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KULICKE & SOFFA INDUSTRIES INC
Willow Grove, PA 19090

PRELIMINARY

Model 9388 LaserPro
Automatic Ball Attach System

Volume 1: Operations
Version 9388-01-01 Software

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99388-0000-001-00

November, 2000

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Model 9388 Laser*Pro* Safety Information

S.1 Symbols and Messages

The following symbols and messages are used in this manual:



WARNING:

Warnings advise the reader that there is a possibility of ***personal injury*** or ***death***, if sufficient care is not taken when performing a specific procedure.

WARNINGs precede the procedure to which they apply. All **WARNING**s are printed in **BOLD BLOCK CAPITALS**.



CAUTION:

Cautions advise the reader that if sufficient care is not taken when performing a specific procedure, there is a possibility of damage to the following:

- Product
- System
- Facility
- Process program
- Machine Dependent Parameters

CAUTIONs precede the procedure to which they apply. All **CAUTION**s are printed in **Bold upper/lower case block letters**.



NOTE:

Notes provide the reader with additional helpful information. This information may be:

- Helpful, but not essential, information
- A reference to another paragraph or volume.

This information is not as critical as that in warnings and cautions. **NOTE**s usually precede, but may also follow, the procedure to which they apply. Notes are printed upper/lower case in block letters.

S.2 Equipment-Specific Warnings



WARNING: *CAUTION* – USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.



WARNING: *CLASS 1 LASER SYSTEM!* THIS MACHINE IS CONSIDERED A CLASS 1 LASER SYSTEM WITH AN EMBEDDED CLASS 4 LASER. REFER TO THE *LASER SAFETY INFORMATION* INCLUDED LATER IN THIS SECTION BEFORE ATTEMPTING TO OPERATE, MAINTAIN, OR SERVICE THIS EQUIPMENT. COVERS ON CERTAIN ASSEMBLIES ARE LABELED "INVISIBLE LASER RADIATION WHEN OPEN. AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION". DO NOT REMOVE THESE COVERS.



WARNING: *ELECTROMAGNETIC FIELDS!* SERVO MOTORS USED TO POSITION THE BOND HEAD AND OPTICS GENERATE STRONG MAGNETIC FIELDS. HEART STIMULATION DEVICES (E.G. PACEMAKERS) MAY BE ADVERSELY AFFECTED DURING BOND HEAD POSITIONING. THEREFORE, PERSONS USING SUCH DEVICES SHOULD NOT BE NEAR THE EQUIPMENT WHILE IT IS IN OPERATION.

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S.3 General Precautions

The following general safety precautions should be observed whenever operating, maintaining, or servicing this equipment:

- Components of the workholder are ***very hot***! Do not allow fingers, or any material with a low melting point to contact heated areas.
- Observe all ***WARNINGS*** and ***CAUTIONS*** noted in the texts of the technical publications for the ball attach system.
- Always disable all motors before putting hands near the ball placement head, XY table, MHS and other powered systems.
- Operate the ball attach system with covers installed and doors closed at all times.
- Disconnect electrical service to the ball attach system before removing the rear covers or opening the cardrack door, unless machine power is required to perform a specific maintenance task.
- Standard precautions related to live electrical circuits must be taken at all times when adjusting or servicing the equipment.
- Never rest tools or materials on the MHS or other parts of the ball attach system while servicing.
- Observe the manufacturer's recommended safety precautions when handling and using chemical substances.
- Solvents and aerosols, if used, must be compatible with the operating environment for the ball attach system and specific process being done.
- Make sure all motors are disabled when connecting or disconnecting a printer to the parallel printer port on the machine.
- Read the laser safety information in paragraph S.5 before attempting to operate, maintain, or service the machine.

S.4 Servicing Electrical Equipment



CAUTION: Before applying AC power to the machine, read through the items outlined in the safety check list below.

Read through the *Safety Supplement* supplied with the bonder. ☐ ✓

Read through Item *S.4.1 Types of Electrical Hazards* below. ☐ ✓

Read through *S.4.2 Verifying Power Supply Configuration* below. ☐ ✓

Read through *S.4.3 Lockout / Tagout Procedure* below. ☐ ✓

S.4.1. Types of Electrical Hazards

At times the operator or maintenance technician may be required to access certain areas of the machine in order to perform setup procedures, calibrations or regular maintenance routines. If the work to be performed in these areas is near exposed energized circuits; the steps to perform the work, as outlined in the 9388 Operation, Maintenance or MHS manuals, will define the type of electrical hazard.

The types of electrical hazards are:

- *Type 1:* Equipment is fully de-energized (electrically cold)
- *Type 2:* Equipment is energized. Live circuits are covered or insulated.
- *Type 3:* Equipment is energized. Live circuits are exposed and accidental contact is possible. Potential exposures are less than 30 volts RMS (42.2 volts peak)

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- *Type 4:* Equipment is energized. Live circuits are exposed and accidental contact is possible. Potential exposures are greater than 30 volts RMS (42.2 volts peak) or radio frequency is present.
- *Type 5:* Equipment is energized. Measurements and/or adjustments require physical entry into the equipment or equipment configuration does not allow the use of clamp-on probes.

NOTE: Work in electrical hazard types 3 through 5 are brought to the readers attention in the 9388 Operation, Maintenance and MHS manuals.

S.4.2 Verifying Power Supply Configuration

CAUTION: Power supply configuration must be checked before power is applied to the machine. If not correctly configured, damage to machine electrical equipment may result.

Power supply configuration must be verified before turning on machine power. If not correctly configured, machine equipment may be damaged when power is applied. Refer to Section 2 of *Model 9388 Volume 2: Maintenance* for the configuration procedure.

S.4.3 Lockout/Tagout Procedure

K&S strongly recommends that the user provide a power connector locking device. When removing power from the machine, implement the user-supplied locking device on the power cable to prevent unintentional or accidental restoration of power to the machine during servicing. The attachment of a tagout device on the lockout device is also recommended. This provides a prominent warning to all personnel that the machine may not be operated until the tagout device and the lockout device are removed. Refer to OSHA standard 29 CFR 1910.147 for detailed information on the control of hazardous energy using lockout/tagout procedures.

S.5 Laser Safety Information

WARNING: ***CAUTION*** **– USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.**

S.5.1 General Information

S.5.1.1 Introduction

The Model 9388 Laser*Pro* uses a laser to reflow and attach solder balls after they are deposited on the work surface. The laser beam is directed from the laser unit via an optical fiber down through the capillary that places the solder balls. After a ball is placed on the work, the laser fires and reflows the solder, which attaches the solder ball.

The laser module consists of eight (8) diode lasers configured to deliver infrared energy to the solder ball head capillary via an optical fiber, a power supply, a laser driver, cooling fans, and an enclosure. The laser module is mounted with six M3 screws at the rear of the upper console. A fixed optical fiber extends approximately one meter from the laser module enclosure. The laser module delivers up to 40 Watts of photonic energy at 915 nanometers wavelength in pulses of up to 100 milliseconds duration. One control cable (from a controller circuit board in the lower console card rack) enables the laser and sets the power and duration of each pulse. The laser module has no internal adjustments, and has no components that can be replaced or altered in any way in the field.

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Maximum power output of the laser module is sufficient to cause serious damage to skin or eyes from exposure to the direct or reflected laser beam. The machine has, therefore, been designed with covers that shield the user from exposure to laser light and safety interlocks that prevent laser operation whenever a cover or door is opened. All normal installation, operation, maintenance, and service procedures can be performed with shielding covers on or the laser system disabled.

The laser module itself is a field-replaceable unit (FRU) which is serviced only at the K&S factory. *There are no user-serviceable parts inside the module.*

This section provides safety information for the 8200 LaserPro laser system. The following topics are covered:

- Laser system CDRH and IEC classification (refer to paragraph S.5.1.2)
- Laser system specifications (refer to paragraph S.5.1.3)
- General laser safety precautions for users (refer to paragraph S.5.1.4)
- Laser system controls (refer to paragraph S.5.2)
- Installation, Operation, Maintenance, and Service procedures in which exposure to hazardous laser radiation levels is possible (refer to paragraphs S.5.3, S.5.4, and S.5.5)
- Laser system preventive maintenance requirements and maintenance restrictions (refer to paragraphs S.5.6 and S.5.7)
- Location and description of laser safety warning labels (refer to paragraph S.5.8)
- Descriptions of laser safety features of the LaserPro ball attach system (refer to paragraph S.5.9)

S.5.1.2 Classification

The Model 9388 LaserPro is classified as a Class 1 laser system with an embedded Class 4 laser. It adheres to both CDRH and IEC regulations.

"Class 1" is defined as a low power, low risk laser or one with sufficient controls to prevent exposure from being hazardous under all circumstances. The class 1 designation can be applied to a laser system with an embedded laser. The class 1 designation does not apply if interlocks on the embedded laser are removed.

"Class 4" is defined as a high power, high risk laser with beam powerful enough to cause damage to eyes or skin from exposure to a direct or reflected beam, and to cause combustion of flammable material.

S.5.1.3 Laser System Specifications

- Output Wavelength

  Laser System: 915 nanometers (nm)

  Embedded Laser Diode: 915 nm

- Maximum Output Power

  Laser System: 40 Watts, continuous. Programmable by user from 0% to 100% in 1% increments, per process requirements.

  Embedded Laser Diode: 8 Watts, continuous (per diode)

- Pulse Duration

  0 to 100 milliseconds (msec). Programmable by user in 0.1 msec increments, per process requirements.

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S.5.1.4 General Laser Safety Precautions

Always observe the following safety precautions when working with the Model 9388.

WARNING: UNDER NO CIRCUMSTANCE SHALL ATTEMPTS BE MADE TO BYPASS OR OTHERWISE DEFEAT THE INCORPORATED LASER SAFETY INTERLOCKS. DOING SO MAY ALLOW EXPOSURE TO HAZARDOUS RADIATION.

WARNING: DO NOT MODIFY COVERS OR DOORS ON THE WORKHOLDER, MAGAZINE HANDLER, OR UPPER CONSOLE . DO NOT OPERATE THE MACHINE IF ANY COVER IS DAMAGED. DOING SO MAY ALLOW EXPOSURE TO HAZARDOUS RADIATION.

WARNING: DO NOT ATTEMPT TO OPEN OR REPAIR THE LASER UNIT. DO NOT ATTEMPT TO MODIFY THE LASER UNIT. DOING SO MAY ALLOW EXPOSURE TO HAZARDOUS RADIATION. THERE ARE NO USER-SERVICEABLE PARTS INSIDE THE LASER UNIT.

WARNING: ALWAYS SHUT MACHINE POWER OFF BEFORE REMOVING OR INSTALLING THE LASER UNIT. FAILURE TO DO SO MAY EXPOSE SERVICE PERSONNEL TO HAZARDOUS RADIATION AND ELECTRICAL SHOCK HAZARDS.

WARNING: MAKE SURE ALL COVERS AND DOORS ARE CLOSED BEFORE ATTEMPTING TO OPERATE THE MACHINE.

WARNING: NEVER ATTEMPT TO OPERATE THE MACHINE WITH THE LASER OPTICAL FIBER DISMOUNTED FROM THE SOLDER BALL HEAD. DOING SO MAY ALLOW EXPOSURE TO HAZARDOUS RADIATION.

S.5.2 Laser System Controls

The laser system is controlled by providing 110 VAC to the laser power supply, and by the *Enable* control line, TTL logic levels, and the *Laser Power* control line (0 to 10 VDC) from the 9388 control system.

No other means to control the laser system exist within the machine. There are no operator controls that allow the user to independently operate the laser system.

S.5.3 Machine Installation

There are no machine installation procedures that will expose the installer or others to hazardous laser radiation.

S.5.4 Operation

There are no operating procedures that will expose the user or others to hazardous laser radiation. Any procedure that requires entry into the MHS (magazine handlers, workholder) or solder reflow area (loading material, replacing capillary, clearing jams, etc.) will activate an interlock and disable the laser by interrupting power to the laser module.

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Never attempt to operate the machine with doors open or covers removed.

For more information about how the laser safety interlocks operate, refer to paragraph S.5.9.2.

S.5.5 Maintenance and Service

There are no normal maintenance procedures that will expose the user or others to hazardous laser radiation. Any procedure that requires entry to the MHS or solder reflow area and that must be done with machine power on will activate an interlock and disable the laser by interrupting power to the laser module. For more information about how the laser safety interlocks operate, refer to paragraph S.5.9.2.

As a general precaution, always remove electrical power from the machine whenever:

- Removing or installing the laser unit.
- Removing or installing the solder head assembly.
- Performing any other service in the area above the workholder or XY table.

There are no other service procedures that will expose the service technician or others to hazardous laser radiation.

S.5.6 Required Maintenance Schedule

The laser unit requires no scheduled maintenance.

S.5.7 Maintenance and Service Restrictions

The laser module contains no field-serviceable components. Do not open the laser module enclosure and attempt to repair, adjust, or modify internal components.

The laser optical fiber is permanently connected to the laser module, so it cannot be replaced without replacing the entire laser module. Do not attempt to detach the optical fiber from the laser module for any reason.

S.5.8 Laser Safety Labels

A laser safety label is affixed at two locations on the rear of the machine. Label locations are shown in Figure S-1.

The label shown in Figure S-2 warns the user that invisible radiation is present when the labeled cover is opened and to avoid skin or eye exposure to the direct or scattered radiation. The cover should never be opened since there are no user-serviceable parts behind the cover.

A copy of the label shown in Figure S-2 is affixed to the inside wall of the laser module enclosure. This label can be seen only after the rear cover of the module has been removed.

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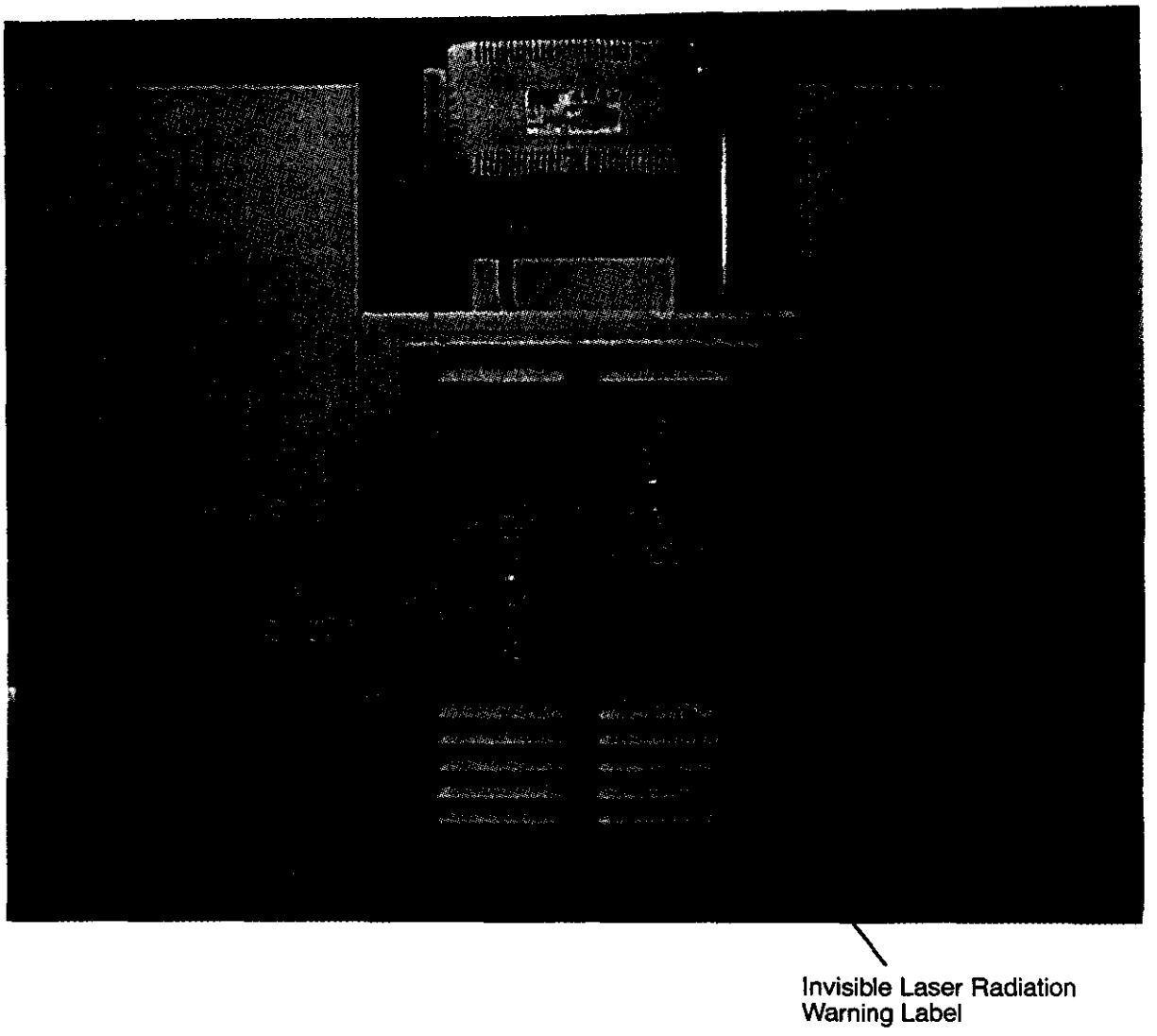


Figure S-1. Laser Safety Label Locations - Rear of 9388 Upper Console



Figure S-2. Label: INVISIBLE LASER RADIATION WHEN OPEN...

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S.5.9 Safety Equipment

S.5.9.1 Safety Equipment for Use by Maintenance Personnel

No special laser safety protective equipment is required to operate, maintain, or service the Model 9388

S.5.9.2 Laser System Interlocks

WARNING: UNDER NO CIRCUMSTANCE SHALL ATTEMPTS BE MADE TO BYPASS OR OTHERWISE DEFEAT THE INCORPORATED LASER SAFETY INTERLOCKS. DOING SO MAY ALLOW EXPOSURE TO HAZARDOUS RADIATION.

To enhance the safety of operators and maintenance personnel, the model 9388 contains a safety interlock assembly located at each of the following stations:

- Input magazine handler access door
- Output magazine handler access door
- Workholder and Bond area access door

Each interlock assembly consists of an electrical switch within the interlock circuitry that monitors the current position of the access door (open or closed). In addition, each interlock assembly contains an electrically operated solenoid that is used to latch the access door. During the execution of a process program, the solenoid is electrically de-energized causing the access door to be mechanically latched (locked) in the closed position. During operator access time (e.g., the loading of magazines) the solenoid is energized, unlatching the access door.

If, during run time, an attempt is made to force open an access door, the bonder will power down the laser by means of a relay . The laser module enable line will also switch to disable the laser. Figure S-3 is a block diagram that illustrates how the safety interlocks operate.

S.5.9.3 Other Laser Safety Features

- All doors and covers are made from a special material that is opaque at the infrared wavelength which the laser emits.
- The output end of the laser optical fiber is mounted so that it always points down toward the work surface.
- The output of the optical fiber is highly dispersive, radiating at a numerical aperture of 0.22.
- The laser unit is dynamically enabled and disabled by machine software so that it operates only to emit the necessary pulses during solder reflow operations.
- The laser unit is protected from random software faults by special enabling codes that must be received exactly for laser pulsing to take place.

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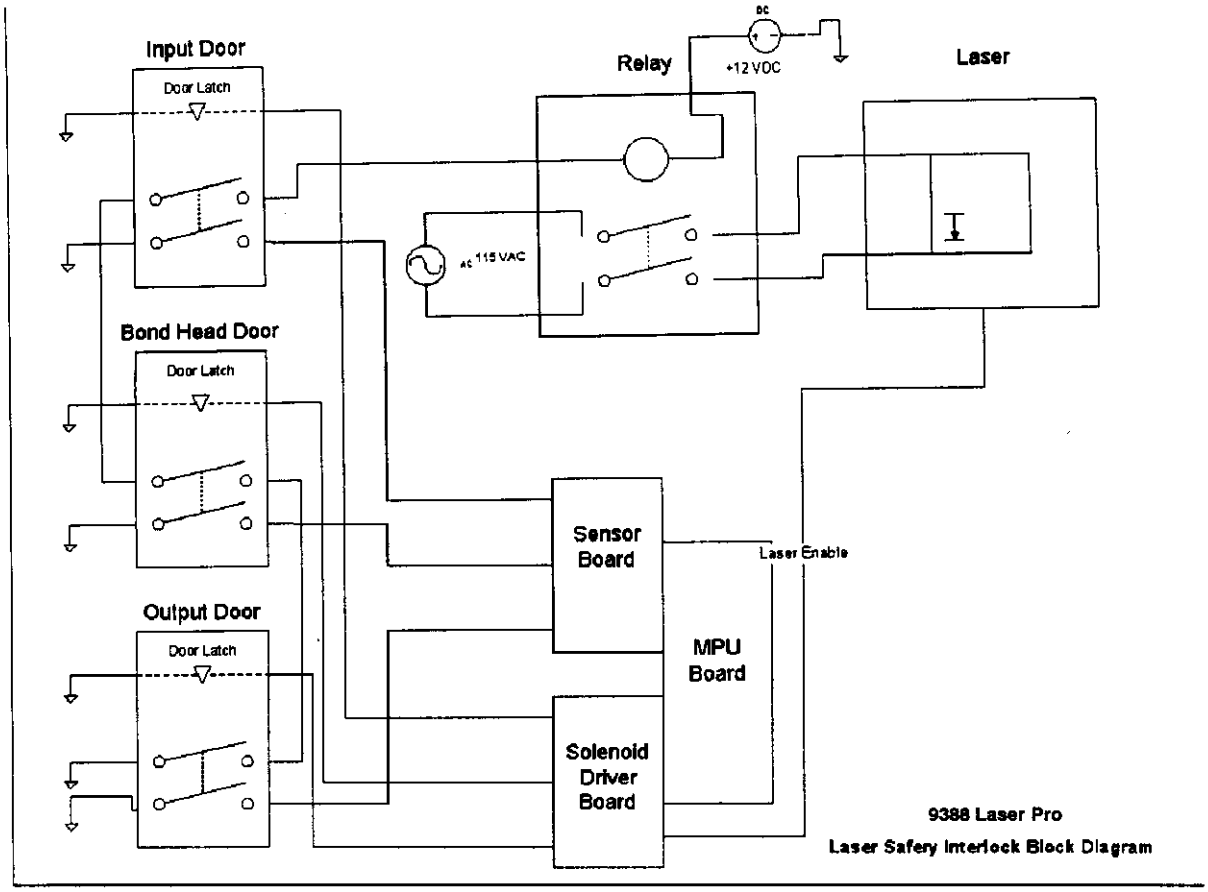


Figure S-3. Block Diagram - Laser Safety Interlocks

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I Use of This Manual

I.A General Introduction

The purpose of this manual is to provide technical information for application design on the K&S Model 9388 LaserPro Automatic Ball Attach System.

The Table of Contents should be used to quickly locate specific information within the manual.

The following manuals should be referred to if additional information is required:

- Model 8020/8028 Volume 2: Maintenance
- Model 8020/8028 Volume 3: Material Handling System (MHS)

I.B Terms and Conventions used in this manual

The following format is used in this publication:

- System modes are capitalized. Example: AUTO
- Control Panel and keyboard buttons are in brackets, capitalized and in bold. Example: **[ENTER]**
- Graphical User Interface (GUI) buttons are capitalized and in bold without brackets. Example: **PROGRAM**
- Numeric "hot key" numbers are in brackets and in bold, followed by the function name. Example: **[1] AUTO** (Mode); **[1] EDIT** (Menu Option)
- Monitor messages are in quotes. Example: "Enable eye point reteach"
- Alphabetic displays where any letter may appear are represented by a capital letter (X).
- Numeric displays where any number may appear are represented using the pound symbol (#).

The following terminology is used in this manual:

Term	Explanation
Activate	Initiating a selection by pressing **[ENTER]** or **[B1]**
Chess	Moving the XY table or bond head using the trackball or arrow keys.
Choose	Selecting a function or parameter from a list of choices. **[ENTER]** or **[B1]** is pressed to confirm and initiate the choice.
Click or Click On	The combined actions of select and activate.
Drag	Repositioning or resizing of an item on the display. This is accomplished by using the trackball and **[B1]** in a held condition during drag. Releasing **[B1]** terminates the drag function.
Index	Initiating workholder motion.
Scroll	Moving a text field in such a way as to have the data move up or down within the field. Arrow keys or sliders are used to accomplish this function.
Select	Placing the pointer on or to highlight a screen button or option.
Target	Chessing hardware such that the monitor crosshair or scan box is at a specific location or area.

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Record of Changes

Change No.	Description	Pages	Rev. Date

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Section 1 INTRODUCTION

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1 Introduction

1.1 Scope

This manual provides basic instructions for programming and operating the Model 9388 LaserPro Automatic Ball Attach System. The software level supported in this manual is 9388-01-01. Variations may exist between prior and future operating software. These variations may not be explained in this manual. See the System Administration information in this manual for the procedure to access software version on the 9388.

Information on mechanical and electrical hardware maintenance can be found in *Volume 2: Maintenance* of the Model 9388 publications set.

Information on the Material Handling System can be found in *Volume 3: Material Handling System* of the Model 9388 publications set.

Information on the Parts and Assemblies can be found in *Volume 4: Illustrated Parts Book* of the Model 9388 publication set.

1.2 General Introduction

This section provides a brief overview of the major machine subsystems, operator interfaces and video monitor displays.

The K&S Model 9388 LaserPro is designed to attach solder balls to integrated circuit (IC) devices. The machine attaches a ball by placing it on a device bond pad, then irradiating it with laser light. The light heats the ball to a temperature sufficient to reflow the solder, thereby attaching the ball to the bond pad.

The machine features an integrated Pattern Recognition System (PRS) and a Class I laser system with laser safety interlocks to protect the user from hazardous levels of laser radiation. Device carriers and their magazines are handled by an automatic material handling system (MHS) incorporated into the 9388.

1.3 Ball Attach Process Overview

1.3.1 Theory of Operation

The Model 9388 LaserPro uses a laser to reflow and attach solder balls after they are deposited on the work surface. The laser beam is directed from the laser unit via an optical fiber down through the capillary that places the solder balls. After a ball is placed on the work, the laser fires and reflows the solder, which attaches the solder ball. See Figure 1-1.

The laser module consists of eight (8) diode lasers configured to deliver infrared energy to the solder ball head capillary via an optical fiber, a power supply, a laser driver, cooling fans, and an enclosure. The laser module is mounted with six M3 screws at the rear of the upper console. A fixed optical fiber extends approximately one meter from the laser module enclosure. The laser module delivers up to [redacted] One control cable (from a controller circuit board in the lower console card rack) enables the laser and sets the power and duration of each pulse. The laser module has no internal adjustments, and has no components that can be replaced or altered in any way in the field.

Maximum power output of the laser module is sufficient to cause serious damage to skin or eyes from exposure to the direct or reflected laser beam. The machine has, therefore, been designed with covers that shield the user from exposure to laser light and safety interlocks that prevent laser operation whenever a cover or door is opened. All normal installation, operation, maintenance, and service procedures can be performed with shielding covers on or the laser system disabled.

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1.3.2 Ball Attach Cycle

Figure 1-1 illustrates the ball attach cycle. The cycle begins when the XY table moves the bond head assembly to align the microfeeder head capillary above a ball attach pad on the work. It ends after a solder ball has been attached to the pad and the microfeeder has been raised from the work, ready to be moved to the next ball attach location in the process program.

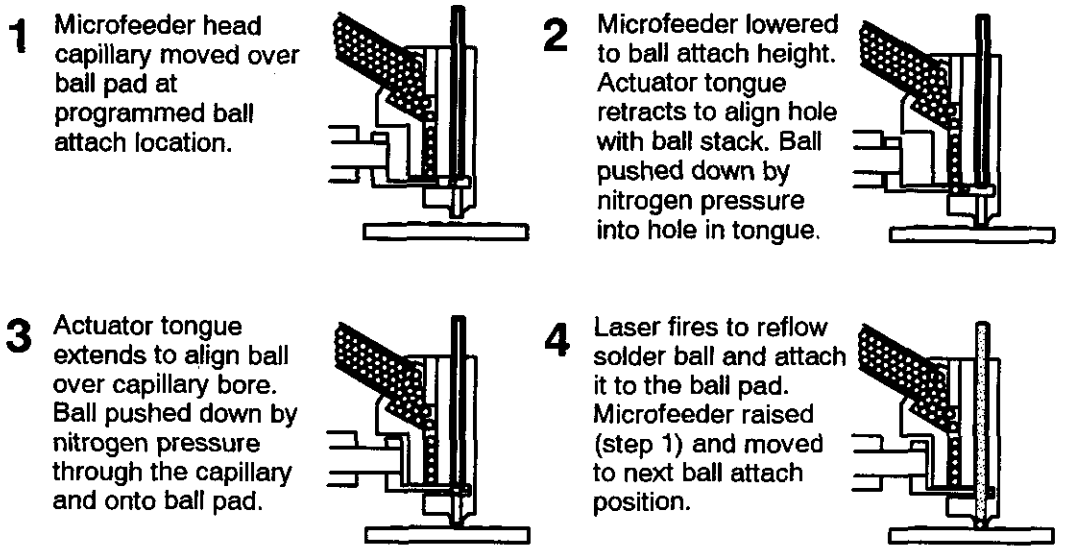


Figure 1-1 Ball Attach Cycle

1.3.3 Advantages Over Conventional Ball Attach Systems

The Laser Pro System provides excellent reliability, which will ensure long runs with no serious interruptions. There are many other advantages the Laser Pro has over conventional ball attach systems, which include the following:

- High first pass yields at fine pitch.
- Efficient space and facilities utilization.
- Low cost and fast ball size changeovers requiring no major tooling.
- Cold processes requiring only localized heating of individual pads.
- Multiple machine advantage, producing better uptime and split production runs.
- Flexible and scalable with the option of adding speed kits and ball size kits, based on production requirements.

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1.4 Machine Subsystems

1.4.1 Lower Console

The lower section of the bonder supports all other machine components. It also houses the power supply and power distribution systems; a card rack that has circuit boards for the bonder and vision system; forced air cooling system for the card rack; and two disk drive units: a floppy disk drive and hard disk drive. See Figure 1-2.

1.4.1.1 Disk Drives

The machine is supplied with a hard disk drive (identified as C:) containing all software necessary for machine operation. In addition, a 3-1/2" floppy disk drive (identified as A:) is provided to store and load process programs and load operating software. See Figure 1-2.

The machine performs an automatic initialization sequence when power is applied. It tests critical components and prepares the system to load the operating software. The operating software is loaded from the hard disk drive unless there is a disk in the floppy drive.

Data for programs and parameters are read from the source disk automatically according to instructions in the operating code. These may also be read when the operator enables a mode, routine, or function.

Similarly, the system writes data to the disk at certain prescribed points in the operating sequence, or when initiated by the operator.

1.4.2 Upper Console

1.4.2.1 XY Table

The XY table consists of two crossed sliders mounted on a large casting attached to the top of the lower console. Each slider is driven by a linear servo motor. The servo motors are responsible for "X" (left-right) and "Y" (front-back) motions. See Figure 1-2.

The ball attach head and optical system are mounted on the XY table. During operation, the two servo motors move them in X and Y to target reference points and locations where solder balls are deposited and attached.

During automatic operation, machine software controls the servo motors. In teaching and in manual operation, the motors are positioned with the trackball and arrow keys on the Man-Machine Interface (MMI).

1.4.2.2 Material Handling System

The Material Handling System (MHS) provides automated loading, movement, precise positioning, and removal of device carriers during the ball attachment process. It also moves magazines from supply to storage for both the loading and removal operations of the 9388. Within the machine, the workholder subsystem of the MHS pulls in a carrier, indexes it before ball attach, positions each device in the carrier for ball attachment, and then removes the carrier after all devices have been processed. See Figure 1-2.

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The primary source of information about Material Handling System setup and operation is Volume 3 of the Model 9388 manual set. However, aspects of the MHS related to the software interface are presented in Sections 3 through 7 of this manual.

All of the MHS subsystems are completely enclosed to shield the user from accidental exposure to hazardous laser radiation. Each of the enclosures has a door or cover that is automatically locked during machine operation and protected by a safety interlock system. If a door is forced open when the laser is operating during ball attach operations, the interlock system will immediately shut off the laser and prevent its operation until the door is closed. For more information concerning safety interlocks, refer to the "Safety Information" section at the beginning of this manual.

1.4.2.3 Ball Attach Head

Mounted on the XY table, the ball attach head consists of a ball feeder, ball singulator, Z motor, motor housing, and a movable link on which the ball feeder and singulator are mounted. A linear servo motor is responsible for the up-down motions of the ball attach head link. See Figure 1-2.

The ball attach head singulator also includes: 1) A mount for the tip of laser optical fiber through which laser light can pass to reflow solder balls after placement; 2) A ball present sensor that can detect whether a ball has been successfully placed on the work surface. 3) A differential variable reluctance transformer (DVRT) that provides positional feedback from the singulator actuator to the machine control system.

The Model 9388 Laser*Pro* uses a laser to reflow and attach solder balls after they are deposited on the work surface. The laser beam is directed from the laser unit via an optical fiber down through the capillary that places the solder balls. After a ball is placed on the work, the laser fires and reflows the solder, which attaches the solder ball.

1.4.2.4 Optics

The electronic optical system includes: 1) A solid state video camera; 2) Objective lens and mirror systems; 3) Vertical and oblique illuminators. All are mounted on the XY table above the ball attach head. See Figure 1-2.

The electronic crosshair seen on the monitor corresponds to the position of the capillary over the device during ball attach operations. Crosshair to capillary position offset is automatically corrected in software.

Many optical parameters (lighting, etc.) are software-adjustable.

1.4.2.5 Laser

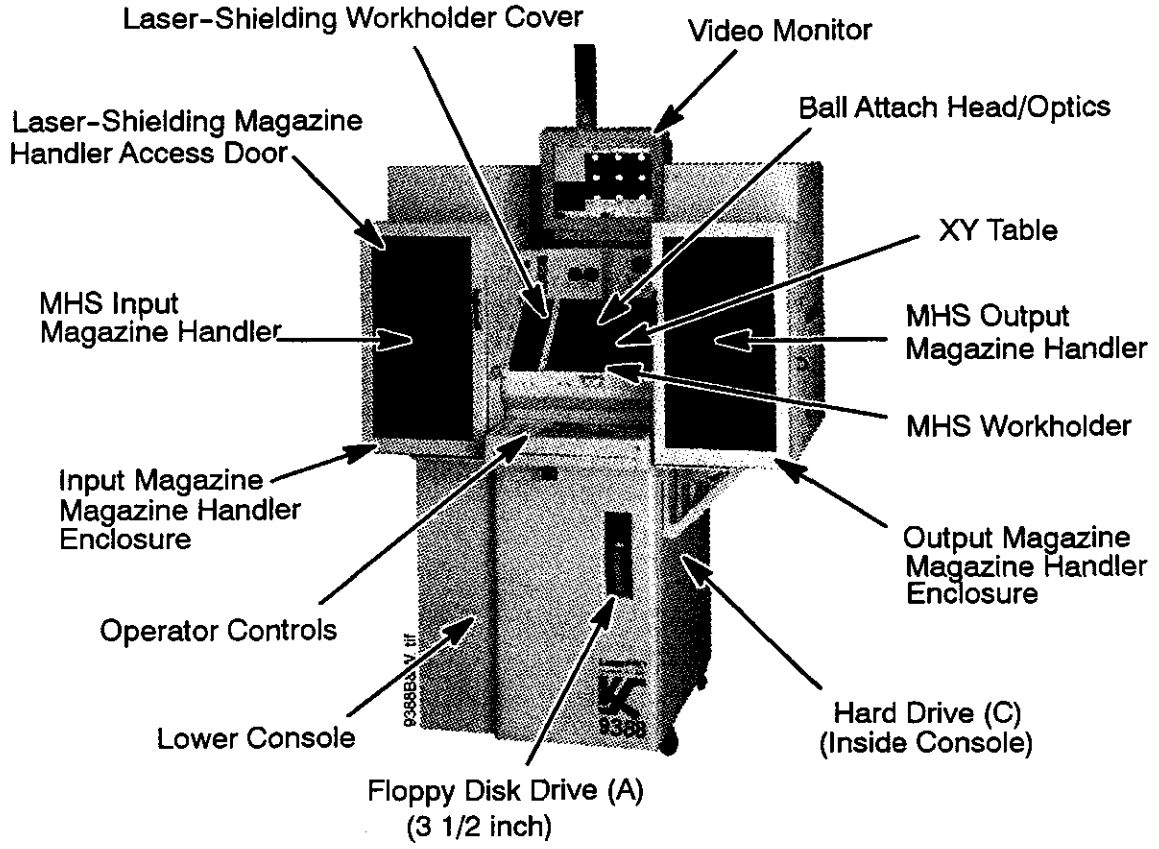
The Model 9388 Laser*Pro* is classified as a Class 1 laser system with an embedded Class 4 laser. It adheres to both CDRH and IEC regulations.

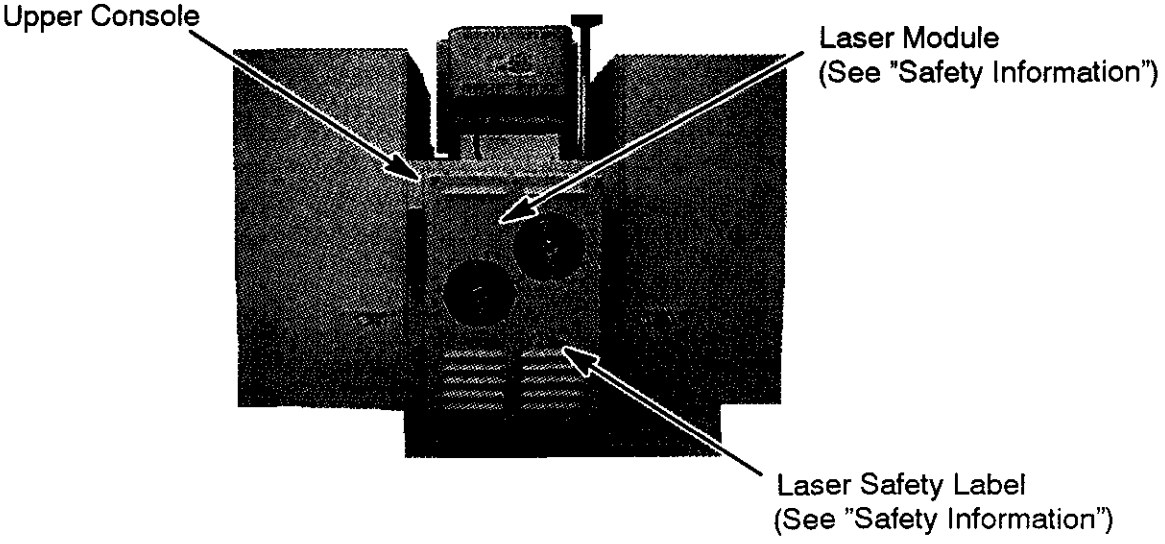
"Class 1" is defined as a low power, low risk laser or one with sufficient controls to prevent exposure from being hazardous under all circumstances. The class 1 designation can be applied to a laser system with an embedded laser. The class 1 designation does not apply if interlocks on the embedded laser are removed. See Figure 1-2.

"Class 4" is defined as a high power, high risk laser with beam powerful enough to cause damage to eyes or skin from exposure to a direct or reflected beam, and to cause combustion of flammable material.

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Rear of Machine - Upper Console

Figure 1-2 Major Subassemblies

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1.4.3 Pattern Recognition System (PRS)

The Pattern Recognition System (PRS - part of the Vision System) allows the ball attach system and the material handling system to find specific reference points (eye points) before each device is processed. This find operation precisely compensates for variations in pad position from device to device.

The PRS uses video information from the optical system. Vertical and oblique lighting are adjusted for optimum illumination. Images are processed and analyzed by the Vision System assembly in the lower console.

1.4.4 Software

The 9388 software is menu-driven with options displayed on the video monitor. Most menus have several levels. The menus are organized by "modes", with related and interdependent procedures grouped together within each mode.

Messages and prompts appear on the monitor to inform the operator of machine status or to request entry of needed information. The Man-Machine Interface (MMI) controls are used for operator response when appropriate.

1.5 Operator Interfaces

1.5.1 **EMERGENCY STOP** (ESTOP) Mushroom Switch

Located on the front of the machine, the red mushroom-shaped button switch removes electrical power from the machine. The ESTOP circuit pulls the Main Power switch on the front of lower console to OFF position whenever either switch is pressed. As long as the ESTOP switch is latched down, the Main Power switch will not hold in the ON position, preventing power from being restored to the machine. See Figure 1-3 for location.

1.5.2 Man Machine Interface

The Man Machine Interface (MMI) is the primary operator interface for both teaching and operating the machine. The trackball, trackball buttons, and most of the keys in the operator keypad have multiple assigned functions depending upon operating mode, current procedure, machine status, etc. Some of the keys have only one function. Of these, **Motor Stop**, **Run/Stop** and **Auto Index** have LED indicators in the key tops that illuminate when the key function is active. See Figure 1-3.

The MMI may be referred to as the Control Panel at some locations within this manual and the other manuals of the Model 9388 Manual Set.

1.5.3 QWERTY Keyboard

A full QWERTY (alphanumeric) keyboard is provided for additional programming and operating functions. The keyboard is located in a drawer below the operator controls on the MMI. See Figure 1-3.

1.5.4 Work Light

The work light is a high intensity lamp mounted on a flexible extension. It may be turned on when more light is needed by the operator to view the work area. Since this additional light can interfere with PRS operations, the work light is software-controlled and is automatically turned off during eye point teach and search routines. See Figure 1-3.



The WORK LIGHT button toggles lamp status on or off except during eye point teach and search routines.

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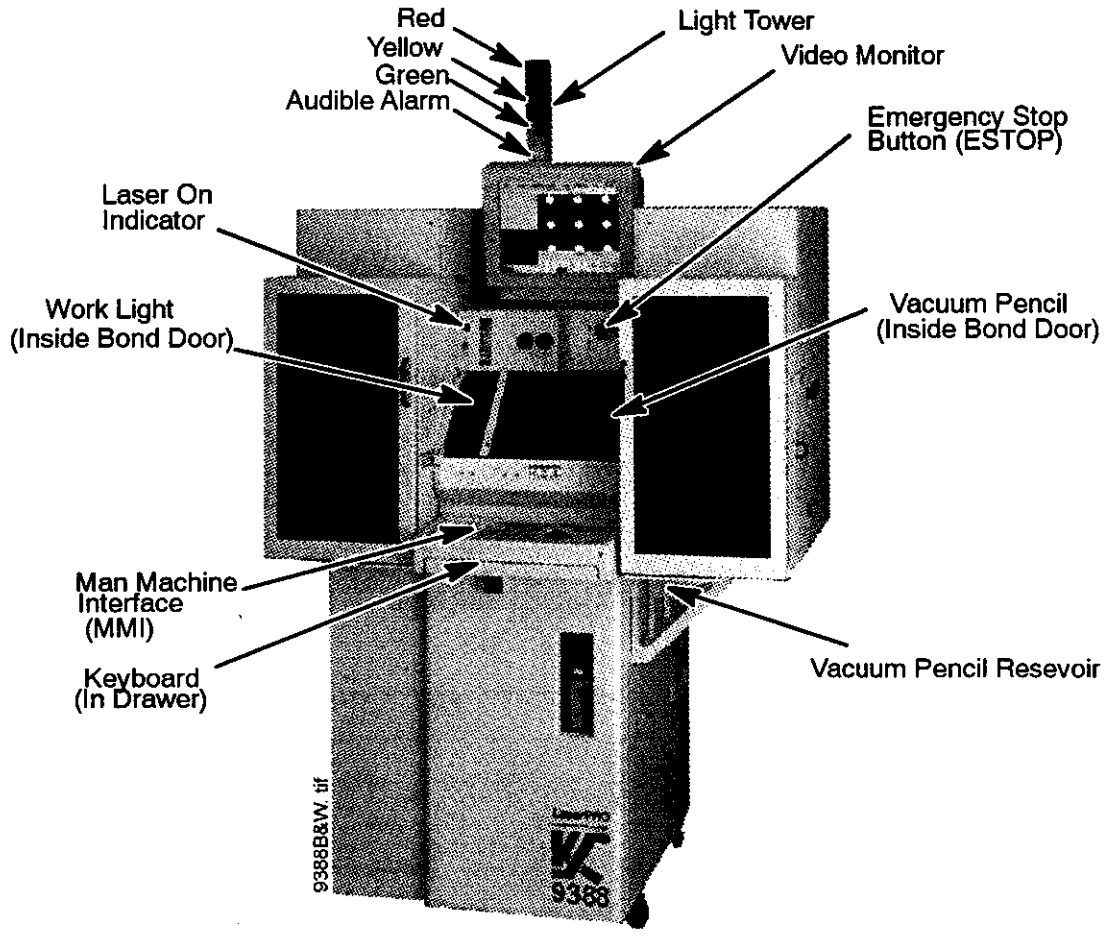


Figure 1-3 Operator Interfaces

1.5.5 Laser On Indicator

The **Laser On** indicator is located on the front panel of the upper console. This indicator lights up as the laser is firing. Although the laser is pulsing during normal operation, the Laser On light will appear to be continuously on. See Figure 1-3.

1.5.6 Audible Alarm

NOTE: The audible alarm may be programmed as required by the user. This programming includes: On and Off for various error groups and machine states. See Section 5: Configuration, in this manual, for more information.

The audible alarm sounds as configured by the operator. The machine silences the alarm when the condition is cleared and acknowledged by the operator. The audible alarm may be disabled as desired. Its volume may be adjusted by turning the plastic ring just below the green light. The following is the default configuration for the audible alarm.

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On	Off
Vision error	Material errors
Ball Attach error	Other errors
MHS error	Warnings
System error	Host errors
Pause/Stop state	Idle/Motor Stop state
	Executing state

1.5.7 Light Tower

NOTE: The signal lights may be programmed as required by the user. This programming includes: On, Off and Flash for various error groups and machine states. See Section 5: Configuration, in this manual, for more information.

The light tower has three signal light units programmed to indicate various operating conditions. See Figure 1-3. Green, red and yellow indicators light under the following conditions by default programming:

Green:

On	Off	Flash
Normal operation	Vision error	Material error
Host interface error	Ball Attach error	System error
Other error	MHS error	Idle/Stop state
Pause/Stop state	Warnings	Executing state

Red:

On	Off	Flash
MHS error	Material error	Vision error
Other error	Warnings	Bonding error
	Host error	System error
	Pause/Stop state	Idle/Motor Stop state
		Executing state

Yellow:

On	Off	Flash
Ball Attach error	Vision error	Material error
MHS error	Pause state	System error
Other error		Warnings
Host error		Idle/Stop state
		Executing state

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1.6 Pneumatic Controls/Indicators

1.6.1 Feeder Pressure Regulator/Gauge

The feeder pressure flows nitrogen around the balls as they enter the bond head unit. This air motion keeps the balls moving within the bond head to ensure proper ball feeding into the singulation unit.

The pressure can be adjusted by the feeder regulator and read on the feeder gauge, which are located on the front of the upper console. See Figure 1-4.

1.6.2 Head Capillary Pressure Regulator/Gauge

The head capillary pressure flows nitrogen into the capillary head area. The nitrogen flow forces the ball downward through the capillary, to assist in proper ball placement. See Figure 1-4.

The pressure can be adjusted by the head capillary regulator and read on the head capillary gauge, which are located on the front of the upper console. See Figure 1-4.

1.6.3 Nitrogen Flow Meter

The nitrogen flow meter indicates that there is an actual flow of nitrogen within the bond head unit. See Figure 1-4.

1.6.4 Solenoid Push Button Switches (*currently not implemented*)

The solenoid push button switches will allow the operator to operate particular solenoid operations from the upper console control panel.

At this time, the solenoids that will operate through this interface have not been determined.

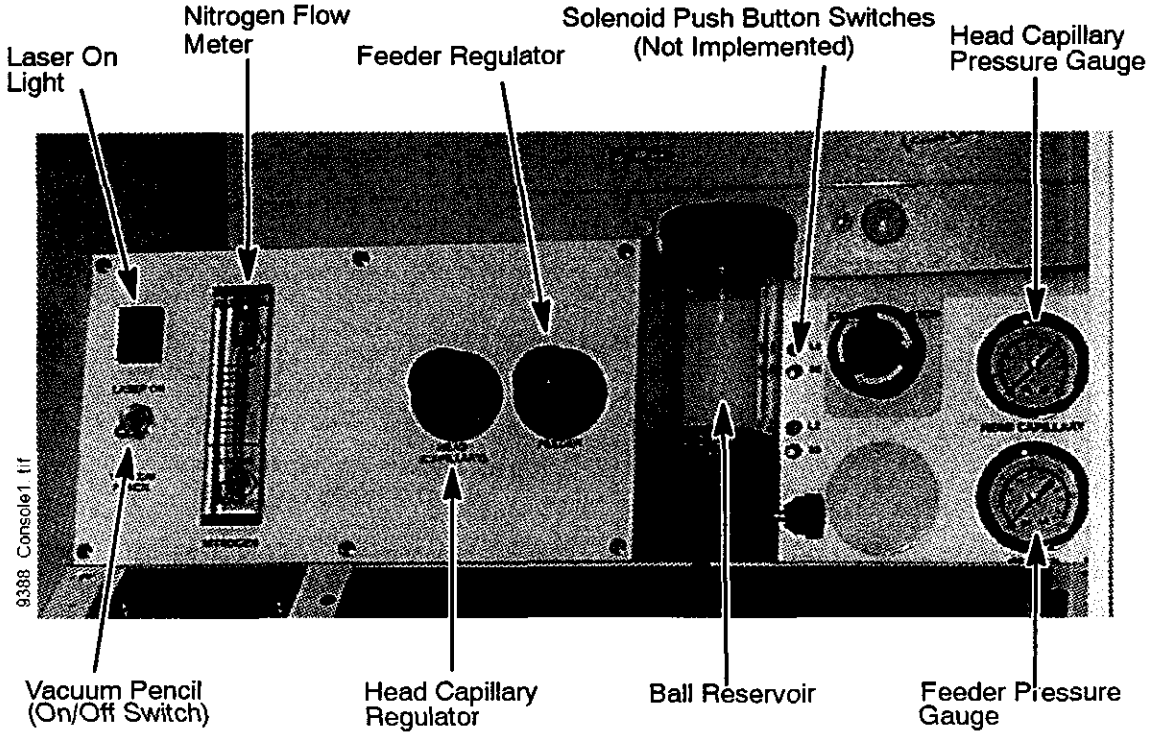


Figure 1-4 Pneumatic Indicators and Controls

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1.6.5 Vacuum Pencil

The vacuum pencil is a vacuum tube that is attached to the inside wall of the output mag handler (see Figure 1-3.) The operator can use this tube to vacuum up any stray balls that may have inadvertently fell in the workholder or bond head area. The tip of the vacuum pencil can be unscrewed for larger balls.

Once the balls have been sucked up by the vacuum, they are stored in the vacuum reservoir located on the right side of the lower console (see Figure 1-3.) Periodically, check the reservoir and when it is full, unscrew the small glass cup, discard the balls, and screw the glass cup back on.

Turn the vacuum on by pushing the switch located on the front of the upper console to the up position. To turn the vacuum off, push the switch to the down position. See Figure 1-4.

1.6.6 Video Monitor

The color video monitor is the primary source of machine and program information. The displays vary depending on operating mode, current operation and machine status. The monitor displays menus, dialog boxes, prompts, messages, image windows, crosshairs, and function buttons. These are used to set up, calibrate, program, and run the machine. See Figure 1-5.

The major components of the screen are the mode bar, two display windows with crosshairs, a series of function buttons, menus, dialog boxes, trackball button function descriptions, and axis position indicators.

Detailed information about the screen components, moving through modes and menus, and making selections and changing parameters or settings is presented in Section 2 "Software."

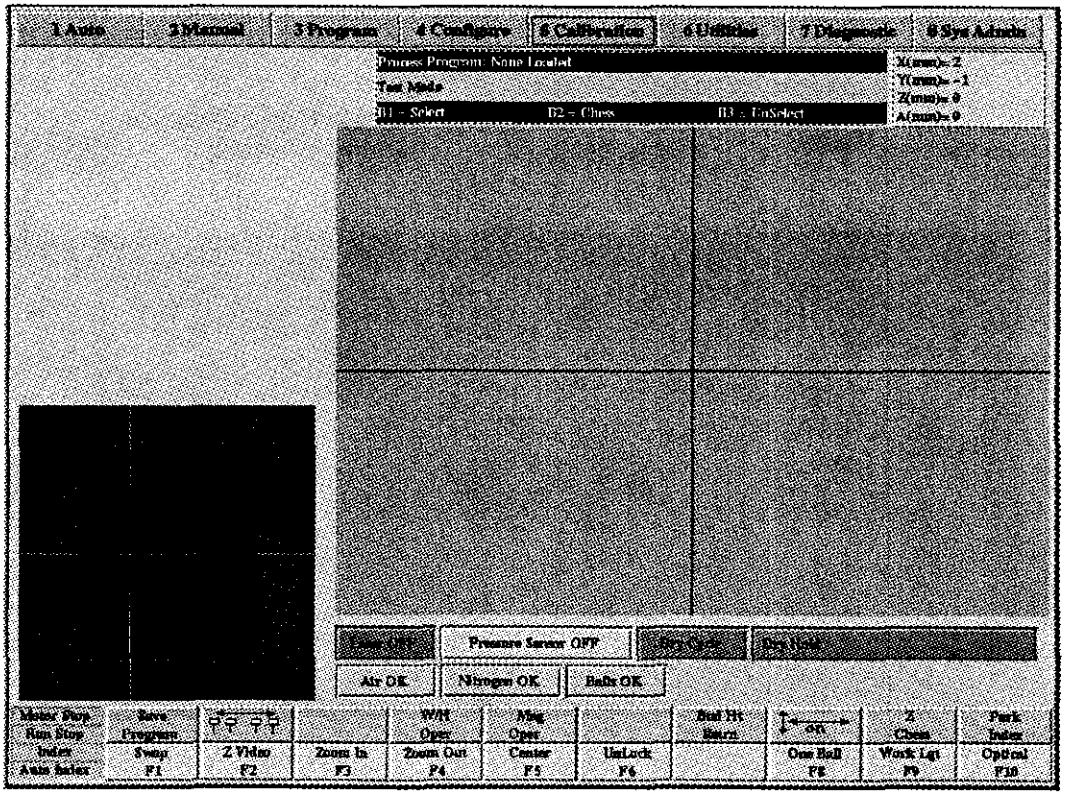


Figure 1-5 Video Monitor Screen

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Section

2 SOFTWARE OVERVIEW

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2 Software Overview

2.1 Introduction

This section contains basic information about the software that operates the 9388. Incorporated are descriptions of the Graphical User Interface (GUI) displays and other features that aid the operator in using the machine.

A Quick Reference Guide to the 9388 GUI is part of the Operations Handbook that is intended to remain with the machine at all times. The purpose of the guide is to aid the operator in quickly locating specific operational features of the user interface.

2.2 Software and Graphic User Interface (GUI)

The software is organized by 'modes' with related and interdependent procedures grouped together within each mode.

Software is menu-driven with options displayed on the video monitor. Most menus have several levels.

Messages and prompts on the monitor are used to inform the operator of machine status or to request entry of needed information. The keyboard and the Man-Machine Interface (MMI) controls are used for operator responses when appropriate. (For clarity in context, the MMI may sometimes be referred to as the Control Panel in the 9388 documentation.)

The monitor also displays error or warning messages in the event of system problems or maintenance requirements.

The Graphic User Interface (GUI) is a Windows-based system for machine programming and operation. The GUI provides for both cursor and keyboard control of and navigation through the machine program. The elements of the GUI are the monitor screen, the MMI, and the keyboard.

2.3 Monitor Screen

The monitor screen (located at the top of the machine) displays menus, dialog boxes, prompts, messages, windows, help information, and function buttons. The menus, etc. are used to set up, calibrate, program, and run the machine. Detailed information follows in this section.

2.4 Man-Machine Interface (MMI)

The MMI is the primary operator interface with controls for both teaching and operating the machine. The trackball, trackball buttons, and most of the keys of the keypad have multiple assigned functions depending on operating mode, current procedure, machine status, etc. See Figure 2-1.

2.4.1 Trackball Buttons

Three buttons (B1, B2, and B3) are located above and to the right of the trackball. Button functions are defined by the software mode and operation being performed. The current definition is displayed in a message box on the monitor.

2.4.2 Trackball

Moves the pointer and cursor on the screen. Also controls XY table movement (chessing) in the X and Y axes when that function is enabled and trackball button **[B2]** is pressed.

2.4.3 [F#]

These are the 10 function keys on the keyboard. They are referenced to the key labels displayed at the bottom of the monitor. Assigned functions change with machine status. Holding **[SHIFT]** (see 2.4.7) selects the top row functions. For example: **[SHIFT + F1]** is Save Program.

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2.4.4 Tab Keys

Move the cursor from data entry field to data entry field. The up and down Tab keys may be used with **[SHIFT]** to page up and page down respectively.

2.4.5 Esc Key

Menu system - exits the current menu.

2.4.6 Number Keys

On menus and dialog boxes, select modes and options that are preceded by numbers when pressed. Operating data and parameter values are also keyed into entry fields using the number keys.

2.4.7 [SHIFT]

When pressed at the same time as another key, provides an alternate, additional function for the key.

2.4.7.1 [Shift][F#]

Selects the corresponding upper function button. See paragraph 2.7.4.

2.4.8 [ENTER]

Places the following types of data into memory when pressed: reference points; bond positions and other program information. If the cursor is on a Button or Toggle function, it responds the same as if the operator presses **[B1]**.

2.4.9 System Control Keys/Buttons

NOTE: The following four functions, Motor Stop, Run/Stop, Index and Auto Index can be operated through keys on the MMI or the System Control Buttons on the monitor. See Figure 2-1 and Figure 2-2.

2.4.9.1 [MOTOR STOP]

Disables all servomotors, stepper motors, and solenoids when selected. The **[MOTOR STOP]** operation does ***not*** remove power from the circuit boards or power supply.

If pressed during running operation the current ball being laid will be completed and the machine will be stopped. Ability to continue the current device may only be provided in a manual rework mode. The machine will enter a STANDBY MODE when this control is selected.

2.4.9.2 [RUN/STOP]

When this function is selected, material will be presented at the bondsite and bonding will start. If the machine is currently running and **[RUN/STOP]** is selected, operation will stop after the next ball is laid.

In this mode a Sequence Stop/Start screen will be displayed to allow machine operation to continue where it left off.

2.4.9.3 [INDEX]

The **[INDEX]** function allows the operator to index a new device to the bondsite. This function is only enabled when material is not being bonded.

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2.4.9.4 [AUTO INDEX]

The **[AUTO INDEX]** function will automatically continue the running of the machine when in operating mode, which is started by the **[RUN/STOP]** function.

[AUTO INDEX] can be selected before or after the **[RUN/STOP]**, while the current device is being processed. If **[AUTO INDEX]** is stopped in the middle of a device, the device at the bondsite will be completed and operation will be stopped.

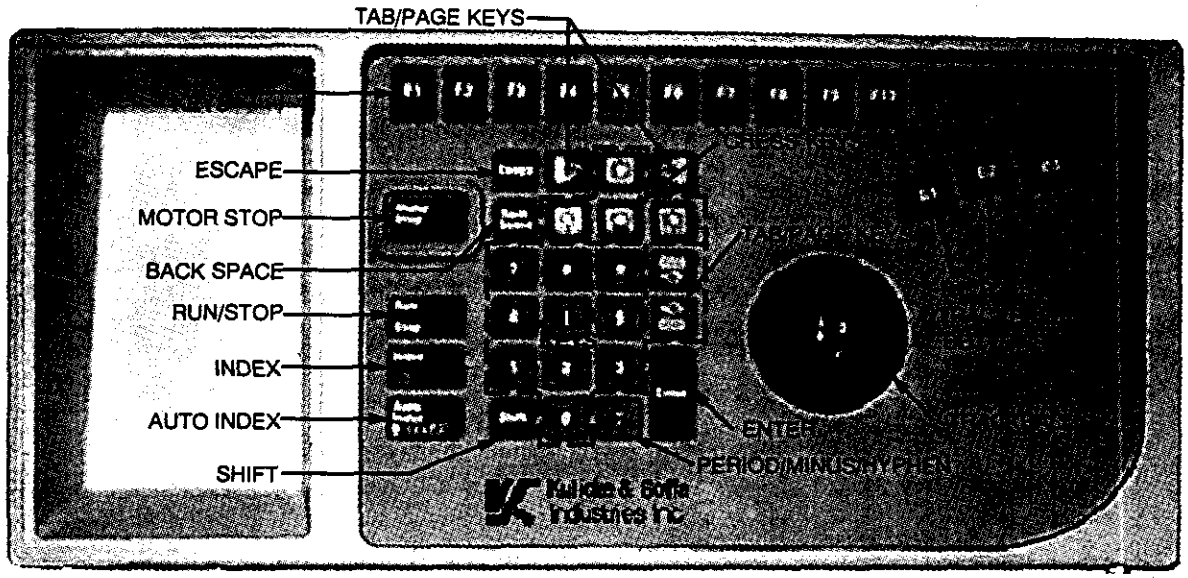


Figure 2-1 Man Machine Interface (MMI) Detail

2.5 QWERTY Keyboard

This input device (in the drawer below the MMI) is used to key in any alphanumeric information, including typing in Process Program names. It has various other programming and operating functions.

2.6 Major Elements of the Screen

The keyboard and MMI allow the operator to make selections, modify parameters, move the crosshair, and position the ball attach head by interacting with the monitor screen. The icons for various control elements radio buttons, scroll bars, buttons, and entry boxes. Some operations may have more than one way to make a change to a parameter or setting. (See Figure 2-2.)

2.6.1 Mode Bar

The current mode is highlighted on the mode bar at the top of the screen. Modes are AUTO, MANUAL, PROGRAM, CONFIGURE, CALIBRATION, UTILITIES, DIAGNOSTICS, and SYS ADMIN (System Administration). Select a mode by keying in the number in the mode box or by positioning the cursor on the mode button and pressing **[B1]** (left 'trackball' button) or **[ENTER]**. (See Figure 2-2.)

2.6.2 Menu

Menus show operations available for a particular mode or previous menu level. Exit a menu by pressing **[ESCAPE]** or placing the pointer on the Done bar and pressing **[B1]**. A menu item is selected by positioning the pointer on the item and pressing **[B1]** or **[ENTER]**. (See Figure 2-2.)

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2.6.3 Function Buttons

The 20 function buttons are in two horizontal button bars located on the bottom of the screen. These buttons provide quick access to functions common to several modes. The lower functions are set on or off by pressing the corresponding **[F#]** key on the MMI. The upper functions are set on or off by pressing **[SHIFT]** plus the corresponding **[F#]** key on the MMI. The operator may also place the pointer arrow on the desired function and press **[B1]** or **[ENTER]**. (See Figure 2-2.)

2.6.4 Display Windows

Two display windows (one large and one small) are present on the screen. The large window can display the live video image or the CAD image. The smaller window can display the live video image or the device image. (See Figure 2-2.) Refer to section 2.7.6 (Monitor Screen Displays) for a detailed description regarding screen displays.

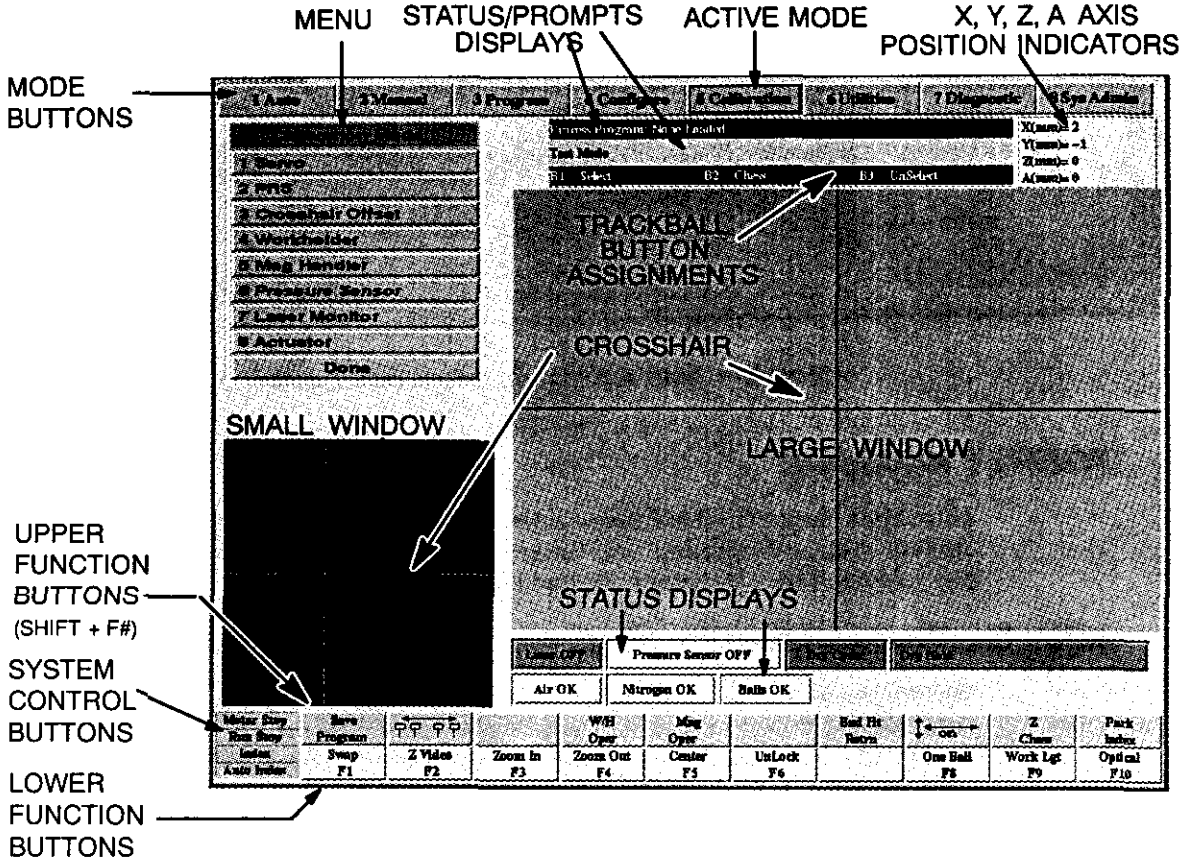


Figure 2-2 Video Monitor Screen Elements

2.6.5 Crosshair

The crosshair is a graphic image on a display window. The crosshair has two purposes: 1) targeting reference points; 2) targeting ball attach locations. In the second function the cross hair represents the target position of the capillary over the device. (See Figure 2-2.)

When the pointer (arrow head) is placed in the video or graphics windows it assumes the shape of a small crosshair. Its purpose is to select a location to which the main large crosshair is to be positioned. Pressing **[B2]** causes the ball attach head to position the crosshair to the position of the pointer.

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2.6.6 Axis Position Indicators

Four position indicators are at the top right corner of the screen. The **X=** and **Y=** position indicators give the position of the cross hair (X, Y) relative to the previously established XY zero point. The **Z=** position indicator gives the position of the ball attach head relative to the Z zero point. The **A=** position indicator gives the position of the ball attach head actuator relative to the A zero point. (See Figure 2-2.)

2.6.7 Status/Prompts Displays

The following section describes the various status and prompt displays located on the video monitor screen. These displays show various operating conditions of the machine. (See Figure 2-2.)

- **Process Program Name:** Shows the name of the currently loaded process program. Located above the large display window.
- **Prompts:** Provide a brief description of what to do next in a given operation. The prompts help the operator perform a task such as teaching an eye point.
- **Trackball Button Information:** Indicates the current function of each trackball button ([B1], [B2], and [B3]). Located above the large display window. The button functions change depending on the operation being performed.
- **Air OK/Low:** Reports the condition of air pressure supplied to the machine. **OK** indicates normal air pressure. **Low** indicates low air pressure.
- **Nitrogen OK/Low:** Reports the condition of nitrogen pressure supplied to the machine. **OK** indicates normal nitrogen pressure. **Low** indicates low nitrogen pressure.
- **Laser On/Off:** The laser can be turned on or off through the Configure mode. The status box shows the laser's current state. Normally, the laser should be **On**, but can be turned **Off** for conditions such as testing and setup. Located below the large display window.
- **Pressure Sensor On/Off:** The pressure sensor can be turned on or off through the Configure mode. The status box shows the pressure sensor's current state. Normally, the pressure sensor should be **On,** but can be turned **Off** for conditions such as testing and setup. Located below the large display window.
- **Dry/Normal Cycle:** The bonder can run in a **Normal Cycle** (normal operating condition) or a **Dry Cycle** (testing or setup condition). The status box shows the machine's current state. Located below the large display window.
- **Run/Idle Status:** Indicates the current operating state of the machine, whether **Idle, Run,** or **Error**. Error conditions such as PRS errors, MHS errors and Servo errors would appear in the **Run/Idle** box should they occur. Located below the large display window.
- **Balls OK/Low:** A **Low** condition indicates to the operator that the ball supply is low and needs to be filled up.

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2.6.8 Procedural Messages

Various procedures, such as Crosshair Offset, have on-screen messages in dialog boxes to guide the operator through the procedures.

2.6.9 Warning Messages:

Warning messages are displayed to inform the operator that: 1) an action about to be done may require additional operations; 2) the operation is approaching a pre-set limit. For example, if the machine is monitoring the solder ball supply, a warning message may be displayed when the machine calculates that the ball reservoir is nearly empty.

2.6.10 Error Messages:

Error detection generates an appropriate message on the monitor describing the nature of the problem. The message often provides instructions for corrective action and may list software options that can be selected to help to recover the error.

Error messages may describe an MHS malfunction, a defect in the program or device such as a PRS teach or find failure, the entry of unacceptable information, a missing solder ball, or equipment failure.

2.6.11 Chessing

This term applies to the user moving various axes of the machine by operating machine controls. The operator does XY chessing using the keypad chess keys or the trackball and its buttons. The operator chesses Z using the up and down arrow keys to the right of the 6 and 9 keys. XY chessing and Z chessing are never enabled at the same time.

2.7 Navigating through the Software

2.7.1 Introduction to the Modes

The Mode Bar at the top of the screen provides access to the major sections of the software. When the display is at the top level, the numbers 1 through 8 appear in front of the mode names. The desired mode can then be selected by keying in the identifying number, or by selecting the virtual button associated with the mode with the cursor and then clicking the leftmost trackball button [B1].

Brief descriptions of the modes are presented below. The first level menus for the modes are shown in Figure 2-3.

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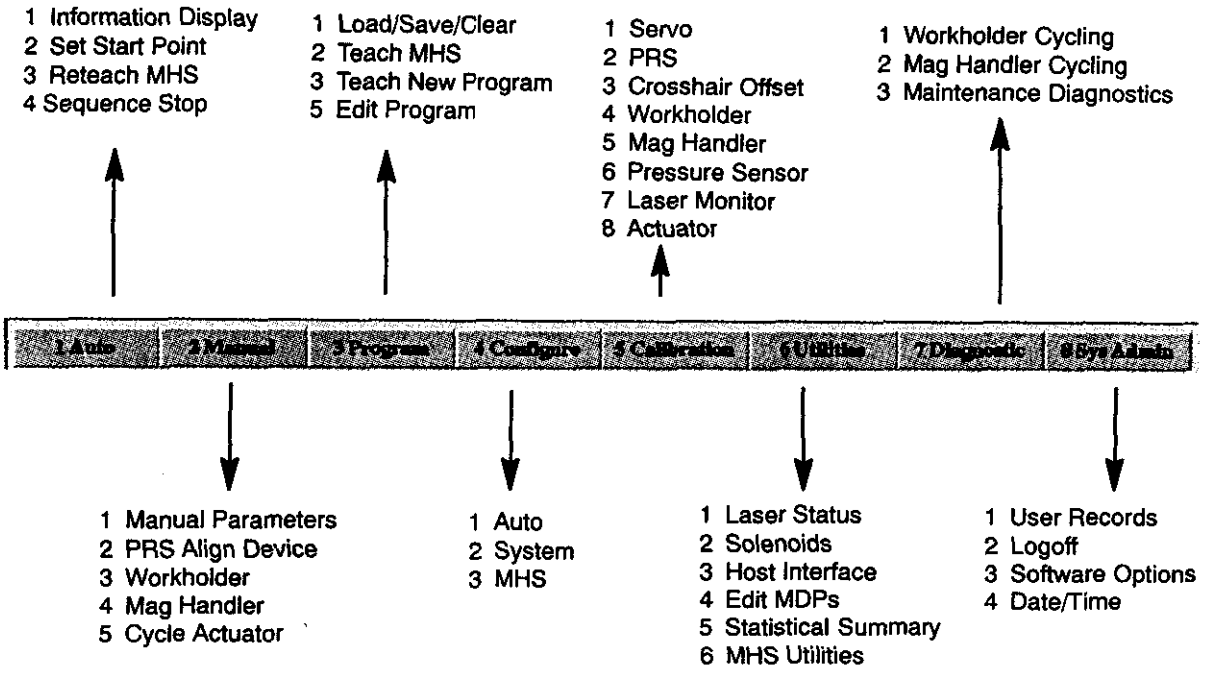


Figure 2-3 Level 1 Menu Tree

2.7.1.1 AUTO

This menu allows the user to set parameters related to automatic operation. In addition to the operator setting parameters in Auto mode the bonder can track track and display certain operating conditions, which include the following.

- Management of process events.
- Detection of and recovery from error conditions.
- Management of the process cycle timing and interruptions.
- Collection and presentation of process data.
- Production and presentation of production data.
- Monitoring machine condition for maintenance requirements.

2.7.1.2 MANUAL

In Manual mode, the machine does not use any loaded process program. Attachment of individual balls and parameter changes are done by the operator. Manual mode may be used to determine the optimum ball attach parameters prior to teaching a Process Program.

2.7.1.3 PROGRAM

In Program mode, the operator can teach or edit a process program. The operator can also load a parameter set or process program into memory from disk, save it to disk, or clear it from memory.

2.7.1.4 CONFIGURE

Configure mode allows the operator to configure or customize the machine to meet production needs.

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2.7.1.5 CALIBRATION

Calibration mode provides facilities for setup and calibration of the Material Handling System (MHS), cross hair offset, PRS, etc.

2.7.1.6 UTILITIES

Utilities mode provides access to process program file operations, non-process program file operations, host interface hookup, MHS utilities, etc.

2.7.1.7 DIAGNOSTICS

Diagnostics mode provides access to tests for several of the major MHS components. The operator can perform a warm start of the MHS or a homing (zero reference) of the MHS positioning motors.

2.7.1.8 SYS ADMIN (System Administration)

Sys Admin mode provides access to maintenance records and software tools for user control, password control, and operator logoff from the machine. This mode provides access to the version and release date information of the machine software and vision system software. System date and time may also be set here.

2.7.2 Introduction to the Menu Tree

The software is arranged as a menu tree with the eight modes (Auto, Manual, etc.) as the major branches of the program. As each mode is selected, submodes are displayed on a menu. Each item selected from a menu produces another menu or starts a dialog. In most cases, there are no more than three levels for a mode. The basic menu structure and method of navigating the menu levels is outlined in Figure 2-4.

Gray-colored text may at times appear in some mode bar buttons or in some menu selections, in place of the normal black text. This indicates that the mode or function is disabled and cannot be selected at the current time. Disabling of modes or menu items occurs when:

- Operations are not possible because of the state of machine operation.
- The operator's access level does not permit access to the operations.

NOTE: The function of the Hot Keys and Enter Keys may not be operational in some menus and dialog boxes. However, the method of using the trackball to position the cursor over the selected option, then pressing [B1] is always available to the operator.

NOTE: On menus and in dialog boxes, numbered items can be selected by: 1) keying in the number to the left of the mode or menu item: 2) using the trackball to position the cursor on the item to be selected and then pressing [B1], the leftmost trackball button.

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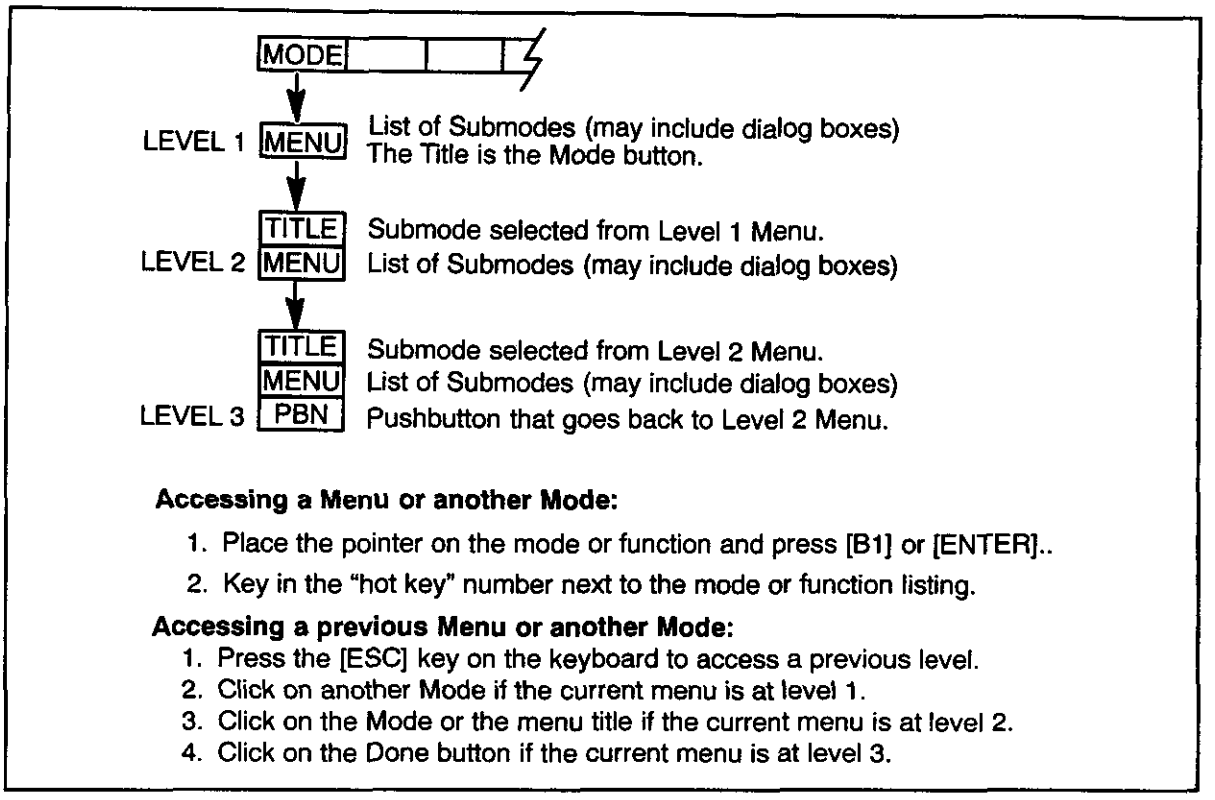


Figure 2-4 Moving from Menu to Menu

2.7.3 Dialog Boxes

2.7.3.1 Introduction

Dialog boxes provide access to most functions when teaching and operating the machine. A desired function is started by clicking on that function within the dialog box or, in some cases, pressing its associated "Hot Key". Dialog boxes appear after menu selections are made. A dialog box may present a series of parameters to be configured. Alternately, one or a series of dialog boxes may step the user through a function such as teaching a process program. The procedural dialog boxes are accompanied by instructional prompts displayed in the information box message area located above the larger of the two display windows. The prompts assist the user by indicating the next operation to be done.

In some cases, items in a dialog box will be inactive (shown in grayed text). When inactive, the option, function, or parameter cannot be selected or changed at the present time. An item may be inactive due to one of the following: 1) another selection must be made or an operation performed before the grayed item can be selected; 2) the selection is not available in the software version being run; 3) the selection is available only if a particular option is installed on the machine.

Clicking the control buttons **DONE** or **NEXT** accepts all new data entered within the selected dialog box, while simultaneously exiting the menu.

Pressing **[ESCAPE]** on the MMI will exit a dialog box without accepting any new data entered. The following topics discuss the elements that comprise a dialog box.

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2.7.3.2 Data Entry Field

A data entry field is used to key in or otherwise change a parameter or setting. In the data entry field example shown in Figure 2-5, Bond Height is set to 150. This setting can be changed by using one of the following methods:

NOTE: The function of the Hot Keys and Enter Keys may not be operational in some menus and dialog boxes. However, the method of using the trackball to position the cursor, then pressing [B1], is always available to the operator.

- Using the MMI's trackball, position the cursor on the item and press [B1] or [ENTER]. Then, key in the new value and press [B1] or [ENTER].
- Using the MMI, press the item's "Hot Key" ([1] in the example). Then, key in the new value and press [B1] or [ENTER].
- Using the MMI's Up/Down tab keys, position the highlighter box on the item, then press [B1] or [ENTER]. Then, key in the new value and press [B1] or [ENTER].

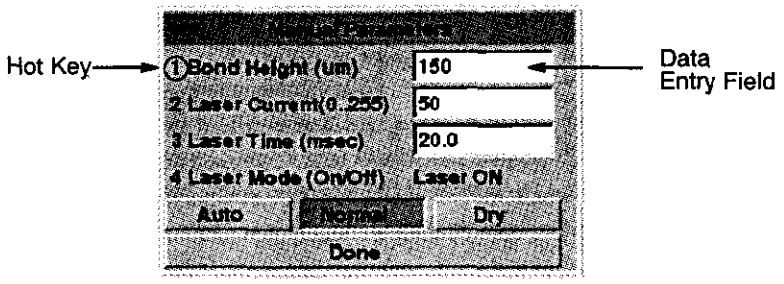


Figure 2-5 Data Entry Field

2.7.3.3 Scroll Bar

A horizontal or vertical bar with a center button used to show additional text or choices. In the example shown in Figure 2-6, the bar is used to display additional files names. To show additional text or choices, position the cursor on the button, press and hold [B1] and drag it. For small movement scrolling, position the cursor on an end arrow and press [B1]. For large movement scrolling, place the cursor in an open area in the scroll bar and press [B1].

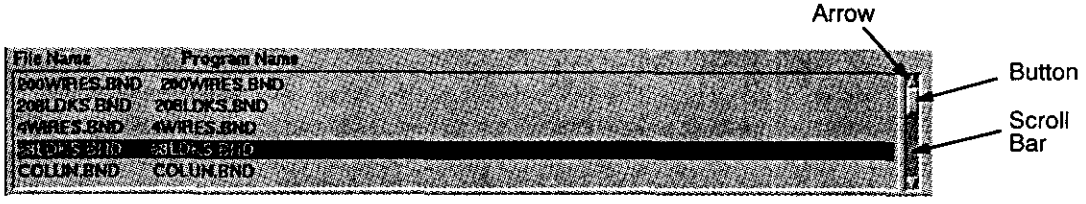


Figure 2-6 Scroll Bar

2.7.3.4 Radio Button

A round shaped button. Only one radio button per group of radio buttons can be active at a time. As shown in Figure 2-7, Normal Index is selected. To select a radio button, use the MMI's trackball to position the cursor on the button, then press [B1].

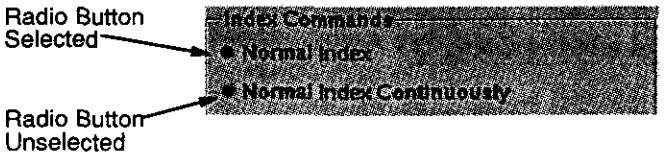


Figure 2-7 Radio Button

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2.7.3.5 Default Button *(to be implemented)*

A square button with a 'D' in the center of it (see Figure 2-8). Clicking on this button will set a parameter value to its pre-determined default value.

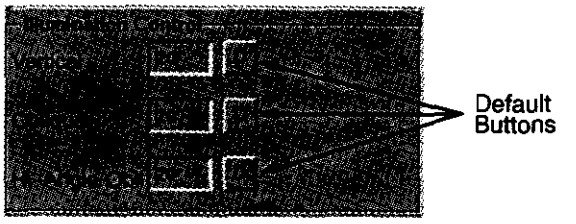


Figure 2-8 Default Button

2.7.3.6 Control Buttons

Every dialog box contains at least one control button (see Figure 2-9). All control buttons are labeled to reflect what operation is performed once the button is selected. When the button is selected, the operation is initiated. Selecting a control button may cause display of another dialog box (see **NEXT** below) or complete an operation (see **OK** below). Other common control buttons are: **DONE, LOAD,** and **SAVE.**

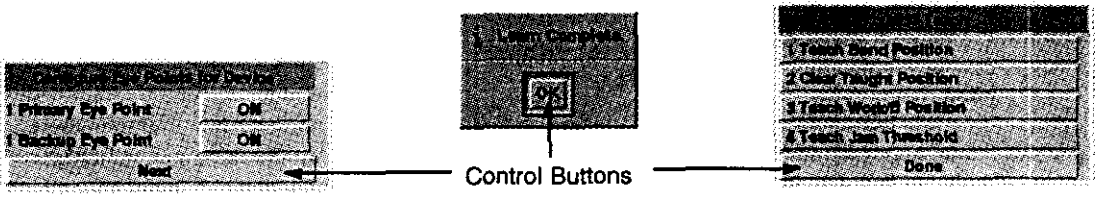


Figure 2-9 Control Buttons

2.7.3.7 Menus

Some dialog boxes contain options that are listed in a specific sequence called a menu. The menu item may be a toggle panel similar to the **Run Mode** item in Figure 2-10. Clicking on this toggle panel repeatedly causes its indicator to the right to alternately display its two possible states, "Auto Run" or "Dry Cycle". When selected, other items in a menu may display another dialog box. For example, when **Auto Run**, is selected in the example, the "Auto Configure" dialog box is displayed. A menu item can also be selected by pressing the item's "Hot Key" on the MMI. Pressing **[4]** in the example causes the "PRS" dialog box to appear.

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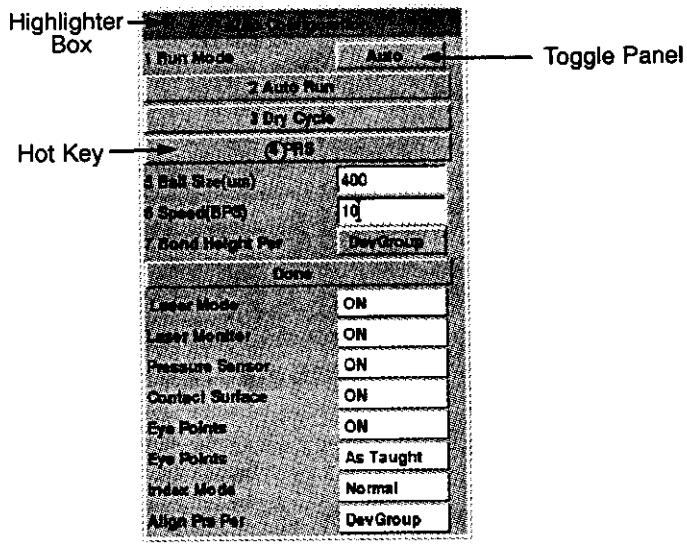


Figure 2-10 Menu Item Selection

When a dialog box first appears, a highlighter box is placed on the default menu item. The user can move the highlighter to the desired item by pressing either the Up or Down tab key. Then, the item can be selected by pressing **[B1]** or **[ENTER]**.

Menu items may also indicate a "mode" of operation" (see Figure 2-11). When a mode is selected, instructions appear in the screen's information box prompting the user on how to perform the operation. Mode menu items are found in the dialog boxes that relate directly to the teaching and editing of process programs.

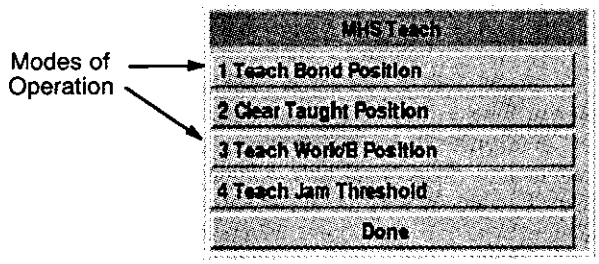


Figure 2-11 Menu Items (Modes)

A mode menu item can be selected by:

- Pressing the mode's "Hot Key".
- Using the Up/Down tab keys to position the highlighter and press **[ENTER]**.
- Using the MMI's trackball, position the cursor on the item and press **[B1]**.

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2.7.4 Function Bar (Upper)

The upper function bar provides easy access to functions that are common to several modes and that require quick access. These buttons may bring up a dialog box. When clicked on, the buttons change color. The Menu Bar is disabled while the dialog box is displayed.

A 'Shift+function key' selection activates tool bar functions. For example, **[SHIFT]+[F10]** parks the indexer.



SAVE PROG (Shift + F1)

Saves the current process program to disk on the default drive.



CONFIGURE GRAPHICS DISPLAY (Shift + F2)

Toggles between the display or removal of bond site labels and the graphics overlay.



WORKHOLDER OPERATIONS (Shift + F4)

Accesses a utilities menu to operate individual functions of the workholder. See section 7.6.3 for more information.



MAGAZINE HANDLER OPERATIONS (Shift + F5)

Accesses a utilities menu to operate individual functions of the input and output magazine handlers. See section 7.6.4 for more information.



BOND HEIGHT RELEARN (Shift + F7)

Forces the ball attach head Z axis to teach itself the point at which the capillary touches the work.



SINGLE DIRECTION CHESSING (Shift + F8)

Toggles between enabling or disabling locked X axis (left-right) and Y axis (front-back) chessing. Z chessing is disabled when this feature is enabled. This feature allows the MMI arrow keys to control X and Y axes movement.



Z CHESS (Shift + F9)

Turns Z chessing on or off. This feature allows the up and down arrow keys to control Z axis movement. XY chessing is disabled when Z chessing is enabled.



PARK INDEXER (Shift + F10)

Forces the workholder indexer to its parked position away from the center of the workholder.

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2.7.5 Function Bar (Lower)

The lower function bar contains 10 function buttons. (See Figure 2-12.) The function associated with a button may change depending on the mode or activity selected. Pressing a function button may be done by positioning the cursor over the function button and clicking [B1] or by pressing the equivalent function key on the keypad.

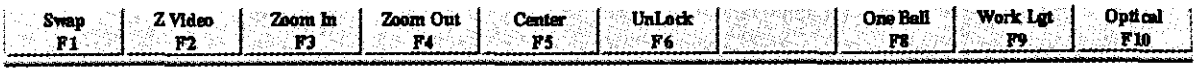


Figure 2-12 Function Bar (lower)

Standard Function Assignments									
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Swap	Z Video	Zoom In	Zoom Out	Center	Unlock		One Ball	Work Light	Optical

[F1] SWAP: Causes the video and graphic images to change windows.

[F2] Z VIDEO: Magnifies the video image. The three video zoom levels are normal (100%), 200% and 400% magnification. Repeatedly pressing F2 cycles through the three levels.

[F3] ZOOM IN: Magnifies the device image. Magnification increases by one level each time the key is pressed. 19 levels are available.

[F4] ZOOM OUT: Shrinks the device image. Magnification decreases by one level each time the key is pressed. 19 levels are available

[F5] CENTER: Positions XY Table at the center of its limits of travel..

[F6] UNLOCK: Enables the operator to unlock the MHS safety doors during specific modes of operation. For example, this function would be available to the operator for tray loading and unloading but not available while the machine is bonding.

[F7] Not used.

[F8] ONE BALL: Allows one ball to be ejected from the ball feeder onto a pad.

[F9] WORK LIGHT: Sets the auxiliary work light ON or OFF as needed. Software turns the work light off during bonding regardless of this setting.

[F10] OPTICAL: Accesses the illumination dialog box. This allows the operator to set vertical and oblique illumination on the work surface as seen in the video display.

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2.7.6 Monitor Screen Displays

2.7.6.1 Live Video Display

The live video image seen by the solid-state camera is shown on the screen in one of the two display windows. Initially, this image is shown in the larger window. **SWAP [F1]** switches the live video image and CAD image between the two display windows. See Figure 2-13.

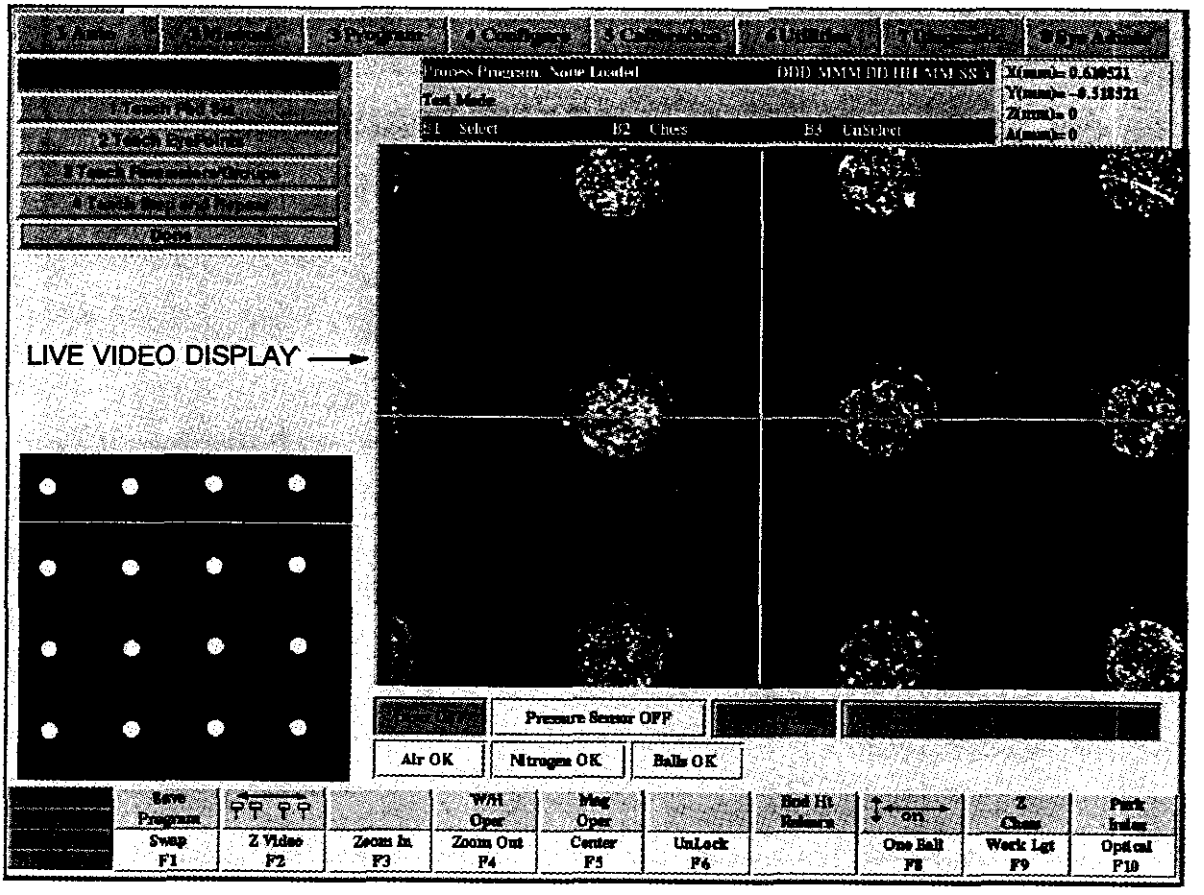


Figure 2-13 Live Video Display

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2.7.6.2 CAD Display

This is an electronic image of identified programmed points that is created as a process program is developed. This display shows the representation of a Pad Set or Pad Set Copy, which are displayed as unfilled circles. 'Swap' **[F1]** switches the CAD image and Live Video image between the two display windows. See Figure 2-14.

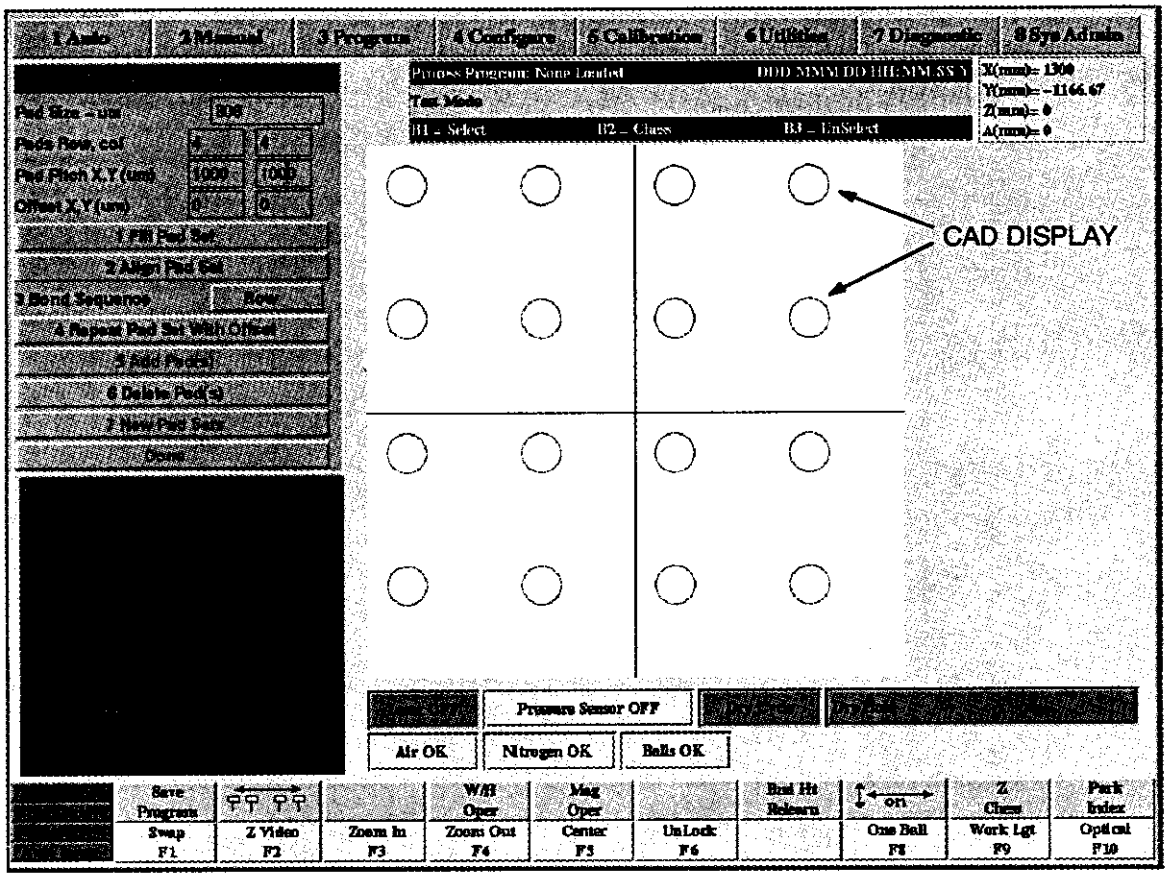


Figure 2-14 CAD Display

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2.7.6.3 Device Display

This display is a representation of the device, which can consist of one or more Pad Sets. The display is generated as the process program is taught. This will assist the operator to ensure that proper alignment of the device is occurring. The single pads are shown as circles filled in yellow, and colored on the circle's perimeter. This image is shown initially in the smaller display window. See Figure 2-15.

2.7.6.4 Live Video Overlay

The Live Video Overlay and Device Image are created as a new process program is taught. Together, they will assist in achieving proper alignment of the actual device. The Live Video Overlay Display will appear over the live video image. See Figure 2-15.

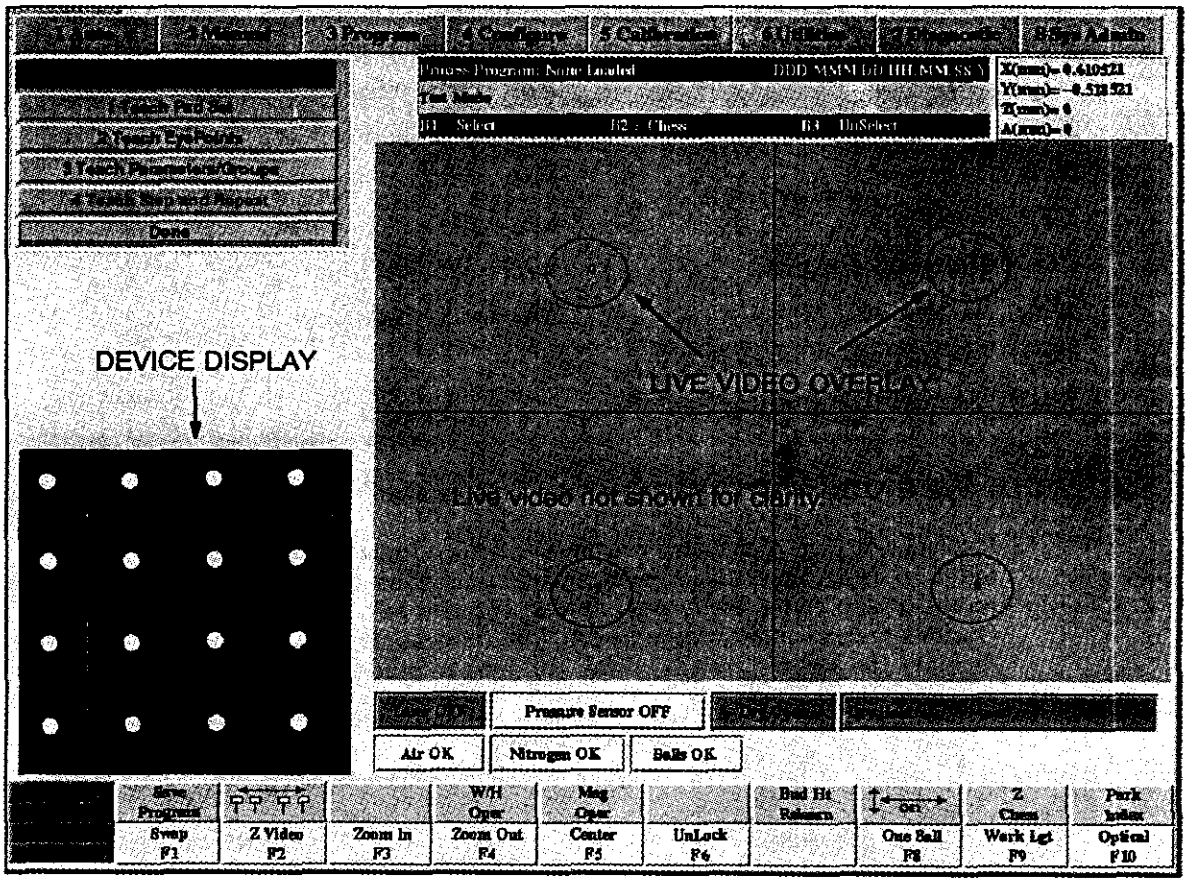


Figure 2-15 Live Video Overlay and Device Displays

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2.8 Abbreviations used in the Software

The abbreviations listed below are commonly used in menus, dialog boxes and help or information messages.

A: Actuator
Admin: Administration
Alt: Alternate
Calc: Calculation
Cal or ***Calib***: Calibration
Cap: Capillary
Chg: Change
Config: Configuration
Dim: Dimension
Dist: Distance
Grip: Gripper
ID: Identifier
I/O: Input and Output
Mag: Magazine
Max: Maximum
MHS: Material Handling System
Min: Minimum
Oper: Operator
Param(s): Parameter(s)
Prev: Previous
Proc: Process
Prox: Proximity
PRS: Pattern Recognition System
Pnt(s): Point(s)
Ref: Reference
Sys: System
Val: Value
w/: with
W/H: Workholder
Xhair: Crosshair

2.9 Software Version Information *(to be implemented.)*

Information regarding the version of software in the 9388 Laser*Pro* can be found in Sys Admin (System Administration) Mode. There is a Menu choice on this menu called **SOFTWARE OPTIONS**. The last selection on the Software Options menu is **SOFTWARE VERSION**. When accessed, the monitor message box displays the version, release date, and part number of the software.

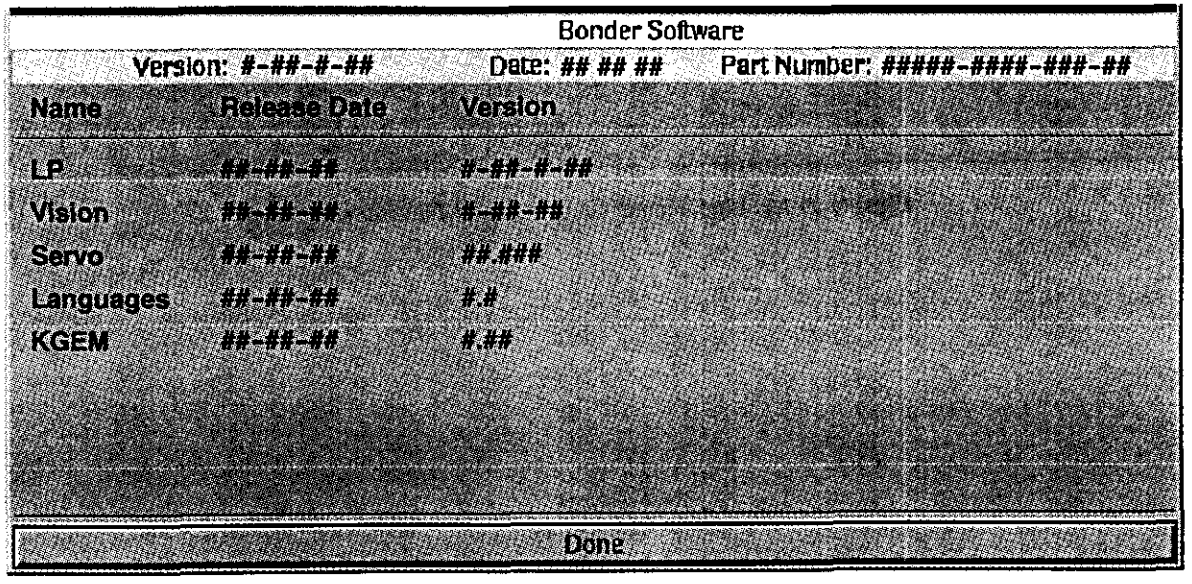


Figure 2-16 Software Version Dialog Box

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Section

3 MACHINE STARTUP

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3 Machine Startup

WARNING: READ THE SAFETY INFORMATION FOUND AT THE FRONT OF THIS MANUAL BEFORE STARTING THE MACHINE. FAILURE TO OBSERVE SAFETY PRECAUTIONS CAN EXPOSE THE USER TO HAZARDOUS LEVELS OF LASER RADIATION.

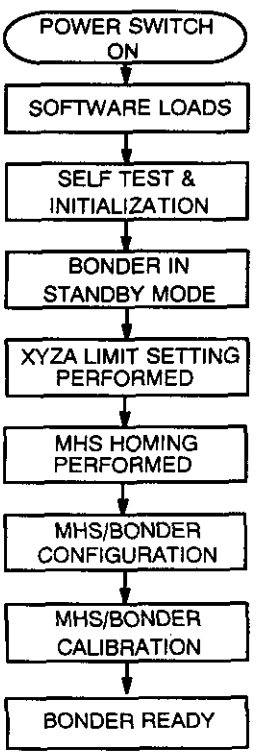
WARNING: THE MACHINE IS A CLASS I LASER SYSTEM CONTAINING AN INTERNAL CLASS IV LASER SYSTEM, WHICH CAN CAUSE EYE AND SKIN DAMAGE. THE COVERS AND INTERLOCK SYSTEM ON THE MACHINE PREVENT THE LASER FROM FIRING IF ANY OF THE DOORS ARE OPENED. DO NOT BYPASS THE INTERLOCKS OR TRY TO FIRE THE LASER WITH COVERS REMOVED. SERVICING THE LASER SHOULD BE DONE BY QUALIFIED TECHNICIANS IN A LASER SAFE AREA.

WARNING: USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.

3.1 Introduction

This section describes the machine power up sequence and related setup procedures. It is assumed that the machine has been correctly installed and that all power and pneumatic connections have been made and verified. It is further assumed that the appropriate magazines, strips, and fixtures are present.

3.2 Power-Up Sequence



The power-up sequence described here is from a prior normal power down of the bonder without PFR active. The entire powerup sequence, from setting the power switch 'ON' to the appearance of the login screen, takes approximately five minutes. While the software is loading from the hard disk (disk light flickers), various self-checks and subsystem initializations are performed. Some of the tests, such as testing the light tower and the bonder lamp, are readily visible to the operator. Others tests are performed at the board level and are not apparent. Any failures detected during powerup are processed and are displayed on the monitor screen after the software is loaded.

The bonder is in STANDBY mode with servos and stepper motors disabled. Clicking on OK takes the bonder out of STANDBY mode. The XYZA motion limits are then determined. The MHS system consisting of the workholder and mag handlers performs a self test of it's motors and home sensors. The operator can now perform any required configuration and calibration of the Material Handling System (MHS) and the bonder.

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3.2.1 Power up

Turn machine power on by first toggling the START switch on, then turn the main circuit breaker on. Wait for the Init Servo button (F7) to appear on the lower tool bar and click on it. See Figure 3-1.

The system will check that the doors are closed. If a door is open a prompt will be displayed on the monitor to close the door. Otherwise, the machine will continue to initialize and will automatically check the rest of it's operating systems.

NOTE: Until the Standby Mode Feature is implemented, click F7 (Init Servo) located on the lower tool bar. See Figure 3-1. Power will be applied to the motors and the initialization will continue as discussed in paragraph 3.2.3.



Figure 3-1 Init Servo Button

3.2.2 Standby Mode (*to be implemented*)

After power is applied, the 9388 program screen and the STANDBY mode dialog box appear on the monitor. Initially, the bonder is in STANDBY mode. Power is applied to the bonder but no motors are energized. The operator selects OK to bring the bonder out of STANDBY mode.

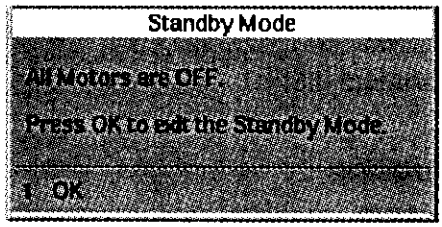


Figure 3-2 STANDBY Mode Dialog Box

3.2.3 XYZA Limit Seeking

Once Init Servo (F7) is selected the XYZA limit seek automatically finds the range limits for X, Y, Z, and A axes of the bond head and workholder.

NOTE: XYZA limit seeking and MHS home positioning are performed automatically by the bonder and require no operator intervention.

NOTE: The '**FAIL**' light emitting diode (LED) indicators on the stepper boards will come on and remain lit until the bootup is completed, login is performed, and the stepper motors are initialized. This does not indicate an equipment problem. After the motors are initialized, the LEDs turn off if no error condition is detected.

3.2.4 MHS Home Positioning

The 'MHS Home Positioning' routine automatically locates the home positions of the MHS motors on the magazine handlers and the workholder. Home is the zero point from which all distances are calculated for each axis. For example, home position for the motor controlling the front rail is at the point where the front rail is closest to the operator; for the rear rail motor, home is at the point when the rear rail is furthest from the operator.

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3.2.5 Calibration

In most cases the bonder will be fully calibrated and ready for use. In the event that any or all the calibration data has been lost, calibration data can be restored by installing the Machine Dependant Parameter (MDP's) from the floppy disk provided with the bonder. See paragraph 8.5.3 for more information.

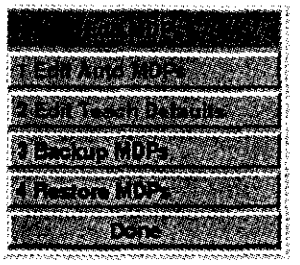


Figure 3-3 Edit MDP's Menu

NOTE: K&S strongly recommends that MDP data be stored on both the hard disk drive and a floppy disk. In the event that the C: drive fails, MDP files may be restored from floppy disk in the A: drive.

Calibrations are described and procedures for them are given in *Section 4: Calibration* in this manual and in *Volume 2: Maintenance* of the 9388 manual set.

3.3 Power-Down Cycle

The operator may simply press [MOTOR STOP] on the MMI, and then set the Main Power Switch to the OFF position.

The 9388 may be left in a "hot" idle condition by pressing [MOTOR STOP] on the MMI and leaving the Main Power Switch set to ON.

3.4 Power Fail Recovery

In the event that the bonder should lose power at any time during operation the operator should perform the power up procedure described in Section 3.2.1.

During Power Up, when prompted, remove any material that may have been present in the workholder during the power failure.

If power fails repeatedly for unknown reasons, contact the K&S service department.

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Section

4 CALIBRATION

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4 Calibration

4.1 Introduction

Calibration ensures that various machine components function within specification, after which the machine is optimized for indexing and bonding. Calibration values and settings are machine dependent parameters (MDPs) and ***cannot*** be transferred from one bonder to another. Figure 4-1 shows the calibration menu and the components of the bonder that get calibrated.

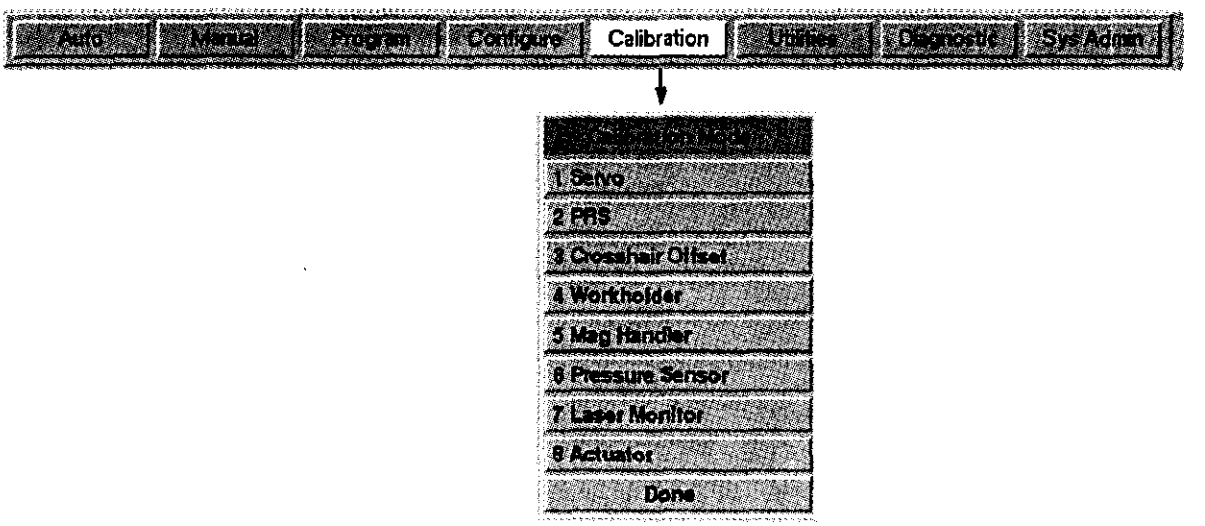


Figure 4-1 Calibration Menu

Calibrations need to be performed as necessary. Reasons for calibration include the following:

- Adjustment or replacement of bond head.
- Adjustment or replacement of ball attach assembly.
- Adjustment or replacement of workholder.
- Adjustment or replacement of mag handler.
- Service or replacement of components within the servo control system.
- Poor bonds.
- Poor strip movement through workholder or mag handler.
- Poor magazine gripping.

NOTE: Performing certain calibrations could easily correct problems the bonder is experiencing with bonding or strip movement through the MHS.

NOTE: If all calibration data has been lost and the MDP's cannot be restored, Figure 4-2 shows the calibration sequence of a bonder from start to finish.

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4.2 Calibration Sequence

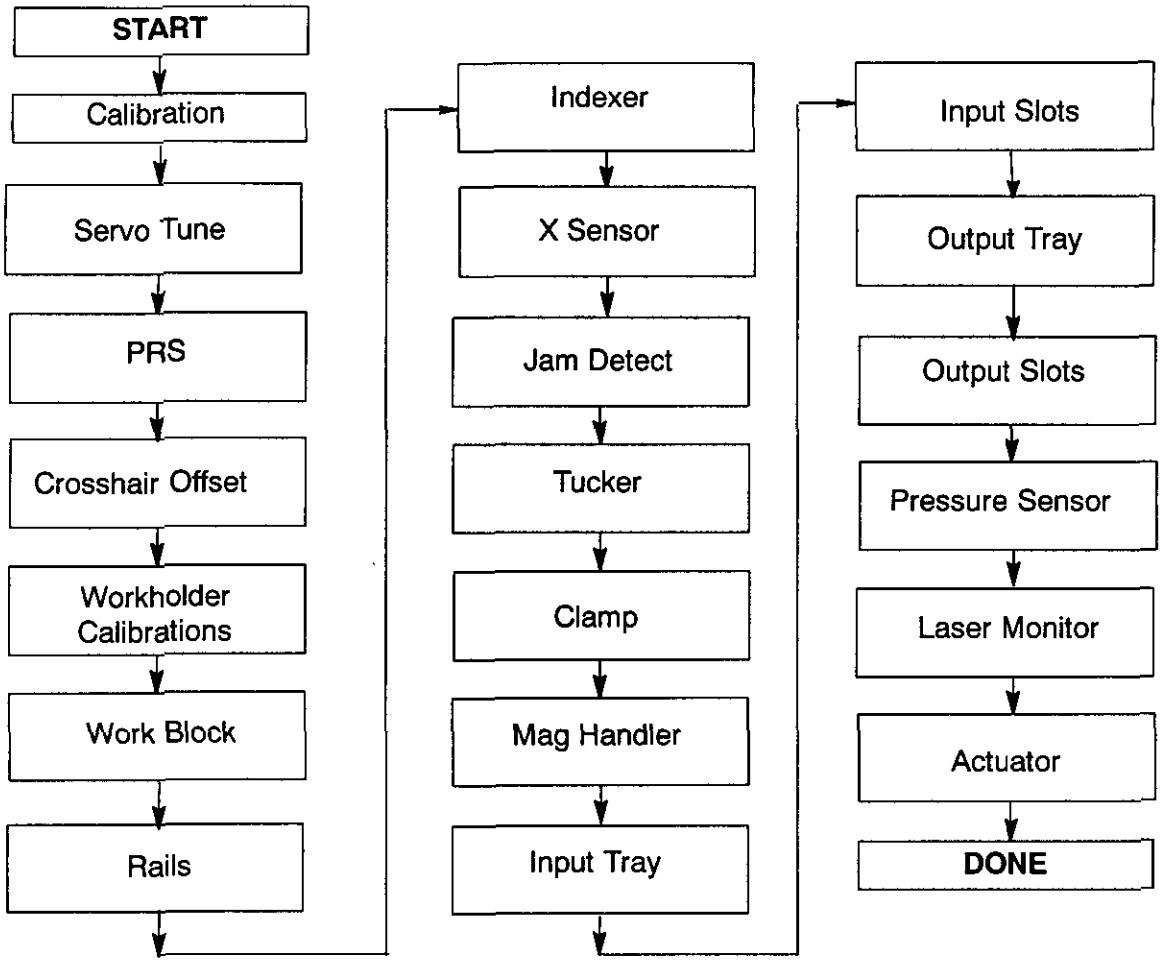


Figure 4-2 Calibration Sequence

4.3 Servo

Servo calibrations are to adjust, or tune the servo gains of the X, Y, Z and A axes.

All movement of the bond head is based on these values. Therefore, these calibrations must be done prior to other calibrations which use bond head movement as part of their procedure.

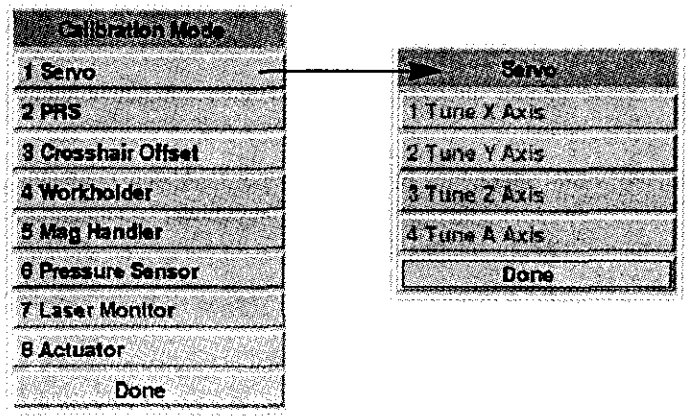


Figure 4-3 Servo Calibration Menu

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4.3.1 Tune X Axis

This calibration automatically adjusts the servo gain of the X axis. The calibration completes all necessary steps once started by the operator. The only option is at the end of calibration, the results may be saved or rejected.

4.3.2 Tune Y Axis

This calibration automatically adjusts the servo gain of the Y axis. The calibration completes all necessary steps once started by the operator. The only option is at the end of calibration, the results may be saved or rejected.

4.3.3 Tune Z Axis

This calibration automatically adjusts the servo gain of the Z axis. The calibration completes all necessary steps once started by the operator. The only option is at the end of calibration, the results may be saved or rejected.

4.3.4 Tune A Axis

This calibration automatically adjusts the servo gain of the A axis. The calibration completes all necessary steps once started by the operator. The only option is at the end of calibration, the results may be saved or rejected.

4.4 Pattern Recognition System (PRS)

This routine establishes the relationship between the number of pixels of video image and the actual physical distance represented. This information is used in PRS displacement calculations. Unless PRS calibration is successfully accomplished, eye points cannot be taught.

Section 4.4.1 below describes the specific items existing in the PRS dialog box.

Thereafter, section 4.4.2 describes a stepwise PRS calibration procedure.

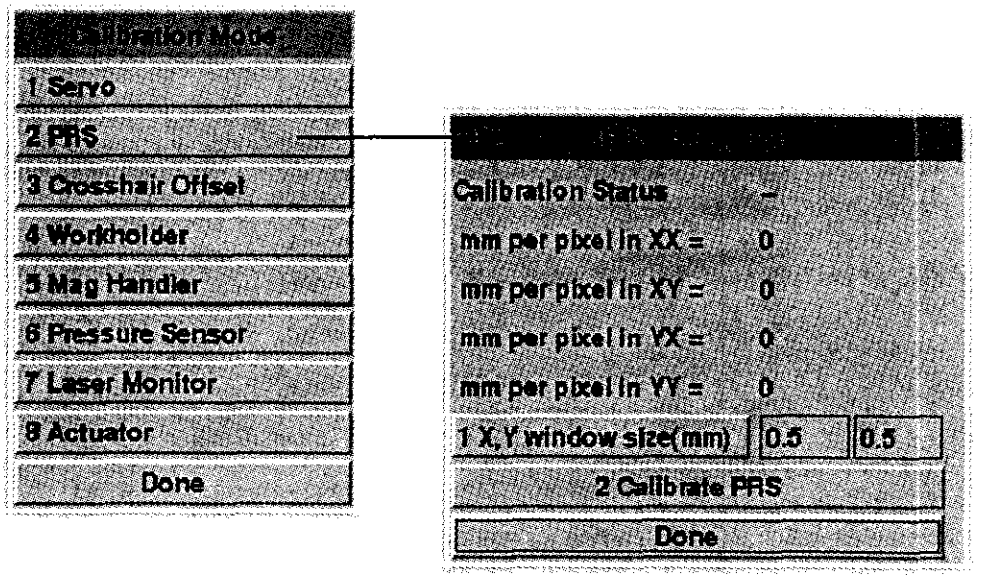


Figure 4-4 PRS Dialog Box

4.4.1 PRS Calibration Setup

NOTE: PRS calibration requires a consistent, reliable, and identifiable eyepoint scene to view. Therefore, a production item must be present in the workholder.

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4.4.1.1 Selecting Eye Point

PRS Calibration requires that a strip is loaded and that a device is displayed. Eye points must be visually unique, repeatable, and consistent.

- Select **[2] PRS** from the Calibration menu to begin. See Figure 4-4.
- Move the PRS Teach Window to a good eye point scene using the trackball and **[B2]** button.

4.4.1.1.1 Current PRS Information

These data give the results of the last PRS calibration. The "X mils per X pixel" and "Y mils per Y pixel" values are the size of a pixel of viewed image by the camera in terms of linear distance of XY table travel in the X and Y axes, respectively. These two values characterize the magnification of the optics system. See Figure 4-4.

The "X mils per Y pixel" value is the displacement in the X axis across the Y dimension of the pixel; the "Y mils per X pixel" value is the displacement in the Y axis across the X dimension of the pixel. These two values characterize the optics system linearity, which is the rotation of the video camera in relation to the XY table axes of motion. Ideally, there should be no camera rotation.

4.4.1.1.2 X,Y Window Size

A rectangular box centered on the cross hair. The window sets the search limits relative to the eye point pattern. The height and width of the rectangle can be sized as required. See Figure 4-4.

4.4.1.1.3 Calibrate PRS

CALIBRATE PRS allows the operator to initiate the PRS calibration. Locating of the eye point either succeeds or fails. If it is not successful, an error message indicating that fact is displayed. Correct the cause of the failure by selecting another eye point, sizing the window, and/or altering the lighting combination. Repeat the calibration procedure. See Figure 4-4.

Locating of the eye point either succeeds or fails. If it is not successful, an error message indicating that fact is displayed. Correct the cause of the failure by selecting another eye point, sizing the window, and/or altering the lighting combination. Repeat the calibration procedure.

If the eye point is located successfully, the monitor displays the PRS scale factors. These factors indicate optics magnification and camera rotation.

Specifications: (applies to calibration data displayed in the dialog box)

XX = 0.1645 ±0.003 mil/pixel (magnification value)

YY = 0.1918 ±0.003 mil/pixel (magnification value)

XY = 0.000 ±0.003 mil/pixel (camera rotation value)

YX = 0.000 ±0.003 mil/pixel (camera rotation value)

The displayed values should conform to the specifications shown above. If any are out of tolerance, adjustment to the optics magnification and/or camera rotation is required (see the 9388 Maintenance Manual for optics adjustment procedures). Perform the PRS Pixel Calibration procedure again after the adjustments have been performed.

Click on **DONE** at the end of the calibration. This saves the calibration and clears the message box from the monitor.

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4.4.2 PRS Calibration Procedure

A. Place a strip on the work block at bond plane height. The strip should be displayed in the large window on the monitor.

B. Select Calibration mode on the tool bar on the GUI. See Figure 4-1.

C. Select PRS. See Figure 4-4.

D. If necessary, adjust illumination by clicking on F10 on the lower tool bar. Click on Update Illumination if changes were made. The strip should appear focused and clear.

E. Enter the X,Y window size, typically 0.5 for both.

F. Chess to the corner of the device and surround the corner circle with the teach box.

G. Click Calibrate PRS. After several seconds, the calibration results will be displayed on the GUI screen.

H. If calibration is successful, select Done to accept calibration data. If not successful refer to paragraph 4.4.1.1.3 above for PRS calibration specifications and reasons for failure..

I. Click on **DONE** at the end of the calibration. This saves the calibration and clears the message box from the monitor.

4.5 Crosshair Offset

Crosshair Offset compensates for the X axis and Y axis displacement between the target viewed through the optics and the actual position where the ball touches the work. This offset will need to be updated as result of one or more of the following: adjusting the optics; a change in device thickness; adjusting or changing the ball attach head. Once this offset is measured and corrected, the ball will contact the exact point targeted by the electronic crosshair. See Figure 4-5 for the Crosshair Offset dialog box.

Section 4.5.1 below describes the specific items existing in the crosshair offset dialog box.

Thereafter, section 4.5.2 describes a stepwise crosshair offset calibration procedure.

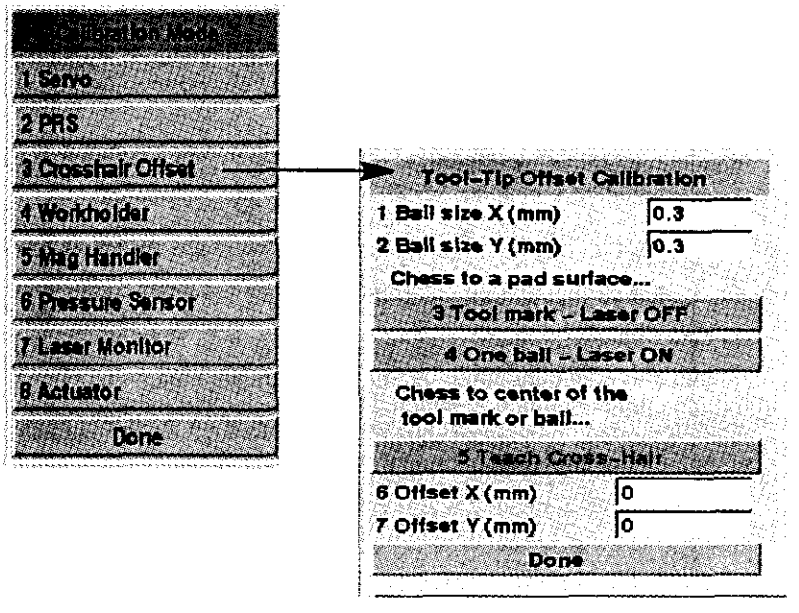


Figure 4-5 Crosshair Offset Dialog Box

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4.5.1 Crosshair Offset Calibration Setup

[1] **BALL SIZE X** is the size of the ball or the size of the mark placed by the capillary on the pad or other markable surface in the x direction.

[2] **BALL SIZE Y** is the size of the ball or the size of the mark placed by the capillary on the pad or other markable surface in the y direction.

- **CHESS TO PAD SURFACE** allows the operator to chess the bond table to a point where a mark can be made or a ball can be placed on the pad surface.

[3] **TOOL MARK-LASER OFF** causes the capillary to make a tool mark on the contact surface.

[4] **ONE BALL-LASER ON** causes one ball to be placed and bonded to the contact surface.

- **CHESS TO CENTER OF TOOL MARK** allows the operator to chess the crosshair to find the center of the ball or the tool mark.

[5] **TEACH CROSSHAIR** will record the position and calculate the difference of expected capillary position and the found position. After this operation subsequent tool mark operations should be very accurately placed.

[6] **OFFSET X** indicates the distance in X direction from the capillary center to the crosshair center. This measurement is calculated automatically by the bonder during the crosshair offset calibration. This value can also be entered manually by the operator.

[7] **OFFSET Y** indicates the distance in Y direction from the capillary center to the crosshair center. This measurement is calculated automatically by the bonder during the crosshair offset calibration. This value can also be entered manually by the operator.

4.5.2 Crosshair Offset Calibration Procedure

A. Select Calibration mode on the top tool bar and the click Crosshair Offset. See Figure 4-5.

B. Enter the X/Y ball size.

C. Place an aluminum foil covered device on the work block.

D. If necessary, adjust illumination by clicking on F10 on the lower tool bar. Click on Update Illumination if changes were made. The strip should appear focused and clear.

E. Chess center of crosshair over the pad surface, and click 3 Tool Mark (laser off).

F. Select F2 (zoom video) if necessary to zoom in on tool mark.

G. Chess to mark using B2 on MMI and center crosshair over tool mark.

H. Click 5 Teach Crosshair to calibrate. The X/Y offset values will be displayed in the Crosshair Offset dialog box.

I. Select Done to accept calibration data and exit crosshair offset calibration screen.

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4.6 Workholder

Workholder calibrations bring all the six component parts of the workholder into proper alignment with one another. This assures that strips will be properly loaded, indexed, and ejected.

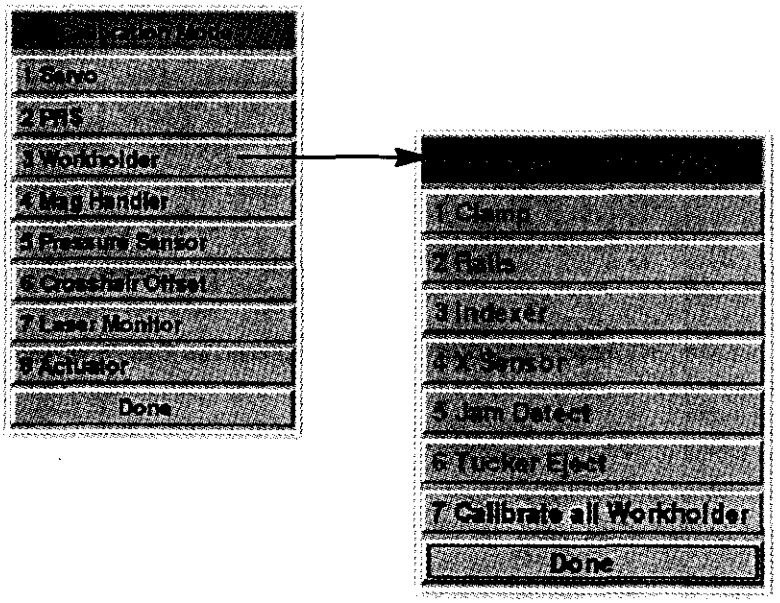


Figure 4-6 Workholder Calibration Menu

4.6.1 Work Block Calibration

Work block calibration is the first to be done in a series of MHS calibrations. This calibration is essential because it establishes the center point of the work block for the Rail, Indexer, and X Registration calibrations.

This function allows teaching specific locations on the work block calibration gauge. These locations allow the Material Handling System to learn the size and center of the work block.

NOTE: Once the workholder calibration sequence has started, the bonder will automatically step the operator through all workholder calibrations. The order in which the calibrations are performed is fixed, and cannot be done randomly.

NOTE: Once the workholder calibration procedure has started all the calibrations must be performed. If the entire procedure is interrupted or cancelled all new workholder calibration data will not be accepted and the original calibration values will still be active.

NOTE: Calibrations should be performed with no material in the workholder or magazine handlers.

NOTE: MHS calibration can not be performed unless X, Y, Z and A servo motion axes have been tuned and crosshair offset has been previously calibrated.

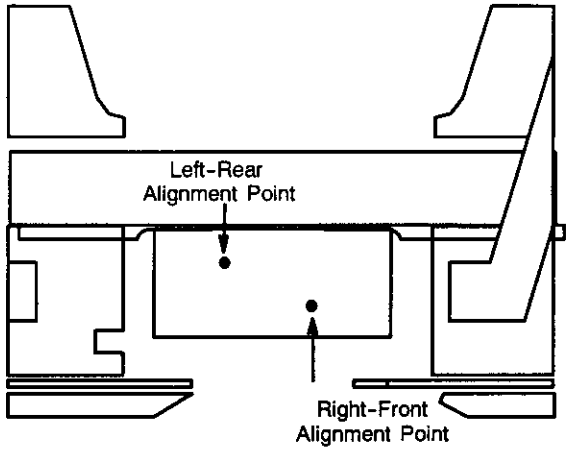
4.6.1.1 Perform Work Block Calibration

Clicking on **[7] CALIBRATE ALL WORKHOLDER** will initiate the calibration sequence. On-screen instructions direct the operator to teach the position of the work block.

There are two circular indented alignment points on the work block calibration gauge (part# 09388-0901-008-00) that are used to establish the center point of the work block. One point is located to the left-rear of the center point. The other point is located to the right-front of the center point. See Figure 4-7.

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Top of calibration gauge shown in the workholder

Figure 4-7 Work Block Calibration

4.6.2 Rail Calibration

In the rail calibration, the front and rear rail home positions are taught with respect to center of bond in the Y axis. Rail calibration should be performed after any significant adjustment to the workholder which may affect the Y centerline of index.

This procedure uses the calibrated work block values to find the center of bond in the Y axis. The user is asked to position the horizontal crosshair at the edge of the vertical strip stopping surface of each rail, which completes the calibration.

4.6.2.1 Perform Rail Calibration

A. Select **CALIBRATION**, then select **WORKHOLDER** from the calibration menu.

B. Upon entering **RAIL** the rails open and the user is asked to remove the strip and clamp insert. After removing strips (if any) and the clamp insert, select **OK**.

C. Remove the work block insert if prompted. Select **OK**. The rails close in toward each other.

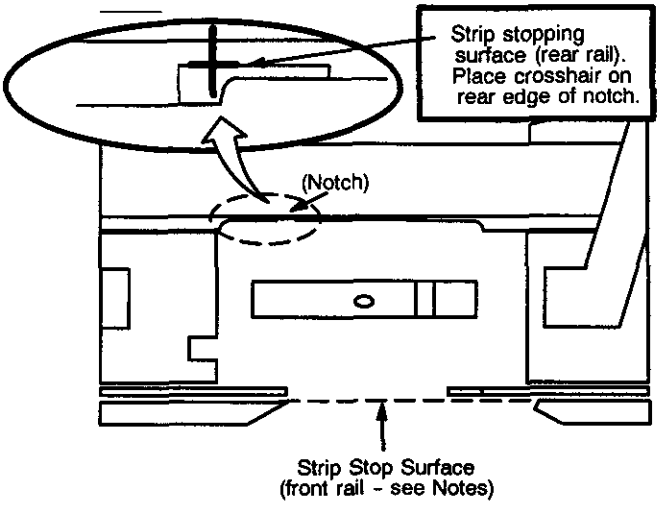
NOTE: It may be difficult to see the edge of the strip stopping surface in the video window. Use the tip of a small tool (tweezers, etc.) held against the strip stopping surface within the camera field of view to locate the edge. Do not press hard enough to move the rail.

D. Locate the notched (cutout) portion of the rear rail (see Figure 4-8). The width of the notch represents the depth of the slot in the rail which supports the strip. Align the horizontal crosshair with the back edge of the notch (stopping surface of the rear rail). Select **OK**.

NOTE: If the stop surface of the right front rail is used in the next step, the bond head will approach its Y limit. To make the alignment easier, the user can hold a straight edge against the stopping surfaces on both sides of the gap between the front rails. Then the user can align the crosshair on the forward edge of the straight edge in the gap.

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Locate front and rear rail strip stopping surfaces

Figure 4-8 MHS Rail Calibration

E. Align the horizontal crosshair with the strip stopping surface of the front rail (back vertical surface). Select **OK**.

F. Install the work block insert. Select **OK**.

4.6.3 Indexer Calibration

Indexer calibration teaches the index gripper assembly home position with regard to center-of-bond position in the X direction. This calibration should be performed after any significant adjustment to the index gripper which may affect the X centerline of index, or the X origin.

This procedure uses the calibrated work block values to determine the center of bond in the X axis. The index gripper is then moved close to the bond site. The user is asked to insert a calibration wafer and align the vertical crosshair with the right edge of the wafer. Confirming the location of this point completes the procedure.

4.6.3.1 Perform Indexer Calibration

A. Upon entering **INDEXER** calibration follow the on-screen prompts and perform the following.

B. Remove strip (if present) and the clamp insert. Select **OK** when done.

C. Remove the work block insert. Select **OK** when done.

D. Place the Calibration Wafer (P/N 03501-0901-001-xx) on the rails benching it against the rear rail and the left side of the closed indexer gripper jaws (see Figure 4-9). Select **OK** when done.

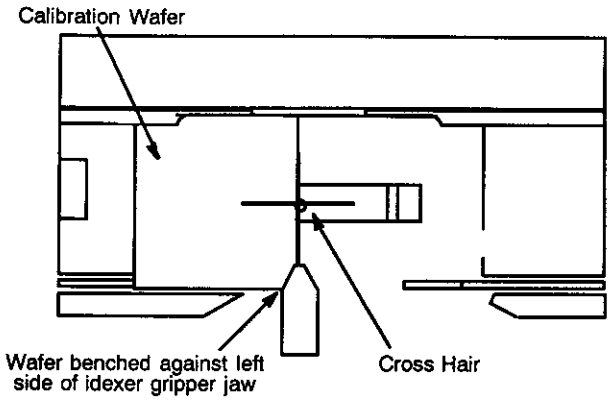
E. Align the vertical line of the crosshair with the right edge of the wafer (see Figure 4-9). Select **OK** when done.

F. Remove the Calibration Wafer. Select **OK** when done.

G. Replace the work block insert. Select **OK** when done.

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Bench wafer against rear rail and closed gripper jaws. Align crosshair with right edge of wafer.

Figure 4-9 MHS Indexer Calibration

4.6.4 X Registration Sensor Calibration

X registration sensor calibration determines the distance from the sensing point of the X registration sensor to the bond site in the X axis. This calibration must be performed after every adjustment to the indexer, or when the X registration sensor is adjusted or replaced.

4.6.4.1 Perform X Registration Sensor Calibration

A. Upon entering **X SENSOR** calibration follow the on-screen prompts and perform the following.

B. Remove material (if any) from the workholder. Select **OK** when done.

C. Locate the sensor amplifier for the X registration sensor (the X registration sensor amplifier is the bottom amplifier below the workholder rails at the left-front of the workholder assembly). Remove the plastic cover from the sensor amplifier. Make sure that the sensor is in its normal operating mode (green LED on sensor amplifier lit - not flashing). If the sensor is not in this state, press the **TEACH** pushbutton switch on the sensor and hold it for approximately two seconds. Select **OK.**

D. Place the calibration wafer (P/N 03501-0901-001-xx) on the workholder rail strip supports for use when calibrating for strips or P/N 08021-0901-011-xx when calibrating for ball grid array (BGA) devices). If using the strip calibration wafer, the silver side of the wafer must be down. Position the wafer over the X registration sensor, as shown in Figure 4-10.

E. Press the **TEACH** pushbutton and hold it for two (2) seconds to place the amplifier in teach mode (red LED on steadily, green LED flashes slowly).

F. Press the **TEACH** pushbutton again to teach the blocked state to the amplifier. The green LED will then flash more quickly to indicate the sensor is ready to learn the unblocked state. Select **OK**.

G. Slide the calibration wafer to the left so that it no longer covers the X sensor. Press the **TEACH** pushbutton again to teach the sensor the unblocked state. All three LEDs on the sensor amplifier flash four times to indicate that teaching is complete. The sensor returns to normal operating mode. Install the the plastic cover on the sensor amplifier. Select **OK**.

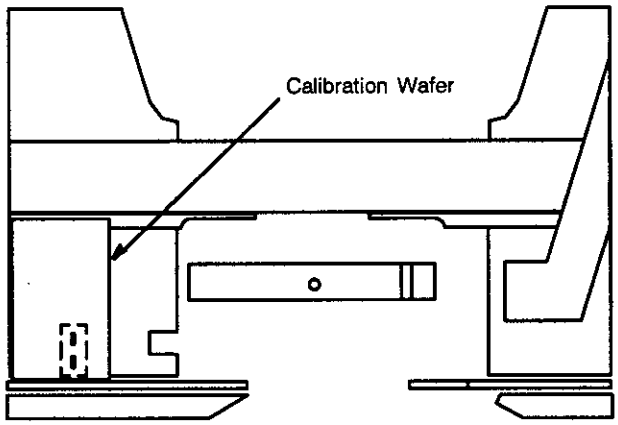
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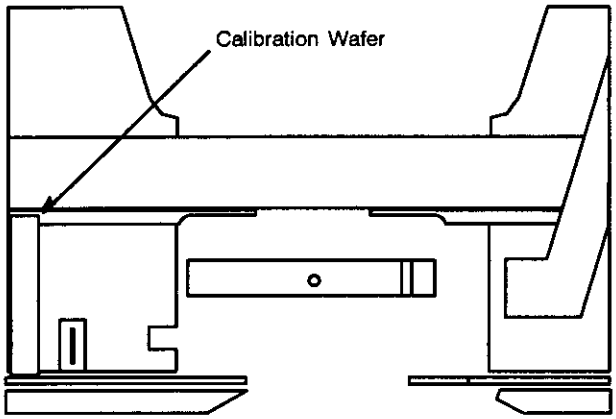
H. Slide the calibration wafer to the right so that it covers the X sensor. Select OK. The index gripper moves left and grips the calibration wafer. The gripper rapidly pulls the wafer to the left and then to the right to locate the point where the sensor sees the right edge of the wafer. It then pulls the wafer to the bond site.

I. Align the vertical line of the crosshair in the GUI video window with the right edge of the wafer (see Figure 4-10). Select OK.

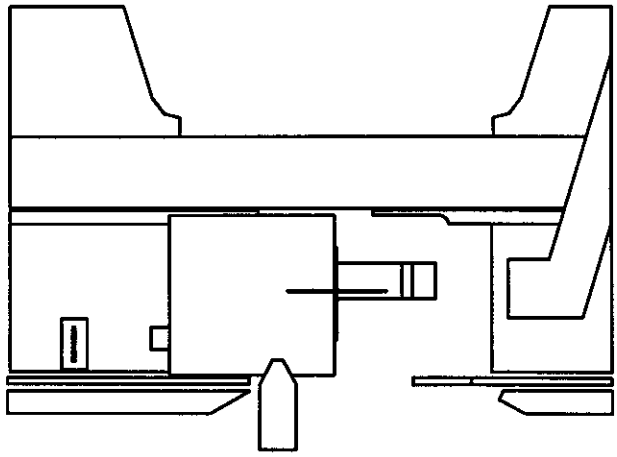
J. Remove the calibration wafer from the workholder. Select OK. Install the work block insert. Select OK.



1. Place calibration gauge wafer on strip supports so that it covers the X registration sensor. Teach the sensor the "blocked" state.



2. Move the wafer to the left so it does not cover the sensor. Teach the sensor the "unblocked" state. Move the wafer to the right over the sensor.



3. Gripper pulls the wafer right then left to locate the X sensor, then moves it to the bond site. Locate the right edge of the wafer with the crosshair.

NOTE

Left-side clamp arm not shown for clarity.

Figure 4-10 X Registration Sensor Calibration

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4.6.5 Jam Control Calibration

Jam control calibration determines two MHS machine dependent parameters (MDPs) used by the jam detection subsystem: Zero Offset and Scale Factor. The machine performs the calibration automatically after it is started by the user. The only user action required is to accept or discard the calibration results.

4.6.5.1 Perform Jam Control Calibration

A. Upon entering the **JAM DETECT** calibration follow the on-screen prompts.

B. The machine performs the calibration automatically.

4.6.6 Tucker Calibration

Tucker calibration determines the distance from the index gripper home position to the index gripper position where the working end of the tucker is aligned with the outer surface of the output magazine handler side wall. This calibration must be performed after every adjustment to the index gripper, or when the tucker is removed/replaced.

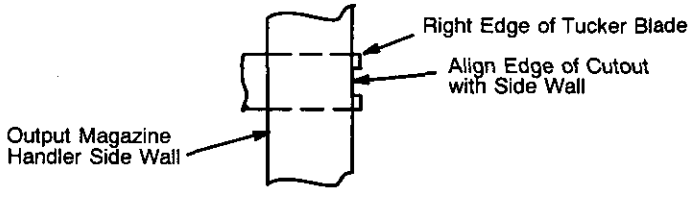
4.6.6.1 Perform Tucker Calibration

A. Upon entering **TUCKER EJECT** calibration follow the on-screen prompts and perform the following.

B. Observe the displayed Warning (see below), then select **OK**

WARNING: THE OUTPUT MAGAZINE COULD BE EJECTED AS PART OF THE CALIBRATION. REMOVE HANDS FROM MAG HANDLER BEFORE SELECTING OK.

C. Use the left/right arrow keys (◀ and ▶) on the control panel to move the index gripper in the X axis until the right edge of the cut in the tucker blade is flush with the outside surface of the output magazine handler side wall (see illustration below). Select **OK**.



Front View

D. Press **[ESCAPE]** as needed to exit calibration mode.

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4.6.7 Clamp Calibration

The purpose of clamp calibration is to teach the bond-plane height for the workholder. This calibration should be performed after replacement or major adjustment to the clamp, work block, bond head, or ball attach mechanism.

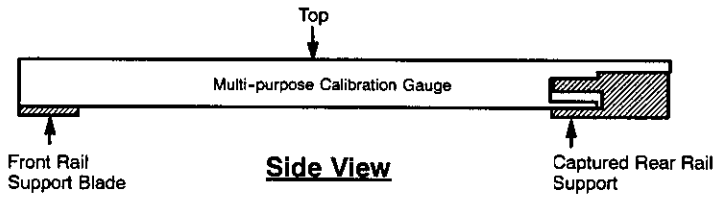
In this procedure, the user is asked to place a multi-purpose calibration gauge across the strip support surfaces of the front and rear rails. Over each support surface, the machine moves the capillary down to find contact with the gauge and from the two contact heights determines the support surface heights. The machine calculates the bond plane height by using the higher of the two support surface heights and adding an offset (approximately 40 mils). The user then positions the capillary over the work block gauge (part # 09388-0901-008-00), after which the capillary is lowered under machine control until its tip contacts the work block gauge. The work block height is adjusted until it matches the calculated bond plane height. The capillary tip is again lowered to contact the work block gauge. The user then installs the clamp insert and positions the capillary over a machined surface on the clamp insert. The work block gauge moves up to contact the clamp insert which then contacts the capillary.

4.6.7.1 Perform Clamp Calibration

A. Follow the on-screen prompts to perform **CLAMP** calibration.

B. Upon entering the **CLAMP** calibration the rails open. A dialog box appears requesting removal of all materials (i.e., clamp insert, strips, and work block insert, if in place). After doing this, select **OK** to continue.

C. Place the multi-purpose calibration gauge (P/N 09388-0901-003-xx) across the front and rear rails and to the right of X center (see Figure 4-11). Orientate the gauge so that the flat side is up and the cut-out portion is at the bottom towards the rear rail. Ensure that the bottom side of the gauge is resting on the rear capture rail's strip supporting surface and the front strip support blade (see illustration below). After doing this, select **OK** to continue. The capillary moves down, touches on the gauge above the front support, rises and moves back, touches on the gauge above the rear support, then moves up and back. The machine calculates front and rear support heights from the two contact heights.



D. Remove the multi-purpose calibration gauge and select **OK**. The rails open. Install the work block gauge on the work block mount, then select **OK**.

E. The work block comes up between the rails until it is at the nominal bond plane height. Position the crosshair over the top surface of the work block gauge. Target the crosshair so that it is to the right of X center (see Figure 4-11). After doing this, select **OK** to continue.

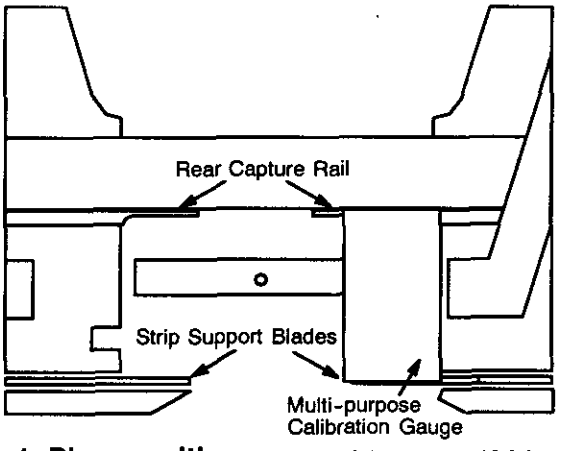
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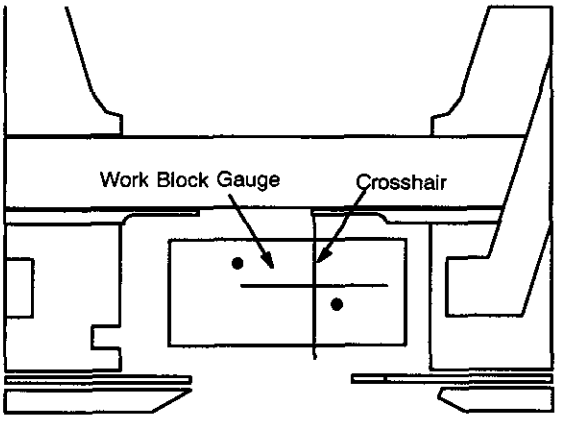
F. The bond head moves down until contact with the work block is sensed, then moves up. The work block position is adjusted so that it is at bond plane height. The bond head moves down again to find contact between the capillary and work block gauge. This is repeated until the work block gauge is actually at the bond plane height, which then becomes Z=0.

G. Install the clamp insert, then select OK. Position the crosshair over the top surface of the clamp insert. (See Figure 4-11). After doing this, select OK to continue.

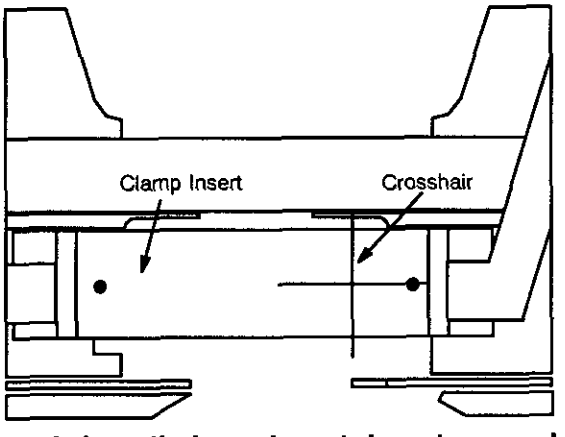
H. The clamp closes. The capillary comes down, touches the clamp insert, and then rises. The work block moves up to nominal position. The capillary moves down to contact the clamp insert surface, then rises. The work block position is adjusted to the clamp position, after which the capillary again moves down to contact the clamp insert. This is repeated until the clamp is raised eight (8) mils. This step ensures that the clamp is at the proper height when the work block is at the clamped position.



1. Place multi-purpose gauge across strip supports. The capillary comes down to contact the gauge at two points.



2. Install work block gauge. Locate cros hair over work block gauge surface.



3. Install clamp insert. Locate crosshair over clamp insert surface

Figure 4-11 MHS Clamp Calibration

I. Select OK in response to 'Calibration was Successful' dialog box.

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4.7 Magazine (Mag) Handler

The Magazine Handler calibrations consist of software routines that are used to calibrate the input slot, output slot, input trays and output trays. Using a series of dialog boxes, the software steps the user through each calibration process. See Figure 4-12.

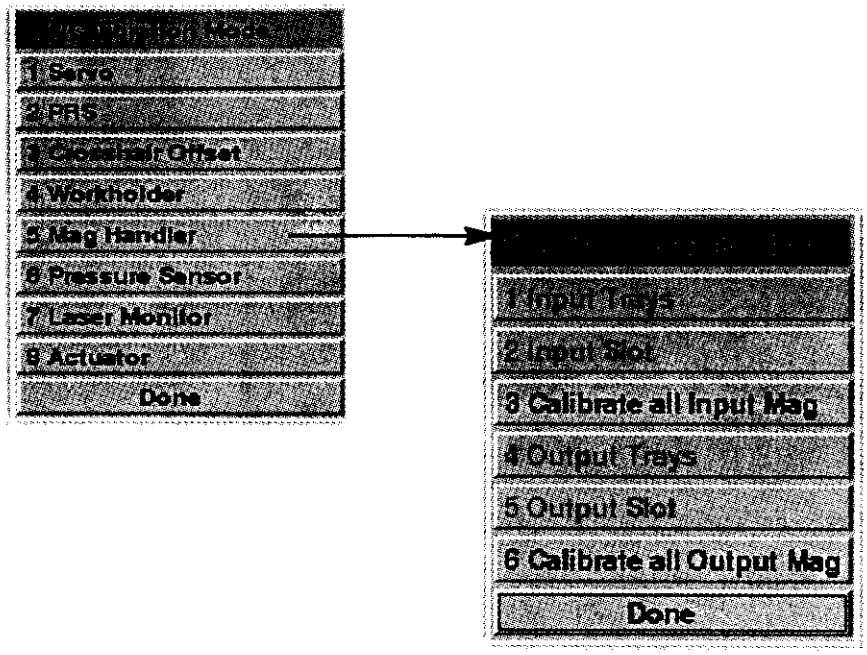


Figure 4-12 Magazine Handler Calibration Menu

NOTE: Each magazine handler calibration must be executed in its entirety. Clicking on the **CANCEL** button at any time before the calibration is complete requires a restart of the calibration procedure.

NOTE: Clicking on F6 on the lower tool bar will unlock the mag handler doors. Once the doors are open pull the Safety Override Switch out. This will allow the operator to perform the following calibrations.

4.7.1 Input/Output Slot Calibration

The Input/Output Slot calibrations consist of software routines that prompt the user to move the input/output magazine handler gripper assembly to specific positions in the Y and Z axes thereby teaching the machine the correct slot positions for strip injection and ejection.

Figure 4-13 identifies the gauges used in the Input/Output Slot calibrations. The figure describes each gauge relating to how it is used when performing the Input and Output Slot calibrations. This figure should be referenced when performing the calibrations.

WARNING: DURING THE CALIBRATION PROCEDURES, MHS COMPONENTS MOVE. BEFORE EXECUTING EACH STEP, REMOVE HANDS FROM THE MAG HANDLER AND WORKHOLDER AREAS.

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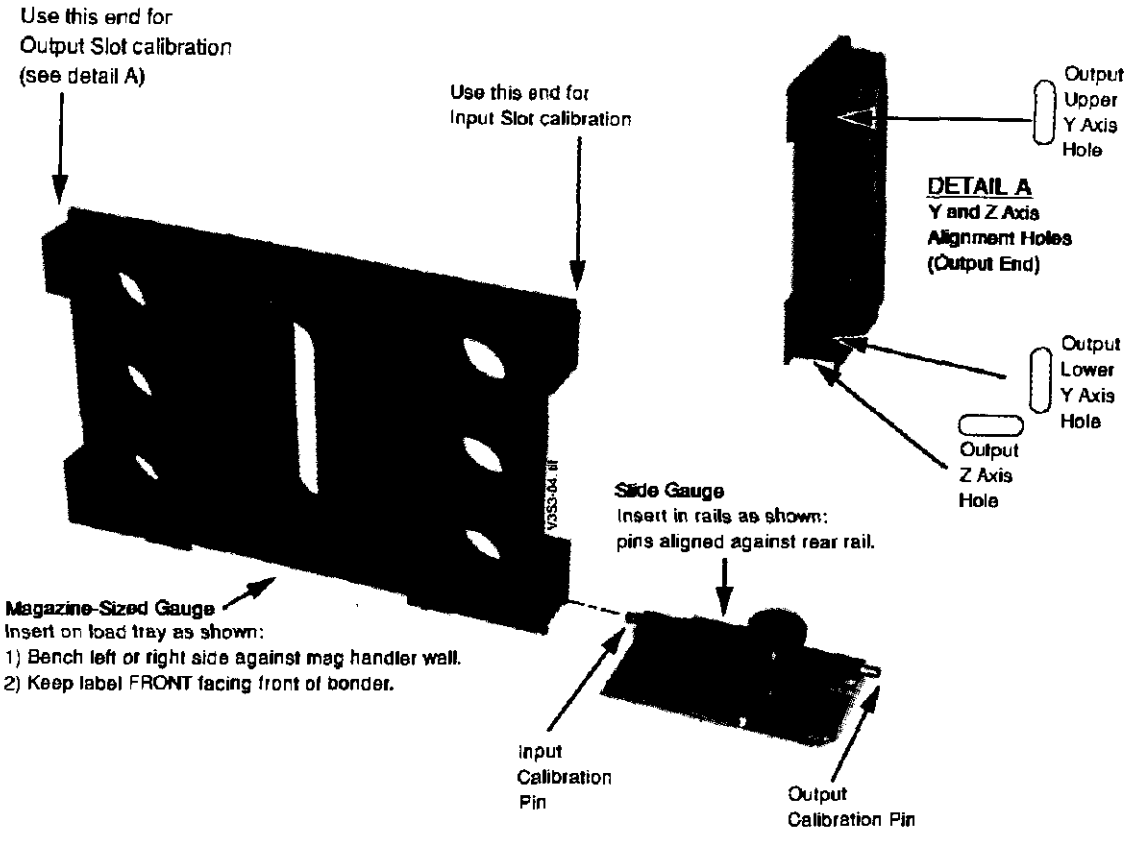


Figure 4-13 Magazine-Sized Gauge and Slide Gauge

NOTE: The steps for calibrating the input slot and output slot are the same. Therefore, only the operations required to perform the 'Input Slot' calibrations are given in the steps that follow.

- Required Gauges
  1. Magazine-Sized Gauge (P/N 03201-0999-007-0X)
  2. Slide Gauge (P/N 08021-0901-014-0X)
- Tools/Material

  None
- Procedure

A. Select **CALIBRATION**, from the mode bar, then select **CALIBRATE ALL INPUT MAG** from the Calibration mode menu. This causes the first in a series of instructional dialog boxes to appear. See Figure 4-12.

B. Remove all material from the workholder. Remove the clamp and work block inserts if necessary. Select **OK** when done.

C. Insert the magazine and slide gauges by executing the following.

1. Place the magazine-sized gauge on the input magazine handler load tray. Position the gauge for pickup by benching it against the input magazine handler wall. Ensure that the label **FRONT** is facing the front of the machine.

2. Insert the slide gauge in the workholder, positioning its pins along the rear rail. Carefully bench the slide gauge (use very little pressure) against the rear rail (see Figure 4-14).

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3. Select OK in the dialog box. This causes the input magazine handler to pick up the magazine-sized gauge.

D. Position the magazine-sized gauge at the correct Z axis location by executing the following.

1. Using the Up and Down arrow keys on the MMI, chess the gripper (fork) so that the slide gauge input pin can be inserted freely into the Z Axis hole on the magazine-sized gauge (observe CAUTION below).

2. When alignment is correct, move the slide gauge back into the workholder, ensuring that the pin is free of the magazine gauge. When the slide gauge is positioned correctly, select OK in the dialog box.



CAUTION: Do not leave the slide gauge inserted into the magazine gauge when chessing gripper.

E. Position the magazine-sized gauge at the correct lower Y axis location by executing the following.

1. Using the Left and Right Arrow keys on the MMI, chess the gripper (fork) so that the slide gauge input pin can be inserted freely into the lower Y Axis hole on the magazine gauge.

2. When alignment is correct, move the slide gauge back into the workholder, ensuring that the pin is free of the magazine gauge. When the slide gauge is positioned correctly, select OK in the dialog box.

F. Position the magazine-sized gauge at the correct upper Y axis location by executing the following.

1. Using the Left and Right Arrow keys on the MMI, chess the gripper (fork) so that the slide gauge input pin can be inserted freely into the upper Y Axis hole on the magazine gauge.

2. When alignment is correct, move the slide gauge back into the workholder, ensuring that the pin is free of the magazine gauge. When the slide gauge is positioned correctly, select OK in the dialog box.

G. Adjust the width of the unload tray magazine guide so that it clears the magazine gauge when the gauge is ejected. Select OK in the dialog box to eject the magazine gauge.

H. Remove the slide gauge from the workholder rails. Select OK when done.

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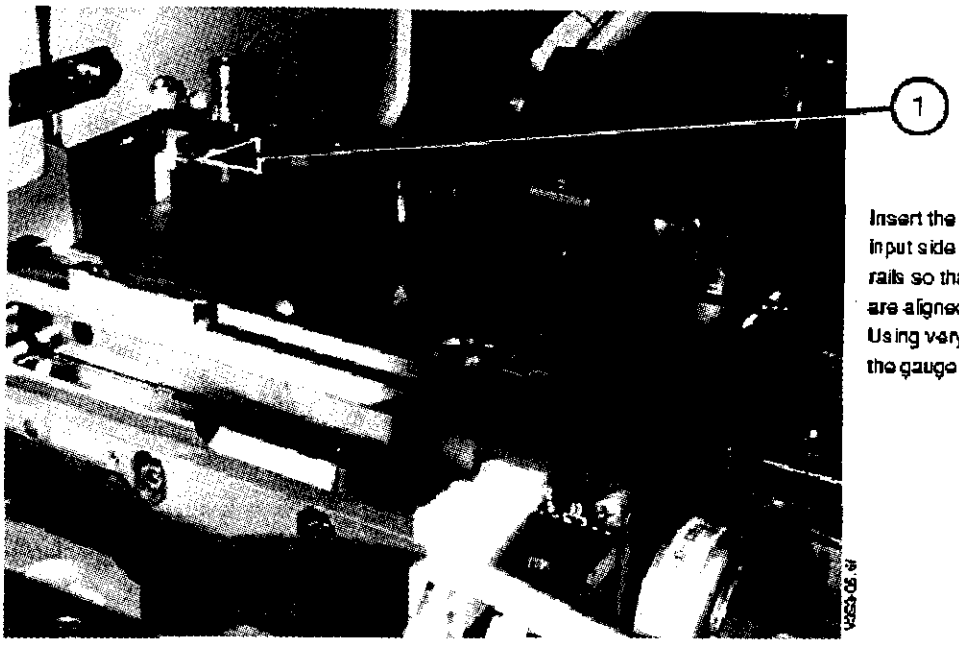


Figure 4-14 Inserting the Slide Gauge

4.7.2 Input/Output Trays Calibration

The Input/Output Trays calibrations consist of software routines that prompt the user to move the input/output magazine handler gripper assembly to specific positions in the Y axis thereby teaching the machine the correct positions for picking up and ejecting magazines.

WARNING: DURING THE CALIBRATION PROCEDURES, MAG HANDLER COMPONENTS MOVE. BEFORE EXECUTING EACH STEP, REMOVE HANDS FROM THE MAG HANDLER AREA.

NOTE: The steps for calibrating the input trays (left side of bonder) and the output trays (right side of bonder) are the same. Therefore, only the operations required to perform the 'Input Trays' calibration are given in the steps that follow.

- Required Gauges

  Empty magazine or straightedge

- Tools/Material

  None

- Procedure

NOTE: Either an empty magazine or a straightedge may be used in this calibration. In the steps below, the use of a magazine is described.

I. Upon entering the tray calibration procedure, the first in a series of instructional dialog boxes will appear.

J. Remove magazines or other material from the input magazine handler's top and bottom trays. Select OK when done.

K. Following the instructions in the dialog box and the steps below, align the input magazine handler's top tray.

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1. Place an empty magazine on the input magazine handler's top tray, benching it to the rear right corner of the tray.
2. Using the Left and Right Arrow keys on the MMI, chess the input magazine handler's gripper (fork) to where the benching buttons above the bottom gripper pad just contact the magazine wall (see Figure 4-15).
3. Select OK in the dialog box when the gripper is at the correct position.

L. Following the instructions in the dialog box and the steps below, verify the top tray calibration.

1. Remove the magazine from the top tray.
2. Select OK in the dialog box. The tray sensor at the front of the gripper finds the sensor flag at the top tray. When done, the gripper moves near the bottom tray and stops. The next dialog box appears on the display.

M. Following the instructions in the dialog box and the steps below, align the input magazine handler's bottom tray.

1. Place an empty magazine on the input magazine handler's bottom tray, benching it to the rear right corner of the tray.
2. Using the Left and Right Arrow keys on the MMI, chess the input magazine handler's gripper (fork) to where the benching buttons above the bottom gripper pad just contact the magazine wall. This is the same procedure that was performed for the top tray.
3. Select OK in the dialog box when the gripper is at the correct position.

N. Following the instructions in the dialog box and the steps below, verify the bottom tray calibration.

1. Remove the magazine from the bottom tray.
2. Select OK in the dialog box. The tray sensor at the front of the gripper finds the sensor flag at the bottom tray.

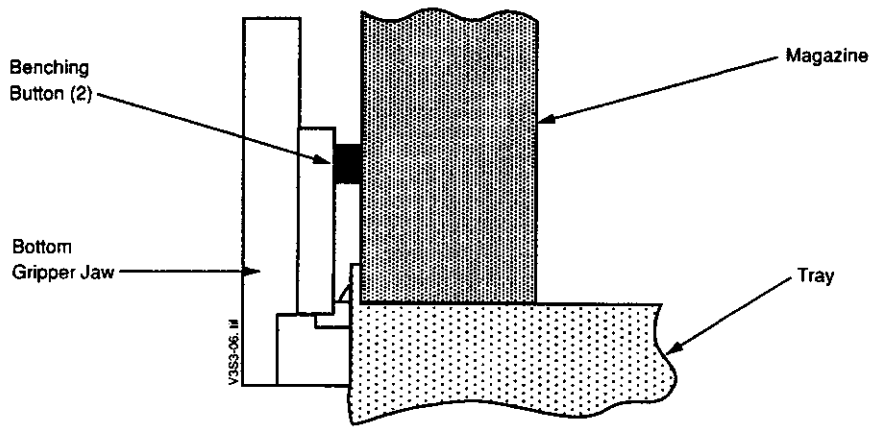


Figure 4-15 Magazine Touching Benching Buttons (Side View)

NOTE: This completes the input mag handler slot and tray calibration procedure. Repeat same steps for the output mag handler slot and tray calibrations by selecting CALIBRATE ALL OUTPUT MAG in the Mag Handler Calibration menu. See Figure 4-12.

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4.8 Pressure Sensor Calibration

The pressure sensor is used to guarantee high yields by providing feedback to the bonding system to verify a ball has properly been fed to the bond surface before the laser is fired. This allows for high yields and eliminates damage to the pads from firing the laser without a ball on the pad surface.

Section 4.8.1 below describes the specific items existing in the crosshair offset dialog box.

Thereafter, section 4.8.2 describes a stepwise crosshair offset calibration procedure.

4.8.1 Pressure Sensor Calibration Setup

Performing the calibration will record pressure values at various capillary height positions, which will set pressure values for the following conditions. See Figure 4-16.

- **Normal condition** with nitrogen flowing around the ball when the ball is sitting on the surface of the pad.
- **Error condition** with a clogged capillary due to improper reflow or an error in feeding.
- **Error condition** of no ball fed when the capillary is above the surface of the pad.

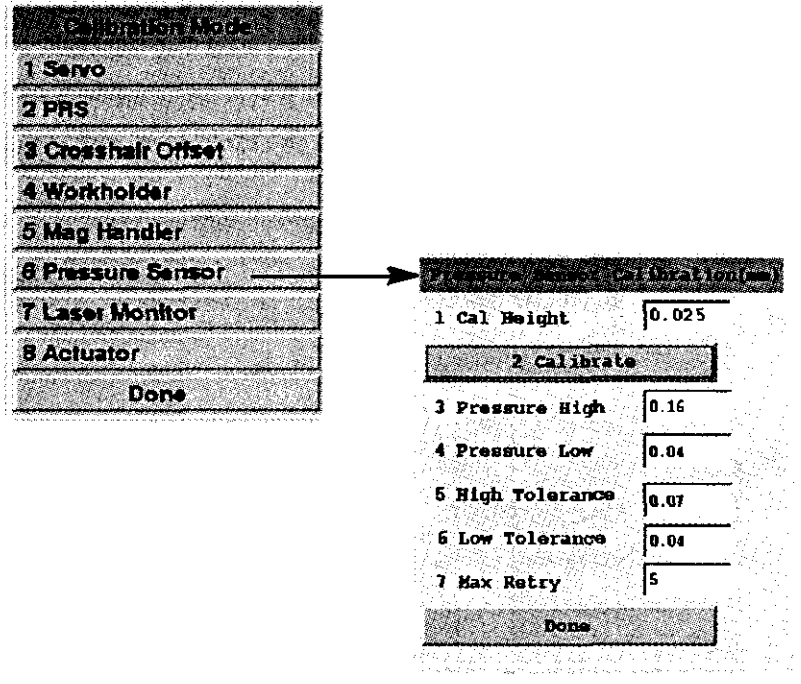


Figure 4-16 Pressure Sensor Calibration Dialog Box

[1] **CAL HEIGHT (UM)** determines the capillary height used to simulate the condition of a ball placed on the pad, typically around .025 mm.

[2] **CALIBRATE** initiates the calibration procedure.

[3] **PRESSURE HIGH** indicates the value of the pressure reading when the capillary is at the simulated position of surrounding the ball.

[4] **PRESSURE LOW** indicates the value of the pressure reading when the capillary is at the simulated position of containing no ball.

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[5] **HIGH TOLERANCE** sets the range of the **PRESSURE HIGH** value used to detect normal or error conditions.

[6] **LOW TOLERANCE** sets the range of the **PRESSURE LOW** value used to detect normal or error conditions.

[7] **MAX RETRY** allows the operator to set the number of retries the bonder will attempt to feed a ball, when a recoverable error is detected. After the number of retries has expired, operator assist is required to correct the problem.

4.8.2 Pressure Sensor Calibration Procedure

A. Select Utility mode on the top tool bar, then select Solenoids. See Figure 4-17.

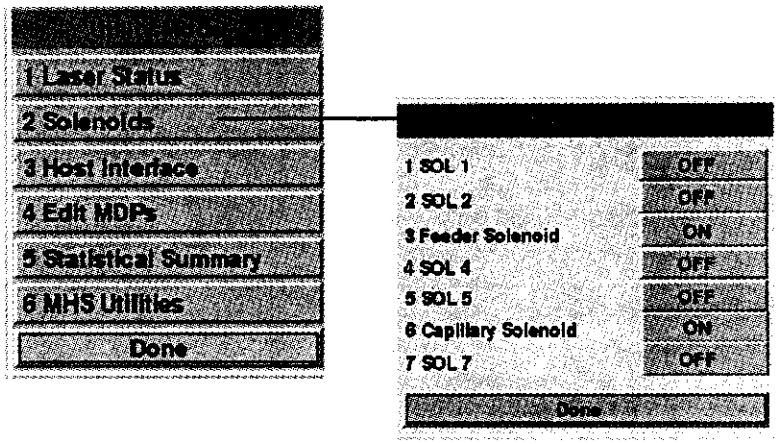


Figure 4-17 Solenoid Status Box

B. Turn **ON** Solenoid 3 and Solenoid 6.

C. Adjust the feeder pressure to 7-8 psi and head capillary pressure to 4-5psi.

D. Place a strip on the work block.

E. Select Calibration mode from the top tool bar, then select Pressure Sensor. See Figure 4-16.

F. Enter 0.025 (typical) into the Cal Height data entry box, then select [2] **CALIBRATE.** See Figure 4-16.

G. After a few seconds, the values for pressure high and low will be displayed. Typically, there should be a 0.8 or greater difference between the two values. **These values will vary depending upon pressure settings and application.**

H. Enter the high and low pressure values in the Pressure Sensor Calibration dialog box. See Figure 4-16.

NOTE: Depending upon application it may be necessary to increase the high pressure value and lower the low pressure value.

I. Enter the High and Low Tolerance values in the Pressure Sensor Calibration dialog box. Typically, the High Tolerance value can range between 0.5 to 1.0 and the Low Tolerance value can range between 0.1 to 0.3. **These values will vary depending upon pressure settings and application.**

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J. Enter 5 (typical) for Max Retry in the Pressure Sensor Calibration dialog box.

K. Select **Done** to accept data and exit the dialog box.

4.9 Laser Sensor Calibration (*to be implemented*)

Performing laser calibration checks for proper laser operation, which also ensures the safety of the operator.

Laser sensor calibration detects heat variations in the power of the laser. It also ensures that the laser fiber is properly seated in the bond head. If a laser error occurs bonding will stop and the error condition will appear on the monitor. See Figure 4-18.

4.9.1 Perform Laser Sensor Calibration

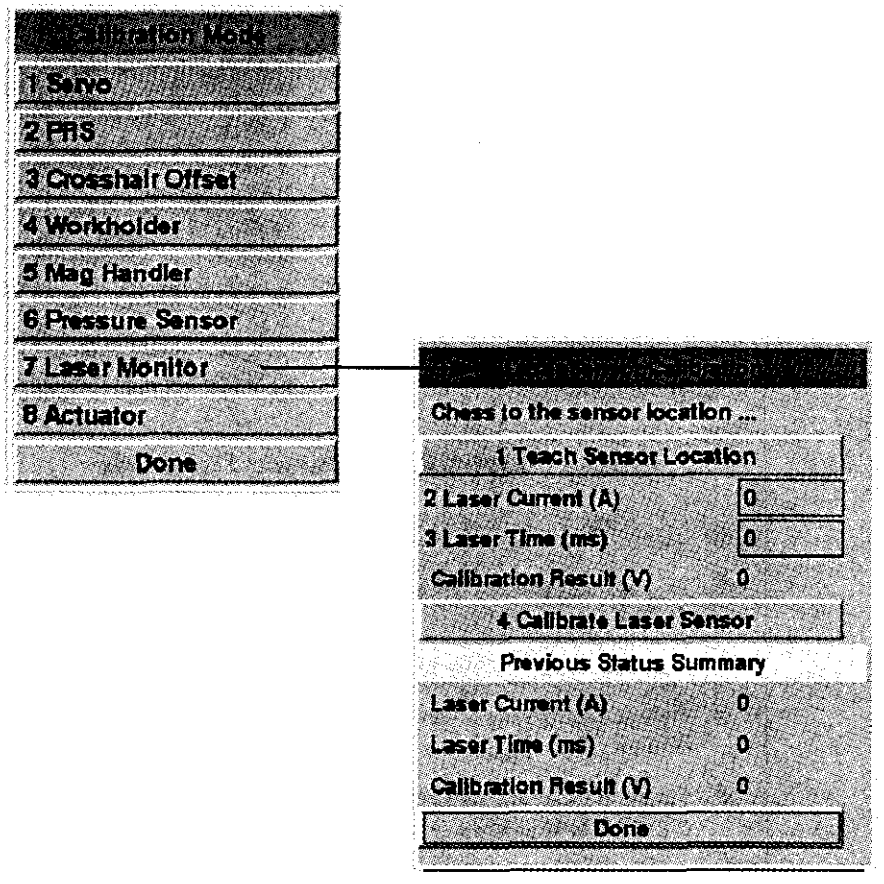


Figure 4-18 Laser Sensor Calibration Dialog Box

- **CHESS TO LASER SENSOR** allows the operator to position the crosshair over the center of the laser fiber located next to the work block.

[1] **TEACH SENSOR LOCATION** allows the operator to teach the location where the periodic laser check will occur.

[2] **LASER CURRENT (A)** is the current (amps) used for laser firing verification.

[3] **LASER TIME (MS)** sets the time the laser will fire per pulse.

- **CALIBRATION RESULT** is the calibration that is monitored by the bonder to ensure that the laser and laser fiber are operating correctly.

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[4] **CALIBRATE LASER SENSOR** initiates the calibration. The bonder will use all the provided parameters and averages to achieve a **CALIBRATION RESULT**. The Laser system will use this value to constantly monitor itself for proper operation.

- **PREVIOUS STATUS SUMMARY** displays the values of the previous Laser Sensor Calibration.

4.10 Actuator Calibration

The actuator calibration establishes the range of travel of the actuator. The calibration completes all necessary steps once started by the operator. At the end of calibration, the results may be saved or rejected.

4.10.1 Perform Actuator Calibration

[1] **CALIBRATE ACTUATOR** initiates the calibration procedure. The calibration completes all necessary steps once started by the operator. Selecting **DONE** saves the new calibration values. Selecting **[ESCAPE]** rejects the new calibration values and saves the existing values. See Figure 4-19.

NOTE: If Actuator Calibration fails after three attempts stop the calibration and perform the following:

1. Turn the power off to the machine. Turn the power back on and fully initialize the machine.
2. Perform the Actuator Calibration. If the failure still exists continue to step 3.
3. Check for a clog in the actuator tongue and capillary head. Refer to *Model 9388 Volume 2 Maintenance Manual,* Section 1. If the failure still exists continue to step 4.
4. Replace the bond head assembly. Refer to *Model 9388 Volume 2 Maintenance Manual,* Section 1.

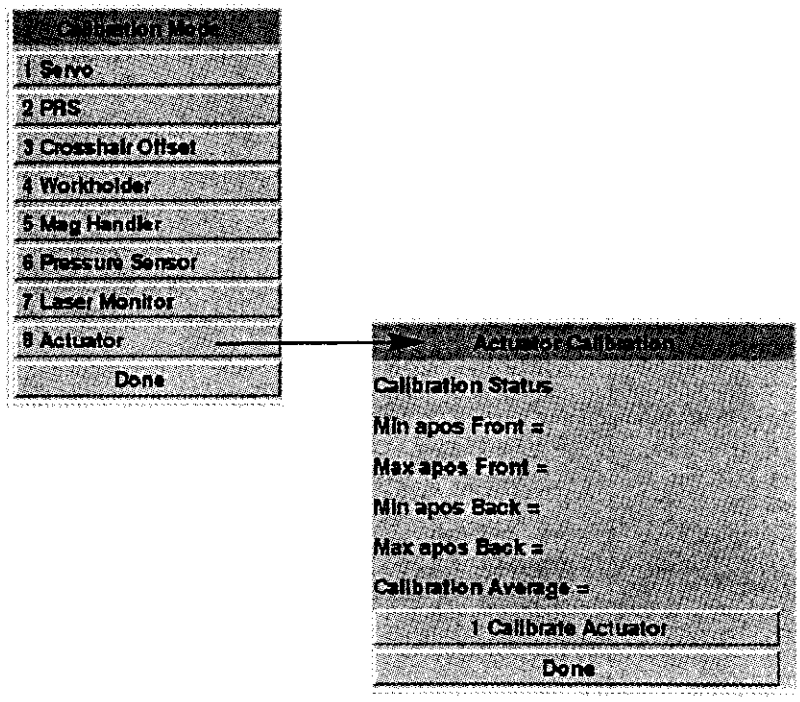


Figure 4-19 Actuator Calibration Menu

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Section

5 CONFIGURING THE MACHINE

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5 Configuring the Machine

5.1 Introduction

Configuring the machine establishes the machine conditions in which the process program is run. Three aspects of machine operation may be configured. (See Figure 5-1). Each of the menu options may be selected by one of the following:

- Key in the number of the function desired, for example **[3]** selects Workholder configuration.
- Place the pointer on the desired function using the trackball and press **[B1]**.
- Use the down and up arrow keys on the MMI to place the highlight on the desired function then press **[B1]** or **[ENTER]**.

Configuring the machine teaches the software default parameter values used in a specific machine and a specific material handling system. All configuration files related to Auto mode as well as the MHS configuration files can be saved by the operator. These parameters are stored on the hard drive and are ***not*** transferrable to another machine and/or material handling system.

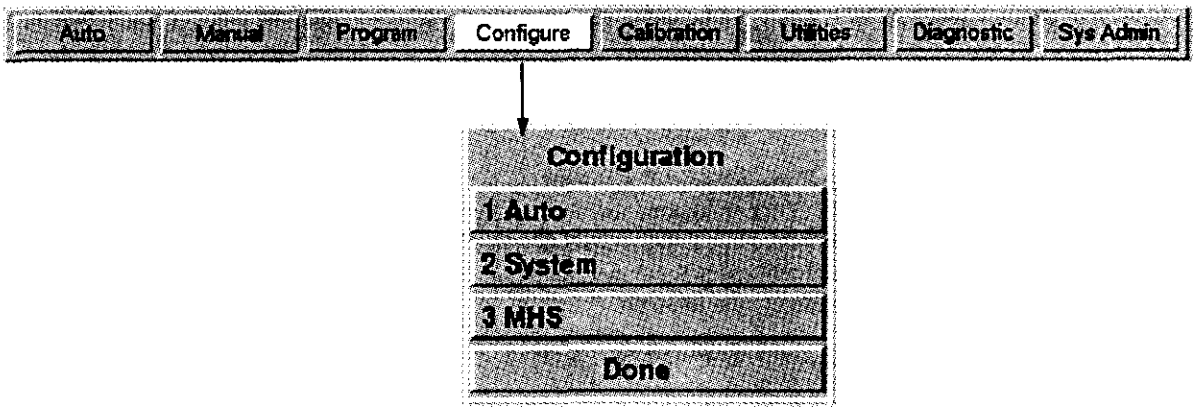


Figure 5-1 Configuration Menu

5.2 Auto Configuration

The purpose of this configuration is to activate or choose specific indexing modes and alignment options to be used while automatic processing is taking place.

The option selections allow the operator to access and set each of the specified operating parameters. Each option has additional choices within its structure.

Clicking on **DONE** exits this function, writing any changes to the hard disk.

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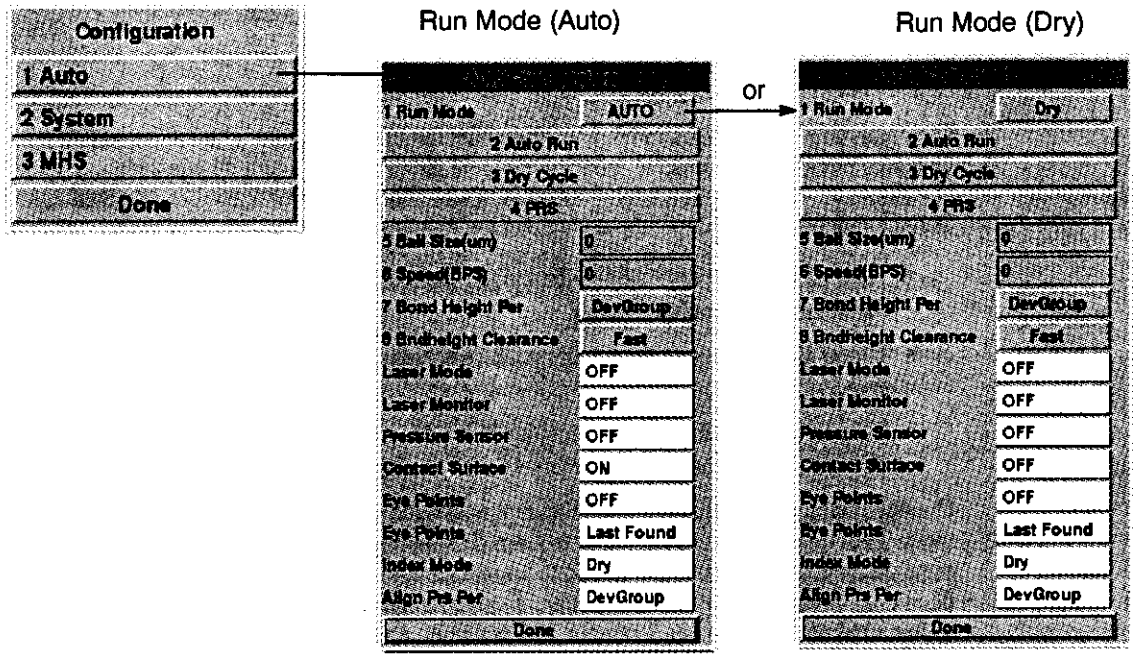


Figure 5-2 Auto Configure Dialog Box

5.2.1 Run Mode

As shown in Figure 5-2, the operator chooses between AUTO RUN and DRY CYCLE. This is accomplished by keying [1] or placing the pointer at the function and pressing [B1] or [ENTER]. Auto Run and Dry Cycle each have a subset of parameters which may also be configured to detail how each is performed within the system.

The message field displays the current Auto Configuration Summary listing the existing settings.

5.2.2 Auto Run

Auto Run options are selected by placing the pointer on the desired function using the trackball and pressing [B1] or [ENTER]. **Auto Run** opens a menu which allows the operator to establish various aspects related to normal production operation. The options are set by keying the number of the "hot key" next to the option. For example, pressing [1] on the MMI sets the Eye Points ON or OFF. These operations allow the operator to define how the 9388 runs in Automatic. Clicking on DONE exits this function, writing any changes to the hard disk drive. See Figure 5-3.

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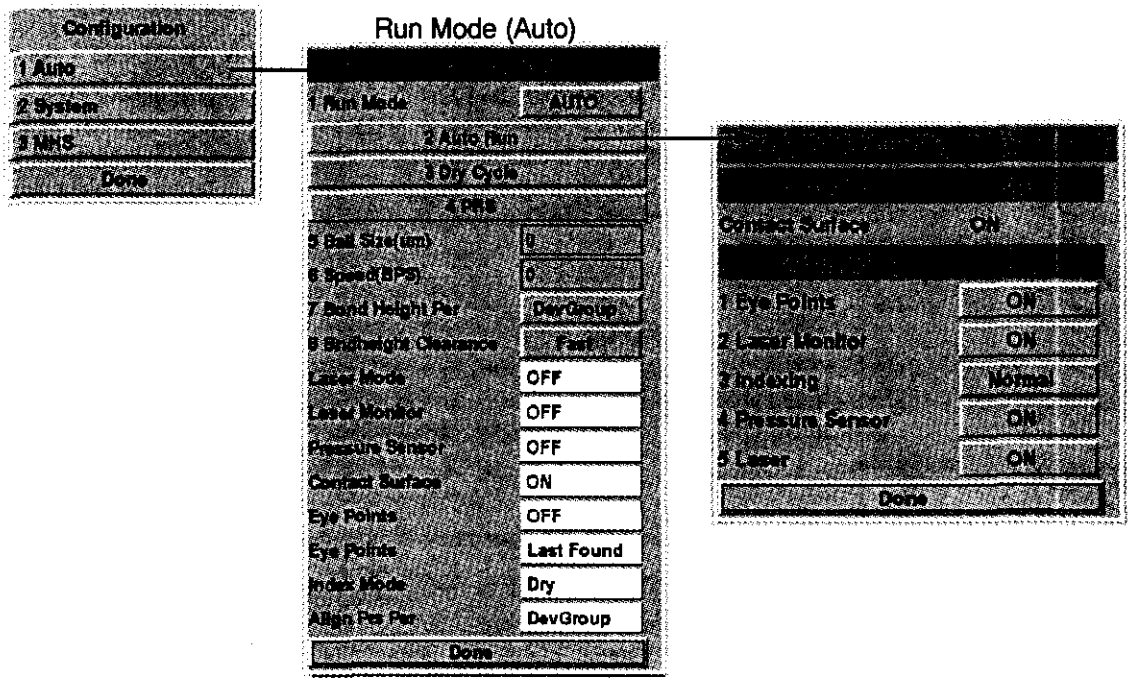


Figure 5-3 Auto Run Dialog Box

Fixed Configuration shows the status of the contact surface, which will be always be **on** during Auto Run.

Adjustable Configuration are items within the dialog box that can be enabled or disabled by the operator. They include Eye Points, Laser Monitor, Indexing, Pressure Sensor and Laser.

NOTE: The options appearing under **[8] BOND HEIGHT CLEARANCE**, display the current state of operating conditions, which are selected within the Auto Run, Dry Cycle and PRS dialog boxes. They will automatically update as the operating conditions are changed.

5.2.2.1 Eye Points

Enables or disables the use of user programmed eye points of the devices process program. Toggle by keying in **[1]** or by placing the pointer or highlight on the function and pressing **[B1]** or **[ENTER]**.

If there are no programmed eye points perform a manual alignment.

5.2.2.2 Laser Monitor

The bonder allows the operator to set the interval between strips that laser monitoring will occur. If laser operation is not detected at the bond head or the correct power is not detected as the laser is firing, a fault will be displayed. Toggle by keying in **[2]** or by placing the pointer or highlight on the function and pressing **[B1]** or **[ENTER]**.

5.2.2.3 Indexing

This selection choice allows the operator to set how material moves through the machine. Toggle by keying **[3]** or placing the pointer or highlight on the function and pressing **[B1]** or **[ENTER]**.

- **NORMAL** is standard automatic indexing of strips when **Auto Index** is enabled on the Man Machine Interface (MMI).
- **SKIP** provides no mechanical indexing. It requires the operator to physically move strips.

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5.2.2.4 Pressure Sensor

This function allows the operator to turn the pressure sensor on or off. Under normal operating conditions the pressure sensor should be on. Under conditions such as testing, troubleshooting or pressure sensor adjustment, the pressure sensor can be tuned off. Toggle by keying in **[4]** or by placing the pointer or highlight on the function and pressing **[B1]** or **[ENTER]**.

5.2.2.5 Laser

This function allows the operator to turn the laser on or off. Under normal operating conditions the laser should be on. Under conditions such as testing or troubleshooting, the laser can be tuned off. Toggle by keying in **[5]** or by placing the pointer or highlight on the function and pressing **[B1]** or **[ENTER]**.

5.2.3 Dry Cycle

This operation allows the operator to define how the 9388 runs in a Dry Cycle during automatic operation. Dry cycle simulates a normal running condition without processing actual strips. Dry Cycle is useful when performing operations such as debug testing or setup. Clicking on **DONE** exits this function, writing any changes to hard disk. See Figure 5-4.

NOTE: The options appearing under **[8] BOND HEIGHT CLEARANCE**, display the current state of operating conditions, which are selected within the Auto Run, Dry Cycle and PRS dialog boxes. They will automatically update as the operating conditions are changed.

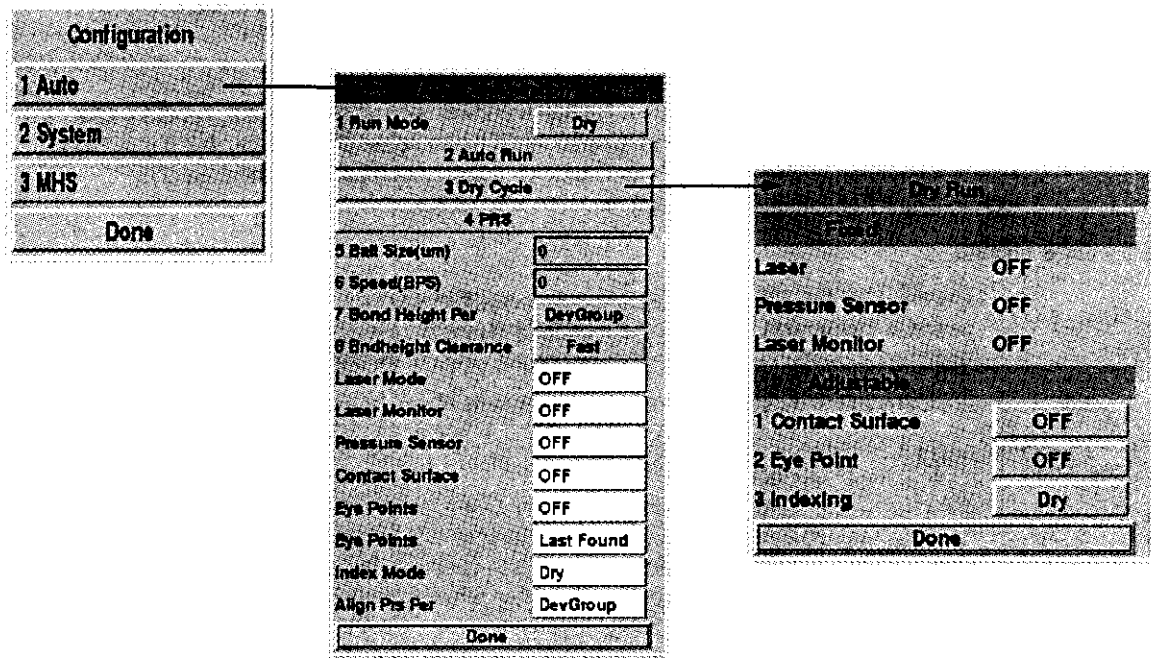


Figure 5-4 Dry Cycle Dialog Box

Fixed Configuration shows the status of the Laser, Pressure Sensor and Laser Monitor, all of which will always be **Off** during Dry Run.

Adjustable Configuration are items within the dialog box that can be enabled or disabled by the operator. They include Contact Surface, Eye Points and Indexing.

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5.2.3.1 Contact Surface

Enables or disables the bond tool contacting the bond surface during dry cycle. Toggle by keying in [1] or by placing the pointer or highlight on the function and pressing [B1] or [ENTER].

5.2.3.2 Eye Points

Enables or disables the use of user programmed eye points of the devices process program. Toggle by keying in [2] or by placing the pointer or highlight on the function and pressing [B1] or [ENTER].

5.2.3.3 Indexing

This function choice allows the operator to set how material moves through the machine during Dry Cycle.

Toggle through the choices by keying in [3] or by placing the pointer or highlight on the function and pressing [B1] or [ENTER].

- **NORMAL** is standard indexing of strips when **Auto Index** is enabled on the Man Machine Interface (MMI).
- **DRY** enables 9388 operation without material present.
- **SKIP** disables indexing regardless of Auto Index status. The machine uses the same package repeatedly.

5.2.4 Pattern Recognition System (PRS)

This dialog box allows the operator to set how the PRS works during Auto or Dry Cycle operation. See Figure 5-5.

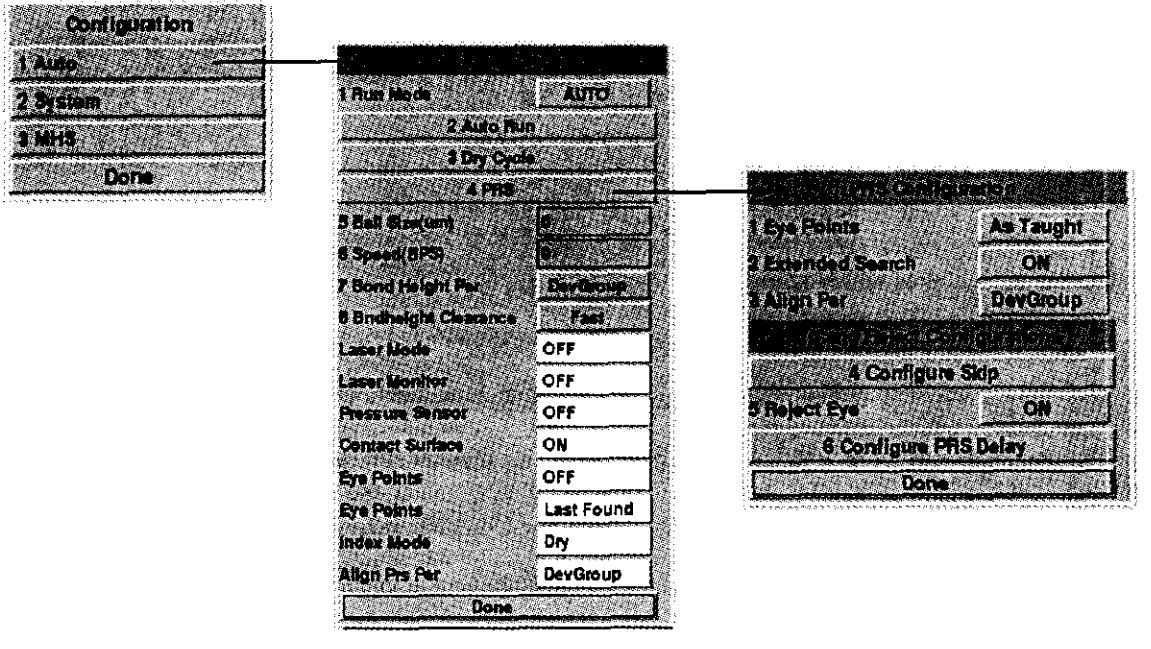


Figure 5-5 PRS Configuration Dialog Box

NOTE: The options appearing under [8] **BOND HEIGHT CLEARANCE**, display the current state of operating conditions, which are selected within the Auto Run, Dry Cycle and PRS dialog boxes. They will automatically update as the operating conditions are changed.

Clicking on **DONE** quits the function and writes any changes to the hard disk.

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5.2.4.1 Eye Points

This function sets how eye points are searched for by PRS. Two toggle choices exist:

- **AS TAUGHT** -- PRS looks for the eye point pattern for the process program at the taught X & Y coordinates plus any allowance as set in the process program.
- **LAST FOUND** -- PRS looks for the eye point pattern using the X & Y coordinates of the previously found eye point of the process program.

Toggle between these options by keying [1] or by placing the pointer or highlight on the function and pressing [B1] or [ENTER].

5.2.4.2 Extended Search

Enables or disables extended table search when the eye point cannot be found successfully at the expected X & Y coordinates.

Toggle between ON or OFF by keying [2] or by placing the pointer or highlight on the function and pressing [B1] or [ENTER].

5.2.4.3 Align PRS Per Device or Device Group

- Align Per Device Group allows the operator to align all pad set copies based on the device group's eyepoints.
- Align Per Device allows the operator to align all pad set copies based on the taught eye points for each pad set.

Toggle between Device and Device Group by placing the pointer on the function and pressing [B1].

5.2.4.4 Configure PRS Skip

These functional options set how the 9388 responds in the event it is not able to find primary or backup eye points. PRS Skip operations supercede operator manual alignment. Three configurable parameters are available for PRS Skip once is it set to ON. See Figure 5-6.

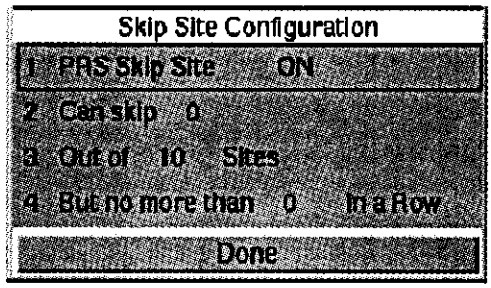


Figure 5-6 PRS Skip Site Configuration Dialog Box

[1] **PRS SKIP SITE** enables or disables the PRS skip site function.

NOTE: Setting or leaving the value at 0 disables the Skip function.

[2] **CAN SKIP** sets the maximum number of sites which can be skipped in a range set in the next function.

[3] **OUT OF # SITES** sets the range of PRS sites for each skip cycle count.

[4] **BUT NO MORE THAN # IN A ROW** sets the number of sites which may be skipped consecutively.

If the total number of skips (option 2 above) or the total number of consecutive skips (option 4 above) are exceeded the 9388 generates an alarm condition.

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5.2.4.5 Reject Eye Point

Enables or disables the Reject Eye Point function. Details about Reject Eye Point programming can be found in *Section 6* of this manual.

Toggle by keying **[5]** or by placing the pointer highlight on the function and pressing **[B1]** or **[ENTER]**.

5.2.4.6 Configure PRS Delay / msec

This option sets the delay time before PRS begins. The delay time allows indexing to complete and the site to stabilize prior to eye point search.

Access by keying **[6]** or by placing the pointer on the function and pressing **[B1]** or **[ENTER]**. Key in the desired numeric value of PRS delay time.

5.2.5 Ball Size (um)

The operator can enter a range of ball sizes depending upon the application. Ball sizes are measured in microns, and can range from 300 microns (um) to 750 um. See Figure 5-7.

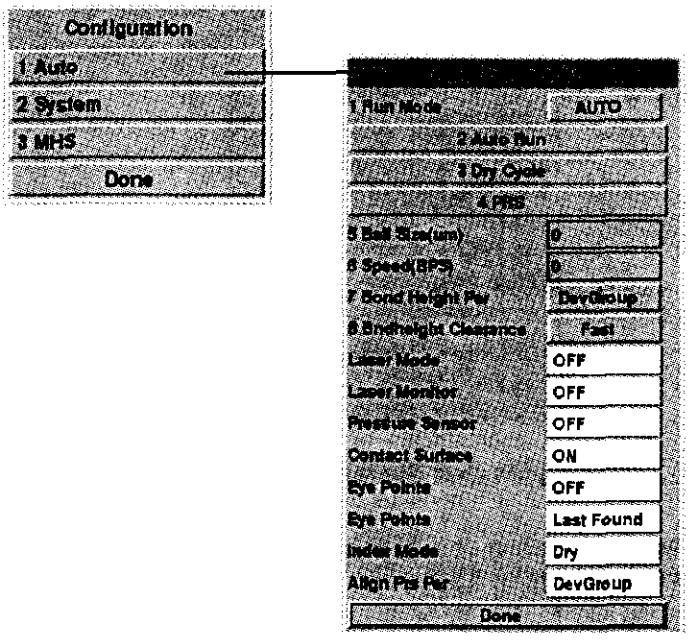


Figure 5-7 Auto Configure Dialog Box

5.2.6 Speed (BPS)

This function allows the operator to select the number of balls per second (BPS) that will be attached to a device. The number selected depends upon ball size, yield, and application of a particular device. See Figure 5-7.

5.2.7 Bond Height Per Device or Device Group

- Bond Height Per Device Group allows the operator to adjust bond height based on the device group's eyepoints.
- Bond Height Per Device allows the operator to adjust bond height based on the taught eye points for each pad set.

Toggle between Device and Device Group by placing the pointer on the function and pressing **[B1]**. See Figure 5-7.

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5.2.8 Bond Height Clearance

This function allows the operator to set the bond height clearance form one index to the next. There are three settings in this option which are **Fast, Taught** and **Top.** See Figure 5-7.

- Fast setting places the bond head head to it's lowest possible position as it moves from one indexing position to the next.
- Taught setting allows the operator to teach a specific height in the instance where the device is not flat and would require additional clearance between movements.
- Top setting places the bond head to it's highest possible position as it moves from one indexing position to the next. This is used for devices that do not have a flat profile and additional clearance is required.

5.3 System Configuration (*to be implemented*)

System Configuration functions are saved on the hard disk, in order to ensure that they are retained during power off or power failure. The 9388 is shipped configured. Program modifications or new configurations may be entered by the user. This can be done locally at the machine or remotely via the network or serial communications port.

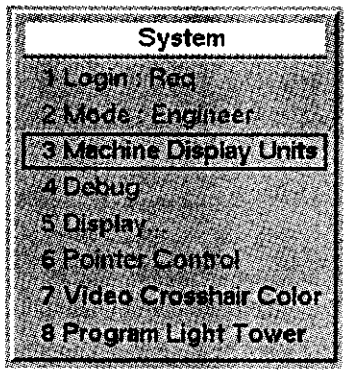


Figure 5-8 System Configuration Menu

[1] **VIDEO CROSSHAIR COLOR** alternates between white (default) and black video crosshair. The operator may use this to select that color which gives the best contrast for Process Programming and other production functions.

[2] **PROGRAM LIGHT TOWER** accesses additional menus allowing signal tower configuration. The operator may set responses to error groups (types) and machine states. See Figure 5-9.

The bottom section of each (Error States and Machine States) dialog box includes a Summary. This summary shows the current settings. Figure 5-10 and Figure 5-11 show the default settings in the Summary section.

Indicator lights may be set to one of three states when an error or state exists. Any or all of the lights may be on simultaneously.

- **On** - Light is on in a steady state
- **Off** - Light is off in a steady state
- **Flashing** - Light pulses on and off

Audible alarm condition may be set to one of two states when an error or state exists.

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- **On** - Audible alarm beeps
- **Off** - Audible alarm is silent

The configuration options are selected using [1] **ERROR GROUPS** or [2] **MACHINE STATES** on the menu shown in Figure 5-9. Below is an explanation of each selection which may appear at the top of the error group or machine state dialog box.

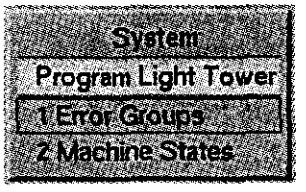


Figure 5-9 Program Light Tower Menu

[1] **ERROR GROUPS** include the following:

- **Vision** - PRS errors
- **Bonding** - Missing ball error
- **Material** - strip injection error
- **MHS** - Load, Workholder and Offload errors
- **System** - System and subsystem errors
- **Other** - Undefined software errors
- **Warnings** - Impending conditions (for example: no material in magazine handler)
- **Host** - SECSII/GEM errors

The error group is selected from a menu list as shown in Figure 5-10.

[2] **MACHINE STATES** include the following :

- **Idle** - Motor Stop engaged or GEM Idle state
- **Pause** - Sequence Stop activated or Operator intervention required (for example: Operator alignment assist is needed)
- **Executing** - Machine is in Run condition (normal operation or warning condition may exist)

The machine state is selected from a menu list as shown in Figure 5-11.

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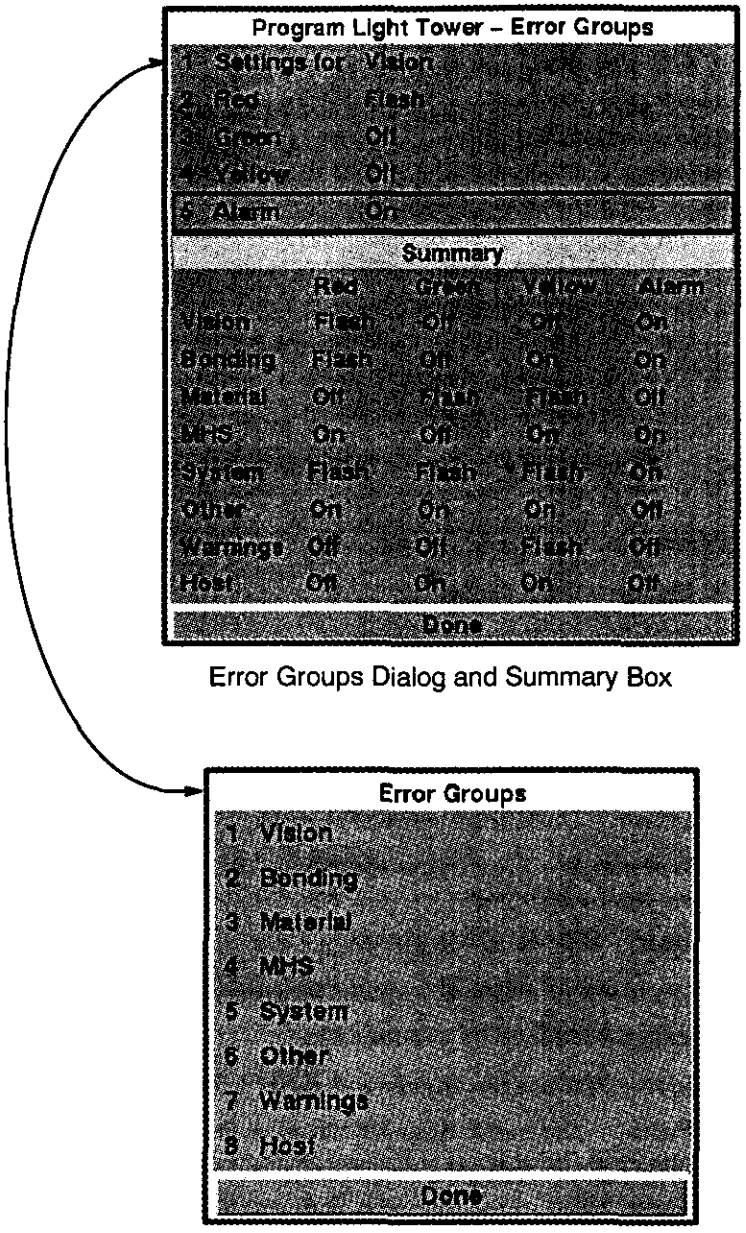


Figure 5-10 Program Light Tower By Error Groups Dialog Boxes

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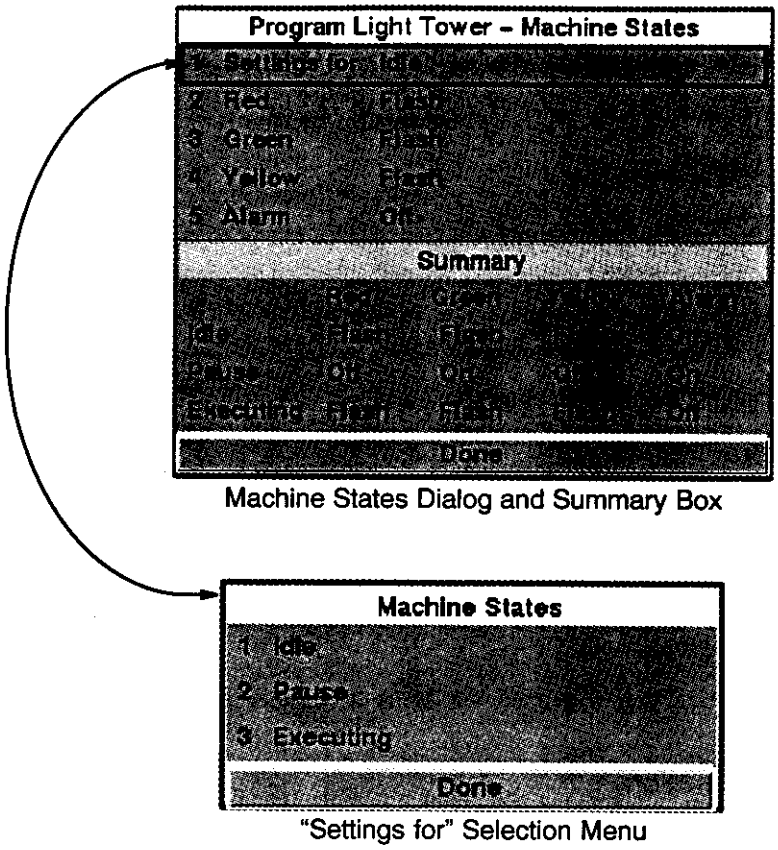


Figure 5-11 Program Light Tower By Machine States Dialog Boxes

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5.4 MHS Configuration

MHS configuration establishes the parameters used to index, hold and eject strips relative to the Workholder and Magazine Handlers of the 9388. See Figure 5-12 for MHS Configuration menu.

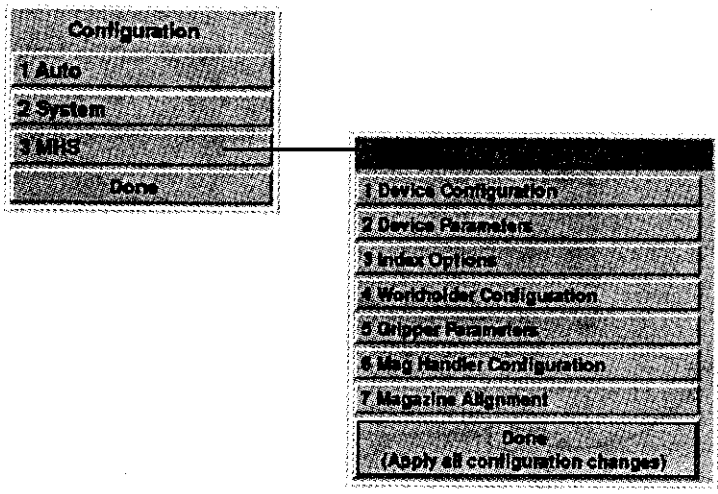


Figure 5-12 MHS Configuration Menu

5.4.1 Device Configuration

Selecting **DEVICE CONFIGURATION** from the MHS Configuration menu causes the Device Configuration dialog box to appear (see Figure 5-13).

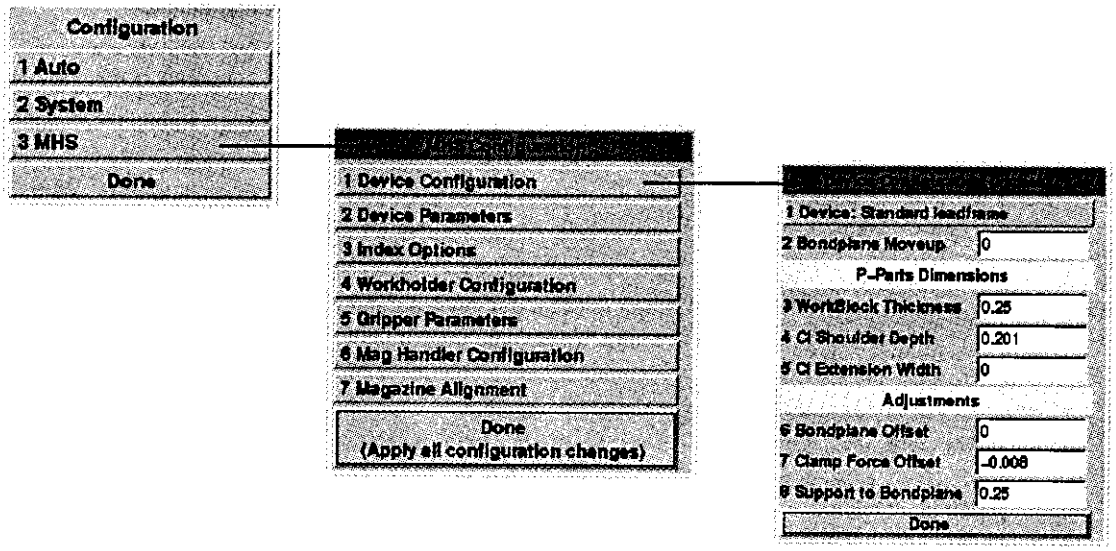


Figure 5-13 Device Configuration Dialog Box

The parameters contained in the Device Configuration dialog box are defined as follows.

[1] DEVICE

Pressing [1] repeatedly causes the Device type selection to toggle between one of the following three choices:

- *Standard Strip*: This parameter setting states that a standard strip device is to be bonded.

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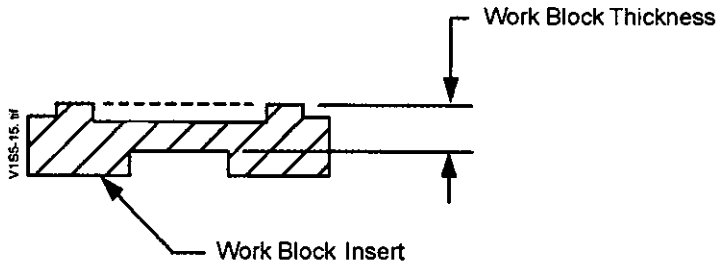
- *Flat Boat Non-singulated*: This parameter setting states that all of the sites (devices) on the flatboat are stationary and cannot be removed from the flatboat (e.g., device matrix groups).
- *Flat Boat Singulated*: This parameter setting states that all of the sites on the flatboat are not stationary and can be removed from the flatboat.

[2] BONDPLANE MOVEUP

Used in support of thicker material types (e.g., flatboat materials - thickness > 45 mils). Parameter indicates a shift in the Z axis of the bond head mounting. The parameter is set to zero for thin materials (e.g., leadframes < 20 mils thick) since the bond head is positioned at its lowest location. For thick materials, the bond head must be raised so that it remains perpendicular at a higher reference plane (relative to the workholder rails). In this case, the parameter is set to the distance that the bond head was raised relative to its lowest mounting position. For more information, see *Volume 3: Model 3102 Material Handling System*; Section1, Table 1-1.

[3] WORK BLOCK THICKNESS

Specifies the vertical distance between the top surface of the work block and the top surface of the work block insert that contacts the device. The default is 250.00 mils for standard work block inserts ***only***. (See Figure 5-14).



NOTE:
The above view illustrates a typical cross section through a work block insert.

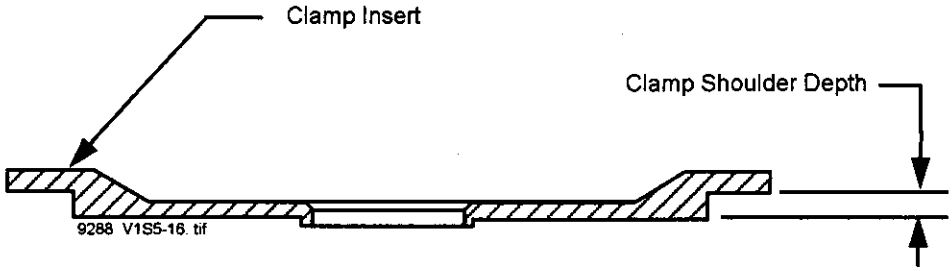
Figure 5-14 Work Block Thickness Dimension

[4] CLAMP INSERT (CI) SHOULDER DEPTH

Specifies the vertical distance between the device contact surface on the clamp insert and the lower clamp frame contact surface also on the clamp insert. The default is 201.00 mils for standard clamp inserts ***only***. (See Figure 5-15).

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NOTE:
The above view illustrates a typical cross section through a clamp insert.

Figure 5-15 Clamp Insert Shoulder Depth Dimension

[5] CI EXTENSION WIDTH

X and Y distances of the extension at the front of a clamp insert. Enter values only if the clamp insert that is used has an extension. (See Figure 5-16.)

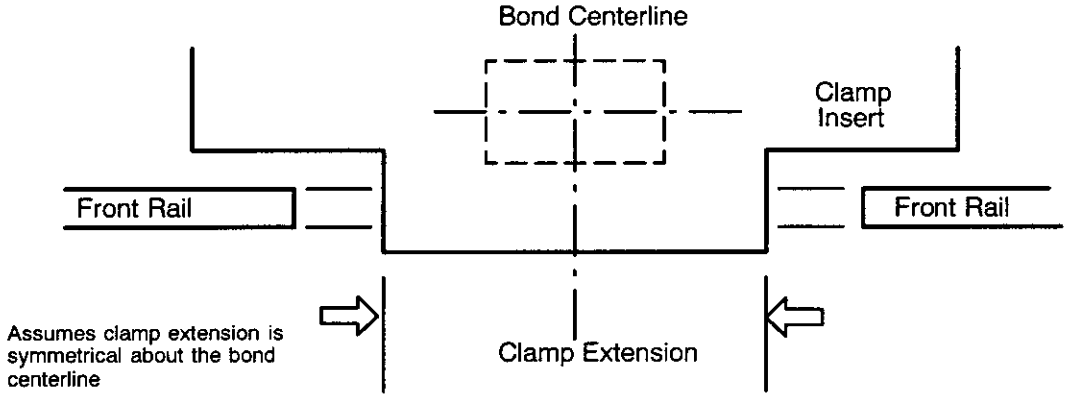


Figure 5-16 Typical Clamp Insert With Extension Applications

[6] BONDPLANE OFFSET

Adjusts position (in Z axis) where top of material is presented when the material is clamped at the bond site. This offset is relative to the the bond plane height. A positive offset value raises the top of the material above the bond plane. A negative offset value lowers the top of the material below the bond plane.

[7] CLAMP FORCE OFFSET

Adjusts the amount of force applied by the clamp insert when material is clamped for bonding. A positive value for clamp offset increases the applied clamp force. The clamp insert is moved down the number of mils entered to apply more force. A negative value for clamp offset reduces the applied clamp force. The clamp insert is moved up the number of mils entered to apply less force.

[8] SUPPORT TO BOND PLANE

This option sets the distance from the top of the work block support pedestal to the top of the work block when the clamps are closed and the work block is at bond height.

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5.4.2 Device Parameters

Selecting **DEVICE PARAMETERS** from the MHS Configuration menu causes the Device Parameters dialog box to appear. See Figure 5-17.

A description of all the options within the dialog box are discussed in this section starting with 5.4.2.1.

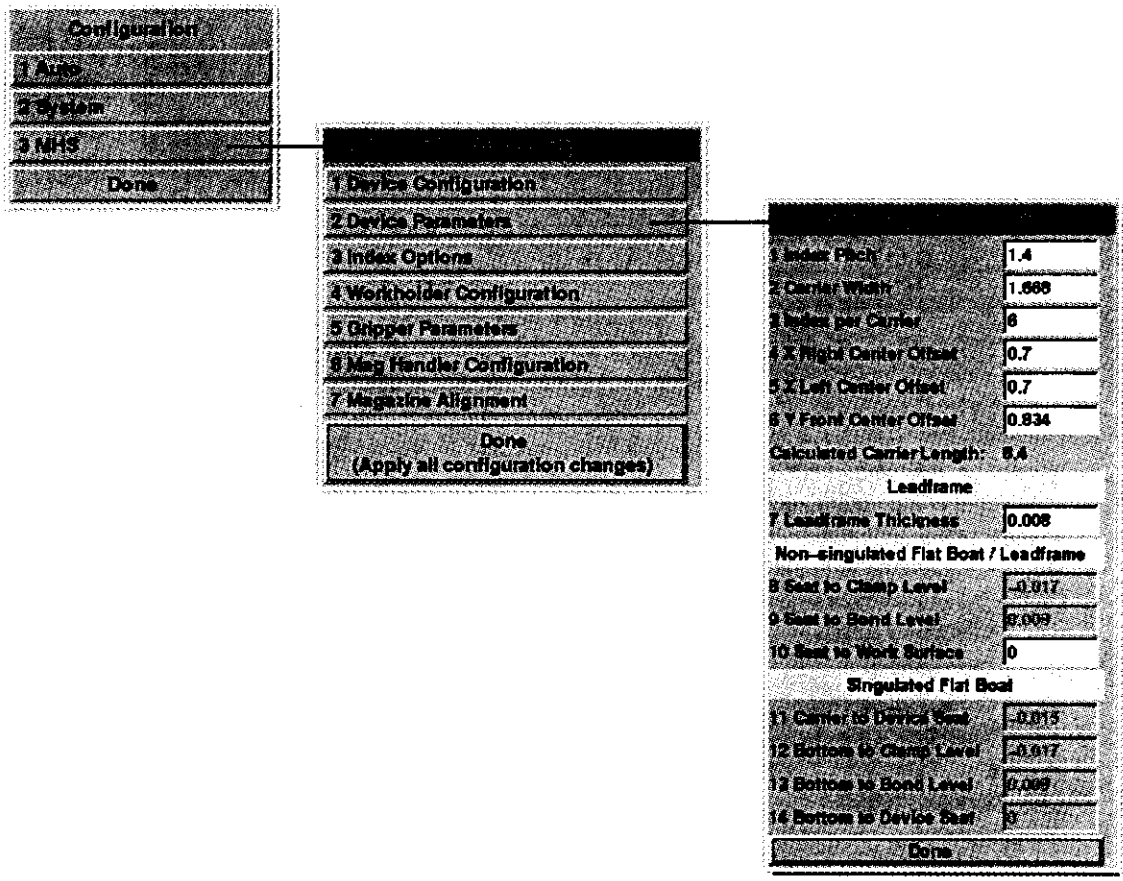


Figure 5-17 Device Parameters Dialog Box

NOTE: In the following section strips are referred to as carriers. A carrier or strip can contain a varied amount of devices depending upon application.

5.4.2.1 Index Pitch

This sets the distance the input gripper moves during each index cycle. It is the distance between the centers of devices or locations of matrix and multichip packages on the strip. See Figure 5-18.

5.4.2.2 Carrier Width

This is the distance from the front edge to the back edge of the strip. This sets front to rear rail closure. See Figure 5-18.

5.4.2.3 Index Per Carrier

This determines the total number of index operations required to move one strip through the workholder.

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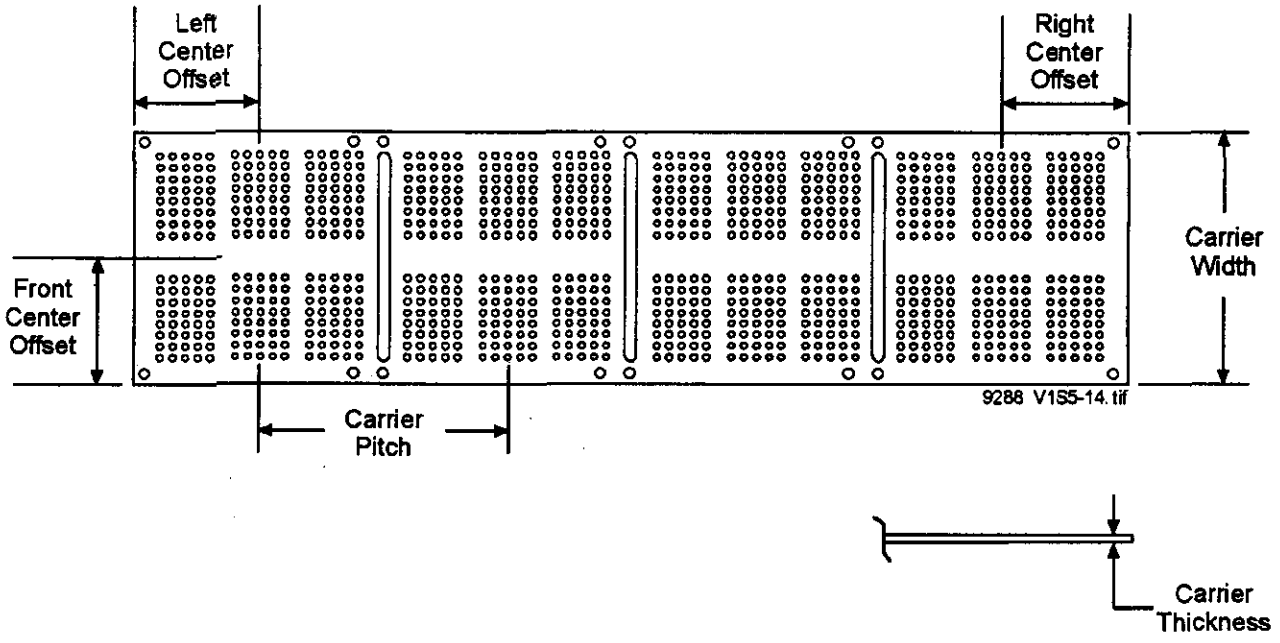


Figure 5-18 Strip Parameters

5.4.2.4 X Right Center Offset

This is the distance from the right edge of a strip to the center of the rightmost index position on that device. It determines the distance of the initial index operation. See Figure 5-18.

5.4.2.5 X Left Center Offset

This is the distance from the left edge of a strip to the center of the leftmost index position on that device. It determines the distance of the last index operation. See Figure 5-18.

5.4.2.6 Y Front Center Offset

This is the distance from the front edge of the strip to the center of a device. It is used to center the device with the center of the work block. See Figure 5-18.

5.4.2.7 Calculated Carrier Length

This is the overall length of the carrier. It automatically calculates the parameters entered above and displays the carrier length. This is used to verify that valid carrier parameters have been entered.

5.4.2.8 Carrier Thickness

This is the thickness of the strip edge. It is used to calculate the correct position of the clamp components. See Figure 5-18.

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5.4.2.9 Non-singulated Flat Boat Parameters

- Seat to Clamp Level

  Vertical distance from the bottom surface of the flatboat carrier to the top clamping surface of the device. This value is positive if the clamping surface is above the workholder rail or negative if below the rail (see Figure 5-19).

- Seat to Bond Level

  Vertical distance from the bottom surface of the flatboat carrier to the second bond plane. This value is positive if the second bond plane is above the workholder rail or negative if below the rail (see Figure 5-19).

- Seat to Heat Surface

  Vertical distance from the bottom surface of the flatboat carrier to the top surface of the heat block insert when the insert is in contact with the device surface. This value is positive if the top surface of the heat block insert is above the workholder rail or negative if below the rail (see Figure 5-19).

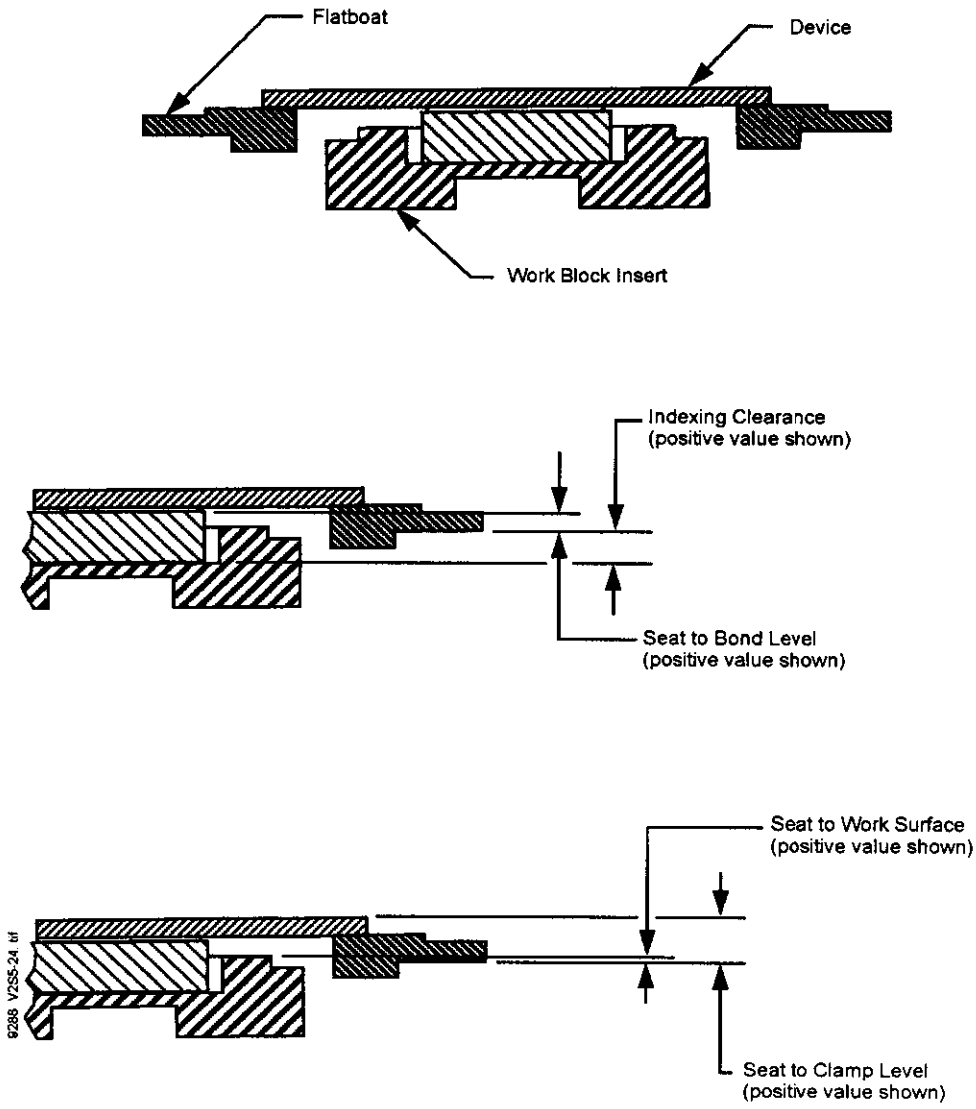


Figure 5-19 Flatboat, Non-singulated Dimensions

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5.4.2.10 Singulated Flat Boat Parameters

- Carrier to Device Seat

  Vertical distance from the bottom surface of the flatboat (at the point where it rests on the workholder rails) to the top surface of the flatboat where the device contacts the flatboat carrier. This value of this parameter is positive if the device seat is above the workholder rail or negative if below the rail (see Figure 5-20).

- Bottom to Clamp Level

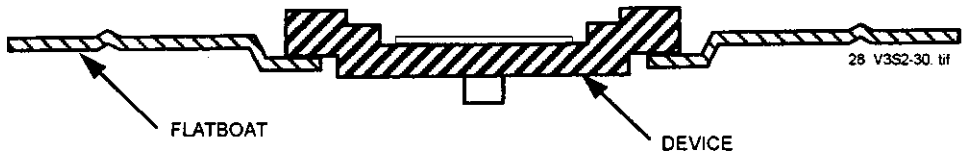
  Vertical distance from the bottom of the device to the top clamping surface of the device (see Figure 5-20).

- Bottom to Bond Level

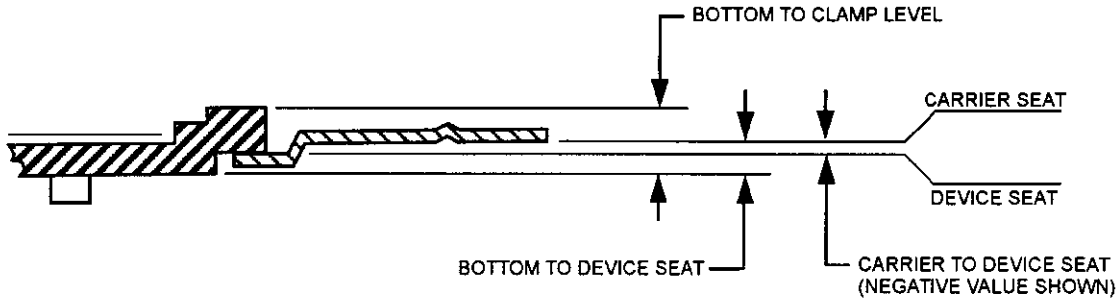
  Vertical distance from the bottom of the device to the second bond plane (see Figure 5-20).

- Bottom to Device Seat

  Vertical offset (if any) from the bottom of the device to the actual contact surface with the flatboat when seated in the flatboat carrier (see Figure 5-20).



NOTE:
THE ABOVE VIEW ILLUSTRATES A TYPICAL CROSS SECTION THROUGH A SINGULATED DEVICE WHILE SEATED IN THE FLATBOAT.



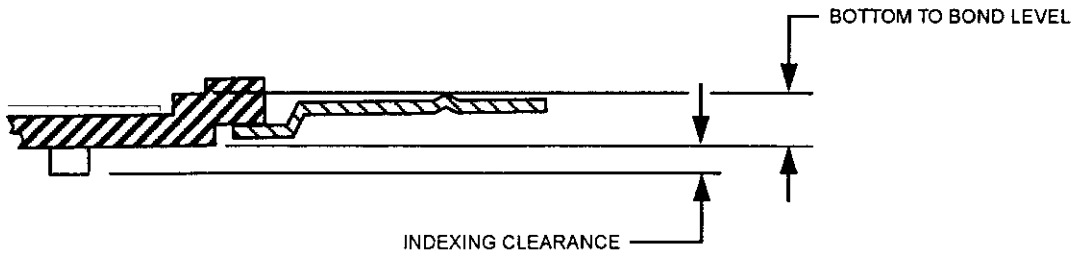


Figure 5-20 Flatboat, Singulated Dimensions

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5.4.3 Index Options

Selecting **INDEX OPTIONS** from the MHS Configuration menu causes the Index Options dialog box to appear. These options set the optional aspects of indexing strips through the workholder. See Figure 5-21.

A description of all the options within the dialog box are discussed in this section starting with 5.4.3.1.

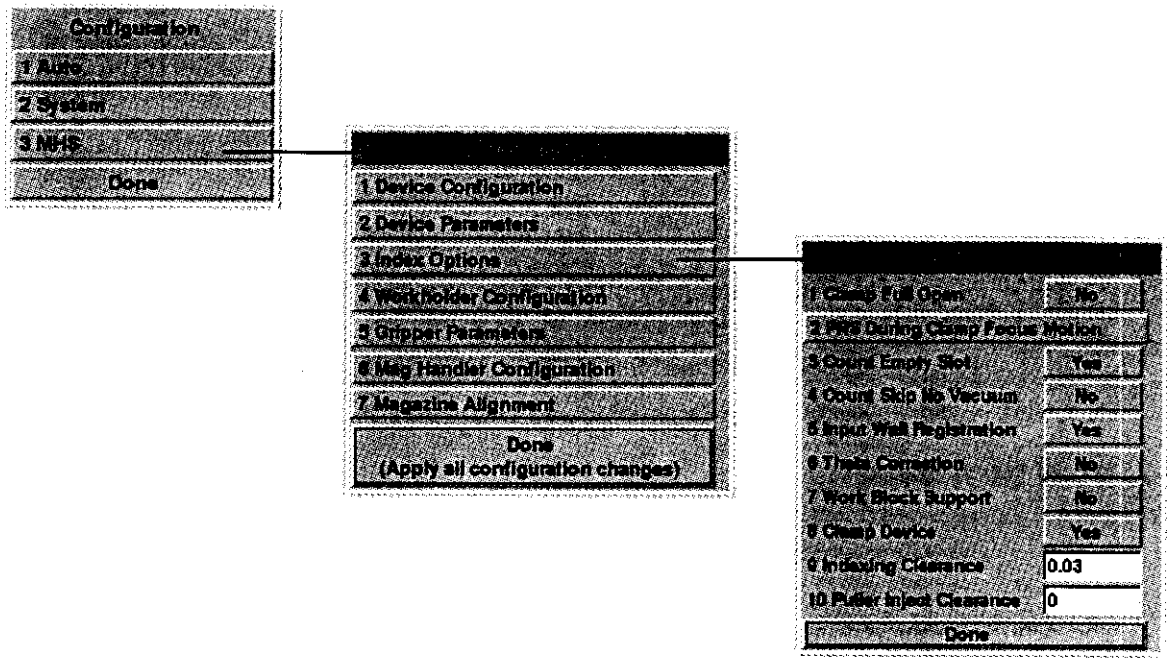


Figure 5-21 Index Options Dialog Box

5.4.3.1 Clamp Full Open

- No -- The clamp opens partially before indexing begins.
- Yes -- The clamp opens fully before indexing begins.

5.4.3.2 PRS

- During Clamp Focus Motion -- This setting allows PRS to seek an eye point while the clamp is moving toward its focus position. Use this setting for large easily defined eye points to save time.
- After Clamp Focus Motion -- This setting delays PRS seek of an eye point until the clamp has moved to focus position. Use this setting for small eye points which must be completely stationary to be located. This setting decreases speed but can improve eye point location accuracy for some materials.

5.4.3.3 Count Empty Slot

- No -- Ignore the empty slot and jog to the next slot.
- Yes -- Skip up to the specified empty slot limit before initiating an operator assist condition.

5.4.3.4 Count Skip No Vacuum

- No -- Do not skip-index to the next strip position if vacuum loss is detected.

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- Yes -- Perform a up to the specified number of skip-indexes to the next strip position if vacuum loss is detected.

5.4.3.5 Input Wall Registration

- No -- Use the X Sensor only to determine strip leading edge position during inject. Use this setting for materials with a leading edge than is likely to be missed by the wall sensor.
- Yes -- Use the Input Wall Strip Sensor to estimate strip leading edge position during inject. An X-sensor positioning error can occur if the wall sensor misses the leading edge.

Select the desired input wall strip registration function using **[ENTER]** to toggle the state.

5.4.3.6 Theta Correction

Allows the user to enable or disable the theta bar. The theta bar straightens the strip as a device is positioned at the bond site.

- Yes -- Theta bar is used for XY correction during indexing.
- No -- Theta bar is not used for XY correction during indexing.

5.4.3.7 Work Block Support

This parameter improves the method by which tape ball grid array (BGA) devices are tucked (ejected) into the output magazine.

- No -- Work block is lowered during the ejection sequence, providing no support to the device carrier.
- Yes -- Work block is not lowered during the ejection sequence, thus supporting the tape BGA during ejection.

5.4.3.8 Clamp Device

This parameter is set at the user's discretion. For example, during the indexing of flatboats, the user may wish to not have the flatboat clamped after being indexed to the bond site.

- Yes -- Clamp closes during bonding.
- No -- Clamp does not close during bonding. Pedestal vacuum only secures the device during bonding.

5.4.3.9 Indexing Clearance

This sets the amount clearance gap between the leading edge of a strip at prebond and the trailing edge of a strip at bond site. This maintains a gap between strips as they pass through the workholder.

5.4.3.10 Puller Inject Clearance

This sets the amount of distance between the trailing edge of the strip and the left side of the workholder. Strip injection by the puller is delayed until this distance is achieved.

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5.4.4 Workholder Configuration

Selecting **WORKHOLDER CONFIGURATION** from the MHS Configuration menu causes the Workholder Configuration dialog box to appear. The Workholder Configuration dialog box is shown in Figure 5-22.

A drawing of the workholder is shown in Figure 5-23 and the tucker mechanism in Figure 5-24.

A description of all the options within the dialog box are discussed in this section starting with 5.4.4.1.

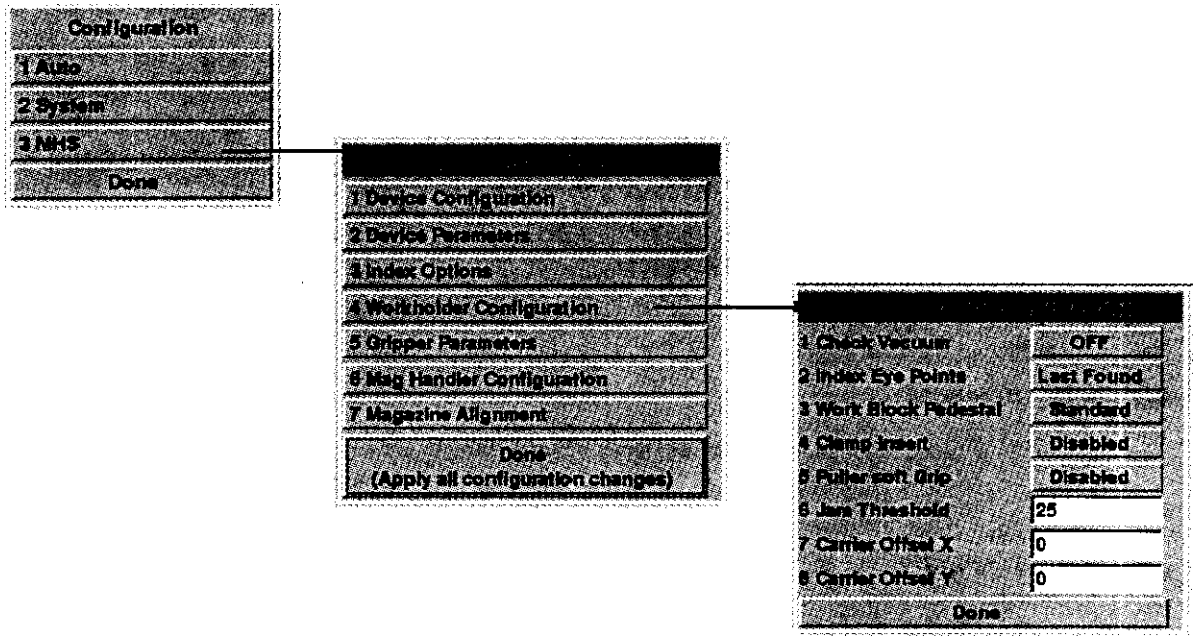


Figure 5-22 Workholder Configuration Dialog Box

5.4.4.1 Check Vacuum

This determines if the workholder monitors the vacuum applied to the bottom of the strip while at the bond site. Off causes the system to ignore clamp vacuum loss errors. On causes the system to detect vacuum loss errors, which would be displayed on the monitor.

NOTE: The Vacuum Sensor is an optional device on the 9388. Therefore, be certain that the option is present before setting to ON. Setting to ON without a sensor present results in a false Vacuum Error with every index.

5.4.4.2 Index Eye Points

This sets the method for strip indexing eye point location.

- As Taught -- Locate the indexing eye points starting at the taught X & Y coordinates.
- Last Found -- Locate the indexing eye points starting at the X & Y coordinates where the last successfully found index eye points were located.

5.4.4.3 Work Block Pedestal

This identifies the type of work block insert mounted on the work block.

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- Standard -- Default work block insert. Approximately 12.7mm (0.5 inch) wide
- Universal -- Universal is approximately 25.4mm (1 inch) wide.

5.4.4.4 Clamp Insert

This value can be set to Enabled or Disabled depending upon application. Select Enabled if using a clamp insert, select Disabled if not using a clamp insert.

5.4.4.5 Puller Soft Grip

This parameter has been designed to be used with flatboat materials, specifically singulated flatboat materials. If the puller jaws close too rapidly on a singulated flatboat, the material can become dislodged from the boat. Soft gripping uses a pair of solenoids to contour the puller jaw motions and minimize the impact of the jaw on the boat.

- Enabled -- Use the puller soft grip option when material (flatboat) is pulled into the workholder.
- Disabled -- Use standard puller gripper force to pull material into workholder.

5.4.4.6 Jam Threshold

This is a relative value between 0 and 255. It sets the sensitivity of the Jam Detect function. Zero is the maximum sensitivity and 255 is the minimum sensitivity.

5.4.4.7 Carrier Offset X

This value is calculated automatically by the MHS teach bond operation. The value represents the X offset adjustment for the first device to be placed at the bondsite.

5.4.4.8 Carrier Offset Y

This value is calculated automatically by the MHS teach bond operation. The value represents the Y offset adjustment for the first device to be placed at the bondsite.

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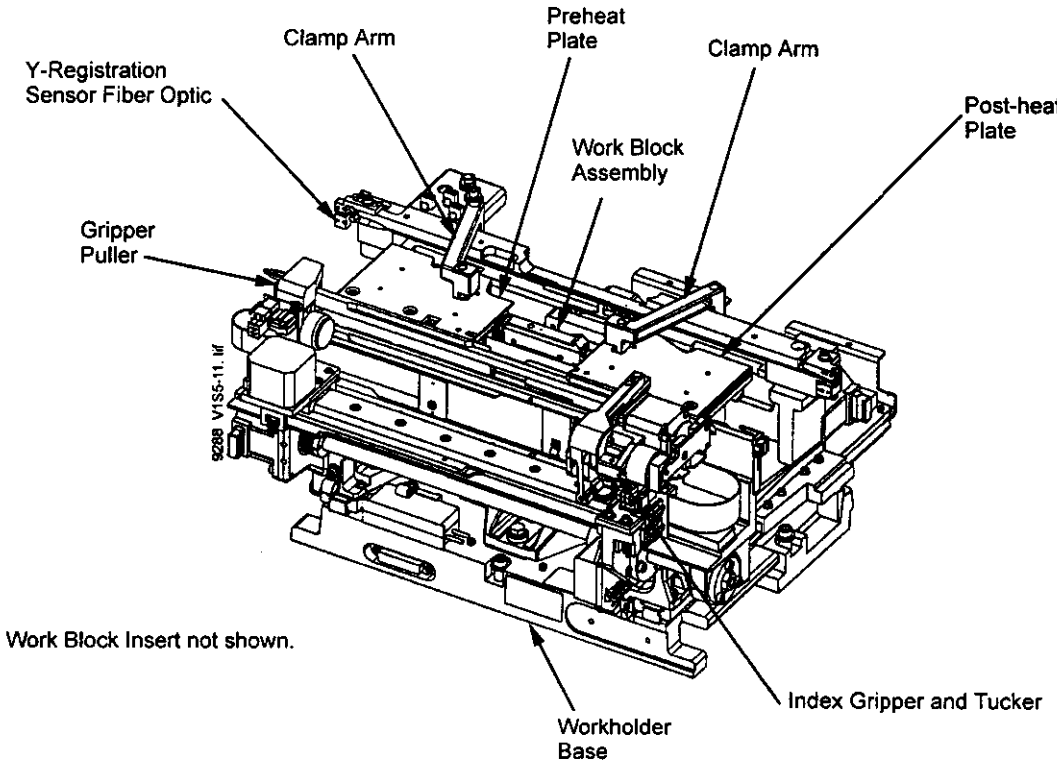


Figure 5-23 9388 Workholder (Model 3201)

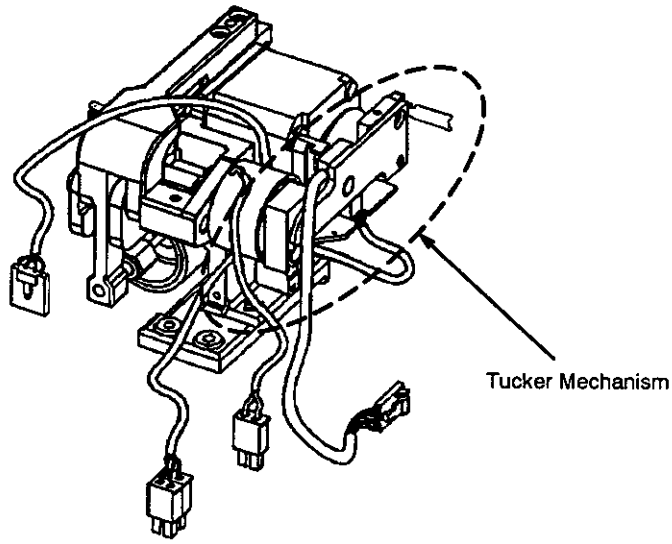


Figure 5-24 Workholder, Tucker Detail

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5.4.5 Gripper Parameters

These parameters are used when strips are injected and indexed. The parameters may be given a numeric value within specification limits. See Figure 5-25.

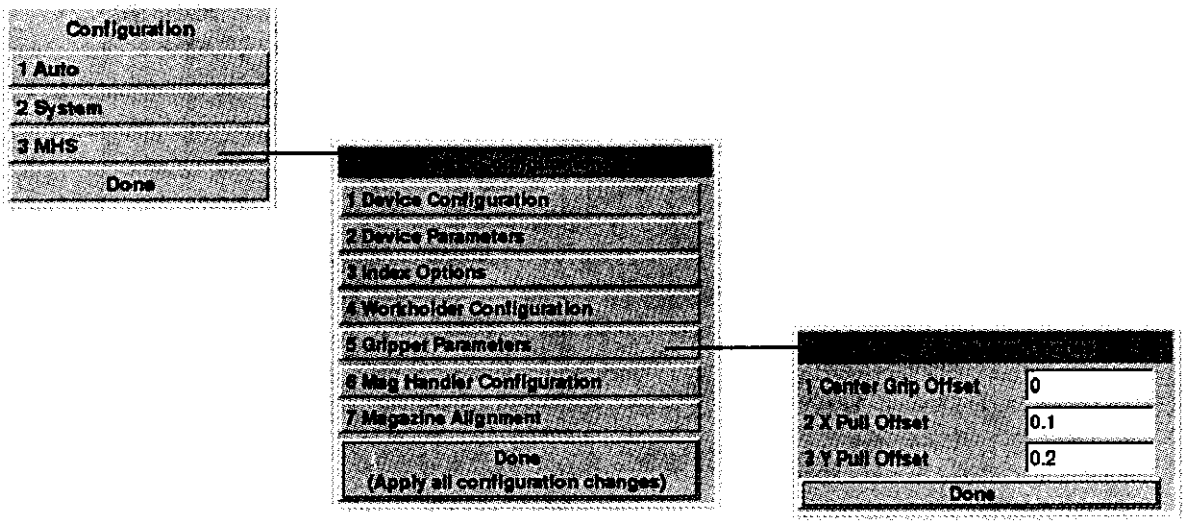


Figure 5-25 Gripper Parameters Dialog Box

5.4.5.1 Center Grip Offset

Moves the index gripper to the left or to the right when the center portion of the strip is gripped during indexing. The purpose of this parameter is to avoid gripping holes or other features at the strips edge. Entering a negative value moves the gripper position towards the input mag handler (left). A positive value moves the gripper towards the output mag handler (right).

5.4.5.2 X Pull Offset

This sets the initial insertion distance of the puller gripper into the magazine to inject a strip. If the puller fails to inject a strip at that insertion distance, an additional 200 mils is added to the insertion. Insertion is again attempted. This process is repeated up to a 600 mil offset before a strip insertion failure is indicated.

5.4.5.3 Y Pull Offset

This sets the Y axis position of the magazine forward from the rear rail and Y register sensor during an inject attempt. This allows the rear edge of the strip to be forward of the edge of the rear rail. This also controls where (in the Y axis) the puller gripper grips a strip during inject.

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5.4.6 Magazine Handler Configuration

Selecting **MAG HANDLER CONFIGURATION** from the MHS Configuration menu causes the Mag Handler Configuration dialog box to appear. This Configure Menu choice allows the Load and Offload Magazine Handlers to be properly configured for user applications. See Figure 5-26.

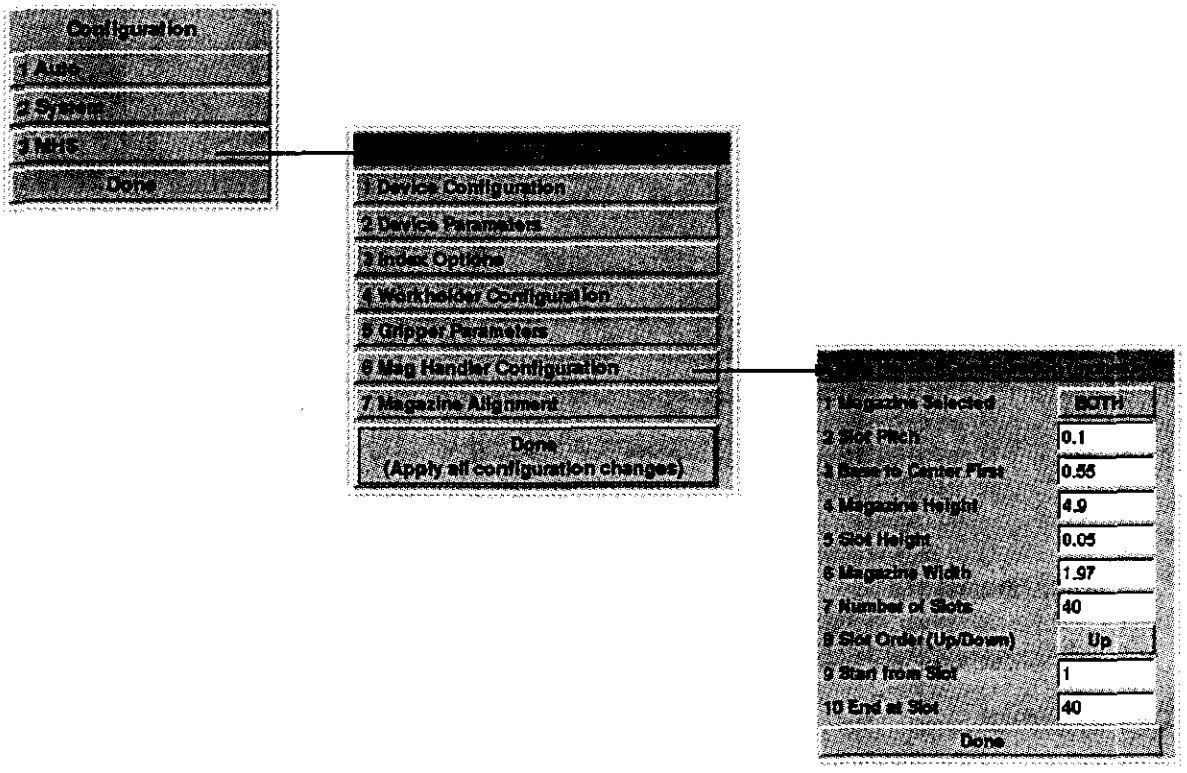


Figure 5-26 Mag Handler Configuration Dialog Box

Use this dialog box to enter the dimensions used to describe the magazine for gripping by the loader and offloader assemblies. The dimensions are also used for locating the magazine and strips with respect to the indexer rails and the workholder gripper jaws and tucker. See Figure 5-27.

Click on **DONE** to write the changes to a temporary file and close the dialog box, a second dialog box to verify the save.

5.4.6.1 Magazine Selected

- Input -- Limits configuration to input magazines only.
- Output -- Limits configuration to output magazines only.
- Both -- Applies configuration to both input and output magazines.

5.4.6.2 Slot Pitch or (Mag Pitch)

This is the vertical distance between ***centers*** of two adjacent magazine slots. This parameter is the distance the magazine is moved vertically during each index.

5.4.6.3 Mag Base Center Distance to First Slot or (Distance From Bottom)

This is the distance from the bottom edge of the magazine to the ***center*** of the first strip slot encountered upward. This parameter sets the position of the gripper to align the bottom magazine slot with the work holder.

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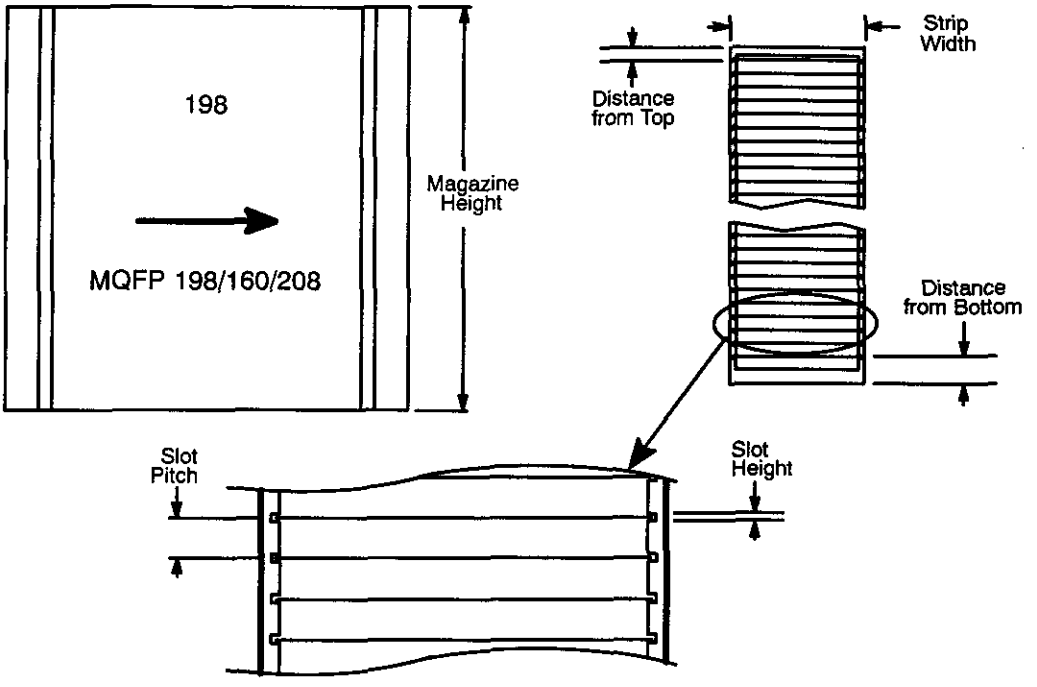


Figure 5-27 Magazine Dimensions

5.4.6.4 Magazine Height

This is the distance from the top edge of the magazine to the bottom edge of the magazine. It sets the closure gap of the gripper opening.

5.4.6.5 Slot Height

This is the distance from the top of a slot to the bottom of the same slot. This value works in conjunction with slot pitch to advance the magazine between strip extraction or insertion.

5.4.6.6 Magazine Width

This is the distance from the left to the right outer surfaces of the magazine as shown in Figure 5-27. This information sets center the magazine relative to the workholder rails.

5.4.6.7 Number of Slots

This is the total number of strip slots in the magazine. This parameter sets the maximum number of magazine handler step operations per magazine. After all slots have been utilized, the magazine is removed and replaced.

5.4.6.8 Slot Order (Up-Down)

This sets the direction of magazine movement.

- Up -- The magazine advances in an upward direction. The top slot is first.
- Down -- The magazine advances in a downward direction. The bottom slot is the first.

5.4.6.9 Start from Slot

This determines the first slot position to be positioned at the workholder.

5.4.6.10 End at Slot

This determines the last slot position to be positioned at the workholder.

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5.4.7 Magazine Alignment

These parameters are used to set Z axis positioning of the supply and receiving magazines during inject and eject operations. See Figure 5-28.

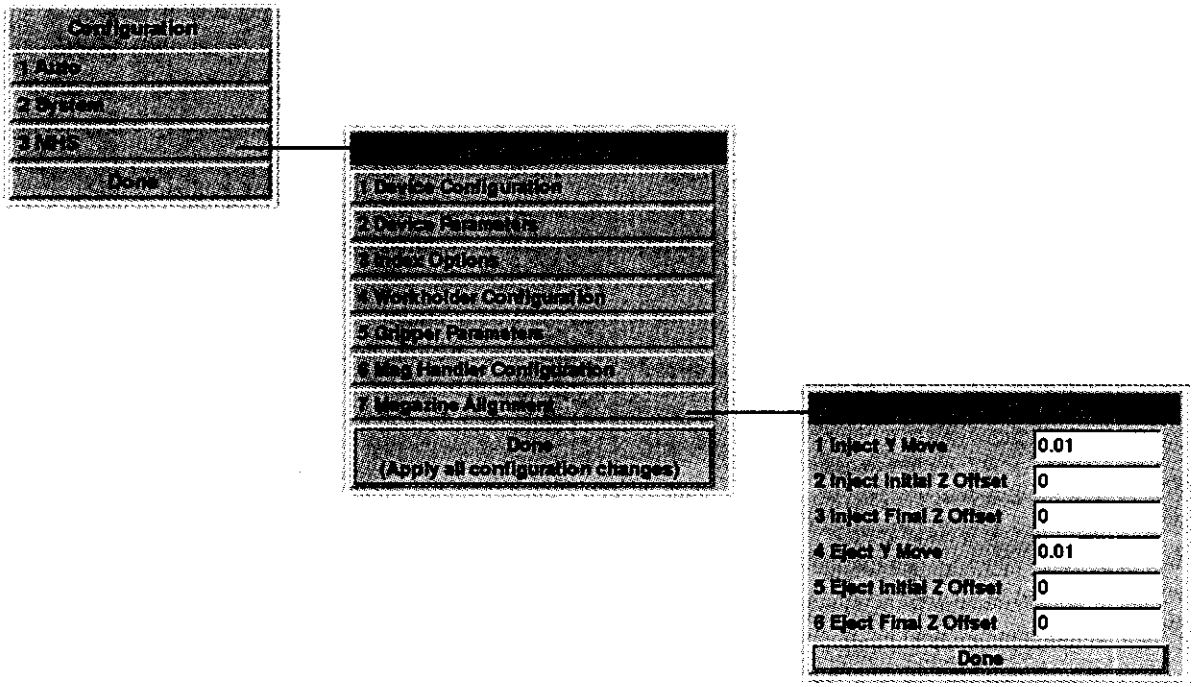


Figure 5-28 Magazine Alignment Dialog Box

5.4.7.1 Inject Y Move

This sets the amount of rail closure after the strip edge is detected. Its purpose is to allow the rails to close further giving more support to the strip. Too large of a value here can cause the strip to drag on the front and rear rails, interfering with indexing.

5.4.7.2 Inject Initial Z Offset

This sets the position of the supply magazine Z axis prior to the initial pull of the strip. Typically the bottom of the magazine slot is exactly in line with the top of the workholder rails. During initial inject it may be advantageous to raise the magazine slightly so that the strip is given additional clearance above the rails for easier initial insertion into the workholder.

5.4.7.3 Inject Final Z Offset

This sets the position of the supply magazine Z axis prior to the final injection of the strip. Typically the bottom of the magazine slot is exactly in line with the top of the workholder rails. During final injection the slots and rails should provide straight support of the strip to prevent warping or drag.

5.4.7.4 Eject Y Move

This sets the amount of movement by the receiving magazine Y axis prior to the initial eject tuck of the strip. This will ensure proper adjustment of the Y axis of the output mag handler as the strip exits the workholder.

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5.4.7.5 Eject Initial Z Offset

This sets the amount of movement by the receiving magazine Z axis prior to the initial eject tuck of the strip. Typically the bottom of the magazine slot is exactly In line with the top of the workholder rails. During initial eject it may be advantageous to lower the magazine slightly so that the strip is given additional clearance above the slots for easier initial insertion into the magazine.

5.4.7.6 Eject Final Z Offset

This sets the position of the receiving magazine Z axis prior to the final injection of the strip. Typically the bottom of the magazine slot is exactly In line with the top of the workholder rails. During final injection the rails and slot should provide straight support of the strip to prevent warping or drag.

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Section

6 TEACH/EDIT PROCESS PROGRAMS

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6 Teach/Edit Process Programs

6.1 Introduction

The purpose of Program Mode is to create or change a process program for the machine to use when processing materials. The information defined while creating a process includes the location of alignment points, location of ball attach sites, and values for parameters that control the ball attachment process.

If the process program is saved to disk, it becomes a master process program that can be used again for a different device.

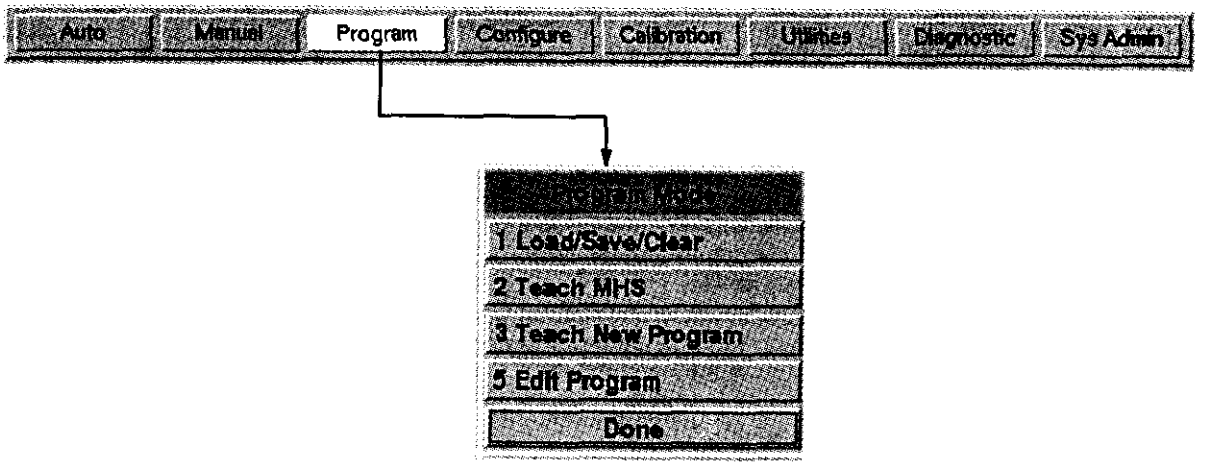


Figure 6-1 Program Mode Menu

While the term "edit" is used to describe the overall mode of this section the term "teach" is also frequently used to indicate a particular function.

6.1.1 Navigation

Each parameter function may be accessed by keying in its corresponding "hot key" number. This number appears to the left of each mode or option. Numeric values may then be keyed in followed by **[ENTER]**. The operator may also use tab up and tab down keys on the MMI to highlight the desired parameter function followed by pressing **[B1]** or **[ENTER]**. The operator may also use the trackball to position the pointer on the desired on screen button and press **[B1]** to activate.

Activating **APPLY** executes the specified file operation on the displayed files. This dialog box remains open. Activating **DONE** executes the specified file operation on the displayed files. The dialog box closes and the original menu is displayed. Activating **CANCEL** quits the function and closes the dialog box. All data remains as it was.

Dialog options which are presented in black text are active and may be used. Dialog options displayed in gray text are inactive and may require other data to be present to become active. Options may be inactive due to the software option level of the system not supporting that function.

Pressing **[ESCAPE]** quits the teach operation. Taught points are ***not*** saved At a Level 1 Menu, the system returns to the "Program" menu. At a Level 2 or Level 3 Menu, the dialog box closes and the previous level menu appears.

More details regarding navigating through the software may be found in *Section 2: Software Overview* of this manual.

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6.1.2 Teaching and Editing

The fundamental difference between teaching and editing is that teaching a program requires the creation of a process program while editing is performed on pre-existing or previously defined process programs. When teaching a program, the person creating it teaches the entire process program by identifying ball attach positions on the process program, setting parameter values, etc. When editing, the person editing a program can load the process program into memory from the A or C drive, having saved it previously, or download it from a host computer via a communications link.

6.2 Graphic Elements used in Teaching/Editing Process Programs

When bond programs are created and when ball attach locations are specified on them, the software uses graphic symbols to represent eye points, operator points, ball attachment pads, and ball attach locations. Numeric labels are also applied to the ball attachment pads and locations to aid in grouping, associating, and modifying these components.

6.3 Program Mode

A process program can be created in a number of ways. Initially, ball attach sites and parameter components of a process program are all taught. After these components are taught and saved, they can be loaded and edited to update an existing program or to create a new one. If off–line programming is available, the program may be designed by a process engineer and then loaded onto the machine's hard disk.

This section, however, describes the dialog boxes and selections used to teach a completely new program.

6.3.1 Load/Save/Clear Program

[1] **CLEAR PROCESS PROGRAM** clears the entire Process Program that is loaded, which is stored back on the hard drive. At this point, a new program can be taught or an existing program can be loaded. When selected with Process Program loaded, a permissive dialog box appears. Clicking on **OK** clears the Process Program. Clicking on **CANCEL** returns to the Clear menu. See Figure 6-2 and Figure 6-3.

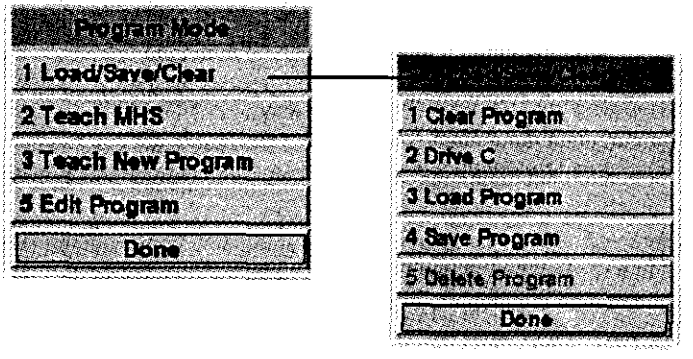


Figure 6-2 Load/Save/Clear Menu

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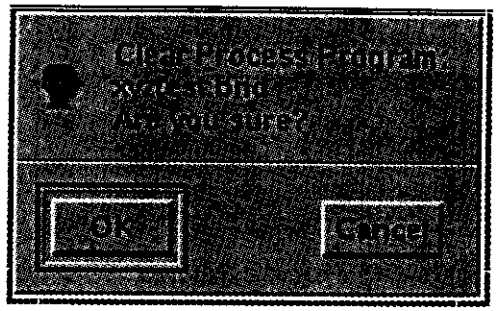


Figure 6-3 Clear Process Program Dialog Box

[2] **DRIVE**: clicking on **DRIVE** toggles between the A drive and C drive. See Figure 6-2.

[3] **LOAD PROCESS PROGRAM** loads an existing Process Program from the selected drive. It displays a listing similar to Figure 6-4 showing all available Process Programs.

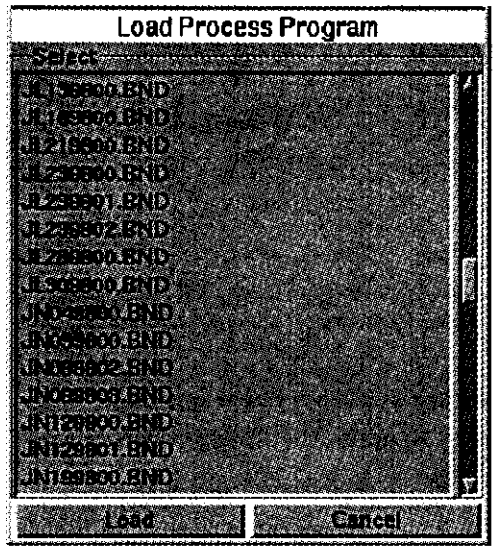


Figure 6-4 Process Program List

Select the desired program by:

- Using the scroll bar or up and down arrow keys located on the right of the list window to move the list. Position the pointer on the desired Process Program. Click on **LOAD** or press **[B1]** to load. Clicking on **CANCEL** restores the Load/Save/Clear menu.
- Using the tab up and tab down keys on the MMI to move the highlight box through the listing. When the desired Process Program is selected Click on **LOAD** or press **[B1]** or **[ENTER]** to load. Clicking on **CANCEL** restores the Load/Save/Clear menu.

[4] **SAVE PROCESS PROGRAM** allows the operator to save a Process Program. The operator may use this to save a newly created Process Program or one which has been edited, giving it a different name. See Figure 6-2 and Figure 6-5.

[5] **DELETE PROGRAM** allows the operator to eliminate a saved process program from the hard drive. Once the process program is deleted it cannot be restored.

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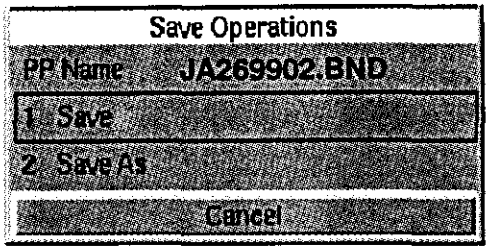
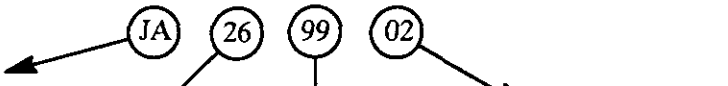


Figure 6-5 Process Program Save Dialog Box

NOTE: Save Prog ([Shift + F1]) function key operates identically to the Save Process Program function described here. **PPName** shows the default Process Program Name. This name is composed of 4 parts shown below.

Example: JA269902



Month:
JA = January
FB = February
MR = March
AP = April
MY = May
JN = June
JL = July
AG = August
SP = September
OC = October
NV = November
DC = December

Day of the month

Last two digits of the year

Program number for the date:
00=First
01=Second
02=Third
03=Fourth
etc.

Three options are available to the operator.

Clicking on **CANCEL** quits the function without performing a save.

[1] **SAVE** stores the Process Program to the selected drive.

[2] **SAVE AS** allows the operator to change file names.

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6.3.2 MHS Teach (*currently not implemented*)

This Program mode selection produces a submenu as shown in Figure 6-6. These functions teach the 9388 how to handle the strip for bonding. The four functional options are described below.

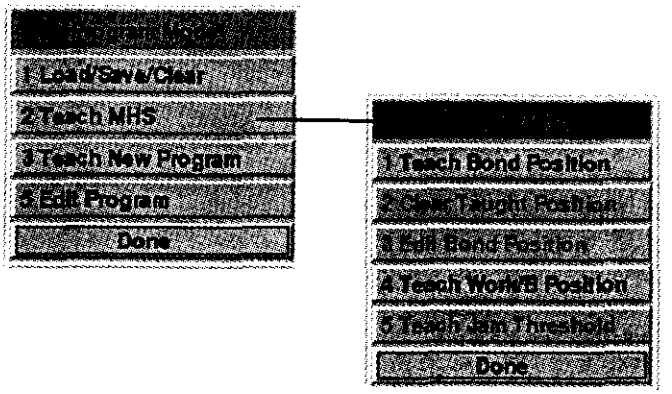


Figure 6-6 MHS Teach Menu

This data should be taught before a Process Program is taught. They enable the proper handling of strips. Without this data, work material will not automatically position correctly.

6.3.2.1 Teach Bond Position

This function allows the operator to teach position of the strip relative to the work block.

The instructions on the monitor, guide the operator through the procedure. The operator teaches the positions such that device will be properly aligned with the vacuum slot.

6.3.2.2 Clear Taught Positions

This function removes the existing data relative to Bond Position, Work Block Position, and Jam Threshold.

6.3.2.3 Teach Work Block (Work/B) Position

This function allows teaching specific locations on the work block. These locations allow the Material Handling System to learn the size and center of the work block. On-screen instructions direct the operator to teach the position of the work block.

6.3.2.4 Teach Jam Threshold

This function sets the sensitivity of the tucker assembly on the gripper indexer. This setting is used to determine if a strip has failed to be inserted into the receiving magazine.

The operator is guided through the procedure by on screen instructions. No messages are displayed to the operator unless the process fails. In that case, an error message appears informing the operator of the nature of the failure and giving an option to repeat the process.

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6.3.3 Process Program Teach Procedure

Section 6.3.3 describes a stepwise procedure on how to teach a new process program. Throughout Section 6.3.3 there will be references to Section 6.3.4 to help guide the operator through the procedure.

Section 6.3.4 describes in detail the various components and steps that exist in the creation of a new process program.

If the process program is saved to disk, it becomes a master process program that can be used again for a different device.

A. Select **CONFIGURE MODE**, then **AUTO**, and enter parameters for ball size and ball speed. See Section 6.3.4.1.

B. Teach Pad Set.

1. **SELECT PROGRAM MODE**, then **TEACH PAD SET**, and enter the appropriate values for pad size, number of pads per column/row and pad pitch. The X/Y offset value should be set to 0 for pad set number 1. See Section 6.3.4.2.
2. Select **BOND SEQUENCE**, either row, column or optimize. Typically, select whichever has more balls for optimal speed. See Section 6.3.4.2.1
3. Select **FILL PAD SET**, this will generate an image of the pad set on the monitor. See Section 6.3.4.2.1.
4. Select **ALIGN PAD SET**, this will generate an Align Pad Set dialog box. Center the crosshair over the upper left most pad in the pad set and press **SELECT PAD IN ORIGIN**. See Section 6.3.4.2.1 and Figure 6-9.
5. Center the crosshair over the upper right most pad in the pad set and press **SELECT PAD IN UPPER RIGHT**. See Section 6.3.4.2.1 and Figure 6-9.
6. Center the crosshair over the lower left most pad in the pad set and press **SELECT PAD IN LOWER LEFT**. The Teach Pad Set menu will return, press **DONE**. See Section 6.3.4.2.1 and Figure 6-9.

C. The **ADD LAST PAD** menu will appear (see Section 6.3.4.3.) This pad is used as a reference point for the bond head to seek when it is finished bonding each device. Locate the crosshair over the desired location and press **ADD PAD**, then press **DONE**, this will bring up the Teach Eye Point menu.

NOTE: The Add Last Pad location that is selected, needs to be the same height as the bonding surface. Choosing an area that is higher than the actual bonding surface may cause damage to the device or bondhead.

D. Teach Operator/Eye Points (see Section 6.3.4.4)

NOTE: The Configure Eye Points for Device dialog box that is shown in Figure 6-12 is for the individual device/pad set that was just taught. In most applications, such as programming the K&S test strip, the **TEACH STEP AND REPEAT** option will be used and the indexing eye points will be based on the entire device group. For this reason, both the primary and backup eye points are **configured to OFF**, however the **operator points must be taught** at this time.

1. Align each operator point, using any spot that you will remember. The edges of the upper right and lower left pads are recommended.
2. Adjust illumination as necessary. See Section 6.3.4.4.2.
3. Select **TEACH** to set operator point 1, then select **NEXT**, which will bring up second operator point dialog box. See Section 6.3.4.4.2.

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4. Select **TEACH** to set operator point 2, then select **NEXT**, which will bring up the Teach Parameters/Groups dialog box. See Section 6.3.4.5.

E. Teach Parameters/Groups

1. Select **BOND HEIGHT**. Typically, set the **BOND HEIGHT** to 1/3 to 1/2 the ball size. See Section 6.3.4.5.

2. Select **LASER POWER**. The range is from 0 to 255, which corresponds to current, measuring from 0 to 10 amps. **Do not fire the laser with more than 8 amps (a setting of 200)**. Typically, the **LASER POWER** setting will range from 130 to 170 depending on ball size and application. See Section 6.3.4.5.

3. Select **BOND TIME**. Typically, the **BOND TIME** setting will range from 7 to 12 milliseconds. This sets the amount of time the laser will fire during ball attachment. See Section 6.3.4.5.

4. Select **Z MOVE HEIGHT**. This value sets the height of the bond head as it moves between bonds. This height is relative to the Bond Height. The operator can base this entry on this formula. See Section 6.3.4.5.

(Ball Size - Bond Height) x 1.5 = Z Move Height.

5. Select **UPDATE PARAMETERS** to save the parameters that were entered, then press **DONE** to exit the Parameters dialog box. See Section 6.3.4.5.

F. Teach Step and Repeat

1. Select Teach Step and Repeat and the **TEACH STEP AND REPEAT** dialog box will appear. See Section 6.3.4.6. The Teach Step and Repeat function is used to add more pad sets to the strip.

2. Enter the number of Devices Per Row and Devices Per Column. See Section 6.3.4.6.

3. Enter the Devices X and Y Pitch values. See Section 6.3.4.6.

4. Select **FILL DEVICE**, then **ALIGN STEP AND REPEAT**. This will generate the Align Step and Repeat dialog box.

5. Center the crosshair over the upper left most pad of the upper right most device and press **SELECT DEV IN UPPER RIGHT**. See Section 6.3.4.6.

6. Center the crosshair over the upper left most pad of the lower left most device and press **SELECT DEV IN LOWER LEFT**. Press **DONE**, this will again bring up the Teach Step and Repeat dialog box.

7. Select **TEACH EYE POINTS**. See Section 6.3.4.6.

8. Configure Eye Points for Group dialog box will appear. Typically, Primary Eye Points are configured **ON** and Backup Eye Points are configured **OFF**. See Section 6.3.4.6.

9. Align each operator point, using any spot that you will remember. The edges of the upper right most pad of the upper right most device and lower left most pad of the lower left most device are recommended. See Section 6.3.4.6.

10. Press **TEACH** to set Operator Point 1, then select **NEXT** to access the second operator point dialog box. Press **TEACH** to set Operator Point 2, then select **NEXT** to access the Eye Point 1 dialog box. See Section 6.3.4.6.

11. Adjust the **TEACH WINDOW** so it is slightly larger than the pad. Adjust the **ALIAS WINDOW** so it slightly larger than the teach window. Adjust the **SEARCH WINDOW** so it extends just short of the next pad. See Section 6.3.4.6.

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12 . Align Eye Point 1 on the upper right most pad on the upper right most device and press **TEACH**, then **DONE**. Eye Point 1 must always be located behind the center of the work block. See Section 6.3.4.6.

13 . Align Eye Point 2 on the lower left most pad of the lower left most device and press **TEACH**. Select **DONE** to exit the Eye Point dialog box. See Section 6.3.4.6.

G. Teaching the process program is complete and can be saved to the hard drive or to a floppy disk. See Section 6.3.1.

6.3.4 Teach Process Program

6.3.4.1 Configure Auto

Enter Configure Mode and select [1] **AUTO**. Enter the Ball Size and Speed (BPS) specifications, then return to Program Mode. See Figure 6-7.

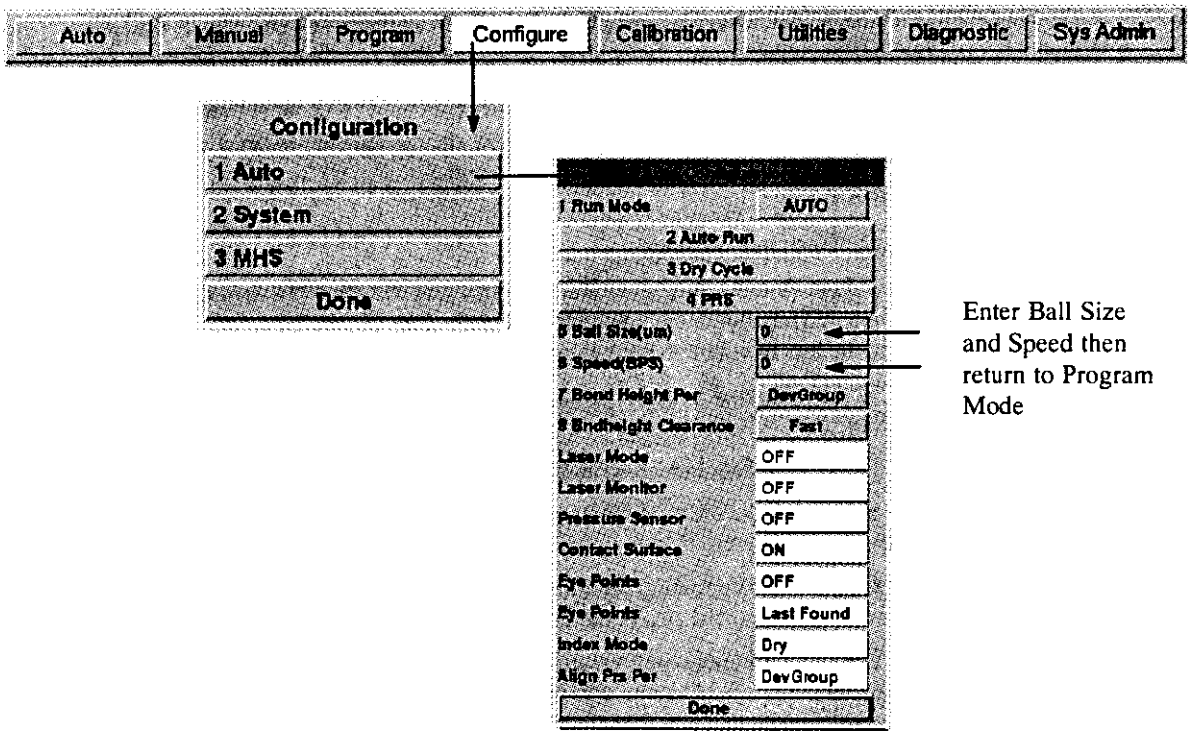


Figure 6-7 Auto Configure Dialog Box

6.3.4.2 Teach Pad Set

Upon entering the Program mode, select Teach Pad Set in the Teach New Program menu. See Figure 6-8.

New Program Pad Set #1 dialog box will appear and this allows the operator to set the parameters in which the bond pads on the device are learned.

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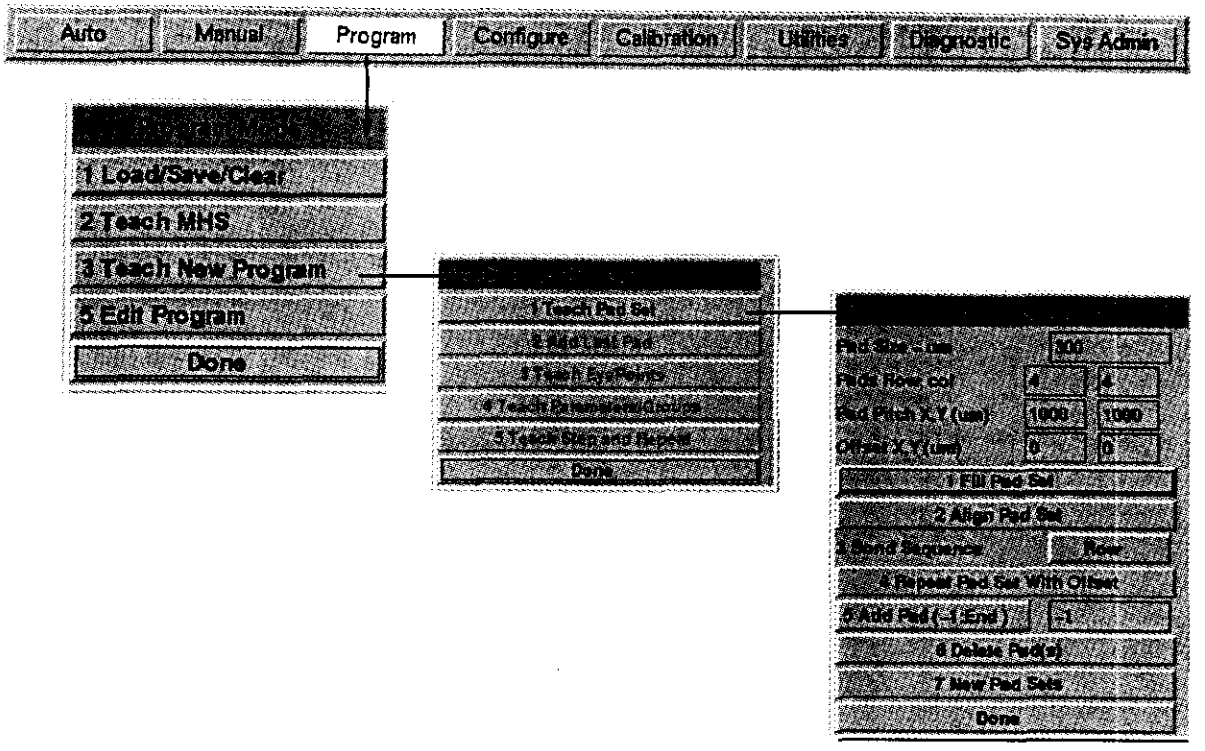


Figure 6-8 New Program Pad Set #1 Dialog Box

6.3.4.2.1 New Program Pad Set #1

- **PAD SIZE (UM)** allows the operator to enter the size of a single pad depending upon application.
- **PADS ROW, COLUMN** allows the operator to enter the number of rows and columns in a single pad set.
- **PAD PITCH X, Y (UM)** allows the operator to enter the distance between the pad centers located within the pad set.
- **OFFSET X, Y (UM)** allows the operator to enter the distance of additional pad sets from a known zero point. Zero point is default for the first pad on the first pad set taught that was taught.

[1] **FILL PAD SET** when selected takes all the parameters entered above and generates a CAD image and device image of the pad set. Initially the CAD image be displayed in the larger display window and the device image will appear in the small window.

[2] **ALIGN PAD SET** when selected generates an Align Pad Set dialog box. (See Figure 6-9.) By teaching the locations indicated in the dialog box, a live video overlay of the pad set will be created over the live image. Also, a true representation of the device image will also be displayed.

[1] PAD 1 IN CAD (*not implemented*)

[2] SELECT PAD IN ORIGIN is actually the upper left most pad in the pad set. Locate the pad in the live video and click on **[2] SELECT PAD IN ORIGIN.**

[3] SELECT PAD IN UPPER RIGHT is the upper right most pad in the pad set. Locate the pad in the live video and click on **[3] SELECT PAD IN UPPER RIGHT.**

[4] SELECT PAD IN LOWER RIGHT is the lower right most pad in the pad set. Locate the pad in the live video and click on **[4] SELECT PAD IN LOWER RIGHT**

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Click on **DONE** in the Align Pad Set dialog box after all three points have been taught. See Figure 6-9.

Clicking on **DONE** in the New Program Pad Set dialog box will update all information and activate the crosshair in the display windows. See Figure 6-9.

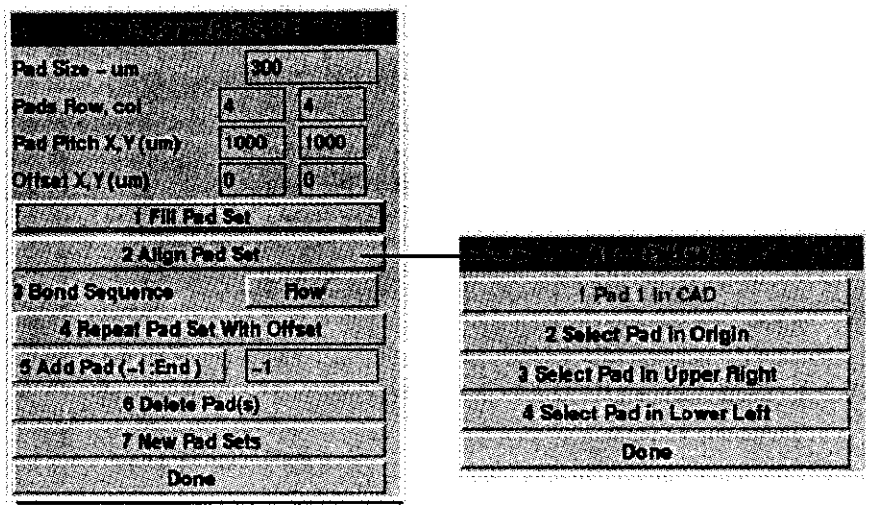


Figure 6-9 Align Pad Set Dialog Box

[3] **BOND SEQUENCE** allows the operator to select the order in which the balls will be laid. The choices are described below.

- **Column** performs a serpentine bonding moving left to right on the device in the X direction, then stepping in Y when all X is done.
- **Row** performs a serpentine bonding moving up and down the device in the Y direction, then stepping in X when all Y is done.
- **Optimize** will automatically move the bondhead through the device the fastest way possible.

[4] **REPEAT PAD SET WITH OFFSET** allows the operator to create a pad set copy using all the original pad set's parameters and enter the copy in another location. This is useful when creating a program that contains a matrix of devices all with the same parameters.

[5] **ADD PAD(S)** allows the operator to add pads to a currently taught pad set. This is useful when creating a pad set copy that deviates slightly from the original.

[6] **DELETE PAD(S)** allows the operator to delete pads to a currently taught pad set. This is useful when creating a pad set copy that deviates slightly from the original.

[7] **NEW PAD SET** (*currently not implemented.*)

Selecting **DONE** updates all new parameters, while exiting the dialog box.

6.3.4.2.2 New Program Pad Set #2

Selecting **REPEAT PAD SET WITH OFFSET** will automatically generate Pad Set #2 dialog box, Pad Set #3 dialog box and so on. The operator can use existing parameters form Pad Set #1 to create a new pad set that may contain different parameters depending upon the application. See Figure 6-10.

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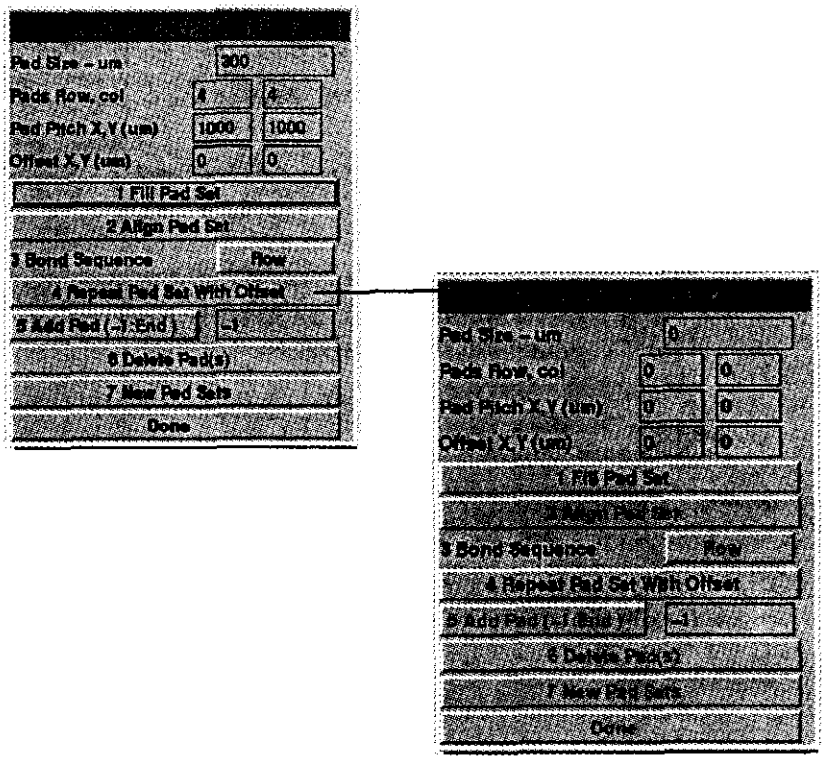


Figure 6-10 New Program Pad Set #2 Dialog Box

6.3.4.3 Add Last Pad

This pad is used as a reference point for the bondhead to seek when it is finished bonding each device. The pad or point selected should be located near the actual last ball that is laid on the device. This point needs to be exclusive from any taught pad location. Once Add Last Pad is taught on the first device it will automatically find the same point on all devices on the strip. See Figure 6-11.

NOTE: The Add Last Pad location that is selected, needs to be the same height as the bonding surface. Choosing an area that is higher than the actual bonding surface may cause damage to the device or bondhead.

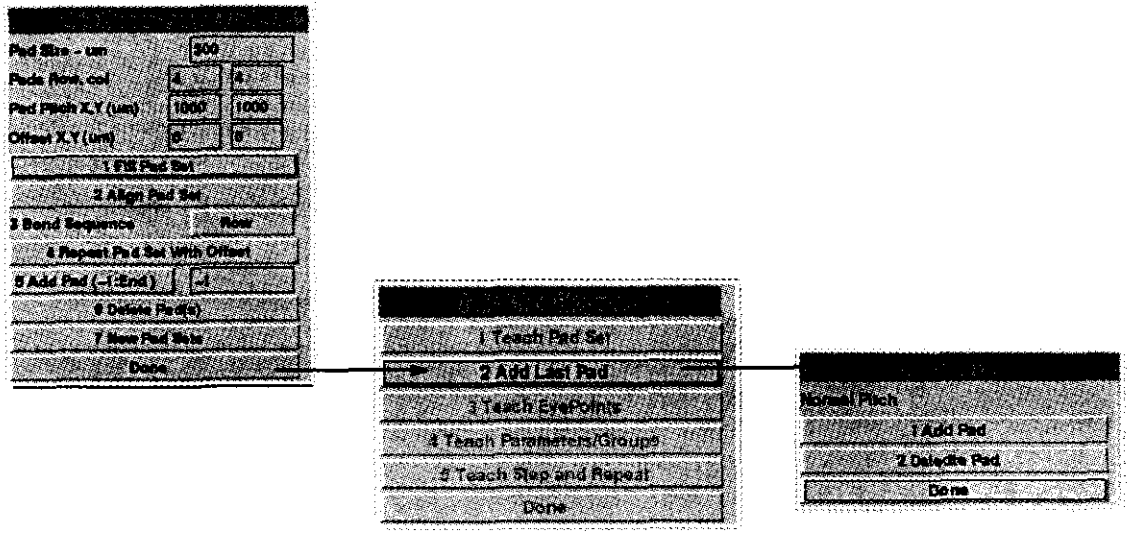


Figure 6-11 Add Last Pad Dialog Box

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[1] **ADD PAD** when selected, allows the operator to select the location of the Add Last Pad reference point.

[2] **DELETE PAD** when selected, deletes the current Add Last Pad reference point.

- Clicking on **DONE** brings up the Teach Eye Points dialog box.

6.3.4.4 Teach Device Eye Points

Teaching the eye points allows the user to teach two points on the device that the vision system (PRS) can identify. This will ensure that the device is properly aligned in the workholder.

Two primary eye points are taught at locations on the device with unique characteristics. To compensate for device rotation, these points are usually diagonally opposite each other. An option is available to teach additional eye points called backup eye points. If, during the execution of the process program, the attempt to locate the primary eye points fails, the process program will make an attempt to locate the backup eye points, if they exist.

Upon selecting the Teach Eye Points option the Configure Eye Points for Device dialog box will appear as shown in Figure 6-12.

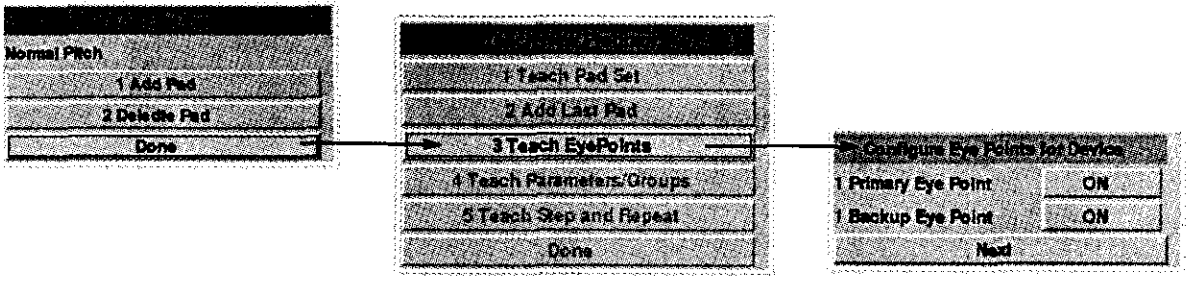


Figure 6-12 Configure Eye Points for Device Dialog Box

NOTE: The Configure Eye Points for Device dialog box that is shown in Figure 6-12 is for the individual device/pad set that was just taught. In most applications, such as programming the K&S test strip, the **TEACH STEP AND REPEAT** option will be used and the indexing eye points will be based on the entire device group. For this reason, both the primary and backup eye points are **configured to OFF**, however the **operator points must be taught** at this time.

6.3.4.4.1 Configure Eye Points for Device

This allows the user to turn the primary eye points and backup eye points **ON** or **OFF**. In the event that both the primary and backup eye points are turned off, the vision system uses the operator points for proper device alignment.

[1] **PRIMARY EYE POINTS** are those patterns first looked for by the PRS to identify and align the device.

[2] **BACKUP EYE POINTS** are used in the event that the primary eye points cannot be located.

- Clicking on **NEXT** brings up the Operator Point 1 dialog box. See Figure 6-13.

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6.3.4.4.2 Teach Operator Point 1

Operator points are taught so that the user can manually align the process program if the PRS does not recognize the eye points. Two operator points are taught at locations easily recognizable by the user. To compensate for device rotation, these points are usually diagonally opposite each other.

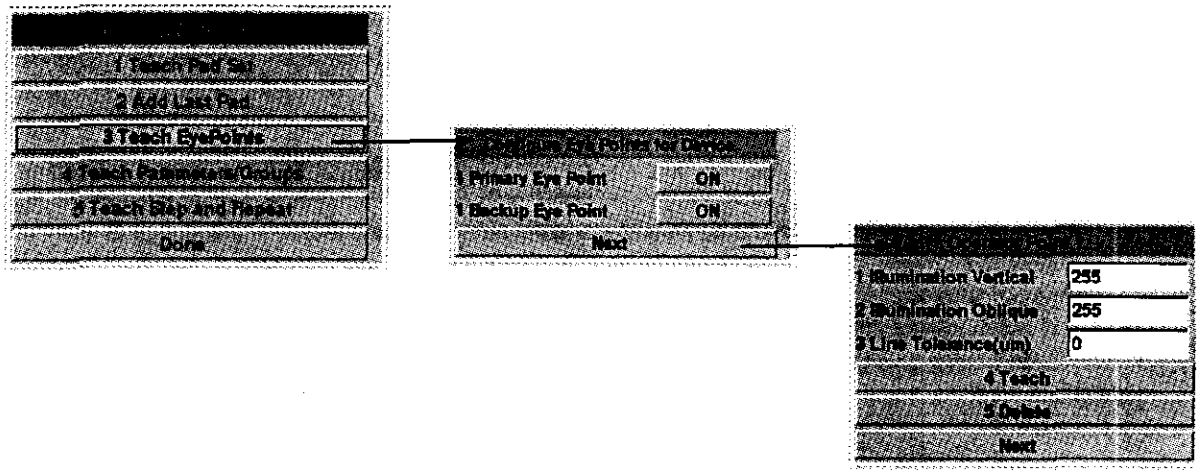


Figure 6-13 Operator Point 1 Dialog Box

[1] **ILLUMINATION: VERTICAL** sets the amount of light projected straight down onto the device.

[2] **ILLUMINATION: OBLIQUE** set the amount of light projected at an angle onto the device. The primary purpose of oblique lighting is to reduce shadows on the device surface. This helps to improve contrast at edges of patterns.

[3] **LINE TOLERANCE (UM)** sets the amount of deviation permitted in the distance between operator points. Typically, operator points are located diagonally opposite from one another. Positioning in this way maximizes the distance between them and improves the accuracy of Line Tolerance. Line tolerance distance units is in mils or mm.

Illumination may be set for each individual operator point to optimize its appearance to the optics. Line Tolerance is set for a pair of operator points. If only one operator point is used, line tolerance is not applied.

[4] **TEACH** enters all new parameters and teaches the operator point.

[5] **DELETE** allows the operator to delete the this operator point.

- Clicking on **NEXT** after clicking on **TEACH** saves all new parameters and brings up the Operator Point 2 dialog box. See Figure 6-14.

6.3.4.4.3 Teach Operator Point 2

This is the second of two operator points. Two operator points are taught at locations easily recognizable by the user. To compensate for device rotation, these points are usually diagonally opposite each other.

After teaching Operator Point 1 as described in Section 6.3.4.4.2, use the same procedure to teach Operator Point 2.

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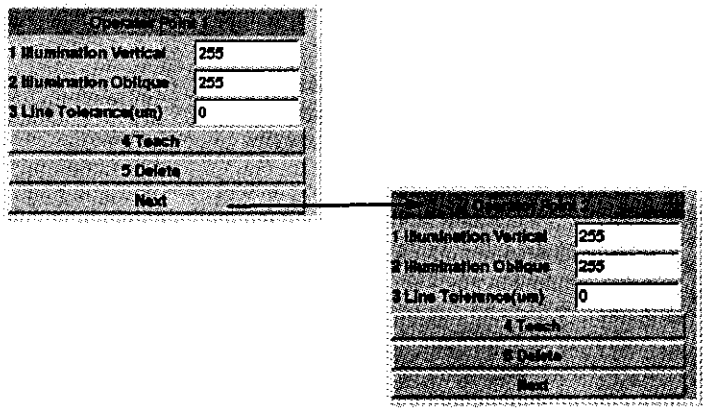


Figure 6-14 Operator Point 2 Dialog Box

- Selecting **NEXT** after clicking on **TEACH** in the Operator Point 2 dialog box saves all new parameters and brings up the teach Primary Eye Point 1 dialog box. See Figure 6-15.

NOTE: If the primary eye points are configured to **OFF**, the Teach Parameters/Groups menu will appear (see Section 6.3.4.5) as opposed to the Primary Eye Point dialog box shown below.

6.3.4.4.4 *Teach Primary Eye Point 1*

Teaching the eye points allows the user to teach one or two points on the device that the vision system (PRS) can identify. This will ensure that the device is properly aligned in the workholder.

Two primary eye points are taught at locations on the device with unique characteristics. To compensate for device rotation, these points are usually diagonally opposite each other. An option is available to teach additional eye points called backup eye points. If, during the execution of the process program, the attempt to locate the primary eye points fails, the process program will make an attempt to locate the backup eye points, if they exist.

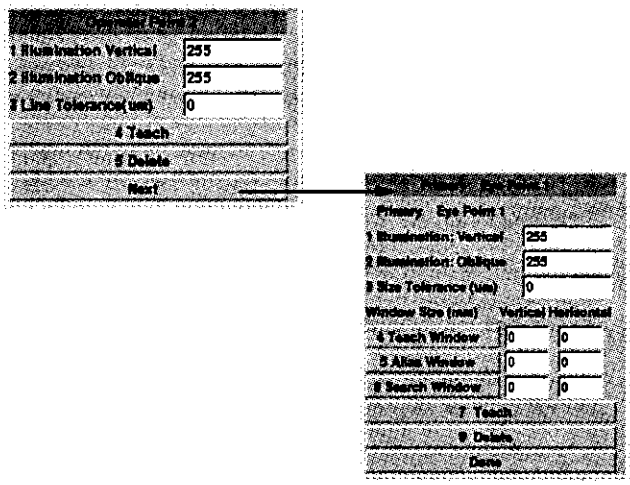


Figure 6-15 Primary Eye Point 1 Dialog Box

[1] **ILLUMINATION: VERTICAL** sets the amount of light projected straight down onto the die.

[2] **ILLUMINATION: OBLIQUE** set the amount of light projected at an angle onto the die. The primary purpose of oblique lighting is to reduce shadows on the die surface. This helps to improve contrast at edges of patterns.

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[3] **SIZE TOLERANCE (UM)** sets the amount of deviation permitted in the distance between operator points. Typically, operator points are located diagonally opposite from one another. Positioning in this way maximizes the distance between them and improves the accuracy of Line Tolerance. Line tolerance distance units is in mm.

[4] **TEACH WINDOW** allows the operator to set the vertical and horizontal size of the teach window. The teach window should contain an image which is non-repeating.

[5] **ALIAS WINDOW** allows the operator to set the vertical and horizontal size of the alias window. The alias window should contain an eye point on the device image that will look the same to the PRS.

[6] **SEARCH WINDOW** allows the operator to set the vertical and horizontal size of the search window. The search window is the search area in which to find a taught eye point. The Search window will contain the alias window and the teach window.

[7] **TEACH** enters all the new values and teaches the eye point.

[8] **DELETE** allows the operator to delete this eye point.

- Selecting **DONE** after clicking on **TEACH** in the Primary Eye Point 1 dialog box saves all new parameters and brings up the Primary Eye Point 2 dialog box. See Figure 6-16.

6.3.4.4.5 Teach Primary Eye Point 2

This is the second of two eye points. Two eye points are taught at locations easily recognizable by the user. To compensate for device rotation, these points are usually diagonally opposite each other.

After teaching Eye Point 1 as described in Section 6.3.4.4.4, use the same procedure to teach Eye Point 2.

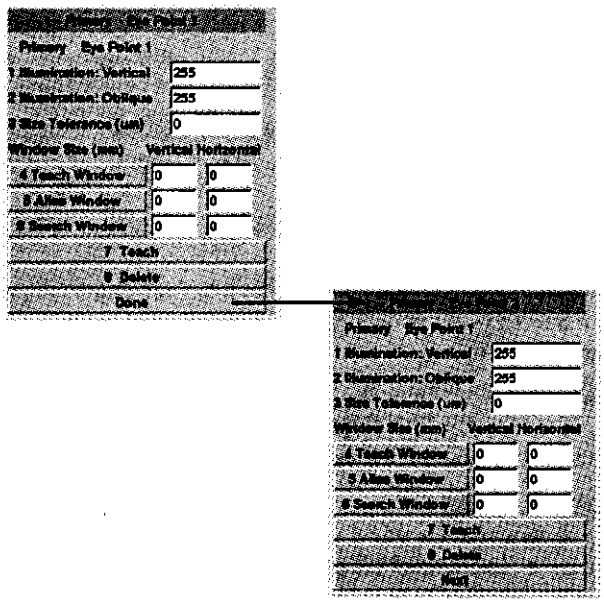


Figure 6-16 Primary Eye Point 2 Dialog Box

- Selecting **NEXT** after clicking on **TEACH** in the Primary Eye Point 2 dialog box saves all new parameters and brings up the Teach Backup Eye Point 1 dialog box. See Figure 6-17.

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6.3.4.4.6 Teach Backup Eye Point 1

Backup eye points are used in the event that the primary eye points cannot be located.

Backup eye points points are taught at locations on the device with unique characteristics. To compensate for die rotation, these points are usually diagonally opposite each other.

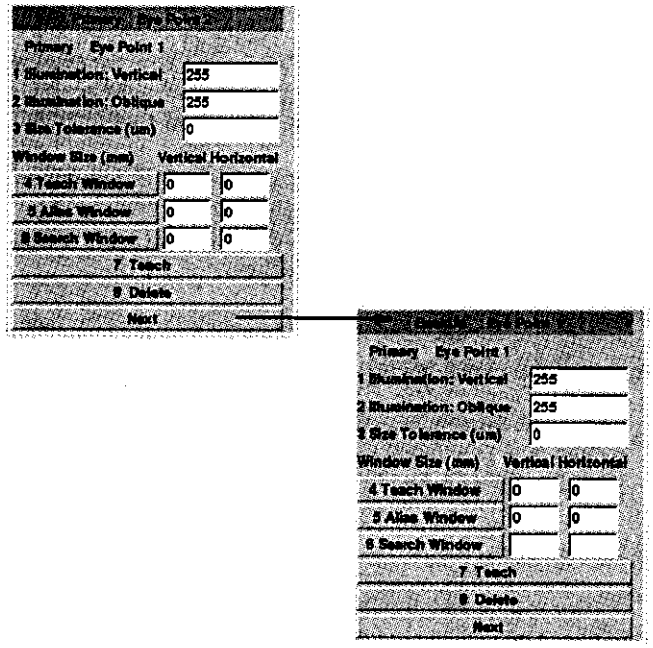


Figure 6-17 Backup Eye Point 1 Dialog Box

[1] **ILLUMINATION: VERTICAL** sets the amount of light projected straight down onto the die.

[2] **ILLUMINATION: OBLIQUE** set the amount of light projected at an angle onto the die. The primary purpose of oblique lighting is to reduce shadows on the die surface. This helps to improve contrast at edges of patterns.

[3] **SIZE TOLERANCE (UM)** sets the amount of deviation permitted in the distance between operator points. Typically, operator points are located diagonally opposite from one another. Positioning in this way maximizes the distance between them and improves the accuracy of Line Tolerance. Line tolerance distance units is in mm.

[4] **TEACH WINDOW** allows the operator to set the vertical and horizontal size of the teach window. The teach window should contain an image which is non-repeating.

[5] **ALIAS WINDOW** allows the operator to set the vertical and horizontal size of the alias window. The alias window should contain an eye point on the device image that will look the same to the PRS.

[6] **SEARCH WINDOW** allows the operator to set the vertical and horizontal size of the search window. The search window is the search area in which to find a taught eye point. The Search window will contain the alias window and the teach window.

[7] **TEACH** enters all the new values and teaches the eye point.

[8] **DELETE** allows the operator to delete this eye point.

- Selecting **NEXT** after clicking on **TEACH** in the Backup Eye Point 1 dialog box saves all new parameters and brings up the Backup Eye Point 2 dialog box. See Figure 6-18.

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6.3.4.4.7 Teach Backup Eye Point 2

This is the second of two backup eye points. Two eye backup points are taught at locations easily recognizable by the user. To compensate for device rotation, these points are usually diagonally opposite each other.

After teaching Backup Eye Point 1 as described in Section 6.3.4.4.6, use the same procedure to teach Backup Eye Point 2.

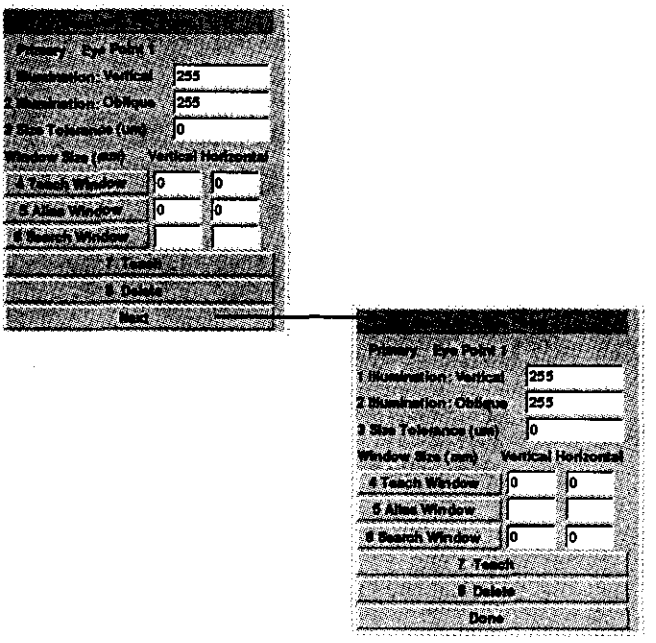


Figure 6-18 Backup Eye Point 2 Dialog Box

- Selecting **DONE** after clicking on **TEACH** in the Backup Eye Point 2 dialog box saves all new parameters and brings up the Teach Parameters/Groups menu box. See Figure 6-19.

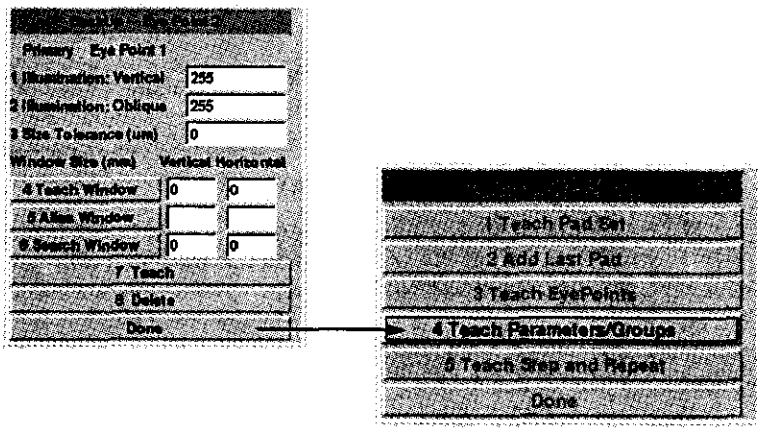


Figure 6-19 Teach Parameters/Groups Menu

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6.3.4.5 Teach Parameters/Groups

The Parameters dialog box shown in Figure 6-20 allows the operator to enter bonding parameters specific to the device being used. These parameters will change depending upon the application differences between devices.

Groups of pads within a pad set can be given their own specific parameters. These groups are given their own group name and their own graphics overlay colors to make each group identifiable to the operator. The need to create pad groups depends upon the application and specifications of a particular device.

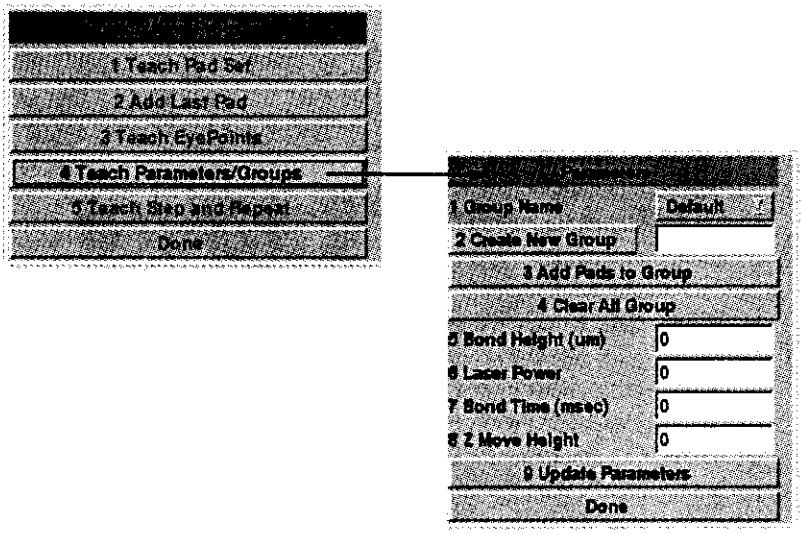


Figure 6-20 Parameters/Groups Dialog Box

[1] **GROUP NAME** allows the operator to view the specific group names along with their associated pads that have been created. A drop down list will be displayed of any group that has been created including the default name.

The default group pads are red. Other groups are gray unless selected, then they become green.

[2] **CREATE NEW GROUP** allows the operator to create a new group name and assign specific parameters to this group.

[3] **ADD PADS TO GROUP** allows the operator to select pads being added to a group by using the trackball. Pressing on **[3] ADD PADS TO GROUP** will add the additional pad to the group.

[4] **CLEAR ALL GROUPS** allows the operator to eliminate all groups taught, while enabling the default group which contains one set of parameters.

[5] **BOND HEIGHT (UM)** allows the operator to adjust the height of the capillary above the pad when laying a ball. The suggested height is usually 1/3 to 1/2 the size of the ball that is being applied in this group.

[6] **LASER POWER** allows the operator to enter the specific laser power setting being applied to all the pads in this group. Values range from 0 to 255, which corresponds to current, measuring from 0 to 10 amps. Do not fire the laser with more than 8 amps (a setting of 200). Typical settings range from 130 to 170 depending on ball size and application.

[7] **BOND TIME (MSEC)** allows the operator to enter the specific laser firing time being applied to all the pads in this group.

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[8] **Z MOVE HEIGHT** allows the operator to adjust the height of the capillary while it moves from one ball placement to the next. An optimized loop height is used, while ensuring the just laid ball is cleared.

[9] **UPDATE PARAMETERS** initiates the creation of a new group with it's own group name that will now be stored in memory.

- Selecting **DONE** exits the Parameters dialog box and will bring up the Teach Step and Repeat menu.

6.3.4.6 Teach Step and Repeat

Step and Repeat allows the operator to copy and duplicate a process to the remaining sites within a matrix. Therefore, a site device requires programming only once. Each site becomes an additional program assigned to its own site. Figure 6-21 shows the Step and Repeat dialog box.

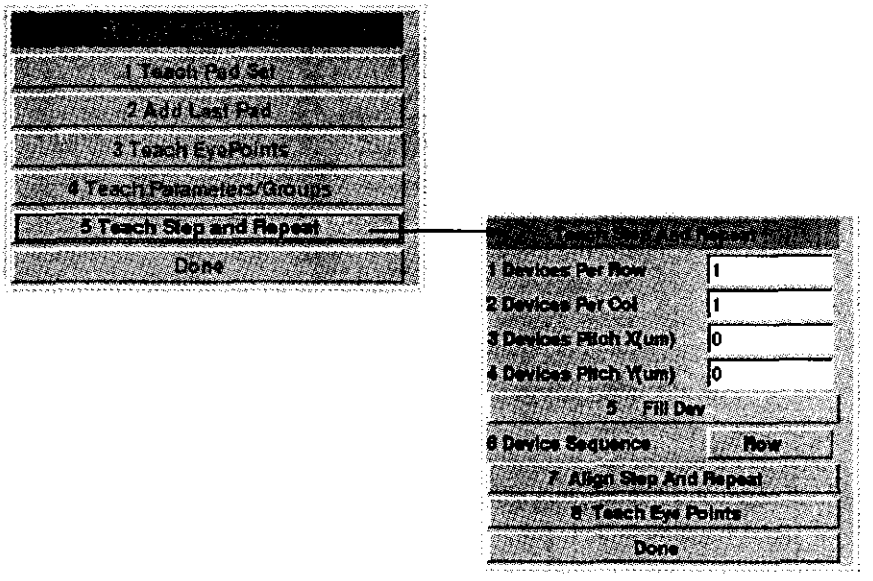


Figure 6-21 Teach Step and Repeat Dialog Box

[1] **DEVICES PER ROW** allows the operator to enter the number of pad set copies in a row in the X (across) direction.

[2] **DEVICES PER COLUMN** allows the operator to enter the number of pad set copies in a column in the Y (up & down) direction.

[3] **DEVICE PITCH X (UM)** allows the operator to enter the size of a single pad set copy in the X direction that will be used to place the next pad set copy in the X direction.

[4] **DEVICE PITCH Y (UM)** allows the operator to enter the size of a single pad set copy in the Y direction that will be used to place the next pad set copy in the Y direction.

[5] **FILL DEVICE** takes all four parameters above and initiates the creation of the device with the selected number of pad set copies in the X and Y direction.

[6] **DEVICE SEQUENCE** allows the operator to enter the bonding sequence of the pad set copies in the device.

- Column
- Row

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6.3.4.6.1 Align Step and Repeat

ALIGN STEP AND REPEAT when selected generates the Align Step and Repeat dialog box. By teaching the locations indicated in the dialog box, a live video overlay of the pad set will be created over the live image. Also, a true representation of the device image will also be displayed. See Figure 6-22.

[3] SELECT DEV IN UPPER RIGHT is the upper left most pad of the upper right most device. Locate the pad in the live video and click on **[3] SELECT DEV IN UPPER RIGHT.**

[4] SELECT DEV IN LOWER LEFT is the upper left most pad of the lower left most device. Locate the pad in the live video and click on **[4] SELECT DEV IN LOWER LEFT.**

- Select **DONE** to exit the Align Step and Repeat dialog box, then select **TEACH EYE POINTS.** See Figure 6-22.

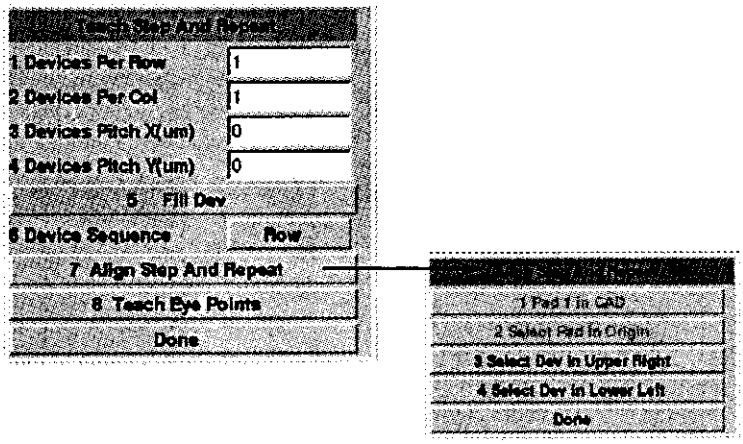


Figure 6-22 Align Step and Repeat Dialog Box

6.3.4.6.2 Teach Device Group Eye Points

Teaching the eye points allows the user to teach two points on the device group that the vision system (PRS) can identify. This will ensure that the device is properly aligned in the workholder.

Two primary eye points are taught at locations on the device group with unique characteristics. To compensate for device rotation, these points are usually diagonally opposite each other. An option is available to teach additional eye points called backup eye points. If, during the execution of the process program, the attempt to locate the primary eye points fails, the process program will make an attempt to locate the backup eye points, if they exist.

Upon selecting the Teach Eye Points option, the Device Group Eye Points Configuration dialog box will appear. Selecting **NEXT** will bring up the Device Group Operator Point as shown in Figure 6-23.

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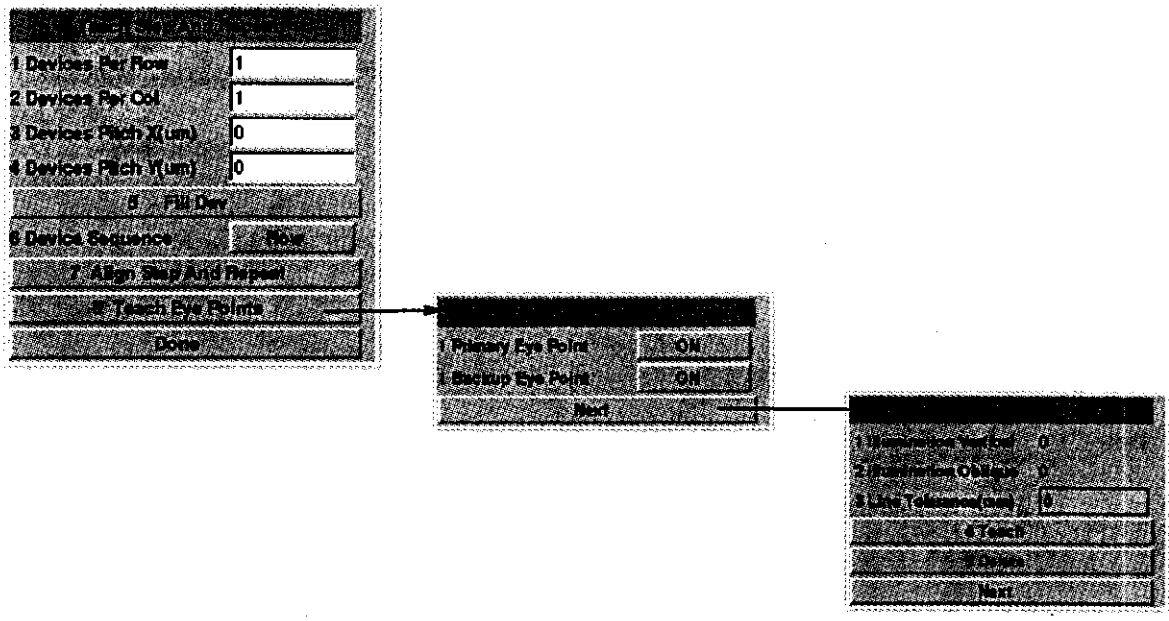


Figure 6-23 Device Group Eye Points Configuration Dialog Box

6.3.4.6.3 Device Group Eye Points Configuration

This allows the user to turn the primary device group eye points and backup device group eye points **ON** or **OFF**. In the event that both the primary and backup eye points are turned off, the vision system uses the operator points for proper device group alignment.

[1] **PRIMARY EYE POINTS** are those patterns first looked for by the PRS to identify and align the device group.

[2] **BACKUP EYE POINTS** are used in the event that the primary eye points cannot be located.

- Clicking on **NEXT** brings up the Device Group Operator Point 1 dialog box. See Figure 6-24.

6.3.4.6.4 Teach Device Group Operator Point 1

Device group operator points are taught so that the user can manually align the process program if the PRS does not recognize the device group eye points. Two operator points are taught at locations easily recognizable by the user. To compensate for device rotation, these points are usually diagonally opposite each other.

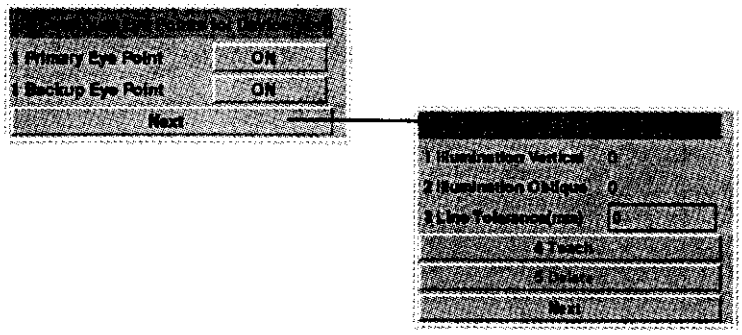


Figure 6-24 Device Group Operator Point 1 Dialog Box

[1] **ILLUMINATION: VERTICAL** sets the amount of light projected straight down onto the device.

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[2] **ILLUMINATION: OBLIQUE** set the amount of light projected at an angle onto the device. The primary purpose of oblique lighting is to reduce shadows on the device surface. This helps to improve contrast at edges of patterns.

[3] **LINE TOLERANCE (UM)** sets the amount of deviation permitted in the distance between operator points. Typically, operator points are located diagonally opposite from one another. Positioning in this way maximizes the distance between them and improves the accuracy of Line Tolerance. Line tolerance distance units is in mils or mm.

Illumination may be set for each individual operator point to optimize its appearance to the optics. Line Tolerance is set for a pair of operator points. If only one operator point is used, line tolerance is not applied.

[4] **TEACH** enters all new parameters and teaches the operator point.

[5] **DELETE** allows the operator to delete the this operator point.

- Clicking on **NEXT** after clicking on **TEACH** saves all new parameters and brings up the Device Group Operator Point 2 dialog box. See Figure 6-25.

6.3.4.6.5 Teach Device Group Operator Point 2

This is the second of two device group operator points. Two operator points are taught at locations easily recognizable by the user. To compensate for device rotation, these points are usually diagonally opposite each other.

After teaching Device Group Operator Point 1 as described in Section 6.3.4.6.5, use the same procedure to teach Device Group Operator Point 2.

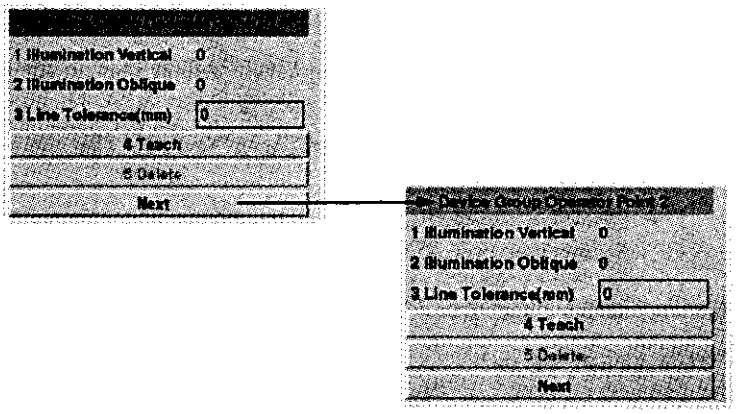


Figure 6-25 Device Group Operator Point 2 Dialog Box

- Selecting **NEXT** after clicking on **TEACH** in the Device Group Operator Point 2 dialog box saves all new parameters and brings up the Device Group Primary Eye Point 1 dialog box. See Figure 6-26.

6.3.4.6.6 Teach Device Group Primary Eye Point 1

Teaching the eye points allows the user to teach two points on the device group that the vision system (PRS) can identify. This will ensure that the device group is properly aligned in the workholder.

Two primary eye points are taught at locations on the device group with unique characteristics. To compensate for device rotation, these points are usually diagonally opposite each other. An option is available to teach additional device group eye points called device group backup eye points. If, during the execution of the process program, the attempt to locate the device group primary eye points fails, the process program will make an attempt to locate the device group backup eye points, if they exist.

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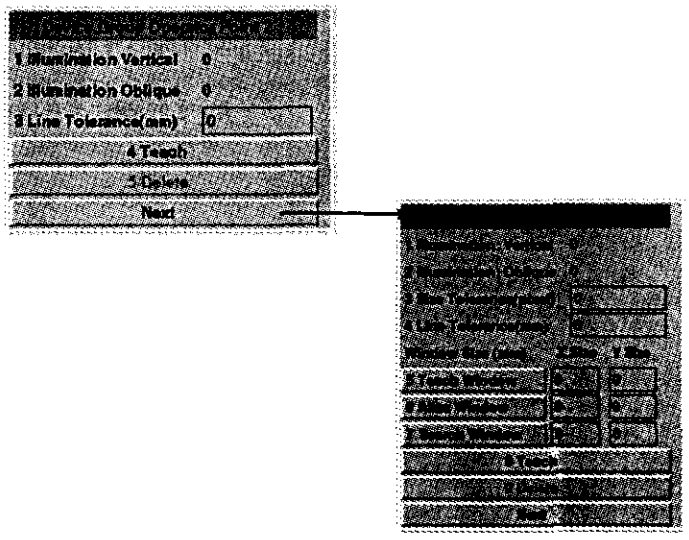


Figure 6-26 Device Group Primary Eye Point 1 Dialog Box

[1] **ILLUMINATION: VERTICAL** sets the amount of light projected straight down onto the die.

[2] **ILLUMINATION: OBLIQUE** set the amount of light projected at an angle onto the die. The primary purpose of oblique lighting is to reduce shadows on the die surface. This helps to improve contrast at edges of patterns.

[3] **SIZE TOLERANCE (UM)** sets the amount of deviation permitted in the distance between operator points. Typically, operator points are located diagonally opposite from one another. Positioning in this way maximizes the distance between them and improves the accuracy of Line Tolerance. Line tolerance distance units is in mm.

[4] **TEACH WINDOW** allows the operator to set the vertical and horizontal size of the teach window. The teach window should contain an image which is non-repeating.

[5] **ALIAS WINDOW** allows the operator to set the vertical and horizontal size of the alias window. The alias window should contain an eye point on the device image that will look the same to the PRS.

[6] **SEARCH WINDOW** allows the operator to set the vertical and horizontal size of the search window. The search window is the search area in which to find a taught eye point. The Search window will contain the alias window and the teach window.

[7] **TEACH** enters all the new values and teaches the eye point.

[8] **DELETE** allows the operator to delete this eye point.

- Selecting **DONE** after clicking on **TEACH** in the Device Group Primary Eye Point 1 dialog box saves all new parameters and brings up the Device Group Primary Eye Point 2 dialog box. See Figure 6-27.

6.3.4.6.7 Teach Device Group Primary Eye Point 2

This is the second of two device group primary eye points. Two device group eye points are taught at locations easily recognizable by the user. To compensate for device rotation, these points are usually diagonally opposite each other.

After teaching Device Group Primary Eye Point 1 as described in Section 6.3.4.6.6, use the same procedure to teach Device Group Primary Eye Point 2.

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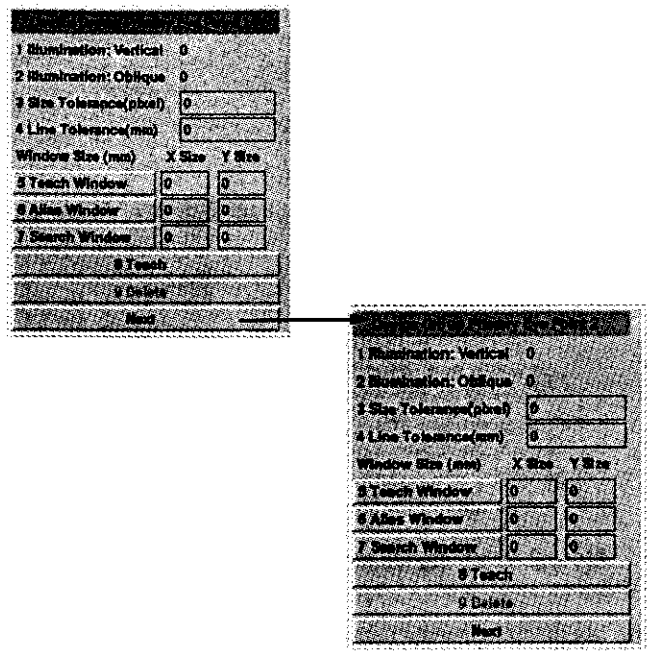


Figure 6-27 Device Group Primary Eye Point 2 Dialog Box

- Selecting **NEXT** after clicking on **TEACH** in the Device Group Primary Eye Point 2 dialog box saves all new parameters and brings up the Device Group Backup Eye Point 1 dialog box. See Figure 6-28.

6.3.4.6.8 Teach Device Group Backup Eye Point 1

Device group backup eye points are used in the event that the device group primary eye points cannot be located.

Device group backup eye points points are taught at locations on the device with unique characteristics. To compensate for die rotation, these points are usually diagonally opposite each other.

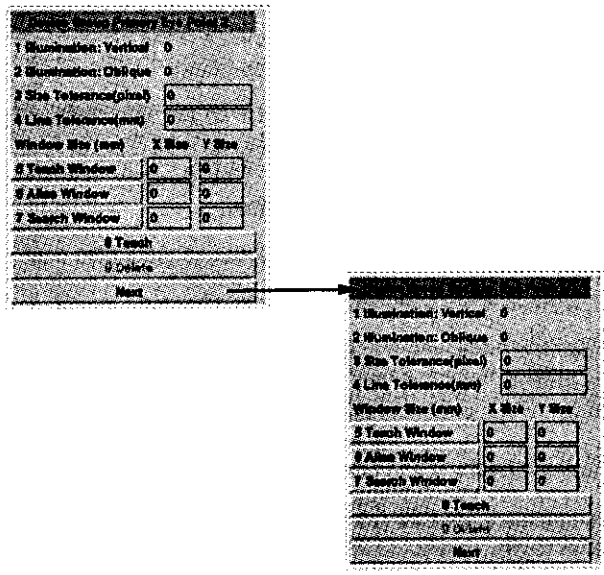


Figure 6-28 Device Group Backup Eye Point 1 Dialog Box

[1] **ILLUMINATION: VERTICAL** sets the amount of light projected straight down onto the die.

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[2] **ILLUMINATION: OBLIQUE** set the amount of light projected at an angle onto the die. The primary purpose of oblique lighting is to reduce shadows on the die surface. This helps to improve contrast at edges of patterns.

[3] **SIZE TOLERANCE (UM)** sets the amount of deviation permitted in the distance between operator points. Typically, operator points are located diagonally opposite from one another. Positioning in this way maximizes the distance between them and improves the accuracy of Line Tolerance. Line tolerance distance units is in mm.

[4] **TEACH WINDOW** allows the operator to set the vertical and horizontal size of the teach window. The teach window should contain an image which is non-repeating.

[5] **ALIAS WINDOW** allows the operator to set the vertical and horizontal size of the alias window. The alias window should contain an eye point on the device image that will look the same to the PRS.

[6] **SEARCH WINDOW** allows the operator to set the vertical and horizontal size of the search window. The search window is the search area in which to find a taught eye point. The Search window will contain the alias window and the teach window.

[7] **TEACH** enters all the new values and teaches the eye point.

[8] **DELETE** allows the operator to delete this eye point.

- Selecting **NEXT** after clicking on **TEACH** in the Device Group Backup Eye Point 1 dialog box saves all new parameters and brings up the Device Group Backup Eye Point 2 dialog box. See Figure 6-29.

6.3.4.6.9 Teach Device Group Backup Eye Point 2

This is the second of two device group eye points. Two eye points are taught at locations easily recognizable by the user. To compensate for device rotation, these points are usually diagonally opposite each other.

After teaching Device Group Backup Eye Point 1 as described in Section 6.3.4.6.8, use the same procedure to teach Device Group Backup Eye Point 2.

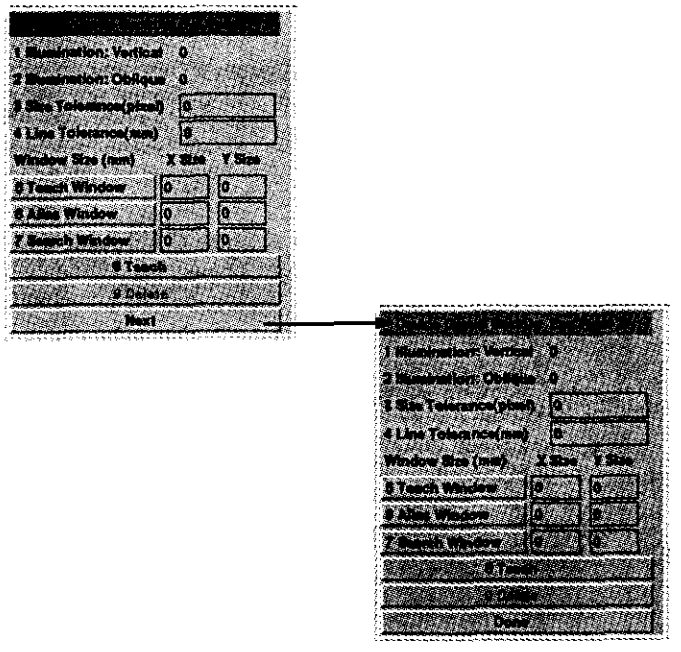


Figure 6-29 Device Group Backup Eye Point 2 Dialog Box

- Teaching the process program is complete and can be saved to the hard drive or to a floppy disk. See Section 6.3.1.

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6.3.5 Edit Program

A process program that has just been taught or one that has just been loaded from disk or from an external host can be modified. In particular, a process program can be selected and changed or deleted. Bond parameters can also be changed if necessary to customize the process program for a particular device. See Figure 6-30.

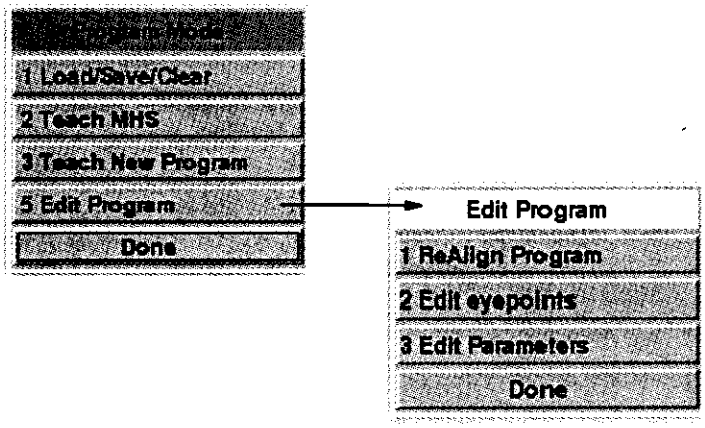


Figure 6-30 Edit Program Menu

6.3.5.1 Realign Program (*currently not implemented*)

6.3.5.2 Edit Eye Points

This function allows the operator to reposition the operator points or the eye points in the event that the device is slightly moved. During this operation the table will first move to the previously taught positions at which point the parameters can be changed as necessary.

The operator can select from two options in the Edit Eye Point menu. Depending upon application, a device eye point or device group eye point can be edited. See Figure 6-31.

6.3.5.2.1 Edit Device Eye Point

This function allows the operator to change the device eye points that currently exist on the process program. Selecting **EDIT DEV EYE** will bring up the Configure Eye Points for Device dialog box as shown in Figure 6-31.

Once in the Configure Eye Points for Device dialog box, use the Teach procedure found in Section 6.3.4.4.1 to continue editing the eye points.

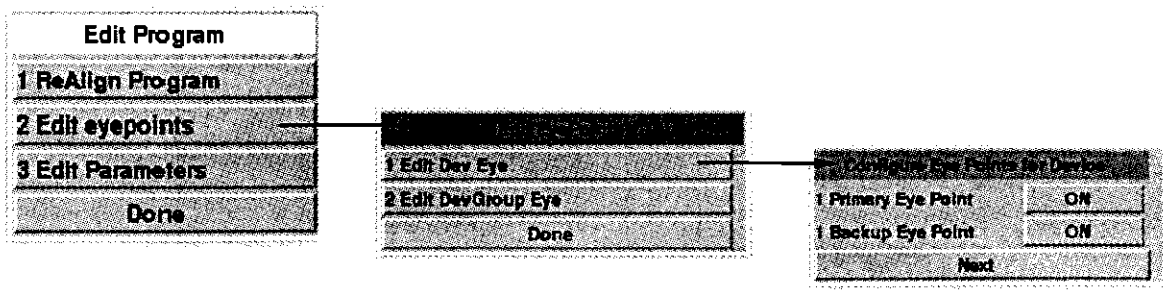


Figure 6-31 Edit Device Eye Point Menu

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6.3.5.2.2 Edit Device Group Eye Points

This function allows the operator to change the device group eye points that currently exist on the process program. Selecting **EDIT DEV GROUP EYE** will bring up the Device Group Eye Points Configuration dialog box as shown in Figure 6-32.

Once in the Device Group Eye Points Configuration dialog box, use the Teach procedure found in Section 6.3.4.6.3 to continue editing the device group eye points.

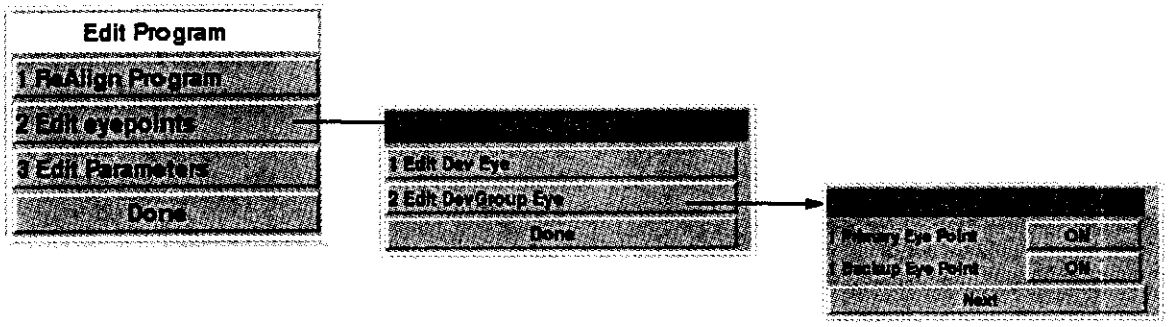


Figure 6-32 Device Group Eye Points Configuration Dialog Box

6.3.5.3 Edit Parameters

This function allows the operator to change the parameters of an existing group within a device to create a new group.

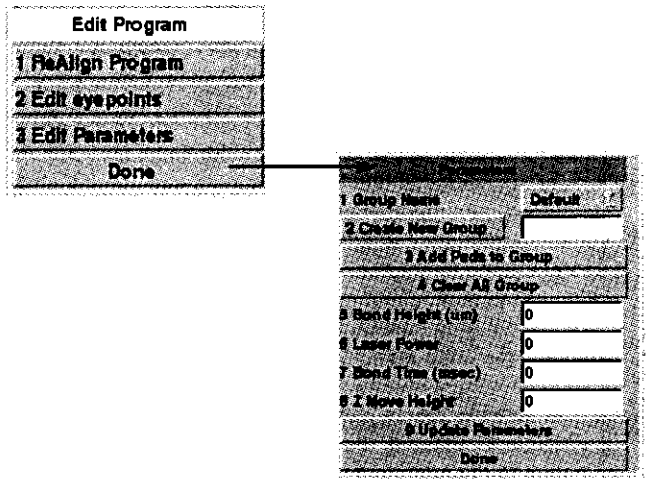


Figure 6-33 Edit Parameters Dialog Box

[1] **GROUP NAME** allows the operator to view the specific group names along with their associated pads that have been created. A drop down list will be displayed of any group that has been created including the default name.

The default group pads are red. Other groups are gray unless selected, then they become green.

[2] **CREATE NEW GROUP** allows the operator to create a new group name and assign specific parameters to this group.

[3] **ADD PADS TO GROUP** allows the operator to select pads being added to a group by using the trackball. Pressing on **[3] ADD PADS TO GROUP** will add the additional pad to the group.

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[4] **CLEAR ALL GROUPS** allows the operator to eliminate all groups taught, while enabling the default group which contains one set of parameters.

[5] **BOND HEIGHT (UM)** allows the operator to adjust the height of the capillary above the pad when laying a ball. The suggested height is usually 1/2 the size of the ball that is being applied in this group.

[6] **LASER POWER** allows the operator to enter the specific laser power setting being applied to all the pads in this group. Values range from 0 to 255, which corresponds to current, measuring from 0 to 10 amps. Do not fire the laser with more than 8 amps (a setting of 200). Typical settings range from 130 to 170 depending on ball size and application.

[7] **BOND TIME (MSEC)** allows the operator to enter the specific laser firing time being applied to all the pads in this group.

[8] **Z MOVE HEIGHT** allows the operator to adjust the height of the capillary while it moves from one ball placement to the next. An optimized loop height is used, while ensuring the just laid ball is cleared.

[9] **UPDATE PARAMETERS** initiates the creation of a new group with it's own group name that will now be stored in memory.

- Selecting **DONE** exits the Parameters dialog box and will bring up the Teach Step and Repeat menu.

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Section

7 OPERATING TASKS

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7 Operating Tasks

7.1 Introduction

This section contains information applicable to the "normal" day to day tasks of producing product on the 9388. Several machine modes are involved in these activities. The sequence begins with Program Mode, presuming that a Process Program exists for the device, which will be loaded and run.

Additionally, functions of the Manual Mode and Auto Mode are covered as they impact operation. For overview information regarding Modes see *Section 2: Software Overview* in this manual.

7.2 Program Mode

Program mode allows the operator to Load, Save, Clear, Teach and Edit Process Programs. Details of all these functions can be found in Section 6 of this manual. To **Load, Save** or **Clear** an existing program continue with section 7.2.1.

7.2.1 Clear an Existing Process Program

This action is required only if a Process Program is already loaded into 9388 RAM memory. Otherwise the operator may load a Process Program. As shown in Figure 7-1, [1] **CLEAR PROGRAM** is the first choice in the **Load/Save/Clear** menu.

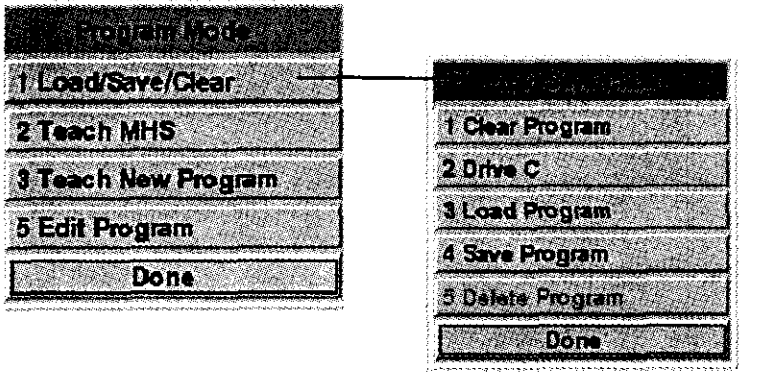


Figure 7-1 Load/Save/Clear Menu

7.2.2 Drive Selection

Clicking on **2 DRIVE** toggles between the A drive and C drive. See Figure 7-1.

7.2.3 Load a Process Program from Disk

The operator must load the desired Process Program from either the C: or A: disk drive. With the Program menu displayed, the desired drive is set by keying in [2] on the MMI to toggle the selection. See Figure 7-1.

To load a Process Program the operator activates [3] **LOAD PROGRAM**. A listing similar to Figure 7-2 appears that shows all available Process Programs.

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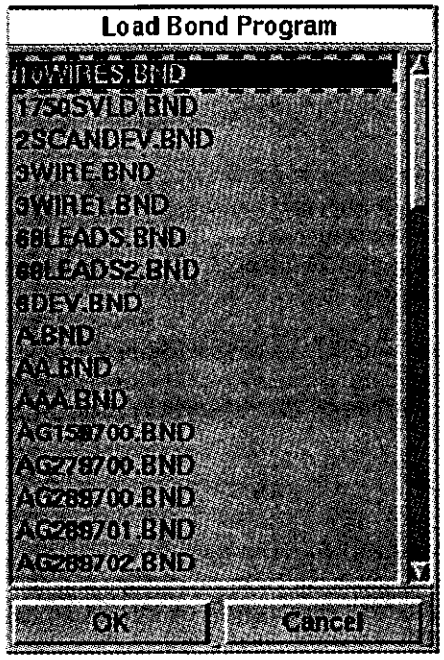


Figure 7-2 Process Program List

Select the desired program by:

- Using the scroll bar located on the right of the list window to move the list. The up and down arrow keys may also be used instead of the scroll bar. Position the pointer on the desired Process Program. Select **OK** or press **[B1]** or **[ENTER]** to load. Selecting **CANCEL** restores the Program menu.
- Using the tab up and tab down keys on the MMI to move the highlight box through the listing. When the desired Process Program is selected select **OK** or press **[B1]** or **[ENTER]** to load. Selecting **CANCEL** restores the Program menu.

A loaded Process Program produces a display similar to that shown in Figure 7-3.

7.2.4 Save Process Program

[4] SAVE PROCESS PROGRAM allows the operator to save a Process Program. The operator may use this to save a newly created Process Program or one which has been edited, giving it a different name.

7.2.5 Delete Program

[5] DELETE PROGRAM allows the operator to eliminate a saved process program from the hard drive. Once the process program is deleted it cannot be restored.

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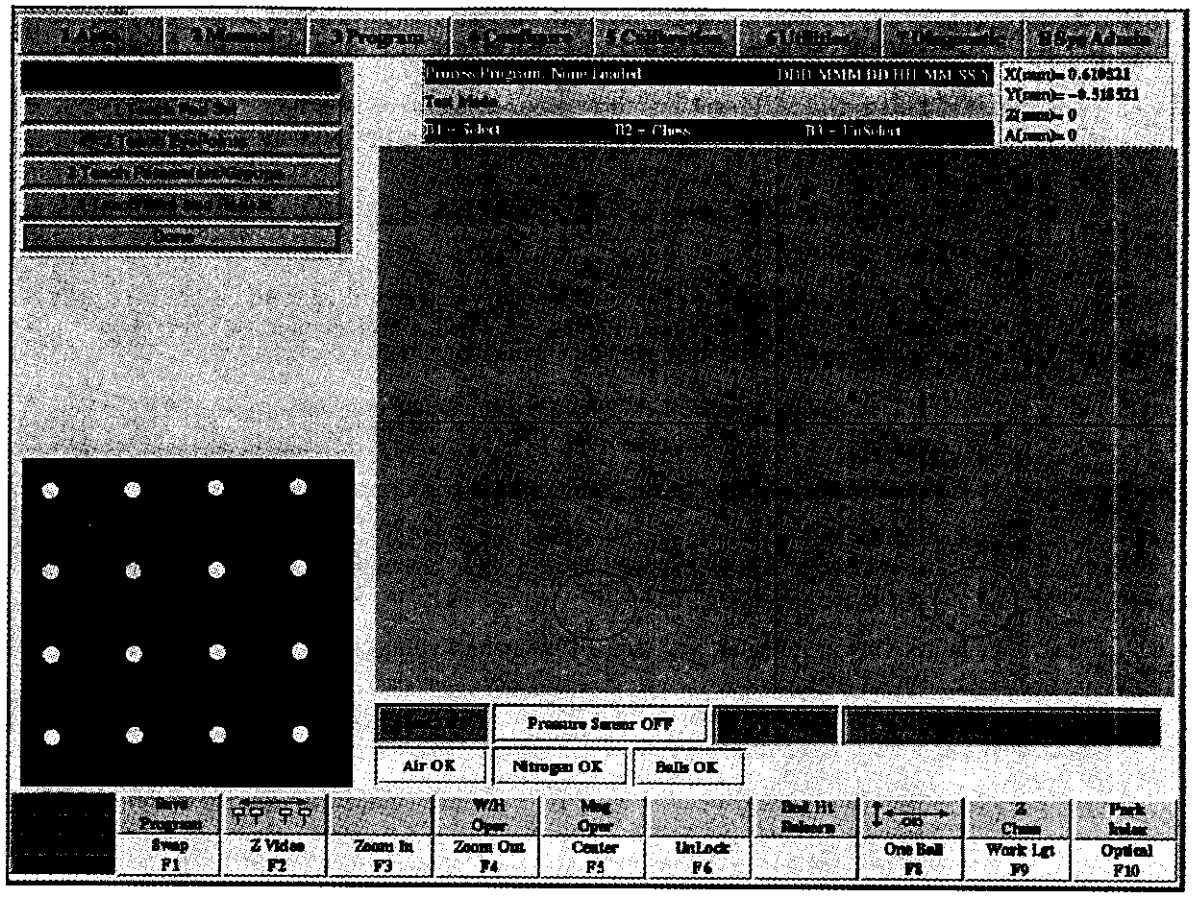


Figure 7-3 Loaded Process Program Display

7.3 Load Balls Into Reservoir

1. Remove the cap from the reservoir.
2. Pour the appropriate size balls into the reservoir.
3. Gently tap the tube between the reservoir and the microfeeder so the balls settle into the tube.
4. Screw the cap onto the reservoir and tighten it in place.

7.3.1 Vacuum Pencil

The vacuum pencil is a vacuum tube that is attached to the inside wall of the output mag handler. The operator can use this tube to vacuum up any stray balls that may have inadvertently fell in the workholder or bond head area during ball loading or calibration. The tip of the vacuum pencil can be unscrewed for larger balls.

Once the balls have been sucked up by the vacuum, they are stored in the vacuum reservoir located on the right side of the lower console. Periodically, check the reservoir and when it is full, unscrew the small glass cup, discard the balls, and screw the glass cup back on.

Turn the vacuum on by pushing the switch located on the front of the upper console to the up position. To turn the vacuum off, push the switch to the down position.

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7.4 Execute Program

1. Once a process program is loaded, select Configure from the mode bar located on top of the screen. Select the Auto option, then press **DONE**. Select the MHS option, then press **DONE**. This will ensure the configuration parameters will update with the process program that was loaded.

   If a new process program needs to be created, refer to Section 6.3.3 of this manual.

2. Ensure the pressure settings on the head capillary and ball feeder are set properly. The pressure settings are set based upon ball size and device type.

   For more information regarding pneumatic controls and indicators refer to Section 1.6 of this manual.

3. Load the appropriate magazines onto the mag handlers.

4. To continuously run strips, press the Auto Index key, then press the Run key. Both the Run key and Auto Index key can be operated through the keyboard or the GUI.

5. To view one index at a time, press the Index key instead of the Auto Index key.

7.5 Auto Mode

This menu allows the user to set parameters related to automatic operation. In addition to the operator setting parameters in Auto mode the bonder can track track and display certain operating conditions, which include the following. (See Figure 7-4.)

- Management of process events.
- Detection of and recovery from error conditions.
- Management of the process cycle timing and interruptions.
- Collection and presentation of process data.
- Production and presentation of production data.
- Monitoring machine condition for maintenance requirements.

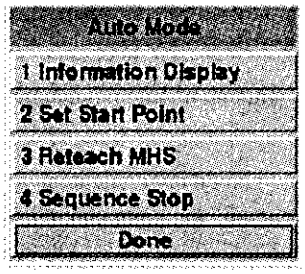


Figure 7-4 Auto Mode Menu

If an error condition is detected in any of the subsystems, automatic operation may be paused or aborted due to these error conditions. The error may simply be displayed for the operator or reported to the host. In all cases, the error will be time-stamped and logged. Depending on the nature of the error, the operator may be able to perform recovery operations and, if required, access MHS functions. If a partial or flawed processing is detected, processing stops, and whenever possible, the current ball attach cycle is completed before operation is halted.

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7.5.1 Information Display

This selection allows the user to display several sets of data about the machine and its production numbers. (See Figure 7-5.) These selections are described in the paragraphs that follow.

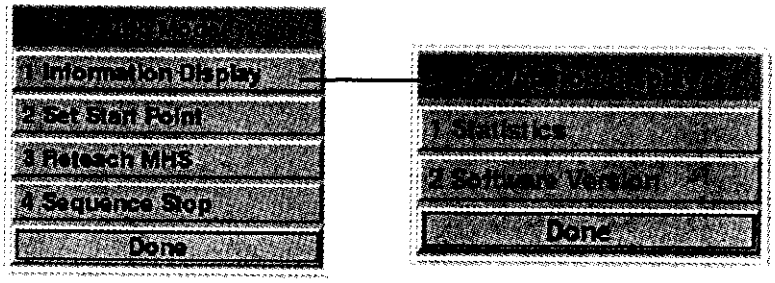


Figure 7-5 Information Display Menu

7.5.1.1 Statistics

This display allows the user to view statistics related to production from a specific start date and time to a specific end date and time (see Figure 7-6 and Figure 7-7).

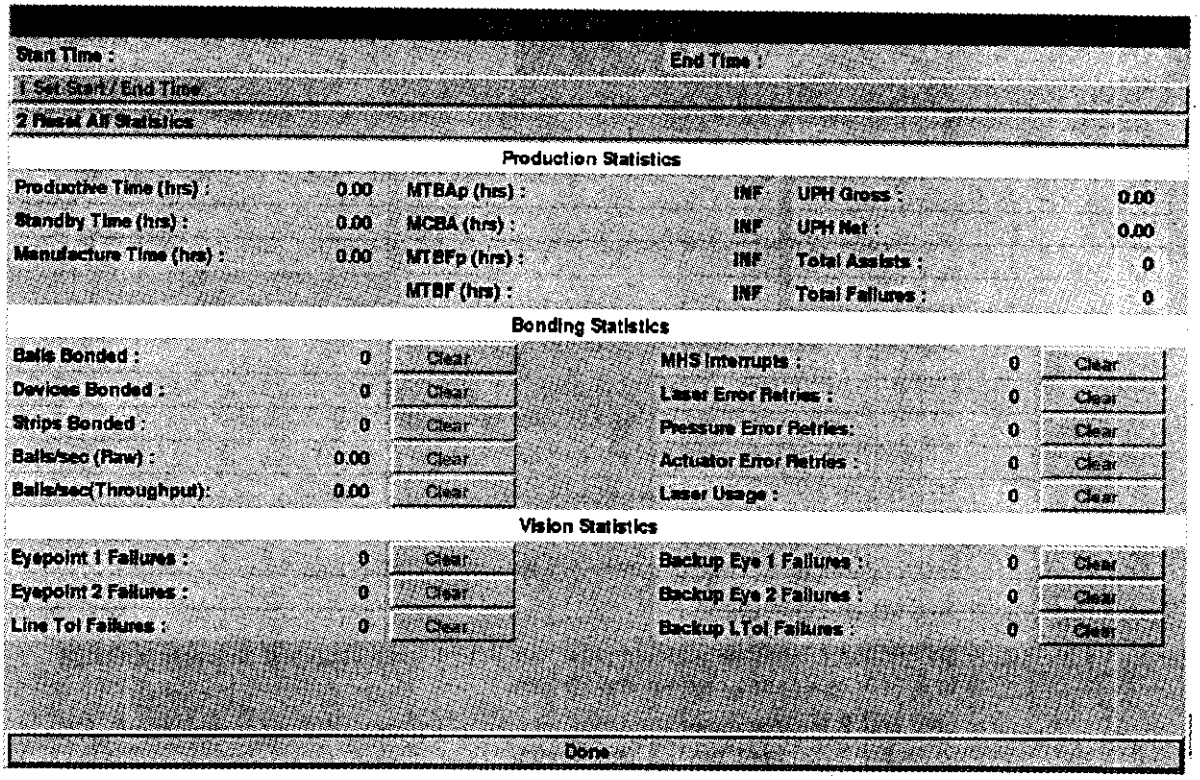


Figure 7-6 Statistics Display

- **Start Time/End Time** display the time and date limits of the summary listing.

  [1] **SET START TIME/SET END TIME** opens the dialog box shown in Figure 7-7.

  [2] **RESET STATISTICS** returns all statistical values to zero.

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- **Production Statistics**

  Productive Time is the number of hours during which the machine was in the AUTO mode, ***excluding*** Exception Handling and Sequence Stop mode.

  Standby Time is the number of hours during which the machine was in the SEQUENCE STOP mode or was doing Exception Handling.

  Manufacture Time is the number of hours during which the machine was in AUTO mode, ***including*** Exception Handling and Sequence Stop mode.

  MTBAp is Mean production Time Between operator Assists.

  MCBA is Mean Cycles Between operator Assists.

  MTBF is Mean Time Between Failures.

  MCBFp is Mean production Cycles Between Failures.

  UPH Gross is the number of Units Per Hour based on Production Time.

  UPH Net is the number of Units Per Hour based on Manufacture Time.

  Total Assists is the total number of operator assists of any kind in AUTO mode.

  Total Failures is the total number of production failures of any kind in AUTO mode.

- **Bonding Statistics**

  Balls Bonded is the total number of solder balls attached during Auto Run mode.

  Devices Bonded is the total number of devices processed during Auto Run mode.

  Strips Bonded is the total number of strips processed during Auto Run mode.

  Balls/sec (raw) is the actual speed of the balls being applied to the device.

  Balls/sec (throughput) is the overall ball speed of the machine, including MHS movements, locating eye points, etc.

  MHS Interrupts is the total number of times the magazine handlers or workholder was interrupted for any reason during Auto Run mode.

  Laser Error Retries indicates the total number of laser retries.

  Pressure Error Retries indicates the total number of pressure sensor retries.

  Laser Usage indicates how man times the laser has fired.

- **Vision Statistics**

  Eye Pt. 1 Failures is the total number of times the vision system failed to locate eye point one on the device.

  Eye Pt. 2 Failures is the total number of times the vision system failed to locate eye point two on the device.

  Line Tol. Failure is the total number of times the line tolerance between eye point one and eye point two failed to be within limits.

  Backup Eye Pt. 1 Failures is the total number of times the vision system failed to locate backup eye point one on the device.

  Backup Eye Pt. 2 Failures is the total number of times the vision system failed to locate backup eye point two on the device.

  Backup Line Tol. Failure is the total number of times the line tolerance between backup eye point one and backup eye point two failed to be within limits.

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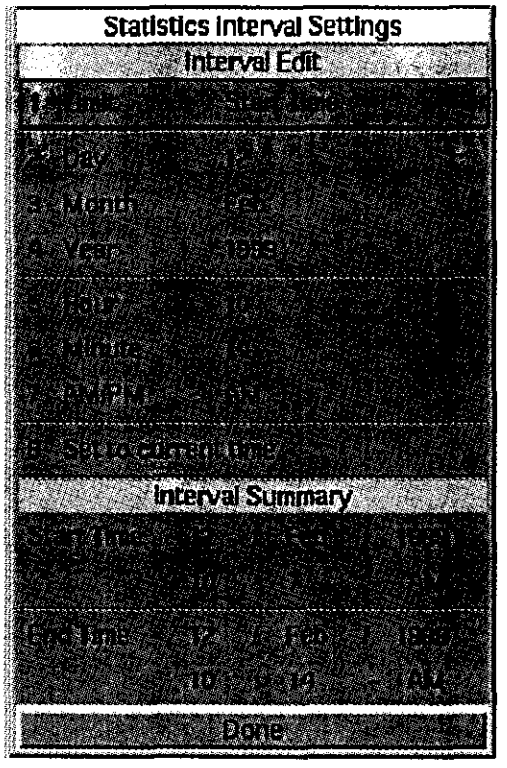


Figure 7-7 Statistics Start and End Dialog Box

[1] **LIMIT** toggles between Start Time and End Time selection.

[2] **DAY** sets the day of the month using a drop down list.

[3] **MONTH** sets the month of the year using a drop down list.

[4] **YEAR** sets the year using a drop down list.

[5] **HOUR** sets the hour of the day using a drop down list of 12 hours.

[6] **MINUTE** sets the minute of the hour using a drop down list.

[7] **AM/PM** sets the AM or PM time selection using a drop down list.

[8] **SET TO CURRENT TIME** sets the selected Start Time or End Time to the current time and date. Apply this to only Start Time or End Time in order to get a display.

Interval Summary displays the Start Time and End Time currently in use. The display will be those times last set.

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7.5.1.2 Software Version

This choice displays the software versions currently installed in the machine. See Figure 7-8.

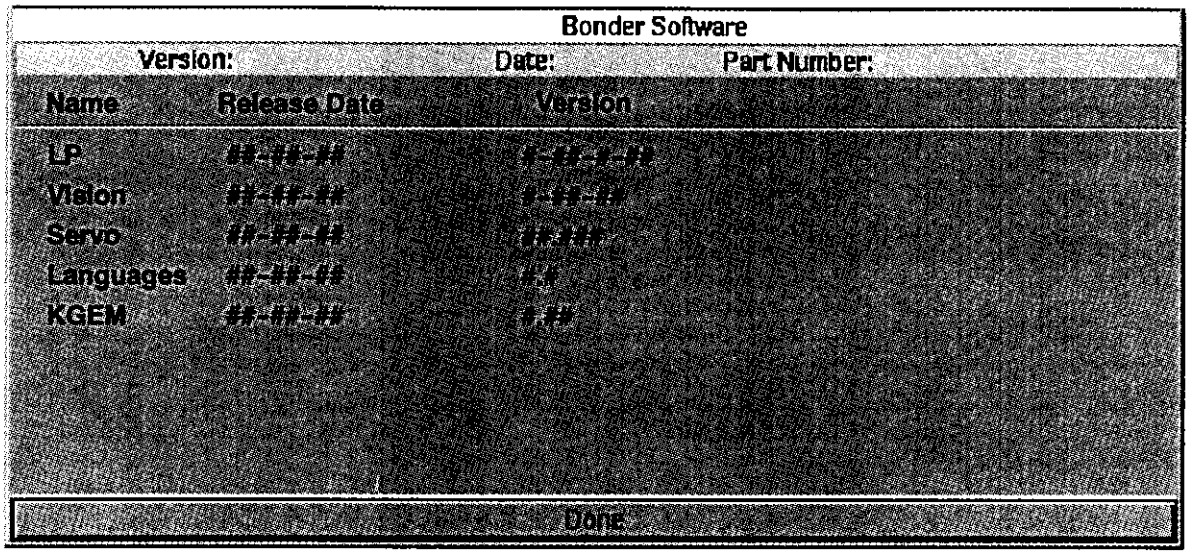


Figure 7-8 Software Version Information

7.5.2 Set Start Point

Set Start Point allows the user to set the starting point of the first derive or the first ball to be bonded, of which the defaults are always one. See Figure 7-9.

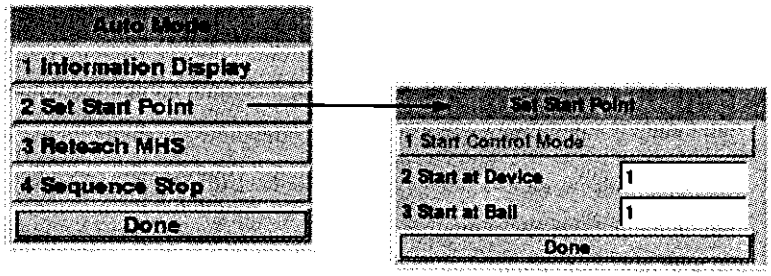


Figure 7-9 Set Start Point Dialog Box

[1] START CONTROL MODE

[2] START AT DEVICE determines the device number on which bonding will start. The devices are numbered based on the matrix bonding sequence of a pad set copy.

[3] START AT BALL determines the single pad in a device on which bonding will start. The single pad number is based on the order of bonding a single pad set.

7.5.3 Reteach MHS (*currently not implemented*)

This menu allows the user to teach the workholder how to handle the strip for bonding. It would be necessary to reteach the MHS if strip handling problems were occurring, or if the strip parameters have changed. Refer to section 6.3.2 in the programming section of this manual.

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7.5.4 Sequence Stop

Sequence Stop halts automatic operation and allows the user several process related options.

NOTE: Chessing is disabled when alignment, bonding, and Motor Stop are active. In addition, ***clearing a process program while in SEQUENCE STOP is not permitted***.

The purpose of SEQUENCE STOP is to allow the operator to pause the automatic bonding process at the end of the ball currently being formed. This pause allows the operator to inspect the bonding results. The operator may take any necessary corrective action.

When machine is in SEQUENCE STOP, the illumination is set to an operator selected default level. This allows the operator to select the right illumination for inspecting a bonded device.

The Step Through Bond Cycle must be preceded by an operator-initiated SEQUENCE STOP. Return to AUTO mode from this stop must also be user-initiated.

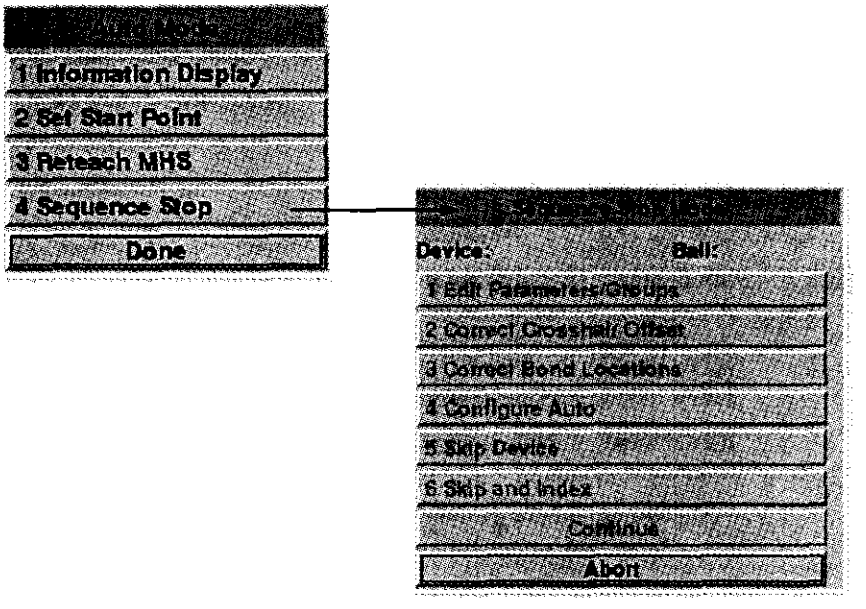


Figure 7-10 Sequence Stop Menu

Device and ball display the current position of the crosshair. For example, if Sequence Stop becomes active while bonding ball 17, this field will reflect that the program has stopped at the next ball to be bonded (i.e., ball: 18).

[1] **EDIT PARAMETERS/GROUPS** Pressing [1] displays the Set Bond Parameters dialog Box. This feature allows the user to inspect and, if needed, change the Bond Parameters.

[2] **CORRECT CROSSHAIR OFFSET** guides the user through the process to correct the difference between the crosshair location and where the ball actually touches the work surface. See paragraph 4.5.1 of this manual for more information.

[3] **CORRECT BOND LOCATIONS** allows repositioning of bond sites on the device.

- Bond display area is currently targeted. The video and graphic displays will have the crosshair at the same location.

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- **CORRECT SINGLE** guides the user through the procedure to correct a single bond site. The operator places the crosshair at the desired location and selects it using [B1]. After the location positioned correctly [B3] is pressed to teach the correct location.
- **CORRECT SEQUENCE** guides the user through the procedure to correct a series of bond sites. The operator places the crosshair over the first bond site and selects it by pressing [B1]. The function of B1 changes to indicate SELECT LAST. The user then positions the crosshair over the last bond in the sequence and presses [B1]. B3 is used in two ways. After selecting the first location, it is UNSELECT. After the selection of the last location it is CORRECT. Pressing [B3] when it is CORRECT causes the software to align the selected sequence of bond sites.

[4] **CONFIGURE AUTO** allows the operator to select indexing modes and alignment options. Refer to paragraph 5.2 of this manual for more information.

[5] **SKIP DEVICE** advances the bond head to the next device within the matrix or on the carrier.

[6] **SKIP & INDEX** allows the user to perform single step functions within the bonding sequence.

- **CONTINUE** allows the user to continue to run in auto mode.

7.5.5 Error Condition Corrections

7.5.5.1 Types of Errors

7.5.5.1.1 Line Out of Tolerance

These errors occur during PRS scan. An eye point deviated from the maximum allowable length of the line between opposite eye points. Automatic processes stop and a prompt will appear on the monitor to manually align the process program. The specific process program is identified in the dialog box and also targeted by the crosshair in both the video and graphic displays.

Eye Point: shows the number of the eye point associated with the line tolerance error.

[1] **MANUAL ALIGN CURRENT PROCESS PROGRAM** allows the operator to align the specified process program. This is the default selection, the instructions shown in the information area of the display explain to the operator how to perform a manual alignment.

[2] **PRS ASSIST: ON/OFF** enables or disables the use of PRS to improve the accuracy of the manual alignment.

[3] **PRS ALIGN CURRENT PROCESS PROGRAM** causes the PRS to align the specified process program. This alignment is totally automated and requires no operator assistance.

[4] **PRS REALIGN ENTIRE SITE** causes the PRS to align the entire process program used. This alignment is totally automated and requires no operator assistance. The single device site is aligned in matrix applications.

[5] **RELEARN EYE POINTS** accesses the relearn/move eye point portion of the Teach Reference dialog box. This function allows the operator to teach the suspect eye points to the PRS.

[6] **SKIP CURRENT DEVICE** advances the Process Program to the next device to be bonded. In a matrix or multi-chip package this is the next site. In single device strips, this indexes the strip.

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[7] **SKIP CURRENT PACKAGE** indexes the strip.

[8] **ABORT** cancels the entire operation.

If the "Relearn Eye Points" option is selected, the operator must do a manual alignment of the process program which failed the eye point scanning. The "Relearn Eye Points" dialog box is displayed. The operator can perform any eye point teach function deemed necessary. When eye point editing is done, the X-Y table moves to the first operator point of the process program and the operator may resume or abort AUTO operation.

After PRS align is performed and the alignment is successful, the X-Y table moves to the corrected first operator point of the current process program based on the alignment result. Then, the operator can press B1 to step through all of the corrected points to verify that they are correct.

7.5.5.1.2 Operator Align

These errors occur during PRS scan. An eye point deviated from the maximum allowable length of the line between opposite eye points. Automatic processes stop and a prompt will appear on the monitor instructing the operator to perform an operator alignment. The specific eye point is identified and targeted by the crosshair in both the video and graphic displays.

Refer to paragraph 7.5.5.1.1 above for an explanation of the components of the dialog box.

If the "Relearn Eye Points" option is selected, the operator must do a manual alignment of the eye point which failed the eye point scanning. The "Relearn Eye Points" dialog box is displayed. The operator can perform any eye point teach function deemed necessary. When eye point editing is done, the X-Y table moves to the first operator point of the process program and the operator may resume operation.

After PRS align is performed and the alignment is successful, the X-Y table moves to the corrected first operator point of the current process program based on the alignment result. Then, the operator can press B1 to step through all of the corrected points to verify that they are correct.

7.6 Manual Mode

In MANUAL mode, the machine does not recognize any process program, but permits bonding of individual balls and parameter changes. Manual mode can be used by the operator to determine the optimum ball parameters prior to teaching a process program. MANUAL mode also provides a number of service routines. See Figure 7-11.

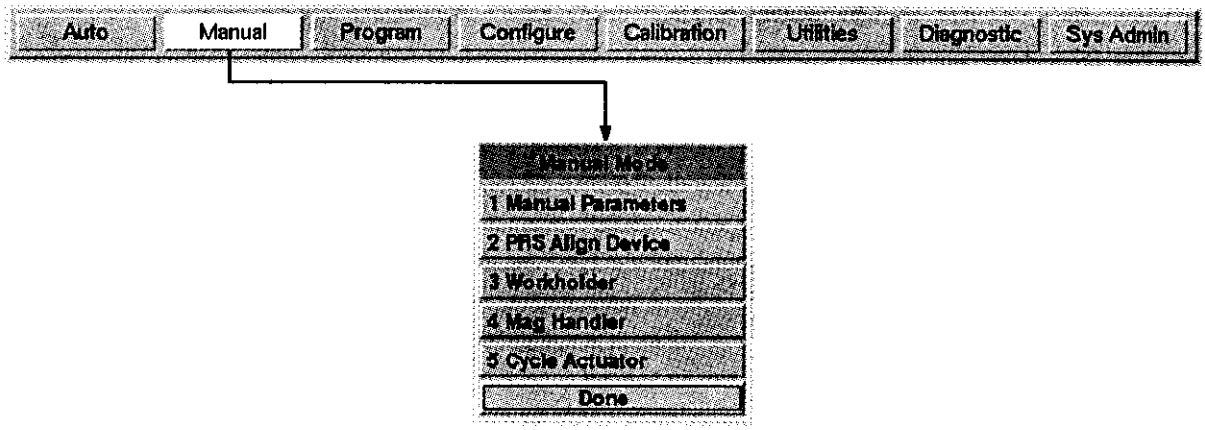


Figure 7-11 Manual Mode Menu

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7.6.1 Manual Parameters

The software allows operator to modify the master parameters and also provides the operator with the opportunity to abort the modification process and keep the original parameters intact. The software also allows the operator to set master parameters back to default factory parameters. See Figure 7-12.

Bond parameters for manual bonding are used ***only*** for manual bonding. Automatic bonding uses the parameter set associated with the loaded Process Program.

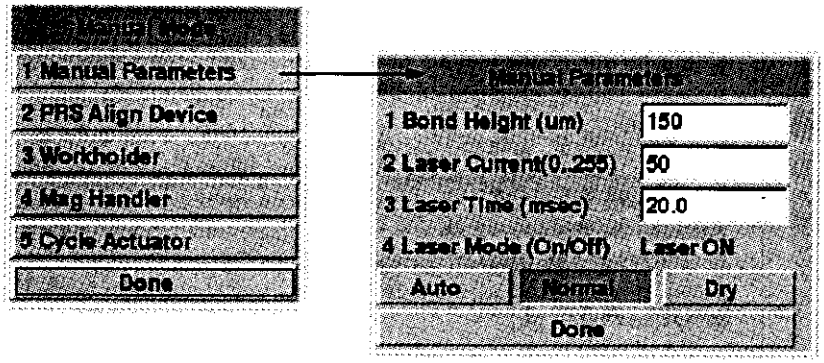


Figure 7-12 Manual Parameters Dialog Box

NOTE: The four options listed below pertain only to laying a single ball.

[1] **BOND HEIGHT (UM)** allows the operator to set the distance between the tip of the capillary and the pad surface.

[2] **LASER CURRENT (0..255)**allows the operator to set the laser power from 0 to 255. The value of 0 represents 0 amps. The value of 255 represents 10 amps.

[3] **LASER TIME (MSEC)** allows the operator to set the amount of time the laser will engage to properly flow the solder ball.

[4] **LASER MODE (ON/OFF)** allows the operator to run the machine with the laser on or off while in Manual mode.

- **Auto, laser can be on or off depending upon configuration.**
- **Normal, laser is on.**
- **Dry, laser is off.**

7.6.2 PRS Align Device (*not implemented*)

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7.6.3 Workholder

The Workholder Utilities menu appears when selected in Manual Mode (see Figure 7-13) or when [3] W/H OPER is selected from the upper tool bar (see Figure 7-14.) The functions listed in this menu allow the operator to send a command to the workholder to perform a single action.

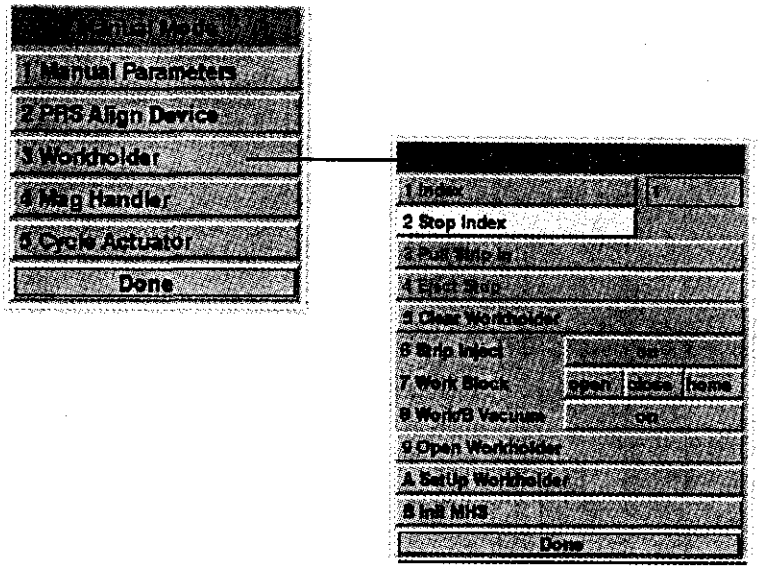


Figure 7-13 Manual Workholder Dialog Box

[1] INDEX allows the operator to index a selected number of devices. See Figure 7-14.

[2] STOP INDEX when selected allows the operator to stop indexing.

[3] PULL STRIP IN loads a strip from the supply magazine on the left side of the machine. A proper magazine with the correct type of strips must be in the loader magazine handler.

[4] EJECT STRIP pushes a strip out of the workholder into the receiving magazine on the right side of the machine. A magazine of the proper type for the strip, with at least one empty slot must be in the unloader magazine handler.

[5] CLEAR WORKHOLDER initiates the sequence which allows a strip to be manually removed from the workholder. Messages appear on the monitor advising the operator of what action is to be taken.

[6] STRIP INJECT enables or disables the gripper puller loading a strip from the supply magazine. Any strips in the workholder may be processed until all bonds are done.

[7] WORK BLOCK allows the user to perform work block related functions. Toggling within the WORK BLOCK option will select either open, close or home work block. Once the desired setting is made, the user selects DONE which causes the Workholder dialog box to appear.

- OPEN WORK BLOCK causes the work block to open (drop) out of bond plane height.
- CLOSE WORK BLOCK causes the work block mechanism to close to bond plane height.
- HOME WORK BLOCK positions the work block at its home position. This is as after initialization.

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[8] **WORK BLOCK VACUUM** allows the user to set the vacuum to On or Off. Once the desired setting is made, the user selects **DONE** which causes the Workholder Utilities dialog box to appear.

[9] **OPEN WORKHOLDER** allows the operator to open the rails on the workholder, after which all the motors on the workholder will move to their home position.

A SET UP WORKHOLDER allows the operator to automatically set up the workholder to the proper indexing location. If the workholder is already set up and this option is initiated, the workholder will reset to the proper indexing position.

B INIT MHS allows the operator to home all the motorized axes of the MHS system, which is useful if an error has occurred. It provides quick verification that the MHS system (software and hardware) is operating correctly.

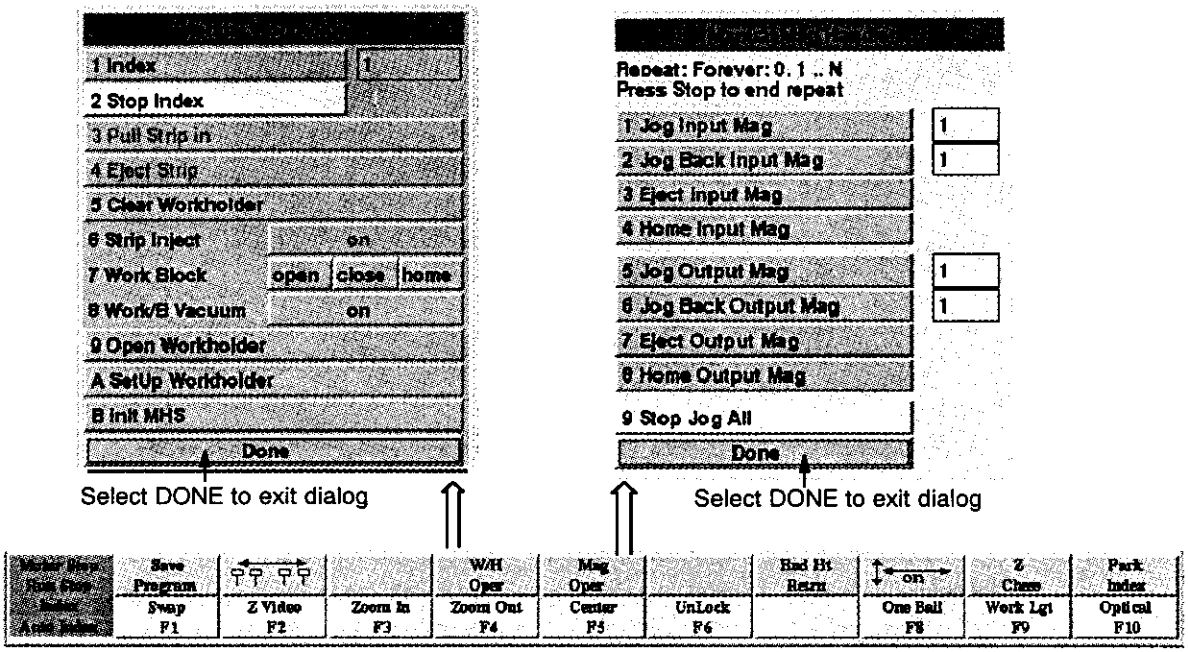


Figure 7-14 MHS Tool Bar Selections

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7.6.4 Mag Handler

The Mag Handler Utilities menu appears when selected in Manual Mode (see Figure 7-15) or when [4] MAG OPER is selected from the upper tool bar (see Figure 7-14.) The functions listed in this menu allow the operator to send a command to either magazine handler to perform a single action.

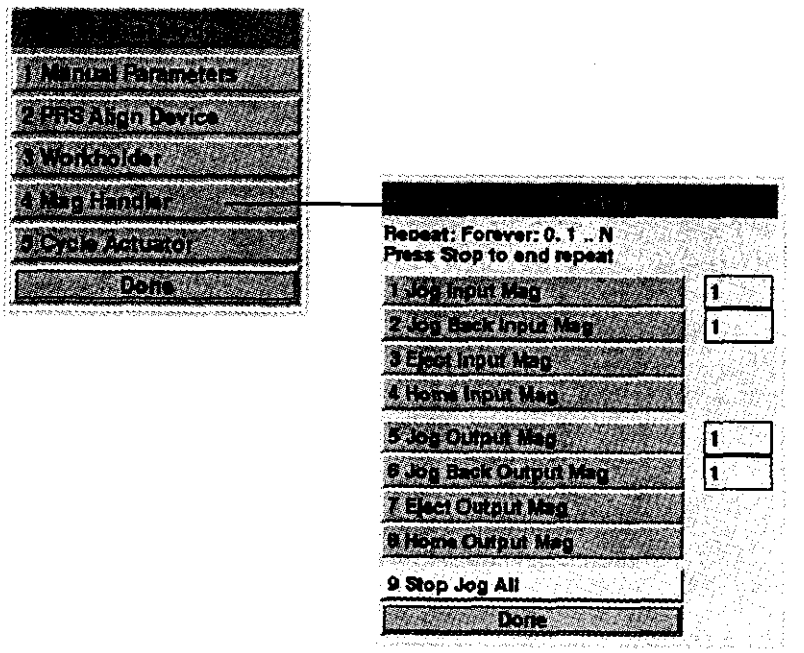


Figure 7-15 Manual Mag Handler Dialog Box

[1] **JOG INPUT MAG** causes the supply (left) magazine to step to the next slot.

[2] **REVERSE JOG INPUT MAG** causes the supply (left) magazine to step backward to the previous slot.

[3] **EJECT INPUT MAG** causes the supply magazine currently in use to be placed on the Unload tray.

[4] **HOME INPUT MAG** allows the operator to home all motorized axes of the input mag handler. If a magazine is in place when this option is activated, the operator will have to eject the magazine before the gripper will move to it's home position.

[5] **JOG OUTPUT MAG** causes the receiving (right) magazine to step to the next slot.

[6] **REVERSE JOG OUTPUT MAG** causes the receiving (right) magazine to step backward to the previous slot.

[7] **EJECT OUTPUT MAG** causes the receiving magazine currently in use to be placed on the Unload tray.

[8] **HOME OUTPUT MAG** allows the operator to home all motorized axes of the output mag handler. If a magazine is in place when this option is activated, the operator will have to eject the magazine before the gripper will move to it's home position.

[9] **STOP JOG ALL** allows the operator to stop the movement of the mag handlers.

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7.6.5 Cycle Actuator

Cycling the actuator allows the operator to cycle the actuator mechanism a specified number of times. This option is primarily used for diagnostic purposes to test the ball feeding system and actuating system. See Figure 7-16.

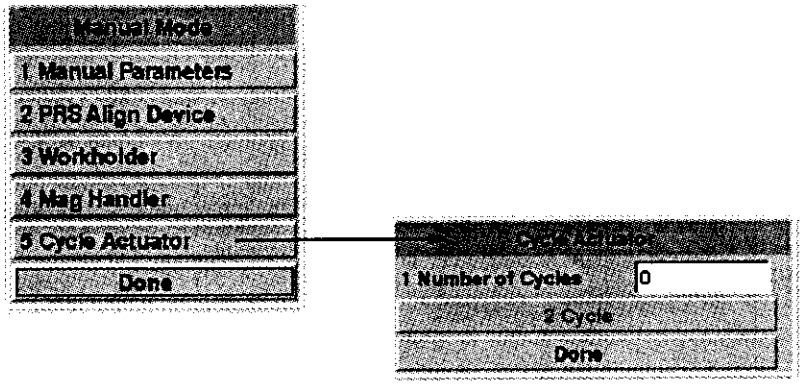


Figure 7-16 Cycle Actuator Dialog Box

[1] **NUMBER OF CYCLES** allows the operator to enter a specific number of cycles that the actuator mechanism will run.

[2] **CYCLE** starts the cycling process by placing the pointer on the **CYCLE** box and clicking **[B1]**.

7.7 Standby Mode

Standby Mode disables the following:

- steppers motors
- solenoids
- servo power
- machine and workholder operation

STANDBY Mode is entered two different ways.

- Set machine power to ON and allow it to initialize. After the initialization process is over, the machine is in Standby mode.
- Press **[MOTOR STOP]** on the MMI keypad while the machine is powered up.

Entering STANDBY Mode aborts the existing mode (if the machine was operating). In this mode, the software disables the amplifiers, turns off the servo relay, and sends commands to CPU2 to stop motors and cancel any pending commands. The Steppers and Solenoids are enabled/disabled on exiting/ entering STANDBY MODE.

The software also sends a command to the PRS system to abort any existing operation. The software will stop Material Handling System operation. If the machine is connected to a Factory Automation Server/System (FAS) host (a computer that can supervise the machine through a communications link using the SEMI SECS protocol), the machine will inform the host about the mode change.

The software logs the time and date when STANDBY mode is entered.

When the operator takes the machine out of STANDBY Mode (by following the initialization instructions), the software enables the servo power and enables the steppers and solenoids. Automatic XYZA limit seeking and MHS home positioning are also activated on exiting STANDBY mode.

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Section

8 UTILITIES

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8 Utilities

8.1 Introduction

Utility mode contains six different utilities which allow the user to check laser status; operate selected solenoids; establishment/modification of a host interface; edit Machine Dependent Parameters (MDPs); check statistical summary; operate the MHS with or without the use of magazines.

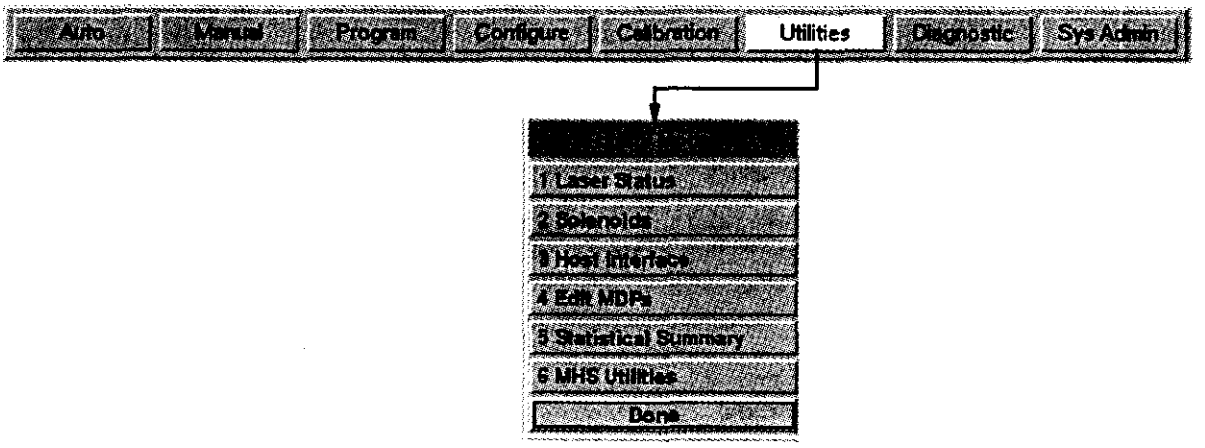


Figure 8-1 Utilities Menu

NOTE: There are protected areas on the disk. Machine operating software is proprietary to Kulicke and Soffa Industries, Inc., and therefore is protected from user access.

8.2 Laser Status

This feature allows the operator to view the operating status of the laser. If a laser fault were to occur during operation the operator could check laser status and clear the fault through this menu. See Figure 8-2. If the same fault persisted additional testing and troubleshooting would be necessary to diagnose the problem.

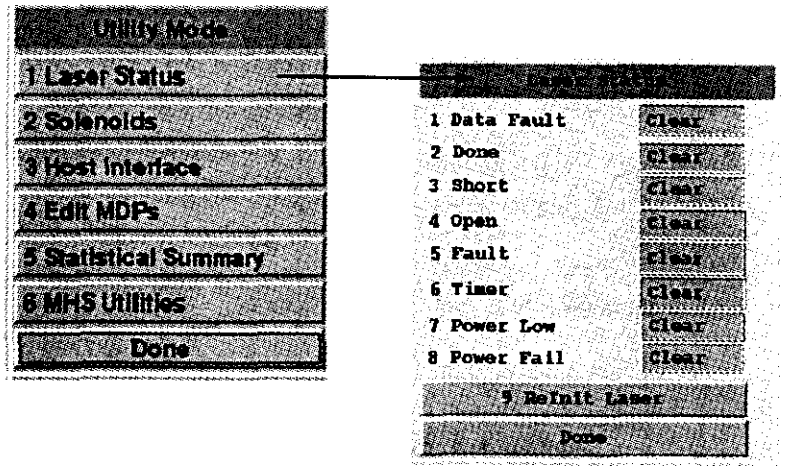


Figure 8-2 Laser Status Dialog Box

The two states the Laser Status will be shown in are **Set** and **Clear.** Under normal operating conditions **Clear** should appear in all the status boxes, with the exception of **[2] DONE**, which will normally display a **Set** condition.

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[1] **DATA FAULT** indicates that an invalid laser parameter has been entered. The operator should check parameters that were entered in either Calibration Mode or Manual Mode to validate the information is correct.

[2] **DONE** will normally displayed as **Set.** If **Clear** is displayed a laser fault has occurred. Check laser parameters and retry. If problem persists additional diagnostics will be necessary.

[3] **SHORT** indicates that one of the eight solenoid drives on the laser produced an over-current condition. Check laser parameters and retry. If problem persists additional diagnostics will be necessary.

[4] **OPEN** indicates an open to one of the paths to the laser diodes. Check laser parameters and retry. If problem persists additional diagnostics will be necessary.

[5] **FAULT** is a secondary indication that an **open** or **short** condition has occurred in the laser. Check all laser parameters and connections and retry operation. If problem persists additional diagnostics will be necessary.

[6] **TIMER** (NA)

[7] **POWER LOW** (NA)

[8] **POWER FAIL** (NA)

[9] **REINIT LASER** allows the operator to re-initialize the laser after a fault or failure has occurred. If re-initializing the laser does not initiate correct laser operation additional diagnostics will be necessary.

8.3 Solenoids

This feature allows the operator to turn on or off individual solenoids located throughout the bonder. Normally, all solenoids should be turned on. For conditions such as diagnostic and testing purposes the selected solenoid can be switched to either an on or off state.

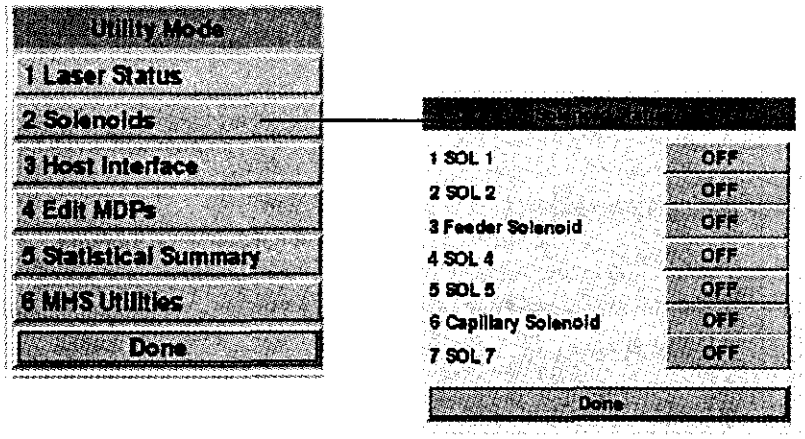


Figure 8-3 Solenoid Status Dialog Box

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8.4 Host Interface *(to be implemented)*

8.5 Edit MDPs

Figure 8-4 shows the Machine Dependent Parameters (MDPs). The Edit MDPs menu accesses editing functions for machine dependent parameters. These functions allow the operator to edit Auto MDPs, edit Teach Defaults, to backup/restore MDPs, and to set Backup/Restore Options.

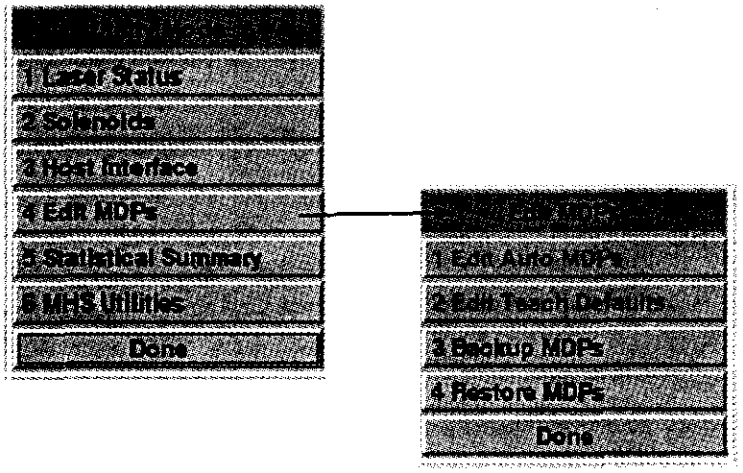


Figure 8-4 Edit MDP's Menu

Below is a list of MDPs. Please note that this list of MDPs is not meant to be complete.

- MDP version number.
- Crosshair offset.
- Pattern recognition system (PRS) calibration parameters.
- Z resolution calibration parameters.
- Master parameter table.
- Workholder parameters.
- X, Y Servo control (gain and offset) parameters.
- Factory automation system (FAS) related MDPs, if any.

8.5.1 Edit Auto MDPs *(to be implemented)*

The Auto MDPs are used to determine whether or not certain functions are available during automatic bonding and to indicate which events are to be monitored so that real-time response statistics regarding the performance of the machine can be acquired. Initially, these MDP defaults are set at the factory. The "Edit Auto MDPs" menu allows the operator to change these default settings to ones which are more appropriate to the specific application. After changing the defaults, the operator can either save the MDPs to disk or quit the editing process without altering the previously existing set of MDPs. Note that the "Auto Configuration" can be changed from the default configuration in either AUTO or CONFIGURATION mode, but permanent changes to the MDPs can only be made with the "Edit Auto MDPs" function.

See paragraph 5.2 of this manual for details regarding the Auto Configure features. Remember that changes made using this method become the machine default values. Changes made here should be done carefully since they alter durable machine conditions and modes of operation.

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8.5.2 Edit Teach Defaults *(to be implemented)*

This set of operations allows the 9388 teach defaults to be set to values more in line with the application. Changes which are made here and saved become the normal defaults for the machine. Make changes carefully.

8.5.2.1 Edit Miscellaneous Teach Defaults *(to be implemented)*

Vert Illum sets the default value of vertical illumination used for general operations.

Obliq Illum sets the default value of oblique illumination used for general operations.

8.5.2.2 Edit Pad Teach Defaults *(to be implemented)*

8.5.2.2.1 Miscellaneous

X Tol sets the default deviation of the pad dimension along the X axis.

Y Tol sets the default deviation of the pad dimension along the Y axis.

X Size sets the default size of the pad dimension along the X axis. The units are in mils or mm.

Y Size sets the default size of the pad dimension along the Y axis. The units are in mils or mm.

Z Height is not used in the 9388 machine.

Vert Illum sets the default for the vertical illumination used during teach operations.

Obliq Illum sets the default for the oblique illumination used during teach operations.

Line Fit Tolerance sets the maximum correction limit for line fit function.

Pitch Fit Tolerance sets the maximum correction limit for line fit function.

8.5.2.2.2 Operator Point

Box X Size sets the default size of the operator point search field in the X axis. Units are in mils or mm.

Box Y Size sets the default size of the operator point search field in the Y axis. Units are in mils or mm.

Line Tol sets the default variation of the hypotenuse of the triangle created by the X and Y dimensions between the operator points. See Appendix D for more information regarding Line Tolerance.

Vert Illum sets the default value of vertical illumination used during teaching of an operator point.

Obliq Illum sets the default value of oblique illumination used during teaching of the an operator point.

Min Delta sets the default minimum distance between operator point locations. Units are in mils or mm.

8.5.2.2.3 Eye Point

X Size sets the default size of the eye point search field dimension along the X axis. The units are in mils or mm.

Y Size sets the default size of the eye point search field dimension along the Y axis. The units are in mils or mm.

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Line Tol sets the default variation of the hypotenuse of the triangle created by the X and Y dimensions between the eye points. See Appendix D for more information regarding Line Tolerance.

View Tol not used.

Retry X Size sets the default X dimension to which the search field changes in the event of an eye point teach failure.

Retry Y Size sets the default Y dimension to which the search field changes in the event of an eye point teach failure.

Min Delta sets the default minimum distance between eye point locations. Units are in mils or mm.

8.5.3 Backup/Restore MDPs

Backup and Restore list selections are advanced operations. The disk space required for backup and the disk space available for A: and C: is reported so that the operator is aware of the remaining storage. Backup/Restore status (percent complete) is displayed while in progress.

8.5.3.1 Backup MDPs

This task copies the MDP data from the hard disk to the floppy disk. This is a good practice for data to be preserved in the unlikely event that the hard drive has a catastrophic failure.

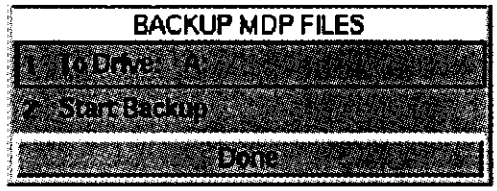


Figure 8-5 Backup MDP's Dialog Box

[1] **To Drive: A: or C:** allows the operator to set the Disk Drive to which the MDP's are written.

[2] **Start Backup** initiates the writing of MDP data to the selected drive. A message appears to advise the operator of the status of the backup. Upon completion the operator clicks on **OK** to continue.

Perform a Backup procedure if MDP data is to be altered for application specific performance. By so doing, they are available if needed.

8.5.3.2 Restore MDPs

This task copies the MDP data from the floppy disk to the hard disk. This allows the MDP data to be rapidly recovered after a catastrophic failure of the hard disk. Restore MDP requires that a Backup was done previously.

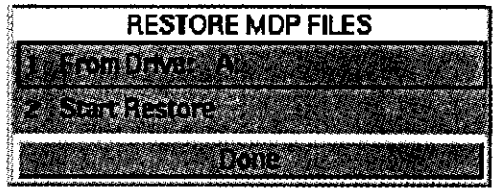


Figure 8-6 Restore MDP's Dialog box

[1] **From Drive: A: or C:** allows the operator to set the Disk Drive from which the MDP's are read.

[2] **Start Restore** initiates the writing of MDP data to the selected drive. A message appears to advise the operator of the status of the restoration. Upon completion the operator clicks on **OK** to continue.

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8.6 Statistical Summary

See Section 7: Operating Tasks paragraph 7.5.1.1 for an explanation of this display.

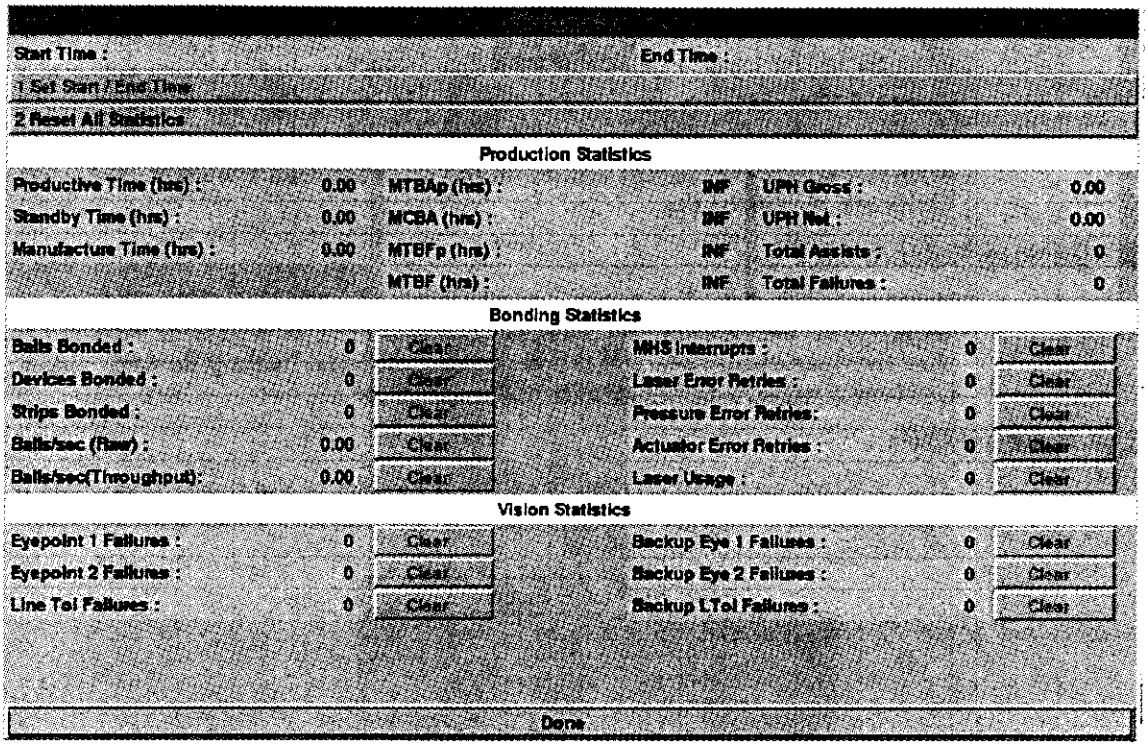


Figure 8-7 Statistical Summary Display

8.7 MHS UTILITIES

The "**MHS Utilities**" give the operator the ability to move a strip or number of strips from the input magazine handler to the workholder and then to the output magazine handler. The operator can also enable indexing without using magazines or strips.

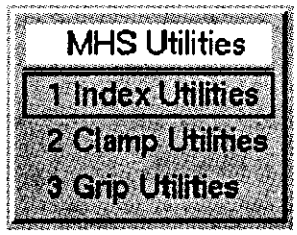


Figure 8-8 MHS Utilities Menu

8.7.1 Index Utilities

Index Utilities allow the operator to set or force various indexer functions.

Index Times: Sets the number of times the workholder will index when indexing continuously for test purposes.

Total Index Count: Reports the number of times that the workholder has indexed. The current count can be cleared by selecting **Clear Total Index Count**.

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Verify Correction:

- Off -- setting for normal production
- On (Port 2) -- used only during factory test and diagnostics

Strip Inject:

- On -- allows the gripper puller to remove strips from the supply magazine and insert them into the workholder.
- Off -- disables the injecting of strips from the supply magazine.

Index Commands: Selects the type of index operation performed. Only one operation may be active at any time.

- Normal Index performs normal inject, index and eject operations. Cycles until the preset count is reached, material is used up or Stop Indexing is selected. This function requires magazines and strips.
- **Normal Index Continuously** performs continuous inject, index and eject operations. Cycles until the Stop Indexing is selected, material is used up or Stop Indexing is selected. This function requires magazines and strips.
- **Dry Index** performs dry cycle inject, index and eject operations. Cycles until the preset count is reached or Stop Indexing is selected. This function does not use magazines and strips.
- **Dry Index Continuously** performs continuous dry cycle inject, index and eject operations. Cycles until Stop Indexing is pressed. This function does not use magazines and strips.
- **Stop Indexing** halts either of the continuous cycle operations.
- **Park Indexer** moves the indexer gripper indexer to its preset park position.

NOTE: Parking the indexer is also a Function Key operation. The operator need not access this dialog box if the indexer is to be parked only.

- **Home Indexer** moves the indexer gripper indexer to its preset home position.

APPLY executes the selected function. The dialog box remains on the screen.

DONE closes the dialog box and the **MHS Utilities** menu reappears. The selected operation continues as defined.

CANCEL closes the dialog box without performing any function. The **MHS Utilities** menu reappears.

8.7.2 Clamp Utilities

Clamp Utilities allow the operator to force or set several Clamp operations.

Clamp Default allows the operator to set a different default value for the gap between the front and rear rails when closed, without a strip in place.

Utilities allow the operator to force the execution of 5 operations.

- **Open** forces the clamp and rails to open. A message appears on-screen advising the operator to remove all material from the workholder.
- **Close** forces the clamp and rails to close.

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NOTE: Opening and closing the clamp are also a Function Key operation. The operator need not access this dialog box if the clamp is to be opened or closed only.

- **Home** cycles the clamp and rails to their default home position.
- **Focus** positions the clamp to be in focus in the optics. This position is relative to the bond plane. Failure to focus may indicate the need to adjust focus.
- **Teach** allows the operator to teach the bond plane position to the clamp mechanism.

APPLY executes the selected function. The dialog box remains on the screen.

DONE closes the dialog box and the **MHS Utilities** menu reappears. The selected operation continues as defined.

CANCEL closes the dialog box without performing any function. The **MHS Utilities** menu reappears.

8.7.3 Gripper Utilities

Gripper Utilities allow the operator to force several gripper functions.

- **Open Puller Gripper** forces the gripper open.
- **Close Puller Gripper** forces the gripper closed.
- **Home Puller Gripper** forces the gripper to its home position.
- **Lift Tucker** raises the tucker blade above the strip.
- **Lower Tucker** lowers the tucker blade to the pushing position relative to the strip.
- **Open Index Gripper All The Way** forces the puller gripper to its full open position.
- **Open Indexer Gripper - Theta Retracted** forces the puller gripper to its full open position with the strip theta correction retracted.
- **Close Indexer Gripper Half Way** forces the puller gripper to 50% closed position.
- **Close Indexer Gripper - Theta Retracted** forces the puller gripper to its full closed position with the strip theta correction retracted.
- **Close Indexer Gripper - Theta Extended** forces the puller gripper to its full closed position with the strip theta correction extended.
- **Home Indexer Gripper** forces the gripper to its default home position.

APPLY executes the selected function. The dialog box remains on the screen.

DONE closes the dialog box and the **MHS Utilities** menu reappears. The selected operation continues as defined.

CANCEL closes the dialog box without performing any function. The **MHS Utilities** menu reappears.

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Section 9 DIAGNOSTICS

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9 Diagnostics

9.1 Introduction

Diagnostic mode contains tests for all significant hardware components, including peripherals, I/O devices, etc. Access to these tests can be password-controlled, if necessary in particular installations. These tests are run without material present in the MHS.

The cycle sequence operates in the following manner.

1. Specified motor drives until its home sensor activates.
2. The motor reverses and drives to the end limit position by count or time, or the limit sensor activates.
3. The motor again reverses and drives until the home sensor activates.
4. The specified delay time passes and the cycle repeats.

   This cycling continues until one of these two conditions are met.

   a) Total cycles = specified cycle count.

   b) Stop cycling operation is selected by the operator.

   See Figure 9-3 for an example of a diagnostic dialog box.

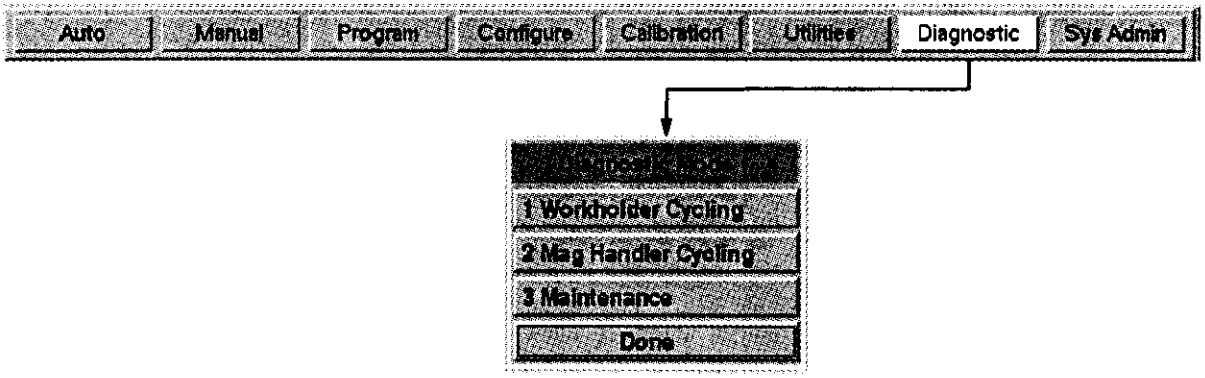


Figure 9-1 Diagnostic Menu

Dialog boxes include the function buttons **APPLY**, **DONE** and **CANCEL**. The function of each is always the same and is as follows.

9.1.1 Apply

This button causes the selected operation to be performed.

9.1.2 Done

This button causes the selected operation to be performed and closes the dialog box. The currently applied condition continues to run. The menu one step up reappears.

9.1.3 Cancel

This button closes the dialog box without applying any set conditions. The menu one step up reappears. If APPLY has been activated, the selected operation remains active until it completes or is stopped.

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9.2 Workholder Cycling

This set of operations allows the manipulation of 5 major components of the workholder assembly. As each choice is activated, a dialog box appears allowing the operator to set different options as to how the test is run.

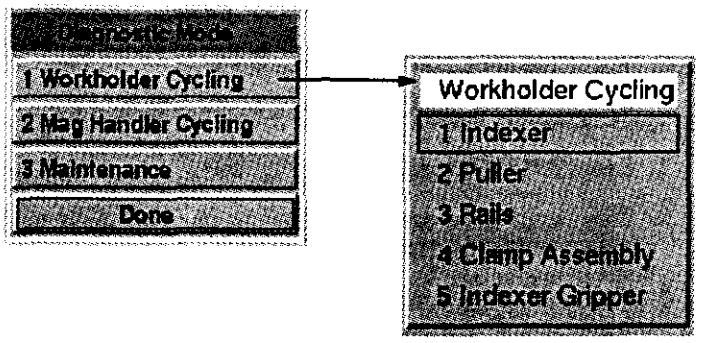


Figure 9-2 Workholder Diagnostic Menu

9.2.1 Indexer

The Indexer Motor Diagnostic functions exercise the Indexer Motor.

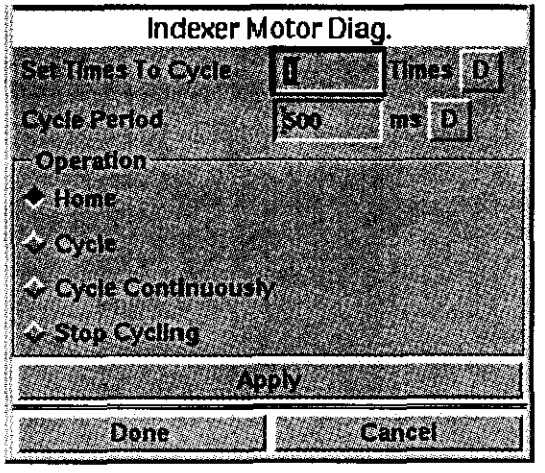


Figure 9-3 Indexer Diagnostic Dialog Box

It is intended that these test be done without material in the workholder. Therefore, the operator is advised to remove material from the workholder at the beginning of the test.

9.2.1.1 Set Times To Cycle

This data field allows the operator to set the number of times the indexer is to cycle.

9.2.1.2 Cycle Period

This data field allows the operator to set the delay time between each cycle. The longer the time the slower the cycling.

9.2.1.3 Operation

9.2.1.3.1 Home

This selection places the indexer at its home position, away from the center of the workholder.

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9.2.1.3.2 Cycle

This selection performs the test as defined in the opening Note.

9.2.1.3.3 Cycle Continuously

This selection runs the indexer continuously until the operator stops cycling.

9.2.1.3.4 Stop Cycling

This selection halts continuous and counted cycles.

9.2.2 Puller

The Puller Motor Diagnostic functions exercises the Puller Motor.

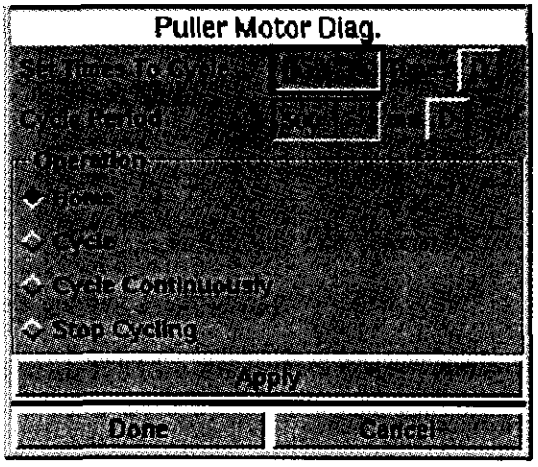


Figure 9-4 Puller Diagnostic Dialog Box

It is intended that these tests be done without material in the workholder. Therefore, the operator is advised to remove material from the workholder at the beginning of the test.

9.2.2.1 Set Times To Cycle

This data field allows the operator to set the number of times the puller is to cycle.

9.2.2.2 Cycle Period

This data field allows the operator to set the delay time between each cycle. The longer the time the slower the cycling.

9.2.2.3 Operation

9.2.2.3.1 Home

This selection places the puller at its home position, away from the center of the workholder.

9.2.2.3.2 Cycle

This selection performs the test as defined in the opening Note.

9.2.2.3.3 Cycle Continuously

This selection runs the puller continuously until the operator stops cycling.

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9.2.2.3.4 *Stop Cycling*

This selection halts continuous and counted cycles.

9.2.3 Rails

The Rail Motor Diagnostic functions exercise the Rail Motors.

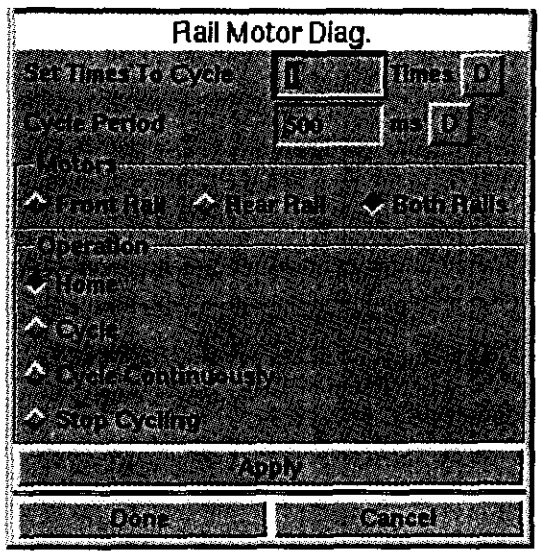


Figure 9-5 Rails Diagnostic Dialog Box

It is intended that these tests be done without material in the workholder. Therefore, the operator is advised to remove material from the workholder at the beginning of the test.

9.2.3.1 Set Times To Cycle

This data field allows the operator to set the number of times the selected rail is to cycle.

9.2.3.2 Cycle Period

This data field allows the operator to set the delay time between each cycle. The longer the time the slower the cycling.

9.2.3.3 Motors

9.2.3.3.1 Front Rail

This selection allows only the front workholder rail to be manipulated.

9.2.3.3.2 Rear Rail

This selection allows only the rear workholder rail to be manipulated.

9.2.3.3.3 Both Rails

This selection allows both the front and rear workholder rails to be manipulated simultaneously.

9.2.3.4 Operation

9.2.3.4.1 Home

This selection places the selected rail at its home position, away from the center of the workholder.

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9.2.3.4.2 Cycle

This selection performs the test as defined in the opening Note.

9.2.3.4.3 Cycle Continuously

This selection runs the selected motor continuously until the operator stops cycling.

9.2.3.4.4 Stop Cycling

This selection halts continuous and counted cycles.

9.2.4 Clamp Assembly

The Clamp Motor Diagnostic functions exercise the Clamp Assembly Motors.

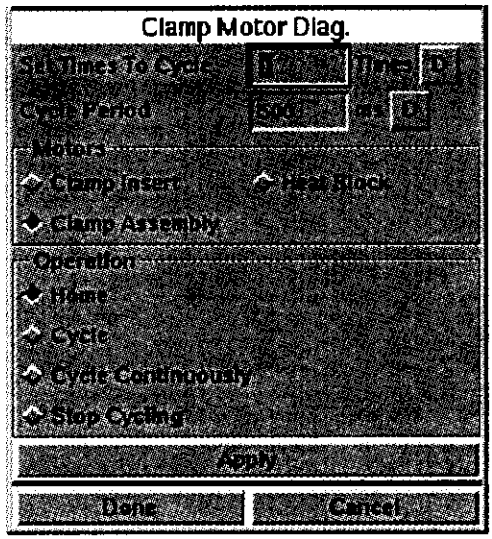


Figure 9-6 Clamp Diagnostic Dialog Box

It is intended that these tests be done without material in the workholder. Therefore, the operator is advised to remove material from the workholder at the beginning of the test.

9.2.4.1 Set Times To Cycle

This data field allows the operator to set the number of times the clamp assembly is to cycle.

9.2.4.2 Cycle Period

This data field allows the operator to set the delay time between each cycle. The longer the time the slower the cycling.

9.2.4.3 Motors

9.2.4.3.1 Clamp Insert

This selection allows only the clamp insert motor to be manipulated.

9.2.4.3.2 Work Block

This selection allows only the work block motor to be manipulated.

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9.2.4.3.3 Clamp Assembly

This selection allows both the clamp insert and work block motors to be manipulated simultaneously.

9.2.4.4 Operation

9.2.4.4.1 Home

This selection places the selected at its home position.

9.2.4.4.2 Cycle

This selection performs the test as defined in the opening Note.

9.2.4.4.3 Cycle Continuously

This selection runs the selected motor continuously until the operator stops cycling.

9.2.4.4.4 Stop Cycling

This selection halts continuous and counted cycles.

9.2.5 Indexer Gripper

The Indexer Gripper Motor Diagnostic functions exercise the Indexer Gripper Motor.

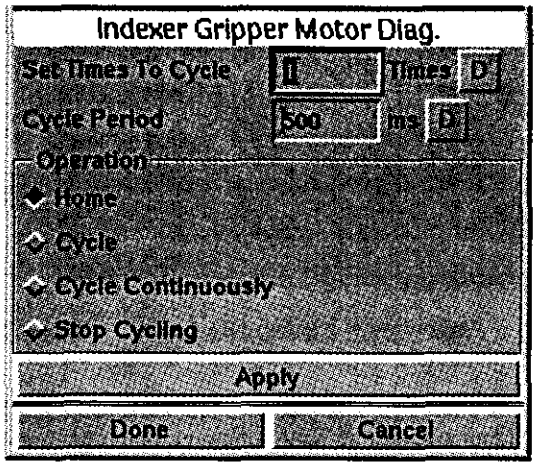


Figure 9-7 Indexer Gripper Diagnostic Dialog Box

It is intended that these tests be done without material in the workholder. Therefore, the operator is advised to remove material from the workholder at the beginning of the test.

9.2.5.1 Set Times To Cycle

This data field allows the operator to set the number of times the indexer gripper is to cycle.

9.2.5.2 Cycle Period

This data field allows the operator to set the delay time between each cycle. The longer the time the slower the cycling.

9.2.5.3 Operation

9.2.5.3.1 Home

This selection places the indexer gripper at its home position.

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9.2.5.3.2 Cycle

This selection performs the test as defined in the opening Note.

9.2.5.3.3 Cycle Continuously

This selection runs the indexer gripper motor continuously until the operator stops cycling.

9.2.5.3.4 Stop Cycling

This selection halts continuous and counted cycles.

9.3 Magazine Handler Cycling

The MHS Mag. Handler Diagnostic functions exercise the input and the output magazine handlers.

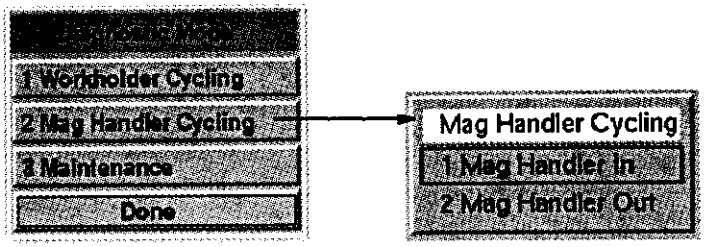


Figure 9-8 Magazine Handler Diagnostic Menu

It is intended that these tests be done without material in the magazine handlers. Therefore, the operator is advised to remove material from the magazine handler before beginning the test.

Since both Magazine Handler dialog boxes are identical, only the Input Magazine Handler diagnostic is presented.

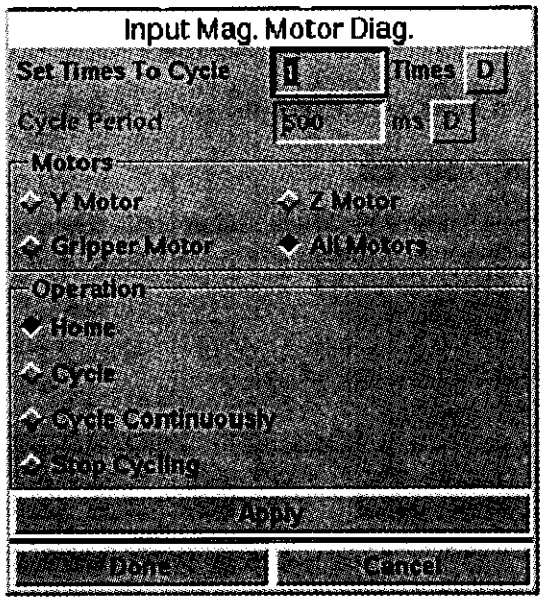


Figure 9-9 Input Magazine Handler Diagnostic Dialog Box

9.3.1 Set Times To Cycle

This data field allows the operator to set the number of times the Magazine Handler is to cycle.

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9.3.2 Cycle Period

This data field allows the operator to set the delay time between each cycle. The longer the time the slower the cycling.

9.3.3 Motors

9.3.3.1 Y Motor

This selection cycles only the Y axis motor.

9.3.3.2 Z Motor

This selection cycles only the Z axis motor.

9.3.3.3 Gripper Motor

This selection cycles only the magazine gripper motor.

9.3.3.4 All Motors

This selection cycles all motors simultaneously.

9.3.4 Operation

9.3.4.1 Home

This selection places the designated motor in its home position.

9.3.4.2 Cycle

This selection performs the test as defined in the opening Note.

9.3.4.3 Cycle Continuously

This selection runs the selected motor continuously until the operator stops cycling.

9.3.4.4 Stop Cycling

This selection halts continuous and counted cycles.

9.4 Maintenance Diagnostics

Maintenance Diagnostics opens a diagnostic menu shown in Figure 9-10. The Sensor Diagnostic dialog box is shown in Figure 9-11.

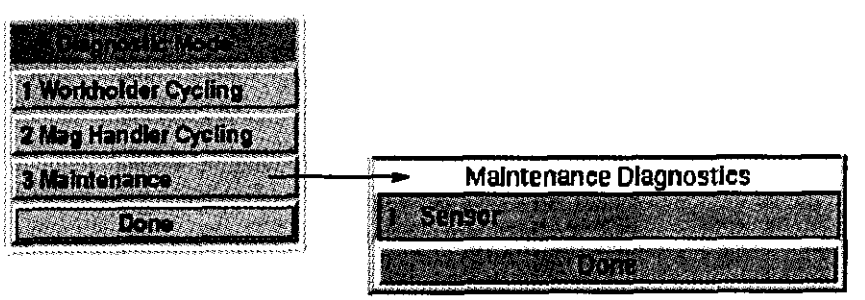


Figure 9-10 Maintenance Diagnostics Menu

9.4.1 Sensors

This selection shows a dialog box like that seen in Figure 9-11. The display shows the user the status (STS), ON/OFF state (SIO) of each named sensor.

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The name of the sensor indicates where is it used and therefore located. The STSI shows the status of the sensor as a result of being actuated and sensed (or not sensed). The Legend at the bottom of the dialog box explains the detected status. Not changed is GRAY, changed is YELLOW, and different is RED. Since some sensor may be momentary, the transitions are thus indicated. SIO indicates the ON or OFF state of the sensor as detected now. The Legend explains that ON is WHITE and OFF is BLACK.

NOTE: More information regarding the specific location and function of these sensors may be found in *Volume 3: Material Handling System* of the manual set for the 9388.

The three function buttons in the dialog box perform the following operations.

FREEZE! holds the currently displayed status conditions, ignoring any changes in inputs.

UNFREEZE! releases the freeze condition allowing changes in status to be reported.

CLEAR STATUS removes all reported status information, resetting the display for a clean start to sensor diagnostics.

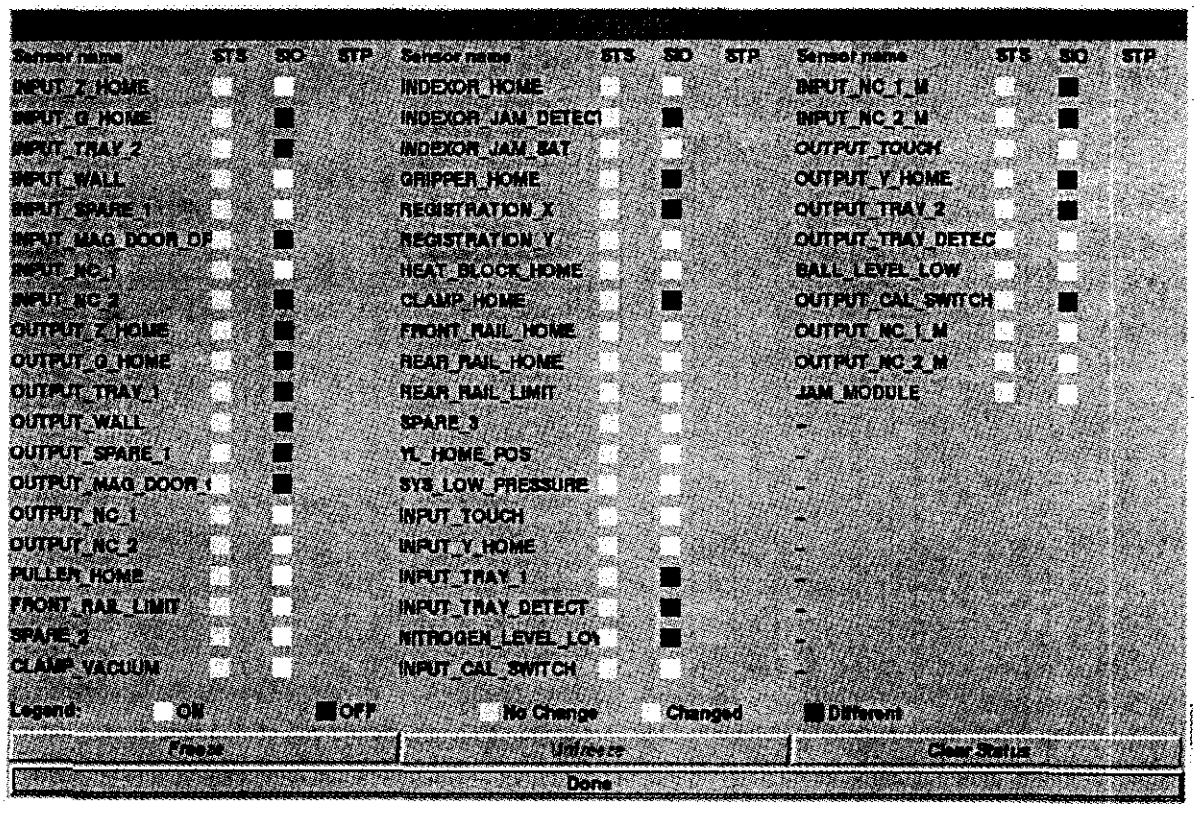


Figure 9-11 Sensors Diagnostic Dialog Box

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Section

10 SYSTEM ADMINISTRATION

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10 System Administration Functions

10.1 Introduction

System Administration functions allow viewing and alteration of data related to the control of a specific 9388 Ball Attach System.

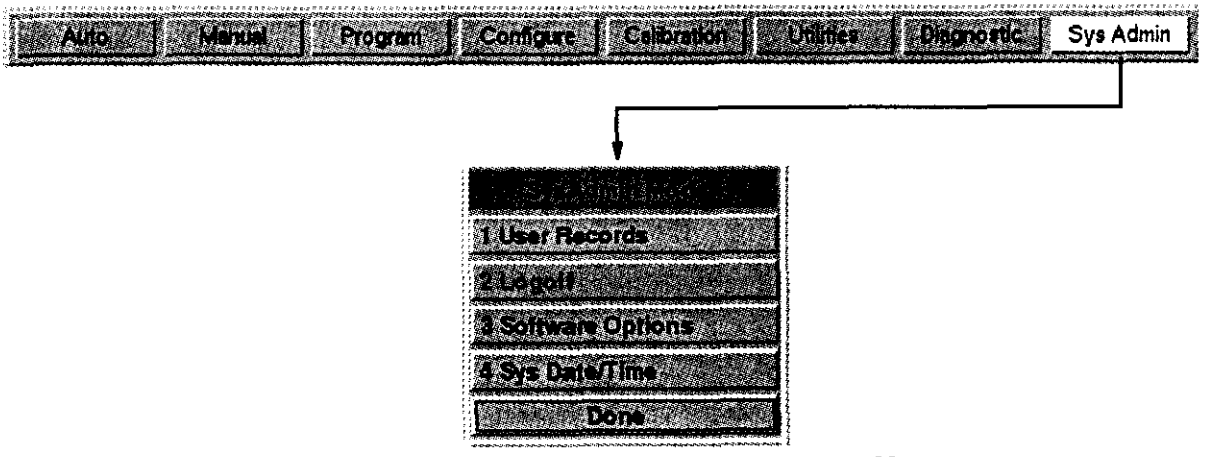


Figure 10-1 System Administration Menu

10.2 User Records (Currently not implemented.)

User Records control access to the machine. See Figure 10-2.

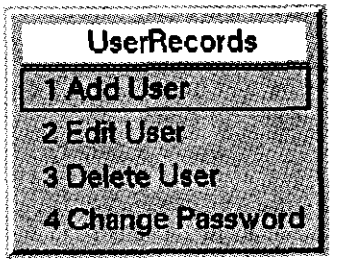


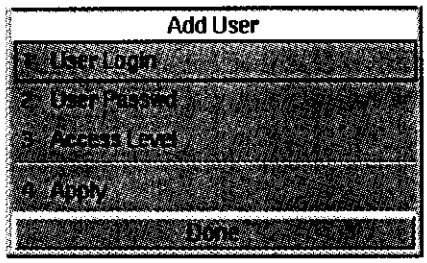
Figure 10-2 User Records Menu

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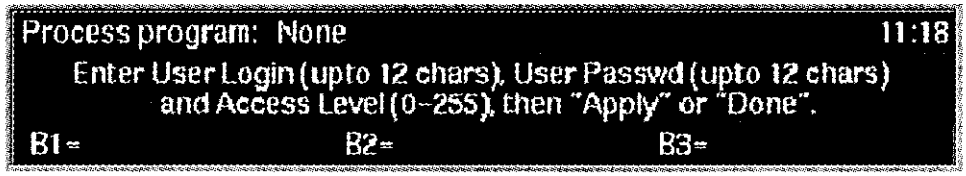
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10.2.1 Add User

This option allows additional users to be added to the 9388 access log. The dialog box shown in Figure 10-3 to appears.



Dialog Box



Instruction Box

Figure 10-3 Add User Dialog Box and Instruction Box

10.2.1.1 User Login

This data field identifies the user name to be added. When the data entry is enabled (field is highlighted), type in login name of the user. It may be up to 12 characters (letters and numbers only). When finished, key **[ENTER]** to close the entry field.

10.2.1.2 User Password

This data field identifies the user password assigned to the name added. When the data entry is enabled (field is highlighted), type in login name of the user. It may be up to 12 characters (letters and numbers only). When finished, key **[ENTER]** to close the entry field.

10.2.1.3 Access Level

This data field identifies the level of access provided to the user. When the data entry is enabled (field is highlighted), type in user's access level. It may be any number from 0 to 255. When finished, key **[ENTER]** to close the entry field.

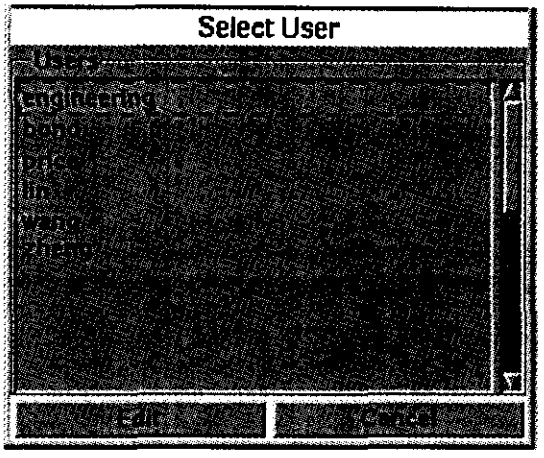
NOTE: Machine functions are clustered into each of the 256 number possibilities.

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10.2.2 Edit User

Edit User allows alterations to existing user information. The listing of user login names and instructions appear as shown in Figure 10-4. The user to be edited is selected from the list by highlighting that login and selecting the **EDIT** button. The screen changes to the dialog box and instructions shown in Figure 10-5. Selecting **CANCEL** closes the Edit User operation and restores the User Records menu, no user is edited.

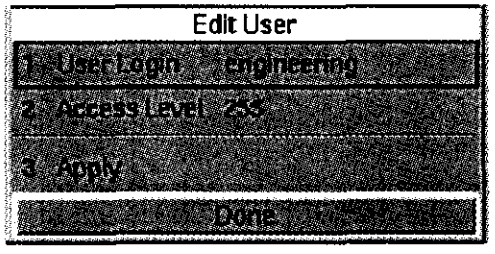


List of Users

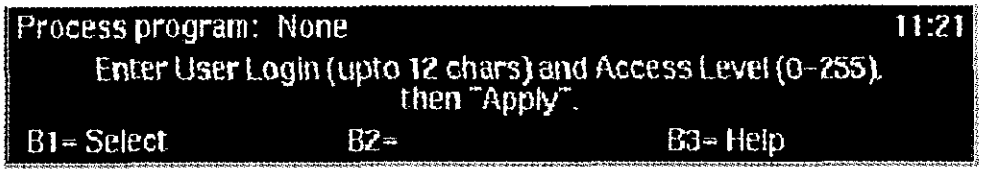


Instruction Box

Figure 10-4 List of Users and Instruction Box



Dialog Box



Instruction Box

Figure 10-5 Edit User Dialog Box and Instruction Box

10.2.2.1 User Login

This data field identifies the user login to be edited. Key in **[1]** to access the data field if the login name is to be changed. When the data entry is enabled (field is highlighted), type in user's login name. It may be up to 12 characters (letters and numbers only). When finished, key **[ENTER]** to close the entry field.

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10.2.2.2 Access Level

This data field identifies the user's level of access. Key in [2] to access the data field if the access level is to be changed. When the data entry is enabled (field is highlighted), type in user's level of access. It may be any number from 0 to 255. When finished, key [ENTER] to close the entry field.

10.2.2.3 Apply

This selection saves the user data configured in the dialog box.

10.2.2.4 Done

This button closes the dialog box. The User Records menu reappears.

10.2.3 Delete User

Delete Users allows users to be removed from the 9388 database. A listing of user login names and instructions appear, similar to those shown in Figure 10-4. The user to be deleted is selected from the list by highlighting that login and selecting the DELETE button (which replaces EDIT in Figure 10-4). The screen changes to the dialog box shown in Figure 10-6. Selecting OK deletes the chosen user. Selecting CANCEL closes the Delete User operation and restores the User Records menu, no user is deleted.

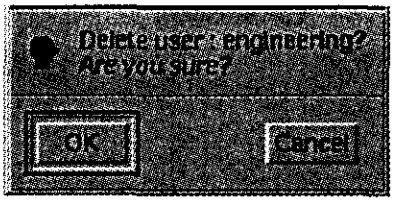
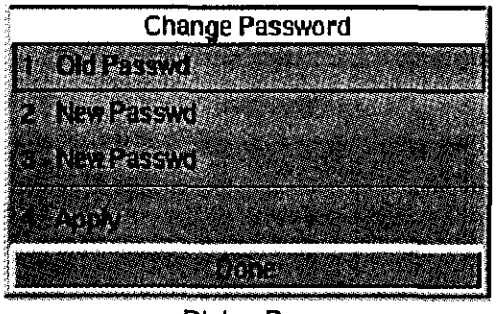


Figure 10-6 Delete User Dialog Box

10.2.4 Change Password

Change Password allows the initial password assigned to the current user to be changed. Access this function by keying [4] when the User Records menu is displayed. The dialog box and instructions shown in Figure 10-7 appears on the monitor.



Dialog Box



Instruction Box

Figure 10-7 Change Password Dialog Box and Instruction Box

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10.2.4.1 Old Password

This data field allows the current user's current password to be entered. The password is concealed, only asterisks appear in the data field. When finished, key **[ENTER]** to close the entry field.

10.2.4.2 New Password

This data field allows the user to type in the desired new password assigned to their login name. When the data entry is enabled (field is highlighted), type in user's login name. It may be up to 12 characters (letters and numbers only). The password is concealed, only asterisks appear in the data field. When finished, key **[ENTER]** to close the entry field.

10.2.4.3 New Password

This data field allows the user to type in the new password assigned to their login name so that it may be verified against the entry just made. When the data entry is enabled (field is highlighted), type in user's login name. The password is concealed, only asterisks appear in the data field. When finished, key **[ENTER]** to close the entry field.

Machine functions are clustered into each of the 256 number possibilities.

10.3 Software Options

Software Options allow the operator to view or verify the software version in use. See Figure 10-8.



Figure 10-8 Software Options Menu

10.3.1 Display Versions

Display Versions dialog box reports the software name, version number, and release date of the current CPU1 version of the software. See Figure 10-9.

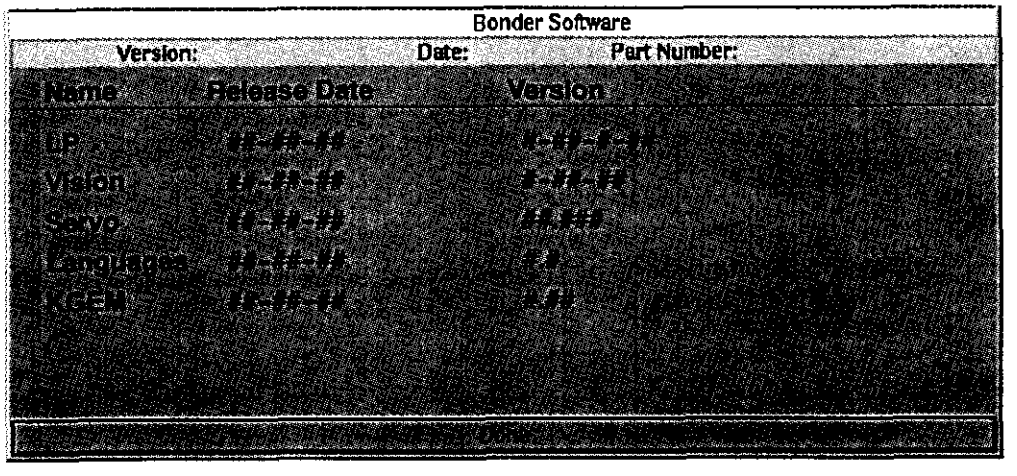


Figure 10-9 Software Versions Dialog Box

Selecting **DONE** closes the dialog box and restores the Software Options menu.

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10.3.2 Verify Version

Verify Version compares the loaded software and the source software. A dialog box similar to that shown in Figure 10-9 appears displaying the information of the source software.

10.3.3 Installation

Calls up a dialog box allowing software to be reloaded or installed into the 9388 machine.

10.4 System Date/Time

This function allows the machine's time and date to be set. This data is added to the tags of process programs, error messages, logon / logoff and statistical summaries.

The first dialog box, shown in Figure 10-10, appears. It shows the current date and time as it was last programmed plus elapsed time. Selecting **CANCEL** closes the dialog box and the System Administration menu reappears.

Select **CHANGE** to set system date or time or both. When this is done, a second dialog box appears (see Figure 10-11).

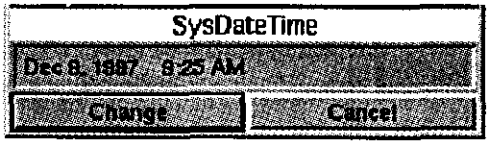


Figure 10-10 System Date and Time Dialog Box

10.4.1 Date

The data fields in this section allow the information about the date to be set.

10.4.1.1 Month

Select the month data field by using the TAB keys on the MMI until the highlight box is around the data field. It may also be accessed by placing the pointer on the data field and pressing **[B1]**.

Once the field is selected, a drop down list of the 12 months appears. Select the desired month by using the trackball to position the pointer on that month while holding **[B1]**. When the proper month is selected, release **[B1]**.

10.4.1.2 Day

Select this data field using the TAB key or pointer method described above. When the data entry field is highlighted, type in the correct day number followed by **[ENTER]**.

10.4.1.3 Year

Select this data field using the TAB key or pointer method described above. When the data entry field is highlighted, type in the correct day number followed by **[ENTER]**.

10.4.2 Time

These data fields allow the time of day to be set.

10.4.2.1 Hour

Select this data field using the TAB key or pointer method described above. When the data entry field is highlighted, type in the correct hour number followed by **[ENTER]**.

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10.4.2.2 Minute

Select this data field using the TAB key or pointer method described above. When the data entry field is highlighted, type in the correct minute number followed by **[ENTER]**.

10.4.2.3 AM/PM

Select this data field using the TAB key or pointer method described above. Select the desired designation by using the trackball to position the pointer on that designation while holding **[B1]**. When the proper one is selected, release **[B1]**.

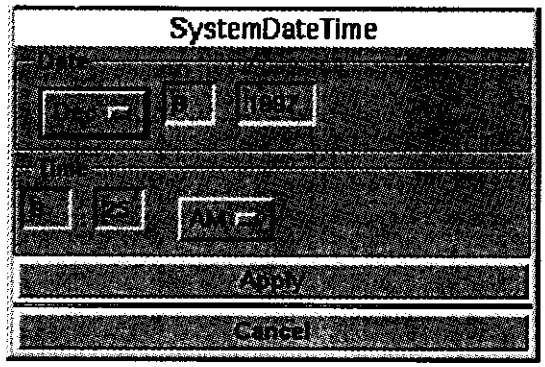


Figure 10-11 Change System Date and Time Dialog Box

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Appendix A

FACILITY REQUIREMENTS

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A Facility Requirements

A.1 Pneumatic and Electrical Supplies

- **Compressed Air**

  Pressure: 4.6 - 7.03 Kg/sq. cm. (65 - 100 psi)

  Minimum consumption (flow rate): 56.6 Liters/min. @ 4.6 Kg/sq. cm. (2.0 CFM @ 65 psi)

  Quality:

  Dew Point: 5° C maximum @ 4.6 Kg/sq. cm. (41° F maximum @ 65 psi)

  Filtration: 0.3mm

- **Compressed Nitrogen**

  Pressure: 4.6 - 7.03 Kg/sq. cm. (65 - 100 psi)

  Minimum consumption (flow rate): 1.0 Liters/min. @ 7.03 Kg/sq. cm. (2.0 CFM @ 65 psi) (300 um balls)

  Quality:

  Dew Point: 5° C maximum @ 4.6 Kg/sq. cm. (41° F maximum @ 65 psi)

  Filtration: 0.3mm

- **Electrical Power**

  Input Voltage: 100 to 240 VAC, -15% to +10%, Single Phase, 50/60 Hz (+/- 3 Hz), Configurable by user

  Power Consumption: 2.0 kVA, nominal

  Electrical Circuit Protection: Electrical circuit protection is provided by circuit breakers that are readily accessible from the front of machine. (Power supply fuses may require alternate access).

A.2 Operating Environment

- **Temperature**: 15° - 30° C (59° - 86° F)
- **Humidity**: 30% - 70% Relative Humidity (non-condensing)
- **Atmospheric Pressure**: 540 - 810 mm Hg (21.2 - 31.9 in. Hg)

A.3 Dimensions and Weight

- **Base machine with MHS**: 1143 mm wide x 1143 mm deep (45" x 45")
- **Working Height** (with leveling feet secured to floor)

  Ball Placement Plane: 1054mm (41.5 in)

  Keyboard: 914mm (36 in)

  Monitor: 1562mm (61.5 in)

- **Weight** (Estimated)

  Machine: 614 Kg (1350 lbs)

  Machine & Shipping Crate: 682 Kg (1500 lbs)

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Appendix B SPECIFICATIONS

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B Specifications

B.1 9388 Machine Specifications:

- **Placement Area**

  50mm (X) by 50mm (Y) (2.0 in (X) by 2.0 in (Y))

  When the system is mass produced, the bond area will comply with this spec at 50 x 58 mm. Pre-production systems will limit the bond area to 50 x 50 mm.

- **Ball Capacity**

  Balls placed per process program: 100,000

  Ball Reservoir Capacity:

  800 um balls: 25,000 balls/reservoir

  300 um balls: 200,000 balls/reservoir

  100 um balls: 1,600,000 balls/reservoir

- **Ball Size Range**

  Minimum: 100 um ball diameter

  Maximum: 800 um ball diameter

  One ball attachment head per nominal ball diameter.

- **Placement Capability**

  Range: 100 um

  Resolution: 1 um

- **Placement Repeatability**

  +/- 10.0 um @ 3 sigma (+/- 0.2 mils)

- **Alignment Capacity**

  150 alignment points per process program

- **Reference System Capacity**

  100 Reference Points per process program

NOTE: The 9388 Laser*Pro* system will be able to attach balls with a melting point in the range of 100 to 350 degrees C. There may, however, be a productivity impact for balls with melting temperatures less than 170° C or greater than 250° C. The productivity impact will be evaluated as customers applications are provided to K&S.

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B.2 PRS Specifications

- ***Camera Resolution***

  768 x 480 pixels

- ***Field of View***

  3.12 mm x 2.23 mm (123 x 88 mils)

- ***Depth of Field***

  750 mm (≈ 30 mils)

- ***Working Distance***

  50 mm (≈ 2in.)

- ***Offset***

  8.75 mm (≈ 344 mils)

- ***Rotational Tolerance***

  ± 5° @ box size of 0.5 mm x 0.5 mm (0.2" x 0.2")

- ***Resolution***

  1/10 pixel (0.5mm)(0.02 mils)

B.3 Laser System Specifications

- ***Configuration***

  Laser Module

  Classification: The Model 9388 Laser*Pro* is classified as a Class 1 laser system with an embedded Class 4 laser. It adheres to both CDRH and IEC regulations.

  Laser Output:

- ***Output Power***

  Laser System: 40 Watts, continuous. Programmable by user from 0% to 100% in 1% increments, per process requirements.

  Embedded Laser Diode: 8 Watts, continuous (per diode)

- ***Output Wavelength***

  915 nanometers (infrared)

- ***Pulse Duration***

  0 to 100 milliseconds (msec). Programmable by user in 0.1 msec increments, per process requirements.

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Appendix C

GLOSSARY OF TERMS & ABBREVIATIONS

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C Glossary of Terms & Abbreviations

-A-

Alias: Area or feature on a die or leadframe which may be mistaken by the PRS for a valid eye point.

Alignment: Material alignment is the positioning of the material at the bondsite. This positioning may be accomplished by the use of the Pattern Recognition System or by the operator depending on the parameters and settings in the bond program.

Alignment Tolerance: Maximum allowable deviation from the programmed distance between the two operator points of a reference system. Valid only for 2-point reference systems. Suggested tolerance should be 10% of the smallest bond pad dimension. For outer leads, it should be referenced to the lead with tolerance and may be somewhat greater to allow for the potentially larger expansion.

Axis Position Indicators: X, Y, and Z values on the upper right of the screen. X and Y values of the crosshair are relative to X-Y zero. Z refers to the bond head height, again with reference to a previously entered zero location. The distances are expressed in mils or millimeters.

-B-

Backup Eyepoint: Another eyepoint on the same die in a different location. Its purpose is to give the vision system a second chance to find an eyepoint for alignment purposes.

Bond Height: The height at which the bonding tool touches the work surface.

Bond Off: A process for forming a gold ball once the wire is loaded through the bond tool (with a fraction of an inch extended beyond the tool). Used when repairing a broken wire or replacing a wire spool.

Bond Power: The ultrasonic energy exerted by the USG during bond time.

Bond Program: see Process Program.

Bonding: Bonding requires the calculation of bond locations based on the alignment data and the control of all the subsystems necessary to accomplish the bonding.

Boot/Booting: The initial activity of the machine after a reset or power up to re-load the machine's program and prepare it for processing.

Button: A button may be square, rectangular, or triangular in shape on the display. Activating a button may result in: a process starting, a dialog box appearing, a list of choices incrementing, values increasing or decreasing, or edit field opening.

-C-

Calibration Mode: A mode of the machine that allows the operator to calibrate parameters of the machine to ensure valid measurements. For example: to set the distance between the tool and the optics (crosshair offset), find limits, set the pixels to pulse ratio in the PRS.

Camera Image: The window that displays the image from the camera on the machine's screen.

Camera Linearity: Alignment of the video camera CCD image element with the machine axes of motion. This is accomplished by rotating the camera body.

Chessing: Moving the work table (in the X and Y directions) using machine controls, such as the trackball or control panel arrows.

Holding the cursor button down will cause the auto repeat function to take effect and the image will move at a continuous rate.

Component Files: The other files used with the **Process Program File** to create a process program. The process program file has the .BND extension and may have a filename of up to 8 characters. Each component file has a different extension (.REF, .PRM, OPR, etc.) and has a filename of up to 8 characters.

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Configure Mode: A mode of the machine that allows the operator to configure or style the machine to meet the factory's needs.

Contact Angle: This parameter should only be used on critical/low looping applications. It controls the angle of approach at the second bond. When set to a value greater than zero, the TIP height should be set to at least 50. The greater the contact angle, the straighter the looping will be.

Crosshair: On-screen horizontal and vertical cross image which are used with the X, Y, and Z directional buttons to locate eye points, lead points, etc. for the program. The large crosshair which appears initially in the center of the graphics and the camera image windows. The two windows and their crosshairs are handled slightly differently. The crosshair on the camera image window is always centered. Selecting a new position causes the camera image to shift and the crosshair is automatically centered. Hence, it is possible to "work your way" across the bond site. The graphics image crosshair can be moved to any position in the graphics window and depending upon the zoom factor this may include the entire work area or only a very small portion of it. Manipulation of either window will cause an appropriate change in the other window.

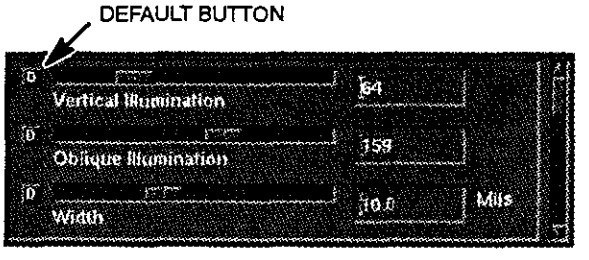
Crosshair Offset: A taught distance which compensates for the fact that the objective lens and the capillary are not in line above a device. This adjustment is necessary when the crosshair is being used to represent the location of the bond tool over the device.

Cursor: The on-screen arrow used to point to and click on menus, menu items, and buttons and to grab and adjust slide bars.

-D-

De-select: To close or turn off a menu, menu item, function, or state by positioning the cursor on top of the desired item and clicking the B1 (left) trackball button. If a state is de-selected, the highlighting will be turned off to show that the state is no longer active.

Default Button: A square button with a "D" in the center of it. Clicking on this button will set a parameter value to its pre-determined default value.



Device Group: A group of wires that are aligned and bonded after/before another group of wires is similarly processed. Typically this is a single bar or chip or package in the work area.

Dialog Box: A window that appears temporarily to request information or to allow adjustment or selection of settings/parameters.

Double-Click: To rapidly press and release the trackball button twice without moving the cursor.

Drag: To move an item on the screen by positioning the cursor over the item and then pressing and holding down the trackball button while moving the cursor.

Dry Cycle: Cycle the MHS workholder without material present in the MHS.

-E-

Eject: This refers to the activity of transferring materials from one mechanical sub-system to another. For example: eject a leadframe refers to the process of moving a leadframe from the output side of the workholder to the output magazine in the output elevator. To eject a magazine means to move it from the elevator to the output platform.

EMO: Emergency Machine Off circuit. An optional control circuit which, when activated, places the bonder into a safe shutdown condition and restricts all hazardous potentials to the main power enclosure in the lower console.

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Enter: Using the MMI keypad or the keyboard ENTER key to set information into working memory.

Eye Point: A human and machine identifiable feature of the material. The number of eyepoints and their location can be specified in process program. This reference point is learned by the PRS during the teach sequence. For each reference system, the number of eye points must equal the number of operator points.

DIE eye point uses the fine detail typically found on die reference systems.

LEAD eye point looks for long straight edges such as those normally found in a leadframe reference system.

Exception: Failure, fault, or unusual occurrence.

-F-

Factory Automation Server/System: A computer which can supervise the wire bonder through a communications link using the SEMI SECS protocol.

FAS: Factory Automation Server/System.

Function Buttons: The row of 10 buttons at the bottom of the screen. These buttons are used to begin or end an action. The action associated with a button may change when a new menu is selected.

Function Keys: The row of 10 keys at the top of the keypad located on the lower console.

-G-

GUI: An abbreviation for the term Graphical User Interface.

-H-

Host: A computer that can gather process information from the machine, select process programs for the equipment, and control the machine.

Host Interface: A technique to exchange information between a host computer and the machine. The host computer may also exert control over the machine using this interface.

Hot Keys: [SHIFT]+[key] or [CTRL]+[key] combinations used to extend the actions of a key or to perform infrequent actions.

-I-

IC: In general, an integrated circuit. As used here, a device with two reference systems: the outer leads or substrate and the die.

Icon: A symbol that represents a window or action/s.

Indexing: Indexing moves new material into position for bonding. Indexing may occur after an entire unit has been processed or after a partial unit has been processed. The index may present an entirely new unit to the bond location or a new part of the same unit.

Inject: Generally this term refers to leadframes and usually means a leadframe will be moved from the input magazine into the workholder.

-J-

Jog: A term to indicate a vertical index of an elevator.

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-K-

Keyboard: A QWERTY keyboard located in a pullout drawer beneath the trackball and keypad.

Kink Height: The vertical distance between the first bond and the position above the first bond where the XY table starts the Reverse Motion.

-L-

L/F: LeadFrame.

Leadframe: Carrier for IC devices incorporating metal leads to which wires from IC bond pads are attached

Light Tower: A post on which a number of signal lights are mounted to indicate the machine's state (Motors stopped, operating automatically, error, etc.).

Linearity: Camera rotation. See Camera Linearity.

Logon: To key in an operator ID and password at the beginning of a bonder operating session.

Logoff: To exit a bonder operating session. Logoff is selected in the Sys Admin mode.

Lot: A grouping of materials for tracking purposes.

Lot ID: A name or number associated with a lot for identification purposes.

Lot Tracking: A technique to monitor the process and collect data for historical purposes.

Lower Console: The machine's main card rack, electronics(cards), power supplies, amps for the servos and steppers, the disk drives, the chassis, and the fans.

LTOL: An abbreviation for the term "line tolerance". Line tolerance is used to ensure that the placement of operator alignment points are valid.

-M-

M/C: Machine.

Machine Dependent Parameter: A bonder or machine specific parameter.

Maintenance Log: A machine operator (or technician, or process engineer, etc.) entered electronic note pad to track maintenance for a particular machine.

Maintenance Mode: A machine mode that provides maintenance facilities for the machine's operator.

Man Machine Interface: Means through which the machine operator communicates with the control system. Operator controls via the trackball, buttons, function keys, and keypad on the lower console. Interactive displays via the monitor screen. Sometimes used to refer to only the control panel assembly.

Manual: Depending upon context this term may refer to the Manual Mode of the machine's operation or indicate human intervention is required to complete a process.

Manual Mode: A machine mode that allows the operator to bond wires in a manual fashion. That is, designate the location of bond sites and lay a single wire.

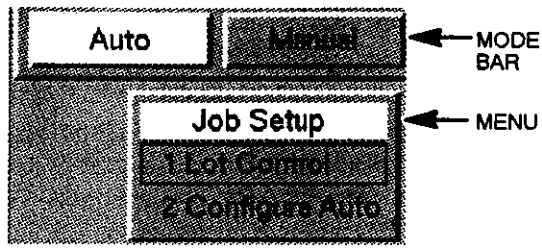
Material Handling System: The Material Handling System consists of the electronics, mechanics, and controlling software that is used to move material through the machine. The Material Handling System may be considered as part of the process if the heating elements are controlled by the Material Handling System.

MBD: Missing Ball Detector.

MDP: see Machine Dependent Parameter

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Menu: A list of available commands in a window. Menu names appear in the menu bar at the top of the window. The illustration shows the "Job Setup" menu.

Mode Bar: The horizontal bar that contains the names of the program's major sections or modes. The mode bar is at the top of the display screen. The illustration shows the leftmost modes in the mode bar. "Auto" is the active mode.

MHS: see Material Handling System.

MMI: see Man Machine Interface.

Mode: A logical grouping of related tasks or functions or a group that would be convenient for the benefit of the machine operator. This term could also be used to refer to an operating state of the machine such as automatic mode or manual mode.

MTBA: Mean Time Between Assists. Average length of time between bonder-detected errors.

MTBF: Mean Time Between Failures. Average length of time between events that require actual repair by a technician.

Multi-Chip: A device with more than 2 reference systems: one for outer leads or substrate and one for each die on the device.

-N-

-O-

On-line Help: A window is displayed containing text that explains an indicated object for the machine operator. Note: once On-line Help is activated other topics are available for review.

On-line Procedure: A window with information for the machine operator that gives step by step instructions for some procedure to be performed on the machine. For example: threading the wire.

Open: To display the contents of a file in a window or to enlarge an icon to a window.

Operator Point: A location on the device or leadframe that a machine operator can identify to ensure the device is properly aligned. This reference point is taught by the operator. Used if the PRS fails. Must be targeted before device can be bonded. Preferred location is on bond pad or streets.

Optics Offset: The displacement between the center of the optical path and the bonding tool.

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-P-

Pad Find: This function uses the PRS to automatically center first bonds on bond pads.

Pattern Recognition System: A part of the Vision System. This term usually refers to the electronics and software that actually recognize patterns at the work site for alignment purposes. The PRS allows the bonder to operate without attention by automatically finding eye points before each device is bonded. Compensates for variations in die location from package to package. Takes video image directly from the monitor.

Performance Logging: Refers to statistical information that can be automatically gathered by the machine and includes such information as MTBA, MTTA, MTBF, MTTR, and Utilization time.

PFR: see Power Failure Recovery.

Pixel: The smallest field of vision of the video camera.

Point: Moving the cursor to a specific area on the screen.

Power Failure Recovery: This routine provides resumption of automatic operation after power failure.

Preheat: Heating the device before it reaches the bond station.

Process Program: Made up of re-usable modules of ASCII text that can be read, modified, saved, and restored. These modules contain the instructions and parametric information that the machine will need to process materials. For example: a process program would contain the missing information in the following steps:

- find all reference systems
- go to position x
- place a first bond using parameters a
- go to position y
- place a second bond using parameters b
- etc.

Process Program File: Main file of a process program. **Component Files** are the other files used with this file to create a process program. The process program file has the .BND extension and may have a filename of up to 8 characters.

Process Statistics: Refers to information automatically gathered by the machine while the equipment is automatically bonding. Included in this set of statistics would be: number of devices bonded, and number of bonds since capillary was replaced.

Program Mode: A machine mode that allows the operator to either load a process program or to teach one.

Prompt: A program initiated statement which indicates an operator action is needed.

PRS: see Pattern Recognition System.

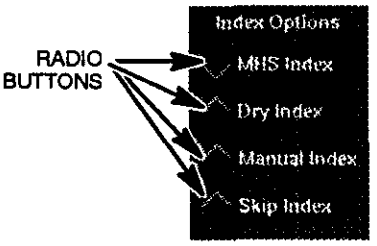
PRS Calibration: A procedure to establish the relationship between the vision systems pixels and the machines motion pulses particularly to ensure linearity and perpendicularity between the two systems.

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-R-

Radio Button: A diamond shaped button. Radio buttons are grouped in sets of two or more. Only one radio button per set can be active at a time. As shown, "MHS Index" is active.



Reference Systems: A reference system is a logical grouping of bond sites, typically all the bond sites of a particular object in the work area, always of the same height. Examples of reference systems are:

- all the bond sites on a die
- all the bond sites on a lead frame

The goal of the reference system technique is to allow the mixing and matching of die and lead frames without the necessity of re-teaching. A complete process program would contain the definition of all of the reference systems in the work area in addition to instructions regarding the wiring of the device.

Reference System Origin: The origin (0,0) of an instance of a reference system.

Reverse Bonding: Refers to the reverse sequence of bonding. Where typically when ball bonding the first (ball) bond is on the die and the second (wedge) bond is on the lead in reverse bonding the first bond is on the lead and the second bond is on the pad.

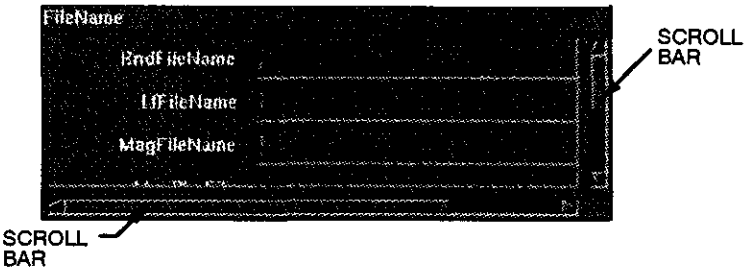
Reverse Motion: The reverse motion causes the XY table to move a defined distance in the reverse direction (away from the second bond) after the bond head has risen to a preset height (Kink Height) while still above the first bond to achieve a unique wire shape.

-S-

Scan Corridor: The area and direction that the VLL will scan when searching for the lead.

Screen: The display area of the monitor.

Scroll Bar: A horizontal or vertical bar with a center button used to show additional text or choices. In the example shown, the bars are used to display additional file names.



Select: To choose or turn on a menu, menu item, function, or state by positioning the cursor on top of the desired item and clicking a trackball button (usually B1). If a state is selected, the selection will be highlighted to show that it is active. Modes and menu items may also be selected by number if a number is to the left of the item.

Sequence Stop Mode: A mode the machine enters when the operator presses Sequence Stop while the machine is in automatic mode. Its effect is to pause the action at the earliest safe place in the process. For example: at the end of a wire or at the end of an index. While in Sequence Stop mode the operator may operate the machine as if it were in Manual mode. While generally it is assumed the operator will leave Sequence Stop and continue processing materials, it is possible to escape automatic operation entirely from this machine mode.

Site: Depending on context it can mean a bonding site (a die pad or lead bonding site), a die, a die and lead frame, or all the area accessible by the bond head.

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Skip: An index where the materials that will be moved away from the work site have not been processed.

SOIC: Small Outline IC.

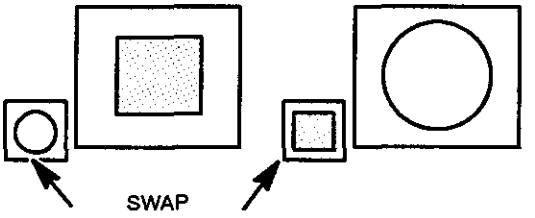
SPC: see Statistical Process Control.

Standby: This mode produces an electrical condition in which power is removed from all motors and solenoids. Heaters and electronics remain in an operational state.

Statistical Process Control: A technique to improve manufacturing yield by gathering and analyzing data, and then altering the process while in progress to improve or keep the product consistent.

Step and Repeat: A machine feature to process a number of identical devices without an index. For example if several identical die are in the same worksite instead of teaching each die individually the operator would teach the process once and then teach only the locations of successive die.

Swap: To move the images in the video windows so that they change places. The image in the large window moves to the small window and the image in the small window moves to the large window.



-T-

[TAB]: A key used to move from one edit field or selection to the next.

Tab: A projecting edge on a multi-layer dialog area. As shown, "Ball"is the active layer of a six-layer set.

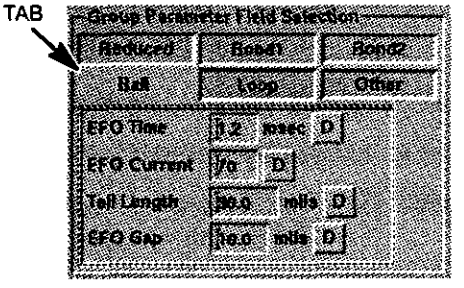


Table Mapping: A method of correcting any precision errors in the XY table positioning.

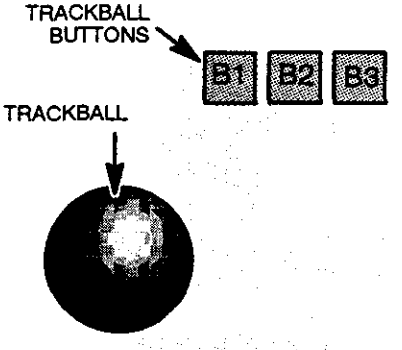
Table Origin: The absolute origin (0,0) of the table. Reference System Origins are located within (mapped on top of) this reference system.

TIP: see Tool Inflection Point.

Tip height: The height above the work surface to start search (or constant) velocity.

Trackball: Input device with three buttons and a ball used to position an on-screen cursor and make selections or adjustments.

Trackball Buttons: The three trackball buttons are located above the trackball and are referred to as B1, B2, and B3 on the screen. The function of each button changes depending on the operations being performed on the screen. Refer to the screen for the current button functions. Some of the possible functions for the three buttons are listed below:



B1 = Left Button: Select, Add/Learn, Unselect, Next, Step
B2 = Center Button: Chess
B3 = Right Button: Delete, Unselect, Auto Learn, Relearn, Assign, Disassociate, Reverse

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-U-

Upper Console: Chassis that supports the light tower, audio alarm, and SVGA monitor. Contains wire feed/BITS electronics, pneumatics, upper machine interface board, EFO box, and cabling. Mounted at the top of the lower console.

UPH: Units Per Hour. The number of units bonded per hour.

UPS: Uninterruptable Power Supply.

Utility Mode: A mode of the machine that allows the operator to make adjustments that are typically not related to the process. For example: copying disks, deleting files, etc.

-V-

Vision System: There are two aspects of the vision system: the optics and the electronics. The Vision System provides information for the proper alignment of die bond sites and leads within the work site.

-W-

W/H: Workholder.

Wet Cycle: Cycle the MHS Indexer with material present in the MHS.

Workholder: A subsystem of the material handling system. The workholder pulls leadframes from an input magazine (held by the input magazine handler), transports the leadframe to the bondsite where each device in the leadframe is positioned, heated, and clamped for bonding, then moves bonded leadframes into an output magazine (held by the output magazine handler).

-X-

X Axis: The side to side motion of the bond head

X-Y Zero: Primary alignment point for a package. Used as point from which all other X and Y coordinates are calculated. Suggested location is at bottom left-hand corner of package on a lead.

XY table: A positioning system for moving a load (a bond head in the case of wire bonders) in XY (horizontal) space.

-Y-

Y Axis: The front to back motion of the bond head.

Yield: The percentage of good bonded devices processed by the machine vs. the number of unbonded devices that enter the machine.

-Z-

Z Apex: The highest point achieved by the Z axis between bonds of a single wire.

Z Axis: The up and down motion of the bond head.

Zoom Box: A square or rectangular box on the image display that is used to define a portion of the image to be magnified.

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