

**KMS-310/400
Operator's Manual**

May 1998

zygo

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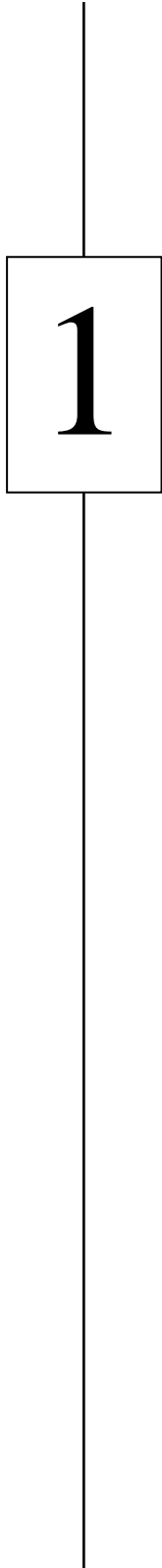
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1

About This Manual

Intended Audience

Manual Organization

Conventions

Contacting Technical Support

Intended Audience

This manual can be used by those unfamiliar with the KMS-310/400 system as a learning tool, and by experienced users as a reference.

The primary users of this manual are photomask manufacturing and wafer fabrication operators and technicians. For those users who wish to create custom measurement scripts, or maintenance engineers who require a more thorough system functional description, please refer to the companion manual, *KMS-310/400 Supervisor's Manual*.

This manual is written for users with a general understanding of measurement and inspection analysis concepts and terms.

Manual Organization

This manual is organized into six chapters:

- *Chapter 1: About this Manual* provides general information about this manual.
- *Chapter 2: Safety* provides general information about machine safety labels, safe system operation, caution and warning symbols, as well as anti-crash protection, light source safety and isopropyl alcohol and mercury lamp safety.
- *Chapter 3: System Overview* provides a brief overview of the KMS-310/400 system.
- *Chapter 4: User Interface* provides an overview of the production-mode software organization and controls.
- *Chapter 5: Operation* provides a task overview and step-by-step procedures for operating the KMS-310/400 system in production mode.
- *Chapter 6: Error Messages* provides a list of error messages for KMS-310/400 version 310_44X and 400_447 software, along with their meaning and required actions.

Conventions

Several conventions are used in this manual to emphasize special information, including:

- warnings and cautions
- tips, notes and cautions
- typographical and keyboard commands

Cautions

Special warnings and cautions to the reader are emphasized with the following convention:



Caution: This text can be used for machine/equipment cautions, as well as warnings. The only difference will be the first word; either caution or warning.

Tips

Special tips or notes to the reader are emphasized with the following convention:



Tip: This text can be used for special notes, examples or tips. The only difference will be the first word, which will read as note, tip or example.

Typographical and Keyboard Conventions

When you are instructed to enter specific information or press certain keys, the following conventions are used:

- Selections, commands, and field names are shown in *italics*.
- Text you are requested to enter is printed in `courier` type.
- Keys you press on the keyboard are shown in brackets, such as [ESC], [ENTER] or [space bar].
- Issuing commands by holding down the first key and pressing the second key are shown as [key1] + [key2], such as [ALT] + [PRINTSCRN].

Contacting Technical Support

For technical assistance, contact your Zygo Service or Applications Engineer at (408) 434-1000.

For information on your system options, or to purchase additional options or site licenses, contact your Zygo Sales Representative or Zygo Corporate Sales.

2

Safety Precautions

Machine Safety Labels

Objective Anti-Crash Protection

Light Source Safety

Isopropyl Alcohol Safety

Mercury Safety

Machine Ergonomic Features

Machine Safety Labels

This section provides a general explanation of the different warning and caution labels used on the KMS-310/400 system, as well as a description and location for each specific warning and caution label on the system.



Important note: Read the operating instructions carefully and completely before operating the KMS-310/400 system. All warnings and cautions in this manual and on the system should be strictly followed.

Caution and Warning Symbols

Table 2-1 lists the caution and warning symbols used throughout the KMS-310/400 system and provides a general description for each label.

Table 2-1. Caution and Warning Symbols (1 of 2)








Symbol	Type of Warning	Description
	Operation warnings and cautions	Alerts you to important operating and maintenance instructions provided in this manual.
	Dangerous voltage warning	Alerts you to the presence of uninsulated dangerous voltage in the KMS-310/400 enclosure. This label indicates dangerous voltage of a sufficient magnitude to constitute risk of electric shock to persons.
	Protective conductor warning	Alerts you to the presence of a protective conductor terminal (protective earth ground).
	Pinch point warning	Alerts you to a potential pinch-point in this area.
	Hot surface warning	Alerts you of a potential hot surface on a lamphouse. Always allow the lamphouse to cool for at least 20 minutes before handling.

Table 2-1. Caution and Warning Symbols (2 of 2)

Symbol	Type of Warning	Description
	Infrared radiation hazard warning	<p>Alerts you to a potential infrared radiation hazard.</p> <p>Never remove a lamphouse or disconnect fiber optics while the lamp is on.</p> <p>Never stare directly into the beam path of any system light source.</p>
	Ultraviolet radiation warning	<p>Alerts you to a potential ultraviolet radiation hazard.</p> <p>Never remove a lamphouse or disconnect fiber optics while a lamp is on. Never stare directly into the beam path of any system light source.</p>

Safety Label Locations

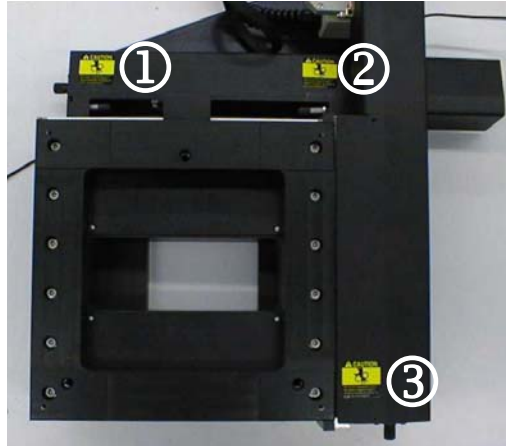
This section provides a location and detailed explanation for each caution and warning label on the KMS-310/400, including those found on the:

- automated stage
- halogen transmitted light source
- Hg-Xe power supply
- mercury or xenon lamphouse
- metal halide lamphouse and power supply
- K2 coupler
- electronics tower (back, sides and inside bottom)
- transparent electrical shock guard

Automated Stage Safety Labels

The automated stage warning labels are shown in Figure 2-1.

Figure 2-1. Automated Stage Warning Labels



- ① Alerts you to a potential pinch-point in this area.
- ② Alerts you to a potential pinch-point in this area.
- ③ Alerts you to a potential pinch-point in this area.

Halogen Transmitted Light Source Safety Labels

The halogen transmitted light source safety labels, located on the front and top of the unit, are shown in Figures 2-2 and 2-3.

Figure 2-2. Halogen Transmitted Light Source Safety Label (Top)



- ① Alerts you to a potential hot surface on the lamphouse. Always allow the lamphouse to cool for at least 20 minutes before handling.

Figure 2-3. Halogen Transmitted Light Source Safety Label (Front)



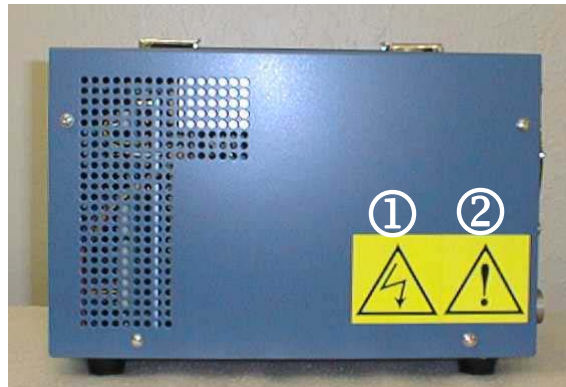
① Alerts you to a potential infrared radiation hazard.

Never remove a lamphouse or disconnect fiber optics while the lamp is on. Never stare directly into the beam path of any system light source.

Hg-Xe Power Supply Safety Labels

The Hamamatsu Hg-Xe power supply safety label is shown in Figures 2-4.

Figure 2-4. Hamamatsu Hg-Xe Power Supply Safety Label



① Never turn on the power if the lamp is not installed. If you do, you are in danger of being electrocuted.



② Make sure the light source power supplies are turned off before replacing the lamp.

Mercury Xenon Lamphouse Safety Labels

The KLH-1 mercury xenon lamphouse safety labels, located on the main lamphouse and fiber-optic units, are shown in Figures 2-5 and 2-6.

Figure 2-5. Mercury Xenon Lamphouse Safety Labels (Main Lamphouse Unit)



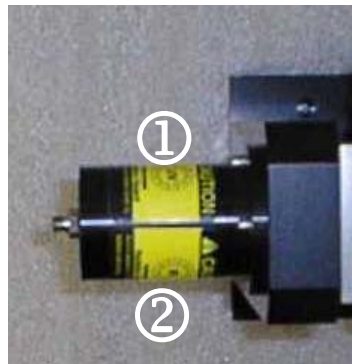
① Make sure light source power supplies are turned off before attempting to replace the lamp.



② Make sure light source power supplies are turned off before attempting to replace the lamp.

Never turn on the power if the lamp is not installed. If you do, you are in danger of being electrocuted.

Figure 2-6. Mercury Xenon Lamphouse Safety Labels (Fiber Optics Unit)



① Make sure light source power supplies are turned off before attempting to replace the lamp.



② Alerts you of a potential infrared radiation hazard. Never remove a lamphouse or disconnect fiber optics while the lamp is on. Never stare directly into the beam path of any system light source.

Metal Halide Lamphouse and Power Supply Safety Labels

The Nikon metal halide lamphouse and power supply safety labels, located on the front and side of the main lamphouse, are shown in Figures 2-7 and 2-8.

Figure 2-7 Metal Halide Lamphouse and Power Supply Safety Labels (Front)

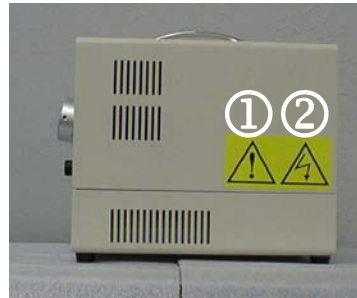


① Alerts you to a potential infrared radiation hazard. Never remove a lamphouse or disconnect fiber optics while the lamp is on. Never stare directly into the beam path of any system light source.



② Alerts you to the potential hazard of ultraviolet radiation. Never remove the lamphouse or disconnect fiber optics while the lamp is turned on. Do not stare directly into the beam path of any light source.

Figure 2-8. Metal Halide Lamphouse and Power Supply Safety Labels (Side)



① Refer to the KMS-310/400 Maintenance Manual before servicing.

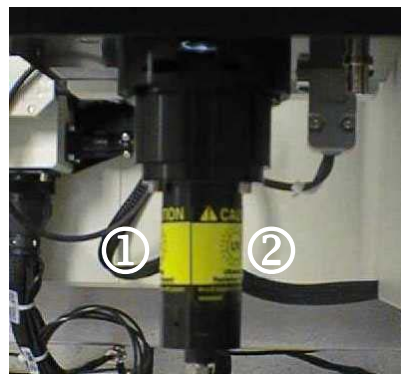


② Uninsulated dangerous voltage within the lamphouse enclosure posing a risk of electric shock. Never open the lamphouse enclosure while lamp power is on.

K2 Coupler Safety Label

The K2 coupler safety labels are shown in Figure 2-9.

Figure 2-9. K2 Coupler Safety Label



① Alerts you to a potential infrared radiation hazard. Never remove a lamphouse or disconnect fiber optics while the lamp is on. Never stare directly into the beam path of any system light source.



② Alerts you to the potential hazard of ultraviolet radiation. Never remove the lamphouse or disconnect fiber optics while the lamp is turned on. Do not stare directly into the beam path of any light source.

Electronics Tower Safety Labels

The electronics tower safety labels, located on the sides, back and inside bottom, are shown in Figures 2-10 through 2-12.

Figure 2-10. Electronics Tower Safety Labels (Sides)



Figure 2-11. Electronics Tower Safety Labels (Back)

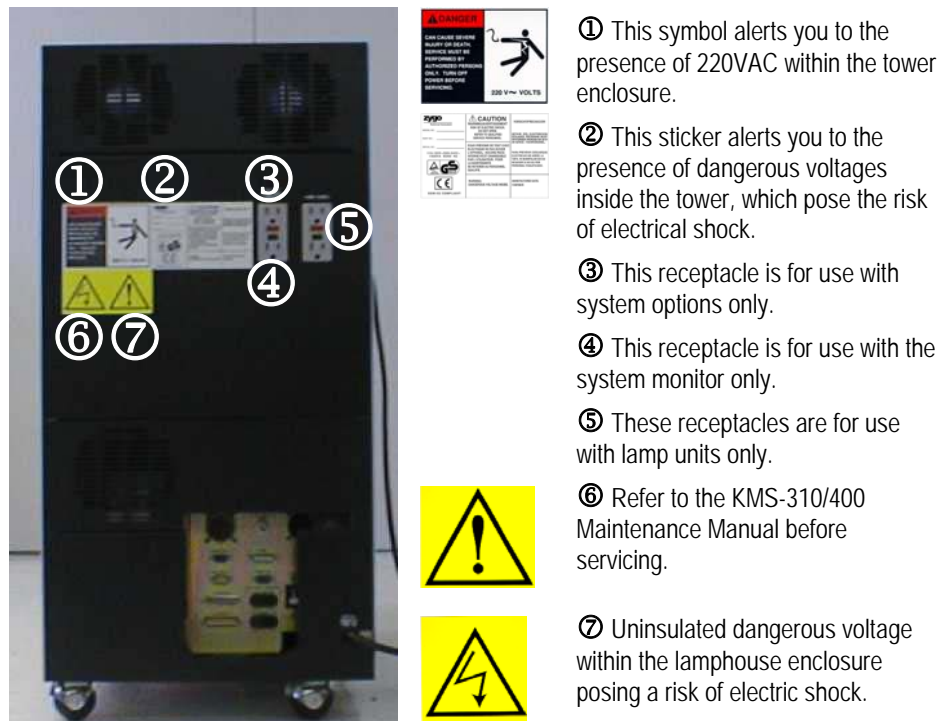
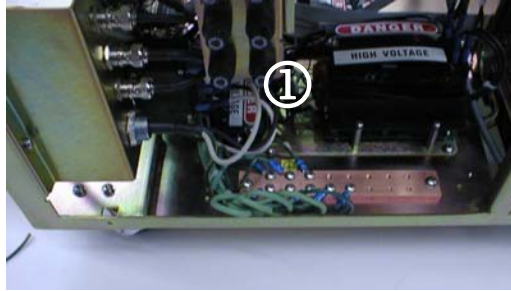


Figure 2-12. Electronics Tower Safety Labels (Inside Bottom)

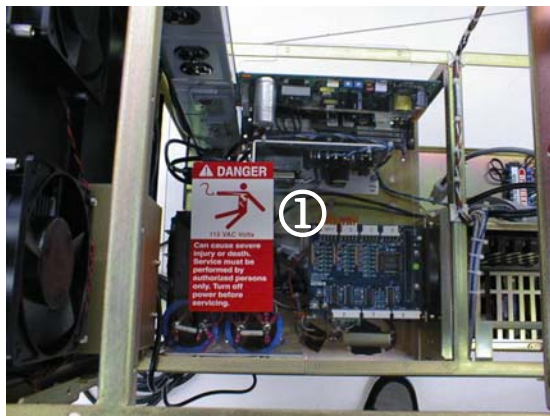


① Alerts you to the presence of a protective conductor terminal (protective earth ground).

Transparent Electrical Shock Guard Safety Label

The transparent electrical shock guard safety label is shown in Figure 2-13.



Figure 2-13. Transparent Electrical Shock Guard Safety Label



① Alerts you to the presence of 115VAC within the unit enclosure. (The clear plastic shield in front of this warning is intended to protect you from accidental electrical shock.)

Objective Anti-Crash Protection

To avoid crashing an objective on the KMS-310/400 system, perform the following procedure during initial system setup or after performing preventive maintenance:

1. With the main menu displayed, select .
2. Use the 100X or 50X magnification objective to focus on the highest (upmost) feature of the image.
3. With the image in focus, note the Z-axis scale reading (in microns).
4. Use the  key to drive the objective 100 microns closer to the image.
For example, the Z-axis scale readings should increase by 100 microns.
5. Use the thumbwheel (on the side of the column) to move the Z-axis limit switch until the red LED on the side of the column illuminates.
The Z-axis lower limit switch is now set.
6. Refocus the 10X objective.

Light Source Safety

This section provides safety information for the following KMS-310/400 light sources:

- mercury xenon lamphouse
- halogen light box
- metal halide light box
- halogen lamphouse
- mercury lamphouse
- xenon lamphouse

Mercury Xenon Lamphouse

The KLH-1 mercury xenon lamphouse is equipped with a safety interlock feature. When the lamphouse is opened, the power circuit loop is placed in an open state and no power will reach the lamp. The lamp will not turn on while the lamphouse is open.

Take the following precautions when working in and around the mercury xenon lamphouse:

1. Never open the lamphouse when the lamp is turned on.
2. Use a hex wrench to remove the KLH-1 lamphouse from its lamp stand. This will prevent unnecessary access and IR/UV exposure.
3. Use a wrench to remove the fiber optic (attached to the optical adapter on the lamp stand). This will prevent unnecessary access and IR/UV exposure.
4. Never stare into the light source.

Halogen Light Box

The halogen light box is equipped with a safety interlock feature. When the light box is opened, the power circuit loop is placed in an open state and no power will reach the lamp. The lamp will not turn on while the light box is open.

Take the following precautions when working in and around the halogen light box:

1. Never open the light box when the lamp is on.
2. Use a hex wrench to remove the liquid light guide (attached to the halogen light box). This feature helps prevent unnecessary access and IR/UV exposure.
3. Never stare into the light source.

Metal Halide Light Box

The metal halide light box is equipped with a safety interlock feature. When the light box is opened, the power circuit loop is placed into an open state and no power reaches the lamp. The lamp will not turn while the light box is open.

Take the following precautions when working in and around the metal halide light box:

1. Never open the light box when the lamp is on.
2. Use a hex wrench to remove the liquid light guide (attached to the metal halide light box). This feature helps prevent unnecessary access and IR/UV exposure.
3. Never stare into the light source.

Halogen Lamphouse

Use a hex wrench to remove the HMX-2 halogen lamphouse from the EPI illuminator. This feature helps prevent unnecessary access and IR/UV exposure.

Mercury Lamphouse

Take the following precautions when working in and around the mercury lamphouse:

1. Use a hex wrench to remove the HMX-4 mercury lamphouse from the K2 module. This feature helps prevent unnecessary access and IR/UV exposure.
2. Never stare into the light source.

Xenon Lamphouse

Take the following precautions when working in and around the xenon lamphouse:

1. Use a hex wrench to remove the HMX-4 xenon lamphouse from the K2 module. This feature helps prevent unnecessary access and IR/UV.
2. Never stare into the light source.

Isopropyl Alcohol Safety

This section outlines potential hazards associated with the use of isopropyl alcohol, as well as emergency response procedures for public safety, evacuation, fire, spills and leaks, and first aid.

Potential Hazards

Potential hazards associated with isopropyl alcohol are shown in Table 2-2. This information comes from *The Department of Transportation Guide #129*.

Table 2-2. Potential Hazards with Isopropyl Alcohol

Hazard Type	Potential Hazards
Health	<ul style="list-style-type: none">▪ May cause toxic effects if inhaled or absorbed through skin.▪ Inhalation or contact with material may irritate or burn skin and eyes.▪ Fire will produce irritating, corrosive and/or toxic gases.▪ Vapors may cause dizziness or suffocation.▪ Runoff from fire control or dilution water may cause pollution.
Fire or Explosion	<ul style="list-style-type: none">▪ Highly flammable; easily ignited by heat, sparks or flames.▪ Vapors may form explosive mixtures with air.▪ Vapors may travel to source of ignition and flash back.▪ Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (such sewers, basements, and tanks).▪ Vapor explosion hazard indoors, outdoors or in sewers.▪ Some may polymerize (P) explosively when heated or involved in a fire.▪ Runoff to sewer may create fire or explosion hazard.▪ Containers may explode when heated.▪ Many liquids are lighter than water.

Emergency Response

Emergency response procedures to be taken in the case of an isopropyl alcohol-related accident are shown in Table 2-3. This information comes from *The Department of Transportation Guide #129*.

Table 2-3. Emergency Response Procedures for Isopropyl Alcohol-Related Accidents (Part 1 of 2)

Type	Emergency Response Guidelines
Public safety	<ul style="list-style-type: none"> ▪ Call the emergency response telephone number on the shipping paper first. If the shipping papers not available, or if there is no answer when you call the number, refer to the appropriate telephone number listed on the inside back cover. ▪ Isolate the spill or leak area immediately for at least 50 to 100 meters (160 to 330 feet) in all directions. ▪ Keep unauthorized personnel away. ▪ Stay upwind. ▪ Keep out of low areas. ▪ Ventilate closed spaces before entering.
Protective clothing	<ul style="list-style-type: none"> ▪ Wear a positive pressure self-contained breathing apparatus (SCBA). ▪ Structural firefighters' protective clothing will only provide limited protection.
Evacuation	<ul style="list-style-type: none"> ▪ If it is a large spill, consider initial downwind evacuation for at least 300 meters (1000 feet). ▪ If a tank, rail car or tank truck is involved in a fire, isolate for 800 meters (1/2 mile) in all directions. Also, consider initial evacuation for 800 meters (1/2 mile) in all directions.
Small fires	<ul style="list-style-type: none"> ▪ Isopropyl alcohol products have a very low flash point: Use of water spray when fighting fire may be inefficient. Use dry chemical, CO₂, water spray or alcohol-resistant foam to fight fire. ▪ Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane.
Large fires	<ul style="list-style-type: none"> ▪ Isopropyl alcohol products have a very low flash point: Use of water spray when fighting fire may be inefficient. ▪ Use water spray, fog or alcohol-resistant foam to fight fire. ▪ Do not use straight streams. ▪ Move containers from fire area if you can do it without risk.
Fire involving tanks or car/trailer loads	<ul style="list-style-type: none"> ▪ Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. ▪ Cool containers with flooding quantities of water until well after fire is out. ▪ Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ▪ Always stay away from the ends of tanks. ▪ For massive fire, use unmanned hose holders or monitor nozzles. If impossible, withdraw from area and let fire burn.

Table 2-3. Emergency Response Procedures for Isopropyl Alcohol-Related Accidents
(Part 2 of 2)

Type	Emergency Response Guidelines
Small spills or leaks	<ul style="list-style-type: none"> ▪ Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). ▪ All equipment used when handling the product must be grounded. ▪ Do not touch or walk through spilled material. ▪ Stop leak if you can do it without risk. ▪ Prevent entry into waterways, sewers, basements or confined areas. ▪ A vapor suppressing foam may be used to reduce vapors. ▪ Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. ▪ Use clean non-sparking tools to collect absorbed material.
Large spills	<ul style="list-style-type: none"> ▪ Dike far ahead of liquid spill for later disposal. ▪ Water spray may reduce vapor; but may not prevent ignition in closed spaces.
First aid	<ul style="list-style-type: none"> ▪ Move victim to fresh air. ▪ Call emergency medical care. ▪ Apply artificial respiration if victim is not breathing. ▪ Administer oxygen if breathing is difficult. ▪ Remove and isolate contaminated clothing and shoes. ▪ In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes. ▪ Wash skin with soap and water. ▪ Keep victim warm and quiet. ▪ Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed. ▪ Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

Mercury Safety

This section outlines potential hazards associated with the use of mercury, as well as emergency response procedures for public safety, evacuation, fire, spills and leaks, and first aid.

Potential Hazards

Potential hazards associated with mercury are shown in Table 2-4. This information comes from *The Department of Transportation Guide #172*.

Table 2-4. Potential Hazards with Mercury

Hazard Type	Potential Hazards
Health	Inhalation of vapors or contact with substance will result in contamination and potential harmful effects. Fire will produce irritating, corrosive and/or toxic gases.
Fire or explosion	Mercury is itself a noncombustible that does not burn. However, if heated, it may react to produce: <ul style="list-style-type: none">▪ Corrosive and/or toxic fumes.▪ Runoff that may pollute waterways.

Emergency Response

Emergency response procedures to be taken in the case of an mercury-related accident are shown in Table 2-5. This information comes from *The Department of Transportation Guide #172*.

Table 2-5. Emergency Response Procedures for Mercury-Related Accidents (Part 1 of 2)

Type	Emergency Response Guidelines
Public Safety	<ul style="list-style-type: none">▪ Call the emergency response telephone number on the shipping paper first. If the shipping paper is not available, or if there is no answer when you call the number, refer to the appropriate telephone number listed on the inside back cover.▪ Isolate the spill or leak area immediately for at least 10 to 25 meters (30 to 80 feet) in all directions.▪ Keep unauthorized personnel away.▪ Stay upwind.
Protective clothing	<ul style="list-style-type: none">▪ Wear positive pressure self-contained breathing apparatus (SCBA).▪ Structural firefighters' protective clothing will only provide limited protection.
Evacuation	<ul style="list-style-type: none">▪ If it is a large spill, consider initial down wind evacuation for at least 100 meters (330feet).▪ When any large container is involved in a fire, consider initial evacuation for 500 meters (1/3 mile) in all directions.
Fire	<ul style="list-style-type: none">▪ Use extinguishing agent suitable for type of surrounding fire.▪ Do not direct water at the heated metal.

Table 2-5. Emergency Response Procedures for Mercury-Related Accidents (Part 2 of 2)

Type	Emergency Response Guidelines
Spill or leak	<ul style="list-style-type: none"> ▪ Do not touch or walk through spilled material. ▪ Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. ▪ Stop leak if you can do it without risk. ▪ Prevent entry into waterways, sewers, basements or confined areas. ▪ Do not use steel or aluminum tools or equipment. ▪ Cover with earth, sand, or other noncombustible material followed with plastic sheet to minimize spreading or contact with rain. ▪ For mercury, use a mercury spill kit. ▪ Mercury spill areas may be subsequently treated with a calcium sulphide/calcium sulfide or sodium thiosulphate/sodium thiosulfate wash to neutralize any residual mercury.
First aid	<ul style="list-style-type: none"> ▪ Move victim to fresh air. ▪ Call emergency medical care. ▪ Apply artificial respiration if victim is not breathing. ▪ Administer oxygen if breathing is difficult. ▪ Remove and isolate contaminated clothing and shoes. ▪ In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes. ▪ Keep victim warm and quiet. ▪ Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

Machine Ergonomic Features

Table 2-6 lists ergonomic features for key KMS-310/400 components.

Table 2-6. KMS-310/400 Ergonomic Features

KMS-310/400 Component	Ergonomic Features
Adjustable monitor	<ul style="list-style-type: none"> ▪ Monitor arm lifts base of monitor 8"-13.25" above the table top. ▪ Monitor arm extends and retracts 10.25". ▪ Monitor arm rotates laterally across an 180⁰ range. ▪ Monitor tilts up or down across a 17⁰ range. ▪ Monitor swivels laterally across a 100⁰ range. ▪ 17" display. ▪ 0.22mm dot pitch. ▪ Low ELF and VLF emission for operator safety to MPR II standards. ▪ Easy to use on-screen menu. ▪ 130-Hz maximum refresh rate.
Keypad	<ul style="list-style-type: none"> ▪ Comes with a 9.5' cord.
Keyboard	<ul style="list-style-type: none"> ▪ Comes with a 2.75' cord.
Other system components	<ul style="list-style-type: none"> ▪ EMO button is colored for easy visibility and positioned for easy accessibility. ▪ Optimal trinocular height of 4.75'. ▪ Optimal machine loading height of 3.5'.



3

System Overview

System Overview

Component Overview

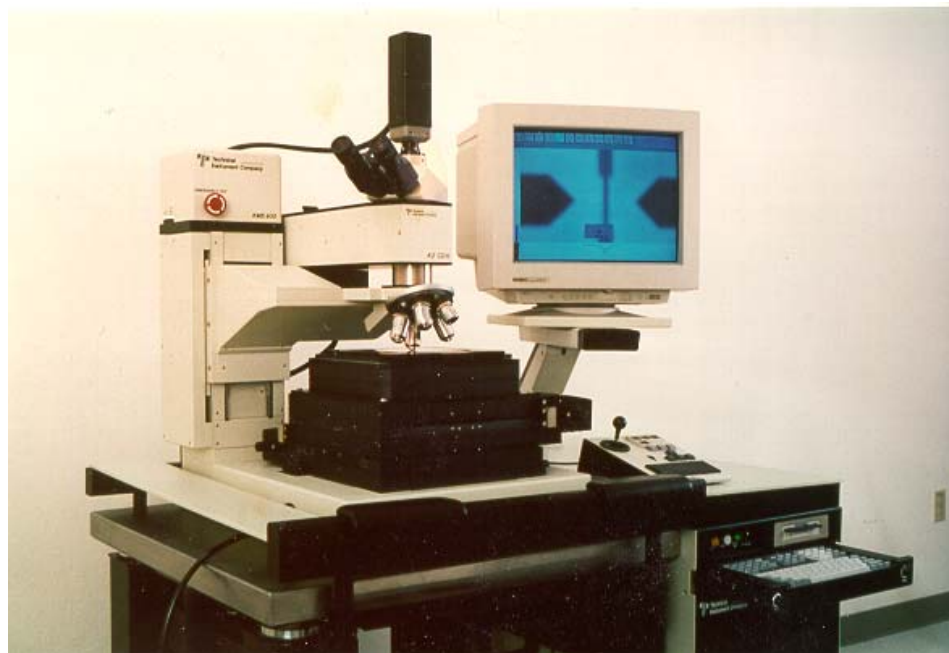
Functional Overview

System Overview

The KMS-310/400 Critical Dimension Measurement and Inspection System (Figure 3-1) is an automated precision measuring system used to produce optical images for more precise inspection and measurement of critical dimensions on a given substrate. Using state-of-the-art technology, the KMS-310/400 design solves a wide variety of measurement and inspection problems.

The KMS-310/400 incorporates a computer-controlled motorized stage to locate previously programmed or referenced locations under a high-magnification objective to within 2 to 5 microns. The measurement routine is controlled by a frame grabber that performs pattern recognition routines.

Figure 3-1. KMS-310/400 Critical Dimension Measurement and Inspection System



Functional Overview

Script routines permit complete automated control of every physical, hardware, or user-programmable software component of the KMS-310/400. The system can be programmed with scripts to make multiple measurements in both the X axis and the Y axis with only one "frame" of information. This information can be incorporated into a routine to also make Z-axis measurements. The single frame of information can then be expanded to average up to 32 frames of information.

Once measurement data is collected, you can output this data to the hard disk, an external printer, or a PC-compatible network.

Key Features and Components

The KMS-310/400 system incorporates a number of key features, including:

- a programmable stage
- piezo-controlled automatic focusing (during measurement) of the microscope stage
- an object-oriented user interface
- an extremely shallow depth-of-focus and high-resolution confocal microscope
- scripted move and measure routines for specific types of measurements including pattern recognition

The extended capabilities associated with a shallow depth-of-focus (by the confocal microscope) allow for measurement of depth differences (Z axis) to a 3-sigma value of 0.03 microns.

The KMS-310/400 system includes several important components, including:

- an embedded IBM-compatible 80486 computer
- confocal microscope capabilities
- a confocal optics module
- measurement electronics
- a computer-controlled 8" x 8" stage

Product Applications

The capabilities of the KMS 310/400 permit automated solutions to many measurement problems that can be imaged within the microscope optics. These solutions include, but are not limited to:

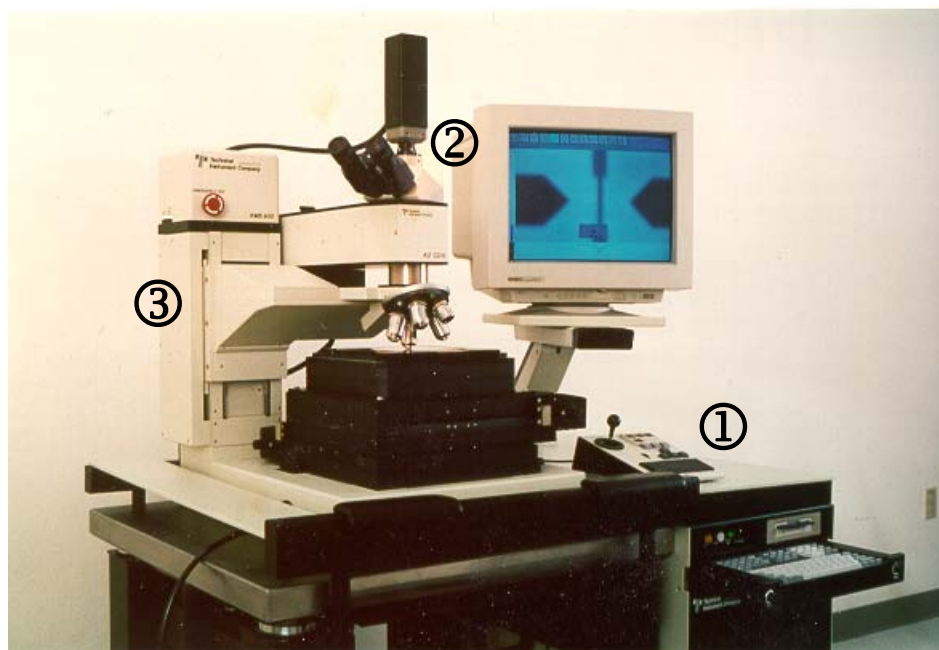
- photomasks for semiconductor manufacturing
- semiconductor wafers
- standard magnetic heads
- thin film magnetic heads
- magnetic heads
- other types of measurements

Component Overview

The KMS 310/400 system consists of three major operating subsystems as shown in Figure 3-2:

- ① the electronic measurement subsystem
- ② the optical display subsystem
- ③ the mechanical subsystem

Figure 3-2. KMS-310/400 Component Overview



Electronic Measurement Subsystem

The electronic measurement subsystem consists of:

- an electronics control unit
- a power and control panel
- an DOS-compatible computer
- the software operating system
- a keypad
- a keyboard
- a Piezo control assembly

All control electronics, PC boards, power supplies, IBM-compatible computer, and other subassemblies of the KMS-310/400 system are located in a common electronics cabinet.

All functions of the critical dimension measurement system are controlled by the IBM-compatible computer, which is located within the electronics control unit. This unit is located below the nonisolated portion of the antivibration table top and contains the camera control unit; the frame grabber, and the remaining control electronics.

Optical Display Subsystem

The optical display subsystem consists of the following components:

- a confocal optics module,
- a VGA monitor
- a CCD camera
- microscope optics
- illumination devices and power supplies

Mechanical Subsystem

The mechanical subsystem consists of the following components:

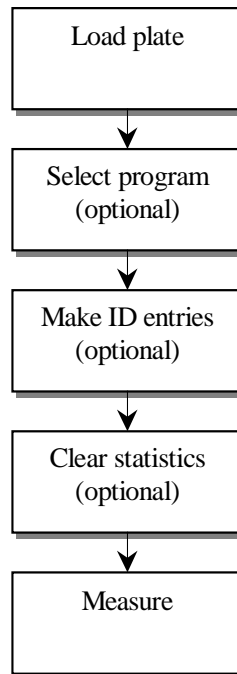
- an 8" x 8" motorized stage
- a mounting stand and column
- an anti-vibration table
- an articulated monitor stand

Included is an air-isolated antivibration table. The instrument stand and its components are mounted on the air-isolated portion of this table. The keypad and high-resolution monitor are located on the non-air isolated portion of the table top. The electronics cabinet is located next to the air-isolated table and under the right portion non-air isolated tabletop.

Functional Overview

The basic steps you will take to operate the KMS-310/400 in production mode are shown in Figure 3-3. For specific instructions on system operation, refer to Chapter 5, *Operation*.

Figure 3-3. Functional Overview





4

User Interface

Overview

Software Controls

Software Organization

Overview

This section provides an overview of the KMS-310/400 software environment, including modes of operation and key terms used to describe software components.

Modes of Operation

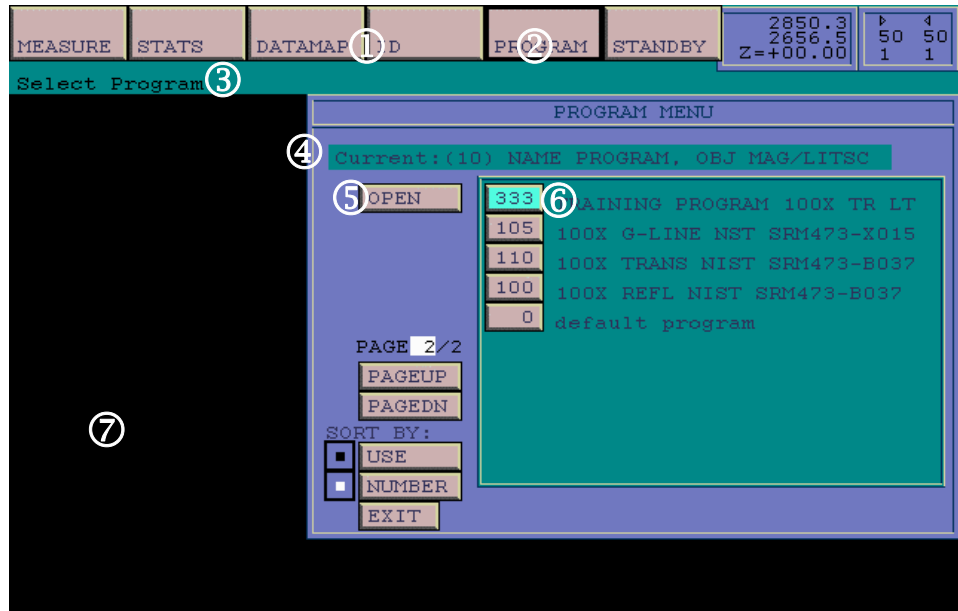
The KMS-310/400 has two modes of operation: *supervisor* and *production* mode. Each of these modes has a different set of menu selections and overall software organization. The supervisor mode is used by process engineers to calibrate the system, set up measurement programs and configure software parameters. The production mode is used by fab operators to measure, record and store substrate test data. This manual provides information for production mode software screens only.

Terminology

A sample software screen, along with key software components, are shown in Figure 4-1. Software elements identified in Figure 4-1 include:

- ① icons
- ② the highlighted current selection
- ③ the message line
- ④ a dialog box
- ⑤ buttons
- ⑥ text fields
- ⑦ the video portion of the screen

Figure 4-1. Key Software Elements



Software Controls

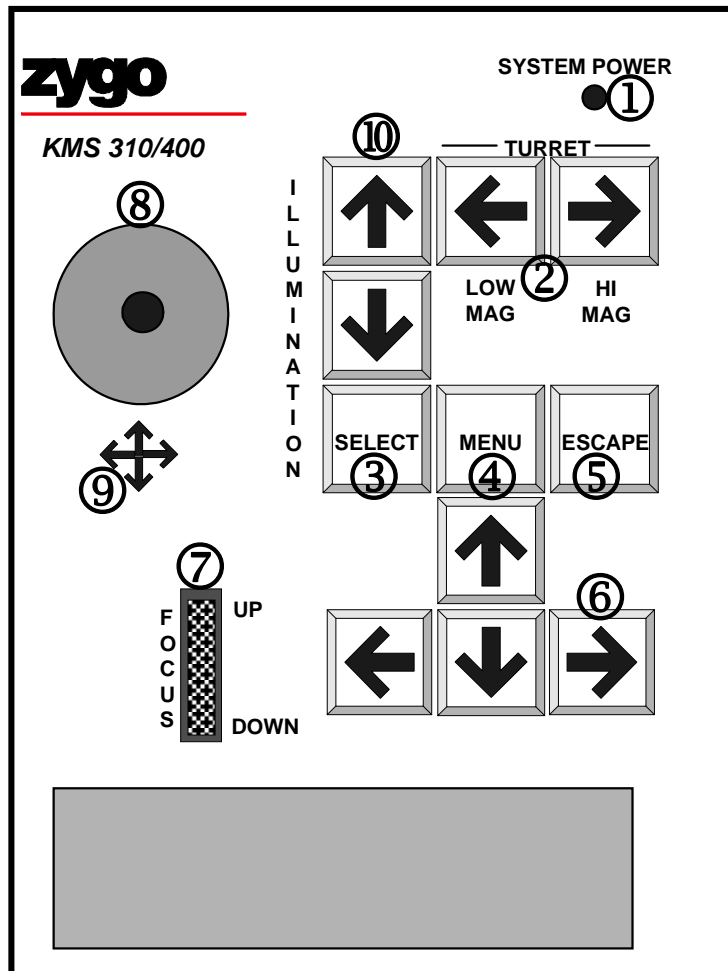
This section provides an overview of software controls, including keypad components and their uses and parallel keyboard functionality.

Using the Keypad

The keypad (Figure 4-2) is the primary control device used to operate the KMS 310/400 system. It contains 11 keys, a joystick for control of the stage's X- and Y-axis, and a thumbwheel for fine focus.

You can control all system functions, except alphanumeric data entry, with the keypad. Use the keypad to control positioning of the motorized stages, the course focus, fine focus, and all KMS-310/400 software functions.

Figure 4-2. KMS-310/400 Keypad



Functions for each of the individual keypad components shown in Figure 4-2 are listed in Table 4-1.

Table 4-1. Keypad Component Functions (Part 1 of 2)

Figure 4-2 Callout	Key/Control	Function
①	System power indicator	When lit, this LED indicates that the entire KMS-310/400 system is ready for operation.
②	Turret and arrow keys High mag and low mag	These keys change objectives by rotating the nosepiece (turret) clockwise and counterclockwise. Each time you press one of the arrow keys, the objective makes one change (representing a specific magnification). If the arrow key is immediately pressed a second time, the system will not accept a request for an additional change until the objective reaches position and the X, Y, and Z stages correct for the offsets programmed into the system. For this reason, once the objective reaches the detent spring position, there may be a slight delay before a second change of objectives will be accepted.
③	Select key	This key operates in conjunction with the highlighted buttons and icons displayed on the software screen. Once a button or icon is highlighted, press the <i>Select</i> key to activate the highlighted function. This key is the same as the [ENTER] key on the computer keyboard.
④	Menu key	This key activates a menu box associated with many of the icons. Pressing the <i>Menu</i> key displays additional menus associated with the highlighted icon. This key is the same as the [F4] key on the computer keyboard.
⑤	Escape key	This key exits most of the currently selected screens or functions, such as an icon, menu or button. The [ESCAPE] key on the keyboard serves the same function as the <i>ESCAPE</i> key.
⑥	Cursor arrow keys	These four keys are used to move from one icon or button to another on the various screens. They are used to change the measurement window's position and size, and to perform other functions once they have been selected.

Table 4-1. Keypad Component Functions (Part 2 of 2)

Figure 4-2 Callout	Key/Control	Function
⑦	Focus up/down thumbwheel	The thumbwheel is used to control the Piezo for fine focus movement of the substrate (viewed through the eyepieces or on the monitor). By carefully moving the thumbwheel, you can control the Piezo to its full (manual) resolution capabilities of 0.01 microns to ± 15 microns (20 microns on the KMS 310R/400R systems). Once the maximum of 15 microns is exceeded, the thumbwheel activates column focus.
⑧	Joystick	If the stage was initialized at the opening screen, the joystick can be used to directly control stage positioning. You can move in both the X and Y directions simultaneously. How fast you move the stage depends on how far you deflect the joystick.
⑨	Stage direction arrows	These arrows serve as directional guides when the joystick is used to control stage positioning.
⑩	Coarse focus (or) illumination switches	These keys raise or lower the column without moving to and selecting the <i>Focus</i> icon.

Keypad/Keyboard Key Equivalents

The KMS 310/400 system includes a drawer-mounted, permanently attached keyboard in the electronics control unit. This keyboard is a full function keyboard and can be used for complete operation of the system, since each of the keys on the keypad have equivalent functions on the keyboard. Table 4-2 lists each keypad function and its equivalent keyboard command.

The keyboard is needed for alphanumeric and DOS entries. For example, entering operator and device identification data on the ID screen and naming programs must be done with the keyboard.

Table 4-2. Keypad/Keyboard Key Equivalents

Keypad Key	Keyboard Key
Select	[ENTER]
Escape	[ESCAPE]
Menu	[F4]
Arrow Keys	Arrow Keys
Turrent CCW (Low Mag)	'N' (either capital or small letter)
Turret CW (High Mag)	'P' (either capital or small letter)

Software Organization

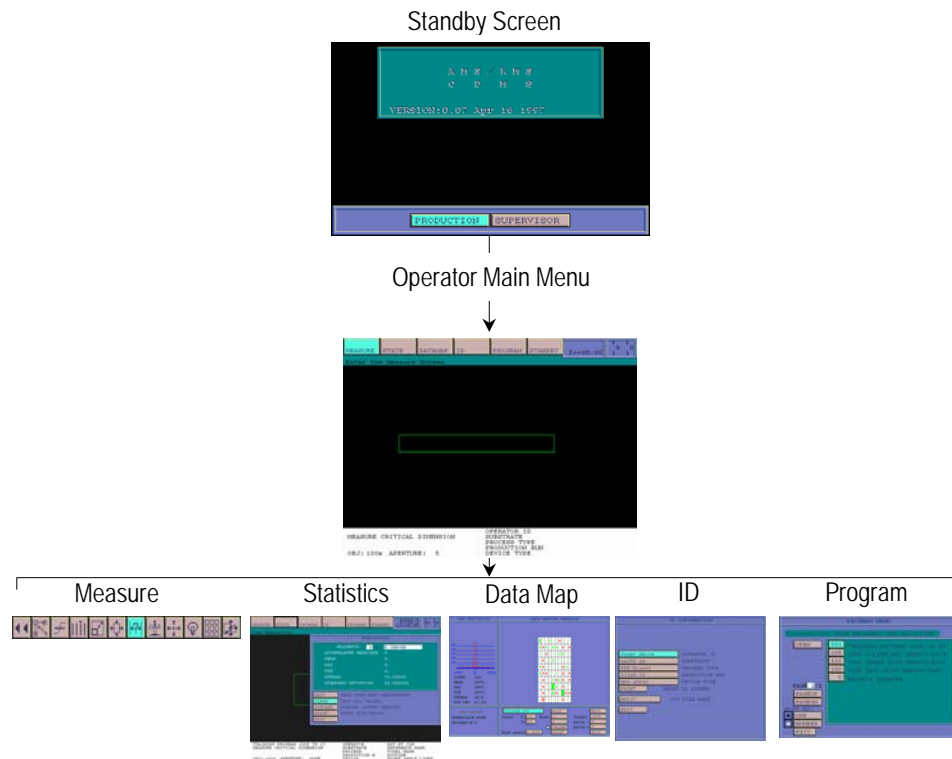
This section provides an overview of the KMS-310/400 software organization, including:

- overall software organization
- the Standby screen
- the Operator Main Menu
- the Measurement submenu
- the Statistics screen
- the Data Map screen
- the ID screen
- the Program screen
- the Return to Standby selection

Overview

An overview of KMS-310/400 software organization is shown in Figure 4-3. Each of the elements in Figure 4-3 are discussed in greater detail in subsequent sections of this chapter.

Figure 4-3. KMS-310/400 Software Map

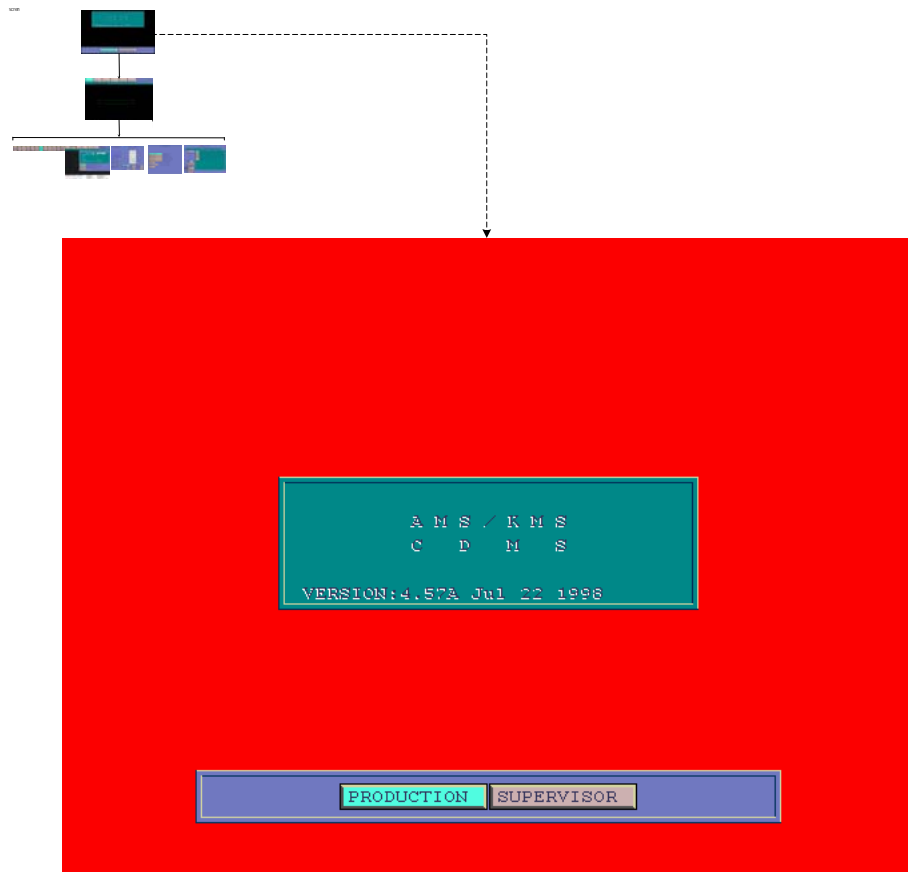


Standby Screen

The KMS-310/400 system displays the Standby screen (Figure 4-4) when the system is first turned on or when idle. This is the entry screen for both supervisor and production mode.

To display the Production Main Menu screen from the Standby screen, select *Production* and press [SELECT].

Figure 4-4. Standby Screen



Production Main Menu

The Production Main Menu screen (Figure 4-5) is used to enter all submenus in production mode.

Figure 4-5. Production Main Menu Screen



Production Main Menu screen menu selections, along with their uses, are listed in Table 4-3.

Table 4-3. Production Main Menu Selections

Menu Selection	Use
Measure	Select this menu item to display the Measure screen with icons and submenus.
Stats	Select this menu item to display the Statistics dialog box.
Data Map	Select this menu item to display the Data Map dialog box.
ID	Select this menu item to display the ID Information dialog box.
Program	Select this menu item to display the Program dialog box.
Standby	Select this menu item to return to the Standby screen.

Measure Screen

The Measure screen (Figure 4-6) is used to perform measurement functions. Uses for each of the Measure screen icons is listed in Table 4-4.

To display the Measure screen:

1. Access the Operator Main Menu screen.
2. Highlight the *Measure* icon.
3. Press [SELECT].

Figure 4-6. Measure Submenu Icons

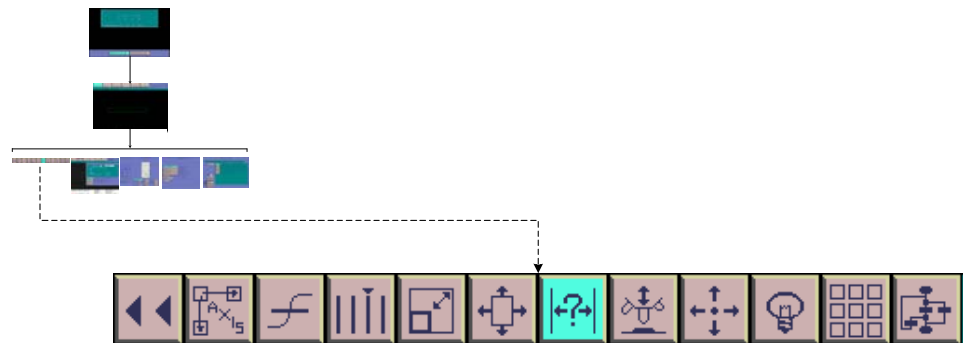









Table 4-4. Measure Screen Icons (1 of 2)

Icon	Icon Name	Function
	Exit/Options	<ul style="list-style-type: none"> ▪ Press [SELECT] to exit the Measure screen and return to the Operator Main Menu screen. ▪ Press [MENU] to allow for bitmap image captures, objective setup, Z-axis calibration and image slice acquisition.
	Swap Axis	<ul style="list-style-type: none"> ▪ Press [SELECT] to toggle axis between horizontal and vertical measurements.
	Adjust Thresholds	Not used in <i>Production</i> mode.
	Select Edge	<ul style="list-style-type: none"> ▪ Press [SELECT] to set edges to be detected for measurement within both windows or within the left or right window. ▪ Press [MENU] to change seek direction for edge detection for either window.
	Size Windows	<ul style="list-style-type: none"> ▪ Press [SELECT] to set the window size. ▪ Depending on the axis selected, you will set the size of both windows, left/right windows, or top/bottom windows.

Table 4-4. Measure Screen Icons (2 of 2)

Icon	Icon Name	Function
	Position Windows	<ul style="list-style-type: none"> Press [SELECT] to set position of both left and right windows or top and bottom windows, together or separately.
	Measure	<ul style="list-style-type: none"> Press [SELECT] to begin measure sequence. Press [MENU] to display Measure Controls menu.
	Focus	<ul style="list-style-type: none"> Press [SELECT] to set column coarse focus. Press [MENU] to set relative focus speed for manual operation. Press [MENU] to change autofocus on either an edge or a surface (Confocal Mode).
	Position Stage	<ul style="list-style-type: none"> Press [SELECT] to type in and move to known distances with raw or aligned (deskewed) coordinates. Press [MENU] to save or go to previously saved stage positions.
	Illumination	<ul style="list-style-type: none"> Press [MENU] to adjust Gain (white) and Offset (black) levels of the feature to be measured.
	Save or Recall Setup	<ul style="list-style-type: none"> Press [SELECT] to save position, size, edge, threshold, illumination settings, and selected axis; or recalls previously saved settings.
	AMPS Scripts	<ul style="list-style-type: none"> Press [SELECT] to run, pause, go to, restart, or exit a script routine you typed in or one that has been previously saved.

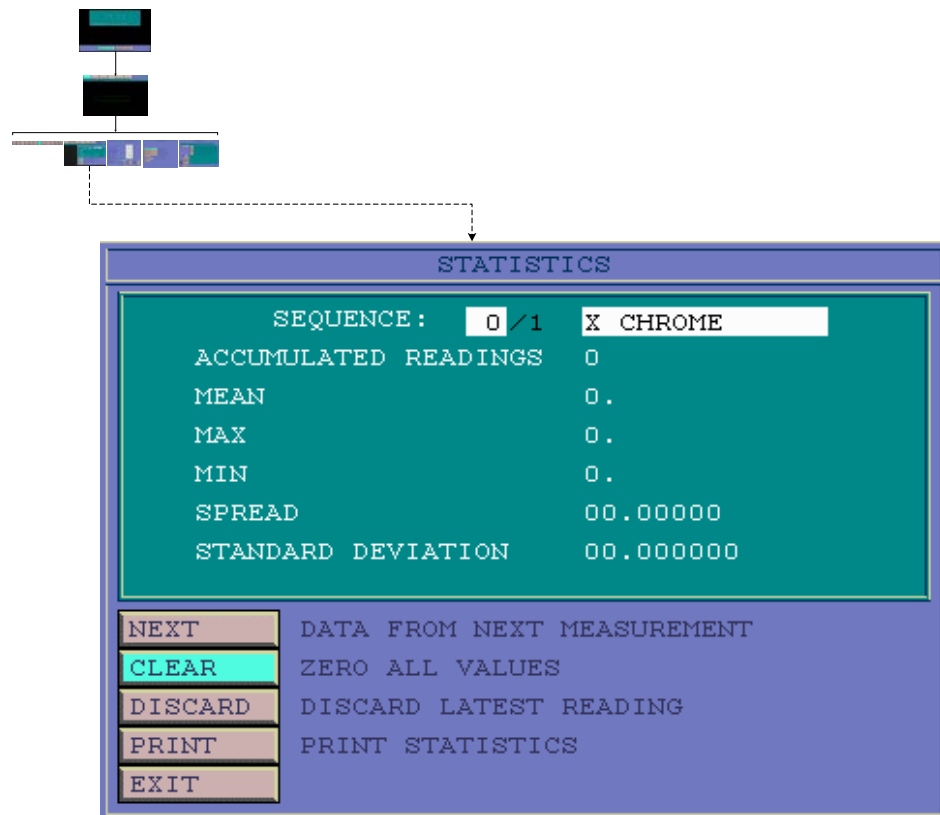
Statistics Menu

If this option is set up and saved in Supervisor Mode, measurement data that is automatically collected with each measurement is displayed in the Statistics dialog box (Figure 4-7).

To display the Statistics dialog box:

1. From the Operator Main Menu screen, highlight the *Stats* icon.
2. Press [SELECT].

Figure 4-7. Statistics Dialog Box



Possible selections in the Statistics dialog box are shown in Table 4-5.

Table 4-5. Statistics Dialog Box Selections

Button	Function
Next	Allows you to view data from previous measurement sequences if you make multiple measurements as a script.
Clear	Allows you to zero the values of all readings taken.
Discard	Removes only the last reading taken from the statistics calculations.
Print	Places all statistics data onto the hard disk or sends it to a printer or host computer, depending upon the setup created in Supervisor Mode.
Exit	Return to the Production Main Menu Screen.

Data Map Menu

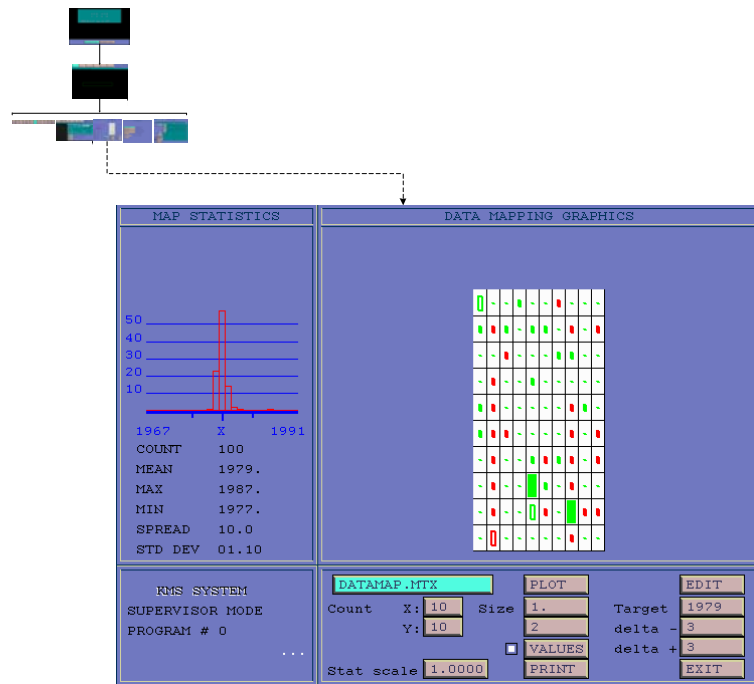
The Data Map dialog box (Figure 4-8) is used to display measurement data in graphical form. Once the data is displayed, you may also edit individual values within the display.

The data map function can only be used once X/Y matrix-formatted measurements are complete.

To display the Data Map dialog box:

1. From the Operator Main Menu screen, highlight the *Data Map* icon.
2. Press [SELECT].

Figure 4-8. Data Map Dialog Box



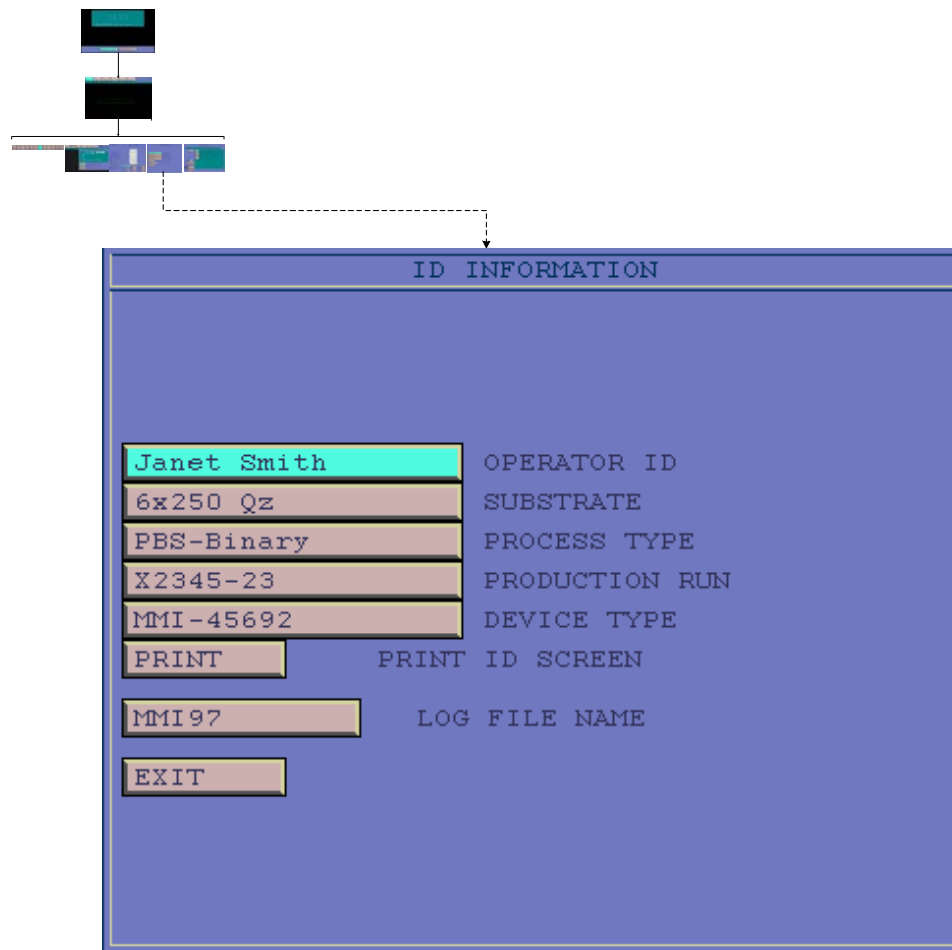
ID Menu

Use the ID Information dialog box (Figure 4-9) to enter your name (or a number for production tracking purposes), information regarding the device you are measuring, or other device identification data.

To display the ID dialog box:

3. From the Operator Main Menu screen, highlight the *ID* icon.
4. Press [SELECT].

Figure 4-9. ID Information Dialog Box



Program menu

Use the Program dialog box (Figure 4-10) to select the correct measurement program. The program dialog box lists the programs in the order they were used from top to bottom.

Selecting the correct program to operate is very important. The system will always return to the last program used, even after power has been turned off.

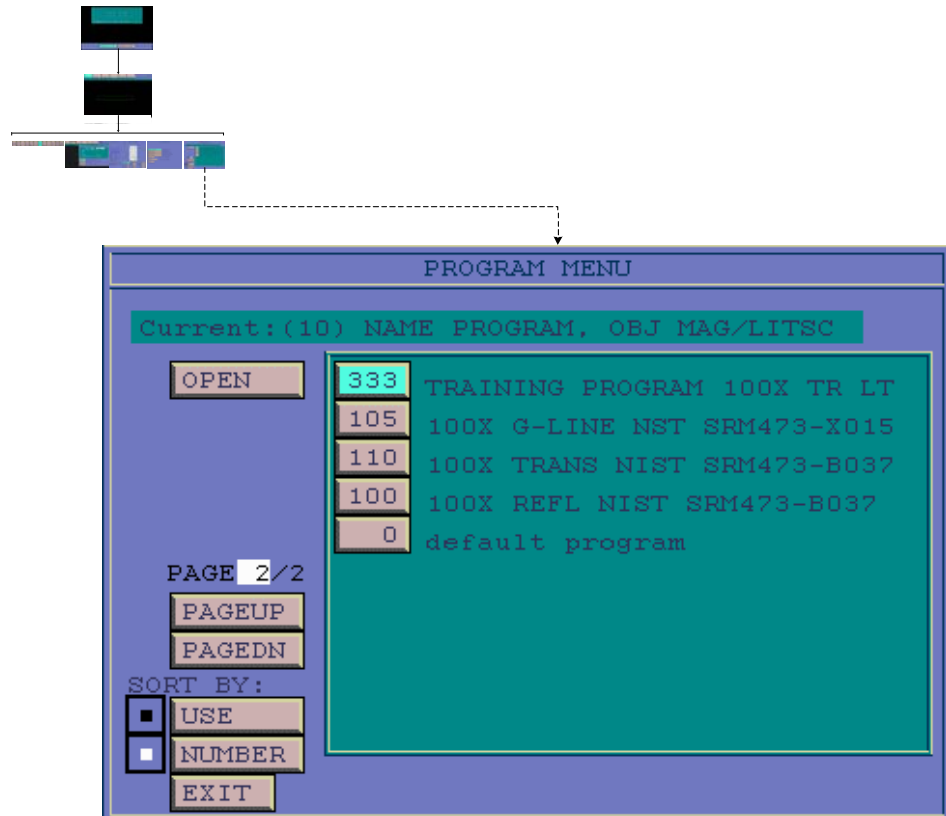


Tip: Remember that each program contains calibration values that are unique to only one total magnification. This requires that only one objective be used with that program if correct measurements are to be obtained.

To display the Program dialog box:

1. From the Operator Main Menu screen, highlight the *Program* icon.
2. Press [SELECT].

Figure 4-10. Program Menu Dialog Box



Return to Standby Screen

Use this selection to return to the Standby screen.

To return to the standby screen:

1. From the Operator Main Menu screen, highlight the *Standby* icon.
2. Press [SELECT].

5

Operation

Overview

Access the Production Menu

Load a Plate

Select a New Program

Change ID Entries

Clear Statistics

Measure in Manual Mode

Measure in Semi-Auto Mode

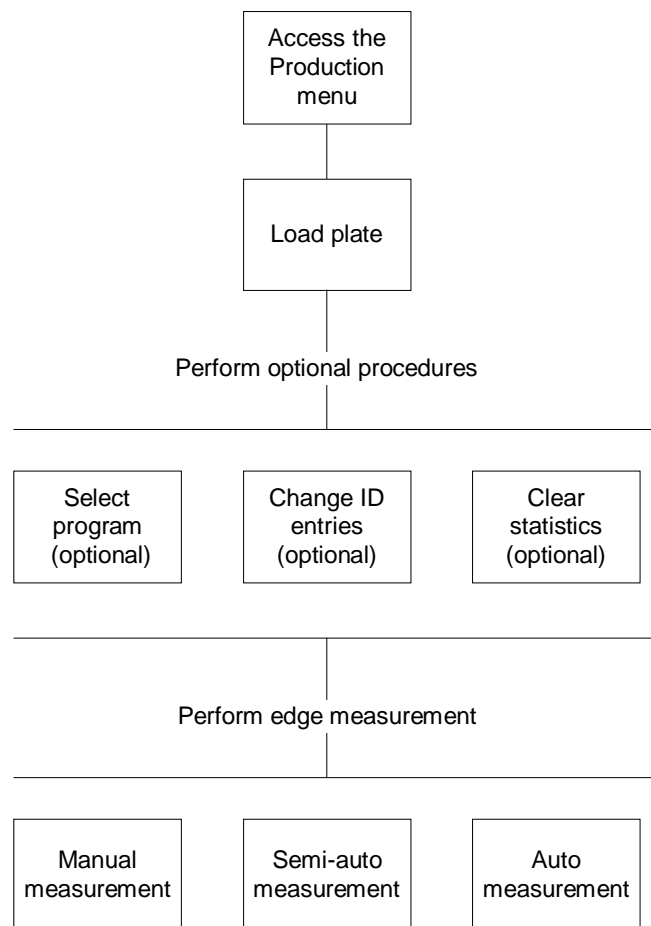
Measure in Auto Mode

Overview

This chapter provides instructions for each main step of the edge measurement process. An overview of this process is shown in Figure 5-1.

Several of the steps shown in Figure 5-1 are optional. Additionally, you can elect to perform the measurement in manual, semi-auto, or fully automatic mode, depending upon your system setup and individual process requirements.

Figure 5-1. Measurement Process Overview



Access the Production Menu

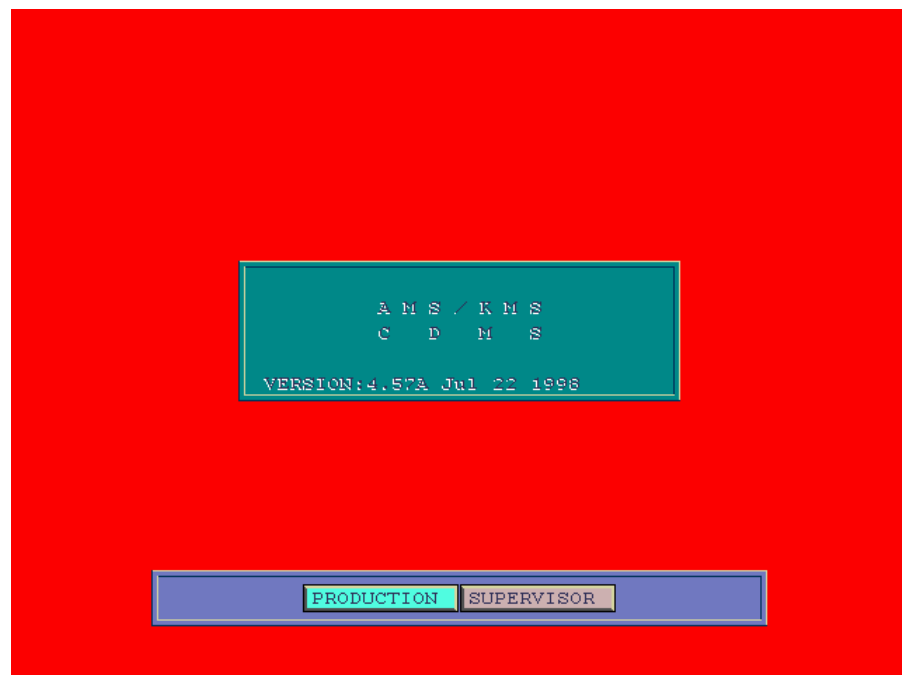


Note: At the beginning of your shift, the system monitor should display the standby screen (Figure 5-2). When this screen is displayed, the system is ready for immediate use. If the Standby screen is not easily accessible, you may need to have an engineer initialize the system from a cold start.

To access the Production main menu:

1. With the Standby screen displayed (Figure 5-2), select *Production* and press [SELECT].

Figure 5-2. KMS-310/400 Standby Screen



The Production main menu and screen are then displayed (Figure 5-3). The following data is displayed along the bottom portion of the screen:

- program name
- previously-entered ID information
- objective and microscope aperture to be used for measurement

Figure 5-3. Production Main Menu and Screen



Load a Plate

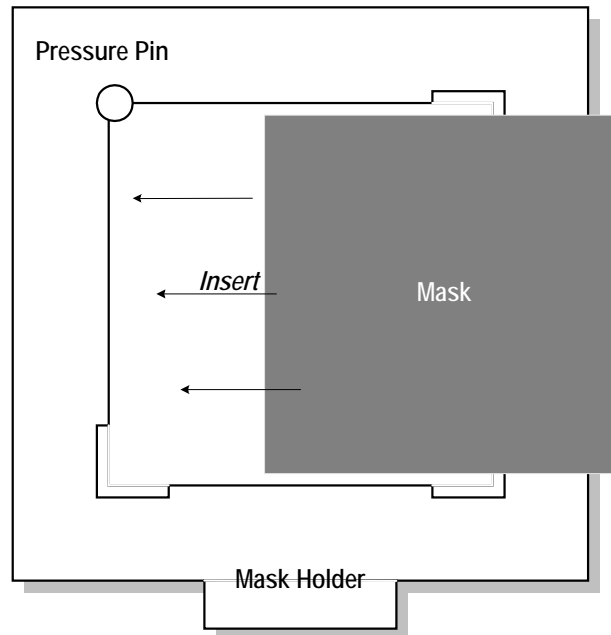


Caution: Focus correctly at 10X or you may crash the objective and/or substrate at higher magnifications.

To load a plate onto the stage:

1. Position the mask so with the titles right side up (chrome side up).
2. Grab the right side of the mask with either a mask pick or your hand.
3. Align the mask with the mask holder so that the right side of the mask lines up with the right side of the mask holder (Figure 5-4).

Figure 5-4. Loading a Plate on the Stage



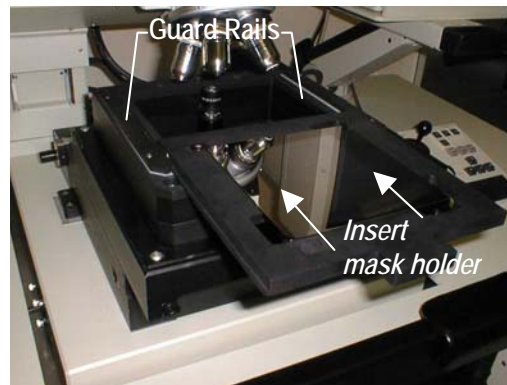
4. Gently push the mask to the left so that the round pressure pin (in the upper left corner of the mask holder) is pushed out of the way.
5. Gently push the mask down into the mask holder so that it rests on the support rails of the mask holder.

6. Insert the mask holder into the guide rails of the stage and gently push the plate in to the backstop (Figure 5-5).



Caution: To avoid injury due to pinch points on the stage, exercise caution when loading the plate onto the stage.

Figure 5-5. Loading a Mask into the Stage



Select a New Program (Optional)

The program used for the last measurement is displayed at the bottom of the Production Main Menu screen. If you want to continue using this program, you do not need to perform the steps in this section. Perform the steps in this section only if you want to select a new measurement program.



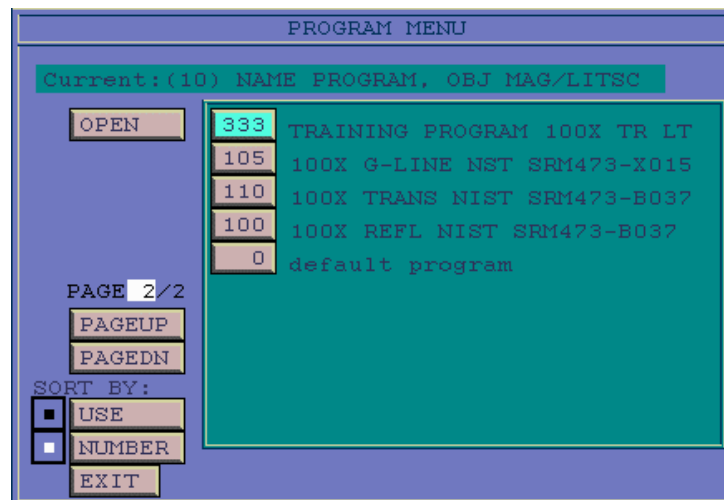
Note: Each program contains calibration values for a unique magnification. For this reason, you can only use the objective specified on the bottom of the Operator Main Menu screen. If you use a different magnification your measurements will not be valid.

To select a new measurement program:

1. With the Production Main Menu screen displayed, highlight *Program* and press [SELECT].

The Program Menu Setup dialog box is displayed (Figure 5-6).

Figure 5-6. Program Menu Setup Dialog Box



2. If you want to sort the programs, highlight either the [USE] or [NUMBER] selection and press [SELECT].
3. If there is more than one page of program listings, use the [PAGEUP] and [PAGEDN] buttons to display the previous or next page of program listings.

4. Highlight the program number you want to use and press [SELECT].



Note: Instead of performing Steps 5 - 7, you can simply press [ESC] to enable the selected program.

5. Select a program name and number.
6. Highlight the [OPEN] button and press [SELECT].
7. Highlight the [EXIT] button and press [SELECT].

Change ID Entries (Optional)

This section provides instructions for entering information about the device that you are measuring. Perform the steps in this section only if you need to change existing ID information.

To change ID entries:

1. With the Production Main Menu screen displayed, highlight the *ID* button and press [SELECT].

The ID Information dialog box is displayed (Figure 5-7).

Figure 5-7. ID Information Dialog Box

The screenshot shows a dialog box titled "ID INFORMATION" with a blue background. It contains several text input fields and buttons. The "OPERATOR ID" field is highlighted in cyan and contains the text "Janet Smith". Other fields include "SUBSTRATE" (6x250 Qz), "PROCESS TYPE" (PBS-Binary), "PRODUCTION RUN" (X2345-23), "DEVICE TYPE" (MMI-45692), "PRINT ID SCREEN" (PRINT), "LOG FILE NAME" (MMI97), and an "EXIT" button.

Field Label	Value
OPERATOR ID	Janet Smith
SUBSTRATE	6x250 Qz
PROCESS TYPE	PBS-Binary
PRODUCTION RUN	X2345-23
DEVICE TYPE	MMI-45692
PRINT ID SCREEN	PRINT
LOG FILE NAME	MMI97
EXIT	EXIT

2. To change information displayed in a text field:
 - a. Highlight the desired information.
 - b. Press [SELECT].
 - c. Enter new data in the text field.
 - d. Press [SELECT] a second time.
3. When you are done, highlight the [EXIT] button and press [SELECT].

Clear Statistics (Optional)

If the statistics option has been set up in Supervisor mode, measurement data is automatically collected each time a measurement is made. You can use this feature to:

- view data from previous measurements
- print measurement data to a file
- discard the latest measurement statistics
- zero (clear) all measurement values

To clear statistics from a previous measurement:

1. With the Production Main Menu displayed, highlight *Stats* and press [SELECT].

The Statistics dialog box is displayed (Figure 5-8). This dialog box displays the following information about the latest measurement taken:

- sequence
- accumulated readings
- mean
- maximum
- minimum
- spread
- standard deviation

Figure 5-8. Statistics Dialog Box

The screenshot shows a dialog box titled "STATISTICS" with a teal background. It displays the following data:

SEQUENCE :	0 / 1	X CHROME
ACCUMULATED READINGS	0	
MEAN	0.	
MAX	0.	
MIN	0.	
SPREAD	00.00000	
STANDARD DEVIATION	00.000000	

Below the data is a list of control options:

NEXT	DATA FROM NEXT MEASUREMENT
CLEAR	ZERO ALL VALUES
DISCARD	DISCARD LATEST READING
PRINT	PRINT STATISTICS
EXIT	

2. To view data for the next stored measurement sequence, highlight the [NEXT] button and press [SELECT].



Note: In order to view stored measurement sequences, you will need to first run a script to set up this option.

3. To zero all values in the Statistics dialog box, highlight the [CLEAR] button and press [SELECT].
4. To discard the last measurement stored in the Statistics dialog box, highlight the [DISCARD] button and press [SELECT].
5. To print the displayed data to a manual LOG file, highlight the [PRINT] button and press [SELECT].
6. To close the Statistics dialog box, highlight the [EXIT] button and press [SELECT].

Measure in Manual Mode



Note: You can perform the measurement routine in manual, semi-auto or fully automatic mode, depending on how your system is configured. Use the procedure in this section to measure in *manual* mode. If you want to perform measurements in semi-auto mode, skip this section and go on to the next section, *Measure in Semi-Auto Mode*. If you want to measure in fully automatic mode, skip this section and go on to the next section, *Measure in Auto Mode*.

The basic steps you will use to perform edge measurements in manual mode are:

1. Locate an image.
2. Size the measurement box.
3. Position the measurement box.
4. Adjust edge selections.
5. Check illumination settings.
6. Measure feature.

Locate an Image

1. With the Production Main Menu screen displayed, highlight *MEASURE* and press [SELECT].

The Measure menu is displayed (Figure 5-9).

Figure 5-9. Measure Menu

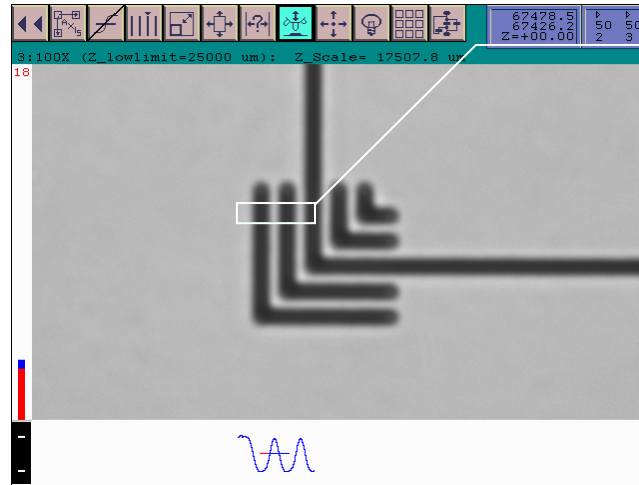


2. Use the → and ← turret keys to rotate the 10X objective into place.
The objective currently in position will be displayed along the upper right portion of the screen.
3. Use the joystick to drive the stage to a target image.
4. Use the ↑ and ↓ Focus keys to bring the image into focus.
5. Use the → and ← turret keys to rotate the turret to the measurement objective (normally 100X).
6. Use the focus thumbwheel to bring the image into focus.


Size the Measurement Box

If the measurement box is not sized correctly (Figure 5-10):

Figure 5-10. Correct Measurement Box Size





This measurement box is sized correctly because it will easily overlap both measurement points on the feature. However, if your measurement box does not easily overlap both measurement points of your feature, you will need to resize it.

1. Highlight the  icon and press [SELECT].
The Size dialog box is displayed.
2. Resize the measurement box to correctly size the measurement box.
When the measurement box is sized correctly, the wave at the bottom of the screen will have well-defined highs and lows (such as in Figure 5-10).
3. Once the measurement box has been correctly sized, highlight *Exit* and press [SELECT].


Position the Measurement Box

To center the measurement box over the target image:

1. Highlight the  icon and press [SELECT].
2. Use the arrow keys to position the window over the target image.
3. Press [SELECT] again to disable the  icon.

Adjust Edge Selections

The left (red) and right (blue) markers inside the measurement box should be aligned with the edges of the feature you want to measure. If you need to adjust the position of either edge, you should:

1. Highlight the  icon.
2. Press the [SELECT] key to toggle the setting displayed in the upper right portion of the screen to *Left*, *Right* or *Both*.

Toggle to displayed window setting to *Left* if you want to move the left (red) edge marker in the measurement box.

Toggle to displayed window setting to *Right* if you want to move the right (blue) edge marker in the measurement box.

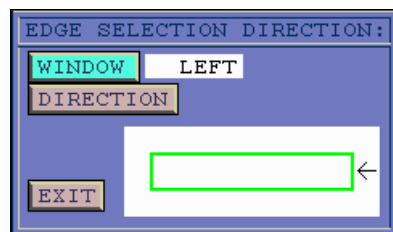
Toggle to displayed window setting to *Both* if you want to move both the left (red) and right (blue) edge markers of the measurement box.

3. Once you have toggled to the desired direction setting, press [ESCAPE].
4. Press the → and ← keys to move the edge to its correct position.
5. To change the direction of the measurement scan:

- a. Highlight the  icon and press [Menu].

The Edge Selection Direction dialog box is displayed (Figure 5-11).

Figure 5-11. Edge Selection Dialog Box



- b. Toggle the [WINDOW] button to change the axis of the scan.
- c. Toggle the [DIRECTION] button to select the direction of the scan.

- d. Highlight the [EXIT] button and press [SELECT].

Check Illumination Settings

Correct illumination settings are critical to the capture of accurate measurements. This section provides a quick check to ensure that illumination settings are correct.

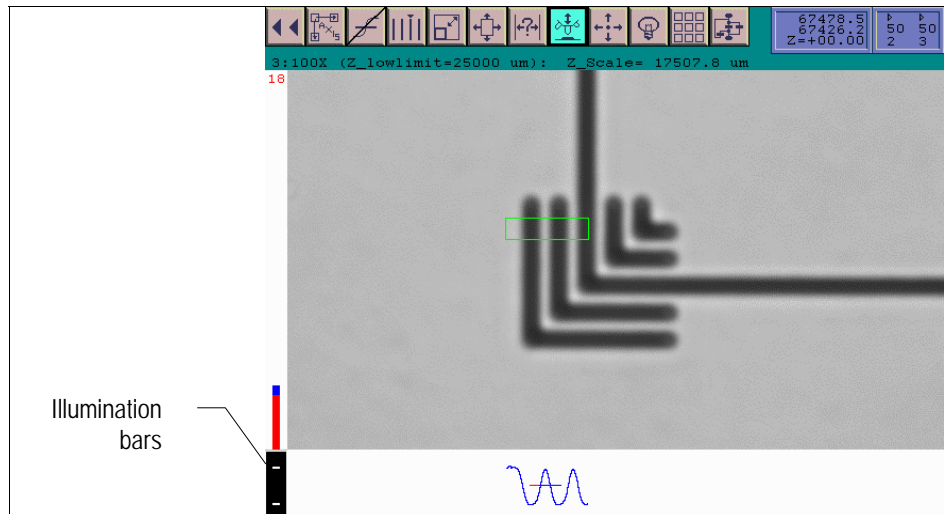


Note: If illumination settings require adjustment, consult with an engineer before making any adjustments. Illumination settings are very involved and Zygo recommends that you not change illumination settings without first consulting an engineer.

To check illumination settings:

1. View the illumination bar along the lower left portion of the screen (Figure 5-12).
2. Make sure the tabs on the illumination bar are not red.
3. If the tabs are not red, proceed to the next section to measure feature edges. If the tabs along the illumination bar are red, consult with an engineer.

Figure 5-12. Correct Illumination Settings



Measure Feature Edges

To measure the edges of a feature:

1. Highlight the  icon and press [SELECT].

The system will then perform an autofocus and measurement routine.

Measure in Semi-Auto Mode



Note: You can perform the measurement routine in manual, semi-auto or fully automatic mode, depending on how your system is configured. Use the procedure in this section to measure in *semi-auto* mode. If you want to perform measurements in manual mode, skip this section and refer to the previous section, *Measure in Manual Mode*. If you want to measure in fully automatic mode, skip this section and go on to the next section, *Measure in Auto Mode*.

The basic steps you will take to measure in semi-auto mode are:

1. Focus the system.
2. Select Go-Stop locations.
3. Measure edges.

Focus the System







To focus the system:

1. With the Production Main Menu screen displayed, highlight [MEASURE] and press [SELECT].

The Measure menu is displayed (Figure 5-13).

Figure 5-13. Measure Menu



2. Drive the stage to the origin (0,0).
3. Focus the origin:
 - a. Highlight the  icon and press [SELECT].
 - b. Use the  and  keys (or the thumbwheel) to bring the location into focus.
4. Auto drive to the deskew location (0,1).
5. Focus the deskew location:
 - a. Highlight the  icon and press [SELECT].
 - b. Use the  and  keys (or the thumbwheel) to bring the location into focus.

Select Go-Stop Locations

To select Go-Stop locations:


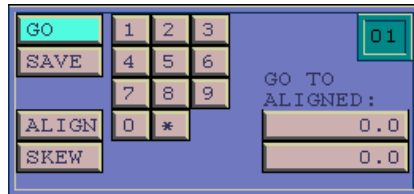
1. Highlight the  icon and press [SELECT].
The Go-Stop Location dialog box is displayed (Figure 5-14).

Figure 5-14. Go-Stop Location Dialog Box



2. Highlight the Go-Stop location number on the keypad and press [SELECT].
3. Highlight *ALIGN* and press [SELECT].
4. Highlight *SAVE* and press [SELECT].
5. Highlight *GO* and press [SELECT].
6. Drive the stage to the deskew point.
7. Highlight *SKEW* and press [SELECT].
8. Highlight *SAVE* and press [SELECT].
9. Move to each consecutive Go-Stop location and save the coordinates by highlighting *SAVE* and pressing [SELECT].

Measure Edges

To measure edges for each Go-Stop location:


1. If you want to recall a specific measurement box for the current Go-Stop location:
 - a. Highlight the  icon and press [SELECT].
The Recall dialog box is displayed (Figure 5-15).

Figure 5-15. Recall Dialog Box






- b. Highlight the recall number on the keypad and press [SELECT].

- c. Highlight *RECALL* and press [SELECT].
- d. Press [ESCAPE] to close the window.

The previously saved measurement box you selected is then displayed automatically.



Note: You can use the Recall dialog box at any time to display a previously saved measurement box.


2. Highlight the  icon and press [SELECT].
The system will then perform an autofocus and measurement routine at the selected Go-Stop location.
3. Highlight the  icon and press [SELECT] to redisplay the Go-Stop Location dialog box.
4. Highlight *GO* and press [SELECT].
5. Press [ESCAPE].
6. Highlight the  icon and press [SELECT] to measure the new location.
7. Repeat steps 3-6 for each Go-Stop location.

Measure in Auto Mode



Note: You can perform the measurement routine in manual, semi-auto or fully automatic mode, depending on how your system is configured. Use the procedure in this section to measure in auto mode. If you want to perform measurements in manual mode, skip this section and refer to the previous section, *Measure in Manual Mode*. If you want to measure in semi-automatic mode, skip this section and refer to the previous section, *Measure in Semi-Auto Mode*.

To perform measurements in auto mode:

1. With the Measurement menu displayed, highlight the  icon and press [SELECT].

The Script File Name? dialog box is displayed (Figure 5-16)

Figure 5-16. Script File Name? Dialog Box



2. Enter the script name you want to run.
3. Press [SELECT].
4. Follow the screen prompts to perform an automatic measurement.



6

Error Messages

System Error Messages

Script Error Messages

System Error Messages

This section provides an explanation for common KMS-310/400 system error messages.

Table 6-1 lists common system error messages. For each error message, this table provides a definition and suggested course of action to correct the problem.

Table 6-1. System Error Messages

Error Message	Meaning	Corrective Action
Z-column error #6	Tried to drive Z-Column below mechanical limit switch	<ol style="list-style-type: none"> 1. Remove the mask. 2. Power down the system. 3. Restart the system.
Z-column at upper limit	Tried to drive the objectives up and too far away from the sample	Select the <i>Focus</i> icon and drive the column back down until the message goes away.
Z-column at lower limit	Tried to drive the objectives down too close to the sample	Select the <i>Focus</i> icon and drive the column away from the sample until the message goes away.
Z-column software limit	Z software limit has been set during objective setup. The operator has attempted to drive towards the sample and past the software limit.	<ol style="list-style-type: none"> 1. Drive the column back away from the sample. 2. If desired, reset to a larger software limit value by performing the objective setup procedure.
Illegal turret move	Virtual objective was set in the System.cfg file and the objective set up was not carried out properly.	Reset the objective setup. Take care to correctly set the relationship between the reference objective and RIC objective plane(s).
Edges not found	<p>Edge selection for given feature is incorrect.</p> <p>Operator has picked the wrong edge count for a given feature.</p>	Select the <i>Edges</i> icon, re-select the correct edges, and scan direction for the feature.
0.000 for measurement value	Measurement was taken on one edge only, or measurement was out of range for the current multi-point (sub-M) file.	<ol style="list-style-type: none"> 1. Select the <i>Edges</i> icon, re-select the correct edges, and scan direction for the feature. 2. Check the expected feature CD value against the multi-point calibration table limits.

Script Error Messages

This section provides an explanation for common KMS-310/400 script error messages.

Table 6-2 lists common KMS-310/400 script error messages. For each error message, this table provides a definition and suggested course of action to correct the problem.

Table 6-2. Script Error Messages (part 1 of 2)

Error Message	Meaning	Corrective Action
Load Failed – RETRY (Yes/No)	Incorrect spelling or path used to run a script. INCLUDE commands are used but the files named are non-existent or are in the wrong path.	<ol style="list-style-type: none"> 1. Check script name and/or path for correct spelling. 2. Check all INCLUDE commands in the script. Make sure that all paths and named scripts are correct. Check actual directories for “included” scripts. 3. Make sure there are no nested INCLUDE commands. A script that uses an INCLUDE command cannot include a second script that also uses INCLUDE commands.
Loadfile ### Failed	LOADCALIB: command failure. The calibration file number that is called out is nonexistent. The system will skip this command and load in the last known calibration file.	<ol style="list-style-type: none"> 1. Make sure the calibration file and associated number have been created and are in the correct place.

Table 6-2. Script Error Messages (part 2 of 2)

Error Message	Meaning	Corrective Action
Matrixwrite Error	Syntax error in setting up the MATRIX commands. An incorrect handle may have been called for called for in a given MATRIXWRITE command, or there is no MATRIXSET command preceding the MATRIXWRITE command.	<ol style="list-style-type: none"> 1. Check the MATRIXOPEN command for errors in the named path. (No spaces are allowed in the path.) 2. Check the MATRIXOPEN command to make sure the named handle is the same as the MATRIXWRITE command handle. 3. Make sure the MATRIXSET command has been used properly preceding the MATRIXWRITE command.
Not A Command :LLLLL	Syntax error in script code. The LLLLL command may not be a spelled correctly, or is not followed by a colon.	<ol style="list-style-type: none"> 1. Make sure the LLLLL command is spelled correctly and is followed by a colon.
Program Does Not Exist	LOADPROG: command error. The program number called out in LOADPROG does not exist.	Add the appropriate program number (called out in LOADPROG) to the script.
Stack Overflow CALLs nested 30 deep	A CALL command has been invoked without the necessary RETURN command to follow.	Check the order of the CALL commands to see if they coincide with a RETURN command.
Stack Underflow More Returns than Calls	A RETURN command has been used without the necessary CALL command being invoked first.	Check the order of the RETURN commands to see if they coincide with the CALL commands in the script.
Value Not Found Use V00 to V99 or decimal	CALL command syntax error. Graphics command syntax error.	<ol style="list-style-type: none"> 1. Make sure the CALL command is followed by a 0, a non-zero value or the variable V##. 2. Make sure graphics commands, such as BOX or LINE, have at least five values after the command. Values should be listed in the order of X1, Y1, X2, Y2, and color.

Glossary

align. To put into proper relative position or orientation.

anomaly (ies). An occurrence on a substrate judged to be unexpected. Something abnormal, incongruous or inconsistent. Once an anomaly is reviewed, it may be classified as a *defect*.

aperture diaphragm. An iris that controls depth of field and contrast.

binary photomask. Photomask using an opaque material (such as chrome) as the attenuator, deposited on a highly transparent material (such as quartz or fused silica).

brightness. The overall intensity level in a video image.

condenser. An optical assembly that organizes random light into a cohesive, focused beam.

contrast. The difference in intensity between (nearby) pixels in a video image.

convolution. An image processing operation used to spatially filter a video image.

deep ultra violet (DUV). Portion of the electromagnetic spectrum from approximately 200nm to 300nm. The typical value associated with this term is 248nm.

defect. 1. A physical, optical, chemical or structural irregularity that degrades the ideal *substrate* structure or the thin films built over the *substrate*. 2. An undesirable classified *anomaly*.

deskew. Software process used to remove the rotational factor from an orthogonal X and Y motion stage.

device. The end-product of a semiconductor process (e.g. DRAM, EPROM, or LOGIC).

die. 1. A *field* sub-unit 2. The area of a *substrate* that contains the *device* being manufactured.

edge detection. A method of isolating and locating an optical edge in a digital video image.

edge. Point at which the waveform crosses from dark to light with transmitted or reflected illumination.

feature. 1. A line or a point (as a feature within a pattern). 2. A physical characteristic of the substrate (e.g., a wafer flat).

field. The printed pattern from a reticle.

gray level. A shade of gray assigned to a pixel in a video image.

illumination e-line. The portion of the electromagnetic spectrum generated from the output of a mercury arc lamp. The typical value associated with this term is 533nm.

illumination g-line. The portion of the electromagnetic spectrum generated from the output of a mercury arc lamp. The typical value associated with this term is 436nm.

illumination, i-line. The portion of the electromagnetic spectrum generated from the output of a mercury arc lamp. The typical value associated with this term is 365nm.

index of refraction. Expressed in the formula ($n=C/V$), where C is the speed of light and V is the speed of light in a given material. Material such as quartz, with low (n) values, will deflect light rays to a lesser extent than material with higher (n) values.

Koehler illumination. A specific illumination technique that provides a uniformly illuminated image field from a non-uniform light source.

layer. The deposition of a certain material on a wafer for the purpose of producing a semiconductor *device*. Many different layers are generally required to produce a device. Several *process steps* may be used to create each layer.

linewidth. For a given cross section of a line, such as chrome on quartz, the calculated distance between specified thresholds.

lot. A group of one or more *substrates* of the same type (e.g., wafers, masks, CDs, etc.).

median filter. An image spatial filtering operation based on an input pixel and its eight neighbors.

metrology equipment. Any equipment that collects and reports information on specific predetermined locations (or *features*) on a *substrate* with consistent data structure, or reports general information about the entire *substrate*.

micron (micrometer). Metric unit of measure that is equal to 1/1,000,000 of a meter.

nanometer. Metric unit of measure that is equal to 1/1,000 of a micron or micrometer.

NIST. Acronym for the National Institutes of Tests and Standards, formerly known as the National Bureau of Standards (NBS).

objective, ELWD. Acronym for extra long working distance. An objective used to gather measurement information when the distance between the sample and the lowest point of the objective are relatively far apart.

objective, RIC. Acronym for refractive index correcting. An objective used to gather measurement information about a sample through a layer of quartz.

objective. The lens closest to the substrate that collects the reflected or transmitted light information and, when properly focused, produces the primary magnified image of the sample.

oculars. A highly corrected magnifier that transfers an image from the objective to the viewer's eyes.

origin. Referred to as the (0,0) coordinate, this location is usually at the lower-left corner of the active geometry or die.

parcentration. The ability of an imaging system to centrally locate a single point of an image in the field of view for more than one objective mounted on a single system.

parfocal. The ability of an imaging system to maintain focus when switching from one objective to another.

pellicle. A thin, optically transparent film, attached to and supported by a frame and attached to a photomask or reticle, used to seal out airborne contamination.

photomask. A combination of transparent and opaque materials, such as quartz with a layer of patterned chromium oxide. Used to transfer the circuit design to the wafer by means of an optical projection system.

pitch. A measurement dimension that utilizes similar slopes of line and space pair features to initiate the calibration of a line width measurement system.

pixel. Industry standard term for the most basic element of a digital image.

planarization. Process used to geometrically level the photomask or reticle using software. This enables the KMS system to maintain a coarse focus across much of the surface of the photomask or reticle.

process steps. 1. The individual steps required to create a complete *process* to make a semiconductor *device*. 2. The individual steps required for each *layer*.

process. The formula or recipe used to create a semiconductor *device*.

resist, electron beam (e-beam resist). Polymer material sensitive to an electron beam source that is used to expose the original image on the photomask or reticle from the design information.

resist, optical (photo-resist). Polymer material sensitive to a light source, such as a laser beam, that is used to expose the original image on the photomask or reticle from the design information.

resolution. Refers to both *spatial* and *intensity* resolution. Spatial resolution is the number of pixels per unit of length along the X- and Y-axes. Intensity resolution is the number of quantified levels that a pixel can have.

reticle. see Photomask

script. Series of commands that direct the KMS system to perform specific functions such as measuring, moving the stage, and performing pattern recognition routines.

spacewidth. For a given cross section of a space, such as the space between two chrome features on quartz, the calculated distance between specified thresholds.

substrate n. The basic unit of material processed by inspection and review equipment, such as wafers, CDs, flat panels and masks.

threshold, detection. The location on the grayscale of a material edge, such as chrome or resist, which designates the initial and final calculation points within an image identification or analysis routine.

threshold, measurement. The location on the grayscale of a material edge, such as chrome or resist, which designates the initial and final calculation points within the measurement routine.

trinoculars. A set of oculars with a third port for the attachment of a camera or other accessory.

turret. The rotational receptacle that multiple objective lenses are affixed to.

working distance. The distance from the focus point of the object plane to the front surface of the objective.

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