WaferMark®
SigmaDSC NT

Operator Manual

P/N: 273.508.00 – Rev: A

Revision History

A	Initial Release

Current Release Date - 13 August 2002

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Strict compliance with the safety procedures set out and referred to in this manual, and extreme care in the use of the equipment, are essential to avoid or minimize the chance of damage to the equipment or personal injury.

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Customer Support Contact Addresses

GSI Lumonics Worldwide Service Headquarters
60 Fordham Road
Wilmington, MA 01887
U.S.A.
Tel: +1–978 661 4300
Fax: +1–978 988 8798

GSI Lumonics North American Regional Customer Center
60 Fordham Road
Wilmington, MA 01887
U.S.A.
Tel: (248) 449 1578
Toll-free: 1–800 262 0160
Fax: (978) 988 9622

GSI Lumonics European Regional Customer Centre
Einsteinstrasse 2
D-85716 Unterschleissheim
Germany
Tel: +49 89–31707 111
Fax: +49 89–31707 350
Toll-free: 0800–58666427

GSI Lumonics International Sales and Service – Western Europe
29 rue Jean Rostand
Parc Orsay Université
F-91893
ORSAY CEDEX
France
Tel: +33 1 69 35 44 35
Fax: +33 1 69 35 44 00

GSI Lumonics International Sales and Service – Southern Europe
Via Umbria, 10
I-20090 Segrate (MI)
Italy
Tel: +39 02 26 99 28 33
Fax: +39 02 26 99 28 22

GSI Lumonics International Sales and Service – Northern Europe

Cosford Lane, Swift Valley
Rugby
Warwickshire CV21 1QN
England
Tel: +44 1788–532 612
Fax: +44 1788–553 564

GSI Lumonics Asia Pacific Regional Customer Center
11th Floor, BOC Credit Card Center
68 Connaught Road West
Sheung Wan
Hong Kong
Tel: +852–2549–8660
Fax: +852–2549–5896

GSI Lumonics International Sales and Service – Singapore
10 Toh Guan Road, #05-01B
TT International Tradepark
Singapore 608838
Tel: +65–774–6788
Fax: +65–774–2488

GSI Lumonics International Sales and Service – Taiwan
51, Lane 2, Kuang Fu Road
Sec 2
Hsinchu 300
Taiwan R.O.C.
Tel: +886–3–575–0670
Fax: +886–3–575–0470

GSI Lumonics International Sales and Service – Korea
SeokCheon Building 401
1551-5 Seo Cho 3-Dong
SeoCho-Ku
Seoul
Korea 137 073
Tel: +82 2 584 5595
Fax: +82 2 584 5598

This Product is Manufactured By:

GSI Lumonics

60 Fordham Road
Wilmington, MA 01887
U.S.A.
Tel: (978) 661 4300
Fax: (978) 988 8798

About GSI Lumonics

GSI Lumonics brings laser-based automated advanced manufacturing systems, instrumentation, and components to leading industrial companies worldwide. The Company supplies products and service to the semiconductor, electronics, medical, automotive, aerospace, and consumer packaging markets. GSI Lumonics shares are listed on the NASDAQ (GSLI) and the Toronto Stock Exchange (LSI).

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Preface

Intended Readers

The *WaferMark® SigmaDSC NT NT Operator Manual* is a standalone document that describes the basic operating procedures needed to start, monitor and stop the processing of lots. It is intended to be read and used as a reference by all personnel who operate the SigmaDSC NT WaferMark®.

Related Documents and Publications

The documentation package also includes the following publications:

- The *WaferMark® SigmaDSC NT Service Manual*, P/N 273.509.00, describes how to service the system. It is intended to be used ONLY by personnel who are trained and certified by GSI Lumonics to service the SigmaDSC NT.
- *WaferMark® NT GEM/SECS Interface User's Guide (P/N 273.495.00).*

One set of these manuals is shipped with each system.

How to Use This Manual

This document is organized into chapters and supplemental appendices. Refer to the Table of Contents for a specific listing of the sections, subsections, figures and tables comprising this document. For the printed version, there is an index for locating information on individual topics.

Conventions Used in This Manual

The following typographical conventions are used in this manual.

General text

- Chapter and section titles, figure and table captions are shown in large bold font.
- Important text and notes, and tips are shown in italics.

- Names of signals, lines, connectors, etc. are shown initially capitalized or upper case and in sans-serif font.

  For example: Vcc, Gnd, Pin 1, CCTV In, USER INTERLOCK.
- Mouse buttons are referenced to a right-hand mouse: MB1 (left button), MB2 (middle button), and MB3 (right button).

  Selection of an item using the left button is defined as left-click.

  Selection of an item using the right button is defined as right-click.

Machine control buttons and switches

- Computer keyboard buttons are shown in initially capitalized Courier bold font.

  For example: **Return**, **F2**, **Ctrl + F1**.
- Control panel buttons, switch positions, and indicators are shown in upper case sans-serif font.

  For example: SHUTTER CLOSE, START, COOLER

Menu, window, dialog box, scrolling list, and field names

- Single menu items, window names, scrolling list items, or field names are shown as initially capitalized sans-serif bold font.

  For example: **Edit**, **Save As**, **File Name**.
- Menu items in a sequence are shown separated by ">".

  For example: **File > Save As**

File Names, Variable Names, and Replacement Text Names

- File names are shown in lower case sans-serif bold font.

  For example: **photograph.jpg**, **newjob.mrk**
- Variable names, such as predefined keywords used in programming, are shown, as they appear, in sans-serif font.

  For example: X-offset, Imax, Absolute.
- Replacement text, used to indicate part of a programming command where the example will be replaced by

an actual value, is shown by lower case sans-serif bold font, within angle brackets.

For example: To open the file enter <drive letter><path><filename>.

Computer code entry and display

- Keyboard entry and screen response is shown, as it appears, in Courier bold font.

  For example: `TRIM_TOOL,VDVM1`

- Software listings are shown, as they appear, in Courier font.

  For example:

```
1...  Get number of update buffers.
2...  Get size of update buffers.
3...  Perform a remote update.
4...  Get a remote update buffer.
Q...  Return to main menu.
```

Cross-references and Links

- On paper, cross references and links are indicated by the number of the item referenced.

  For example:

  This is described in the System Performance section (2.4).

- On screen, cross references and links are indicated by underscored text or by the inline symbol 🖱➔

What to do if Something Goes Wrong

GSI Lumonics is committed to providing timely and effective customer support to its customers worldwide. You may telephone or FAX the nearest office (see Customer Support Contact Addresses at the front of this manual) or if unsure, contact the factory in Wilmington, Massachusetts and your inquiry will be directed to the proper office.

The Customer Support Center Internet E-mail address is

support@gsilumonics.com

GSI Lumonics will respond to E-mail messages within 24 hours of receipt.

ISO 9001 Certification

GSI Lumonics's Advanced Manufacturing Systems Group at 60 Fordham Road in Wilmington, Massachusetts, USA has established and applies a quality system for the design and manufacture of laser systems for the Semiconductor Industry. It has received the ISO 9001 version 2000 certification, registration number 74 300 7674A.

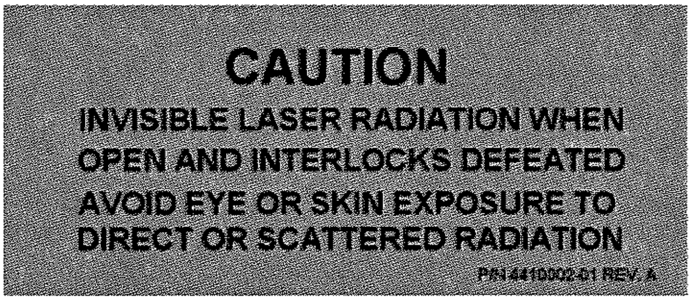
1 Safety

Please read this chapter before carrying out installation, operation or maintenance of this laser equipment.

All users of the WaferMark® SigmaDSC NT laser marking system, including system operators, customer personnel trained by GSI Lumonics to perform system maintenance tasks, and GSI Lumonics field service personnel must be familiar with the Safety information in this section before installing, operating, or maintaining this system.

This product is a Class 1 (I) laser system. However, several hazards may be present when servicing the equipment. Exercise extreme caution at all times. These potential hazards include:

- Laser hazards (Section 1.3) - In normal operations, the WaferMark® SigmaDSC NT system is a Class I system. The system laser access panels have built-in interlock protection. However, any service which directly or indirectly exposes the laser beam can render the system a Class 4 (IV) hazard for radiation exposure. Figure 1-1 shows an actual Laser Hazard label copied from the outside panel of the system.



CAUTION

INVISIBLE LASER RADIATION WHEN
OPEN AND INTERLOCKS DEFEATED
AVOID EYE OR SKIN EXPOSURE TO
DIRECT OR SCATTERED RADIATION

P/N 4410002-01 REV. A

Figure 1-1 – Caution Laser Hazard Label

⚠ WARNING

Laser Hazard

Perform all maintenance/service actions within the safety guidelines discussed in this section and follow the Control Measures listed in ANSI Z136.1-1993, American National Standard for the Safe Use of Lasers. Wear laser safety glasses or goggles with a minimum optical density (OD) 6.0 for 1053 nm and 8.0 for 532 nm when the laser is energized during maintenance/service. This provides adequate protection for most applications.

NEVER EXPOSE YOURSELF TO A DIRECT LASER BEAM.

⚠ WARNING

Potential Laser Radiation Exposure

The GSI Lumonics WaferMark® SigmaDSC NT laser marking system has an Nd:YLF laser. During normal operation, the system functions as a Class I laser product pursuant to the United States Code for Federal Regulations, Title 21, Sub-chapter J, Part 1040; and to EN 60825–1: 1994

USE OF CONTROLS OR ADJUSTMENTS, OR THE PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN, MAY RESULT IN HAZARDOUS LASER RADIATION EXPOSURE.

- Electrical hazards (Section 1.4) - The WaferMark® SigmaDSC NT system power supply output can reach a High Voltage level and is potentially lethal. The system cabinet access panels have built-in interlock protection. Observe all electrical precautions. Figure 1-2 displays an actual Electrical Hazard label copied from the side of the system.

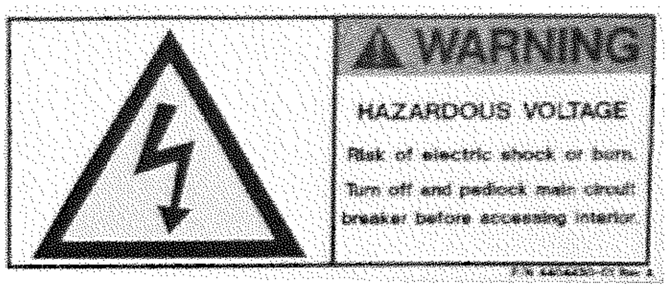


Figure 1-2 – Warning Electrical Hazard Label

DANGER

Electrocution Hazard

To avoid potentially lethal electrical hazards, observe all electrical precautions during system maintenance/service.

- Mechanical hazards (Section 1.6 - The movements of the WaferMark® SigmaDSC NT robot pose the risk of mechanical pinch and jam hazards. Hazard tape marks a clearance zone. The operator (and other personnel) should avoid reaching inside of this area when the system is operating.
- Environmental hazards (Section 1.7) - During the marking of bare silicon wafers, the WaferMark® SigmaDSC NT system poses no environmental hazards. However, introducing doping chemicals, such as Gallium Arsenide (GaAs), is highly toxic and requires the proper venting of toxic gases. If toxic chemicals are introduced into the processing, ensure that the system's built-in vent system is connected to an exhaust vent system that complies with governmental and corporate regulations for hazardous fume removal.

Modification of the equipment or changes in application may make any of these hazards applicable in the new situation. GSI Lumonics recommends that you read this complete safety chapter in order to become familiar with all aspects of laser safety.

Safety of this equipment is reinforced by the use of safety labels which are fixed to the equipment in a visible manner. The type of safety labels used and their location is detailed later in this chapter.

The use of controls, replacement parts, adjustments, or procedures other than those specified within this manual may result in exposure to any of these hazards.

The degree of seriousness of the hazard is indicated by the use of the following signal words. Each is presented with an example:

DANGER

Indicates an imminent hazard which, if not avoided, is extremely likely to result in death or serious injury.

NOTE: Use of this signal word is limited to the most extreme situations.

Example:

> ⚠ **DANGER**
> **Potential for Electrocution**
>
> Disconnect from the wall unit or disengage safety switch prior to servicing unit.

WARNING

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

Example:

> ⚠ **WARNING**
> **Laser Hazard**
>
> Use laser safety goggles at all times when servicing the laser.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It is also used to alert the user against unsafe working practices and potential damage to the equipment.

Example:

⚠ CAUTION

RISK OF INJURY OR DAMAGE TO EQUIPMENT

Always keep the keys in a secure place when not in use to prevent unauthorized operation of the equipment.

⚠ CAUTION

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

1.1 Location and Description of Warning Labels

The safety and CDRH labels used on the WaferMark® SigmaDSC NT System are shown in Table 1-1. Each label is identified in Table 1-1 by an ***identification letter***. The locations of each label on the system are shown in Figure 1-3 through Figure 1-9 by the corresponding label identification letter.

Table 1-1 – WaferMark® SigmaDSC NT System Safety and CDRH Labels

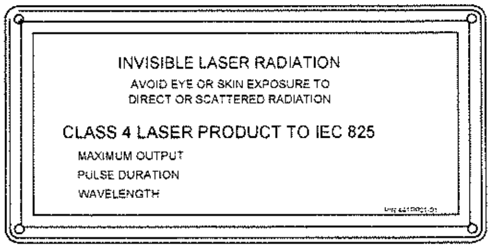
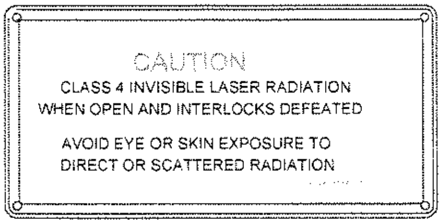
Identification Letter	Label	Locations Used
A	 INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT TO IEC 825 MAXIMUM OUTPUT PULSE DURATION WAVELENGTH	See Figure 1-7.
B	 CAUTION CLASS 4 INVISIBLE LASER RADIATION WHEN OPEN AND INTERLOCKS DEFEATED AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION	See Figure 1-3, Figure 1-6 and Figure 1-7 .

Table 1-1 – WaferMark® SigmaDSC NT System Safety and CDRH Labels

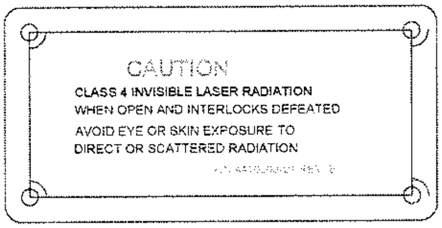
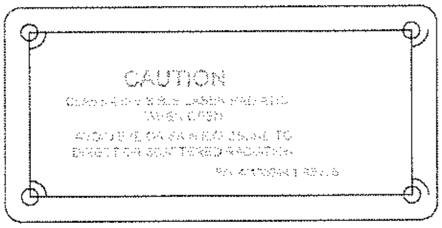
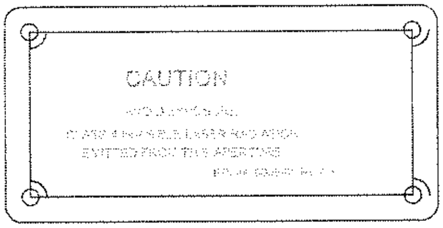
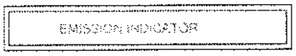
Identification Letter	Label	Locations Used
C	 CAUTION CLASS 4 INVISIBLE LASER RADIATION WHEN OPEN AND INTERLOCKS DEFEATED AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION	See Figure 1-4 and Figure 1-6.
D	 CAUTION [illegible] LASER [illegible] [illegible] [illegible] TO [illegible] SCATTERED [illegible]	See Figure 1-7 .
E	 CAUTION [illegible] [illegible] LASER [illegible] EMITTED FROM THIS APERTURE	See Figure 1-7.
F	 PRODUCT COMPLIES WITH IEC 825 (1990); EN60825 (1991) P/N 4410009-01 REV. A	See Figure 1-6.
G	 EMISSION INDICATOR	See Figure 1-3.

Table 1-1 – WaferMark® SigmaDSC NT System Safety and CDRH Labels

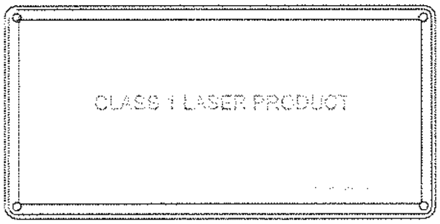
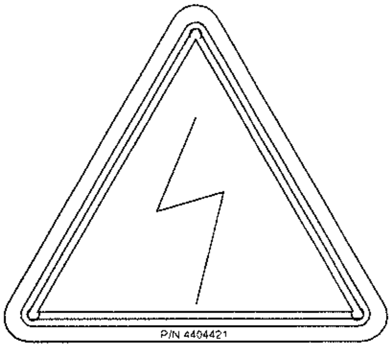
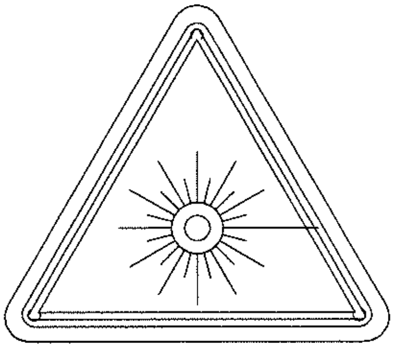
Identification Letter	Label	Locations Used
H		See Figure 1-6 .
J		See Figure 1-3, Figure 1-6 and Figure 1-8.
K		See Figure 1-3, Figure 1-6 and Figure 1-8.
L, M		See Figure 1-3 , Figure 1-4 and Figure 1-7.

Table 1-1 – WaferMark® SigmaDSC NT System Safety and CDRH Labels

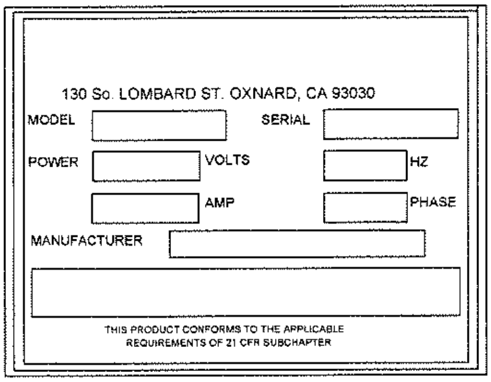
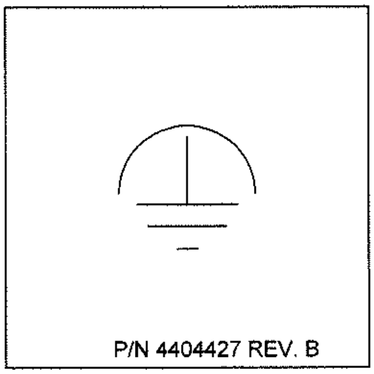
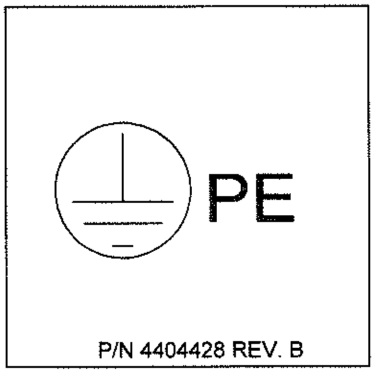
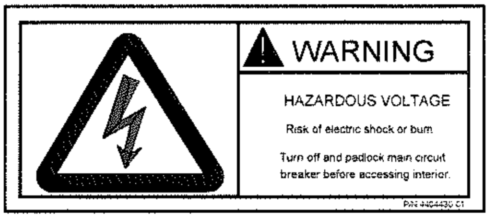
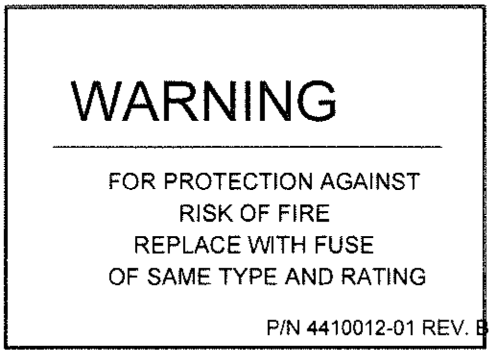
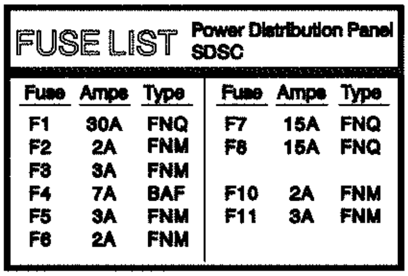
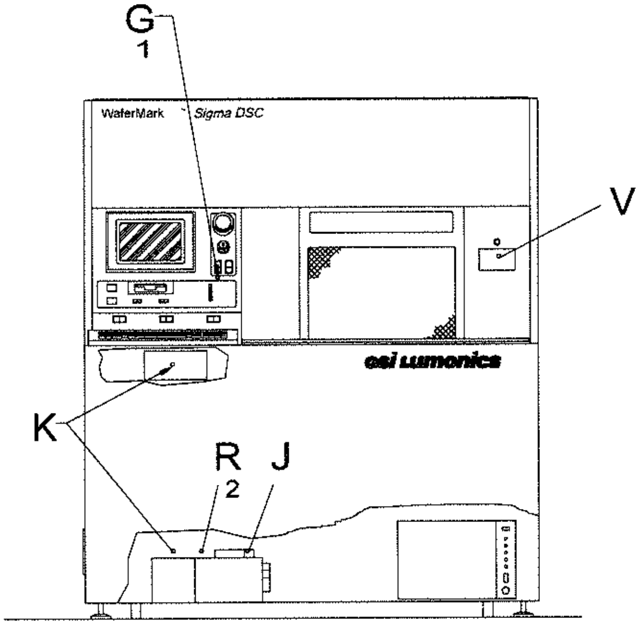
Identification Letter	Label	Locations Used
N	 130 So. LOMBARD ST. OXNARD, CA 93030 MODEL ☐ SERIAL ☐ POWER ☐ VOLTS ☐ HZ ☐ AMP ☐ PHASE MANUFACTURER ☐ THIS PRODUCT CONFORMS TO THE APPLICABLE REQUIREMENTS OF 21 CFR SUBCHAPTER	See Figure 1-6 .
P		See Figure 1-8.
PE		See Figure 1-8.
Q	 P/N 4404426-01 CAUTION Invisible laser radiation when open and interlock defeated. AVOID EYE OR SKIN EXPOSURE TO	Apply Q labels to interlock defeat flags (3 places).Used in conjuction with Label B.

Table 1-1 – WaferMark® SigmaDSC NT System Safety and CDRH Labels

Identification Letter	Label	Locations Used
R	 WARNING HAZARDOUS VOLTAGE Risk of electric shock or burn Turn off and padlock main circuit breaker before accessing interior.	See Figure 1-3, Figure 1-4 and Figure 1-5.
S	 WARNING FOR PROTECTION AGAINST RISK OF FIRE REPLACE WITH FUSE OF SAME TYPE AND RATING P/N 4410012-01 REV. B	See Figure 1-6 and Figure 1-8.
T	 FUSE LIST Power Distribution Panel SDSC Fuse Amps Type — Fuse Amps Type F1 30A FNQ — F7 15A FNQ F2 2A FNM — F8 15A FNQ F3 3A FNM F4 7A BAF — F10 2A FNM F5 3A FNM — F11 3A FNM F6 2A FNM	See Figure 1-8.
U	 SEISMIC TIE-POINT P/N 4410014-01 REV. A	See Figure 1-9.
V	 WARNING MECHANICAL HAZARD ROBOT MAY MOVE UNEXPECTEDLY RISK OF BODILY INJURY. DO NOT CROSS HAZARD ZONE WHEN WARNING LIGHT IS ON.	See Figure 1-3.

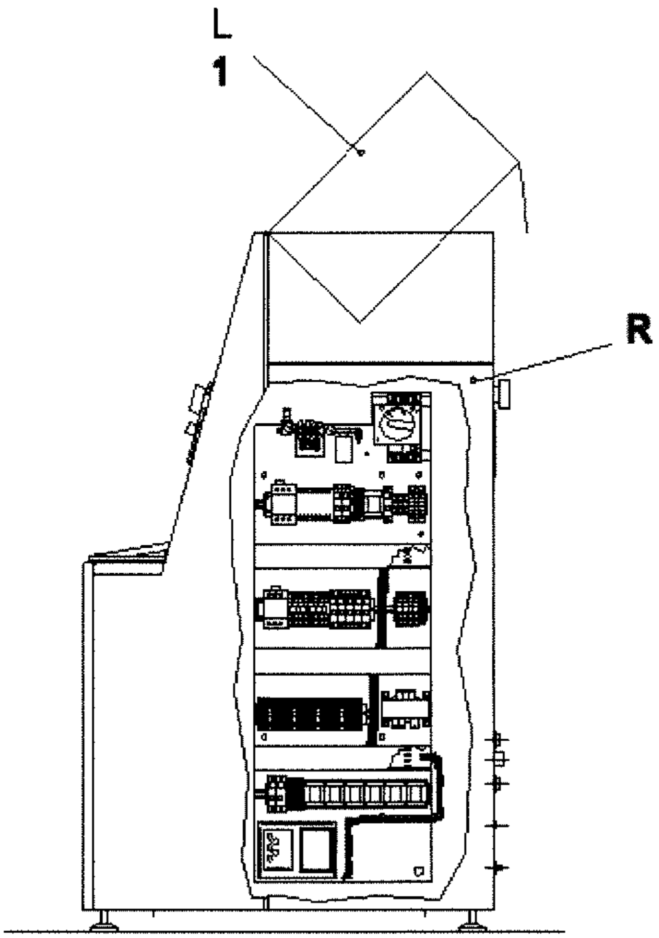
Refer to GSI Lumonics Drawing No. 2950169 for the safety and CDRH labels and GSI Lumonics Drawing No. 2950170 for label locations on the system.



1 Label G
Place directly under POWER ON indicator

2 Label R
Center on top of ventilation grill

Figure 1-3 – Safety and CDRH 1, Front View of System



1 Label L
Centered inside top cover

Figure 1-4 – Safety and CDRH Label Locations, Rightside View of System

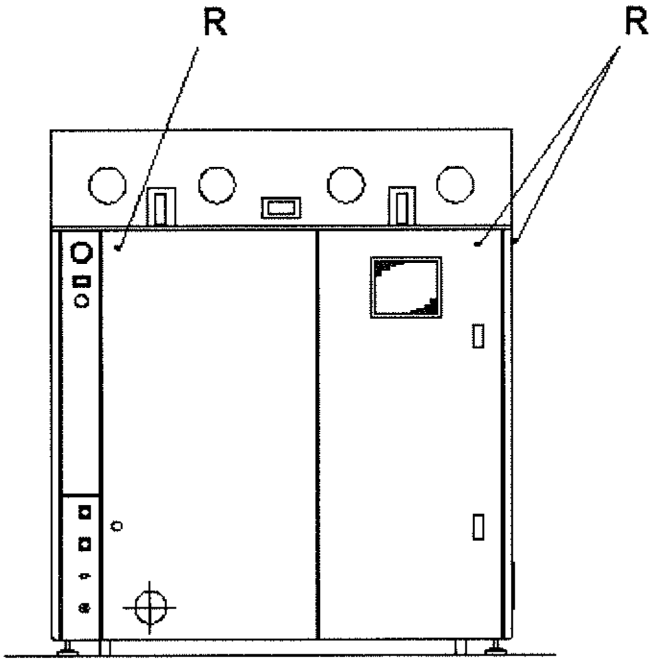
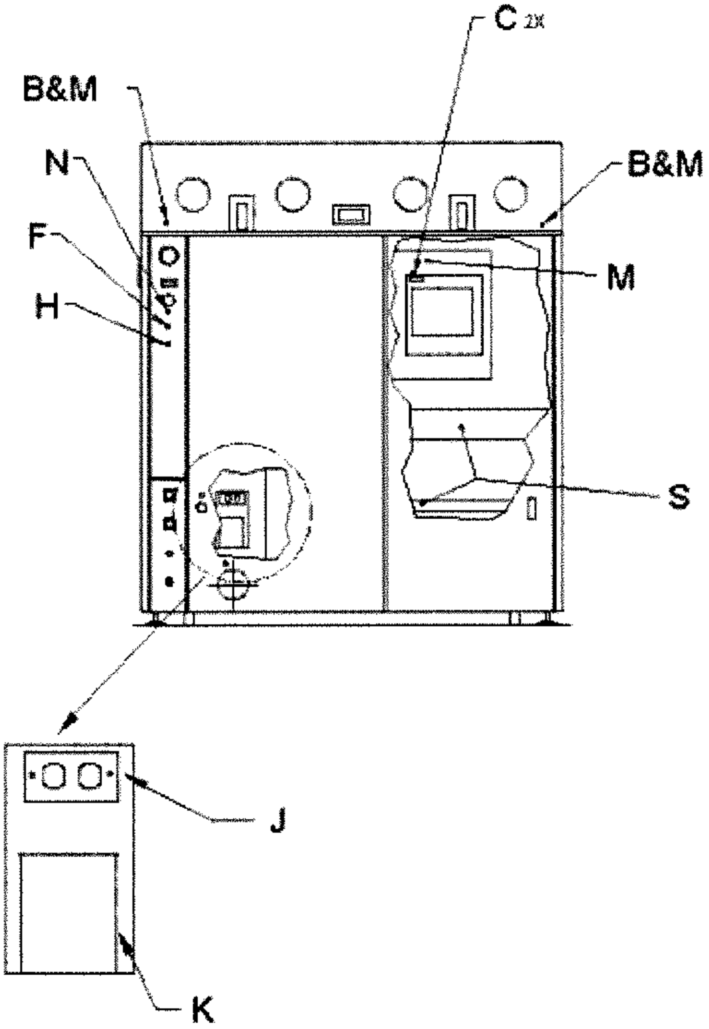


Figure 1-5 – Safety and CDRH Label Locations, Rear Access Panel

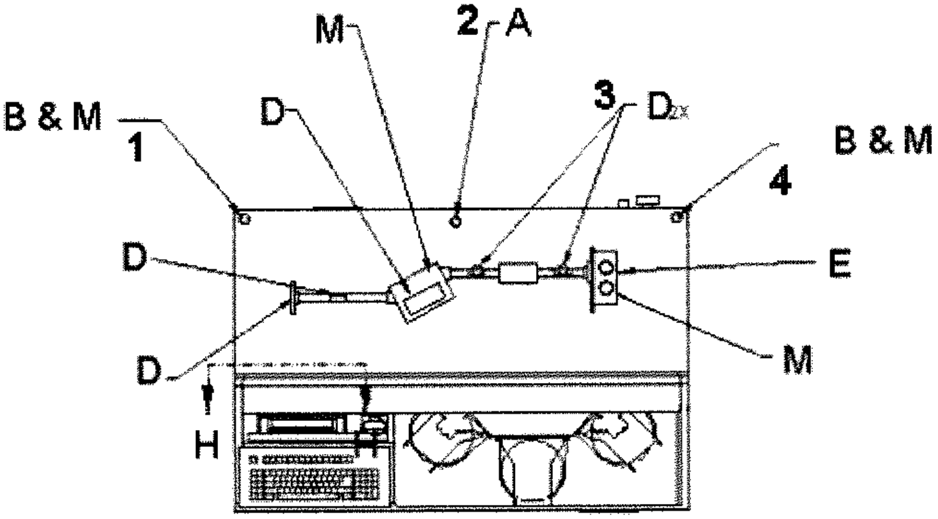


1 Label C (2 places)
Top outside of door and at top of door opening

2 Label S
Front panel of Laser Controller. (Fuse panel marking engine)

3 Label K
Place on side

Figure 1-6 – Safety and CDRH Label Locations, Rear of System



1 Label B
Corner of laser baseplate

2 Label A
Center of laser baseplate

3 Label D
2 places

4 Label B
Corner of laser baseplate

Figure 1-7 – Safety and CDRH Label Locations, Top View with Top Cover Removed

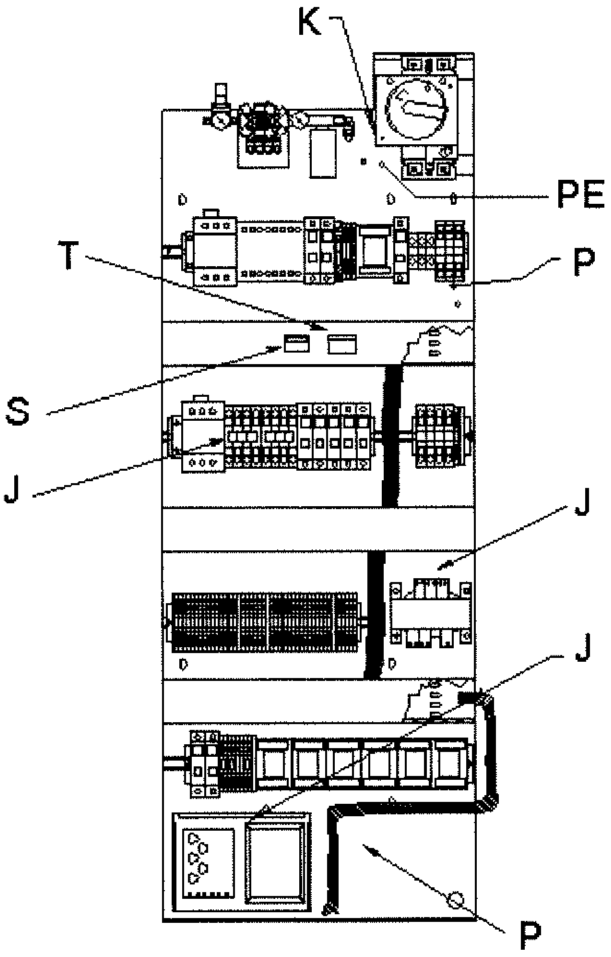
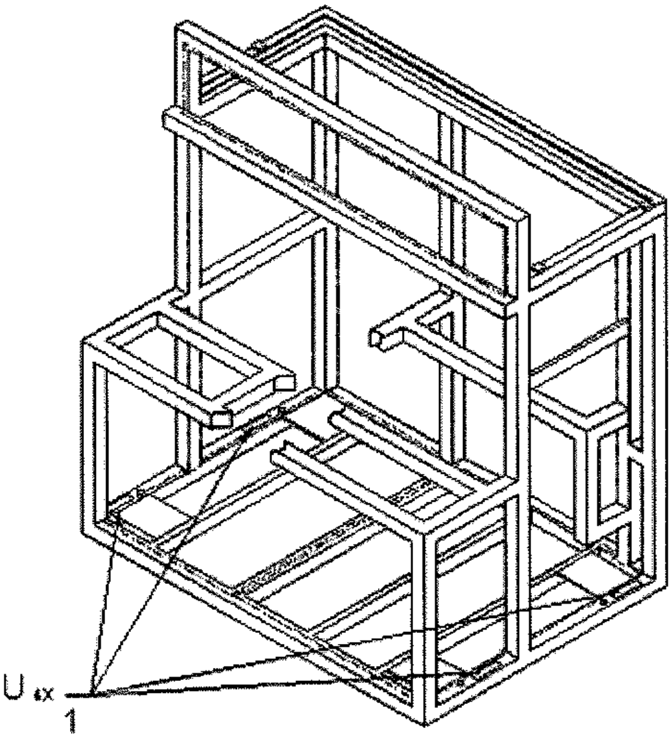


Figure 1-8 – Safety and CDRH Label Locations, Power Distribution Panel



1	Label U 4 places

Figure 1-9 – Safety and CDRH Label Locations, Seismic Tie-Down

1.2 Laser Classification

The WaferMark® SigmaDSC NT System uses the following lasers:

Table 1-2 – Wavelength Emitted by the WaferMark® SigmaDSC NT Laser

Laser type	Wavelength	Visible or Invisible
Nd:YLF	1.047 – 1.053μm	Invisible
Optional Laser	0.527 μm	Green

These lasers are classified as follows:

Table 1-3 – WaferMark® SigmaDSC NT Laser Classification

Laser Class - IEC (CDRH)	Description	Hazard Potential
1 (I)	The WaferMark® SigmaDSC NT System in its normal operating mode is a Class 1 (I) laser and is inherently safe. Under normal operating conditions, it does not produce a hazard.	None
4 (IV)	During servicing, the WaferMark® SigmaDSC NT System is a Class 4 (IV) lasers. Both direct beams and diffuse reflections are hazardous and may cause severe damage to eyes and skin.	High

GSI Lumonics certifies the basic WaferMark® SigmaDSC NT product, when installed in the standard configuration, as a Class I laser product containing a Class IV laser system. If an integrator modifies the WaferMark® SigmaDSC NT laser system for use in the United States, a report must be submitted to CDRH for approval. United States verification of compliance can be obtained from:

Office of Compliance Center for Devices and Radiological Health
2098 Gaither Road
Rockville, MD 20850
Tel. (301) 594-4654; FAX (301) 594-4672

1.3 Laser Hazards

A laser beam is an intense, collimated beam of monochromatic light. This beam can damage human tissue. Take precautions to ensure that personnel working in the direct vicinity of the laser output cannot come into direct contact with the beam.

1.3.1 Eye Damage

The laser output for the WaferMark® SigmaDSC NT may be visible (or invisible depending on the wavelength). See Table 1-2.

⚠ WARNING
Optical Hazard

When the WaferMark® SigmaDSC NT System is being serviced, always use the appropriate certified laser safety goggles. In the servicing state, the beams are potentially damaging to eyesight and may result in permanent eye damage if laser radiation is allowed to enter the eye either directly or by reflection.

1.3.2 Eye Protection and Safety Enclosures

⚠ WARNING
Optical Hazard

Laser safety glasses are designed to protect the wearer from reflected or scattered radiation. For a laser wavelength of 1053 nm, use goggles with a minimum Optical Density of 6.0. ***Never*** look directly into a laser beam, even when wearing safety glasses.

When servicing the WaferMark® SigmaDSC NT system, unless suitable laser-proof barriers are set up, all personnel working within 619 meters (2,789 feet) of the equipment must wear certified laser safety eyewear that is appropriate for the laser wavelength. The barrier should be at least 7-8 feet (2-2.4 meters) high, with no openings through which the beam could pass. The barrier can be any material with a minimum optical density of 6 rated for 1053 nm wavelength of light.

NOTE: Normal eye glasses and contact lenses ***do not*** *offer adequate protection against laser hazards. Personnel without eye protection must be excluded from the laser area.*

Laser safety glasses must conform to EN207 and 208:1994 - "Personal eye-protection - Filters and eye-protectors against laser radiation" or the guidelines in ANSI Z.136.1:1993. The regulations in force will depend on the location of the laser installation. In general, EN standards will apply in Europe and ANSI standards in North America.

⚠ **WARNING**
Optical Hazard

Discard and replace damaged laser safety glasses. If the appearance or optical quality of glasses changes during use, verify the cause immediately.

1.3.3 Skin Damage

If a laser beam from a low-power laser, such as those used for marking, touches the skin, it can cause a burn. Normally, this is not severe if the affected part is quickly removed from the beam. However, prolonged exposure can cause severe skin damage. Take every precaution to ensure that no part of the body enters the beam path, especially during installation, servicing, and maintenance.

⚠ **WARNING**
Optical Hazard

To avoid exposure to the direct beam, never defeat any interlock on the beam path guarding.

1.3.4 Emission Warning Indicators

To ensure the highest level of safety, the equipment is considered to be capable of producing laser output as soon as the power supply of the laser source is activated electrically. To indicate this, a green “Laser On” emission warning indicator on the Operator Panel illuminates.

1.4 Electrical Hazards

Laser power supplies and machine controllers contain electrical supplies which are potentially dangerous and hence precautions must be taken to prevent the risk of electrocution.

1.4.1 General Precautions

- Access panels must only be removed by personnel trained and certified by GSI Lumonics.

- Ensure that only trained personnel, familiar with electrical hazards, have access to the area.
- Read the operating and maintenance instructions for the equipment before beginning any service procedures.
- Follow accepted working procedures and codes of practice as well as the electrical safety code for the site where the equipment is installed.
- Keep the area around the equipment dry. Never operate the equipment if there is a water leak in the cooling system.
- Never wear rings, bracelets, or other jewelry when working around electrical circuits.
- Never work on electrical equipment alone. Always have a colleague close by.
- Always wait for five minutes after isolating the equipment to ensure that stored energy has dissipated.
- Isolate the main power input at the circuit breaker.
- Never operate the equipment if any main power cable is frayed or damaged.
- Never operate the equipment in production with access panels removed.

1.4.2 Component Replacement

- Before replacing fuses, exchanging printed circuit boards, or disconnecting wiring:
  - Isolate the system at the main circuit breaker, lock it in the OFF position and attach a notice indicating that maintenance work is in progress.
  - Remove the key from the main switch on the control panel.
- Never assume the polarity of cabling or replacement components. Refer to electrical schematics or contact GSI Lumonics for confirmation.

1.4.3 Additional Considerations for High Voltages

Before working on the power supply or discharge system:

- Ensure that only trained personnel, familiar with electrical hazards, have access to the area.
- Remove the key from the main switch on the control panel.
- Isolate the main power input at the circuit breaker, lock it in the OFF position and attach a notice, indicating that maintenance work is in progress.
- Read the operating, maintenance, and troubleshooting procedures to become familiar with the location of high voltage components and discharge probes.
- Ensure that storage capacitors have been fully discharged by probing them with the grounded, insulated discharge probe provided with the equipment.
- Once it is certain that the capacitors are discharged, attach a shorting link across the capacitor terminals. The shorting link must remain in place for the duration of the servicing operation.
- Do not override safety interlocks unless a key-operated override facility or special overridable interlock switch is fitted to the equipment.
- Use only GSI Lumonics-approved replacement parts.

1.5 Interlocks and Emergency Stop (E-Stop)

1.5.1 Interlocks

The WaferMark® SigmaDSC NT System has laser safety interlocks installed in the laser enclosure and the marking chamber. These protect against:

- Exposure to laser radiation
- Exposure to electrical hazards
- Exposure to mechanical hazards
- Damage to the equipment due to abnormal operating conditions or fault conditions.

When the laser enclosure cover is raised or the access door at the rear of the marking chamber is opened, the safety interlock connection is broken. This prevents the laser from operating by immediately closing the safety shutter to prevent beam emission. The safety shutter meets the requirements of 21 CFR 1040.

The safety interlocks can be overridden when performing service or maintenance by installing interlock defeat flags to bridge the open wiring circuit that is created when the cover is removed or the door opened.

⚠ WARNING

Potential Laser Hazard

Only GSI Lumonics trained and certified personnel should operate the system with the interlock defeat flags installed. If this is done, all safety precautions must be followed to ensure that all personnel are protected from exposure to the laser beam. All personnel must wear safety eyewear approved for this system (see Section 1.3.2).

1.5.2 Keyswitches

Keyswitches are fitted to the main control panel. Start-up and operation of the equipment is only possible after a key is inserted into the switch and is turned to the ON position. The key cannot be removed from the switch until it is returned to the OFF position. In certain cases, the keyswitch has several positions which provide access to different levels of operation and maintenance.

⚠ CAUTION

RISK OF INJURY OR DAMAGE TO EQUIPMENT

Always keep the keys in a secure place when not in use to prevent unauthorized operation of the equipment.

1.5.3 Emergency Stop (E-Stop)

When the equipment is used alone an Emergency Stop (E-Stop) button is fitted to the main control panel and to any remote control panels which may be connected to the equipment. E-Stop buttons are colored red with a yellow bezel. Pressing the E-Stop shuts down the equipment to a level where no hazards exist. The equipment does not restart when the E-Stop button is reset. Follow the normal start-up procedure to return to operational status.

1.6 Mechanical Hazards

Part handling equipment, robots, and machinery can move at high speeds and in an unexpected manner. Take the following precautions to prevent dangerous situations.

1.6.1 General

- Do not wear loose fitting clothing, tie, or jewelry which could become entangled in moving parts.
- Do not try to remove piece parts from a moving handling system.

1.6.2 Robots and CNC (Computer Numerical Control) Equipment

- Do not enter, or place any part of the body in, a robot cell or work enclosure when the equipment is in operation. Place the equipment in the Emergency-Stop (E-Stop) mode and ensure that all motion has stopped before accessing the cell or enclosure.
- If a teach pendant is provided, ensure that only the person carrying the teach pendant enters the cell or enclosure.
- Check the correct operation of the Emergency-Stop (E-Stop) button on a teach pendant before entering a cell or enclosure.
- Place the equipment in the Emergency-Stop (E-Stop) mode whenever the equipment is not in use.
- Position all controllers and teach pendants outside the movement envelope of the equipment in normal operating mode.
- Test any new or modified program at low speed for at least one full cycle.
- Ensure that all safety features, such as light curtains, door interlocks, pressure mats, and safety barriers, are in good condition and are working correctly by testing them every week, or more often if they are subjected to heavy usage.
- If a work cycle is interrupted, extra care must be taken when resetting the equipment and homing axes. Axes may move in an unpredictable manner. If there is any doubt that an unsafe

path may be followed by any axis, a manual reset and homing procedure must be carried out by trained personnel.

1.6.3 Special Precautions During Installation

- Ensure that only trained and qualified personnel are permitted within the work envelope of the equipment.
- Identify the work envelope of the equipment with floor markings, signs, and barriers.
- Eliminate areas where parts of the body may become trapped between moving and fixed parts of the equipment (pinch points).
- Provide sufficient room to permit safe teaching and maintenance procedures.

1.7 Environmental Hazards

1.7.1 Fire Hazard

If there is any doubt about the reactivity of a material, carry out a processing test on a small piece and have an assistant present to:

- Switch off the laser equipment.
- Stand by with a suitable fire extinguisher.

1.7.2 Isopropyl Alcohol (Propanol)

Isopropyl alcohol is used as a water displacing solvent for cleaning optics.

⚠ **WARNING**

Flammable - Irritant

Isopropyl alcohol is a colorless, flammable liquid. Effects of ingestion or inhalation are nausea, intoxication, depression of the central nervous system, headache, decreased blood rate, and coma. High vapor concentrations may cause eye injury and skin irritation.

Isopropyl alcohol is a health risk and explosive hazard. Vapor can travel distances to an ignition source and flash back. Observe the following precautions at all times:

- Keep the container tightly closed.
- Keep it away from sources of ignition.
- Avoid breathing the vapor and eye contact.
- Do not smoke in the vicinity of the solvent or its vapor.

If spilled, observe the following precautions:

- Evacuate the area of all unnecessary personnel.
- If the workplace exposure limit is exceeded, wear protective equipment.
- Wear safety glasses with side-shields at all times.
- Eliminate any ignition sources until the area is free from explosion or fire hazard.
- Do not smoke in the vicinity.
- Electrically ground all equipment when handling the product.
- Stop the leak or source of the spill, if possible and without risk of personal injury.
- Ventilate the area of the spill or leak.
- Using appropriate protective gloves (Nitrile rubber or Viton is recommended) and wearing splash-proof goggles, take up the spilled liquid with sand or other absorbent material and place it in sealed containers for disposal.

1.7.3 Methanol

Methanol is used as a degreasing solvent and is recommended for cleaning optics.

⚠ **WARNING**

Flammable - Poison - Irritant

Methanol is a colorless liquid. It is a flammable poison that burns with a blue, non-luminous flame. Its main toxic effect is exerted upon the nervous system, particularly the optic nerves and possibly the retina, which can progress to permanent blindness. The vapor is harmful and may be fatal or cause blindness if swallowed. Potential health effects may include irritation to eyes; irritation, dryness and cracking of the skin; and may also cause nausea, vomiting, dizziness, blindness or death.

Since methanol is highly flammable, the following precautions should be observed:

- Keep the container tightly closed.
- Keep it away from sources of ignition.
- Avoid breathing the vapor and eye contact.
- Do not smoke in the vicinity of the solvent or its vapor.

If spilled, observe the following precautions:

- Do not touch the spilled material.
- Stop the leak or source of spill if you can do this without risk.
- Ventilate the area of the spill or leak.
- Using appropriate protective gloves (Nitrile rubber or Viton is recommended) and wearing splash-proof goggles, take up the spilled liquid with sand or other absorbent material and place it in sealed containers for disposal.

First aid procedures for inhalation, eye contact, skin contact, and ingestion require immediate medical assistance.

1.7.4 Fumes

When the WaferMark® SigmaDSC NT System is used to mark coated wafer material, various by-products are generated during the marking process. The mark-point exhaust safely filters and exhausts dangerous by-products.

Always regard by-products of bare wafer marking as a potential health and safety hazard and take effective steps to prevent inhalation. Depending on the composition of the material being marked, airborne contaminates can include metallic fumes and dust, metallic oxide fumes, chemical and gaseous vapors.

Rely on one of the following control measures:

- Containment of processing by-products in a safety enclosure.
- Evacuation of processing by-products and gases.
- Personal protection worn by operators.
- Evacuation via exhaust ventilation.

The first two methods are preferred; personal protection is a last resort.

ANSI (Z136.1 - 1986) states that "personal exposure to toxic or carcinogenic materials must be maintained within permissible exposure limits by ventilation, enclosure, isolation, substitution, shielding or other appropriate engineering controls, or by proper utilization of personnel protective equipment".

1.8 Product Compliance

The WaferMark® SigmaDSC NT complies with Title 21, Code of Federal Regulations, Subchapter J, Part 1040 (21 CFR 1040), CFR 1040.10 and 1040.11, as applicable, and with EN 60825-1: 1994. Labels required under these regulations are depicted in the IEC Safety Label Identification drawing shown in Drawing No. 2950169-01 in the Addendum drawing package *WaferMark® SigmaDSC NT Service Manual* (P/N 273.491.00). The actual labels installed on the equipment will be in the language of the country where the system is located. The placement of labels on the equipment is shown in Drawing No. 2950188, provided in the Addendum drawing package.

The WaferMark® SigmaDSC NT conforms to applicable European Union directives. CE verification of compliance can be obtained from:

GSI Lumonics Attn: CE Compliance
60 Fordham Road

Wilmington, MA 01887
Tel: (978) 661–4300; FAX: (978) 988–9353

1.9 Training of Personnel

GSI Lumonics provides training for operators, service, and maintenance personnel. Personnel who have been trained in service and maintenance shall be limited to performing only procedures and tasks taught during the training course. All other tasks must only be performed by GSI Lumonics-certified service personnel.

GSI Lumonics can also provide additional or advanced training. Retraining is recommended periodically, and especially, if equipment is upgraded.

1.10 Conditions of Use

This laser equipment should only be used under the following circumstances:

- By properly trained personnel
- On approved materials
- Using approved processing procedures
- Using approved maintenance and servicing procedures
- Under approved conditions
- With due authorization.

1.10.1 Approved Process Materials

Approved process materials are those which present no hazard to personnel and do not cause damage to the equipment. Material toxicity, flammability, process by-products, etc. must be taken into account prior to laser processing. For information about material safety, contact the material supplier.

1.10.2 Approved Processing Procedures

Approved processing procedures are those which are not hazardous to personnel or to the equipment. Choice of procedures must take into account toxicity and flammability of the material, process by-products, and the arrangements for fume containment and extraction.

1.10.3 Approved Maintenance and Servicing Procedures

During maintenance or service of this equipment, it may be necessary to establish a temporary Class 4 (IV) Laser Controlled Area (LCA) and to take other control measures to prevent accidental eye and skin exposure to laser radiation. This is necessary for any of the following reasons:

- The laser source covers have been removed and the shutter interlock is defeated.
- The beam delivery security has been breached and the shutter or power supply interlocks have been defeated.
- The safety enclosure door is open or interlocked covers have been removed and the shutter interlocks have been defeated.
- Non-interlocked covers have been removed.

The site Laser Safety Officer is responsible for establishing the boundaries of the LCA and imposes controls which include but are not limited to:

- Area controls
- Access restriction
- Enforced wearing of personal eye protection
- Utilization of temporary barriers, shrouds, beam stops, etc.

A notice should be posted outside the LCA when the equipment is operating in Class 4 mode.

Barriers, shrouds, beam stops, etc. used to construct the LCA should be specifically selected to withstand direct and diffusely scattered laser beams.

1.10.4 Approved Conditions Satisfying Local, National, and International Safety Regulations

Approved processes must satisfy the requirements of applicable local, national, and international safety standards and statutory requirements relating to electrical, laser radiation, and health hazards. In addition, they must satisfy the requirements of the Laser Safety Officer and the local safety regulations.

1.10.5 Due Authorization

Authorization must be obtained from the following personnel to confirm that the proposed production, maintenance, or servicing procedure satisfies the necessary safety conditions:

1. A competent, authorized person having a professional qualification in an appropriate technical discipline.
2. The supervisor responsible for the working area.
3. The site Laser Safety Officer or an authorized GSI Lumonics employee.

2 General Description

The WaferMark® SigmaDSC NT laser wafer marking system provides a highly-advanced marking system for quickly and permanently identifying wafers throughout the semiconductor fabrication process. Three cassette stations and efficient robot handling provide a high throughput of wafer product of various wafer sizes. Precise computer software guides the process using an innovative diode–pumped laser design. The WaferMark® SigmaDSC NT System Handler/Control Cabinet is a completely self-contained package, including a self-contained water chiller unit, on a small footprint within a finely-crafted stainless steel enclosure (See Figure 2-1).

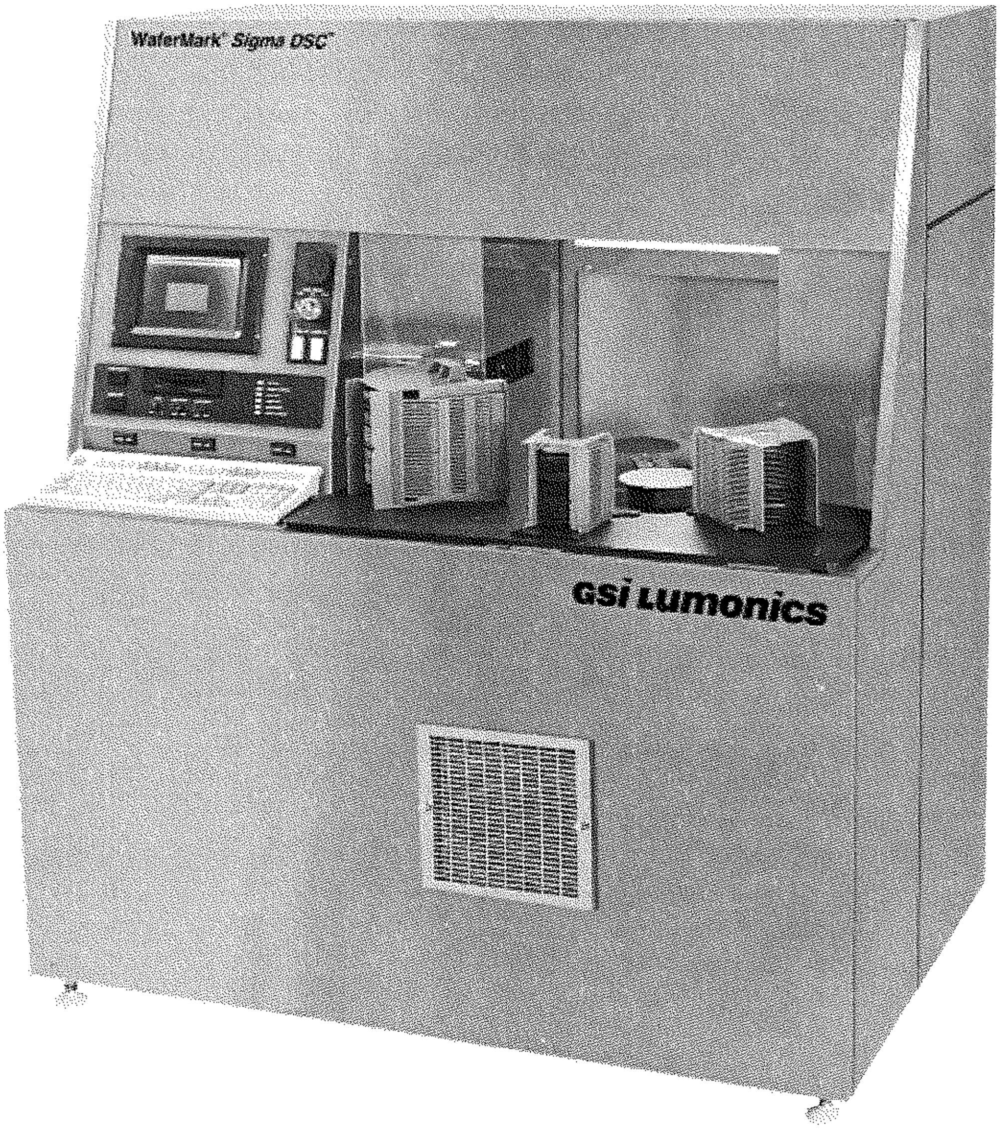


Figure 2-1 – WaferMark® SigmaDSC NT System

The WaferMark® SigmaDSC NT System can be loaded with as many as three cassettes, each containing up to 25 100 mm, 125 mm, 150 mm or 200 mm wafers. Under system control, the robot selects an individual wafer that is transported to the marking chamber and returned to the proper cassette slot after marking.

The WaferMark® SigmaDSC NT System provides the following controls and indicators to enable the operator to interface with the system.

- Operator Workstation
- Main circuit breaker
- E-Stop pushbuttons
- Signal tower/audible indicator (option).

The controls and indicators are described in this section.

In addition, this section describes the following major subsystems of the WaferMark® SigmaDSC NT System:

- Wafer Handling System
- Laser and Optic System
- Power Distribution Panel
- Marking Chamber
- Chiller Assembly

2.1 Equipment Specification

2.1.1 Utilities

Electrical:

Standard Connections:

208 VAC, single phase, 50/60Hz, 23 FLA

220 VAC, single phase, 50/60Hz, 22 FLA

240 VAC, single phase, 50/60Hz, 20 FLA

Optional Connections:

380 VAC, single phase , 50/60Hz, 13 FLA

416 VAC, single phase , 50/60Hz, 12 FLA

Vacuum:

635–732 tor @ 56.6 l/min.

63.5 — 76.2 cm (25– 30 in.) Hg at 2 SCFM)

$\frac{1}{4}$—in. diameter press-lock connection

Exhaust:

560 l/min. (20 CFM) flow rate max

32 mm (1.25–inch) diameter port

2.1.2 Weights

Weight (Total):

637 kg (1,405 lbs)

Weight (Load Distribution)

Load Point	Weight	% Total Weight
Right Front Foot	178 kg/393 lb	28
Left Front Foot	210 kg/464 lb	33
Right Rear Foot	159 kg/351 lb	25
Left Rear Foot	89 kg/197 lb	14

2.1.3 Dimensions

Dimensions:

1675 mm height x 1461 mm width x 987 mm depth

(66 inches height x 57.5 inches width x 38.9 inches depth)

2.1.4 Operating and Storage Environment

Operating Environment:

Ambient Temperature 12.8° - 29.5°C (55.0° - 85.0°F)

Humidity (relative) Non-condensing

Compatible with Class I Clean Room Requirements

Storage Environment:

Ambient Temperature 12.8° - 29.5°C (55.0° - 85.0°F)

Humidity (relative) Non-condensing

2.1.5 System Performance

Marking Performance

Fonts

Bar Code 412; IDM (or ID Matrix); SEMI OCR 5x9; Single Dot Matrix 9x17; Double Density Dot Matrix 10x18. Also available as options are Engrave OCR-A and Triple Density Dot Matrix 15x23. Other custom fonts are available upon request. Contact GSI Lumonics for additional information.

Position

Multiple mark group at any orientation on the wafer front surface within a 25 mm band around the wafer circumference.

Marking Process

Hardmark

Dot Diameter

60 – 90 µm

Dot Roundness

Major to minor axis ratio less than 1:1

Dot Depth

Dot depth varies, depending on customer needs. The general mark depth is 68 µm / 10 pulses

Throughput

1. For single pulse, 5 x 9 dot matrix, 12 characters (marking per *SEMI specification M12–0998*): 240 wafers/hour
2. For single pulse, 10 x 18 dot matrix, 12 characters (marking per *SEMI specification M12–0998*): 170 wafers/hour

NOTE: These throughput values are based on single pulse marking. For the marking described above, the throughput is much less. Also, see the Throughput under "Wafer Transport", below.

Workstation:

The workstation consists of:

- ***System Computer***: The system computer is an IBM-compatible PC with a minimum processor of 600 MHz with 3.5–inch floppy drive, CD-ROM drive and hard disk drive for storage for all system parameters.
- ***Software***: The WaferMark application software runs on a Windows® NT-based operating system, using operator-prompted pull-down menus. Format using flat panel monitor, trackball (pointing device) and a reduced-size keyboard. Barcode wedge device is optional.
- ***Diagnostics***: Complete system diagnostic indicators are displayed on the front panel, along with an emergency OFF (EMO) button and system keyswitch.
- ***Communications***: SECS II / GEM interface; optional.

Wafer-Handling

Wafer Size Range

For SigmaDSC: 100, 125, 150, and 200 mm (4-, 5-, 6-, and 8-inch).

For SigmaDSC300: 200 and 300 mm (8-inch and 12-inch).

Alignment

Optical alignment over the entire wafer size range with no hardware change over for both flatted and notched wafers.

Repeatability

±125μm (±.005 inches) in both X- and Y-axes relative to the primary fiducial.

Wafer Transport

Pick-and-place robot arm with dual vacuum wand (end effectors).

Throughput

For SigmaDSC: Up to 240 wafers per hour (marking per *SEMI specification M12–0998*) single pulse).

For SigmaDSC300: Up to 150 wafers per hour.

Sense and Receive Modules

Three load/unload cassette stations capable of performing no-work-over-work handling.

LASER AND OPTICS

Laser Type

Acousto-optic, Q-switched, TEMoo, Nd: YLF diode-pumped laser

- Maximum Output: 4 W
- Pulse Duration: CW/50 ns
- Wavelength: 1053 nm (standard)

Optics

Flat-field focusing lens

2.1.6 Precautions for Transport

The system contains sensitive electronic and optical components. ***Always*** use the:

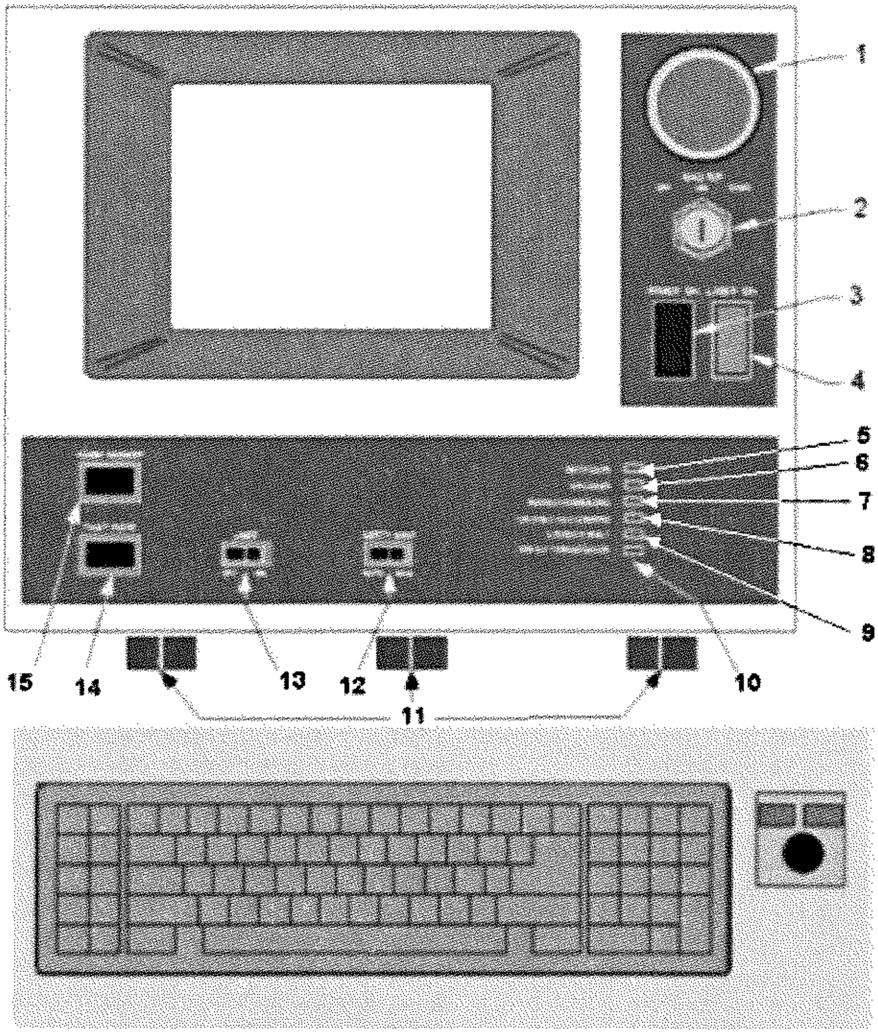
- Shipping restraints supplied with the system when moving any part of the system
- Transport tubes on the mark station to lift and move the station
- Rear of the main portal assembly to lift and move the unit.

For information or assistance, contact the local GSI Lumonics Regional Customer Center.

2.2 Operator Workstation

The operator workstation is where the operator initiates, controls and monitors all WaferMark® SigmaDSC NT operations. The workstation interfaces directly with the system computer. Major components of this module are the monitor, trackball, keyboard, E-Stop/keyswitch panel, and status and control panel. The status and control panel switches control wafer loading and laser operation; the indicators monitor the primary system functions for abnormal conditions or failures.

This section describes the function and operation of the controls and indicators provided at the operator workstation.



1 E-STOP pushbutton switch
When pressed, power is immediately removed from all system components. Note: This switch is intended for emergency use only–not for powering the system down under NORMAL conditions. Unnecessary use of this pushbutton can corrupt system data and job files.

2 MASTER OFF/ON/START three position key switch

1. In the OFF position, no power is available to any of the system components.

   Note: The key can only be removed when the switch is in the OFF *position.*
2. In the ON position, the power control relays check the status of the E-STOP circuitry and the positions of the

(non-energized) contacts on the main contactors, and the (power control) relays are then primed accordingly.

3. When momentarily turned to the START position, power is applied to all system components. (Remember that power to the laser will only be applied if the LASER switch was left in the ON position.) If the power control relays were ***NOT*** latched in the correct state when the keyswitch was in the ON position (due to a fault with the E-STOP circuitry or a welded contact on either of the main contactors), then power will not be applied to any of the system components.
4. When the keyswitch is released to the ON position, the power control circuits are latched and power is maintained to the system components.

   NOTE: Any time that the system is going to be powered down, first shut down the Windows NT program using the **Start** *bar.*

3 POWER ON indicator (green)
Lights when MASTER keyswitch has been set to START and the main contactors have energized, indicating that power is being applied to all system components.

NOTE: Power to the laser is dependent on the position of the LASER ON *switch.*

4 LASER ON indicator (blue)
Lights when the LASER switch is set to ON to indicate that the laser power supply could be powered on and that a hazard exists from the possibility that the laser may be lasing.

5 AIR FLOW indicator (inoperable)
The SigmaDSC NT does not contain an air filtration system; therefore, the light is inoperable.

6 VACUUM indicator
Lights to indicate that insufficient system vacuum has been detected by vacuum sensor. When lit, system marking will be suspended until the fault has been corrected.

7 WAFER HANDLING indicator
Lights to indicate that a wafer handling fault has occurred. When lit, system marking will be suspended until the fault has been corrected.

8 CASSETTE LOADING indicator
Lights to indicate a cassette loading fault. When lit, system marking will be suspended until the fault has been corrected.

9 LASER FAULT indicator
Lights to indicate a laser fault. This can be either coolant flow interlock, coolant temperature fault, coolant level interlock, shutter failed to open, warm-up timeout, current pulse width at max., or external interlock. When lit, system marking will be suspended until the fault has been corrected.

10 SAFETY INTERLOCK indicator

Lights to indicate that open interlocks have been detected in the laser head and/or marking chamber. When lit, system marking will be suspended until the fault has been corrected.

11 LOAD/UNLOAD switch/indicator
Three combination switch/indicators prompt the operator for cassette loading and show job progress and status.

Table 2-1 illustrates all combinations of the LOAD/UNLOAD *switch indicators and the required operator response or marking job status.*

12 SAFETY DOOR switch
Opens marking chamber safety door when set to MAN (Manual). In the AUTO (Automatic) position, safety door operation is software controlled.

Note: The MAN *position should only be used by trained maintenance personnel.*

13 LASER ON/OFFswitch
When set to ON, starts the Chiller and provides an enabling signal to the laser diode power supply (in the Laser Controller.) When set to OFF, the laser diode power supply is disabled and the Chiller is stopped.

14 FAULT CLEAR switch/indicator
Lights to indicate a detected fault; when pressed, generates a software reset which causes original fault condition to be re-examined. Indicator goes out if fault has been successfully corrected.

Table 2-2 illustrates system status for all combinations of the ALARM SILENCER *and* FAULT CLEAR *pushbutton switches.*

15 ALARM SILENCER switch/indicator
Silences audible alarm which sounds and accompanies the appropriate fault indicator when a detected fault occurs.

Table 2-2 illustrates system status for all combinations of the ALARM SILENCER *and* FAULT CLEAR *pushbutton switches.*

Figure 2-2 – WaferMark® SigmaDSC NT Operator Workstation — Controls and Indicators

Table 2-1 – LOAD / UNLOAD Pushbutton Indicator Status

Unload	Load	Required Action or Status
OFF	Flashing	Load cassette prompt; indicated action is for operator to load appropriate platform and press LOAD.
OFF	ON	LOAD has been pressed and the appropriate presenter platform is moving to the process position.
ON	ON	Marking in progress.
ON	OFF	Marking complete, appropriate presenter platform is moving to the load/unload position.

Table 2-1 – LOAD / UNLOAD Pushbutton Indicator Status

Unload	Load	Required Action or Status
Flashing	OFF	Operator remove cassette prompt.
Flashing	Flashing	Cassette loading fault; this condition should be accompanied by CASSETTE LOADING indicator.

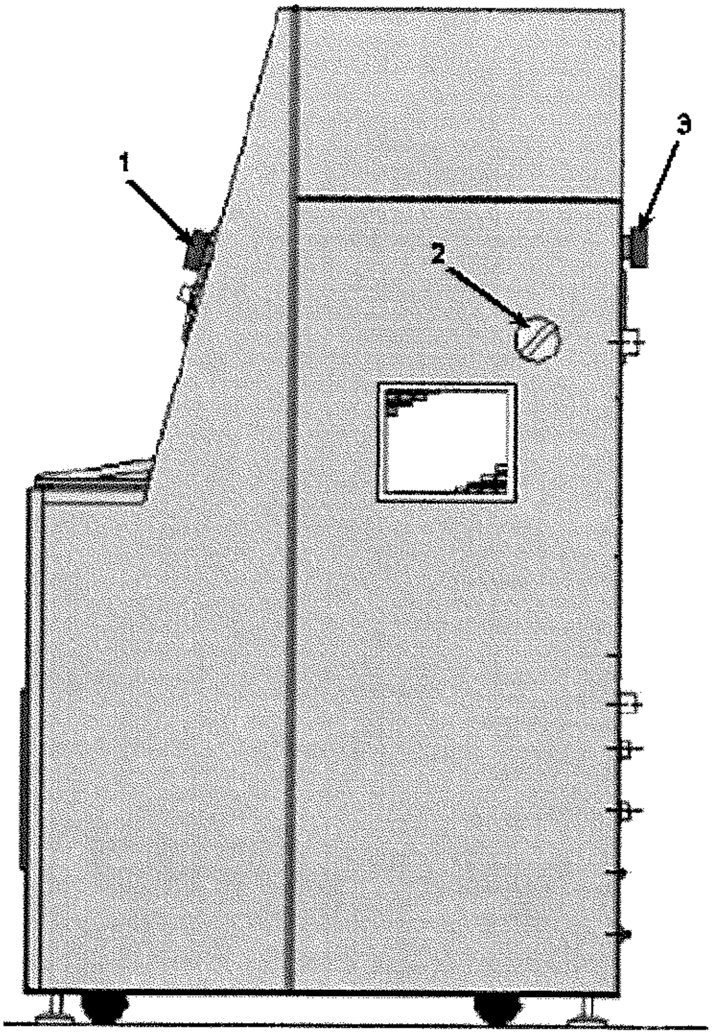
Table 2-2 – ALARM SILENCER and FAULT CLEAR Status

Alarm Silencer	Fault Clear	Status
Flashing	Flashing	Fault condition, system marking halted, alarm sounding.
ON	Flashing	ALARM SILENCER has been pressed to silence alarm, fault condition continues.
ON	ON	ALARM SILENCER and FAULT CLEAR have been pressed, fault condition continues.
OFF	OFF	Normal condition.

2.3 Main Circuit Breaker

The Main Circuit Breaker for the WaferMark® SigmaDSC NT system is located on the right-hand side of the Handler/Control cabinet, as shown in Figure 2-3. The Main Circuit Breaker is mounted on the Power Distribution Panel (PDP) inside the cabinet and protrudes through the right side access panel for use by the operator.

The Main Circuit Breaker is positioned to ON during system start up to apply power to the system and is positioned to OFF to shutdown the system (See Figure 2-4).



1 E-Stop Pushbutton Switch
Located on Operator Workstation

2 Main Circuit Breaker
3 E-Stop Pushbutton Switch
Located on rear left of system (looking from rear)

Figure 2-3 – Main Circuit Breaker and E-Stop Switches Locations (facing right side of system)

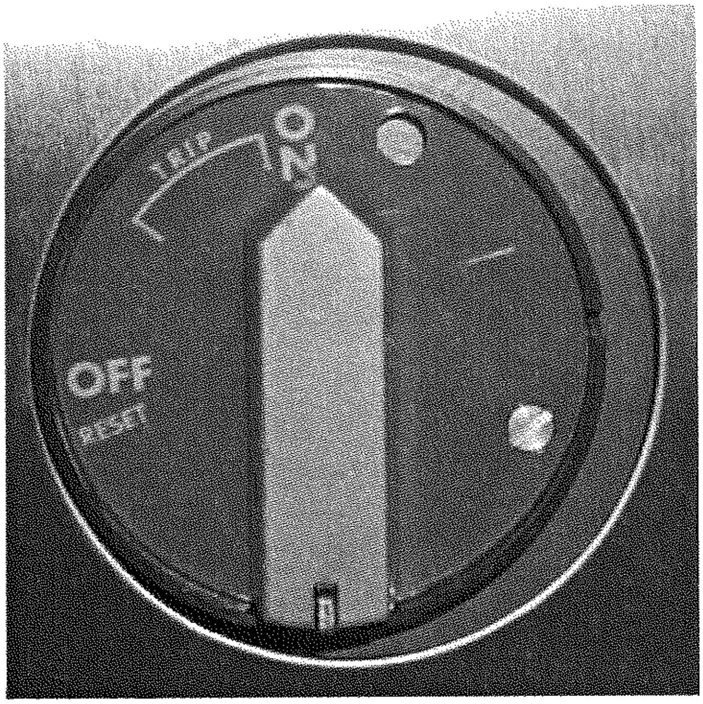


Figure 2-4 – Main Circuit Breaker

2.4 E-Stop Switches

The WaferMark® SigmaDSC NT System provides two Emergency Stop E-Stop) switches. One is located on the Operator Workstation at the front of the Handler/Control cabinet; the second E-Stop is located on the leftside rear of the cabinet when facing from the rear (See Figure 2-3).

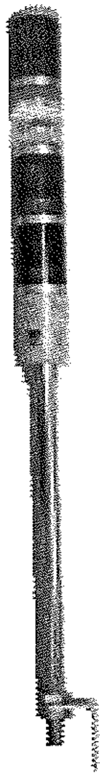
Pressing the E-Stop pushbutton switch in an emergency situation will turn off the laser and remove all power to the system, thereby immediately terminating any laser marking and wafer handling operations in progress.

Before the system can be powered on again, pull the activated E-Stop pushbutton to its full out (normal non-activated) position in order to re-arm the E-Stop circuit. Power on the system as specified in Section 3.2.1.

2.5 Signal Tower and Audible Indicator

A four-color signal tower (optional), when attached to the outside of the system, indicates the status of the system according to a predefined lighting sequence. The externally-mounted signal tower is connected to the system via plug (J3) at the rear panel of the Handler Marker enclosure. Some color variations are customer-specified.

Shown here is a typical signal tower configuration.



2.5.1 Signal Tower Operational Modes

SIGNAL_TOWER and Audible Indicator

To ensure the highest level of safety, the equipment is considered to be capable of producing laser output as soon as the power supply of the laser source is activated electrically. Depending on the configuration option, the signal tower illuminates, flashes, and/or sounds the audible indicator.

The keyword statement `SIGNAL_TOWER` (entered in the **Maintenance Startup** file) defines the operational mode for the signal tower lights controlled by the Grayhill board. The keyword can be set to either =0, =1, or =2. If the keyword is omitted from the file, the system defaults to Mode 0.

- Mode 0 is the mode described in Section 2.5.2. From the top, the colors in the four-color signal tower are red, amber, green, and blue.

  NOTE: This manual refers to the color "amber", but the amber light is sometimes called orange or yellow.
- Mode 1 is the mode described in Section 2.5.3. If using a four-color signal tower, this mode uses only the top three lights; the blue light is connected, but not used.
- Mode 2 is the mode described in Section 2.5.4. If using a four-color signal tower, this mode uses only the top three lights; the blue light is connected, but not used.

NOTE: The function associated with the "amber" and "green" lights differs by mode.

Refer to the appropriate Section (2.5.2, 2.5.3, or 2.5.4) for a full description of the signal tower operating mode used on your system.

2.5.2 Signal Tower Operational Mode 0

When operating in Mode 0, signal tower colors indicate the following functions:

COLOR	FUNCTION NAME	PURPOSE	FUNCTION
Red	Fault Light	Indicates whether the system is ready for normal operation or is reporting a fault or error condition.	• **Flashes** when an error is generated (either from a recoverable error or an unrecoverable fault.) • **Off** when the fault or error condition has been corrected and the **CLEAR** pushbutton has been pressed.
Amber	Run Light	Indicates whether the system is RUNNING or WAITING.	• **Flashes** when the system is IDLE or not processing a job. • **Flashes** while waiting for a LOAD or UNLOAD operation. (Blue light also flashes.) • **On** when the LOAD or UNLOAD request has been satisfied. • **On** while the system is processing a job.
Green	SECS Light	Indicates the state of the SECS interface.	• **Flashes** when SECS is operating in SEMI-AUTO mode and SECS_PAT_MODE=0 (See note below.) • **On** when SECS is operating in the FULL-AUTO mode. • **Off** when SECS is in the SEMI-AUTO mode and SECS_PAT_MODE=1 (see note below). • **Off** if the SECS mode is disconnected.
Blue	Operator Call Light	Indicates that an operator action is pending.	• **Flashes** while waiting for a LOAD or UNLOAD operation. (Amber light also flashes.) • **On** when a SECS S10 Terminal Request has been received or if a HOST Terminal Request arrives while the operator is editing. • **Off** when the LOAD or UNLOAD request has been satisfied. • **Off** when the SECS S10 Terminal Request has been completed.

When operating in Mode 0, the status of each colored light in the signal tower signifies:

COLOR	STATUS: ON	STATUS: FLASHING	STATUS: OFF
RED	—	Error	—
AMBER	Processing	Waiting	—
GREEN (`SECS_PAT_MODE=0`)	Full-Auto	Semi-Auto	Manual
GREEN (`SECS_PAT_MODE=1`)	Full-Auto	—	Semi-Auto (See Note)
BLUE	Operator Call	(Un)Load Request	(Un)Load Satisfied

NOTE: The GREEN signal tower light's status depends on the keyword statement `SECS_PAT_MODE` *in the Maintenance Startup file. If the keyword is set to =0 or the statement is not present, the light flashes when operating in the Semi-Auto mode (default). If the keyword is set to =1, the light is off in this mode. (This optional keyword allows the customer to choose how the light displays the SEMI-AUTO mode.)*

The following table shows the specific operation of each light in the four-color signal tower:

STATUS	FAULT (Error) RED	RUN (Normal) AMBER	SECS (commun-ication) GREEN	OPERATOR (Call) BLUE
Idle or Waiting	—	Flashing	—	—
Processing	—	On	—	—
Load or Unload Request	—	Flashing	—	Flashing
Load or Unload Satisfied	—	Flashing → On	—	Flashing →Off
Error Message	Flashing	—	—	—
Fault Cleared & CLEAR P/B Pressed	Flashing → Off	—	—	—
SECS S10 Terminal Request	—	—	—	On
Terminal Request Completed	—	—	—	On → Off
SECS Full-Auto	—	—	On	—
SECS Semi-Auto (SECS_PAT_MODE=0. See Note above)	—	—	Flashing	—
SECS Semi-Auto (SECS_PAT_MODE=1. See Note above)	—	—	OFF	—

The status conditions in the above table are:

Full-Auto

Operation is the same as the current WaferMark® standard with barcode reader messages active.

Semi-Auto

Limited input command from Host. (S1F1 & S2F21 mode change only). Barcode Readers are not active.

Processing

Running a job. Not idle.

Waiting

Waiting for load buttons to be pressed to start processing; or, waiting for cassettes to be unloaded during or after a job has finished.

Unload Request

Waiting for cassettes to be loaded or unloaded; or, the HOST has sent a Terminal message to the operator.

Operator Call

Waiting for cassette to be unloaded. Unload lights flashing.

Load Request

Waiting for load buttons to be pressed. Load lights flashing.

Error

An error has occurred requiring operator intervention. All recoverable errors and fault light conditions are reported in an error message.

NOTE: The colored lenses mounted on the standard four-color signal tower are in the order: red (top), amber, green, and blue (bottom). For convenience, this is the order that the colors are *shown in the tables above. However, if needed, the individual lenses on the signal tower (or the wiring to the lenses) can be altered to display the system status in a different color sequence to suit specific customer requirements.*

2.5.3 Signal Tower Operational Mode 1

***Light Tower and Audible Indicator*:** To ensure the highest level of safety, it is assumed that the equipment is capable of producing laser output as soon as the power supply of the laser source is activated electrically. Depending on the configuration options, the light tower illuminates, flashes and/or sounds the audible indicator.

In Mode 1 operation, only the top three lights are used when using a four-color signal tower. The blue light remains connected, but is not used. When operating in Mode 1, signal tower colors indicate the following functions:

COLOR	FUNCTION NAME	PURPOSE	FUNCTION
Red	Fault Light	Indicates whether the system is ready for normal operation or is reporting a fault or error condition. Depending on the condition, an audible alarm may also be sounded.	• **Flashing/audible** when an error message is generated (either from a recoverable error or an irrecoverable fault). Indicates failure or abort. Immediate operator action is required. • **On** after operator suppresses audible alarm acknowledging condition. Equipment is not capable. An alarm has been acknowledged, but not corrected. • **Off** when the fault or error condition has been corrected and the **CLEAR** pushbutton has been pressed. • Although not specific to Mode 1 operation in general, the following faults occur only when the system is running: *INTERLOCK* *POWER_LEVELS_OK* *DOOR_MANUAL_SWITCH*

COLOR	FUNCTION NAME	PURPOSE	FUNCTION
Amber	Operator Light	Indicates that an operator action is pending. Depending on the condition, an audible alarm may also be sounded.	• **Flashing/audible** while waiting for an operation (Green light also flashes) when a SECS S10 Terminal Request has been received or if a HOST Terminal Request arrives while the operator is editing. Generally, indicates an alarm is unacknowledged and requires an operator's action. • **On** after the operator surpresses an audible alarm, acknowledging the conditon. The alarm is acknowledged, but the LOAD or UNLOAD operation EQUIPMENT still NEEDS ASSISTANCE. • **Off** when the SECS S10 Terminal Request has been completed or when the LOAD or UNLOAD request has been satisfied.
Green	Run Light	Indicates whether the system is RUNNING or WAITING.	• **Flashing/no audible** when the system is idle or not processing a job. The alarm is acknowledged, but the equipment still needs assistance. • **Flashes** while waiting for a LOAD or UNLOAD operation. (Amber light also flashes.) • **On** while the system is processing a job or when the LOAD or UNLOAD request has been satisfied.
NOTE: Multiple lights can be active simultaneously, depending on the equipment state. The transition from Flashing to On for the red light and the amber light is activated when the operator silences the alarm button; this acts as a general acknowledgment of the fault or alarm condition.			

Each light indicates the following operating conditions:

- When operating in Mode 1, the status of each colored light in the signal tower signifies:

COLOR	STATUS: ON	STATUS: FLASHING	STATUS: OFF
Red	—	Error	—

COLOR	STATUS: ON	STATUS: FLASHING	STATUS: OFF
Amber	Operator Call	(Un)Load Request	(Un)Load Satisfied
Green	Processing	Waiting	—

The status conditions in the above table are defined as follows:

Processing

Running a Job. Not idle.

Waiting

Waiting for load buttons to be pressed to start processing; or, waiting for cassettes to be unloaded during or after a job has finished.

Error

An unrecoverable error has occurred, requiring operator intervention. All recoverable errors and fault light conditions are reported in an error message.

Operator Call

Waiting for cassettes to be loaded or unloaded, or the HOST has sent a Terminal message to the operator. System may be in an error state.

Load Request

Waiting for load buttons to be pressed. Load lights flashing.

Unload Request

Waiting for cassettes to be unloaded. Unload lights flashing.

	FAULT (Error)	OPERATOR (Call)	RUN (Normal)
STATUS	RED	AMBER	GREEN
Idle or Waiting	—	—	Flashing
Processing	—	—	On
Load or Unload Request	—	Flashing	Flashing

STATUS	FAULT (Error) RED	OPERATOR (Call) AMBER	RUN (Normal) GREEN
Load or Unload Acknowledge	—	On	Flashing
Load or Unload Satisfied	—	Off	On
Error Message	Flashing	—	—
Acknowledged Error	On	—	—
Fault Cleared & CLEAR P/B Pressed	Off	—	—
Terminal Request	—	Flashing	—
Terminal Acknowledge	—	On	—
Terminal Request Completed	—	Off	—

2.5.4 Signal Tower Operational Mode 2

When operating in Mode 2, signal tower colors indicate the following functions::

COLOR	FUNCTION NAME	PURPOSE	FUNCTION
Red	Fault Light	Indicates whether the system is ready for normal operation or is reporting a fault or error condition. Depending on the condition an audible alarm may also be sounded.	• **Flashing /audible** when an error message is generated (either from a recoverable error or an irrecoverable fault). Indicates failure or abort. Immediate assistance is required. • **On** when the Host sends an S2F41 Alarm Light command with the parameter set to ON. This is the only way a steady state ON condition can occur. The command does not take effect if the light is already flashing; i.e., a fault is active. If a fault occurs while the light is steady ON due to a Host command, the Host control is ignored. • **Off** when the fault or error condition has been corrected and the **CLEAR** pushbutton has been pressed, or an error condition does not exist but the Host sends an S2F41 (no Alarm Light) command with the parameter set to OFF. • Although not specific to Mode 2 operation in general, the following faults occur only when the system is running: *INTERLOCK* *DOOR_MANUAL_SWITCH* *POWER_LEVELS_OK*

COLOR	FUNCTION NAME	PURPOSE	FUNCTION
Amber	Operator Light	Indicates an operator action is pending.	• **Flashing** while waiting for a LOAD operation, when a Host Terminal Request has been received, or if a HOST Terminal Request arrives while the operator is editing. • **On** when a GSI Lumonics trained and certified technician is performing maintenance. Maintenance consists of either having the laser enclosure cover interlock open or performing some action within the Maintenance Menu. • **Off** when LOAD request the SECS S10 Terminal Request or the Maintenance operation has been completed.
Green	Run Light	Indicates the system is RUNNING or WAITING.	• **Flashing** when an UNLOAD is pending a job may have completed or may still be in progress (for multiple cassette jobs). • **On** while the system is processing wafers; no UNLOAD pending. • **Off** when the system is IDLE and no UNLOAD is pending.

NOTE: Multiple lights may be active simultaneously, depending on the equipment state.

When operating in Mode 2, the status of each colored light in the signal tower signifies:

COLOR	STATUS: ON	STATUS: FLASHING	STATUS: OFF
RED	Host Control	Error	Host Control No Error
AMBER	Maintenance	Load Request	Load Satisfied Not Maintenance
GREEN	Processing	Unload Request	Idle Unload Satisfied

The status conditions in the above table are defined as follows:

Processing

Running a Job. Not idle

Error

An error requiring operator intervention. All errors and fault conditions are reported in an error message.

Load Request

Waiting for load buttons to be pressed. Load lights flashing.

Unload Request

Waiting for cassettes to be unloaded. Unload lights flashing.

The following table shows the specific operation for function and color for each light when operating in Mode 2:

STATUS	FAULT (Error) RED	OPERATOR (Call) AMBER	RUN (Normal) GREEN
Idle or Waiting	—	—	—
Processing	—	—	On
Unload Request	—	—	Flashing
Load Request	—	Flashing	—
Fault condition	Flashing	—	—
Fault Cleared & CLEAR P/B Pressed	Flashing → Off	—	—
Host Command (S2F41, On) and no Faults	On	—	—
Host Command (S2F41, Off) and no Faults	On → Off	—	—
Maintenance Terminal Request	—	On	—

Signal Tower Light Control by Host

The S2F41 Host Command allows the Host to control the FAULT light when no faults are present. If a fault is present, the command response from the equipment will be NOT NOW. The signal tower command has been generalized to work with more than just the FAULT light by introducing the Light Position parameter. At this time, however, only position 1, the FAULT light position, will be accepted; any other position will generate an error response with a bad parameter value indicator. For further information, please refer to the

WaferMark® NT GEM/SECS Interface User's Guide (P/N 273.495.00).

See Table 2-2 for a description to reset a fault condition.

2.6 Wafer Handling System

The Wafer Handling System automatically loads and aligns wafers to be marked, and unloads wafers after marking has occurred. The main components of the Wafer Handling System are the cassette presenters, robot, and wafer aligner. Robotic movement and wafer alignment are controlled by the Robot and Aligner Controllers, respectively.

2.6.1 Cassette Presenter

In the WaferMark® SigmaDSC NT configuration, the cassette presenter consists of three loading platforms (1, 2 and 3). Each platform accepts a standard H-bar cassette containing as many as 25 silicon wafers (100 mm, 125 mm, 150 mm, and 200 mm). Wafers to be marked are selected from the cassette(s) and returned after marking.

As a cassette is loaded or unloaded, sensors on each loading platform generate status signals indicating which platform(s):

- have mounted cassettes
- are in-process (i.e., are being addressed by the robot)
- are ready for loading.

The computer causes the appropriate LOAD/UNLOAD indicators at the Operator Workstation to light or flash to indicate each platform's status.

2.6.2 Robot

The robot selects and transports individual wafers from a platform-mounted cassette to the aligner located in the marking chamber. After marking, the robot retrieves the marked wafer and returns it to the specified cassette.

During operation, two end-effectors mounted on top of the robot arm handle two wafers simultaneously; one wafer is held ready to be inserted into the marking chamber as soon as the wafer in the chamber has been marked and removed. A vacuum seal between the wafer and end-effector surface allow wafers to be picked up, retained, and released during the handling process.

2.6.3 Aligner

The aligner is a self-contained unit located inside the marking chamber. It receives and positions each wafer for marking in the desired area. The robot places each wafer on an aligner rotary chuck prior to marking. The chuck then rotates the vacuum-held wafer while a CCD sensor determines the wafer positional eccentricity and offset and locates its reference mark.

2.6.4 Vacuum System

A vacuum system in the Handler/Control cabinet distributes externally-supplied vacuum to the cassette presenter, robot, and marking chamber components of the Wafer Handling System. These components use the vacuum to rotate the cassettes on the (optional) movable presenter system, secure the wafer to the end effector, operate the safety door, and hold the wafer during aligning.

A vacuum gauge and preset vacuum sensor on the Power Distribution Panel monitor the system vacuum level. The sensor generates a vacuum fault signal which causes the VACUUM indicator on the Operator Workstation to light when system vacuum falls below the preset level.

2.7 Laser and Optic System

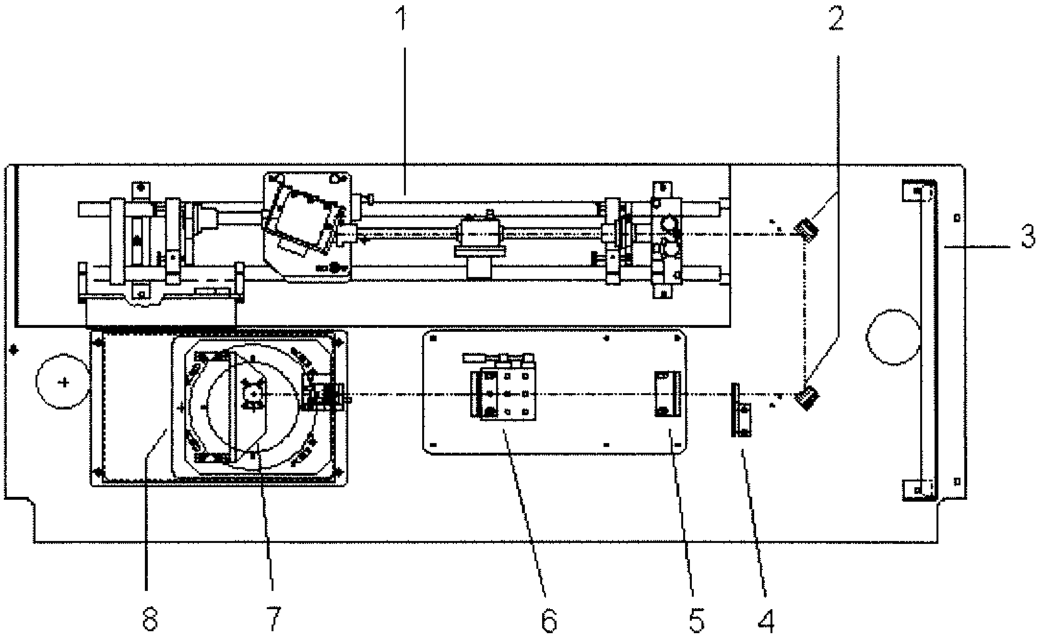
The integrated Laser and Optic System generates, modulates and directs the laser beam during wafer marking. Various optic elements in the optic system expand, stabilize, focus and steer the beam. The Laser Controller directs and controls the laser during operation. The main components of the integrated Laser and Optic System are descirbed below.

2.7.1 Laser Rail

The integrated laser rail and optic assembly is enclosed in a compartment at the top of the Handler/Control Cabinet. The laser rail is accessed by raising the hinged cover. This breaks the interlock safety switches, preventing any further laser operation.

The major components housed in the enclosure (see Figure 2-5) are the:

- Laser assembly
- Beam delivery optics, and
- Galvo scanners.



1	Sigma 100 Laser
2	Turning Mirrors
3	Beam Stop
4	Slow Shutter
5	100 mm Lens
6	100 mm Lens on Micrometer Slide
7	Flat Field Lens
8	X, Y Galve Scanners

Figure 2-5 – Laser and Optic System Layout [!!Drawing To be replaced!!]

2.7.2 Laser Assembly

The Laser assembly contains the following components:

- Energy Module
- Rear Optic and Mount
- Current Modulator
- Pumping Chamber
- Q-Switch
- Front Optic and Mount
- Beam Shutter

The Laser assembly components are set by a GSI Lumonics trained and certified service person to control the operation and function of the laser. Refer to Section 2.1.5.

2.7.3 X and Y Galvo Scanners

The X and Y galvanometric scanners control the actual movement of the lasing beam over the wafer surface. The X and Y galvanometric scanners move the laser beam horizontally and vertically during marking under control of positioning signals from the System Computer (see Figure 2-5).

2.7.4 Flat Field Lens

The flat field lens is the last element in the optic chain before the lasing beam enters the marking chamber (See Figure 2-5). The lens expands the area in which the beam can be focused to a 7 x 7 inch field.

2.7.5 Beam Path

As the laser beam exits from the laser rail, it is turned 180° (in the horizontal direction) by two turning mirrors—each set 90° apart (see Figure 2-5). The beam then passes through two focusing lenses which expand and collimate the beam. The output from the focusing lenses is deflected by two turning mirrors onto the X galvo mirror, then to the Y galvo mirror. The beam then passes through the flat field lens to the work surface. Any rotational motion of either the X or Y galvanometric scanner will deflect the laser beam to produce the required mark on the wafer.

2.8 Power Distribution Panel

Power is distributed throughout the system from the Power Distribution Panel (PDP), which is mounted on the right-hand side of the Handler/Control cabinet. The components within the PDP perform the following functions:

- Distributes AC power to the electronics bay.
- Provides filtered power to the Robot and Aligner Controllers, system marking computer, and the Laser Controller.
- Provides major system interface between the system computer and system discrete functions and devices
- Provides 24 VDC Power supply for the system interface board
- Interfaces the WaferMark® SigmaDSC NT System with optional red, amber, green, and blue Signal Tower lights.
- Provides a vacuum gauge for display of externally-supplied vacuum pressure. Provides the vacuum sensor for sensing when the vacuum level is below acceptable limits
- Provides adjustable vacuum solenoids drive the presenter and safety door pneumatic cylinders.
- Distributes 115 VAC to the +24 VDC Power Supplies, Marking Engine, Monitor, Laser Controller, Robot, Aligner, and Laser Diode Module.
- Distributes +24 VDC supplied from the +24 VDC Power Supply for component control.

2.8.1 Power Control

The main power cable for the equipment is connected to the Main Circuit Breaker, which is located near the top, right-hand side of the Power Distribution Panel. When the Main Circuit Breaker is turned on, input power at 208, 220, 240, 380, or 416 VAC is routed through an RFI filter to a step-down transformer that transforms the voltage to a nominal 115 VAC for system use.

At this point, the distribution of power to the WaferMark® SigmaDSC NT system is controlled by the 3-position MASTER keyswitch on the Operator Workstation.

2.9 Chiller Assembly

The closed-loop Chiller Assembly circulates coolant through the Laser Assembly in order to to maintain the laser diodes at a constant temperature and to remove excess heat from the Laser Assembly.

The Chiller Assembly is mounted on the base of the Handler/Control cabinet. A pressure relief valve is located on the unit to protect the system from excess pressure. The Chiller is also equipped with a drip tray to collect any coolant leakage.

In the event a coolant level sensor detects the level of coolant in the chiller reservoir is below the level sensor, the system generates a coolant level fault which will stop the laser and light the LASER FAULT indicator on the Operator Workstation.

In the event a coolant temperature sensor detects the coolant is not at its required temperature, a coolant temperature fault is generated by the system,which will stop the laser and light the LASER FAULT indicator on the Operator Workstation.

In the event a coolant flow sensor detects that the coolant flow has dropped below a level which is adequate to protect the laser diode module, a coolant flow fault is generated by the system,which will stop the laser and light the LASER FAULT indicator on the Operator Workstation.

2.10 Marking Chamber

The marking chamber provides an enclosed, controlled area for wafer marking. The chamber contains the aligner.

2.11 Air Flow System

The mark-point exhaust system runs from the marking chamber to the outlet at the rear of the Handler/Control cabinet and uses 1.125-inch (inside diameter) steel tubing. The mark-point exhaust external extraction system requires a flow rate of 20–60 CFM (566–1700 L/min) and vacuum at greater than 2 in of H2O.

NOTE: For external connection to the vacuum exhaust system, GSI Lumonics highly recommends the use of the same material.

2.12 Power Supply

The system requires grounded service to maintain safe, clean and stable power. The system power transformer provides a variety of power selections as specified by Section 2.1.1 Electrical Power.

2.13 Beam Delivery

The laser beam is directed through a series of focusing lenses, precision turning mirrors, and galvos to reflect the beam to the wafer target positioned on the aligner.

2.14 Work Handling

A cassette with up to 25 wafers can be placed into one of three presentation stations. On command, the robot picks a wafer from a slot in the cassette and places it in the aligner. The aligner balances and orients the wafer. The marking process takes place while the wafer is on the aligner chuck in the marking chamber. The galvos precision and aligner accuracy hold the marking process within a very tight tolerance. After the marking, the robot removes the wafer and returns it to the cassette slot.

2.15 Machine Control

The system performs its various sequential required tasks under the direction and control of the WaferMark® SigmaDSC NT software. The operator controls the system hardware by using the system software **Main** and **Edit** menu selections.

3 Operation

The Operation section documents the functional operation of the WaferMark® SigmaDSC NT system by identifying the controls and describing the setup procedures, security levels, modes, and options. In addition, this section defines the Marking Queue, System Files, and Marking Dot Matrix and describes the coordinate systems for the Text, Wafer, Robot, and Aligner.

3.1 System Features

The WaferMark® system features are:

1. Five levels of operator security: three specified levels and two customer-selectable levels (unspecified).
2. Jobs are entered into a job queue for marking in sequential order.
3. Marking is initiated for a specific count of wafers.
4. The handler can be operated in either the selected Simplex mode (same wafer source and destination) or Duplex mode (different wafer source and destination).
5. Pull-down menus, overlaid windows and dialog boxes provide ease of operation. For most screen displays, the user is prompted for data in various fields.
6. Operating parameters, system configuration, data cassette configurations, and security access can be changed via on-screen menus.

3.2 System Power On and Off Procedures

The following procedures contain instructions for powering on the system in preparation for laser marking and powering off the system when marking is complete. Also included are instructions on how to shut down the system during an emergency.

3.2.1 System Power On Procedure

To initialize the WaferMark® SigmaDSC NT system from a shutdown condition:

Procedure:

1. Verify that the MASTER key switch and LASER switch on the Operator Panel are both set to OFF.
2. If the system circuit breaker on the right-hand side of the system is OFF, turn it to ON and turn on any other required utilities.
3. Turn the MASTER key switch on the Operator Panel to ON, then momentarily turn to the START position. Verify that the green POWER ON indicator on the operator panel is lit.
4. Turn the LASER switch to ON. The Chiller pump starts and begins circulating the coolant to the laser.
5. Once the Windows NT Operating is booted, you must log in with administrative access.

   NOTE: It takes a few minutes for the equipment to initialize. When the software is initialized, the system start-up sequence is complete.
6. Perform marking operations using test wafers.

   NOTE: When powering down the system, first shut down the Windows® NT program from the Windows ***Start*** *menu.*

3.2.2 System Power Down Procedure

Power down the system using the following steps in order:

1. Terminate the WaferMark® User Interface program by selecting the **Main** menu, then the **Exit** command.

   NOTE: Only an Engineer can initiate this operation.
2. Shut down the Windows NT operating system from the **Start** button.

   NOTE: Whenever powering down the system, first power down the Windows NT operating system from the **Start** *button. Do NOT turn off the Windows NT computer power until the computer's monitor screen shows that the Windows NT shutdown is complete. Also, shut down any PC attached to the system before powering down.*

⚠ **CAUTION**

Risk of Damage to System Computer and the Wafer

ONLY use the E-STOP push-button to shut down the system in an EMERGENCY. Pressing the E-STOP will immediately remove all power from the system. This causes the vacuum to cease, which could result in damage to the wafer currently on the robot arm. It also causes the PC to shut down, which may result in the loss of job information or damage to software files. As a result, the Windows NT-based computer could have problems restarting. To ensure the ability to resume normal production following any emergency shutdown, BACKUP YOUR PC PROCESSING FILES AS FREQUENTLY AS YOUR FACILITY MANAGEMENT DEEMS NECESSARY. Additionally, it may be necessary to reteach the robot following an emergency shutdown.

3. On the Operator Panel, turn the LASER switch to OFF.
4. Turn the MASTER key switch to OFF. Verify that the green POWER ON indicator goes out; then remove the key.
5. Set the system circuit breaker on the right-hand side of the Handler/Control cabinet to OFF.

⚠ **CAUTION**

Do NOT use the E-Stop pushbutton to shut down the system except in an EMERGENCY.

Pressing the E-Stop will immediately remove all power from the system and may result in the loss of job information or damage to software files.

3.3 Emergency Power Off

If an emergency situation occurs during WaferMark® SigmaDSC NT System operation, use either of the following methods to eliminate the crisis:

Procedure:

1. Press the (red) E-STOP pushbutton. (One E-STOP pushbutton is located on the Operator Panel and another is located at the rear of the Handle/Control cabinet.)
2. Turn the Main Circuit Breaker on the right-hand side panel of the Handler/Control cabinet to OFF.

Both methods immediately turn off the laser and remove power to the WaferMark® SigmaDSC NT System.

3.4 User Interface Operations

The User Interface program for the WaferMark® allows the user to control the major Job Operations and Marking Operations functions of the system.

NOTE: Throughout this manual, all commands and functions referenced are in the User Interface program unless otherwise noted.

The Job operations functions are:

1. Select jobs for marking.
2. Specify the marking text, font, size and position.
3. Initiate and control the actual marking process.
4. Edit wafer information specified in a job.
5. Specify or alter the system configuration.

The Marking operations functions are:

1. Perform sample marking.
2. Enable the auto marking mode.
3. Adjust the general marking parameters for the system.
4. Perform system marking calibration.

3.5 Operating Security Levels

Five different levels of operating security are available for the WaferMark User Interface; three are assigned and two can be specified by the customer:

1. Production Operator (PO)—lowest privileges.
2. Customer-specified 1 (undefined).
3. Supervisor Operator (SO)
4. Customer-specified 2 (undefined).
5. Engineer Operator (EO)—highest privileges.

The level of security privileges determines the individual operator's access to commands from the available menus or user screens. The names, passwords and security levels of all system operators are maintained in the **USERINFO.FIL** security file, which can be created or modified by the customer using the procedure provided in Section 4.4.

During system operation, the program continually verifies that the operator, when choosing a particular menu or user screen, has adequate authority to perform that function or operation. The results of a compare between the security level of the logged-on operator and the security level assigned by the program to the software function selected determines whether access to that operation is allowed or denied.

NOTE: The security access feature is implemented only if a **USERINFO.FIL** *file exists in the program directory. If required, the customer may waive all restrictions to the operating system by simply deleting or renaming the file.*

3.5.1 Security Level Operating Functions

The security level determines which operating system functions are accessible.

Production Operator:

File - Clear Message.
File - Log Off
File - Exit < **Alt+F4**>.
JobQueue - Add Job.
JobQueue - Delete Job.
Control - Mark All <**F3**>.
Control - Stop/Pause <**F4**>.
Control - Go/Resume <**F5**>.
Control - Quit <**F6**>.
Control - Transfer <**F7**>.
Control - Abort <**F8**>.
Control - Sample <**F9**>.

Supervisor Operator:

All functions available to the Production Operator (above).
Control - Reset.
SECS Terminal (if implemented).
SECS Mode (if implemented).
Edit File - New **Ctrl+N**.
Edit File - Open **Ctrl+O**.
Edit File - Clear Message.
Edit File - Log Off.
Edit File - Exit.
Edit JobQueue - Add Job.
Edit JobQueue - Delete Job.
Maintenance - Barcode Data.
Maintenance - Serial Numbers.
Maintenance - Laser Power.
Maintenance - ID Matrix.
Maintenance - Loader.

Engineer Operator:

All functions available to the Supervisor Operator.
Maintenance - Robot
Maintenance - Aligner
Maintenance - Marker
Maintenance - Presenter Data
Maintenance - Calibrate
Maintenance - Startup Data
Maintenance - Cassette Definitions
Maintenance - Users
Maintenance - Reader and Optic Options.

Customer-specified 1:

Customer can assign levels (undefined).

Customer-specified 2:

Customer can assign levels (undefined).

For additional information regarding security and access control, refer to Section 4.4.

3.6 Marking Queue

The User Interface provides a Marking Queue that consists of a FIFO (first-in, first-out) list of jobs loaded by the operator in preparation for marking. Jobs are listed by their filenames. The text column shows the mark text for the first of the mark group in the job file or by the first 18 characters of job text. After the operator has selected <F3>, **Mark All** command from the **Control** menu, the flashing LOAD indicator prompts the operator to load a cassette. When a cassette has been set in place, the operator presses the LOAD button, the handling and marking sequence begins, and the indicator stops flashing; thereafter, this process is repeated for each queued job. All jobs are marked in the order that they appear in the queue. Additional jobs can be added to the queue while marking is in progress.

NOTE: No mechanical changes are required to change wafer sizes. Simply load the wafers onto the system and verify that the process job specifies the size of wafer placed onto the system.

Marking terminates when one of the following conditions occurs:

1. On completion of marking each job in the queue.
2. On completion of marking the final job in the queue.
3. When the operator aborts the sequence after pressing the **LOAD** button.

Marking can be interrupted (and can also be resumed) if one of the following conditions occurs:

1. The operator pauses the system.
2. A system fault occurs.

3.7 System Files

Handling and marking operations use several different software files that are either created and modified by the user or installed by the factory. The functions performed by these files are described in the following sections.

3.7.1 Maintenance Startup Data Files (FACTORY.SET File)

GSI Lumonics initially creates the **FACTORY.SET** file (also referred to as the **Maintenance Startup Data** file). This file is loaded during the software initialization sequence after power has been applied to the system. The file contains information in the form of keywords that define the basic setup and operating mode of the system.

The customer can alter the initial startup conditions by modifying the appropriate keywords listed in the file, using the **Startup data** command in the **Maintenance** menu. Appendix A provides a complete list of keywords that can be included in the **Maintenance Startup Data** file, and that are available for alteration.

3.7.2 User Information File

The User Information (or Security) file is an optional file that restricts access of operating personnel to particular functions of the system. If the file exists, the program reads the information in the file during the software initialization sequence. The Engineer Operator can create or modify this file by using the **Users** command in the **Maintenance** menu. For further information on implementing this feature, refer to Section 4.4, Security and Access Control.

3.7.3 Cassette Data File

GSI Lumonics has created the cassette data that is loaded during the software initialization sequence. The file contains definitions of all types of wafer cassettes that can be employed on the system. For each type of cassette, the information defines the wafer size, number of slots, pitch, offset, home position, and a descriptive name of the cassette. The user specifies a descriptive name when creating a marking job; subsequently, the associated information controls the handler robot motion during marking operations. If necessary, the Engineer Operator can modify this data file by using the **Cassette Definitions** command in the **Maintenance** menu. This may be necessary when different types of cassettes are used on the system that not already listed in the file. For further information, refer to Section 4.9.7.

3.7.4 MARKER.SET File

GSI Lumonics provides a preliminary **MARKER.SET** file; however, to suit particular marking requirements, the Engineer Operator might modify the file using the **Marker** command in the **Maintenance** menu. The file contains a master list of all marker parameters and general variables used during the marking process by any job loaded from disk.

The marker uses general variables to control the laser throughout the job marking process. The marker employs the parameters to control galvanometer motion and timing, the font style and the number of marking passes. Parameters are divided into separate Parameter Sets with different values specified in each Parameter Set; only those Parameter Sets that are specified in the job file are used during a marking process.

3.7.5 Robot Calibration File

GSI Lumonics has created the Robot Calibration file and is loaded during the software initialization sequence. The handler controller directs the motion of the robot assembly using the data in the file. Calibration data specifies the desired speed and acceleration of the robot for the three axes (R, T, Z), and the physical distances that the robot assembly and arms must travel to arrive at the designated reference locations of the cassette stations and the aligner.

If necessary, the robot calibration file can be modified using the robot command in the Maintenance menu of the User Interface. Typically, certain values may require alteration following a major modification or replacement of a handler or robot assembly component.

Note: Modifying the Robot Calibration file should only be performed by factory-trained personnel or by a qualified field service representative, on the advise of GSI Lumonics.

3.7.6 Marker Calibration File

GSI Lumonics created the **Marker Calibration** file which is loaded during the initialization sequence. The file contains parameters that affect the laser shutter timing, galvanometer calibration setup, and other marker timing signals. This screen is used only to calibrate certain parameters of the system. There are no specific requirements for modifying these parameters when components are replaced. Use the **Calibrate** command in the **Maintenance** to modify these values.

NOTE: Only GSI Lumonics field service personnel should make changes to the Marker Calibration file.

3.7.7 Job File

The user creates the Job file when the system is fully initialized. Once created, any job file can be recalled and used to mark a series of wafers or can be altered using the program editing features.

A job file contains certain information that describes the wafer handler and marking text. The following is an example of a typical job file:

Information	Definition
wafermark_SC:22,0,0,7854.55,1997042212274600,2001083114540850	WaferMark® program designation only.
options:0,1000,0,1,1,0,0,1,1,1,0,0,T7,0,1	Job options
thickness:1,755,745,5	Thickness options
mvmt:1,0,0,0,1,0,0,0	Transfer from stations n,n,n to x,x,x. The valid movements depend on the number of presenters.
lot:0,25	Current lot count, max lot count.
wfr:0,0,0,0,0,0,0	Size, Type, Origin, Rotations.
unit:1	Units, English or Metric.
name:	First text line identifier.
curr:ABC[492]	Last text line last marked.

Information	Definition
tmpl:ABC[492]	First line original text template.
char:0,1.626,0.813,1.422,0.010,0,1.200,3.100,0.000,0,0,0.000,0,0,0	First line size (mm) and position information.
positions:1020,130,155,0,0,0,0,0,0,0,0,0	Position Coordinate Type

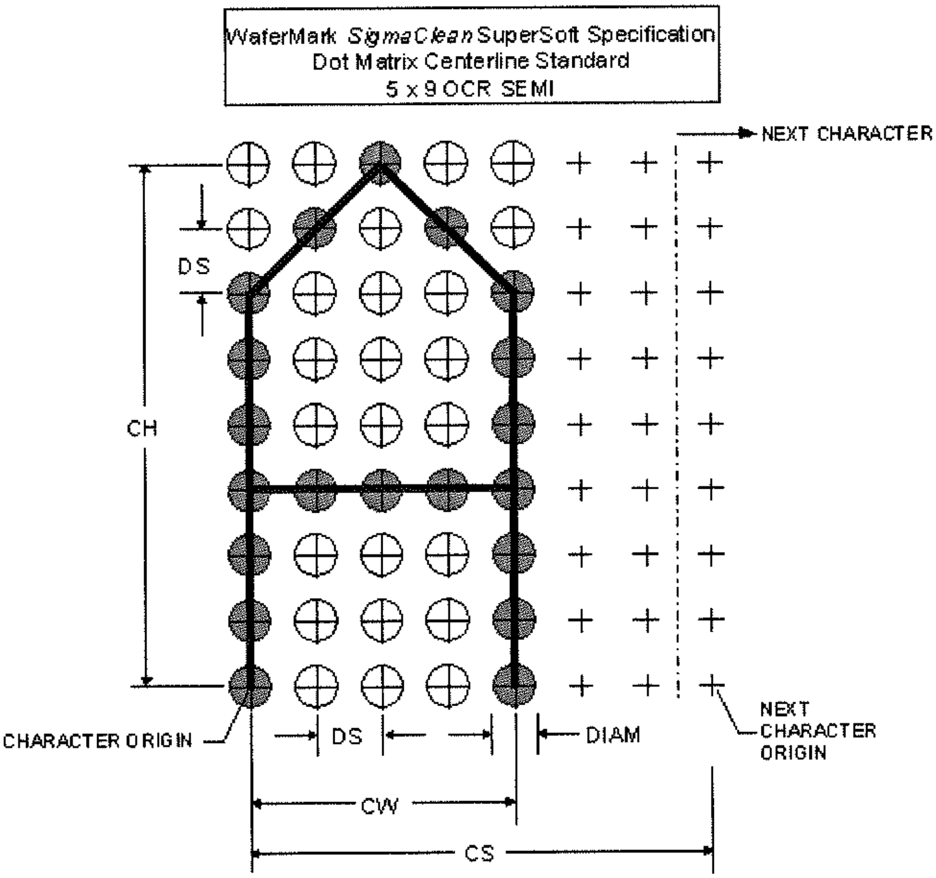
3.8 Marking Dot Matrix

The selected character font governs character generation via a dot matrix process for the marking process. The table lists a typical assortment of dot matrix combinations available for the marking process.

NOTE: The dot diameters given in Figure 3-1, Figure 3-2, and Figure 3-3 are not part of the IBM or SEMI spec; they are representative of typical values only. Change the illustrative total character height, character width, and character spacing values to conform to your system's actual measured value of the dot diameter.

Dot Matrix:	
DM9X17V3.FON	(9 x 17)
DMDSMI60.FON	(5 x 9) SEMI STANDARD DOT MATRIX
DMDSMI62.FON	(10 x 18) OCR SEMI DOUBLE DENSITY
Barcode:	
BBC412A2.FON	(12 x 22) SEMI SPEC
BBC412A3.FON	(12 x 22) IBM SPEC
BBC412A4.FON	(12 x 22) IBM SPEC (Start character right justified)
BC41230I.FON	(30 x 12) IBM SPEC (BBC412-30)
BC41230S.FON	(30 x 12) SEMI SPEC
Engrave:	
OCR51.FON	OCR ENGRAVE

(Engrave is not a primary or recommended marking mode; however, OCRS51.FON is provided for customers who may wish to use this mode.)

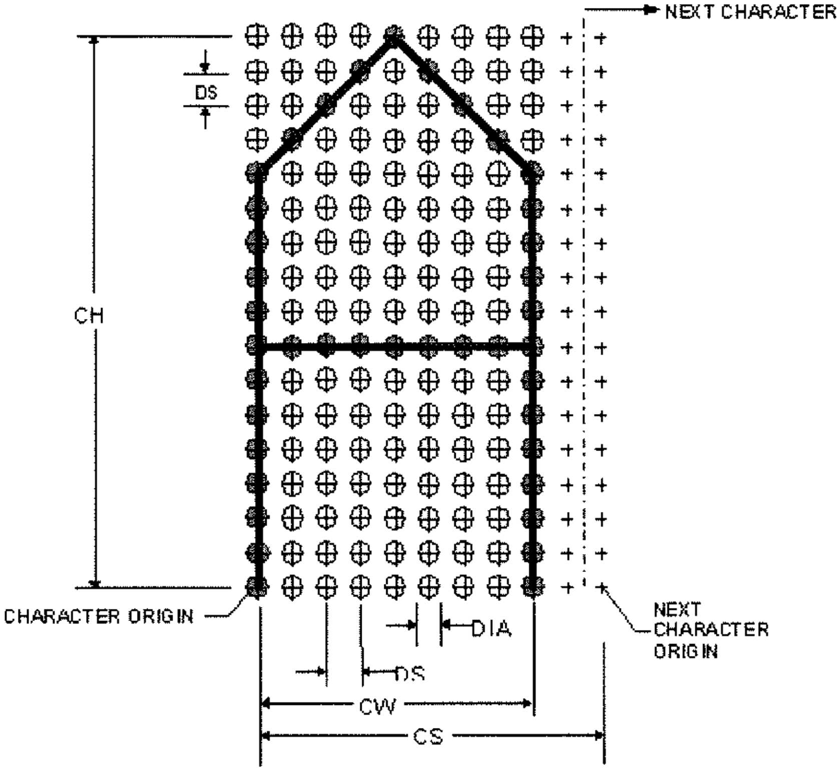


DOT DIAMETER	**DIAM** (refer to note, bottom of page 3-6)	0.070 ± 0.010 mm
DOT SEPARATION MIN.	$\mathbf{DS_{min}}$	0.115 mm
DOT COUNT HEIGHT	$\mathbf{DC_h}$	9 mm
DOT COUNT WIDTH	$\mathbf{DC_w}$	5 mm
*CHARACTER HEIGHT	$\mathbf{CH_{min} = (DC_h - 1) * DS}$	0.920 mm
*CHARACTER WIDTH	$\mathbf{CW_{min} = (DC_w - 1) * DS}$	0.460 mm
CHARACTER SPACING	$\mathbf{CS_{min} = (DC_w * DS) \pm 0.050}$	0.575 mm

* *Note: For OCR, Character Height and Width must be adjusted to maintain a 2-to-1 aspect ratio*

Figure 3-1 – 5 x 9 OCR SEMI Dot Matrix Specification

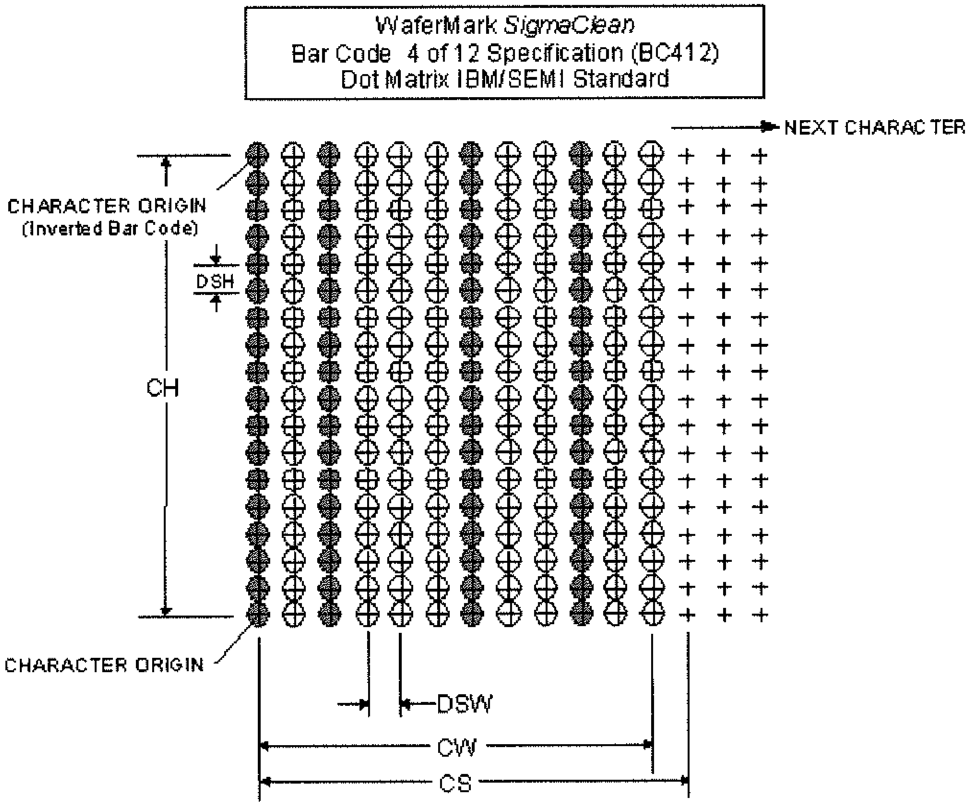
WaferMark *SigmaClean* MultiSoft Specification
Dot Matrix Centerline Standard
9 x 17 OCR SEMI



DOT DIAMETER	**DIAM** (refer to note, bottom of page 3-6)	0.065 ± 0.020 mm
DOT SEPARATION MIN.	$\mathbf{DS}_{min}$	0.090 mm
DOT COUNT HEIGHT	$\mathbf{DC}_h$	17 mm
DOT COUNT WIDTH	$\mathbf{DC}_w$	9 mm
*CHARACTER HEIGHT	$\mathbf{CH}_{min} = (\mathbf{DC}_h - 1) * \mathbf{DS}$	1.440 mm
*CHARACTER WIDTH	$\mathbf{CW}_{min} = (\mathbf{DC}_w - 1) * \mathbf{DS}$	0.720 mm
CHARACTER SPACING	$\mathbf{CS}_{min} = (\mathbf{DC}_w * \mathbf{DS}) \pm 0.050$	0.810 mm

* *Note : For OCR, Character Height and Width must be adjusted to maintain a 2-to-1 aspect ratio*

Figure 3-2 – 9x17 OCR SEMI Dot Matrix Specification



DOT COUNT HEIGHT	**DCH**	18 mm
DOT COUNT WIDTH	**DCW**	12 mm
BOT DIAMETER	**D** (refer to note, bottom of page 3-6)	0.1 mm
CHARACTER HEIGHT*	**CH**	2.000 ± 0.025 mm
CHARACTER WIDTH*	**CW**	1.320 ± 0.025 mm
DOT SPACING HEIGHT	**DSH**	0.117 ± 0.0015 mm
DOT SPACING WIDTH	**DSW**	0.120 ± 0.025 mm
CHAR SPACING*	**CS**	1.440 ± 0.025 mm

* These parameters must be entered into program
Illustration shows letter "A" coded in binary Bar Code 4 of 12 (BC412)

Figure 3-3 – Barcode 4 of 12 specification

3.9 Text Coordinate System

3.9.1 Dot Matrix Character Cells

The text to be marked must be characterized by parameters that define the physical location of the mark and the size. Any given dot matrix font contains a definition of the dot matrix cell – consisting of N columns and M rows of dots. This cell size applies to all characters in the font but may be different from one font to another.

NOTE: Fonts do not specify the physical size of the character, only the relative placement of the dots within the character cell. The reference point (or character origin) for a given character is always the lower left dot position in the cell — regardless of whether a dot is actually placed at this position for a given character. The reference point for a complete line of text (characters) is the lower left dot position of the first character in the line.

3.9.2 Dot Matrix Character Height

Character Height is defined as the distance from the center of the dot on the bottom row of the character cell to the center of the dot on the top row of the cell (in the same column). This parameter is defined in either inches or millimeters.

3.9.3 Dot Matrix Character Width

Character Width is defined as the distance from the center of the left-most dot in the character cell to the center of the right-most dot of the cell (in the same row). This parameter is defined in either inches or millimeters.

3.10 Wafer Coordinate System

For the job parameters, the normal origin of the Cartesian coordinate system is the location where the circumference of 8-inch wafers intersect at the 0 (zero) coordinate in the Y-axis (see Figure 3-4). This origin is derived by applying a mechanical offset to the galvo mirrors from the absolute center of the laser marking window. During system calibration, the origin is further adjusted using global parameters (X and Y Offset) to precisely locate the (0, 0) X/Y origin coordinates exactly at the center of the 8-inch wafer notch.

To accommodate other wafer sizes, the system uses marking offset keywords in the Maintenance Startup file to specify the offset between the origin established at the 8-inch wafer notch and the corresponding location at each wafer size. To the user entering the X, Y offsets to the start of the mark, the (0, 0) origin used as a reference point is at the same position on any wafer, irrespective of the size of wafer.

Although the laser window is 7-inches square, the effective marking area that can be used for accurate, debris-free marking is between the origin point for an 8-inch wafer (shown in Figure 3-4 and a position approximately 2.5 inches in the direction of the +Y axis.

In general, three parameters determine the position of the mark on the wafer:

1. **X and Y Position**

   The X and Y Position Parameters are the Cartesian coordinates from the center of the lower left dot in the first character of the string to be marked to the active origin, as defined above. This parameter is in inches or millimeters.

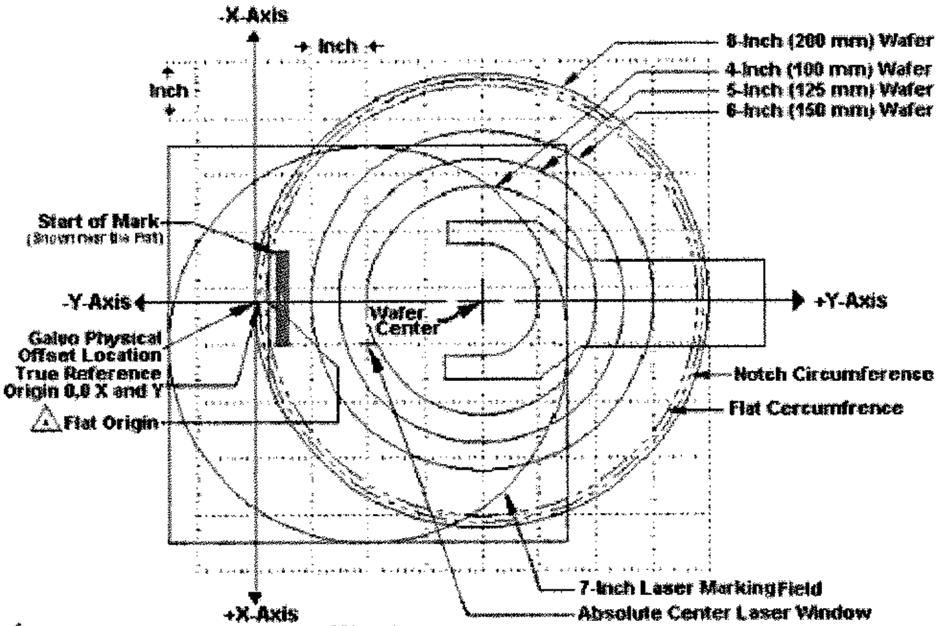
2. **Angle of Rotation**

   The Angle of Rotation is the angle by which a wafer must be rotated in order to mark at a different place around the perimeter of the wafer. Figure 3-4 illustrates normal marking in which the mark is placed near the notch or flat, with the direction of the mark at 0° relative to the +X axis. If an angle of 90° is applied, the wafer would be rotated in a clockwise direction so that the mark would be placed 90° to the right of the notch or flat. For an angle of 180°, the mark would be placed opposite the notch or flat; and, for an angle of 270°, the mark would be placed 90° to the left of the notch or flat.

3. Character Spacing

Character Spacing is defined as the number of intra-column dot distances between the center of the left-most dot of the first character's cell to the center of the left-most dot of the second character's cell (in the same dot row). This parameter is related to the Character Width parameter because SuperSoft constant velocity dot matrix marking requires the dot spacing in a given raster to be consistent throughout the entire raster; that is, constant laser repetition rate and constant beam velocity require constant inter-dot spacing.

If single character marking mode is implemented as explained in Section3.13, each character in a text string will effectively be handled and marked individually so that the actual character spacing value specified in the job will be applied between characters. (When operating in this mode, the software does ***NOT*** adjust the actual spacing in order to locate successive characters at an exact dot position on the dot matrix grid, as indicated in Figure 3-1 and Figure 3-2.)



System with Cybeq aligners, only an CFF implemented
(If CNR is implemented, the notch will be the origin.

Figure 3-4 – Mark Window Coordinate Reference Point

3.11 Robot Coordinate Definition

The robot is equipped with a double-ended End Effector with vacuum control at each end.

The robot transports wafers and performs all major wafer-handling tasks using a radial coordinate system: R, T, Z, where:

- R is the radial distance from the center of rotation.
  - +R = the radial distance from the center point when the arm is extended. These values move Arm 0 out.
  - –R = the radial distance from the center point when the arm is retracted. These values move Arm 1 out.

  As an example, Station A (Arm 0) will be assigned a positive R value and Station B (Arm 1) will be assigned a negative R value.
- T is the angle (theta (θ)) that the arm is rotated from the home position, in which +T is measured in the clockwise direction and -T is measured in a counter-clockwise direction.
- Z is the elevation that the entire arm mechanism is raised (+Z) or lowered (-Z).

3.12 Aligner Coordinate Definition

The purpose of the aligner is to center the wafer on the vacuum chuck and then rotate it in order to mark at the appropriate place(s) along the perimeter of the wafer. The aligner does this by sensing the features or perimeter edge of the wafer, and repositioning it using a single axis stage until the wafer is correctly positioned on the aligner to permit marking.

3.13 Single Character Marking Mode

The implementation of this feature removes the requirement that all marking characters for a group are based on a complete dot matrix grid, as shown in Figure 3-1 and Figure 3-2. (This restriction was previously enforced by the physical properties of the galvo system.) When Single Character Marking mode is implemented, the value of Character Spacing (CS) will be used by the Marker to recalculate the origin of the next character in the string, irrespective of the grid matrix shown in either of these two illustrations.

To enable the Single Character Marking mode, the following keyword statement must be added to the **Maintenance Startup** file:

```
SINGLE_CHARACTER_MARKING_MODE=YES
```

3.14 Inverted Character Marking

When creating or editing an existing job, select the **Type** field in the **Job Definition** screen to specify the type of marking—either Normal, Inverted, Arc or Arc-Inverted (as explained in Chapter 5).

When marking inverted text, the system references the top of the character. For non-inverted marking, the system references the character origin (see Figure 3-5). When a group is selected to mark inverted text, the software adds 180° to the text angle offset and adds character height to the Y position.

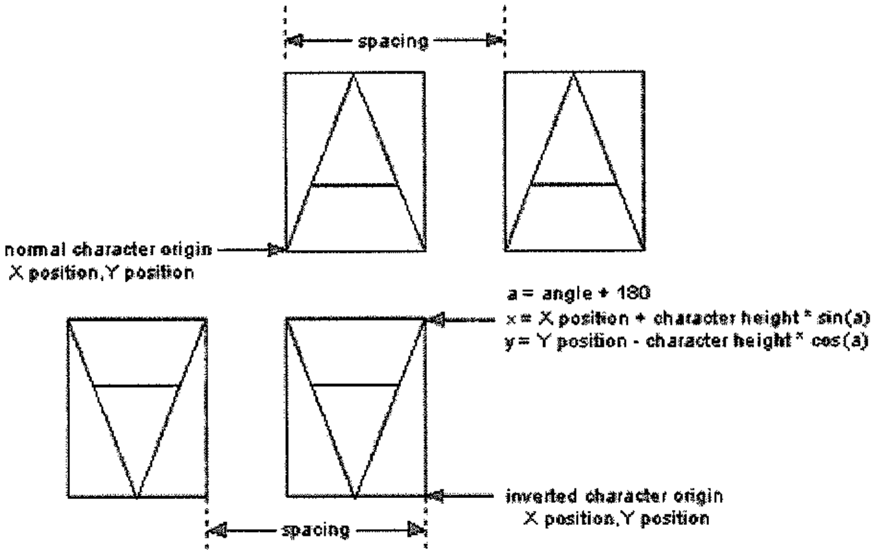


Figure 3-5 – Normal and Inverted Reference Points

3.15 Radial Marking Mode

With the implementation of Radial Marking mode for dot matrix marking, the character origin for the marking text will be at the lower left center for normal text, and at the top center for inverted text. In effect, this means that if inverted radial marking is selected, the character box will be positioned exactly the same as for normal (non-inverted) marking, except that the character itself will appear inverted. This feature is demonstrated in Figure 3-6. (Note that to implement radial marking, the Single Character Marking mode MUST also be implemented, as explained in Section 3.13.)

Also implemented in the Radial Marking mode is Auto Center Justify, in which the string of text characters will automatically be centered about the starting angle entered (where 0° lies along the +Y axis).

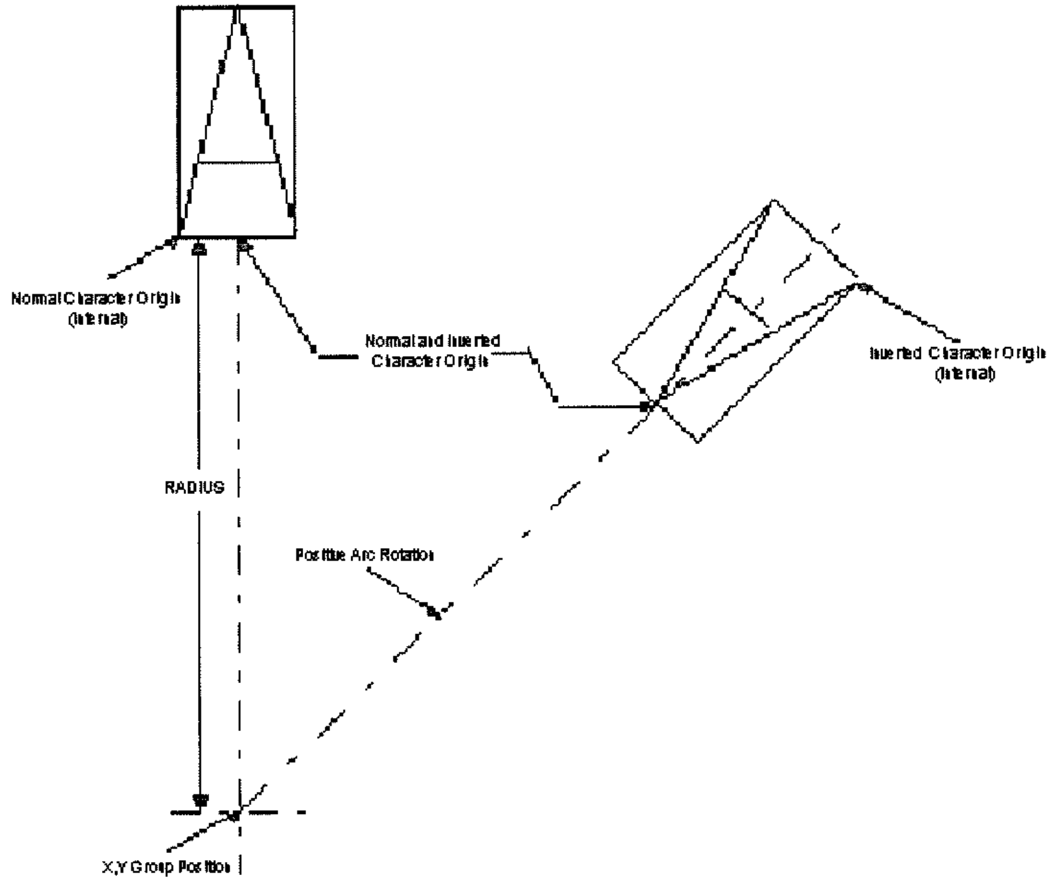


Figure 3-6 – Radial Marking Mode Reference Points

3.16 CYBEQ Aligner Improved Positioning Capability

Current systems installed with Cybeq aligners feature a new mode that will allow wafer alignment using either Constant Flat Position (CFP) or Constant Notch Radius (CNR). When implemented, the aligner uses edge detection to locate the flat or notch; the aligner then provides coordinate information for the edge of the flat or notch to the software. The software uses these coordinates to calculate the position of the mark at a precise but constant distance from the edge of the wafer. The main advantage of operating in this mode is that the mark position on the wafer will be consistent when marking at the flat, irrespective of the length of the flat (and, therefore, the absolute distance from the center of the wafer to edge at the flat).

To implement CFP or CNR mode, the following keyword statement must be added to the **Maintenance Startup** file:

```
CONSTANT_ALIGNER_POSITION=YES
```

3.17 180 ° Aligner Offset for Flat and Notch Marking

To provide consistency between systems with different styles of aligner, an additional keyword statement is available for inclusion in the **Maintenance Startup** file that will standardize the reference designation for wafer rotation when marking at the flat or notch. On systems installed with aligners that require a wafer rotational value of 180° to produce a mark at the flat or notch, adding this keyword statement will automatically apply an angular offset value of 180°, thereby allowing the user to use 0° as the reference designation for flat or notch alignment.

To enable 0° reference for wafer alignment when marking at the flat or notch, the following keyword statement should be included in the **Maintenance Startup** file:

```
ALIGNER_OFFSET_TOP=180.0
ALIGNER_OFFSET_BOTTOM=180.0
```

NOTE: This statement should be included only on systems that currently use a 180° reference for wafer alignment.

3.18 Fault Detection and Alarm Indication

A fault is a condition is identified by fault lights on the operator workstation at the front of the Handler Marker enclosure. When a fault is detected, an audible alarm sounds and the **Alarm Silencer** and **Fault Clear** buttons both flash.

NOTE: Faults interrupt, but do not abort the job that is in progress.

After the faults are cleared, the job can be resumed or aborted. The faults caused may be hardware- or software-related. Hardware faults such as low-vacuum, laser fault, cassette not sensed at the presenter, or an open interlock, etc. Most wafer handling faults, such as an empty cassette slot or a wafer that cannot be aligned, are detected and announced by the software. Most software faults are indicated by a panel fault light and a text explanation displayed (in red) in the Error windowpane area of the **Main** menu screen. Both hardware and software faults produce an audible alarm that can be silenced by pressing the **Alarm Silencer** button. Should an interlock error occur during the marking process, some of the current mark may be lost (depending on the time at which the error occurs in the marking process).

After a fault has been cleared, pressing the flashing **Fault Clear** and **Alarm Silencer** buttons turns off the alarm and flashing indicators. However, if the fault is not cleared immediately, pressing the **Alarm Silencer** button also turns off the Alarm Silencer indicator and the audible alarm; however, the **Fault Clear** indicator continues to flash on and off until the fault is cleared and the **Fault Clear** button is pressed.

3.19 Special Operating Features

The following special features are available for implementation on WaferMark® SigmaDSC NT by including the indicated keyword statements in the Maintenance Startup file (**FACTORY.SET**):

- Enable a single cassette per job option using the ONE_CASSETTE_JOBS keyword.
- Enable a default job name option using the JOB_NAME keyword.
- Enable an external job add facility using the JOB_ADD_HOOK keyword.
- Enable saving the job after each wafer is completed using the JOB_SAVE keyword.

Each feature works independently and any changes to the keyword statement will be applied after the edited **FACTORY.SET** file has been saved and the system has been rebooted. Although certain changes will take effect immediately after the file has been saved, other changes will not; therefore, it is recommended that the system is always rebooted after saving any changes to the **FACTORY.SET** file. (It should also be noted that default settings for these keyword statements are established immediately before processing the **FACTORY.SET** file; this ensures that any keyword commented out ("!") in the file during the edit is not retained when the file is reprocessed.)

3.19.1 Job Add Hook Feature (Software Option)

The Job Add Hook feature executes an external process, **JOBADDHK.EXE**, in the Windows environment. This task accepts an input from the operator or a wedge reader and places the text into the first text group of the selected job.

To use the Job Add Hook feature:

1. Specify the keyword statement `JOB_ADD_HOOK=YES` in the **Maintenance Startup** file.
2. After the job is selected, the following message displays to the operator:

```
Please enter job slip information.
```

3. Either manually type the input or use the wedge reader. To manually enter the job slip information:
   a. Type exactly seven digits, followed by a single alphabetic character.
   b. Press the **<Enter>** key.
   c. The input process terminates and the **Main** menu redisplays without any further action. The **JOBADDHK.EXE** verifies this format and appends the additional characters -`[01]`- to initialize the serialization for the job. After the input is completed, the Handler Parameters confirmation window is presented to the operator with the first text group indicating the operator job slip input and subsequent processing.
   d. Edit the count motion or text groups in the usual manner.

To complete the Job Add process:

1. The initial field selection is set to the **OK** box. If the job information is correct, press the **<Enter>** key.

NOTE: A customer can use the **JOBADDHK.C** *program as a model for a different method of processing during the job adds process;* **JOBADDHK.H** *defines the return code from the process. The size of this process is limited to about 25-30 kilobytes.*

3.19.2 Job Add Hook Duplicate Mark Database (Additional Software Option)

The **JOBADDHK** feature searches the lot identification database and checks if the lot identification for the current lot has already been used. The database maintains the last n lot identifiers that are entered by the operator.

NOTE: This search option works in conjunction with **JOBADDHK** *and is available only in a special version of the* **JOBADDHK.EXE** *program. The special version of* **JOBADDHK** *allows the operator to select between a production (PROD) or dummy (DUMMY) input format for the lot identifier.*

The production input format is specified in Section 3.19.1. If the correct format is entered, the database is searched. If a duplicate lot identifier is found, an error message is reported to the operator. If the input is unique, then the characters - `[01]` - are appended to the input and the resulting string replaces the first text group in the job.

The dummy format is not restricted in any way and no search is performed. The string replaces the first text group in the job without modification.

A lot identifier, once associated with a job that is added to the job queue, is retained in the database even if the job is never executed or is aborted. Once associated with a job, a lot identifier cannot be issued again.

NOTE: Do not edit the lot identifier database.

To use the Job Add Hook Dupicate Mark feature:

1. Specify the keyword `LOT_CHECK=YES` in the **Maintenance Startup** file (**FACTORY.SET**).
2. Specify the lot size, n, of the **JOBADDHK** database that will be maintained in the keyword `LOT_CHECK_SIZE=<integer>`. The default size is 50.

3.19.3 Job Name Feature

When the keyword statement `JOB_NAME=<filename>` is entered in the **Maintenance Startup Data** file (**FACTORY.SET**), the normal file selection window presented to the operator after the **ADD** command has been selected from the **Job** menu will be bypassed. In this keyword statement, <file> is the name of a file in the **JOBDIR** directory; it is entered without the **.JOB** extension. This feature is designed to eliminate keystrokes used in the job selection process if the same job is used repeatedly in a production environment.

3.19.4 One Cassette Jobs Feature

When the setup keyword **ONE_CASSETTE_JOBS=YES** is entered in the **Maintenance Startup Data (FACTORY.SET)**file, job lot size is limited to the size of the cassette, regardless of the count entered in the Handler Parameters confirmation window (Section 4.7.1). If less than the maximum wafer count for the selected cassette size is specified, only that number of wafers will be marked. If the cassette does not contain enough wafers to satisfy the requested lot size, the job will still terminate when the last wafer in the cassette is marked. This feature allows the operator to queue up three unique jobs—one for each presenter. Each time a job is added, the lot size is set to the number of slots in the cassette specified for the job, not the previously used value saved with the job.

NOTE: This keyword must be set to **=NO** *if* **CONTINUOUS_CYCLE=YES** *(Continuous cycle is for debugging use ONLY). Continuous cycle works with multiple cassettes for lot sizes greater than two cassettes and allows the system to run non-stop, without load and unload signals, until all jobs are finished.*

3.19.5 Job Save Feature

The keyword statement **JOB_SAVE_[YES|NO]** can be entered in the **Maintenance Startup Data (FACTORY.SET)** file to specify saving the job after each wafer has been completed. This feature provides fault tolerance to power outages when serialization is critical. Note that implementation of this feature will reduce throughput by approximately 3–4 wafers per hour. If this keyword statement is omitted from the **Maintenance Startup Data** file, the save condition will default to **NO**.

3.19.6 Protected Job Templates Feature

A job template may be defined allowing operators to use jobs in the template directory as models to be edited and saved in working job directories. However, operators are prevented from saving or deleting jobs in the template directory.

A special access level is required for saving or deleting files in this directory. The level is defined by the keyword statement `ACCESS_TEMPLATE=[1|2|3|4|5]`, which defaults to Supervisor `[2]`. For further information on access levels, refer to Section 4.4, Security and Access Control.

A template directory must use the exact spelling **TEMPLATE**, to signify the special status of the directory. More than one template directory may be defined.

When referring to a template directory, the user must use **TEMPLATE\jobname**, where **jobname** is the actual job filename. Loading a file from the template directory for editing in the **Edit** menu does not require special user access other than that needed to access the menu itself. However, the access level for editing should be lower than the level required to save or delete files in a template directory.

NOTE: Jobs in a template directory can NOT be executed as a normal job; they must be loaded and saved into a normal working job directory and executed from there.

3.19.7 Burn Log Feature

The burn log is a directory that records historical data listing the marking job summaries in string configuration. To create and maintain a burn log, the keyword statement BURNLOG=YES can be included in the Maintenance startup data or **FACTORY.SET** file.

If the keyword =YES, a burn log file will be maintained for each job file, with a record of all wafers completed for a specific job file. Each individual job will create its own burn log file, using the job filename, followed by the extension LOG. For example, if job MARK05T.JOB was created and run for the first time at 7:00 a.m. with 20 wafers, a **MARK05T.LOG** file would be created at this time; if later, at 5:15 p.m., the same job was run again to mark 15 wafers, then the burn log file would now consist of 35 records describing all wafers marked by this job. Each time a wafer is marked by a particular job, a new record will be appended to the log file; this process would continue indefinitely unless the keyword is changed to =NO.

The format of the burn log entry will be as follows:

```
<date><Time>;<operator id>;<src>-><dest>;group name 1>;group
name text 1>;
<group name 2>;<group name 1>
<group name n>;<group name n>;<CRLF>
```

<src>→<dest> refer to source and destination cassette and slot identifiers. For example: (1,1)→(2, 25) indicates that the wafer came from slot 1 in cassette presenter 1, and went to slot 25 in presenter 2.

The following is an example of a real log in which the motion is 1→2, 3→1 (no work-over-work mode):

```
3-21-01
13:39:45.7;p;(1,1)->(2,25);group1;K2A00UHQ17:group2;AXA00UHEE17;
3-21-01
13:39:47.1;p;(1,2)->(2,24);group1;KIA00UIQ18:group2;AWA00UIEE18;
3-21-01
13:39:48.5;p;(1,3)->(2,23);group1;KHA00UJQ19:group2;AVA00UJEE19;
```

Note: It is the customer's responsibility to maintain the log files by periodically purging inactive or large files from disk; failure to maintain the log system could eventually cause a disk error if the disk is allowed to fill up with these log files.

The error, **BURNLOG_FILE_FAULT** will typically occur when the disk is full, or too many filenames have overflowed the directory table associated with the burn log operations. To eliminate this problem, any unused files must be purged, or larger files off-loaded to another disk or floppy diskette.

Burnlog Keywords

BURNLOG=[YES|NO]

Enables creating and maintaining a burn log.

BURNLOG_DIR

By default, the burn log files will be maintained in the directory specified by the keyword JOB_DIR; however, a different directory may be specified using the **BURNLOG_DIR** keyword; for example: **BURNLOG_DIR=d**:\burnlogs\.

3.19.8 Sort Feature

By specifying the keyword SORT=YES in the Maintenance Startup data or **FACTORY.SET** file, successfully marked wafers are put into the destination cassette slot in the same slot location number as the source slot from which it was retrieved. Enabling the sort mode automatically sets the motion to 2→1, meaning that the source cassette will be at presenter #2, and the destination cassette will be at presenter #1. The default condition of the SORT keyword is =NO.

Any process problems caused by reading, database search, or marking, will result in the wafer being returned to the source cassette and slot from which it was originally retrieved. Note, however, that only wafers that have read failures will be re-processed if the re-processing feature is enabled.

3.19.9 Compression Cassette Movement Feature

The compression movement feature provides the ability to take sparsely-filled cassettes, mark the wafers, and then put the wafers into the destination cassette without intervening empty slots. This process exclusively uses the 2→1 motion with the "no work over work" movement, where there will be no empty slots in the destination cassette between slot 1 and slot n (where n is the lot size).

To enable the compression movement feature:

1. Specify **COMPRESS=YES** in the maintenance startup data or **FACTORY.SET** file; the default condition of this keyword is **=NO**.
2. If desired, use the general serialization method, which employs the braces {} and CHARSET=9876543210, to synchronize decrementing serial numbers that match the slot number in the destination cassette.
3. In the job text of the **Job Confirm Handler** screen, set both lot size and final serial number.

4. To maintain the synchronizing of slot serialization when an empty slot or bad mark occurs during processing, specify the following **FACTORY.SET** file parameters:
   a. `BAD_MARK_INCR=YES`
   b. `EMPTY_SLOT_INC=NO`, and
   c. `ONE_CASSETTE_JOBS=NO`.

The maximum lot size is restricted to the size of the destination cassette at presenter 1; however, the operator can load as many cassettes at presenter 2 as needed to satisfy the lot size. If more wafers exist in the source cassette than are specified in the lot count, they will be left in the source cassette.

NOTE: The compression cassette method is not compatible with reprocessing or sorting.

3.19.10 Printer Report Feature

The keyword `PRINTER_REPORT=YES` can be specified in the **Maintenance Startup Data (FACTORY.SET)** file to enable the generation of a custom report output from a serial port to either a serial port or PC for further processing.

The serial port for the report data uses the keyword `PRINTER_COM=[1|2|3|4|5|6|7|8|9|10]`, where the default is COM 2. The report format consists of:

```
Job Complete
Job ID:<jobname>
TIME:yymmddhhmmss
Lot Size:<integer>
First Wafer Text (for n groups)
<group text1>
<group text2>
"
<group textN>
Last Wafer Text (for n groups)
<group text1>
"
<group text3>
<group testn>
**EOT** (End Of Text marker)
```

For example, assume job AB12.JOB has just been run and contains two text groups defined as:

```
CAL05{AA}2KK.025C1
AUS01{*}2KK.025C1
```

Also assume that the lot size specified was 13, but only eight wafers in the cassette were actually processed. The actual text generated at the completion of the job would be:

```
Job Complete
Job ID:AB12
TIME:950313143950
Lot Size:13
Processed:8
First Wafer Text
CAL05AA2KK.025C1
AUS01AA2KK.025C1
Last Wafer Text
CAL05B12KK.025C1
AUS01B12KK.025C1
**EOT**
```

3.19.11 Manual Cassette Identifier Feature

A feature of the master software program allows the operator to manually enter the cassette identifier to the system when the cassette is mounted. This identifier is sent as an S6F3 message to the Host to provide a means for the Host to pre-process jobs associated with a unique cassette.

To enable the Manual cassette Identifier feature, specify

```
GET_CASETTE_INFO=YES
```

in the Maintenance Startup Data **(FACTORY.SET)**.

If the keyword is omitted from the file or the condition is set to `=NO`, this feature is disabled.

When the feature is enabled and the operator mounts a cassette:

1. An alarm sounds to indicate that an operator input is required.
2. The **Alarm Silencer** and **Fault Clear** buttons flash.
3. The message

   `Operator input required.  Press F5 to continue.`

   displays on the screen.

NOTE: No other input is allowed until the operator responds.

To silence the alarm:

1. Press the **Fault Clear** button.
2. Press the <F5> function key. The dialog box shown in Figure 3-7 displays.

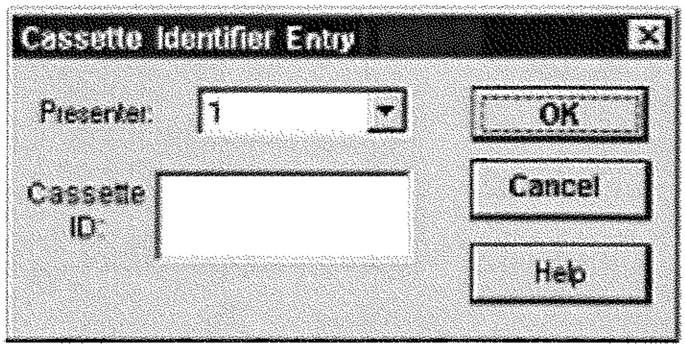


Figure 3-7 – cassette Identifier Entry

3. Click the down arrow in the `Presenter` listbox. The name of the mounted cassette automatically appears on the first line.
4. Enter the Cassette ID in the corresponding box.
5. Press **OK**.

The identifier is immediately sent to the Host using the S6F3 message.

Pressing the **Cancel** button reverts to the default setting and displays a confirmation dialog box is displayed as shown in Figure 3-8.

NOTE: The **Help** *button is inactive.*

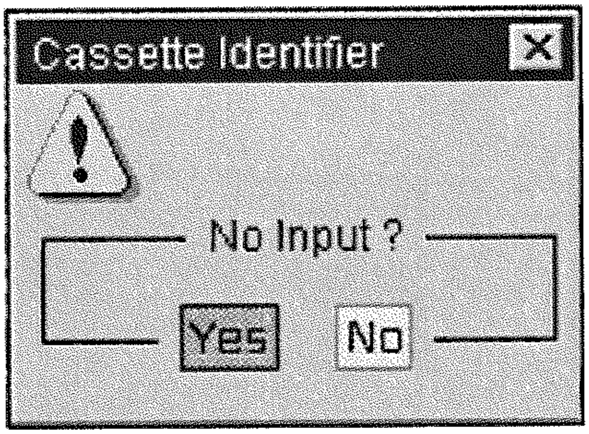


Figure 3-8 – Identifier Confirmation Box

3.19.12 Starting Slot Feature

The Starting Slot feature requires that the operator enter the starting wafer slot number whenever a cassette is mounted on a presenter.

To activate this feature, specify the keyword `STARTING_SLOT=YES` in the Maintenance Startup Data file (**FACTORY.SET**).

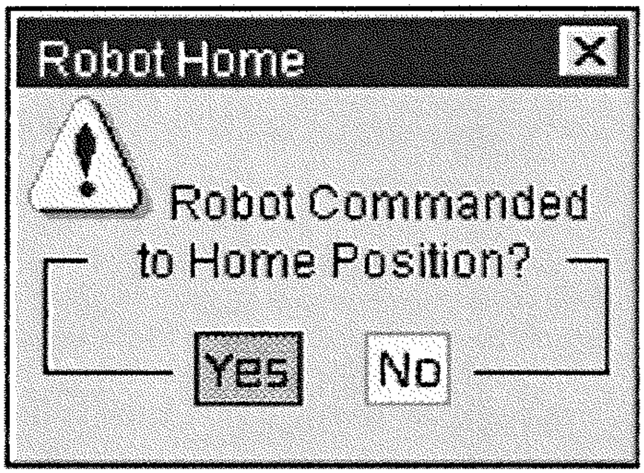
The system tests the slot number for a valid range; if a job is in progress, the cassette is known. However, if a job is not running, the operator must specify the cassette.

A test is performed before the first wafer is fetched to verify that the slot is valid. If the slot is not valid at runtime, an error message is displayed to the operator and the job aborts.

3.19.13 Robot Home Level Feature

`ROBOT_HOME_LEVEL={1|2|3|4|5}` is a keyword implemented in software release V4.54 which enables the robot to be homed at login time. This allows the robot position counters to be reset automatically, ensuring that any positioning errors accumulated during the previous production shift are zeroed out before the start of a new work shift.

After a new operator has selected a menu command and correctly logged in to the system, the program first checks the access level of the operator against the level specified by this keyword. If the login access level is the same or lower than the keyword level, a **Robot Home** dialog box will prompt the operator to home the robot as shown in Figure 3-9.



Robot Commanded to Home Position?

Figure 3-9 – Robot Home Dialog Box

Selecting **Yes** will cause the robot to return to the home position while selecting **No** will not home the robot. After responding to this message, the pop-up window closes allowing the operator to continue with normal operations.

Example: If the keyword has been set to =SO, this message will be displayed for all Supervisors and Production Operators (i.e., not for Engineers) during login. If the keyword has been set to =NULL, the message will not be displayed for any system user.

3.19.14 Duplicate Reads and Duplicate Marks Detection Feature

The keyword DUPLICATE_READS=[YES|NO] can be used to stop processing whenever the system detects that the same text is being reported from the Reader at the same time as mark text is being generated. This test compares the previous read only. The default setting does NOT ALLOW duplicate reads. To ensure that faults detected at the Reader will generate an error calling for the operator to inspect the situation, READ_ERRORS=YES must also be set.

DUPLICATE_MARKS=[YES|NO] can be used to stop processing whenever the system detects that the same text is about to be marked at the next mark time. This test compares the previous mark only. The default setting ALLOWS duplicate marks.

3.19.15 Operator Inspect Feature

`INSPECT=[YES|NO]` allows the operator to inspect each wafer from the beginning of a job until a wafer is accepted; thereafter, the remaining wafers in the lot will be processed normally.

After processing the first wafer the system will stop to allow the operator to inspect the wafer. The operator is then instructed to press function key **<F5>** to continue when the inspection has been completed. A pop-up window is displayed asking the operator whether or not the wafer is satisfactory. If the wafer is approved, the system will continue normal processing for the remainder of the lot. If this wafer is not approved, the system processes the next wafer and stops again waiting for the operator to inspect the wafer. This mode will continue until a wafer has been approved or the lot has been completed.

3.19.16 Robot Sensors For Search Mode Feature

Using the keyword ROBOT_SENSORS=0X0001 in the Maintenance Startup file, a limited wafer search movement can be enabled. This feature requires additional WIP sensors installed in front of each cassette. The robot vacuum sensor and WIP sensors will determine if the robot holds a wafer immediately after the fetch from the cassette. If there is no wafer, then another fetch will be initiated rather than waiting for the aligner WIP sensor to detect that there is a missing wafer. Note that the search mode only works for uni-cassette modes; that is, the wafer source and destination are the same, and the wafer is always returned to the same cassette and slot, as follows:

3.19.17 Engineering Units of Measurement

For all screen operations, engineering dimensions are displayed in the unit of measurement that is specified by the keyword `METRIC` in the current **Maintenance Startup Data** file.

To display all dimensions in millimeters, specify `METRIC=YES`.

To display all dimensions in inches, specify `METRIC=NO`.

All dimensional values saved in a job file retain the unit of measurement that is specified in the **Maintenance Startup Data** file at the time of saving. However, if the `METRIC` keyword is subsequently changed to the alternate unit in the **Maintenance Startup Data** file, all parameters specified in the original units will be automatically converted when the job is next loaded.

3.19.18 Text Substitution Mode

Mark text fields can be defined from a text file. The file is a simple sequential ASCII text file, where a <CR>< LF> delimits each record. Data from the file may be combined with other text that is permanently defined in the job. This file can also be downloaded via the SECS Host, or loaded by the operator at Job Add time.

The group text in the job will be modified whenever the group text definition contains the text substitution statement:

`[Filename{=<filename.ext>}]`

where <filename.ext> may be any legal Windows drive:\path\filename.ext.

Example: `ABC [Filename=c:text\lot100.txt] DEF[000]`

In this example, the mark would consist of the letters ABC, a space, the text from the ASCII file, a space, the letters DEF, and a serial number starting at 000. Other active text groups may be used which are defined in the normal manner.

The format of the text file records requires each record to be terminated, either by a new line character \n, **<LF>** or by **<CR><LF>** depending on the originator's environment.

When the job is added to the job queue, all group text in the job is scanned for a text substitution statement. If the statement is present and the optional parameter <filename.ext> is missing, the operator will be prompted for a filename. The root directory for the operator-selected text is specified using the keyword **TEXT_DIR**. If the <filename.ext> does not include a [drive:\path] identifier, software will check to verify that the file is in the path specified by the TEXT_DIR keyword. If this keyword has been omitted from the **Maintenance Data Startup** file, the search path defaults to the directory specified by the `JOB_DIR` keyword.

After a file has been located, a temporary copy is created on the local hard disk to be accessed during the marking operation. This allows the operator to copy a file from a floppy disk to the hard disk, which can then be accessed by the system during the marking, thus avoiding loss of throughput due to lengthy access delays when transferring data from the floppy.

During marking, each occurrence of the `[Filename{=<filename.ext>}]` statement causes the next record to be retrieved from the text file, and substituted in the appropriate group text location. The `[Filename{=<filename.ext>}]` statement can not be included in the text substitution records (i.e., redirection from within a text file is not allowed).

The repeat bracket operator [*] is valid for Filename statements; that is, the occurrence of the repeat bracket will substitute the last record read from the file, if the Filename statement was the last bracket occurrence in the job.

3.20 Wafer X, Y Coordinate Rotation

⚠ **CAUTION**

Possible Marking Problem

When marking 4-, 5-, and 6- inch wafers, the aligner may cover part of the wafer, making it impossible to mark the entire flat with a zero degree rotation.

In software release 4.51, the coordinate system, mark angle, and wafer rotation can be offset by the number of degrees specified in the Maintenance — Startup data or **FACTORY.SET** file, using the keyword **COORDINATE_ROTATION[n]** — where [n] is <**4**> for 4-inch wafers, <**5**> for 5-inch wafers, and <**6**> for 6-inch wafers, as follows:

- Select the Startup command from the Maintenance menu and enter the keyword **COORDINATE_ROTATION[n]**. Specify an angle that the wafer can be rotated from its current position so that the wafer flat can be marked without interference from the aligner.

- Enter the keywords `OFFSET[n]F.X`, `OFFSET[n]F.Y` for Flat marking, or `OFFSET[n]N.X`, `OFFSET[n]N.Y` for Notch marking—where [n] is <**4**> for 4-inch wafers, <**5**> for 5-inch wafers, and <**6**> for 6-inch wafers. Enter values X and Y which will move (offset) the 0,0 point to the required position where the mark will start on the flat/notch of the wafer after it has been rotated.

3.20.1 Wafer X, Y Coordinate Rotation Correction Factors

Certain systems may experience a constant misalignment error after rotation. The following keywords can be entered in the **Maintenance Startup Data** or **FACTORY.SET** file to compensate for this error by adding a correction value to the associated `COORDINATE_ROTATION` value before it is sent to the Marker:

```
FDG[4]=0.0
FDG[5]=0.0
FDG[6]=0.0
```

The default value for these corrections is 0.0.

3.21 Access Restrictions During SECS Remote

During SECS-controlled operations, the operator may be restricted from use of the **Job Add** and/or **Job Delete** functions when the SECS control mode is operating, as follows:

```
SECS_MODE_CONTROL=1 and Full-Auto
or
SECS_MODE_CONTROL=2 and Remote
```

If the keywords `OPERATOR_ADD` and `OPERATOR_DELETE` are set to `=NO`, the operator cannot access these functions from the **Job** menu. If set to `=YES` or if the keywords are omitted from the **Maintenance Startup Data** file, there operator can use the **Job Add** and/or **Job Delete** functions .

3.22 Movement 3⇒1

The wafer movement from cassette 3→1 is implemented in software release V4.54. This movement processes source wafers from cassette 3 and puts the marked wafers in cassette 1. (For GEM/SECS used by S2F27 or S2F41, the LOC data item now includes this movement.)

3.23 Reader or Verify Settling Time

The use of the keyword READER_SETTLE allows a controlled delay (in seconds) between the time the robot finishes its move to a read or verify station, until the time that the read command is sent to the reader. This delay will allow any vibration in the end effectors of the robot to die away before the reader attempts to read the wafer. The default value is 0 (seconds), and the minimum setting should be no less than 0.053 seconds (53 milliseconds).

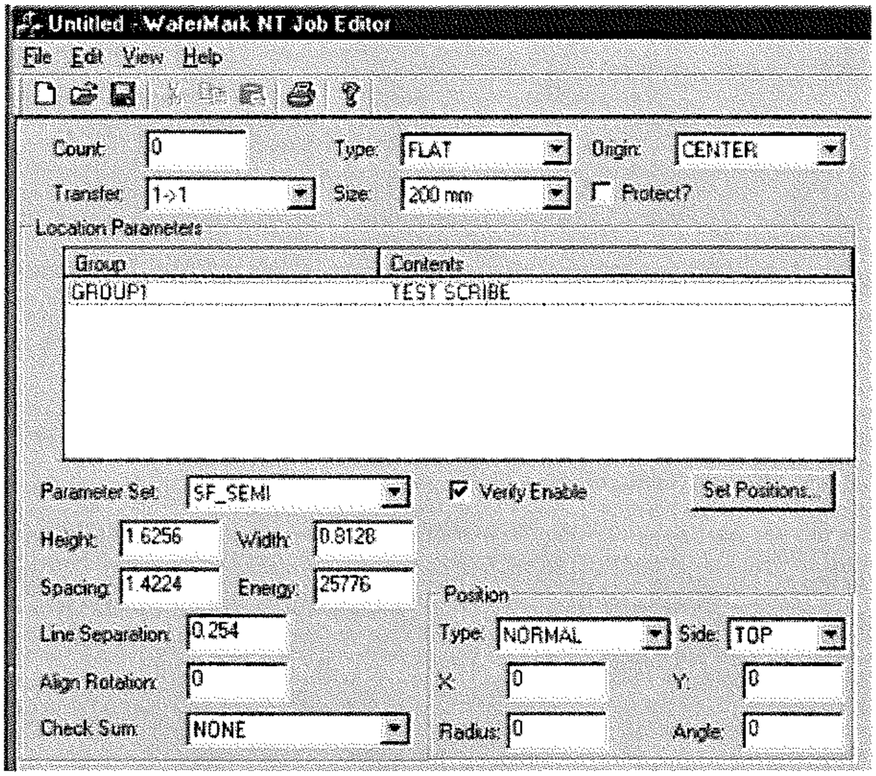
3.24 Exhaust Flow Sensor Monitoring

An optional exhaust alarm sensor in the plenum exhaust duct indicates a flow failure in the exhaust system. The sensor is regularly monitored by the alarm system that reports the error flow exhaust (2104) if a fault is detected. This stops the system and requires operator intervention. Before the system can be returned to normal operation, the sensor must indicate a correct condition.

3.25 Wizard Reader

The Wizard Identification System requires the setup of the communications, reply character, and specific reader configurations, as follows:

- From the **Main** menu, select the **Operational Sequence** menu (3).
- Select the **Communications Configuration** menu (C).
- Set the Baud rate to 9600, 8 data bits, 1 stop bit, and no parity. Turn off the optional reply characters.
- If the Reader is being setup to read before marking, use Configuration 1.
- If the Reader is being used to verify after marking, assign a unique configuration with the same number as the group, for each group to be verified, in the order specified on the **Job Editor** screen (1, 2, 3, . . .). See Figure 3-10.



Count: 0
Type: FLAT
Origin: CENTER
Transfer: 1->1
Size: 200 mm
☐ Protect?

Group	Contents
GROUP1	TEST SCRIBE

Parameter Set: SF_SEMI
☑ Verify Enable
Height: 1.6256
Width: 0.8128
Spacing: 1.4224
Energy: 25776
Line Separation: 0.254
Align Rotation: 0
Check Sum: NONE
Type: NORMAL
Side: TOP
X: 0
Y: 0
Radius: 0
Angle: 0

Figure 3-10 – Job Editor Screen

3.25.1 Group Verify Flag and File Specification (Wizard Reader Only)

You can enable or disable the verification after marking process for a given group by setting the **Verify Enable** checkbox to **Yes** or **No** for each group definition.

NOTE: Because all groups previously were verified in existing jobs, the **Verify** *field defaults to* **Yes** *for existing jobs (for backwards compatibility). For new jobs and new groups added to existing jobs, the* **Verify** *field defaults to* **No**. *For all jobs from earlier software versions that used the Verify option, you must specify the setup file required to configure the reader for reading the group.*

Setup files are stored on disk using the **Reader** command from the **Maintenance** menu:

1. Use the **Reader** command in the **Maintenance** menu to download the appropriate configurations for setting up a job.

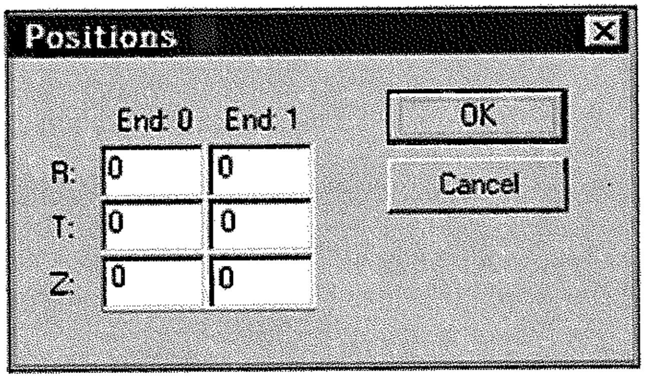
2. The **Verify File** listbox displays the Wizard selection. Always choose the setup files from the list supplied rather than typing in some name. To pick from the list of current setup files on disk, press the **Spacebar**.

NOTE: If you do not specify the setup file name when Verify is set to **Yes**, *an error will occur when trying to save the file.*

Refer to the *WaferMark® GEM\SECS Interface User Guide manual (P/N 273.495.00)* for a detailed description of the change in the job file format associated with this option. The GEM job commands cannot access this field. .

NOTE: This flag is not available to the Host through the GEM interface

With the **Verify Enable** checked, the **Set Positions** button becomes active. Clicking on the **Set Positions** button brings up the following **Positions** dialog box which contains the position code for End 0 and and End 1 code for Radial, Theta, and Height (see Figure 3-11).



Positions

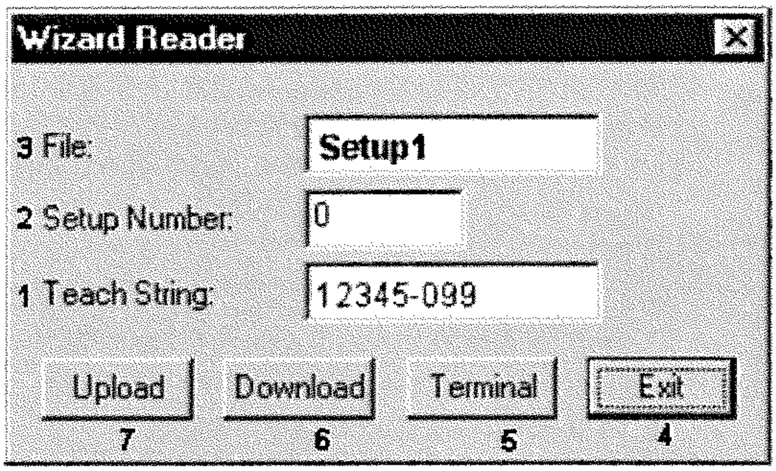
	End 0	End 1
R:	0	0
T:	0	0
Z:	0	0

Figure 3-11 – Wizard Position Dialog Box

3.25.2 Wizard Reader Upload and Download of Setup Files

If the keyword `READER_TYPE=3` is specified in the **Maintenance Startup Data** file, the Wizard special reader interface is provided when the **Reader** command is selected from the **Maintenance** menu (See Figure 3-12). Access to this menu is restricted according to the access level specified by the keyword `ACCESS_MAINT_READER`.

The primary use of this interface is to enable the operator to download and name new Wizard setup files for storage on the local hard disk of the WaferMark system for later use while running jobs. The upload feature is primarily used for verification and testing of existing setups on disk.



3 File: Setup1

2 Setup Number: 0

1 Teach String: 12345-099

1 Teach String
The teach string is the order of sequence in the setup.

2 Setup Number
An arbitrary number assigned to identify the setup.

3 File
Download file name.

4 Exit button
Clicking the Exit button abandons the wizard reader setup.

5 Terminal button
Clicking the Terminal button accesses the terminal for communication.

6 Download button
Clicking the Download button saves the name and setup file to disk.

7 Upload button
Clicking the Upload button is used mainly to verify and test the present setup on the disk.

Figure 3-12 – Wizard Reader Window

3.26 LVS Reader

Mark verification uses the LVS reader containing TIPROBE custom program PROMs. Post-mark top text verification is controlled by the keyword `VERIFY=[YES|NO]`, defaulting to `=NO`. `VERIFY=YES` requests verification of ONLY the Base35 encoded Group 2 Barcode text field. `VERIFY=NO` is performed on the Group

1 OCR or any other mark text in the job. When enabled, any verification failure will generate an error condition that stops the system and requires operator intervention before processing can continuing.

The Label Vision Systems Model LVS-3000 with the SDI-100 read head and TIPROBE PROM set has three 8-position switch blocks on the SysCom PWB, inside the decoder box, which configure the communications and Barcode formats during operation.

Switch Position	Function
1-1, 1-2, & 1-3	Sets only the INPUT baud rate. The output baud rate is fixed at 9600 baud. The software does not support split speed operation. OFF, OFF, ON =9600 baud.
1-4	Sets the data word length, in bits. OFF = 8 data bits.
1-5 & 1-6	Sets the parity check bit. OFF, OFF = no parity.
1-7	Sets the number of stop bits in the data word. OFF = stop bit.
1-8	Not defined.
2-1	Controls the Start of Transmission character STX. OFF = disabled.
2-2 & 2-3 2-5	Response string terminator. OFF, OFF =**<CR>& <LF>**.
2-4	Send SOH and EOT. OFF = disabled.
2-6	Gate signal polarity. OFF = TTL low true. Gating signal line not used.
2-6	Data flow, continuous or gated. OFF = continuous.
2-7	Duplicate data filter in continuous mode. ON = send duplicates.
2-8	Report No Read during Gate period. OFF = send 13 characters after 3 seconds of bad reads.
3-1 & 3-2	Barcode character length.
3-3, 3-4, & 3-5	OFF, OFF, OFF, OFF, OFF = Automatic length. TIPROBE only works with 13 character base35 encoded barcode marks.
3-6, 3-7, & 3-8	Verify / Good read count threshold. OFF, OFF, OFF = at least 2 identical marks.

Cloak Options	
Switch Position	**Function**
1-2 & 1-3	—
1-4 & 1-5	ON, ON, ON, ON
1-7 & 1-8	OFF, OFF
2-1 & 2-2	—
2-4 & 2-5	—

Cloak Options	
2-6 & 2-8	ON, ON, ON, ON
2-3 & 2-7	OFF, OFF

The LVS decoder box has the followings switches and connectors on the rear panel:

- Video In and Video Cam Power connectors: Connect the SDI-100 read head here.
- Mode switch: To select between setup, SEC TEST, and Gated modes with the TIPROBE PROMs, the serial command capability functions only in Gated mode (which has been redefined to Remote Serial Control mode).
- Beeper On/Off switch: Choose one.
- (2) Video Out connectors: Connect the monitor to the Video Out closest to the Mode switch for setup, tuning and normal operation. The highlighted area indicates the active (or non-cloaked) scan lines.
- Gate Input connector1: Not used. Ignored.
- Accessory Port connector 1: To simulate the TIPROBE's normal multiplexed camera input mode, pins 3, 9, 10, 12, and 13 must be connected on an HD15 male connector which is plugged into the accessory port.
- RS-232 Out connector: A cable with one male and one female 9-pin D connectors and Data lead pins (2,3 & 5) only, should be used on the serial port. A NULL modem (cross-connect pins 2 and 3) is required.

  NOTE: With the TIPROBE custom PROM set, the functions of several of the standard switch settings are modified or overridden.

3.27 Programmable Optics Selection

For systems installed with programmable optics, one of two optic positions can be selected at the job level using the **Job Options** dialog box (described in Section 4.12.5). The **Maintenance** menu also provides access to the optics control that allows the two optic positions to be exercised. For further information, please refer to the **Maintenance** menu–**Optics** (options) described in Section 4.9.14.

3.28 300 MM Wafer Loader – Fixload and Stackload-13

For 300 mm wafers only, the wafer loader replaces the standard cassette presenter operation. Software version 4.81 enables a new cassette handler interface using the JENOPTIK INFAB loaders – either the 300 mm FIXLOAD or the 300 mm STACKLOAD-13. These loaders manage standard FOUP wafer carriers containing 13 wafers per carrier.

The FIXLOAD utilizes a single cassette station, Presenter 1. The STACKLOAD utilizes two cassette stations, Presenters 1 and 3. The number of Presenters is ignored, and the internal value is set depending on the LOADER_TYPE keyword in the **FACTORY.SET** file. However, the LOAD and UNLOAD indicators on the Operator Workstation behave in the normal manner.

During normal operation the loader may be initialized at a cold boot, with or without a FOUP in place. Initializing the load will cause the FOUP to be closed and undocked to allow the operator to remove the FOUP. A normal pre-load is allowed using the loader and the operator will typically queue a job, select **START**, mount the FOUP, and then press LOAD. The loader will dock the FOUP, open the cover, and lower the access door for processing. After the last wafer has been processed, the sequence is reversed. A **RESET** from the **Control Menu** will cause the loader to be initialized, closing the FOUP, undocking, and then closing the door.

⚠ CAUTION

Possible Damage to Equipment

Before doing a cold start or **RESET**, ensure that there are no obstructions such as handler parts in the motion paths of the parallel door opener and landport shuttle (STACKLOAD).

The CONTINUOUS_CYCLE may be used with this feature. After 13 slots have been processed, the loader will UNLOAD the FOUP, LOAD it again, and then continue processing. This cycle is repeated until the specified lot has been completed.

For service testing, the Maintenance Menu **LoadEr** command allows a standard interface to the loader.

3.29 ROBOT SENSOR CHECKING

Sensors associated with the robot operation may be used at various stages of processing to determine the presence or absence of the wafer. When the wafer is being fetched from the cassette, the sensor may be used to effect a 'search mode' by checking for the presence of the wafer while the robot is still in front of the cassette presenter position. The robot vacuum sensor, the reflective sensors, or both may be activated by the 'search mode' . If both sensors are activated, the vacuum will be checked first, then the reflective sensor. If either sensor is activate, then the wafer is assumed to be present.

The vacuum sensor may also be used at the aligner position to check for the proper release or retrieval of the wafer.

The sensors use the keyword `ROBOT_SENSORS=<hex>`, where the hex value specifies the type and location to check the presence or absence of a wafer. Any combination of hex patterns is allowed.

```
0x0001 Check the robot reflective sensor at the cassette
position
0x0002 Check the robot vacuum sensor at the aligner position
0x0004 Check the robot vacuum sensor at the cassette
position
```

The default value is 0; no checking is done. Valid values are:

```
0x0001
0x0002
0x0003
0x0004
0x0005
0x0006
```

3.30 Single-End Effector Mode for Robot

The cassette system 300 mm single-ended robot uses a single-end effector, using the keyword `ROBOT_ENDS=[1|2]` in the **Maintenance Startup Data** file. The default is `2`. For a 300 mm single-ended robot, the value should be set to 1. For a setting of 1, the end effector, called End 0, is used exclusively and is independent of any keywords, such as `presenter` or `ROBOT_TYPE`, etc.

3.31 Custom Serialization Using Parends

Custom serialization uses the parenthesis character as delimiters '(' and ')'. This serialization indicator is reserved for custom serialization, for this and future requirements of a similar type. The keyword `PAREN={1|2}` specifies the type of custom serialization. The default is 1.

When `PAREN=1`, the serialization format consists of 5 decimal digits, divided into two fields: xxx yy.

When `PAREN=1`, the serialization format consists of 5 decimal digits, divided into two fields: xxx yy.

`For example:   Group 1 PL76L120(00101)`

When `PAREN=2`, the serialization format consists of two separate paren fields within the same group. Both fields consist of decimal numbers only. The first field is the lot number field, the second field is the wafer (or disk) number.

`For example:   Group 1 A015(001)\ (01)`

The wafer number is the least significant part of the serialization format. This field counts in decimal from 01 to 50 (00 is not used). When the field is incremented to a value of 51, a carry is propagated to the lot number field and the wafer number field is reset to a value of 01.

The lot number field is the most significant part of the serialization format. This field counts in decimal from 001 to 999 and rolls over to 001 (again, 000 is not used).

`For example:   Group 1 A015(001)\ (01)`

A Serial bin is not allowed within the parenthesis operator and will generate the error *`7119, Invalid Serial Number (Type 49).`*

The last serial number generated by a paren serialization field can be duplicated in a following group by specifying the notation (*) in the appropriate group message. During marking, this notation copies the previous serialization field into the specified field position of the current group.

```
For example:   Group 1 PL76L120(00101)
Group 2 AR15(*)
```

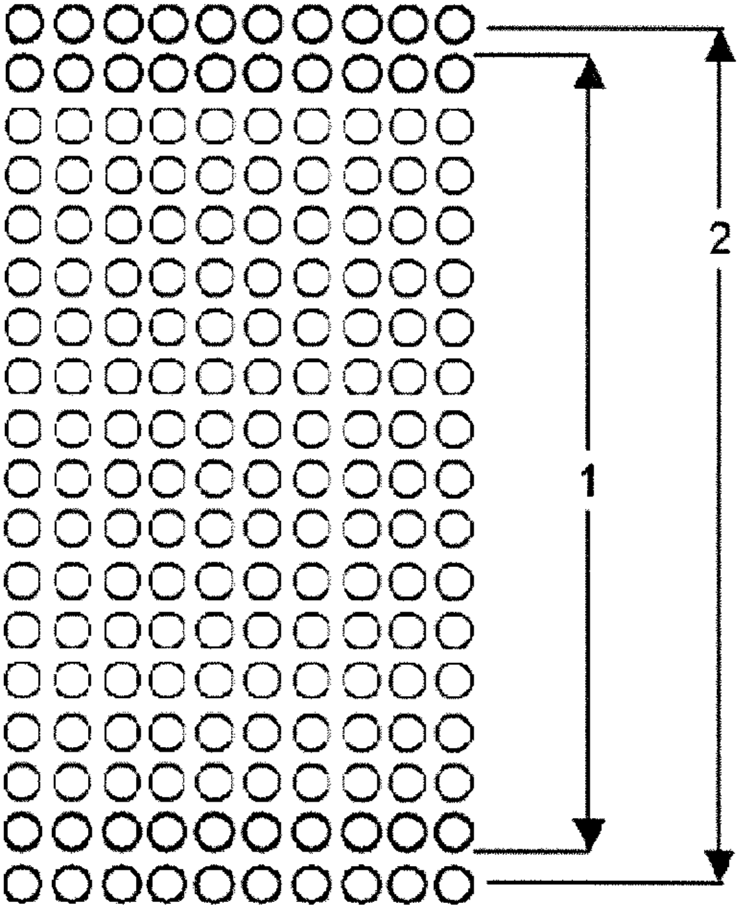
In this example, AR1500101 would be generated for marking by Group 2.

3.32 Multiple Density Measurement

This information is for customers who would like to change the method of defining the distance of the height and width for multiple-density fonts.

Usually, height and width is measured from the center of the left-most dot to the center of the right-most dot. Typically, users measure these distances using the centerline of the outside lines, where the outside line may consist of two dots for double density, three dots for triple density, etc.

The matrix in Figure 3-13 applies for double density.



1 Method A
2 Method B

Figure 3-13 – Five X Nine Double-Density Dot Matrix

For multiple densities of the 5x9 dot matrix, the adjustment can be generalized depending on the density, n, for n>1:

```
Adjusted character height = CH +(CH/(8*n))
Adjusted character width = CW +(CW/(8*n))
```

where CH and CW describe the height and width measured from the center of the left-most dot to the center of the right-most dot.

For example, the double-density adjustments would be:

```
Adjusted character height = CH + (CH/16)
Adjusted character width = CW + (CW/8)
```

Each line in an ASCII file maintained in the font directory, **SCALE5x9.FIL**, describes the fonts to be scaled using this method. Each line is determined by a carriage return <CR> and line feed <LF>.

The format of each line consists of:

```
<font_Name><density>
```

where:

```
<font name> is the font name without the extension
<density> is the font density
```

For example, a typical **SCALE5x9.FIL** might contain two high-density fonts, as follows:

```
DMDSMI62;2
DMDSMI63;3
```

At the time a job is loaded for execution, the font directory is inspected for the presence of the file **SCALE5x9.FIL**. If the file does not exist, no scaling of the height or width occurs. If the file exists, each font in the job is checked against **SCALE5x9.FIL**. If the font is in the file, the scaling process is performed using the formulae above as a function of the <density>.

4 User Interface Operating Guide

This chapter describes the various menus and windows and system operating procedures that enable the operator to perform selected wafer handling and marking tasks.

4.1 Introduction

The WaferMark® SigmaDSC NT User Interface is the operator's principal tool to enter jobs into the marking queue, define wafer-handling specifications, initiate marking on selected wafers, and perform other system maintenance routines.

4.2 System Initialization

Immediately following the application of power, discussed in Section 3.2, the system performs an initialization sequence that conditions the hardware and software for wafer handling and marking tasks. During that sequence, the hardware is preconditioned and checked for proper functionality, and various software programs are loaded for use in controlling wafer handling and marking. System initialization events are carried out in the following order:

HARDWARE INITIALIZATION

The Hardware Initialization sequence consists of the Machine Control Initialization, Robot Initialization, and Aligner Initalization.

Machine Control Initialization

Resets interfaces to a known state and resets all FOUPs.

Robot Initialization

1. Checks for proper communication.
2. Sets mode to inform after motion.
3. Turns on servos.
4. Homes all axes of motion.
5. Sets speed and acceleration for optimum performance.

Aligner Initialization

1. Checks for proper communication.
2. Homes all axes of motion.
3. Sets wafer diameter and timeouts.
4. Resets position of check to get ready for operation.

SOFTWARE INITIALIZATION

The Software Initialization consists of the User Interface Initialization, Machine Control Initialization, Marker Initialization, Robot Initialization, and Aligner Initalization.

User Interface Initialization

Builds up all menus and screens that can be used on startup.

System Database Initialization

Reads the Maintenance Startup file, USERINFO.FIL security file, and initializes all operating parameters.

Machine Control Initialization

Gets current definition of all FOUPs (size, number of slots, pitch, etc.)

Marker Initialization

Loads the Marker parameters from the **MARKER.SET** files.

Robot Initialization

Homes the Robot motors and ensures all station addresses are loaded correctly.

Aligner Initialization

Homes the aligner motors.

The completion of the system initialization sequence is indicated when the monitor screen at the operator's workstation displays the Windows NT® dialog box requiring the operator to enter the operator password in the **Main** menu of the User Interface as described in Section 4.5.

If the security access feature has been implemented on the system, certain operating functions are password-protected and require authorized access for selected operations to be initiated. The procedures for implementing and managing this security access feature are provided in Section 4.4.

4.3 Screen Control Using Trackball, Icons, or Keystrokes

The menus in the User Interface program follow typical Windows conventions:

- The terms trackball, mouse and pointer (used herein) are generic for any pointing device.
- The trackball and keyboard are the primary control devices for Windows NT® input actions.
- "Clicking" refers to pressing on the left switch activation.

The **Main** menu of the User Interface menu bar displays the following menus: **File**, **JobQueue**, **Control**, **Maintenance** and **Help**.

To activate the associated drop-down list of commands:

1. Using the pointing device (trackball or mouse), click on the desired menu item.
2. Click on the desired command to execute it.

You can also use keystrokes to select menus and commands. The keyboard procedures to perform these tasks are similar for each operation.

To activate a menu command using the keyboard:

1. Press **<F10>** to activate the **Main** menu.

   *NOTE: Pressing function key **<F10>** on a DOS software-based system is a **Log Off** command.*
2. Use the cursor (arrow) keys to navigate left and right, or down to select (highlight) a command from the list

   NOTE: Throughout the operating instructions, the term "cursor keys" refers to the keys marked with arrows on the *numeric section of the keyboard. Also, the term "select" refers to highlighting the appropriate command or data field by using the cursor keys.*

3. Press **<Enter>** to initiate the selected command.

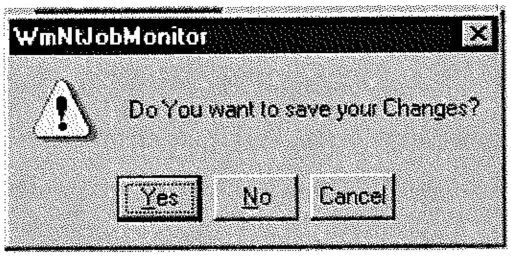
You can also use the icons located beneath the **Main** menu bar to select certain commands. These icons are shortcuts to commands such as **New Job**, **Open Job**, and **Add Job**. A brief description of the icon's function appears when the pointer is placed directly over the icon. To initiate the command, click the icon.

The **Close**, **Maximize** and **Minimize** buttons in the top right-hand corner of the main program window are disabled to prevent operator errors.

To exit the program, either press **<Alt+F4>** or:

1. Select **File**.
2. **Exit** from the **Main** menu or **Editor** menu.

   NOTE: If exiting from within the Job Editor when a change has been made, clicking on the **Exit** *command will bring up a Save? dialog box requiring the user to select Yes, No, or Cancel.*



Do You want to save your Changes?

To activate the drop-down menu item and displays a list of available commands:

1. Press the **<Enter>** key.
2. After a menu has been activated, the first command in the list becomes highlighted, indicating it is available for immediate use.
3. Use the <↑> or <↓> cursor keys to highlight each in turn to select a command from the list.

4. With the desired command highlighted, press the **<Enter>** key to initiate the operation.

To select a menu from the main User Interface screen, press **<Alt>** and the first letter of the menu item's title. For example, the letter **J** opens the **JobQueue** menu. If the menu bar is already activated (by clicking on it or pressing <F10>), you do not need to press the **<Alt>** key.

NOTE: Once a drop-down menu has been activated, any available command in the list (not grayed out) can also be initiated by pressing the keyboard letter that matches the underscored letter in the highlighted command's title. For example, pressing the letter **D** *initiates the Delete command from the JobQueue menu. Using this convention, the operator can simply press* **J** *followed by* **A** *(Add a job) to display the window used to enter jobs into the marking queue.*

Data entry uses a similar technique to that described above. The operation consists of selecting (i.e., highlighting) a particular data field (e.g., a dialog box) on the screen, then entering or changing the data using keystrokes. Any highlighted data field is active and ready for alteration.

Each selected data field has a predetermined length and is preceded by an associated name template that describes the field contents.

Most data entry screens presented during operations contain a combination of command fields and data fields.

To select particular fields from the display:

1. Use the **<Tab>** key and the **Up <↑>** and **Down <↓>** cursor keys to navigate to any of the commands or data fields displayed on the screen.
2. Press the **<Tab>** key to sequentially highlight each data field in turn from left to right across the screen.
3. Press the **<Shift+Tab>** keys to select the fields in the reverse direction.
4. Use the <↑> and <↓> cursor keys to select data fields on different rows.

4.4 Security and Access Control

The security access feature is implemented only if a **User Information** file exists in the program directory.

NOTE: If the **User Information** *file does not exist, ALL system operating functions are accessible to each system user. The procedure for creating a security file is provided as an Addendum of this manual.*

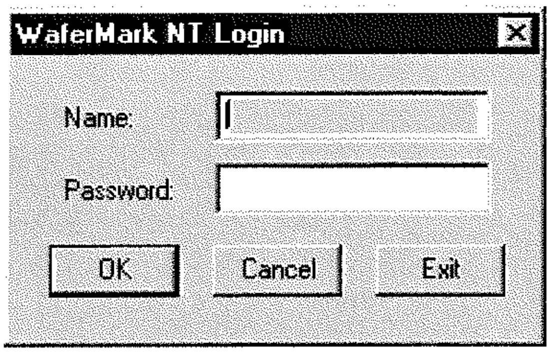
When the system is initialized, users must use keystrokes to select specific functions from the various User Interface screens to initiate all handling, marking, and maintenance operations. Certain commands listed in the four menus are password-protected to ensure that the current operator has the appropriate authority to proceed.

The **Main** menu opens on the screen immediately following completion of the initialization sequence. An operator must correctly log into the system before any commands become accessible from the menus on the menu bar.

NOTE: A `Not Logged In` *message displays at the bottom left of the screen to indicate this lockout feature.*

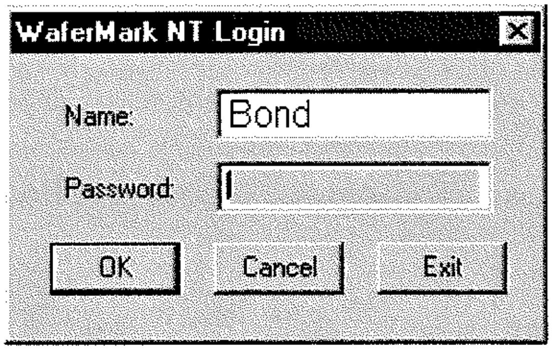
To login, enter a name and password and select **OK** or **<Enter>**. The program compares these entries with the user entries in the **User Information** file. If the information matches, the operation initiates and the operator's name and security level display at the bottom of the screen. If any subsequent command is not accessible at the current security level, the operator must log out and a person with the required higher access level must login to perform that command.

The following illustration demonstrates how the password window is normally displayed on the screen. This example assumes that the operator has not logged on to the system and has selected the Add Job command from the JobQueue menu:



To log onto the system and access the command:

1. Type the appropriate user name (in uppercase or lowercase) on the first line.
2. ClickOK or pressEnter. The cursor moves to the Password entry line, which highlights as follows:



Name: Bond

Password:

3. Types your assigned password.

   NOTE: As each character is entered, an asterisk (*) displays at the corresponding character position.
4. ClickOK or pressEnter to validate your login.

   NOTE: You can enter the password information only three times before the operation is canceled and the password window is cleared from the screen.

   Access to other commands is restricted according to the current security level. Commands made inaccessible by a security level appear greyed out and are inactive. Section 3.5.1 lists the functions available for each security level.

5. If your security level is insufficient to access a command, the following error message displays:

WaferMark NT Logon

Insufficient Access Authority

Click on **OK** or press the **Enter** key to return to the Main menu.

4.4.1 Composition of the User Information File

The **User Information** file consists of a single line of text for each user specifying the user ID (or name), a password, and the assigned security level. The syntax for each user entry is as follows:

```
<ID> <Password> <Security Level>
```

...where <ID> must be a string of (up to) 10 alphanumeric characters.

Examples:

```
ABC
123
P
WASHINGTON
```

...where <Password> can be blank or a string of (up to) 10 alphanumeric characters.

Examples:

```
xxxxx
(blank)
A
12345
```

...where <Security Level> is a customer-determined security access level, with a value: 0, 1, 2, 3, 4, 5, and

0 = new user was added, but no access level was set

1 = Production Operator

3 = Supervisor Operator

5 = Engineering Operator

Levels 2 and 4 are undefined.

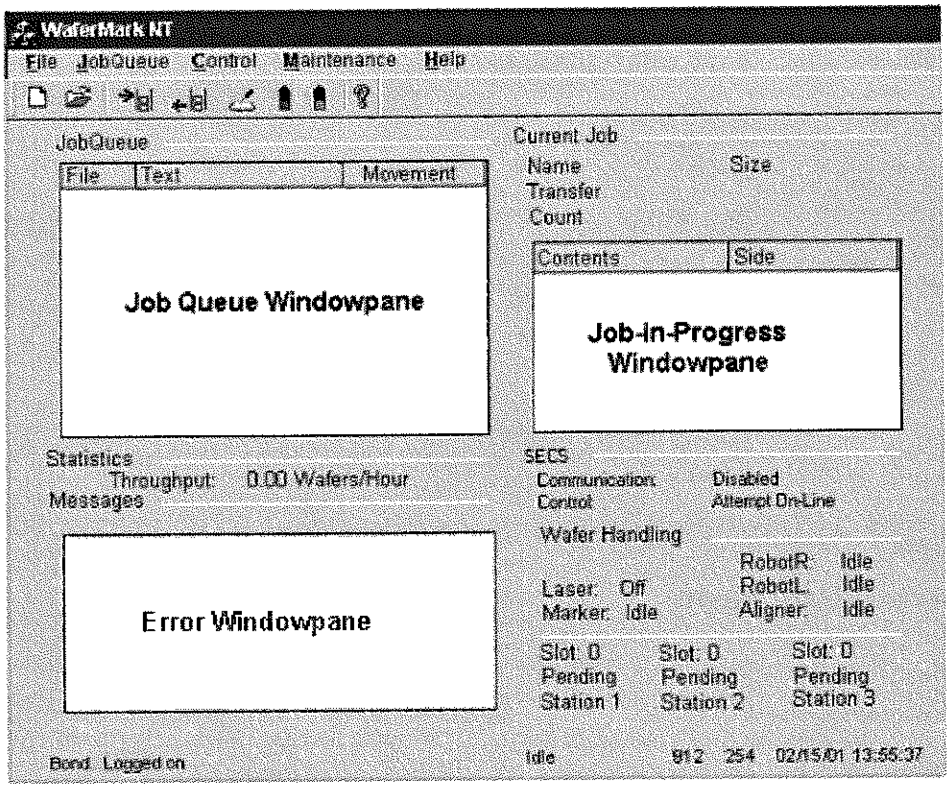
The following example shows a typical **USERINFO.FIL** file:

```
BOND, JAMES, 5
HARRY, 098, 1
JOHN, 1
123, ABC, 3
ABC 3
WASHINGTON, GEORGE, 5
```

NOTE: Line entries in the file are not case sensitive; they can be entered in uppercase or lowercase.

4.5 Main Menu

Figure 4-1 shows the **Main Menu** window of the User Interface. This window displays on the screen immediately after the system initialization sequence completes. This menu is displayed during all system operations except maintenance testing and system setup.



Throughput: 0.00 Wafers/Hour

Communication: Disabled
Control: Attempt On-Line

Laser: Off
Marker: Idle
RobotR: Idle
RobotL: Idle
Aligner: Idle

Slot: 0 Pending Station 1
Slot: 0 Pending Station 2
Slot: 0 Pending Station 3

Bond Logged on
Idle 912 254 02/15/01 13:55:37

Figure 4-1 – Main Menu Window

4.5.1 Description of the Main Menu

At the top of the **Main** menu window is a menu bar containing five drop-down submenus used to access system commands: **File**, **JobQueue**, **Control**, **Maintenance**, and **Help**. Navigate these menus and select commands using the methods described in Section 4.3.

The **Main** menu window also contains several windowpanes and status indicators, as described below.

JobQueue Windowpane

The area shown enclosed on the upper-left of the screen is the **JobQueue** windowpane. It displays information associated with the job, including wafer size and handler movement. The Job Queue is a list of all jobs loaded by the operator in preparation for marking. Queued jobs are listed by filename (without the respective .JOB extension). The text column shows the mark text for the first of the mark groups in the job file. The movement column indicates the cassette definition and the wafer movement scheme.

Current Job Windowpane

Throughout a marking process, details of the current job (on the right of the screen) are displayed as job filename, wafer size (in mm), cassette transfer selection, and current-marking count.

The Contents and Side title headings (two-columns) are in the **Job-in-Progress** windowpane. The **Contents** indicator displays the text string in the process of marking from the current file job.

The **Side** indicator lists the side of the wafer on which the marking is done.

Handling Components Status

The lower-right corner of the screen indicates the status of each of the major wafer handling components. Each component is represented by a status word that describes the current operation. This enables the operator to monitor the overall progress of the system operation. The slot number of the current selected wafer is also displayed in this area of the screen and at each location in the handling system where a cassette is present.

Statistics

The **Statistics** windowpane displays the wafer throughput rate per hour, or productiveness, of the WaferMark system.

SECS Communication Windowpane

If SECS communication is enabled (as shown) for your WaferMark system, the **SECS Communication** windowpane will indicate the status of the SECS connection. It contains two elements: Communication and Control. When Communications is not enabled, no SECS communications windowpane will be displayed.

Messages - Error Windowpane

The area at the lower-left corner of the screen is the **Error** windowpane. It displays any error messages and alarm conditions, with text messages displayed in red.

Status Line

Immediately below the **Main** screen is the system status line that continuously indicates the access level 1, 2, 3, 4, or 5 according to the operator currently logged in and the name of the current operator, the status of the system, and the current system date and time.

The second message of the status line is the status of the system that continuously lists the various system status conditions. A list of status condition indicators is provided in Table 4-1.

Table 4-1 – Status Condition Indicators

Indicator	Status
IDLE	System is not running a job.
RUNNING	System is processing a job normally.
STOPPED	System has stopped processing the current job.
STEPPING	System is executing one step in the process.
QUITTING	System is terminating the job prior to completion.
ABORTED	System is halting all operations and will not be resuming.

4.5.2 Accelerator Keys

Table 4-2 – Main Menu Accelerator Keys

Key	Function
<F10>	Highlight Command (Windows NT® only).
Alt+<F3>	Clear all error messages from the screen.
PageUp	Scroll error message list up one page.
PageDown	Scroll error message list down one page.
Alt+<F4>	Exit Program. Use of this Hard Option should be avoided. It terminates the software program.

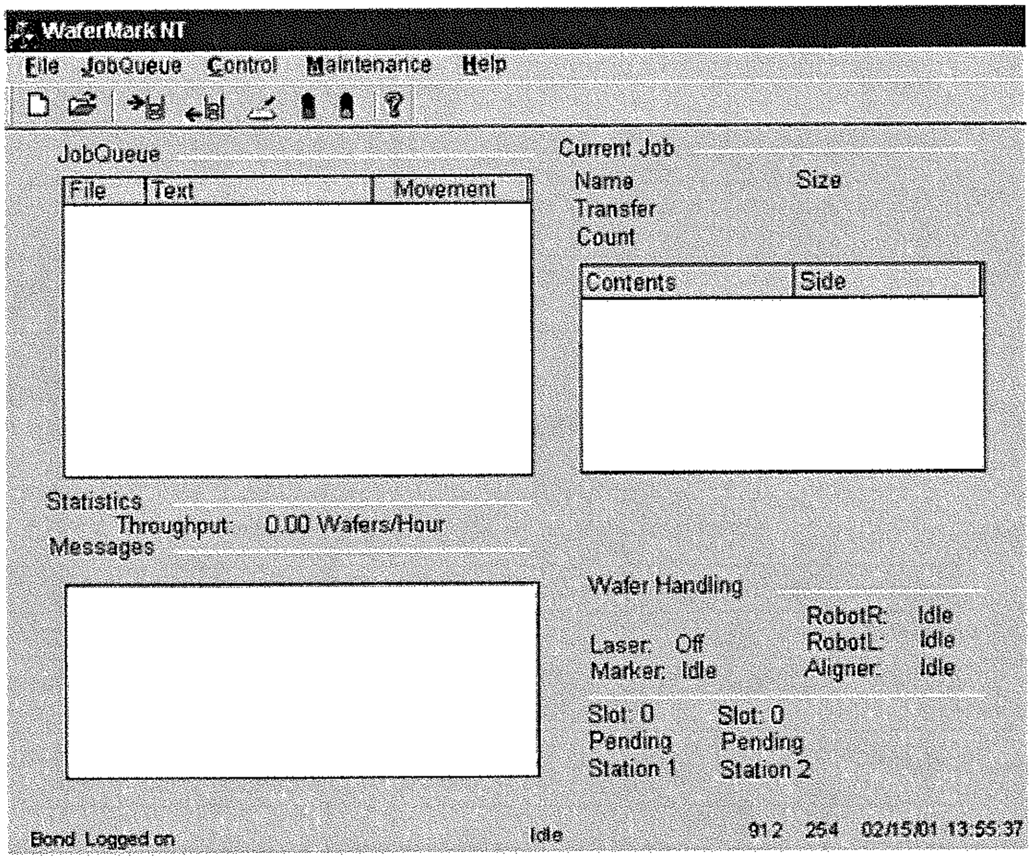
Table 4-2 – Main Menu Accelerator Keys

Ctrl+Tab	Alternates actuates Load 1 or Load 2 buttons.
Accelerator keys	See Section 4.5.2 for the accelerator keys.
Main menu command function keys	See Table 4–1 Main menu command functions in Section 4.5.8.
Editor menu command function keys	See Table 4–2 Editor menu command functions in Section 4.12.

4.5.3 Main Menu Displayed for 300 mm Fixload Wafer Loader Installed

When the 300 mm option is installed, the following keywords are specified in the Maintenance Startup file:

Factory Set or Startup Code	Function
LOADER=[YES / NO]	Activates the loader interface when set to YES; the default is NO.
LOADER_COM=[2|3|4|5|6]	Specifies the serial communication port for the loader interface when active; the default is 4.
LOADER TYPE=[0|1]	Specifies either the FIXLOAD or the STACKLOAD-13. 0=FIXLOAD 1=STACKLOAD-13 (the default).



Throughput: 0.00 Wafers/Hour

RobotR: Idle
Laser: Off
RobotL: Idle
Marker: Idle
Aligner: Idle

Slot: 0
Pending
Station 1

Slot: 0
Pending
Station 2

Bond Logged on
Idle
912 254 02/15/01 13:55:37

For 300 mm FIXLOAD wafer loader systems, the normal cassette states in the Main menu are replaced with the FIXLOAD states, which consist of the following:

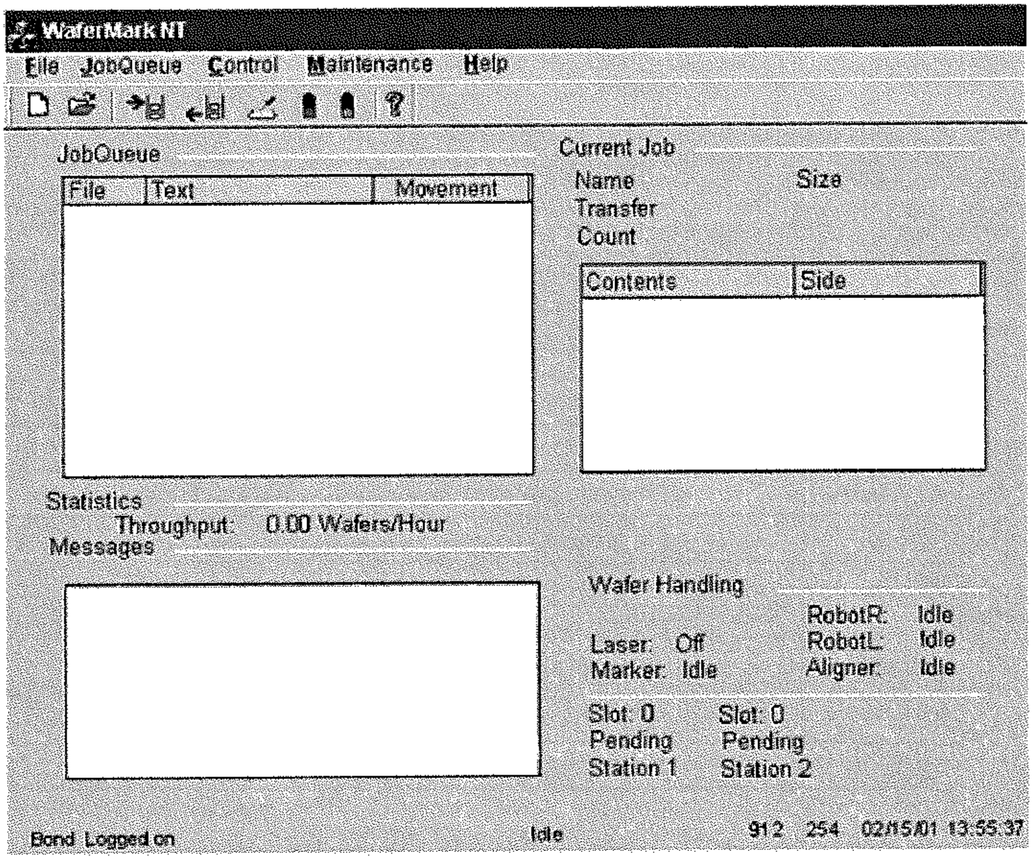
Key	Function
Idle	waiting for load or unload by operator, or job initiation.
m_Process	move to process position.
Process	in process position.
m_Load	move to load position, then to idle.
Init	begin initialization.
w_Init	wait for initialization to complete.
Fault	fault condition.

The UNLOAD indicator for Presenter 2 illuminates when the system has commanded the loader to perform an initialization, load, or unload operation. Other operations are locked out during this interval; however, a RESET will override this condition, causing an initialization (or re-initialization).

4.5.4 Main Menu Displayed for 300 mm Stackload Wafer Loader Installed

For 300 mm STACKLOAD wafer loader systems, the normal cassette states in the **Main** menu are replaced with the STACKLOAD states, which consist of the following:

Key	Function
Idle	waiting for load or unload by operator, or for job initiation.
m_Process	move to process position.
Process	in process position.
m_Load	move to load position, then to idle.
Init	begin initialization.
w_Init	wait for initialization to complete.
Shuttle	loader is moving the other tray to the opener position.
Fault	fault condition.



Name
Size
Transfer
Count

Throughput: 0.00 Wafers/Hour

Laser: Off
Marker: Idle
RobotR: Idle
RobotL: Idle
Aligner: Idle

Slot: 0 Slot: 0
Pending Pending
Station 1 Station 2

Bond Logged on Idle 912 254 02/15/01 13:55:37

The cassette area of the display reflects two presenters when a STACKLOAD is being used. In the lower right corner, the tray number, either 1 or 2, indicates the tray currently at the door opener position. This is the only position where the operator can mount or dismount a FOUP from the STACKLOAD.

The UNLOAD indicator for Presenter2 illuminates when the system has commanded the loader to perform an initialization, load, or unload operation. Other operations are locked out during this interval; however, a RESET will override this condition, causing an initialization (or re-initialization).

For STACKLOAD only, the **LOAD** button for Presenter 2 illuminates when the operator can command a shuttle operation. To send a command to the STACKLOAD to move the other tray to the door opener position, press the **LOAD** button when it is illuminated.

4.5.5 Functions of the Main Menu

Navigate the **Main** menu items and select commands from the drop-down lists using the methods described in Section 4.3.

File Menu

The **File** menu enables the operator to select a new job, open a job, clear a message, log off, or exit the file by using the commands **New, Open, Clear Messages, Log Off,** or **Exit** as described in Section 4.6.

JobQueue Menu

The **JobQueue** menu enables the operator to select and load jobs (**Add Job**) that will be automatically entered into the marking queue at the end of the current queue or to delete a job (**Delete Job**) as described in Section4.7.

Table 4-3 – Job Queue Menu Commands

Command	Function
A	Add Job command.
D	Delete Job command.

Control Menu

The **Control** menu enables the operator to control the actual marking process; this includes starting, stopping, pausing, resuming, and aborting the marking cycle. The operator can also control wafer handling, including transfer and quit transfer operations. From the **Control** menu, the operator can initiate a sample mark of the current job for maintenance purposes or before beginning production marking.

If a control operation is aborted for any reason, a Supervisor or Engineer must reinitialize the system.

From the **Control** drop-down menu, the operator can select the commands **Mark All**, **Stop/Pause**, **Go/Resume**, **Quit**, **Transfer**, **Abort**, and **Samples**, as described in Section 4.8. In addition, a Supervisor or Engineer can select the **Reset** command.

For details about operating security levels, see Section 3.5.

NOTE: Once the control menu is open, the function keys are disabled. These keys are usable only from the general application screen.

Maintenance Menu

The **Maintenance** menu provides a variety of subsystem setup menus that allow the Engineer or GSI Lumonics field service personnel to specify or alter the configuration of the system and to set up the individual system hardware components.

The **Maintenance** drop-down menu provides commands for **Robot, Aligner, Marker, Presenter Data, Calibrate, Startup Data, Cassette Definition, Barcode Data, Users, Serial Numbers, Reader, Laser Power, ID Matrix, Optics** and **Loader** functions (see Section4.9).

Help Menu

The **Help** menu provides information about the WaferMark job monitor.

4.5.6 Selecting a Title Bar and Menu

To select a menu from the title bar, direct the trackball pointer across the title bar selection and the drop down menu is opened when the bar is pointed or use any of the following procedures:

1. Press function key **<F10>** to highlight the title bar. Move the → (Right)←(Left) or cursor key to highlight the selected title bar. Press ↓ (Down) cursor key to open the drop-down menu. Use the ↑ (Up) or ↓ (Down) cursor key to highlight the appropriate command and press the **Enter** key.
2. Type the **Alt** key, together with the letter that is highlighted in the menu title; see Table 4-1 on the next page for the Main menu selections.

4.5.7 Selecting a Menu Command

To select a command from an open menu direct trackball pointer to selection and click or use the following procedure:

1. If the required command is first in the list, press <**Enter**>.

2. If a function key number is shown next to the required command in a menu, press this key.

   NOTE: The function key is operative when the menu is closed.
3. Press the keystroke corresponding to the bold character of the command name displayed in menu.
4. Use the ↑ (Up) or ↓ (Down) cursor keys to position the highlight desired command, then press **Enter**.

4.5.8 Main Menu Command Functions

Table 4-4 lists the **Main** menu command functions.

Table 4-4 – Main Menu Command Functions

Command	Function
Alt+F	Opens the File drop-down menu.
Alt+J	Opens the JobQueue drop-down menu.
Alt+C	Opens the Control drop-down menu.
Alt+M	Opens the Maintenance drop-down menu.
Alt+H	Opens the Help drop-down menu.
<Alt+F4>	Exits the program. Use of this Hard Option should be avoided. It terminates the software program.
<Alt+F3>	Clears error messages from the screen.
Function key **<F3>**	Mark All command.
Function key **<F4>**	Stop/Pause command.
Function key**<F5>**	Go/Resume command.
Function key**<F6>**	Quit command.
Function key**<F7>**	Transfer command.
Function key **<F8>**	Abort command.
Function key **<F9>**	Sample command.
FILE MENU	
Ctrl+N	Selects a New Job.
Ctrl+O	Opens a job.
C	Clear Messages.
L	Log Off command.
X	Exit File command.
CONTROL MENU	

Table 4-4 – Main Menu Command Functions

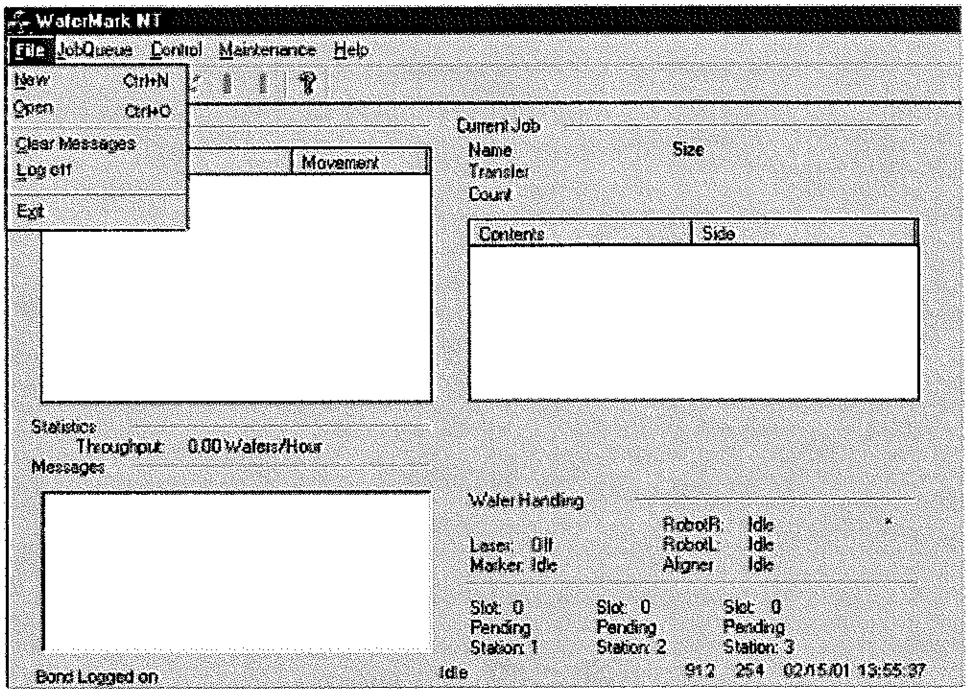
Command	Function
M / <F3>	Mark All command.
P / <F4>	Stop/Pause command.
G / <F5>	Go/Resume command.
Q / <F6>	Quit command.
T / <F7>	Transfer command.
<F8>	Abort command.
S / <F9>	Sample command.
R	Reset command.
NOTE: If the SECS is enabled, the following three commands are available:	
SECS Terminal	
SECS File	
SECS Mode	
MAINTENANCE MENU	
R	Robot.
A	Aligner.
M	Marker.
P	Presenter data.
L	Calibrate.
S	Startup data.
C	Cassette definition.
B	Barcode data.
U	Users.
N	Serial Numbers.
D	Reader.
W	Laser Power.
I	ID Matrix.
T	Optics.
L	Loader.

Table 4-4 – Main Menu Command Functions

Command	Function
HELP MENU	
A	About WaferMark NT Job Monitor.

4.6 File Menu

Click on the ***File*** title bar (or press function key **<F10>**and type **F**) at the Main menu, to open the File drop-down menu and reveals a list of available job file commands as follows:



Throughput: 0.00 Wafers/Hour

RobotR: Idle
Laser: Off
RobotL: Idle
Marker: Idle
Aligner: Idle

Slot: 0 Pending Station: 1
Slot: 0 Pending Station: 2
Slot: 0 Pending Station: 3

Bond Logged on Idle 912 254 02/15/01 13:55:37

4.6.1 New File Job Command

To create a new job, select the **New** command from the **File** menu (or **<Ctrl+N>**). This command will open the **Job Editor**. Go to Section 4.12 for instructions on using the **Job Editor**. Each time you add a new job file, the new job name is added to the top of the file list in the **Job Queue** windowpane.

NOTE: An alternate method is to click on the New Job icon on the toolbar.

4.6.2 Open File Job Command

To **Open** an existing Job file, select the **Open** command from the **File** menu (or <Ctrl+O>). This brings up the **Job Editor** with a Select Job box that asks you to choose the job to edit. Go to Section 4.12 for instructions on using the Job Editor.

NOTE: An alternate method is to click on the Folder icon on the toolbar.

4.6.3 Clear Messages Command

Selecting the **Clear Messages** command from the **File** menu (or typing C) removes the Error or Alarm messages displayed (in red) in the **Error** windowpane.

4.6.4 Log Off Commands

Selecting the **Log off** command from the **File** menu (or typing L) logs out the current operator at the Main menu and terminates the current session. The system then displays a **Log-In** dialog box.

4.6.5 Exit

You can exit from the WaferMark application in two ways:

1. To abandon the current session and log off from the **Main** menu only, select the **Exit** command from the **File** menu.
2. To abandon the current session and log off from the system, press **<Alt+F4>**.

NOTE: Whenever powering down the system, first shut down the Windows® NT program from the Windows **Start** *menu bar.*

4.7 Job Queue Menu

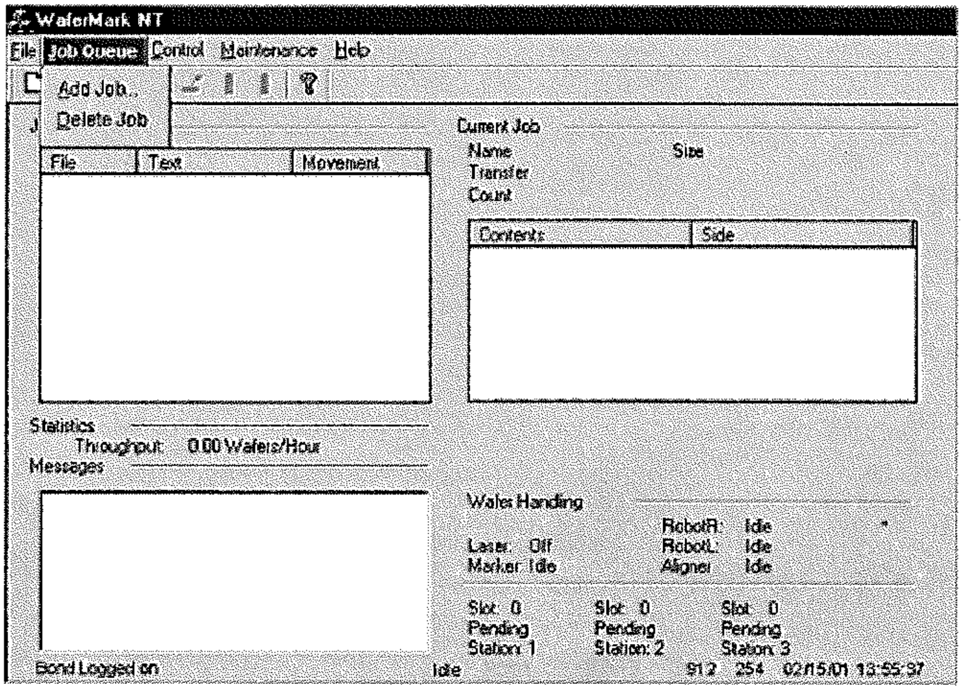
To reveal the available **JobQueue** commands, as shown below (see Figure 4-2):

1. Click on the **JobQueue** drop-down menu or press **<F10>**.

2. Press the <J> key.

To automatically load jobs into the marking queue (at the end of the current queue), select the **Add Job** command from the **JobQueue** menu.

To remove the jobs from the job queue, select the **Delete Job** command.



Throughput: 0.00 Wafers/Hour

Laser: Off
Marker: Idle
RobotR: Idle
RobotL: Idle
Aligner: Idle

Bond Logged on
Idle
912 254 02/15/01 13:55:37

Figure 4-2 – Job Queue Menu

4.7.1 Add Job Command

To select and load an existing job file and add the job to the end of the marking queue:

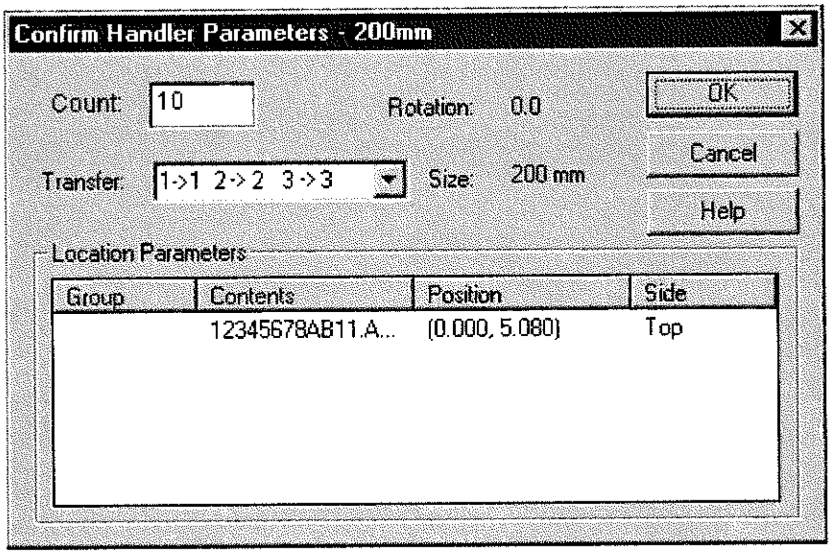
1. Click on the **Add Job** command from the **JobQueue** or on the **Add Job** icon on the toolbar. This command functions the same as a standard Windows NT **File** + **Open** command.

   NOTE: The **Help** *button is currently inactive.*

2. With the job filename specified, press **Open** to load the job. The **Confirm Handler Parameters** dialog box

then displays the current handler parameters and marking text specified in the job.

The **Confirm Handler Parameters** dialog box allows you to change the **Transfer** selection or any of the group text for this job, or simply to confirm that the information is correct for this job. A typical example follows:



Count: 10

Rotation: 0.0

Transfer: 1->1 2->2 3->3

Size: 200 mm

Group	Contents	Position	Side
	12345678AB11.A...	(0.000, 5.080)	Top

The **Transfer** list box displays a pulldown list of options for the sequence of wafer movement during wafer marking (see Transfer in Table 4-15).

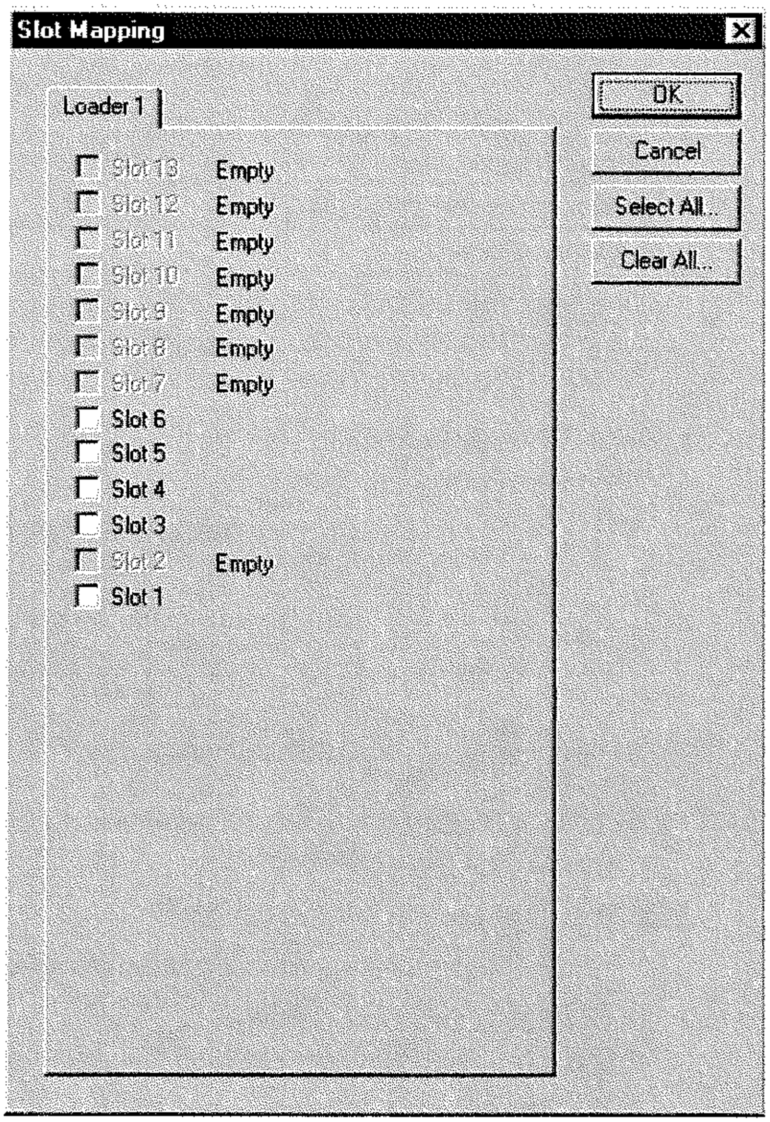
The **Rotation** tag identifies the orientation of the slot or flat of a silicon wafer on the mark chamber aligner needed to accurately align the desired marking field under the lasers work envelope. The rotation (in degrees 0 - 360) is specified in the job setup Options (see in Section 4.12.5).

The **Size** tag specifies the wafer size in the cassette. The Location Parameters area lists the Group, Contents, Position and marking Side of the wafer job.

NOTE: If you have the **Slot Mappings** *option, continue with the next step. Otherwise, this process is complete.*

To perform slot mapping:

1. Click on the **Slot Mappings** button. The **Slot Mapping** dialog box displays, as shown below:



☐ Slot 13 Empty
☐ Slot 12 Empty
☐ Slot 11 Empty
☐ Slot 10 Empty
☐ Slot 9 Empty
☐ Slot 8 Empty
☐ Slot 7 Empty
☐ Slot 6
☐ Slot 5
☐ Slot 4
☐ Slot 3
☐ Slot 2 Empty
☐ Slot 1

The slot map indicates cassette slots that contain wafers with open slot checkboxes. The empty cassette slots are grayed out (unavailable) and labeled ***Empty***.

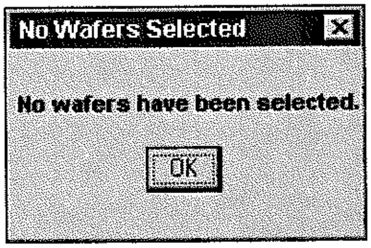
2. Click on an open slot checkbox to select that wafer slot position; this also places a checkmark in the box. Table 4-5 describes the functions of the dialog box buttons.

Table 4-5 – Slot Mapping Dialog Box Button Functions

Button	Function
OK	Accepts changes and returns to the Confirm Handler Parameters window.
Cancel	Abandons changes and returns to the Confirm Handler Parameters window.
Select All	Selects all occupied slot positions.
Clear All	Clears all selections.

3. Press the **OK** button to close the slot map window. When you select the **OK** button on the confirmation screen, the Job is added to the marking queue and the current window closes.

If you clicked on **OK** without selecting the wafer slots, a **No Wafers Selected** message box appears.



No wafers have been selected.

Click **OK** to return to the **Confirm Handler Parameters** dialog box and select the **Slot Mappings** button to select the wafers.

NOTE: The **Help** *button is currently inactive.*

For additional descriptions of parameters displayed in this window, see Section 4.12.5.

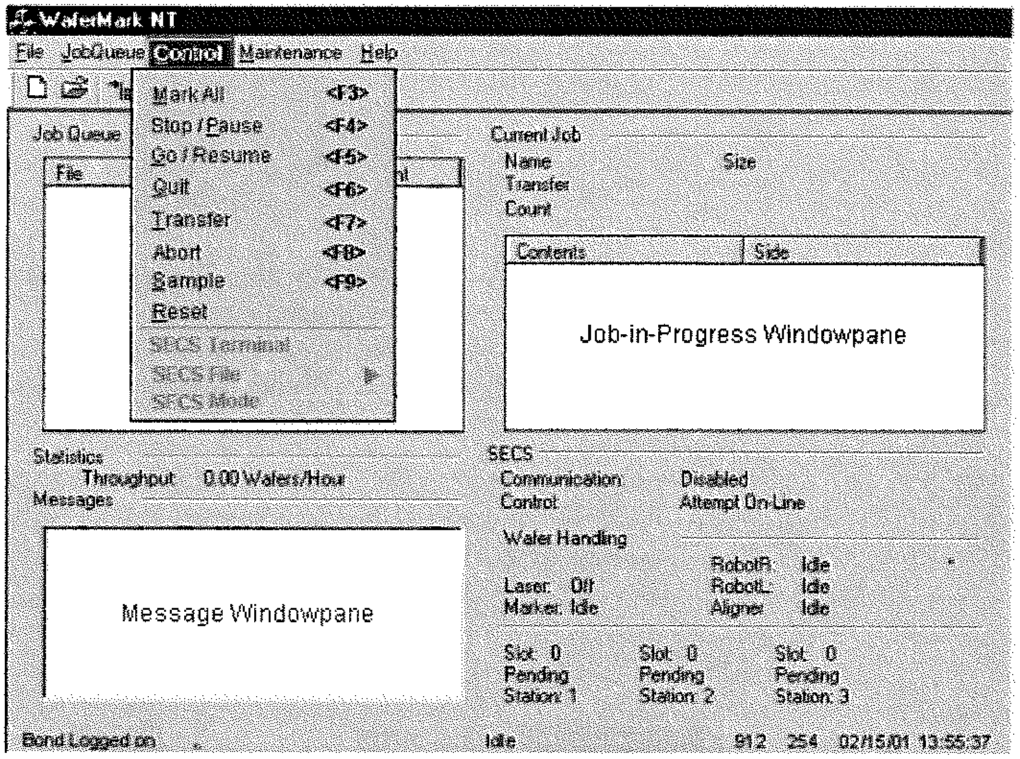
NOTE: Side selection is relative only when a flipper is installed in system.

4.7.2 Delete Job Command

The **Delete Job** (in queue) command is used to delete a job listed in the queue. The **Delete Job** command will remain inaccessible (in the background) until the operator selects the job title for deletion. This is accomplished by clicking on the job name. The selected job will remain highlighted until deleted. The **Delete** command will then become accessible. Clicking the **Delete Job** button (or typing **D**) will delete only the job that was marked (highlighted). The operator can delete only one job at a time. Clicking on the**Delete Job** icon from the toolbar after a job name has been marked (highlighted) will also delete that job.

4.8 Control Menu

Click on the **Control** drop-down menu (or **<F10+C>**) to list commands that control Marker operations (see Figure 4-3).



Name
Size
Transfer
Count

Throughput 0.00 Wafers/Hour

Communication Disabled
Control Attempt On-Line

RobotR: Idle
Laser: Off
RobotL: Idle
Marker: Idle
Aligner: Idle

Slot: 0 Slot: 0 Slot: 0
Pending Pending Pending
Station: 1 Station: 2 Station: 3

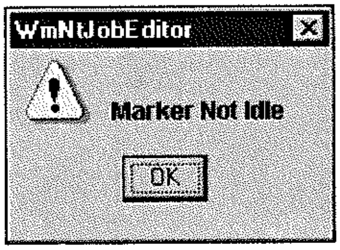
Bond Logged on
Idle
912 254 02/15/01 13:55:37

Figure 4-3 – Control Menu

NOTE: If SECS communications is enabled for the WaferMark® system, the SECS windowpane indicates the status of the SECS connection; otherwise, this option and the SECS terminal file and control options shown here are hidden.

4.8.1 Mark All Command

Assuming that you have a job in the queue, click on the **Mark All** command (or: if the Control Menu is open, typeM; if the Control Menu is closed, press <F3>) to initiate normal job production marking when the system is in the *IDLE* state. Clicking on the **Mark All** icon on the toolbar produces the same result. If the system is not *IDLE*, selecting **Mark All** has no effect and the following message is displayed:



The operator must acknowledge this message by clicking **OK**. This clears the message and **Control** screen and returns the operator to the **Main** menu; at this point, the **JobQueue** item will be highlighted in preparation for adding a job to the marking queue.

The first job in the marking queue is identified as the current job. Once the operation has been started, the system state is set to ***RUNNING*** and the green signal tower light goes on. The Wafer-in-Place sensor first verifies there are no extraneous wafers on the aligner prior to starting the mark. At this time, the recipe (job) is moved from the top of the **JobQueue** windowpane and transferred to the **Job-in-Progress** windowpane at the top right of the screen. The **Job-in-Progress** windowpane (as identified in the Main Control menu figure above) displays the job name (Name), transfer information, count, cassette name (Size), contents (mark text) and side.

After the current job has completed marking and wafer handling operations without error, the program purges the contents of the current job, turns off the green signal tower light and returns the system state to *IDLE*.

4.8.2 Stop / Pause Command

Click on the **Stop/Pause** command (or type **P** or press <F4>) to stop the marking and wafer handling operations. Any marking and handler motion that is in process completes before the system stops.

4.8.3 Go / Resume Command

Click on the **Go/Resume** command (or type G or press <F5>) to cause the job in process to resume if the system is in the ***STOPPED*** state. After the command has been selected, the state condition will be set to ***RUNNING*** and the operation will resume from the point at which the system stopped.

4.8.4 Quit Command

Click on the **Quit** command (or type **Q**, or press <F6>) to terminate the job in progress. When the **Quit** command has been selected, no new wafers will be removed from the cassettes and any wafers in the handling and marking process will continue until this sequence is finished. The system remains in the quitting state until all wafers in progress have been completed and returned to the cassette. The **Quit** command is effective only if the system is in either the ***RUNNING*** or ***STOPPED*** state. Until any operation in progress has been completed, the system will be in the ***QUITTING*** state. After all wafers have been returned to their cassettes, the system will purge the contents of the current job, turn off the green signal tower light (if installed), and return to the ***IDLE*** state.

4.8.5 Transfer Command

Click on the **Transfer** command (or type **T**, or press <F7>) to enable a normal operational sequence to be performed in a single step mode. Each successive step in the sequence is initiated by pressing <F7> again. For this command to be effective, the system must be in the ***IDLE*** state. (If the system is in a ***STOPPED*** state, the **Transfer** command is disabled.) When the command is issued while in the ***IDLE*** state, the first entry in the job queue will become the current job and turn on the green signal tower light. The step that causes the job to complete will also purge the contents of the current job, return the state to *IDLE*, and turn off the green signal tower light.

4.8.6 Abort Command

Use the Abort command for emergency situations only. Click on the **Abort** command or press <F8> to terminate the job in progress. No new wafers will be removed from the cassette. Any robot, aligner, or marker operation will stop immediately, and any wafers in the handling sequence will remain at the current locations. No attempt will be made to return the wafers to their original cassette locations. For the **Abort** command to initiate, the system must be ***RUNNING*** or ***STOPPED***. After an operation has been aborted, the Engineer must perform a **Reset** command from the **Control** menu. This will reinitialize the system and return it to the *IDLE* state.

NOTE: ***The Abort command should be used ONLY in an emergency.*** *Once aborted, a job cannot be resumed. Wafers are left in their current positions at the time of the abort. To return wafers to their cassettes requires either the use of manually entered Robot and Aligner commands or hand transferring.*

4.8.7 Sample Command

Click on the **Sample** command (or type S, or press <F9>) to align a wafer on the chuck. When the wafer is properly aligned, a signal is sent to the marker to initiate a single marking cycle.

NOTE: This command is valid only when the system is in the ***Running*** *state. Before selecting the Sample command, first use the Transfer command to transfer a wafer to the Aligner. (See Section 4.8.5).*

4.8.8 Reset Command

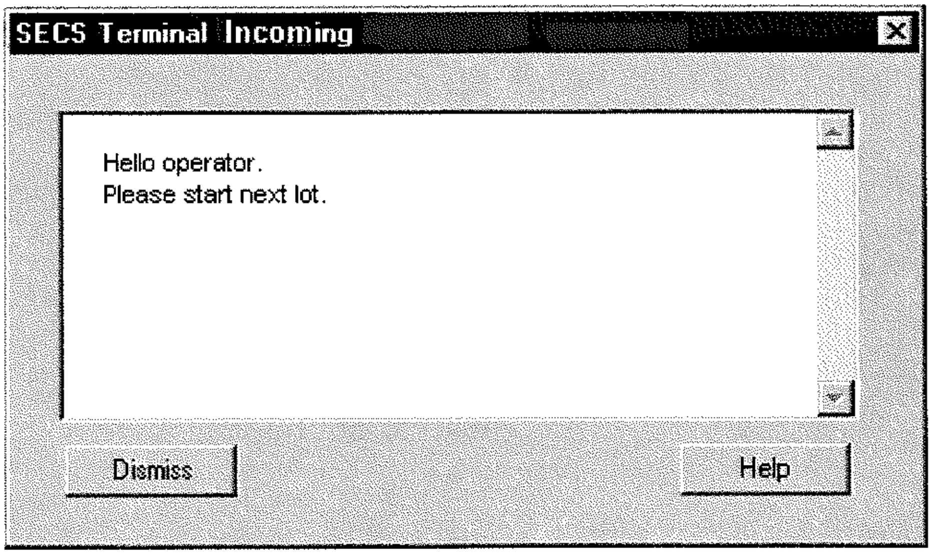
After issuing an **Abort** command, click on the **Reset** command (or type **R**) to initiate a system reset and initialization. The system will reinitialize, restore everything to the home position, and return to the *IDLE* state.

4.8.9 SECS Terminal Command

The SECS Terminal command is only displayed in the **Control** menu if the keyword statement `SECS_HOST_PRESENT=YES` is included in the **Maintenance Startup Data** file. This mode enables the Host or operator to communicate via a terminal interface with the operator or Host, respectively. These messages are transferred using the Stream 10 functions.

The screens displayed for SECS terminal operation are shown below. When an incoming message arrives, the **SECS Terminal Incoming** (message) window displays the message, an operator call prompt occurs and the amber signal tower light illuminates to alert the operator that the Host is waiting to present a message.

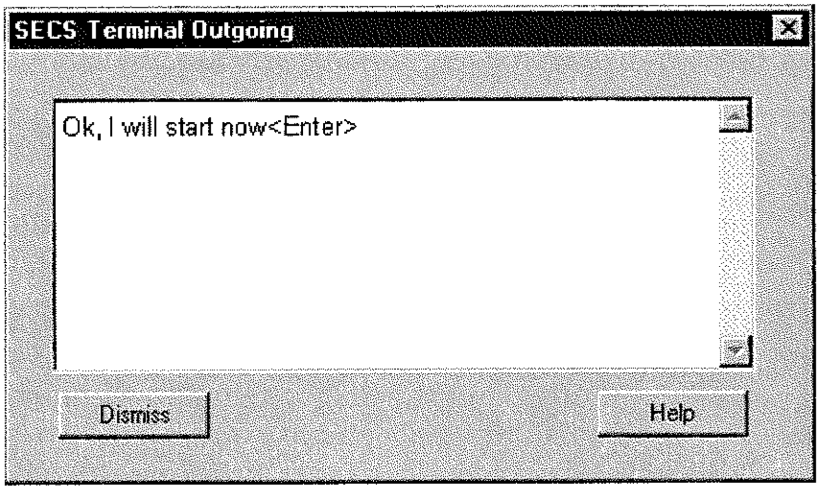
If the operator is currently editing from the **Maintenance** menu, the incoming message is not displayed. This is reported back to the Host, but the amber signal tower light is turned ON. To extinguish the amber signal tower light without removing the message window, the operator presses the **ACK** button on the terminal screen. To extinguish the amber signal tower light and acknowledge and remove the incoming message, the operator presses the **Dismiss** button.



Hello operator.
Please start next lot.

NOTE: If the operator is doing another task, the operator can acknowledge the message when that task is completed.

If the operator has not received a message and selects **SECS Terminal** from the **Control** menu, the following screen appears:



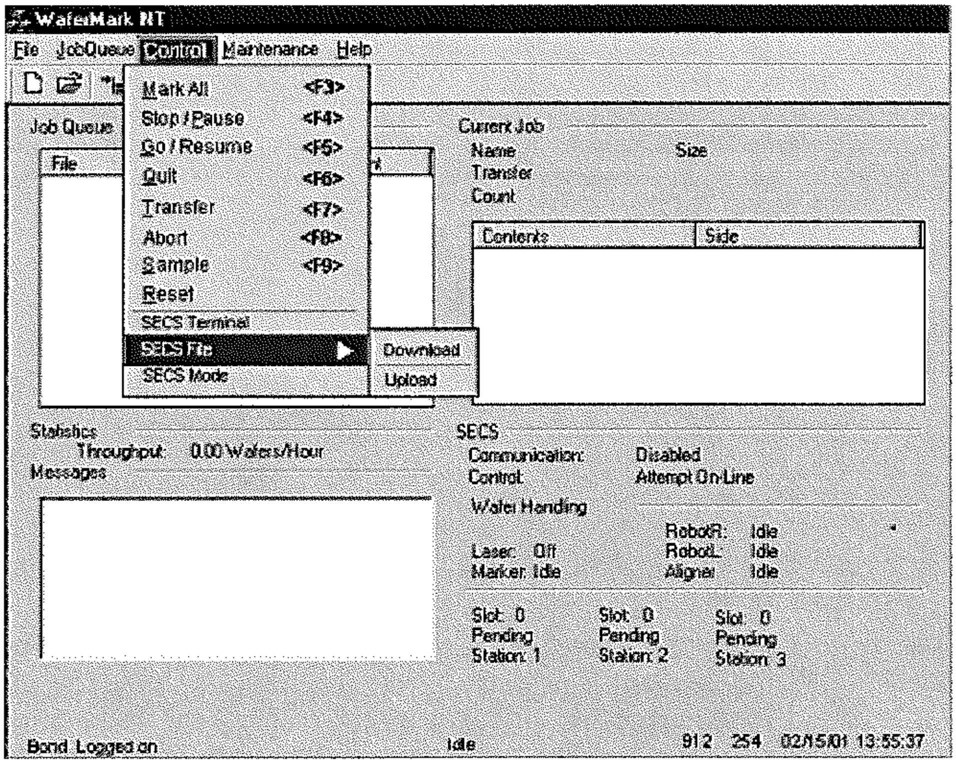
Ok, I will start now<Enter>

Press the **Dismiss** button to acknowledge and remove the outgoing message.

NOTE: The **Help** *button is inactive at this time.*

4.8.10 SECS File Commands

The **SECS File** command allows the operator to upload and download job files to the Host, if the Host is communicating. When selected from the **Control** menu, the **Download** and **Upload** commands are available (see Figure 4-4).



Name
Size
Transfer
Count

Throughput: 0.00 Wafers/Hour

Communication: Disabled
Control: Attempt On-Line

RobotR: Idle
Laser: Off
RobotL: Idle
Marker: Idle
Aligner: Idle

Slot: 0
Pending
Station: 1

Slot: 0
Pending
Station: 2

Slot: 0
Pending
Station: 3

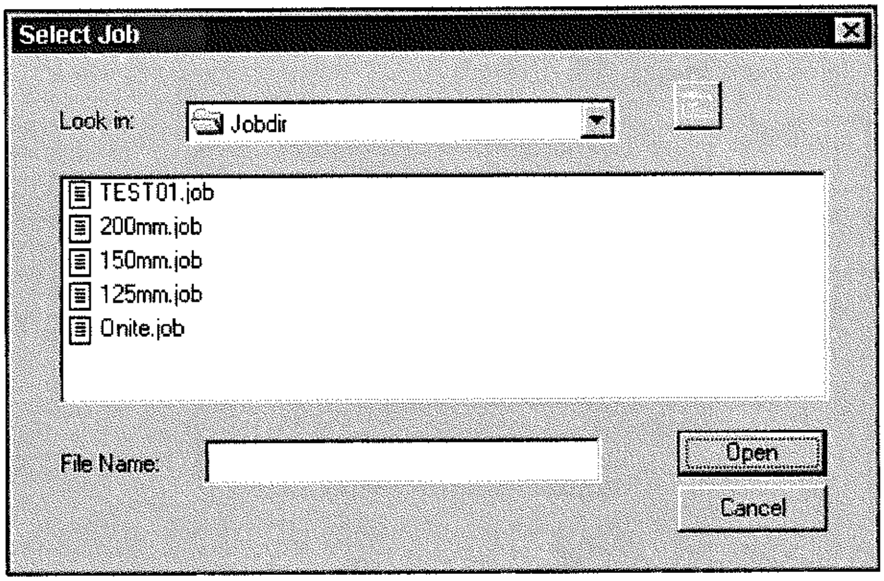
Bond Logged on
Idle
912 254 02/15/01 13:55:37

Figure 4-4 – SECS File Commands

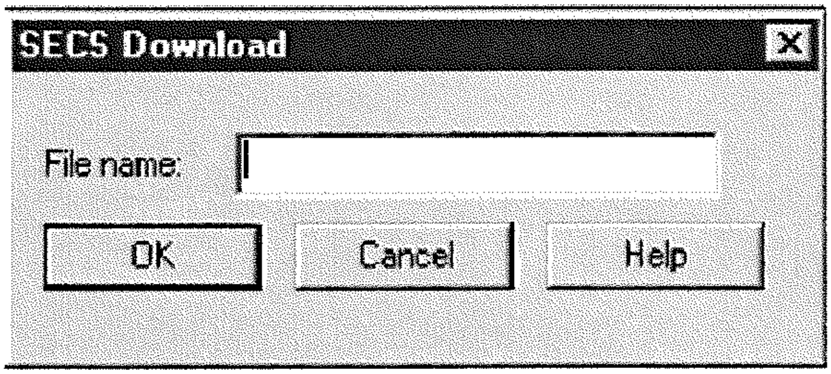
To upload a job:

1. Click on the **Upload** command.
2. Select a job from the current job directory (**JOBDIR**) or one of its subdirectories and upload that job to the Host.
3. Click on the **Open** button.

If the Host cannot receive the upload, an alert message indicates the Host's rejection of the upload request.



The **Download** command is limited to Job files only. When a download is requested, the job filename must be entered in a form that the Host can understand. After the Host has sent the file, it will be stored in the default JOBDIR. If the Host prefixes the job name with a directory, it is expected that the directory already exists. Examine the "Look In" listbox content. It is expected that only files with the **.JOB** extension will be downloaded from the Host, since the only place they can be stored is in the **JOBDIR**. (If the Host wishes to download other files, the Host must initiate the transfer using the S7F1/F3 capability. In this respect, the Host is not restricted (as is the operator) to the files that can be downloaded to the WaferMark system.) Clicking on the **OK** button downloads the File name entry.



Clicking on the **Cancel** button terminates the File name entry. The **Help** button is not functional and exists only for future development.

4.8.11 SECS Mode Command

The equipment constant `SECS_MODE_CONTROL` allows the WaferMark to operate in a GEM-compliant mode or other modes which are not compliant. The GEM-compliant mode conforms to the Control Modes described in SEMI E5-93; however, the NON-GEM modes are included for backward compatibility with existing customer implementations.

The equipment constant statement `SECS_MODE_CONTROL` can be set to:

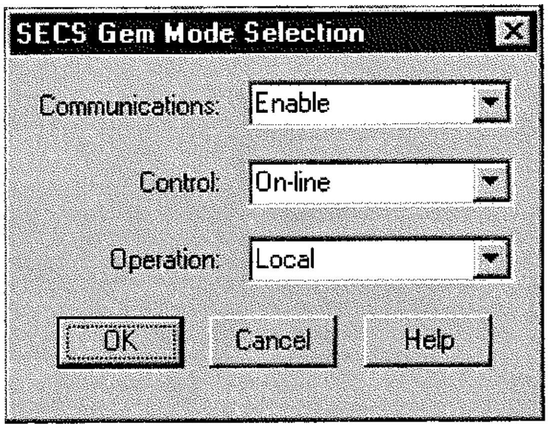
```
=0 for NON-GEM (old standard SECS-II implementation)
=1 for NON-GEM (Custom #1 of old standard SECS=II
implementation)
=2 for GEM mode control.
```

If the `SECS_MODE_CONTROL` statement is not present in the **Maintenance Startup Data** file, the system will operate in default automatic mode.

When the mode settings have been entered, the status of communications and the control mode are displayed on the SECS windowpane.

GEM Mode Control Selection

If `SECS_MODE_CONTROL=2` is specified in the **Maintenance Startup Data** file, selecting **SECS Mode** from the **Control** menu will display the following dialog box:



Communications: Enable

Control: On-line

Operation: Local

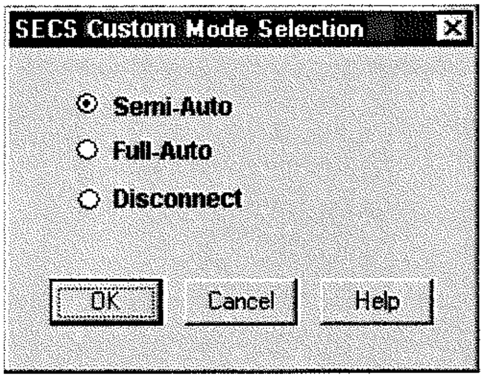
From the **SECS GEM Mode Selection** dialog box, click on the **Communications** drop-down list to select either ENABLE or DISABLE. Click on the **Control** drop-down list to select either ON-LINE or OFF-LINE. Click on the **Operation** drop-down list to select either LOCAL or REMOTE. In order to save changes made to these fields, click on the **OK** button to save and close the dialog box. Clicking on the **Cancel** button will nullify any changes made and restore the settings that were in place when the dialog box was opened. The **Help** button is not functional and exists only for future development.

Custom Mode Selection

If `SECS_MODE_CONTROL=1`, the system will be operating in NON-GEM Custom 1 SECS mode. **Custom 1** allows the operator to change between Full and Semi-Automatic mode, or electrically disconnect from the Host at the UART. These modes are similar to Remote/Local and Off-Line, but do not conform to GEM models. This option implements S1F65 and S1F69 barcode messages with automatic Barcode Readers at each presenter, and also implements a multi-message sequence whenever a communication mode is established. (For further details, refer to the *WaferMark® GEM/SECS Interface User's Guide*, P/N 273.495.00, for a full description of the factory operational script for this mode.)

If `SECS_MODE_CONTROL=1` is specified in the **Maintenance Startup Data** file, the system will be operating in NON-GEM Custom

1 SECS mode; therefore, selecting **SECS Mode** from the **Control** menu will display the following window:



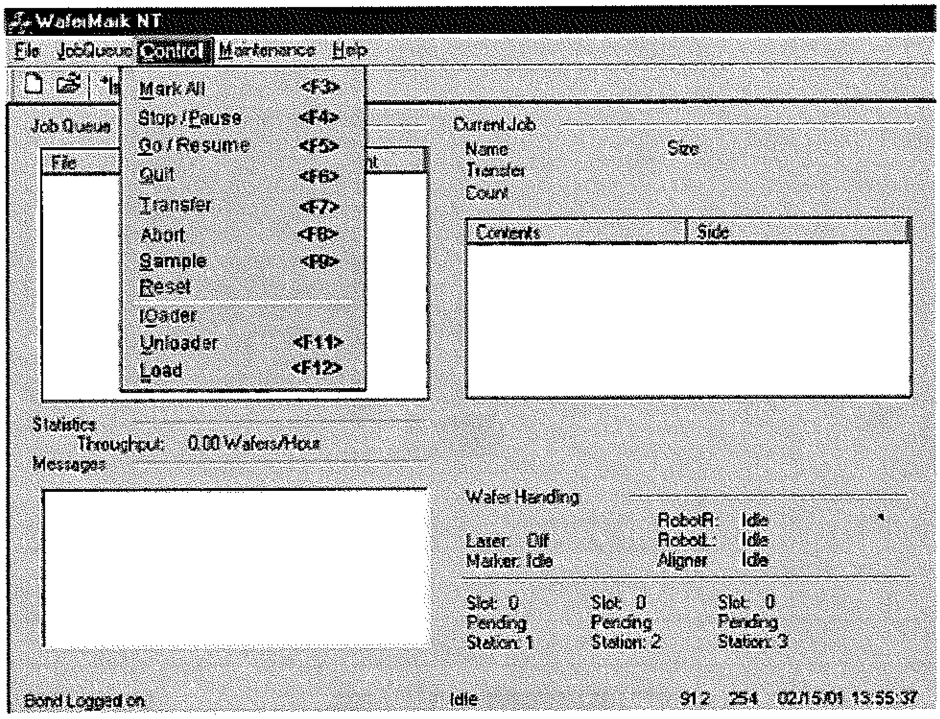
The functions of the operating modes, Semi-Auto, Full Auto, and Disconnect are:

Function	Description
Semi-Auto Mode	Allows limited input command from Host: S1F1 S2F21 (mode change only) and Stream 10 Terminal operation. (If Barcode Readers are installed, they are not active; this is the default setting.)
Full-Auto Mode	Operation is the same as the current WaferMark standard, with the Barcode Reader messages active if the keyword statement BARCODE_ENABLE=YES is specified in the Maintenance Startup Data file.
Disconnect Mode	Allows the operator to electrically disconnect from the Host at the UART. After normal completion of SECS initialization, the operator can disconnect and then re-connect freely as long as the system is IDLE and not attempting to initialize the Host. When disconnected, the system will provide no response to any Host requests.

With SECS_MODE_CONTROL=1, the communications status and current operating mode will be displayed in the SECS windowpane.

4.8.12 SMIF (Standard Mechanical InterFace) Loader Option

If the SMIF option is chosen, the following screen appears when you select the Control menu.



Throughput: 0.00 Wafers/Hour

Laser: Off
Marker: Idle
RobotR: Idle
RobotL: Idle
Aligner: Idle

Slot: 0 Pending Station: 1
Slot: 0 Pending Station: 2
Slot: 0 Pending Station: 3

Bond Logged on   Idle   912 254 02/15/01 13:55:37

NOTE: Although the Loader Option can and often does share the control menu with the SECS option, only the Loader option is shown here.

Two different SMIF devices can be used:

- SMIF-SAP Loader Interface (see Section 4.8.13).
- Jenoptik INFAB ERGOSPEED II (see Section 4.8.16).

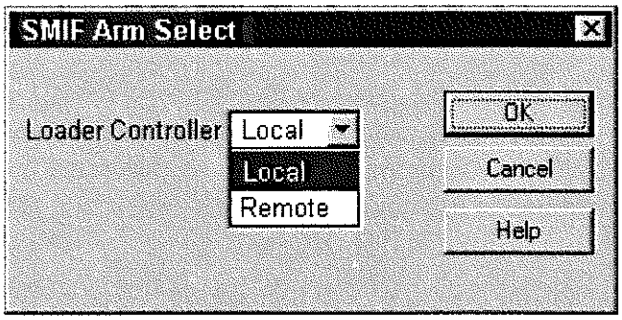
4.8.13 SMIF-SAP Loader Interface

Selecting the lOader, Unloader, and Load commands from the **Control** menu accesses the SMIF-SAP loader. The SMIF-SAP Loader Interface, using a parallel-to-serial interface, provides another method of loading cassettes on and off the cassette presenter stations. The SMIF-SAP Loader Interface (p/n 6650155) uses a serial-to-8-bit I/O interface Keithely M1750. The M1750 uses a Master serial port to communicate between the WaferMark and the SMIF parallel port. The SMIF Arm uses the serial interface to provide another method of loading cassettes on and off the cassette presenter stations. Hardware interlocks on the SMIF and one line of the SMIF's parallel input provide a crash safety feature.

4.8.14 Loader Command

The Loader command allows the operator to select Local or Remote control of the SMIF Arm. To choose the SMIF Arm controller:

1. From the **Control** menu, click the **lOader** button (or type **o**).
2. Click the listbox selections for **LOCAL** or **REMOTE**, as needed:



   a. To load/unload cassettes independent of the WaferMark equipment via the WaferMark equipment GEM/SECS interface by the Host, select **REMOTE**; the Load and Unload functions will not function.
   b. To control all loading/unloading of cassettes using the **Load/Unload** functions of the **Control** menu, select **LOCAL**.

   The WaferMark software checks the state of the equipment and the SMIF device before proceeding with any operation. The SMIF must not already be active, the SMIF must have a pod, the cassette in place sensor for the middle presenter must be correct, and the cassette/control state of the equipment must be acceptable to the cassette operation. Once mounted, the pod must be locked before it can be loaded. Once loaded, it must be unloaded before the pod can be unlocked. Once unloaded, the pod must be unlocked and pod removed before another pod can be mounted. To circumvent this last restriction, set the key DISMOUNT_REQUIRED=NO.

NOTE: The process must take no longer than 2 seconds or the following error is declared:

```
6203,SMIF_LOAD Sequence error:%d,%d,%d
Where the status, %d,%d,%d, should be
0,  0,  1
|  |  |-⇒ mode is AUTO
|  |-----⇒ cassette is in place
|---------⇒ system ready
```

4.8.15 Unloader Command

When the operator clicks on the **Unloader** button, the WaferMark software checks for SMIF Arm output MANUAL_MODE status. If the SMIF Arm is idle or "not active", the output is equal to a 1 (one). This allows a **Load** or **Unload** command sequence. Also, the wait before failure has a two second time out. The WaferMark then monitors the READY, READY_TO_ UNLOAD and the CASSETTE_IN_PLACE lines.

The wait for them to become 'active' is a maximum of 2 seconds, after which the following SMIF UNLOAD sequence error occurs.

```
6204,SMIF_UNLOAD Sequence error:%d,%d,%d,%d
Where the status, %d,%d,%d,%d, should be
0,  0,  0,  1
|  |  |  |-⇒ mode is AUTO
|  |  |-----⇒ ready to unload
|  |---------⇒ cassette is in place
|-------------⇒ system ready
```

Before the UNLOAD process can begin, the cassette-in-place sensor must be TRUE. The WaferMark then sets PORT LOCK input to the SMIF Arm to be unlocked (not active) and the HOST READY TO UNLOAD and the LOAD/UNLOAD lines to active. When the READY line goes 'not active', the unload operation is complete if and only if the cassette-in-place sensor now is FALSE. When the unload is complete the WaferMark sets HOST READY TO UNLOAD and REMOTE LOAD/UNLOAD lines to not active. If `LOADER = YES` and the SMIF interface has been successfully initialized, a status indicator appears on the main screen of WaferMark, row 12, column 40, where:

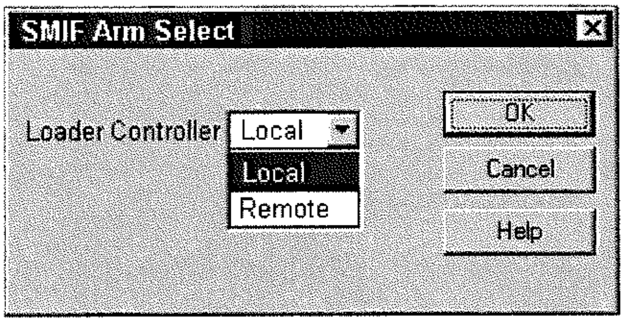
- L, if "local" is selected.
- R, if "remote" is selected.

4.8.16 Jenoptik INFAB ERGOSPEED Loader Interface

The Jenoptik INFAB ERGOSPEED II SMIF (Standard Mechanical Interface) Arm provides another method of loading/unloading a cassette to the center cassette presenter station. This SMIF loader uses a standard RS-232 serial interface. The commands are in ASCII.

Loader Command

The lOader function, with 'O' as the accelerator key, lets the operator choose between LOCAL or REMOTE control of the SMIF Arm.



The following two selections are possible, by using the list box selection for LOCAL or REMOTE.

1	REMOTE setting: a cassette may be loaded/unloaded via the WaferMark equipment GEM/SECS interface by the Host; the Load and Unload functions do not function.
2	LOCAL setting:, an operator controls all loading/unloading of cassettes using the Load/Unload functions of the Control menu.

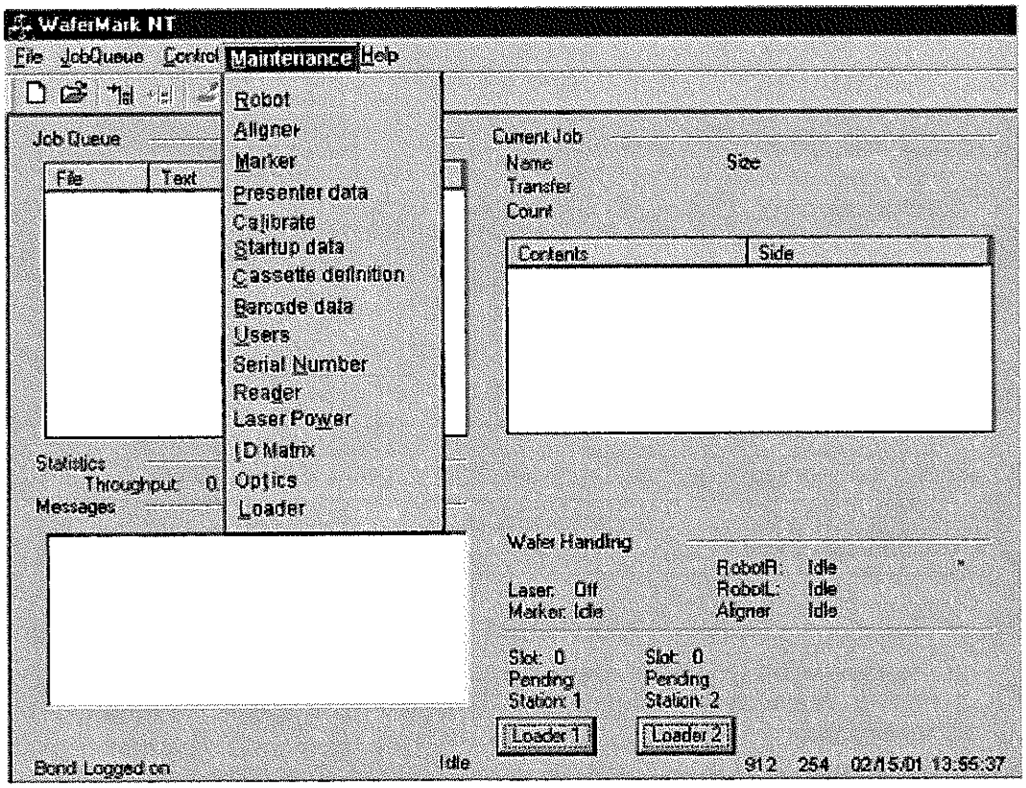
When a LOAD or UNLOAD is requested by the operator or the Host, the WaferMark checks the state of the equipment and the SMIF device before proceeding with the operation. The SMIF must not already be active, the SMIF must have a cassette, the cassette-in-place sensor for the middle presenter must not be TRUE, and the cassette/control state of the equipment must be acceptable to a cassette load operation. Similarly for the

UNLOAD process except the cassette-in-place sensor must be TRUE. If LOADER = YES and the SMIF interface has been successfully initialized, then a status indicator will appear on the main screen of WaferMark, row 12, column 40, where;

- L if "local" selected.
- R if "remote" selected.

4.9 Maintenance Menu

Click on the **Maintenance** item on the **Main** menu (or press **<F10>** and type **M**) to open the list of job **Maintenance** commands available to the Engineer or GSI Lumonics field service personnel to specify or alter the configuration of the system and to set up individual system hardware components.



Throughput 0

RobotR: Idle
Laser: Off
RobotL: Idle
Marker: Idle
Aligner Idle

Slot: 0
Pending
Station: 1

Slot: 0
Pending
Station: 2

Bond Logged on
Idle
912 254 02/15/01 13:55:37

The **Maintenance** menu provides the engineer with the commands for Robot, Aligner, Marker, Presenter Data, Calibrate, Startup Data, Cassette Definitions, Barcode Data, Users, Serial Number, Reader, Laser Power, ID Matrix, Optics, and Loader.

NOTE: The Robot or Aligner should ONLY be accessed if an unrecoverable fault occurs and it is necessary to clear wafers from the Robot or Aligner, as explained in Section 4.14 (Clearing Wafer Handling Faults).

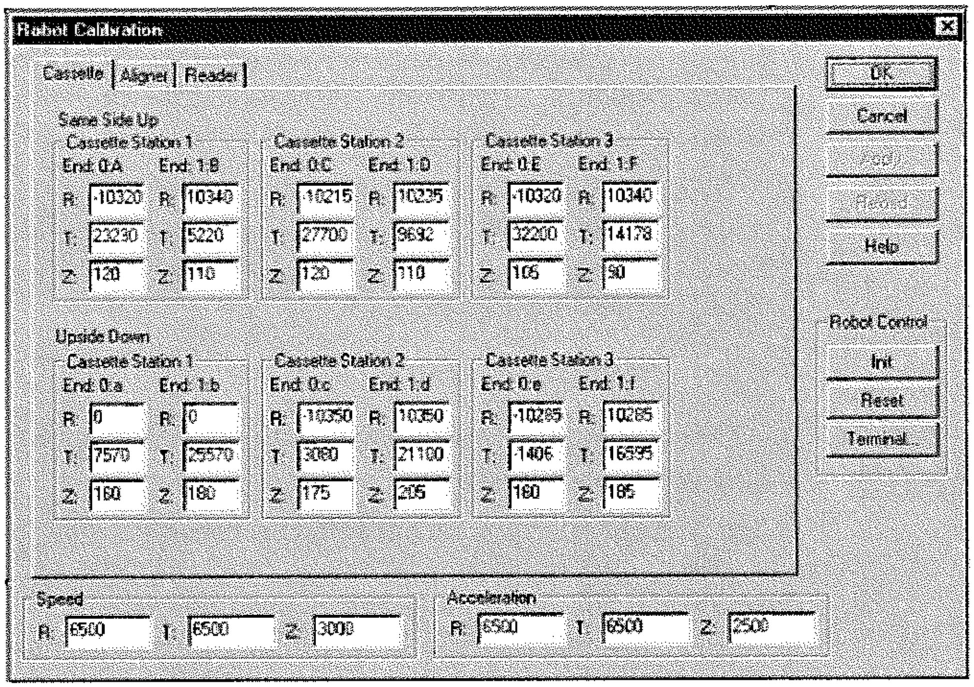
4.9.1 Robot Command

NOTE: Due to security level access restrictions, only Engineers can use this command.

The **Robot** command calibrates the robot subsystem for the wafers and cassettes used in the marking process. If a Reader is installed, the robot will need two sets of calibration parameters – one set used by the robot to transfer wafers into and out of the two cassettes, and another set for positioning the wafers directly under the Reader before they are returned to the destination cassette.

When **Robot** is selected from the **Maintenance** menu, the **Robot Calibration** window opens with selection tabs for the cassette, Aligner, and Reader. The Reader tab appears only when the Reader option hardware is included with the WaferMark® SigmaDSC NT system. Clicking on any tab will bring up the associated calibration values. Each page displays the positional parameter values for the robot.

The following illustration demonstrates how the **Robot Calibration** dialog box is displayed when the **Standard Marking** option is selected. The fields are shown with typical calibration values applied.



Same Side Up

	Cassette Station 1		Cassette Station 2		Cassette Station 3	
	End: 0:A	End: 1:B	End: 0:C	End: 1:D	End: 0:E	End: 1:F
R:	-10320	10340	-10215	10235	-10320	10340
T:	23230	5220	27700	9692	32200	14178
Z:	120	110	120	110	105	90

Upside Down

	Cassette Station 1		Cassette Station 2		Cassette Station 3	
	End: 0:a	End: 1:b	End: 0:c	End: 1:d	End: 0:e	End: 1:f
R:	0	0	-10350	10350	-10285	10285
T:	7570	25570	3080	21100	-1406	16595
Z:	160	180	175	205	180	185

Speed

R: 6500 T: 6500 Z: 3000

Acceleration

R: 6500 T: 6500 Z: 2500

NOTE: The layout in the above screen is identical for all wafer sizes except 300 mm. Because there are only two presenters installed in the 300 mm cassette configuration, the entry fields for Station 3 do not display during Robot Calibration.

The information contained within the **Robot Calibration** screen is used to determine the motion of the Robot and the distances that each arm must travel in order to select a wafer from any cassette mounted on the Presenter platforms. A set of calibrated values is maintained in the ROBOT.SET file that describes the variety of different wafer and cassette types that can be used in the handling and marking process. Each type requires a unique set of calibrated robot parameters. Once adjusted correctly, these should suffice until certain handler components are replaced. Figure 4-5 shows the physical layout of the wafer handling components; reference this diagram to better understand the significance of the information displayed on the **Robot Calibration** screen.

Robot Calibration data consists of the following settings:

Data	Setting Description
Speed	The speed at which the Robot assembly moves in the R, T, and Z axes. Each value is independently set and tuned to achieve maximum throughput, while maintaining stability and consistency of wafer picking.
Radial Speed	The R (radial) value defines the speed that the arm extends and retracts from the center point.
Theta Speed	The T (theta) value defines the speed that the arm is rotated in around the center point.
Height Speed	The Z (height) value defines the speed that the entire arm mechanism is raised or lowered.
Acceleration	The acceleration of the Robot arm in the three axes: R, T (Θ), and Z. The values are independently applied in a similar manner to the Speed values described above.
NOTE: The values for Speed and Acceleration that are currently shown on the screen have been determined and applied by GSI Lumonics at the factory. Do NOT alter these settings without the prior approval of GSI Lumonics. Only GSI Lumonics field service engineer or personnel trained and certified by GSI Lumonics to do so should make this adjustment.	
Station Address	Provides the physical Robot coordinates for the different stations - the Aligner, and Presenters 1, 2, and 3. Basically, this means the distances and direction that each arm must be extended, rotated from center, and raised (or lowered). In the case of the Z coordinate for the Presenter stations, this value represents the Pitch or distance between one wafer slot to the next slot in the cassette.

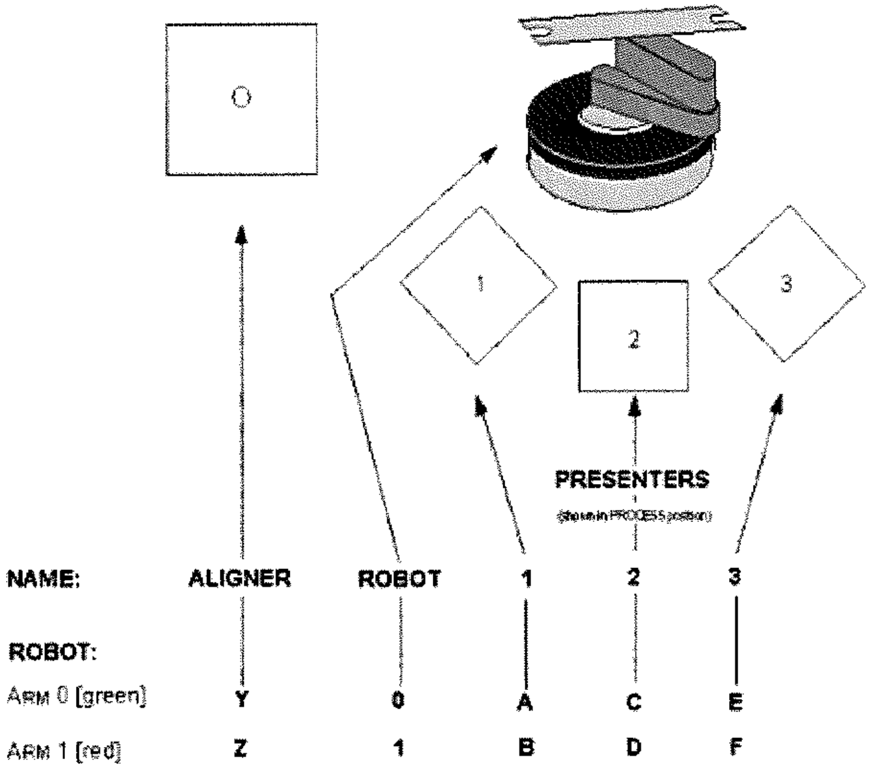
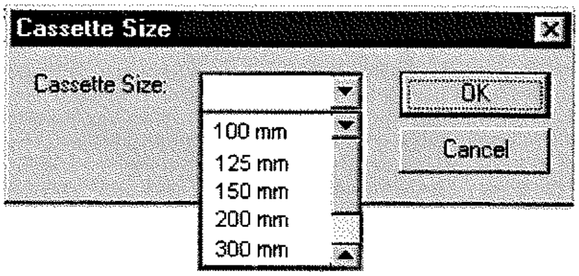


Figure 4-5 – Handler Layout Terminology

The heading bar on the Robot Calibration Screen displays five options that perform the following functions:

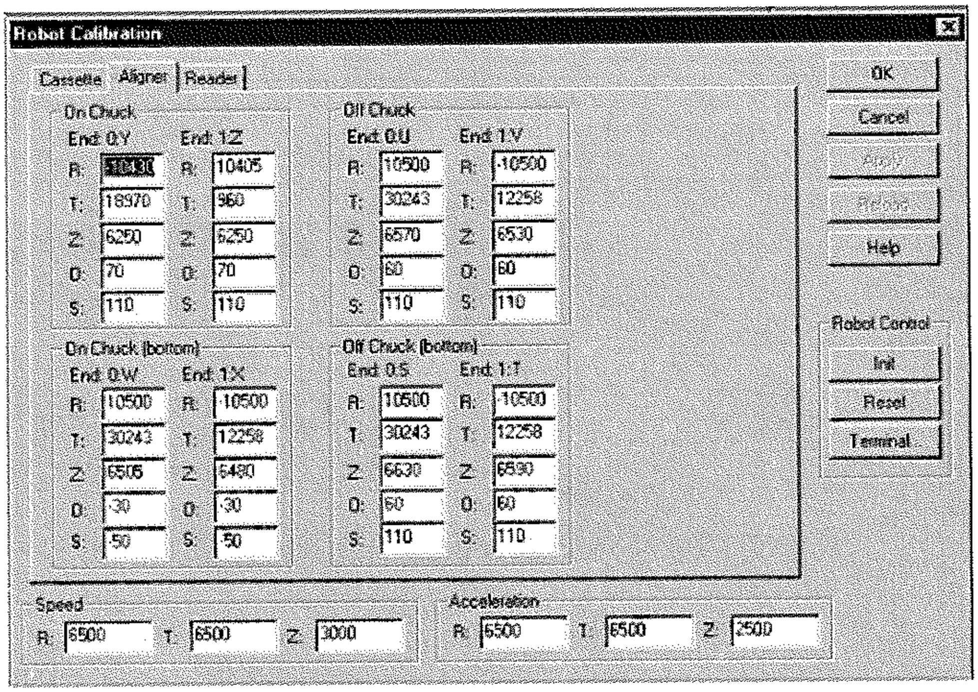
Button	Clicking on this button ...
OK	after inspection or alteration of the data accepts the calibration changes.
Cancel	after inspection or alteration of the data abandons the changes or procedure.
Apply	directs the software to use the changes or entered data.
Reload	reloads the existing Robot.SET file in order to inspect or change the current robot calibration data. If changed information is not saved, then clicking on the Reload button will reload the original data from the file.
Help	The Help button is inoperative.
ROBOT CONTROLS	
Init.	sets the Robot electronics to the settings specified on the screen that requires entering the wafer size information required for handling operations. Thus, it brings up the Cassette Size dialog box for selection of wafer size. Selecting the size wafer, the operator presses the pull-down arrow button that displays the various wafer size selections. Clicking on the selected size highlights the selection and places the size title in the dialog box.

Reset	provides reset to the robot controller. After selection, selecting the initialization option must reinitialize the robot.
Terminal	provides a direct connection from the User Interface to the Robot electronics. For further information, refer to the Robot service document provided in the system documentation package. If this terminal has not been initialized then the terminal will be displayed.



The Cassette Size window allows you to specify the size selection to the robot controller logic.

NOTE: After a Robot has been replaced, the Robot must be programmed with new values for each station. ONLY persons trained and certified by GSI Lumonics to do so are allowed to reprogram the Robot. For further information, contact GSI Lumonics at the address shown in the Preface, .



On Chuck
End 0Y: R: [illegible] T: 18970 Z: 6250 O: 70 S: 110
End 1Z: R: 10405 T: 960 Z: 6250 O: 70 S: 110

Off Chuck
End 0U: R: 10500 T: 30243 Z: 6570 O: 60 S: 110
End 1V: R: -10500 T: 12258 Z: 6530 O: 60 S: 110

On Chuck (bottom)
End 0W: R: 10500 T: 30243 Z: 6505 O: -30 S: -50
End 1X: R: -10500 T: 12258 Z: 6480 O: -30 S: -50

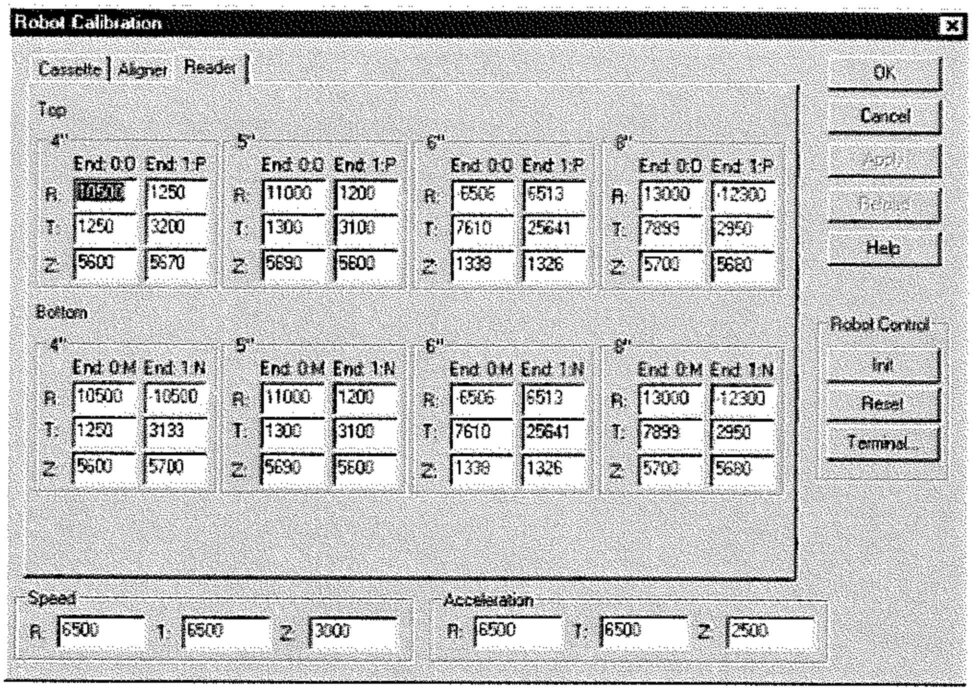
Off Chuck (bottom)
End 0S: R: 10500 T: 30243 Z: 6630 O: 60 S: 110
End 1T: R: -10500 T: 12258 Z: 6590 O: 60 S: 110

Speed: R: 6500 T: 6500 Z: 3000

Acceleration: R: 6500 T: 6500 Z: 2500

Designation	Function
End 0 Y	End-effector Y (Green arm)
End 1 Z	End-effector Z (Red arm)
R Axis	Radial value defines distance coordinate that the arm extends and retracts from the center point of the robot to the center point of the aligner.
T Axis	Theta value defines the location coordinate that the arm is rotated in around the center point of the robot to locate the aligner.
Z Axis	Height value defines the location coordinate that the entire arm mechanism is raised or lowered to place a wafer on the aligner.
O	Offset value defines the amount of required off-center compensation in approaching the aligner.
S	Step value defines the amount of step (rise or drop) to pick or drop a wafer at the aligner.

The following illustration demonstrates how the **Robot Calibration** screen is displayed for a sample WaferMark® configuration when the Reader option is selected from the window. The screen is shown with typical calibration values applied. Also, the following reader panel displays the typical robot positioning parameters for the four-inch, five-inch, six-inch and eight-inch wafers.



Top

	4" End 0:0	4" End 1:P	5" End 0:0	5" End 1:P	6" End 0:0	6" End 1:P	8" End 0:0	8" End 1:P
R:	10500	1250	11000	1200	-6506	6513	13000	-12300
T:	1250	3200	1300	3100	7610	25641	7899	2950
Z:	5600	5670	5690	5600	1339	1326	5700	5680

Bottom

	4" End 0:M	4" End 1:N	5" End 0:M	5" End 1:N	6" End 0:M	6" End 1:N	8" End 0:M	8" End 1:N
R:	10500	-10500	11000	1200	-6506	6513	13000	-12300
T:	1250	3133	1300	3100	7610	25641	7899	2950
Z:	5600	5700	5690	5600	1339	1326	5700	5680

Speed: R: 6500 T: 6500 Z: 3000

Acceleration: R: 6500 T: 6500 Z: 2500

4.9.2 Aligner Command

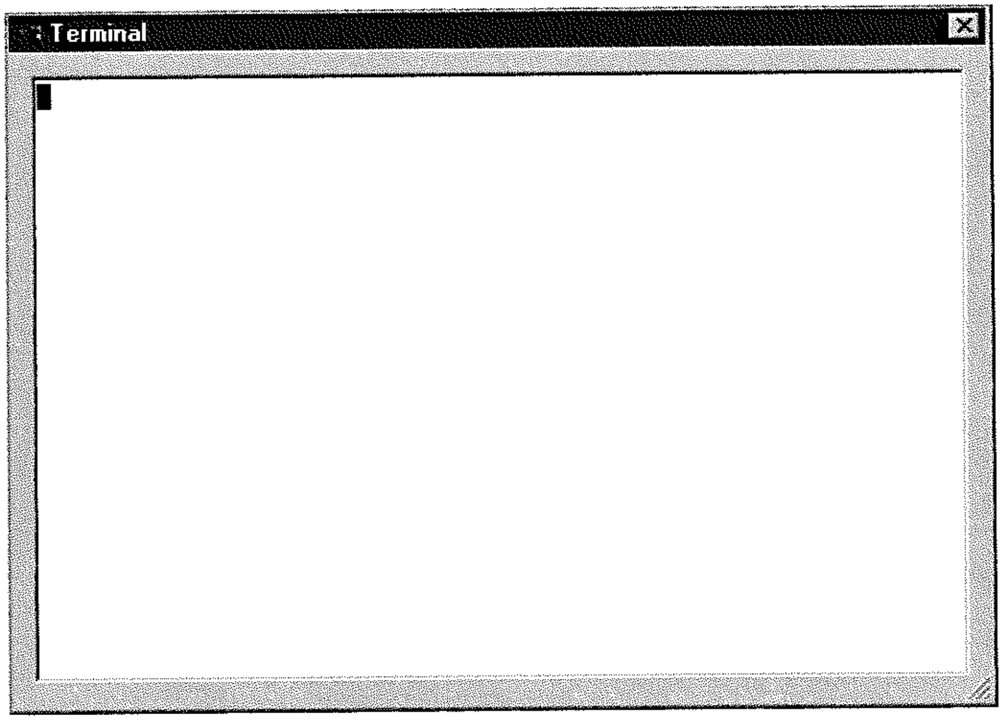
The Aligner is a standalone device that aligns the wafer. The Aligner has a vacuum hold, turntable, wafer-edge sensor and wafer size adaptor.

The Aligner balances the wafer while locating the wafer center or notch for precision positioning and orientation. The robot places a wafer on the turntable and the vacuum holds the wafer. The turntable turns the wafer while the sensor tracks positional changes. The turntable stops and the vacuum hold releases the wafer. The Aligner checks the wafer again. It may be necessary to perform this process three times to align a wafer.

NOTE: Only a GSI Lumonics trained and certified Engineer should use the **Aligner** *command.*

Click on the **Aligner** command on the **Maintenance** menu (or use the **Aligner** icon or type A at the **Maintenance** menu) to provide a direct connection from the User Interface to the Aligner Controller. This allows the Engineer to directly issue commands to the aligner from a terminal.

For further information, refer to the *PRI Aligner Controller manual* provided in the system documentation package.

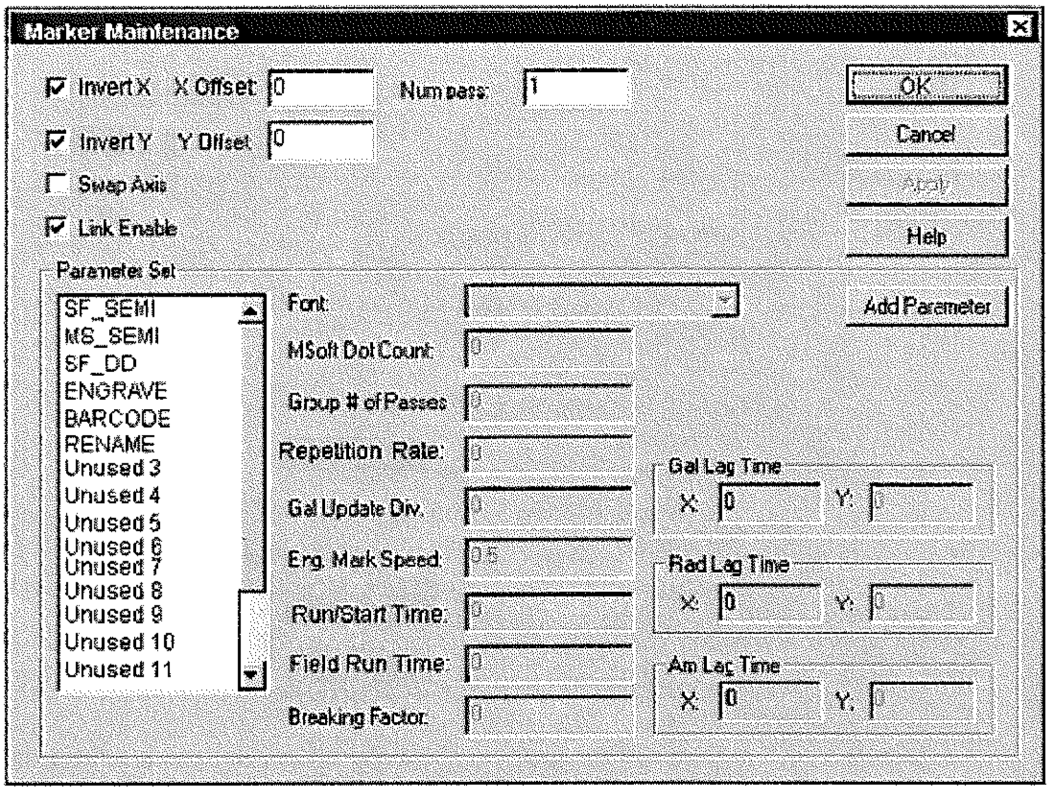


4.9.3 Marker Command

Click on **Maintenance**, then select **Marker** or type M. This displays the Marker Maintenance panel. The top portion of this panel contains the fields specified in the ***Marker General Variable Definitions***, defined below.

The lower portion, entitled "Parameter Set", contains the **Add Parameter** button. When the operator clicks this button, the software displays a rectangle in which the operator types a name for the new parameter set, then specifies values for the fields specified in the ***Marker Parameter Definitions***, defined below.

When selected, the **Marker** command reveals the **Marker Maintenance** screen, as displayed below:



☑ Invert X X Offset: 0 Num pass: 1

☑ Invert Y Y Offset: 0

☐ Swap Axis

☑ Link Enable

Font:

MSoft Dot Count: 0

Group # of Passes: 0

Repetition Rate: 0

Gal Update Div.: 0

Eng. Mark Speed: 0.5

Run/Start Time: 0

Field Run Time: 0

Breaking Factor: 0

Gal Lag Time X: 0 Y: 0

Rad Lag Time X: 0 Y: 0

Am Lag Time X: 0 Y: 0

All dimensional values are indicated in the engineering unit of measurement specified by the keyword METRIC in the Maintenance Startup file; if METRIC=YES, units are displayed in millimeters; if METRIC=NO, units are displayed in inches.

Marker General Variable Definitions

The general variables are defined in the following list; they are shown with the name as it appears on the screen and the expanded description that appears at the bottom of the screen when the variable is highlighted.

NOTE: The following keyword statements can be added to the Maintenance Startup Data (FACTORY.SET) file to allow precise adjustment of the 0,0 X and Y reference origin for each wafer size available: 4-, 5-, 6-, and 8-inch (100, 125, 150, and 200 mm). These keywords provide adjustment for both NOTCH and FLAT marking. (The following keywords indicate zero offsets.)

OFFSET[4][F].X=0.0	OFFSET[5][F].X=0.0	OFFSET[6][F].X=0.0	OFFSET[8][F].X=0.0
OFFSET[4][F].Y=0.0	OFFSET[5][F].Y=0.0	OFFSET[6][F].Y=0.0	OFFSET[8][F].Y=0.0
OFFSET[4][N].X=0.0.	OFFSET[5][N].X=0.0	OFFSET[6][N].X=0.0	OFFSET[8][N].X=0.0
OFFSET[4][N].Y=0.0	OFFSET[5][N].Y=0.0	OFFSET[6][N].Y=0.0	OFFSET[8][N].Y=0.0

Y Offset (Y Field Offset)

Y Offset Correction has the same definition as X Offset and is applied to the Y-axis.

Marker Parameter Definitions

The parameters that appear in the Parameter Set table are defined in the following list; each parameter is also shown with the name as it appears on the screen and the expanded description that appears at the right of the screen when the variable is highlighted.

Parameter Set (Parameter Set Name)

The name entered here is used by the **Location** field in the **Job Definition** screen to identify which Parameter Set will be used to mark the indicated line of text for the current job. Duplicate names will produce a pop-up error, notifying the operator of any duplicate names. The offending page will be left on the screen after the message has been acknowledged.

Font File Name (Font File Name)

The filename entered here determines the font style to be applied for the appropriate Parameter Set; this can be a dot-matrix or ID matrix font, barcode font or an engrave font. Any font can be selected from this list.

NOTE: Fonts can be only GSI Lumonics Type 3 font styles.

MSoft Dot Count (MultiSoft Dot Count or 0 for SuperSoft)

This specifies the number of pulses that will be placed at each dot location. If 0 is specified, the SuperSoftMark mode is used for marking (raster scan); if a number larger than 0 is used, a Multi mode is used.

Group Num Pass (Number of Marking Passes (UNIT: Count, 0=don't mark))

Determines the number of times that the laser will repeat the mark for each line of text that uses the indicated Parameter Set. (The Parameter Set is specified in the Location field of the Job Definition screen) in certain cases, multiple passes provide best marking definition.

Repetition Rate (Laser Repetition Rate (UNIT: Hz))

Repetition Rate determines how fast laser pulses are generated when marking text. The software calculates the optimum repetition rate for maximum marking speed. No operator input is needed.

Gal Update Rate (Number of Galvo Updates per Dot (UNIT: Count))

This value determines the rate at which the X and Y galvo channel updates occur. When increased, this parameter improves dot placement, but also decreases the overall length of the possible mark; the more accurate the dot placement in a multipass mark the better the mark placement. Also, the more galvo updates per second, the more of list memory used per second of marking. Shorter mark durations may be achieved by decreasing the update rate.

NOTE: This parameter does not affect the mark quality of a Supersoft Mark, but may affect its dot placement accuracy.

Eng. Mark Speed (Engraved Mode Marking Speed (UNIT: Inches/second))

NOTE: This general variable is used in engrave mode marking only. Although engrave is not a primary or recommended marking mode, one engrave font (OCRS51.FON) is included in the standard system fonts.
Used with engrave fonts only, this parameter determines the linear speed that the galvanometers traverse across the mark area of a line segment.

Run Start Time (Running Start Turnaround Time (UNIT: Seconds))

The running Start Time parameter unit is a measurement of time which is converted to a distance that the galvos will travel, from a rest position, until reaching the start of a mark; this (distance) allows the galvos time to accelerate and achieve a constant velocity speed before marking begins.

Field Run Time (Full Field Running Start Time (UNIT: Seconds))

Field Run Time is similar to the Run Start Time parameter; however, it is used only for multi-line marking. This delay is necessary to allow the galvos additional time to settle before starting to mark the next row in a line of text. Because the galvos are driven under coarse control between the end of the first line and the start of the second line, this additional delay improves galvo action during the changeover.

X Gal Lag Time (X-axis Linear Lag (UNITS: Seconds))

This parameter is primarily used for engrave mode marking. X-axis Galvo Lag Time is used to compensate for variations in the inherent mechanical delays in galvanometer motion that cause the start of a segment mark to begin later than specified. This is most noticeable where a mark starts on the line of a previously marked segment-for example, the crossbar of the character H. X-Axis Galvo Lag will cause the crossbar to be offset in one direction, so that it starts to the left of the left vertical bar, or ends to the right of the right vertical bar. The amount of lag (and therefore, offset) is directly dependent on marking speed.

For precise constant velocity marking, lag values must be measured on the system of intended use. When adjusting for lag, do not use extreme values for marking speed or galvo rate, unless the job specifically calls for them. When calibrating lag, vary the values slowly at first, especially for higher marking speeds.

Y Gal Lag Time (Y-Axis Linear Lag (UNITS: Seconds))

This parameter has the same definition as X galvo lag and is applied to the Y-axis.

X Rad Lag Time (X-axis Radial Lag (UNITS: Seconds))

When marking arcs, this time value is converted to an angular error (phase error) that is added to the starting angle so that the arc will begin in the proper place.

NOTE: This parameter applies only to radial marking.

Y Rad Lag Time (Y-axis Radial Lag (UNITS: Seconds))

When marking arcs, this time value is converted to an angular error (phase error) that is added to the starting angle so that the arc will begin in the proper place.

NOTE: This parameter applies only to radial marking.

X Am Lag Factor (X-axis Amplitude Lag (UNITS: Seconds))

This value is used to scale the radius during arc marking in order to compensate for the skating effect that occurs during angular motion. The corrected radius value is used to control the galvos. For a value of 1,000, no correction takes place. Typically, as marking speed increases or character size decreases, this value should be increased.

Y Am Lag Factor (Y-axis Amplitude Lag (UNITS: Seconds))

This parameter has the same definition as X Amplitude Lag, and is applied to the Y-axis.

Braking Factor (Arc Braking Factor (Unit: Scalar))

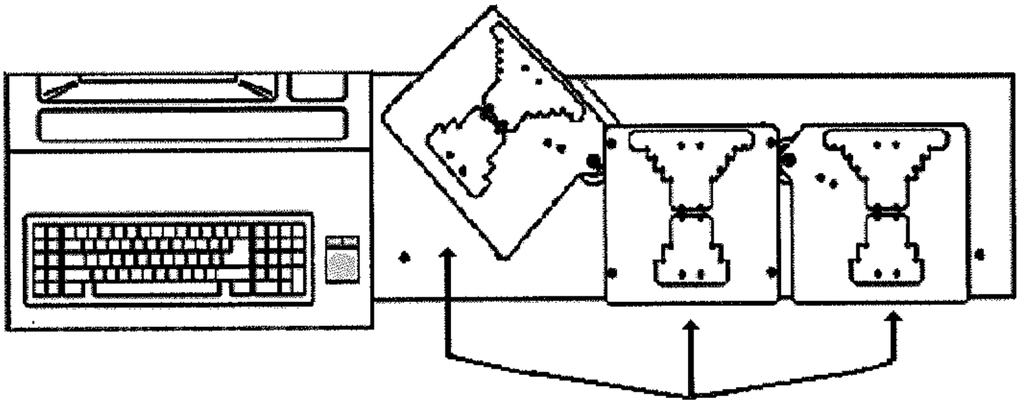
This parameter value represents a value in gain that is used to cancel a position error. It is applied to the end of an arc that is followed by a linked arc or segment.

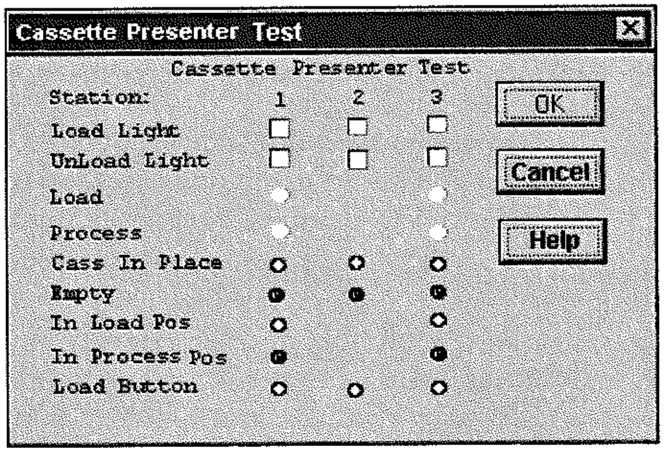
NOTE: This parameter applies only to radial marking.

Click on the **OK** button to accept any changes and closes the menu and returns to the Main menu. Click on the **Cancel** button to nullify any changes and restore the options to the settings that were there when the window was opened. Click on the **Apply** button to apply the parameter and holds the Marker Maintenance window open. The **Help** button is inactive. Click on the **Add Parameter** button to open all the parameter boxes within the window and allow the engineer to alter or change existing parameters.

4.9.4 Presenter Data Command

Only factory personnel should ever use the **Presenter Data** command. With engineer or factory personnel access privileges, click on the **Presenter Data** command (or type **P** on the **Maintenance** menu) to bring up the following **Cassette Presenter Test** screen. This screen is used during the setup of the presenters to check the presenters and indicators operation, as described in Table 4-6.





Cassette Presenter Test

Station:	1	2	3
Load Light	☐	☐	☐
UnLoad Light	☐	☐	☐
Load	○		○
Process	○		○
Cass In Place	○	○	○
Empty	●	●	●
In Load Pos	○		○
In Process Pos	●		●
Load Button	○	○	○

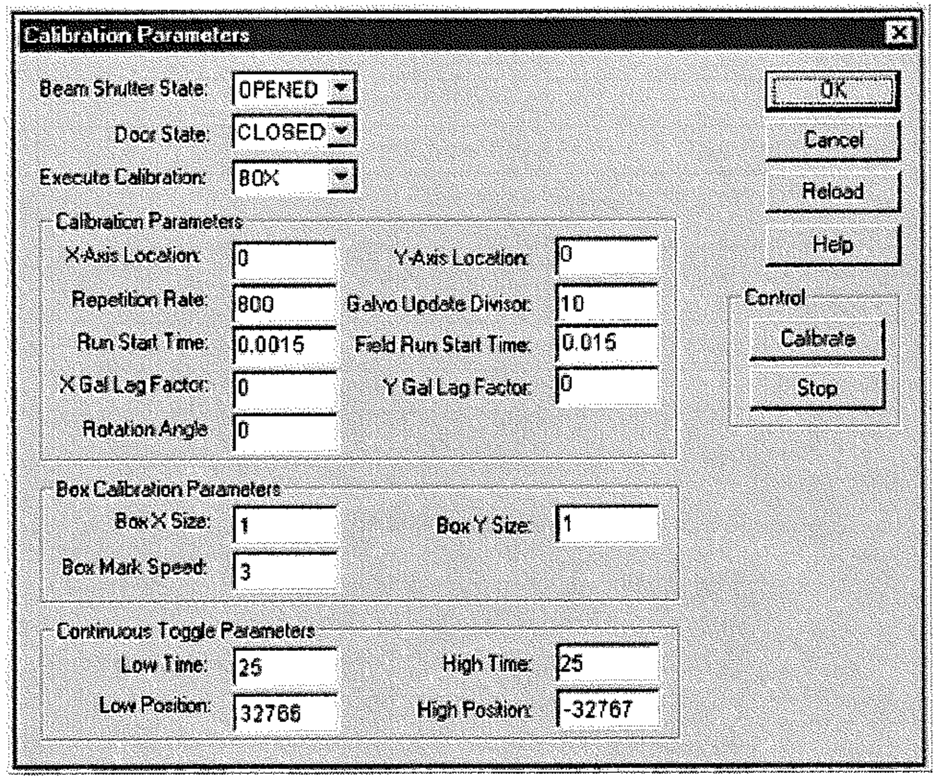
Table 4-6 – Peforming the Cassette Presenter Test

In order to ...	click on the ...
illuminate the load light	**Load Light** check box
illuminate unload light	**Unload Light** check box
cause the presenters to move to the load position	**Load** button
cause the presenters to move to the process position	**Process** button
... then, click on the **OK** button to accept any changes, close the menu and return to the Main menu.	

NOTE: The **Cancel** *button abandons the presenter test. The* **Help** *button is inactive.*

4.9.5 Calibrate Command

The **Calibrate** command is primarily used to set up the galvanometers. It also is used while aligning the optical path. When this command is selected, the **Calibration Parameters** dialog box displays (as shown below for a typical application). Table 4-7 describes the elements of the **Calibration Parameters** dialog box.



Beam Shutter State: OPENED
Door State: CLOSED
Execute Calibration: BOX

Calibration Parameters
X-Axis Location: 0
Y-Axis Location: 0
Repetition Rate: 800
Galvo Update Divisor: 10
Run Start Time: 0.0015
Field Run Start Time: 0.015
X Gal Lag Factor: 0
Y Gal Lag Factor: 0
Rotation Angle: 0

Box Calibration Parameters
Box X Size: 1
Box Y Size: 1
Box Mark Speed: 3

Continuous Toggle Parameters
Low Time: 25
High Time: 25
Low Position: 32766
High Position: -32767

Table 4-7 – Elements of the Calibration Parameters Dialog Box

Element/Parameter	States	Definition
Beam Shutter State (listbox)	Opened	Opened the beam shutter.
	Closed	Closed the beam shutter.
Execute Calibration (listbox)	Box	Galvanometers arranged in box pattern.
	X Galvo Only Y	Activates only X galvanometers.
	Galvo Only	Activates only Y galvanometers.
	Both X & Y Galvo	Activates both the X and Y galvanometers.

Table 4-7 – Elements of the Calibration Parameters Dialog Box

Calibration Parameters	X Axis Location	Value represents X location.
	Y Axis Location	Value represents Y location.
	Repetition Rate	The Repetition Rate determines how fast laser pulses are generated when marking text. Typically, this parameter is set to a value between 500 and 1,000 Hz.
	Galvo Update Divisor	The rate at which the X and Y galvanometer channel updates occur. When increased, this parameter improves marking quality, but also decreases the overall length of the possible mark; the more galvo updates per second, the more list memory is used per second of marking.
	Run Start Time	A measurement of time that is converted to a distance that the galvos will travel from a rest position until reaching the start of a mark; this (distance) allows the galvos time to accelerate and achieve a constant velocity speed before the marking begins.
	Field Run Start Time	Field Run Time parameter is only used for multi-line marking to provide a delay to allow the galvos additional time to settle before starting to mark a new line of text. Because the galvos are driven under coarse control between the end of the first line and the start of the second line, this additional delay improves galvo action during the changeover.
	X Gal Lag Factor	X-axis Galvo Lag Time is the period, in seconds, used to compensate for variations in the inherent mechanical delays in X galvanometer motion that cause the start of a segment mark to begin later than specified.
	Y Gal Lag Factor	Y-axis Galvo Lag Time is the period, in seconds, used to compensate for variations in the inherent mechanical delays in Y galvanometer motion that cause the start of a segment mark to begin later than specified.
	Rotation Angle	The Text Rotation Angle is the angle that the line of text will be rotated (clockwise or counterclockwise) relative to the X and Y position coordinates (that is, the start of the mark for this line).
Box Calibration Parameters	Box X Size	Value representing the X size (width) of the box.
	Box Y Size	Value representing the Y size (depth) of the box.
	Box Mark Speed	A numeric value representing the period required to mark a box.

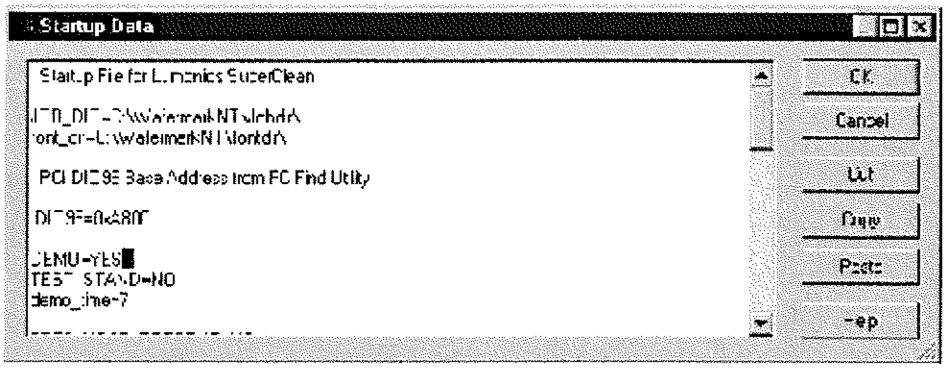
Table 4-7 – Elements of the Calibration Parameters Dialog Box

Continuous Toggle Parameters	Low Time	A value representing the period that the toggle is low.
	High Time	A value representing the period that the toggle is high.
	Low Position	A value representing the period that the toggle is low.
	High Position	A value representing the period that the toggle is high.
Buttons	OK button	Saves the specified Calibration parameters and returns the operator to the Main Menu.
	Cancel button	Abandons any changes to the Calibration parameters.
	Reload button	Places the default parameters into the Calibration window.
	Help button	The Help button is inoperative.
Control Buttons	Calibrate	Clicking on the Calibrate button after inspection or alteration of the data saves the changes into memory.
	Stop	Clicking on the Stop button after inspection or alteration of the data stops saving changes and awaits a Reload command.

4.9.6 Startup Data Command

The Maintenance **Startup Data** command is used by the Engineer Operator to inspect or change information that is specified in the Maintenance **Startup data** file (FACTORY.SET file); this file is loaded during system initialization and establishes the basic software operating conditions using key words. A keyword listing is contained in Appendix A.

When selected, the **Startup data** command opens the **Maintenance Startup Data** file (**FACTORY.SET**) and displays the following in Figure 4-6:

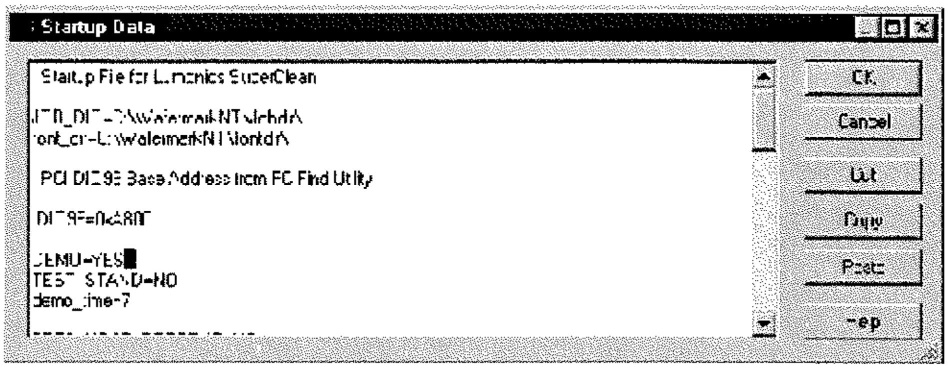


```
 Startup File for Lumonics SuperClean

[illegible]_DIR=C:\Wafermark NT\[illegible]
font_cr=C:\Wafermark NT\fontdir\

 PCI DIO98 Base Address from PC Find Utility

 DIO9F=0xA80F

DEMU=YES
TEST_STAND=NO
demo_time=7
```

Figure 4-6 – Startup data screen

This software file contains information that is used by the User Interface and Marker programs. All line entries that begin with an exclamation mark (!) are comment lines that are ignored during the loading of the file. GSI Lumonics has established the contents of this file, although the Engineer Operator may be requested to modify the file if additional features are incorporated, or new programs loaded at a future date. For this purpose, the **Maintenance Startup Data** file in Appendix A provides a listing of the available Keyword information.

*NOTE: Throughout this section, highlighting for data selection is accomplished by dragging the trackball pointer or using **Shift** + cursor-arrow (← Left)/(→ Right)/(↑ Up)/(↓ Down) to highlight the area.*

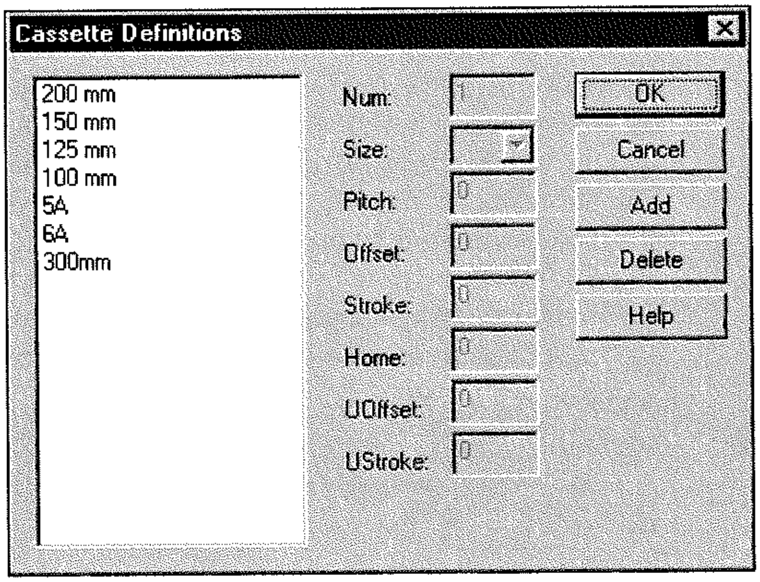


```
 Startup File for Lumonics SuperClean

[illegible]_DIR=C:\Wafermark NT\[illegible]
font_cr=C:\Wafermark NT\fontdir\

 PCI DIO98 Base Address from PC Find Utility

 DIO9F=0xA80F

DEMU=YES
TEST_STAND=NO
demo_time=7
```

4.9.7 Cassette Definitions Command

The **Cassette Definitions** command enables the Engineer to edit the **Cassette Definitions** file **(CASSETTE.SET)** that contains the specifications of each type of cassette used on this system. The program references the **Cassette Definitions** file during a search for matching wafer information when a job is loaded or during entries in the **Job Definition** screen.

When the **Cassette Definitions** command is selected from the **Maintenance** menu, the contents of the file are displayed as shown in Figure 4-7:



200 mm
150 mm
125 mm
100 mm
5A
6A
300mm

Num: 1
Size:
Pitch: 0
Offset: 0
Stroke: 0
Home: 0
UOffset: 0
UStroke: 0

Figure 4-7 – Cassette Definition File

The cassette file can contain specifications of up to 10 cassette types, and each type is defined using the following terms:

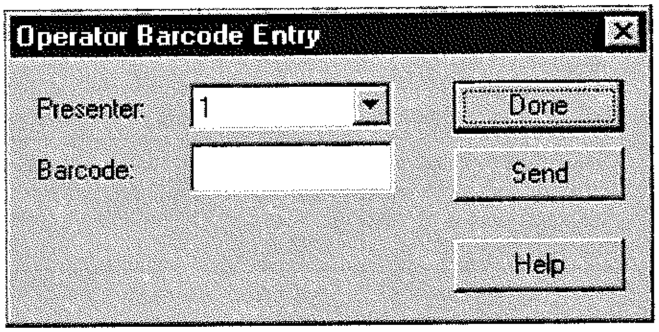
Terms	Definitions
NAME	The name is the size of the wafer in millimeters that is indicated on the Job Definition screen.
NUM	The number (Num) of wafer slots in the cassette (usually 25).
SIZE	The size of the wafers, in inches. Clicking on the button opens a drop-down box listing the various sizes.
PITCH	The pitch is the distance, in mils, from one cassette slot to the next.

Terms	Definitions
OFFSET	Offset is the distance below a slot that the arm will approach during a get wafer operation. This value should never require changing; however, if this should ever be necessary, only GSI Lumonics trained personnel should perform this adjustment.
STROKE	The stroke is the distance from the offset position that the arm will rise in order to lift the wafer during a get wafer operation. This value should never require changing; however, if this should ever be necessary, only GSI Lumonics trained personnel should perform this adjustment.
HOME	Home is the distance from the nominal bottom-most slot for a portal and the physical bottom-most slot for this specific style of cassette. This value compensates for manufacturing variances between cassettes.
UOFFSET	The distance above a slot that the arm will approach during a "put wafer " in the upside down method. This value should never require changing; however, if this should ever be necessary, only GSI Lumonics trained, certified personnel should perform this adjustment.
USTROKE	The distance from the offset position that the arm will lower in order to set the wafer during a "put wafer" operations in the upside-down method. This value should never require changing; however, if this should ever be necessary, only GSI Lumonics trained, certified personnel should perform this adjustment.
OK button	Clicking on the OK button after inspection or alteration of the data accepts the changes.
Cancel button	Clicking on the Cancel button after inspection or alteration of the data abandons the changes and prior settings remain.
Add button	Clicking on the Add button opens the Cassette definitions, adding, altering, and defining cassette parameters as to wafer size, station, position, and slot location selections.
Delete button	To perform a Delete function, you must first highlight the data that you want to delete. Place the pointer over the menu, click on the Delete button and remove the data.
Help button	The Help button is inoperative at the present time. The button was added to the Cassette definitions menu to facilitate future development of a Help option that will assist the Engineer through the Cassette definition portion of the WaferMark session.

4.9.8 Barcode Data Command

The **Barcode Data** command item in the **Maintenance** menu allows the user to transmit a barcode for a specific presenter port, directly to the Host. This action is completely independent of the Barcode Reader, and is designed to aid in isolating problems associated with barcode data errors detected by the Host—either due to a faulty reader, or data transmission errors between the WaferMark and the Host.

Click on the **Barcode Data** bar (or type B) from the **Maintenance** menu. When selected, the following window is displayed:

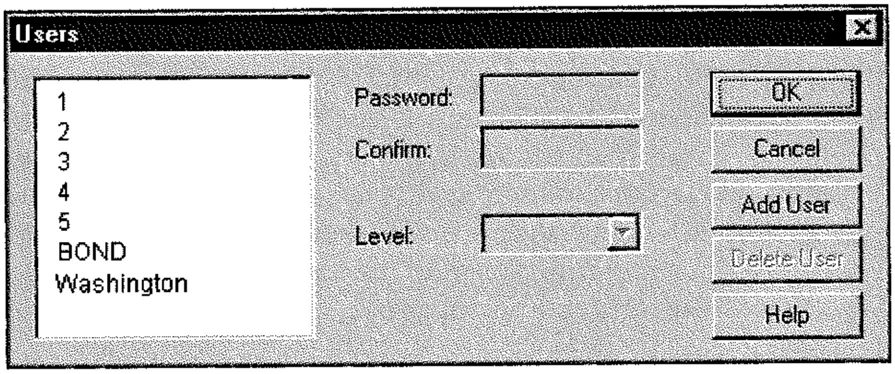


Presenter: 1

Click on the **Presenter** listbox button and select the number of the presenter port, the number will remain in the presenter box. The selected number will appear in the **Presenter** listbox. Click on the **Barcode** field and enter the code you want to send to the Host. Click on the **Send** button and transmit the information to the Host. Clicking on the **Done** button closes the window. The **Help** button is not active.

4.9.9 Users Command

The **Users** command enables the Engineer Operator to edit the **USERINFO.FIL** file in order to add, delete or reassign operator names and passwords. When selected, the file opens and displays as shown in Figure 4-8. Each user is listed and the final field for each line is the assigned operator security level (see Section 3.5). Table 4-8 describes the functions of the buttons in the **Users** command dialog box.



1
2
3
4
5
BOND
Washington

Figure 4-8 – Users Command Dialog Box

Table 4-8 – Users Command — Dialog Box Buttons

Button	Function
Add User	Adds a new user information file to the system and terminates access while protecting the equipment, products, and programs. *NOTE: To add a user, the password and confirmation must be correct or the* **OK** *button will be grayed out.*
Delete User	Removes a user information file from the system and terminates access while protecting the equipment, products, and programs.

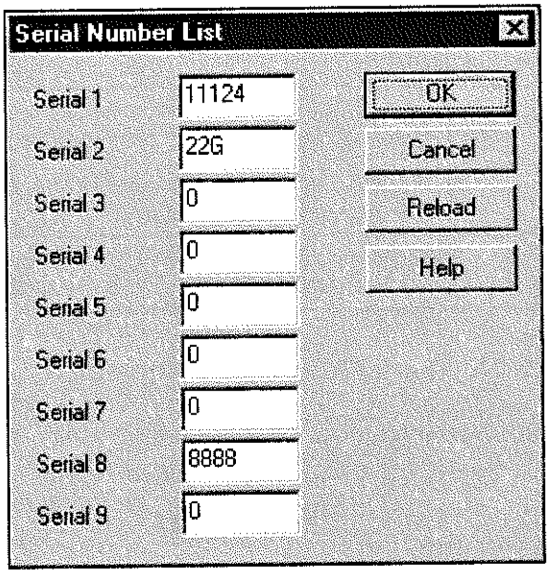
4.9.10 Serial Numbers Command

The **Serial Number** command enables a job text field to refer to a list of serial numbers designated Serial1 through Serial9. The list of serial numbers resides in the file **SERIAL.SET** which is accessible by any job.

The job message text can address any slot in the serial number list, using the syntax {Serial#} or [Serial#], where # refers to the serial number position in the list. After completing each wafer, all serial numbers in the list referenced in the job are advanced incrementally, and the **SERIAL.SET** file updated.

Access permission for setting or editing serial numbers in the list is provided according to the access level defined by the keyword statement `ACCESS_MAINT_SERIAL_NUMBERS=[1|2|3|4|5]`. If not included in the **Maintenance Startup Data** file, the access condition defaults to Supervisor.

Click on the **Serial Number** command from the **Maintenance** menu to display a **Serial Number List** dialog box as shown in Figure 4-9 and below is a table describing the button functions:



Serial 1 11124
Serial 2 22G
Serial 3 0
Serial 4 0
Serial 5 0
Serial 6 0
Serial 7 0
Serial 8 8888
Serial 9 0

Figure 4-9 – Serial Number List

Serial numbers referenced in the job definition's group text use the form [Serial1], [Serial2], ...[Serial9] or {Serial1}, {Serial2}, ...{Serial9}. The names are case sensitive and must be exact. (For example, if {SERIAL1} was used in the text, it could be misinterpreted as alphanumeric serialization, as explained in Chapter 5.)

NOTE: The same serial slot should not be referenced in the job using different formats; i.e., [ ] and { } since the increments may be inconsistent for the application. Each serial slot is advanced incrementally, once per wafer, regardless of the number of references within the job.

A blank (empty) serial slot is considered undefined. If such a slot is referenced in the job, an error will occur. The serial numbers data file **SERIAL.SET** contains the values of all serial numbers. The file format is:

```
!03-25-95 18:44:22.3;p;
Serial1=175R
Serial2=367
Serial3=11122
. . . . . . =
Serial8=6767
Serial9=
```

The first line defines the date, time, and operator of the last definition or update of the file. If an error occurs during the reading or writing of the file, the error message ***Serial number file fault*** is reported.

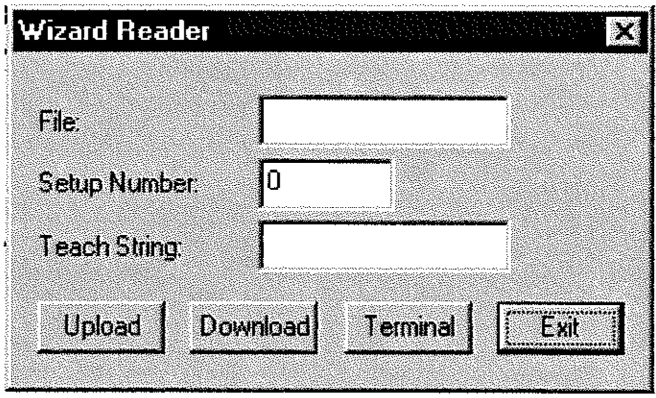
Table 4-9 describes the functions of the buttons in the Serial Number List dialog box.

Table 4-9 – Serial Number List — Dialog Box Buttons

Button	Function
OK	Accepts changes and closes the dialog box.
Cancel	Abandons any changes and closes the dialog box.
Reload	Permits reloading of serial numbers into the serial number list.
Help	Inoperative at the present time (for future development).

4.9.11 Reader Command

The Reader is an optional feature. The **Reader** command is only displayed in the Maintenance menu if the Maintenance Startup file contains the keyword statement
`READER_ENABLE=YES`
. (For further details about the Reader, seeAppendix E.)



File:
Setup Number: 0
Teach String:

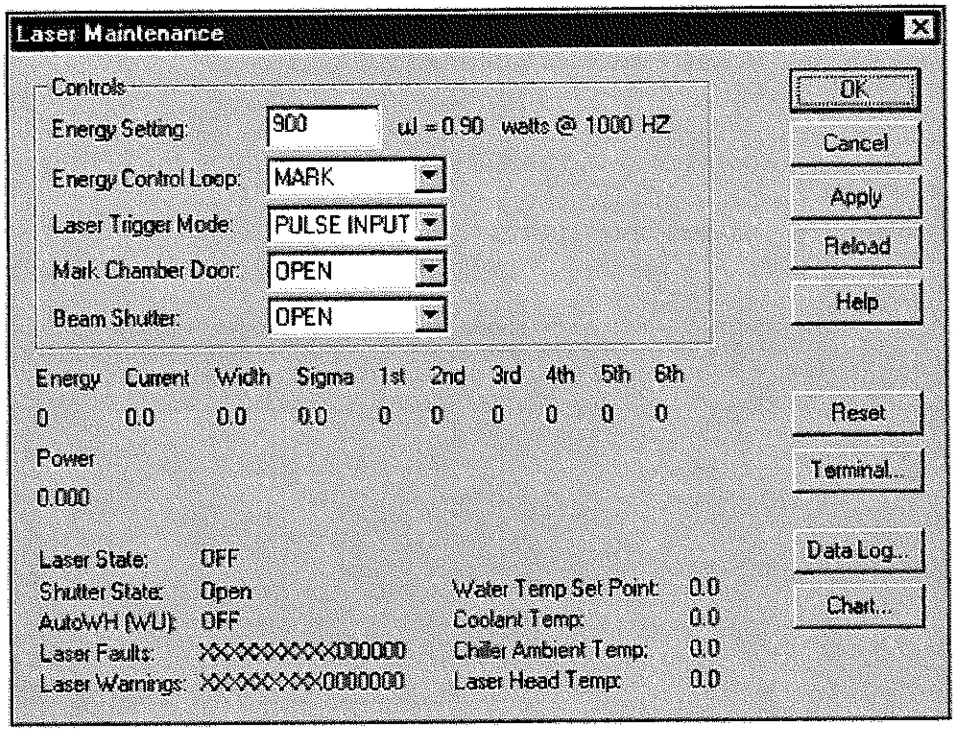
When the Reader option is installed and enabled, if Reader_Type=3, the Wizard Reader dialog box displays and the system operates in MODE 2 (MODE 1 is the normal system operating mode). The Reader command can then be selected from the Maintenance menu. The keyword `ACCESS_MAINT_READER=[1|2|3|4|5]` defines the access level required to enter the terminal mode with the attached Reader. The default access level is 5 (Engineer). The Robot Calibration displays the reader location parameters under the Reader tab.

If the Reader_Type=4, a terminal box displays to allow the user to talk directly to the reader.

4.9.12 Laser Power Command

The **Laser Power** command enables the Supervisor or Engineer to adjust the laser energy setting for wafer marking, and perform maintenance checks of the laser.

When the **Laser Power** command is selected from the **Maintenance** menu, the **Laser Maintenance** dialog box displays as follows:



Energy Setting: 900 uJ = 0.90 watts @ 1000 HZ
Energy Control Loop: MARK
Laser Trigger Mode: PULSE INPUT
Mark Chamber Door: OPEN
Beam Shutter: OPEN

Energy	Current	Width	Sigma	1st	2nd	3rd	4th	5th	6th
0	0.0	0.0	0.0	0	0	0	0	0	0

Power
0.000

Laser State: OFF
Shutter State: Open
AutoWH (WU): OFF
Laser Faults: XXXXXXXXXX000000
Laser Warnings: XXXXXXXXX0000000

Water Temp Set Point: 0.0
Coolant Temp: 0.0
Chiller Ambient Temp: 0.0
Laser Head Temp: 0.0

The **Laser Maintenance** dialog box is divided into two sections. Use the optional function keys and laser setting fields in the upper section to perform setup, adjustment, and checking of the laser. Use the lower section of the window to monitor the state of the laser, shutter, and coolant.

Table 4-10 describes the laser setting fields available for change.

Table 4-10 – Laser Maintenance Dialog Box—Laser Settings

Field	Description
Energy Setting	Enter **Energy Setting** in micro Joules (Range: 0 - 2000 µJ). This is the laser energy for the job marking. Typically, this value is between 930 and 950 µJ. To save the current laser setting for future use, use the Save **<F4>**option; the value is saved in the file, **SIGMA1.SET** and can be reloaded using the **Load <F3>**option.
Energy Control Loop	Toggle the **Energy Control Loop** field to one of three settings: **OFF**, **ON**, or **MARK**. To stabilize the laser pulse energy, the software can adjust the Diode Current Pulse Width based on the value of the Laser Pulse Energy input. If the measured value of pulse energy is less than the desired setting, the pulse width is increased until the desired value is reached. If the pulse energy is higher than the desired setting, the pulse width is decreased. When **OFF**, the control loop is off and the current pulse width is not adjusted. When **ON**, the control loop is turned on for all conditions. The current pulse width is changed to minimize the difference between the set energy and the actual energy—even when marking. When set to **MARK**, the control loop is turned on, but will only adjust the pulse width when the laser is NOT marking, or if the laser is significantly away from the set energy during marking. THIS IS THE NORMAL SETTING FOR MARKING. Ensure that this position is set before resuming production marking.
Laser Trigger Mode	This field toggles to one of four settings: PULSE INPUT, INTERNAL, SPECIAL, and DIODES OFF. These settings are used for maintenance only. For NORMAL marking, set the mode to PULSE INPUT.
Mark Chamber Door	This field toggles to OPEN or CLOSE. OPEN lowers the door; CLOSE raises the door. *NOTE: If the door is toggled to OPEN while the Beam Shutter field is in the OPEN position, the shutter closes automatically.*
Beam Shutter	This field toggles to OPEN or CLOSE. OPEN opens the shutter; CLOSE closes the shutter. *NOTE: If the door is in the OPEN position when this field is toggled to OPEN, the shutter does not open.*

Table 4-11 describes the **Laser Maintenance** dialog box function buttons.

Table 4-11 – Laser Maintenance Dialog Box— Buttons

Button	Function
OK	Accepts changes and closes the dialog box.
Cancel	Checks to see if changes have been made, prompts the user with a Save/Cancel dialog box, if changes have not been saved.
Yes	Saves the changes.
No	Abandons the changes and the keeps the default settings.

Table 4-11 – Laser Maintenance Dialog Box— Buttons

Apply	Directs the software to use the changes or entered data
Reload	Reloads the SIGMA1.SET file that contains previously saved settings of the Energy Setting, Energy Control Loop, and Laser Trigger Mode.
Help	Inoperative at the present time (for future development).
Reset	Provides a software reset to the laser to clear all latched faults. *NOTE: Pressing the* ***FAULT CLEAR*** *push-button on the operator panel when the laser alarm is flashing also clears a latched laser fault.*
Terminal	Used by Field Service Engineers during maintenance operations for setting up the laser, controller, and beam path. This option displays a terminal screen that allows the engineer to issue commands to the Laser Controller software for controlling the laser. (For a list of software commands used in this screen, refer to the *WaferMark® SigmaDSC NT NT Service Manual (P/N 273.492.00)*, provided with the system.)
DataLog	Starts the downloading of all laser events that have been recorded (in memory) by the Laser Controller. When selected, a dialog displays prompting the user to enter a filename for the log, as shown in Figure 4-11.
Chart	Used by Field Service Engineers as a diagnostic tool for sample recording of all laser and coolant data for output to chart programs, such as Microsoft Excel. When this option is selected, a dialog box displays prompting the user to enter a name for the chart file, as shown in Figure 4-10.

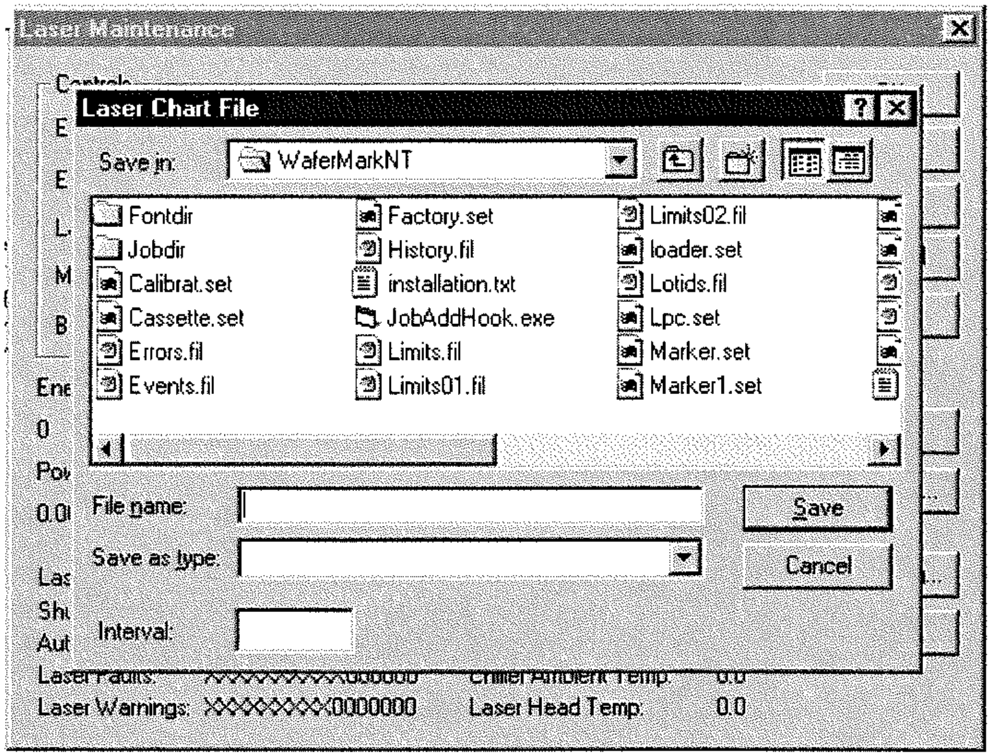
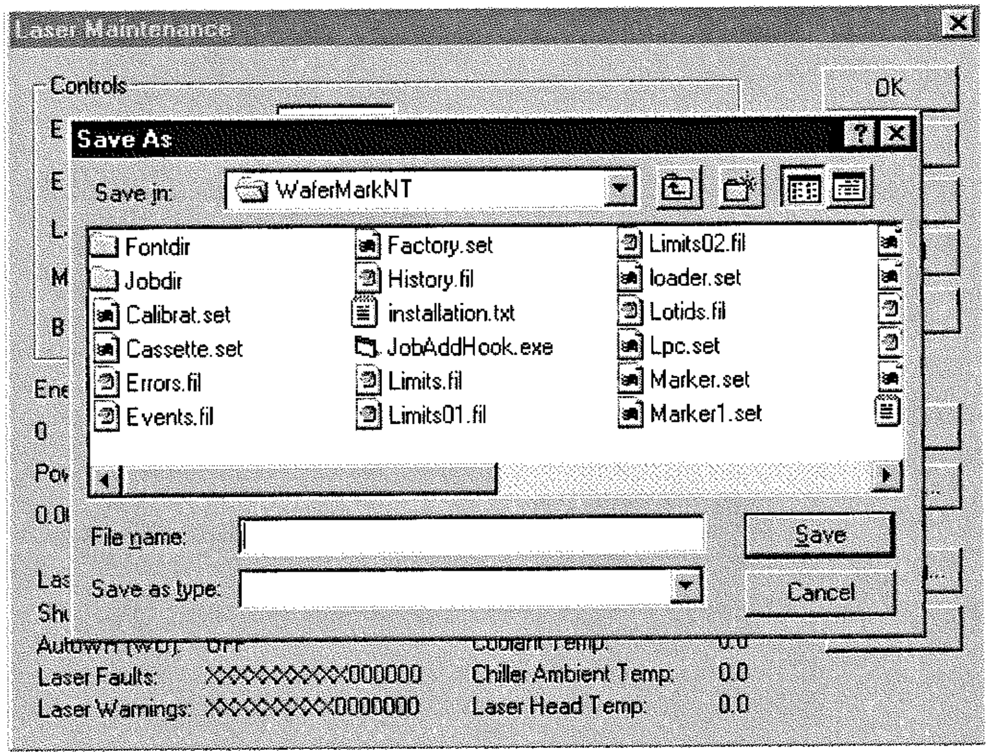


Figure 4-10 – Chart Button — Laser Chart File Dialog Box

To create a log file, enter a unique filename and press **Save**. The log file is created with the extension, **.csv**.



Save in: WaferMarkNT

File name:

Save as type:

Laser Faults: XXXXXXXXXX000000

Laser Warnings: XXXXXXXXX0000000

Chiller Ambient Temp: 0.0

Laser Head Temp: 0.0

Figure 4-11 – DataLog Button — Save As Dialog Box

After entering a unique filename, enter a sample rate value, between 1 and 3600 (seconds) in the **Interval** field, and then click **Save.**

The data fields shown in the lower half of the screen provide a continuous display of the status of the laser and chiller. These fields indicate the conditions as described in Table 4-12

Table 4-12 – Status Conditions for Laser and Chiller

Status	Condition Description
Shutter State	Echoes the position of the beam shutter set in the laser controls (above).
Laser State	Indicates the current laser state— WARM-UP, READY, FAULT, STANDBY, and UNKNOWN. WARM-UP is the laser transition phase between changing energy values and the laser steady state. READY is when the laser is ready for marking. FAULT is any fault recorded by the Laser Controller. STANDBY is the normal condition awaiting a Mark Enable signal when a wafer is on the Aligner and is ready for marking. UNKNOWN is when the laser is in an unknown (fault) condition which cannot be recognized by the Laser Controller.

Table 4-12 – Status Conditions for Laser and Chiller

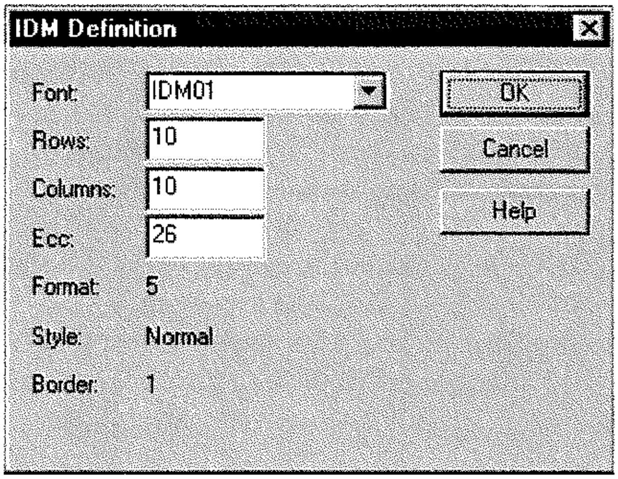
Auto WH (WU)	Indicates the condition of first pulse suppression. WU is a terminal command used to turn first pulse suppression ON or OFF. The default condition for first pulse suppression is ON.
Laser Faults	Indicates the bit configuration of faults recorded by the Laser Controller.
Laser Warnings	Indicates the bit configuration of warnings recorded by the Laser Controller.
Water Temp Set Point	Indicates the water temperature set point of the coolant for normal operation.
Coolant Temp	Indicates the actual temperature of the coolant.
Chiller Ambient Temp	Indicates the air temperature circulating about the Chiller unit.
Laser Head Temp	Indicates the temperature of the head sensor, located on the energy monitor PCB.
Save button	Saves for future wafer job marking the current settings of Energy Setting, Energy Control Loop, and Laser Trigger Mode in the **SIGMA1.SET** file.

4.9.13 ID Matrix Command

The **ID Matrix** command allows the operator to define or edit ID Matrix fonts.

NOTE: To mark these fonts, Marker Version 5.02 or later is required.

1. Select the **ID Matrix** command from the **Maintenance** menu. The **IDM Definition** dialog box appears, as shown in the following example:



IDM Definition

Font: IDM01
Rows: 10
Columns: 10
Ecc: 26
Format: 5
Style: Normal
Border: 1

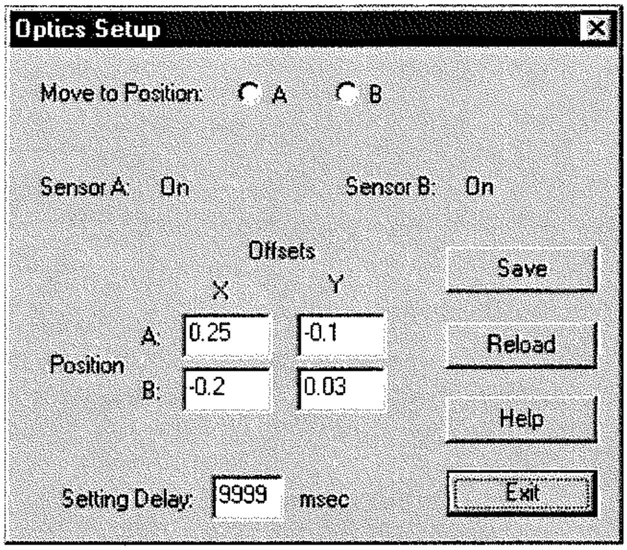
2. Use the **IDM Definition** block to create IDM fonts for marking a 2D matrix. The block contains a pull-down list of all fonts that have already been created for marking IDM.
3. Modify the fonts as desired, including the fields described in Table 4-13.

Table 4-13 – IDM Definition Dialog Box—Values and Functions

Value/Function	Description
Font	A pull-down list of existing IDM fonts created for marking IDM. *NOTE: You can select an existing IDM font to modify or type a new font name to create a new font.*
Rows	The number of Rows listed in the IDM definition block.
Columns	The number of Columns listed in the IDM definition block.
ECC	The Error Correction Code has a value of 26; this represents ECC200.
Format code	The Format code is a fixed field with a value of 5; this indicates that the system is marking ASCII text.
Style	The Style is a pre-set fixed value, called "normal", for defining a particular character appearance and presentation within the rules of standard practices.
Border	The Border code 1 is a pre-set fixed value representing the pattern comprising the outside boundary of the marking.

4.9.14 Optics Command

The dual optics option feature extends the versatility of the marker with additional hardware. When `OPTICS=YES` in the **Maintenance Startup Data** file, the **Optics** command is added to the **Maintenance** menu and allows the Engineer to exercise the optics positions. (If the special software is not installed but the `Optics` keyword is entered and set to `=YES`, an error message will be displayed after the **Maintenance Startup Data** file has been saved. This message advise that the keyword is an invalid option for the version build.) The **Optics** command is protected from unauthorized access from the **Maintenance** menu by the keyword `ACCESS_MAINT_OPTICS =[1|2|3|4|5]`, which defaults to the Supervisor level (`=3`). Clicking on the **Optics** command brings up the following **Optics Setup** dialog box:



Optics Setup

Move to Position: ○ A ○ B

Sensor A: On

Sensor B: On

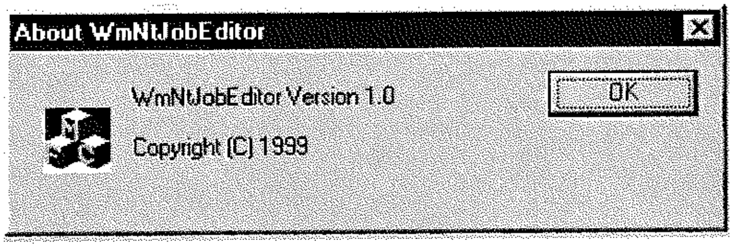
Position	Offsets X	Offsets Y
A:	0.25	-0.1
B:	-0.2	0.03

Setting Delay: 9999 msec

Clicking on A or B (Move to Position) selects the required position. The two position sensors, A and B, are updated periodically. The X and Y Offset values compensate for optical position errors. These values are treated exactly the same as the offset defined in the **Maintenance Startup Data** file by the keyword `OFFSET`. For example, `OFFSET[4][F].X` and `OFFSET[4][f].Y`. When a job requires the optics to change position, a **Settling Delay** is used; currently, the default is **1000 milliseconds** (1 second). This is the delay that occurs after the appropriate sensor (A or B) has indicated the optics unit is in position. Processing resumes after this delay. Click on the **Save** button to store the settings. Click on the **Exit** button to close the window. The **Help** button currently has no action and is reserved for future development.

4.10 Help Menu

Click on the **Help** button of the **Main** menu (or press <F10+H>) to display the version of the WaferMark NT Job Editor.



WmNtJobEditor Version 1.0

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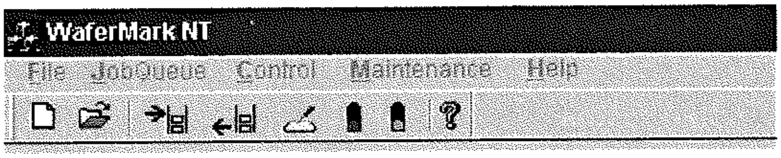
4.11 Main Tool Bar

The Main toolbar contains icons that provide shortcuts to some common functions. The icons (as shown below) are: New Job, Open Folder, Add Job, Delete Job, Mark, Stop, Go, and Help.



4.11.1 New Page Icon

Click on the **New Job** icon command (or press <Ctrl+N>) to bring up the **Job Editor** menu. See 4.6.1 to continue.

4.11.2 Open Job Icon

Click on the **Open Job** icon to open an existing job. See Section 4.6.2 to continue.

4.11.3 Add Job Icon

Click on the **Add Job** icon command to select and load an existing job file to the marking queue. See Section 4.7.1 to continue.

4.11.4 Delete Job Icon

The **Delete Job** icon command is used to delete a job listed in the queue. The **Delete Job** command will remain inaccessible (in the background) until the operator clicks on or highlights the job title for deletion. See Section 4.7.2 to continue.

4.11.5 Mark All Icon

NOTE: The **Mark All** *icon is grayed out unless a job is in the marking queue.*

Click on the **Mark All** icon to initiate normal job production marking when the system is in the IDLE state. If the system is not IDLE, selecting **Mark All** has no effect. See Section 4.8.1 for more information.

4.11.6 Stop Icon

Clicking on the **Stop** icon (red light) on the toolbar suspends the marking and wafer handling operations. See Section 4.8.2 for more information.

4.11.7 Go Icon

Clicking on the **Go** icon (green light) on the toolbar causes the job in process to resume if the system is in the STOPPED state. See Section 4.8.3 for more information.

4.11.8 Help About Icon

Clicking on the **Help About** icon will display the WaferMark NT Version Information (see Section4.10).

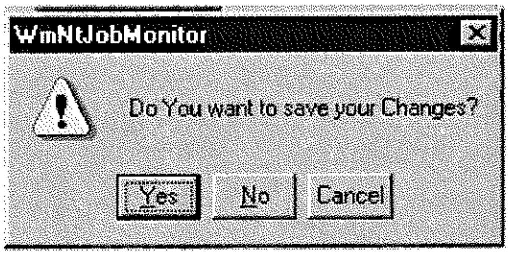
4.12 Job Editor Menu

NOTE: The instructions in this manual assume that the reader is familiar with the Windows® NT operating system. The Help button in the SigmaDSC NT application is inoperative at the present time.

As illustrated below, the WaferMark NT **Job Editor** menu uses a title bar menu, toolbar menu, and Status bar for controlling and modifying the marking process.

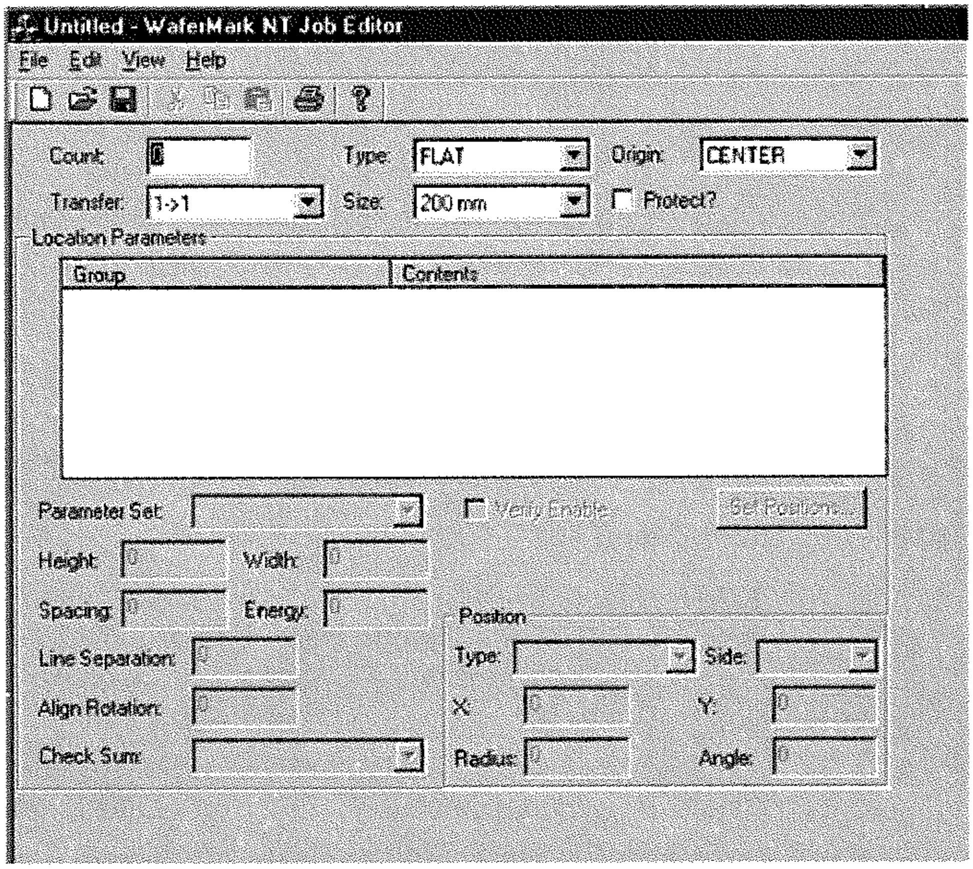
To open a new job, select the **Job Editor** menu from the **Main** menu. The **Job Editor** menu has a title bar with the following submenus: **File, Edit, View,** and **Help**. The toolbar provides icons for the command functions: **New, Open File, Save, Cut, Copy, Paste, Print,** and **Help**.

NOTE: If exiting from within the Job Editor, click on the **Exit** *command to bring up a Save? dialog box, then select Yes, No, or Cancel.*



WmNtJobMonitor

Do You want to save your Changes?



Untitled - WaferMark NT Job Editor

Count: 0

Type: FLAT

Origin: CENTER

Transfer: 1->1

Size: 200 mm

☐ Protect?

The **Job Editor** window contains editable fields for the:

- *count* (number of wafers to be processed)
- *type* of wafer (notch or flat)

- ***origin*** (reference for the mark is at the center of the fiducial (always))
- ***transfer*** position(s)
- ***size*** (wafer cassette definition)
- ***protect*** selection.

The Location Parameters box lists the group name and its content. Other data includes the Parameter Set, Height, Width, Spacing, Energy Setting, Line Separation, Align Rotation, and Check Sum method. The position data includes the Type, Side, X and Y Coordinates, Radius, and Angle data.

Table 4-14 lists the command functions associated with the **Job Editor** menu.

Table 4-14 – Job Editor Menu Command Functions

Command	Function
JOB EDITOR MENU Selections:	
Help	Provides information about the WaferMark NT job monitor. The File menu is opened and the list of available commands is displayed as shown in Section 4.12.1.
FILE MENU Selections:	
Ctrl+N	Creates a New Job.
Ctrl+O	Opens a Job.
Ctrl+S	Writes (saves) the job to the storage disk.
A	Save As... (saves the job using a new name or new storage location).
Ctrl+P	Prints out the job data.
V	Print Preview (displays print job on the screen).
R	Print Setup (shows the print parameters setup).
X	Exits File.
EDIT MENU selections:	
Undo	Performs an UNDO function.
Cut	Performs a CUT function.
Copy	Performs a COPY function.
Paste	Performs a PASTE function.
Insert Group	Performs an INSERT GROUP function.
Delete Group	Performs a DELETE GROUP function.

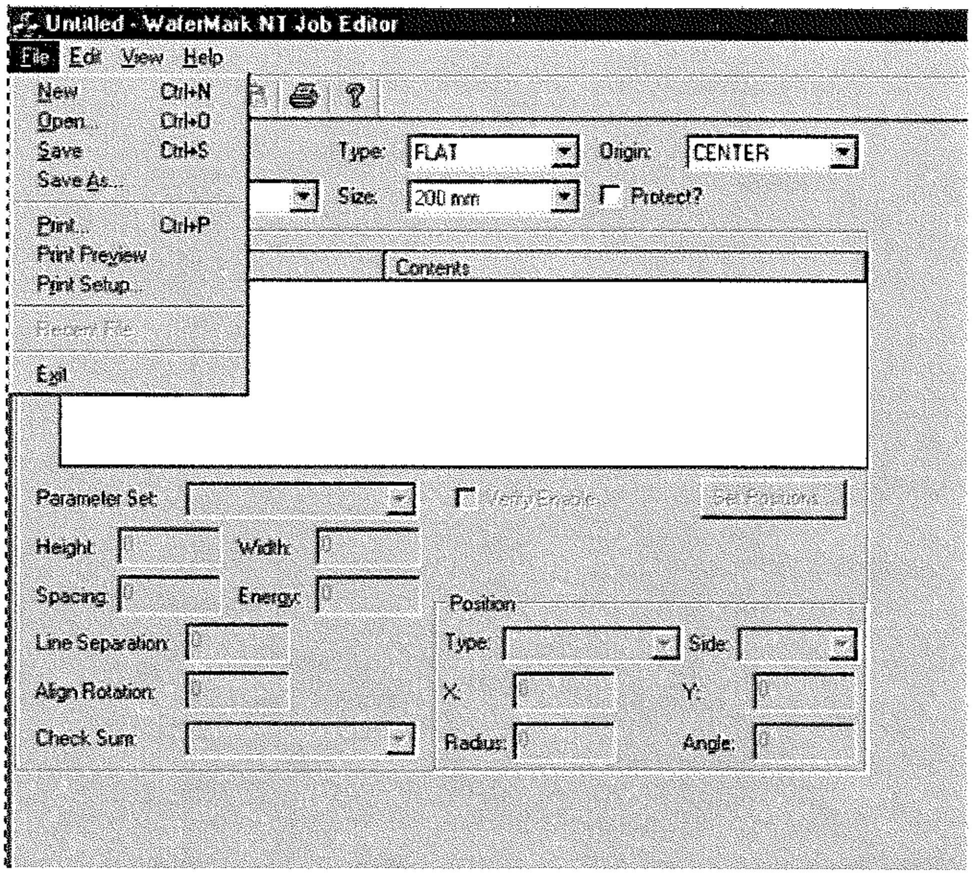
Table 4-14 – Job Editor Menu Command Functions

Command	Function
Options	Allows the operator to select job options.
VIEW MENU selections:	
Toolbar checkbox	Toolbar (checkbox) checkmark = show toolbar.
Status bar checkbox	Status bar (checkbox) checkmark = show status.
HELP MENU:	
A	About WaferMark NT Job Monitor.

4.12.1 File Menu

Click on the **File** item on the **Job Editor** menu (or press **<F10>** and **F**) to open the **File** drop-down menu with a list of available job **File** commands.

The **File** *commands are standard Windows® NT commands.*



Type: FLAT

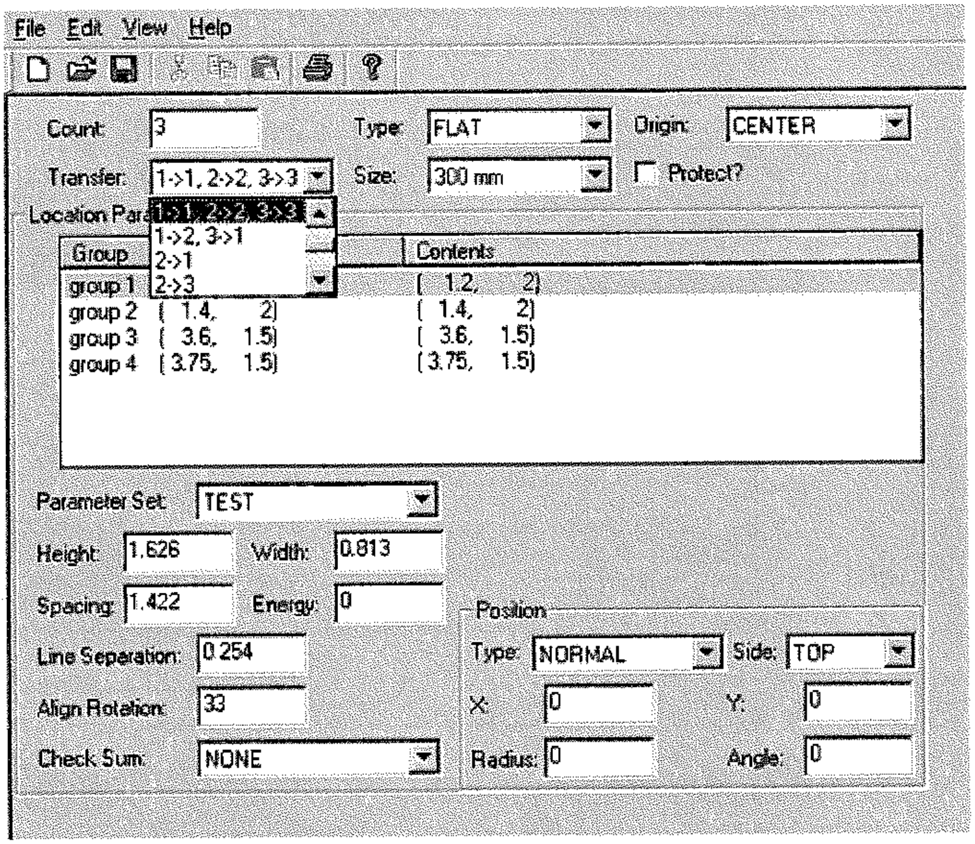
Origin: CENTER

Size: 200 mm

☐ Protect?

4.12.2 Edit Menu

Click on the **Edit** item on the **Job Editor** menu (or press **<F10>** and type **E**) to open the the drop-down list of available **Edit** commands, as illustrated below. The **Edit** commands include the standard Windows® NT commands to **Undo**, **Cut**, **Copy**, and **Paste**, and the SigmaDSC NT commands (as described below) to **Insert Group**, **Delete Group**, or to select **Options**.



Count: 3
Type: FLAT
Origin: CENTER
Transfer: 1->1, 2->2, 3->3
Size: 300 mm
☐ Protect?

Group		Contents
group 1		(1.2, 2)
group 2	(1.4, 2)	(1.4, 2)
group 3	(3.6, 1.5)	(3.6, 1.5)
group 4	(3.75, 1.5)	(3.75, 1.5)

Parameter Set: TEST
Height: 1.626
Width: 0.813
Spacing: 1.422
Energy: 0
Line Separation: 0.254
Align Rotation: 33
Check Sum: NONE

Position
Type: NORMAL
Side: TOP
X: 0
Y: 0
Radius: 0
Angle: 0

Insert Group Command

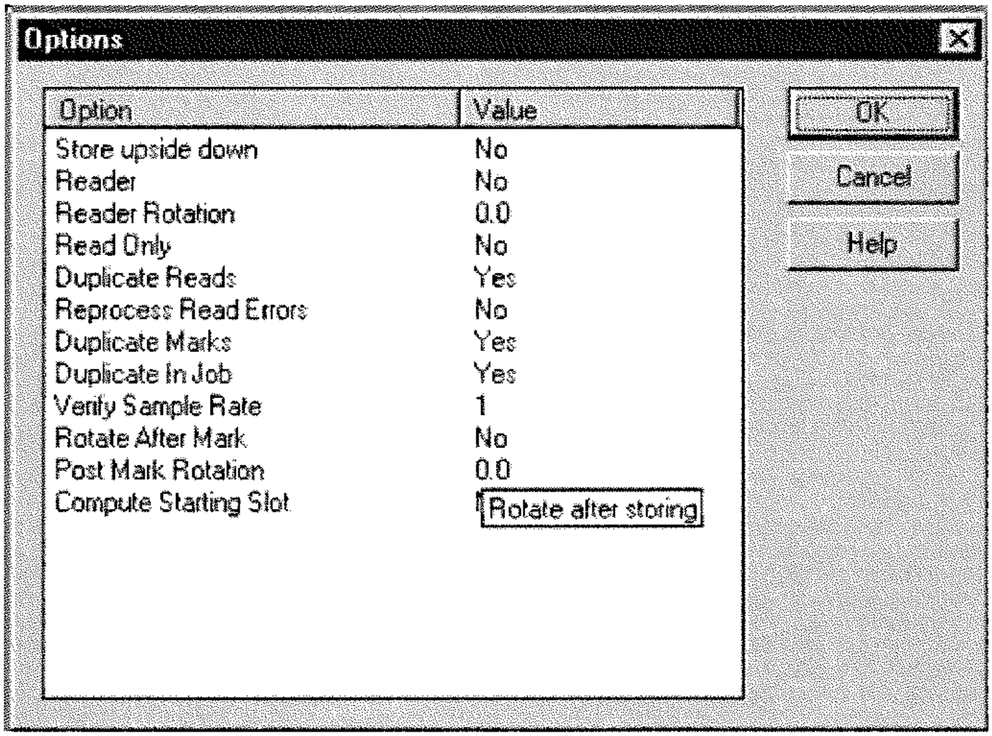
Select the **Insert Group** command from the **Edit** menu (or type I from the **Edit** menu) to insert a new group into the location parameters window.

Delete Group Command

To perform a **Delete Group** function, highlight the group to be deleted, then select the **Delete Group** command from the **Edit** menu (or press the DEL key) to remove the group.

Options Command

Click on the **Options** command (or type O from the **Edit** menu) to open the **Options** dialog box that lists the options and their values. The **Options** dialog box shown below represents a typical application.



Option	Value
Store upside down	No
Reader	No
Reader Rotation	0.0
Read Only	No
Duplicate Reads	Yes
Reprocess Read Errors	No
Duplicate Marks	Yes
Duplicate In Job	Yes
Verify Sample Rate	1
Rotate After Mark	No
Post Mark Rotation	0.0
Compute Starting Slot	Rotate after storing

Figure 4-12 – Options Dialog Box

Options Dialog Box Entries

Store upside down

Once the wafer has been marked, it is returned to the cassette in the upside down position. That is, the wafer is flipped before being returned to the cassette.

Reader

Enable reading bottom of wafer. Only displayed if the Reader option is installed and this feature is implemented (i.e., READER_ENABLE=YES in the **Maintenance Startup Data** file). This option allows the Reader to be enabled on a job basis. If toggled to **Yes**, using the Spacebar the text read from the bottom of the wafer will be substituted for each [Reader] phrase in the marking job.

Whenever `Reader: Yes/No` is displayed in the **Job Options** window `(READER_ENABLE=YES)`, the following options are also displayed:

`Duplicate Reads: Yes`

`Duplicate Marks: Yes`

`Duplicate in Job: Yes`

`Reprocess Reader Errors: No`

Using these default settings, duplicates are allowed in reads, marks and in-the-job, but reprocessing is not enabled. Two identical jobs can be defined — one for processing and one for rework. In the normal job, Duplicate Marks and Duplicate Reads will be **NO**, with Reprocess Reader Errors set to **YES**. In the rework job, Duplicate Marks and Duplicate Reads will be **YES**, with Reprocess Reader Errors set to **NO**. When Duplicate in Job is set to **NO**, the first text group is compared with all the previous first text groups in the job to ensure that no duplication occurs. If a duplicate is found, then a special process error occurs: `7066 duplicate marks in job`, followed by the offending mark text, followed by the message: `LOT MUST BE 100% INSPECTED`. When the operator selects GO/RESUME, the job is forced to terminate via an internal QUIT.

Reader Rotation (UNIT: Degrees)

Only displayed if the Reader option is installed and this feature is implemented (`READER_ENABLE=YES` in the **Maintenance Startup Data** file). This variable indicates the angle that the Reader will be rotated in order to read the text messages marked by this job.

Read Only

No marking? Only displayed if the Reader option is installed and this feature is implemented (`READER_ENABLE=YES` in the **Maintenance Startup Data** file).

Verify Sample Rate

When VERIFY=YES in the **Maintenance Startup Data** file, this job level option specifies the verification sample rate. After the first wafer has been verified, every nth wafer is then verified. For example, if the sample rate is 5, only wafers 1, 6, 11, . . ., etc. will be verified. The default value is '1', which will cause every wafer to be verified. A sample rate of '0' will disable sample verification for that job only.

Rotate after Mark

Only displayed if ROTATE_AFTER_MARK is enabled in the **Maintenance Startup Data** file. This job level option allows the operator to select whether the aligner performs an alignment process at the completion of marking—just before the robot picks up the wafer. This will ensure that all wafers will be in the same orientation in the cassette at the completion of the job.

Post Mark Rotation

Final Position (UNIT: Degrees). Only displayed if ROTATE_AFTER_MARK is enabled. This field specifies the alignment rotation to be performed when Rotate after Mark has been toggled to Yes.

NOTE: If VERIFY=YES*, then alignment rotation cannot be performed.*

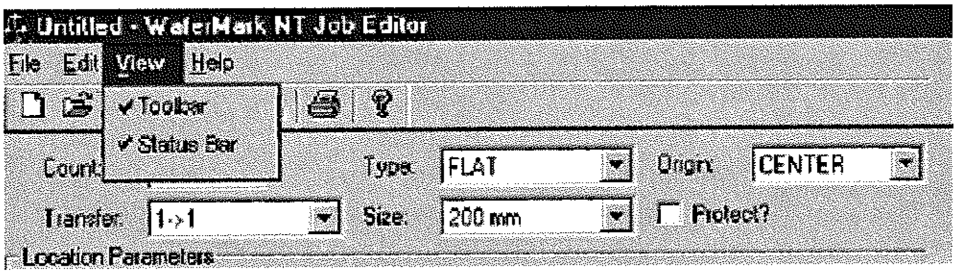
Compute Starting Slot

This field will only be displayed if COMPUTE_STARTING_SLOT is enabled in the **Maintenance Startup Data** file. This option computes the starting slot, depending on the lot size. This method assumes that wafers will fill the upper portion of the cassette; empty slots will begin at slot 1 (the bottom slot). For example, if the lot size is 15 and the cassette has 25 slots, the starting slot would be slot 11; only slots 11 through 25 would be processed and slots 1 through 10 would not be processed.

NOTE: This option is allowed only for lot sizes less than or equal to one cassette.

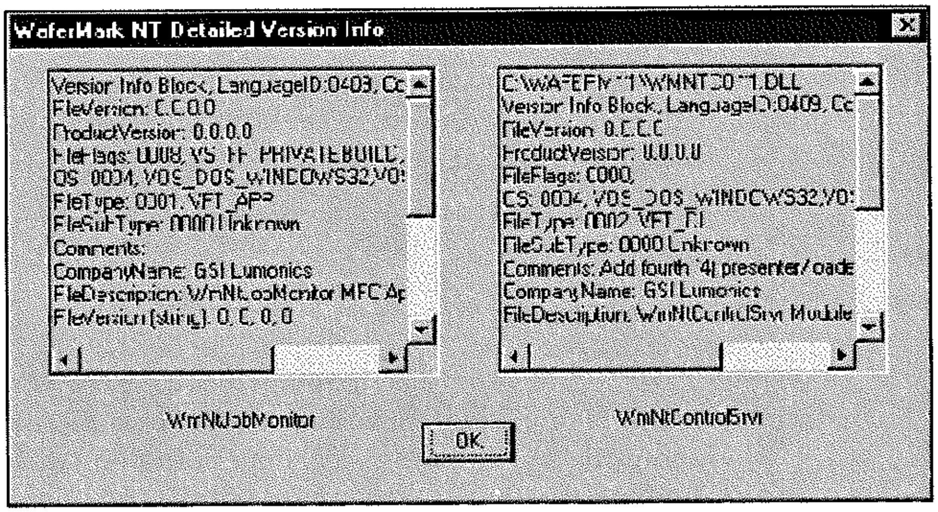
4.12.3 View Menu

Click on the **View** item on the **Job Editor** menu (or press <F10> and V) to open the **View** drop-down menu and reveal the standard Windows® NT **Toolbar** and **Status Bar** items. These selections toggle on and off.



Count:
Type: FLAT
Origin: CENTER
Transfer: 1->1
Size: 200 mm
☐ Protect?

This displays the WaferMark® NT Detailed Version Information that has the WaferMark® NT Job Monitor data (left side) and the WaferMark® NT Control Server data (right side):



```
Version Info Block, LanguageID:0403, Cc
FileVersion: 0.0.0.0
ProductVersion: 0.0.0.0
FileFlags: 0008, VS_FF_PRIVATEBUILD,
OS: 0004, VOS_DOS_WINDOWS32,VO
FileType: 0001, VFT_APP
FileSubType: 0000 Unknown
Comments:
CompanyName: GSI Lumonics
FileDescription: WmNtJobMonitor MFC Ap
FileVersion (string): 0, 0, 0, 0
```

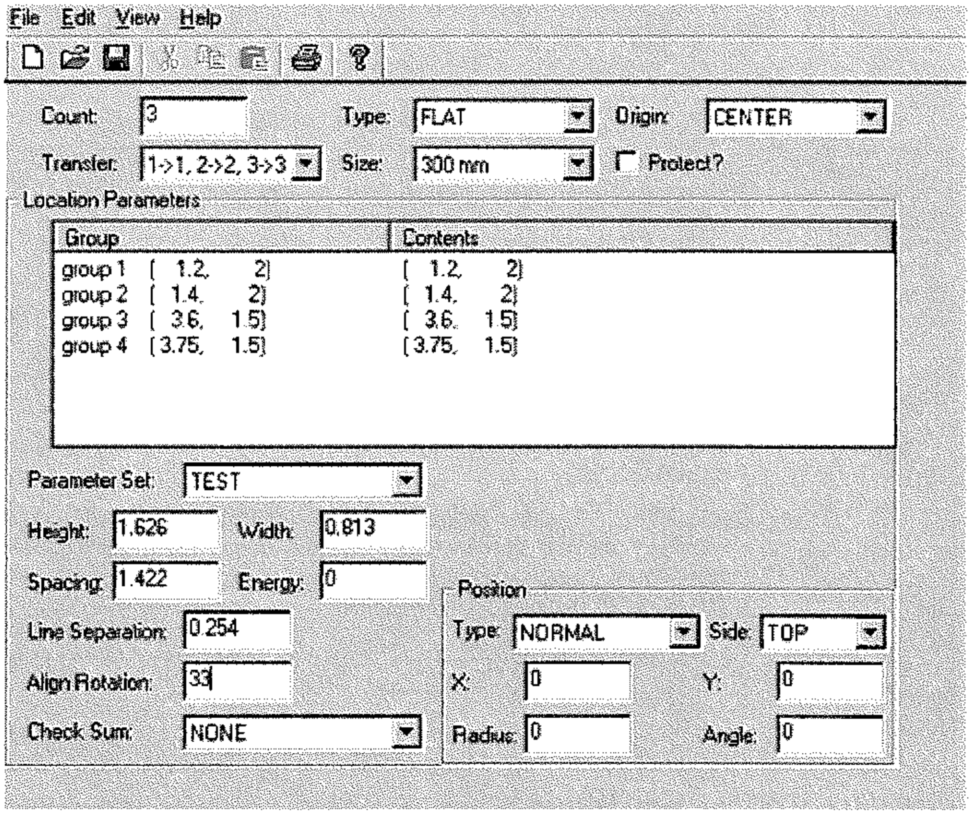
```
C:\WAFERM~1\WMNTC0~1.DLL
Version Info Block, LanguageID:0409, Cc
FileVersion: 0.0.0.0
ProductVersion: 0.0.0.0
FileFlags: 0000,
OS: 0004, VOS_DOS_WINDOWS32,VO
FileType: 0002 VFT_DLL
FileSubType: 0000 Unknown
Comments: Add fourth '4) presenter/loade
CompanyName: GSI Lumonics
FileDescription: WmNtControlSrvr Module
```

NOTE: The above displays the upper portion of the version data.

4.12.4 Job Editor Toolbar

The **Job Editor** toolbar consists of standard Windows® NT icons that provide shortcuts to the command functions: **New, Open, Save, Cut, Copy, Paste, Print,** and **Help**.

4.12.5 Job Definition



Count: 3

Type: FLAT

Origin: CENTER

Transfer: 1->1, 2->2, 3->3

Size: 300 mm

☐ Protect?

Location Parameters

Group	Contents
group 1 [1.2, 2]	[1.2, 2]
group 2 [1.4, 2]	[1.4, 2]
group 3 [3.6, 1.5]	[3.6, 1.5]
group 4 [3.75, 1.5]	[3.75, 1.5]

Parameter Set: TEST

Height: 1.626

Width: 0.813

Spacing: 1.422

Energy: 0

Line Separation: 0.254

Align Rotation: 33

Check Sum: NONE

Position

Type: NORMAL

Side: TOP

X: 0

Y: 0

Radius: 0

Angle: 0

The **Job Definition** screen allows the operator to load a selected job and inspect or change any existing wafer and marking information specified in the job. Changes can be saved back to the original file or used as a template to create a new job.

Select the **New** command from the **Edit** menu to create a new job using predetermined default data that is set into fields.

Location Parameters are described in Table 4-15.

The information in the **Job Definition** screen consists of a number of wafer and marking fields that can be changed or modified to suit individual job requirements. To alter a particular field value, the field data must first be selected (by double-clicking or pulling down, depending on the field), then replaced with new alpha or numeric data; any previous data is automatically erased.

NOTE: All dimensional values are shown in the unit of measurement specified by the `METRIC` *keyword in the* **FACTORY.SET** *file.*

The wafer and marking fields available for change from this screen are defined in Table 4-15.

Table 4-15 – Job Definitions

Field	Description
Count	Specifies the number of wafers to be marked.
Type	Specifies the wafer fiducial as **FLAT** or **NOTCH**.
Origin	Indicates that the reference for the mark is at the center of the fiducial. *NOTE: This field cannot be changed.*
Transfer	Specifies the sequence of wafer movement during wafer marking. *NOTE: This field display is controlled by the MOVEMENT_MODE= parameter (see Appendix section A.2).* For example, 1→1 indicates that the wafers to be marked are picked from cassette number 1 and placed back into cassette number 1 after marking. Valid transfer choices (in the form ***source cassette*** → ***destination cassette***) depend upon the selected MOVEMENT_MODE. For example: • 1→1 • 2→2 • 1→1, 2→2. *NOTE: Use the sequence 1→1, 2→2 when the wafers to be marked are loaded into both cassettes.*
Size	Specifies the cassette definition (see Section 4.9.7).
Protect?	Protect Group? When checked, enables the Supervisor to optionally prevent access by Production Operators to the text field in the Confirm Handler Parameters window at Job Add time.
Location Parameters	
Group	Optionally-assigned title by which the operator can associate the contents of a specific marking job. For example, if a cassette contains wafers from the XYZ Corporation and the text to be marked is `ABC123`, the operator might choose to assign ***XYZ*** as the Group title. *NOTE: Although no title is required, in the above example,* ***XYZ*** *provides a meaningful reference to the operator.*

Table 4-15 – Job Definitions

Contents	Displays one or more lines of text to be marked (see NOTE, below). Serial numbers can be included as part of some other text and can be specified by typing the starting serial number, enclosed by square brackets (for example: [00105]). The current serial number is incremented by a count of 1 after each wafer has been marked. Any changes that are made to a line of text automatically erases any existing text on that line. *NOTE: Enter Marking text **only** in the UPPERCASE.* To add a new marking group, click on the **Insert Group** command to create a new (highlighted) text line for the new group. Groups can also be deleted by clicking on the **Delete Group** command when the group line is highlighted on the screen.
Parameter Set	The name assigned to one of the available Marker Parameter sets. To select a different set, click on the Marking Parameter Set listbox button and scroll through the list to select the desired set.
Height	Character Height is the vertical height of each character in the line of text to be marked.
Width	Character Width is the horizontal width of each character in the line of text to be marked.
Spacing	Intercharacter Spacing is the distance separating between each marked character, measured from the first dot of one character to the first dot of the next character.
Energy Setting	Measured in micro Joules (Range: 0 - 2600 µJ), this is the laser energy for the job marking. Typically, this value is between 930 and 950 µJ.
Line Separation	Interline Spacing is the spacing between the bottom of one line of text and the top of the next line of text.

Table 4-15 – Job Definitions

Align Rotation	The alignment rotation (in degrees) required to position the highlighted line of text (i.e., mark position). The wafer rotates in a clockwise direction to the start of the mark, relative to the flat or notch, by the specified degrees. The rotation angle can be varied between 0.0 and 360.0 degrees in increments of one-tenth of a degree. For example, to mark at the left edge of the wafer requires a rotation angle of 270.0. *NOTE: The actual angle will depend on the type of Aligner installed — that is, according to whether the Aligner rotates clockwise or counterclockwise.* The wafer initially aligns to the rotation angle of the first group. All text groups with the same rotation as the first group are marked in the first pass. If groups were not marked on the first pass, the wafer rotates to the position of the next unmarked group, then all groups with that rotation are marked. This process repeats until all text groups have been marked. *NOTE: To minimize the impact on throughput, minimize the number of unique rotation values.* For systems operating with the flipper option implemented, `Top Rotation` and/or `Bottom Rotation` are indicated. No numerical relationship between the Top and Bottom rotation values exists in the software. The customer must determine both values using trial and error. If mark text is defined for a side, then that side's rotation is displayed. If the system is set up for the flipper and a particular job only marks on the bottom side of the wafer, then only the `Bottom Rotation` field appears on this screen and on the Confirm Handler Parameters screen. If both sides have text, this screen appears as shown in the above illustration. If the flipper is not present, then only the Align Rotation field is displayed (referring to the top). *NOTE: This field defaults to the value set for the* `Top Rotation`, `Bottom Rotation` *or* `Align Rotation` *field, depending on whether a flipper is used and the side(s) on which marking is to occur.*
Check Sum	Lists the standards for checksum character generation: SEMI_STD OCR, IBM_412 OCR, SEMI_412 OCR, IBM_412 BC, SEMI_412 BC, COGNEX, and NONE. If NONE is selected, no check character is generated for the line of text; otherwise, a generated check character is inserted in the text at the position determined by the standard selected.
Position	
Type	Coordinate System Type. Indicates the type (or visual appearance) of the actual mark — Normal (upright), Inverted, Arc, or Arc-Inverted.
Side	Side of the wafer on which the marking is done (Top or Bottom).
X Coordinate	X-axis Location. The offset value in the direction of the X-axis from the 0,0 X-Y coordinate center of the laser field near the edge of the wafer to the lower left dot of the first character cell of the first text character in the string. *NOTE: If* `CONSTANT_ALIGNER_POSITION=YES` *in the Maintenance Startup file, edge detection is implemented and the offset value is from the true center of the notch or flat.*

Table 4-15 – Job Definitions

Y Coordinate	Y-axis Location. The offset value in the direction of the Y-axis from the 0,0 X-Y coordinate center of the laser field near the edge of the wafer to the lower left dot of the first character cell of the first text character in the string.
Radius	Arc Radius. When Type specifies Arc or Arc-Inverted, the radius is the angular distance from the 0, 0 X-Y coordinate center of the laser field to the center. Text marking along an arc or inverted arc marking, enter the radius value of the arc; otherwise, ensure that this value is set to 0.000.
Angle	Text Rotation Angle or Arc Start Angle. The angle at which the line of text is to be rotated (clockwise or counterclockwise) relative to the X- and Y- coordinates that specify the start of the mark for this line. If the text is to be marked at an angle (normal) to the direction of the X-axis, enter the angle of text rotation. If marking normal text with no rotation, ensure that this value is set to 0.000. If the Coordinate System Type is Arc (i.e., marking text along an arc), this specifies the angle at which the arc begins.

4.13 Error Handling

The system continuously monitors the hardware fault indicators. When the system cannot successfully proceed through the processing stages, the software generates errors. For a detected error, the following conditions occur:

Error or Fault State Sequence:

1. Enters the STOP state. Completes any Robot Aligner or Marker operation in progress. Sets the STOP state.
2. Turns off the green light on the signal tower.
3. Enables the audible alarm device.
4. Enables the signal tower lights, as follows:
   a) Errors: Turns on the amber light.
   b) Faults: Turns on the red light.
5. Sets the **ALARM SUPPRESS** indicator to flashing.
6. Sets the **FAULT CLEAR** indicator to flashing.

Error or Fault Response State Sequence

1. Pressing **ALARM SILENCE** at any time shuts off the alarm and the ALARM SILENCE indicator.

2. Once the fault is cleared, pressing **FAULT CLEAR** shuts off the **FAULT CLEAR** indicator and turns off (both) red and amber lights on the signal tower.

   Note, pressing the **FAULT CLEAR** *when a fault is still present, causes the alarm to sound again.*
3. The system is now in the STOPPED state. Any error state is actually a ***don't care*** condition until the sequence is resumed. Pressing **GO** causes the system to follow the next sequence:

   a) Faults: Check all fault bits prior to allowing the system to resume.

   b) Errors: Just GO; let system detect its own errors.
4. System returns to a RUNNING state and turns on the green light on the signal tower, if installed.

4.13.1 Hardware Error Definitions

A hardware error implies that system operation can be resumed after the operator has fixed the problem. An amber light on the signal tower indicates errors of this class.

Any of the following can detect hardware errors:

- Laser
- Robot
- Aligner
- Wafer handler
- Missed picks
- cassette placement
- Marker
- Software-generated errors

4.13.2 Hardware Fault Definitions

A hardware fault error implies that something is broken and requires repair or replacement. If installed, a red light on the signal tower indicates errors of this class.

The operator panel fault indicators also indicate these faults:

- Airflow fault
- Vacuum fault
- cassette loading fault
- Laser fault
- Wafer handling fault
- Interlock fault

4.14 Clearing Wafer Handling Faults

If the current job aborts and leaves a wafer on either the Aligner or the Robot arm, the wafer must only be removed by personnel trained and certified by GSI Lumonics to perform the removal procedures.

To remove the wafer, either use the software to command the handler system to return the wafer to an empty cassette slot or remove the wafer by hand. Both methods require special procedures to avoid damage to the wafer and/or components of the handler system. For instructions to remove a wafer from the robot arm ...

- using software, see Section 4.14.1
- manually, see Section 4.14.2

For instructions to remove a wafer from the aligner ...

- using software, Section , see Section 4.14.3
- manually, see Section 4.14.4

IMPORTANT

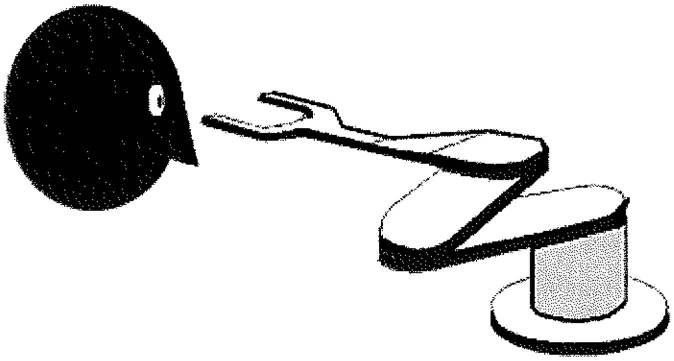
NOTICE: Certain customers may have a safety policy that does not allow operators to remove wafers from the wafer handler system manually. Therefore, before using either of the procedures for removing a wafer, verify with your Supervisor or Engineer which method is acceptable.

⚠ WARNING
PINCH POINT HAZARD

ROBOT ARM MAY MOVE SUDDENLY—END EFFECTOR CAN CAUSE SERIOUS EYE DAMAGE OR OTHER BODILY INJURY.

NEVER attempt to remove or retrieve a wafer from the handler or marking enclosure while the system is processing a job or the handler is in motion.

ALWAYS stop or abort the job and remove the wafer in accordance with the procedure described in this manual.

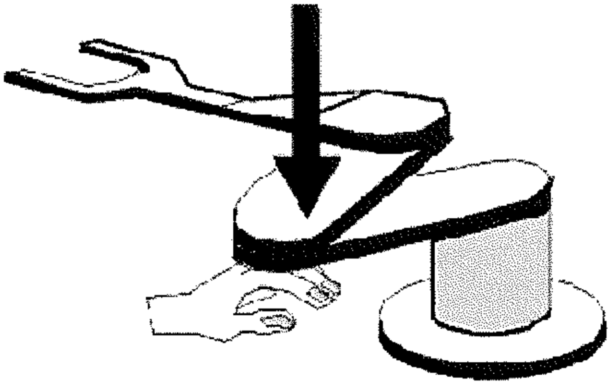


⚠ **WARNING**

PINCH POINT HAZARD

ROBOT ARM MAY MOVE SUDDENLY

LOWER LINK OF ROBOT ARM CAN CAUSE SERIOUS HAND OR BODILY INJURY. NEVER attempt to remove or retrieve a wafer from the handler or marking enclosure while the system is processing a job or the handler is in motion. ALWAYS STOP or abort the job and remove the wafer in accordance with the procedure described in this manual.

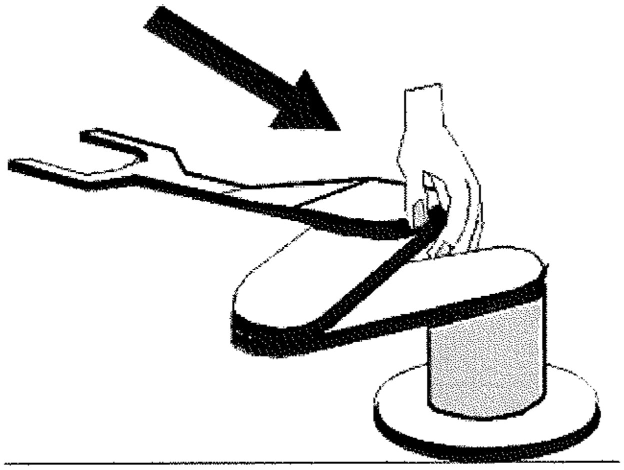


⚠ WARNING

PINCH POINT HAZARD

ROBOT ARM MAY MOVE SUDDENLY

PLACING HANDS OR FINGERS WITHIN AREA OF ROBOT ARM TRAVEL CAN CAUSE SERIOUS INJURY. NEVER attempt to remove or retrieve a wafer from the handler or marking enclosure while the system is processing a job or the handler is in motion. ALWAYS STOP or abort the job and remove the wafer in accordance with the procedure described in this manual.



4.14.1 Removing a Wafer from the Robot Arm Using Handler Commands

Use the following procedure to use handler commands to return a wafer to a slot in a cassette if the wafer is on the Robot Arm.

⚠ CAUTION

Potential Wafer and/or Equipment Damage

Before performing the following procedure, verify that the wafer will be transferred into an empty cassette slot. Failure to do so could result in damage to the wafer on the arm and/or the wafer in the cassette slot, as well as possible damage to the robot arm.

Assume that the wafer is on robot arm 1 and will be returned to Presenter 2, slot 6.

Procedure:

1. Select the **Robot** command from the **Maintenance** menu.

2. Press the **Terminal** button.
3. On the keyboard, turn on the **Caps Lock** key so that all typing is entered in uppercase.
4. Check the robot to see that the wafer is present.
5. Refer to the CAUTION notice above. Verify that the cassette slot is empty.
6. Type `PUT B,6` and press **<Enter>**.

   The robot transfers the wafer into Slot 6 of Station B (cassette on Presenter 2) and returns to the middle position.

   NOTE: If the wafer was on robot arm 0 instead of robot arm 1, the robot would transfer the wafer to Station A.
7. On completion, select **OK** or **Cancel** to exit the **Robot Communications** window and return to the **Control** menu.

4.14.2 Manually Removing a Wafer from the Robot Arm

This method of removing wafers from the handler may not be permitted by your organization. Before proceeding, verify with your supervisor that this operation is allowed. To remove the wafer:

Procedure:

1. Select the **Robot** command from the **Maintenance** menu.
2. Press the **Terminal** button.
3. On the keyboard, turn on the **Caps Lock** key so that all typing is entered in uppercase.

> ⚠ **CAUTION**
> **Potential Wafer Damage**
>
> Proceed with care in the following steps. Failure to do so may cause the wafer to fall off the end effector.

4. If the wafer is on
   - Robot Arm 0 (green), type `OUT 1,1`. Do ***not press*** **Enter**.
   - Robot Arm 1 (red), type `OUT 2,1`. Do ***not press*** **Enter**.

5. With the vacuum wand in one hand, steady or support the wafer on the end effector. Press **Enter**.
6. Carefully remove the wafer.
7. On completion, select **OK** or **Cancel** to exit the **Robot Communications** window and return to the **Maintenance** menu.

   NOTE: Upon completion of this wafer removal procedure, re-initialize the system and reset the software.

4.14.3 Removing a Wafer from the Aligner Using Handler Commands

Use the following procedure to use handler commands to return a wafer to a slot in a cassette if the wafer is on the Aligner.

Assume that the wafer is on the Aligner and will be returned to Presenter 1, slot 2.

This procedure must be performed in separate stages, as follows:

A) Open Safety door (between robot and aligner).

B) Turn off the vacuum that is holding the wafer to the Aligner.

C) Withdraw the wafer.

D) Return the wafer to the cassette.

Procedure:

1. Set the safety door switch to the MANUAL position (this opens the marking chamber door).
2. Select the **Aligner** command from **Maintenance** menu.
3. On the keyboard, turn on the **Caps Lock** key so that the typing is entered in uppercase.

⚠ CAUTION

Step 3 must be carried out before proceeding.

Failure to perform Step 4 before proceeding so could result in bending the robot arm.

4. Type REL and press **Enter** to turn off the vacuum on the Aligner chuck.

5. Select **OK** or **Cancel** to exit the **Aligner Communications** window and return to the **Maintenance** menu.
6. Select **Robot** command from the **Maintenance** menu.
7. Press the **Terminal** button.
8. Check the robot to see if there is an arm available for transfer (i.e., not carrying a wafer).

> ⚠ **CAUTION**
>
> **The robot arm to be selected must NOT be carrying a wafer.**
>
> Otherwise, probable damage will occur to the wafer on the arm, the wafer on the Aligner and to the Robot arm.

9. For this example, assume arm 0 (green) is available (i.e., not carrying a wafer). Type `GET Y` for arm 0. (If arm 1 was available, you would type `GET Z` for arm 1.) Press **Enter**.

   The robot withdraws the wafer from the Aligner and returns to the middle position.
10. To transfer the wafer into slot 2 of Presenter 1:
    a. Verify that cassette slot 2 at Presenter 1 is EMPTY.
    b. Type `PUT A,2` and press **Enter**.
11. On completion, select **OK** or **Cancel** to exit the **Robot Communications** window and return to the **Maintenance** menu.

4.14.4 Manually Removing a Wafer from the Aligner

This method of removing wafers from the handler may not be permitted by your organization. Before proceeding, verify with your supervisor that this operation is allowed. To remove a wafer manually:

Procedure:

1. Select the **Aligner** command from the **Maintenance** menu.
2. On the keyboard, turn on the **Caps Lock** key so that all typing is entered in uppercase.
3. Type `REL` and press **Enter** to turn off the vacuum on the Aligner chuck.

4. Open the access door and remove the wafer, using a vacuum wand.
5. On completion, select **OK** or **Cancel** to exit the **Aligner Communications** window and return to the **Maintenance** menu.

   NOTE: Upon completion of this wafer removal procedure, reinitialize the system and reset the software.

5 Job Setup Instructions

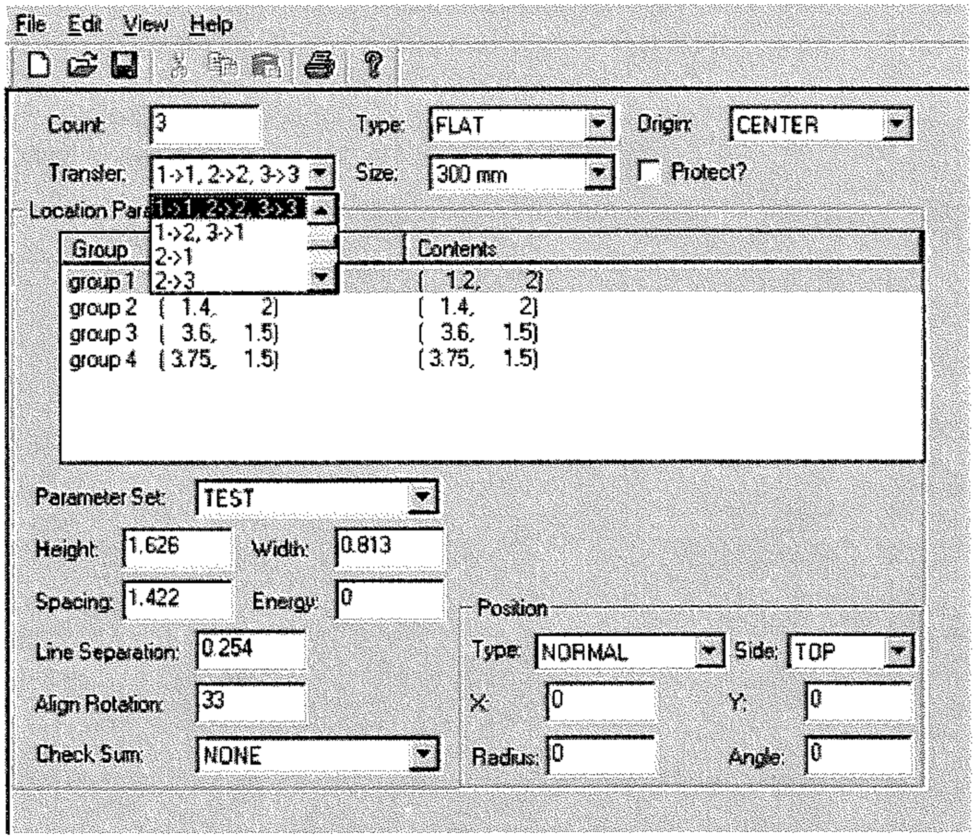
This chapter provides step-by-step instructions for setting up jobs to be marked by the WaferMark® SigmaDSC NT system.

5.1 Introduction

These Job Setup instructions assume that the user (either a Supervisor or Engineer) is setting up a new job as described in Section 5.1.1 or opening and copying an existing job as described in Section 5.1.2.

5.1.1 New Job Steps

Selecting the **New** command from the **Main** menu displays the **Job Editor** menu. Confirm or setup the following global parameters for the recipe on the screen:



Count: 3
Type: FLAT
Origin: CENTER
Transfer: 1->1, 2->2, 3->3
Size: 300 mm
☐ Protect?

1->1, 2->2, 3->3
1->2, 3->1
2->1
2->3

Group		Contents
group 1		(1.2, 2)
group 2	(1.4, 2)	(1.4, 2)
group 3	(3.6, 1.5)	(3.6, 1.5)
group 4	(3.75, 1.5)	(3.75, 1.5)

Parameter Set: TEST
Height: 1.626
Width: 0.813
Spacing: 1.422
Energy: 0
Line Separation: 0.254
Align Rotation: 33
Check Sum: NONE

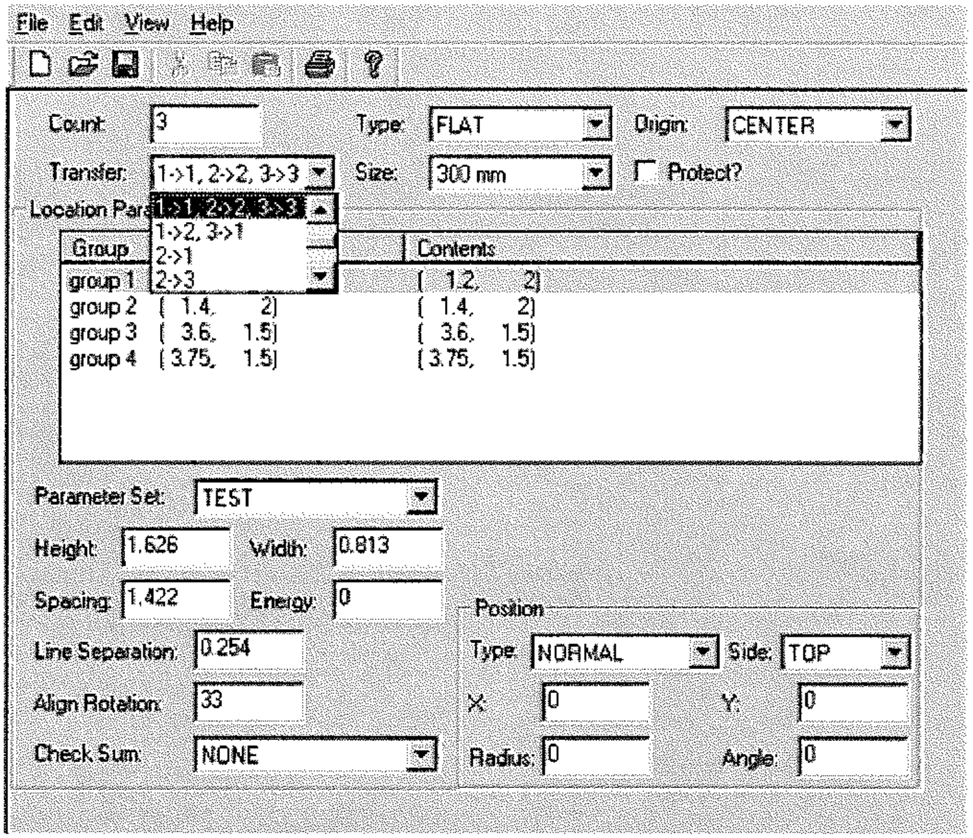
Type: NORMAL
Side: TOP
X: 0
Y: 0
Radius: 0
Angle: 0

1. **Count:** Enter the number of wafers to be marked for this job. Refer to Table 4-15.
2. **Transfer:** Click on the listbox to open and select the appropriate cassette transfer sequence. Refer to Table 4-15.
3. **Type:** Click on the listbox to open and select the reference point for the mark: either FLAT or NOTCH. Refer to Table 4-15.
4. **Size:** Click on the listbox to open and select the appropriate cassette definition for the wafers to be marked. Refer to Table 4-15.
5. **Origin:** Click on the listbox to open and make the appropriate field selection, such as **CENTER**.
6. **Protect?:**A checkbox field to select **Yes** (checkmark) or **No** (no checkmark). A checkmark in the box prevents all Production Operators from altering the **Contents** text field in the **Confirm Handler Parameters** window immediately before the job is loaded into the marking queue (as explained in Section 4.7.1). If no checkmark is in the box, any Operator can access the **Contents** text field to change the text for this job before marking.

Location Parameters: Group and Contents

The Group name is a placeholder tag and does not affect any parameters. Perform the following steps to define each Group in the job and its contents:

7. Click on the **Edit** item on the **Job Editor** menu and select the **Insert Group** command from the drop-down list, as shown below.



Count: 3
Type: FLAT
Origin: CENTER
Transfer: 1->1, 2->2, 3->3
Size: 300 mm
☐ Protect?

Group		Contents
group 1		(1.2, 2)
group 2	(1.4, 2)	(1.4, 2)
group 3	(3.6, 1.5)	(3.6, 1.5)
group 4	(3.75, 1.5)	(3.75, 1.5)

Parameter Set: TEST
Height: 1.626
Width: 0.813
Spacing: 1.422
Energy: 0
Line Separation: 0.254
Align Rotation: 33
Check Sum: NONE
Type: NORMAL
Side: TOP
X: 0
Y: 0
Radius: 0
Angle: 0

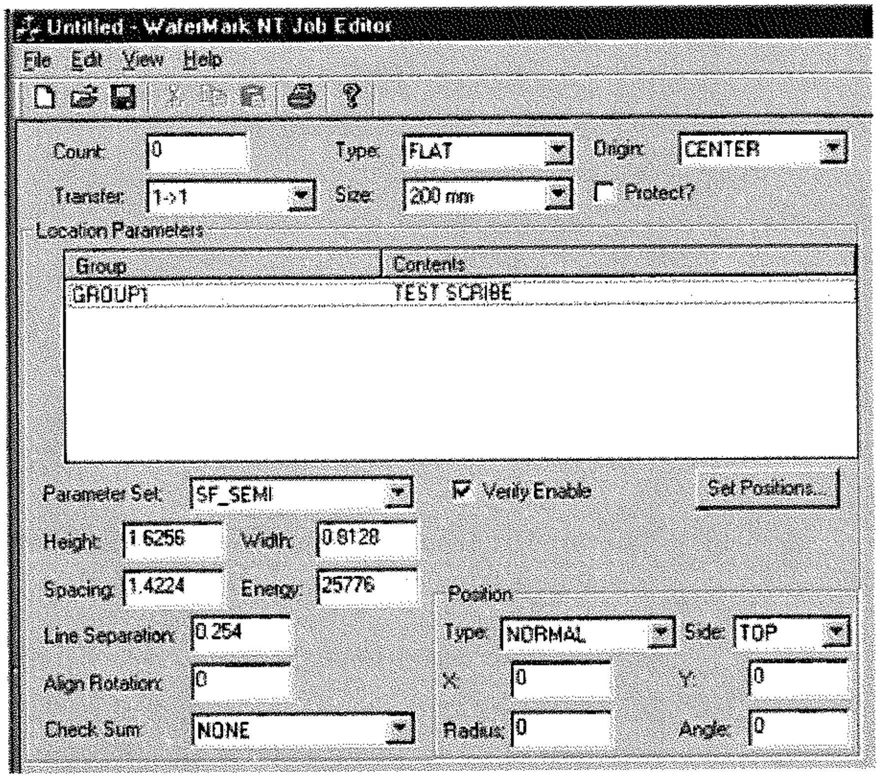
8. The **Group/Contents** window in the **Location Parameters** box becomes active (located in the center area of the **Job Editor** menu). Enter the appropriate **Group Name** into the Group line as instructed below, then press <Enter>.

   a. **Contents (Group 1)**: Double-click the area just below the Contents header to select the **Contents** field. Enter the exact text or message to be marked. If the field requires a serial number, enter the serial number format according to the information provided in Chapter 6.

   b. **Contents (Group n)**: Create new text groups (if required by the job) by clicking on the **Insert Group** command; this starts a new line for the new group in the **Contents** field. Enter the text or message and serial number, if needed, as in Step a. If this line is no longer required, click on **Delete Group**command and press <Enter>.

c. **Group:** Double-click on the appropriate **Contents** field to select the **Group** field. Enter a title that describes this group or leave the field blank. This title is used on the main screen while the group is being marked.

9. Either select each of the Location parameters that require changing or retain the default settings for each. To navigate the fields in this window, use the pointer, **<Tab>** or arrow keys.



Count: 0
Type: FLAT
Origin: CENTER
Transfer: 1->1
Size: 200 mm
☐ Protect?

Group	Contents
GROUP1	TEST SCRIBE

Parameter Set: SF_SEMI
☑ Verify Enable
Height: 1.6256
Width: 0.8128
Spacing: 1.4224
Energy: 25776
Line Separation: 0.254
Align Rotation: 0
Check Sum: NONE

Position
Type: NORMAL
Side: TOP
X: 0
Y: 0
Radius: 0
Angle: 0

Figure 5-1 – Job Editor

a. **Parameter Set:** Click on the listbox to open and select the name field for the Parameter Set.

b. **Height:** Enter the value for the character height.

c. **Width:** Enter the value for the character width.

d. **Spacing:** Enter the value for spacing between successive characters.

   e. **Energy:** The laser power setting, between 0 and 2600 μJoules, that is used to mark the current job. Typically, this value is between 930 and 950 μJ.

   f. **Line Separation:** For multi-line marking only, enter the value of spacing between each line of text.

   g. **Align Rotation:** Enter the number in degrees around the circumference of the wafer where the mark will be located, as measured from the notch or the flat. Typically, 0 degrees represents the location of the notch of flat.

   h. **Check Sum:** If the mark includes a check sum, select the field from the listbox for **SEMI_STD OCR, IBM_412 OCR, SEMI_412 OCR, IBM_412 BC, SEMI_412 BC** or **COGNEX**. If a check sum is not required, select **NONE** from the listbox .

10. ***Position Parameters***

    Perform the following steps to define each Position parameter:

    a. **Type:** Select from the listbox for Normal (upright) marking, Inverted marking, Arc marking or Arc-inverted marking.

    b. **Side:** Select the side on which marking is to occur — TOP or, if the system has a flipper robot, BOTTOM.

    c. **X-coordinate:** Enter the offset value from the Reference Origin (or X-coordinate, 0) to the location for the start of the mark.

    d. **Y-coordinate:** Enter the offset value from the Reference Origin (or 0, Y-coordinate) to the location for the start of the mark.

    e. **Radius:** If you are marking an arc or inverted arc, enter the radius of the arc; otherwise, set this value to 0.000.

    f. **Angle:** If the text will be marked at an angle (normal) to the direction of the X-axis, enter the angle of text rotation. If you are marking text along an arc, enter the angle at which the arc will begin. If you are marking normal text with no rotation, set this value to 0.000.

11. The **Edit Options** displays whatever options are enabled by keywords in the **FACTORY.SET** file.

NOTE: It is important to set the **Laser Power** *option.*

12. The job setup is now complete. Save the file.

5.1.2 Open and Copy an Existing Job

To create a new job by copying and modifying an exiting job:

1. Select an existing job in the **Select Job** dialog box.
2. Modify the existing job (by entering new text or altering font styles or other marking parameters). See Table 4-15 for job definitions and to determine whether and how to keep or change job parameters.
3. Save the job with a different filename.

NOTE: This method is preferred if there are only minor differences between one job and another such as the message string.

5.2 Determining the Layout of the Mark

The first step in setting up a job is to determine how the text or message to be marked will be laid out on the wafer. Figure 5-2 illustrates the coordinate reference points used by the laser and the marker software.

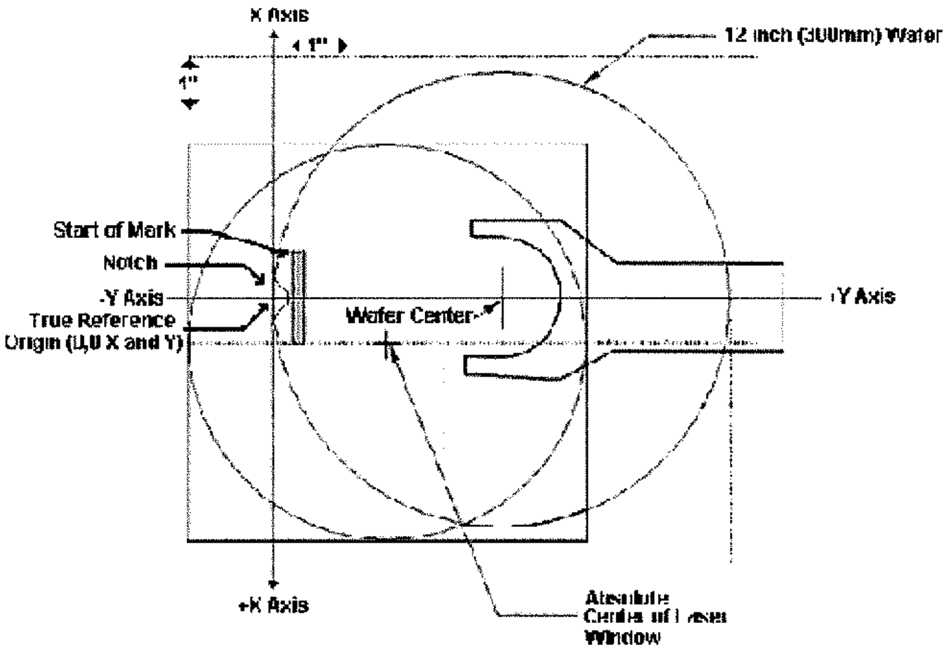


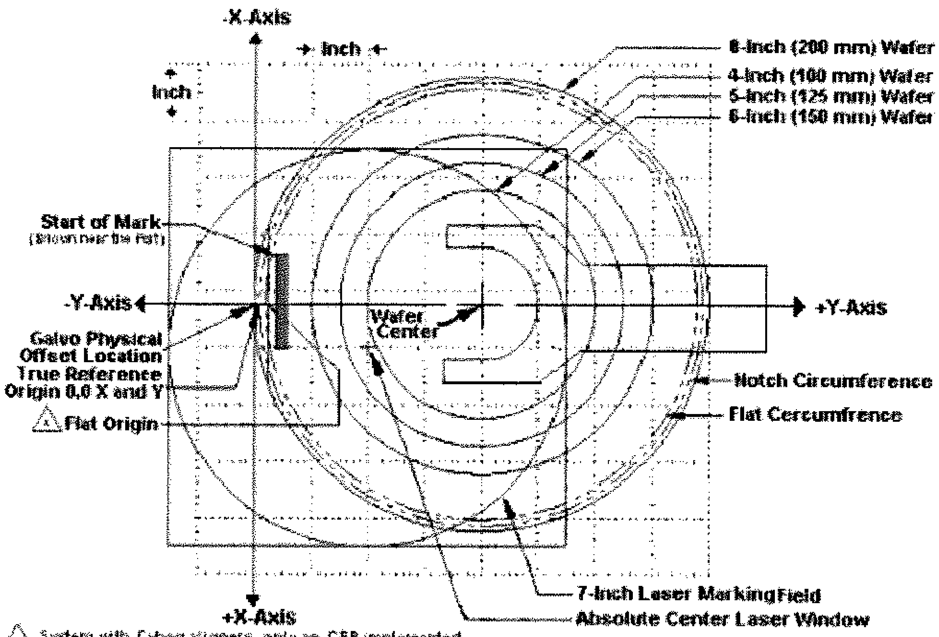
Figure 5-2 – Marking Window Coordinate Reference Points: 12-inch Wafers

1. Before parameter values that control the actual laser marking process can be entered, determine the following requirements for the message to be marked:
   a. The actual message.
   b. The size of wafer to be marked.
   c. The reference point on the wafer — either Flat or Notch. This is used to align the wafer on the aligner chuck. All positioning measurements specified in the job are relative to this reference point.
   d. The style of font that will be used to mark the message — either dot matrix or barcode.
   e. The height and width of the characters, the inter-character spacing and inter-line spacing (if any).
2. Calculate the message length.
3. Determine the expected offsets, in both the X and Y axes, from the 0,0 X- and Y-coordinate reference point on the circumference of the wafer (shown in Figure 5-3 as the True

Reference Origin) to the start of the mark (i.e., the lower left corner of the first character in the text string).

4. Determine whether the mark will be at the Flat/Notch, opposite the Flat/Notch, or at some position between. If the mark will not be at the Flat/Notch, determine the angle that the wafer must be rotated so that the start of the mark will be at the position indicated in Figure 5-3.
5. Determine whether the text will be rotated (at an angle to the normal mark shown in Figure 5-3), angular (following an arc radius or the circumference of the wafer), or inverted.
6. Determine the number of marking groups that will be required to mark the complete message. Normally, one group is sufficient for a single line of text; more are required if any of the marking characteristics are different — such as the font, character size, mark positions for multiple text strings, etc.

   NOTE: It is not essential to determine the number of groups at this time (they can be "built up" as the set up of the job progresses); however, doing so now simplifies duplicating tasks later in the job setup process.
7. Determine the wafer cassette handling sequence and the number of wafers in the lot.



⚠ System with Cybeq aligners, only an CFP implemented (If CNR is implemented, the notch will be the origin.

Figure 5-3 – Marking Window Coordinate Reference Points: 4- to 8-inch Wafers

5.3 Additional Job Setup Considerations

The guidelines given in Section 5.1.1 apply for most normal marking conditions. However, for systems with the Reader option installed and implemented, the setup screens and windows are slightly different; they display additional parameter fields that must be defined in the job. Although the information given in Section 5.1.1 still applies when setting up jobs on systems with these options, also refer to Chapter 4 for information regarding additional parameter fields.

To fine-tune the marking accuracy and quality:

1. Save the job.
2. Verify the mark by marking a test wafer.
3. Adjust the appropriate parameter values, as needed, to accurately position the mark at the required location

or alter the marker parameters to provide the best marking clarity and definition.

4. When satisfied with the sample mark, save the job again.

6 Serialization

Serialization describes the WaferMark® SigmaDSC NT system marking serial numbers on wafers using available searialization formats.

6.1 Introduction

This chapter describes the serialization formats available for serial number marking by the WaferMark® SigmaDSC NT system.

6.2 Serialization Message Formats

Different message formats are used to specify either standard or special serialization. Standard serialization uses square brackets [] to enclose the serial digit field; special serialization uses braces {}. The following are examples of each:

- [00174] specifies numerical marking using the numerical sequence 0 thru 9.
- {004B9C} specifies alphanumeric marking using the character sequence defined by the CHARSET keyword.

A message can consist of multiple braces { } or brackets [ ]; however, one cannot be embedded within another. For example, [0000{DEF}] is an illegal entry.

6.3 Special Serialization Character Definitions

While the standard serialization format is limited to single-digit incrementing of a numerical value (from 0 to 9), the special serialization format allows you to specify a serialization text string of up to 36 characters in length, consisting of the:

- Numerals 0 through 9, and
- Uppercase alphabetic characters A through Z.

No other characters (including punctuation) are allowed in a serial or text string.

NOTE: Within a string definition, each character can occur only once.

The special serialization text string is specified in the **Maintenance Startup Data (FACTORY.SET)** file using the keyword `CHARSET`.

6.3.1 String Sequence

The string sequence determines whether the value increments or decrements and the range of the serial value. There is no restriction on the order of the characters in the string, although the sequence in which they are defined determines how the serial value changes from one mark to the next, as shown in example 4 below. The following examples demonstrate various serial string definitions:

1. `CHARSET=0123456789ABCDEF` defines incrementing hexadecimal serialization.
2. `CHARSET=FEDCBA9876543210` defines decrementing hexadecimal serialization.
3. `CHARSET=0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ` defines the full alphanumeric serialization range.
4. `CHARSET=XYZ789` defines a serial sequence: X, Y, Z, 7, 8, 9, X, Y, Z, 7, 8, 9, etc.

To use the standard serial format to serialize a tray of wafers in the sequence 1 to 25, enclose the starting serial digit field with square brackets; for example: [01].

To number the wafers in the reverse order (from 25 to 1):

1. Specify the decrementing serial format `CHARSET=9876543210` in the **Maintenance Startup Data** file.
2. Enclose the starting serial digit field with braces; for example `{25}`

   The number decrements in the sequence: 25, 24, 23, 22, ...02, 01.

6.3.2 Mod 34 and Mod 35 Serialization

Mod 34 and Mod 35 serial marking require specific character string definitions. These must be specified as follows:

- MOD 34 Serialization
  `CHARSET=0123456789ACDEFGHIJKLMOPQRSTUVWXYZ.`

  NOTE: The letters B and N are absent.
- MOD 35 Serialization
  `CHARSET=0123456789ABCDEFGHIJKLMNPQRSTUVWXYZ.`

  NOTE: The letter O is absent.

6.4 Serial Number Duplication

To duplicate the last serial number generated in one group by a serial field in the current group, specify the notation `[*]` or `{*}` in the appropriate group's message. During marking, this notation simply copies the previous serialization field into the specified field position of the current group.

To repeat the last serial number generated by a bracket field [ ], specify `[*]`.

To repeat the last serial number generated by a brace field { }, specify `{*}`.

Example:

1. Group 1 `PL76L20{0000}`
2. Group 2 `AR15{*}`

In this example, `AR150000` is generated for marking by Group 2.

A valid expression could mix serial brackets and braces, and repeats of either type. However, a repeat symbol can only be used after a defined field of the same type, that is, {nnnn} before {*} and [nnnn] before [*]. The premature use of either {*} or [*] generates an error.

6.5 Serial Numbers List

The Serial Number List is a software feature that tracks serialization across multiple jobs. The list has nine slots, designated **Serial1** thru **Serial9**. During marking, a text field in the current job can access any of the slots in the list. On completion of marking each wafer, the software increments each serial slot addressed in the job text and updates the serialization file (**SERIAL.SET**).

In order to specify (new) starting serial numbers or edit existing ones, access the Serial Numbers List by selecting the **Serial Numbers** command from the **Maintenance** menu.

To address a slot in the Serial Number List, the job message text uses the syntax `{Serial#}` or `[Serial#]`, where # refers to the serial number position in the list. The names are case sensitive and must be exact; this is because software recognizes the case of the syntax to access the Serial Number List. (If `{SERIAL1}` was mistakenly used in the text, it would be interpreted as special alphanumeric serialization, as explained in Section 6.2 (Serialization Message Formats.)

NOTE: Do not use different forms to reference the same serial slot in a job, i.e. [ ] and { }; the incrementation may be inconsistent for the application. Each serial slot increments only once per wafer, regardless of the number of references within the job.

A blank (empty) serial slot is considered undefined. If such a slot is referenced in a job, an error is created.

6.5.1 Repeat Serialization

In job text, use the syntax [*] or {*} to indicate repeat serialization of a serial number in the Serial Number List ***only*** if the previous text field that specifies serialization is either `[Serialn]` or `{Serialn}`, respectively. The value "n" is a place holder that references one of the serial number blocks 1 to 9 from the Serial Number screen.

For example:

1. Group 1 `AB01[Serial1]`.
2. Group 2 `RAC`.
3. Group 3 `AB01[*]`.

6.6 Empty Slot Serialization

To allow serial number incrementation for empty slots in a cassette, enter the keyword statement `EMPTY_SLOT_INCR=[YES|NO]` in the **Maintenance Startup Data** file. If omitted from the file, the condition defaults to `NO`.

Appendix A Factory Settings File

This appendix lists the **Maintenance Startup Data** or **FACTORY.SET** file keywords used to specify the parameters of the system software operation and options.

A.1 Description of the FACTORY.SET File

Each line in the **FACTORY.SET** file contains a unique keyword with an assigned value that is used to configure the system during the power-on initialization sequence.

The syntax for each line entry is `KEYWORD=<VALUE>`, where `KEYWORD` and `<VALUE>` can be any of those shown in the following table.

Depending on the particular keyword, `<VALUE>` can be one of the following:

1. `INT`: an integer, such as 0, 5, -22
2. `UNSIGNED`: an integer greater than zero
3. `YES/NO`: Yes or No
4. `STRING`: a string containing any printing characters
5. `DEFAULT`: the default value.

NOTE: Spaces in the file are significant. Any characters entered in lowercase are automatically mapped to uppercase by the program.

The file can also be used to enter comments by starting the line with an exclamation point (`!`). Comment lines are ignored when the file is read.

A.2 Use of Access Keywords

The `ACCESS` keyword can be used in the **Maintenance Startup Data** file or **FACTORY.SET** file to specify or change the security level of any of the menus or commands shown in the list below.

The syntax is as shown in the following example:

`ACCESS_EDIT_EXISTING=3` means that only supervisors and engineers, i.e., a higher level, can edit existing jobs.

Access values are:

- 0 = Access level undefined.

- 1 = Operator.
- 2 = User-defined.
- 3 = Supervisor password needed.
- 4 = User-defined.
- 5 = Engineering password needed.

Table A-1 – Access Code Default Table

Access Codes	**Access Default Level**
ACCESS_CONTROL_ABORT ACCESS_CONTROL_MARK_ALL ACCESS_CONTROL_PAUSE ACCESS_CONTROL_QUIT ACCESS_CONTROL_RESET ACCESS_CONTROL_RESUME ACCESS_CONTROL_SECS_FILES ACCESS_CONTROL_SECS_MODE ACCESS_CONTROL_SECS_TERMINAL ACCESS_JOB_ADD ACCESS_JOB_DELETE ACCESS_MAINT_BARCODES	1
ACCESS_EDIT_DELETE ACCESS_EDIT_EXISTING ACCESS_EDIT_NEW ACCESS_TEMPLATE	3
ACCESS_FILE_EDIT ACCESS_MAINT_ALIGNER ACCESS_MAINT_CALIBRATE ACCESS_MAINT_CASSETTE ACCESS_MAINT_CASSETTE_SET ACCESS_MAINT_FACTORY_SET ACCESS_MAINT_IDM ACCESS_MAINT_LOADER ACCESS_MAINT_LPC ACCESS_MAINT_MARKER ACCESS_MAINT_OPTICS ACCESS_MAINT_READER ACCESS_MAINT_ROBOT ACCESS_MAINT_SERIAL_NUMBERS ACCESS_MAINT_USER_INFO	5

A.3 Keywords Table

NOTE: This Keyword Table is used for multiple products. NOT all keywords in this Keyword Table apply for the cassette system.

KEYWORD	TYPE	DEFAULT	DEFINITION
ALIGN_IN_MARK_SAMPLE	YES/NO	YES	If transfer is used and mark sample is pressed, should the wafer be aligned?
ALIGN_RETRIES	INT	5	Sets the maximum number of retries allowed for an alignment process to complete before generating an error.
ALIGN_TIME	INT	60	Specifies the number of seconds allowed for an unsigned integer to complete an alignment .
ALIGN_WHEN_STEPPING	YES/NO	YES	Align wafer during STEP transfers?
ALIGNER_COM	INT	1	Sets Aligner communication port.
ALIGNER_DEBUG	—	0	Sets Aligner debug mode.
ALIGNER_MULTIPLE	INT	0	Sets the number of additional redundant alignments required before marking.
ALIGNER_OFFSET_ BOTTOM[F] ALIGNER_OFFSET_ BOTTOM[N]	FLOAT	180.0	Standardizes reference designation for wafer rotation when marking at flat or notch.
ALIGNER_OFFSET_READER	FLOAT		Applies fixed offset to the rotation alignment for reading.
ALIGNER_OFFSET_TOP[F] ALIGNER_OFFSET_TOP[N]	FLOAT	180.0	Standardizes reference designation for wafer rotation when marking at flat or notch.
ALIGNER_PRESENT	YES/NO	YES	Is there a working Aligner present? Keyword must be used and set to YES.
ALIGNER_TIMEOUT	YES/NO	NO	If alignment is not required when running a job, set to NO.
ALIGNER_TYPE	INT	0	• 0=CYBEQ • 1=Equipe(Default) • 2=Wizard.
BAD_MARK_INCR	YES/NO	YES	Increment serial number on a bad mark.

KEYWORD	TYPE	DEFAULT	DEFINITION
BAD_MARK_THRESHOLD	INT	0	Number of bad marks in a row before an error occurs.
BARCODE_COM	UNSIGNED	3	Barcode Reader 9154 Controller serial port identifier: • Com0–Port 1 • Com1–Port 2 • Com2–Port 3 • Com3–Port 4.
BARCODE_ENABLE	YES/NO	NO	Allow Full-Auto operation with barcode Reader data; otherwise, only Semi-Auto capability over SECS Host link.
BARCODE_READER_1	YES/NO	YES	Allows selective disabling of barcode Reader #1.
BARCODE_READER_2	YES/NO	YES	Allows selective disabling of barcode Reader #2.
BARCODE_READER_3	YES/NO	YES	Allows selective disabling of barcode Reader #3.
BURNLOG	YES/NO	NO	Enable burnlog files.
BURNLOG_DIR	STRING	\JOBDIR\	Directory path for burnlog files.
FOUP_DEBUG	UNSIGNED	0	FOUP debug flag.
FOUP_PRELOAD	YES/NO	NO	No FOUP pre-loading as default.
CHARSET	STRING	0 — 9	Serialization string. Can be any characters 0-9 and/or A-Z.

KEYWORD	TYPE	DEFAULT	DEFINITION
COGNEX_NUM_CHARS	UNSIGNED	10	Sets number of characters in Cognex checksum character set. • If only numerics (0-9) are being used, set the keyword to =10. • If alphanumerics are being used, set keyword to =34. Cognex character set is predefined and does not have B or N characters.
COMPRESS	YES/NO	NO	Enable "no work over work" compression movement using 2→1 motion.
CONSTANT_ALIGNER_ POSITION	YES/NO	NO	CYBEQ aligners only. Align to Constant Flat Position (CPI) or Constant Notch Radius (CNR).
CONTINUOUS_ANGLE	YES/NO	NO	—
CONTINUOUS_CYCLE	YES/NO	NO	—
CONTINUOUS_MARK	YES/NO	NO	—
CONTROL_DEBUG	UNSIGNED	0	—
CONTROLDEFAULTSTATE	STRING	0	—
CONTROLONLINEFAILEDSTATE	STRING	1	—
COORDINATE_ROTATION[3}	FLOAT	0.0	Specifies an angle where the wafer flat can be marked without interference with the aligner. 4", 5", 6" and 8" wafers only.
COORDINATE_ROTATION[4] COORDINATE_ROTATION[5] COORDINATE_ROTATION[6] COORDINATE_ROTATION[8]	FLOAT	180.0	Rotates X, Y coordinates for mark angle and wafer rotation.

KEYWORD	TYPE	DEFAULT	DEFINITION
COORDINATE_ROTATION[12]	FLOAT	0.0	Specifies an angle where the wafer flat can be marked without interference with the aligner. 4", 5", 6" and 8" wafers only. Rotates X, Y coordinates, mark angle, and wafer rotation.
COUNT_SLOTS	YES/NO	NO	Does not include empty slots in count.
DATA_DIR	STRING	\DATA\	Directory path for data files.
DATE_FMT	UNSIGNED	MMDDYY	Date format: can be MMDDYY, DDMMYY, YYMMDD.
DEC_CHAR	STRING	—	—
DEMO_TIME	INT	—	—
DUPLICATE_MARKS	YES/NO	—	—
DUPLICATE_READS	YES/NO	—	—
EDIT_WHILE_RUNNING	YES/NO	—	—
EMPTY_SLOT_INCR	YES/NO	—	—
ERROR_DIRECTORY	STRING	—	—
ERROR_FILE	STRING	—	—
FDG[3]	FLOAT	0.0	Is the correction term added to the Coordinate Rotation value before it is sent to the marker?
FDG[4]	FLOAT	0.0	Correction value for 4" wafers which is added to rotation value specified in the job COORDINATE_ ROTATION value before it is sent to the marker.
FDG[5]	FLOAT	0.0	Correction value for 5" wafers, which is added to rotation value specified in the job COORDINATE_ ROTATION value before it is sent to the marker.

KEYWORD	TYPE	DEFAULT	DEFINITION
FDG[6]	FLOAT	0.0	Correction value for 6" wafers, which is added to rotation value specified in the job COORDINATE_ROTATION value before it is sent to the marker.
FDG[8]	FLOAT	0.0	Correction value for 8" wafers, which is added to rotation value specified in the job COORDINATE_ ROTATION value before it is sent to the marker.
FDG[12]	FLOAT	0.0	The correction term is added to the associated COORDINATE_ ROTATION value before it is sent to the marker.
FILE_CHECKS	FILE_ CHECKS	NO	Invoke test of number of records in [Filename] file.
FLIPPER_PRESENT	YES/NO	NO	Process groups for bottom wafer marking. Must have rotating end effector.
FONT_DIR	STRING	.\FONT\	Directory path for font files (FON file extension).
JOB_ADD_HOOK_BUT_NOQUE	YES /NO	NO	Invokes JOBADDHK.EXE.
JOB_DIR	STRING	.\JOB\	Directory path for job files (.JOB file extension).
JOB_NAME	STRING	!	Use production job filename (commented out of FACTORY.SET using exclamation point).
JOB_SAVE	YES/NO	NO	Save job after each wafer is completed.
LASER_COM	INT	3	COM port that the laser is connected to___.
LASER_DEBUG	INT	0x0000	Enable debug of serial commands to laser if set to non-zero value
LASER_ENABLE	YES/NO	NO	Enable communication to Laser Controller.

KEYWORD	TYPE	DEFAULT	DEFINITION
LASER_FIRE_DELAY	INT	300e-6	Delay (in seconds) between fire trigger issued to laser and time of laser mark pulse.
LASER_MAX_ENERGY	INT	2600	Defines maximum possible energy for the DPL in µJ.
LASER_MAX_ENERGY_RATE	INT	1000	Defines maximum possible energy when operating at maximum repetition rate for the DPL in µJ.
LASER_MAX _RATE	INT	4000	Defines maximum possible repetition rate for the DPL in Hz.
LASER_PULSE_WIDTH	INT	50	Tuning delays in seconds
LASER_TYPE	INT	0	Defines the laser controller. 0 = Sigma100. 1 = Sigma200.
LIMIT_PERIOD	INT	60	Interval between sample for Limit Monitoring process from 1 to 500 seconds
LOADER	YES/NO	NO	Activates the loader interface if set to Yes.
LOADER_COM[2/3/4/5/6]	INT	4	Specifies the serial communication port for the loader interface when active.
LOG_ALIGNER_ERRORS	YES/NO	YES	Are Aligner errors to be logged?
LOG_ROBOT_ERRORS	YES/NO	YES	Are Robot errors to be logged?
LOT_CHECK	YES/NO	NO	Verifies that JOBADDHK lot ID is not a duplicate.
LOT_CHECK_SIZE	INT	50	Size of JOBADDHK database.
LPC_POWER_CHECK	YES/NO	NO	Enable power check IDLE mode when not marking.
LPC_LCS_SETTLE	INT	400	Settle time switching from LPC mode 1 to 2 in milliseconds.
LPC_TR_SETTLE	INT	140	Settle time switching from LPC mode 2 to 1 in milliseconds.
LPC_ENABLE	YES/NO	NO	Enable LPC interface?

KEYWORD	TYPE	DEFAULT	DEFINITION
LPC_POWER=<value>	INT		LPC power level setting.<value> is range between 0.000 and 5.000 Watts.
LPC_POWER=1.5			Power level set when LPC_POWER_CHEC= NO, but LPC_ENABLE=YES.
MARK_ON_CHUCK	YES/NO	NO	Will wafer topside contact Aligner surface when aligning and marking bottom side?
MARK_TIMEOUT	INT	5	Amount of time to allow for a mark to be completed.
MARKER_DEBUG	YES/NO	NO	Marker debug flag.
MARKER_FREQ	FLOAT	5e6	CW50 timer frequency.
MARKER_PRESENT	YES/NO	YES	Tells system if Marker is present in system: must be used.
MAXSPOOLTRANSMIT	INT	0	Maximum number of messages transmitted from spool in response to S6F23 request.
MAX_X	INT	3000	Maximum X axis mark field dimension allowed in jobs.
MAX_Y	INT	3000	Maximum Y axis mark field dimension allowed in jobs.
METRIC	YES/NO	NO	Sets system to Metric or English measurements.

KEYWORD	TYPE	DEFAULT	DEFINITION
MOVEMENT_MODE	0/1/2/3/4/5/6	0	Describes the meaning of the 1->2, 3->1 movement in three-presenter systems. The default value, 0, uses the standard implementation of the 1->2, 3->1 movement, i.e., the 'no work over work', inverted, movement. Slot 1 of the source is put into the last slot of the destination. Mode 1is a direct 1->2 movement only, slot n of the source goes to slot n of the destination. This movement is intended to accommodate a SMIF device at presenter 2. This movement supports SORT and COMPRESS in the 1->2 movement. That is, if SORT or COMPRESS is selected, the 1->2 movement is forced, rather than the default 2->1 movement. If ONE_CASSETTE_JOB is set, the transfers that are multi-cassette are automatically removed before the transfer options are displayed. The settings corresponding to movements are: MOVEMENT_MODE=0: 1->2, 3->1 2->1 2->3 3->1 3->2 1->1 2->2 3->3 1->1, 2->2, 3->3 4->4 1->1, 2->2, 3->3, 4->4 MOVEMENT_MODE=1: 1->1 2->2 3->3 1->1, 2->2, 3->3 4->4 1->1, 2->2, 3->3, 4->4 MOVEMENT_MODE=2: 1->2, 3->1 2->1 2->3 3->1 3->2 1->1 2->2 3->3 1->1, 2->2, 3->3 MOVEMENT_MODE=3: 1->1 2->2 3->3 1->1, 2->2, 3->3 MOVEMENT_MODE=4: 1->2, 2->1 1->2 2->1 1->1 2->2 1->1, 2->2 MOVEMENT_MODE=5: 1->1 2->2 1->1, 2->2 MOVEMENT_MODE=6: 1->1

KEYWORD	TYPE	DEFAULT	DEFINITION
OFFSET[3] [F].X	FLOAT	0.0	Moves the 0, 0 point to the position of the flat or notch of the rotated wafer Offset value for each wafer size and type.
OFFSET[3] [F].Y	FLOAT	0.0	
OFFSET[3] [N].X	FLOAT	0.0	
OFFSET[3] [N].Y	FLOAT	0.0	
OFFSET[4][F].X	FLOAT	0.0	
OFFSET[4][F].Y	FLOAT	0.0	
OFFSET[5][F].X	FLOAT	0.0	
OFFSET[5][F].Y	FLOAT	0.0	
OFFSET[5][N].X	FLOAT	0.0	
OFFSET[5][N].Y	FLOAT	0.0	
OFFSET[6][F].X	FLOAT	0.0	
OFFSET[6][F].Y	FLOAT	0.0	
OFFSET[6][N].X	FLOAT	0.0	
OFFSET[6][N].Y	FLOAT	0.0	
OFFSET[8][F].X	FLOAT	0.0	
OFFSET[8][F].Y	FLOAT	0.0	
OFFSET[8][N].X	FLOAT	0.0	
OFFSET[8][N].Y	FLOAT	0.0	
ONE_FOUP_JOBS	YES/NO	NO	Use one FOUP per job.
OPERATOR_ADD	YES/NO	YES	Restrict operator Job Add function during SECS operation when control mode is REMOTE.
OPERATOR_DELETE	YES/NO	YES	Restrict operator Job Delete function during SECS operation when control mode is REMOTE.
OPERATOR_EDIT	YES/NO	YES	Restrict operator Job Edit function during SECS operation when control mode is REMOTE.

KEYWORD	TYPE	DEFAULT	DEFINITION
OPERATOR_LOAD	YES/NO	YES	Allow or restrict operator from using LOAD buttons during SECS controlled operation when control model is REMOTE.
OPERATOR_MAINT	YES/NO	YES	Restrict operator Maintenance functions during SECS operation when control mode is REMOTE.
OPERATOR_START	YES/NO	YES	Restrict operator use of Mark All during SECS operation when control mode is REMOTE.
OPTICS	YES/NO	NO	Used for equipment with programmable optics installed.
OVERWRITESPOOL	YES/NO	YES	Overwrite data in spool area when limits exceeded. If =NO, stops spooling when exceeded.
PRESENTERS_MOVE	YES/NO	YES	Sets presenters to move or not from the PROCESS (inner) position.
PRINTER_COM	1/2/3/4/5/ 6/7/8/9/10	2	Serial port to use for custom report output to serial printer or PC.
PRINTER_REPORT	YES/NO	NO	Invokes custom report output feature.
PROCESS_DATA_LOG_COM	INT	5	COM port used to access I/O Pak. Range 0–5.
PROCESS_DATA_LOGGING	YES/NO	NO	Enables process data logging.
READ_ERR_DIR operator	STRING		JOB_DIR directory path for error log (.ERR file extension) of read errors of mark not read by Accumen system or the operator.
READ_ONLY_ERRORS	YES/NO	NO	When (Job Option) Reader Only = Yes, keyword determines if operator views wafer results (=YES), or error message sent to Host reporting non-read (=NO).

KEYWORD	TYPE	DEFAULT	DEFINITION
READER	STRING		=[Filename{=<filename.ext>}] specifies location of text if group text specifies [Reader], but Reader flag =NO or Reader is not functioning.
READER_CHECKSUM	YES/NO	NONE	Define checksum to use either • SEMI-STD • IBM-412 • SEMI-412 • COGNEX. • NONE.
READER_COM	UNSIGNED	1	Communication port for Acumen Reader.
READER_ENABLE	YES/NO	NO	Reader attached to WMSigma.
READER_ERRORS	YES/NO	YES	Report Reader error to operator.
READER_GUARD front of the aligner.	SLOT	0	If required, the wafer is flipped in front of the aligner to prevent collision with the reader. The value set indicates the slot number in which to begin flipping.
READER_SETTLE	FLOAT		System wait time after robot position for read/verify to allow vibration to cease before read command issued.
REPROCESS_READER_ERRORS	YES/NO	NO	Reprocess read errors after normal job cycle completed.
RESELS_PER_INCH	FLOAT	10000	Resels per inch.
ROBOT_COM	INT	0	Sets Robot communication port.
ROBOT_DEBUG	YES/NO	NO	Robot debug flag ROBOT_DELAY. This keyword is obsolete and no longer used.

KEYWORD	TYPE	DEFAULT	DEFINITION
ROBOT_ENDS	1/2	1	The number of end effectors on the robot; 1.
ROBOT_GET_OPTION	INT	0	Sets Robot GET option; activates or deactivates vacuum sensors.
ROBOT_HOME_LEVEL	NULL PO SO EO	NULL	Enable robot home at login time. NULL=No password required.
ROBOT_RETRY_ALIGNER	INT	0	Number of times to retry a failed GET from aligner.
ROBOT_RETRY_FOUP	INT	0	Number of times to retry a failed GET from FOUP.
ROBOT_SENSORS	HEX	0	The hex value specifies the type and location to check for the presence or absence of a wafer: • 0X0001 reflective sensor at cassette • 0X0002 at aligner • 0X0004 gripper sensor at cassette.
ROBOT_TYPE	INT	0	Must be set to =0 for all Robot types.
SECS_BAUD	INT	none	(Refer to SECS manual).
SECS_COM			(Refer to SECS manual).
SECS_COMMUNICATION	YES/NO	NO	Communicate with Host during system init. or wait for operator to select ENABLE from SECS Mode Menu.
SECS_CUSTOM_INIT	INT	1	If SECS_MODE_ CONTROL=1 (Custom mode) specifies initial comm state: • 1=Full Auto; • 2=Semi-Auto • 3=Disconnect.
SECS_DEVID			(Refer to SECS manual.)

KEYWORD	TYPE	DEFAULT	DEFINITION
SECS_DUPLICATE_BLOCK	YES/NO	NO	Disable duplicate block detection.
SECS_EVENT_REPORT	OPERATOR PROCESS		Report Operator and/or Process events.
SECS_HOST_PRESENT	YES/NO	NO	Enable SECS on the WMSigma (Refer to SECS manual).
SECS_MAX_RECEIVE	UNSIGNED	2048	Max size of incoming message from Host.
SECS_MODE_CONTROL	INT	0	• 0=old standard SECS-II • 1= Custom of old standard SECS-II • 2= GEM.
SECS_PAT_MODE	INT	0	• 0=standard four-color • 1=optional four-color
SECS_PROCESS_REPORT	STRING	NONE	{POWER SLOT MONITOR NONE} Generate S6F3 report with power measurement slot information, process data logging or none. (Can use any combination of these.)
SECS_REMOTE	YES/NO	NO	Establish REMOTE state after comm init. or go to LOCAL.
SECS_RTY			(Refer to SECS manual.)
SECS_SLAVE	YES/NO	YES	(Refer to SECS manual.)
SECS_T1			(Refer to SECS manual.)
SECS_T2			(Refer to SECS manual.)
SECS_T3			(Refer to SECS manual.)
SECS_T4			(Refer to SECS manual.)
SECS_TERMINAL_ID	INT	1	SECS Terminal identifier.
SEP_CHAR CHAR			Thousands separator character for numeric fields (default is **COMMA**).

KEYWORD	TYPE	DEFAULT	DEFINITION
SHUTTER_DELAY	FLOAT	1	Delay after alignment before shutter opens to begin marking.
SIGNAL_CONFIG	<filename>		Name of file which describes operation of signal tower.
SIGNAL_FLASH	FLOAT		Flash interval for blinking operation of signal tower lights.
SIGNAL_TOWER	UNSIGNED	0	Tower display: • Mode 0 = use 4 lights • Mode 1 and 2 = use 3 lights (not blue) • Mode 3 = use programmable signal tower.
SINGLE_CHARACTER_MARKING_MODE	YES/NO	NO	Character spacing value (CS) will be used to recalculate origin of next character in string.
SLOW_SHUTTER-SENSOR	YES/NO	NO	Enables the use of slow shutter sensor. When enabled, an alarm occurs upon opening, if the shutter does not open within 1 second. When disabled, a fixed delay of 250 milliseconds occurs after opening. The use of the sensor or the fixed delay does not typically apply to closing the slow shutter.
SORT	YES/NO	NO	Enable sorting. OK wafer to FOUP1, others to 2. Forces motion 2→1.

KEYWORD	TYPE	DEFAULT	DEFINITION
SPOOL	INT	0	For SECS_MODE_ CONTROL =0 or =1, specifies method of unloading spool: • 0=Disabled • 1=Enabled using GEM control • 2=Enabled using Automatic and GEM controls.
SRP	INT		This ROBOT.SET keyword allows adjustment of the retract position for the 300 mm robot when using the flipping capabilities.
STARTING_SLOT	YES/NO	NO	=YES requires operator to input slot number when FOUP is mounted.
STORE_UPSIDE_DOWN	YES/NO	NO	Used only if Flipper option is installed. Choose to store wafers upside down (=YES).
TEXT_DIR	STRING	.\JOB\	Directory path for text files.
THICKNESS_DELTA	—	0	Undersigned integer (pulses).
THICKNESS_ENABLED	—	0	[0/1] (0 = not enabled) (line 3) i.e., thickness:1,755,745,5
THICKNESS_LL	—	0	Undersigned integer (microns).
THICKNESS_UL	—	0	Undersigned integer (microns).
TIME_FORMAT	INT	0	Controls whether the equipment sends the data items STIME and TIME in 12– or 16-byte format. The default of TIME_FORMAT=0, selecting the older 12-byte format.
TIMING_DEBUG	YES/NO	NO	Enable debugging information in .DBG or SYSTEM.LOG file.

KEYWORD	TYPE	DEFAULT	DEFINITION
VERIFY	YES/NO	NO	Enable verification of all text fields in job using Acumen Reader.
VERIFY_ERRORS	HEX	0	The hex value specifies the type of action the operator is asked to perform when a verify failure occurs. After all the retries have been used, • 0x0001 asks the operator to input text based on reader display. • 0x0002 asks the operator whether or not to verify the remaining group(s) on this side of the wafer. This request repeats for each failure, if there are more groups remaining on the same side of the wafer. A combination value of 0x03 performs both actions.
VERIFY_RETRIES	INT	1	Specifies the number of retries to attempt when a verify failure occurs. In the case of the Wizard reader, the setup file is loaded on each retry.

KEYWORD	TYPE	DEFAULT	DEFINITION
WAFER_DATA		<RPTID>	Specify process data collected for each wafer using S2F33: • 102=Mark text only • 103=Mark text and location • 104=Mark text and power • 105=Mark text location power • 106=Location only • 107=Power only • 108=Location and power.
WAIT_CYCLE_START	YES/NO	YES	Wait for cycle start.
WAIT_FOR_RPO	YES/NO	NO	Makes system wait for response from Aligner after RPO command is issued.
WIP_ERROR	YES/NO	NO	Sets system to error or not if wafer is or is not in place on Aligner.
WIP_SENSOR	YES/NO	YES	Does the system have a wafer in place sensor in system? Activates WIP sensor. Must be used.
YES	STRING	YES	String for positive choices.

Appendix B Error Messages

This appendix lists possible error messages, the probable cause of the error condition and the corrective action.

B.1 Introduction

This appendix lists all error messages displayed to the operator on the Control screen during system operation and the recommended corrective action.

B.2 Error Message List

```
|80287_OVERFLOW
|80287_UNDERFLOW
|80287_ZERODIVIDE
|80287_EXCEPTION
```

Cause: Arithmetic error on the slave board.

Corrective action: Reboot the system. Consult a GSI Lumonics Customer Support Center.

Aligner error 4xxx

Corrective action: Refer to the Aligner manual for this error code. Contact the nearest GSI Lumonics Customer Support Center.

Aligner reposition failed

Cause: Aligner failed while attempting to reposition.

Corrective action: Reboot the system. Contact the nearest GSI Lumonics Customer Support Center.

Aligner reposition took too long

Corrective action: Reboot the system. Contact the nearest GSI Lumonics Customer Support Center.

Aligner CCD sensor data not valid

Cause: Aligner did not see the entire edge of the wafer or the data that was taken is bad.

Corrective action: Press **Fault-Clear**, then issue a **Go-Resume**. If the error persists, check for the 300 mm wafer size parameter in the job.

Aligner CCD sensor sync error

Cause: The Aligner sync pulse is not in proper timing. Aligner needs adjustment.

Corrective action: Contact the nearest GSI Lumonics Customer Support Center.

Aligner Time-out error

Cause: Internal time-out of the aligner.

Corrective action: Contact the nearest GSI Lumonics Customer Support Center.

Aligner Vacuum failure

Cause: Aligner not receiving enough vacuum.

Corrective action: Check the vacuum regulator and source.

Aligner Too many flats found

Cause: The Aligner discovered a wafer flats error.

Aligner Unacceptable electrical noise

Cause: The Aligner discovered unacceptable electrical noise.

Aligner Wafer flat not found

Cause: The Aligner discovered no wafer flat.

Aligner offset undo took too long

Cause: The Aligner offset undo timeouts took too long.

Aligner undo failed

Cause: Aligner could not complete UNDO operation properly.

Alignment took too long

Cause: External time-out by GSI Lumonics software indicates that the Aligner took too long to align the wafer.

Corrective action: Press **Fault-Clear Issue Go-Resume**. If error persists, contact the nearest GSI Lumonics Customer Support Center.

Bad command to port # : <text>

Cause: Command sent to either the Aligner or Robot was not executed. This could be caused by a communication failure

Corrective action: Reboot the system.

Bad mark <text>, FOUP # wafer #

Cause: User aborted job during the mark or no response from the marking engin processor during handshaking.

Corrective action: Do not abort while marking. If not aborted, another error message will be displayed; refer to that message for corrective action.

Barcode Controller IO init error

Cause: Barcode Reader Controller failed to initialize.

Barcode Reader data too long

Cause: Data marked exceeds barcode Reader field

Barcode Reader # not connected

Cause: Barcode Reader disconnected or not functioning.

Barcode Reader # Read Error

Cause: Barcode read from wafer could not be recognized.

Barcode Reader # Write Error

Cause: Barcode transmitted to the Controller is in error.

Burnlog Fault

Cause: The disk is full or too many filenames have overflowed the directory table associated with the burnlog operations.

*Corrective action:*Purge unused files or offload larger files to another disk or floppy diskette. Use the SCANDSK program from Windows® NT to verify the integrity of the system and the amount of available storage.

Can't delete selected directory

The delete function failed to delete directory.

Can't delete selected file

Cause: An Edit-Delete command was unable to delete a job file.

Corrective action: Retry the operation. Check for proper sequence of the Edit-Delete function.

Can't home robot

Cause: System unable to home the Robot. This could be caused by a communication failure.

Corrective action: Check the robot cable connections. Reboot the system.

Can't mark: No wafer on aligner

Cause: No wafer is present on the aligner or the wafer is not blocking the sensor on the Aligner.

Corrective action: Check the Aligner to see if there is a wafer on it. If okay, check the sensor and the reflector.

Cannot exit: system not IDLE

Cause: An attempt was made to exit the software with the system not in an idle state. This could mean that the existing job is not complete.

Corrective action: First, check the wafer count, x of y; if okay, issue a Control-Reset command.

Cass # wafer # UNMARKED!

Cause: Check previous errors listed in the SYSTEM.LOG file for the cause of the mark failure.

Corrective action: Press GO to resume.

cassette fault, presenter # (MOVE_L)

Cause: cassette presenter did not reach the load position.

Corrective action: Check the presenter for proper operation; if okay, check the microswitch. If the problem cannot be identified, contact the nearest GSI Lumonics Customer Support Center.

CASS_FAULT

Cause: cassette sensor tripped while the job was running.

Corrective action: Check the cassette position. Press **Fault-Clear**, then issue a **Go-Resume**. If the error persists, check the sensor. If the problem cannot be identified, contact the nearest GSI Lumonics Customer Support Center.

CW50_TIMER_STUCK

Cause: Laser pulse rate control card failure.

Corrective action: Reboot the system. If the error persists, contact the nearest GSI Lumonics Customer Support Center.

Door didn't close after retrying.

Cause: Door didn't close after retrying.

Corrective action: Check the vacuum; check the door action. If the error persists, consult a GSI Lumonics Customer Support Center.

Door didn't open after retrying.

Cause: System unable to open laser safety door.

Corrective action: Check the vacuum; check the door action. If the error persists, consult a GSI Lumonics Customer Support Center.

Drive not ready

Cause: Hard or floppy disk failure.

Corrective action: If present, remove the floppy. Reboot the system. If the error persists, check bus voltages and connectors. If the problem cannot be identified, contact the nearest GSI Lumonics Customer Support Center.

Duplicate marks will occur!

Cause: DUPLICATE_MARKS=NO and text to be marked on the next wafer is same as the text marked on the previous wafer.

Corrective action: Check if duplicate marks are allowed. If allowed, change keyword to =YES. If not allowed, check for incorrect job text setup.

Duplicate read data error!

Cause: DUPLICATE_READS=YES and text to be marked on next wafer is the same as the text read by Reader on previous wafer.

Corrective action: Check if duplicate reads are allowed. If allowed, change keyword to =NO. If not allowed, Reader may not be reading properly. Also, ensure keyword READ_ERRORS=YES is specified to ensure faults detected at the Reader will generate an error reported to the operator.

Error in mailbox init: <text>

Cause: Multibus time-out error.

Corrective action: Reboot the system. If the error persists, contact the nearest GSI Lumonics Customer Support Center.

Error in NMI: <text>

Cause: Multibus error.

Corrective action: Contact the nearest GSI Lumonics Customer Support Center.

ERROR: Unable to create global system data record

Cause: An error was detected while trying to create global system data record.

ERROR: Unable to create global ST519 data record

Cause: An error was detected while trying to create global ST519 data record.

ERROR: Unable to create global data record

Cause: Out of memory (RAM).

Corrective action: Contact the nearest GSI Lumonics Customer Support Center.

ERROR: Unable to open help file

Cause: The help file SCOS.HLP is corrupted or not present.

Corrective action: Install the proper help file. Contact the nearest GSI Lumonics Customer Support Center.

Exhaust flow fault

Cause: Flow failure in plenum exhaust. System stopped.

Corrective action: Check plenum for obstruction. Also check is that exhaust extraction system is operating.

External Interlock

Cause: An interlock is open on an external switch connected in series between pins 12 and 13 of the user interface connector.

Corrective action: Refer to Appendix G, Laser Faults and Warnings.

File read error

Cause: Job file is corrupted.

Corrective action: Load a different job file.

File read error <filename>

Cause: Scribe database file could not be opened.

Corrective action: Check in the **FACTORY.SET** file that the WINDOWS NT path for the database file is valid.

File read error:TEXT

Cause: Text file read error occurred. Job will be terminated.

Corrective action: Create a new text file. Run SCANDSK disk diagnostic program from Windows® NT.

File write error

Cause: Hard disk is full.

Corrective action: Create space on the hard disk by offloading unnecessary files.

Flow Interlock

Cause: Air trapped in the coolant tubing reducing effective flow rate. Pump fuse may be blown or chiller power switch is turned off.

Corrective action: Refer to Appendix G, Laser Faults and Warnings.

Hardware error: <text>

Cause: Will be followed by description.

Corrective action: First, check for a possible hardware component failure. If the problem cannot be identified, contact the nearest GSI Lumonics Customer Support Center.

Heap is corrupted

Cause: Internal memory error.

Corrective action: Reboot the system.

Insufficient Access Authority

Cause: Person trying to access the software is not authorized.

Corrective action: Have Engineer review access authority listed in the **USERINFO.FIL** file.

Interlock open fault

Cause: One of the system maintenance panels is open.

Corrective action: Check the states of all interlock panels and switches.

Invalid job file format

Cause: Some part of the job being asked for is invalid. This error may also occur if the disk is full when the job is being saved.

Corrective action: Check the job file for invalid parameters or check the amount of hard disk space available.

IO init error

Corrective action: Reboot the system.

IO_INIT_ERROR_BCR

Cause: Barcode Controller IO init error.

IO_DEVICE_ERROR_BCR

Cause: Barcode Reader not connected.

IO_WRITE_ERROR_BCR

Cause: Barcode Reader write error.

IO_READ_ERROR_BCR

Cause: Barcode Reader read error.

IO_NO_READERS_ERROR_BCR

Cause: Check Barcode Reader read

Job group_data memory allocation error

Cause: Out of memory in the system job file directory.

Corrective action: Backup and delete any unnecessary or obsolete job files. If the problem cannot be identified, contact the nearest GSI Lumonics Customer Support Center.

Job queue empty.

Cause: No job in marking queue when trying to start a job operation.

Corrective action: Load a job.

Keyword invalid

Cause: Unrecognized keyword in startup files .SET.

Corrective action: Refer to Appendix A for valid Keyword list. Note that this problem can be caused by blank spaces in the file.

Laser Error

Cause: The laser reported a warning via an "FS" error message. Displays appropriate error message from the laser. These errors are only monitored while the system is not marking.

Corrective action: Refer to the troubleshooting section of the *SIGMA 100* manual.

Laser Error: Previous Mark May Be Incomplete

Cause: Displayed if a laser error is detected within three seconds of marking a wafer. Provides warning to the operator that the previous wafer may not be completely marked.

Corrective action: Refer to the troubleshooting section of the *SIGMA 100* manual.

Laser fault

Cause: Laser fault detected by the Laser Controller. Displays appropriate error message from the "FF" bits in the laser.

Corrective action: Refer to the troubleshooting section of the *Sigma 100* manual.

Laser I/O Timeout

Cause: A timeout occurred while waiting for a response to a command sent to the Laser Controller.

Corrective action: Refer to the troubleshooting section of the *Sigma 100* manual.

Laser I/O Init. Error

Cause: An error occurred while initializing the Laser Controller port.

Corrective action: Refer to the troubleshooting section of the *Sigma 100* manual.

Laser I/O Init. Fault

Cause: A timeout occurred when sending data to the laser communication port.

Corrective action: Refer to the troubleshooting section of the *Sigma 100* manual.

Laser Not Ready While Marking

Cause: Laser not ready to mark. Normally, laser is in standby mode until a wafer is detected in the mark chamber. This asserts a mark enable signal to the laser, which responds by performing a power check and then goes ready. This error is typical if Mark All is attempted while system is in warm-up mode.

Corrective action: Wait until laser ready message is displayed on the screen, then select **Mark All**.

Level Interlock

Cause: Coolant level is low in the reservoir.

Corrective action: Refer to Appendix G, Laser Faults and Warnings.

Log Full

Cause: Flash memory used for the data log is full (or nearly full).

Corrective action: Refer to Appendix G, Laser Faults and Warnings.

MAILBOX_OVERSIZE_MESSAGE

Cause: Message length exceeds mailbox capacity.

MAILBOX_PUT_FULL

Cause: Mailbox input or output capacity is full.

MAILBOX_SEMAPHORE_BUSY

Cause: Mailbox Semaphore was busy when signaled for access.

MAILBOX_SEMAPHORE_TIMEOUT

Cause: A Mailbox Semaphore Timeout error occurred.

MAILBOX_SYNC_FAIL

Cause: A multibus error occurred

Corrective action: First, check cable connections; if OK, reboot the system. If the problem cannot be identified, contact the nearest GSI Lumonics Customer Support Center.

MAILBOX_TIMEOUT

Cause: Signal not received after a command was issued (no response from other boards).

Corrective action: First, check cable connections; if okay, reboot the system. If the problem cannot be identified, contact the nearest GSI Lumonics Customer Support Center.

MARK ALL FAILED

Cause: System failed to execute the job.

Corrective action: Check to verify that the job is set up correctly; then retry the operation or reboot the system. If the problem cannot be identified, contact the nearest GSI Lumonics Customer Support Center.

Mark Energy

Cause: Laser energy level varied by more than 3% during marking.

Corrective action: Refer to Appendix G, Laser Faults and Warnings.

Mark station door closed

Corrective action: Check the status of the safety door.

Marker not idle

Cause: Attempted to start a job while the previous job was still running, or the previous job had an error.

Corrective action: If the job is running, let it finish. If there is an error, issue a **Go/Resume** command or press**Ctrl +Reset**.

MARKER_DATA_ERROR

Corrective action: Reboot the system.

MARKER_ERROR

Corrective action: Reboot the system.

MARKER_GALVO_TIME

Cause: There is a galvanometer problem.

Corrective action: Contact the nearest GSI Lumonics Customer Support Center.

MARKER_GR_RANGE

Corrective action: Contact the nearest GSI Lumonics Customer Support Center.

MARKER_GR_DATA

Corrective action: Contact the nearest GSI Lumonics Customer Support Center.

MARKER_NO_FONT

Cause: No fonts present in the font directory.

Corrective action: Install fonts on the system.

MARKER_NO_GROUP

Cause: Group was not named or there is invalid data in the group.

Corrective action: Check the data in the Maintenance - Marker screen.

MARKER_NO_POSTEX

Cause: Dot matrix font was not expanded.

Corrective action: Contact the nearest GSI Lumonics Customer Support Center.

MARKER_NO_PREEX

Cause: Engrave mode font was not expanded.

Corrective action: Consult the factory.

MARKER_OUT_OF_MEMORY

Cause: Marker has used all available memory and can no longer perform the task in progress.

Corrective action: Reboot the system.

MARKER_OUT_OF_MEMORY

Cause: Marker has used all available memory and can no longer perform the task in progress.

Corrective action: Reboot the system.

MARKER_SIO_BUFFER_FULL

Cause: Marker serial buffer is full.

Corrective action: Issue **Go-Resume**.

MARKER_SIO_NOTSETUP

Corrective action: Reboot the system. Contact the nearest GSI Lumonics Customer Support Center.

MARKER_USER_BREAK

Cause: Mark Sample was pressed and then pressed again before the first mark sample was completed.

MARKING_X_BOUNDARY.

Cause: Exceeded the X-Axis marking range.

Corrective action: Change the job parameters so they are within the valid range.

MARKING_Y_BOUNDARY

Cause: Exceeded the Y-Axis marking range.

Corrective action: Change the job parameters so they are within the valid range.

MARKTEXT_INVALID_CHAR0

Cause: A character was placed in the marking text that is not valid for the checksum type specified.

Corrective action: Refer to Appendix C, then change the marking text.

MARKTEXT_INVALID_CHAR1

Cause: A character was placed in the marking text that is not valid for the checksum type specified.

Corrective action: Refer to Appendix C, then change the marking text.

MARKTEXT_INVALID_CHAR2

Cause: A character was placed in the marking text that is not valid for the checksum type specified.

Corrective action: Refer to Appendix C, then change the marking text.

MARKTEXT_INVALID_CHAR3

Cause: A character was placed in the marking text that is not valid for the checksum type specified.

Corrective action: Refer to Appendix C, then change the marking text.

MARKTEXT_INVALID_CHECKSUM

Cause: A character was placed in the marking text that is not valid for the checksum type specified.

Corrective action: Refer to Appendix C, then change the marking text.

MARKTEXT_INVALID_SERIAL_NO

Cause: Asked system to serialize an invalid character.

Corrective action: Change the marking text.

Missing signal tower condition %s

Cause: Signal tower light condition not specified correctly.

Corrective action: Refer to the description of conditions in AppendixH.4).

NMI_FLOAT_EXCEPTION

Variables in the floating point causing an interrupt.

Cause: Hardware failure.

Corrective action: Reboot the system. Contact the nearest GSI Lumonics Customer Support Center.

NMI_NO_MULTIBUS_ACCESS

No multibus access.

Cause: Hardware failure.

Corrective action: Reboot the system. Contact the nearest GSI Lumonics Customer Support Center.

NMI_NO_MULTIBUS_XACK

No multibus acknowledge.

Cause: Hardware failure.

Corrective action: Reboot the system. Contact the nearest GSI Lumonics Customer Support Center.

NMI_LOCAL_RAM_PARITY_ERROR

A local RAM parity error was detected.

Cause: Hardware failure.

Corrective action: Reboot the system. Contact the nearest GSI Lumonics Customer Support Center.

NMI_UNKNOWN

*Cause:*Hardware failure.

Corrective action: Reboot the system. Contact the nearest GSI Lumonics Customer Support Center.

No Barcode Readers Connected

Cause: Disconnected cable to the barcode Reader Controller.

Corrective action: Verify all wiring between the CPU, Barcode Controller, and individual Readers.

No Jobs in Marking Queue

Cause: An attempt was made to mark without a job in the queue.

*Corrective action:*Add a job to the marking queue. Refer to Section 4.7.1.

No Jobs to Process.

Cause: An attempt was made to mark without a job in the queue.

Corrective action: Add a job to the marking queue. Refer to Section 4.7.1.

No mark waf# /cass#: bad GET

Cause: cassette slot empty may or may not stop the system; it depends on the **FACTORY.SET** file.

Corrective action: Review the **FACTORY.SET** file and compare against the list shown in Appendix A.

Not enough memory for SECS message.

Cause: Heavy system processing activity may not leave sufficient memory available to send a long message.

Oakland Windowing Library ERROR!! errno = #

Corrective action: Reboot the system. Contact the nearest GSI Lumonics Customer Support Center.

One cassette mode to reprocess

Cause: The reprocessing mode can only use the one-cassette mode.

presenter I stuck error

Cause: Indicates that either the LOAD or PROCESS sensor for the presenter is stuck.

Corrective action: Inspect sensor and check for correct operation. Replace sensor if necessary.

Printer data memory allocation error

Cause: Out of memory. This error should not occur. If it does, contact the nearest GSI Lumonics Customer Support Center.

Printer IO init error %i

Cause: The serial printer device or PC could not be initialized when sending a custom report.

Corrective action: Check the cable from the WMSC serial port to the device.

PROCLOG file fault %s

Corrective action: Contact the nearest GSI Lumonics Customer Support Center.

Pulse Width > 185

Cause: Diode current pulsewidth has reached 185µs, which indicates the laser requires service.

Corrective action: Refer toAppendix G, Laser Faults and Warnings.

Pulse Width at Max

Cause: Diode current pulsewidth is greater than the maximum value of 195µs. This shuts down the laser.

Corrective action: Refer to Appendix G, Laser Faults and Warnings and contact GSI Lumonics for laser service.

READER Checksum fault:<SRC>

Cause: The wafer at the specified location has a checksum fault in the mark read.

READER I\O Fault

Cause: Communication initialization failed.

READER I\O Init Fault

Cause: Communication initialization failed.

Corrective action: Probable wiring or other hardware problem or the com port is not properly assigned.

READER I\O Timeout

Cause: The reader timed out during communication.

READER Unknown Checksum

Cause: Specified reader checksum is unknown.

READER Unreadable Wafer:<src>

Cause: The wafer at the specified source is unreadable.

READER Verify Error: <src>

Cause: The wafer at the specified source failed to verify.

Retry bad GET wafer# /cass#

Cause: **FACTORY.SET** retry option was unable to get the wafer from the desired slot.

Corrective action: Issue **Go/Resume**command.

Repetition Rate

Cause: The calculated laser trigger rate for marking has been exceeded.

Corrective action: Refer to Appendix G, Laser Faults and Warnings.

Robot error, Internal comm

Corrective action: Check the cable connectors, then reboot the system. If the problem cannot be identified, contact the nearest GSI Lumonics Customer Support Center.

Robot FAULT (<text>): arm # status

Corrective action: Check the cable connectors, then reboot the system. If the problem cannot be identified, contact the nearest GSI Lumonics Customer Support Center.

Robot init while moving: aborted

Cause: Tried to set the Robot while the Robot was moving.

Corrective action: Reboot the system.

Robot motion error, R axis

Corrective action: Issue a **Ctrl+Reset**.

Robot motion error, T axis

Corrective action: Issue a **Ctrl+Reset**.

Robot motion error, Z axis

Corrective action: Issue a **Ctrl+Reset**.

Robot motion error, Servos off

Corrective action: Issue a **Ctrl+Reset**.

Robot motion failure

Cause: Robot failed to perform the motion that it was asked to perform.

Corrective action: Check the cable connectors, then reboot the system. If the problem cannot be identified, contact the nearest GSI Lumonics Customer Support Center.

Robot tripped limit switch, halted

Corrective action: Check the robot for proper motion, then reboot the system. If the problem cannot be identified, contact the nearest GSI Lumonics Customer Support Center.

Robot type invalid #

Corrective action: Check the **FACTORY.SET** file for the correct ROBOT_TYPE designation as specified in Appendix A; if the problem cannot be identified, contact the nearest GSI Lumonics Customer Support Center.

Robot: Bad Aligner GET wafer left

Cause: Robot unable to retrieve the wafer from the Aligner.

Robot: cassette PUT failed

Cause: Robot failed to put the wafer in the cassette (option not implemented due to no detection).

Corrective action: Contact the nearest GSI Lumonics Customer Support Center.

Scribe database missing key: <KEY>

Cause: Could not locate barcode (read from wafer) in the scribe database file.

Corrective action: Compare barcode on wafer with barcodes listed in database file.

Scribe database format: <LINE>

Cause: Barcode records in the scribe database file are not in the correct format.

Corrective action: Check database file for records not in the ASCII format:<barcode>,<text>.

SECS Host communication fault!

Corrective action: Check the SECS cable connection. Refer to Appendix A and check that the SECS Keywords are properly specified in the **FACTORY.SET** file.

SECS IO init error #

Corrective action: Reboot the system. Refer to the *WaferMark® GEM/SECS Interface User's Guide (P/N 273.495.00).*

SECS S%d F%d not received!

Cause: Host is not responding to an ENQ.

Corrective action: Using SEC SIM, make a message log of the rejected message, then contact the nearest GSI Lumonics Customer Support Center.

SECS S%d F%d received late!

Cause: Message was received late. This could be the result of a Host-to-system timing problem.

SECS S%d F%d rejected by HOST with %d

Cause: Host does not recognize the message sent.

Corrective action: Using SEC SIM, make a message log of the rejected message, then Contact the nearest GSI Lumonics Customer Support Center.

SECS message data memory allocation error

Corrective action: Reboot the system. Refer to the *WaferMark® GEM/SECS Interface User's Guide (P/N 273.495.00).*

Serial number file fault

Cause: Read or write error while updating the SERIAL.SET file. Possible timing problem.

Corrective action: Compare data in file against information in Serial Number List. If necessary, return to WINDOWS NT and run Scandsk to check system integrity and available disk space.

SECS S%d F%d rejected by the Host with %d

Cause: SECS command rejected by Host system

Shutter Failed to Close

Cause: Software has detected that the shutter failed to open when commanded.

Corrective action: Refer to Appendix G, Laser Faults and Warnings.

Shutter Failed to Open

Cause: The beam shutter remains open although a command has been issued to close the shutter.

Corrective action: Refer to Appendix G, Laser Faults and Warnings.

Temperature

Cause: The temperature bandwidth of the chiller reservoir is varying by more than +0.5°C after warm-up.

Corrective action: Refer to Appendix G, Laser Faults and Warnings.

Temperature Fault

Cause: The coolant is outside the range for stable operation. Reservoir temperature cannot vary by more than +2°C and -5°C.

Corrective action: Refer to Appendix G, Laser Faults and Warnings.

Text file fault : SHORT

Cause: The ASCII text file has been exhausted before completion of the job. The job will be terminated and the remaining wafers will be unmarked.

Text file fault : LONG

Cause: At the completion of a job, the ASCII text file will be accessed one additional time. If there is still data available, a wafer map alignment error will occur.

Text read error: TXT

Cause: A text file read error has occurred. This error will terminate the job.

T-gap Expired

Cause: The laser control has not received a trigger pulse for more than 60 minutes.

Corrective action: Refer to Appendix G, Laser Faults and Warnings.

Thickness option

Thickness option requires a line 3
keyword entered as <line 3> +thickness:
<thickness_enabled><thickness_ul><thickness_ll><thickness_delta>
(See Key Word).

Time out on port #: <text>

Cause: Robot or Aligner communication was lost or not established.

Corrective action: Check the cables. Reboot the system.

Too many alignment failures

Cause: Aligner failed to align the wafer after several retries.

Corrective action: The number of retries allowed is specified in the **FACTORY.SET** file. Check that this value is sufficient, then issue Go-Resume.

Unknown error message identifier reported #

Corrective action: Contact the nearest GSI Lumonics Customer Support Center.

Vacuum fault

Cause: Not enough vacuum applied to the system.

Corrective action: Check the vacuum source and level.

Wafer map allocation error

Cause: The reprocessing mode requires memory that is not available at this time.

Warmup Timeout

Cause: The temperature of the chiller reservoir did not reach its set point within 12 minutes of entering warm-up.

Corrective action: Refer to Appendix G, Laser Faults and Warnings.

WIP: Bad Aligner GET, retrying

Cause: Retrying option is used in the **FACTORY.SET** file; the wafer was not properly retrieved from the Aligner.

Corrective action: Refer the Keyword ROBOT_RETRY_ALIGNER in Appendix A, then issue a **Go/Resume**command.

WIP: Bad Aligner GETs wafer left

Cause: Wafer left on the Aligner after an attempt was made to retrieve it.

Corrective action: Displayed on the screen.

WIP: Wafer present on Aligner

Cause: Wafer is on the Aligner when attempting to start a job.

Corrective action: Manually remove the wafer.

B.3 Sorted Error Message List

Table B-1 provides a list of all possible error messages sorted in alphabetical order. Table B-2 provides sorted error code in numeric order.

Table B-1 – Error Description Sorted in Alphabetical Order

Error Code	Error Description
7022	%d Bad mark, cassette %1d wafer %1d.
6033	%s board not responding.
7025	%s: invalid class definition.
7031	%s: No mark waf%d/cass%d: bad GET.
7008	%s=%s, keyword invalid.
6311	Abnormal Substrate Position on %d
2019	ABORT if wafer on robot arm!
6300	Access Mode Violation on %d
2012	Airflow fault.
6017	Aligner, CCD sensor synchronizations error.
6018	Aligner, CCD sensor data not valid.
6019	Aligner, Time-out error.
5004	Aligner, Too many flats found.
6032	Aligner, Unacceptable electrical noise.
6020	Aligner, Vacuum failure. Low or no vacuum.

Table B-1 – Error Description Sorted in Alphabetical Order

Error Code	Error Description
5003	Aligner, Wafer flat not found.
5001	Aligner error 4xxx.
5002	Aligner error 6xxx.
5005	Aligner error Axxx.
5006	Aligner error Bxxx.
5007	Aligner error Cxxx.
5008	Aligner error Dxxx.
5009	Aligner error Exxx.
5010	Aligner error Fxxx.
6039	Aligner offset undo took too long.
6027	Aligner reposition failed.
6026	Aligner reposition took too long.
6040	Aligner undo failed.
6016	Alignment successful!
6024	Alignment took too long.
6304	Attempt to Use Out of Service Load Port on %d
7028	Bad command to port %d: %s.
2013	Bad internal voltage level(s). Possible power supply or circuit overload problem.
7018	Bad mark, cassette %1d wafer %1d.
7020	Bad mark, cassette %1d wafer %1d.
7023	Bad mark, cassette %1d wafer %1d.
6034	Barcode Controller IO init error %i. Barode controller input/output start error.
8005	Barcode Reader %d data too long.
6035	Barcode Reader %i not connected.
6037	Barcode Reader %i Read Error.
6036	Barcode Reader %i Write Error.
8006	Burnlog fault: %s.
6030	Can't home robot. Check robot position.
6021	Can't initialize door. Check door: open?
6023	Can't mark: No wafer on aligner – Vacuum senses low.

Table B-1 – Error Description Sorted in Alphabetical Order

Error Code	Error Description
2000	Can't start: Wafer on aligner (WIP). Wafer in process.
6313	Carrier Clamp/Unclamp Failure on %d.
6307	Carrier Dock/Undock Failure on %d.
6306	Carrier Placement Error on %d.
6305	Carrier Presence Error on %d.
6310	Carrier Removal Error on %d.
6301	Carrier Verification Failure on %d.
6025	Cassette %1d wafer %1d UNMARKED. GO resumes.
6008	Cassette fault, presenter %i (MOVE_L).
6006	Cassette fault, presenter %i (MOVE_P).
6007	Cassette fault, presenter %i (PROCESS).
6009	Cassette fault, presenter %i (WAIT_I).
7076	CIDRW %s Error: (%d).
7074	CIDRW %s IO init Error: %i.
7075	CIDRW %s IO Timeout (%d).
8020	Collection file fault (%d).
8104	COMMAND_ARGUMENT.
8105	COMMAND_DATA.
8103	COMMAND_INVALID.
6312	Content Map Missing on %d
2011	Cover gas fault.
8003	CRC error in data. Data sum does not match cyclical redundancy check digit.
6100	CW50_TIMER_STUCK.
6022	Door didn't close after retrying. Check door.
6005	Door didn't open after retrying. Check door.
6309	Duplicate CarrierID on %d:%s
7066	Duplicate marks in job!
7058	Duplicate marks will occur!
7057	Duplicate read data error!
8011	Equipment constant file fault.

Table B-1 – Error Description Sorted in Alphabetical Order

Error Code	Error Description
8010	Equipment constant table fault.
8007	Error log fault:%s.
8015	Event file fault (%d).
2104	Exhaust flow fault.
2003	Fault %l: wafer may be on aligner.
7015	field '%s' not in job_sed.
7013	field '%s' not in jobq_cm_sed.
7002	field 'cassette sled'.
7014	field 'job sled' not in job_sed.
7012	field 'jobq_sled' not in jobq_cm_sed.
7003	File Lock Failed %s.
8001	File read error %s.
7004	File Unlock Failed %s.
8002	File write error %s.
8122	FP87_EXCEPTION_ID.
8121	FP87_OVERFLOW_ID.
8120	FP87_UNDERFLOW_ID.
8119	FP87_ZERODIVIDE_ID .
2018	GO if wafer on Aligner.
2022	GO to resume.
6002	Hardware error: %s.
7069	HSMS IO init errror
7300	ID compare fault: %s,%s
7027	Illegal aligner state: %d.
7010	Illegal cassette %d state: %d.
7001	Illegal control state: %d.
7024	Illegal marker state: %d.
7030	Illegal robot state, end %d: %d.
6028	Interlock open fault.
7120	Invalid checksum: %s.

Table B-1 – Error Description Sorted in Alphabetical Order

Error Code	Error Description
8016	Invalid event identifier, %d.
7011	Invalid job file format: %s.
7119	Invalid serial number (type %d).
2028	Invalid starting slot: %d.
6003	I/O init error %i.
6004	I/O init error %i.
3002	Job aborted %s.
7016	Job group data memory allocation error.
3001	Job queue empty.
7007	KWFIO_LOOKUP failed: floating point.
7006	KWFIO_LOOKUP failed: hex integer.
7005	KWFIO_LOOKUP failed: unsigned integer.
2102	Laser Error: %s.
2103	Laser Error: Possibly incomplete mark.
2100	Laser Fault: %s.
7202	Laser I/O Fault.
7201	Laser I/O Init. Error.
7200	Laser I/O Timeout.
2010	Laser lamp fault.
2101	Laser Not Ready While Marking (Error %d).
8018	Limit file fault (%d).
7042	LPC I/O Fault %d
7041	LPC I/O Timeout %d.
7040	LPC I/O init error %i.
6104	LPC_POWER_HIGH.
6103	LPC_POWER_LOW.
6102	LPC_POWER_LOW_HIGH.
7067	Loader %d door Closed during GET/PUT
7078	Loader %d E84 Timed out in %s, @ %d.
7065	Loader %d Error (%d)

Table B-1 – Error Description Sorted in Alphabetical Order

Error Code	Error Description
7063	Loader %d IO init Error:%i
7064	Loader %d IO Timeout (%d)
6200	M1750_ACK_error, %d
6202	M1750_INIT _ERROR,%d
6201	M1750_RESPONSE_ERROR,%s
8101	MAILBOX_GET_BUSY.
8101	MAILBOX_GET_BUSY.
7105	MAILBOX_INIT_FAILED.
8102	MAILBOX_OVERSIZE_MESSAGE.
7106	MAILBOX_SEMAPHORE_TIMEOUT.
7107	MAILBOX_SYNC_FAIL.
2015	Manually remove and GO to resume.
7017	MARK ALL FAILED.
7077	Mark Approval Timed Out
7021	Mark may be incomplete.
8023	Marks.set file fault, %s
6031	Mark station door closed.
7110	Marker Comm GET_EMPTY.
7109	Marker Comm PUT_FULL.
7108	Marker Comm TIMEOUT %d.
7124	MARKER_COMMANDLINE_OPTION.
8300	MARKER_DATA_ERROR.
8100	MARKER_ERROR.
5100	MARKER_FATAL.
8115	MARKER_FN_RANGE.
8116	MARKER_FONT_CONTENTS.
7129	MARKER_FONT_CTLZ.
7132	MARKER_FONT_FILE.
7130	MARKER_FONT_HEADER.
7128	MARKER_FONT_ID3.

Table B-1 – Error Description Sorted in Alphabetical Order

Error Code	Error Description
7125	MARKER_FONT_LENGTH.
7127	MARKER_FONT_READ.
7123	MARKER_FONT_SCALING.
7126	MARKER_FONT_SEEK.
7131	MARKER_FONT_TYPE.
4103	MARKER_GALVO_TIME.
8113	MARKER_GR_DATA.
8114	MARKER_GR_RANGE.
8200	MARKER_HEAP_ERROR.
4100	MARKER_INTERRUPT_OVERRUN.
6101	MARKER_INTERRUPT_STUCK.
7133	MARKER_IO_INIT
8118	MARKER_JOBFILE_BAD.
8117	MARKER_JOBFILE_NONE.
4102	MARKER_LASER_TIME.
8110	MARKER_NO_FONT.
8109	MARKER_NO_GROUP.
7121	MARKER_NO_POSTEX.
8112	MARKER_NO_PREEX.
8111	MARKER_NO_ROV.
7103	MARKER_NOT_IMPLEMENTED.
7117	MARKER_OUT_OF_FONTS.
7118	MARKER_OUT_OF_LAYERS.
7102	MARKER_OUT_OF_MEMORY.
7101	MARKER_PROGRAM_EXIT.
7122	MARKER_RV_DATA.
4101	MARKER_SHUTTER_ADVANCE.
8107	MARKER_SIO_BUFFER_FULL.
8106	MARKER_SIO_NOTSETUP.
7104	MARKER_USER_BREAK.

Table B-1 – Error Description Sorted in Alphabetical Order

Error Code	Error Description
7100	MARKER_WARNING.
7111	MARKING_X_BOUNDARY.
7112	MARKING_Y_BOUNDARY.
8023	marks.set file fault, %s
7113	MARKTEXT_INVALID_CHAR0.
7114	MARKTEXT_INVALID_CHAR1.
7115	MARKTEXT_INVALID_CHAR2.
7116	MARKTEXT_INVALID_CHAR3.
8108	MARKTEXT_OVERSIZE.
7059	Missing signal tower condition %s.
7138	MSTRCOM_GET_BUSY.
7136	MSTRCOM_GET_EMPTY.
7137	MSTRCOM_GET_SHORT.
7139	MSTRCOM_OVERSIZE_MESSAGE.
7135	MSTRCOM_PUT_FULL.
7134	MSTRCOM_TIMEOUT:%d
5103	NMI_AT_BUS_FAULT.
5105	NMI_FLOAT_EXCEPTION.
5104	NMI_LOCAL_RAM_PARITY_ERROR.
5101	NMI_NO_MULTIBUS_ACCESS.
5102	NMI_NO_MULTIBUS_XACK.
5106	NMI_UNKNOWN.
6038	NO Barcode Readers Connected.
7009	No Jobs to process.
7056	Not enough memory @ %d!
7068	Not enough memory for HSMS message!
7035	Not enough memory for SECS message!
7049	One cassette mode to re-process!
7062	Optics Error: %i.
8021	Optics file fault (%d).

Table B-1 – Error Description Sorted in Alphabetical Order

Error Code	Error Description
7060	Optics I/O init error: %i.
7061	Optics I/O Timeout.
2027	Presenter %d load/process sensor.
7054	Printer data memory allocation error.
7055	Printer I/O init error %i.
8022	PROCLOG file fault: %s.
7070	Reader Camera Select (%i)
7047	READER Checksum fault:%s.
7071	Reader Definition Select (%i):%s
7045	READER I/O Fault: %ds.
7043	READER I/O Init Fault.
7044	READER I/O Timeout: %d.
7046	READER Unknown Checksum.
7050	READER Unreadable Wafer: %s.
7051	READER Verify Error: %s.
2004	Remove wafer on Aligner.
2002	Remove wafer(s) on Robot.
8014	Report file fault.
6014	Robot error, NV SRAM.
6015	Robot error, Internal comm.
2026	Robot FAULT (%s): arm %d, status %s.
2014	Robot init while moving: aborted.
6010	Robot motion error, T axis.
6011	Robot motion error, R axis.
6012	Robot motion error, Z axis.
6013	Robot motion error, Servos off.
2025	Robot motion failure.
2001	Robot tripped limit switch, halted.
7032	Robot type invalid: %d.
2023	Robot: Bad aligner GET, wafer left.

Table B-1 – Error Description Sorted in Alphabetical Order

Error Code	Error Description
2024	Robot: Cassette PUT failed.
6029	Safety door manually switched open.
7053	Scribe database format: %s.
7052	Scribe database missing key: %s.
7034	SECS HOST communication fault!
7036	SECS IO init error %i.
7037	SECS message memory allocation error.
7033	SECS S%d, F%d not received!
7038	SECS S%d, F%d received late!
7039	SECS S%d, F%d rejected by HOST with %d.
8004	Seek error.
8009	Serial number file fault.
6302	Slot Map Read Failed on %d
6303	Slot Map Verification Failed on %d
6207	SMIF Error, %d at %d
6206	SMIF I/O, %d at %d
6205	SMIF I/O INIT, %d at %d.
6203	SMIF LOAD, %s.
6204	SMIF UNLOAD,%s.
8019	Spool file fault (%d).
8013	Status history file fault.
8012	Status variable file fault.
8008	Text file fault: %s.
8024	Thickness data file fault, %s.
7029	Time out on port %d:%s.
7026	Too many alignment failures.
7019	User aborted during mark.
2009	Vacuum fault.
7072	Verify Limit Fault %s.
7073	Verify Parsing Fault %s.

Table B-1 – Error Description Sorted in Alphabetical Order

Error Code	Error Description
7048	Wafer map allocation error.
2008	Water flow fault.
2007	Water level fault.
2006	Water resistivity fault.
2005	Water temperature fault.
2017	WIP bounced? Was off, now on!
6001	WIP Error. Calibration Not Performed.
2021	WIP: Bad aligner GET, retrying.
2020	WIP: Bad aligner GETs, wafer left.
2016	WIP: Wafer present on aligner.
8017	Wrong file down.

Error Codes Sorted in Numerical Order

Table B-2 – Error Codes Sorted in Numerical Order

Error Code	Error Description
2000	Can't start: Wafer on aligner (WIP).
2001	Robot tripped limit switch, halted.Robot overrun error.
2002	Remove wafer(s) on robot. Vacuum detect wafer/s on robot endeffector/s.
2003	Fault %l: wafer may be on aligner
2004	Remove wafer on aligner. Vacuum detect wafer/s on aligner.
2005	Water temperature fault. Temperature too hot or too cold (May be reservoir heater failure.)
2006	Water resistivity fault.
2007	Water level fault. Check Water Level in Reservoir.
2008	Water flow fault. Check Pump. Check plumbing connections or pinched hose.
2009	Vacuum fault. Insufficient vacuum pressure detected.
2010	Laser lamp fault.
2011	Cover gas fault.
2012	Airflow fault.
2013	Bad internal voltage level(s).
2014	Robot init while moving: aborted.
2015	Manually remove and GO to resume.

Table B-2 – Error Codes Sorted in Numerical Order

2016	WIP: Wafer present on aligner.
2017	WIP bounced? Was off, now on!
2018	GO if wafer on aligner.
2019	ABORT if wafer on robot arm!
2020	WIP: Bad aligner GETs, wafer left.
2021	WIP: Bad aligner GET, retrying.
2022	GO to resume.
2023	Robot: Bad aligner GET, wafer left.
2024	Robot: Cassette PUT failed.
2025	Robot motion failure.
2026	Robot FAULT (%s): arm %d, status %s.
2027	Presenter %d load/process sensor.
2028	Invalid starting slot:%d.
2100	Laser Fault: %s.
2101	Laser Not Ready While Marking (Error %d).
2102	Laser Error: %s.
2103	Laser Error: Possibly incomplete mark.
2104	Exhaust flow fault.
3001	Job queue empty.
3002	Job aborted %s.
4100	MARKER_INTERRUPT_OVERRUN.
4101	MARKER_SHUTTER_ADVANCE.
4102	MARKER_LASER_TIME.
4103	MARKER_GALVO_TIME.
5001	Aligner error 4xxx.
5002	Aligner error 6xxx.
5003	Aligner, Wafer flat not found.
5004	Aligner, Too many flats found.
5005	Aligner error Axxx.
5006	Aligner error Bxxx.
5007	Aligner error Cxxx.

Table B-2 – Error Codes Sorted in Numerical Order

5008	Aligner error Dxxx.
5009	Aligner error Exxx.
5010	Aligner error Fxxx.
5100	MARKER_FATAL.
5101	NMI_NO_MULTIBUS_ACCESS.
5102	NMI_NO_MULTIBUS_XACK.
5103	NMI_AT_BUS_FAULT.
5104	NMI_LOCAL_RAM_PARITY_ERROR.
5105	NMI_FLOAT_EXCEPTION.
5106	NMI_UNKNOWN.
6001	WIP Error. Calibration Not Performed.
6002	Hardware error: %s.
6003	IO init error %l.
6004	IO init error %l.
6005	Door didn't open after retrying.
6006	Cassette fault, presenter %i (MOVE_P).
6007	Cassette fault, presenter %i (PROCESS).
6008	Cassette fault, presenter %i (MOVE_L).
6009	Cassette fault, presenter %i (WAIT_I).
6010	Robot motion error, T axis.
6011	Robot motion error, R axis.
6012	Robot motion error, Z axis.
6013	Robot motion error, Servos off.
6014	Robot error, NV SRAM.
6015	Robot error, Internal comm.
6016	Alignment successful!
6017	Aligner, CCD sensor sync error.
6018	Aligner, CCD sensor data not valid.
6019	Aligner, Time-out error.
6020	Aligner, Vacuum failure.
6021	Can't initialize door.

Table B-2 – Error Codes Sorted in Numerical Order

6022	Door didn't close after retrying.
6023	Can't mark: No wafer on aligner.
6024	Alignment took too long.
6025	Cass %1d wafer %1d UNMARKED. GO resumes.
6026	Aligner reposition took too long.
6027	Aligner reposition failed.
6028	Interlock open fault.
6029	Safety door manually switched open.
6030	Can't home robot.
6031	Mark station door closed.
6032	Aligner, Unacceptable electrical noise.
6033	%s board not responding.
6034	Barcode Controller I/O init error %i.
6035	Barcode Reader %i not connected.
6036	Barcode Reader %i Write Error.
6037	Barcode Reader %i Read Error.
6038	No Barcode Readers Connected.
6039	Aligner offset undo took too long.
6040	Aligner undo failed.
6100	CW50_TIMER_STUCK.
6101	MARKER_INTERRUPT_STUCK.
6102	LPC_POWER_LOW_HIGH.
6103	LPC_POWER_LOW.
6104	LPC_POWER_HIGH.
6200	M1750_ACK_error, %d
6201	M1750_RESPONSE_ERROR,%s
6202	M1750_INIT _ERROR,%d
6203	SMIF LOAD,%s
6204	SMIF UNLOAD,%s
6205	SMIF I/O INIT, %d at %d
6206	SMIF I/O, %d at %d

Table B-2 – Error Codes Sorted in Numerical Order

6207	SMIF Error, %d at %d
6300	Access Mode Violation on %d.
6301	Carrier Verification Failure on %d.
6302	Slot Map Read Failed on %d.
6303	Slot Map Verification Failed on %d.
6304	Attempt to Use Out of Service Load Port on %d.
6305	Carrier Presence Error on %d.
6306	Carrier Placement Error on %d.
6307	Carrier Dock/Undock Failure on %d.
6308	Carrier Open/Close Failure on %d.
6309	Duplicate CarrierID on %d:%s.
6310	Carrier Removal Error on %d.
6311	AbnormalSubstratePosition on %d.
6312	ContentMapMissing on %d.
6313	Carrier Clamp/Unclamp Failure on %d.
7001	Illegal control state: %d.
7002	field 'cassette_sled' not in cassette_def_sed.
7003	File Lock Failed %s.
7004	File Unlock Failed %s.
7005	KWFIO_LOOKUP failed: unsigned integer.
7006	WFIO_LOOKUP failed: hex integer.
7007	KWFIO_LOOKUP failed: floating point.
7008	%s=%s, keyword invalid.
7009	No Jobs to process.
7010	Illegal cassette %d state: %d.
7011	%s: Invalid job file format.
7012	field 'jobq_sled' not in jobq_cm_sed.
7013	field '%s' not in jobq_cm_sed.
7014	field 'job_sled' not in job_sed.
7015	field '%s' not in job_sed.
7016	Job group_data memory allocation error.

Table B-2 – Error Codes Sorted in Numerical Order

7017	MARK ALL FAILED.
7018	Bad mark, cassette %1d wafer %1d.
7019	User aborted during mark.
7020	Bad mark, cassette %1d wafer %1d.
7021	Mark may be incomplete.
7022	%d Bad mark, cassette %1d wafer %1d.
7023	Bad mark, cassette %1d wafer %1d.
7024	Illegal marker state: %d.
7025	%s: invalid class definition.
7026	Too many alignment failures.
7027	Illegal aligner state: %d.
7028	Bad command to port %d: %s.
7029	Time out on port %d: %s.
7030	Illegal robot state, end %d: %d.
7031	%s: No mark wafer %d/cassette%d: bad GET.
7032	Robot type invalid: %d.
7033	SECS S%d, F%d not received!
7034	SECS HOST communication fault!
7035	Not enough memory for SECS message!
7036	SECS I/O init error %i
7037	SECS message memory allocation error.
7038	SECS S%d, F%d received late.
7039	SECS S%d, F%d rejected by HOST with %d.
7040	LPC I/O init error %i.
7041	LPC I/O Timeout %d.
7042	LPC I/O Fault %d
7043	READER I/O Init Fault.
7044	READER I/O Timeout: %d.
7045	READER I/O Fault: %d.
7046	READER Unknown Checksum.
7047	READER Checksum fault: %s.

Table B-2 – Error Codes Sorted in Numerical Order

7048	Wafer map allocation error.
7049	One cassette mode to re-process!
7050	READER Unreadable Wafer: %s.
7051	READER Verify Error: %s.
7052	Scribe database missing key: %s.
7053	Scribe database format: %s.
7054	Printer data memory allocation error.
7055	Printer IO init error %i.
7056	Not enough memory @ %d!.
7057	Duplicate read data error.
7058	Duplicate marks will occur!
7059	Missing signal tower condition %s.
7060	Optics IO init error: %i.
7061	Optics IO Timeout.
7062	Optics IO Error: %i.
7063	Loader %d IO init Error:%i.
7064	Loader (%d) IO Timeout (%d).
7065	Loader (%d) Error (%d).
7066	Duplicate marks in job!
7067	Loader %d door closed during GET/PUT
7068	Not enough memory for HSMS message!
7069	HSMS IO init errror.
7070	Reader Camera Select (%i): %i.
7071	Reader Definition Select (%i):%s.
7072	Verify Limit Fault %s.
7073	Verify Parsing Fault %s.
7074	CIDRW %s IO init Errror: %i.
7075	CIDRW %s IO Timeout (%d).
7076	CIDRW %s Errror: (%d).
7077	Mark approval timed out.
7078	Loader %d E84 Timed out in %s, @ %d.

Table B-2 – Error Codes Sorted in Numerical Order

7100	MARKER_WARNING.
7101	MARKER_PROGRAM_EXIT.
7102	MARKER_OUT_OF_MEMORY.
7103	MARKER_NOT_IMPLEMENTED.
7104	MARKER_USER_BREAK.
7105	MAILBOX_INIT_FAILED.
7106	MAILBOX_SEMAPHORE_TIMEOUT.
7107	MAILBOX_SYNC_FAIL.
7108	Marker_Comm_TIMEOUT %d.
7109	Marker_Comm_PUT_FULL.
7110	Marker_Comm_GET_EMPTY.
7111	MARKING_X_BOUNDARY.
7112	MARKING_Y_BOUNDARY.
7113	MARKTEXT_INVALID_CHAR0.
7114	MARKTEXT_INVALID_CHAR1.
7115	MARKTEXT_INVALID_CHAR2.
7116	MARKTEXT_INVALID_CHAR3.
7117	MARKER_OUT_OF_FONTS.
7118	MARKER_OUT_OF_LAYERS.
7119	Invalid serial number (type %d).
7120	Invalid checksum:%s.
7121	MARKER_NO_POSTEX.
7122	MARKER_RV_DATA .
7123	MARKER_FONT_SCALING.
7124	MARKER_COMMANDLINE_OPTION.
7125	MARKER_FONT_LENGTH.
7126	MARKER_FONT_SEEK.
7127	MARKER_FONT_READ.
7128	MARKER_FONT_ID3.
7129	MARKER_FONT_CTLZ.
7130	MARKER_FONT_HEADER.

Table B-2 – Error Codes Sorted in Numerical Order

7131	MARKER_FONT_TYPE.
7132	MARKER_FONT_FILE.
7133	MARKER_IO_INIT.
7134	MSTRCOM_TIMEOUT:%d.
7135	MSTRCOM_PUT_FULL.
7136	MSTRCOM_GET_EMPTY.
7137	MSTRCOM_GET_SHORT.
7138	MSTRCOM_GET_BUSY.
7139	MSTRCOM_OVERSIZE_MESSAGE.
7200	Laser I/O Timeout.
7201	Laser I/O Init. Error.
7202	Laser I/O Fault.
7300	ID compare fault: %s,%s.
8001	File read error %s.
8002	File write error %s.
8003	CRC error in data.
8004	Seek error.
8005	Barcode Reader %d data too long.
8006	Burnlog fault: %s.
8007	Error log fault: %s
8008	Text file fault: %s.
8009	Serial number file fault.
8010	Equipment constant table fault.
8011	Equipment constant file fault.
8012	Status variable file fault.
8013	Status history file fault.
8014	Report file fault.
8015	Event file fault (%d).
8016	Invalid event identifier, %d.
8017	Wrong file downloaded %s.
8018	Limit file fault (%d).

Table B-2 – Error Codes Sorted in Numerical Order

8019	Spool file fault (%d).
8020	Collection file fault (%d).
8021	Optics file fault (%d).
8022	PROCLOG file fault, %s.
8023	Marks.set file fault, %s.
8024	Thickness data file fault, %s.
8100	MARKER_ERROR.
8101	MAILBOX_GET_BUSY.
8102	MAILBOX_OVERSIZE_MESSAGE.
8103	COMMAND_INVALID.
8104	COMMAND_ARGUMENT.
8105	COMMAND_DATA.
8106	MARKER_SIO_NOTSETUP.
8107	MARKER_SIO_BUFFER_FULL.
8108	MARKTEXT_OVERSIZE.
8109	MARKER_NO_GROUP.
8110	MARKER_NO_FONT.
8111	MARKER_NO_ROV.
8112	MARKER_NO_PREEX.
8113	MARKER_GR_DATA .
8114	MARKER_GR_RANGE.
8115	MARKER_FN_RANGE.
8116	MARKER_FONT_CONTENTS.
8117	MARKER_JOBFILE_NONE.
8118	MARKER_JOBFILE_BAD.
8119	FP87_ZERODIVIDE_ID.
8120	FP87_UNDERFLOW_ID.
8121	FP87_OVERFLOW_ID.
8122	FP87_EXCEPTION_ID.
8200	MARKER_HEAP_ERROR.
8300	MARKER_DATA_ERROR.

Appendix C WaferMark® SigmaDSC NT Checksums

This appendix provides checksum information for the WaferMark® SigmaDSC NT system.

C.1 Introduction

The checksum can be selected from the **Edit** menu, using the **Existing** command (see Section H.4.3.

Checksum algorithms provide functions as follows:

- Algorithm 0: None - No digits are added or altered.
- Algorithm 1: SEMI - Adds two digits at the end.
- Algorithm 2: IBM-412 OCR - Inserts one character in second position (per IBM specifications).
- Algorithm 3: SEMI-412 OCR - Inserts one character in second position (per SEMI T193 specifications).
- Algorithm 4: IBM-412 barcode - Same as IBM 412 OCR plus inserts stop character.
- Algorithm 5: SEMI-412 barcode - Same as SEMI 412 OCR plus inserts start and stop characters.
- Algorithm 6: Cognex - Inserts one character in second position (per COGNEX specifications).

Table C-1 provides examples of the checksum algorithms marked output.

Table C-1 – Checksum Examples

Algorithm No.	Checksum	Input	Marked
1	SEMI	123456	123456A0
2	IBM-412OCR	123456	1323456
3	SEMI-412 OCR	123456	1N23456
4	IBM-412 BC	123456	1323456>
5	SEMI-412 BC	123456	<1N23456>
6	NEX	123456	1023456
< = Start Character; > = Stop character			

SEMI Checksum:

Using default example: 23 produces 23D2.

Refer to the table below:

Character	Value	8*Value	Mod 59
2	18	144	26
3	19	152	34
A	33	594	4
0	16	—	16

Check = (a3 + 8*(a2+8*(a1+8*a0))) mod 59

= (16 + 8*(33+8*(19+8*18))) mod 59

= 10712 mod 59

= 33

NOTE: Refer to the ***SEMI Standard for Traceability*** *for the complete algorithm and values.*

IBM 412 CheckSum:

Char value of digits 0 ... 9 (ASCII 0x30...0x39) is 0...9.

Char value of letters A ... N (ASCII 0x41...0x4E) is 10...23.

Char value of letters P ... Z (ASCII 0x50...0x5A) is 24...34.

Other characters are invalid.

Calculate the IBM 412 CheckSum, as follows:

1. Insert a dummy 0 in second position.
2. Define Fo = sum of odd values modulo 35 and Fe = sum of even values modulo 35.
3. Check digit = 17*(F odd + 2*F even) modulo 35.
4. Replace the dummy 0 with check digit.
5. To verify, recalculate Fe and now Fo + 2Fe modulo 35 must be 0.
6. If barcode, add <> around the text.

SEMI 412 Checksum:

For SEMI 412 Checksum, the character value of digits and letters are according to the following table.

NOTE: Other characters are invalid.

Character	Value	Character	Value
0	00	I	27
1	15	J	16
2	17	K	24
3	29	L	04
4	11	M	34
5	33	N	12
6	19	O	—
7	21	P	32
8	08	Q	18
9	02	R	01
A	07	S	14
B	25	T	13
C	20	U	26
D	22	V	05
E	09	W	31
F	30	X	28
G	03	Y	23
H	06	Z	10

Calculate the SEMI 412 Checksum, as follows:

1. Insert a dummy 0 in second position.
2. Define Fo = sum of odd values modulo 35 and Fe = sum of even values modulo 35.
3. Check digit = 17*(Fodd + 2*Feven) modulo 35.
4. Replace the dummy 0 with check digit.
5. To verify, recalculate Fe and now Fo + 2Fe modulo 35 must be 0.
6. If barcode, insert <> around the text .

COGNEX Checksum:

The following keyword sets the number of characters in the COGNEX checksum character set; the value is changed using the Startup data command from the **Maintenance** menu (see Section 4.9.6).

```
COGNEX_NUM_CHARS=10
```

- If only numerics (0-9) are being used, use COGNEX_NUM_CHARS=10.
- If alphanumerics are being used, use COGNEX_NUM_CHARS=34.
- The COGNEX character set is predefined and does not have B or N characters.

Appendix D Barcode Reader Option

This appendix describes the setup and operation of the Barcode Reader.

D.1 Introduction

This appendix describes the implementation and customization of the Barcode Reader option and the setup of the Intermec Barcode Reader. Also provided is a list of error codes that can occur during Barcode Reader operation.

D.2 Barcode Reader Option

If the Barcode Reader option is installed, you must include the keyword statement

```
BARCODE_ENABLE=YES
```

in the Maintenance Startup data or Maintenance Startup file; this statement activates the barcode software feature. (If the Barcode Reader option is not installed, the system defaults to

```
BARCODE_ENABLE=NO
```

.)

To disable Individual Barcode Readers, enter the following keyword statements in the Maintenance Startup file:

```
BARCODE_READER_1=NO
BARCODE_READER_2=NO
BARCODE_READER_3=NO
```

NOTE: The numeric suffixes (1, 2, and 3) correspond to the cassette port identifier; the default for each setting is =YES.

For details about Barcode customization, see Section D.3; for details about the Intermec Barcode Reader setup, see Appendix-sectionD.5.

D.3 Barcode Reader Customization

Note: For Intermec barcode Reader setup instructions, refer to Appendix-sectionD.5.

Where installed, the barcode feature consists of three barcode reader units mounted at the front of the machine. The readers are used to read cassette ID labels placed on the top of each wafer cassette and each cassette ID consists of a maximum of 18 characters printed in barcode 3 of 9.

All three barcode readers are multiplexed to a single controller that uses COM2 on the WaferMark® marker engine. Only one cassette size (8-inch wafer) is supported and the barcode labels must be positioned within 3 millimeters with an angular deviation of less than 3 degrees.

The Maintenance Startup line entry `BARCODE_COM` specifies the serial port that the 9154 controller uses for communicating with the system; the default value is 3 (COM2 of Marker [slave] CPU).

If the barcode software is enabled, the WaferMark® system activates the barcode scanner for a particular cassette port when the cassette sensor for that port detects a change. The scanner is activated while the cassette is still in motion to help avoid any bad spots on the barcode.

After a cassette has been placed on the presenter, the following message displays in the normal message area of the screen to show that the scanner has been activated for the indicated presenter:

```
message:  Scanning barcode on presenter 1
```

If the scan is successful, a S6F3 (DVS) message is sent to the HOST. This message is defined in detail in the *WaferMark SECS Interface User's Guide* and includes all information relative to the cassette that is required by the HOST. When the scan is successful, the following message, including the scanned barcode data, are displayed in the message area on the screen:

```
message:  Scan successful on presenter 1:<data>
```

If the scan fails, an S6F3 (DVS) message is sent to the HOST to indicate the failure. The operator should then remove the cassette from the presenter and visually check the barcode label to ensure it is in the proper position and that it appears to be a good barcode. The cassette should then be placed on the presenter again to see if a good read of the barcode is possible. Each time a barcode read fails, the following message displays on the screen and is also sent to the HOST in an S5F1 error message:

```
message:  Barcode Reader 1 Read Error
```

When a barcode read failure occurs, the fault light flashes to request operator attention. The operator can then elect to manually enter the barcode information by selecting the Barcode Data option from the Maintenance menu.

Once a barcode scan is successfully done, the HOST system can send the appropriate commands to initialize a marking job for the cassette that has been loaded on the system.

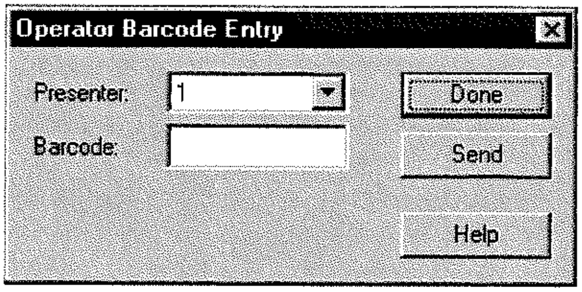
Next, the HOST issues a remote command S2F27 or S2F41 to add a job to the job queue and start processing. The **LOAD** button then flashes for the presenter that holds the cassette to be processed. The operator presses the **LOAD** button or the HOST can send the remote Load command to accomplish the same.

D.4 Barcode Data Maintenance

The **Barcode Data** command item listed in the Maintenance menu allows the user to transmit a barcode for a specific presenter port, directly to the Host.

NOTE: This action is completely independent of the Barcode Reader, and is designed to aid in isolating problems associated with barcode data errors detected by the Host – either due to a faulty reader, or data transmission errors between the WaferMark and the Host.

1. Click on the **Barcode Data** bar from the Maintenance menu (or type B). When selected, the following window is displayed:



2. Click on the pull-down button and highlight select the number of the presenter port.

3. Click on the second line and enter the barcode data you wish to send to the Host.
4. Click on the **Send** button to transmit the information to the Host.
5. Click on the **Done** button to close the window.

NOTE: The **Help** *button is not active.*

D.5 Intermec Barcode Reader Setup

Three reading heads are organized in a multi-drop configuration using the Intermec 9154 Controller. A 2830 Decoder that has a unique address that allows the 9154 Controller to communicate with any of the three Decoders controls each head. The address scheme of the Decoder depends on the device perspective; that is, the 2830 EEPROM contains an identifier, set by the configuration process, which starts at 1 and continues 2, 3, ... However, the 9154 Controller addresses device 1, as seen at the 2830, as device A, B, C, and so on.

Each 2830 Decoder and the 9154 Controller needs to be configured before they can be used in the WaferMark® SigmaDSC NT system. PROCOMM can be used to configure each of the devices, although no remote method is provided to configure the units on-line (as is possible with the Symbolic Technology units).

To configure the 2830 Decoder:

1. Connect power and turn on the unit.
2. Short pin 7 to pin 11 on the DB25 connector. An intermittent beep sounds.
3. Remove one end of the jumper momentarily and, in less then 5 seconds, reconnect the jumper. The tone should change from intermittent to steady, indicating that the unit is initialized to its default settings.

   NOTE: At this point, the unit can be interfaced to ProComm (or similar program) to communicate serially via the rear DB25 connector.
4. Connect the serial interface and set the parameters to:

   `9600, E, 7, 1`

To activate the Configuration menu:

1. Enter <D>; that is, literally, the less than symbol (<), followed by capital D, followed by the greater than symbol (>).
2. Set the <CAP LOCK> ON (since all the 2830 commands are in CAPS).
3. Select the **Communications** menu by pressing the space bar, and then enter CR to access the menu.
4. Set the **PROTOCOL** parameter to **MULTIDROP** and set the address as required.
5. Set the **PREAMBLE** and **POSTAMBLE** to **DISABLED**.

   NOTE: All other defaults on this screen should be correct.
6. Type M to return to the **Main** menu.
7. Select the **Operations** menu.
8. Set **TRIGGERING MODE** to **SERIAL**.
9. Set **TRIGGERING CHARACTER** to a lower case **a**.
10. Set **WHEN TO OUTPUT** to **AS SOON AS POSSIBLE**.
11. Set **GOOD DECODE READS = 3** .
12. Set **MATCH CODE = DISABLED**.
13. Type M to return to the **Main** menu.
14. Select the **CODE TYPES** menu and verify that the **CODE 39** column is **ENABLED**.
15. Type M to return to the **Main** menu.
16. Select the **USER OUTPUTS** menu.
17. Set the **LASER ON/OFF** to **ENABLED**.

    NOTE: All other default settings are correct.
18. This completes the configuration. To save the configuration in **EEPROM**, press ESC and select the **E** option to exit.
19. Type Y when asked to save the configuration to the **EEPROM**.

To configure the 9154 Controller:

1. Connect the serial interface to the front panel DB9 connector (A DB9 to DB25 converter may be of assistance.).

2. Connect the serial interface; set the parameters to:

   `9600 E 7 2`

3. Set up the ProComm Terminal Configuration CR Translation (in) for **<CR><LF>** rather than **<CR>**.
4. Type **Ctrl+T** to enter the menu system configuration.
5. Select **Operating Parameters**, **1**.
6. Set the **Host Line Parameters** to:

   `9600 N 8 1`

7. Type **Ctrl+T** to exit the **Operating Parameters** menu.
8. Enter the **Transmission Parameters** menu.
9. Set the parameters as shown in the following tables.

   *NOTE: Enter **Ctrl+X** to leave an entry blank.*

To Host:	**Command/Value**
Number of Records per Block	1
Record Separator:	—
Header:	—
SOM:	<STX>
EOM:	<STX>
RES:	<STX>Z<CR>
AFF:	<STX>Y<CR>
NEG:	<STX>Z<CR>
Error Message SOM:	<STX>
Error Message EOM:	<ETX>
Transparency Check:	N
Data Wait Mode:	N

From Host:	**Command/Value**
POL:	<ENQ>
SEL:	<SEL>
AFF:	<ACK>
NEG:	<NAK>
DLE:	<DLE>

From Host:	Command/Value
SOM:	<STX>
EOM:	<ETX>
Record Separator:	—
Delay On (X 10ms):	1
Time Out (X 1Sec):	60
X On / X Off Enable:	y
LRC Enable:	N

10. Exit the**Transmission Parameters** menu by Ctrl+T.
11. Enter the **Select Polled Devices** menu.
12. Set the status for devices A, B, and C to **E** (=Enable).
13. This completes the configuration of the 9154 controller. Press Esc and save the configuration to **EEPROM.**

D.6 Barcode Reader Error Messages

The following error messages can occur during operations using the Barcode Reader:

Barcode Reader data too long

Cause: Data marked exceeds Barcode Reader field.

Barcode Controller IO init error

Cause: Barcode Reader Controller failed to initialize.

No Barcode Readers Connected

Cause: Disconnected cable to the Barcode Reader Controller.

Barcode Reader # not connected

Cause: Barcode Reader disconnected or not functioning.

Barcode Reader # Read Error

Cause: Barcode read from wafer could not be recognized.

Barcode Reader # Write Error

Cause: Barcode transmitted to the Controller is in error.

Appendix E Read and Scribe Mode 2 Operation

This appendix describes the Mode 2 operation known as read and scribe for the WaferMark® SigmaDSC NT system.

E.1 Introduction

This appendix describes the Mode 2 operation of the WaferMark® SigmaDSC NT system. During normal operation, the WaferMark® system operates in Mode 1. However, systems installed with the optional Reader (Accumen, Control Module Inc., or comparable Reader system) can be operated in Mode 2. This is also known as the ***Read and Scribe*** mode.

The Reader system reads the text from the bottom side of wafers, which is then marked on the top surface. This read and mark scheme also incorporates a reprocessing operation that may be necessary if the read operation fails during the normal processing of the wafer.

The system may also include a camera and separate monitor, which can be used to display the mark contents on the bottom of the wafer. This allows the operator to manually read and enter the data, if the automatic read scan fails during normal processing.

The basic Read and Scribe operation consists of the following processes:

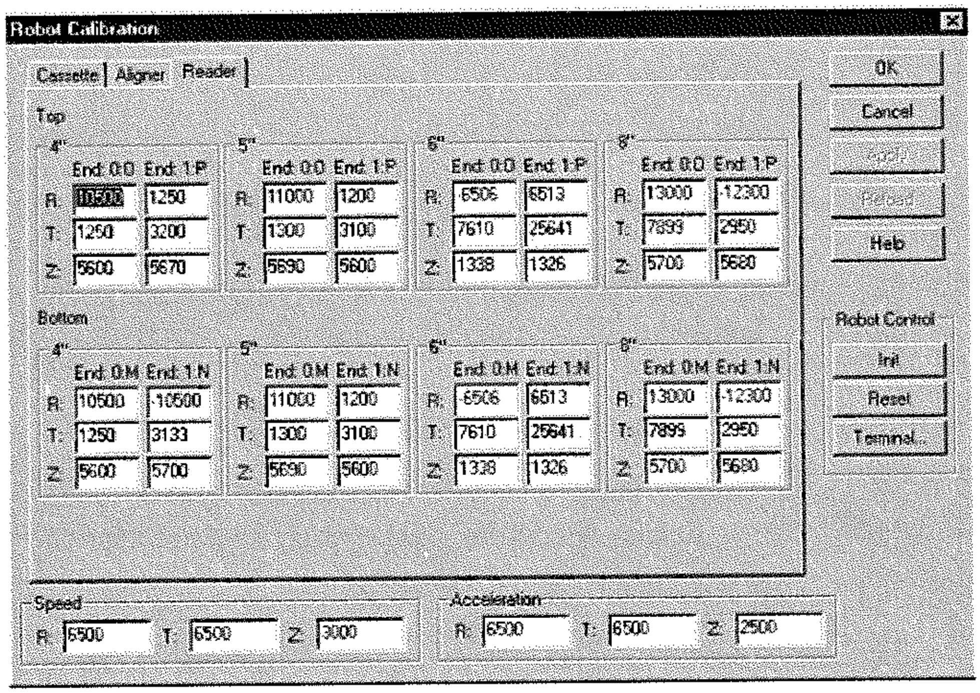
- Fetch the wafer from the source cassette
- Place the wafer on the Aligner
- Rotate the wafer to the angle required for the Reader scan
- Extract the rotated wafer
- Position the wafer over the Reader camera
- Read the wafer text (bottom side), process the checksum and save the data for the mark
- Return the wafer to the Aligner
- Align the wafer to the mark location
- Mark information on the top surface of the wafer
- Extract the wafer and return it to the destination cassette.

E.2 Robot Setup

The Robot must be setup for the Reader position for each of the standard wafer sizes—4, 5, 6, and 8 inches (100, 125, 150, and 200 mm). Reader positions are defined as O and P, for end effectors 0 and 1, respectively; and there are four unique O and P pairs defined in the new Robot Calibration screen for each of the four wafer sizes.

NOTE: When the Reader is enabled (`READER_ENABLE=YES` *specified in the* **FACTORY.SET** *file),* ***PgUp*** *for Reader is added at the top of the screen. If this keyword statement is omitted or not entered in the file, the Reader page is not available.*

Clicking on the **Reader** tab of the Robot Calibration screen shows the typical Reader setup screen.



Top

	4" End 0:O	4" End 1:P	5" End 0:O	5" End 1:P	6" End 0:O	6" End 1:P	8" End 0:O	8" End 1:P
R:	10500	1250	11000	1200	-6506	6513	13000	-12300
T:	1250	3200	1300	3100	7610	25641	7893	2950
Z:	5600	5670	5690	5600	1338	1326	5700	5680

Bottom

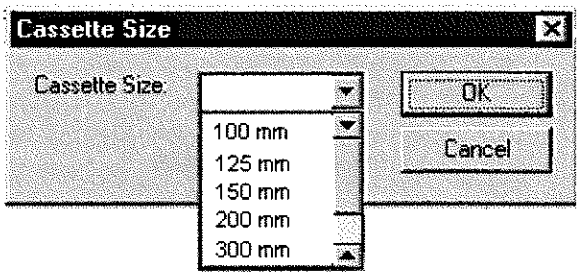
	4" End 0:M	4" End 1:N	5" End 0:M	5" End 1:N	6" End 0:M	6" End 1:N	8" End 0:M	8" End 1:N
R:	10500	-10500	11000	1200	-6506	6513	13000	-12300
T:	1250	3133	1300	3100	7610	25641	7895	2950
Z:	5600	5700	5690	5600	1338	1326	5700	5680

Speed: R: 6500 T: 6500 Z: 3000

Acceleration: R: 6500 T: 6500 Z: 2500

E.3 Reader Position Teach

To teach the Robot O and P positions, select the desired cassette size by pressing **Init** on the Reader position screen; this displays the following pop-up list:



The names in the list are derived from the cassette definitions (previously specified) in the **CASSETTE.SET** file. Since the user arbitrarily specifies the names, they may not indicate the actual cassette size; in this case, it may be necessary to read this file in order to ascertain the actual wafer size.

E.4 Reader Keywords

The following keyword statements can need to be entered in the **FACTORY.SET** file for Mode 2 Read and Scribe operations:

`ACCESS_MAINT_READER=[0|1|2|3|4|5] Default 5 (Engineer)`

This is a fixed offset applied to the rotation alignment for reading.

READ_ERR_DIR Default \JOBDIR

Specified the directory where the **<jobname>.ERR** file will be maintained. This file is used for error processing. It logs all confirmed read errors in which the label on the bottom of the wafer could not be read by the Reader or by the operator. As a result, the error log records wafers where no marking could be performed.

NOTE:The **ERRORS.FIL** *file is an error database that must exist in the MASTER directory in order to provide error processing of the Reader system. This is included in new-build systems, but must be added to the directory on systems being upgraded.*

NOTE: The **ERRORS.FIL** *file is an error database that must exist in the MASTER directory, in order to provide error processing of the Reader system. This will be included in new-build systems, but must be added to the directory on systems being upgraded.*

READER_CHECKSUM Default =NONE

Defines the checksum expected for the read operation. Whenever the [Reader] phrase is satisfied, either by reading a wafer reading a file or receiving input from an operator, the input text will be verified for the correct checksum if the READER_CHECKSUM keyword has been set to one of the following:

IBM-412 OCR
IBM-412 BC
SEMI-STD OCR
SEMI-412 OCR
SEMI-412 BC
COGNEX

NOTE: This checksum can be different than the checksum specified in the Job Definition screen for mark text groups.

READER_COM=[0|1|2|3|4] Default =4

Defines the communication port to which the Reader is attached.

READER_ENABLE=[YES|NO] Default =NO

Defines whether or not the Reader is attached to the WaferMark system. This keyword provides global enable/disable control over all jobs. Control of the Reader in individual jobs is possible by toggling the **Reader Enable?** setting in the Job Definition screen.

READER=[Filename{=<filename.ext>}]

When the group text specifies the [Reader] phrase, and either the Reader flag is set to NO or the Reader is not functioning, the text for the [Reader] phrase will be obtained from the file specified in this keyword statement. This operation is further described in paragraph E.8 (Reader Text Substitution File).

READER_ERRORS=[YES|NO] Default =YES

Specifies whether read errors are announced to the operator if the system cannot read the barcode and character mark. This control keyword is independent of the keyword statement REPROCESS_READER_ERRORS.

READER_TYPE=[0|1|2|3|4|5|6] Default =0

Specifies the Reader being used as 0=Acumen; 1=CMI 1818-002; 2=LVS-3000/TIPROBE; 3=Wizard (Vision Boxes); 4=RECIF; 5=COGNEX_READER // Insight 1000; 6=COGNEX_READER1 // Insight 1700.

NOTE: The ACUMEN reader can be used for either VERIFY or READER modes, but ***not both****. The CMI Reader* ***cannot*** *be used in the VERIFY mode described in Appendix F (Mark Verification). The LVS reader can* ***only*** *be used in the VERIFY mode with a MEMC-SWI, base35 formatted Bar-code mark.*

REPROCESS_READER_ERRORS=[YES|NO] Default =NO

Defines whether or not read errors will be processed after the normal job cycle has completed. If set to **=NO**, then, whenever a wafer cannot be read successfully, an alarm will occur requiring operator intervention. The reprocessing operation is described in further detail in Appendix section E.7 (Error Processing).

If REPROCESS_READER_ERRORS=YES then read failures encountered on the first pass will be recorded in a local transient file, WAFER.ERR. After the first pass on the cassette is completed, the WAFER.ERR informs software which wafers require re-processing. If, during the second pass, a wafer cannot be read again, then the process will require operator intervention again, as described above. Note that ONE_CASSETTE_JOBS=YES must be specified in the **FACTORY.SET** file to enable recording of read failures for re-processing.

E.5 Group Text Reader Definition

The position of the text retrieved from the Reader is specified in the group text field by the bracket phrase: [Reader].

During marking, the group text is modified whenever the field contains the [Reader] phrase.

`Example: ABC [Reader] DEF[000]`

In this example, the mark on each wafer would consist of the letters ABC, a space followed by the text read by the Reader, a space, the letters DEF, and a serial number starting at 000.

NOTE: The [Reader] phrase can occur multiple times in either the same group or in multiple groups. Also, other active text groups can be defined by the standard operating mode. However, the text will be the same for all locations where [Reader] is specified.

E.6 Reader and Text Group Checksum Operation

Following a Reader read, the checksum characters are extracted from the Read text, then a checksum is regenerated from the resulting string using the algorithm specified by the READER_CHECKSUM keyword. The result is then compared to the (original) extracted checksum characters for a correct match. If correct, the string (without the checksum) modifies the [Reader] phrase in the group text.

If a Checksum Switch is specified in the Location Parameters window, a checksum of the whole group is generated and applied to the text before marking.

NOTE: The checksum used by the input [Reader] phrase can be different than that used for the actual group text to be marked.

E.7 Error Processing

When a job is first loaded from the queue to the active status, all text in the job is scanned for a [Reader] phrase. If the phrase is present, the bottom of each wafer is read before the marking operation takes place. If the Reader Read operation fails, the system attempts to read the alphanumeric text for the barcode. The following error processing occurs:

1. If the keyword READER_ERRORS=YES and the system cannot read either the barcode or the text field, it reports an error to the operator.

NOTE: This is independent of the setting of the REPROCESS_READER_ERRORS keyword.

2. If the keyword REPROCESS_READER_ERRORS=YES, the error are recorded in a local error log, **WAFER.ERR**, for re-processing after the job is complete. However, if the keyword is set to =NO, the Operator Input Process is initiated.
3. The Operator Input Process stops the system operation through the alarm/fault process.
4. Study the Accumen display screen to discern the character mark.
5. Press **GO\RESUME <F5>** to continue normal processing. This initiates a text input pop-up window.
6. Type the required text, followed by **<Enter>**.
7. If you cannot read the wafer, just press **<Enter>**.

   *NOTE: The **Esc** key will not function at this time.*
8. If no text is entered, a second pop-up screen requests verification that you have no text to input.
9. However, if the text entered fails the checksum match, the previous input pop-up screen is presented again.
10. If the bottom side of the wafer cannot be read and the system confirms that no read is possible (by not entering any text), the marking process is terminated.
11. This causes an error record to be added to the read error log for the job (**<jobname>.err**) and the HOST to be notified of the read failure (implying no mark was written) using S5F1, error code `7050READER: Unreadable Wafer (<cassette> <slot>)`.
12. When REPROCESS_READER_ERRORS=YES and the first pass on the cassette is completed, the **WAFER.ERR** error log specifies which wafers require re-processing.
13. Each wafer listed in the log is processed again.
14. If the reader operation fails again on the second pass, the Operator Input Process is invoked, as described above beginning in Step 3.

NOTE: ONE_CASSETTE_JOBS=YES is required when re-processing is enabled. The above description includes both *end effectors. All operations for INCR_EMPTY_SLOTS and INCR_BAD_MARK follow their original definition.*

E.8 Reader Text Substitution File

The use of the keyword statement READER=[Filename{=**<finename.ext>**}] in the **FACTORY.SET** file provides a recovery path for various errors, which may occur in the system and external data functions.

If the [Reader] phrase occurs in a job, but either the Reader flag in the job definition has been set to No or the Reader is not active due to a hardware failure, the Read File mode (using the above phrase) can be employed, instead of the normal Reader operation.

A Reader hardware failure can be a com port problem, a camera problem, PC failure, or the global enable flag READER_ENABLE is set to =NO. Should this condition occur, no error processing, re-processing, or robot movement that is normally associated with the Reader operation will take place.

The following section explains how changing from the Read and Scribe mode to the Read File mode can provide a practical recovery path for the user.

For example, suppose a large lot of wafers cannot be read due to some process problem; it would be very cumbersome to reprocess the complete lot in the normal Reader mode; this would require operator intervention during the recovery process, for each wafer. A practical solution would be to create a disk file on a floppy with the required marking information for the wafer, then edit the job which will be used to read and mark the wafers by setting the Reader Enable flag to No. Now, during the marking operation, whenever the [Reader] phrase is encountered in the group text, the operation will change from the Read and Scribe mode to the Read File mode. In this case, the text to be inserted at the [Reader] phrase will now be obtained from the file and path specified by the keyword READER=[Filename{=<filename.ext>}]. The path may either be specific, or a root path such as A:\. In this example, the path would be the floppy drive, A:\.

E.9 Scribe Database Reader Operation

An enhancement to the standard Read and Scribe Mode 2 operation is the Scribe Database feature. In this process, the specified Reader reads the barcode on the bottom of the wafer, and the barcode used as a key to index a database file provided by the user. Then, whenever the [Reader] phrase occurs in the job definition, the database is searched to locate the barcode, and the associated text field in the file is then used for the mark at the position where the [Reader] phrase occurs.

This process requires that the system is operating in the Read and Scribe Mode 2 with the Reader enabled, and that the keyword SCRIBE_DATABASE=YES is specified in the **FACTORY.SET** file. If the keyword is not specified, this condition defaults to =NO.

SCRIBE_DATABASE_PATH=SCRIBE_DATABASE_PATH=

`<textkey>, <text>`

Comment lines may also be used in the file by entering an exclamation symbol (!) in the first character position on the line; however, blank lines in the file will cause an error.

An example of a scribe file is as follows:

! TEST.DBF
LINE1, MARK1
LINE2, MARK2
LINE3, MARK3
LINE4, MARK4
! LAST LINE

The following are error conditions that can occur if the database is incorrectly set up:

- If the keyword SCRIBE_DATABASE_ERRORS=YES is specified in the **FACTORY.SET** file, and the database does not contain a barcode read from the bottom of the wafer, then an alarm will occur, requiring operator acknowledgment. The default condition for this keyword is =YES.
- If the barcode cannot be located in the database, the error Scribe database missing key: <key> will always

be sent to the Host. If the burnlog is enabled, an entry will also be made in the job's error log.

- If the scribe database cannot be opened, then the error File read error <filename> will be sent to the Host
- If any records are found in the database which do not conform to the format specification: <barcode>, <text>, the error Scribe database format: <line> will be sent to the Host.

Although the Reader may employ the re-processing operation, the scribe database operation is independent of Reader re-processing operations. When a successful read occurs—whether from the Reader or the operator—that input is used to search the database.

Many failure scenarios are possible using the READER control keywords for re-processing and error handling-all of which are compatible with the scribe database operation.

New Keywords

A new coded word,which is entered and stored in the key field (called **FACTORY.SET** file) in a required syntax, that initiates a desired function through a software routine.

SCRIBE_DATABASE=[YES|NO]

Enables the scribe database method using the specified Reader.

SCRIBE_DATABASE_PATH=[Windows path]

Describes the path to the scribe database.

SCRIBE_DATABASE_ERRORS=[YES|NO]

Enables an alarm, which the operator must respond to, when the database does not contain a barcode read from the bottom of the wafer.

E.10 Control Module Inc. (CMI) Reader Setup

The CMI Reader has an eight-position DIP-switch that must be set to the following setup:

Switch	Function	Position	Setting
1	Baud Rate	ON	= 9600 (7 data bits, odd parity)
2	RS-232 Comm Mode	ON	= Non-Protocol/<DATA CR>
3	Data Buffer Mode	OFF	= Xmit After Decode
4	CIM Sensor Type	ON	= Micro-Scanner
5	Scan Direction	ON	= Forward
6	Wafer Code Type	ON	= IBM BC-412
7	Set-up (AGC)	OFF	= Closed Loop (Read)
8	Sample Speed	OFF	= Slow

A 9-pin D sub connector with all pins present should be used on the serial port. A NULL modem is not required.

Appendix F Mark Verification

This appendix describes the operation of the mark verification feature using the Acumen Reader hardware option

F.1 Introduction

The Mark verification can be implemented by entering the keyword statement VERIFY=[YES | NO] in the **FACTORY.SET** file. If the keyword is omitted, the condition defaults to =NO.

NOTE: If VERIFY=YES and READER_ENABLE=YES, a pop-up error message notifies the operator that using both the Reader and verify modes is not supported.

F.2 Mark Verification Process

When VERIFY=YES, mark verification takes place for all text fields in the job. The process consists of the following sequence:

- The topside of the wafer is marked, and then verified.

During verification, if any mark fails, the process will be terminated. This generates an error and alarm condition will occur, but no choice will be offered to the operator; the wafer will always be returned to the cassette. The system will halt while awaiting operator intervention.

Any operator actions associated with the Reader and verify operation will be reported via an Event Report Send SECS message to a Host computer. (For further information, please refer to the *WaferMark® NT GEM/SECS Interface User's Guide (P/N 273.495.00).*)

F.3 Reader Configuration

The Acumen Reader requires a unique configuration for each text group used in the job. Configuration 1 corresponds to Group 1, and Configuration 2 corresponds to Group 2, etc. The RETRY setup for the Reader must also indicate ABORT on a read failure, unless another configuration is set up to perform a tuning operation. (Ensure that any second level-tuning configuration does not conflict with another normal group number. That is, if there are four groups, then configurations 1 through 4 ***MUST*** define those reading positions.)

F.4 Robot Calibration Screen

Clicking on the **Verify Position** button in the Job Editor screen (see Figure 3-10) displays the pop-up **Positions** dialog box (see Figure 3-11) for robot locations. This dialog box contains the position code for End 0 and End 1 code for Radial, Theta, and Height.

F.5 Burnlog Verification Entries

If the keyword statement BURNLOG=YES, the mark text will be written to the burnlog on completion of marking each wafer. If VERIFY=YES and verification fails, then special entries will be written to the burnlog, before the normal entry, indicating the first failing mark on the wafer side.

For example, the following burnlog entries show a verify failure for a job with just a single group:

1.
```
3-27-01 8:28:04.0;;(2 1)->(2 1);group 1;KA420;**FAILED
    VERIFY**;
```
2.
```
3-27-01 8:28:04.0;;(2 1)->(2 1);group 1;KA420;
```
3.
```
3-27-01 8:28:20.5;;(2 2)->(2 2);group 1;KA421;**FAILED
    VERIFY**;
```
4.
```
3-27-01 8:28:20.5;;(2 2)->(2 2);group 1;KA421
```

In this example, the second entry for each wafer shows the normal entry for the burnlog. This entry will always follow any message indicating **FAILED VERIFY**.

Note that the final entry for each wafer indicates the actual text marked on the wafer, preceded by any verified failures that may have occurred.

Appendix G Laser Faults and Warnings

This appendix describes the bit configuration for the Laser Faults and Laser Warnings fields that are displayed in the **Laser Maintenance** window when the **Laser** command is selected from the Maintenance menu.

G.1 Introduction

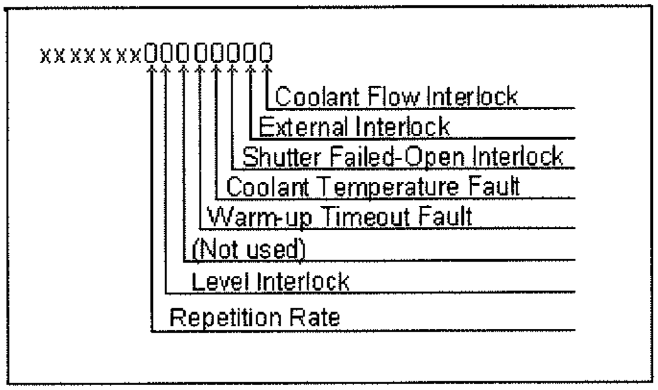
The **Laser** command will normally be selected after a standard error message has been reported to the operator during operations from the main screen. Bits set in the Laser Faults or Laser Warning status fields of the **Laser Maintenance** window usually indicate a problem with the laser or associated modules. Such problems cannot normally be corrected by the system operator and will require the immediate attention of a service engineer. If assistance is needed in correcting a problem reported by a laser error message, please contact your nearest GSI Lumonics Regional Customer Center at the address shown in the Preface (How To Get Technical Support).

G.2 Laser Faults

The software checks the hardware interlocks and fault conditions during the WARM-UP and READY states. If any open interlocks or faults occur, the software stops all trigger pulses to the diode laser module, turns off the power relay to disable the diodes, and turns off the heat exchanger fan and water pump relays in the chiller. The software also reports all laser faults to the operator by displaying an appropriate message on the screen.

When the Laser command is selected from the Maintenance menu, a string displays in the Laser Faults field at the bottom of the **Laser Maintenance** window indicating the condition of the faults and interlocks. Each bit in the binary string represents a fault, where a 0-bit indicates no fault and a 1-bit indicates a fault. The bits are numbered from right to left, starting at bit 0. Bits 0 through 7 are currently used to represent faults.

Format:



Example: 0000000000001001

(bit 15 . . . . bit 0)

. . . indicates two faults, represented by bit 0 and bit 3.

G.2.1 LASER FAULT Messages and Definitions

The occurrence of any hardware interlock or fault condition is reported to the operator by a Fault message which is displayed in the lower left area of the screen. Each message is associated with a specific bit set in the Laser Faults field of the **Laser Maintenance** window, as previously described in Section G.2.

The Fault messages displayed on the screen, and corresponding Fault bits (reported by the laser software) are as follows:

Fault Message	Laser Fault Bit
Flow Interlock	bit 0
External Interlock	bit 1
Shutter Failed to Close	bit 2
Temperature Fault	bit 3
Warmup Timeout	bit 4
(Not used)	bit 5
Level Interlock	bit 6
Repetition Rate	bit 7

The following descriptions of Laser Fault bits define the Fault messages and action required to correct a problem. If a corrective action is not provided here or if you require further assistance, contact GSI Lumonics.

Coolant Flow Interlock — Bit 0

This fault is most often seen while filling the chiller reservoir and is caused by air trapped in the coolant tubing, reducing the effective flow rate. It could also mean that the pump fuse has blown or the chiller power switch is turned off.

External Interlock — Bit 1

An external interlock is open. One of the external interlock switches connected in series between pins 12 and 13 of the user interface connector on the rear panel of the control (J13) is open.

Shutter Failed – Open Interlock — Bit 2

The beam shutter remains open, although a command has been issued to close the shutter.

Coolant Temperature Fault — Bit 3

Temperature is outside of the range of stable operation. For a given set point the reservoir temperature cannot vary by greater than +2 / -5 °C.

Warm-up Timeout Fault — Bit 4

The temperature of the chiller reservoir did not reach its set point within 12 minutes of entering warm-up.

(Not used) — Bit 5

Coolant Level Interlock — Bit 6

The coolant level in the reservoir is low. Refill the reservoir with coolant. If this condition occurs regularly, ensure that the reservoir sealing screw at the top of the reservoir is sealing correctly and that there are no other minor coolant leaks in the chiller system.

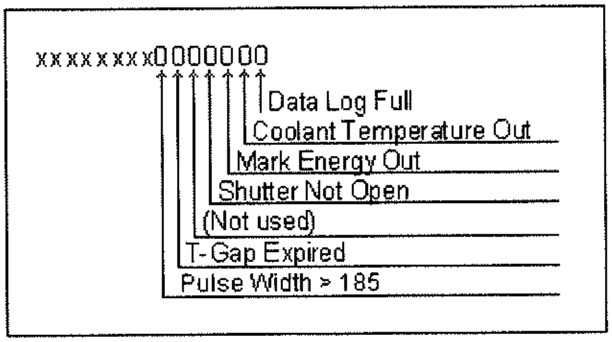
Repetition Rate — Bit 7

This error should not occur on WaferMark DSC systems which use the Sigma 200 laser. If the screen displays the Repetition Rate error message, or bit 7 is ever set in the Laser Faults field of the **Laser Maintenance** window, contact GSI Lumonics for further advice.

G.3 Laser Warnings

The software monitors certain conditions and sets bits in a 16-bit binary status word if a condition is detected that may be helpful for diagnostics, but is not serious enough to be considered a fault. The status word is displayed in the Laser Warnings field at the bottom of the **Laser Maintenance** window, when the **Laser** command is selected from the Maintenance menu. Status bits are numbered from right to left, starting at bit 0, and each bit is latched until that particular condition no longer exists. The monitored status conditions are:

Format:



G.3.1 LASER WARNING Messages and Definitions

The occurrence of any laser warning condition is reported to the operator by a status message that is displayed in the lower left area of the screen. Each message is associated with a specific bit set in the Laser Warnings field of the **Laser Maintenance** window, as previously described in Section G.3.

The Status messages displayed on the screen and corresponding Laser Warning bits are:

Status Message	Laser Bit
Log Full	bit 0
Temperature	bit 1
Mark Energy	bit 2
Shutter Failed to Open	bit 3
(Not used)	bit 4
T_gap Expired	bit 5
Pulse Width > 185	bit 6

For a definition of Status messages and action required to clear the condition, refer to the following descriptions of laser Status bits. If a corrective action is not provided here or if you require further assistance, contact GSI Lumonics.

Data Log Full — Bit 0

The flash memory used to log data about the laser's performance is full (or nearly full). Cleared when flash is erased.

Coolant Temperature Out — Bit 1

The temperature bandwidth of the chiller reservoir is varying by more than ±0.5°C after warm-up. This condition is cleared when the temperature returns to a value within specification.

Mark Energy Out — Bit 2

An energy correction was required because the energy level varied by more the 3% during the marking process. Cleared when **MARK ENABLE** is brought low.

Shutter Not Open — Bit 3

The software has detected that the shutter failed to open during a shutter open command. Cleared when the shutter is commanded to close.

(Not used) — Bit 4

This bit is unassigned.

T-Gap Expired — Bit 5

While the Mark Enable signal input has been active (low), the laser control has not received a trigger pulse for more than 60 minutes. Cleared when an external trigger is received.

Pulse Width > 185µs — Bit 6

The diode current pulse width reached 185µs. This indicates that the laser requires a scheduled maintenance. If the current pulse duration reaches its maximum of 195µs, the control will shut down the laser and produce a `Pulse Width at Maximum` fault. Cleared when the pulse width drops below the boundary limit.

Appendix H Programmable Signal Tower

This appendix provides provides a flexible user interface that is capable of managing each of the eight positions (four–colored lamps and four– audio tone alarms).

H.1 Introduction

The signal tower is available in a variety of configurations, ranging from one to eight positions, where each position can be either a light or an alarm tone. The optional GSI Lumonics Programmable Signal Tower (PST) provides a flexible user interface, which is capable of managing each position. The color of the lens for each light, and the operating functions of the lights and alarms, are arbitrary. They are determined by the user, according to the monitoring requirements and are specified during the configuration setup in the user interface program. All configuration information is associated with the position of the light or alarm in the signal tower. These positions are numbered sequentially from 1 to 8, from top to bottom, as shown in Table H-1. Typically, the top positions are lights and the lower positions are alarms.

The standard GSI Lumonics signal tower configurations provide either three or four colored lights—in the order red, amber, green and, in the four-color signal tower, blue. Table H-1 shows an example of an eight-position signal tower in a configuration with four colored lights and four tones.

Table H-1 – Eight-Position Signal Tower with Alarm Tones

1	🟥	**Red Light**	**Error lamp (steady), or DANGER or SAFETY ALARM (flashing), requiring immediate operator attention.**
2	🟧	**Amber Light**	**Equipment not ready (steady)**
3	🟩	**Green Light**	**SECS or Machine is running (steady) or Standby; or, ready & waiting to process (flashing).**
4	🟦	**Blue Light**	**Manual Operation or Operator Stop**

Table H-1 – Eight-Position Signal Tower with Alarm Tones

5	1	Alarm Tone 1	High tone annunciator alarm indicates DANGER or SAFETY ALARM ALERT requiring immediate operator attention.
6	2	Alarm Tone 2	Fault Indicator
7	3	Alarm Tone 3	Defined by engineer
8	4	Alarm Tone 4	Defined by engineer

Configure the programmable signal tower (PST) parameters using an off-line program, called **STOWER.EXE**. This appendix provides a description of the signal tower configuration program operating instructions and a number of simple examples for models.

H.2 Operation

The PST option allows customization of the signal tower to the requirements of the end user. Using a series of dialog screens, the PST program enables the user to create new signal tower files, edit existing files and delete unwanted files. Access to the PST configuration program functions is provided through the **File** menu commands.

To implement the PST option, the keyword `SIGNAL_TOWER=3` must be entered in the **FACTORY.SET** file.

This keyword defines the operational mode for the signal tower lights controlled by the Grayhill board. Other modes are described in Chapter 2, Section 2.5.1 of this manual.

The operation of the signal tower is determined by the configuration file specified by the keyword SIGNAL_CONFIG=<filename> in the **FACTORY.SET** file. When specified, this file is automatically loaded when the system initializes. (Note that the filename in the keyword must be specified without the extension. The file normally resides in the **\MASTER** directory.)

H.3 Initiating the PST Configuration Program

The PST configuration program is initiated from the Windows Screen in the MASTER directory by clicking on the program and execute it:

```
stower
```

After the **<Enter>** key has been pressed on the system keyboard, the initial screen for the Signal Tower Configuration Program is displayed as shown in Figure H-1. This screen is known as the Main Program Screen.

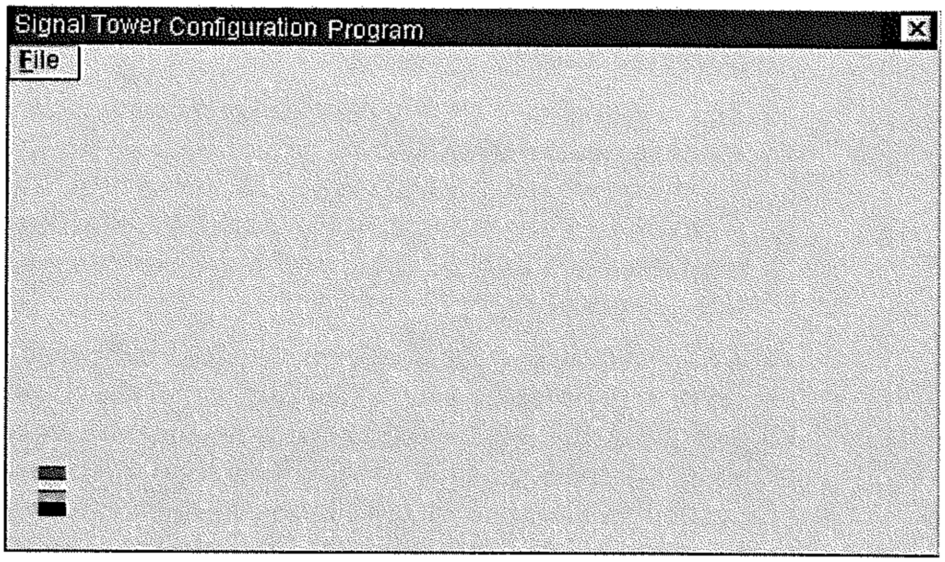


Figure H-1 – Main Program Screen — Initial Presentation

H.4 File Menu Commands

The **File** menu provides the basic access to the configuration files. From this pull-down menu, the user can select functions used to create, edit or delete a configuration file as follows:

- The **New** command creates a new file with all configuration fields reset to default values.
- The **Existing** command accesses a currently existing file for modification or use as a template (see Section H.4.3).
- The **Delete** command removes an existing file from the file list.

- The **Exit** command terminates the program and returns the user to the Windows screen.

Specifying the following keywords can control user access to individual commands in the **File** menu and appropriate access levels in the **FACTORY.SET** file:

```
ACCESS_PST_NEW=[0|1|2] Default:  Engineer
ACCESS_PST_EXISTING=[0|1|2] Default:  Engineer
ACCESS_PST_DELETE=[0|1|2] Default:  Engineer
ACCESS_PST_EXIT=[0|1|2] Default:  No password required
```

If any of these keywords is not specified in the file, access to the corresponding command(s) will automatically default to the user indicated above.

The access levels (0, 1, and 2) correspond to the user levels specified in the **USERINFO.FIL**, which also resides in the **\MASTER** directory, where 0 is Operator, 1 is Supervisor, and 2 is Engineer. If this file is not present in the directory, security access is not implemented, and all users will have access to all functions of this program.

After initializing the program, the first user will be prompted to logon immediately after selecting any of the commands (except **Exit**) from the **File** menu. If the user does not have sufficient authority, the selected operation will be abandoned after two retries. If a logged on user later selects a (different) command that requires a higher access level, the user will again be prompted to log on with the appropriate (higher) access level before the operation is initiated.

When the **File** menu is open, commands can be selected by either highlighting the required command and then pressing the **<Enter>** key, or by simply pressing the highlighted letter key for the appropriate command. **File** menu list is shown in Figure H-2, and the various commands and resulting dialog screens are described in the following sections.

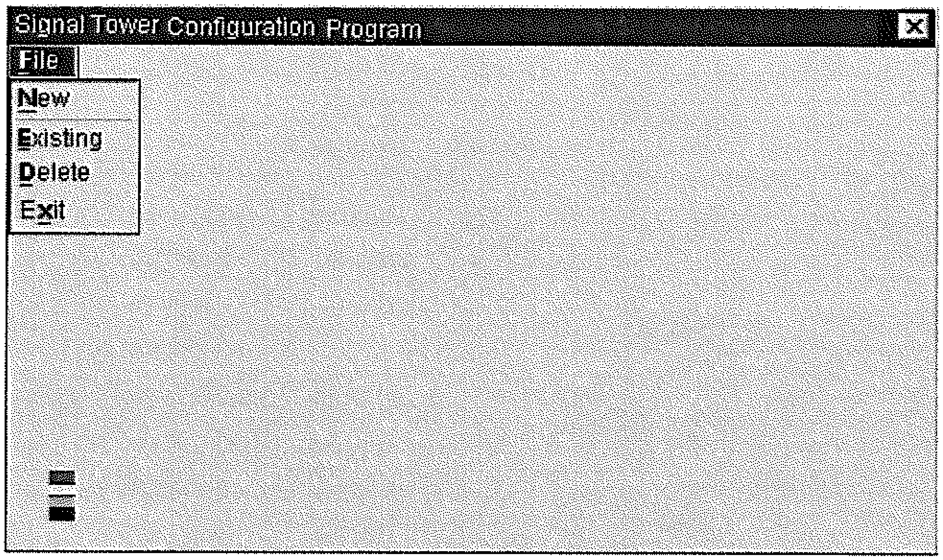
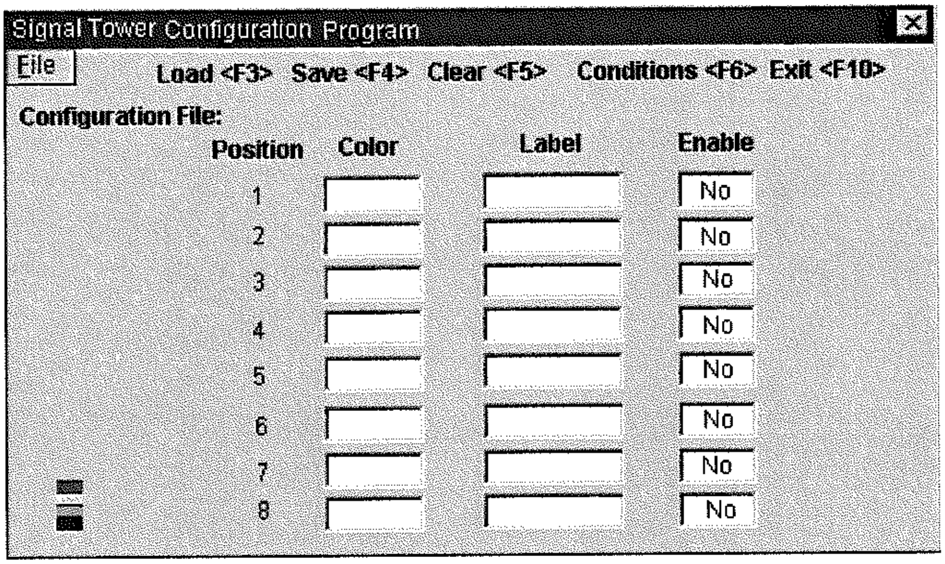


Figure H-2 – Main Program Screen with File Command Selected

H.4.1 New File Command

The **New** file command allows the user to create a new configuration file. When **New** is selected, the signal tower Definition Screen is displayed with all fields cleared or preset to a default state as shown in Figure H-3.



Configuration File:

Position	Color	Label	Enable
1			No
2			No
3			No
4			No
5			No
6			No
7			No
8			No

Figure H-3 – New Signal Tower Definition Screen

This screen allows the user to do the following:

- Assign a color and functional label to each light position, e.g., Green and Running.
- Assign a descriptive name and functional label to each alarm position, e.g., Tone 1 and Alarm.
- Enable or disable each light or alarm position.

Note that the names used for Color and Label are determined by the user according to the monitoring requirements; they are only entered here to assist in recognition of the function of each position.

The functions of the various fields shown in this screen are as follows:

Configuration File:

If this screen has been entered after selecting the **New** command from the File menu, this field will be empty. If an Existing configuration has been loaded by selecting the **Existing** command (see Section H.4.3) or by selecting the **Load <F3>** option in this screen, this field will contain the name of the configuration file. This field is not available for alteration.

Position

Indicates the physical position of each light or alarm on the signal tower, with position 1 being on top.

Color

An informational field for the user only. Indicates the color of the lens used for that position or a descriptive name for an alarm tone.

Label

An informational field for the user only. Label is a user-specified name which identifies the functional conditions that operate the light or alarm in that position.

Enable

Enables the light or alarm at that position, when set to Yes, and disables the light, when set to No. The **<Spacebar>** toggles the condition.

The arrow keys and the **<Tab+Shift>** keys control cursor movement to any field on the system display. Vertical cursor movement is controlled by the ↑up and ↓down arrow keys and horizontal cursor movement is controlled by the **<Tab>** and **<Tab + Shift>** keys. Pressing the **<Tab>** key moves the cursor to the right; pressing the **Tab and Shift** keys together moves the cursor to the left.

The following is a summary of the five options that are displayed on the heading bar:

Load File <F3>

The **Load <F3>** option is included in this screen to allow the user to load an existing configuration file that will be used as a template for creating a new configuration file. Loading an existing file will copy the data from the file into the various fields of the screen.

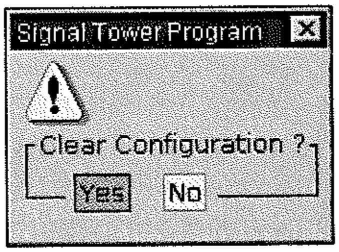
When this option is selected, this opens the **File Operations** window and prompts the user to enter a filename. This window and file loading operation are further described in Section H.4.3 (Existing File Command).

Save File <F4>

This **Save <F4>** option is used to save the signal tower configuration data either to an existing configuration file or to a new file. When selected, the File Operations window opens and prompts the user to enter a filename. The method of saving a file is functionally the same as for Load File. All valid configuration files are saved and maintained in the **\MASTER** directory.

Clear <F5>

The **Clear <F5>** option clears all label fields and sets the **Enable** field to the default **No** condition. Before the operation is initiated, the following message prompts the user to confirm that the fields will be cleared as follows:



Signal Tower Program

Clear Configuration ?

Conditions <F6>

The **Conditions <F6>** option displays the Light Condition Definition Screen shown in Figure H-4. The user can select events or conditions that will cause each light to blink, turn on and turn off or will cause each alarm to turn on or off.

Exit <F10>

The **Exit <F10>** option abandons the current editing session and returns the user to the Main Program Screen. (Note that the Esc key can also be used to exit from this screen.)

To Create a New Configuration

Using the **Tab** and up/down arrow keys, position the cursor in the **Color** column opposite the first position number of the light or alarm in the signal tower. Type in the appropriate color for the lens or alarm at that position. Press the **Tab** key to move the cursor to the **Label** column, then type a label function name. (This entry is optional, but may be useful for other users by describing the conditions that will activate the light or alarm.) Now, press the **Tab** key to move the cursor to the **Enable** column. Using the **spacebar**, toggle the indicator to **Yes**.

To configure the next position, press **<Enter>** to move the cursor to the **Color** field for the next position. Repeat the procedure in the previous section for all other positions that will be used in the signal tower. Any positions that will not be used should be left blank and the **Enable** field left at **No**.

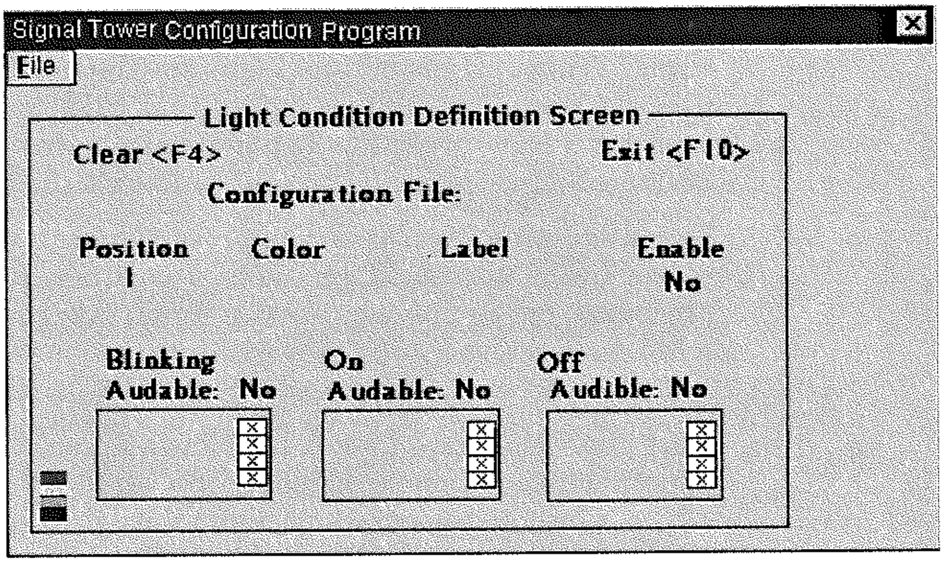
Once the Colors and Labels have been entered and the appropriate positions enabled (**Enable** set to **Yes**), the **Conditions <F6>** option must now be selected, in order to specify the system events or conditions, which will trigger each light or alarm defined in the list. For instructions on specifying events, refer to the following sections.

H.4.2 Light Condition Definition Screen Entry

When **Conditions <F6>** is selected, the Light Condition Definition Screen is presented as shown in Figure H-4. There can be eight possible screens, one for each of the light and alarm positions. These screens allow the user to specify the conditions (or events) that will cause a specific light or alarm to operate. The screen, which is displayed, is determined by the location of the cursor in the position list of the Signal Tower Definition Screen (see Figure H-3), when the **Conditions <F6>** option is selected.

Typically, the user will specify the color and label for position 1, then select **Conditions <F6>** to display the Light Condition Definition Screen for this position (see Figure H-4). After entering the appropriate information, the user will then return to the Signal Tower Definition Screen and duplicate this procedure for position 2. Thereafter, this process will be repeated until all enabled light and/or alarm positions have been defined.

Note that the **Position, Color, Label,** *and* **Enable** *fields are not available for change in this screen. These fields are copied from the Signal Tower Definition Screen.*



Configuration File:

Position 1

Color

Label

Enable No

Blinking Audable: No

On Audable: No

Off Audible: No

Figure H-4 – Light Condition Definition Screen Initialized for Position 1

For positions 1 through 8, the conditions that will turn a light to Blinking On or Off are specified in the appropriate columns shown across the bottom of this screen (see Figure H-4). A **Blinking** condition has precedence over an **On** condition and an **On** condition has precedence over an **Off** condition.

Any time that an event associated with a condition occurs, all conditions associated with that light are evaluated. If any **Blinking** conditions are satisfied, the light will blink, even if some **On** condition or **Off** condition may also be satisfied; these conditions are therefore ignored.

The evaluation of the conditions associated with a light is triggered by an event which is linked to a condition. For alarm positions, the event conditions will only turn the tones On or Off; also, **Audible** (described below) is not used for these positions.

The three columns shown here define the light conditions as follows:

The three columns shown here define the light conditions, as follows:

Blinking

This column contains all user-specified conditions that will cause the light to change from its current state, which may be either off or on, to blinking.

Blinking may also be referred to as ***flashing)***

On

This column contains all user-specified conditions that will cause the light to turn on (from an off condition only).

Off

This column contains all user-specified conditions that will cause the light to turn off.

Note that for any condition specified in the **Blinking** *or* **On** *column, there* ***MUST*** *be a corresponding condition in the* **Off** *column, which will turn the light off.*

Audible

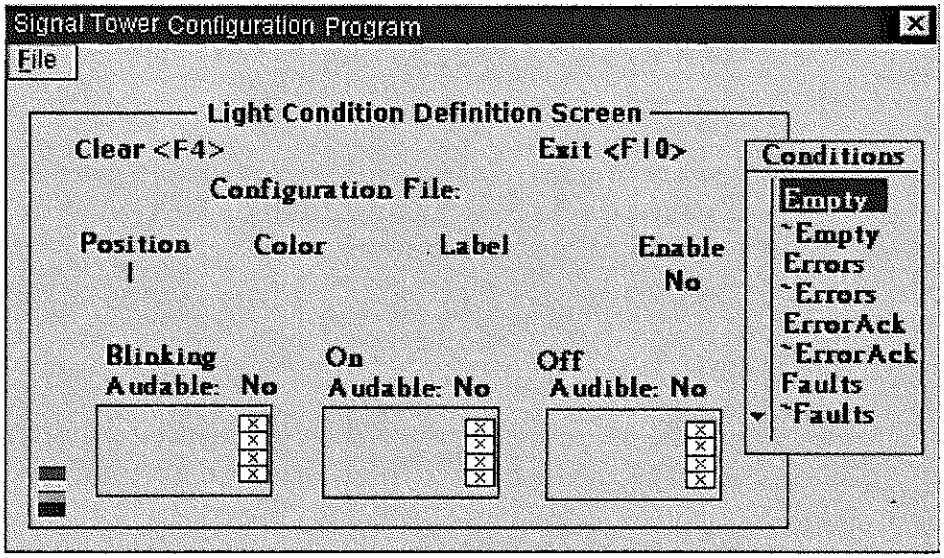
The occurrence of any of the conditions in this column, which are set to **Yes**, will cause an audible alarm. This field is toggled to **Yes** or **No** by selecting the field and pressing the **spacebar**.

Note that this audible tone refers to the WaferMark system alarm tone, ***NOT*** *to any of the tones in the signal tower. To activate these alarm tones only, the* **Audible** *field must be set to* **No.**

To Add a Condition to a Column

Use the arrow and **Tab** key to highlight the required column, then press the Gray + key (on the far right of the keyboard). This will open a window near the bottom right-hand corner of the screen showing a complete list of available conditions.

This window is shown in Figure H-5.



Light Condition Definition Screen

Configuration File:

Position: 1

Color:

Label:

Enable: No

Blinking Audable: No

On Audable: No

Off Audible: No

Figure H-5 – Definition Screen shown with Gray ' + ' Key Selected

Now, press the **Tab** key to move the cursor to the window, then position the cursor to the required condition using the up and down arrow keys; the condition will now be highlighted. Press **<Enter>**.

This will add the selected condition in the appropriate column. Delete this condition from the window list and close the window.

Note that once a condition has been assigned to a column that condition is then no longer available for selection from condition list. A particular condition can only be assigned once.

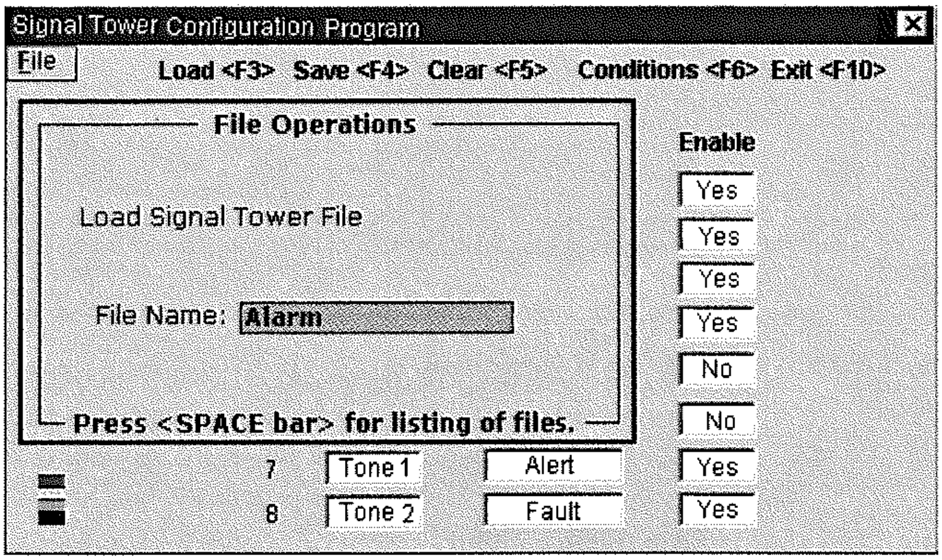
To DELETE a condition in a column, use the arrow and **Tab** key to highlight the required column; select the condition in the list, then press the Gray "-" key.

The current condition list and associated events usually include a condition and the ***NOT*** case of the condition to simplify activating and de-activating the light. A current list of condition names is provided at the end of this appendix.

When all conditional data for a particular signal tower light has been entered, select **Exit** or press **Exit <F10>** to return to the Signal Tower Definition Screen.

Repeat this process for the remaining lights until all lights that will be employed in the signal tower have been defined.

When the conditional data has been defined for all lights, return to the Signal Tower Definition Screen, then select **File Save** or press **Save <F4>**to save the configuration in a file. The program will respond by displaying the File Operations Window as shown in Figure H-6.



File Operations

Load Signal Tower File

File Name: Alarm

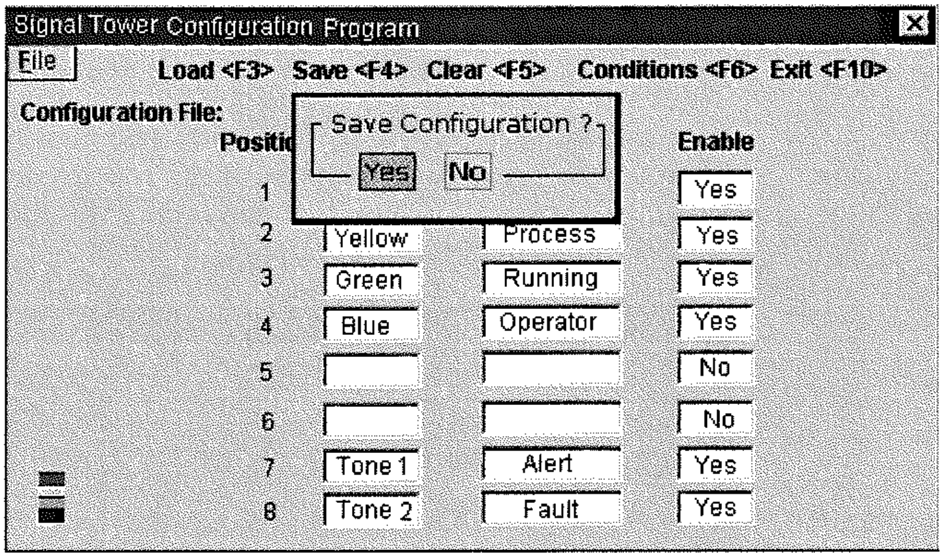
Press <SPACE bar> for listing of files.

			Yes
			Yes
			Yes
			Yes
			No
			No
7	Tone 1	Alert	Yes
8	Tone 2	Fault	Yes

Figure H-6 – File Operations Window — Save Option Selected. File Operations Window — Save Option Selected

Enter a filename and press **<Enter>**; the data will be saved in the named configuration file with the filename extension TOW.

If you intend to abandon any changes you have entered, select **Exit** or press **Exit <F10>**. Before discarding the data, the program will display a prompt requesting confirmation whether or not you wish to save the configuration. This prompt message is shown in Figure H-7.



Configuration File:

Positi			Enable
1			Yes
2	Yellow	Process	Yes
3	Green	Running	Yes
4	Blue	Operator	Yes
5			No
6			No
7	Tone 1	Alert	Yes
8	Tone 2	Fault	Yes

Figure H-7 – Exit Selected — Prompt Message to Save the Configuration

If you select **Yes**, the program will redisplay the Main Program Screen and open the File Operations dialog as shown in Figure H-6. Enter a filename and press **<Enter>**; the data will be saved in the named configuration file with the filename extension TOW.

If you select **No**, all information that you previously entered in the configuration screens will be abandoned and the program will redisplay the Main Program Screen.

H.4.3 Existing File Command

The **File > Existing** command enables the user to select and load an existing configuration file for editing or use as a template for a new configuration file. When selected, the File Operations window is opened on the screen and the operator is prompted for a filename as shown in Figure H-8.

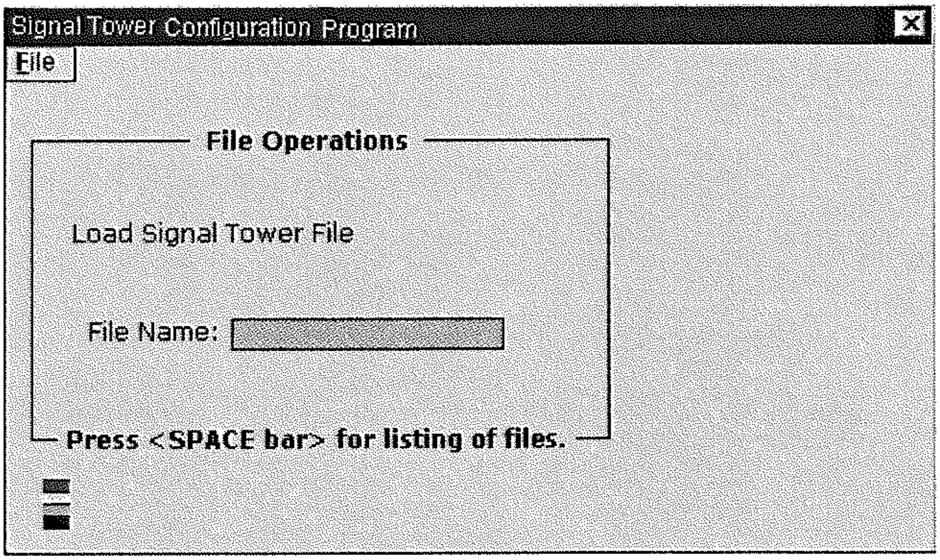
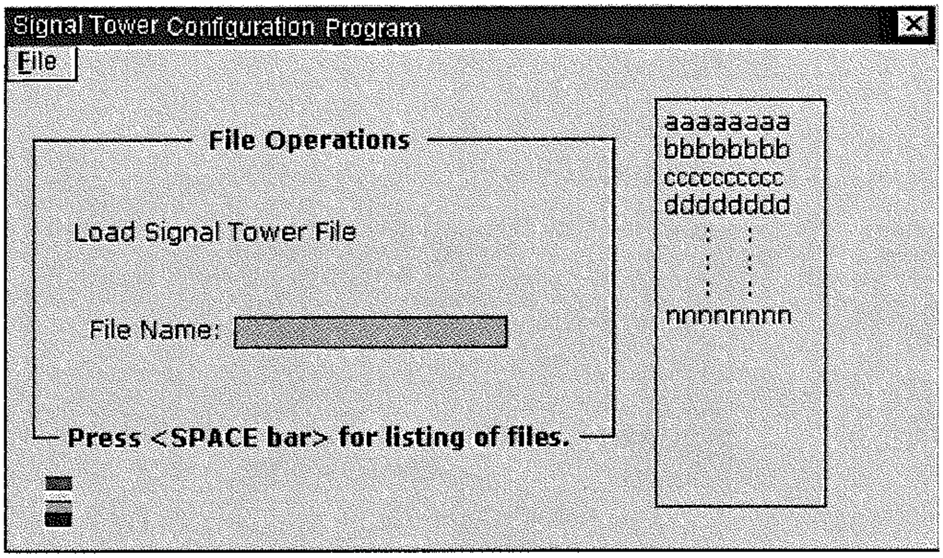


Figure H-8 – File Operations Window — Filename Direct Entry

To select a configuration file, type the filename and press **<Enter>**. If the entered filename is invalid or unknown, the following message will be displayed in the **Message Area** of the Main menu:

```
nnnnnnnn.tow:  No such file or directory
```

If the filename of a particular configuration file is not known, press the **<spacebar>** to display a list of all available configuration files and directories as shown in Figure H-9.



Load Signal Tower File

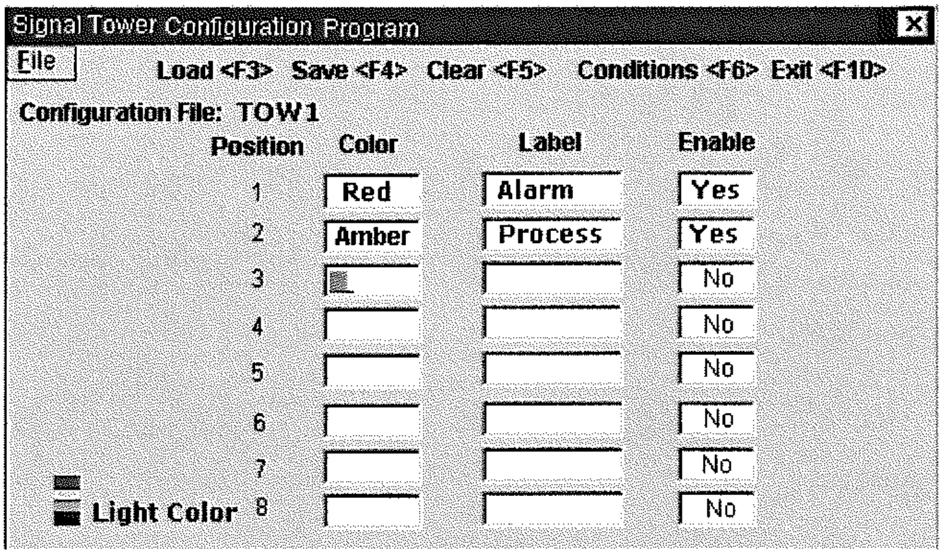
File Name:

Press <SPACE bar> for listing of files.

Figure H-9 – File Operations Window —Directory and File Display

Select a file, using the cursor keys, to highlight the desired filename. Press **<Enter>** to transfer the selection to the File Name line, then press **<Enter>** again to load the file. When the file has been loaded, the data is available for modification or use as a template to create a new configuration file.

When loaded, the Signal Tower Definition Screen appears. Figure H-10 shows an example of this screen with positions 1 and 2 specified.

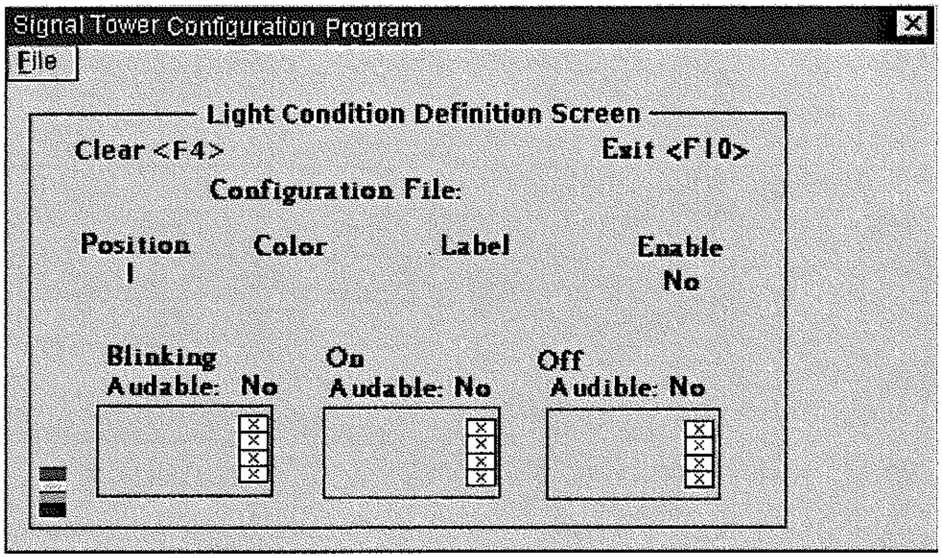


Configuration File: TOW1

Position	Color	Label	Enable
1	Red	Alarm	Yes
2	Amber	Process	Yes
3			No
4			No
5			No
6			No
7			No
8			No

Figure H-10 – Signal Tower Definition Screen —Example of Entries for Positions 1 and 2

Figure H-11 shows a typical example of the Light Condition Definition Screen with conditions specified for positions 1 and 2. Entering configuration data in these fields and the function of the title bar options is described in Section H.4.2 (Light Condition Definition Screen Entry).



Light Condition Definition Screen

Clear <F4>

Exit <F10>

Configuration File:

Position	Color	Label	Enable
1			No

Blinking
Audable: No

On
Audable: No

Off
Audible: No

Figure H-11 – Light Condition Definition Screen - Typical Entries for Light Position 1

H.4.4 Delete File Command

The **File > Delete** command enables the user to delete any current configuration file. All valid files are maintained in the **\MASTER** directory with the file extension TOW.

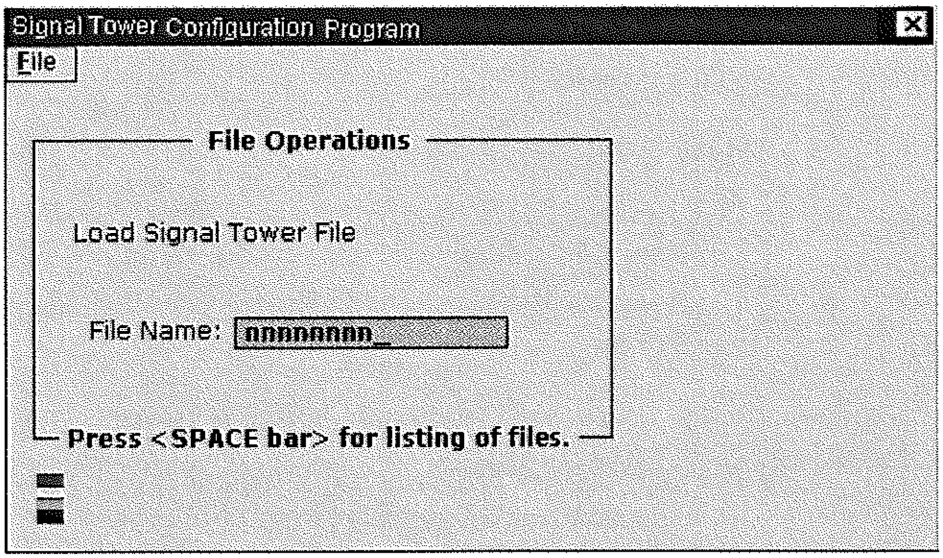
When the **Delete** command is selected, this opens the File Operations window on the screen and prompts the operator for a filename as shown in Figure H-12.

NOTE: If the keyword ACCESS_PST_DELETE has been entered in the **FACTORY.SET** *file, access to this command is restricted to users with the security level specified by this keyword. If the current operator is at a lower level, a message will prompt the user to enter a higher security level when this command is selected.*

To delete a configuration file, type the name of the file on the entry line. If the filename is not known, press the **<spacebar>** to display a list of all available configuration files and sub-directories. Select the filename from the directory list and press <Enter> to transfer the name to the entry line.

Note that the filename extension is never entered in the filename field; it is always assumed to be TOW.

Press **<Enter>** again. The program will now display a confirmation prompt as shown in Figure H-13.



Signal Tower Configuration Program

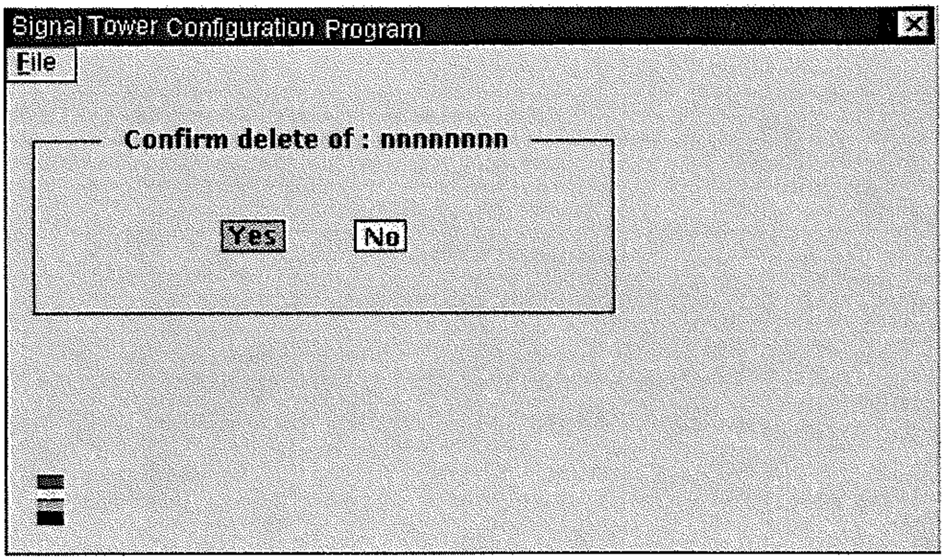
File Operations

Load Signal Tower File

File Name: nnnnnnnn_

Press <SPACE bar> for listing of files.

Figure H-12 – File Operations Window — Delete Configuration File Entry



Signal Tower Configuration Program

Confirm delete of : nnnnnnnn

Figure H-13 – Delete File Confirmation Prompt

If the entered filename is invalid or unknown, the following message will be displayed in the Message Area of the Main menu:

```
nnnnnnnn.tow:  no such file or directory
```

To delete the configuration file, select **Yes**; this will immediately delete the file and returns the user to the Main Program Screen. To abandon the delete operation, press the right arrow (→) key and select **No**.

H.4.5 Exit File Command

The Exit command terminates the Signal Tower Configuration program and returns the user to the Windows NT screen.

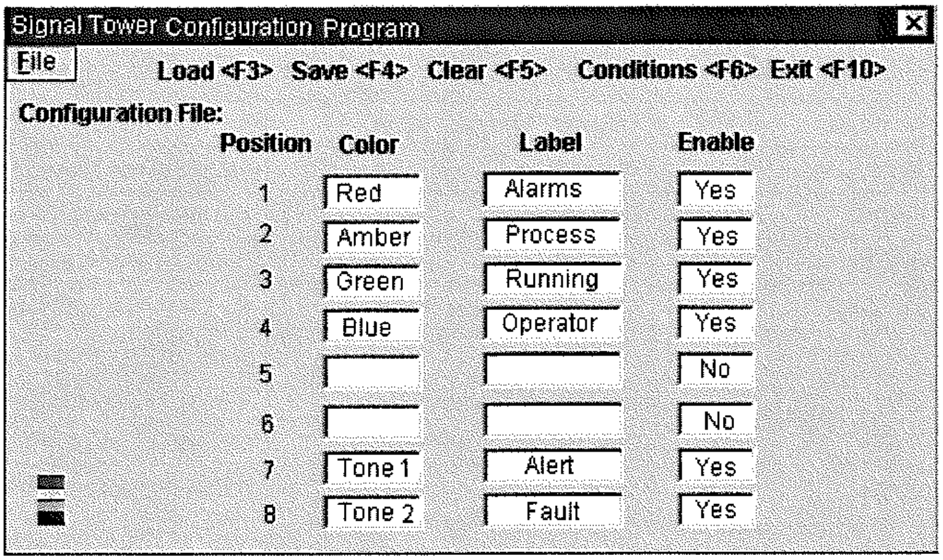
To terminate the program and return to Windows, Click on the **Exit** bar (or type `x`).

H.4.6 Custom Programmable Signal Tower

For this custom programmable signal tower, positions 7 and 8 have been provided for programmable tones. The file **custom01.tow** describes the new configuration including the tones. The Custom Programmable Signal Tower implements the following conditions:

Light	Description
Red Flashing-	Danger or Safety Alarm requiring immediate operator attention with high tone annunciator.
Amber-	Equipment not ready or warming up as in power on condition.
Amber Flashing-	Process alarm requiring operator attention with mid tone annunciator.
Blue-	Operator Stop or manual mode
Green-	Machine is running in auto mode.
Green Flashing-	Standby or waiting; ready to process.

When loaded, the Custom Programmable Signal Tower screen appears. Figure H-14 shows an example of this screen.



Configuration File:

Position	Color	Label	Enable
1	Red	Alarms	Yes
2	Amber	Process	Yes
3	Green	Running	Yes
4	Blue	Operator	Yes
5			No
6			No
7	Tone 1	Alert	Yes
8	Tone 2	Fault	Yes

Figure H-14 – Custom Programmable Signal Tower Screen

H.5 Condition and Event List

The condition list usually includes both a condition and a NOT(~) condition for each event to facilitate activating and de-activating the various light conditions. In general, conditions should be used in pairs. For example, if RUNNING turns On the GREEN light, then ~RUNNING should be used to turn it Off. There is a natural symmetry in the triggering events associated with the conditions RUNNING and ~RUNNING, which will behave in a logical fashion. The full list of conditions and events is provided in Table H-2.

Table H-2 – Condition and Event List

Condition Name	Event Stimulus	Description
Empty	Material Removed Port 1 Material Removed Port 2 Material Removed Port 3	If any cassette port is empty.
~Empty	Material Received Port 1 Material Received Port 2 Material Received Port 3	No cassette port is empty.No cassette port is empty.
Errors	Alarm Present	An error is present.
~Errors	AllAlarms Cleared	No errors present.

Table H-2 – Condition and Event List

Condition Name	Event Stimulus	Description
Errors Ack	Operator Silenced Alarm	An acknowledged error is present.
~Errors Ack	Alarm Present	An un-acknowledged error is present.
Faults	Alarm Present	A fault is present.
~Faults	All Alarms Cleared	No faults are present.
Fault Ack	Operator Silenced Alarm	An acknowledged fault is present.
~Fault Ack	Alarm Present	An un-acknowledged fault is present.
Idle	Processing State Change	The equipment is idle.
~Idle	Processing State Change	The equipment is not idle.
Load	Load Required Port 1 Load Required Port 2 Load Required Port 3	A cassette port requires loading
~Load	Operator Load 1 Operator Load 2 Operator Load 3	No cassette port requires loading.
OpStop	Operator QUIT Operator STOP Operator RESET Operator ABORT	The equipment was stopped by the operator.
~OpStop	Processing State Change	The equipment has resumed running.
Running	Processing State Change	The equipment is running.
~Running	Processing State Change	The equipment is not running.
Unload	Cassette Complete 1 Cassette Complete 2 Cassette Complete 3	A cassette unload is required.
~Unload	Materia lRemoved Port 1 Material Removed Port 2 Material Removed Port 3	No cassette unload is required.
Communicating	GEM Communicating	Communicating with Host.
~Communicating .	GEM Not Communicating	Not communicating
Disabled .	GEM Disabled	Communication disabled
Enabled	GEM Enabled	Communication enabled.
On-Line	GEM OnLine	Communication on-line.
Off-Line	GEM OffLine Equipment OFF_LINE	Communication off-line.
Local	GEM OnLine Control State LOCAL	Communicating locally.
Remote	GEM OnLine Control State REMOTE	Communicating remotely.

Table H-2 – Condition and Event List

Condition Name	Event Stimulus	Description
Terminal	GEM Terminal	Terminal request for operator.
Terminal Ack	Terminal Message Ack	Terminal request acknowledge.
Full Auto	Custom Mode Change	Host in Full-Auto.
Semi Auto	Custom Mode Change	Host in Semi-Auto.
Disconnected	Custom Mode Change	Host disconnected.

Appendix I Units and Dimensions

The following tables show units and dimensions used in this manual.

I.1 SI Unit Multiples

Symbol	Prefix	Multiplier
M	mega	1 000 000 = 10^6
k	kilo	1 000 = 10^3
h	hecto	100 = 10^2
da	deca	10 = 10^1
d	deci	0.1 = 10^{-1}
c	centi	0.01 = 10^{-2}
m	milli	0.001 = 10^{-3}
µ	micro	0.000 001 = 10^{-6}
n	nano	0.000 000 001 = 10^{-9}
p	pico	0.000 000 000 001 = 10^{-12}

I.2 Standard Dimensional Abbreviations

Unit	Description
A	ampere
°C	degree Celsius
cd	candela
dB	decibel
eV	electron-volt
F	farad
°F	degree Fahrenheit
ft	foot
g	gramme (gram)
gal	gallon
H	henry
h	hour
Hz	hertz

Unit	Description
in	inch
J	joule
°K	degree Kelvin
l	litre (liter)
lb	pound
lbf	pound force
m	metre (meter)
min	minute
N	newton
Ω	ohm
Pa	pascal
pi	pica
psi	pounds per square inch
pt	point
rad	radian
S	siemens
s	second
t	tonne
V (VAC, VDC)	volt (volt alternating current, volt direct current)
VA	volt-ampere
W	watt

Appendix J Conversion Factors

SI metric units and Imperial units are used throughout this manual. The following approximate conversion factors may prove useful.

SI Metric Unit	Conversion Factor	Imperial Unit
	Length	
meter	39.370	inch
millimeter	0.039 370	inch
	Area	
square meter	1 550	square inch
square millimeter	1.55×10^{-3}	square inch
	Volume	
liter	0.219 969	gallon (UK)
liter	0.264 172	gallon (US)
	Mass	
kilogram	2.204 623	pounds
	Pressure	
113.25 kilopascal	1 atmosphere	14.695 916 pounds force per square inch
	Temperature	
0 degrees Celsius	Freezing point of water	32 degrees Fahrenheit
100 degrees Celsius	Boiling point of water	212 degrees Fahrenheit

Appendix K Glossary

This appendix is a collection of common abbreviations, acronyms, and definitions used in the laser, related environmental, and semiconductor industry.

Word	Definition
aligner	A tool used to locate the center and balance a wafer by spinning and re-aligning position. Also called a prealigner.
Bonded Wafer	A composite dielectrically isolated substrate formed by fusing together (at high temperature) the oxidized surfaces of two individual silicon substrates.
cal	calibration
Cass	A cassette or cassette is a case devise for holding, storing, transporting, handling, and protecting multiple silicon wafers before and after processing steps.
clean room	An enclosed area in which the temperature, humidity, and particulate matter size are precisely controlled within specified units. Clean room classification defines the maximum number of particles of 0.3 micron size or larger that may exist in one cubic foot of space anywhere in the designated area. ie.,Class 1 clean room only one particle of any kind may exist in one cubic foot of space. Newer clean rooms are typically Class 1-10, and are needed for manufacturing ICs with feature size close to 1 micron.
CIDRW	Carrier ID(Identification) Reader Writer
<CR>	Carriage return, a control character used in print codes to command the head to go to the begining of the line. ASCII Hex code: 13, Octal Code: 0D
dialog box	A box that provides an operator with interactive and integrated exchange (handshaking) with the operating system.
FACTORY.SET	FACTORY.SET file or Maintenance Startup file key words assegn values in system software program parameters for operation and options.
FIFO	First in first out defines a stack or list the jobs are processed in the order in which it is received.
gal	galvo
gem	GEM is a control mode that complies with SEMI E5–92
HSMS	High Speed Message Service
idm	Identification matrix definition of font file.
intlk	Interlock
ldg	Loading
KWFIO	TBD
<LF>	Line feed, a control character used in print codes to move head down one line below. ASCII Hex code: 12, Octal Code: 0C
list box	A button that opens a drop-down list of selectable options for display in the box.

Word	Definition
Location	Indicates the X and Y position parameters for the start of the mark. If Location is selected (highlighted), the Location Parameter window is added to the screen. Within this window are a number of parameters that can be adjusted to change the position or final appearance of the current line of text. These parameters are used during the actual marking process, in conjunction with the Parameter Set general variables that are listed in the Marker Parameter table.
LPC	Laser Power Controller (lamp-based system only)
LVS	Label Vision Systems
MSTRCOM	Master Commications.
menu	A displayed list of options from which the operator chooses to perform an action.
NMI	Non Maskable Interrupt
Recipe	The marking instruction for a job
SECS	Sequential event control system, a code protocol for controlling and reporting status, fault and actions and compatible with internet use.
SMIF	Standard Mechanical InterFace– Usually the interface for a device for loading and unloading the marking system.
SW	Software — computer programs that drive the hardware functions in a system.
Wafer	A thin slice, typically 10-30 mils thick, sawed from a cylindrical ingot (boule) of bulk semiconductor material (usually silicon), four to eight inches in diameter. Arrays of ICs or discrete devices are fabricated in the wafers during the manufacturing process.
Window	A portion of a display screen that contains a message or information for display.
WIP	Wafer in progress or work in progress sensors at presentation stations.

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