be sure to follow the instructions indicated with these symbols to ensure correct and safe operation.

Symbol	Meaning
⚠ **WARNING**	Disregarding instructions marked with this symbol may lead to death or serious injury.
⚠ **CAUTION**	Disregarding instructions marked with this symbol may lead to injury or property damage.

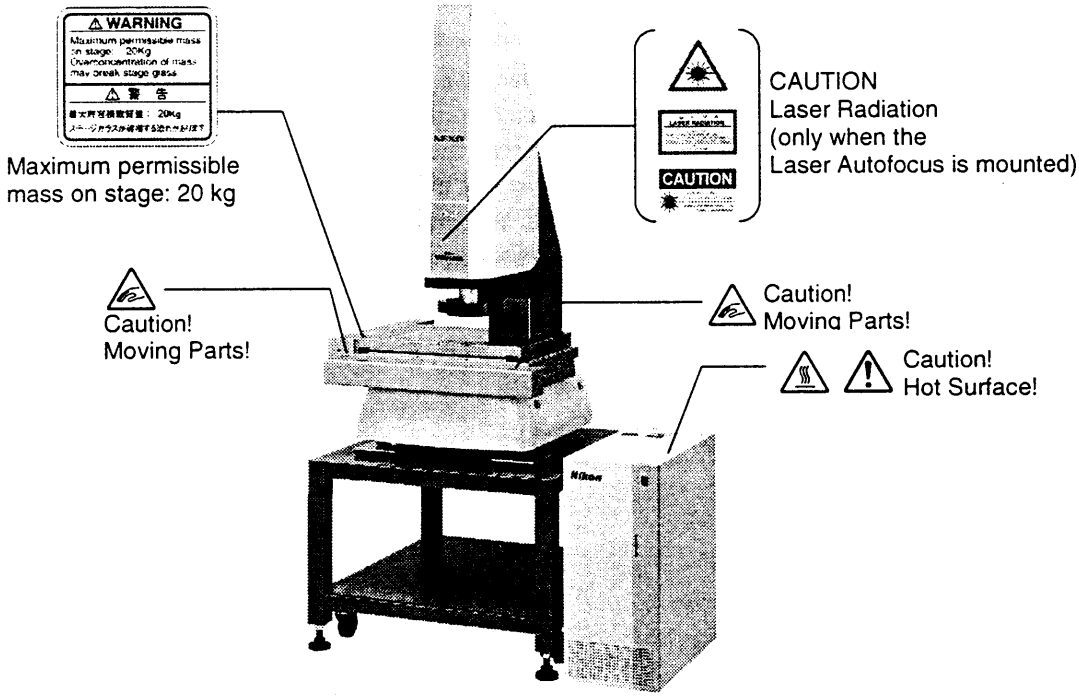
Meaning of Symbols on the Product

Symbol	Explanation
	**Caution! Hot Surface!** These symbols on the top plate of the controller remind you of the following cautions: • There are built-in lamps inside the controller for diascopic and episcopic illuminations. The lamps and their surroundings become extremely hot when the lamp is on and immediately after they have been turned off. • Serious burns can result from touching the lamps and their surroundings while the lamp is on and immediately after they have been turned off. Do not touch these hot surfaces. • Do not bring flammable materials (including cloth, paper, gasoline, paint thinner, alcohol, etc.) near the controller when the lamp is on and immediately after the lamps have been turned off. • Before replacing the lamp, always wait until the lamps are cooled down. • To prevent electric shock while replacing the lamp, always turn the power switch on the controller off and unplug the power cord from the outlet. • Always use the specified type of lamp. Using another type of lamp could result in an accident or fire. (Refer to p. 13.) • There are ventilation openings for a cooling fan on the rear of the controller. In order to allow for adequate dissipation of heat, install the controller so that there is an open space of at least 20 cm between the rear panel of the controller and the nearest wall. Also, do not obstruct the ventilation openings on the front of the controller.

Symbol	Explanation
	**Caution! Moving Parts!** This symbol on the stage reminds you of the following cautions: • Do not touch the main unit or the stage while they are in motion. Your hands or fingers could be caught in the machinery. • Do not place your hand within the area of stage movement in the X and Y directions, nor under the components that move in the Z direction. Your hands or fingers could be caught in the machinery. • When working on the stage, such as placing a sample on the stage, never move the movable components.

Symbol	Explanation
	**Maximum permissible mass on stage: 20 kg** This label on the stage reminds you of the following cautions: • The maximum mass that can be placed on the stage is 20 kg. • Never exceed the maximum permissible mass, taking into consideration not only the mass of the workpiece but also the mass of the clamps, etc. • Exceeding the maximum permissible mass could cause the stage glass to break.

Symbol	Explanation
  	When the Laser Auto focus model VMR-LAF10 is mounted on the main unit, the whole system falls under the Class II defined in 21 CFR Part 1040.10 in FDA (USA) or under the Class 3A Laser product defined in IEC(EN)60825-1(1997), and the marks and labels on the left are indicated on the main unit. These marks and labels remind you of the following cautions; • Do not look directly at the laser beam (red beam). Doing so could damage your eyesight. • Never watch lens aperture of the beam emitter directly or via mirrors while laser beams are emitted. • Never operate the laser AF when setting or removing the mirror-surfaced workpiece on or from the stage. • Before using the VMR-LAF10 for the NEXIV VMR Series, be certain to read the instruction manual for the VMR-LAF10 carefully. The instruction manual contains important safety information.



⚠ WARNING

1. Purpose of system

   This system is a precision optical measuring system. Do not use it for any purpose other than measurement and observation. The controller for this system was developed specifically for this system; do not use it for any other purpose.

2. Do not disassemble the system

   Never attempt to disassemble this system except as specifically instructed in this instruction manual. Attempting to disassemble the system could harm the performance of the system, and also carries a risk of electric shock and injury.

   The zoom head, guide, and scale are adjusted at the factory with extreme precision, so never attempt to disassemble them. If you notice a problem, contact your nearest Nikon representative.

3. Turn off the power when connecting or disconnecting cables

   When connecting or disconnecting any of the cables, always turning off the power and unplug the power cord first to prevent any possible electric shock.

   Before turning off the power, be sure to first close any programs that may be running.

4. Emergency stop

   In a case of emergency, press the yellow STOP switch located on the top right of the joystick box. The system stops immediately.

   To recover from an emergency stop, turn the power off, clear the condition that necessitated the emergency stop, and then restart the system.

5. Mass of the workpiece

   The maximum mass that may be placed on the stage is 20 kg. Never exceed the maximum permissible mass, taking into consideration not only the mass of the workpiece but also the mass of the clamps, etc. Exceeding the maximum permissible mass could cause the stage glass to break, which could result in serious injury or a major accident.

6. Moving the system

   Moving the system to another installation location always accompanies the danger of the system tipping over. Always contact your nearest Nikon representative before moving the system. Nikon cannot bear any responsibility for accidents that may occur while the system is being moved without authorization. (However, you can move the system if there are no inclines or changes in level along the path over which the system is to be moved. Be certain that you have read page 7 and understand all of the warnings and cautions described therein before attempting to move the system.)

⚠ CAUTION

1. Confirm the input voltage
   - Before plugging in the power cord, confirm that the input voltage indications on the host computer and the display (located on labels near the power receptacles) match the supply voltage that is being used.
     If the input voltage is not identical to the supply voltage, do not attempt to connect the power but contact your nearest Nikon representative. Using the incorrect supply voltage could cause a malfunction, fire, or electric shock.
   - The input voltage for the VMR-3020 automatically switches between 100-120 V ± 10% and 220-240 V ± 10%. The power supply receptacle is located on the rear of the controller.
   - Always plug the power cords for this system (including the VMR-3020, the computer, and the computer display) into a grounded three-conductor outlet. Improper grounding can result in electric shock or abnormal operation.
   - Always be sure to turn OFF all of the power switches before plugging in the power cords.

2. Do not touch the moving parts
   Do not touch any moving parts, because your hands or fingers could be caught in the system.

3. Heat from the controller and cautions concerning lamp replacement
   The lamps and their surroundings become extremely hot when the lamp is on and immediately after they have been turned off.
   - Be careful and avoid burns. If it is necessary to replace the lamp, wait a sufficient amount of time in order to allow the lamp to cool.
   - Do not bring highly flammable materials (gasoline, benzene, paint thinner, alcohol, etc.), cloth or paper near the controller. Doing so could start a fire.
   - There are ventilation openings for a cooling fan on the rear of the controller. In order to allow the adequate dissipation of heat, install the controller so that there is an open space of at least 20 cm between the rear panel of the controller and the nearest wall. Do not obstruct the ventilation openings on the front of the controller.
   - In order to prevent electric shock or other accidents while replacing the lamp, always turn the power switch on the controller off and unplug the power cord from the outlet before replacing the lamp.
   - Always use the specified type of lamp. Using another type of lamp could cause a malfunction.

   Specified lamp
   - Ratings: 12 V 100 W halogen lamp
   - Model: JCR12V100WH10 (Philips, long-life type)
     or 64637 (Osram, long-life type)

Cautions Concerning Use

1. Installation Location

   To avoid mis-operation and to peform safe and precise measurement, be sure to observe the following points when installing this system.

   Be especially careful not to pinch your fingers, etc., when installing the system.

   - Install the system in a clean environment. Dust and oily vapors can have a clear and adverse impact on the performance of the system. Dirt and corrosion on the guide surfaces of the stage in particular can cause a deterioration in the precision of the system.
   - Install the system in a location where the temperature ranges from 10 to 35 °C and where the humidity is less than 70%. Installation in a hot, humid location can result in condensation and malfunctions.
   - Install the system in a controlled temperature environment (i.e., an environment that is not subject to rapid changes in temperature). Temperature changes can cause measurement errors.
   - Before selecting the installation location, study the requirements described on page 17. Pay special attention to the load-bearing strength of the floor.
   - Install the system in a location with little vibration.
   - Install the system in a location that is not subject to sudden voltage fluctuations or electronic noise.
   - When the lamp is on, the top of the controller becomes extremely hot.
   - If the ventilation holes for the cooling fan in the controller are blocked, a malfunction or fire could result.
   - Install the controller so that there is an open space of at least 20 cm between the rear panel of the controller and the nearest wall. Do not obstruct the ventilation openings on the front of the controller.
   - The lamp in the controller requires replacement occasionally. Therefore, when installing the system, leave enough space to permit access so that the lamp can be replaced.
   - When installing the system, leave at least 20 cm of space between the nearest wall and the sides of the main unit or the measurement stand. Furthermore, when setting up a personal computer rack, etc., next to the main unit and the measurement stand, leave at least 20 cm of space. Otherwise, the moving stage could bump into the wall or adjacent equipment.

2. Handle carefully

   This system is a precision instrument that requires careful handling. Striking the system or operating it in a reckless manner could damage the system.

   Do not forcefully bend or pull the fiber light guide. Doing so could damage the fiber inside and reduce its light-carrying ability.

3. Measurement and temperature

   Generally, the dimensions of a workpiece will change according to the temperature. (The amount of change depends on a coefficient that is inherent to the material.) The operation of this system is guaranteed over a wide temperature range, but in order to obtain stable and reproducible measurement results, the system should be used in an adequately controlled temperature environment with less temperature change. In addition, when using this system for the first time, be sure that you have allowed the system to become fully adjusted to the temperature environment. (Usually, this simply requires leaving the system in that temperature environment for about 24 hours.)

4. Measurement stand

   Although a special measurement stand is provided for the main unit, another stand may be used as long as it offers adequate strength and rigidity.

5. LED illumination

When using LED illumination, be careful not to touch or to let the workpiece come into contact with the exposed portions of the LEDs on the inner diameter of the LED ring. Touching the LEDs could bend some of the individual LEDs out of position, resulting in reduced illumination or mis-operation.

6. Vertical mover

Do not let the optical head or the LEDs collide with the workpiece or the clamps. If there is a collision, press the STOP switch, turn off the power, and then remove the cause of the collision.
After restarting the system, even if it appears that everything is operating normally, be sure to "calibrate the optical head" and "check the Laser Autofocus focal position offset". We also recommend that you have your nearest Nikon representative inspect the system.

7. Cleaning finished surfaces and plastic components

We recommend using a silicone cloth to clean finished surfaces and plastic components. If a surface is especially dirty, wipe it with a dilute, mild detergent. Do not use solvents (such as paint thinner, alcohol, or ether).

8. Isolation from the power supply

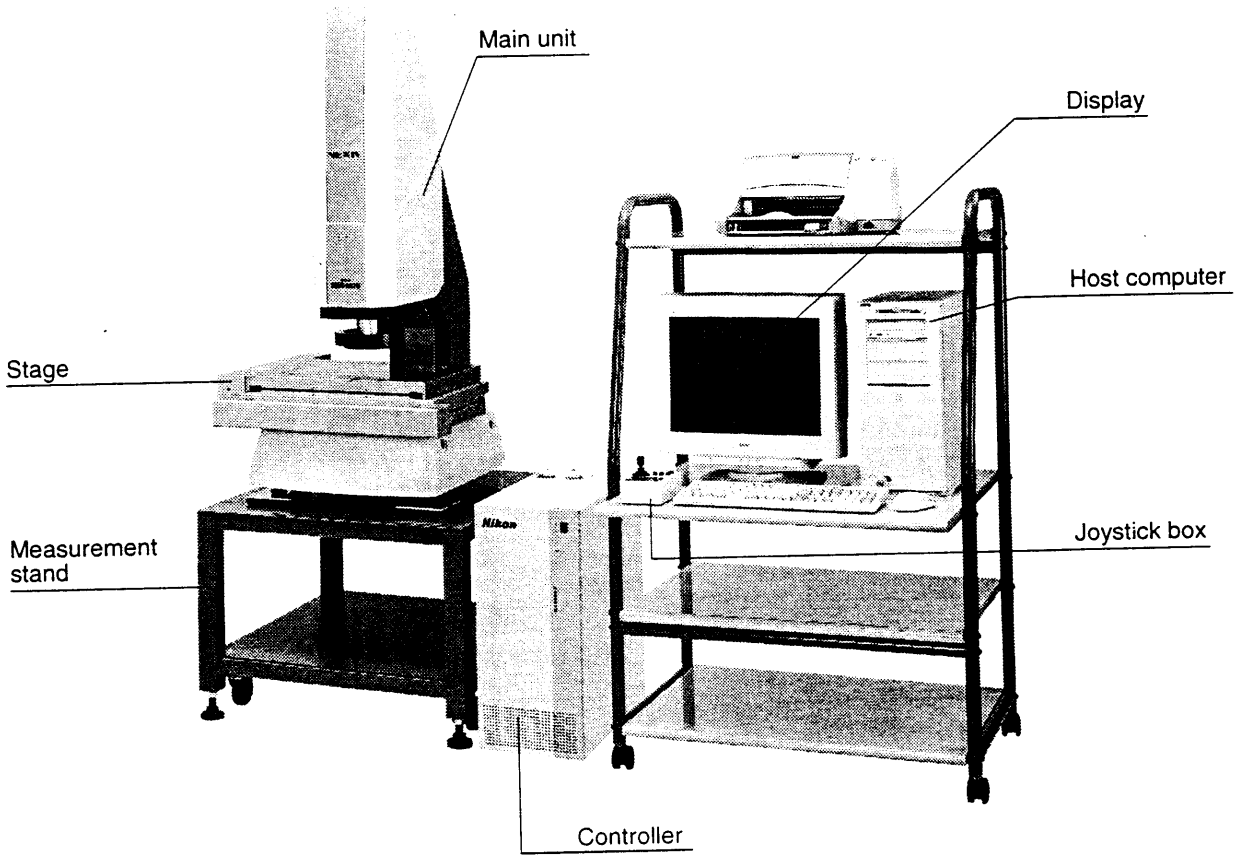
The weak electric power is running through the system even when its power switch is turned off. In the following conditions, be sure to unplug the power cord from the power outlet.

- When the system is not used for a long period of time.
- When you wish to isolate the system from the power source.
- In case of malfunction.

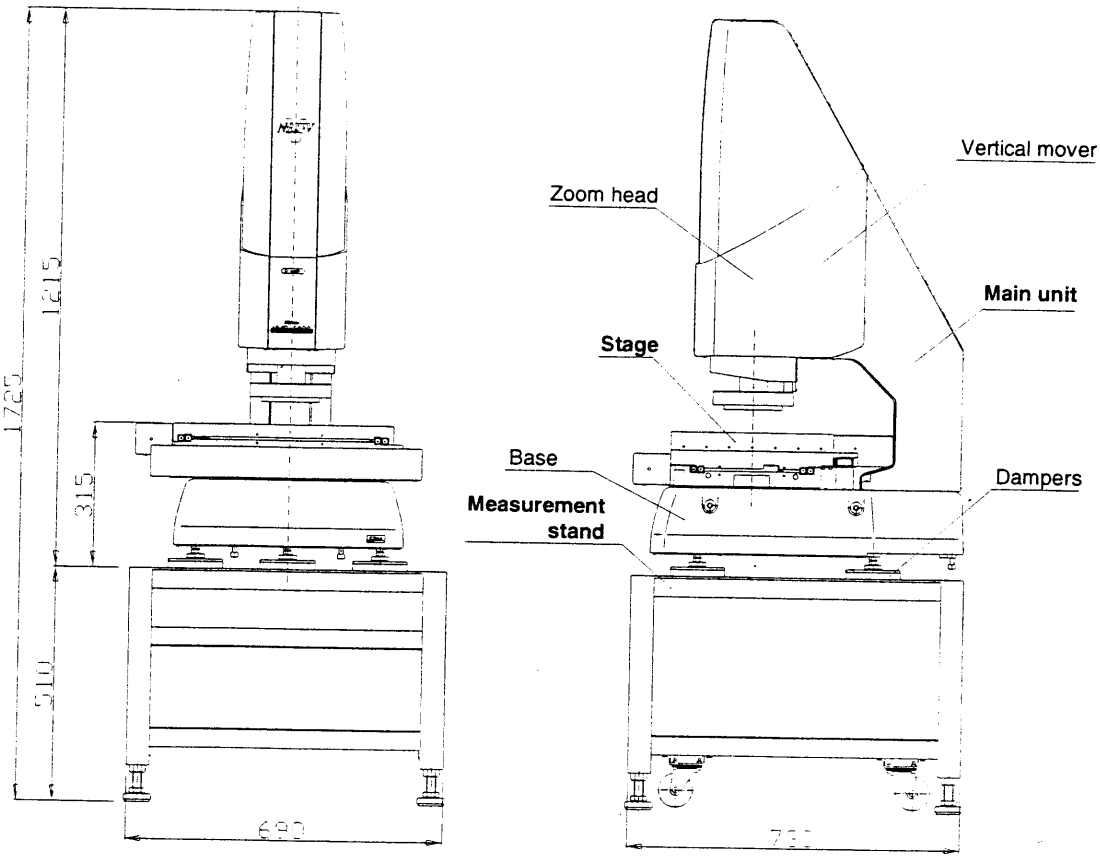
Contents

Chapter I. Names of Parts and Their Functions

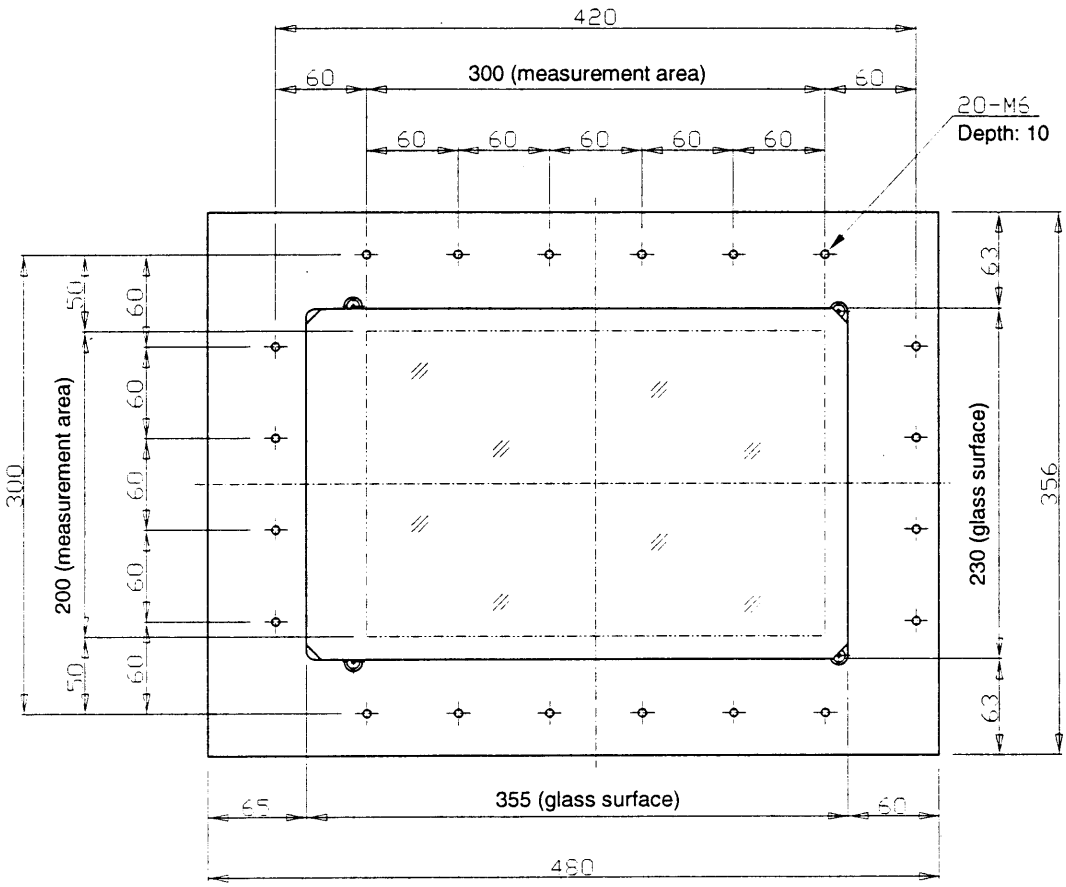
1.1 General



1.2 Main Unit/Measurement Stand



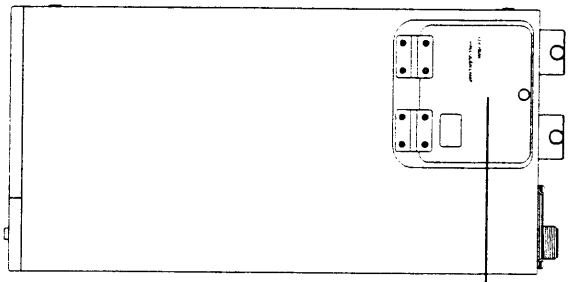
1.3 Top View of Stage



Maximum permissible mass: 20 kg
Including the mass of the clamps to fix workpiece.

1.4 Controller

Green	Lights when the power is on.
Yellow	Indicates the operating status of the internal CPU.
Yellow	Indicates the operating status of the internal DSP.
Yellow	Reserved (for options).
Red	Indicates the operating status of the internal CPU.
Red	Indicates the operating status of the internal DSP.
Red	Reserved (for options).



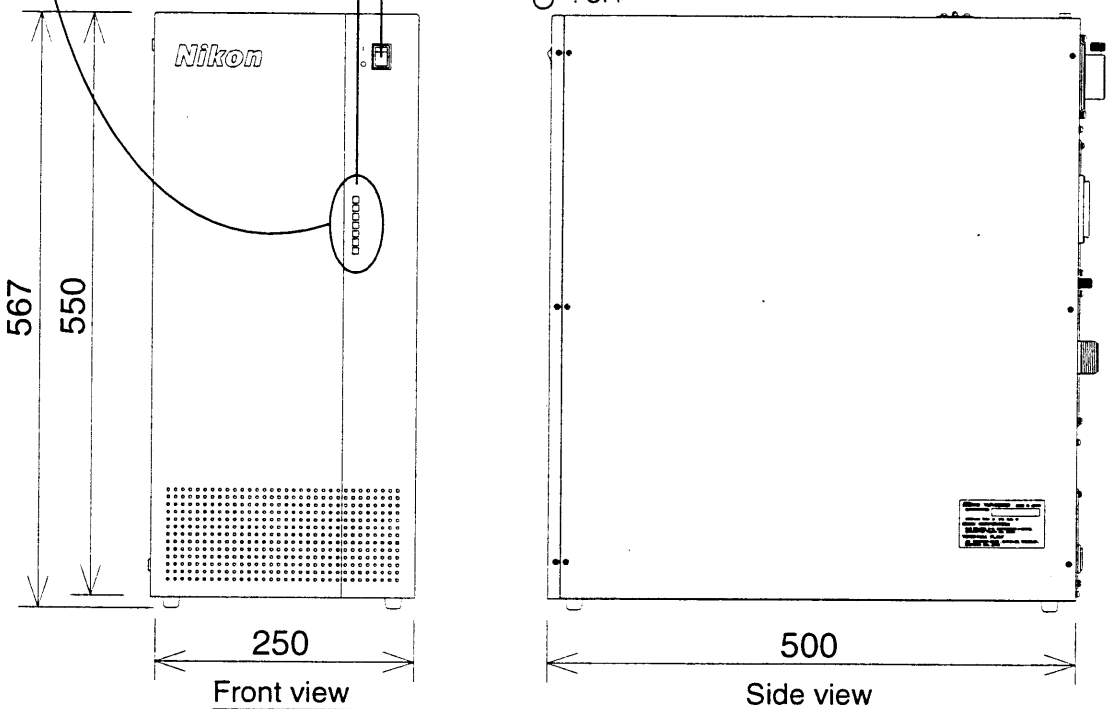
Top view

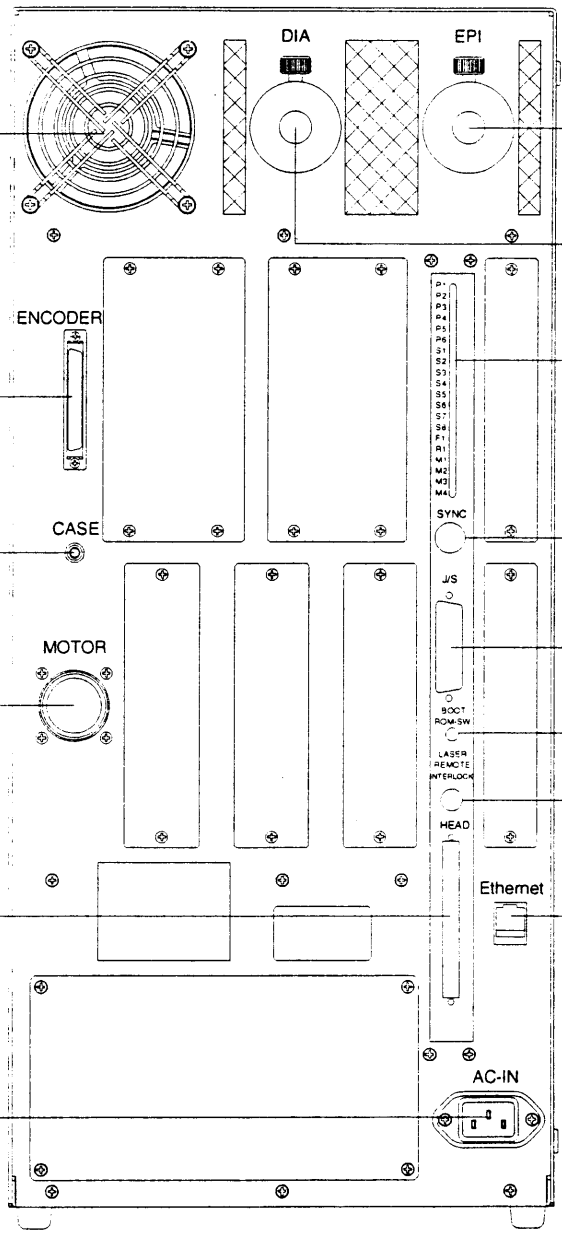
Description of Status indicator LEDs

Status indicator LEDs
Indicate the status of the controller.

Power switch
Turns on and off the power of the main unit.
| : ON
○ : OFF

Lamp housing cover
Open to replace the lamp.





Fan motor

Episcopic illumination fiber light guide connector
Connect the episcopic fiber light guide.

Diascopic illumination fiber light guide connector
Connect the diascopic fiber light guide.

ENCODER connector
Connect to the ENCODER connector on the main unit with the cable provided.

Status indicator LEDs
These LEDs indicate the status of the controller.

External trigger connector
Connect to the SYNC connector on the rear of the host PC with the cable provided.

CASE terminal

J/S connector
Connect to the connector on the joystick box with the cable provided.

MOTOR connector
Connect to the MOTOR connector on the main unit with the cable provided.

BOOT ROM switch
This switch is used when upgrading the ROM.

LASER REMOTE INTERLOCK jack
When the Laser Autofocus (VMR-LAF10) is used in conjunction with the main unit, insert the jumper plug provided here. To permit remote operation of the laser, connect an external interlock device here instead of the jumper plug. (If the connection between the terminals is open, laser emission is blocked; if the connection is closed, the laser operates normally.)

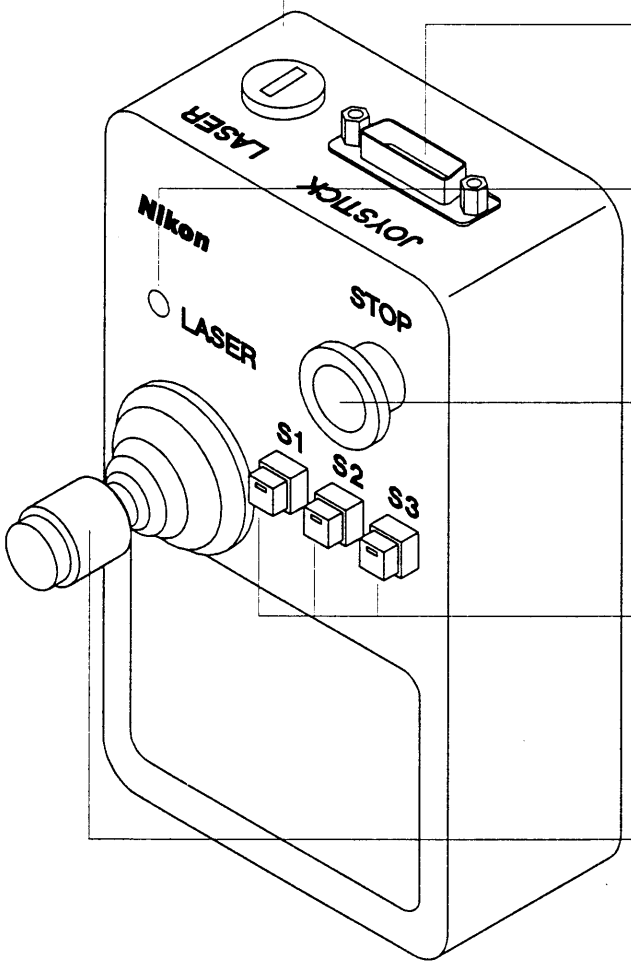
HEAD connector
Connect to the HEAD connector on the main unit with the cable provided.

Power receptacle
Connect to the AC power supply with the cable provided. Be sure to turn the power switch off first when connecting / disconnecting the cable.

Ethernet connector
Connect to the Ethernet connector on the host PC with the cable provided.

Rear View of Controller

1.5 Joystick Box



LASER KEY switch

Turns on and off the laser radiation for the Laser Autofocus.

Joystick connector

Connect to the J/S connector on the rear of the controller with the cable provided.

LASER LED

Lights when the laser for the optional Laser Autofocus is on.

STOP switch

Stops all moving components. To recover, restart the system.

Soft keys

Set the functions from the host computer.
Functions such as:

- Joystick slow drive mode
- Clamping of each axis
- Zoom factor

Joystick

Moves the workpiece in the X and Y directions, and movse the Vertical Mover in the Z direction for focusing. The drive speed varies, depending on the angle of the incline and the degree to which the knob is turned.

Chapter II. Moving the System

⚠WARNING

Moving the system to another installation location always accompanies the danger of the system tipping over. Always contact your nearest Nikon representative before moving the system. Do not attempt to move the system yourself. Nikon cannot bear any responsibility for accidents that may occur while the system is being moved without authorization.

1) This system may tip over if it is tilted more than 15°.
2) If there are any inclines or changes in level along the path over which the system is to be moved, the main unit must be removed from the measurement stand and placed on a special pallet for moving. Have qualified service personnel handle the task of removing the main unit from the measurement stand and placing the main unit back on the measurement stand.
3) A special pallet is required when transporting the system by truck, etc.
4) Do not allow condensation to form on the system while it is being transported.

(As an exception to the rule, you can move the system if there are no inclines or changes in level along the path over which the system is to be moved. Be certain that you have read this section thoroughly and understand all of the cautions described herein before attempting to move the system.)

5) The controller weighs approximately 31 kg. More than two people is needed to lift it up. The half-sitting posture will hurt your back. Use your knees. Also be careful not to let your hands and feet get caught under the equipment.

This chapter explains how to move the system when there are no inclines or changes in level along the path over which the system is to be moved, allowing the system to be moved without requiring the main unit to be removed from the measurement stand.

2.1 Cautions

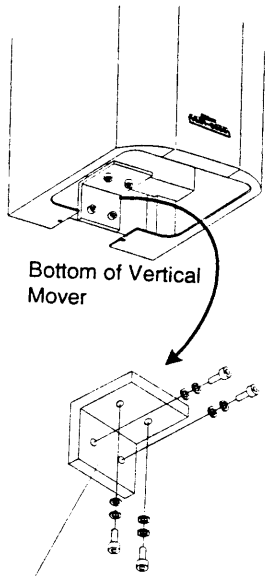
1) This system may tip over if it is tilted more than 15°. Always keep the system in a level attitude while moving it.
2) Do not allow condensation to form on the system while it is being transported. If condensation does form on the system, never turn the power on until the condensation has dissipated naturally. Do not use any drying or heating system to speed the process. Doing so could damage the system or cause a deterioration of precision.

2.2 Required tools

- Screwdriver (+)
- Hexagonal wrench (3, 4 mm)
- Open-end wrench (30 mm)
- Level
- Shipping clamps provided with the system

2.3 Moving Procedure

1) **Attach shipping clamps to the vertical mover.**
   (1) Move up the vertical mover to the limit using the joystick.
   (2) Fix the longer part of the shipping clamp to the screw holes at the lower front of the vertical mover cover.
   (3) Lower the vertical mover using the joystick until the vertical mover comes in contact with the shipping clamp. Then fix the shipping clamp to the vertical mover.



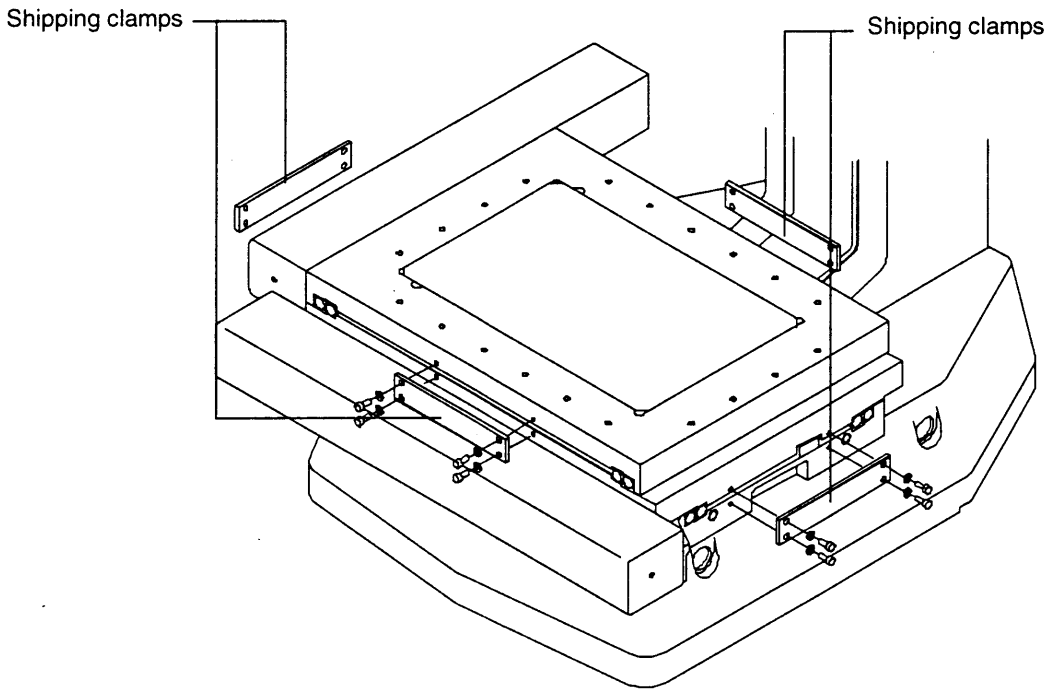
2) **Turn off the power.**
   Turn off the power switch for the main unit, located on the front of the controller, and the power switch on the host computer. Then, unplug the controller's power cord from the power outlet.

3) **Disconnect the host computer.**
   Disconnect (on the host computer side) the communications cable and the camera cable that connect the host computer to the main unit.

4) **Disconnect the controller.**
   Disconnect the fiber light guides connected to the rear of the controller.
   Disconnect (on the controller side) the other cables that are connected to the rear of the controller.
   Protect the ends of the disconnected fiber light guides and cords and secure them in a location where they will not get in the way while the system is being transported.

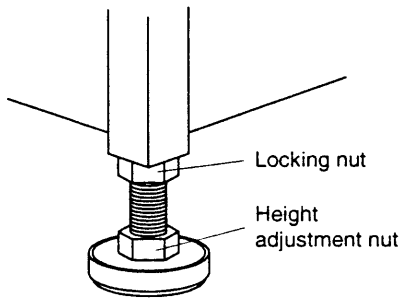
5) **Attach shipping clamps to the stage.**

Attach one shipping clamp each to the front and back of the stage.
Attach one shipping clamp each to the left and right sides of the stage.
Be careful not to apply undue force on the stage when doing so.
All four of these shipping clamps are identical.



6) **Use the casters on the measurement stand to move the system.**

Loosen the locking nuts on each of the legs of the measurement stand and then turn the height adjustment nuts so that all four casters are touching the floor.
Push the measurement stand so that it moves slowly and gently. Do not push the main unit.
If there are any inclines or changes in level along the path over which the system is to be moved, the main unit must be removed from the measurement stand. Contact your nearest Nikon representative beforehand so that qualified service personnel can handle this task. Nikon cannot bear any responsibility for accidents that may occur while the system is being moved without authorization.



Measurement Stand Leg

7) **Secure the measurement stand.**

Once the measurement stand has been moved to its new position, turn the height adjustment nuts on each of the legs of the measurement stand so that the measurement stand is secured in place. The legs should all be extended so that all of the casters are off of the floor.

Do not tighten the locking nuts until after step 9 ("Level the system") has been performed.

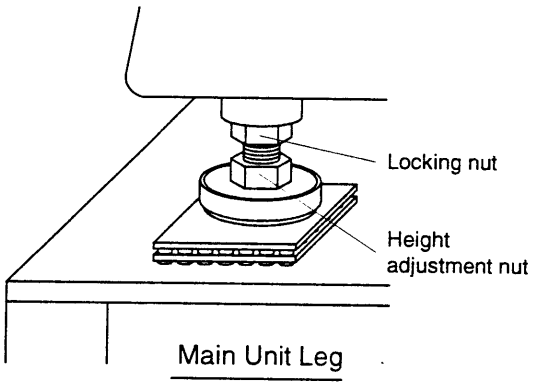
8) **Remove the shipping clamps.**

Remove the shipping clamps in the reverse of the order described in step 5 ("Attach shipping clamps to the stage") and step 1, ("Attach a shipping clamp to the Vertical Mover").

9) **Level the system.**

Place a level on the stage glass and adjust the height adjustment nuts on the legs of the measurement stand and the main unit until the surface of the stage glass is level. Adjust any major tilt through the four legs of the measurement stand and make fine adjustments through the three legs of the main unit. After all adjustments have been completed and the surface glass is level, be sure to tighten the locking nuts on all of the legs of the measurement stand and the main unit.

Make sure that all four legs of the measurement stand are making firm contact with the floor and are stable.



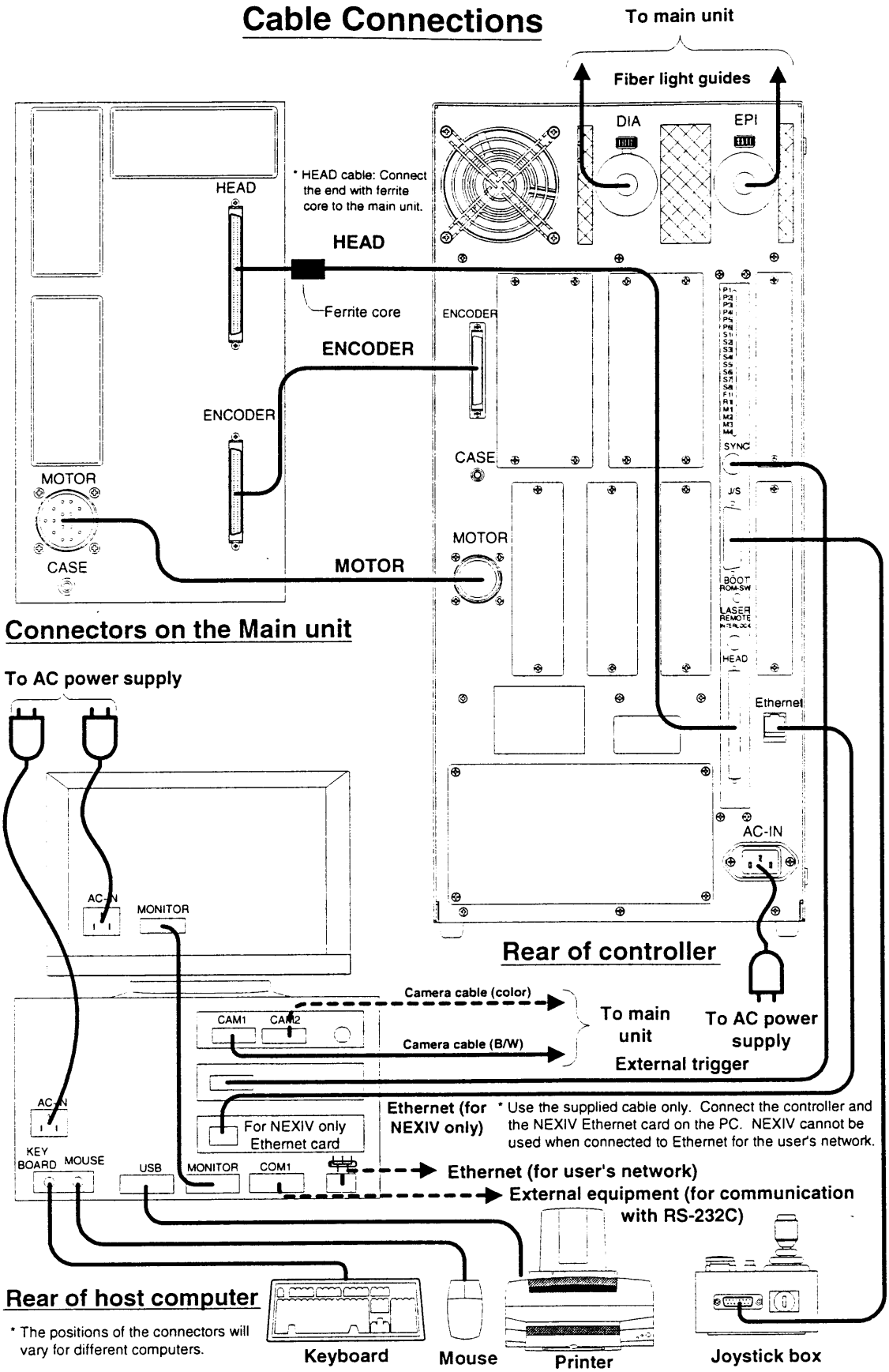
10) **Connect the controller.**

Connect the fiber light guides and the cables to the controller. (Refer to the figure on the next page.)

11) **Connect the host computer.**

Connect the communications cable and the camera cable to the host computer. (Refer to the figure on the next page.)

Cable Connections



Connectors on the Main unit

12) Connect the power cord.

Plug the controller's power cord into a 3-conductor outlet.

13) Confirm operation.

After confirming that all of the steps described above have been completed, start up the system and confirm that it is operating correctly.
Do not, however, turn on the power if condensation has formed on the system while it was in transport. Wait until the condensation has dissipated naturally.
If the system does not operate correctly, check the following.

(1) Is the power cord plugged securely into the outlet?
(2) Is the power supply adequate?
(3) Are the various cords (fiber light guides, cables, power cord) connected to the controller properly?
(4) Is the power switch on the controller in the "ON" position?
(5) Is the communications cable between the host computer and the main unit connected correctly?
(6) Have all of the shipping clamps been removed?
(7) Are the four legs of the measurement stand resting solidly and in a stable fashion on the floor?
(8) Is the main unit level?
(9) Is the floor where the system has been newly installed sturdy enough?
(10) Is the floor where the system has been newly installed free from vibration?

If the system still does not operate correctly after checking all of the above items, discontinue using the system and contact your nearest Nikon representative.

14) Calibrate the optical head.

Before making any measurements, perform the following calibrations, (1) through (3). Failure to calibrate the head will mean that measurements that are taken will be incorrect.

(1) Magnification compensation
(2) Optical axis compensation
(3) Camera rotation compensation

Use the special templates for calibration.
Failure to perform these calibrations will mean that measurements that are taken will be incorrect.
For details on the calibration procedure, refer to the instruction manual for the "VMR Automeasure."
Calibration should be performed on a regular basis (approximately once per month).

Chapter III. Operation

Basically, this system is operated through the host computer. For details on making measurements, refer to the instruction manual for the "VMR Automeasure." This chapter explains how to turn the system on and off, how to replace the lamp, etc.

3.1 Turning the Power On and Off

Power ON: Turn on the power switch on the front of the controller.
Turn on the power switch on the host computer.

Power OFF: Close all of the applications that are currently running, including NEXIV. Shut down Windows, which will shut off the host computer.
Turn off the power switch on the front of the controller.

3.2 Cleaning

Use this system in as clean an environment as possible in order to prevent dust and grease from accumulating on the system. In particular, clean the stage guide surfaces regularly so that they are always kept clean.

3.3 Lubrication

While cleaning, apply Riken Seiyu's M-1 lubricant to the stage guide surfaces as needed.

3.4 Replacing the Lamp

The lamp has a limited operational life. Although it depends on how the system is used, the lamp may need to be replaced once every few weeks or once every few months. (The rated life of the lamp is about 1000 hours. However, the manner in which the lamp is used and the environment affect the actual life of the lamp.)

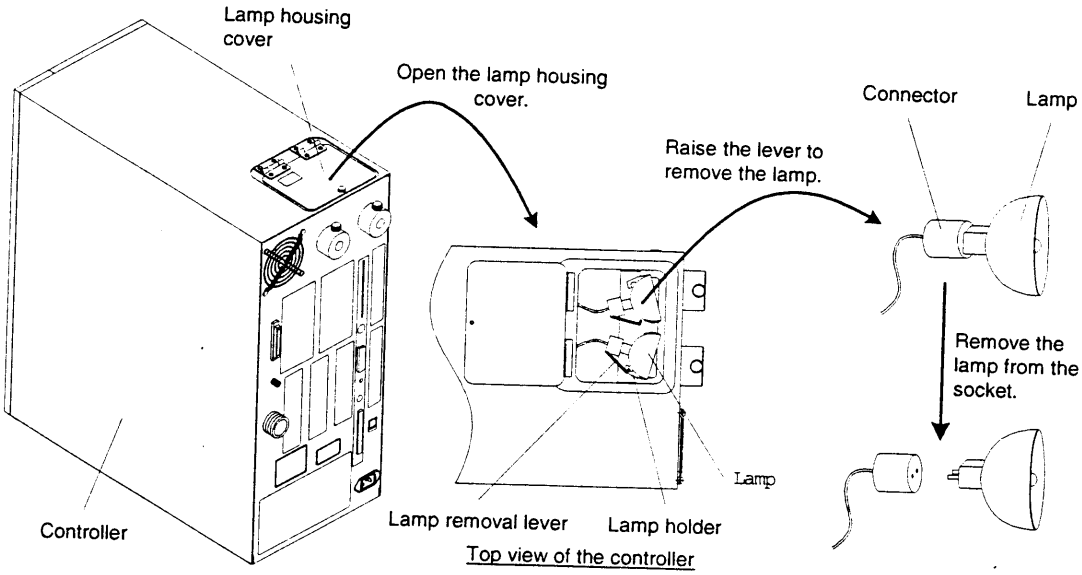
The lamps are installed in the controller at the factory for shipping and adjustment. Note that these lamps may burn out faster than indicated in the specifications.

- The lamps and their surroundings become extremely hot when the lamp is on and immediately after they have been turned off. When replacing the lamp, always wait until the lamps and their surroundings cool sufficiently.
- Do not touch the glass bulb of the lamp or its reflector with your bare hands. Doing so can reduce the illumination produced by the lamp, and can result in a blurred screen display. If you do get any fingerprints on the bulb or the reflector, use a soft cloth or a silicone cloth to wipe them away.
- Always use the specified type of lamp. Using another type of lamp could cause an system malfunction.

Specified lamp	Ratings:	12 V 100 W halogen lamp
	Model:	JCR12V100WH10 (Philips, long-life type)
		or 64637 (Osram, long-life type)

● Lamp replacement procedure

(1) Turn off the power switch on the front of the controller.
(2) Unplug the power cord from the power outlet.
(3) Wait until the lamps and their surroundings have cooled off.
(4) Loosen the screw on the lamp housing cover, and then open the cover.
(5) Gently raise the lamp removal lever, and then remove the old lamp from the lamp holder.
(6) Remove the old lamp from the lamp socket.
(7) Install a new lamp in the lamp socket.
(8) Push the new lamp straight down into the lamp holder.
(When doing so, make sure that the lamp positions are not crossed. If crossed, the diascopic and episcopic illumination will be reversed.)
(9) Close the lamp housing cover and tighten the lamp housing cover screw.
(10) Turn on the power switch on the front of the controller.



Top view of the controller

3.5 Encoder signal auto correction

This system is equipped with an optical linear encoder that offers excellent stability, but slight signal deviations can arise as a result of extended use, dirt on the encoder scale, rapid temperature deviations, etc. Although these deviations are on the order of submicrons, they can have a cumulative effect on precision. This system is equipped with a diagnostic function that detects this type of signal deviation and compensates for it. As with optical head calibration, this function should be executed on a regular basis.

Chapter IV. Performance and Specifications

4.1 Model

- Type: Single-column X-Y stage type
- Dimensions (W × D × H)
  - Main unit: 625 x 728 × 1195 mm
  - Controller: 250 x 524 × 567 mm
  - Joystick box: 100 x 181 × 98 mm
  - Measurement stand: 690 x 730 × 510 mm
- Mass
  - Main unit (including stage and head): 160 kg
  - Controller: 31 kg
  - Measurement stand: 40 kg

4.2 Measurement

- Measurement range: 305 × 205 × 155 mm (X × Y × Z)
- Measurement method: Diascopic linear encoder
- Minimum display unit: 0.1 µm

4.3 Drive

- Drive method: All-axis DC servo motor
- Maximum drive speed: X,Y: 150 mm/s
  Z: 50 mm/s
- Positioning precision: 1.0 µm (for X, Y, Z)

4.4 Sections

- X-Y stage section
  - Effective stroke: 300 × 200 mm
  - Size of stage surface: 480 × 356 mm
  - Size of stage glass: 355 × 230 mm
  - Workpiece mass for which precision is guaranteed: 5 kg
  - Workpiece mass for load bearing capacity is guaranteed: 20 kg
  - Maximum permissible mass on stage glass: 20 kg
- Vertical Mover section
  - Effective stroke: 150 mm
- Zoom head section
  - Zoom factor: 15x

	Type 1	Type 2	Type 3
Magnification range	0.5 to 7.5 ×	1 to 15 ×	2 to 30 ×
N.A.	0.026 to 0.15	0.05 to 0.3	
Zoom position	0.5 / 1 / 2 / 4 / 7.5 ×	1 / 2 / 4 / 8 / 15 ×	2 / 4 / 8 / 16 / 30 ×
Viewfield on workpiece	9.33 × 7 to 0.622 × 0.467 mm	4.67 × 3.5 to 0.311 × 0.233 mm	2.33 × 1.75 to 0.155 × 0.117 mm
W.D.	50 mm (10 mm when LED illumination 75M is used)		

- Illumination
  - Two systems (diascopic, vertical episcopic): Inside controller
  - Lamp: 12V 100W halogen lamp
    Philips JCR12V100WH10
    or Osram 64637
- Camera
  - Size: Type 1/3