# Nikon

## IC Wafer Inspection System

# DART

**for**

# Optistation-V

# Operator's Guide

Publication # D-OG-0800-10

## SAFETY PRECAUTIONS

- The OPTISTATION-V uses a laser of Class 1. The laser beam, which is 30 µW in power and 780 nm in wavelength, is not visible to the eye.

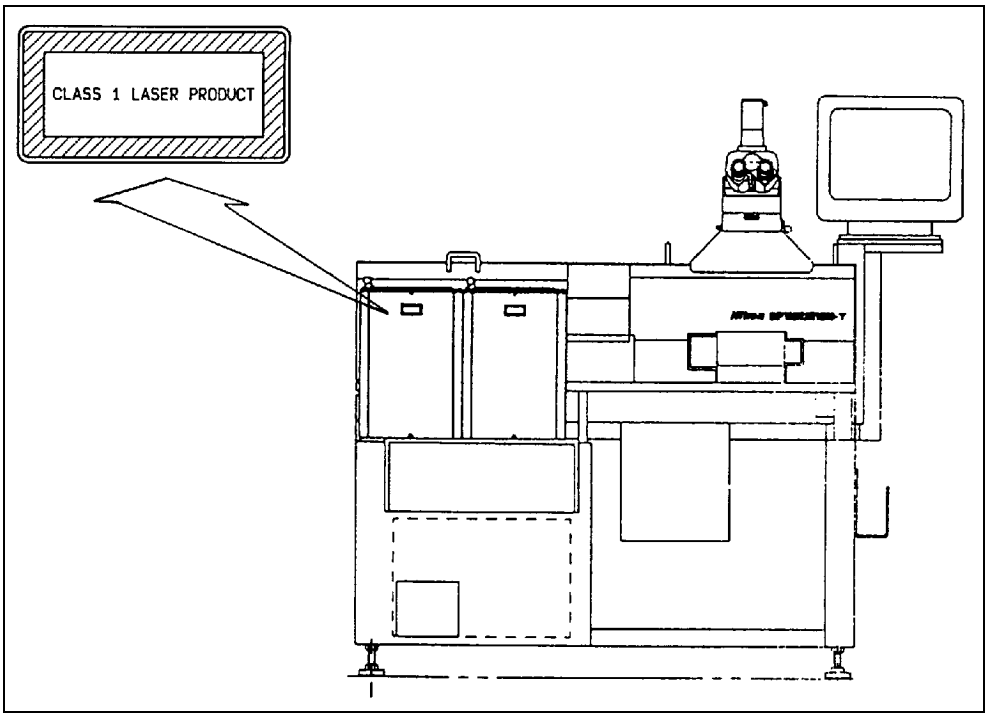


**Figure 1**

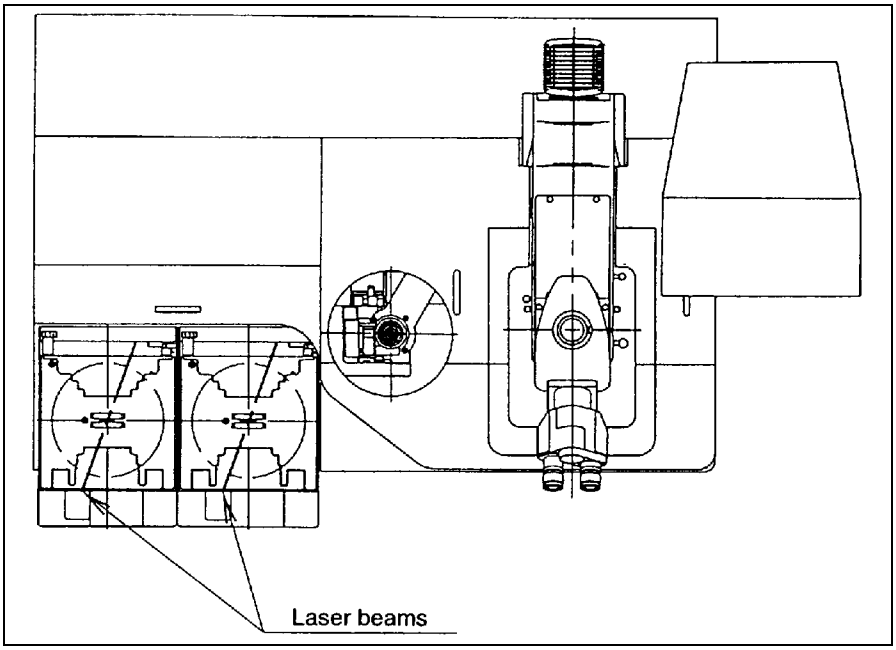


**Figure 2 - Openings (Optical Path Schematic)**

- **Openings**

The macro unit is built with an opening, which has a caution label. Do not put your hand or any object into this opening, injury may result.

- **Input Voltage**

Before connecting the power cord, make sure that your supply voltage complies with the input voltage labeled on your OPTISTATION-V. Use of non-compliant voltage can cause a malfunction, fire, or electric shock.

Specification of input voltage
100 to 120-volt area: 100 to 120 volts ± 10%
220 to 240-volt area: 200 to 240 volts ± 10%
Be sure to flip off the power switch before connecting the power cord.

- **Fuse**

Be sure to use the designated fuse. Use of a non-conforming fuse can blow at power on/off switching, or cause a malfunction or fire.

- Power supply front surface
  Fuse designated for 100 to 120-volt area: 15-amperes / 125-volt time-lag fuse
- Power Supply rear surface
  Fuse designated for 100 to 120-volt area: 5-amperes / 250-volt time-lag fuse
  Fuse designated for 220 to 240-volt area: 2.5-amperes / 250-volt time-lag fuse

When replacing the fuse, first flip off the main switch and disconnect the power cord, to prevent an electric shock.

**Heat of light source**

The halogen lamp and lamp house are very hot during lighting of the lamp. They are still hot after the halogen lamp is turned off. Be cautious to avoid getting burned.

- A warning label alerts you to this danger. The label is found on the upper cover of the main body in the rear bottom of the lamp house.
- Do not touch the lamp or lamp house within 30 minutes of turning off the power supply.

Keep highly flammable materials (gasoline, petroleum benzene, paint thinner, alcohol, etc.), cloths, and paper off the lamp house. They could catch fire.

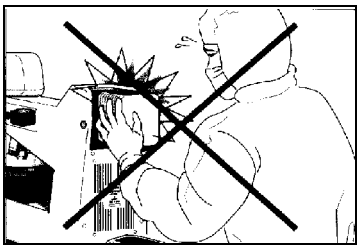

**Figure 3**

▪ **Cautions in replacing the halogen lamp**

- Ensure that the light source uses the designated lamp house and lamp (see the figure below). Failure to observe can damage the main stand.
- When replacing the halogen lamp, allow the lamp to cool down to a safe level.
- Before replacing the halogen lamp, be sure to flip off the power switch and disconnect the power cord from the receptacle outlet. Failure to observe can cause an electric shock or equipment damage.

Designated lamp house: Nikon halogen lamp house, 12V, 100W
Designated lamp: Halogen lamp, 12V, 100W, long-life type (Osram HLX64623 or Phillips 7724)

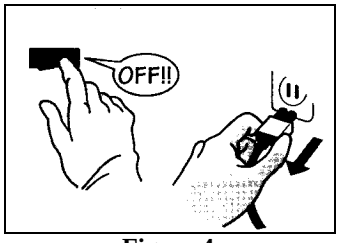


**Figure 4**

▪ **Disassembly**

The OPTISTATION-V is fine-tuned before shipment. Your disassembling work must be limited to the covers and/or components specified in this document.

▪ **System environment**

Install the OPTISTATION-V in a clean room or clean bench that meets these conditions:

- Temperature 23° ±3°c, humidity 50 ±20%
- Exposed to minimum vibration
- Also, protect the equipment from rapid voltage variations and electric noise, as these can lead to equipment malfunction.

▪ **External pressure**

Do not apply pressure greater than necessary to the following items:

- Covers
- Transport arms
- Prealignment system (light emitter and receiver)
- Wafer cassette elevator
- Light shield plates for sensors

▪ **Chuck assembly**

Use enough care to avoid damaging the chuck assembly, which comes in direct contact with wafers.

- **Equipment cleaning**

When cleaning the equipment, do not use organic solvents (alcohol, ether, paint thinner, etc.) on coated metal surfaces or on plastic items. Use of silicon cloth is recommended.

- **Noise**

Noise from the Optistation-V is 70 dB(A) or less.

# TABLE OF CONTENTS

# 1. SYSTEM DESCRIPTION

## 1.1 Machine Overview

### 1.1.1 Machine Appearance

Your OPTISTATION-V machine may be a double-cassette or single-cassette type. The figure below shows the double-cassette type. The single-cassette type has only one cassette unit.

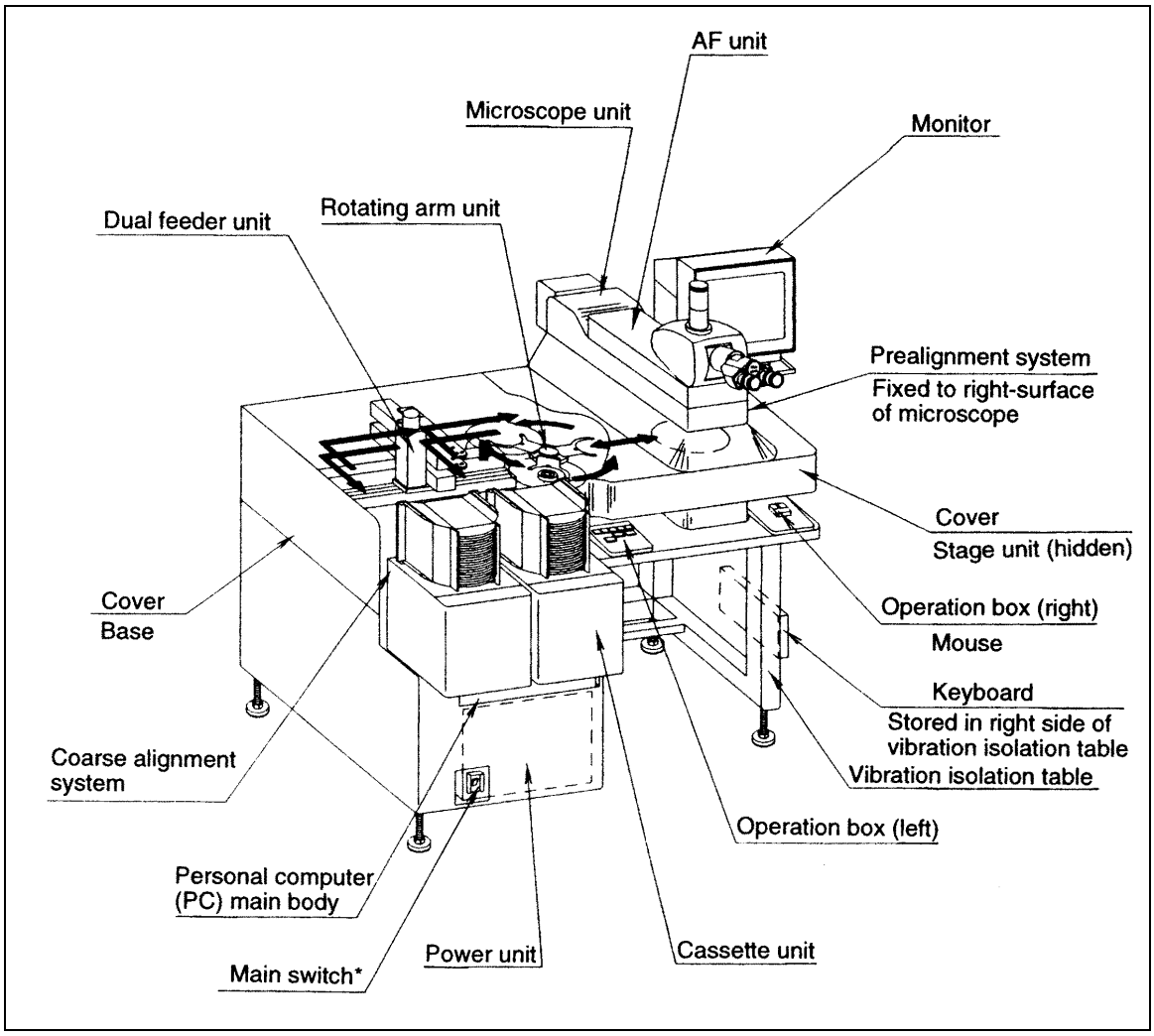


**Figure 1-1-Machine External View**

* Flipping on the main switch connects the power supply to the machine main body, PC main body, and monitor.

### 1.1.2 Top View

The figure below is a top view when the cover is removed.

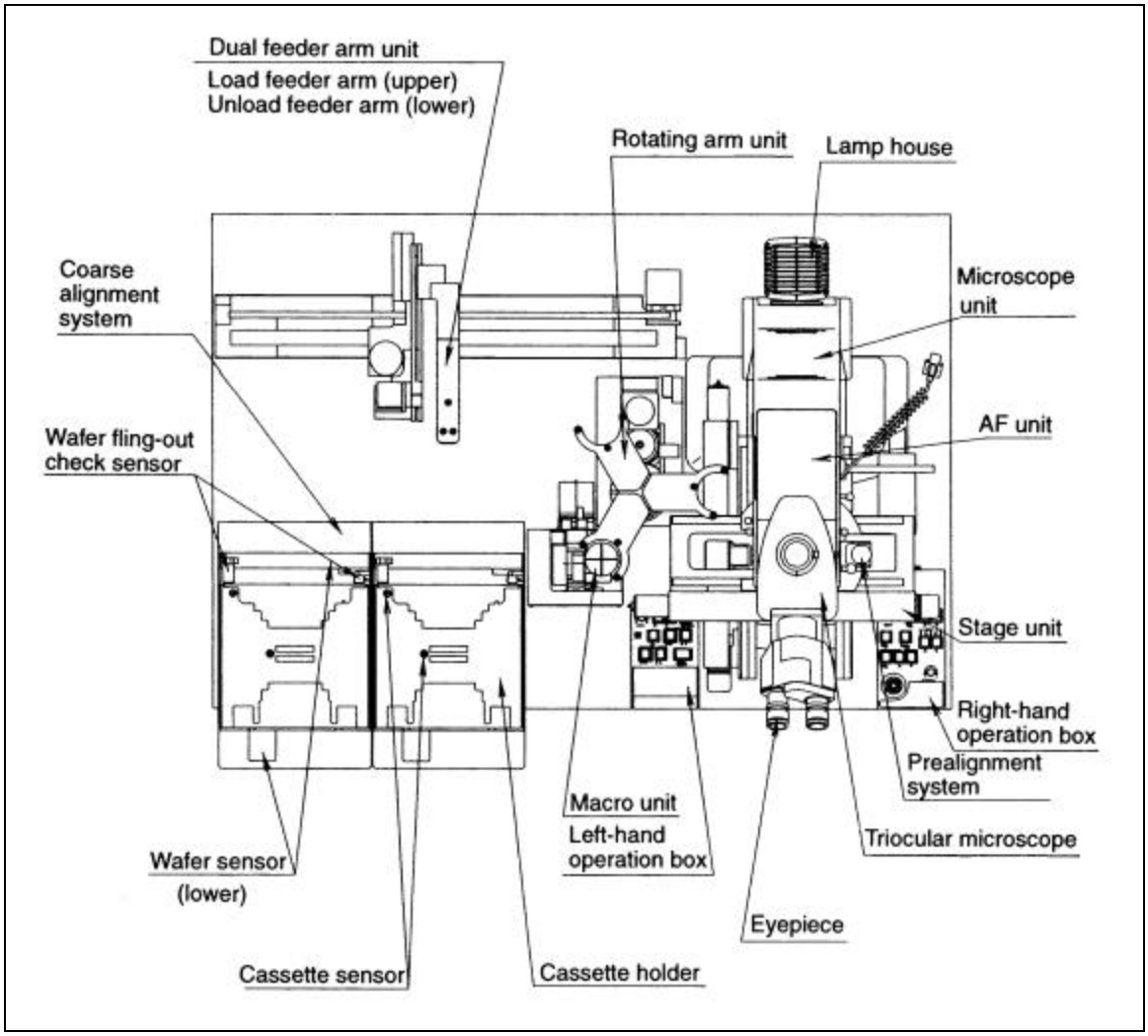


**Figure 1-2- Top View**

### 1.1.3 Utilities Connections

#### (1) Energy connections

A **Vacuum**

- Pressure: ≤ -80 kPa (-600 mmHg)
- Exhaust rate: ≥ 30 Nl/min
- Joint: 1/4PT

B **Compressed air** (for air-operated vibration isolation table only)

- Pressure: ≤ 5 kgf/cm2
- Exhaust rate: ≥ 0.4 nl/min
- Joint: 1/4PT

C **Electricity**

- 100 - 120 Va-c ±10%, 50/60 Hz — 220 - 240 Va-c ±10%, 50/60 Hz
- Current consumption: 17.3 A max. — Current consumption : 10 A max.

#### (2) Cable connections

- Power supply to PC main body
- Keyboard, mouse
- Power supply to CRT
- RS-232C cable

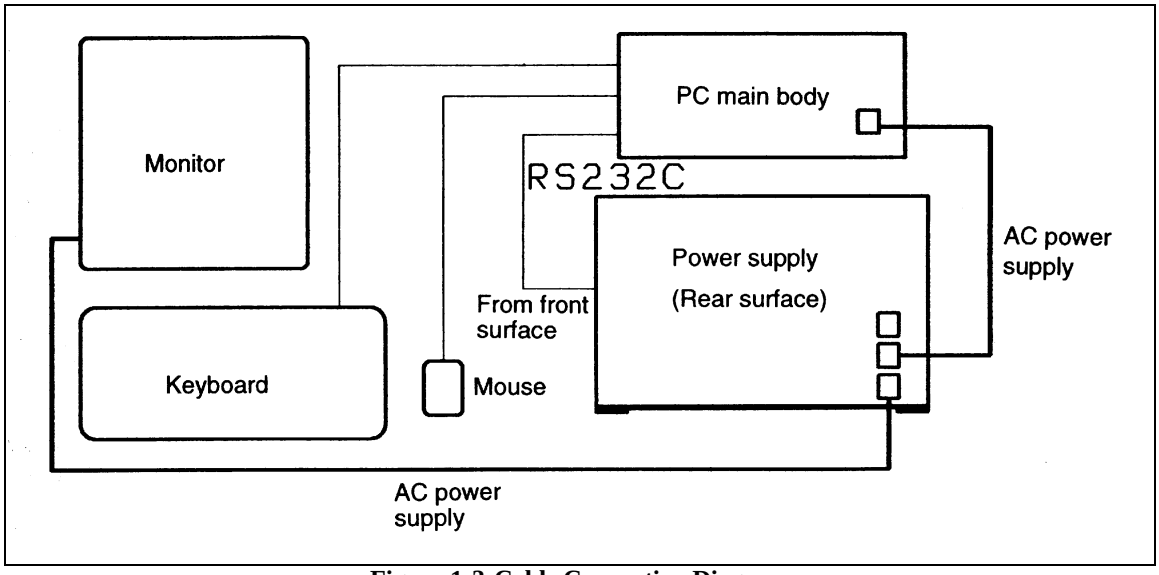


**Figure 1-3-Cable Connection Diagram**

## 1.2 Components and Functions

### 1.2.1 NEMA Box

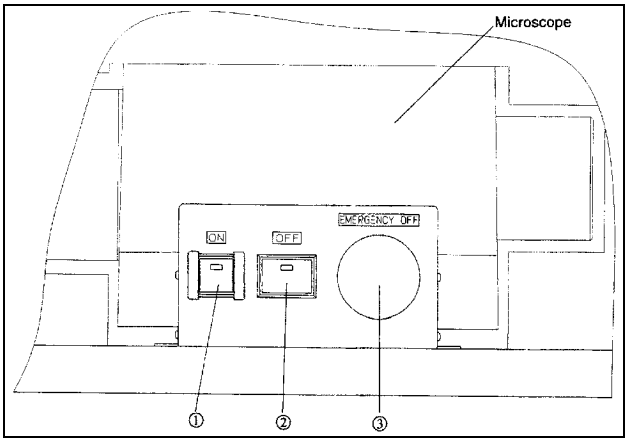


**Figure 1-4 -NEMA Box**

1) MAINLINE ON lamp

This lamp is lighting when the lockout handle 3 is in the ON position. Lighting of this lamp indicates that the main circuit breaker of the system is ON.

2) POWER ON lamp

This lamp lights when the MAIN ON switch located on the switch box is pressed. Lighting of this lamp indicates that power is supplied to all sections except for the moving sections of the equipment.

3) Lockout handle

This handle turns on and off the main power breaker of the main body. Once you set the handle to ON, leave it in the ON position. Then, use the MAIN ON and MAIN OFF switches when you do on/off switching of the power to the main body.

*This handle should only be operated by the System Administrator.*

### 1.2.2 Operation Boxes

#### (1) Left-hand operation box

The judgment keys are centralized on this box.

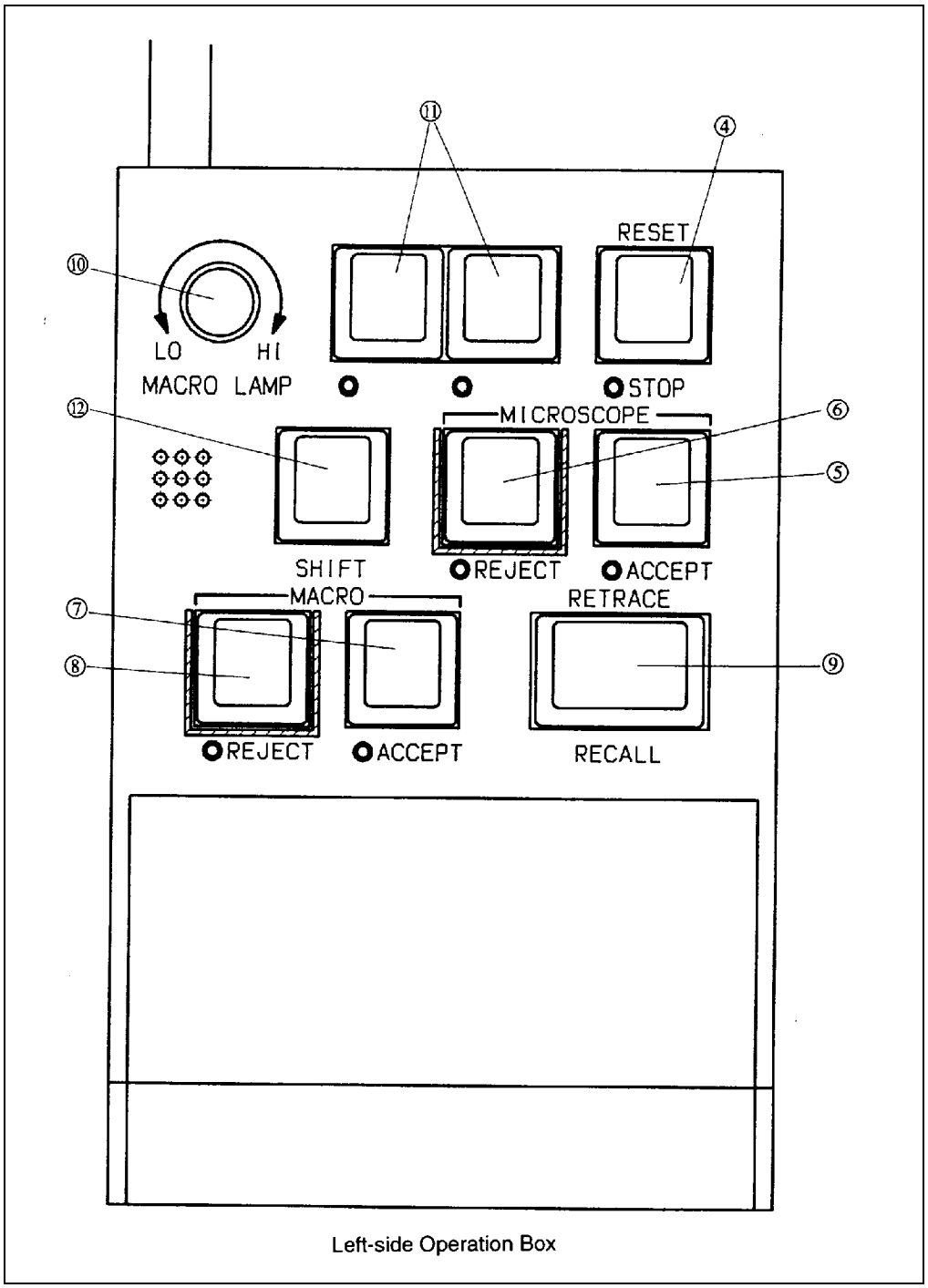


**Figure 1-5 -Left-hand Operation Box**

4) STOP/RESET key

Pressing the STOP/ RESET key stops the machine operation.

To clear the stop state, press the STOP/ RESET key while holding the SHIFT key down. The machine resumes operation if it has no alarm factor.

5) Microscopic ACCEPT key

Pressing this key during microscopy gives an "OK" judgment to the wafer.

6) Microscopic REJECT key

Pressing this key during microscopy gives a "REJECT" judgment to the wafer.

7) Macro ACCEPT key

Pressing this key during macro inspection gives an "OK" judgment to the wafer.

8) Macro REJECT key

Pressing this key during macro inspection gives a "REJECT" judgment to the wafer.

9) PROGRAM RECALL/RETRACE key

When the stage is standing still in microscopic inspection, pressing this key moves the stage to the next point defined in the stage program. Pressing this key while holding the SHIFT key down moves the stage to the previous point.

10) Macro lamp brightness control

Turning this control clockwise makes the macro illumination lamp brighter.

11) Option keys

These two keys are reserved for optional functions.

12) SHIFT key

This key is used in combination with another key.

### (2) Right-hand operation box

The keys for microscope operation are centralized on this box.

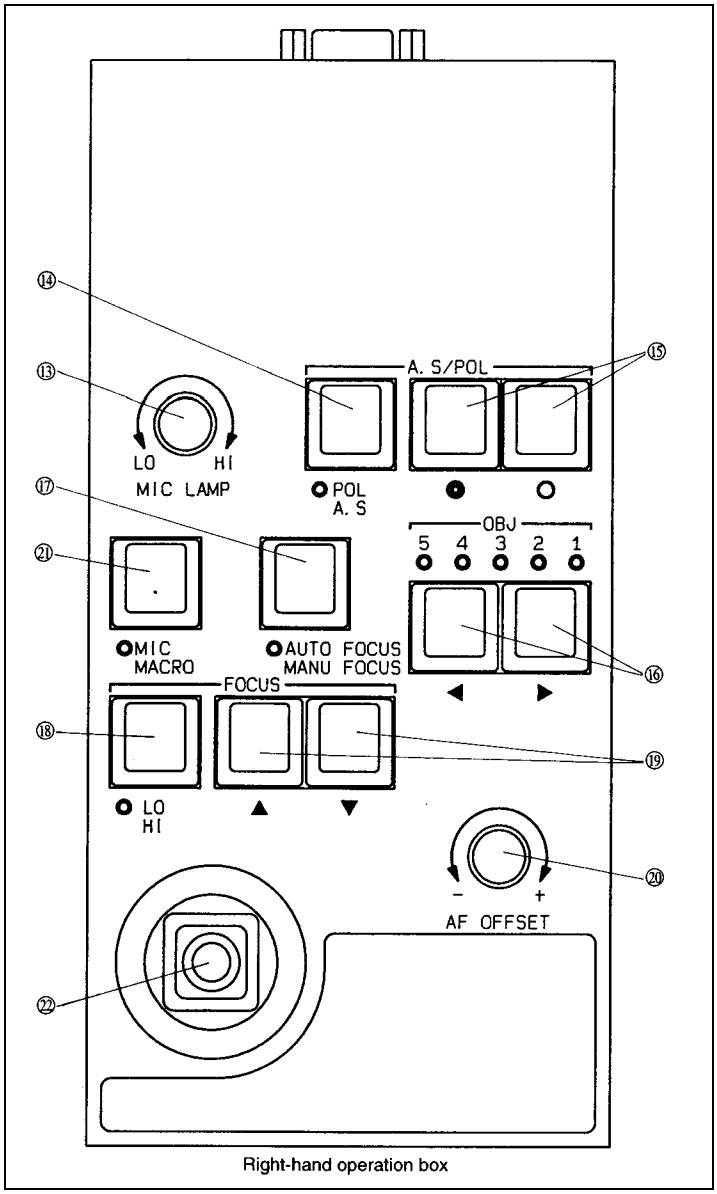


**Figure 1-6 -Right-Hand Operation Box**

13) Microscope lamp brightness control

Controls the lamp voltage. Turning this control clockwise increases the lamp voltage, making the illumination brighter.

14) Aperture diaphragm opening-closing/motorized polarizer rotation selector switch

Toggles between the two functions of the keys.

15) Aperture diaphragm opening-closing/polarizer rotation keys

For aperture diaphragm opening-closing function:

- Left key The aperture diaphragm closes as far as this key is held down.
- Right key The aperture diaphragm opens as far as this key is held down.

For polarizer rotation function

- Left key The polarizer rotates counterclockwise as far as this key is held down.
- Right key The polarizer rotates clockwise as far as this key is held down.

16) Objective selector key

Pressing this key drives the motorized nosepiece, introducing the next objective. Holding this key down drives the revolving nosepiece continuously.

- Right key The next objective to the left of the optical path enters the optical path.
- Left key The next objective to the right of the optical path enters the optical path.

The five LEDs, numbered 1 to 5, correspond to the objective mounting holes in the motorized nosepiece. One of these LEDs lights to indicate the objective currently in the optical path.

17) Auto focus/manual focus selector key

Toggles the auto focus on and off. The LED is lit when the auto focus is active; it flickers when the auto focus is active but short of illumination; it is out when the auto focus is inactive.

18) Manual focus fine/coarse selector switch

Toggles the manual focus between fine and coarse modes. When in fine mode, the LED is lit.

19) Manual focus keys

- When the ▲ key is held down, the stage syringe moves up at the speed selected with the coarse/fine key.

- When the ▼ key is held down, the stage syringe moves down at the speed selected with the coarse/fine key.

- When both ▲ and ▼ keys are pressed simultaneously, the stage syringe comes to a stop. It stays stopped as far as the keys are held down.

These keys take priority over the auto focus function.

20) Focus offset control

Fine-adjusts the auto-focus focal point to give an offset.

Rotating this control clockwise moves the focal point upward off the object. Rotating the control counterclockwise moves the focal point downward.

21) Microscope/macro selector key for joystick

Toggles the joystick between microscope stage move function and macro stage tilt function. The LED is lit when the key is assigned the microscope stage function.

In normal operation, joystick is automatically set to the macro stage function when a wafer has been loaded on the macro unit. After macro judgment finished or timed out, the joystick switches to the microscope stage function.

This key also enables switching to manual mode halfway through inspection.

22) Joystick

- For microscope stage function

  When the wafer is not being moved in automatic mode, the joystick can be used to manually move the X-Y stage as desired. The stage moves in the same direction that the joystick lever is tilted.

- For macro stage function

  The wafer can be tilted in accordance with the tilt angle and direction of the joystick. The tilt position given to the wafer will be the sum of the X-tilt angle, Y-title angle, and the joystick position value.

### 1.2.3 Microscope Unit

The microscope unit provides observation optics for microscopic observation of wafers. The unit consists of a focus drive, motorized nosepiece, objectives, eyepiece tube, eyepieces, and a lamp house.

**(1) Eyepiece diopter adjustment**

1) Rotate the diopter correction ring of each eyepiece to align its lower edge with the line engraved around the center shaft.

2) Switch to the 40x objective. (If 40x is not available, use 60x or 100x). Focus on the wafer using the FOCUS key.

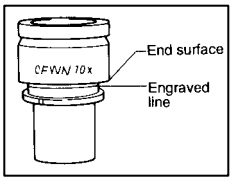


**Figure 1-7**

Set the auto focus/manual focus selector key to the auto focus status. If the wafer image is blurred, adjust the focus with the focus offset control.

3) Switch to the 10x objective. (If 10x is not available, use 20x or 5x). Focus on the wafer by rotating each diopter correction ring individually for the right and left eyepieces. In this case, do not use the FOCUS key or focus offset control. (Figure 1 - 8)

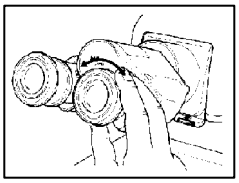

**Figure 1-8**

- Repeat steps 2 and 3, and the diopter adjustment will be complete.
- Besides compensating for diopter differences between the user's eyes, the above adjustment also helps to maintain the correct microscope tube length, enabling full advantage to be taken of the parfocality of Nikon's high-quality objectives.

**(2) Interpupillary distance adjustment**

While observing the wafer, adjust the interpupillary distance to make the right and left view fields appear as one.

This operation facilitates observation through both eyepieces (Figure 1-9).

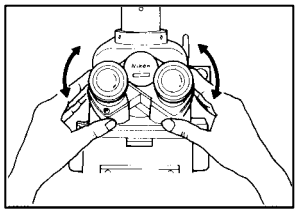

**Figure 1-9**

### (3) Focusing upper-limit adjustment

This adjustment should be carried out with care so that the end of the objective does not contact the wafer.

Remove the microscope fine/coarse-movement axis protection cover by rotating it counterclockwise. Do not attempt to touch the axis with your hand, as this may lead to a machine failure.

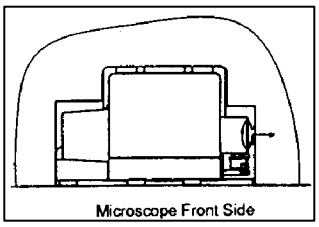


**Figure 1-10**

Use a single-blade screwdriver, rotate the limit adjustment knob, which is seen from the front side. Press the MANUAL FOCUS key and hold it down; if the adjustment is correct, the fine-movement axis should rotate 1 or 1.5 turns from the focal position and stop at the limit.

Rotating the limit adjustment knob clockwise lowers the upper-limit position. Rotating it counterclockwise raises the upper-limit position.

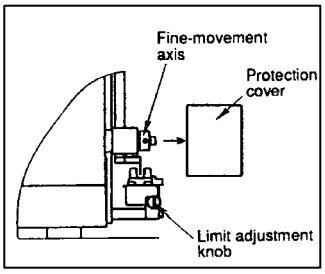


**Figure 1-11**

### (4) Mirror blocks

The machine accommodates two mirror blocks. One is for bright field, labeled "B.F." The other is for dark field, labeled "D.F.".

- Pushing in the mirror block selector lever brings the right-hand mirror block into the optical path. Pulling out the lever brings the left-hand mirror block into the optical path.
- The bright-field block should be installed on the right-hand side, and the dark-field block on the left-hand side.

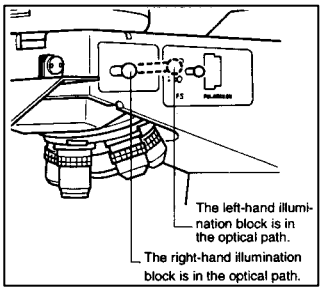


**Figure 1-12**

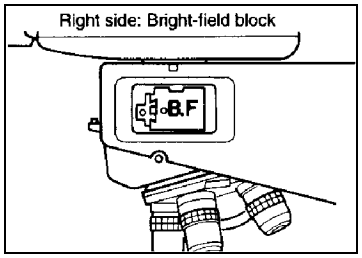


**Figure 1-13**

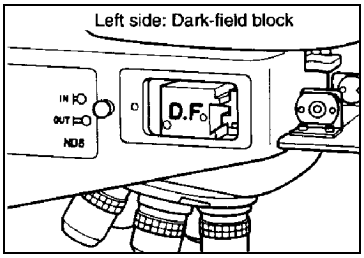


**Figure 1-14**

**(5) Procedure for bright-field microscopy**

1) Push in the mirror block selector lever to bring the bright-field mirror block (labeled "B.F.") into the optical path.

*Note: Confirm that the bright-field mirror block has been mounted on the right side.*

2) If the polarizer and analyzer are in way of the optical path, remove them out of the optical path. Remove the Nomarski prism from the revolving nosepiece.

3) Push in the ND8 anti-glare filter lever to place the filter in the optical path.

4) Insert both the NCB11 filter and ND filter into the optical path. Select an ND filter to suit the wafer's reflectance.

5) Press the objective selector key to set the objective you want.

6) Adjust brightness with the ND filters and brightness control dial.

7) Adjust the episcopic field diaphragm lever so that it is slightly larger or smaller than the view field.

* The field diaphragm determines the size of the wafer's illuminated area relative to the eyepiece view field. If it is opened too wide, stray light will enter the view field to generate a flare, and lower the image contrast. Therefore, correct adjustment of the field diaphragm is extremely important especially in photomicrography. Generally, good photomicrographic results can be achieved by stopping down the illuminated area so that it is slightly smaller than the diagonal dimensions of the film format.

8) Adjust the aperture diaphragm with the aperture diaphragm opening-closing key.

* The aperture diaphragm is used to adjust the illumination system's numerical aperture (N.A.), and plays an important part in determining image resolution and contrast. To adjust the diaphragm, remove the eyepiece and observe the diaphragm image on the objective's exit pupil visible inside the eyepiece tube. Generally, a good image of appropriate contrast can be obtained when the aperture is stopped down to 70~80% of the objective's exit pupil.

**(6) Procedure for dark-field microscopy**

1) Pull out the mirror block selector lever to position the dark-field mirror block (labeled "D.F.") into the optical path.

   Confirm that the dark-field mirror block has been mounted on the left side.

2) If the polarizer and analyzer are in the optical path, remove them out of the optical path. Remove the Nomarski prism from the revolving nosepiece.

3) Adjust the lamp brightness control for maximum brightness.

4) Push in the ND8 anti-flare filter lever to place the filter in the optical path.

5) Insert the NCB11 filter into the optical path.

6) Fully open the apertures with the aperture diaphragm opening-closing key and field aperture lever.

7) Press the objective selector key to set the objective you want. Then, adjust the focus.

8) Adjust brightness with the ND filter and brightness control dial.

- Switching over between bright-field and dark-field microscopy.

   1. Push in the ND8 anti-glare filter lever to position the ND8 filter in the optical path.

   2. From bright-field to dark-field.

      a) Pull out the mirror block selector lever to position the dark-field mirror block (labeled "D.F.") into the optical path.

      b) Fully open the field and aperture diaphragms.

      c) Adjust brightness with the ND filters and brightness control dial.

   3. From dark-field to bright-field.

      a) Push in the mirror block selector lever to position the bright-field mirror block (labeled "B.F.") into the optical path.

**CAUTION**
**Take care because glare may enter the view field when you remove the dark-field block from the optical path.**

      b) Adjust the field and aperture diaphragms.

      c) Adjust brightness with the ND filter and brightness control dial.

**(7) Procedure for differential interference microscopy**

1) Push in the mirror block selector lever to position the bright-field mirror block (labeled "B.F.") into the optical path.

2) Mount the motorized episcopic polarizer DIC, λ-plate, and analyzer, ensuring that they are all out of the optical path.

3) Pull out the ND8 filter anti-glare lever and remove the filter out of the optical path.

4) Insert the NCB11 filter into the optical path.

5) Press the objective selector key to set the objective you want. Then, adjust the focus.

6) Adjust the aperture diaphragm with the aperture diaphragm opening-closing key and episcopic field diaphragm lever.

7) Insert the motorized episcopic polarizer DIC and analyzer in the optical path. (Figure 1-15)

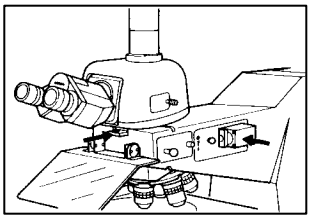

**Figure 1-15**

8) Mount the Nomarski prism on the motorized universal nosepiece and insert it in the optical path.

The type of the Nomarski prism to be mounted differs depending on the objective type. Check the indication on the prism, and select the correct one to suit the objective, referring to the table below. Alphabetical indications on the Nomarski prism and the objective should be the same. Indication on the objective is found next to the NA indication on the barrel.

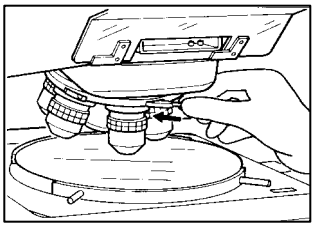

**Figure 1-16**

| Letter on Nomarski prism | Objective |
|---|---|
| A | BD Plan DIC 10x 20x 50x 100x |
| B | BD Plan DIC 5x |
| C | ELWD BD Plan DIC 50x 100x |
| E | ELWD BD Plan DIC 20x |

**Table 1**

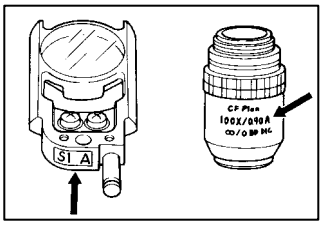


**Figure 1-17**

9) Press the polarizer rotation key to align the index dot on the polarizer with the horizontal bar marker [-]. This is the crossed Nicols position. If the analyzer is a fixed type, its direction has already been adjusted. If a rotating analyzer is used, align its index dot [? ] on the rotation ring with the pointer [→] to obtain the crossed Nicols effect. (Figure 1-18)

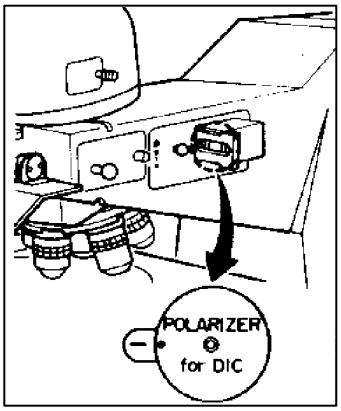


**Figure 1-18**

**(8) Procedure for bright-field simplified polarization and sensitive polarization microscopy**

1) Push in the mirror block selector lever to position the bright-field mirror block (labeled "B.F.") into the optical path.

2) Mount the motorized episcopic polarizer, λ-plate, and analyzer, ensuring that they are all out of the optical path.

3) Remove the Nomarski prism if it is in the motorized nosepiece.

4) Pull out the ND8 filter anti-glare lever and remove the filter out of the optical path.

5) Insert the NCB11 filter into the optical path.

6) Press the objective selector key to set the objective you want. Then, adjust the focus.

7) Adjust the aperture diaphragm with the aperture diaphragm opening-closing key and episcopic field diaphragm lever.

8) Insert the motorized episcopic polarizer and analyzer in the optical path. (Ensure that the λ-plate is out of the optical path.)

9) With the λ-plate out of the optical path, press the motorized episcopic polarizer rotation key so that the index dot on the polarizer is aligned with the horizontal bar marker [-].

10) Adjust brightness with the ND filter and brightness control dial.

11) Insert the λ-plate (mounted on the motorized episcopic polarizer) into the optical path. Now, you are ready for microscopic observation using a sensitive color of red purple.

**(9) Filters**

The following table summarizes the types of filters, and their applications and locations.

| Type of Filter | Symbol | Applications | Location |
|---|---|---|---|
| Conversion of color Temperature | NCB11 | General microscopy & color photomicrography | Episcopic filter sliders |
| Light reduction | ND2<br>ND4 | Controls brightness in general microscopy or color photomicrography.<br>ND2 and ND4 dim brightness to ½ and ¼, respectively. | Episcopic filter sliders |
| Anti-glare | ND8 | Prevents glaring in ND8 bright-field microscopy (episcopic).<br>Used as a ND8 under bright-field illumination, and as a transparent glass under dark-field illumination. | Built into microscope arm (ND8 auti-glare in-out filter lever) |
| Green interference | GIF | Monochrome microscopy & controls adjustment | Episcopic filter sliders |

**Table 2**

To use filters, follow these instructions:

- Episcopic filter sliders

  Push in this slider to the second (i.e., last) click position. The filter is now in the optical path. The sliders should be kept in position for dust protection.

- ND8 anti-glare filter in-out lever

  Push in this lever as far as it reaches the limit. The ND8 filter is now in the optical path. If the ND8 filter is not necessary, pull the lever out to the other limit. The lever must in no case be left anywhere between the limits.

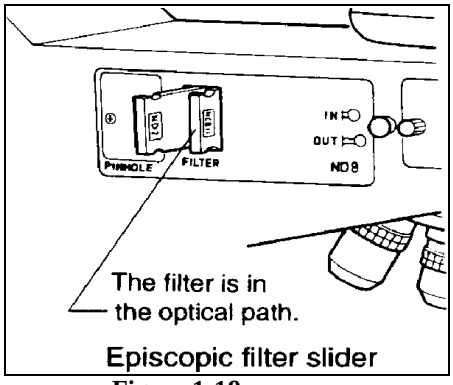


**Figure 1-19**

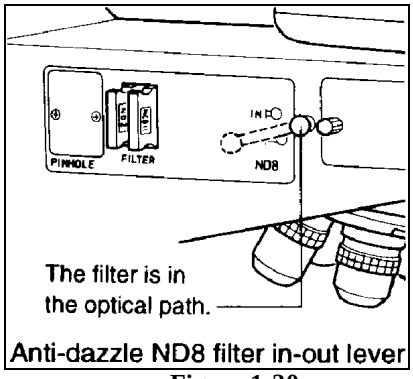


**Figure 1-20**

### (10) Description of sliders

#### 1) Motorized episcopic polarizer DIC

For differential interference microscopy under episcopic illumination, use this slider together with the analyzer and Nomarski prism. This slider allows simplified polarization microscopy as well.

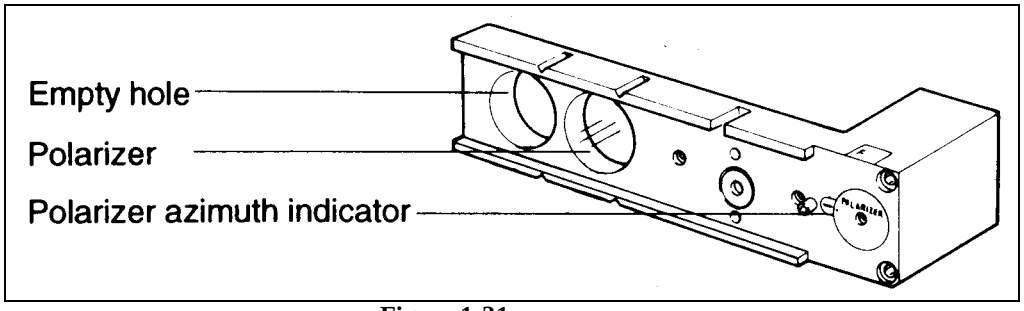


**Figure 1-21**

- To enable differential interference microscopy, push the polarizer slider in to the second click position to bring the polarizer into the optical path. (Figure 1-22)

- To switch to bright/dark-field microscopy, pull the polarizer slider out (rightward) to the first click position. This brings the empty hole into the optical path. (Figure 1-23)

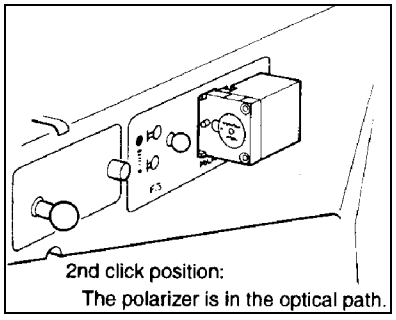


**Figure 1-22**

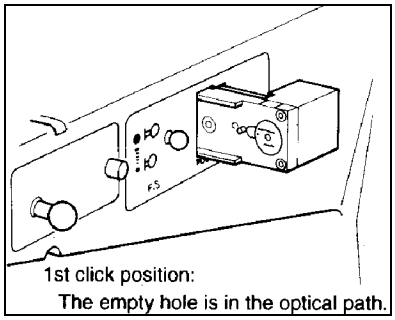


**Figure 1-23**

- To set polarizer azimuth, press the polarizer rotation key on the operation box while looking at the azimuth indicator.

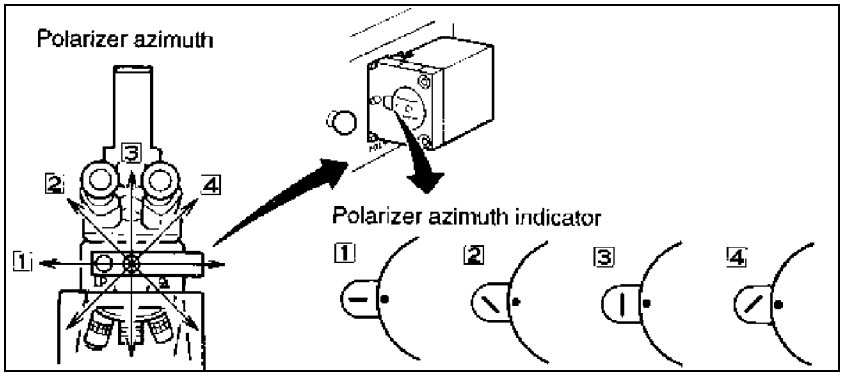


**Figure 1-24**

**2) Motorized episcopic polarizer**

For simplified polarization microscopy under episcopic illumination, use this slider together with the analyzer.

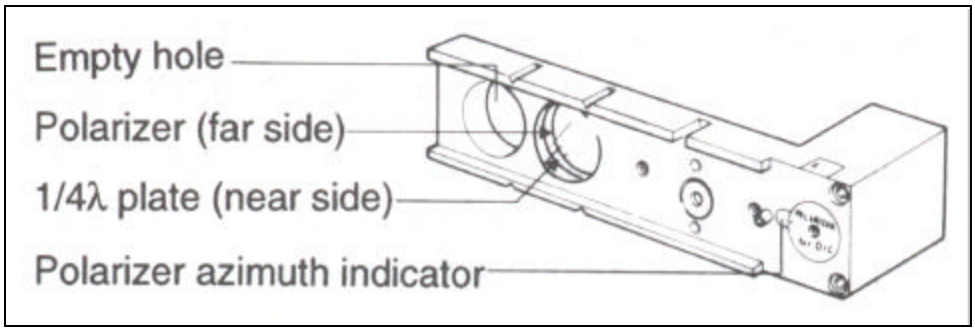


**Figure 1-25**

- To enable simplified polarization microscopy, push the polarizer slider in to the second click position to bring the polarizer into the optical path. (See Figure 1-22 on the previous page.)

- To switch to bright/dark-field microscopy, pull the polarizer slider out (rightward) to the first click position. This brings the empty hole into the optical path.

- To set polarizer azimuth, press the polarizer rotation key on the operation box while looking at the azimuth indicator. (See Figure 1-24 on the previous page.)

**3) Analyzer**

For simplified polarization or differential interferometer microscopy, set this slider in place of the anti-dust slider furnished. Use this slider together with the motorized episcopic polarizer.

- To enable simplified polarization or differential interferometer microscopy, push the analyzer slider in to the second click position to bring the analyzer into the optical path.

- To switch to bright/dark-field microscopy, pull the analyzer slider out (rightward) to the first click position.

- Analyzer azimuth is shown in Figure 1-26.

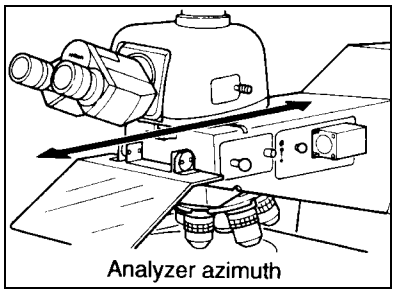


**Figure 1-26**

**4) First-order red compensator**

For sensitive polarization or differential interferometer microscopy, use this slider by attaching to the motorized episcopic polarizer.

- To enable sensitive polarization or differential interferometer microscopy, push the first-order red compensator in to the limit to bring it into the optical path. (Figure 1-27 below)

- To change the compensation range in differential interferometer microscopy, switch from sensitive polarization to simplified polarization microscopy. (Figure 1-28 below)

- To switch from sensitive polarization or differential interferometer microscopy to bright/dark-field microscopy, pull the polarizer slider (and therefore the first-order red compensator slider) out (rightward) to the first click position. (Figure 1-29 below)

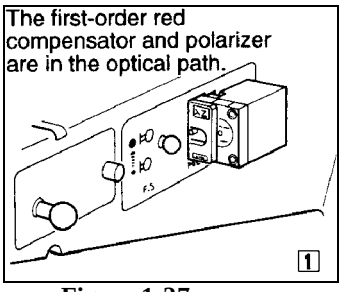


**Figure 1-27**

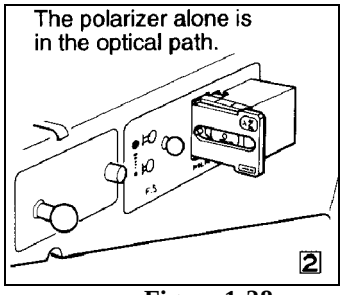


**Figure 1-28**

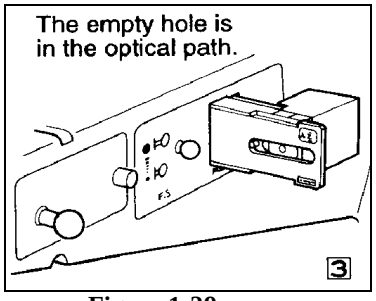


**Figure 1-29**

**5) Pinhole diaphragm**

For microscopy using a high-magnification objective, the pinhole diaphragm can be inserted into the episcopic illuminator. The pinhole diaphragm is suitable for observation with greater depth of focus, particularly for observing contact holes.

- To install the pinhole diaphragm:

  1. Remove the cover from the left-hand face of the arm, labeled "PINHOLE".

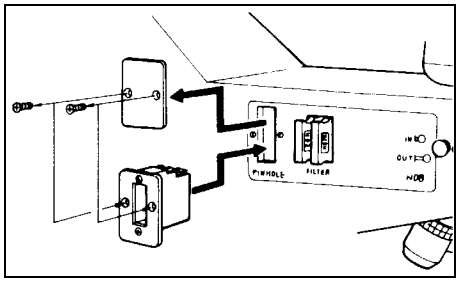


**Figure 1-30**

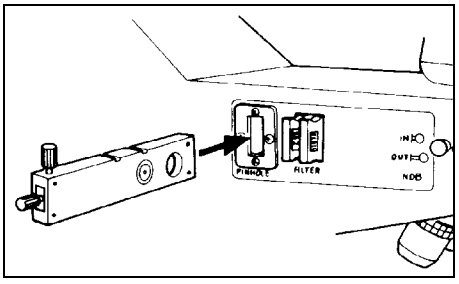


**Figure 1-31**

2. Attach the pinhole diaphragm adapter to the arm by using the two countersunk head screws furnished.

3. Insert the pinhole unit into the pinhole diaphragm adapter.

- Push the pinhole unit in to the limit. The pinhole diaphragm is now in the optical path.

  To center the pinhole diaphragm, remove the eyepieces and adjust the two screws. The pinhole diaphragm should be positioned to the center of the objective's pupil. (Use of a centering microscope is recommended.)

- Pull the pinhole unit out (leftward) to the first click position. The empty hole is now in the optical path, allowing opening/closing of the aperture diaphragm in the usual way. (The aperture diaphragm does work when the pinhole diaphragm is in the optical path. However, the aperture diaphragm has no effect because its smallest possible diameter is greater than the pinhole diameter. The exception is with use of a glass pinhole diaphragm; the aperture diaphragm has an effect when it is fully stopped down.)

### 1.2.4 Cassette Unit

- Place a cassette onto the cassette holder and move it up and down.
- Two cassette sensors are provided. One recognizes presence of a cassette, while the other checks whether the wafer to inspect is 8-inch or not.
- Wafer sensor detects the vertical position of each wafer in the cassette, as well as presence of each wafer.
- The wafer fling-out check sensor stops the cassette from vertical movement if it detects a wafer that is protruding from the cassette.

### 1.2.5 Coarse Alignment System

- When a wafer loaded from the cassette passes through the coarse alignment system, its perimeter is detected to determine the displacement relative to the feeder arm.

### 1.2.6 Dual Feeder Arm Unit

- This unit consists of a load feed arm for loading a wafer from the cassette, and an unload feeder arm.
- This unit is a dual-tier structure, with the load feeder arm located above the unload feeder arm.
- The displacement determined in the coarse alignment system is corrected at the wafer receiving position of the rotation arm. An XY drive mechanism provides the correction.

### 1.2.7 Rotating Arm

- This unit changes wafers by transferring three wafers simultaneously. Specifically, the unit moves the wafer sitting on the load feeder arm to the macro unit, moves the wafer sitting in the macro unit onto the stage, and moves the wafer sitting on the stage to the unload feeder arm.

### 1.2.8 Macro Unit

- The macro unit tilts and rotates the wafer to allow you a visual check for flaws, particles, and other problems.
- In inspection process, the wafer is brought up, and then moved at a preset tilt angle and rotating speed.
- The tilt angle can be changed as desired with the joystick.

### 1.2.9 Stage Unit

- This unit consists of an X-Y stage and θ stage, which are driven by motors.
- Prealignment is executed, correcting the off-center displacement by the XY drive mechanism and correcting the declination angle by the θ stage.
- The wafer is automatically moved to the observation point defined in the recipe.
- The wafer can be moved at constant or variable speed as controlled with the joystick.

### 1.2.10 Prealignment System

- This system rotates the wafer on the stage and detects its perimeter. The sensor function of the system detects the off-center displacement of the wafer relative to the stage chuck center, as well as the orientation flat (notch) position.

### 1.2.11 Auto Focus (AF) System

- This system controls the vertical movement of the stage to reach the focus position of the object under inspection.

### 1.2.12 Covers

- The covers provide safety protection. They must not be removed without due reason, e.g., for maintenance work.

### 1.2.13 PC, Keyboard, Monitor, Mouse

- These comprise the controller of the OPTISTATION-V. Operations on the monitor use the mouse and keyboard entries.

### 1.2.14 Power Unit

- This unit contains the main power supply, as well as control boards.

### 1.2.15 Vibration Isolation Table

- This table contains the power unit and PC main body. The right side of the table accommodates the keyboard.

# 2. Getting Started

DART is a computer software Graphical User Interface (GUI) application that controls the Nikon Optistation-V. The DART PC (the computer on which DART is installed) is connected directly to the Optistation-V using a standard serial port. In addition, the DART PC can also be connected to a video camera (which is installed on the Optistation), allowing the DART user to see magnified wafer images in a video window on the PC.

Figure 2-1 below shows how the DART PC, video camera, and Optistation-V are connected.

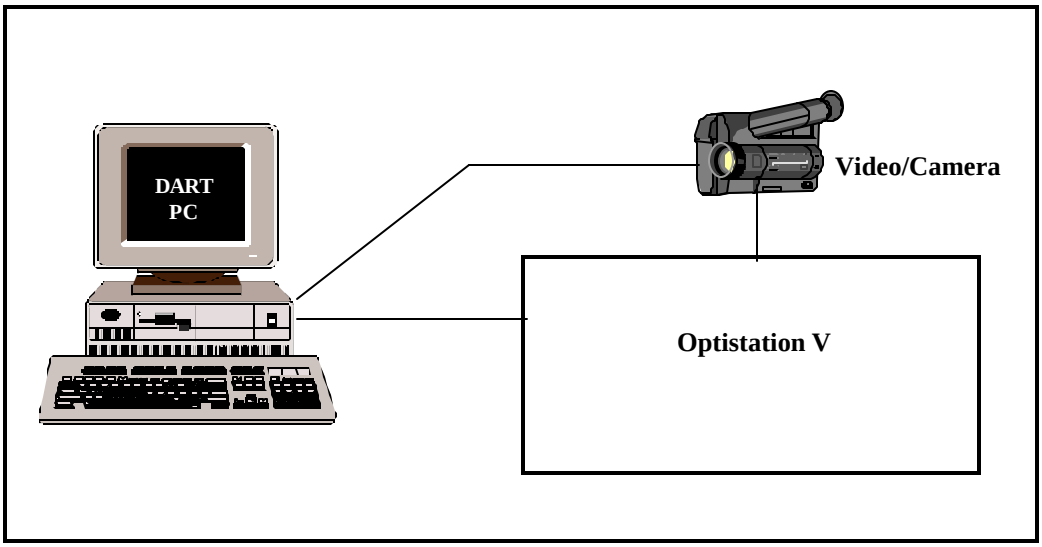


**Figure 2-1 - DART System Overview**

By following the step-by-step instructions in this manual, you will learn how to perform a basic wafer inspection, as well as learn how to make simple adjustments to DART settings. Designed to be as simple to use as possible, this manual will help get you started even if this is your first time using DART.

For best results, follow the directions in this manual in the same order that they are presented.

## 2.1 Mouse Clicking

This manual will often ask you to "*click*" on a graphical object on the screen. Within the context of this guide, to "*click*" on an object means to position the mouse pointer over the object and press the left mouse button.

For example, if the manual says to "*click* on '**Yes**'", position the mouse pointer over the '**Yes**' button of the active window (the window that you are currently working in) and press the left mouse button, as illustrated in Figure 2-2 below.


**Figure 2-2 - Click on 'Yes'**

When asked to "*double-click*", *click* twice in rapid succession. When asked to "*right-click*", press the right mouse button instead of the left. On a mouse with three buttons, to "*right-click*" means to press the rightmost button. *The middle mouse button will never be used in this manual.*

DART systems are often shipped with three button track balls, which are identical in function to a three button mouse.

## 2.2 Logging onto Windows NT 4.0

To begin, you must power up both the **DART PC** (and associated peripherals) and the **Optistation-V**. After a memory check and boot sequence, you will be presented with two boot options. These options will be:

Windows NT Workstation 4.0
Windows NT Workstation 4.0 [VGA Mode]

The default option (highlighted) should be 'Windows NT Workstation 4.0'.
To continue booting, you can press the 'Enter' key on your PC keyboard, or simply wait until the timer counts down to zero before choosing the default option.

**Note:**

When Windows NT begins to load, you will see a message that says "Press spacebar NOW to invoke the Hardware Profile/Last Known Good menu".

DO NOT press the spacebar at this time, as DART will not function correctly if you do.

When Windows NT Workstation is finished loading, you should see the window shown below in Figure 2-3, asking you to *press* '**Ctrl**' + '**Alt**' + '**Delete**' to log on.

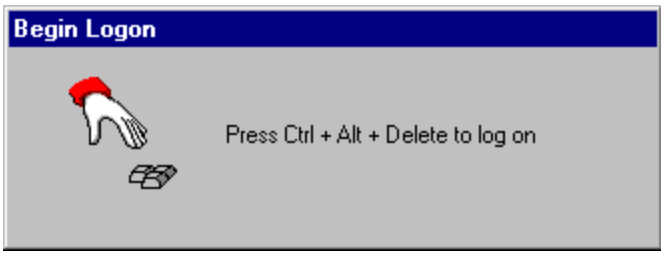


**Figure 2-3 - Begin Logon**

Press and hold down the '**Ctrl**' key on the keyboard, and while holding it down, press and hold down the '**Alt**' key. While holding down both 'Ctrl' and 'Alt', press the '**Delete**' key. When you let go of all three keys, a logon window will appear, shown below in Figure 2-4.


**Figure 2-4 -Logon Information**

*Enter* '**DART**' in the username field and *click* '**OK**' to continue. *Do not enter anything in the password field.*

**Note:** Contact your supervisor or administrator if you cannot log on. Your user name and/or password may have been changed.

## 2.3 Starting DART

Once you are logged onto Windows NT 4.0, look for the **DART Application folder** (shown in Figure 2-5 below) on your Desktop.

*Note: There may be less and/or different items in this folder, depending on the configuration of the DART "package".*

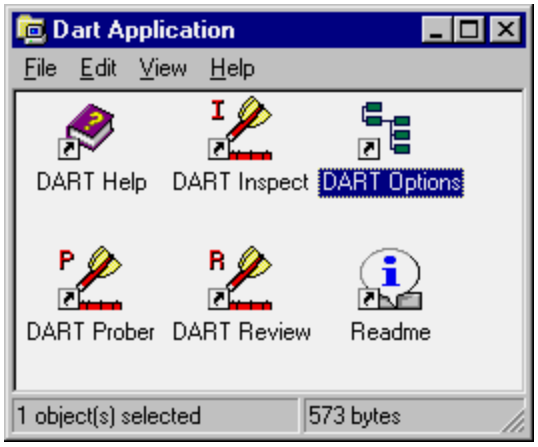


**Figure 2-5 -DART Application**

If you cannot find the open folder shown above, locate the closed **DART Application folder** (shown in Figure 2-6 below) and *double-click* it, or *right-click* and select '**Open**' from the pop-up menu. This will open the folder as depicted in Figure 2-5.


**Figure 2-6 -DART Application Folder**

Turn the **Optistation-V** on (if it is not already on) by pressing the button labeled '**ON**'.

To run **DART**, *double-click* on the 

icon in the DART Application folder.
*(Note: DART Review, if available, can also be chosen.)*

*Double-clicking* on this icon will "invisibly" start the Optistation-V control software and automatically launch DART.

| | |
|---|---|
| Note: | Make sure the Optistation-V is turned on before double-clicking on the 'Start OSTV First' icon. |

As soon as you have *double-clicked* the 'DART Inspect' icon, DART will begin to load. As DART begins its initialization, you will see the window shown in Figure 2-7.


**Figure 2-7 - DART initializing window**

When DART connects to the Optistation-V control software and the Optistation-V has finished initializing all of its components, it will display the following window. (Figure 2-8)


**Figure 2-8 -OSTV Communications**

Congratulations! You have successfully started DART and are almost ready to begin inspecting wafers. When you are ready to proceed to the next section, click '**OK**'.

# 3. Using DART

As soon as DART has finished loading, you are presented with a number of windows. In this tutorial, we will discuss only those windows that are helpful in performing a basic wafer inspection.

In order to receive the full benefit from this manual, you should have the following windows open on your DART screen:

- the Run Window,
- the Wafer Window,
- the Control Window, and
- the Status Window.

If you have more windows open than the ones listed above, you do not need to close them. However, this tutorial will only discuss those windows listed above. If you are missing any of the mentioned windows, click on the **Window**' pull-down menu and select the window(s) you are missing from the list.

Your DART screen should look like Figure 3-1 below, although your window positions do not need to be the same.

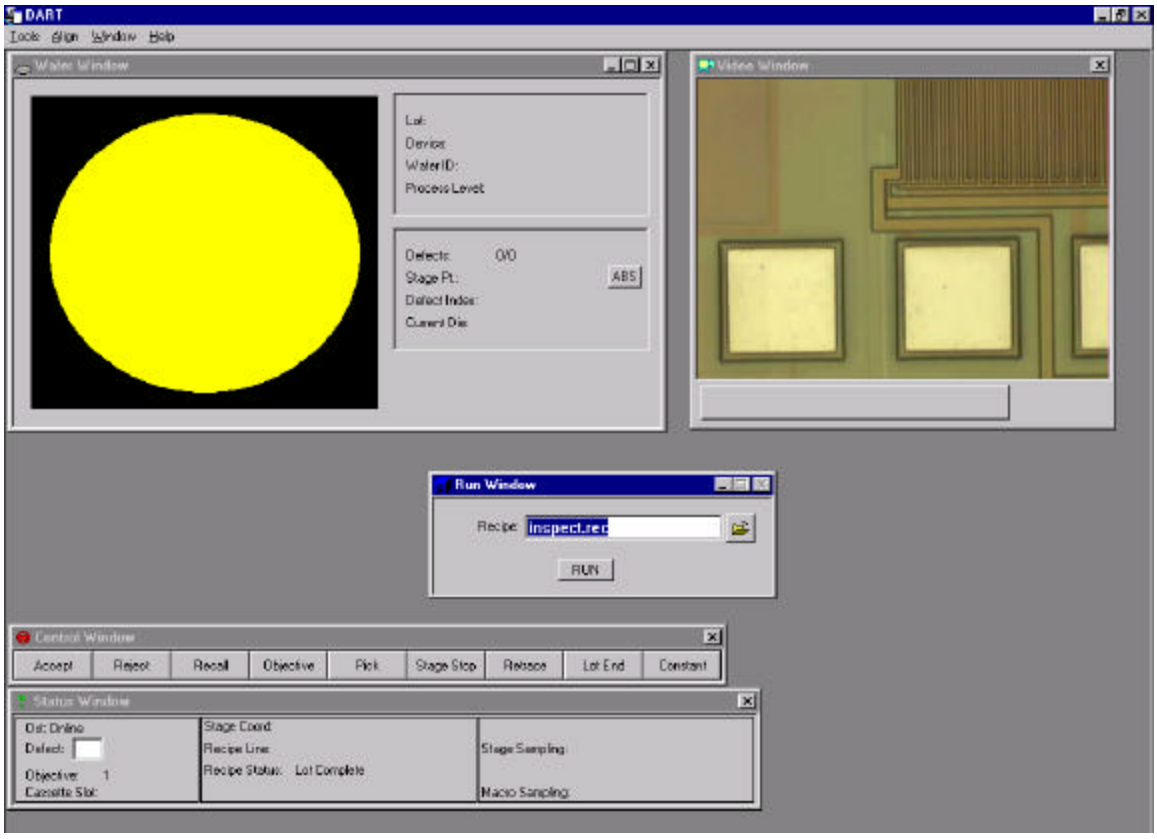


**Figure 3-1 DART Application Window**

## 3.1 The Run Window

The **Run Window** is always active when you start DART. Although the Run Window can offer the user many options, this tutorial will only deal with two of these, the '**Setup**' and the '**Recipe**' options. The **Run** Window should look like Figure 3-2 below.


**Figure 3-2 -Run Window**

### 3.1.1 Setup Files

A setup file contains instructions that tell DART what kind of wafer inspection the operator wishes to perform. There are three basic types of inspections:

| | |
|---|---|
| **Inspect** | A basic inspection of a wafer that has not already been inspected and does not have an associated map file or defect information. |
| **Review** | Inspection of a wafer that has already been inspected by a Tencor, KLA, or similar device and that has an associated map file and defect data. |
| **Inspect and Save** | Similar to Inspect, but with the added ability to catalogue and save defect information. |

In this tutorial, you will only be dealing with a basic inspection. The '**Setup**' field of the **Run Window** should contain the '**Inspect.set**' setup file, as shown in Figure 3-2 above.

## 3.2 Recipes

A recipe is a set of instructions that tell DART how to perform a wafer inspection. Organized as a series of steps, a recipe most closely resembles a simple computer program. While you do not need to understand how to create or edit recipes in order to perform a basic wafer inspection, it is essential that you understand some of the elements of a basic recipe.

**Stage Point** A stage point is a location on the wafer.

A recipe may contain instructions to proceed to a given stage point, await user input, and then proceed to another stage point. An example is a simple recipe that has four predetermined stage points. As soon as the inspection begins, the stage moves to view the first stage point, and waits for the user to push the 'Recall' button (section 3.6). As soon as the user pushes the button, the stage moves to view the second stage point, and so on, until all the stage points have been viewed.

**Scan** A scan is a recipe instruction that slowly moves the stage along a preset course, allowing the operator conducting the inspection to view all the areas of the wafer covered by the scan.

To follow this tutorial, you should use the default '**Inspect.rec**' recipe. The name of the current recipe is displayed in the **Run Window**, in the field next to the word '**Recipe**'.

Follow the steps below to select the 'Inspect.rec' recipe, even if it is already displayed in the Run Window. Although it may not be necessary, this will teach you the steps to change the current recipe should you have to do so later.

**Step 1**: In the **Run Window**, click on the  button that corresponds to the '**Recipe**' field. This will open the '**Load File**' window shown in Figure 3-3 below.

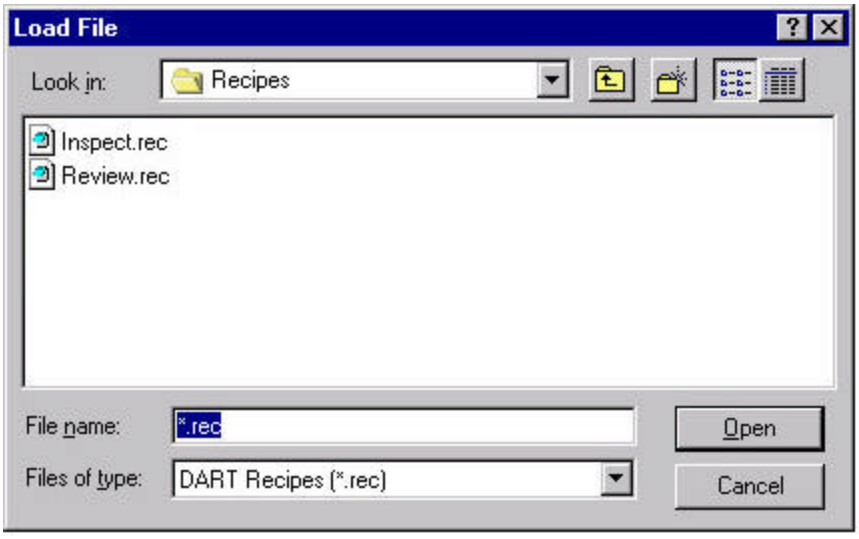


**Figure 3-3 -Load Recipe File**

**Step 2**: Click on Inspect.rec to select it. *(Note: There may be more recipe files in your 'Load File' window than the two shown above.)*

**Step 3**: Once '**Inspect.rec**' is selected, click on Open .

Congratulations! You have successfully loaded a recipe file and are almost ready to begin your inspection.

## 3.3 Starting a Run

Now that you have selected a recipe, you are ready to begin your first wafer inspection using DART. Before starting, make sure there is a full wafer cassette on the Optistation-V elevator.

There are two elevators on the Optistation-V, one of which should contain a full cassette called the '**Accept**' cassette, and the other should contain an empty cassette called the '**Reject**' cassette. Wafers start in the 'Accept' cassette, and if they pass inspection they are returned there. If they fail inspection, they are transferred to the 'Reject' cassette. *(Note: This applies only for dual elevator versions of the Optistation-V, and not for the single elevator version.)*

The inspection of wafers in a wafer cassette is called a '**Lot**". As soon you start the Lot, the Optistation-V will remove a wafer from the cassette and move it to the micro or macro stage, depending on the recipe instructions. **Do not close DART until the Lot has completed.**

To begin the Lot, click on RUN in the Run Window.

When the Lot begins, continue reading the following sections in the order they are presented. As some of the windows are described, you will be given a set of simple exercises that will assist you in understanding how DART works.

## 3.4 The Wafer Window

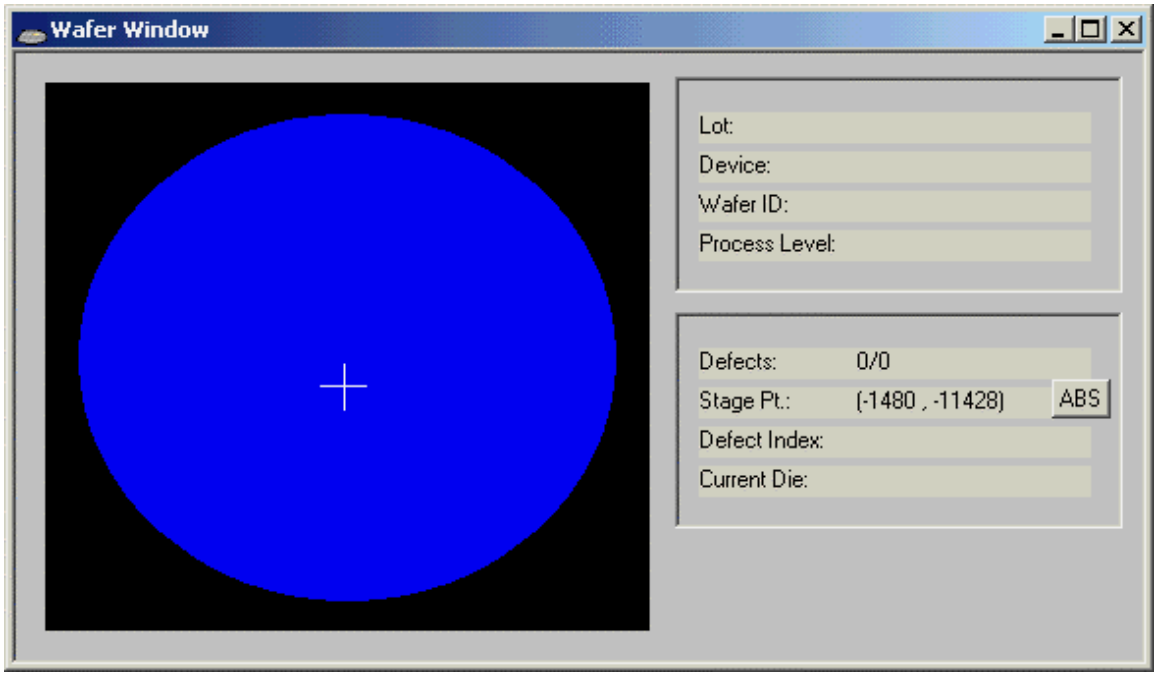


**Figure 3-4 -The Wafer Window**

The **Wafer Window**, shown in Figure 3-4 above, is best described as a graphical map of the wafer currently loaded on the micro inspection stage. It is divided into two sections: the **wafer view section** and the **data section**.

### 3.4.1 Wafer View Section

The **wafer view** section consists of a blue circle (which represents the wafer) and a small crosshair - which represent the current position of the stage in relation to the Optistation microscope. By *clicking* anywhere in the blue circle, you can move the micro inspection stage to position that part of the wafer under the microscope.

*(Note: The color of the circle is user selectable, so your circle may be a different color than the one pictured here.)*

In more advanced applications of DART, the **wafer view** section will also display **die patterns**, **defect numbers and positions**, **category numbers**, and other relevant information.

### 3.4.2 Data Section

The **data section** displays information about the current wafer and Lot. In a simple inspection such as the kind we are performing in this tutorial, the only relevant information is the stage position, called '**Stage Pt:**' in the Wafer Window.

In Figure 3-4 above, the current position is shown as being '*-1480, -11428*'. *(Note: This position is relative to the X and Y axes as designated to the wafer.)*

All positional measurements in DART are shown in **microns**, which is a very small unit of measurement (it is one thousandth of a millimeter). For some idea on how small a micron is, consider that there are 25,400 microns in an inch. Positions in DART are given by their X,Y coordinates, where the X coordinate is the first number, and the Y coordinate is the second number.

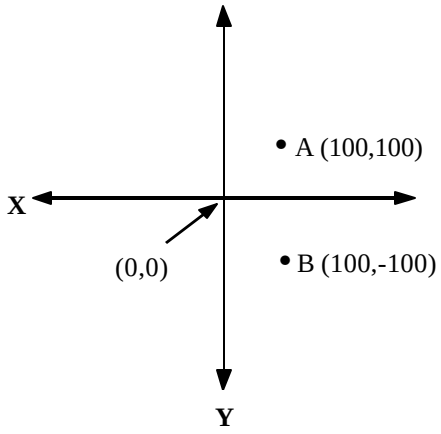


**Figure 3-5 -Sample Cartesian Plane**

This system of X and Y coordinates is called a **Cartesian plane**. Examine the sample Cartesian plane in Figure 3-5 above. The **X coordinate** refers to a location along the horizontal X-axis, where negative values are located to the left of the center (where the X-axis meets the Y-axis, represented as 0,0), and a positive value is located to the right of the center (0,0). The **Y coordinate** refers to a location along the vertical Y-axis, where negative values are located below the center, and positive values are located above it. Thus sample point A, represented by two positive values (100, 100), is 100 microns to the right of the center on the X-axis, and 100 microns above the center on the Y-axis. Sample point B, represented by a positive X coordinate and a negative Y coordinate, is 100 microns to the right of the center on the X-axis, and 100 microns below the center on the Y-axis.

In the **Wafer Window**, the center of the wafer represented by the blue circle is the center of the Cartesian plane (coordinates 0,0). *Our current position, as shown Figure 3-4, is 1480 microns (approximately 0.05 inches) to the left of the wafer's center along the horizontal X-axis, and 11428 microns (approximately 0.45 inches) below the center along the vertical Y-axis.*

### 3.4.3 ABS/REL Button

In addition to providing information, the data section of the Wafer Window contains a button called **ABS/REL**. This button has two modes, absolute (**ABS**) and relative (**REL**). This button changes the way in which the current stage position is reported. The face of the button changes to reflect its current mode. When you first start DART, the button is in Absolute mode (ABS).


In the default **absolute mode**, the center of the wafer is 0,0 as described in Section 3.4.2.


In **relative mode**, the current stage position at the time relative mode is engaged becomes 0,0, and all coordinates will be reported as being relative to that position. This is useful for measuring a distance between two points on the wafer.

### 3.4.4 Wafer Window Exercise

*Make sure there is a wafer on the stage. If not, refer back to section 3.3 for instructions on how to start a Lot.*

Click in various parts of the blue circle. Observe how the micro inspection stage moves with each mouse click. Also note the changing coordinates in the data section of the Wafer Window.

If you are having difficulty understanding the Cartesian plane, it may help to observe how the coordinates change as you move around the wafer.

## 3.5 The Video Window

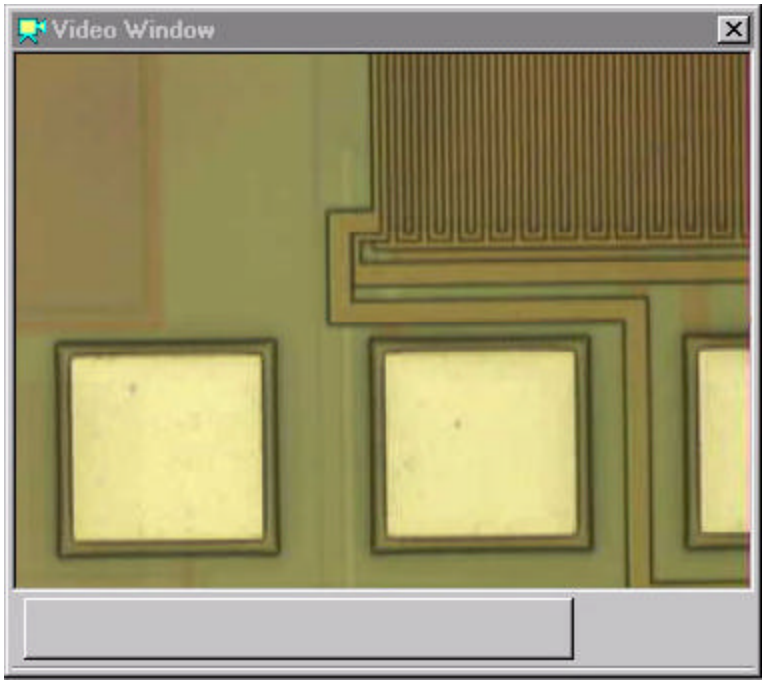


**Figure 3-6 -Video Window**

The **Video Window** is an option requiring the installation of additional hardware and software.

*If your DART PC is not equipped with the required options, you may skip this section and proceed to section 3.6.*

Using an external video camera connected to the Optistation-V, the Video Window displays images as seen through the eyepiece of the Optistation microscope. Using the Video Window, a DART operator can inspect wafers without the need to constantly look through the microscope's eyepiece. This can make the inspection process much quicker and easier for the operator.

In advanced applications of DART, the Video Window is used to assist in aligning the wafer, capturing and archiving wafer images, and more.

## 3.6 The Control Window


**Figure 3-7 -Control Window**

The Control Window is made up of buttons that control the inspection process. Like most other windows in DART, the Control Window can be configured to display all or some of its fields. Your Control Window may not look exactly like the own shown in Figure 3-7. *Regardless of what buttons appear in your window, focus only on those buttons that appear in your Control Window* ***and*** *are mentioned in this tutorial.*

Many of the buttons in the Control Window are also present on the Optistation-V keypads and perform the same functions.

Take a moment to study the buttons and their uses listed below; then complete the exercises that follow:


This button indicates that you have finished inspecting the wafer and have found it to be acceptable. When this button is pressed, DART will remove the wafer from the micro inspection stage and return it to the cassette from which it came. This cassette is called the "Accept" cassette.

Functionally, this button is equivalent to "**Load**", in that it will Load the first or next wafer, and/or complete the recipe.


The 'Reject' button also indicates that you have finished inspecting the wafer, but have found it unacceptable.

When this button is pressed, DART will remove the wafer from the micro inspection stage and place in the second cassette, called the 'Reject' cassette.


Perhaps the most commonly used of all Control Window buttons, '**Recall**' advances to the next line of instruction in a recipe when user input is required. Recipes are comprised of a series of steps that may or may not require user input to continue. When user input is required to continue, the user must press the '**Recall**' button. *For example, the recipe we are currently using is waiting for you to press 'Recall' before proceeding to the next stage point*.

Functionally, the 'Recall' button is equivalent to "**Next**", for advancement to the next command in the recipe.


This button is used to change the microscope objective, thereby changing the degree of magnification as seen through the microscope eyepiece (and the DART Video Window). Pressing this button will open a drop down list of Objectives, numbered 1 through 5. The '1' objective is the lowest level of magnification, and the '5' objective is the highest level of magnification. The actual magnification depends on the type of objective installed.


This button allows you to change the **sampling pattern** before starting a Lot. A sampling pattern is a set of instructions that inform DART which of the 25 wafers in a cassette will be inspected on the macro inspection stage, the micro inspection stage, or both.

*For a more thorough look at the 'Pick' button, see section 3.6.2.*


This button will temporarily suspend the movement of the micro inspection stage, whether it is moving from one stage point to another, or performing a scan (section 3.2). Once the stage has stopped, the operator can use the Optistation joystick to manually manipulate the stage.

To resume stage movement, press the 'Stage Stop' button again. The 'Stage Stop' is functionally equivalent to '**Pause**' in relation to running a recipe.


'Retrace' is the opposite of 'Recall'. 'Retrace' will reverse to the previous inspection point, whereas 'Recall' will proceed to the next stage point (or other recipe defined coordinate),. *Using 'Recall' and 'Retrace' together, it is possible to move through an entire recipe forward and then backwards.*

'Retrace' is functionally equivalent to '**Previous**' in relation to running a recipe.


Pushing the 'Lot End' button will return all wafers to the cassette and ends inspection (and/or review) of the Lot. You will be returned to the Run Window, where you can select a new recipe or start the Lot again using the same recipe.

This is functionally equivalent to '**Finish**', as it completes all scheduled tasks.



This button (which has two settings, 'Constant' and 'Variable') is used to configure the Optistation-V joystick. The face of the button changes to depict its current setting.

Under the '**Variable**' setting, the speed of the joystick varies depending on how sharply the joystick is tilted. *For example, if you push slightly on the joystick, the stage will move very slowly. As you tilt the joystick more, the speed increases.*

With the '**Constant**' setting, the speed remains the same regardless of the degree of tilt. The speed of the stage while in 'Constant' mode can be set with the Stage Settings window (see section 3.8.2).

### 3.6.1 Control Window Exercises

Make sure there is a wafer on the stage. *If not, refer back to section 3.3 for instructions on how to start a Lot.*

When the first wafer is loaded onto the micro inspection stage, the microscope (seen through the eyepiece or the Video Window) should be positioned over the first stage point.

A. *Click* on the '**Recall**' button and observe how the stage moves to the second stage point.

B. *Click* on the '**Retrace**' button and observe how the stage moves back to the first stage point.

C. *Click* on the '**Objective**' button to increase the magnification. Cycle through all the available objectives; then return to the one you started with.

D. Set the '**Constant'/'Variable**' button to '**Constant**' and move the Optistation joystick. Then set the button to '**Variable**' and see how the joystick's behavior changes.

E. *Click* several times on the '**Recall**' button until the recipe comes to an end and a new wafer is loaded onto the stage.

F. *Click* on the '**Reject**' button and observe how the wafer is returned to the 'Reject' cassette.

G. *Click* on the '**Accept**' button and observe how the wafer is returned to the 'Accept' cassette.

*Click* on the '**Lot End**' button to end the Lot and return to the Run Window.

### 3.6.2 Pick Button

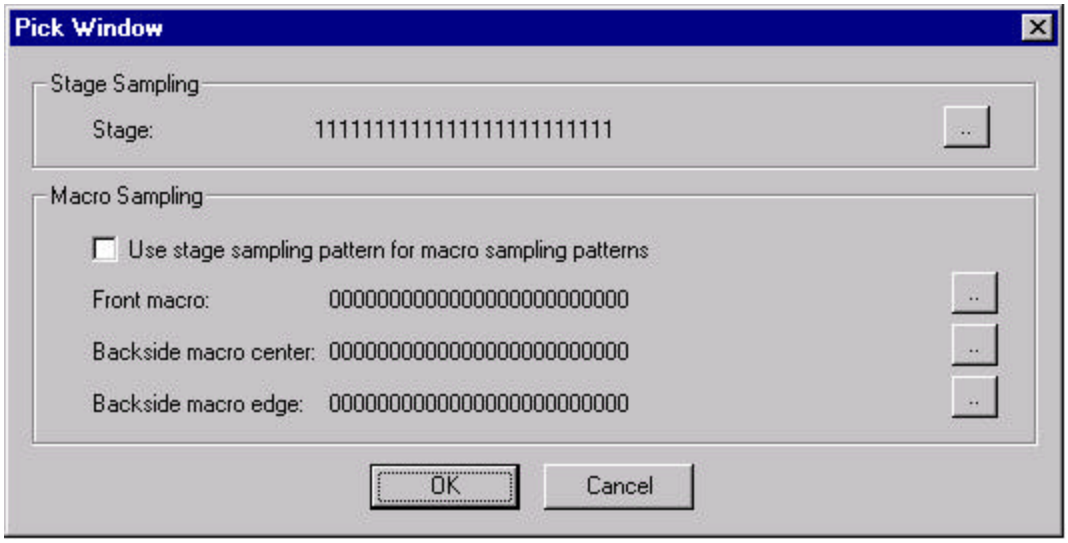


**Figure 3-8 -Pick Window**

Before understanding the function of the **Pick Window**, it is necessary to understand sampling patterns. A wafer cassette contains 25 wafers, any or all of which can be inspected on the micro stage and/or the macro stage. A **sampling pattern** informs DART which of the 25 wafers are to be inspected on the **micro stage**, which are to be inspected on the **macro stage**, and of those, which are to have their tops (front) inspected, and which are to have their undersides (back) inspected. Each of the different type of inspections (stage, front macro, back macro) has its own sampling pattern, allowing any or all of the wafers to be inspected using all, some, or none of the inspection types.

As an option, some Optistations can perform two types of **back macro** inspections; back center and back edge *(as shown in Figure 3-8)*.

- **Back center** is when the wafer is held by its sides and the operator can view its center.
- **Back edge** is when the wafer is held by its center (which is the regular back macro inspection on those Optistations not equipped with this feature) so that the edges of the wafer can be viewed.

*Note: Since not all Optistations have this feature, these two types of back macro inspections will not be discussed further in this manual.*

A recipe contains the macro and stage sampling pattern as part of its instructions. However, a DART user will often find it necessary to change the sampling pattern for various reasons.

For example:

If the operator wanted to perform an inspection of only the last two wafers in a cassette, it would not be necessary to cycle through all the wafers just to get to the last two. *Clicking* on the '**Pick**' button brings up the **Pick Window**, shown in Figure 3-8, which allows you to adjust the sampling pattern before the start of a recipe.

**The stage and macro sampling patterns set in the Pick Window take precedence over those in a recipe, even if the recipe was loaded after the changes in the Pick Window were made.** However, the changes made in the Pick Window last for only one Lot, after which they revert back to the recipe settings.

**Note:** The 'Pick' button cannot be used once a recipe starts, and will result in an error message if you attempt to do so.

To change a sampling pattern for a type of inspection, *click* on the corresponding [..] (ellipsis) button in the Pick Window. This will open the **Sampling Window** (shown in Figure 3-9 below). As an option, by clicking on the '**Use stage sampling pattern for macro sampling patterns**' checkbox in the **Pick Window**, DART will use one sampling pattern (the stage pattern) for all the different inspection types.

*For example: if you have wafer 1 selected in the Stage Sampling Pattern, wafer 1 will also be inspected on the Macro Stage.*

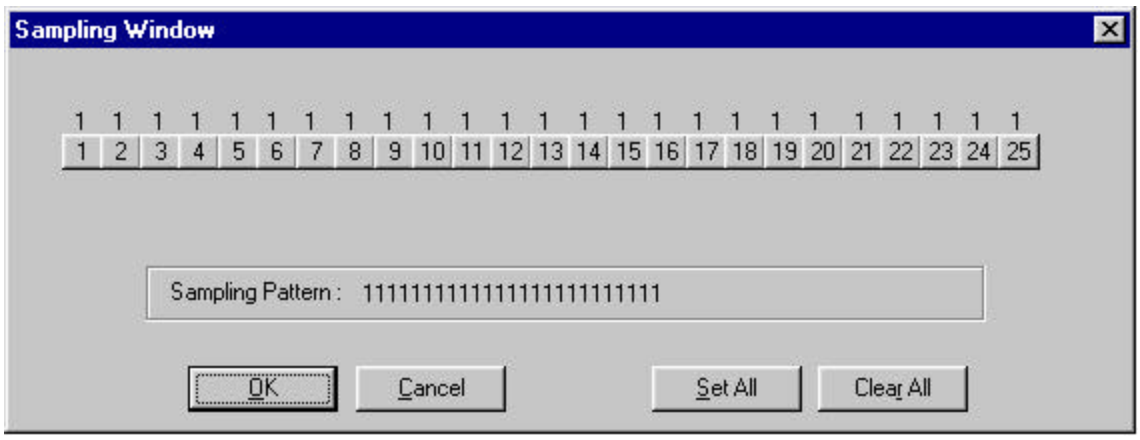


**Figure 3-9 -Sampling Window**

The **Sampling Window** contains a row of 25 numbered boxes ( [1] [2] [3] , etc.), each of which represents a wafer in the cassette. Above these numbered boxes is a value, either a '0' or a '1', which serve to identify those wafers that have been selected for inspection ('**1**') and those that have not ('**0**').

There are three ways to make changes to the sampling pattern in the Sampling Window:

1. To select or deselect an individual wafer, *click* on the numbered box representing that wafer.

   *For example: if wafer 1 is currently selected for inspection (there is a '1' above the numbered box), and you wish to deselect it, click on* [1] .

   *The '1' above the numbered box will change to '0' and the wafer will no longer be selected for inspection.*

2. To select all wafers for inspection regardless of their current status, *click* on [Set All]

3. To deselect all wafers regardless of their current status, *click* on [Clear All]

*Click* [Cancel] to exit without saving changes.

### 3.6.3 Pick Exercise

Make sure there is no wafer on the stage. *If there is a wafer on the stage, click on the Lot End button in the Control Window. This will return all the wafers back to the accept cassette.*

1. *Click* on the '**Pick**' button.
2. Change the sampling patterns to inspect wafers 1 and 2 on the micro stage, and wafers 3 and 4 on the macro stage.
3. Inspect the front of wafer 3, and the back of wafer 4.
4. Run the recipe again and observe how your new sampling pattern is carried out.

Congratulations! You have completed a simple wafer inspection!

Before continuing, click 

in the Run Window to start a new Lot using the same 'Inspect.rec' recipe.

## 3.7 The Status Window

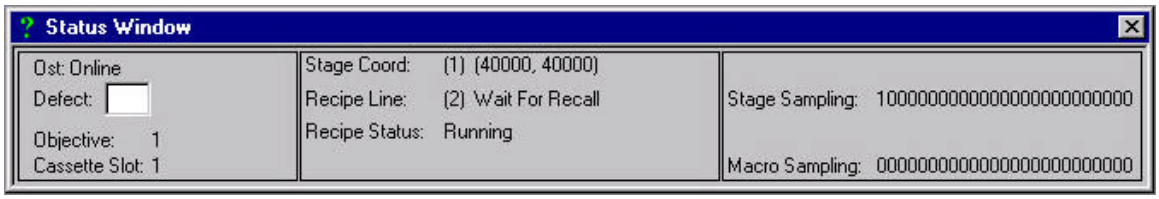


**Figure 3-10 -Status Window**

The Status Window contains information about the current recipe and Lot.

Here is a brief description of the Status Window fields:

**Ost:** Displays the current **status of the communications link** between the DART PC and the Optistation (abbreviated as "Ost").

The two possible readings are '**Online**', which means that the Optistation is connected, and '**Offline**', which means that the Optistation is not connected or communicating with the DART PC.

**Defect:** This field is where defect 'description numbers' would be entered (during a more advanced wafer inspection process).

**Objective:** Displays the number of the current objective on the Optistation microscope.

**Cassette Slot:** Indicates which slot in the cassette the wafer on the stage originated from.

**Stage Coord:** Displays the current recipe **stage coordinates** being observed by the Optistation microscope for the wafer on the micro stage.

*In Figure 3 – 10 above, the field is showing that currently the stage is positioned at the first recipe stage point (shown as (1)), and at coordinates 40000, 40000.*

**Recipe Line:** Shows the current active line of the Recipe. *In Figure 3 – 10 above, the current active recipe line is line 2, "Wait for Recall". This tells you that DART is waiting for you to click on the 'Recall' key before proceeding.*

**Recipe Status**: Displays the current status of the recipe.

There are several messages that can appear in the 'Recipe Status' field:

**Run Started:** Is shown between the time you first start a Lot and the moment that the first wafer is placed on the stage.
**Running:** This is shown when the recipe is in progress.
**Wafer Unload:** Is shown during the transfer of wafers to and from the stage.
**Stage Stop:** Shown when the 'Stage Stop' button has been pressed.
**Lot Complete:** Shown when the last wafer in the Lot has been removed from the stage.

**Stage Sampling:** Shows the current Stage Sampling pattern, or which wafers in the cassette will be inspected on the micro inspection stage.

If the Stage Sampling pattern was modified using the 'Pick' button, the words "Stage Pick Enabled" will appear above the pattern.

**Macro Sampling:** Shows the current macro sampling pattern, or which wafers in the cassette will be inspected on the macro stage. The information shown is the combined front macro and back macro sampling patterns. Any wafer selected for either pattern will be displayed as a '1' in the Macro Sampling field.

If the Macro Sampling pattern was modified using the 'Pick' button, the words "Macro Pick Enabled" will appear above the pattern.

## 3.8 Macro and Stage Tools

Located in the DART 'Tools' menu (Figure 3 – 11 below), Stage Tools allow you to adjust the behavior of the macro and micro inspection stages.


**Figure 3-11 -Tools Menu**

### 3.8.1 Macro Settings

*Click* on the 'Tools' menu, followed by 'Macro Settings'. This will open the Macro Settings window shown in Figure 3-12 below.

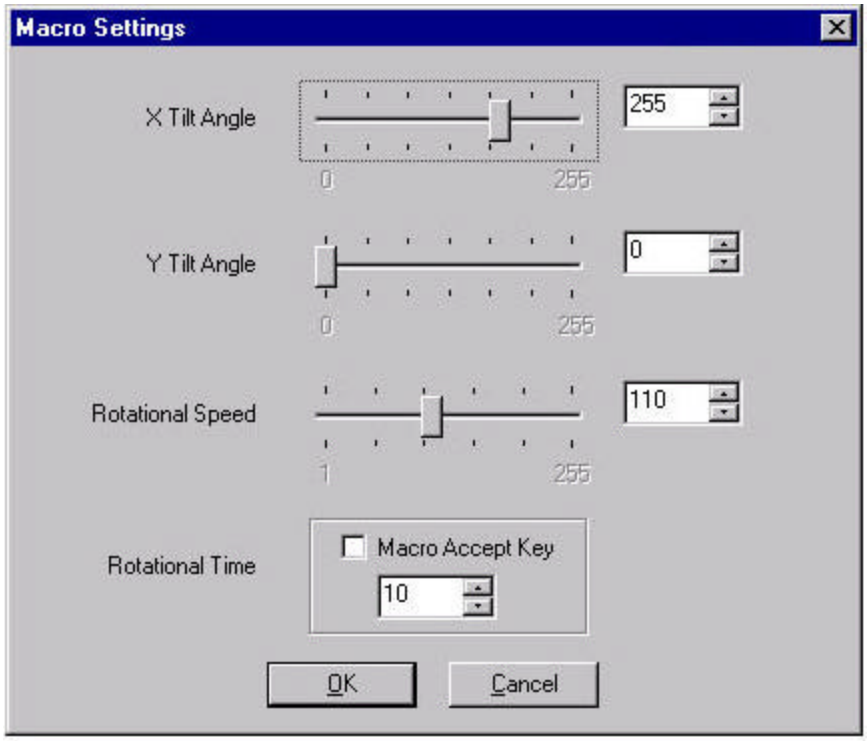


**Figure 3-12 -Macro Settings**

This window allows you to precisely control the macro stage. *Your supervisor or administrator may or may not want you to change the macro settings. Consult him or her before making changes.*

**X Tilt Angle and Y Tilt Angle**

When a wafer is on the macro inspection stage, the operator is inspecting the wafer with his or her naked eye. The **Macro Stage** tilts the wafer in a preset angle and rotates it, allowing the operator to see the entire wafer surface easily. The X and Y tilt angles are based on a Cartesian plane - the X angle being the horizontal tilt angle and the Y angle being the vertical tilt angle.

*(Note: see Section 3.4 for further information about Cartesian planes.)*

Although the usual position from which the macro inspection is performed is slightly to the right of the macro stage, it is easier to understand how the angle system works by standing in front of the macro stage. All references to line of sight in the figures below are therefore from directly in front of the macro stage.

The **Tilt Angle** adjustment in the Macro Settings window allows you to specify the degree of tilt. The slider moves from left to right, changing the value of the tilt angle from 0 to 255 (extreme tilting in the opposite directions). *The center position (128) has no tilt at all.* These figures do not represent actual degrees, but rather a numerical representation based on the minimum and maximum tilt angles. Below is an illustration of some possible tilt angles. *The illustration is not exact and is only meant as an approximation.*

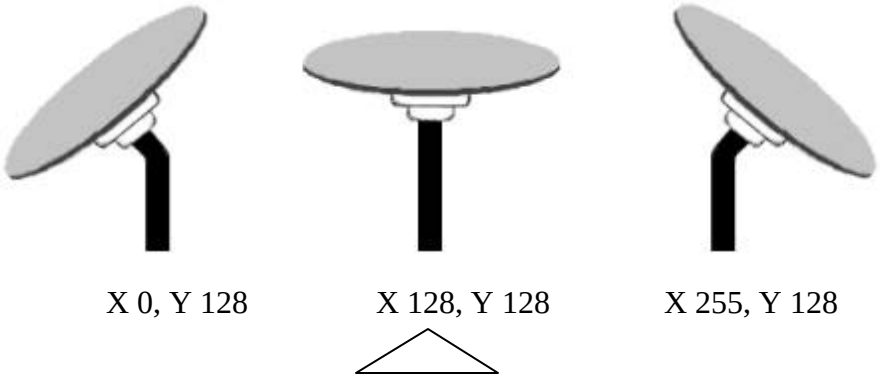


**Figure 3-13 -X Tilt Angle**

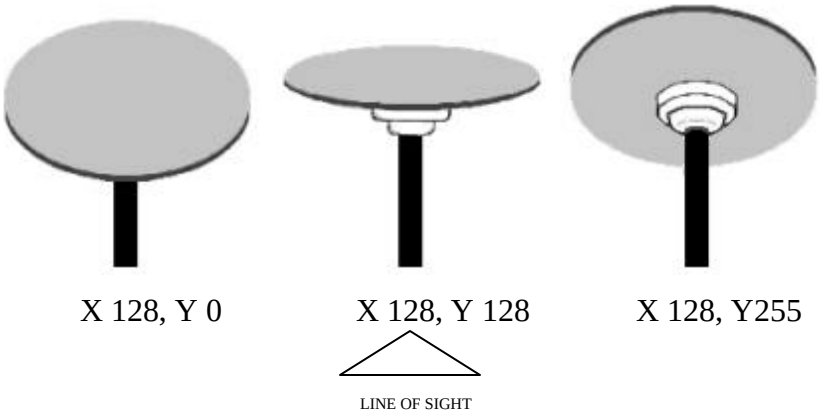


**Figure 3-14 -Y Tilt Angle**

By understanding how changing the X and Y values changes the way the macro stage tilts the wafer, it is possible to easily customize your preferred wafer tilt angle. By setting both values to their center positions (128,128), the wafer will be absolutely flat - like the surface of a table (shown in the previous figures). By combining the X and the Y tilt factors, you can tilt the wafer in any direction.

The default tilt angle is approximately X 200, Y 0, allowing the entire wafer surface to be seen from the usual viewing position behind the microscope eyepiece.

When performing a **back macro**, the center tilt angle (128,128) is offset by about 30 degrees along the positive Y axis (tilted away from the viewer, similar to X128, Y255 shown above*). If you are having difficulty conceptualizing this, a more simple way to put it is that when doing a back macro inspection, DART will add about 50 points (on the slide scale of 0 to 255) to whatever Y tilt setting you specify.*

**Rotational Speed, Rotational Time, and Macro Accept Key**

The **Rotational Speed** setting allows you to change the speed of the macro stage as it rotates the wafer during a macro inspection. The lowest value (1) will not rotate the wafer at all, allowing the most thorough and time-consuming inspection. The highest value (255) will rotate the wafer very quickly, allowing the quickest inspection.

The **Rotational Time** setting allows you to set the amount of time in seconds that the wafer remains on the macro stage.

As an option, there is a checkbox called '**Macro Accept Key**' which, if checked, will keep the wafer on the macro stage until the 'Macro Accept' button on the Optistation keypad is pressed.

*Click* 

to exit without saving changes.

### 3.8.2 Stage Settings

Click on the 'Tools' menu, followed by 'Stage Settings'. This will open the Stage Settings window shown in Figure 3-15 below.

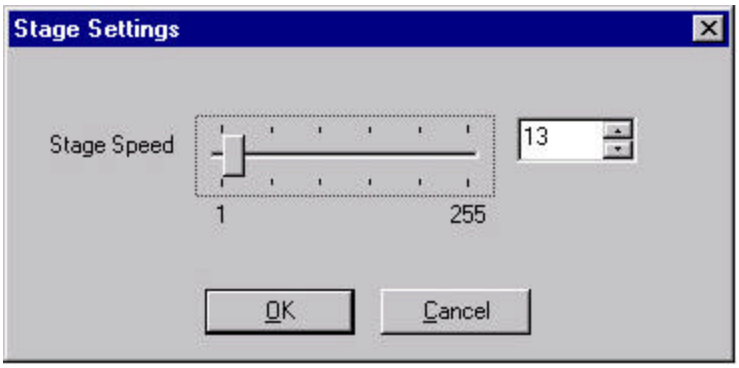


**Figure 3-15 -Stage Settings**

The slider can adjust the stage speed from a setting of 1 (extremely slow) to a setting of 255 (extremely fast). The Stage Speed setting affects the speed of the stage when conducting a scan *(see section 3.2)*, or when the stage is moved using the Optistation joystick when in '**Constant**' mode.

The numerical display for the Stage Speed can be used directly instead of using the slider. You can highlight the number (left click and drag with the mouse) and then enter the number with the number keys on the computer keyboard, or you can use the up or down arrow on the display box to move the number up or down.

*Click* Cancel to exit without saving.

# 4. Troubleshooting

## 4.1 Common Problems

**Problem**: *I got the error message shown below. (Figure 4 - 1)*

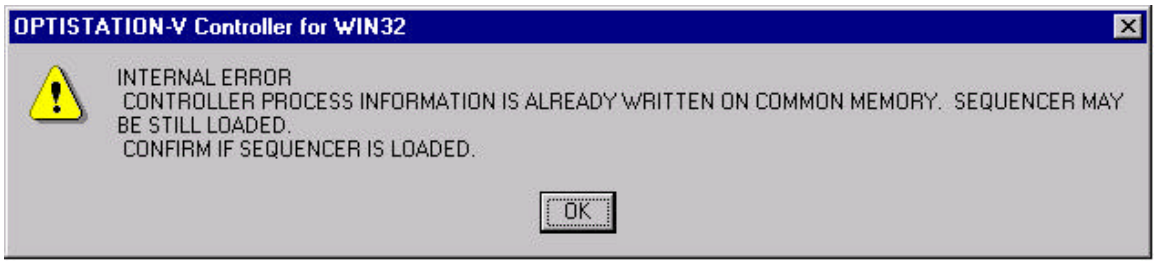


**Figure 4-1 -Communication Error**

**Solution**: The Optistation-V controller software is already running. This message may have occurred if the 'Start OSTV' icon on Windows' desktop was launched.

Log out of Windows, log back in (which will close all open programs) and then Run DART by clicking on the '**DART Inspect**' icon in the '**DART Application' folder**.

**Problem**: *I am using DART with an IMASCAN video board. I started a Lot and opened the Video Window, but I am not getting any video.*

**Solution**: Make sure the video camera adapter is turned on. If it is not, turn it on and restart DART. DART must go through its initialization sequence before the video camera is detected.

If the video camera adapter is turned on, ask your supervisor or administrator to make sure the video option is enabled in DART Options.

**Problem**: *There are wafers on the stage but DART is not running a Lot. How do I get the wafers back into the appropriate cassette?*

**Solution**: Start DART as you normally would. After DART and Optistation-V initializes, you will be presented with the following '**Collecting Wafers**' window:

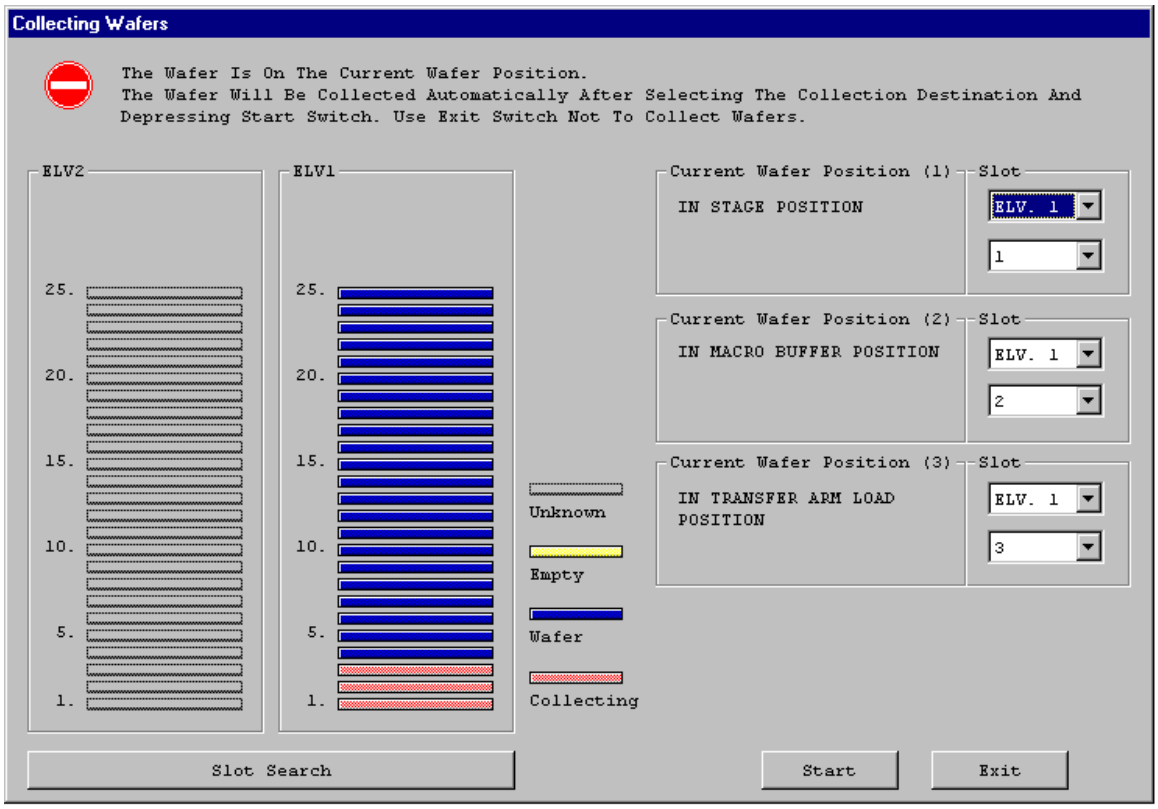


**Figure 4-2 - Wafer Recovery**

The **Collecting Wafers** window shows you which stage positions have wafers on them, which spots in the wafer cassette are not filled, and allows you to choose where you want to place each wafer. Although you can change the default options, the Collecting Wafers window does not require any user input to configure the wafer recovery process.

To return the wafers to the slots they came from, simply *click* 

**Problem**: *While trying to run a Lot, an error dialog (like the one shown below) appears.*

**Solution**: There is a problem with the Optistation-V, and DART has generated an error message. There are many Optistation-V error messages that can occur, and it is up to you to determine whether this problem can be solved without assistance.

We will discuss a common error message that results from a loss of vacuum to the Optistation-V and the steps necessary to correct it.

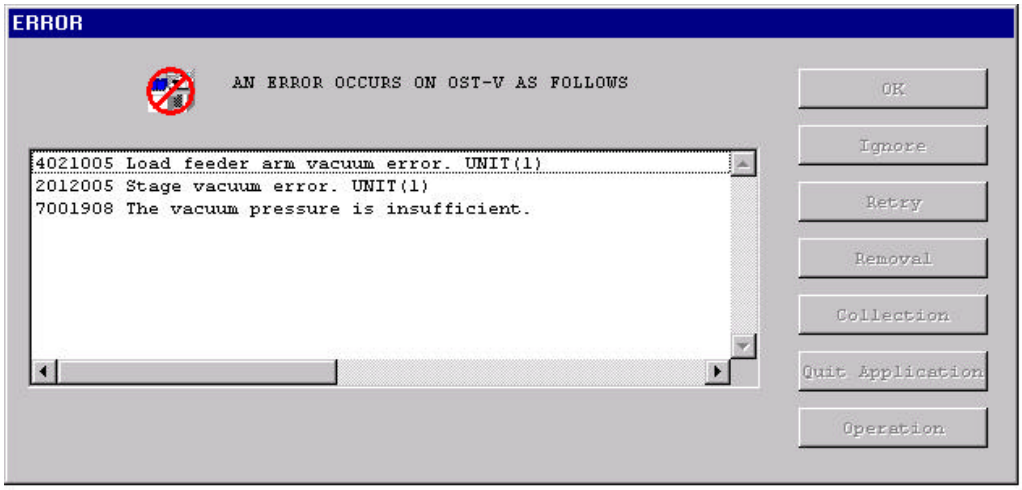


**Figure 4-3 -OSTV Error**

Shown in Figure 4-3 above is the error dialog that occurs when the Optistation-V loses vacuum pressure. If the message had been generated for a different reason, the text in the **Error** window would provide details of the different errors that occurred.

To correct this problem, you must first eliminate the source of the error, which in this case is the lack of vacuum. If the vacuum supply has been turned off, you must turn it on. Once the supply has been turned on, select any of the three error messages in the Error window by clicking on the text as shown below in Figure 4-4.

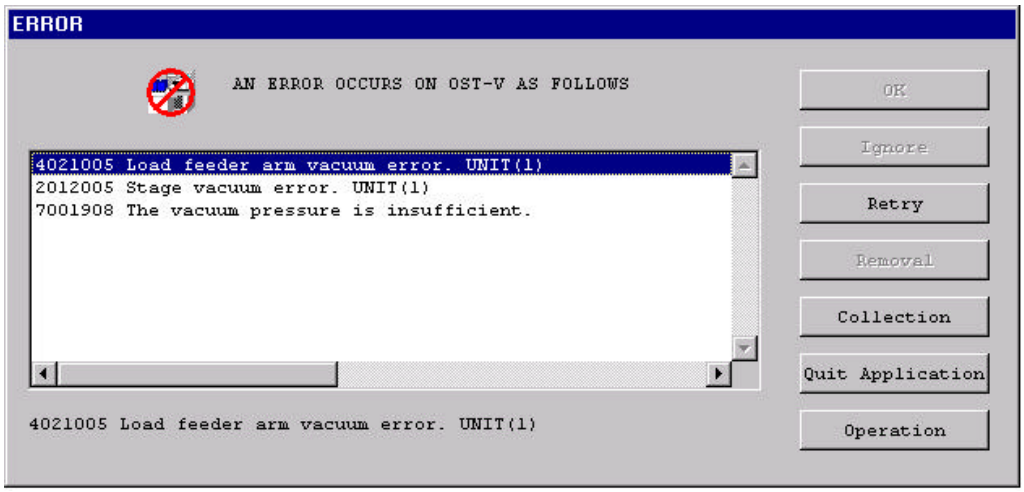


**Figure 4-4 -Retry**

Once an error is selected, click on the '**Retry**' button to close Error window.

Assuming you have restored the vacuum, you have successfully solved the problem.

Other Optistation error messages work similarly, but the underlying problem may be too difficult to solve without assistance.

The following describes the meaning of each button and the action they provide.

| | |
|---|---|
| OK | This button is enabled for an error encountered in the PC. Pressing this button does not affect the operation of the main body. |
| IGNORE | This button is enabled for an error that can be ignored without having to retry the action that generated the error. Currently, a non-contact error is the only such error. |
| RETRY | This button retries the action that halted with the error. |
| REMOVAL | This button indicates an error encountered during wafer transport. If the error requires removal of the wafer, remove the wafer and then press this button. |
| COLLECTION | This button returns all wafers currently on the transport route back to the original position. A wafer that was in the macro unit or on the stage will skip judgment. |
| QUIT APPLICATION | This button disconnects internal programs of the controller PC. Pressing this button disables communication with the Optistation-V. |
| OPERATION | This button is used to change the position of a wafer by issuing a single-action command.<br><br>*This button is only enabled for the Engineer or higher levels.* |

## 4.2 Error Code Table

**Error message for PC**

- **Errors common to data processing**

  000001 An attempt was made to register a registered process.

  000002 A function was called without going through initialization.

  000003 Passed argument was not understandable.

  000004 Data that was read out was abnormal.

  000005 Buffer (internal buffer) overflow.

  000006 Short of space on disk (HD or FD).

  000007 Data does not exist.

  000008 An attempt was made to specify non-registered process information.

  000009 Other definition error.

  000010 An attempt was made to use undefined DID.

  000011 Memory mapped file is not created yet.

- **Errors in recipe handling**

  000100 Recipe name is not set yet.

  000101 Unable to find the specified recipe.

  000102 An attempt was made to specify a used recipe.

  000103 Data out of range.

  000104 Currently invalid recipe.

  000105 Unable to find product definition.

  000106 Unable to find stage inspection definition.

  000107 Unable to find macro inspection definition.

  000108 Recipe is not mapped.

- **Errors in temporary file processing**

  000200 Error occurred in creation of a temporary file.

  000201 Error occurred in access to a temporary file.

  000202 Error occurred in deletion of a temporary file.

- **Errors in data file processing**

  000300 Error occurred in creation of a file.

  000301 Error occurred in writing to a file.

  000302 Error occurred in access to a file.

  000303 Error occurred in deletion of a file.

  000304 Unable to find the file.

  000305 Unable to open the file.

  000306 Access was attempted to a file of different format.

  000307 Unable to find the file on the specified path.

  000308 The system was not able to open the file.

  000309 Access was denied.

  000310 Unable to open the file because it is currently opened by another process.

  000311 The data is locked by another process.

  000312 EOF was reached.

  000313 Disk full.

  000314 File already exists.

  000315 Unable to create a directory or file.

  000316 Error occurred in reading of a file.

- **Error in data processing for elevator**

  000400 Cassette definitions are not set for elevator.

- **Data for stage**

  000500 The stage was at the highest coordinate data position, but even higher data was requested. (Warning)

000501 The stage was at the lowest coordinate data position, but even lower data was requested. (Warning)

000502 Call was made beyond the last alignment point. (Warning)

- **Communication**

001003 Communication: Send/receive error.

001004 Communication: Command inconsistent between PC and main body.

001005 Communication: A completion report came for an operation that had not been ordered.

001007 Communication: Duplicate command was ordered.

- **Memory**

002001 Memory: Allocation error.

- **Comma**

003001 Comma: Open error.

- **Pipe**

004001 Pipe: Create error.

- **Event**

005001 Event: Create error.

- **Process and thread**

007001 Function call: Unable to create a process or thread.

- **Miscellaneous**

0999001 Undefined error.

- **Error messages for macro unit**

1001001 Top-tier sensor: Sensor is not shaded when pulse is sent.

1001002 Top-tier sensor: Sensor remains shaded when pulse is sent.

1002001 Bottom-tier sensor: Sensor is not shaded when pulse is sent.

1002002 Bottom-tier sensor: Sensor remains shaded when pulse is sent.

1003003 X tilt angle: Failure to return to horizontal position.

1003004 X tilt angle: Failure to tilt to the specified angle.

1003006 X tilt angle: Overcurrent was detected (overload).

1004003 Y tilt angle: Failure to return to horizontal position.

1004004 Y tilt angle: Failure to tilt to the specified angle.

1004006 Y tilt angle: Overcurrent was detected (overload).

1005007 Top- and bottom-tier sensors: Both sensors are shaded.

1006008 Chuck: Wafer came off during suction.

1006009 Chuck: Wafer is sucked when it should not be.

1009007 Top- and middle-tier sensors: Both sensors are shaded.

1010007 Bottom- and middle-tier sensors: Both sensors are shaded.

1011007 Top-, middle-, and bottom-tier sensors: All sensors are shaded.

1020030 The specified macro unit does not exit.

1030040 Cycle cam: Unable to execute macro operation because the rotating arm has not lowered.

- **Error messages for stage**

2001001 X stage: X reference sensor is not shaded during initialization.

2001002 X stage: X+ limit sensor was shaded halfway through movement.

2001003 X stage: X- limit sensor was shaded halfway through movement.

2001004 X stage: X-axis servo error.

2001007 X stage: Counter-error was detected during movement (overspeed).

2001016 X-axis transfer over-limit.

2001022 Time-out in movement to inside of X limit.

2002001 Y stage: Y reference sensor is not shaded during initialization.

2002002 Y stage: Y+ limit sensor was shaded while in operation.

2002003 Y stage: Y- limit sensor was shaded while in operation.

2002004 Y stage: Y-axis servo error.

2002007 Y stage: Counter-error was detected during movement (overspeed).

2002016 Y-axis transfer over-limit.

2003001 Alignment: Wafer rotation time-out.

2003008 Unable to read FIFO data.

2003009 Unable to set PPMC.

2003018 Unable to detect wafer center.

2003019 X-axis off-center error.

2003020 Y-axis off-center error.

2003021 X-/Y-axis off-center error.

2003041 Unable to execute-already in execution.

2004001 Skipping: Time-out in movement to target point.

2005001 Scanning: Time-out in movement to target point.

2006001 Alignment: Time-out in rotation during NCPA.

2007004 Transfer: Time-out in soft-limit stand-by.

2008001 Transfer: Time-out in movement to intermediate point.

2009001 Transfer: Time-out in movement to transfer point.

2009004 Transfer: Time-out in stop process.

2010001 Alignment movement: Time-out in movement to target point.

2011004 Time-out in initialization stop process.

2011017 Not initialized yet.

2011022 Initialization time-out.

2012005 Chuck: Wafer came off during suction.

2012006 Chuck: Wafer is sucked when it should not be.

2013010 Nosepiece: Failure to reach the specified position (the specified magnification).

2014011 Aperture: Clockwise rotation limit detected.

2014012 Aperture: Counterclockwise rotation limit detected.

2015013 Z-stage: Upper-limit detected.

2015014 Z-stage: Lower-limit detected.

2016015 Joystick: Unable to switch.

2016022 Joystick time-out.

2016041 Key: Unable to switch joystick.

2017016 Coordinate soft-limit exceeded.

2019015 Time-out in shift to idle state.

2020030 The specified unit does not exist.

2030040 Command format error.

2030041 Multiple command was received.

2030904 Undefined error.

2030905 ACK time-out.

2030906 Reply time-out.

2998902 System error: Command queue destroyed.

2998903 System error: Send queue destroyed.

2999901 System error:

2999902 System error: Alarm queue destroyed.

- **Error messages for rotating arm**

3001001 Cycle cam: Failure to reach the home position when the arm is rotated.

3001002 Cycle cam: Failure to reach the specified position when the arm is rotated.

3002003 Arm 1: Wafer came off during suction.

3002004 Arm 1: Wafer is sucked when it should not be.

3003003 Arm 2: Wafer came off during suction.

3003004 Arm 2: Wafer is sucked when it should not be.

3004003 Arm 3: Wafer came off during suction.

3004004 Arm 3: Wafer is sucked when it should not be.

3010040 Cycle cam: Mismatch between stored position and actual position.

3010041 Cycle cam: Unable to execute-already in execution.

3010042 Cycle cam: Mismatch between specified position and actual arm position.

- **Error messages for feeder**

4001001 Front-limit sensor (load side): Sensor was not shaded after end of pulse sending.

4001003 Front-limit sensor (load side): Sensor was shaded too early during pulse sending.

4002001 Front-limit sensor (unload side): Sensor was not shaded after end of pulse sending.

4002003 Front-limit sensor (unload side): Sensor became shaded during pulse sending.

4003001 Rear-limit sensor (load side): Sensor was shaded too early during pulse sending.

4003003 Rear-limit sensor (load side): Sensor became shaded during pulse sending.

4004001 Rear-limit sensor (unload side): Sensor was not shaded after end of pulse sending.

4004003 Rear-limit sensor (unload side): Sensor became shaded during pulse sending.

4005001 C2 sensor: Sensor was not shaded after end of pulse sending.

4005002 C2 sensor: Sensor remained shaded after end of pulse sending.

4005003 C2 sensor: Sensor became shaded during pulse sending.

4006001 C1 sensor: Sensor was not shaded after end of pulse sending.

4006002 C1 sensor: Sensor remained shaded after end of pulse sending.

4006003 C1 sensor: Sensor became shaded during pulse sending.

4007001 B sensor: Sensor was not shaded after end of pulse sending.

4007002 B sensor: Sensor remained shaded after end of pulse sending.

4007003 B sensor: Sensor became shaded during pulse sending.

4008001 Upper-limit sensor: Sensor was not shaded after end of pulse sending.

4008002 Upper-limit sensor: Sensor remained shaded after end of pulse sending.

4008003 Upper-limit sensor: Sensor became shaded during pulse sending.

4009001 Lower-limit sensor: Sensor was not shaded after end of pulse sending.

4009002 Lower-limit sensor: Sensor remained shaded after end of pulse sending.

4009003 Lower-limit sensor: Sensor became shaded during pulse sending.

4010001 Home sensor for vertical movement: Sensor was not shaded after end of pulse sending.

4010003 Home sensor for vertical movement: Sensor became shaded during pulse sending.

4011004 Front- and rear-limit sensors (load side): Both sensors are shaded.

4012004 Front- and rear-limit sensors (unload side): Both sensors are shaded.

4013004 Right- and left-limit sensors: Either sensor is faulty.

4014004 Upper- and lower-limit sensors: Either sensor is shaded on both sides.

4015004 Home sensor and left-limit sensor for slider: Either sensor is faulty.

4016004 Home sensor and right-limit sensor for slider: Either sensor is faulty.

4017004 Home sensor and upper-limit sensor for elevator: Either sensor is faulty.

4018004 Home sensor and lower-limit sensor for elevator: Either sensor is faulty

4019004 Home sensor and right-and left-limit sensors for slider: One of the sensors is faulty.

4021005 Arm (load side): Wafer came off during suction.

4021006 Arm (load side): Wafer is sucked when it should not be.

4022005 Arm (unload side): Wafer came off during suction.

4022006 Arm (unload side): Wafer is sucked when it should not be.

4030040 Mismatch between stored position and actual position.

4030041 Unable to execute-already in execution.

- **Error messages for elevator**

5001001 Upper-limit sensor: Sensor was not shaded after end of pulse sending.

5001003 Upper-limit sensor: Sensor remained shaded after end of pulse sending.

5001005 Upper-limit sensor: Sensor became shaded during pulse sending.

5002003 Lower-limit sensor: Sensor remained shaded after end of pulse sending.

5002005 Lower-limit sensor: Sensor became shaded during pulse sending.

5002015 Cassette check sensor: Only 8-inch cassette is ON.

5003002 Cassette check sensor: Unable to execute without cassette.

5003004 Cassette check sensor: Wrong wafer size.

5004006 Fling-out check sensor: Wafer is protrudent from the carrier.

5005007 Upper-limit sensor: Sensor does not deliver output if its gain is maximized.

5005008 Upper-limit sensor: Sensor is short of output (due to optical-axis misalignment).

5005009 Upper-limit sensor: Sensor output does not lower when sensor gain is lowered.

5006007 Lower-limit sensor: Sensor does not deliver output if its gain is maximized.

5006008 Lower-limit sensor: Sensor is short of output (due to optical-axis misalignment).

5006009 Lower-limit sensor: Sensor output does not lower when sensor gain is lowered.

5007009 Sensor sum value: Sensor output does not lower when sensor gain is lowered.

5008010 Wafer sensor: Wafer is tilted too much.

5008011 Wafer sensor: There is no gap for the feeder to slide into.

5008012 Wafer sensor: Insufficient shading.

5008013 Wafer sensor: The detected center position does not match the pitch.

5008016 Upper- lower-limit sensor: Either sensor is faulty.

5010017 Elevator coarse alignment sensor: Y coordinate: No data was obtained.

5010018 Elevator coarse alignment sensor: Y coordinate: No data was obtained.

5011014 Slot: A wafer exists in the destination slot.

5011045 Elevator slot: No wafer in the sender slot.

5041018 Coarse alignment sensor: Shaded from the start.

5060019 Coarse alignment sensor: Computation result exceeded the correction-value range.

5060020 Coarse alignment sensor: Short of measurement points.

5060021 Coarse alignment sensor: Short of light intensity.

5070030 Elevator: The specified elevator unit does not exist.

5070040 Elevator: Mismatch between stored position and actual position.

5084041 Elevator: Unable to execute – already in execution.

- **Error messages for auto focus**

6001001 Upper-limit sensor: Sensor was shaded.

6002001 Lower-limit sensor: Sensor was shaded.

6003003 AF: Short of search-light intensity.

6010030 AF: The specified AF unit does not exist.

- **Error messages for main-body CPU**

  7001001 Each CPU: Program error.

  7001907 Each CPU: Failed in wafer removal.

  7001908 Vacuum sensor: Short of vacuum pressure.

## 4.3 Maintenance Command List

Initialize entire lob
Turn off all vacuum chucks
Joystick constant-speed mode
Joystick variable-speed mode
Change objective: Nosepiece 1
Change objective: Nosepiece 2
Change objective: Nosepiece 3
Change objective: Nosepiece 4
Change objective: Nosepiece 5

Initialize stage
Turn on stage suction
Turn off stage suction
Move to stage transfer position
Order request for stage coordinate
Order stage coordinate movement (for jump)
Order stage coordinate movement (for scan)

Move from current position to stage coordinate X+ limit position
Move from current position to stage coordinate X-limit position
Move from current position to stage coordinate Y+ limit position
Move from current position to stage coordinate Y-limit position
Start stepping
Stop stepping

- **Stage test operation commands**

Start XTEST
Stop XTEST
Start YTEST
Stop YTEST
Order start of coordinate reporting at fixed intervals
Order stop of coordinate reporting at fixed intervals

- **Commands for auto focus**

Enable AF
Disable AF
Start AF scan

- **Command for alignment**

Start NCPA alignment

- **Commands for elevator**

  - **Elevator 1**

    Initialize elevator 1
    Move elevator 1 to upper-limit position
    Move elevator 1 to wafer position at specified pocket
    Move elevator 1 to feeder-in position at specified pocket
    Move elevator 1 up by one pocket
    Move elevator 1 down by one pocket
    Execute elevator-1 wafer mapping
    Execute elevator-1 wafer sensor AGC
    Turn on elevator-1 laser
    Turn off elevator-1 laser

  - **Elevator 2**

    Initialize elevator 2
    Move elevator 2 to upper-limit position
    Move elevator 2 to wafer position at specified pocket
    Move elevator 2 to feeder-in position at specified pocket
    Move elevator 2 up by one pocket
    Move elevator 2 down by one pocket
    Execute elevator-2 wafer mapping
    Execute elevator-2 wafer sensor AGC
    Turn on elevator-2 laser
    Turn off elevator-2 laser

- **Commands for feeder**

  - **Feeder 1 (load feeder)**

    Initialize load feeder
    Turn on load feeder suction
    Turn off load feeder suction
    Take load feeder wafer out of pocket
    Bring wafer into pocket (after it is taken out of load feeder)
    Move load feeder to front-limit position: Y axis
    Move load feeder to rear-limit position: Y axis

  - **Feeder 2 (unload feeder)**

    Initialize unload feeder
    Turn on unload feeder suction
    Turn off unload feeder suction
    Take unload feeder wafer out of pocket
    Bring wafer into pocket (after it is taken out of unload feeder)
    Move unload feeder to front-limit position: Y axis
    Move unload feeder to rear-limit position: Y axis

- **Common to both feeders**

  Move feeder to buffer position: X axis
  Move feeder to elevator 1
  Move feeder to elevator 2
  Move feeder up by half pocket
  Move feeder down by half pocket
  Move feeder to upper-limit position
  Move feeder to lower-limit position
  Move feeder to home position

- **Commands for macro unit**

  Initialize macro unit
  Turn on macro unit suction
  Turn off macro unit suction
  Move macro unit to top-tier position
  Move macro unit to bottom-tier position
  Move macro unit to observation point: middle-tier position
  Move macro unit to observation point: top-tier position
  Execute front-surface macro inspection
  Execute rear-surface macro inspection
  Turn on automatic macro judgment
  Turn off automatic macro judgment
  Exit macro inspection
  Turn on macro lamp
  Turn off macro lamp

- **Commands for rotating arms**

  Initialize rotating arm
  Turn on rotating arm-1 suction
  Turn off rotating arm-1 suction
  Turn on rotating arm-2 suction
  Turn off rotating arm-2 suction
  Turn on rotating arm-3 suction
  Turn off rotating arm-3 suction
  Turn rotating arm 120 degrees

- **Commands for microscope**

  Turn on microscope lamp
  Turn off microscope lamp

## 4.4 Routine Maintenance

### 4.4.1 Cleaning the Lens

- Remove dust by sweeping with a soft brush or lightly wiping with gauze.
- Only when removing fingerprints or oils, wipe them off using soft cotton, lens tissue, or gauze lightly moistened with absolute alcohol (methyl alcohol or ethyl alcohol).
- To clean immersion oil, use petroleum benzine.
- If petroleum benzine is not available, use methyl alcohol. However, methyl alcohol is weak in cleaning power, so it requires three to four wipes.
- Do not use petroleum benzine when wiping the incident lens of the microscope column.

* Absolute alcohol and petroleum benzine are highly inflammable, requiring care in handling, such as when using a fire source nearby or switching a power supply.

### 4.4.2 Cleaning the Wafer Suction Surface

- Wipe the wafer suction surface using a clean cloth lightly moistened with absolute alcohol (methyl alcohol or ethyl alcohol).
- Do not apply excessive force to the transport arm.

### 4.4.3 Replacing the Lamp

**CAUTIONS**

- **Ensure that the lamp house is "Nikon halogen lamp house 12V-100W".**
- **Ensure that the lamp is a halogen lamp 12V-100W .**
- **When replacing the lamp, wait until the lamp and the lamp house have sufficiently cooled down.**
- **Before replacing the lamp, be sure to set the lockout handle to OFF. Failure to observe can cause an electric shock or equipment damage.**
- **When installing a new lamp, do not touch the lamp bulb with bare hands. Oils or fingerprints from your hands can stick fast to the new bulb, leading to low light intensity. If dirt or fingerprints are put on the bulb, thoroughly wipe them off.**
- **Insert the lamp house fully into the microscope column, and then fix it.**

Loosen the lamp house cover clamp screw with a coin or the like 1, and then remove the cover 2.

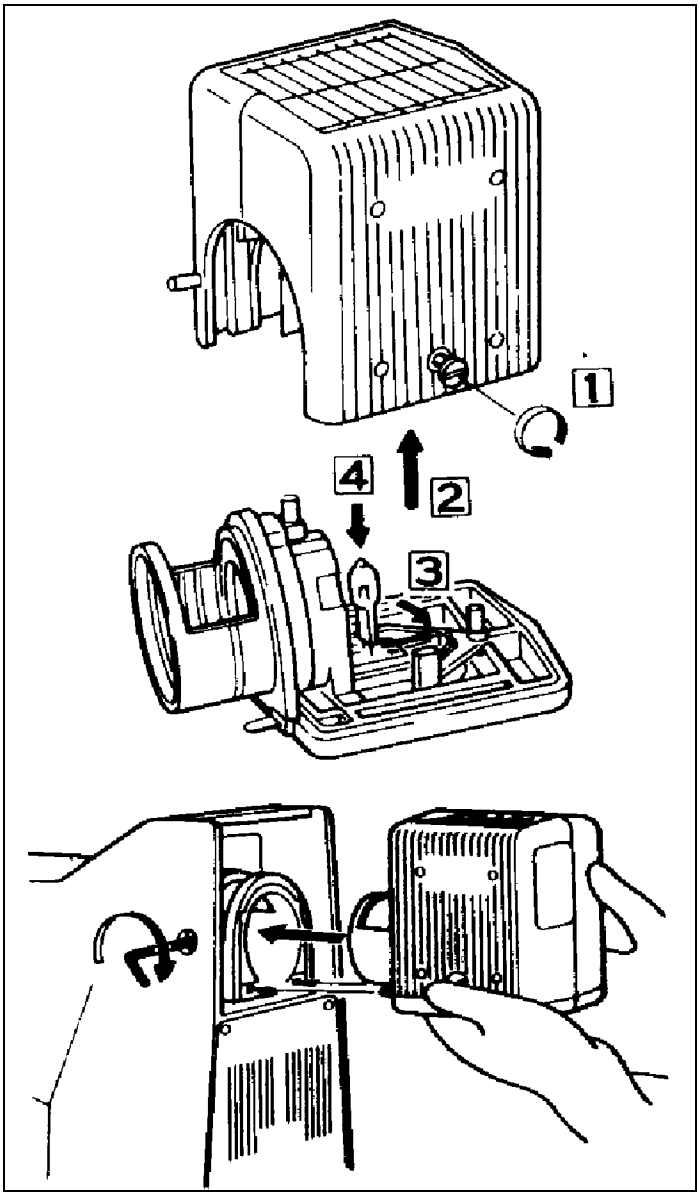


**Figure 4-5**

Press down the lamp clamp lever while inserting the lamp into the socket pin hole as far as it touches the stopper 3, 4.

When setting the clamp lever to the previous position, do it carefully so the lamp is mounted upright.

Close the cover and tighten the lamp house cover clamp screw.

Set the lamp house fully into the adapter and then clamp it.

## 4.5 Replacing Fuses

Ensure that all fuses are designated ones. With any other fuse, it can blow with on/off switching of power, or even cause a fire or equipment failure.

When replacing a fuse, first set the lockout handle to OFF to prevent an electric shock.

Fuse replacement must be a job of a serviceman or trained person.

## 4.6 Lockout System

The NAME box (main-power controller) of the Optistation-V has a main power breaker that is capable of turning on and off all power supplies to the system. When overcurrent comes in, the main power breaker automatically locks out the system by cutting off system power.

Lockout procedure:

1. On the switch box, press the MAIN OFF switch to turn off system power. The POWER ON lamp goes out.

2. Turn the lockout handle of the main power breaker to the OFF position. The MAINLNE ON lamp goes out.

3. With the lockout handle of the main power breaker still in the OFF position, pull out the lock tool out of the handle.

4. Padlock the lock tool.

5. Make sure that the lockout handle of the main power breaker is held from rotating.

6. Finally, make sure that the system is completely out of operation.

## 4.7 Emergency Circuit

Cable Connection Diagram
Move elevator 1 down by one pocket
Execute elevator-1 wafer mapping
Execute elevator-1 wafer sensor AGC
Turn on elevator-1 laser
Turn off elevator-1 laser

# 5. SPECIFICATIONS

- **Applicable wafer size**

  4-, 5-, 6-, 8-inch

- **Microscope unit**

| | |
|---|---|
| Objectives | CF&IC EPi Plan, CF&IC EPi Plan Apo, CF&IC BD Plan, CF&IC BD Plan, Apo series |
| Eyepiece | CFUWL 10x (field number 25) |
| Optics | CF&IC |
| Illumination | 12 V, 100 W, halogen lamp |
| Eyepiece tube | Triocular extension tilt eyepiece tube TL |
| Auto focus | LED illumination slit type AF |
| Revolving nosepiece | BD 5-hole motorized revolving nosepiece (Standard) |
| Option | Confocal microscope unit |

- **Macro unit**

| | |
|---|---|
| Rotation | 360°, endless |
| Tilt angle | 0 ±30° each for X and Y axes |
| Operation | Automatic to preset values, or manual with joystick |

- **Stage unit**

| | |
|---|---|
| Stage stroke | 208 mm x 208 mm |
| Travel modes | • Auto mode<br>Automatic movement to recipe-programmed observation points (jump or scan)<br>• Manual mode<br>Variable speed corresponding to joystick angle<br>Low-speed travel corresponding to objective magnification<br>• Coordinate correction<br>X and Y |
| Observation points | 100 points per wafer inspection file (Up to 4000 inspection files) |

- **Wafer transport unit**

| | |
|---|---|
| Number of elevators | Two or one |
| Elevator location | Front |
| Transport | Mechanical transport by vacuum suction<br>Non-contact prealignment |
| Material of wafer suction area | PEEK (polyether-ether-ketone) |

- **Functions**

Sampling assignment

GO/NG sort

Online help

| | |
|---|---|
| Online operation (optional) | RC-232C or TCP/IP |
| Communication with host computer | Lot management and system management using GEM |

- **Environment**

| | |
|---|---|
| Room temperature | 23° ±3°C |
| Humidity | 50% ±20% |

- **Utilities requirements**

| | |
|---|---|
| Electricity | 100 to 120 VA-c ±10%, 50/60 Hz, 10 A max. |
| Vacuum | ≤ -80 KPa (-600 mmHg) |

- **Dimensions and weight**

| | |
|---|---|
| Single-cassette type | 995(W) x 1000(D) x 1380(H) mm; approx. 290 kg |
| Double-cassette type | 1200(W) x 900(D) x 1380(H) mm; approx. 320 kg |

- No part of this manual may be reproduced in any form without permission.

- This manual is subject to change without notice.




***Nikon* Inc.**

**1300 Walt Whitman Road**
**Melville, NY 11747 U.S.A.**
**Telephone (631) 547.4200**