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About the Wafer Sorter Operations Manual

This operations manual has been designed to assist you in understanding and operating your MicroVision MVT 7080™ Wafer Sorter - a high-performance, robotic wafer handling system that combines fast and safe wafer handling, the flexibility to accommodate a wide range of wafer sizes, and easy operation. To ensure that users realize and maintain optimal performance from their MVT 7080 Wafer Sorters, we have strive to provide easy-to-follow descriptions of both system setup procedures and troubleshooting measures for system technicians, and clear illustrations of the system graphical user interface and menu-to-menu descriptions of runtime setup & operating procedures for system operators.

This operations manual is comprised of eight main sections:

Section A: Customer Information includes a Wafer Sorter Order Configuration file that lists vital order information and profiles a system's installed components.

Section B: System Overview describes the features and options of the MVT 7080, provides a general overview and description of its capabilities, lists system specifications, introduces the user to the system’s mechanical layout, and presents the system’s variety of modular configurations. This section also provides system technicians with the basic information needed for initial system installation, power-up and power-down. In addition, illustrated descriptions of the various elements of the graphical user interface provide both technicians and operators with a valuable preview of the system’s features and how to access them.

Section C: Software Installation & Accounts Setup provides system technicians with detailed, step-by-step instructions on installing system software and setting up user accounts.

Section D: System Setup & Configuration provides system technicians with detailed, step-by-step instructions on calibrating and fine-tuning a new or upgraded system for runtime setup and operation; these include using the HOGT NT Software, setting up the controller, and performing system integration procedures for four different modular configurations.

Section E: Runtime Setup provides system technicians with step-by-step instructions on managing user access and creating wafer flow, reader IDs, and bright light macroinspection recipes for use during actual runtime operation.

Section F: Runtime Operation provides system operators with step-by-step, illustrated guides to performing basic wafer sorting operations.

Section G: Troubleshooting & Preventative Maintenance provides system technicians with a detailed guide to diagnosing and correcting system problems, and includes a system preventative maintenance check list.

Section H: Electrical Diagrams & Parts List

The following pages include a customersatisfaction fax survey used to aid us in providing all of our customers with the highest levels of service possible. Please complete this survey and fax back to Microvision at your earliest convenience. Your time and cooperation are greatly appreciated.

To learn more about the MVT 7080 Wafer Sorter, or to request support, contact Microvision Corp. Sales, Application & Support:

phone: 612.975.9911 fax: 612.975.9922
email: info@mvglobal.com internet: http://www.mvglobal.com
RE: MicroVision Post-Marketing Customer Satisfaction Survey

Dear MicroVision Customer:

Congratulations on your purchase of a world-class MicroVision automated inspection solution. To aid us providing you and all our customers with the highest level of customer service possible please complete the following survey and fax it back to MicroVision at (612) 975-9922. Your cooperation is greatly appreciated.

MicroVision Post-Marketing Customer Satisfaction Survey

1. Company: ____________________________
   Your Name: ____________________________
   Position: ____________________________
   Phone: ____________________________
   Fax: ____________________________
   E-Mail: ____________________________

   System Type: (circle one)
   MVT 1080
   MVT 5060
   MVT 5080
   MVT 7080
   MVT 651NT
   MVT 981
   MVT 981T
   Other: ____________________________

   System Serial #: ____________________________

   Install Date: ____________________________

Date: ____________________________

Pages Sent (including this one): 2

MicroVision Post-Marketing Customer Satisfaction Survey

Page 1 of 2
2. How satisfied are you with the knowledge and helpfulness of your MicroVision Representative (5 indicates a high level of satisfaction, 1 indicates a low level of satisfaction): 1 2 3 4 5 (circle one)  
Comment (optional)  

3. How satisfied are you with the knowledge and helpfulness of your MicroVision representative during the System Specification Process (5 indicates very productive interaction, 1 indicates unproductive interaction): 1 2 3 4 5 (circle one)  
Comment (optional)  

4. How satisfied are you with the timeliness and accuracy of the System Specification Process (5 indicates a high level of satisfaction, 1 indicates a low level of satisfaction): 1 2 3 4 5 (circle one)  
Comment (optional)  

5. Was your tool received by the promised delivery date?  
Yes No (circle one)  

6. Did your tool arrive intact?  
Yes No (circle one)  
Comment (optional)  

7. Does the installed tool meet all agreed to specifications?  
Yes No (circle one)  
Comment (optional)  

8. Rate the performance of MicroVision personnel during System Installation (5 indicates a very professional performance, 1 indicates an unprofessional performance): 1 2 3 4 5 (circle one)  
Comment (optional)  

9. Rate the technical support during System Installation (5 indicates very professional performance, 1 indicates unprofessional performance): 1 2 3 4 5 (circle one)  
Comment (optional)  

10. Have your personnel been adequately trained to safely and productively operate the tool?  
Yes No (circle one)  
Comment (optional)  

11. Suggestions (optional):  
                            
                            
                            
                            
                            
                            
                           Upon completing this survey, please fax to Microvision Corp. 612.975.9922  

Thank you for your time and cooperation. Your completed response will aid us in providing you, our customer, with the highest levels of service possible.
Section B: System Overview

Fast, Safe and Easy Wafer Handling ........................................ 2
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Introduction:
Fast, Safe &
Easy Wafer
Handling

Congratulations on your purchase of a MicroVision MVT 7080™ Wafer Sorter, the first choice for the most advanced semiconductor facilities in the world. This high-performance wafer sorter combines the following features to provide fast and safe wafer handling, the flexibility to accommodate a wide range of wafer sizes, and easy operation:

- 3-axis robotic handler with integrated laser mapping system for sorting, splitting or randomizing wafer lots;
- High speed aligner;
- Integrated wafer ID reader with advanced illumination system for accurate and repeatable optical character recognition;
- Small footprint - 2, 3 or 4 cassette configurations available;
- Over 300 wafers per hour in sort mode;
- 75 to 200mm wafer capability;
- Optional integrated bright light macroinspection station;
- Recipe or manual control;
- Flat-screen color LCD or Super VGA display;
- Windows NT™ operating system.
Introduction: The MicroVision MVT 7080™ Wafer Sorter represents a new generation of high-performance robotic wafer handlers for semiconductor wafer fabs. It combines intelligent motion control with features such as laser mapping, advanced illumination and OCR, optional bright light macroinspection, and a Windows NT™ operating system to provide a complete wafer sorting and macroinspection solution in an extremely small footprint.

Available in 2, 3 or 4 cassette configurations, this system enables an operator to quickly and safely sort, split, merge or randomize 75 to 200mm wafer lots.

This system features the MicroVision robot with its integrated laser mapping system for safety and a dual paddle design for fast throughput. Closed-loop control of all axes, vacuum sensors on each handling element, and a backup vacuum reservoir provide additional assurance of secure handling.

Advanced illumination and OCR (Optical Character Recognition) is used for wafer ID reading at the system’s high-speed aligner station.

The optional integrated bright light macroinspection module increases the utility of this system and allows macro defect inspection to be performed more efficiently. Macroinspection can be performed manually with joystick control or pre-programmed.

Easy-to-use, Windows NT™ based software allows operators to store wafer flows and comprehensive recipes or operate in manual mode. Scribe information, together with a graphical display of each wafer’s status and program setup information are displayed in real time on either a flat screen or super VGA color monitor.

Communications packages are available for SECS / GEM, FTP and TCP/IP protocols.
Introduction:

System Specifications

- MicroVision MVT 7080 Wafer Sorter
- 3-axis robotic handler with laser mapping system
- High speed aligner
- 2, 3 or 4 cassette stations
- 75 to 200 mm wafer capability
- Flat panel color monitor
- Integrated control electronics

Vision (OCR) System

- Integrated mounted electronics and vision processor
- High resolution CCD camera and optics
- Advanced illumination system

Software Configurations

- Sorter software
- Wafer ID reader (OCR) software
- Barcode reader software
- FABCOM software (SECS / GEM and TCP/IP communications)

Facility / Installation Requirements

- MVT 7080 Dimensions: 965mm (w) x 1016mm (d) x 1397mm (h)
- 35° (w) x 40° (d) x 55° (h)
- System Power
  - USA: 110 VAC +/- 10%, 50/60 Hz, 15 Amps, single phase
  - Europe: 220 - 240 VAC +/- 10%, 50/60 Hz, 5 Amps, single phase
- Installation Overvoltage Category: II
- Protection Against Electric Shock: Class 1
- Voltage Tolerance: +/- 10% of normal rated line
- Vacuum: 84.3 KPa (25" Hg)
- Temperature: 5°C (41°F) to 40°C (104°F)
- Humidity: 10% to 90% non-condensing
- System classification: Class 10 clean room environment
- Pollution Degree: 2

Optional Bright Light Macroinspection Module

- High intensity light (up to 250 watts) with ducted cooling fan
- User-definable tilt between -30° and 30°
- User-definable rotation speed and rate of tilt variation
- Configurations can be saved as inspection recipes
- Joystick or fully automatic operation

Annex A

- System Power
  - USA: 110 VAC +/- 10%, 50/60 Hz, 15 Amps, single phase
  - Europe: 220 - 240 VAC +/- 10%, 50/60 Hz, 5 Amps, single phase
IEC Symbols

The MVT 7080 Wafer Sorter utilizes the following IEC (International Electro-Technical Commission) symbols:

- Earth (Ground) Terminal (IEC 417, No. 5017)
- Protective Conductor Terminal (IEC 417, No. 5019)
- On - Power Supply (IEC 417, No. 5007)
- Off - Power Supply (IEC 417, No. 5008)

CAUTION, risk of electric shock (ISO 3864, No. 8.3.6)

CAUTION, outlet for use only with equipment supplied by manufacturer. Maximum Rating: 15 A, 125 VAC.

Cautions

CAUTION: Protection provided by the equipment may be impaired if it is used in a manner not specified by the manufacturer.

CAUTION: To ensure the safety of users and proper operation, the MVT 7080 Wafer Sorter must be connected to a properly grounded power source.

CAUTION: System users must wear a wrist strap for grounding purposes to prevent electric static discharge.
When installing an MVT 7080 Wafer Sorter, it is important to position the system in a manner that affords quick and easy access to the power supply disconnect point, the controller, the PC, and all system cabling located within the system chassis. For optimal accessibility to all internal components, an obstruction-free, 2-foot wide aisle should be maintained around the perimeter of the system, allowing easy unlatching and removal of the chassis outer panels on all four sides.

![Diagram showing system components and access points]
Section B: System Overview

System Geography:
Wafer Sorter Layouts

- Aligner Array
- Wafer Light
- OCR Camera
- Robot Module
- Bright Light Module
- X, Y and Theta Axes
- Joystick
- Station A
- Station B
- Station C
- Station D
- Joystick
- Monitor
- Mouse
- Keyboard
System
Geography:
Robot Module

- Laser
- Paddle 1 Vacuum Sensor LED
- Paddle 1 Vacuum Sensor Adjustment Screw
- Paddle 2 Vacuum Sensor LED
- Robot Can
- Robot Top View
- Paddle 1
- Paddle 2
- Vacuum

Can Angle Map
- 2-Cassette
- Section B: 155 degrees
- Section A: -155 degrees

Aligner: 0 degrees

Robot Side View

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System Geography:
Robot Module

Section B: System Overview

Bright Light: Statron 8:
140 degrees -140 degrees

Station 3:
Bright Light

Aligner:
0 degrees

Station A:
-90 degrees

Station B:
-140 degrees

Station C:
140 degrees

Aligner:
0 degrees

Station A:
-90 degrees

Station B:
-140 degrees

Station D:
90 degrees

Bright Light:
140 degrees

Aligner:
0 degrees

Station A:
-90 degrees

Station B:
-140 degrees

Station C:
140 degrees

4-Cassette

4-Cassette

3-Cassette

3-Cassette

2-Cassette

Bright Light

Aligner:
0 degrees

Station A:
-90 degrees

Station B:
-140 degrees

Station C:
140 degrees

Aligner:
0 degrees

Station A:
-90 degrees

Station B:
-140 degrees

Station D:
90 degrees

Bright Light:
140 degrees

Aligner:
0 degrees

Station A:
-90 degrees

Station B:
-140 degrees

Station C:
140 degrees

System Geography:
Bright Light Module

Bright Light Front View
cover removed

Bright Light Top View
Cooling Fan
High Intensity Light (250w, 120v)

X-Axis: side facing robot
Theta Axis: negative

Bright Light Y-Axis: positive

Adjustment Screw
Sensor LED
Vacuum Sensor

Controller Cabling

The system controller serves as the system's motion governor. It is linked via cabling to the PC, all cassette stations, and all module sensors and motorized axes. All prompts for mechanical motion are communicated first to the controller, which orchestrates their execution among the system’s modules.

Refer to the diagram above and the chart to the right when connecting cables to the controller. Note that all system cables are labeled with cable numbers to prevent connection errors.

Replacing the System Fuse

The 6 Amp System Fuse (802-626-001) is located at the back of the controller beneath the cover of the On/Off switch and power receptacle.

To gain access to the system fuse, first unplug the power cord from the power receptacle, then use a flat head screwdriver to pry up and open the left side of the cover. The fuse is located between the On/Off switch and the receptacle.

Controller Cabling

Robot Z
Robot Theta
Robot Paddle
Robot Sensors
Station A
Station B
Station C
Station D
Host 1 (to PC)
Host 2 (to PC)
Host 3
Host 4
Aligner Chuck
Aligner X
Aligner Sensors
Bright Light X-Tilt
Bright Light Y-Tilt
Bright Light Theta
Bright Light Sensors
Flip
Aux (to system VFC sensors)
Wafer Light
Bright Light

Cable #
740-000-215
740-000-214
740-000-213
740-000-209
740-000-210
748-000-211
749-000-212
749-000-222
749-000-222
749-000-216
749-000-217
749-000-206
740-000-219
740-000-220
740-000-207
740-351-100
740-351-050
740-000-226
740-000-279
740-000-227
The system PC, or computer, accommodates the system's various drivers, and the Windows NT and Workstation software programs. It serves as the user's interface with the controller, which orchesrates the execution of motion commands among the system's modules.

Refer to the diagram above and the chart to the right when connecting cables to the PC.

Note that several cables are factory-supplied and therefore not labeled.
System Power-Up Sequence

1. Turn the MVT 7080 Power Main Switch to the ON position.
2. Power-up the VGA color monitor if the system is equipped with one.
3. Power-up the system PC. The computer will scan for a keyboard, mouse and virus, check the integrity of the hard drive, and load Windows NT.
4. Once Windows NT has loaded, a Welcome window will appear, prompting the operator for a user name and password; enter these in the appropriate boxes and verify that WORKSTATION is displayed in the box labeled From. Select the OK button to prompt the display of the Windows NT Program Manager window.
5. Set the Controller ON/OFF switch to the ON position. The operator will hear the sound of solenoids and cooling fans being activated.
6. Within the Windows NT Program Manager window, locate the MicroVision WorkStation window and select the MicroVision icon. The operator will be presented with a LogOn window. Enter a user name and password in the appropriate boxes and select the OK button.
7. As the WorkStation program is launched, the operator will be presented with the MVT 7080 graphical user interface.

System Power-Down Sequence

1. Make sure that all wafers are returned to cassettes and that all modules and the robot are empty.
2. Select File from the main window menu bar and Exit from the File pull-down menu to prompt the display of an Exit WorkStation window.
3. Within the Exit WorkStation window, enter a password where prompted and select Terminate Program from among the Select Exit Type options. Select the OK button to prompt the display of the Windows NT Program Manager window.
4. From within the Windows NT Program Manager window, select File from the menu bar and Exit from the File pull-down menu to prompt the display of a Shutdown Computer window.
5. From within the Shutdown Computer window, verify that the Shutdown option is selected and select the OK button. The operator will then be presented with another Computer Shutdown window that features a RESTART button - do not select it.
6. Set the Controller ON/OFF switch to the OFF position.
7. Power-down the PC.
8. Power-down the VGA color monitor if the system is equipped with one.
9. Turn the MVT 7080 Power Main Switch to the OFF position.
Graphical User Interface

2-Cassette

2-Cassette/Bright Light
MicroVision MVT 7080™ Wafer Sorter

Graphical User Interface
Graphical User Interface

Menu Bar & Pull-Down Menus:
Utilized primarily for system setup and runtime setup, the main window menu bar and pull-down menus provide access to the user manager, setup, diagnostic, and recipe windows described in the following pages.
**Graphical User Interface**

**Run Window:**

During runtime setup and operation, the scalable Run window serves as the system’s main control panel. It contains selections that allow an operator to initiate or abort a run, proceed in step mode, enable or disable Bright Light, Aligner and OCR options, accept or reject wafers, and choose a particular workspace. The following tool buttons are contained in the Run window:

- **Run**
- **Stop Run**
- **Abort Run**
- **Step Mode**
- **Bright Light Accept**
- **Bright Light Reject**
- **Stage Accept (NIA)**
- **Stage Reject (NIA)**
- **Bright Light Enable**
- **Aligner Enable**
- **Reader Enable**

**Station Windows:** Cassette stations are represented by scalable station windows. After mapping, each window displays the location and status of each wafer sensed with a particular wafer icon:

- **Black Solid**: wafer sensed but not selected for processing.
- **Green Solid**: wafer sensed and selected for processing.
- **Red Solid**: wafer sensed as being cross-slotted in cassette.
- **Magenta Outline**: wafer is out of cassette and being processed. If OCR read has been performed, the scribe characters will be displayed over the outlined icon.
- **Magenta Solid**: wafer processed and deposited in its destination. If OCR read has been performed, the scribe characters will be displayed over the solid icon.
Section B: System Overview

Reader Window:
During runtime setup the scalable Reader window is used to train the system’s cameras and calibrate its OCR to read a sample wafer’s scribe.

After an OCR attempt, the window displays a live image of the scribe and all its characters surrounded by color-coded calibration boxes; green indicates OK, red indicates failure.

During runtime operation, this window will display a live image of each wafer’s scribe.

The tool buttons featured in this window are described at right.

Bright Light Window: The scalable Bright Light window allows an operator to perform front or backside bright light macroinspection under manual or recipe control. The following tool buttons are contained in the bright light window.

- Joystick
- Lamp
- Start Recipe
- Stop Recipe
- Flipper Enable
- Flip Wafer

Open existing file
Save file to diskette
Play live image
Pause live image
Maximize image
Minimize image
Flip image
Maximizes image in reader window only

Upper & lower light source intensity
Graphical User Interface

The MVT 7080 software is designed to accommodate users with wide ranging degrees of system knowledge, from operators to service engineers. User manager windows provide the primary means for controlling user access from within the system software. Accessed by selecting User from the main window menu bar, these windows enable a user to add or delete system users from the current users list, issue passwords, and specify each user's level of privilege.

Setup Windows:

Used primarily during runtime setup, the setup windows are used to configure the software settings of a system's various modules to accurately reflect its modular configuration and the specific tasks it will be required to perform during runtime operation. The following windows are accessed by selecting Setup from the main window menu bar:

- System Setup
- Robot Setup
- Aligner Setup
- Light Cipher
- Reader Setup
- Joystick Setup
Diagnostic Windows:

Used primarily for system setup and troubleshooting, the diagnostic windows serve to provide Host NT access to the system controller, display a chronological history of a system's use, and reveal a system's current hardware status. These windows are accessed by selecting Diagnostics from the main window menu bar.
Graphical User Interface

Recipe Windows:
Used primarily during runtime setup, recipe windows enable users to select recipes for runtime operation, delete a recipes from the system, and create and edit new recipes. Wafer flow, reader, and bright light recipes can be accessed by selecting Recipes from the main window menu bar.
Section C: Software Installation

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1.9. Copying and Saving Existing Files
   1.1. This step needs to be completed only if machine is not a new build. Disregard if machine is a new build.
   1.2. Copy all files needing to be saved from the hard drive to a blank floppy. Such files may include reader recipes, wafer recipes, inspection recipes, and host cfg files.

2.0. Inserting Boot Floppy and Master CD
   2.1. Make sure the network cable is unplugged from the back of the computer.
   2.2. Insert NT 4.0 boot floppy disk into disk drive.
   2.3. Press Ctrl+Alt+Delete to reboot computer. Be sure floppy is already inserted into disk drive.
   2.4. While the computer is booting, insert the master CD into the CDROM drive.

3.0. Preparing Hard Drive Partition for Formatting
   3.1. Fixed Disk Setup Program (F disk) instructions: Enter the information listed below when prompted to do so. Note: Type bold information only.
   3.2. Type 3 (Delete partition or Logical DOS Drive) in [ ] provided. Enter the selection.
   3.3. Type 4 (Delete non DOS partitions) in [ ] provided. Enter the selection.
   3.4. There should now be a warning dialogue box stating 'Warning! Data in the deleted Non-DOS partition will be lost. What Non-DOS partition do you want to delete?' on the screen.
   3.5. Type 1 (Delete partition on line 1) in [ ] provided. Enter the selection.
   3.6. There should now be a "Do you wish to continue?" warning box on the screen.
   3.7. Type Y in the [ ] provided. Enter the selection.
   3.8. Press Esc (Escape) to return to the main menu.
   3.9. Type 1 (Create DOS partition or Logical DOS Drive) in [ ] provided. Enter the selection.
   3.10. Type 1 (Primary DOS Partition) in [ ] provided. Enter the selection.
   3.11. There should now be a question box asking 'Do you wish to use the maximum available size for the Primary DOS Partition and make the partition active (Y/N)?' on the screen.
   3.12. Type Y (Make it an active partition) in [ ] provided. Enter the selection.
   3.13. At the prompt: 'Insert DOS system diskette in drive A: Press any key when ready'. Press Enter. The computer should now begin to reboot.

4.0. Formatting Hard Drive Partitions
4.1. After rebooting to Fdisk, press ESC.
4.2. At the prompt: "Proceed with format (Y/N)?" type Y. Enter the selection.
4.3. After computer has finished formatting, the prompt "Format complete" should appear on the screen. Press Enter.

5.0. Windows NT Installation
5.1. Be sure to follow all instructions on the screen. Never press any key other than Enter.
5.2. Once Windows NT 4.0 WorkStation begins to copy files, remove the floppy disk from the disk drive.

At this point Windows NT 4.0 WorkStation will copy files, reboot, copy more files, reboot, convert to NTFS, and again reboot. After Windows NT 4.0 WorkStation Setup has completed the rest of the setup, the computer will again reboot. The computer will automatically logon as Administrator the first time and load service pack 4.

6.0. Creating an Operator Account
6.1. Click the Start button in the lower left corner of the NT Desktop.
6.2. Scroll up to, and select Programs.
6.3. Scroll right and select Administrative Tools (Common).
6.4. Select User Manager.
6.5. Click User in the pull down at the top of the window.
6.6. Click New User.
6.7. The New User window opens. Type operator into blank next to User Name.
6.8. Do not enter any information into Full Name and Description blanks.
6.9. Type operator into blanks next to Password and Confirm Password.
6.10. Select check box next to User cannot change password and Password never expires.
6.11. Deselect check box next to User must change password at next logon.
6.12. Click the Groups button.
6.13. Click the Add button.
6.15. Click OK for New User.
6.16. Close the User Manager.

7.0. Setting-up AutoAdminLogon (Optional)
7.1. Do this step if the customer wants the system to automatically logon as operator.
7.2. Click Start in the lower left corner of the NT Desktop.
7.3. Scroll up to and click Run.
7.4. The Run window opens. Type regedit into box next to Open.
7.5. Click OK. The Registry Editor window opens.
7.6. Click the plus sign + next to the HKEY_LOCAL_MACHINE folder.
7.7. Click the plus sign + next to the Software folder.
7.8. Click the plus sign + next to the Microsoft folder.
7.9. Click the plus sign + next to the Windows NT folder.
7.10. Click the plus sign + next to the Current Version folder.
7.11. Click Winlogon folder.
7.12. Double click AutoAdminLogon in the right pane of Registry Editor window.
7.13. Type 1 in the Edit string box (AutoAdminLogon). Click OK.
7.15. Type operator
7.16. Click OK.
7.17. Double click DefaultUserName.
7.18. Type operator
7.19. Click OK.
7.20. Exit Registry Editor.

8.0. Changing Startup
8.1. Right click My Computer icon in the upper left corner of the NT Desktop.
8.2. Select Properties.
8.3. Select Startup/Shutdown tab in the System Properties window.
8.4. Change the number in the "Show list for box seconds" to 0 (zero) Click OK.

9.0. Changing Event Log Settings
Section C: Software Installation

9.1. Click Start in the lower left corner of the NT Desktop.
9.2. Scroll up to and select Programs.
9.3. Scroll over to Administrative Tools (Common).
9.4. Scroll over to and click Event Viewer.
9.5. Click the Log pull down menu and scroll down to Log Settings.
9.6. The Event Log Settings window opens. Note: The 'Change settings for [Log]' should be set to System.
9.7. Click Overwrite Events as Needed under the Event Log Wrapping section.
9.8. Repeat the previous step for both the Security and Application settings in the 'Change settings for [Log]'. These can be accessed through the pull down in this section.
9.9. Click OK. Close Event Viewer.

10.0. Restarting
10.1. Click Start in the lower left corner of the NT Desktop.
10.2. Scroll up to and select Shut Down.
10.3. Select Restart the computer and click Yes. Note that the computer must be rebooted at this point.
10.4. If optional steps 7.0 through 7.20 are correctly followed, logon will be automatic.
10.5. If automatic logon fails to occur, logon as operator (password: operator).

11.0. Installing Microsoft Internet Explorer
11.1. Click the Start button in the lower left corner of the NT Desktop.
11.2. Click Run.
11.3. Type d:\ie4. bat
11.4. Click OK.
11.5. The Internet Explorer 4.01 SP1 Active Setup window opens. Click Next
11.6. Choose “I accept the agreement”. Click Next.
11.7. Installation Option appears with Standard Installation highlighted. Click Next.
11.8. Windows Desktop Update appears asking, “Would you like to install it?” Choose Yes.
11.9. Click Next.
11.10. Active Channel Selection – United States IS highlighted. Click Next.
11.11. Destination Folder window opens. C:\Program Files\Plus\Microsoft Internet is the default. Click Next.
11.12. After the file copying is complete, click OK
11.13. A message is displayed, “Setup must restart your computer”. Click OK
11.15. The Internet Explorer will finish installing before the desktop appears with a Welcome – Microsoft Internet Explorer window. Close this window now, and the next time this window appears (after rebooting), deselect the check box that says, “Show this next time you log in”

12.8. Changing Display Properties
Section C: Software Installation

12.1. Right click in an open area of the NT Desktop.


12.3. The Display Properties window opens. Click the Background tab.

12.4. Under the section Wallpaper click Mvsplash.

12.5. Click the Screensaver tab.

12.6. Under the section Screen Saver click either Starfield or Beziers. Note: These two selections are best since they cause less wear on the CPU and they are less prone to lockups than 3D screensavers.

12.7. Click the Web tab.

12.8. Deselect the check box next to “View my Active Desktop as a web page”.

12.9. Click the Plus! tab.

12.10. Select all possible choices listed in the Visual Settings section.

12.11. Click the Settings tab.

12.12. In the Font Size box select Large Fonts.

12.13. Click OK in message box for Change System Font.


12.15. Click OK for changes made in Plus!

12.16. Click Yes in the Change System Font.

12.17. Click OK for the Insert Disk message box.

12.18. Click Browse in the Files Needed dialogue box.

12.19. Click Open in the Locate File dialogue box.

12.20. Click OK in the Files Needed dialogue box.

12.21. Click No if asked to overwrite a newer file with an older file.

12.22. Click Yes (restart) in the System Settings Change message box.

12.23. Installing Joystick Drivers
If there is no Joystick accompanying this machine, disregard this block of instructions.

Click the Start button in the lower left corner of the NT Desktop.

Click Run.

Type D:\Joystic.bat

Click OK.

The Welcome window opens. Click Next.

The Installation Option window opens. Deselect all options except 32 bit Universal Library and Install.

Click Next.

The Choose Destination Location window opens. Click Next.

The Create Program Folder window opens. Click Next.

Close the Computer Boards window.

A Question window opens after all files have been copied. Choose No.

A Restarting Computer window opens. Choose "No, I will start my computer later". Click OK.

Installing MicroVision Front End Software

Click Start in the lower left corner of the NT Desktop.

Scroll to and click Run.

Type D:\MV375.bat. Click OK.

The Selected Components window opens.

Select choices required by the customer and follow all directs on the screen.

After all selections have been made and all files have been copied a Setup Complete window opens.

"Yes I want to restart my computer now" is the default. Click Finish.

Starting UPS Service
If UPS will not be used, disregard this section of instructions.

Click Start in the lower left corner of the NT Desktop.

Scroll to and select Settings.

Scroll to and select Control Panel.

Double click the Services icon.

The Services window opens. Highlight MicroVision UPS Service.

Click Start Up.

The Service window opens. Click Automatic.

Click OK.

The Services window opens once again. Click Start.

Click Close.

Close Control Panel.

Changing Computer Name

If installing on a new build skip this step. Click Start in the lower left corner of the NT Desktop.

Scroll to and select Settings.

Scroll to and select Control Panel.

Double click the Network icon.

Click the Identification tab. Click the Change button. The Identification Changes window opens.

Type the Tool ID Number into the space provided. Click OK.

The Network Configuration window opens. Click OK.

Skip to step 17.5.

Installing Computone Driver
Click Start in the lower left corner of the NT Desktop.
Scroll to and select Settings.
Scroll to and select Control Panel.
Double click the Network icon.
Click the Adapters tab.
Click Add. The Select Network Adapter window opens.
Click Have Disk... The Insert Disk window opens.
Type \swd\v4\win32app\mvdrvlib\computone in the appropriate box.
Click OK. The Select OEM Option window opens.
Click OK. The V4 Configuration window opens.
Make the following selections:
Mode: Enhanced
IRQ: 5
I/O Addr: 0x40
Serial: 2
Com: 3.
Note: The Board 2 section should not be used.
Click OK. The V4 Board Switch Setting window opens.
All switches should be Off except 4 and 9, read from left to right. Click OK.
The Network window opens. Click Close.
The Network Settings Changes window opens. Click Yes.

18.0. Copying Saved Files
Copy all files saved on the floppy during Step 1.0 back to the appropriate drive/ directory.

19.0. Changing to Magnified Cursors (Optional)
Click Start in the lower left corner of the NT Desktop.
Scroll to and select Settings.
Scroll to and select Control Panel.
Double click the Mouse icon.
Click the Pointers tab.
Select Magnified from the Scheme box. Click OK.

20.0. Deleting Unwanted Icons (Optional)
20.1. Delete unwanted icons from the desktop; the Confirm Folder Delete window will open for each.
20.2. Click Yes.

21.0. Auto-hide Start Bar (Optional)
21.1. Right click the bar at the bottom of the NT Desktop.
21.2. Click Properties on the pull down menu that has appeared.
21.3. Click the Task Bar tab if it is not already selected.
21.4. Click Auto Hide.
21.5. Click OK.

22.0. Adding WorkStation.exe to StartUp (Optional)
22.1. Right click Start in the lower left corner of the NT Desktop.
22.2. Click Explore. The Exploring window opens.
22.3. Click the plus sign + next to the Programs folder.
22.4. Click the StartUp folder.
22.5. Click File in the menu bar at the top of the window.
22.7. Type c:\win32app\workstation\workstation.exe into the Command line.
22.8. Click Next.
22.9. The Select Title for the Program window opens. Click Finish.

23.0. Adjusting Date, Time and Time Zone (Optional)
23.1. Double click the time displayed in the bottom right corner of the NT Desktop. Adjust the time, date, and time zone as needed. Click OK.
Section D: System Setup & Integration

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Using the Host NT Software

Host Software Overview

The Host software serves as a system technician's primary means of interfacing with the Microvision MVT 7080 controller, or motion governor. All controller setup, system integration and module testing procedures are performed using this command language. The following pages will describe how to access Host, provide a brief overview of the Host syntax, and define the ASCII command names that serve as the base of this language.

Accessing Host NT

Host commands can be issued to the controller via two different software interfaces: the Host interface, and the WorkStation interface. Each procedure described in this manual indicates which of these interfaces should be employed for its successful completion.

Host Interface:

From within the Windows NT desktop select (double click) the Host NT version 4.7 icon to prompt the display of the Host NT window. The system is now ready to accept Host commands at the command line.

Alternatively, a user may access Host NT software from within the workstation interface via Controller Terminal windows, shown to the right. This is done by selecting Diagnostics from the main window menu bar and Controller 1 (for controller channel 1) or 2 (for controller channel 2) from the Diagnostics pull-down menu.

Note that the host interface accessed from the Windows NT desktop should be used to perform most setup and integration procedures, while the controller terminal windows can be used to perform minor or fine adjustments.
Using the Host NT Software

Host NT Syntax

Host commands issued to the controller must adhere to the following format:

[command] [object of reference] [parameter # or value] [parameter value or blank]

For example, using the above format, the command WELR 11 1 1 can be interpreted in the following manner:

WELR = pick up wafer [11 = cassette station 01] [1 = wafer # 1] [1 = paddle 1]

Therefore, entering WELR 11 1 1 at the Host NT command line would prompt the robot module to pick up wafer # 1 from cassette station B using robot paddle 1.

<table>
<thead>
<tr>
<th>Robot Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Load wafer</td>
</tr>
<tr>
<td>L2</td>
<td>Load cassette</td>
</tr>
<tr>
<td>L3</td>
<td>Load robot</td>
</tr>
<tr>
<td>L4</td>
<td>Load station</td>
</tr>
<tr>
<td>M1</td>
<td>Move wafer</td>
</tr>
<tr>
<td>M2</td>
<td>Move cassette</td>
</tr>
<tr>
<td>M3</td>
<td>Move robot</td>
</tr>
<tr>
<td>M4</td>
<td>Move station</td>
</tr>
<tr>
<td>C1</td>
<td>Clear wafer</td>
</tr>
<tr>
<td>C2</td>
<td>Clear cassette</td>
</tr>
<tr>
<td>C3</td>
<td>Clear robot</td>
</tr>
<tr>
<td>C4</td>
<td>Clear station</td>
</tr>
<tr>
<td>R1</td>
<td>Run program</td>
</tr>
<tr>
<td>R2</td>
<td>Run macro</td>
</tr>
<tr>
<td>R3</td>
<td>Run script</td>
</tr>
<tr>
<td>R4</td>
<td>Run function</td>
</tr>
</tbody>
</table>

Section D: System Integration D-3

Host NT Software

NT Syntax

Host commands issued to the controller must adhere to the following format:

[command] [object of reference] [parameter # or value] [parameter value or blank]

For example, using the above format, the command WELR 11 1 1 can be interpreted in the following manner:

WELR = pick up wafer [11 = cassette station 01] [1 = wafer # 1] [1 = paddle 1]

Therefore, entering WELR 11 1 1 at the Host NT command line would prompt the robot module to pick up wafer # 1 from cassette station B using robot paddle 1.

Command | Description | Syntax  | Example |
---------|-------------|---------|---------|
L1       | Load wafer  | L1(1)   | L1(1)   |
L2       | Load cassette| L2(0)   | L2(0)   |
L3       | Load robot  | L3(0)   | L3(0)   |
L4       | Load station| L4(0)   | L4(0)   |
M1       | Move wafer  | M1(1)   | M1(1)   |
M2       | Move cassette| M2(1)   | M2(1)   |
M3       | Move robot  | M3(1)   | M3(1)   |
M4       | Move station| M4(1)   | M4(1)   |
C1       | Clear wafer  | C1(0)   | C1(0)   |
C2       | Clear cassette| C2(0)   | C2(0)   |
C3       | Clear robot  | C3(0)   | C3(0)   |
C4       | Clear station| C4(0)   | C4(0)   |
R1       | Run program  | R1(0)   | R1(0)   |
R2       | Run macro   | R2(0)   | R2(0)   |
R3       | Run script  | R3(0)   | R3(0)   |
R4       | Run function | R4(0)   | R4(0)   |

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<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Syntax</th>
<th>Examples</th>
</tr>
</thead>
</table>
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Using the Host |
### Using the Host NT Software

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<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Syntax</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAPA</td>
<td>Get offset of a finished piece</td>
<td>MAPA</td>
<td>MAPA 2</td>
</tr>
<tr>
<td>MAPC</td>
<td>Get data matching megaphone</td>
<td>MAPC [Device]</td>
<td>MAPC 1, 7</td>
</tr>
<tr>
<td>MAPS</td>
<td>Get data matching megaphone and count in water status</td>
<td>MAPS</td>
<td>MAPS 1, 2</td>
</tr>
<tr>
<td>MARK</td>
<td>Sensor mapping file height</td>
<td>MARK [file]</td>
<td>MARK 1, 2</td>
</tr>
<tr>
<td>MAPS</td>
<td>Generator alignment data</td>
<td>MAPS [Device]</td>
<td>MAPS 1, 2</td>
</tr>
<tr>
<td>MCLR</td>
<td>Motor current for specified and accepted energy</td>
<td>MCLR [Device]</td>
<td>MCLR 1, 2</td>
</tr>
<tr>
<td>SWB</td>
<td>Number of designer data</td>
<td>SWB [Device]</td>
<td>SWB 1, 2</td>
</tr>
<tr>
<td>NME</td>
<td>Set current limits of specific sector</td>
<td>NME [Device]</td>
<td>NME 1, 2</td>
</tr>
<tr>
<td>MDFC</td>
<td>Motor deviation limits to be modified</td>
<td>MDFC</td>
<td>MDFC 1, 2</td>
</tr>
<tr>
<td>MDF</td>
<td>Deviation limits for a specified time</td>
<td>MDF [Device]</td>
<td>MDF 1, 2</td>
</tr>
<tr>
<td>MDL</td>
<td>Set current limits for a specified timer</td>
<td>MDL [Device]</td>
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</tr>
<tr>
<td>MDFC</td>
<td>Learn limits for a specified timer</td>
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</tr>
<tr>
<td>Command</td>
<td>Description</td>
<td>Syntax</td>
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<td>---------</td>
<td>-------------</td>
<td>--------</td>
<td>---------</td>
</tr>
<tr>
<td>FILTER</td>
<td>Lyre resonance is off for longer or programmable stage modes</td>
<td>FILTER [R] (or [T])</td>
<td>FILTER T</td>
</tr>
<tr>
<td>AUTOS</td>
<td>Turn rejection on for longer or programmable stage modes</td>
<td>AUTOS [R] (or [T])</td>
<td>AUTOS T</td>
</tr>
<tr>
<td>TUNE</td>
<td>Turn resonance on for longer or programmable stage modes</td>
<td>TUNE [R] (or [T])</td>
<td>TUNE T</td>
</tr>
<tr>
<td>VAR</td>
<td>manual resonance is on for longer or programmable stage modes</td>
<td>VAR [R] (or [T])</td>
<td>VAR T</td>
</tr>
<tr>
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</tr>
<tr>
<td>VAR</td>
<td>manual resonance is on for longer or programmable stage modes</td>
<td>VAR [R] (or [T])</td>
<td>VAR T</td>
</tr>
</tbody>
</table>

**Using the Host NT Software**

---

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Controller Setup

The controller governs the motion of all system modules. Before a system's modules can be integrated into a coordinated working unit, however, the controller's processor card must be checked, tested and loaded with the latest hex and configuration files, using the following procedures:

1. 0. Using the diagram below, visually check the processor card for the following:
   - Crystal upgraded to 66 MHz (label on chip states speed)
   - Processor Intel 1960 CF 33 MHz chip
   - JP15 in ON position (pins 1 and 2 jumpered)
   - JP12, JP13 and JP16 in OFF position (pins 2 and 3 jumpered)
   - Hex EEPROM
   - Config EEPROM
   - Boot EEPROM
Controller Setup

2.0. Power-up the Controller and verify that the 5 volt indicator on the distribution board flashes on then off.

3.0. Upgrade to current hex and boot version.

3.1. Enter the system’s current version of Host software.

3.2. Initiate a self-diagnostic check to see if the computer and controller are communicating properly; a return of ‘0’ indicates successful communication.

SELF

3.3. Record the system’s current configuration file. The configuration file will be named SETUP.CFG and placed in the host directory.

3.4. Exit the Host software and make sure SETUP.CFG was recorded successfully.

QUIT

3.5. Re-enter the Host software.

3.6. Erase the current configuration file stored on the Config EEPROM; this takes about 30 seconds.

ERAS 2

3.7. Erase the current hex code stored on the Hex EEPROM; this takes about 30 seconds.

ERAS 1

3.8. Turn off the controller and wait a minute, then turn it back on.

3.9. Copy the SETUP.CFG file to a floppy disk. Also copy any Workstation recipes and setup screens you want transferred over to the new software.

3.10. Follow the Workstation software installation procedures outlined in Section C: Installing Software to install new workstation software and the latest hex code and host versions.

3.11. Locate the Boot EEPROM on the processor board; if it is not labeled Boot 4.0 a new Boot EEPROM will have to be installed. Procedures 3.11.1. through 3.11.9. describe how to do this:

3.11.1. Power down the controller box and remove its lid.

3.11.2. Disconnect the cable going to the mapping board located in front of the processor board.

3.11.3. Use the white tabs to remove the processor board from the distribution board.

3.11.4. Place the processor board on a flat surface.

3.11.5. Use an EPROM extractor, or small screwdriver, to remove the obsolete device - be careful not to bend the leads while removing or installing EPROMs.

3.11.6. Install the new Boot EEPROM (BOOT 4.0)

3.11.7. Making sure that the pin 1 location is facing up, install the processor board back into place with the cable going into the mapping board.

3.11.8. Power the controller box back up.

3.11.9. Open the Host software and initiate a self-diagnostic check; ‘O004’ should be the response, meaning there isn’t a hex file loaded.

SELF
Section D: System Integration

Controller Setup

3.13. Download the latest version of hex code to the EEPROM (this will change the baud rate automatically and install the hex code, this generally takes 3-4 minutes).

3.14. Install the new configuration file, this takes 2-3 minutes. Be sure to designate the correct configuration: 2 cassette = 2c.cfg; 2 cassette / bright light = 2cbl.cfg; 3 cassette = 3c.cfg; 3 cassette / bright light = 3cbl.cfg; 4 cassette = 4c.cfg.

3.15. Save the parameters and reset the controller (This will activate the new software code in the EEPROM; once the controller has been powered down and up).

3.16. Once the controller has been powered up, open the Host software and initiate a self-diagnostic check; a ‘0’ should be the response, indicating that the Hex and Config files were transferred correctly.

3.17. Insert the floppy disk containing the system’s old configuration data, SETUP.CFG, into the computer’s floppy disk drive. Double-click on the My Computer icon in the NT Desktop and display the contents of the floppy disk drive. Double-click on SETUP.CFG to open it in NOTEPAD. Save the NOTEHEAD and Host windows so that they are displayed side by side.

3.18. In the Host software, set the following motor parameters in the new configuration (displayed in Host) to match those in the old configuration file (displayed in NOTEHEAD).

- KJRK 0 [value from NOTEHEAD] KJRK 1 [value from NOTEHEAD]
- KPRP 0 [value from NOTEHEAD] KPRP 1 [value from NOTEHEAD]
- KDRV 0 [value from NOTEHEAD] KDRV 1 [value from NOTEHEAD]
- KINT 0 [value from NOTEHEAD] KINT 1 [value from NOTEHEAD]
- KJRK 2 [value from NOTEHEAD] KJRK 3 [value from NOTEHEAD]
- KPRP 2 [value from NOTEHEAD] KPRP 3 [value from NOTEHEAD]
- KDRV 2 [value from NOTEHEAD] KDRV 3 [value from NOTEHEAD]
- KINT 2 [value from NOTEHEAD] KINT 3 [value from NOTEHEAD]
- KJRK 4 [value from NOTEHEAD] KJRK 5 [value from NOTEHEAD]
- KPRP 4 [value from NOTEHEAD] KPRP 5 [value from NOTEHEAD]
- KDRV 4 [value from NOTEHEAD] KDRV 5 [value from NOTEHEAD]
- KINT 4 [value from NOTEHEAD] KINT 5 [value from NOTEHEAD]
- KPRP 6 [value from NOTEHEAD] KPRP 7 [value from NOTEHEAD]
- KDRV 6 [value from NOTEHEAD] KDRV 7 [value from NOTEHEAD]
- KINT 6 [value from NOTEHEAD] KINT 7 [value from NOTEHEAD]
- TUNF 1 [value from NOTEHEAD] TUNR 1 [value from NOTEHEAD]
- TUNF 2 [value from NOTEHEAD] TUNR 2 [value from NOTEHEAD]
- TUNF 3 [value from NOTEHEAD] TUNR 3 [value from NOTEHEAD]
- TUNF 4 [value from NOTEHEAD] TUNR 4 [value from NOTEHEAD]

3.19. Save the parameters.

3.20. Reference the robot, aligner and bright light modules to ensure that the new parameter values were set correctly.

3.21. Proceed to integrate the sorter modules using the appropriate configuration-specific procedure set.
2-Cassette System Setup & Integration Sequence:

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Initial Power-Up & Hardware Check; 2-Cassette

1.1.0. System Power-Up

1.1.1. Set the controller On/Off switch to the On position.

1.1.2. Make sure E-Stop is pulled out and turn the system On/Off switch clockwise as far as it will go to power up the controller - note that the On/Off switch will return to a position midway between the Off and On labels. Wait 20 seconds and again turn the system On/Off switch clockwise as far as it will go to activate system motor.

1.1.3. Power-up the VGA color monitor.

1.1.4. Power-up the system PC. The computer will scan for a keyboard, mouse and viruses, check the integrity of the hard drive, and load Windows NT.

1.1.5. Once Windows NT has loaded, a Welcome window will appear, prompting the operator for a user name and password; enter these in the appropriate boxes and verify that WORKSTATION is displayed in the box labeled From:. Select the OK button to prompt the display of the Windows NT Desktop window.

1.1.6. Within the Windows NT Desktop locate and select (double click) the Host NT icon to prompt the display of the Host NT window. The system is now ready to accept host commands at the command line.

1.2.0. Controller Board 1 (Master)

1.2.1. Perform self-diagnostic test; a return of 0 ensures that serial connections to controller board 1 are sound.

1.3.0. Main Vacuum Test

1.3.1.1. Verify that the system vacuum sensor is connected to the AUX port on the controller back panel.

1.3.1.2. Detach the vacuum line from the back of the sorter chassis. Turn the sensor adjustment screw CW until the LED turns on, then CCW until the LED turns off.

1.3.1.3. Reattach the vacuum line to the back of the sorter chassis and verify that the LED turns on.

1.3.1.4. Prompt the current hardware sensor status of the controller.

1.3.1.5. Detach the main vacuum line from the sorter chassis.

1.3.1.6. Again, prompt the current hardware sensor status of the controller, the returned values should be different than those returned in step 1.3.1.4.

1.3.2. Robot Paddle Vacuum Test
1.3.2.1. Activate paddle 1 vacuum.
SVAC 1 1 1

1.3.2.2. Adjust paddle 1 vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

1.3.2.3. Deactivate paddle 1 vacuum.
SVAC 1 1 0

1.3.2.4. Activate paddle 2 vacuum.
SVAC 1 2 1

1.3.2.5. Adjust paddle 2 vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

1.3.2.6. Deactivate paddle 2 vacuum.
SVAC 1 2 0

1.3.2.7. Place a small wafer on paddle 1 and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).
VACT 1 1

1.3.2.8. Turn paddle 1 vacuum adjustment screw and repeat vacuum test until turn-on value is 35000 (± 5000); remove wafer.

1.3.2.9. Place a small wafer on paddle 2 and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).
VACT 1 2

1.3.2.10. Turn paddle 2 vacuum adjustment screw and repeat vacuum test until turn-on value is 35000 (± 5000); remove wafer.

1.3.3. Aligner Chuck Vacuum

1.3.3.1. Activate aligner chuck vacuum.
SVAC 2 1 1

1.3.3.2. Remove the back cover of the aligner and adjust the vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

1.3.3.3. Deactivate aligner chuck vacuum.
SVAC 2 1 0

1.3.3.4. Place a small wafer on aligner chuck and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).
VACT 2 1

1.3.3.5. Turn aligner chuck vacuum sensor adjustment screw and repeat vacuum test until turn-on and turn-off values are 35000 (± 5000); remove wafer.

1.3.3.6. Replace aligner back cover.

1.4.1. Reference Robot Module
1.4.1.1. Reference robot theta axis.
   MREF 1 (make sure 11 references in all four quadrants)

1.4.1.2. Disable robot paddle axis motor.
   MEBL 2 0

1.4.1.3. Manually swing the robot paddle over the robot, record position, enable robot paddle axis motor, and reference robot paddle axis.
   RPDS 2 1
   MEBL 2 1
   MREF 2

1.4.1.4. Reference robot z axis.
   MREF 0

1.4.2. Reference Aligner Module
   1.4.2.1. Reference aligner theta and x axes motors.
   MREF 3
   MREF 4

1.4.3. Check Array Board
   1.4.3.1. Turn on the illumination and check the pixels of the array.
            OUTP 4 100
            ALND (128 should scroll up and down the screen)

   1.4.3.2. Stop the scrolling and turn off the illumination.
            ESC (stops the scrolling)
            OUTP 4 0

1.4.4. Check the upper light source on the wafer light
   1.4.4.1. Turn on the light above the acrylic block.
            OUTP 5 100

   1.4.4.2. Turn off the light source.
            OUTP 5 0

1.4.5. Check the lower light source on the wafer light
   1.4.5.1. Turn on the light source below the light shield.
            OUTP 10 100

   1.4.5.2. Turn off the light source.
            OUTP 10 0
System Integration: 2-Cassette

2.1.0. Cassette Station Levelling

2.1.1. On the underside of the sorter chassis, locate each cassette station's respective access port and loosen the four fasteners located there.

2.1.2. Remove the sensor cable clamps that cover up the set screw holes under the cassette stations.

2.1.3. Loosen the three set screws located under the cassette station until they are not touching the bottom of their station.

2.1.4. Raise the robot z axis.

2.1.5. Disable the robot theta and paddle motors.

2.1.6. Turn on robot paddle 1 vacuum and place a wafer over the vacuum port.

2.1.7. Manually rotate the robot theta axis to swing paddle 1 and the wafer over the cassette station - note that the centerline of paddle 1 must point to the center of the robot for proper leveling. Using the wafer as a baseline, determine which cassette station is the highest; proceed to level that station first.

2.1.8. Place three leveling blocks around the edge of the highest cassette station. Manually swing the wafer over the cassette station. Lower the robot z axis until the underside of the wafer makes contact with one of the blocks.

2.1.9. Adjust the three set screws under the station until the wafer makes equal contact with all three blocks. Once the station is level, rotate the set screw located closest to the robot clockwise (CW) 1/4 turn.

2.1.10. Manually swing paddle 1 and the wafer away from the station. Beginning with the two fasteners situated farthest from the robot and proceeding in small increments, retighten the four fasteners located on the underside of the pedestal.

2.1.11. Manually swing paddle 1 and the wafer back over the station and use the blocks to ensure that it is still level. Repeat the leveling procedure if necessary.

2.1.12. While supporting the wafer, turn off the vacuum to robot paddle 1 and remove the wafer.

2.1.13. Enable the robot theta and paddle motors.

2.1.14. Enable the robot theta and paddle motors.
2.2.9. Robot Paddle Calibration

2.2.1. Reference the robot theta axis.
MREF 1

2.2.2. Reference the robot paddle axis.
MREF 2

2.2.3. Set the station reference flag for the robot.
SRFL 1

2.2.4. Rotate the robot paddle axis until paddle 1 is centered over the robot.
MOV R 2 [degrees]

2.2.5. Place a calibration pin into the robot calibration pin hole.

2.2.6. Rotate the robot paddle axis until the inside edge of paddle 1 makes contact with calibration pin, as paddle one approaches the pin, decrease the increment of rotation.
MOV R 2 [degrees]

2.2.7. Set the robot paddle reference position and paddle 1 calibration angle.
RPOS 2 1
MREF 2
SCAL 1 1 0

2.2.8. Check to see if robot paddle 1 centers properly over the robot.
MVPC 1

2.2.9. Save settings.
SAVE
System Integration:

Section D: System Integration

2.3.6. Robot Z Axis Calibration

2.3.1. Center robot paddle 1 over the center of the robot and set the robot height (z axis) to 1 inches.

MOVC 1

MOVA 0 1

2.3.2. Rotate the robot theta axis until the robot faces cassette station A.

MOVR 1 [n degrees]

2.3.3. Extend paddle 1 out over cassette station A.

MOVR 2 180

2.3.4. Adjust the robot z axis brake timeout value.

SCAL 1 6 10000000

2.3.5. Place a 1 inch calibration block adjacent to the tip of the extended robot paddle. Raise or lower the robot z axis until the height of the paddle’s bottom edge matches that of the block - as paddle 1 approaches the block downward movement should be in increments of .001".

MOVR 0 [+/- .001]

2.3.6. Set the robot z axis motor reference position.

RPOS 0 1

2.3.7. Reference the robot z axis.

MREF 0

2.3.8. Move the robot z axis to the newly set zero position.

MOVA 0 0

2.3.9. Center paddle 1 over the robot, then extend it out over the cassette station A; use the calibration block to see if RPOS recorded properly.

MOVC 1

MOVR 2 180

2.3.10. Center paddle 2 over the robot, then extend it out over the cassette station A; use the calibration block to see if RPOS recorded properly.

MOVC 2

MOVR 2 180

2.3.11. Raise or lower the robot z axis until the height of the paddle’s bottom edge is equal to the height of the block - as paddle 2 approaches the block downward movement must be in increments of .001".

MOVR 0 [+/- .001]

2.3.12. Set the paddle offset and center paddle 1 over the robot.

POFF 1

MVPC 1

2.3.13. Set default limits for the robot z, theta and paddle axes.

FLIM 0

FLIM 1

FLIM 2

2.3.14. Reset the robot z axis brake timeout value.

SCAL 1 6 2000000

2.3.15. Save settings.

SAVE
2.4.0. **Can Angle Calibration**

2.4.1. Center robot paddle 1 over the robot, prompt a reading of the robot z-axis negative limit, and move the robot z-axis to a height that equals its negative limit plus 1 inch.

MOVC 1
LINN 0
MOVA 0 [negative limit + 1]

2.4.2. Rotate the robot theta axis until the robot faces cassette station A.

MOVR 1 [degrees]

2.4.3. Center robot paddle 1 over the robot then extend it over cassette station A.

MVPC 1
MOVR 2 180

2.4.4. Place a calibration pin in the calibration hole on top of cassette station A. Rotate the robot theta axis in small increments until the paddle makes contact with the calibration pin.

MOVR 1 [± 12 degrees]

2.4.5. Define the world position and set the can angles for a sorter with two cassettes.

FWLD 155
SCAL 2 0 0
SCAL 10 0 155
SCAL 11 0 155
XPOS 1 0
SCAL 1 7 55
SREF 1

2.4.6. Test the settings by rotating the paddle end of the robot to face the aligner.

SPRK 1

2.4.7. Save settings.

SAVE
Section D: System Integration

2.5.0. Aligner Calibration

2.5.1. Reference all aligner axes.
SREF 2

2.5.2. Move aligner x axis until the chuck is positioned over the center of the module.
MOVR 4 [-.2 inches]

2.5.3. Center robot paddle 1 over the robot and rotate the robot theta axis until the robot's paddle end faces the aligner.
MVRC 1

2.5.4. Raise the robot z axis to a height above the aligner chuck.
MOVA 0 3.0

2.5.5. Extend robot paddle 1 over the aligner chuck and turn on robot paddle 1 vacuum.
MOVR 2 180
SVAC 1 1

2.5.6. Manually place a wafer onto robot paddle 1. Make sure it is centered over the chuck.

2.5.7. Lower the robot z axis until any part of the wafer makes contact with the aligner chuck. Do not proceed lower than the aligner chuck as this may damage the wafer.
MOVR 0 [-.005 inches]

2.5.8. Access the aligner's bottom panel and loosen the four shoulder bolts if they do not have springs. Adjust the three aligner leveling screws until the gap between the chuck and the wafer appears even from all vantage points. Retighten the shoulder bolts if they do not have springs.

2.5.9. While supporting the wafer turn off paddle 1 vacuum.
SVAC 1 1

2.5.10. Move the aligner x axis in a positive direction.
MOVR 4 2

2.5.11. Place a calibration pin in the calibration hole on top of the aligner's surface. Make sure it is perpendicular to the top plate.

2.5.12. Move the aligner x axis in the negative direction until the calibration pin makes contact with robot paddle 1.
MOVR 4 [-.02 inches]

2.5.13. Record the aligner x axis reference position, set the aligner x axis transfer position, and reference the aligner module.
RPOS 4 1
XPOS 4 0
MREF 4

2.5.14. Pull the calibration pin out of the aligner's calibration hole and park the aligner.
SPRK 2

2.5.15. Check to see if the aligner parked at the correct position, then center robot paddle 1 over the robot.
MVPC 1

2.5.16. Set default limits for aligner x and theta axes.
FLIM 3
FLIM 4

2.5.17. Save settings.
SAVE
2.6.0. Setting Aligner Transfer Position

2.6.1. Center robot paddle 1 over the robot and rotate the robot theta axis until the robot's paddle is level with the aligner.

`MOVC 1`

2.6.2. Raise the robot z axis to a height above the aligner chuck.

`MOVA 0 2.5`

2.6.3. Extend robot paddle 1 over the aligner chuck and turn on robot paddle 1 vacuum.

`MOVR 2 180`

2.6.4. Manually place a wafer onto robot paddle 1. Make sure it is centered over the chuck.

2.6.5. Set the aligner transfer position by repeatedly lowering the wafer until contact with the aligner chuck is sensed.

`FVAC 2 1`

2.6.6. Set the default transfer heights.

`SCAL 2 1 -.03`

`SCAL 2 2 -.05`

`SCAL 2 3 -.015`

`SCAL 2 4 0.03`

2.6.7. Save settings.

`SAVE`
2.7.0. **Aligner Sensor Array Calibration**

2.7.1. Turn on the aligner sensor array illumination

OUTP 4 100

2.7.2. Use a small flathead screwdriver to gently turn the potentiometer to maximum brightness; be careful not to strip the potentiometer as its maximum range of motion is only 3/4 turn.

2.7.3. Move the aligner x-axis until the wafer edge is centered under the aligner sensor array.

MOVX 4 [* distance]

2.7.4. Prompt a display of the wafer edge location with respect to the sensor array; a properly positioned edge would read between 60 and 68. Select the ESC button to terminate the ALND display.

ALND

2.7.5. Adjust the aligner x-axis as needed.

MOVX 4 [± .05]

2.7.6. Repeat steps 7.4. and 7.5. until the ALND reading falls between 60 and 68.

2.7.7. Turn the potentiometer until ALND reading decreases by 1. Select the ESC button to terminate the ALND display.

ALND

2.7.8. Turn off aligner sensor array illumination.

OUTP 4 0

2.7.9. Autocalibrate the aligner sensor array.

ALNC 1

2.7.10. Support the wafer by hand, turn off the aligner chuck vacuum and manually remove the wafer.

SVAC 2 1 0

2.7.11. Save settings.

SAVE
2.8.0. Laser Offset Setup

2.8.1. Reference all robot axes.
SREF 1

2.8.2. Set wafer mapping algorithm.
MAPA 2

2.8.3. To determine the laser offset position, first place a calibration pin at the calibration hole on the top of cassette station A. Next, position a white card or slip of paper behind the pin, opposite the robot. Execute the following commands to position the robot z and theta axes so that the robot laser is aimed at the calibration pin.

LIMN 0 (returns negative limit)
MOVA 0 [negative limit + .05 inches]
MOVA 1 90

2.8.4. Turn on the laser and rotate the robot theta axis until the shadow of the pin falls directly in the center of the laser beam projected onto the paper.
LASR 1
MOVR 1 [.2]

2.8.5. Prompt the current robot theta position and use it to set the laser offset.
MPOS 1 (returns current position)
SCAL 1 14 [90 - current position]

2.8.6. Turn the laser off.
LASR 0

2.8.7. Save the settings.
SAVE
2.9.1. Place a full cassette on cassette station A. Remove the wafer in slot 2.

2.9.2. Calibrate the mapping set up.

MAPS 10

2.9.3. Put the wafer back in slot 2.

2.9.4. Map the cassette.

MAPC 10

2.9.5. Prompt a return of the mapping data over a specified range of mapping angles.

SCAN 10 -2.4.2

2.9.6. Study the returned mapping angles and their corresponding data. Determine at which mapping angles this cassette was correctly mapped. From among the angles that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.8) in the following procedures.

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<th>Angle</th>
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<td>-1.8</td>
<td>0.00000000000000000000000000000000</td>
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<td>-1.6</td>
<td>1.04000000000000000000000000000000</td>
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<td>-1.4</td>
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<tr>
<td>-1.2</td>
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<tr>
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2.9.7. Set the low mapping angle.

SCAL 10 [low angle value]

2.9.8. Set the high mapping angle.

SCAL 10 [high angle value]

2.9.9. Auto calibrate the best mapping start position.

MAPH 10

2.9.10. Map the cassette and check the accuracy of returned data.

MAPC 10

2.9.11. Save the settings.

SAVE
2.10.1. Place a full cassette on cassette station B.

2.10.2. Calibrate the mapping set up.

2.10.3. Put the wafer back in slot 2.

2.10.4. Map the cassette.

2.10.5. Return the mapping data over a specified range of mapping angles.

2.10.6. Study the returned mapping angles and their corresponding data. Determine at which mapping angles the cassette was correctly mapped. From among the angles that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (low = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.8) in the following procedures.

2.10.7. Set the low mapping angle.

2.10.8. Set the high mapping angle.

2.10.9. Auto calibrate the best mapping start position.

2.10.10. Map the cassette and check the accuracy of returned data.

2.10.11. Save the settings.
Setting Wafer Transfer Positions: Cassette Station A

2.11.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station A.

2.11.2. Map the cassette
MAPC 10

2.11.3. Find the negative limit and move the robot z axis to a position slightly above it:
LIMN 0
MOVA 0 \[negative limit + .1\]

2.11.4. Extend robot paddle 1 into the cassette below wafer 1:
WE00 10 1

2.11.5. Repeatedly raise robot height until vacuum contact with wafer 1 is sensed.
FVAC 10 1 \[repeat until contact is made\]

2.11.6. Remove paddle 1 from the cassette.
WO00 10 1

2.11.7. Establish robot paddle 1 offset. Repeat the following procedure (11.8-11.13) until paddle 1 is centered between wafers 1 and 2.

2.11.8. Move the robot z-axis to the wafer 2 drop-off height.
WDO0 10 2 1

2.11.9. Disable the robot theta axis motor.
MEBL 1 0

2.11.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

2.11.11. Adjust paddle 1 offset position.
SCAL 11 8 \[-003\]

2.11.12. Manually swing robot paddle 1 out of the cassette and center it over the robot.

2.11.13. Enable the robot theta axis motor.
MEBL 1 1

2.11.14. Check/adjust wafer pitch. Repeat the following procedure (11.15-11.21) until paddle 1 is centered between wafers 24 and 25.

2.11.15. Move the robot z-axis to the wafer 25 drop-off height.
WDO0 10 25 1

2.11.16. Disable the robot theta axis motor.
MEBL 1 0

2.11.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.

2.11.18. Adjust the wafer pitch.
SCAL 10 17 \[1.0001\]

2.11.19. Manually swing paddle axis out of cassette and center over robot.

2.11.20. Finable robot theta-axis.
MEBL 1 1

2.11.21. Map the cassette and check results for accuracy.
MAPC 10

2.11.22. Save Settings.
SAVE
2.12.0. Setting Wafer Transfer Positions: Cassette Station 6

2.12.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station 6.

2.12.2. Map the cassette:
MAPC 11

2.12.3. Find the negative limit and move the robot z-axis to a position slightly above it:
LIMM 0
MOVA 0 [negative limit + .1]

2.12.4. Extend robot paddle 1 into the cassette below wafer 1:
WE00 11 1

2.12.5. Repeatly raise robot height until vacuum contact with wafer 1 is sensed:
FVAC 11 1 (repeat until contact is made)

2.12.6. Remove paddle 1 from the cassette:
WOOR 11 1

2.12.7. Establish robot paddle 1 offset. Repeat the following procedure (12.8. - 12.13) until paddle 1 is centered between wafers 1 and 2:

2.12.8. Move the robot z-axis to the wafer 2 drop-off height:
WDOO 11 2 1

2.12.9. Disable the robot theta-axis motor:
MEBL 1 0

2.12.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2:

2.12.11. Adjust paddle 1 offset position:
SCAL 11 6 [.003]

2.12.12. Manually swing robot paddle 1 out of the cassette and center it over the robot:

2.12.13. Enable the robot theta-axis motor:
MEBL 1 1

2.12.14. Check/adjust wafer pitch. Repeat the following procedure (12.15. - 12.21) until paddle 1 is centered between wafers 24 and 25:

2.12.15. Move the robot z-axis to the wafer 25 drop-off height:
WDOO 11 25 1

2.12.16. Disable the robot theta-axis motor:
MEBL 1 0

2.12.17. Manually swing robot paddle 1 into cassette between wafers 24 and 25:

2.12.18. Adjust the wafer pitch:
SCAL 11 17 [.0001]

2.12.19. Manually swing paddle-axis out of cassette and center over robot:

2.12.20. Enable robot theta-axis:
MEBL 1 1

2.12.21. Map the cassette and check results for accuracy:
MAPC 11

2.12.22. Save Settings:
SAVE
System Integration:
2-Cassette / Bright Light

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Initial Power-Up & Hardware Check: 2-Cassette with Bright Light

1.1.0. System Power-Up

1.1.1. Set the controller On/Off switch to the On position.

1.1.2. Make sure E-Stop is pulled out and turn the system On/Off switch clockwise as far as it will go to power up the controller — note that the On/Off switch will return to a position midway between the Off and On labels. Wait 20 seconds and again turn the system On/Off switch clockwise as far as it will go to activate system motor.

1.1.3. Power-up the VGA color monitor.

1.1.4. Power-up the system PC. The computer will scan for a keyboard, mouse and viruses, check the integrity of the hard drive, and load Windows NT.

1.1.5. Once Windows NT has loaded, a welcome window will appear, prompting the operator for a user name and password; enter these in the appropriate boxes and verify that WORKSTATION is displayed in the box labeled From: Select the OK button to prompt the display of the Windows NT Desktop window.

1.1.6. Within the Windows NT Desktop locale and select (double-click) the Host NT Icon to prompt the display of the Host NT window. The system is now ready to accept host commands at the command line.

1.2.1. Controller Board 1 (Master)

Switch to controller channel 1 and perform self diagnostic test; a return of 1 ensures that serial connections to controller board 1 are sound.

CHAN 1 SELF

1.2.2. Controller Board 2 (Slave)

Switch to controller channel 2 and perform self diagnostic test; a return of 0 ensures that serial connections to controller board 2 are sound. Switch back to controller channel 1.

CHAN 2 SELF
CHAN 1

1.3.1. Main Vacuum Test

1.3.1.1. Verify that the system vacuum sensor is connected to the AUX port on the controller back panel.

1.3.1.2. Detach the vacuum line from the back of the sorter chassis. Turn the sensor adjustment screw CW until the LED turns on, then ICCW until the LED turns off.

1.3.1.3. Reattach the vacuum line to the back of the sorter chassis and verify that the LED turns on.

1.3.1.4. Prompt the current hardware sensor status of the controller.

HWST

1.3.1.5. Detach the main vacuum line from the sorter chassis.

1.3.1.6. Again, prompt the current hardware sensor status of the controller; the returned values should be different than those returned in step 1.3.1.4.

HWST

1.3.2. Robot Paddle Vacuum Test
System Integration: 2-Cassette / Bright Light

1.3.2.1. Activate paddle 1 vacuum.
SVAC 1 1

1.3.2.2. Adjust paddle 1 vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

1.3.2.3. Deactivate paddle 1 vacuum.
SVAC 1 0

1.3.2.4. Activate paddle 2 vacuum.
SVAC 1 2 1

1.3.2.5. Adjust paddle 2 vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

1.3.2.6. Deactivate paddle 2 vacuum.
SVAC 1 2 0

1.3.2.7. Place a small wafer on paddle 1 and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).
VACT 1 1

1.3.2.8. Turn paddle 1 vacuum adjustment screw and repeat vacuum test until turn-on value is 35000 (+ 5000); remove wafer.

1.3.2.9. Place a small wafer on paddle 2 and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).
VACT 1 2

1.3.2.10. Turn paddle 2 vacuum adjustment screw and repeat vacuum test until turn-on value is 35000 (+ 5000); remove wafer.

1.3.3. Aligner Chuck Vacuum

1.3.3.1. Activate aligner chuck vacuum.
SVAC 2 1 1

1.3.3.2. Remove the lock cover of the aligner and adjust the vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns on; 2) turn vacuum adjustment screw CCW until LED turns off; 3) turn vacuum adjustment screw CW until LED turns off.

1.3.3.3. Deactivate aligner chuck vacuum.
SVAC 2 1 0

1.3.3.4. Place a small wafer on aligner chuck and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).
VACT 2 1

1.3.3.5. Turn aligner vacuum sensor adjustment screw and repeat vacuum test until turn-on and turn-off values are 35000 (+ 5000); remove wafer.

1.3.3.6. Replace aligner back cover.
1.3.4. **Bright Light Vacuum**

1.3.4.1. Remove the guard on the bright light by unscrewing the three m4 fasteners.

1.3.4.2. Remove the access panel from the bright light gimbal housing – this panel is distinguishable by its two threaded sensor access holes. The bright light vacuum sensor is located on the left side of the module while the flipper vacuum sensor is located on the right.

1.3.4.3. Position the bright light chuck until it appears level

MOV R 7
MOV R 8

1.3.4.4. Place a small wafer on the bright light chuck and initiate a vacuum test to prompt turn-on value (left) and turn-off value (right).

VACT 3 1

1.3.4.5. Turn bright light vacuum sensor adjustment screw and repeat vacuum test until turn-on and turn-off values are 35,000 (± 5,000); remove wafer.

1.3.5. **Wafer Flipper Vacuum**

1.3.5.1. Remove the access panel from the bright light gimbal housing – this panel is distinguishable by its two threaded sensor access holes. The bright light vacuum sensor is located on the left side of the module while the flipper vacuum sensor is located on the right.

1.3.5.2. Switch to controller channel 2.

CHAN 2

1.3.5.3. Move the flipper up until it clears the top surface of the bright light chuck.

MOV R 19

1.3.5.4. Place a wafer over the vacuum ports of the flipper and hold it into position with your hand.

1.3.5.5. Place a wafer over the vacuum ports of the flipper and hold it into position by hand. Initiate a vacuum test to prompt turn-on value (left) and turn-off value (right).

VACT 3 2

1.3.5.6. Turn flipper vacuum sensor adjustment screw and repeat vacuum test until turn-on and turn-off values are 50,000 (± 5,000); remove wafer.

1.3.5.7. Park the bright light module.

SPRK 3

1.3.5.8. Switch to controller channel 1.

CHAN 1

1.4.1. **Reference Robot Module**

1.4.1.1. Reference robot theta axis.

RREF 1 (make sure it references in all four quadrants)

1.4.1.2. Disable robot paddle axis motor.

MEBL 2 0

1.4.1.3. Manually swing the robot paddle over the robot, record position, enable robot paddle axis motor, and reference robot paddle axis.

RPOS 2 1

MEBL 2 1

RREF 2

Section D: System Integration

1.4.1.4. Reference robot z axis.
MREF 0

1.4.2. Reference Aligner Module
1.4.2.1. Reference aligner theta and x-axes motors.
MREF 3
MREF 4

1.4.3. Check Array Board
1.4.3.1. Turn on the illumination and check the pixels of the array.
OUTP 4 100
ALND (128 should scroll up and down the screen)
1.4.3.2. Stop the scrolling and turn off the illumination.
ESC (stops the scrolling)
OUTP 4 0

1.4.4. Check the upper light source on the wafer light
1.4.4.1. Turn on the light above the acrylic block.
OUTP 5 100
1.4.4.2. Turn off the light source.
OUTP 5 0

1.4.5. Check the lower light source on the wafer light
1.4.5.1. Turn on the light source below the light shield.
OUTP 10 100
1.4.5.2. Turn off the light source.
OUTP 10 0

1.4.6. Reference Bright Light Module
1.4.6.1. Reference all bright light and flipper axes.
MREF 7
MREF 8
MREF 9
MREF 19
1.4.6.2. Reference bright light station.
SREF 3

1.4.7. Bright Light Illumination Check
1.4.7.1. Turn high-intensity lamp on then off.
OUTP 6 100
OUTP 6 0
System Integration: 2-Cassette with Bright Light

2.1.0. **Cassette Station Leveling**

2.1.1. On the underside of the sorter chassis, locate each cassette station's respective access port and loosen the four fasteners located there.

2.1.2. Remove the sensor cable clamps that cover up the set screw holes under the cassette stations.

2.1.3. Loosen the three set screws located under the cassette station until they are not touching the bottom of their station.

2.1.4. Raise the robot z axis.

2.1.5. Disable the robot theta and paddle motors.

2.1.6. Turn on robot paddle 1 vacuum and place a wafer over the vacuum port.

2.1.7. Manually rotate the robot theta axis to swing paddle 1 and the wafer out over the cassette stations. Note that the centerline of paddle 1 must point to the center of the robot for proper leveling. Using the wafer as a baseline, determine which cassette station is the highest; proceed to level that station first.

2.1.8. Place three leveling blocks around the edge of the highest cassette station. Manually swing the wafer over the cassette station. Lower the robot z axis until the underside of the wafer makes contact with one of the blocks.

2.1.9. Adjust the three set screws under the station until the wafer makes equal contact with all three blocks. Once the station is level, rotate the set screw located closest to the robot clockwise (CW) 1/4 turn.

2.1.10. Manually swing paddle 1 and the wafer away from the station. Beginning with the two fasteners situated farthest from the robot and proceeding in small increments, retighten the four fasteners located on the underside of the pedestal.

2.1.11. Manually swing paddle 1 and the wafer back over the station and use the blocks to ensure that it is still level. Repeat the leveling procedure if necessary.

2.1.12. Manually swing paddle 1 and the wafer over the next station, keeping the same robot 2 height, and perform the leveling procedure described above (2.1.9 - 2.1.11).

2.1.13. While supporting the wafer, turn off the vacuum to robot paddle 1 and remove the wafer.

2.1.14. Enable the robot theta and paddle motors.

---

**Notes for System Integration**

- **System Integration:** 2-Cassette with Bright Light
- **Robot Motor Control:**
  - MEBL 1
  - MEBL 2
- **Vacuum Control:**
  - SVAC 1
- **Adjustments:**
  - MOVR
  - MOVA
  - MEBL 0
  - MEBL 2

---

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Section D: System Integration

Robot Paddle Calibration

2.2.0. Reference the robot theta axis.
MREF 1

2.2.1. Reference the robot paddle axis.
MREF 2

2.2.2. Set the station reference flag for the robot.
SRFL 1

2.2.3. Reference the robot paddle axis until paddle 1 is centered over the robot.
MOV R 2 [x degrees]

2.2.4. Place a calibration pin into the robot calibration pin hole.

2.2.5. Rotate the robot paddle axis until paddle 1 makes contact with calibration pin; as paddle one approaches the pin, decrease the increment of rotation.
MOV R 2 [y degrees]

2.2.6. Set the robot paddle reference position and paddle 1 calibration angle.
RPOS 2 1
MREF 2
SCAL 1 1 0

2.2.7. Check to see if robot paddle 1 centers properly over the robot.
MVPC 1

2.2.8. Save settings.
SAVE

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2.3.0. Robot Z Axis Calibration

2.3.1. Center robot paddle 1 over the center of the robot and set the paddle height (Z axis) to 1 inch.
   MOVC 1
   MOVA 0.1

2.3.2. Rotate the robot theta axis until the robot faces cassette station A.
   MOVR 1 [± degrees]

2.3.3. Extend paddle 1 out over cassette station A.
   MOVR 2 180

2.3.4. Adjust the robot Z axis brake timeout value.
   SCAL 1 6 1000000

2.3.5. Place a 1 inch calibration block adjacent to the tip of the extended robot paddle.
   Raise or lower the robot Z axis until the height of the paddle's bottom edge matches that of the block - as paddle 1 approaches the block downward movement must be in increments of .001".
   MOVR 0 [+ or - .001]

2.3.6. Set the robot Z axis motor reference position.
   RPOS 0 1

2.3.7. Reference the robot Z axis.
   MREF 0

2.3.8. Move the robot Z axis to the newly set zero position.
   MOVA 0 0

2.3.9. Center paddle 1 over the robot, then extend it out over the cassette station A, use the calibration block to see if RPOS recorded properly.
   MVPC 1
   MOVR 2 180

2.3.10. Center paddle 2 over the robot, then extend it out over the cassette station A.
   MVPC 2
   MOVR 2 180

2.3.11. Raise or lower the robot Z axis until the height of the paddle's bottom edge is equal to the height of the block - as paddle 2 approaches the block downward movement must be in increments of .001".
   MOVR 0 [+ or - .001]

2.3.12. Set the paddle offset and center paddle 1 over the robot.
   POFF 1
   MVPC 1

2.3.13. Set default limits for the robot Z, theta and paddle axes.
   FLIM 0
   FLIM 1
   FLIM 2

2.3.14. Reset the robot Z axis brake timeout value.
   SCAL 1 6 2000000

2.3.15. Save settings.
   SAVE
Section D: System Integration

2.4.0. Can Angle Calibration

2.4.1. Center robot paddle 1 over the robot, prompt a reading of the robot z axis negative limit, and move the robot z axis to a height that equals its negative limit plus .1 inches.
MVPC 1 LMIN 0 MOVA 0 [negative limit + .1]

2.4.2. Rotate the robot theta axis until the robot faces cassette station A.
MOVR 1 [θ degrees]

2.4.3. Center robot paddle 1 over the robot then extend it over cassette station A.
MVPC 1 MOVR 2 180

2.4.4. Place a calibration pin in the calibration hole on top of cassette station A. rotate the robot theta axis in small increments until the paddle makes contact with the calibration pin.
MOVR 1 [.12 degrees]

2.4.5. Define the world position and set the can angles for a sorter with two cassettes and a bright light module:
FWLD 90
SCAL 2 0 0
SCAL 3 0 140
SCAL 10 0 -90
SCAL 11 0 -140
XPOS 1 0
SCAL 1 7 55
SREF 1

2.4.6. Test the settings by rotating the paddle end of the robot to face the aligner.
SPRK 1

2.4.7. Save settings.
SAVE
2.5.0. Aligner Calibration

2.5.1. Reference all aligner axes.
SREF 2

2.5.2. Move aligner x axis until the chuck is positioned over the center of the module.
MOVR 4 [+0.2 inches]

2.5.3. Center robot paddle 1 over the robot and rotate the robot theta axis until the robot paddle end faces the aligner.
MVPC 1

2.5.4. Raise the robot z axis to a height above the aligner chuck.
MOVR 3.0

2.5.5. Extend robot paddle 1 over the aligner chuck and turn on robot paddle 1 vacuum.
MOVR 2 180
SVA C 1 1 1

2.5.6. Manually place a wafer onto robot paddle 1. Make sure it is centered over the robot.
MOVR 1 0

2.5.7. Lower the robot z axis until any part of the wafer makes contact with the aligner chuck. Do not proceed lower than the aligner chuck as this may damage the wafer.
MOV R 0 [-0.005 inches]

2.5.8. Access the aligner’s bottom panel and loosen the four shoulder bolts if they do not have springs. Adjust the three aligner leveling screws until the gap between the chuck and the wafer appears even from all vantage points. Retighten the shoulder bolts if they do not have springs.

2.5.9. While supporting the wafer, turn off paddle 1 vacuum.
SVAC 1 1 0

2.5.10. Move the aligner x-axis in a positive direction.
MOVR 4 2

2.5.11. Place a calibration pin in the calibration hole on top of the aligner’s surface. Make sure it is perpendicular to the top plate.

2.5.12. Move the aligner x-axis in the negative direction until the calibration pin makes contact with robot paddle 1.
MOVR 4 [-0.02 inches]

2.5.13. Record the aligner x-axis reference position, set the aligner x-axis transfer position, and reference the aligner module.
RPOS 4 1
XPOS 4 0
MREF 4

2.5.14. Pull the calibration pin out of the aligner’s calibration hole and park the aligner.
SPRK 2

2.5.15. Check to see if the aligner parked at the correct position, then center robot paddle 1 over the robot.
MVPC 1

2.5.16. Set default limits for aligner x- and theta axes.
FLM 3
FLM 4

2.5.17. Save settings.
SAVE
2.6.0. Setting Aligner Transfer Position

2.6.1. Center robot paddle 1 over the robot and rotate the robot theta axis until the robot’s paddle end faces the aligner.
MOVC 1
MOVA 1 0

2.6.2. Raise the robot z axis to a height above the aligner chuck.
MOVA 0 3.5

2.6.3. Extend robot paddle 1 over the aligner chuck and turn on robot paddle 1 vacuum.
MOVR 2 180
SVAC 1 1 1

2.6.4. Manually place a wafer onto robot paddle 1. Make sure it is centered over the chuck.

2.6.5. Set the aligner transfer position by repeatedly lowering the wafer until contact with the aligner chuck is sensed.
FVAC 2 1

2.6.6. Set the default transfer heights
SCAL 2 2 -.03
SCAL 2 3 -.005
SCAL 2 4 .015
SCAL 2 5 .03

2.6.7. Save settings.
SAVE
2.7.9. **Aligner Sensor Array Calibration**

2.7.1. Turn on the aligner sensor array illumination
OUTP 4 100

2.7.2. Use a small flathead screwdriver to gently turn the potentiometer to maximum brightness. Be careful not to strip the potentiometer as its maximum range of motion is only 314 turn.

2.7.3. Move the aligner x-axis until the wafer edge is centered under the aligner sensor array.
MOV R 4 [distance]

2.7.4. Prompt a display of the wafer edge location with respect to the sensor array; a properly positioned edge would read between 60 and 68. Select the ESC button to terminate the ALND display.
ALND

2.7.5. Adjust the aligner x-axis as needed.
MOV R 4 [.05]

2.7.6. Repeat steps 7.4. and 7.5. until the ALND reading falls between 60 and 68.

2.7.7. Turn the potentiometer until ALND reading decreases by 1. Select the ESC button to terminate the ALND display.
ALND

2.7.8. Turn off aligner sensor array illumination.
OUTP 4 0

2.7.9. Auto-calibrate the aligner sensor array.
AL NC 1

2.7.10. Support the wafer by hand, turn off the aligner chuck vacuum and manually remove the wafer.
SVAC 2 1 0

2.7.11. Save settings.
SAVE
2.8.0. Laser Offset Setup

2.8.1. Reference all robot axes.

SREF 1

2.8.2. Set wafer mapping algorithm.

MAPA 2

2.8.3. To determine the laser offset position, first place a calibration pin in the calibration hole on the top of cassette station A. Next, position a white card or slip of paper behind the pin, opposite the robot. Execute the following commands to position the robot z and theta axes so that the robot laser is aimed at the calibration pin.

LIMN 0 (returns negative limit)

MOVA 0 [negative limit + .05 inches]

MOVA 1 90

2.8.4. Turn on the laser and rotate the robot theta axis until the shadow of the pin falls directly in the center of the laser beam projected onto the paper.

LASR 1

MOVR 1 [z .2]

2.8.5. Prompt the current robot theta position and use it to set the laser offset.

MPOS 1 (returns current position)

SCAL 1 14 [90 - current position]

2.8.6. Turn the laser off.

LASR 0

2.8.7. Save the settings.

SAVE
System Integration:
MicroVision MVT 7080T5: Wafer Sorter

2.9.6. Mapping Setup: Cassette Station A

2.9.1. Place a full cassette on cassette station A. Remove the wafer in slot 2.

2.9.2. Calibrate the mapping setup.

MAPS 10

2.9.3. Put the wafer back in slot 2.

2.9.4. Map the cassette.

MAPC 10

2.9.5. Prompt a return of the mapping data over a specified range of mapping angles:

2.9.6. Study the returned mapping angles and their corresponding data. Determine at which mapping angles the cassette was correctly mapped. From among the angles that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.8) in the following procedures:

-2.8
-2.6
-2.4
-2.2
-2.0
-1.8
-1.6
-1.4
-1.2
-1.0
-0.8
-0.6
-0.4
-0.2
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0

2.9.7. Set the low mapping angle

SCAL 10 1 [low angle value]

2.9.8. Set the high mapping angle

SCAL 10 2 [high angle value]

2.9.9. Auto calibrate the best mapping start position

MAPH 10

2.9.10. Map the cassette and check the accuracy of returned data.

MAPC 10

2.9.11. Save the settings

SAVE
System Integration: 2-Cassette / Bright Light

Section D: System Integration D-41

Mapping Setup: Cassette Station B

2.10.1. Place a full cassette on cassette station B. Remove the wafer in slot 2.

2.10.2. Calibrate the mapping set up.

2.10.3. Put the wafer back in slot 2.

2.10.4. Map the cassette.

2.10.5. Prompt a return of the mapping data over a specified range of mapping angles.

2.10.6. Study the returned mapping angles and their corresponding data. Determine at which mapping angles the cassette was correctly mapped. From among the angles that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.8) in the following procedures.

-2.0 00000000000000000000000000000000
-1.8 00000000000000000000000000000000
-1.6 00000000000000000000000000000000
-1.4 00000000000000000000000000000000
-1.2 00000000000000000000000000000000
-1.0 00000000000000000000000000000000
-0.8 00000000000000000000000000000000
-0.6 00000000000000000000000000000000
-0.4 00000000000000000000000000000000
-0.2 00111000000000000000000000000000
 0.0 00111000000000000000000000000000
 0.2 00111000000000000000000000000000
 0.4 00111000000000000000000000000000
 0.6 00111000000000000000000000000000
 0.8 00111000000000000000000000000000
 1.0 00111000000000000000000000000000
 1.2 00111000000000000000000000000000
 1.4 00111000000000000000000000000000
 1.6 00111000000000000000000000000000
 1.8 00111000000000000000000000000000
 2.0 00111000000000000000000000000000
 2.2 00111000000000000000000000000000
 2.4 00111000000000000000000000000000
 2.6 00111000000000000000000000000000
 2.8 00111000000000000000000000000000
 3.0 00111000000000000000000000000000
 3.2 00111000000000000000000000000000
 3.4 00111000000000000000000000000000
 3.6 00111000000000000000000000000000
 3.8 00111000000000000000000000000000
 4.0 00111000000000000000000000000000

2.10.7. Set the low mapping angle

2.10.8. Set the high mapping angle

2.10.9. Auto calibrate the best mapping start position.

2.10.10. Map the cassette and check the accuracy of returned data.

2.10.11. Save the settings.
2.11.9.  Setting Wafer Transfer Positions: Cassette Station A

2.11.10. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station A.

2.11.11. Map the cassette.

MAPC 10

2.11.12. Find the negative limit and move the robot z-axis to a position slightly above it.

LIMN 0

MOVA 0 [negative limit + 1]

2.11.13. Extend robot paddle 1 into the cassette below wafer 1.

WE00 1 1

2.11.14. Repeatedly raise robot height until vacuum contact with wafer 1 is sensed.

FYAC 10 1 (repeat until contact is made)

2.11.15. Remove paddle 1 from the cassette.

WOOR 10 1 1

2.11.16. Establish robot paddle 1 offset. Repeat the following procedure (11.8. - 11.13.) until paddle 1 is centered between wafers 1 and 2.

2.11.17. Move the robot z-axis to the wafer 2 drop-off height.

WDOO 10 2 1

2.11.18. Disable the robot theta axis motor.

MEBL 1 0

2.11.19. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

2.11.20. Adjust paddle 1 offset position.

SCAL 10 6 [.003]

2.11.21. Manually swing robot paddle 1 out of the cassette and center it over the robot.

2.11.22. Enable the robot theta axis motor.

MEBL 1 1

2.11.23. Check / adjust wafer pitch. Repeat the following procedure (11.15. - 11.21.) until paddle 1 is centered between wafers 24 and 25.

2.11.24. Move the robot z-axis to the wafer 25 drop-off height.

WDOO 10 25 1

2.11.25. Disable the robot theta axis motor.

MEBL 1 0

2.11.26. Manually swing robot paddle 1 into cassette between wafers 24 and 25.

2.11.27. Adjust the wafer pitch.

SCAL 10 17 [.0001]

2.11.28. Manually swing paddle axis out of cassette and center over robot.

2.11.29. Enable robot theta axis.

MEBL 1 1

2.11.30. Map the cassette and check results for accuracy.

MAPC 10

2.11.31. Save Settings.

SAVE
2.12.0. Setting Wafer Transfer Positions: Cassette Station B

2.12.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station B.

2.12.2. Map the cassette:
MAPC 11

2.12.3. Find the negative limit and move the robot z-axis to a position slightly above it.
LMM 0
MOVA 0 [negative limit + 0.1]

2.12.4. Extend robot paddle 1 into the cassette below wafer 1.
WE00 11 1 1

2.12.5. Repeatedly raise robot height until vacuum contact with wafer 1 is sensed.
FVAC 11 1 (robot until contact is made)

2.12.6. Remove paddle 1 from the cassette.
WO00 11 1 1

2.12.7. Establish robot paddle 1 offset. Repeat the following procedure (12.8 - 12.13) until paddle 1 is centered between wafers 1 and 2.

2.12.8. Move the robot z-axis to the wafer 2 drop-off height.
WO00 11 2 1

2.12.9. Disable the robot theta axis motor.
MEBL 1 0

2.12.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

2.12.11. Adjust paddle 1 offset position.
SCAL 11 6 [.003]

2.12.12. Manually swing robot paddle 1 out of the cassette and center it over the robot.

MEBL 1 1

2.12.14. Check / adjust wafer pitch. Repeat the following procedure (12.15 - 12.21) until paddle 1 is centered between wafers 24 and 25.

2.12.15. Move the robot z-axis to the wafer 25 drop-off height.
WO00 11 25 1

MEBL 1 0

2.12.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.

2.12.18. Adjust the wafer pitch.
SCAL 11 17 [.0001]


2.12.20. Enable robot theta-axis
MEBL 1 1

2.12.21. Map the cassette and check results for accuracy.
MAPC 11

2.12.22. Save Settings:
SAVE
System Integration:
2-Cassette / Bright Light

2.13.0  Joystick Calibration
2.13.1  Exit Host NT software and start workstation software.
2.13.2  Enable the bright light option in the system setup screen.
2.13.3  Exit and re-enter the workstation software.
2.13.4  Select setup from the main tool bar.
2.13.5  Click joystick.
2.13.6  Make sure the power curve is set to four and the dead band is between four and fifteen.
2.13.7  Click calibrate joystick.
2.13.8  Follow the eight instruction steps to calibrate the joystick.
2.13.9  Click yes to accept the joystick calibration and exit the window.
2.13.10 Exit Workstation software.
System Integration: 2-Cassette / Bright Light

2.14.0. Bright Light Leveling & Transfer Heights (without Wafer Flipper)

2.14.1. Make sure guard has been removed and the vacuum sensitivity is set correctly. The mapping and transfer heights of the stations should already be set.

2.14.2. Increase the software limits:
- LIMP 7 720
- LIMP 8 720
- LIMN 7 -720
- LIMN 8 -720

2.14.3. Remove a wafer from a cassette with the robot.

2.14.4. Move the robot to the Z transfer position of the bright light.

2.14.5. Position the bright light chuck until it appears level.

2.14.6. Disable the theta axis and manually move the wafer on paddle one over the bright light chuck.

2.14.7. Raise or lower the Z axis of the robot until the bottom surface of the wafer is close to the top surface of the bright light chuck.

2.14.8. Make fine leveling adjustments of the bright light chuck. There should be an even gap between the surfaces of the chuck and wafer.

2.14.9. Manually move the wafer over the center of the robot.

2.14.10. Set the transfer positions of the bright light and reference the motors.

2.14.11. Check to see if the chuck parks itself at the correct position.

2.14.12. Make sure the transfer positions are at their default positions:
- SCAL 3 -.02
- SCAL 3 - .01
- SCAL 3 .01
- SCAL 3 .03


2.14.15. Enable the theta axis on the robot and remove the wafer from the bright light chuck.
MEBL 11
WOLR 311

2.14.16. Set the software limits back to their original default parameters.
FLIM 7
FLIM 9

2.14.17. If the robot transfers the wafer cleanly to and from the bright light, save the parameters.
SAVE

2.14.18. Replace the bright light housing panel.
2.15.5. Bright Light Leveling & Transfer Heights (with Wafer Flipper)

2.15.1. Make sure guard has been removed and the vacuum sensitivity is set correctly. The mapping and transfer heights of the stations should already be set up. The robot cam angles should also be set.

2.15.2. Switch to controller channel 2.
CHAN 2

2.15.3. Increase the software limits:
LIMP 7 720
LIMP 8 720
LIMN 7 -720
LIMN 8 -720

2.15.4. Switch to controller channel 1.
CHAN 1

2.15.5. Remove a wafer from a cassette with the robot.
WELR 10 2 1

2.15.6. Move the robot to the Z transfer position of the bright light.
WLOO 3 1 1

2.15.7. Switch to controller channel 2.
CHAN 2

2.15.8. Position the bright light chuck until it appears level.
MOVR 7 t
MOVR 8 t

2.15.9. Switch to controller channel 1.
CHAN 1

2.15.10. Disable the theta axis and manually move the wafer on paddle one over the bright light chuck.
MSEL x 0

2.15.11. Raise or lower the Z axis of the robot until the bottom surface of the wafer is close to the top surface of the bright light chuck.
MOVR 0 0 0 0 0

2.15.12. Switch to controller channel 2.
CHAN 2

2.15.13. Make fine leveling adjustments of the bright light chuck. There should be a even gap between the surfaces of the chuck and wafer.
MOVR 7 t
MOVR 8 t

2.15.14. Manually move the wafer over the center of the robot.

2.15.15. Set the transfer positions of the bright light and reference the motors
RPOS 7 1
RPOS 8 1
MREF 7
MREF 8

2.15.16. Check to see if the chuck parks itself at the correct position.
SPRK 3
System Integration:
2-Cassette / Bright Light

2.15.17. Make sure the transfer positions are at their default positions:
- SCAL 3.2 -0.03
- SCAL 3.3 -0.01
- SCAL 3.4 -0.01
- SCAL 3.5 -0.03

2.15.18. Manually move the wafer over the bright light chuck.

2.15.19. Set the bright light transfer height — repeat until contact is made.

2.15.20. Switch to controller channel 1.

2.15.21. Enable the theta axis on the robot and remove the wafer from the bright light chuck.

2.15.22. Switch to controller channel 2.

2.15.23. Set the software limits back to their original default parameters:
- FLIM 7
- FLIM 8
- FLIM 9

2.15.24. If the robot transfers the wafer cleanly to and from the bright light, save the parameters.

2.15.25. Switch to controller channel 1.

2.15.26. Replace the bright light housing panel.
2.16.0. **Wafer Flipper Leveling & Transfer Positions**

2.16.1. Make sure the joystick has been calibrated and the robot transfers wafers to the bright light chuck cleanly.

2.16.2. Transfer a wafer to the bright light chuck with the robot.

2.16.3. Switch to controller channel 2.

2.16.4. Move the bright light chuck and the flipper until the top surface of the flipper makes evenly contact with the bottom surface of the wafer.

2.16.5. Prompt motor positions and record.

2.16.6. Set transfer positions using recorded values.

2.16.7. Park the bright light.

2.16.8. Test the new flip parameters.

2.16.9. Return the wafer back to the bright light chuck.

2.16.10. Save the settings and place the cover and guard back into position.

2.16.11. Switch to controller channel 1.
D-50 MicroVision MVT 7080™ Wafer Sorter System
Integration: 3-Cassette
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Initial Power-Up & Hardware Check: 3-Cassette

1.1. System Power-Up

1.1.1. Set the controller On/Off switch to the On position.

1.1.2. Make sure E-Stop is pulled out and turn the system On/Off switch clockwise as far as it will go to power up the controller - note that the On/Off switch will return to a position midway between the Off and On labels. Wait 20 seconds and again turn the system On/Off switch clockwise as far as it will go to activate system motor.

1.1.3. Power-up the VGA color monitor.

1.1.4. Power-up the system PC. The computer will scan for a keyboard, mouse and values, check the integrity of the hard drive, and load Windows NT.

1.1.5. Once Windows NT has loaded, a Welcome window will appear, prompting the operator for a user name and password; enter these in the appropriate boxes and verify that WORKSTATION is displayed in the box labeled From. Select the OK button to prompt the display of the Host NT window. The system is now ready to accept host commands at the command line.

1.2. Controller Board 1 (Master)

1.2.1. Perform self diagnostic test; a return of 0 ensures that serial connections to controller board 1 are sound.

1.3. Main Vacuum Test

1.3.1.1. Verify that the system vacuum sensor is connected to the AUX port on the controller back panel.

1.3.1.2. Detach the vacuum line from the back of the sorter chassis. Turn the sensor adjustment screw CW until the LED turns on, then CCW until the LED turns off.

1.3.1.3. Reattach the vacuum line to the back of the sorter chassis and verify that the LED turns on.

1.3.1.4. Prompt the current hardware sensor status of the controller.

1.3.1.5. Detach the main vacuum line from the sorter chassis.

1.3.1.6. Again, prompt the current hardware sensor status of the controller; the returned values should be different than those returned in step 1.3.1.4.

1.3.2. Robot Paddle Vacuum Test

Section D: System Integration

1.3.2.1. Activate paddle 1 vacuum.
SVAC 1 1 1

1.3.2.2. Adjust paddle 1 vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

1.3.2.3. Deactivate paddle 1 vacuum.
SVAC 1 1 0

1.3.2.4. Activate paddle 2 vacuum.
SVAC 1 2 1

1.3.2.5. Adjust paddle 2 vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

1.3.2.6. Deactivate paddle 2 vacuum.
SVAC 1 2 0

1.3.2.7. Place a small wafer on paddle 1 and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).

1.3.2.8. Turn paddle 1 vacuum adjustment screw and repeat vacuum test until turn-on value is 35000 (± 5000); remove wafer.

1.3.2.9. Place a small wafer on paddle 2 and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).

1.3.2.10. Turn paddle 2 vacuum adjustment screw and repeat vacuum test until turn-on value is 35000 (± 5000); remove wafer.

1.3.3. Aligner Chuck Vacuum

1.3.3.1. Activate aligner chuck vacuum.
SVAC 2 1 1

1.3.3.2. Remove the back cover of the aligner and adjust the vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns on; 2) turn vacuum adjustment screw CCW until LED turns off.

1.3.3.3. Deactivate aligner chuck vacuum.
SVAC 2 1 0

1.3.3.4. Place a small wafer on aligner chuck and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).

1.3.3.5. Turn aligner vacuum sensor adjustment screw and repeat vacuum test until turn-on and turn-off values are 35000 (± 5000); remove wafer.

1.3.3.6. Replace aligner back cover.

1.4.1. Reference Robot Module
System Integration: 3-Cassette

1.4.1.1. Reference robot theta axis.
   MREF 1 (make sure it references in all four quadrants)

1.4.1.2. Disable robot paddle axis motor.
   MEBL 2 0

1.4.1.3. Manually swing the robot paddle over the robot, record position, enable robot paddle axis motor, and reference robot paddle axis.
   RPOS 2 1
   MEBL 2 1
   MREF 2

1.4.1.4. Reference robot z axis.
   MREF 0

1.4.2. Reference Aligner Module

1.4.2.1. Reference aligner theta and x-axes motors.
   MREF 3
   MREF 4

1.4.3. Check Array Board

1.4.3.1. Turn on the illumination and check the pixels of the array.
   OUTP 4 100
   ALND (128 should scroll up and down the screen)

1.4.3.2. Stop the scrolling and turn off the illumination.
   ESC (stops the scrolling)
   OUTP 4 0

1.4.4. Check the upper light source on the wafer light

1.4.4.1. Turn on the light above the acrylic block.
   OUTP 5 100

1.4.4.2. Turn off the light source.
   OUTP 5 0

1.4.5. Check the lower light source on the wafer light

1.4.5.1. Turn on the light source below the light shield.
   OUTP 10 100

1.4.5.2. Turn off the light source.
   OUTP 10 0
2.1. Cassette Station Leveling

2.1.1. On the underside of the sorter chassis, locate each cassette station’s respective access port and loosen the four fasteners located there.

2.1.2. Remove the sensor cable clamps that cover up the set screw holes under the cassette stations.

2.1.3. Loosen the three set screws located under the cassette station until they are not touching the bottom of their station.

2.1.4. Raise the robot Z-axis.

2.1.5. Disable the robot theta and paddle motors.

2.1.6. Turn on robot paddle 1 vacuum and place a wafer over the vacuum port.

2.1.7. Manually rotate the robot theta axis to swing paddle 1 and the wafer out over the cassette stations - note that the centerline of paddle 1 must point to the center of the robot for proper leveling. Using the wafer as a baseline, determine which cassette station is the highest; proceed to level that station first.

2.1.8. Place three leveling blocks around the edge of the highest cassette station. Manually swing the wafer over the cassette station. Lower the robot Z-axis until the underside of the wafer makes contact with one of the blocks.

2.1.9. Adjust the three set screws under the station until the wafer makes equal contact with all three blocks. Once the station is level, rotate the set screw located closest to the robot clockwise (CW) 1/4 turn.

2.1.10. Manually swing paddle 1 and the wafer away from the station. Beginning with the two fasteners situated farthest from the robot and proceeding in small increments, retighten the four fasteners located on the underside of the pedestal.

2.1.11. Manually swing paddle 1 and the wafer back over the station and use the blocks to ensure that it is still level. Retighten the leveling procedure if necessary.

2.1.12. Manually swing paddle 1 and the wafer over the next station, keeping the same robot Z-height, and perform the leveling procedure described above (2.1.9 - 2.1.11).

2.1.13. While supporting the wafer, turn off the vacuum to robot paddle 1 and remove the wafer.

2.1.14. Enable the robot theta and paddle motors.
2.2. Robot Paddle Calibration

2.2.1. Reference the robot theta axis.
MREF 1

2.2.2. Reference the robot paddle axis:
MREF 2

2.2.3. Set the station reference flag for the robot:
SRFL 1

2.2.4. Rotate the robot paddle axis until paddle 1 is centered over the robot.
MOVR 2 [degrees]

2.2.5. Place a calibration pin into the robot calibration pin hole.

2.2.6. Rotate the robot paddle axis until the inside edge of paddle 1 makes contact with calibration pin; as paddle one approaches the pin, decrease the increment of rotation.
MOVR 2 [degrees]

2.2.7. Set the robot paddle reference position and paddle 1 calibration angle:
RPOS 2 1
MREF 2
SCAL 1 1 0

2.2.8. Check to see if robot paddle 1 centers properly over the robot:
MVPC 1

2.2.9. Save settings.
SAVE
2.3. Robot Z Axis Calibration

2.3.1. Center robot paddle 1 over the center of the robot and set the robot height (z axis) to 1.1 inches.
- MOVC 1
- MOVA 0.1

2.3.2. Rotate the robot theta axis until the robot faces cassette station A.
- MOVR 1 [* degrees]

2.3.3. Extend paddle 1 out over cassette station A.
- MOVR 2 180

2.3.4. Adjust the robot z axis brake timeout value.
- SCAL 1 6 10000000

2.3.5. Place a 1 inch calibration block adjacent to the tip of the extended robot paddle. Raise or lower the robot z axis until the height of the paddle's bottom edge matches that of the block - as paddle 1 approaches the block downward movement should be in increments of .001".
- MOVR 0 [+/- .001]

2.3.6. Set the robot z axis motor reference position.
- RPOS 0 1

2.3.7. Reference the robot z axis.
- MREF 0

2.3.8. Move the robot z axis to the newly set zero position.
- MOVA 0 0

2.3.9. Center paddle 1 over the robot, then extend it out over the cassette station A; use the calibration block to see if RPOS recorded properly.
- MOVC 1
- MOVR 2 180

2.3.10. Center paddle 2 over the robot, then extend it out over the cassette station A; use the calibration block to see if RPOS recorded properly.
- MOVC 2
- MOVR 2 180

2.3.11. Raise or lower the robot z axis until the height of the paddle's bottom edge is equal to the height of the block - as paddle 2 approaches the block downward movement must be in increments of .001".
- MOVR 0 [+/- .001]

2.3.12. Set the paddle offset and center paddle 1 over the robot.
- POFF 1
- MVPC 1

2.3.13. Set default limits for the robot Z, theta and paddle axes.
- FLIM 0
- FLIM 1
- FLIM 2

2.3.14. Reset the robot z axis brake timeout value.
- SCAL 1 6 2000000

2.3.15. Save settings.
- SAVE
3. Cassette Can Angle Calibration

2.4.1. Center robot paddle 1 over the robot, prompt a reading of the robot z axis negative limit, and move the robot z axis to a height that equals the negative limit plus 1 inch.
   MVPC 1
   LIMN 0
   MOVA 0 [negative limit + 1]

2.4.2. Rotate the robot theta axis until the robot faces cassette station A.
   MOVR 1 [degrees]

2.4.3. Center robot paddle 1 over the robot then extend it over cassette station A.
   MVPC 1
   MOVR 2 180

2.4.4. Place a calibration pin in the calibration hole on top of cassette station A. rotate the robot theta axis in small increments until the paddle makes contact with the calibration pin.
   MOVR 1 [± 12 degrees]

2.4.5. Define the world position and set the can angles for a sorter with three cassettes:
   FWLD 90
   SCAL 2 0 0
   SCAL 10 0 90
   SCAL 11 0 140
   SCAL 12 0 140
   XPOS 1 0
   SCAL 1 7 55
   SREF 1

2.4.6. Test the settings by rotating the paddle end of the robot to face the aligner:
   SPRK 1

2.4.7. Save settings.
   SAVE
Aligner Calibration

2.5.1. Reference all aligner axes.
SREF 2

2.5.2. Move aligner x axis until the chuck is positioned over the center of the module.
MOVR 4 [+-.2 inches]

2.5.3. Center robot paddle 1 over the robot and rotate the robot theta axis until the
robot's paddle end faces the aligner.
MVPC 1
MOVA 1 0

2.5.4. Raise the robot z axis to a height above the aligner chuck.
MOVA 0 3.0

2.5.5. Extend robot paddle 1 over the aligner chuck and turn on robot paddle 1 vacuum.
MOVR 2 180
SVAC 1 1 1

2.5.6. Manually place a wafer onto robot paddle 1. Make sure it is centered over the
chuck.

2.5.7. Lower the robot z axis until any part of the wafer makes contact with the aligner
chuck. Do not proceed lower than the aligner chuck as this may damage the
wafer.
MOV 0 [+.005 inches]

2.5.8. Access the aligner's bottom panel and loosen the four shoulder bolts if they do
not have springs. Adjust the three aligner leveling screws until the gap between
the chuck and the wafer appears even from all vantage points. Retighten the
shoulder bolts if they do not have springs.

2.5.9. While supporting the wafer turn off paddle 1 vacuum.
SVAC 1 1 0

2.5.10. Move the aligner x axis in a positive direction.
MOVR 4 2

2.5.11. Place a calibration pin in the calibration hole on top of the aligner's surface. Make
sure it is perpendicular to the top plate.

2.5.12. Move the aligner x axis in the negative direction until the calibration pin makes
contact with robot paddle 1.
MOVR 4 [-.02 inches]

2.5.13. Record the aligner x axis reference position, set the aligner x axis transfer posi-
tion, and reference the aligner module.
RPPOS 4 1
XPOS 4 0
MREF 4

2.5.14. Pull the calibration pin out of the aligner's calibration hole and park the aligner.
SPRK 2

2.5.15. Check to see if the aligner parked at the correct position, then center robot paddle
1 over the robot.
MVPC 1

2.5.16. Set default limits for aligner x and theta axes.
FLIM 3
FLIM 4

2.5.17. Save settings
SAVE

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2.6. Setting Aligner Transfer Position
2.6.1. Center robot paddle 1 over the robot and rotate the robot theta axis until the robot's paddle end faces the aligner.
MOVA 1 0
2.6.2. Raise the robot z axis to a height above the aligner chuck.
MOVA 0 3.5
2.6.3. Extend robot paddle 1 over the aligner chuck and turn on robot paddle 1 vacuum.
MOVR 2 180
SVAC 1 1 1
2.6.4. Manually place a wafer onto robot paddle 1. Make sure it is centered over the chuck.
2.6.5. Set the aligner transfer position by repeatedly lowering the wafer until contact with the aligner chuck is sensed.
FVAC 2 1
2.6.6. Set the default transfer heights.
SCAL 2 2 -.03
SCAL 2 3 -.005
SCAL 2 4 .015
SCAL 2 5 .03
2.6.7. Save settings.
SAVE
Aligner Sensor Array Calibration

2.7.1. Turn on the aligner sensor array illumination.
OUTP 4 100

2.7.2. Use a small flathead screwdriver to gently turn the potentiometer to maximum brightness. Be careful not to skip the potentiometer as its maximum range of motion is only 3/4 turn.

2.7.3. Move the aligner x-axis until the wafer edge is centered under the aligner sensor array.
MOVR 4 [x distance]

2.7.4. Prompt a display of the wafer edge location with respect to the sensor array; a properly positioned edge would read between 60 and 68. Select the ESC button to terminate the ALND display.

2.7.5. Adjust the aligner x-axis as needed.
MOVR 4 [x distance]

2.7.6. Repeat steps 7.4. and 7.5. until the ALND reading falls between 60 and 68.

2.7.7. Turn the potentiometer until ALND reading decreases by 1. Select the ESC button to terminate the ALND display.

2.7.8. Turn off aligner sensor array illumination.
OUTP 4 0

2.7.9. Autocalibrate the aligner sensor array.
ALNC 1

2.7.10. Support the wafer by hand, turn off the aligner chuck vacuum and manually remove the wafer.
SVAC 2 1 0

2.7.11. Save settings.
SAVE
2.8. Laser Offset Setup

2.8.1 Reference all robot axes.
SREF 1

2.8.2 Set wafer mapping algorithm.
MAPA 2

2.8.3 To determine the laser offset position, first place a calibration pin in the calibration hole on the top of cassette station A. Next, position a white card or slip of paper behind the pin, opposite the robot. Execute the following commands to position the robot and theta axes so that the robot laser is aimed at the calibration pin.

LIMN 0 (returns negative limit)
MOVA 0 [negative limit + .05 inches]
MOVA 1 90

2.8.4 Turn on the laser and rotate the robot theta axis until the shadow of the pin falls directly in the center of the laser beam projected onto the paper.
LASR 1
MOVR 1 [-2]

2.8.5 Prompt the current robot theta position and use it to set the laser offset.
MPOS 1 (returns current position)
SCAL 1 14 [90 - current position]

2.8.6 Turn the laser off
LASR 0

2.8.7 Save the settings.
SAVE
Mapping Setup: Cassette Station A

2.9.1. Place a full cassette on cassette station A. Remove the wafer in slot 2.

2.9.2. Calibrate the mapping set up.

MAPS 10

2.9.3. Put the wafer back in slot 2.

2.9.4. Map the cassette.

MAPC 10

2.9.5. Prompt a return of the mapping data over a specified range of mapping angles.

SCAN 10 -2 4.2

2.9.6. Study the returned mapping angles and their corresponding data. Determine at which mapping angle the cassette was correctly mapped. From among the angles that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.8) in the following procedures.

2.9.7. Set the low mapping angle.

SCAL 10 1 [low angle value]

2.9.8. Set the high mapping angle.

SCAL 10 2 [high angle value]

2.9.9. Auto calibrate the best mapping start position.

MAPH 10

2.9.10. Map the cassette and check the accuracy of returned data.

MAPC 10

2.9.11. Save the settings.

SAVE
2.10. Mapping Setup: Cassette Station 8

2.10.1. Place a full cassette on cassette station B. Remove the wafer in slot 2.

2.10.2. Calibrate the mapping setup.

MAPS 11

2.10.3. Put the wafer back in slot 2.

2.10.4. Map the cassette.

MAPC 11

2.10.5. Prompt a return of the mapping data over a specified range of mapping angles.

SCAN 11-2.4.2

2.10.6. Study the returned mapping angles and their corresponding data. Determine at which mapping angles the cassette was correctly mapped. From among the shifts that mapped correctly, select a 1 degree range that was midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.0) in the following procedures.

-2.0 000000000000000000000000000000
-1.8 000000000000000000000000000000
-1.6 000000000000000000000000000000
-1.4 000000000000000000000000000000
-1.2 000000000000000000000000000000
-1.0 000000000000000000000000000000
-0.8 000000000000000000000000000000
-0.6 000000000000000000000000000000
-0.4 000000000000000000000000000000
-0.2 001110100000111010000110100010
1.0 101001101010101101001010010010
1.2 101110110111111011100100110111
1.4 111111111111111111111111111111
1.6 111111111111111111111111111111
1.8 111111111111111111111111111111
2.0 111111111111111111111111111111
2.2 111111111111111111111111111111
2.4 111111111111111111111111111111
2.6 111111111111111111111111111111
2.8 111111111111111111111111111111
3.0 111111111111111111111111111111
3.2 111111111111111111111111111111
3.4 101101101101101101101101101101
3.6 001101101101101101101101101101
3.8 000000000000000000000000000000
4.0 000000000000000000000000000000

2.10.7. Set the low mapping angle.

SCAL 11 [low angle value]

2.10.8. Set the high mapping angle.

SCAL 112 [high angle value]

2.10.9. Auto calibrate the best mapping start position.

MAPH 11

2.10.10. Map the cassette and check the accuracy of returned data.

MAPC 11

2.10.11. Save the settings.

SAVE
Mapping Setup: Cassette Station C

2.11.1. Place a full cassette on cassette station C. Remove the wafer in slot 2.

2.11.2. Calibrate the mapping set up. MAPS 12

2.11.3. Put the wafer back in slot 2.

2.11.4. Map the cassette. MAPC 12

2.11.5. Prompt a return of the mapping data over a specified range of mapping angles. SCAN 12.2.4.2

2.11.6. Study the returned mapping angles and their corresponding data. Determine at which mapping angles the cassette was correctly mapped. From among the angles that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.8) in the following procedures.

```
   -2.0  000000000000000000000000000000000
   -1.8  000000000000000000000000000000000
   -1.6  000000000000000000000000000000000
   -1.4  000000000000000000000000000000000
   -1.2  000000000000000000000000000000000
   -1.0  000000000000000000000000000000000
   -0.8  000000000000000000000000000000000
   -0.6  000000000000000000000000000000000
   -0.4  011110100011001001101001110010000
   -2.0  011110100011001001101001110010000
   -1.0  101001010100101010010010010010010
   1.2  000101100101001001101001111111111
   1.4  000101100101001001101001111111111
   1.6  000101100101001001101001111111111
   1.8  000101100101001001101001111111111
   2.0  111111111111111111111111111111111
   2.2  111111111111111111111111111111111
   2.4  111111111111111111111111111111111
   2.6  111111111111111111111111111111111
   2.8  111111111111111111111111111111111
   3.0  111111111111111111111111111111111
   3.2  111111111111111111111111111111111
   3.4  111111111111111111111111111111111
   3.6  011110100100101010010010010010000
   3.8  011110100100101010010010010010000
   4.0  011110100100101010010010010010000
```

2.11.7. Set the low mapping angle SCAL 12 1 [low angle value]

2.11.8. Set the high mapping angle SCAL 12 2 [high angle value]

2.11.9. Auto calibrate the best mapping start position. MAPH 12

2.11.10. Map the cassette and check the accuracy of returned data. MAPC 12

2.11.11. Save the settings SAVE
2.12. **Setting Wafer Transfer Positions: Cassette Station A**

2.12.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station A.

2.12.2. Map the cassette:

```
MAPC 10
```

2.12.3. Find the negative limit and move the robot z-axis to a position slightly above it:

```
LIMN P
MOVA 0 [negative limit + .1]
```

2.12.4. Extend robot paddle 1 into the cassette below wafer 1:

```
WE00 10 1 1
```

2.12.5. Repeatedly raise robot height until vacuum contact with wafer 1 is sensed:

```
FVAC 10 1 (repeat until contact is made)
```

2.12.6. Remove paddle 1 from the cassette:

```
WOOR 10 1 1
```

2.12.7. Establish robot paddle 1 offset. Repeat the following procedure (12.8. - 12.13.) until paddle 1 is centered between wafers 1 and 2:

2.12.8. Move the robot z-axis to the wafer 2 drop-off height:

```
WDOO 10 2 1
```

2.12.9. Disable the robot theta axis motor:

```
MEBL 1 0
```

2.12.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

2.12.11. Adjust paddle 1 offset position:

```
SCAL 10 6 [.003]
```

2.12.12. Manually swing robot paddle 1 out of the cassette and center it over the robot:

```
MEBL 1 1
```

2.12.13. Enable the robot theta axis motor:

```
MEBL 1 1
```

2.12.14. Check/adjust wafer pitch. Repeat the following procedure (12.15. - 12.21.) until paddle 1 is centered between wafers 24 and 25:

2.12.15. Move the robot z-axis to the wafer 25 drop-off height:

```
WDOO 10 25 1
```

2.12.16. Disable the robot theta axis motor:

```
MEBL 1 0
```

2.12.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.

2.12.18. Adjust the wafer pitch:

```
SCAL 10 17 [.001]
```


2.12.20. Enable robot theta-axis:

```
MEBL 1 1
```

2.12.21. Map the cassette and check results for accuracy:

```
MAPC 10
```

2.12.22. Save Settings.

```
SAVE
```

---

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2.13. **Setting Wafer Transfer Positions: Cassette Station B**

2.13.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station B.

2.13.2. Map the cassette.

2.13.3. Find the negative limit and move the robot z-axis to a position slightly above it.

2.13.4. Extend robot paddle 1 into the cassette below wafer 1.

2.13.5. Repeatedly raise robot height until vacuum contact with wafer 1 is sensed.

2.13.6. Remove paddle 1 from the cassette.

2.13.7. Establish robot paddle 1 offset. Repeat the following procedure (13.8 - 13.13.) until paddle 1 is centered between wafers 1 and 2.

2.13.8. Move the robot z-axis to the wafer 2 drop-off height.

2.13.9. Disable the robot theta axis motor.

2.13.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

2.13.11. Adjust paddle 1 offset position.

2.13.12. Manually swing robot paddle 1 out of the cassette and center it over the robot.


2.13.14. Check / adjust wafer pitch. Repeat the following procedure (13.15 - 13.21.) until paddle 1 is centered between wafers 24 and 25.

2.13.15. Move the robot z-axis to the wafer 25 drop-off height.

2.13.16. Disable the robot theta axis motor.

2.13.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.

2.13.18. Adjust the wafer pitch.


2.13.20. Evaluate robot theta-axis.

2.13.21. Map the cassette and check results for accuracy.

2.13.22. Save Settings.
2.14. **Setting Wafer Transfer Positions: Cassette Station C**

2.14.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station C.


MAPC 12

2.14.3. Find the negative limit and move the robot z axis to a position slightly above it.

LIM 0

MOVA 0 (negative limit + .1)

2.14.4. Extend robot paddle 1 into the cassette below wafer 1.

WE00 12 1 1

2.14.5. Repeatedly raise robot height until vacuum contact with wafer 1 is sensed.

FVAC 12 1

(repeat until contact is made)

2.14.6. Remove paddle 1 from the cassette.

WOOR 12 1 1

2.14.7. Establish robot paddle 1 offset. Repeat the following procedure (14.8 - 14.13) until paddle 1 is centered between wafers 1 and 2.


WO00 12 2 1


MEBL 1 0

2.14.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

2.14.11. Adjust paddle 1 offset position.

SCAL 12 6 [.003]

2.14.12. Manually swing robot paddle 1 out of the cassette and center it over H00 100.


MEBL 1 1


WO00 12 2 5 1


MEBL 1 0

2.14.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.


SCAL 12 17 [.0001]


MEBL 1 1

2.14.21. Map the cassette and check results for accuracy.

MAPC 12


SAVE
System Integration:

3-Cassette / Bright Light System Setup & Integration Sequence:

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Initial Power-Up & Hardware Check: 3-Cassette with Bright Light

1.1. System Power-Up

1.1.1. Set the controller On/Off switch to the On position.

1.1.2. Make sure E-Stop is pulled out and turn the system On/Off switch clockwise as far as it will go to power up the controller — note that the On/Off switch will return to a position midway between Off and On labels. Wait 20 seconds and again turn the system On/Off switch clockwise as far as it will go to activate system motor.

1.1.3. Power-up the VQA color monitor.

1.1.4. Power-up the system PC. The computer will scan for a keyboard, mouse and viruses, check the integrity of the hard drive, and load Windows NT.

1.1.5. Once Windows NT has loaded, a Welcome window will appear, prompting the operator for a user name and password; enter these in the appropriate blanks and verify that WORKSTATION is displayed in the box labeled From:. Select the OK button to prompt the display of the Windows NT Desktop window.

1.1.6. When the Windows NT Desktop locate and select (double click) the Host NT icon to prompt the display of the Host NT window. The system is now ready to accept host commands at the command line.

1.2.1. Controller Board 1 (Master)

Switch to controller channel 1 and perform self diagnostic test: a return of 0 ensures that serial connections to controller board 1 are sound.

CHAN 1 SELF

1.2.2. Controller Board 2 (Slave)

Switch to controller channel 2 and perform self diagnostic test: a return of 0 ensures that serial connections to controller board 2 are sound. Switch back to controller channel 1.

CHAN 2 SELF

CHAN 1

1.3.1. Main Vacuum Test

1.3.1.1. Verify that the system vacuum sensor is connected to the AUX port on the controller back panel.

1.3.1.2. Detach the vacuum line from the back of the sorter chassis. Turn the sensor adjustment screw CW until the LED turns on, then CCW until the LED turns off.

1.3.1.3. Reattach the vacuum line to the back of the sorter chassis and verify that the LED turns on.

1.3.1.4. Prompt the current hardware sensor status of the controller.

HWST

1.3.1.5. Detach the main vacuum line from the sorter chassis.

1.3.1.6. Again, prompt the current hardware sensor status of the controller; the returned values should be different than those returned in step 1.3.1.4.

HWST

1.3.2. Robot Paddle Vacuum Test
1.3.2.1. Activate paddle 1 vacuum.
SVAC 1 1
1.3.2.2. Adjust paddle 1 vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.
1.3.2.3. Deactivate paddle 1 vacuum.
SVAC 1 1 0
1.3.2.4. Activate paddle 2 vacuum.
SVAC 1 2 1
1.3.2.5. Adjust paddle 2 vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.
1.3.2.6. Deactivate paddle 2 vacuum.
SVAC 1 2 0
1.3.2.7. Place a small wafer on paddle 1 and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).
VACT 1 1
1.3.2.8. Turn paddle 1 vacuum adjustment screw and repeat vacuum test until turn-on value is 35000 ± 5000; remove wafer.
1.3.2.9. Place a small wafer on paddle 2 and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).
VACT 1 2
1.3.2.10. Turn paddle 2 vacuum adjustment screw and repeat vacuum test until turn-on value is 35000 ± 5000; remove wafer.

1.3.3. Aligner Chuck Vacuum.
1.3.3.1. Activate aligner chuck vacuum.
SVAC 2 1 1
1.3.3.2. Remove the back cover of the aligner and adjust the vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.
1.3.3.3. Deactivate aligner chuck vacuum.
SVAC 2 1 0
1.3.3.4. Place a small wafer on aligner chuck and initiate a vacuum test to prompt turn-on value (left) and turn-off value (right).
VACT 2 1
1.3.3.5. Turn aligner vacuum sensor adjustment screw and repeat vacuum test until turn-on and turn-off values are 35000 ± 5000; remove wafer.
1.3.3.6. Replace aligner back cover.
1.3.4: Bright Light Vacuum

1.3.4.1: Remove the guard on the bright light by unscrewing the three M4 fasteners.

1.3.4.2: Remove the access panel from the bright light shaving housing — this panel is distinguishable by its two threaded sensor access holes. The bright light vacuum sensor is located on the left side of the module while the flipper vacuum sensor is located on the right.

1.3.4.3: Position the bright light chuck until it appears level.

1.3.4.4: Place a small wafer on the bright light chuck and initiate a vacuum test to prompt turn-on value (left) and turn-off value (right).

1.3.4.5: Turn bright light vacuum sensor adjustment screw and repeat vacuum test until turn-on and turn-off values are 35000 ± 5000; remove wafer.

1.3.5: Wafer Flipper Vacuum

1.3.5.1: Remove the access panel from the bright light shaving housing — this panel is distinguishable by its two threaded sensor access holes. The bright light vacuum sensor is located on the left side of the module while the flipper vacuum sensor is located on the right.

1.3.5.2: Switch to controller channel 2.

1.3.5.3: Move the flipper up until it clears the top surface of the bright light chuck.

1.3.5.4: Place a wafer over the vacuum ports of the flipper and hold it into position with your hand.

1.3.5.5: Place a wafer over the vacuum ports of the flipper and hold it into position by hand. Initiate a vacuum test to prompt turn-on value (left) and turn-off value (right).

1.3.5.6: Turn flipper vacuum sensor adjustment screw and repeat vacuum test until turn-on and turn-off values are 50000 ± 5000; remove wafer.

1.3.5.7: Park the bright light module.

1.3.5.8: Switch to controller channel 1.
Section D: System Integration

1.4.1. Reference Robot Module

1.4.1.1. Reference robot theta axis.
MREF 1 (make sure all references in all four quadrants)

1.4.1.2. Disable robot paddle axis motor.
MEBL 2 0

1.4.1.3. Manually swing the robot paddle over the robot, record position, enable robot paddle axis motor, and reference robot paddle axis.
RPOS 2 1
MEBL 2 1
MREF 2

1.4.1.4. Reference robot z axis.
MREF 0

1.4.2. Reference Aligner Module

1.4.2.1. Reference aligner theta and x-axes motors.
MREF 3
MREF 4

1.4.3. Check Array Board

1.4.3.1. Turn on the illumination and check the pixels of the array.
OUTP 4 100
ALND (128 should scroll up and down the screen)

1.4.3.2. Stop the scrolling and turn off the illumination.
ESC (stops the scrolling)
OUTP 4 0

1.4.4. Check the upper light source on the wafer light

1.4.4.1. Turn on the light above the acrylic block.
OUTP 5 100

1.4.4.2. Turn off the light source.
OUTP 5 0

1.4.5. Check the lower light source on the wafer light

1.4.5.1. Turn on the light source below the light shield.
OUTP 10 100

1.4.5.2. Turn off the light source.
OUTP 10 0
1.4.6. Reference Bright Light Module
1.4.6.1. Reference all bright light and flipper axes
MREF 7
MREF 8
MREF 9
MREF 19

1.4.6.2. Reference bright light station.
SREF 3

1.4.7. Bright Light Illumination Check
1.4.7.1. Turn high-intensity lamp on then off.
OUTP 6 100
OUTP 6 0
System Integration: 3-Cassette with Bright Light

2.1. Cassette Station Leveling

2.1.1. On the underside of the sorter chassis, locate each cassette station’s respective access port and loosen the four fasteners located there.

2.1.2. Remove the sensor cable clamps that cover up the set screw holes under the cassette stations.

2.1.3. Loosen the three set screws located under the cassette station until they are not touching the bottom of their station.

2.1.4. Raise the robot z axis.

MOV A 0

2.1.5. Disable the robot theta and paddle motors.

MEBL 1 0
MEBL 2 0

2.1.6. Turn on robot paddle 1 vacuum and place a wafer over the vacuum port.

SVAC 1 1 1

2.1.7. Manually rotate the robot theta axis to swing paddle 1 and the wafer out over the cassette stations - note that the centerline of paddle 1 must point to the center of the robot for proper leveling. Using the wafer as a baseline, determine which cassette station is the highest, proceed to level that station first.

2.1.8. Place three leveling blocks around the edge of the highest cassette station. Manually swing the wafer over the cassette station. Lower the robot z axis until the underside of the wafer makes contact with one of the blocks.

MOVR 0 [-.001]

2.1.9. Adjust the three set screws under the station under the wafer makes equal contact with all three blocks. Once the station is level, rotate the set screws located closest to the robot clockwise (CW) 1/4 turn.

2.1.10. Manually swing paddle 1 and the wafer away from the station. Beginning with the two fasteners situated farthest from the robot and proceeding in small increments, retighten the four fasteners located on the underside of the pedestal.

2.1.11. Manually swing paddle 1 and the wafer back over the station and use the blocks to ensure that it is still level. Repeat the leveling procedure if necessary.

2.1.12. Manually swing paddle 1 and the wafer over the next station, keeping the same robot z height, and perform the leveling procedure described above (2.1.9 - 2.1.11).

2.1.13. While supporting the wafer, turn off the vacuum to robot paddle 1 and remove the wafer.

SVAC 1 1 0

2.1.14. Enable the robot theta and paddle motors.

MEBL 1 1
MEBL 2 1
2.2 Robot Paddle Calibration

2.2.1 Reference the robot theta axis.
     MREF 1

2.2.2 Reference the robot paddle axis.
     MREF 2

2.2.3 Set the station reference flag for the robot.
     SRFL 1

2.2.4 Rotate the robot paddle axis until paddle 1 is centered over the robot.
     MOV R 2 [degrees]

2.2.5 Place a calibration pin into the robot calibration pin hole.

2.2.6 Rotate the robot paddle axis until the inside edge of paddle 1 makes contact with
     calibration pin, as paddle one approaches the pin, decrease the increment of
     rotation.
     MOV R 2 [degrees]

2.2.7 Set the robot paddle reference position and paddle 1 calibration angle.
     KPOS 2 1
     MREF 2
     SCAL 1 1 0

2.2.8 Check to see if robot paddle 1 centers properly over the robot.
     MVP C 1

2.2.9 Save settings.
     SAVE
2.3. Robot Z Axis Calibration

2.3.1. Center robot paddle 1 over the center of the robot and set the robot height (z axis) to 1 inches.

MVPC 1
MOVA 0 .1

2.3.2. Rotate the robot theta axis until the robot faces cassette station A.

MOV R 1 [. degrees]

2.3.3. Extend paddle 1 out over cassette station A.

MOV R 2 180

2.3.4. Adjust the robot z axis brake timeout value.

SCAL 1 6 1000000

2.3.5. Place a 1 inch calibration block adjacent to the tip of the extended robot paddle.
Raise or lower the robot z axis until the height of the paddle's bottom edge matches that of the block - as paddle 1 approaches the block downward movement should be in increments of .001".

MOV R 0 (+-.001)

2.3.6. Set the robot z axis motor reference position.

RPOS 0 1

2.3.7. Reference the robot z axis.

MREF 0

2.3.8. Move the robot z axis to the newly set zero position.

MOVA 0 .0

2.3.9. Center paddle 1 over the robot, then extend it out over the cassette station A, use the calibration block to see if RPOS recorded properly.

MVPC 1
MOV R 2 180

2.3.10. Center paddle 2 over the robot, then extend it out over the cassette station A.

MVPC 2
MOV R 2 180

2.3.11. Raise or lower the robot z axis until the height of the paddle’s bottom edge is equal to the height of the block - as paddle 2 approaches the block downward movement must be in increments of .001".

MOV R 0 (+-.001)

2.3.12. Set the paddle offset and center paddle 1 over the robot.

POFF 1
MVPC 1

2.3.13. Set default limits for the robot z, theta and paddle axes.

FLIM 0
FLIM 1
FLIM 2

2.3.14. Reset the robot z axis brake timeout value.

SCAL 1 6 2000000

2.3.15. Save settings.

SAVE
2.4. Integration: 2.4.1. 3-Cassette / Bright Light

System Integration:

3-Cassette / Bright Light

Can Angle Calibration

2.4.1. Center robot paddle 1 over the robot, prompt a reading of the robot z axis negative limit, and move the robot z axis to a height that equals its negative limit plus .1 inches.
MVPC 1
LIMN 0
MOVA 0 [negative limit + .1]

2.4.2. Rotate the robot theta axis until the robot faces cassette station A.
MOVR 1 [c degrees]

2.4.3. Center robot paddle 1 over the robot then extend it over cassette station A.
MVPC 1
MOVR 2 180

2.4.4. Place a calibration pin in the calibration hole on top of cassette station A. rotate the robot theta axis in small increments until the paddle makes contact with the calibration pin.
MOVR 1 [.12 degrees]

2.4.5. Define the world position and set the can angles for a sorter with three cassettes and a bright light module:
FWLD 90
SCAL 2 0 0
SCAL 3 0 140
SCAL 10 0 -140
SCAL 11 0 -90
SCAL 12 0 90
XPOS 1 0
SCAL 1 7 55
SREF 1

2.4.6. Test the settings by rotating the paddle end of the robot to face the aligner.
SPRK 1

2.4.7. Save settings.
SAVE
Aligner Calibration

2.5.1. Reference all aligner axes.
SREF 2

2.5.2. Move aligner x axis until the chuck is positioned over the center of the module.
MOVR 4 [+2 inches]

2.5.3. Center robot paddle 1 over the robot and rotate the robot theta axis until the robot's paddle end faces the aligner.
MVPC 1

2.5.4. Raise the robot z axis to a height above the aligner chuck.
MOVA 0 3.0

2.5.5. Extend robot paddle 1 over the aligner chuck and turn on robot paddle 1 vacuum.
MOVR 2 180
SVAC 1 1 1

2.5.6. Manually place a wafer onto robot paddle 1. Make sure it is centered over the chuck.

2.5.7. Lower the robot z axis until any part of the wafer makes contact with the aligner chuck. Do not proceed lower than the aligner chuck as this may damage the wafer.
MOVR 0 [±.005 inches]

2.5.8. Access the aligner's bottom panel and loosen the four shoulder bolts if they do not have springs. Adjust the three aligner leveling screws until the gap between the chuck and the wafer appears even from all vantage points. Tighten the shoulder bolts if they do not have springs.

2.5.9. While supporting the wafer, turn off robot paddle 1 vacuum.
SVAC 1 1 0

2.5.10. Move the aligner x axis in a positive direction.
MOVR 2

2.5.11. Place a calibration pin in the calibration hole on top of the aligner's surface. Make sure it is perpendicular to the top plate.

2.5.12. Move the aligner x axis in the negative direction until the calibration pin makes contact with robot paddle 1.
MOVR 4 [-.02 inches]

2.5.13. Record the aligner x axis reference position, set the aligner x axis transfer position, and reference the aligner module.
RPOS 4 1
XPOS 4 0
MREF 4

2.5.14. Pull the calibration pin out of the aligner's calibration hole and park the aligner.
SPRK 2

2.5.15. Check to see if the aligner parked at the correct position, then center robot paddle 1 over the robot.
MVPC 1

2.5.16. Set default limits for aligner x and theta axes.
FLIM 3
FLIM 4

2.5.17. Save settings.
SAVE
2.6. Setting Aligner Transfer Position

2.6.1. Center robot paddle 1 over the robot and rotate the robot theta axis until the robot's paddle and faces the aligner.

MVPC 1
MOV A 1 0

2.6.2. Raise the robot z axis to a height above the aligner chuck.

MOVA 6 3.5

2.6.3. Extend robot paddle 1 over the aligner chuck and turn on robot paddle 1 vacuum.

MOVR 2 180
SVAC 1 1 1

2.6.4. Manually place a wafer onto robot paddle 1. Make sure it is centered over the chuck.

2.6.5. Set the aligner transfer position by repeatedly lowering the wafer until contact with the aligner chuck is sensed.

FVAC 2 1

2.6.6. Set the default transfer heights.

SCAL 2 2 -.03
SCAL 2 3 -.035
SCAL 2 4 0.015
SCAL 2 5 .03

2.6.7. Save settings.

SAVE
Section D: System Integration

2.7. **Aligner Sensor Array Calibration**

2.7.1 Turn on the aligner sensor array illumination

OUTP 4 100

2.7.2 Use a small flathead screwdriver to gently turn the potentiometer to maximum brightness; be careful not to stop the potentiometer as its maximum range of motion is only 3/4 turn.

2.7.3 Move the aligner x-axis until the wafer edge is centered under the aligner sensor array.

MOVR 4 [distance]

2.7.4 Prompt a display of the wafer edge location with respect to the sensor array. A properly positioned edge would read between 60 and 68. Select the ESC button to terminate the ALND display.

ALND

2.7.5 Adjust the aligner x-axis as needed.

MOVR 4 [+.05]

2.7.6 Repeat steps 7.4 and 7.5 until the ALND reading falls between 60 and 68.

2.7.7 Turn the potentiometer until ALND reading decreases by 1. Select the ESC button to terminate the ALND display.

ALND

2.7.8 Turn off aligner sensor array illumination.

OUTP 4 0

2.7.9 Autocalibrate the aligner sensor array.

ALNC 1

2.7.10 Support the wafer by hand, turn off the aligner chuck vacuum and manually remove the wafer.

SVAC 2 1 0

2.7.11 Save settings.

SAVE
2.8. Laser Offset Setup

2.8.1. Reference all robot axes.
SREF 1

2.8.2. Set wafer mapping algorithm.
MAPA 2

2.8.3. To determine the laser offset position, first place a calibration pin in the calibration hole on the top of cassette station A. Next, position a white card or piece of paper behind the pin, opposite the robot. Execute the following commands to position the robot z and theta axes so that the robot laser is aimed at the calibration pin.
LIMN 0 (returns negative limit)
MOVA 0 [negative limit + .05 inches]
MOVA 1 90

2.8.4. Turn on the laser and rotate the robot theta axes until the shadow of the pin falls directly in the center of the laser beam projected onto the paper.
LASR 1
MOV R 1 [.2]

2.8.5. Prompt the current robot theta position and use it to set the laser offset.
MEPOS 1 (returns current position)
SCAL 1 14 [90 - current position]

2.8.6. Turn the laser off.
LASR 0

2.8.7. Save the settings.
SAVE
2.9. **Mapping Setup: Cassette Station A**

2.9.1. Place a full cassette on cassette station A. Remove the wafer in slot 2.

2.9.2. Calibrate the mapping set up.

**MAPS 10**

2.9.3. Put the wafer back in slot 2.

2.9.4. Map the cassette.

**MAPP 10**

2.9.5. Prompt a return of the mapping data over a specified range of mapping angles.

**SCAN 10 -2 4 2**

2.9.6. Study the returned mapping angles and their corresponding data. Determine at which mapping angles the cassette was correctly mapped. From among the angles that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.9) in the following procedures.

-2.0 000000000000000000000000
-1.8 000000000000000000000000
-1.6 000000000000000000000000
-1.4 000000000000000000000000
-1.2 000000000000000000000000
-1.0 000000000000000000000000
-0.8 000000000000000000000000
-0.6 000000000000000000000000
-0.4 000000000000000000000000
-0.2 000000000000000000000000
0.0 101101101111111111111111
0.2 101101101111111111111111
0.4 101101101111111111111111
0.6 101101101111111111111111
0.8 101101101111111111111111
1.0 101101101111111111111111
1.2 101101101111111111111111
1.4 101101101111111111111111
1.6 101101101111111111111111
1.8 101101101111111111111111
2.0 101101101111111111111111
2.2 101101101111111111111111
2.4 101101101111111111111111
2.6 101101101111111111111111
2.8 101101101111111111111111
3.0 101101101111111111111111
3.2 101101101111111111111111
3.4 101101101111111111111111
3.6 001001100110011111111111
3.8 001001100110011111111111
4.0 000000000000000000000000

2.9.7. Set the low mapping angle

**SCAL 10 1** [low angle value]

2.9.8. Set the high mapping angle

**SCAL 10 2** [high angle value]

2.9.9. Auto calibrate the best mapping start position.

**MAPP 10**

2.9.10. Map the cassette and check the accuracy of returned data.

**MAPP 10**

2.9.11. Save the settings

**SAVE**
**System Integration:**

3-Cassette / Bright Light

### 2.10. Mapping Setup: Cassette Station B

#### 2.10.1. Place a full cassette on cassette station B. Remove the wafer to slot 2.

#### 2.10.2. Calibrate the mapping set up:

**MAPS 11**

#### 2.10.3. Put the wafer back in slot 2.

#### 2.10.4. Map the cassette:

**MAPC 11**

#### 2.10.5. Proceed with return of the mapping data over a specified range of mapping angles.

**SCAN 11 - 2. 4.2**

#### 2.10.6. Study the returned mapping angles and their corresponding data, determine which mapping angle the cassette was correctly mapped. From among the angles that mapped correctly, select a 1 degree range that falls midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.8) in the following procedures.

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<tr>
<th>Angle Value</th>
<th>Data</th>
</tr>
</thead>
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</tr>
<tr>
<td>-1.8</td>
<td>00000000000000000000000000000000</td>
</tr>
<tr>
<td>-1.6</td>
<td>00000000000000000000000000000000</td>
</tr>
<tr>
<td>-1.4</td>
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</tr>
<tr>
<td>-0.6</td>
<td>00000000000000000000000000000000</td>
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<tr>
<td>-0.4</td>
<td>00000000000000000000000000000000</td>
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<tr>
<td>-0.2</td>
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<td>3.8</td>
<td>00000000000000000000000000000000</td>
</tr>
<tr>
<td>4.0</td>
<td>00000000000000000000000000000000</td>
</tr>
</tbody>
</table>

#### 2.10.7. Set the low mapping angle:

**SCAL 11 [low angle value]**

#### 2.10.8. Set the high mapping angle:

**SCAL 11 [high angle value]**

#### 2.10.9. Auto calibrate the best mapping start position:

**MAPH**

#### 2.10.10. Map the cassette and check the accuracy of returned data:

**MAPC 11**

#### 2.10.11. Save the settings:

**SAVE**
2.11. Mapping Setup: Cassette Station C

2.11.1. Place a full cassette on cassette station C. Remove the wafer In slot 2.

2.11.2. Calibrate the mapping set up.

MAPS 12

2.11.3. Put the wafer back in slot 2.

2.11.4. Map the cassette.

MAPC 12

2.11.5. Prompt a return of the mapping data over a specified range of mapping angles.

SCAN 12 -2 4.2

2.11.6. Study the returned mapping angles and their corresponding data. Determine which mapping angles the cassette was correctly mapped. From among these angles that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.8) in the following procedures.

-2.0 00000000000000000000000000000000
-1.8 00000000000000000000000000000000
-1.6 00000000000000000000000000000000
-1.4 00000000000000000000000000000000
-1.2 00000000000000000000000000000000
-1.0 00000000000000000000000000000000
-0.8 00000000000000000000000000000000
-0.6 00000000000000000000000000000000
-0.4 00000000000000000000000000000000
-0.2 00000000000000000000000000000000
+0.2 00000000000000000000000000000000
+0.4 00000000000000000000000000000000
+0.6 00000000000000000000000000000000
+0.8 00000000000000000000000000000000
+1.0 00000000000000000000000000000000
+1.2 00000000000000000000000000000000
+1.4 00000000000000000000000000000000
+1.6 00000000000000000000000000000000
+1.8 00000000000000000000000000000000
+2.0 00000000000000000000000000000000
+2.2 00000000000000000000000000000000
+2.4 00000000000000000000000000000000
+2.6 00000000000000000000000000000000
+2.8 00000000000000000000000000000000
+3.0 00000000000000000000000000000000
+3.2 00000000000000000000000000000000
+3.4 00000000000000000000000000000000
+3.6 00000000000000000000000000000000
+3.8 00000000000000000000000000000000
+4.0 00000000000000000000000000000000

2.11.7. Set the low mapping angle

SCAL 12 1 [low angle value]

2.11.8. Set the high mapping angle

SCAL 12 2 [high angle value]

2.11.9. Auto calibrate the best mapping start position.

MAPH 12

2.11.10. Map the cassette and check the accuracy of returned data.

MAPC 12

2.11.11. Save the settings

SAVE
Setting Wafer Transfer Positions: Cassette Station A System Integration: Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station A.

Map the cassette.

Find the negative limit and move the robot z-axis to a position slightly above it.

Extend robot paddle 1 into the cassette below wafer 1.

Repeatedly raise robot height until vacuum contact with wafer 1 is sensed.

Remove paddle 1 from the cassette.

Establish robot paddle 1 offset. Repeat the following procedure (12.8 - 12.13.) until paddle 1 is centered between wafers 1 and 2.

Move the robot z-axis to the wafer 2 drop-off height.

Disable the robot theta axis motor.

Adjust paddle 1 offset position.

Manually swing robot paddle 1 out of the cassette and center it over the robot.

Enable the robot theta axis motor.

Check / adjust wafer pitch. Repeat the following procedure (12.15. - 12.21.) until paddle 1 is centered between wafers 24 and 25.

Move the robot z-axis to the wafer 25 drop-off height.

Disable the robot theta axis motor.

Manually swing robot paddle 1 into the cassette between wafers 24 and 25.

Adjust the wafer pitch.

Manually swing paddle and out of cassette and center over robot.

Enable robot theta-axis.

Map the cassette and check results for accuracy.

Save Settings.
2.13. Setting Wafer Transfer Positions: Cassette Station B

2.13.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station B.

2.13.2. Map the cassette.

MAPC 11

2.13.3. Find the negative limit and move the robot z-axis to a position slightly above it.

LIMN 0
MOVA 0 [negative limit + .1]

2.13.4. Extend robot paddle 1 into the cassette below wafer 1.

WEOO 11 1 1

2.13.5. Repeatedly raise robot height until vacuum contact with wafer 1 is sensed.

FVAC 11 1 [repeat until contact is made]

2.13.6. Remove paddle 1 from the cassette.

WDOO 11 1 1

2.13.7. Establish robot paddle 1 offset. Repeat the following procedure (13.8 - 13.13.) until paddle 1 is centered between wafers 1 and 2.

2.13.8. Move the robot z-axis to the wafer 2 drop-off height.

WDOO 11 2 1

2.13.9. Disable the robot theta axis motor.

MEBL 1 0

2.13.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

2.13.11. Adjust paddle 1 offset position.

SCAL 11 6 [.003]

2.13.12. Manually swing robot paddle 1 out of the cassette and center it over the robot.


MEBL 1 1

2.13.14. Check / adjust wafer pitch. Repeat the following procedure (13.15 - 13.27.) until paddle 1 is centered between wafers 24 and 25.

2.13.15. Move the robot z-axis to the wafer 25 drop-off height.

WDOO 11 25 1

2.13.16. Disable the robot theta axis motor.

MEBL 1 0

2.13.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.

2.13.18. Adjust the wafer pitch.

SCAL 11 17 [.0001]


2.13.20. Enable robot theta-axis.

MEBL 1 1

2.13.21. Map the cassette and check results for accuracy.

MAPC 11

2.13.22. Save Settings.

SAVE
2.14. Setting Wafer Transfer Positions: Cassette Station C

2.14.1. Place a cassette with wafers in positions 1, 24, and 25 onto cassette station C.


MAPC 12

2.14.3. Find the negative limit and move the robot z-axis to a position slightly above it.

LIMN 0

MOV 3 (negative limit +1)

2.14.4. Extend robot paddle 1 into the cassette below wafer 1.

WEOD 12 1 1

2.14.5. Repeatedly raise robot height until vacuum contact with wafer 1 is sensed.

FVAC 12 1 (repeat until contact is made)

2.14.6. Remove paddle 1 from the cassette.

WOOR 12 1 1

2.14.7. Establish robot paddle 1 offset. Repeat the following procedure (14.8 - 14.13) until paddle 1 is centered between wafers 1 and 2.


WDOO 12 2 1


MEBL 1 0

2.14.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

2.14.11. Adjust paddle 1 offset position.

SCAL 12 6 [±.003]

2.14.12. Manually swing robot paddle 1 out of the cassette and center it over the robot.


MEBL 1 1


WDOO 12 25 1


MEBL 1 0

2.14.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.


SCAL 12 17 [±.0001]


MEBL 1 1

2.14.21. Map the cassette and check results for accuracy.

MAPC 12


SAVE
2.15. Joystick Calibration

2.15.1. Exit Host NT software and start workstation software.

2.15.2. Enable the bright light option in the system setup screen.

2.15.3. Exit and re-enter the workstation software.

2.15.4. Select setup from the main tool bar.

2.15.5. Click joystick.

2.15.6. Make sure the power curve is set to four and the dead band is between four and fifteen.

2.15.7. Click calibrate joystick.

2.15.8. Follow the eight instruction steps to calibrate the joystick.

2.15.9. Click yes to accept the joystick calibration and exit the window.

2.15.10. Exit workstation software.
System Integration: 3-Cassette / Bright Light

2.16

Bright Light Leveling & Transfer Heights (without Wafer Flipper)

2.16.1.

Make sure guard has been removed and the vacuum sensitivity is set correctly. The mapping and transfer heights of the stations should already be set up. The robot parameters should also be set.

2.16.2.

Increase the software limits:

LIMP 7 720
LIMP 8 720
LIMN 7 -720
LIMN 8 -720

2.16.3.

Remove a wafer from a cassette with the robot.

2.16.4.

Move the robot to the Z transfer position of the bright light.

2.16.5.

Position the bright light chuck until it appears level.

MOVR 7 ±
MOVR 8 ±

2.16.6.

Disable the theta axis and manually move the wafer on paddle one over the bright light chuck.

2.16.7.

Raise or lower the Z axis of the robot until the bottom surface of the wafer is close to the top surface of the bright light chuck.

MOVR 8 ± .001

2.16.8.

Make fine leveling adjustments of the bright light chuck. There should be an even gap between the surfaces of the chuck and wafer.

MOVR 7 ±
MOVR 8 ±

2.16.9.

Manually move the wafer over the center of the robot.

2.16.10.

Set the transfer positions of the bright light and reference the motors.

RPOS 7 1
RPOS 8 1
MREF 7
MREF 8

2.16.11.

Check to see if the chuck parks itself at the correct position.

SPRN 3

2.16.12.

Make sure the transfer positions are at their default positions.

SCAL 3 2 -.03
SCAL 3 3 -.01
SCAL 3 4 .01
SCAL 3 5 .03

2.16.13.

Manually move the wafer over the bright light chuck.

2.16.14.

Set the bright light transfer height – repeat until contact is made.

FVAC 3

2.16.15.

Enable the theta axis on the robot and remove the wafer from the bright light chuck.

MEBL 1 1
WOLR 3 1 1
System Integration: 3-Cassette / Bright Light

2.15.15. Set the software limits back to their original default parameters
FLIM 7
FLIM 8
FLIM 9

2.16.17. If the robot transfers the wafer cleanly to and from the bright light, save the parameters.
SAVE

2.16.18. Replace the bright light housing panel.
2.17. **Bright Light Leveling & Transfer Heights (with Wafer Flipper)**

2.17.1. Make sure guard has been removed and the vacuum sensitivity is set correctly. The mapping and transfer heights of the stations should already be set up. The robot angles should also be set.

2.17.2. Switch to controller channel 2. 
CHAN 2

2.17.3. Increase the software limits:
- LM7 720
- LM8 720
- LM7 -720
- LM8 -720

2.17.4. Switch to controller channel 1. 
CHAN 1

2.17.5. Remove a wafer from a cassette with the robot. 
WELR 10 2 1

2.17.6. Move the robot to the Z transfer position of the bright light. 
WLOD 3 1 1

2.17.7. Switch to controller channel 2. 
CHAN 2

2.17.8. Position the bright light chuck until it appears level. 
MOVR 7 0
MOVR 8 0

2.17.9. Switch to controller channel 1. 
CHAN 1

2.17.10. Disable the theta axis and manually move the wafer on paddle one over the bright light chuck. 
MEBL 1 0

2.17.11. Raise or lower the Z axis of the robot until the bottom surface of the wafer is close to the top surface of the bright light chuck. 
MOVR 7 0
MOVR 8 0

2.17.12. Switch to controller channel 2. 
CHAN 2

2.17.13. Make fine leveling adjustments of the bright light chuck. There should be an even gap between the surfaces of the chuck and wafer. 
MOVR 7 0
MOVR 8 0

2.17.14. Manually move the wafer over the center of the robot. 

2.17.15. Set the transfer positions of the bright light and reference the motors: 
RPOS 7 1
RPOS 8 1
MREF 7
MREF 8

2.17.16. Check to see if the chuck parks itself at the correct position. 
SPRk 3

2.17.17. Make sure the transfer positions are at their default positions: 
SCAL 3 .02
SCAL 3 .01
SCAL 4 .01
SCAL 5 .03

---

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2.17.16. Manually move the wafer over the bright light chuck.

2.17.19. Set the bright light transfer height – repeat until contact is made.

FVAC 3

2.17.20. Switch to controller channel 1.

CHAN 1

2.17.21. Enable the theta axis on the robot and remove the wafer from the bright light chuck.

MBEX 1

WOLR 3 1 1

2.17.22. Switch to controller channel 2.

CHAN 2

2.17.23. Set the software limits back to their original default parameters.

FLIM 7

FLIM 8

FLIM 9

2.17.24. If the robot transfers the wafer cleanly to and from the bright light, save the parameters.

SAVE

2.17.25. Switch to controller channel 1.

CHAN 1

2.17.26. Replace the bright light housing panel.
Make sure the joystick has been calibrated and the robot transfers wafers to the bright light chuck cleanly.

Transfer a wafer to the bright light chuck with the robot.

Switch to controller channel 2.

Move the bright light chuck and the flipper until the top surface of the flipper makes evenly contact with the bottom surface of the wafer.

Prompt motor positions and record.

Set transfer positions using recorded values.

Park the bright light.

Test the new flip parameters.

Return the wafer back to the bright light chuck.

Save the settings and place the cover and guard back into position.

Switch to controller channel 1.
4-Cassette System Setup & Integration Sequence:

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Initial Power-Up & Hardware Check: 4-Cassette

1.1. System Power-Up

1.1.1. Set the controller On/Off switch to the On position.

1.1.2. Make sure E-Stop is pulled out and turn the system On/Off switch clockwise as far as it will go to power up the controller - do not shut the On/Off switch and return to a position midway between the Off and On labels. Wait 20 seconds and again turn the system On/Off switch clockwise as far as it will go to activate system motor power.

1.1.3. Power-up the VGA color monitor.

1.1.4. Power-up the system PC. The computer will scan for a keyboard, mouse and viruses, check the integrity of the hard drive, and load Windows NT.

1.1.5. Once Windows NT has loaded, a Welcome window will appear, prompting the operator for a user name and password; enter these in the appropriate boxes and verify that WORKSTATION is displayed in the box labeled From:. Select the OK button to prompt the display of the Windows NT Desktop window.

1.1.6. Within the Windows NT Desktop locate and select (double click) the Host NT icon to prompt the display of the Host NT window. The system is now ready to accept host commands at the command line.

1.2. Controller Board 1 (Master):

1.2.1. Perform self diagnostic test; a return of 0 ensures that serial connections to controller board 1 are sound.

1.3.1. Main Vacuum Test

1.3.1.1. Verify that the system vacuum sensor is connected to the AUX port on the controller back panel.

1.3.1.2. Detach the vacuum line from the back of the sorter chassis. Turn the sensor adjustment screw CW until the LED turns on, then CCW until the LED turns off.

1.3.1.3. Reattach the vacuum line to the back of the sorter chassis and verify that the LED turns on.

1.3.1.4. Prompt the current hardware sensor status of the controller.

1.3.1.5. Detach the main vacuum line from the sorter chassis.

1.3.1.6. Again, prompt the current hardware sensor status of the controller; these results should be different than those returned in step 1.3.1.4.
1.3.2. **Robot Paddle Vacuum Test**

1.3.2.1. Activate paddle 1 vacuum.
   SVAC 1 1

1.3.2.2. Adjust paddle 1 vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

1.3.2.3. Deactivate paddle 1 vacuum.
   SVAC 1 1 0

1.3.2.4. Activate paddle 2 vacuum.
   SVAC 1 2

1.3.2.5. Adjust paddle 2 vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

1.3.2.6. Deactivate paddle 2 vacuum.
   SVAC 1 2 0

1.3.2.7. Place a small wafer on paddle 1 and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).
   VACT 1 1

1.3.2.8. Turn paddle 1 vacuum adjustment screw and repeat vacuum test until turn-on value is 35000 (± 5000); remove wafer.

1.3.2.9. Place a small wafer on paddle 2 and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).
   VACT 1 2

1.3.2.10. Turn paddle 2 vacuum adjustment screw and repeat vacuum test until turn-on value is 35000 (± 5000); remove wafer.

1.3.3. **Aligner Chuck Vacuum**

1.3.3.1. Activate aligner chuck vacuum.
   SVAC 2 1

1.3.3.2. Remove the back cover of the aligner and adjust the vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

1.3.3.3. Deactivate aligner chuck vacuum.
   SVAC 2 1 0

1.3.3.4. Place a small wafer on aligner chuck and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).
   VACT 2 1

1.3.3.5. Turn aligner vacuum sensor adjustment screw and repeat vacuum test until turn-on and turn-off values are 35000 (± 5000); remove wafer.

1.3.3.6. Replace aligner back cover.
1.4.1. Reference Robot Module

1.4.1.1. Reference robot theta axis.
MREF 1 (make sure it references in all four quadrants)

1.4.1.2. Disable robot paddle axis motor:
MEBL 2 0

1.4.1.3. Manually swing the robot paddle over the robot, record position, enable robot paddle axis motor, and reference robot paddle axis:
RPDS 2 1
MEBL 2 1
MREF 2

1.4.1.4. Reference robot z axis
MREF 0

1.4.2. Reference Aligner Module

1.4.2.1. Reference aligner theta and x-axes motors:
MREF 3
MREF 4

1.4.3. Check array board

1.4.3.1. Turn on the illumination and check the pixels of the array.
OUTP 4 100
ALND (128 should scroll up and down the screen)

1.4.3.2. Stop the scrolling and turn off the illumination.
ESC (stops the scrolling)
OUTP 4 0

1.4.4. Check the upper light source on the wafer light.

1.4.4.1. Turn on the light above the acrylic block.
OUTP 5 100

1.4.4.2. Turn off the light source.
OUTP 5 0

1.4.5. Check the lower light source on the wafer light.

1.4.5.1. Turn on the light source below the light shield.
OUTP 10 100

1.4.5.2. Turn off the light source.
OUTP 10 0
Section D: System Integration

4-Cassette Station Leveling

2.1.1. On the underside of the sorter chassis, locate each cassette station's respective access port and loosen the four fasteners located there.

2.1.2. Remove the sensor cable clamps that cover up the set screw holes under the cassette stations.

2.1.3. Loosen the three set screws located under the cassette station until they are not touching the bottom of their station.

2.1.4. Raise the robot z-axis.

2.1.5. Grasp the robot theta and paddle motors.

MEBL 1 0
MEBL 2 0

2.1.6. Turn on robot paddle 1 vacuum and place a wafer over the vacuum port.

SVAC 1 1 1

2.1.7. Manually rotate the robot theta axis to swing paddle 1 and the wafer out over the cassette stations - note that the centerline of paddle 1 must point to the center of the robot for proper leveling. Using the wafer as a baseline, determine which cassette station is the highest; proceed to level that station first.

2.1.8. Place three leveling blocks around the edge of the highest cassette station. Manually swing the wafer over the cassette station. Lower the robot z-axis until the underside of the wafer makes contact with one of the blocks.

MOV R 0 [- .001]

2.1.9. Adjust the three set screws under the station until the wafer makes equal contact with all three blocks. Once the station is level, rotate the set screw located closest to the robot clockwise (CW) 1/4 turn.

2.1.10. Manually swing paddle 1 and the wafer away from the station. Beginning with the two fasteners situated farthest from the robot and proceeding in small increments, retighten the four fasteners located on the underside of the pedestal.

2.1.11. Manually swing paddle 1 and the wafer back over the station and use the blocks to ensure that it is still level. Repeat the leveling procedure if necessary.

2.1.12. Manually swing paddle 1 and the wafer over the next station, keeping the same robot z-height, and perform the leveling procedure described above (2.1.9 - 2.1.11).

2.1.13. While supporting the wafer, turn off the vacuum to robot paddle 1 and remove the wafer.

SVAC 1 1 0

2.1.14. Enable the robot theta and paddle motors.

MEBL 1 1
MEBL 2 1
2.2. Robot Paddle Calibration

2.2.1. Reference the robot theta axis.
MREF 1

2.2.2. Reference the robot paddle axis.
MREF 2

2.2.3. Set the station reference flag for the robot.
SRFL 1 1

2.2.4. Rotate the robot paddle axis until paddle 1 is centered over the robot.
MOVR 2 [- degrees]

2.2.5. Place a calibration pin into the robot calibration pin hole.

2.2.6. Rotate the robot paddle axis until the inside edge of paddle 1 makes contact with calibration pin, as paddle one approaches the pin, decrease the increment of rotation.
MOVR 2 [- degrees]

2.2.7. Set the robot paddle reference position and paddle 1 calibration angle.
RPDS 2 1
MREF 2
SCAL 1 1 0

2.2.8. Check to see if robot paddle 1 centers properly over the robot.
MVPC 1

2.2.9. Save settings.
SAVE
Section D: System Integration

4-Cassette

2.3. Robot Z Axis Calibration

2.3.1. Center robot paddle 1 over the center of the robot and set the robot height (z axis) to 1 inches.
   MOV A 0 1

2.3.2. Rotate the robot theta axis until the robot faces cassette station A.
   MOV R 1 [degrees]

2.3.3. Extend paddle 1 out over cassette station A.
   MOV R 2 180

2.3.4. Adjust the robot z axis brake timeout value.
   SCAL 1 6 1000000

2.3.5. Place a 1 inch calibration block adjacent to the tip of the extended robot paddle. Raise or lower the robot z axis until the height of the paddle’s bottom edge matches that of the block - as paddle 1 approaches the block downward movement should be in increments of .001”.
   MOV R 0 [+- .001]

2.3.6. Set the robot z axis motor reference position.
   RPOS 0 1

2.3.7. Reference the robot z axis.
   MREF 0

2.3.8. Move the robot z axis to the newly set zero position.
   MOVA 0 0

2.3.9. Center paddle 1 over the robot, then extend it out over the cassette station A; use the calibration block to see if RPOS recorded properly.
   MOV C 1
   MOV R 2 180

2.3.10. Center paddle 2 over the robot, then extend it out over the cassette station A.
   MOV C 2
   MOV R 2 180

2.3.11. Raise or lower the robot z axis until the height of the paddle’s bottom edge is equal to the height of the block - as paddle 2 approaches the block downward movement must be in increments of .001”.
   MOV R 0 [+- .001]

2.3.12. Set the paddle offset and center paddle 1 over the robot.
   POFF 1
   MOV C 1

2.3.13. Set default limits for the robot Z, theta and paddle axes.
   FLIM 0
   FLIM 1
   FLIM 2

2.3.14. Reset the robot z axis brake timeout value.
   SCAL 1 6 2000000

2.3.15. Save settings.
   SAVE
2.4. Can Angle Calibration

2.4.1. Center robot paddle 1 over the robot, prompt a reading of the robot z-axis negative limit, and move the robot z-axis to a height that equals its negative limit plus .1 inches.

MVPC 1
LIMN 0
MOVA 0 [negative limit = -.1]

2.4.2. Rotate the robot theta axis until the robot faces cassette station A.

MOVR 1 [θ degrees]

2.4.3. Center robot paddle 1 over the robot then extend it over cassette station A.

MVPC 1
MOVR 2 180

2.4.4. Place a calibration pin in the calibration hole on top of cassette station A. Tighten the robot theta axis in small increments until the paddle makes contact with the calibration pin.

MOVR 1 [θ <= 12 degrees]

2.4.5. Define the world position and set the cam angles for a sorter with four cassette:

FWLD 90
SCAL 2 0 0
SCAL 11 0 -90
SCAL 12 0 140
SCAL 13 0 90
XPOS 1 0
SCAL 17 55
SREF 1

2.4.6. Test the settings by rotating the paddle end of the robot to face the aligner.

SPRK 1

2.4.7. Save settings.

SAVE
2.5. Aligner Calibration
2.5.1. Reference all aligner axes.
SREF 2
2.5.2. Move aligner x axis until the chuck is positioned over the center of the module.
MOVR 4 [+,.2 inches]
2.5.3. Center robot paddle 1 over the robot and rotate the robot theta axis until the robot's paddle ends face the aligner.
MVPC 1
MOVA 1 0
2.5.4. Raise the robot z axis to a height above the aligner chuck.
MOVA 0 3.0
2.5.5. Extend robot paddle 1 over the aligner chuck and turn on robot paddle 1 vacuum.
MOVR 2 180
SVAC 1 1 1
2.5.6. Manually place a wafer onto robot paddle 1. Make sure it is centered over the chuck.
2.5.7. Lower the robot z axis until any part of the wafer makes contact with the aligner chuck. Do not proceed lower than the aligner chuck as this may damage the wafer.
MOVR 0 [+.005 inches]
2.5.8. Access the aligner's bottom panel and loosen the four shoulder bolts if they do not have springs. Adjust the three aligner leveling screws until the gap between the chuck and the wafer appears even from all vantage points. Retighten the shoulder bolts if they do not have springs.
2.5.9. While supporting the wafer turn off paddle 1 vacuum.
SVAC 1 1 0
2.5.10. Move the aligner x axis in a positive direction.
MOVR 4 2
2.5.11. Place a calibration pin in the calibration hole on top of the aligner's surface. Make sure it is perpendicular to the top plate.
2.5.12. Move the aligner x axis in the negative direction until the calibration pin makes contact with robot paddle 1.
MOVR 4 [-.02 inches]
2.5.13. Record the aligner x axis reference position, set the aligner x axis transfer position, and reference the aligner module.
RPOS 4 1
XPOS 4 0
MREF 4
2.5.14. Pull the calibration pin out of the aligner's calibration hole and park the aligner.
SPRK 2
2.5.15. Check to see if the aligner parked at the correct position, then center robot paddle 1 over the robot.
MVPC 1
2.5.16. Set default limits for aligner x and theta axes.
FLIM 3
FLIM 4
2.5.17. Save settings.
SAVE
2.6. Setting Aligner Transfer Position

2.6.1. Center robot paddle 1 over the robot and rotate the robot theta axis until the robot's paddle end faces the aligner.
MVPC 1
MOVA 1 0

2.6.2. Raise the robot z axis to a height above the aligner chuck.
MOVA 0 3.5

2.6.3. Extend robot paddle 1 over the aligner chuck and turn on robot paddle 1 vacuum.
MOVR 2 180
SVAC 1 1 1

2.6.4. Manually place a wafer onto robot paddle 1. Make sure it is centered over the chuck.
FVAC 2 1

2.6.5. Set the aligner transfer position by repeatedly lowering the wafer until contact with the aligner chuck is sensed.
FAC 2 1

2.6.6. Set the default transfer heights.
SCAL 2 2 -.03
SCAL 2 3 -.005
SCAL 2 4 .015
SCAL 2 5 .03

2.6.7. Save settings.
SAVE
Aligner Sensor Array Calibration

2.7.1. Turn on the aligner sensor array illumination.
OUTP 4 100

2.7.2. Use a small flathead screwdriver to gently turn the potentiometer to maximum brightness; be careful not to strip the potentiometer as its maximum range of motion is only 3/4 turn.

2.7.3. Move the aligner x-axis until the wafer edge is centered under the aligner sensor array.
MOVR 4 [x distance]

2.7.4. Prompt a display of the wafer edge location with respect to the sensor array; a properly positioned edge would read between 60 and 68. Select the ESC button to terminate the ALND display.
ALND

2.7.5. Adjust the aligner x-axis as needed.
MOVR 4 [.05]

2.7.6. Repeat steps 7.4. and 7.5. until the ALND reading falls between 60 and 68.

2.7.7. Turn the potentiometer until ALND reading decreases by 1. Select the ESC button to terminate the ALND display.
ALND

2.7.8. Turn off aligner sensor array illumination.
OUTP 4 0

2.7.9. Autocalibrate the aligner sensor array.
ALNC 1

2.7.10. Support the wafer by hand, turn off the aligner chuck vacuum and manually remove the wafer.
SVAC 2 1 0

2.7.11. Save settings.
SAVE
2.8. Laser Offset Setup

2.8.1 Reference all robot axes.
SREF 1

2.8.2. Set wafer mapping algorithm
MAPA 2

2.8.3. To determine the laser offset position, first place a calibration pin in the hole on the top of cassette station A. Next, position a white card or slip of paper behind the pin, opposite the robot. Execute the following commands to position the robot z and theta axes so that the robot laser is aimed at the calibration pin.

LIMN 0 (returns negative limit)
MOVA 0 [negative limit + .05 inches]
MOVA 1 90

2.8.4. Turn on the laser and rotate the robot theta axis until the shadow of the pin falls directly in the center of the laser beam projected onto the paper.
LASR 1
MOVR [+ .2]

2.8.5. Prompt the current robot theta position and use it to set the laser offset.
MPOS 1 [returns current position]
SCAL 1 14 [90 - current position]

2.8.6. Turn the laser off.
LASR 0

2.8.7. Save the settings.
SAVE
Mapping Setup: Cassette Station A

1. Place a full cassette on cassette station A. Remove the wafer in slot 2.
2. Calibrate the mapping setup.
3. Put the wafer back in slot 2.
4. Map the cassette.

10

5. Prompt a return of the mapping data over a specified range of mapping angles.

15

6. Study the returned mapping angles and their corresponding data. Determine at which mapping angles the cassette was correctly mapped. From among the angles that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.8) in the following procedures.

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7. Set the low mapping angle.
8. Set the high mapping angle.
9. Auto calibrate the best mapping start position.
10. Map the cassette and check the accuracy of returned data.
11. Save the settings.
2.10. Mapping Setup: Cassette Station B

2.10.1. Place a full cassette on cassette station B. Remove the wafer in slot 2.

2.10.2. Calibrate the mapping setup.
   MAPS 11

2.10.3. Put the wafer back in slot 2.

2.10.4. Map the cassette
   MAPC 11

2.10.5. Prompt a return of the mapping data over a specified range of mapping angles.

2.10.6. Study the returned mapping angles and their corresponding data. Identify (via MAPS) at which mapping angles the cassette was correctly mapped. From listing the angles that mapped correctly, select a 1 degree range that has a biasing between the highest and lowest angles (low = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.8) in the following procedures.

-2.0 000000000000000000000000
-1.8 000000000000000000000000
-1.6 000000000000000000000000
-1.4 000000000000000000000000
-1.2 000000000000000000000000
-1.0 000000000000000000000000
  # 000000000000000000000000
-0.8 000000000000000000000000
-0.6 000000000000000000000000
-0.4 000000000000000000000000
-0.2 001101000001101000100100
  1.0 101001101010110001001000
  1.2 101101001011101010011011
  1.4 111111111111111111111111
  1.6 111111111111111111111111
  1.8 111111111111111111111111
  2.0 111111111111111111111111
  2.2 111111111111111111111111
  2.4 111111111111111111111111
  2.6 111111111111111111111111
  2.8 111111111111111111111111
  3.0 111111111111111111111111
  3.2 111111111111111111111111
  3.4 101011101011101010011011
  3.6 001011001011001010010000
  3.8 000000000000000000000000
  4.0 000000000000000000000000

2.10.7. Set the low mapping angle
   SCAL 11 1 [low angle value]

2.10.8. Set the high mapping angle
   SCAL 11 2 [high angle value]

2.10.9. Auto calibrate the best mapping start position
   MAPH 11

2.10.10. Map the cassette and check the accuracy of returned data.
   MAPC 11

2.10.11. Save the settings
   SAVE
2.11. Mapping Setup: Cassette Station C
2.11.1. Place a full cassette on cassette station C. Remove the wafer in slot 2.
2.11.2. Calibrate the mapping setup.
   MAPS 12
2.11.3. Put the wafer back in slot 2.
2.11.4. Map the cassette.
   MAPC 12
2.11.5. Prompt a return of the mapping data over a specified range of mapping angles.
   SCAN 12 -2 4.2
2.11.6. Study the returned mapping angles and their corresponding data. Determine at which mapping angles the cassette was correctly mapped. From among the angles that mapped correctly, select a 1-degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.8) in the following procedures.

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<th>Data</th>
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</table>

2.11.7. Set the low mapping angle.
   SCAL 12 1 [low angle value]
2.11.8. Set the high mapping angle.
   SCAL 12 2 [high angle value]
2.11.9. Auto calibrate the best mapping start position.
   MAPH 12
2.11.10. Map the cassette and check the accuracy of returned data.
   MAPC 12
2.11.11. Save the settings.
   SAVE
2.12. **Mapping Setup: Cassette Station D**

2.12.1. Place a full cassette on cassette station D. Remove the wafer in slot 2.

2.12.2. Calibrate the mapping set up.

MAPS 13

2.12.3. Put the wafer back in slot 2.

2.12.4. Map the cassette.

MAPC 13

2.12.5. Prompt a return of the mapping data over a specified range of mapping angles.

SCAN 13

2.12.6. Study the returned mapping angles and their corresponding data. Determine at which mapping angles the cassette was correctly mapped. From among those angles, that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.8) in the following procedures.

2.12.7. Set the low mapping angle

SCAL 13 [low angle value]

2.12.8. Set the high mapping angle

SCAL 13 [high angle value]

2.12.9. Auto-calibrate the best mapping start position.

MAPH 13

2.12.10. Map the cassette and check the accuracy of returned data

MAPC 13

2.12.11. Save the settings

SAVE
2.13. Setting Wafer Transfer Positions: Cassette Station A

2.13.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station A.

2.13.2. Map the cassette.

MAPC 10

2.13.3. Find the negative limit and move the robot z-axis to a position slightly above it.

LIMN 6
MOV A 0 [negative limit + 1]

2.13.4. Extend robot paddle 1 into the cassette below wafer 1.

WE00 I0 1 1

2.13.5. Repetitively raise robot height until vacuum contact with wafer 1 is established.

FVAC 10 1 (repeat until contact is made)

2.13.6. Remove paddle 1 from the cassette.

WOOR I0 1

2.13.7. Establish robot paddle 1 offset. Repeat the following procedure (13.8. - 13.13.) until paddle 1 is centered between wafers 1 and 2.

2.13.8. Move the robot z-axis to the wafer 2 drop-off height.

WDOO 10 2 1

2.13.9. Disable the robot theta axis motor.

MEBL 1 0

2.13.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

2.13.11. Adjust paddle 1 offset position.

SCAL 10 6 [.005]

2.13.12. Manually swing robot paddle 1 out of the cassette and center it over the robot.


MEBL 1 1

2.13.14. Check/adjust wafer pitch. Repeat the following procedure (13.15. - 13.21.) until paddle 1 is centered between wafers 24 and 25.

2.13.15. Move the robot z-axis to the wafer 25 drop-off height.

WDOO 10 25 1

2.13.16. Disable the robot theta axis motor.

MEBL 1 0

2.13.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.

2.13.18. Adjust wafer pitch.

SCAL 10 17 [.0001]


2.13.20. Enable robot theta-axis.

MEBL 1 1

2.13.21. Map the cassette and check results for accuracy.

MAPC 10

2.13.22. Save Settings.

SAVE
2.14. Setting Wafer Transfer Positions: Cassette Station B

2.14.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station B.


MAPC 11

2.14.3. Find the negative limit and move the robot z-axis to a position slightly above it.

LIMN 0

MOV 0 [negative limit + .1]

2.14.4. Extend robot paddle 1 into the cassette below wafer 1.

WEDO 11 1 1

2.14.5. Readjust raise robot height until vacuum contact with wafer 1 is regained.

FVAC 11 1 [readjust until contact is made]

2.14.6. Remove paddle 1 from the cassette.

WDOR 11 1 1

2.14.7. Establish robot paddle 1 offset. Repeat the following procedure (14.8. - 14.13.) until paddle 1 is centered between wafers 1 and 2.

LIMN 0

MOVA 0 [negative limit + .1]

MOVA 0 [negative limit - .1]


WDOR 11 2 1


MEBL I 0

2.14.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

2.14.11. Adjust paddle 1 offset position.

SCAL 11 6 [- .003]

2.14.12. Manually swing robot paddle 1 out of the cassette and center it over the robot.


MEBL I 1


WDOO 11 25 1


MEBL I 0

2.14.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.


SCAL 11 17 [.0001]


MEBL I 1

2.14.21. Map the cassette and check results for accuracy.

MAPC 11


SAVE
System Integration: 4-Cassette

2.15. Setting Wafer Transfer Positions: Cassette Station C

2.15.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station C.

2.15.2. Map the cassette.

2.15.3. Find the negative limit and move the robot z-axis to a position slightly above it.

2.15.4. Extend robot paddle 1 into the cassette below wafer 1.

2.15.5. Repeat above steps until vacuum contact with wafer 1 is sensed.

2.15.6. Remove paddle 1 from the cassette.

2.15.7. Establish robot paddle 1 offset. Repeat the following procedure (15.8 - 15.13) until paddle 1 is centered between wafers 1 and 2.

2.15.8. Move the robot z-axis to the wafer 2 drop-off height.

2.15.9. Disable the robot theta axis motor.

2.15.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

2.15.11. Adjust paddle 1 final position.

2.15.12. Manually swing robot paddle 1 out of the cassette and center it over the robot.

2.15.13. Enable the robot theta axis motor.

2.15.14. Check and adjust wafer pitch. Repeat the following procedure (15.15 - 15.21) until paddle 1 is centered between wafers 24 and 25.

2.15.15. Move the robot z-axis to the wafer 25 drop-off height.

2.15.16. Disable the robot theta axis motor.

2.15.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.

2.15.18. Adjust the wafer pitch.

2.15.19. Manually swing paddle-axis out of cassette and center over robot.

2.15.20. Enable robot theta axis.

2.15.21. Map the cassette and check results for accuracy.

2.15.22. Save Settings.
2.15. **Setting Wafer Transfer Positions: Cassette Station D**

2.15.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station D.

2.15.2. Map the cassette.

MAPC 13

2.15.3. Find the negative limit and move the robot z-axis to a position slightly above it.

LIMN 0

MOVA 0 (negative limit +.1)

2.15.4. Extend robot paddle 1 into the cassette below wafer 1.

WDOO 13 1 1

2.15.5. Reposition robot paddle 1 until vacuum contact with wafer 1 is sensed.

PVAC 13 1 (repet until contact is made)

2.15.6. Remove paddle 1 from the cassette.

WDOO 13 1 1

2.15.7. Establish robot paddle 1 offset. Repeat the following procedure (16.8 - 16.13) until paddle 1 is centered between wafers 1 and 2.

2.15.8. Move the robot z-axis to the wafer 1 drop-off height.

WDOO 13 2 1

2.15.9. Disable the robot theta axis motor.

MEBL 1 0

2.15.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

2.15.11. Adjust paddle 1 offset position.

SCAL 13 6 [±.003]

2.15.12. Manually swing robot paddle 1 out of the cassette and center it over the robot.

2.15.13. Enable the robot theta axis motor.

MEBL 1 1

2.15.14. Check / adjust wafer pitch. Repeat the following procedure (16.15 - 16.21) until paddle 1 is centered between wafers 24 and 25.

2.15.15. Move the robot z-axis to the wafer 24 drop-off height.

WDOO 13 25 1

2.15.16. Disable the robot theta axis motor.

MEBL 1 0

2.15.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.

2.15.18. Adjust the wafer pitch.

SCAL 13 17 [±.0001]

2.15.19. Manually swing paddle-axis out of cassette and center over robot.

2.15.20. Enable robot theta axis.

MEBL 1 1

2.15.21. Map the cassette and check results for accuracy.

MAPC 13

2.15.22. Save Settings.

SAVE
### Section E: Runlime Setup

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Section Overview

Runtime setup is the process through which system technicians prepare an operational MVT 7080 Wafer Sorter for runtime operation. This section is designed to serve as a guide to that process by providing detailed descriptions and step-by-step instructions for the topics and procedures described below. Note that these procedures are considered restricted, and should only be performed by persons with Maintenance, Engineer, or Service Engineer access privilege.

1.1. Power-Up & Power Down Sequences describes how to safely turn the system on and off.

2.0. Managing User Access defines the four degrees of system access, or privilege, and describes how to grant privilege, add users and delete users.

3.0. System / Module Setup describes how to correctly enter module software settings to accurately reflect a system's particular modular configuration.

4.0. Selecting and Creating Wafer Flow Recipes describes how to select, delete, create and edit recipe files that serve to determine the flow of wafers during runtime operation.

5.0. Selecting and Creating Reader Recipes describes how to select, delete, create and edit recipe files that contain ID reader settings customized to accommodate a specific wafer style's size, scribe location, scribe font, and scribe quality.

6.0. Selecting and Creating Bright Light Recipes describes how to select, delete, create and edit recipe files used to determine the tilt and rotation of wafers during bright light macroinspection.

Note on System Pull-Down Menus

The procedures described in this section require considerable use of the interface’s pull-down menus, accessed via the Workstation Main window menu bar. Users are advised to become familiar with the contents of the pull-down menus prior to undertaking runtime setup procedures, noting that options disclosed in a subdued manner are not active on the MVT 7080 Wafer Sorter.

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Section E: Runtime Setup

1.1.0. Power-Up Sequence

1.1.1. Turn the MVT 7080 Main Power Switch to the ON position.

1.1.2. Power-up the VGA color monitor if the system is equipped with one.

1.1.3. Power-up the system PC. The computer will scan for a keyboard, mouse and viruses, check the integrity of the hard drive, and load Windows NT.

1.1.4. Once Windows NT has loaded, a Welcome window will appear, prompting the operator for a user name and password; enter these in the appropriate boxes and verify that WORKSTATION is displayed in the box labeled From. Select the OK button to prompt the display of the Windows NT Program Manager window.

1.1.5. Set the Controller ON/OFF switch to the ON position. The operator will hear the sound of solenolds and cooling fans being activated.

1.1.6. Within the Windows NT Program Manager window, locate the MicroVision WorkStation window and select the MicroVision icon. The operator will be presented with a Logon window. Enter a user name and password in the appropriate boxes and select the OK button.

1.1.7. As the WorkStation program is launched, the operator will be presented with the MVT 7080 graphical user interface.

1.2.0. Power-Down Sequence

1.2.1. Make sure that all wafers are returned to cassettes and that all modules and the robot are empty.

1.2.2. Select File from the WorkStation menu bar and Exit from the File pull-down menu to prompt the display of an Exit WorkStation window.

1.2.3. Within the Exit WorkStation window, enter a password where prompted and select Terminate Program from among the Select Exit Type options. Select the OK button to prompt the display of the Windows NT Program Manager window.

1.2.4. From within the Windows NT Program Manager window, select File from the menu bar and Exit from the File pull-down menu to prompt the display of a Shutdown Computer window.

1.2.5. From within the Shutdown Computer window, verify that the Shutdown option is selected and select the OK button.

1.2.6. Set the Controller ON/OFF switch to the OFF position.

1.2.7. Power-down the PC.

1.2.8. Power-down the VGA color monitor if the system is equipped with one.

1.2.9. Turn the MVT 7080 Power Main Switch to the OFF position.
The ILTVT 7080 software is designed to accommodate users with a wide range of system knowledge, from operators to service engineers. To ensure the integrity of system files, recipes, and settings, access to the MVT 7080 is divided into 4 degrees of privilege: Operator, Maintenance, Engineer, and Service Engineer. An operator is granted the least degree of system access, while a service engineer is granted the greatest degree of system access.

The following windows provide the primary means for managing user access from within the system software:

1. Select User from the Workstation Main window menu bar, then Manager from the User pull-down menu. This will prompt the display of the Workstation User Manager window, which shows the complete list of system users and their levels of privilege. From this window, users can be granted or denied access by being added or deleted from the list.

2. To add a new user, select the ADD USER button to prompt the display of the Add User window. Enter the user's name and password, confirm the password, set the user's level of privilege, and select the OK button.

3. To delete a user, scroll to and highlight the user in the Current Users List. Select the DELETE USER button. At the User Manager window, select the YES button.
Setting Up the System & System Modules

This portion of runtime setup serves to ensure that all module software settings are correctly selected and entered to reflect a system's particular modular configuration and the specific tasks it will be required to perform during runtime operation.

3.1. System Setup

3.1.1. Select Setup from the Workstation Main window menu bar, then System Setup from the Setup pull-down menu to prompt the display of the System Setup window, shown below.

3.1.2. Within the System Setup window, verify that all applicable modules are selected, i.e., Robot, Aligner, Bright Light or Reader. Select the OK button.

3.1.3. Exit and then reenter Workstation program to activate the menu selections.

3.1.4. Verify that all applicable module screens are accessible. If the wafer ID reader is to be used during Runtime Setup, verify that the reader screen is active and that the system can capture video from the reader camera. If the camera cover is on, it will need to be taken off for setup.
System/Module Setup

3.2.0. Robot Setup

3.2.1. Select Setup from the Workstation Main window menu bar, then Robot from the Setup pull-down menu to prompt the display of the Robot Setup window. This window provides access to the following options and settings:

**Paddle Usage** - On all systems the dual paddle option should be on. The only reason to select the paddle 1 or 2 options are when there is a problem with one of the paddles. In this case the good paddle should be turned on.

3.2.2. Verify that all appropriate options are selected and correct settings are entered and select the OK button.

3.3.0. Aligner Setup

3.3.1. Select Setup from the Workstation Main window menu bar, then Aligner from the Setup pull-down menu to prompt the display of the Aligner Setup window. This window provides access to the following options and settings:

**Dual Wafer Swap** - This box enables the system to perform a dual wafer swap on the aligner. For this to work the dual paddle usage option should be turned on in the Robot Setup menu. This option should always be turned on for sorters and off for workstations.

**Center Wafer** - This option will jog the position of the wafer on the aligner to perfectly center the wafer before transfer to the destination cassette. This option should always be turned on.

**Pick-Up Angle** - This is the angle in degrees that a wafer is rotated to before being picked up from the aligner. For sorters this angle is determined by the angle at which the flat or notch is desired in the destination cassette.

3.3.2. Verify that all appropriate options are selected and correct settings are entered and select the OK button.
3.4.1. Select Setup from the Workstation Main window menu bar, then Bright Light from the Setup pull-down menu to prompt the display of the Bright Light Setup window. This window provides access to the following options and settings:

- **Joystick Control**: This is the maximum speed that the x, y, and theta-axis will move at on the bright light with relation to each motor’s velocity limit. The recommended value for this setting is 50%.

- **Allow Dual Wafer Swap**: This box allows the system to perform a dual wafer swap on the bright light module. This option can only be used on systems using 6-inch wafers.

- **Maximum Time Lamp On**: This is the maximum time that the bright light lamp will stay on before automatically shutting off. The value in this box is in milliseconds. The typical values are between 30,000 and 60,000.

3.4.2. Verify that all appropriate options are selected and correct settings are entered and select the OK button.

3.5.1. Select Setup from the Workstation menu bar, then Reader from the Setup pull-down menu to prompt the display of the Reader Setup window. This window provides access to the options and settings described in detail on the following page:
Enable Reader - This option enables OCR operation.

Verify Lot - When this option is selected the system verifies that all the wafers in a given cassette have the same lot ID.

Snap Image Before Reading - This option prompts the system to capture and display in the Reader window images of the wafer ID being read from wafers positioned on the aligner, it must be selected to perform real time OCR reading on wafers. If this option is not selected, the system can only perform OCR reading on previously saved wafer ID images displayed in the Reader window, which can be loaded from the hard drive using the icons at the top of the Reader window.

Interactive OCR Read - When this option is selected the Message From OCR Read window will appear after a read is attempted. This window displays the characters read in each scribe position and the scores for those characters, also displayed is the overall score for that particular read attempt.

16 Color Display - When this option is selected, the system will display the graphics in the Reader window in a 16 color gray scale; this is only used on LCDs that are using a 16 color gray scale graphics mode driver.

Show Detailed Graphics - This option prompts the display of detailed reader graphics in the Reader window after each read attempt, showing where the reader located individual characters of the scribe.

OCR Reader Type - This option specifies the specific OCR software to be employed and must always be set to Internal OCR.

Align Retries - This setting specifies the number of times the aligner will try to relocate the position of the scribe on the wafer after all read attempts have failed. This value is typically set to 1.

Read Attempts - This setting specifies the number of times the reader will attempt to read the scribe before an alignment retry is attempted. This value is typically set between 3 and 9 attempts.

Read Retry Angle Increment - This setting specifies the number of degrees that the wafer is rotated after each failed read attempt. This value is typically set from 100 to 500 degrees.

Communications Timeout - This setting specifies the time limit in milliseconds for the system to respond to a command. If the system fails to respond within the set limit, a timeout error message will be generated.

No Read Recovery Mode - This group of options specifies what is done with a wafer after all Read Attempts and Align Retries have failed.

Online - Prompts the operator to manually enter the unreadable wafer’s scribe.

Offline - Puts the unreadable wafer back in the source cassette and continues with the next wafer selected. After attempting to read all selected wafers, the system will then rescan all initially unreadable wafers, attempt to read them again, and if unable to read a second time, prompt the operator to manually enter the scribe.

Reject - Returns the unreadable wafer to the source cassette. To retry OCR, the operator must manually rescan the wafer.

External Read Trigger - Acquires a snap image from either Siliconis barcode reader or Acumen reader.

Verify that all appropriate options are selected and correct settings are entered and select the OK button.
3.6.0. Joystick Setup

Select Setup from the Workstation Main window menu bar, then Joystick from the Setup pull-down menu to prompt the display of the Joystick Setup window. This window provides access to the following options and settings:

**Power Curve** - This setting defines the velocity curve of an axis controlled by the joystick from 0 to maximum speed. The recommended setting for this value is 4.

**Dead Band** - This setting determines how far from center the joystick has to be moved before a stage or bright light axis will begin to move. The larger this value, the farther from center the joystick has to be moved before motion occurs. Typical values are 15-30%.

**Calibrate Joystick** - Selecting this button will prompt the Joystick Calibration window, follow the eight-step instruction set.

3.6.2. Verify that all appropriate options are selected and correct settings are entered and select the OK button.
Wafer Flow Recipes

4.0. Selecting & Creating Wafer Flow Recipes

Wafer flow recipes are saved files of instructions that determine the flow of wafers during runtime operation by specifying the source and destination cassette for each transfer. The following instructions describe how to select a wafer flow recipe for runtime operation, delete a recipe from the system, and delete and add new recipes.

To proceed, first select Recipes from the Workstation Main window menu bar, then Wafer Flow from the Recipes pull-down menu. This will prompt the display of a window featuring the options: New, Open, Edit and Delete.

4.1.0. Select a Wafer Flow Recipe:

4.1.1. To select a recipe for runtime operation, select Open from the options window to display the Select Wafer Flow Recipe window.

4.1.2. Highlight the desired wafer flow recipe and select the OK button. Reader and bright light recipes can also be selected at this time if they are made available from within the Linked Recipes window.

4.2.0. Delete a Wafer Flow Recipe:

4.2.1. To delete a recipe from the system, select Delete from the options window to display the Delete Wafer Flow Recipe window.

4.2.2. Highlight the desired recipe and select the DELETE FILE button.
Section E: Runtime Setup

4.3.0. Creating a Wafer Flow Recipe

To create a wafer flow recipe, select New from the options window to prompt the display of the Wafer Flow Recipe window. This window enables a user to create and edit custom wafer flow recipes based on either a wafer’s source cassette or its ID number, and link them to specific reader and bright light recipes.

4.3.1. Flow Tab: Select the Flow tab from the Wafer Flow Recipe window to prompt the display of the Flow window. Next, choose between the two different methods of dictating wafer flow by accessing the pull-down windows in the Type column.

4.3.1.1. Transfer Flow. This method of dictating wafer flow uses a wafer’s source cassette and slot position to determine its destination cassette and slot. Within the Flow window, users must select Transfer in the Type column, and then specify a source cassette and slot and its corresponding destination cassette and slot. When run, this type of recipe prompts the robot to transfer any viable wafer from the specified source position to its corresponding destination position.

4.3.1.2. WaferNum Flow. This method of dictating wafer flow is script oriented, using a wafer’s OCR-read number to determine its destination cassette and slot. Within the Flow window, users must select WaferNum in the Type column, and then specify a series of wafer numbers and their corresponding destination cassettes and slots. When run, this type of recipe employs the system OCR to read a wafer’s scribe and determine its number. It then prompts the robot to deposit the wafer in the destination cassette and slot that correspond to its number.
4.3.2. Recipe Selection Tab: Select the Recipe Selection tab from the Wafer Flow Recipe window to prompt the display of the Recipe Selection window. This window enables specific reader and bright light recipes to be linked to the wafer flow recipe. When initiating a run, the operator will be prompted to select from among these recipes. This window also provides access to the following options:

- **Select at Run Time**: At the initiation of each run, the operator is prompted to choose a specific wafer flow recipe. When the Select at Run Time option is selected for either the reader or bright light, the operator is also allowed to select from among their respective lists of recipes. If it is not selected, the operator is limited to the recipe linked to the selected wafer flow recipe.

- **Select at Run Enabled**: This option enables or disables the Select at Run Time option described above.

4.3.3. Run Options Tab: Select the Run Options tab from the Wafer Flow Recipe window to prompt the display of the Run Options window. This window enables specific reader and bright light recipes to be linked to the wafer flow recipe. When initiating a run, the operator will be prompted to select from among these recipes. This window also provides access to the following options:

- **Preselect Wafers**: If this option is selected, all wafers mapped to the source side of the wafer flow recipe will be selected for processing. If it is not selected, the operator will have to manually select all wafers for processing.

- **Select at Run**: If this option is selected, the operator will be prompted to manually select all wafers for processing at the beginning of the run.

- **Enter Cassette IDs**: If this option is selected, the operator will be prompted to manually key in a cassette's ID or scan its barcode with a barcode wand.
**Bright Light Enable** - If selected, this option allows the bright light module to be employed by an active recipe.

**Aligner Enable** - If selected, this option allows the aligner module to be employed by an active recipe.

**Wafer Read Enable** - If selected, this option allows the reader (OCR) module to be employed by an active recipe.

**Feature Enable at Run** - If this option is selected an operator can immediately enable or disable the various features of the Run window by clicking on their respective icons.

**Destination Enable at Run** - If this option is selected an operator is prompted for each wafer's destination cassette and slot after ID or barcode reading.

**Microinspection Station** - This array of options is not available for an MVT 7080 Wafer Sorter.

**Lot Verification** - If this option is selected the system will alert an operator to the presence of wafers with incongruous lot numbers.

---

**4.3.4. Save Wafer Flow Recipe:** Verify that all flow parameters, link settings and options are set correctly, then save the recipe using the following sequence:

1. Select the **SAVE AS** button.
2. When prompted, type in the wafer flow recipe name (for this example, NEW) and select the **ENTER** button.
3. Select the **OK** button.
5.0. Selecting & Creating Reader Recipes

Reader recipes are saved files of ID reader settings that are customized to accommodate a specific wafer style’s size, scribe location, scribe font and scribe quality. The following instructions describe how to select a reader recipe for runtime operation, delete a recipe from the system, and create and edit new recipes.

To proceed, first select Recipes from the Workstation Main window menu bar, then Reader from the Recipes pull-down menu. This will prompt the display of a window featuring the options: New, Open, Edit and Delete.

5.1. Select a Reader Recipe:

5.1.1. To select a recipe for runtime operation, select Open from the options window to display the Open Reader Recipe window.

5.1.2. Highlight the desired recipe and select the OK button.

5.2. Delete a Reader Recipe:

5.2.1. To delete a recipe from the system, select Delete from the options window to display the Delete Reader Recipe window.

5.2.2. Highlight the desired recipe and select the DELETE FILE button.

5.3. Creating a Reader Recipe:

To create a reader recipe, select New from the options window to prompt the display of the Reader Recipe window, shown on the facing page. This window enables a user to create and edit reader recipes that are customized to accommodate a specific wafer style’s size, scribe location, scribe font and scribe quality.

5.3.1. Options Tab: Select the Options tab from the Reader Recipe window to prompt the display of the Options window, which lists the settings used to properly position the wafer under the camera and the wafer light intensities needed to accurately read the scribe.
OCR Read Radius - This is the distance in millimeters from the aligner dropoff position that the aligner x-axis must move to place the scribe in the camera view. This value will depend upon the size of wafer and the location of scribe on the wafer.

OCR Read Angle - This is the number of degrees from where the array detects the notch or flat that the wafer needs to be rotated to place the scribe under the reader camera. This value will depend upon the size of wafer and the location of the scribe on the wafer.

Manual Read Angle - This is the number of degrees from where the array detects the notch or flat that the wafer needs to be rotated to place the scribe in position for visual inspection. Typically, this value is set to 90 degrees.

Light Levels - These settings specify the lamp intensities for the two wafer ID reader light sources used to illuminate the scribe on the wafer. These values range from 0 to 100 percent.

Read Options - These options specify the type of read method used on the wafer: OCR enables the reading of alphanumeric scribe characters; Barcode enables the reading of barcode patterns; and Flip Image prompts the system to rotate the scribe 180 degrees before a read is attempted. It is used when the scribe appears upside down in the Reader window when the play button is pressed.

Camera - These settings specify which camera, top or back, will be employed to capture scribe or barcode images. The top side option is used when the scribe or barcode is situated on the top of the wafer; the back side option is used when the scribe or barcode is situated on the back, or bottom, of the wafer.
8.3.2. Wafer ID Tab: Select the Wafer ID tab from the Reader Recipe window to prompt the display of the Wafer ID window. This window lists the settings used to specify the length of the scribe and the locations of the individual components of the scribe.

Wafer ID Length - This value represents the total number of characters contained in the scribe, including the lot ID, wafer number and checksum if present.

Lot ID Position - This value represents the location of the first character in the lot ID. Typically, this value is set to 1.

Lot ID Length - This value represents the total number of characters contained in the lot ID.

Wafer Number Position - This value represents the location of the first character in the wafer number.

Wafer Number Length - This value represents the total number of characters contained in the wafer number. Typically, this value is set to 2.

**Example:**

<table>
<thead>
<tr>
<th>ID Length</th>
<th>Lot ID</th>
<th>Wafer Number</th>
<th>Checksum</th>
</tr>
</thead>
<tbody>
<tr>
<td>U12204.10.G2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.3.3. **Constraints Tab**: Select the Constraints tab from the Reader Recipe window to prompt the display of the Constraints window. This window is used to define the possible valid characters for each character position of the scribe.

- **Character Constraints box** - Located at the bottom of the window, this box lists a line of valid characters for each character position of the scribe.
- **Characters Line** - This box displays the set of possible valid characters included in the highlighted line in the Character Constraints box at the bottom of the window.
- **Character Options** - Three sets of character options are displayed above the Characters Line box. These are the 0-9 option, the A-Z option, and the User Defined option. To perform the fastest, most accurate OCR read, it is recommended that the User Defined option be employed.

5.3.4. **Save Reader Recipe**: Verify that all entered characters are appropriate and correctly reflect all scribe possibilities, then perform the following save sequence:

5.3.4.1. Select the SAVE AS button.
5.3.4.2. When prompted, type in the reader recipe name (for this example, NEW) and select the ENTER button.
5.3.4.3. Select the OK button.
5.3.5. **Position Wafer on Aligner**: Use the following instructions to setup a wafer on the aligner in preparation for OCR calibration.

5.3.5.1. Within the Run window, verify that only the Aligner and Wafer Reader options are selected.

5.3.5.2. Place a wafer in the cassette for calibration. Note that the best OCR results are achieved when the wafer, and especially its scribe, are clean and free of any dirt or dust. In addition, when setting up reader recipes, choose as a subject the scribe with the highest quality characters.

5.3.5.3. From the Workstation Main Menu, select Recipes from the menu bar and Reader from the Recipes pull-down menu. Select Open from the options window to prompt the display of the Open Reader Recipe window. Highlight the newly created reader recipe and select the OK button.

5.3.5.4. Select the Run button from within the Run window.

5.3.5.5. After the cassette is mapped, select a wafer for calibration by positioning the pointer over the wafer icon within the mapped cassette station window and clicking the left button of the pointer device.

5.3.5.6. Select the Run button from within the Run window.
5.3.5.7. As the robot picks up the wafer and is transferring it to the aligner, select the Step Mode option from within the Run window.

5.3.5.8. Repeatedly select the Run button from within the Run window until the wafer ID is rotated to the read position under the camera.

5.3.5.9. From within the Reader window, select the magnify button to enlarge the image viewing area. Then, select the play button to prompt the display of the live wafer/so the image from the camera.
5.3.5.10. Select Diagnostics from the Workstation Main window menu bar, and Controller 1 from the Diagnostics pull-down menu to prompt the display of the Controller Terminal window.

Proceed to fine tune the position of the scribe within the Reader window via Controller Terminal 1 by entering the MOVR 3 command to rotate the wafer and the MOVR 4 command to adjust the angular position of the wafer edge and scribe in the Reader window - to maintain a live image on the screen. If necessary, select the pause and play buttons. Adjust the bar on the acrylic block to block direct lighting of the scribe from the upper wafer light.

If necessary, adjust the camera mount and focus the camera to attain optimal positioning of the wafer edge and scribe in the Reader window - to maintain a live image on the screen. If necessary, select the pause and play buttons. Adjust the bar on the acrylic block to block direct lighting of the scribe from the upper wafer light.

5.3.6. Calibration Tab: Access the new reader recipe saved in procedure 4 by selecting Edit from the options window. Select the Calibration tab from the Reader Recipe window to prompt the display of the Calibration window, shown below. This window lists the settings used to describe the size and appearance of the scribe’s characters and the minimum read acceptance score for each OCR attempt.

Character Type - This setting describes the contrast scheme of the scribe image displayed in the Reader window. Direct lighting displays the scribe as black characters on a white background. Indirect lighting displays the scribe as white characters on a black background. Typically, the best OCR results are attained using indirect lighting.

Calibrate Font - This button is used to perform an OCR calibration and display its results. This effectively determines the actual scribe size and character spacing values that appear in the Advanced window.

Checksum Enable - This option is used to activate the checksum feature. When activated, the operator is prompted to verify the lot number of the first wafer read; all subsequent wafers that do not share that number are then rejected. This setting should not be activated during calibration.
**Image Windows** - This box contains the settings used to adjust the dimensions of the read box, character calibration box, and the calibration string box in the reader window. Adjustments are made by selecting the button next to each setting and manipulating its size while observing the changes in the reader window. The calibration character and calibration string boxes should be very tight around their respective character or characters. The read box should be at least 4 characters wider than the entire scribe and 2 to 3 times its height; the scribe should be centered inside of read box.

**Calibration String** - The calibration string is the series of characters that the sample image will be compared to during calibration. Enter the scribe characters from the sample wafer in this box.

**Read Acceptance Threshold** - This value represents the minimum acceptance score required for each character to be considered valid.

5.3.6.1. In the Character Types box select the option that best describes how the scribe’s characters contrast with the background of the wafer.

5.3.6.2. Verify that the Checksum option is not enabled.

---

**Reader Recipes**

**Section E: Runtime Setup**

**Image Windows**

- **Read Acceptance Threshold (1-100):** 60

**Calibration String:** U1204A10 Gz

**Read Acceptance Threshold (1-100):** 60

---

5.3.6.3. Read: Within the Image Windows box select the Read option. Then, use the X and Y position, width and height arrows to move and size the read box to encompass all characters of the scribe. The best OCR read can be obtained when the read box extends nearly all the way across the reader window and approximately one half of a character above and below the scribe characters.

5.3.6.4. Calibration Character: Within the Image Windows box select the Calibration Character option. Then, use the X and Y position, width and height arrows to move and size the calibration character box so that it tightly encompasses one character of the scribe - the box should actually overlap the outer pixels of the character. For the best OCR read, field service recommends using the zero character.

5.3.6.5. Calibration String: Within the Image Windows box select the Character String option. Then, use the X and Y position, width and height arrows to move and size the character string box so that it tightly encompasses all characters of the scribe - the box should be positioned approximately one pixel from the outer edges of the scribe and not touch any of the characters.
Enter the scribe characters in the box labeled Calibration String:

In the box labeled Read Acceptance Threshold [1 - 100], enter 60.

Select the CALIBRATE FONT button. The system will perform the calibration and then display the results within the message window shown to the right.

First, ensure that all characters were correctly read by checking the Read column. Then, check the score returned by each character—a score of 60 or above is considered optimal, while a score below 30 is unacceptable.

If the data displayed in the message window are unacceptable, select the OK button to exit the window and perform one or all of the following corrective measures:

- verify that the information in the Wafer ID and Constraints tabs is correct;
- verify that the scribe is of sufficient quality and free of dust;
- adjust camera focus;
- adjust camera aperture;
- adjust illumination;
- adjust calibration character and calibration string boxes;
- move character calibration box to a different character.

Reselect the CALIBRATE FONT button.

When the calibration window displays acceptable data, select the OK button and proceed to the next step.

Select the SAVE button, then select the APPLY button.
5.3.6.11. Select the READ button from within the Reader window to perform an OCR read on the scribe.

If the scribe passes, the scribe displayed in the live image window will be surrounded by a green box, and each character of the scribe will be encompassed by a green character box.

If the scribe does not pass, the scribe displayed in the live image window will be surrounded by a red box, all passed characters will be encompassed by green character boxes, and all failed characters will be encompassed by red character boxes.

5.3.6.12. Deselect Step Mode from within the Run window.

5.3.7. Advanced Tab: Select the Advanced tab from the Reader Recipes window to prompt the display of the Advanced window. This window contains options used to specify scribe search and image preprocessing methods used to locate and optimize the scribe image, and settings used to adjust the calculated character dimensions of the scribe.

Search Method: This box allows the user the option of choosing between two different methods of locating the wafer scribe:
- Standard - Faster, default method for locating scribe, used when the scribe is situated on a clean background.
- Pattern - Slower, more rigorous method for locating scribe, used when the scribe is on imperfect, noisy background.

Create Search Pattern: This button is used to initiate the pattern search method described above. Its use requires the tight setting of a character string box, described in procedure 6, around the character string.

Preprocess: This box allows the user the option of specifying the combination of different image processing methods used to optimize the scribe image before an OCR read is attempted.
Section E: Runtime Setup

**Reader Recipes**

**Standard** - Fastest, default method for optimizing the scribe image; used when the scribe is comprised of clean, well-defined characters. When this option is selected, only standard image preprocessing is performed.

**Enhance** - When this option is selected, an enhanced image processing routine is employed in addition to the standard method. It is used when the scribe is comprised of characters on a noisy background, requiring more rigorous processing.

**Arc Removal** - When this option is selected, an arc removal routine is employed in addition to the standard and enhanced methods. It is used when the scribe is comprised of characters on a very noisy background that contains arc patterns caused by clamp rings.

**Character Dimensions**:
- **Width** - This value represents the width of each character in the scribe.
- **Height** - This value represents the height of each character in the scribe.
- **Spacing** - This value represents the horizontal distance from the start of one character to the beginning of the next.

![Reader Recipe: New](image)
6.0. Selecting & Creating Bright Light Recipes

Bright light recipes are saved files of bright light settings that dictate a wafer’s degree of x and y tilt and rotation applied while undergoing bright light macroinspection on the bright light chuck. The following instructions describe how to select a bright light recipe for runtime operation, delete a recipe from the system, and create and edit new recipes.

To proceed, first select Recipes from the Workstation Main window menu bar, then Bright Light from the Recipes pull-down menu. This will prompt the display of a window featuring the options: New, Open, Edit and Delete.

6.1. Select a Bright Light Recipe:

6.1.1. To select a recipe for runtime operation, select Open from the options window to display the Open Bright Light Recipe window.

6.1.2. Highlight the desired recipe and select the OK button.

6.2. Delete a Bright Light Recipe:

6.2.1. To delete a recipe from the system, select Delete from the options window to display the Delete Bright Light Recipe window.

6.2.2. Highlight the desired recipe and select the DELETE FILE button.

6.3. Creating a Bright Light Recipe:

To create a bright light recipe, select New from the options window to prompt the display of the Bright Light Recipe window. This window enables a user to create and edit custom bright light recipes.

6.3.1. Options: Select the Options tab from the Bright Light Recipe window to prompt the display of the Options window, shown below. This window lists the following settings:

X Tilt - This setting specifies the tilt of the bright light chuck’s X-axis; values can range from -30 to 30 degrees.

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**Bright Light Recipes**

**Section E: Runtime Setup**

**E-27**

- **X Y Tilt** - This setting specifies the tilt of the bright light chuck's Y-axis; values can range from -30 to 30 degrees.
- **Theta** - This setting specifies the bright light chuck's rate of rotation; values can range from 0 to 100.
- **Duration** - This setting specifies the time set for flipper auto-flip: 1000 = 1 second, 2000 = 2 seconds.
- **Flipper Disabled** - This setting disables the wafer flipper.
- **Flip After Key Hit** - When this setting is selected, the operator must select the flipper key to flip wafer to its back side orientation.
- **Flip After Front Side Duration** - Wafer flipped automatically after duration.
- **Return Wafer Upon Key Hit** - When this setting is selected, the operator must select the flipper key to return wafer to its front side orientation.
- **Return Wafer After Duration** - Wafer returned automatically after duration.

- **Angle (deg) ([+10 to +70])** - This setting specifies the angle at which the flipper presents the wafer's back side.

---

6.3.2. **Save Bright Light Recipe**: Verify that all tilt and rotation settings are correctly entered, then save the recipe using the following sequence:

6.3.2.1. Select the SAVE AS button.

6.3.2.2. When prompted, type in the bright light recipe name (for this example, NEW) and select the ENTER button.

6.3.2.3. Select the OK button.

---

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Section F: Runtime Operation

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Alignment & OCR ..................................... 8
Concluding a Run .................................... 9
Runtime Operation

Section Overview

This section provides system operators with a basic, step-by-step guide to performing runtime operation procedures on the MVT 7080 Wafer Sorter. Operators should note that the bright light macroinspection and optical character recognition procedures apply only to systems on which these optional modules are installed and enabled in the System Setup window and the Settings box of the Run window. Runtime operation procedures are covered in the following sequence:

1. Loading Cassettes
   Describes how to safely load full wafer cassettes onto stations A, B, C or D of the sorter.

2. Initiating the Run
   Explains how to enable all necessary modules in the Run window, select appropriate recipes, and proceed with laser mapping of the cassettes.

3. Selecting Wafers
   Describes how to interpret the meaning of wafer icons in station windows after laser mapping and select wafers for processing.

4. Bright Light Macroinspection
   Outlines the bright light macroinspection sequence of runtime operation, including how to engage the joystick to perform manual macroinspection.

5. Alignment & OCR
   Covers the alignment and OCR sequence of runtime operation, including how to interpret a successful read and responding to no-read recovery.

6. Concluding the Run

CAUTION:
Protection provided by the equipment may be impaired if it is used in a manner not specified by the manufacturer.

System users must wear a wrist strap for grounding purposes to prevent electrostatic discharge.
Section F: Runtime Operation

Modular Configuration

The layout of the system main interface window (i.e., the arrangement of its modular and station windows) is determined by its particular modular configuration.

2-Cassette

2-Cassette
Bright Light

3-Cassette
Runtime Operation

Modular Configuration

The layout of the system main interface window (i.e., the arrangement of its module and status windows) is determined by its particular modular configuration.
1.0. **Loading Cassettes onto the MVT 7080**

To load a cassette onto the MVT 7080, place it on the station platform, slightly tilting it back, and slide its lower back edge up against the heel of the platform. Gently lay the front of the cassette down, allowing the H-bar to fit between the pins. The spring-loaded sensor on the center of the platform will detect the presence of the cassette; this sensor will abort all operations on the cassette if it detects that it has been moved.

2.0. **Initiating the Run**

2.1. Verify that all necessary options within the Run window are enabled.

2.2. Select the Run button from the Run window. The following tool buttons are also contained in the Run window:

- Run
- Stop Run
- Abort Run
- Step Mode
- Bright Light Accept
- Bright Light Reject
- Stage Accept (NIA)
- Stage Reject (NIA)
- Bright Light Enable
- Aligner Enable
- Reader Enable
- Step Enable (NIA)
- Ask Destination for Accepts
- Ask Destination for Rejects
- Sorter Workspace
- Inspection Workspace (NIA)
- Defect Review Workspace (NIA)
- Bright Light Workspace

2.3. If no runtime recipes are active, the operator is presented with the Select Wafer Flow Recipe window. Highlight the appropriate wafer flow, reader and bright light recipes and select the OK button.

If the system has just been reset, it will first reference all active modules then proceed with laser mapping of the cassettes.
Selecting wafers from mapped cassettes

Each cassette station present on the system is represented by a station window. After initial mapping, each station window displays the location and status of every wafer present in its corresponding cassette. A wafer’s status is indicated by the character of its icon:

- **Black Solid**: wafer sensed but not selected for processing.
- **Green Solid**: wafer sensed and selected for processing.
- **Red Solid**: wafer sensed as being cross-slotted in cassette.
- **Magenta Outline**: wafer is out of cassette and being processed. If OCR read has been performed, the scribe characters will be displayed over the outlined icon.
- **Magenta Solid**: wafer has been processed and deposited in its destination. If OCR read has been performed, the scribe characters will be displayed over the solid icon.

3.1. Select viable wafers for processing by positioning the pointer over their corresponding icons within the station windows and clicking the left button of the pointing device. Multiple wafers can be selected by clicking and holding the left button down and dragging the pointer across other wafer icons. Selected icons will change from black to green.

3.2. Choose the Run button from the Run window to proceed.
**Bright Light Macroinspection**

If the system is equipped with a bright light module and the bright light option is enabled in the Run window, the robot will proceed to transfer a selected wafer from the source cassette to the bright light chuck. There the wafer is rotated and tilted under a high-intensity lamp at the rate and angle dictated by the active bright light recipe. If the system is not equipped with a bright light module, or if the bright light option is not enabled in the Run window, the robot will proceed to transfer a selected wafer to the aligner chuck.

![Joystick](image1)

**Wafer Tilt Control:**
Bright X & Bright Y Axes

**Wafer Rotation Control:**
Bright T (theta) Axis

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From the bright light chuck, the wafer is transported to the aligner chuck, where it is passed over the aligner array to locate its edges. If the Wafer Reader option is selected in the Settings box of the Run window, the robot will proceed to center the wafer on the aligner chuck, rotate it to locate its flat or notch, and then position it under the camera for OCR reading of the scribe, as specified in the active reader recipe. Selecting the PLAY button from the Reader window will prompt the display of a live OCR image. Reader window buttons are described to the right. If the wafer reader option is not selected, the wafer is aligned only.

5.1. Successful Read

5.1.1. If OCR reading of the scribe is successful, the status bar in the Reader window displays an OK message, the scribe displayed in the live image window is surrounded by a green box, and each character of the scribe is encased by a green character box. The scribe text and its score are also displayed in this window.

5.1.2. The robot then lifts the passed wafer from the aligner chuck and transfers it to the destination cassette specified in the active wafer flow recipe. The wafer's ID and a solid magenta wafer icon are then displayed in the destination cassette's corresponding station window.

5.1.3. If the Ask Destination option is selected in the Settings box of the Run window, the operator will be prompted to specify the destination cassette and slot into which the passed wafer should be placed. This is accomplished by placing the pointer over the appropriate wafer slot in the desired station window and clicking the mouse button.
Alignment & OCR

5.2. No Read Recovery

If an OCR reading of the scribe is not successful (i.e., No Read), the status bar in the Reader window displays a FAILED message. The scribe displayed in the live image window is surrounded by a red box, all passed characters are encompassed by green character boxes, and all failed characters are encompassed by red character boxes. The system's response to a failed read depends upon how the No Read Recovery Mode is defined within the Reader Setup window (not accessible from Operator mode).

5.2.1. Online - if the No Read Recovery Mode is set to Online and all read attempts and realign attempts have failed, the system will prompt the operator to manually enter the scribe, which can be read directly from the image presented in the Reader window. The wafer will then be deposited in the destination cassette as specified in the wafer flow recipe. If manual entry is declined the wafer will be returned to its source location.

5.2.2. Offline - if the No Read Recovery Mode is set to Offline and all read attempts and realign attempts have failed, the system will return the wafer to the source cassette and continue with the next wafer. After all attempts to read all wafers, the unreadable wafers will be reselected and a second attempt to read them will commence. This time the system will act like the offline option is selected and prompt the operator to enter the scribe if all read attempts and realign attempts fail again.

5.2.3. Reject - if the No Read Recovery Mode is set to Reject and all read attempts and realign attempts have failed, the system will return the wafer to the source cassette and continue with the next wafer. Nothing further will be done to the rejected wafer unless reselected by the operator.

Concluding a Run

6.0. Concluding a Run

When all selected wafers have been processed, the robot will move to its park position; the operator can then remove processed cassettes and load new ones for the next run.
Section G: Troubleshooting & Preventative Maintenance

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Trouble-shooting & Preventative Maintenance

Section Overview
This section is intended to provide system technicians with a general guide to detecting, diagnosing and correcting system problems. It is divided into the following four subsections:

1. Interfaces - describes the various interface windows used to perform troubleshooting measures, monitor a system’s current hardware status, and review a chronological history of a system’s use.

2. Trouble Tables - lists common system problems and their remedies.

3. Module Tests - lists aligner, robot, and bright light module tests used to pinpoint system problems.


When performing troubleshooting measures, it is recommended that Host commands be issued to the controller via the Host NT interface. This interface is accessed by selecting the Host NT version 3.0 icon from within the Windows NT Main window.

CAUTION:
Protection provided by the equipment may be impaired if it is used in a manner not specified by the manufacturer.

Host NT Interface:

Hardware Status:
The Hardware Status window displays the current status of all cassette stations and enabled modules, and is accessed by selecting Diagnostics from the main window menu bar, and then Hardware from the Diagnostics pull-down menu. It allows a technician to determine the following: whether or not a module's vacuum is operational and able to sense wafers; whether or not a cassette is present on a station and if it has been mapped; whether or not the joystick is active; and whether or not an emergency stop has been initiated.
**Event Viewer:**

The Event Viewer window is designed to provide system technicians with a detailed chronological history of the system's use. This is useful in determining when and why error messages were generated, and how individual users are utilizing the system. The Event Viewer window is accessed by selecting Diagnostics from the main window menu bar, and Event Log from the Diagnostics pull-down menu. Additional detail about an error occurrence can be gained by double clicking on its item line in the Event Viewer window to prompt the display of the Event Details window.

### Log View Options

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Source</th>
<th>Category</th>
<th>Event</th>
<th>User</th>
<th>Computer</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/27/02</td>
<td>5:12:37 PM</td>
<td>WORKSTATION</td>
<td>LogSetup</td>
<td></td>
<td></td>
<td>Artisan Technology Group</td>
</tr>
<tr>
<td>11/27/02</td>
<td>5:12:37 PM</td>
<td>WORKSTATION</td>
<td>LogSetup</td>
<td></td>
<td></td>
<td>Web Station</td>
</tr>
<tr>
<td>11/27/02</td>
<td>5:12:37 PM</td>
<td>WORKSTATION</td>
<td>LogSetup</td>
<td></td>
<td></td>
<td>Artisan Technology Group</td>
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<tr>
<td>11/27/02</td>
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<td>WORKSTATION</td>
<td>LogSetup</td>
<td></td>
<td></td>
<td>Web Station</td>
</tr>
</tbody>
</table>

---

**Event Details**

<table>
<thead>
<tr>
<th>EventID</th>
<th>Date/Time</th>
<th>Source</th>
<th>User</th>
<th>Computers</th>
<th>Category</th>
<th>Type</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>EventA</td>
<td>12/35 AM</td>
<td>EventLog</td>
<td>Artisan</td>
<td>Web Station</td>
<td>ARTISAN</td>
<td>Info</td>
<td>Description</td>
</tr>
</tbody>
</table>

---

**Event Viewer Window:**

The Event Viewer window is designed to provide system technicians with a detailed chronological history of the system's use. This is useful in determining when and why error messages were generated, and how individual users are utilizing the system. The Event Viewer window is accessed by selecting Diagnostics from the main window menu bar, and Event Log from the Diagnostics pull-down menu. Additional detail about an error occurrence can be gained by double clicking on its item line in the Event Viewer window to prompt the display of the Event Details window.

---

**Event Details Window:**

- **EventID:** EventA
- **Date/Time:** 12/35 AM
- **Source:** EventLog
- **User:** Artisan
- **Computers:** Web Station
- **Category:** ARTISAN
- **Type:** Info

---

**Description:**

The EventLog window is designed to provide system technicians with a detailed chronological history of the system's use. This is useful in determining when and why error messages were generated, and how individual users are utilizing the system. The Event Viewer window is accessed by selecting Diagnostics from the main window menu bar, and Event Log from the Diagnostics pull-down menu. Additional detail about an error occurrence can be gained by double clicking on its item line in the Event Viewer window to prompt the display of the Event Details window.
### Aligner Module: Indications of Need for Maintenance/Repair

<table>
<thead>
<tr>
<th>Problem Indication</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scratch or flat misalignment.</td>
<td>Aligner array intensity needs adjustment. Aligner array needs recalibration.</td>
</tr>
<tr>
<td>Wafer not placed on aligner properly.</td>
<td>Check transfer perimeters. Check orange not on aligner x-axes.</td>
</tr>
<tr>
<td>Wafer reader out of alignment.</td>
<td>Make sure wafer matches wafer reader recipe. Make sure camera did not move. Make sure screen did not move on wafer.</td>
</tr>
</tbody>
</table>

Refer to Aligner Module Testing on page 6 of this section.

### Robot Module: Indications of Need for Maintenance/Repair

<table>
<thead>
<tr>
<th>Problem Indication</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Err ref limit width bad.</td>
<td>Adjust oplo sensor for theta axis.</td>
</tr>
<tr>
<td>Err ref drag robot while referencing theta-axis.</td>
<td>Check integrity of 16-pin theta-axis connector. Check motor terminals for loose connections.</td>
</tr>
<tr>
<td>Err ref drag robot while referencing paddle-axis.</td>
<td>Check integrity of 16-pin paddle-axis connector. Check motor terminals for loose connections.</td>
</tr>
<tr>
<td>Err ref limit width bad.</td>
<td>Adjust oplo sensor for theta axis.</td>
</tr>
<tr>
<td>Noise when robot rotates.</td>
<td>Inner and outer cams are rubbing; screen upper and lower can mounts, relax tightens.</td>
</tr>
<tr>
<td>Noise when robot moves up or down.</td>
<td>Realign, clean and lubricate z-axes feed screw.</td>
</tr>
<tr>
<td>Robot theta not parking properly.</td>
<td>Check theta-axis encoder. Check for broken theta axis belt. Check set screws on pulleys.</td>
</tr>
<tr>
<td>Paddle axe drifting.</td>
<td>Check for loose set screws on pulleys. Paddle axe encoder needs realignment.</td>
</tr>
<tr>
<td>Vacuum sensed on arm when no wafer present.</td>
<td>Test and adjust vacuum sensor. Check vacuum channel - it may have collapsed.</td>
</tr>
<tr>
<td>Vacuum will not turn off.</td>
<td>Particle lodged in vacuum solenoid - remove and clean.</td>
</tr>
<tr>
<td>Vacuum sense lost during transfer.</td>
<td>Adjust and clean vacuum sensor; check for leaks. Check wiring to solenoid.</td>
</tr>
<tr>
<td>Vacuum error when picking up or dropping off wafer to module.</td>
<td>Check level between paddles and module. Check pickup and drop-off transfer heights. Check vacuum sensors on robot and module.</td>
</tr>
</tbody>
</table>

Refer to Robot Module Testing on page 11 of this section.
### Bright Light Module

#### Indications of Need for Maintenance/Repair

<table>
<thead>
<tr>
<th>Problem Indication</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check level to bright light module and re-reference</td>
<td>Realign encoder on axis that was off. Adjust park position.</td>
</tr>
<tr>
<td>Latches loose when in the park position and motors extended</td>
<td>Tighten loose connecting rod screws.</td>
</tr>
<tr>
<td>Bright light gimbal or stage wandering, no control when joystick active</td>
<td>Joystick driver lost. Exit and rerun workstation program (no need to reboot). Rerun joystick calibration routine.</td>
</tr>
<tr>
<td>Bright light gimbal or stage drifting slightly, have some control with the joystick</td>
<td>Check joystick calibration routine.</td>
</tr>
</tbody>
</table>

#### Cassette Stations

#### Indications of Need for Maintenance/Repair

<table>
<thead>
<tr>
<th>Problem Indication</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassette sensor stuck down</td>
<td>Check cassette placement and platform pins.</td>
</tr>
<tr>
<td>Cassette sensor flag needs adjusting (too long)</td>
<td>Check cassette placement and platform pins.</td>
</tr>
<tr>
<td>Slotted sensor needs replacing</td>
<td>Check cassette placement and platform pins.</td>
</tr>
</tbody>
</table>

#### General System

#### Indications of Need for Maintenance/Repair

<table>
<thead>
<tr>
<th>Problem Indication</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module or motor connected to wrong controller port</td>
<td>Check host 7 connector.</td>
</tr>
<tr>
<td>Motor torque limit</td>
<td>Check motor wiring. Check axis encoder wiring; realign encoder.</td>
</tr>
<tr>
<td>Motor stall limit</td>
<td>Check encoder wiring; realign encoder. Check for loose pulley between motor shaft and encoder.</td>
</tr>
<tr>
<td>Reference error limit stuck</td>
<td>Check slotted sensor to that axis.</td>
</tr>
<tr>
<td>Index mark not found on encoder</td>
<td>Check red and black wire on encoder cables; realign encoder.</td>
</tr>
<tr>
<td>House vacuum not detected</td>
<td>Check house vacuum pressure. Check house vacuum sensor adjustment. Check power to controller (fuses). Check aux port connector on controller.</td>
</tr>
</tbody>
</table>
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Module Testing: 
Aligner

1.1.5. **Theta Encoder Test**
This procedure verifies that the encoder is properly interpreting the position of the aligner theta-axis.

1.1.1. **Switch to controller channel 1.**
CHN 1

1.1.2. **Set encoder to 0.**
MPOS 0 0

1.1.3. **Disable theta-axis motor.**
MEBL 0

1.1.4. **Prompt continuous reading of encoder position.**
CPOS 3

1.1.5. **Manually rotate theta one full rotation in CCW direction; this should prompt a reading of 360 degrees (+/- 3 degrees).**

1.1.6. **Manually rotate theta one full rotation in CW direction; this should prompt a reading of 0 degrees (+/- 3 degrees).**

1.1.7. **Return to prompt.**
ESC

1.1.8. **Enable theta-axis motor.**
MEBL 1

1.1.9. **Reference theta-axis motor.**
MREF 3

1.2.0. **Theta Motor Test**
This procedure verifies that the aligner theta motor can properly rotate the aligner theta axis in a clockwise and counterclockwise direction.

1.2.1. **Switch to controller channel 1.**
CHN 1

1.2.2. **Reference theta-axis motor.**
MREF 3

1.2.3. **Rotate theta-axis 90 degrees in CCW direction.**
MOVR 3 90

1.2.4. **Rotate theta-axis 90 degrees in CW direction.**
MOVR 3 -90
Module Testing: Aligner

1.3.0. X-Axis Encoder Test

This procedure verifies that the encoder is properly interpreting the position of the aligner x-axis.

1.3.1. Switch to controller channel 1.
CHAN 1

1.3.2. Set encoder to 0.
MPOS 4 0

1.3.3. Disable x-axis motor.
MEBL 4 0

1.3.4. Prompt continuous reading of encoder position.
CPDS 4

1.3.5. Manually move x-axis approximately 1 inch, this should prompt a return value of approximately 1 inch.

1.3.6. Return to prompt.
ESC

1.3.7. Disable x-axis motor.
MEBL 4 1

1.3.8. Reference x-axis motor.
MREF 4

1.4.0. X-Axis Motor Test

This procedure verifies that the aligner x-axis motor can properly move the aligner x-axis in both the right and left directions.

1.4.1. Switch to controller channel 1.
CHAN 1

1.4.2. Reference x-axis motor.
MREF 4

1.4.3. Move x-axis to encoder position 1.5.
MOVA 4 1.5

1.4.4. Move x-axis .5 inches in left direction.
MOVR 4 -.5

1.4.5. Move x-axis .5 inches in right direction.
MOVR 4 .5
1.5.0. Vacuum Setup & Test

This procedure calibrates the aligner vacuum sensor.

1.5.1. Switch to controller channel 1.
CHAN 1

1.5.2. Activate vacuum.
SVAC 2

1.5.3. Remove back cover of aligner and adjust vacuum sensor: 1) turn the vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

1.5.4. Deactivate vacuum.
SVAC 2 0

1.5.5. Initiate vacuum test; this will prompt a turn-on value (left) and turn-off value (right).
VACT 2

1.5.6. Adjust turn-on value to 35,000 (repeat until turn-on value is within 5,000).

1.6.0. Illumination Assembly Test & Setup

This procedure calibrates the intensity of the aligner wafer array light.

1.6.1. Switch to controller channel 1.
CHAN 1

1.6.2. Activate illumination light.
OUTP 4 100

1.6.3. Adjust potentiometer to see illumination light.

1.6.4. Prompt continuous reading of pixel data.
ALND

1.6.5. Adjust potentiometer to lowest possible setting while maintaining full array reading of 128.

1.6.6. End continuous read.
ESC

1.6.7. Deactivate illumination light.
OUTP 4 0
Module Testing:  
**Aligner**

1.7.0. **Wafer Light Test (if OCR is installed)**

   This procedure verifies that the aligner wafer light is functioning properly.

   1.7.1. Switch to controller channel 1.
   **CHAN 1**

   1.7.2. Activate upper wafer light LEDs.
   **OUTP 5 100**

   1.7.3. Deactivate upper wafer light LEDs.
   **OUTP 5 0**

   1.7.4. Activate lower wafer light LEDs.
   **OUTP 10 100**

   1.7.5. Deactivate lower wafer light LEDs.
   **OUTP 10 0**

1.8.0. **Station Reference with Backlash Test**

   This procedure orients the aligner, theta, and x axes with respect to encoder positions.

   1.8.1. Switch to controller channel 1.
   **CHAN 1**

   1.8.2. Reference theta-axis motor.
   **MREF 3**

   1.8.3. Reference x-axis motor.
   **MREF 4**

   1.8.4. Reference both axes and initiate vacuum test.
   **SREF 2**

1.9.0. **ALNC Aligner Array Setup**

   This procedure calibrates the aligner array to properly detect and align wafers.

   1.9.1. Switch to controller channel 1.
   **CHAN 1**

   1.9.2. Activate vacuum.
   **SVAC 2 1 1**

   1.9.3. Manually place a wafer on the center of the chuck.

   1.9.4. Activate illumination light.
   **OUTP 4 100**

   1.9.5. Move wafer back and forth across array 5 times.
   **ALNC 1**

   1.9.6. Save parameter data.
   **SAVE**

   1.9.7. Deactivate illumination light.
   **OUTP 4 0**

   1.9.8. While supporting wafer, deactivate vacuum and remove wafer.
   **SVAC 2 1 0**
Module Testing:

Robot Module Tests:

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Robot Side View

Robot Top View
Module Testing: Robot

2.1.0 Laser Module Test

This procedure verifies that both the robot laser and the robot photo sensor are functioning properly.

2.1.1 Switch to controller channel 1.

2.1.2 Activate laser.

2.1.3 Deactivate laser.

2.1.4 Increase gain to 16.

2.1.5 Prompt continuous reading of laser sensor module.

2.1.6 Place a piece of paper 3 inches in front of laser; this will trigger a continuous reading of 255.

2.1.7 Return to prompt.

2.2.0 Paddle Vacuum Setup & Test

This procedure calibrates the robot paddle 1 and robot paddle 2 vacuum sensors.

2.2.1 Switch to controller channel 1.

2.2.2 Activate paddle 1 vacuum.

2.2.3 Adjust paddle 1 vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

2.2.4 Deactivate paddle 1 vacuum.

2.2.5 Activate paddle 2 vacuum.

2.2.6 Adjust paddle 2 vacuum sensor: 1) turn the vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

2.2.7 Deactivate paddle 2 vacuum.

2.2.8 Initiate paddle 1 vacuum test; this prompts turn-on value (left) and turn-off value (right).

2.2.9 Adjust turn-on value to 35,000 (repeat until turn-on value is within 5,000).

2.2.10 Initiate paddle 2 vacuum test; this prompts turn-on value (left) and turn-off value (right).

2.2.11 Adjust turn-on value to 35,000 (repeat until turn-on value is within 5,000).
Module Testing:

Robot

2.3.0. Theta Encoder Test

This procedure verifies that the encoder is properly interpreting the position of the robot theta-axis.

2.3.1. Switch to controller channel 1.
CHAN 1

2.3.2. Reference all robot axes.
SREF 1

2.3.3. Set encoder to 0.
MPOS 0 0

2.3.4. Disable theta-axis motor.
MEBL 1 0

2.3.5. Link paddle axis to theta-axis.
LINK 1

2.3.6. Prompt continuous encoder reading.
CPOS 1

2.3.7. Rotate theta-axis one full rotation in CCW direction; this prompts a reading of 360 degrees (+/- 3 degrees).

2.3.8. Rotate theta-axis one full rotation in CW direction; this prompts a reading of 0 degrees (+/- 3 degrees).

2.3.9. Return to prompt.
ESC

2.3.10. Enable theta-axis motor.
MEBL 1 1

2.3.11. Reference theta-axis motor.
MREF 1

2.4.0. Theta Motor Test

This procedure verifies that the robot theta motor can properly rotate the robot theta-axis in a clockwise and counter-clockwise direction.

2.4.1. Switch to controller channel 1.
CHAN 1

2.4.2. Reference all robot axes.
SREF 1

2.4.3. Link paddle axis to theta-axis.
LINK 1

2.4.4. Rotate theta-axis 90 degrees in CCW direction.
MOVR 1 90

2.4.5. Rotate theta-axis 90 degrees in CW direction.
MOVR 1 -90

2.4.6. Unlink paddle axis from theta-axis.
LINK 0
Module Testing:

2.5.6. Paddle Encoder Test
This procedure verifies that the encoder is properly interpreting the position of the robot paddle axis.

2.5.1. Switch to controller channel 1.
CHAN 1

2.5.2. Set encoder to 0.
MPOS 2 0

2.5.3. Disable paddle axis motor.
MEBL 2 0

2.5.4. Prompt continuous encoder reading.
CPOS 2

2.5.5. Manually rotate paddle axis one full rotation in CCW direction; this prompts a reading of 360 degrees (+/- 3 degrees).

2.5.6. Manually rotate paddle axis one full rotation in CW direction; this prompts a reading of 0 degrees (+/- 3 degrees).

2.5.7. Return to prompt.
ESC

2.5.8. Enable paddle axis motor.
MEBL 2 1

2.5.9. Reference paddle axis motor.
MREF 2

2.6.6. Paddle Motor Test
This procedure verifies that the robot paddle motor can properly rotate the robot paddle axis in a clockwise and counter-clockwise direction.

2.6.1. Switch to controller channel 1.
CHAN 1

2.6.2. Reference all robot axes.
SREF 1

2.6.3. Rotate paddle axis 10 degrees in CCW direction.
MOVR 2 10

2.6.4. Rotate paddle axis 10 degrees in CW direction.
MOVR 2 -10
Module Testing: Robot

2.7.0. Z-Axis Motor & Encoder Test

This procedure verifies that the encoder is properly interpreting the position of the robot z-axis, and that the robot z-axis motor can properly move the robot up and down along the z-axis.

2.7.1. Switch to controller channel 1.

CHAN 1

2.7.2. Reference all robot axes. Ensure that paddle is centered over robot; if not, paddle must be calibrated.

SREF 1

2.7.3. Raise robot z-axis to encoder position 1.

MOVA 0 1

2.7.4. Disable z-axis motor. Listen for "click", which indicates brake engagement.

MEBL 0 0

2.7.5. Enable z-axis motor. Listen for "click", which indicates brake disengagement.

MEBL 0 1

2.7.6. Set encoder to 0.

MPOS 0 0

2.7.7. Raise z-axis .5 inches.

MOVR 0 .5


MPOS 0

2.7.9. Lower z-axis .5 inches.

MOVR 0 -.5

2.7.10. Prompt encoder reading. Returns reading of 0.

MPOS 0

2.7.11. Reference all robot axes.

SREF 1

2.8.0. Station Reference

This procedure orients the robot theta and paddle axes with respect to encoder positions.

2.8.1. Switch to controller channel 1.

CHAN 1

2.8.2. Reference theta-axis motor.

MREF 1

2.8.3. Reference paddle axis motor.

MREF 2

2.8.4. Reference all robot axes.

SREF 1
Module Testing: Robot

2.9.0. Z-Axis Travel Limit Test & Setting of Software Limits
This procedure determines the up and down travel limits of the robot z-axis hardware and establishes software protection limits.

2.9.1. Switch to controller channel 1.
CHAN 1

2.9.2. Set negative limit beyond hardware limit.
LIMN 0 -7

2.9.3. Move z-axis to encoder position 1
MOVA 0 .1

2.9.4. Move z-axis to lower travel limit. Repeat until torque limit error is encountered.
MOVR 0 -.02

2.9.5. Prompt lower Z height position reading.
MPos 0

2.9.6. Set software negative limit. Obtain Z height position from system response to previous command.
LIMN 0 [Z height position + .02]

2.9.7. Set positive limit beyond hardware limit
LIMP 0 7

2.9.8. Move z-axis to encoder position 6.4
MOVA 0 6.4

2.9.9. Lower z brake delay.
SCAL 1 6 100

2.9.10. Move z-axis to upper travel limit. Repeat until torque limit error is encountered.
MOVR 0 .02

2.9.11. Prompt upper Z height position reading.
MPos 0

2.9.12. Set software positive limit. Obtain Z height position from system response to previous command.
LIMP 0 [Z height position - .02]

2.9.13. Set z brake delay to normal setting.
SCAL 1 6 2499840

SAVE

2.10.0. Final Module Checks

2.10.1. Interference - Check for interference between moving parts. Ensure that all wiring is secure and cannot be damaged in any way by moving parts.

2.10.2. Lubrication - Check lubrication of z-axis, lubricate with NSK #1 grease if necessary.

2.10.3. Grounding - Make sure that the robot ground cable is attached to the robot.
Module Testing:

Bright Light Module Tests:

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Bright Light

Bright Light with Wafer Flipper
Module Testing: Bright Light

3.1.0. Theta Encoder Test
This procedure verifies that the encoder is properly interpreting the position of the bright light theta-axis.

3.1.1. Switch to controller channel 1.
CHAN 1

3.1.2. Set encoder to 0.
MPOS 9 0

3.1.3. Disable theta-axis motor.
MEBL 9 0

3.1.4. Prompt continuous encoder reading.
CPOS 9

3.1.5. Manually rotate theta axis one full rotation in CCW direction. Reading of 360 degrees (should be within 3 degrees).

3.1.6. Manually rotate theta axis one full rotation in CW direction. Reading of 0 degrees (should be within 3 degrees).

3.1.7. Return to prompt.
ESC

3.1.8. Enable theta-axis motor.
MEBL 9 1

3.1.9. Reference theta-axis motor.
MREF 9

3.2.0. Theta Motor Test
This procedure verifies that the bright light theta motor can properly rotate the bright light theta axis in a clockwise and counter-clockwise direction.

3.2.1. Switch to controller channel 1.
CHAN 1

3.2.2. Reference theta-axis motor.
MREF 9

3.2.3. Rotate theta-axis 90 degrees in CCW direction.
MOVR 9 90

3.2.4. Rotate theta-axis 90 degrees in CW direction.
MOVR 9 -90
3.3.0. X-Axis Motor & Encoder Test
This procedure verifies that the encoder is properly interpreting the position of the bright light x-axis, and that the bright light x-axis motor can properly move the bright light x-axis back and forth.

3.3.1. Switch to controller channel 1.
CHAN 1

3.3.2. Reference x-axis motor.
MREF 7

3.3.3. Move x-axis to encoder position 0.
MOVA 7 0

3.3.4. Set encoder to 0.
MPOS 7 0

3.3.5. Rotate x-axis 10 degrees in positive direction.
MOVR 7 10

3.3.6. Prompt encoder reading.
MPOS 7

3.3.7. Rotate x-axis 10 degrees in negative direction.
MOVR 7 -10

3.3.8. Prompt encoder reading.
MPOS 7

3.3.9. Reference x-axis motor.
MREF 7

3.4.0. Y-Axis Motor & Encoder Test
This procedure verifies that the encoder is properly interpreting the position of the bright light y-axis, and that the bright light y-axis motor can properly move the bright light y-axis back and forth.

3.4.1. Switch to controller channel 1.
CHAN 1

3.4.2. Reference y-axis motor.
MREF 8

3.4.3. Move y-axis to encoder position 0.
MOVA 8 0

3.4.4. Set encoder to 0.
MPOS 8 0

3.4.5. Rotate y-axis 10 degrees in positive direction.
MOVR 8 10

3.4.6. Prompt encoder reading.
MPOS 8

3.4.7. Rotate y-axis 10 degrees in negative direction.
MOVR 8 -10

3.4.8. Prompt encoder reading.
MPOS 8

3.4.9. Reference y-axis motor.
MREF 8
Module Testing: Bright Light

3.5.0. Vacuum Setup & Test
This procedure calibrates the bright light vacuum sensor.

3.5.1. Switch to controller channel 1.
CHAN 1

3.5.2. Activate vacuum sensor.
SVAC 3 1

3.5.3. Remove front cover of bright light module and adjust vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

3.5.4. Deactivate vacuum sensor.
SVAC 3 0

3.5.5. Initiate vacuum test. Adjust turn-on value until equal to turn-off value.
VACT 3 1

3.6.0. Station Reference
This procedure orients the bright light x, y and theta axes with respect to encoder positions.

3.6.1. Switch to controller channel 1.
CHAN 1

3.6.2. Reference x-axis.
MREF 7

3.6.3. Reference y-axis.
MREF 8

3.6.4. Reference theta-axis.
MREF 9

3.6.5. Reference all bright light axes.
SREF 3
Module Testing: Bright Light

3.7.6. Leveling of Bright Light Chuck & Setting Axes Limits

This procedure levels the bright light chuck and establishes software protection limits for the bright light x and y axes.

3.7.1. Switch to controller channel 1.

3.7.2. Set x-axis offset to 0.

3.7.3. Set y-axis offset to 0.

3.7.4. Set x-axis negative limit.

3.7.5. Set y-axis negative limit.

3.7.6. Set x-axis positive limit.

3.7.7. Set y-axis positive limit.

3.7.8. Reference all bright light axes.

3.7.9. Rotate x-axis. Repeat until chuck is level.

3.7.10. Rotate y-axis. Repeat until chuck is level.

3.7.11. Prompt encoder reading.

3.7.12. Set x-axis offset. Obtain position from previous command.

3.7.13. Prompt encoder reading.


3.7.15. Reference all bright light axes.

3.7.16. Move all bright light axes to drop-off position. Make sure chuck is level.

3.7.17. Set x-axis positive limit.

3.7.18. Set x-axis negative limit.

3.7.19. Set y-axis positive limit.

3.7.20. Set y-axis negative limit.

3.7.21. Save settings.

SAVE
Module Testing: Bright Light

3.8.0 Inspection Light Test
This procedure verifies that the bright light thermostat and shut-off are functioning properly.

CAUTION: This is not a routine test; it should only be performed when a malfunction of the bright light thermal cut-off is suspected.

3.8.1 Switch to controller channel 1.
CHAN 1

3.8.2 With cooling fan unplugged, turn on bright light.

3.8.3 Activate high-intensity light. Leave the light on for 4-5 minutes. Within 5 minutes, the thermostat should open and shut the light off.
OUTP 6 100

3.8.4 When light shuts off, plug in the cooling fan. For proper cool down, run the fan for at least 5 minutes.

3.8.5 Deactivate high-intensity light.
OUTP 6 0

3.9.0 Flipper Encoder and Motor Test
This procedure verifies that the bright light thermostat and shut-off are functioning properly.

3.9.1 Switch to controller channel 2.
CHAN 2

3.9.2 Reference the flipper module.
MREF 19

3.9.3 Park the bright light module.
SPRK 3

3.9.4 Move the flipper module to its zero position.
MOVA 19 0

3.9.5 Prompt an encoder reading of the flipper module - it should be "0".
MPOS 19

3.9.6 Move the flipper module five degrees in the positive direction.
MOVR 19 5

3.9.7 Prompt an encoder reading of the flipper module - it should be "5".
MPOS 19

3.9.8 Park the bright light module.
SPRK 3
Module Testing: Bright Light

3.10. Flipper Vacuum Test

This procedure calibrates the flipper vacuum sensor.

3.10.1. Remove the access panel from the bright light gimbal housing - this panel is distinguishable by its two-threaded sensor access holes. The bright light vacuum sensor is located on the left side of the module while the flipper vacuum sensor is located on the right.

3.10.2. Switch to controller channel 2. CHAN 2

3.10.3. Move the flipper up until it clears the top surface of the bright light chuck.

3.10.4. Place a wafer over the vacuum ports of the flipper and hold it into position with your hand.

3.10.5. Place a wafer over the vacuum ports of the flipper and hold it into position by hand. Initiate a vacuum test to prompt turn-on value (left) and turn-off value (right). VACT 3

3.10.6. Turn flipper vacuum sensor adjustment screw and repeat vacuum test until turn-on and turn-off values are 5000 (± 500), remove wafer.

3.10.7. Park the bright light module SPRK 3
Module Testing: Bright Light

3.11.0. **Flipper Upper & Lower Limit Test**

This procedure verifies that the flipper upper and lower limit optos are functioning properly.

3.11.1. Switch to controller channel 2.
CHAN 2

3.11.2. Park the bright light module.
SPRK 3

3.11.3. Prompt reading of flipper lower limit optos. A return of "1" indicates that the optos correctly sense the presence of flag.
INPV 59

3.11.4. Move the flag above the lower limit optos.
MOVR 19 10

3.11.5. Prompt reading of flipper lower limit optos. A return of "0" indicates that the optos correctly sense the absence of flag.
INPV 59 0

3.11.6. Park the bright light module.
SPRK 3

3.11.7. Prompt reading of flipper upper limit optos. A return of "0" indicates that the optos correctly sense the absence of flag.
INPV 60

3.11.8. Raise the flipper positive travel limit.
LIMP 19 70

3.11.9. Move the flipper to its positive travel limit - disregard the resulting error message.
MOVA 19 70

3.11.10. Prompt reading of flipper upper limit optos. A return of "1" indicates that the optos correctly sense the presence of flag.
INPV 60

3.11.11. Park the bright light module.
SPRK 3

3.11.12. Reset flipper travel limits.
FLIM 19
Section G: Troubleshooting & Preventative Maintenance

MVT 7080 Wafer Sorter
Preventative Maintenance Checklist

☐ Check the robot pick-up position angles for each module.
☐ Check the level of the cassette platforms to the robot paddles.
☐ Check the mapping of the cassette stations.
☐ Check paddle 1 and paddle 2 insertion into the cassette between wafers 1 and 2 and wafers 24 and 25.
☐ Check pickup lift, extraction and drop-off for wafers 1, 2, 24 and 25 for each cassette platform.
☐ Check the level of the aligner to the robot paddles.
☐ Adjust the pickup and drop-off positions of the robot to the aligner.
☐ Check the level of the bright light chuck to the robot paddles.
☐ Adjust the pickup and drop-off positions of the robot to the bright light module.
☐ Check the vacuum sensor sensitivity on the robot paddles 1 and 2, bright light chuck, and aligner chuck.
☐ Check the OCR reader alignment and the reader calibration recipes.
☐ Check joystick calibration.
☐ Cycle 50 wafers through each cassette station with all options turned on (bright light, aligner, and reader).
☐ Wipe and clean interior and exterior of machine using 70-100% IPA solution and cleanroom approved wipes. DO NOT USE ACETONE.

Other issues addressed:

Parts Used:

Service Engineer: ____________________
MicroVision MVT 7080™ Wafer Sorter

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<table>
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**Section H: Diagrams**

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Click on the Topic List hyperlink above to browse 4-Cassette sub-topics.
7.1.4. System Power-Up

7.1.1.1. Set the controller On/Off switch to the On position.

7.1.1.2. Make sure E-Stop is pulled out and turn the system On/Off switch clockwise as far as it will go to power up the controller – note that the On/Off switch will return to a position midway between the Off and On labels. Wait 20 seconds and again turn the system On/Off switch clockwise as far as it will go to activate system motor.

7.1.1.3. Power-up the VGA color monitor.

7.1.1.4. Power-up the system PC. The computer will scan for a keyboard, mouse and vtrays, check the integrity of the hard drive, and load Windows NT.

7.1.1.5. Once Windows NT has loaded, a Welcome window will appear, prompting the operator for a user name and password; enter these in the appropriate boxes and verify that WORK STATION is displayed in the box labeled From:. Select the OK button to prompt the display of the Windows NT Desktop window.

7.1.1.6. Within the Windows NT Desktop locate and select (double-click) the Host NT icon to prompt the display of the Host NT window. The system is now ready to accept host commands at the command line.
7.1.2. **Controller Board 1 (Master)**

7.1.2.1. Perform self diagnostic test; a return of 0 ensures that serial connections to controller board 1 are sound.

SELF
7.1.3.1. **Main Vacuum Test**

7.1.3.1.1. Verify that the system vacuum sensor is connected to the AUX port on the controller back panel.

7.1.3.1.2. Detach the vacuum line from the back of the sorter chassis. Turn the sensor adjustment screw CW until the LED turns on, then CCW until the LED turns off.

7.1.3.1.3. Reattach the vacuum line to the back of the sorter chassis and verify that the LED turns on.

7.1.3.1.4. Prompt the current hardware sensor status of the controller. HWST

7.1.3.1.5. Detach the main vacuum line from the sorter chassis.

7.1.3.1.6. Again, prompt the current hardware sensor status of the controller; the returned values should be different than those returned in step 7.1.3.1.4. HWST

Setup & Integration: 175
7.1.3.2. **Robot Paddle Vacuum Test**

7.1.3.2.1. **Activate paddle 1 vacuum.**

7.1.3.2.2. **Adjust paddle 1 vacuum sensor:**
1) Turn vacuum adjustment screw CW until LED turns off; 
2) Turn vacuum adjustment screw CCW until LED turns on; 
3) Turn vacuum adjustment screw CW until LED turns off.

7.1.3.2.3. **Deactivate paddle 1 vacuum.**

7.1.3.2.4. **Activate paddle 2 vacuum.**

7.1.3.2.5. **Adjust paddle 2 vacuum sensor:**
1) Turn vacuum adjustment screw CW until LED turns off; 
2) Turn vacuum adjustment screw CCW until LED turns on; 
3) Turn vacuum adjustment screw CW until LED turns off.

7.1.3.2.6. **Deactivate paddle 2 vacuum.**

7.1.3.2.7. Place a small wafer on paddle 1 and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).

7.1.3.2.8. Turn paddle 1 vacuum adjustment screw and repeat vacuum test until turn-on value is 35000 ± 5000; remove wafer.

7.1.3.2.9. Place a small wafer on paddle 2 and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).

7.1.3.2.10. Turn paddle 2 vacuum adjustment screw and repeat vacuum test until turn-on value is 35000 ± 5000; remove wafer.

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7.1.3.3. **Aligner Chuck Vacuum**

7.1.3.3.1. Activate aligner chuck vacuum.

**SVAC 2 1 1**

7.1.3.3.2. Remove the back cover of the aligner and adjust the vacuum sensor: 1) turn vacuum adjustment screw CW until LED turns off; 2) turn vacuum adjustment screw CCW until LED turns on; 3) turn vacuum adjustment screw CW until LED turns off.

7.1.3.3.3. Deactivate aligner chuck vacuum.

**SVAC 2 1 0**

7.1.3.3.4. Place a small wafer on aligner chuck and initiate vacuum test to prompt turn-on value (left) and turn-off value (right).

**VACT 2 1**

7.1.3.3.5. Turn aligner vacuum sensor adjustment screw and repeat vacuum test until turn-on and turn-off values are 35000 (± 5000); remove wafer.

7.1.3.3.6. Replace aligner back cover.
7.1.4.1. Reference Robot Module

7.1.4.1.1. Reference robot theta axis.
MREF 1 (make sure it references in all four quadrants)

7.1.4.1.2. Disable robot paddle axis motor.
MEBL 20

7.1.4.1.3. Manually swing the robot paddle over the robot, record position, enable robot paddle axis motor, and reference robot paddle axis.
RPOS 21
MEBL 21
MREF 2

7.1.4.1.4. Reference robot z axis.
MREF 0
7.1.4.2. Reference Aligner Module

7.1.4.2.1. Reference aligner theta and x-axes motors.
MREF 3
MREF 4
7.1.4.3. **Check Array Board**

7.1.4.3.1. Turn on the illumination and check the pixels of the array.
- `OUTP 4 100`
- `ALND` (129 should scroll up and down the screen)

7.1.4.3.2. Stop the scrolling and turn off the illumination.
- `ESC` (stops the scrolling)
- `OUTP 4 0`
7.1.4.4. **Check the Upper Light Source on the Wafer Light**

7.1.4.4.1. Turn on the light above the acrylic block.
OUTP 5 100

7.1.4.4.2. Turn off the light source.
OUTP 5 0
7.1.4.5. Check the Lower Light Source on the Wafer Light

7.1.4.5.1. Turn on the light source below the light shield.
OUTP 10 100

7.1.4.5.2. Turn off the light source.
OUTP 10 0
7.2.1. Cassette Station Leveling

7.2.1.1. On the underside of the sorter chassis, locate each cassette station's respective access port and loosen the four fasteners located there.

7.2.1.2. Remove the sensor cable clamps that cover up the set screw holes under the cassette stations.

7.2.1.3. Loosen the three set screws located under the cassette station until they are not touching the bottom of their station.

7.2.1.4. Raise the robot 2 axis.

7.2.1.5. Disable the robot theta and paddle motors.

7.2.1.6. Turn on robot paddle 1 vacuum and place a wafer over the vacuum port.

7.2.1.7. Manually rotate the robot theta axis to swing paddle 1 and the wafer out over the cassette stations - note that the centerline of paddle 1 must point to the center of the robot for proper leveling. Using the wafer as a baseline, determine which cassette station is the highest; proceed to level that station first.

7.2.1.8. Place three leveling blocks around the edge of the highest cassette station. Manually swing the wafer over the cassette station. Lower the robot z axis until the underside of the wafer makes contact with one of the blocks.

7.2.1.9. Adjust the three set screws under the station until the wafer makes equal contact with all three blocks. Once the station is level, rotate the set screw located closest to the robot clockwise (CW) 1/4 turn.

7.2.1.10. Manually swing paddle 1 and the wafer away from the station. Beginning with the two fasteners situated farthest from the robot and proceeding in small increments, retighten the four fasteners located on the underside of the pedestal.

7.2.1.11. Manually swing paddle 1 and the wafer back over the station and use the blocks to ensure that it is still level. Repeat the leveling procedure if necessary.

7.2.1.12. Manually swing paddle 1 and the wafer over the next station, keeping the same robot z height, and perform the leveling procedure described above (7.2.1.9. - 7.2.1.11.).

7.2.1.13. While supporting the wafer, turn off the vacuum to robot paddle 1 and remove the wafer.

SWAC 110

Setup & Integration: 183
7.2.1.14. Enable the robot theta and paddle motors.
MELBL 1 1
MELBL 2 1

Setup & Integration: 184
7.2.2. **Robot Paddle Calibration**

7.2.2.1. Reference the robot theta axis.
- MREF 1

7.2.2.2. Reference the robot paddle axis.
- MREF 2

7.2.2.3. Set the station reference flag for the robot.
- SRFL 1 1

7.2.2.4. Rotate the robot paddle axis until paddle 1 is centered over the robot.
- MOV R [8 degrees]

7.2.2.5. Place a calibration pin into the robot calibration pin hole.

7.2.2.6. Rotate the robot paddle axis until the inside edge of paddle 1 makes contact with calibration pin; as paddle one approaches the pin, decrease the increment of rotation.
- MOV R [8 degrees]

7.2.2.7. Set the robot paddle reference position and paddle 1 calibration angle.
- RPOS 1 1
- MREF 2
- SCAL 1 1 0

7.2.2.8. Check to see if robot paddle 1 centers properly over the robot.
- MVPC 1

7.2.2.9. Save settings.
- SAVE

Setup & Integration: 185
7.2.3. Robot Z Axis Calibration

7.2.3.1. Center robot paddle 1 over the center of the robot and set the robot height (z axis) to .1 inches.
MVPC 1
MOVA 0 .1

7.2.3.2. Rotate the robot theta axis until the robot faces cassette station A.
MOVR 1 [5-degrees]

7.2.3.3. Extend paddle 1 out over cassette station A.
MOVR 2 180

7.2.3.4. Adjust the robot z axis brake timeout value.
SCAL 1 8 10000000

7.2.3.5. Place a 1 inch calibration block adjacent to the tip of the extended robot paddle. Raise or lower the robot z axis until the height of the paddle's bottom edge matches that of the block - as paddle 1 approaches the block downward movement should be in increments of .001".
MOVR 0 [v- .001]

7.2.3.6. Flat the robot z axis motor reference position.
RPD S 0 1

7.2.3.7. Reference the robot z axis.
MREF 0

7.2.3.8. Move the robot z axis to the newly set zero position.
MOVA 0 0

7.2.3.9. Center paddle 1 over the robot, then extend it out over the cassette station A; use the calibration block to see if RPOS recorded properly.
MVPC 1
MOVR 2 180

7.2.3.10. Center paddle 2 over the robot, then extend it out over the cassette station A; MVPC 2
MOVR 2 180

7.2.3.11. Raise or lower the robot z axis until the height of the paddle's bottom edge is equal to the height of the block - as paddle 2 approaches the block downward movement must be in increments of .001".
MOVR 0 [v- .001]

7.2.3.12. Set the paddle offset and center paddle 1 over the robot.
POTF 1
MVPC 1

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7.2.3.13. Set default limits for the robot Z, theta and paddle axes.
FLIM Z
FLIM 1
FLIM 2

7.2.3.14. Reset the robot Z axis brake timeout value.
SCAL 1 & 2000000

7.2.3.15. Save settings.
SAVE

Setup & Integration: 187
7.2.4. Can Angle Calibration

7.2.4.1. Center robot paddle 1 over the robot, prompt a reading of the robot z axis negative limit, and move the robot z axis to a height that equals its negative limit plus .1 inches.
MVPC 1
LMIN 0
MOVA 1
7.2.4.2. Rotate the robot theta axis until the robot faces cassette station A.
MOVR 1 [± degrees]
7.2.4.3. Center robot paddle 1 over the robot then extend it over cassette station A.
MVPC 1
MOVR 2 150
7.2.4.4. Place a calibration pin in the calibration hole on top of cassette station A. Rotate the robot theta axis in small increments until the paddle makes contact with the calibration pin.
MOVR 1 [± 12 degrees]
7.2.4.5. Define the world position and set the can angles for a sorter with two cassettes:
PWLD 90
SCAL 2 0 0
SCAL 10 0 -90
SCAL 11 0 -160
SCAL 12 0 140
SCAL 13 0 90
XP0B 1 0
SCAL 1 7 55
SREF 1
7.2.4.6. Test the settings by rotating the paddle end of the robot to face the aligner.
SPRK 1
7.2.4.7. Save settings.
SAVE

Setup & Integration: 188
7.2.5. Aligner Calibration

7.2.5.1. Reference all aligner axes.
SREF 2

7.2.5.2. Move aligner x axis until the chuck is positioned over the center of the module.
MOV R 4 [-0.2 inches]

7.2.5.3. Center robot paddle 1 over the robot and rotate the robot theta axis until the robot's paddle end faces the aligner.
MVPC 1
MOVA 1 0

7.2.5.4. Raise the robot z axis to a height above the aligner chuck.
MOVA 0 3 0

7.2.5.5. Extend robot paddle 1 over the aligner chuck and turn on robot paddle 1 vacuum.
MOV R 2 1 0
SVAC 1 1 1

7.2.5.6. Manually place a wafer onto robot paddle 1. Make sure it is centered over the chuck.

7.2.5.7. Lower the robot z axis until any part of the wafer makes contact with the aligner chuck. Do not proceed lower than the aligner chuck as this may damage the wafer.
MOV R 0 [-0.055 inches]

7.2.5.8. Access the aligner's bottom panel and locoate the four shoulder bolts if they do not have springs. Adjust the three aligner leveling screws until the gap between the chuck and the wafer appears even from all vantage points. Relighten the shoulder bolts if they do not have springs.

7.2.5.9. While supporting the wafer turn off paddle 1 vacuum.
SVAC 1 1 0

7.2.5.10. Move the aligner x axis in a positive direction.
MOV R 4 2

7.2.5.11. Place a calibration pin in the calibration hole on top of the aligner's surface. Make sure it is perpendicular to the top plate.

7.2.5.12. Move the aligner x axis in the negative direction until the calibration pin makes contact with robot paddle 1.
MOV R 4 [-0.62 inches]

7.2.5.13. Record the aligner x axis reference position, set the aligner x axis transfer position, and reference the aligner module.
RPOS 4 1
XPOS 4 0
IRREF 4

Setup & Integration: 189
7.2.5.14. Pull the calibration pin out of the aligner's calibration hole and
park the aligner.
SPRK 2

7.2.5.15. Check to see if the aligner parked at the correct position, then
center robot paddle 1 over the robot.
MVPC 1

7.2.5.16. Set default limits for aligner x and theta axes.
FLIM 3
FLIM 4

7.2.5.17. Save settings.
SAVE

Setup & Integration: 190
7.2.6. Setting Aligner Transfer Position

7.2.6.1. Center robot paddle 1 over the robot and rotate the robot theta axis until the robot’s paddle end faces the aligner.
    MVPC 1
    MOVA 1 0

7.2.6.2. Raise the robot z axis to a height above the aligner chuck.
    MOVA 0 3.5

7.2.6.3. Extend robot paddle 1 over the aligner chuck and turn on robot paddle 1 vacuum.
    MOVR 2 1 8 9
    SVAC 1 1 1

7.2.6.4. Manually place a wafer onto robot paddle 1. Make sure it is centered over the chuck.

7.2.6.5. Set the aligner transfer position by repeatedly lowering the wafer until contact with the aligner chuck is sensed.
    FVAC 2 1

7.2.6.6. Set the default transfer heights.
    SCAL 2 2...03
    SCAL 2 3...005
    SCAL 2 4...015
    SCAL 2 5...03

7.2.6.7. Save settings.
    SAVE
7.2.7. **Aligner Sensor Array Calibration**

7.2.7.1. Turn on the aligner sensor array illumination.
**OUTP 4 100**

7.2.7.2. Use a small flathead screwdriver to gently turn the potentiometer to maximum brightness; be careful not to strip the potentiometer as its maximum range of motion is only 3/4 turn.

7.2.7.3. Move the aligner x-axis until the wafer edge is centered under the aligner sensor array.
**MOVR 4 [2 distance]**

7.2.7.4. Prompt a display of the wafer edge location with respect to the sensor array; a properly positioned edge would read between 60 and 68. Select the ESC button to terminate the ALND display.
**ALND**

7.2.7.5. Adjust the aligner x-axis as needed.
**MOVR 4 [1.65]**

7.2.7.6. Repeat steps 7.2.7.4. and 7.2.7.5. until the ALND reading falls between 60 and 68.

7.2.7.7. Turn the potentiometer until ALND reading decreases by 1. Select the ESC button to terminate the ALND display.
**ALND**

7.2.7.8. Turn off aligner sensor array illumination.
**OUTP 4 0**

7.2.7.9. Autocalibrate the aligner sensor array.
**ALNC 1**

7.2.7.10. Support the wafer by hand, turn off the aligner chuck vacuum and manually remove the wafer.
**SVAC 2 1 0**

7.2.7.11. Save settings.
**SAVE**

Setup & Integration: 192
7.2.8. **Laser Offset Setup**

7.2.8.1. Reference all robot axes,
SREF 1

7.2.8.2. Set wafer mapping algorithm,
MAPA 2

7.2.8.3. To determine the laser offset position, first place a calibration pin in the calibration hole on the top of cassette station A. Next, position a white card or slip of paper behind the pin, opposite the robot. Execute the following commands to position the robot z and theta axes so that the robot laser is aimed at the calibration pin.
LMBN 0 [returns negative limit]
MOVA 0 [negative limit + .05 inches]
MOVA 1 90

7.2.8.4. Turn on the laser and rotate the robot theta axis until the shadow of the pin falls directly in the center of the laser beam projected onto the paper.
LASR 1
MOVR 1 [± .2]

7.2.8.5. Prompt the current robot theta position and use it to set the laser offset.
MPOS 1 [returns current position]
SCAL 1 14 [90 - current position]

7.2.8.6. Turn the laser off.
LASR 0

7.2.8.7. Save the settings.
SAVE

Setup & Integration: 193
7.2.9. Mapping Setup: Cassette Station A

7.2.9.1. Place a full cassette on cassette station A. Remove the wafer in slot 2.

7.2.9.2. Calibrate the mapping set up.
MAPS 10

7.2.9.3. Put the wafer back in slot 2.

7.2.9.4. Map the cassette.
MAPC 10

7.2.9.5. Prompt a return of the mapping data over a specified range of mapping angles.
SCAN 10-2 4 2

7.2.9.6. Study the returned mapping angles and their corresponding data. Determine at which mapping angles the cassette was correctly mapped. From among the angles that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.8) in the following procedures:

<table>
<thead>
<tr>
<th>Angle</th>
<th>Mapping Data</th>
</tr>
</thead>
<tbody>
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<tr>
<td>-1.8</td>
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<tr>
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<td>-1.2</td>
<td>00000000000000000000000000000000</td>
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<tr>
<td>-1.0</td>
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<tr>
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<tr>
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<td>00000000000000000000000000000000</td>
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</table>

7.2.9.7. Set the low mapping angle.
SCAL 10 1 [low angle value]

7.2.9.8. Set the high mapping angle
SCAL 10 2 [high angle value]

Setup & Integration: 194
7.2.9.9. Auto calibrate the best mapping start position.
MAPH 10

7.2.9.10. Map the cassette and check the accuracy of returned data.
MAPC 10

7.2.9.11. Save settings.
SAVE
7.2.10. Mapping Setup: Cassette Station B

7.2.10.1. Place a full cassette on cassette station B. Remove the wafer in slot 2.

7.2.10.2. Calibrate the mapping set up.

7.2.10.3. Put the wafer back in slot 2.

7.2.10.4. Map the cassette.

7.2.10.5. Prompt a return of the mapping data over a specified range of mapping angles.

7.2.10.6. Study the returned mapping angles and their corresponding data. Determine at which mapping angle the cassette was correctly mapped. From among the angles that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.8 and high = 2.6) in the following procedures.

```
-2.0  00000000000000000000000000000000
-1.8  00000000000000000000000000000000
-1.6  00000000000000000000000000000000
-1.4  00000000000000000000000000000000
-1.2  00000000000000000000000000000000
-1.0  00000000000000000000000000000000
-0.8  00000000000000000000000000000000
-0.6  00000000000000000000000000000000
-0.4  00000000000000000000000000000000
-0.2  00110000000000000000000000000000
  0.2  00110000000000000000000000000000
  1.0  10100001010000100000000000000000
  1.2  10110001011110100000000000000000
  1.4  11111111111111111111111111111111
  1.6  11111111111111111111111111111111
  1.8  11111111111111111111111111111111
  2.0  11111111111111111111111111111111
  2.2  11111111111111111111111111111111
  2.4  11111111111111111111111111111111
  2.6  11111111111111111111111111111111
  2.8  11111111111111111111111111111111
  3.0  11111111111111111111111111111111
  3.2  11111111111111111111111111111111
  3.4  11111111111111111111111111111111
  3.6  00010110101101010101010101010101
  3.8  00000000000000000000000000000000
  4.0  00000000000000000000000000000000
```

7.2.10.7. Set the low mapping angle.

SCAL 11 1 [low angle value]

7.2.10.8. Set the high mapping angle.

SCAL 11 2 [high angle value]

Setup & Integration: 196
7.2.10.9. Auto calibrate the best mapping start position.
MAPH 11

7.2.10.10. Map the cassette and check the accuracy of returned data.
MAPC 19

7.2.10.11. Save settings.
SAVE
7.2.11. Mapping Setup: Cassette Station C

7.2.11.1. Place a full cassette on cassette station C. Remove the wafer in slot 2.

7.2.11.2. Calibrate the mapping set up.
MAP's 12

7.2.11.3. Put the wafer back in slot 2.

7.2.11.4. Map the cassette.
MAP C 12

7.2.11.5. Prompt a return of the mapping data over a specified range of mapping angles.
SCAN 12 < 2 < 2

7.2.11.6. Study the returned mapping angles and their corresponding data. Determine at which mapping angles the cassette was correctly mapped. From among the angles that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.6 and high = 2.8) in the following procedures.

-2.0 00000000000000000000000000
-1.8 00000000000000000000000000
-1.6 00000000000000000000000000
-1.4 00000000000000000000000000
-1.2 00000000000000000000000000
-1.0 00000000000000000000000000
-0.8 00000000000000000000000000
-0.6 00000000000000000000000000
-0.4 00000000000000000000000000
-0.2 00110010000111001001010100
1.0 10100011011001101000101000
1.2 10111001111111101001011111
1.4 11111111111111111111111111
1.6 11111111111111111111111111
1.8 11111111111111111111111111
2.0 11111111111111111111111111
2.2 11111111111111111111111111
2.4 11111111111111111111111111
2.6 11111111111111111111111111
2.8 11111111111111111111111111
3.0 11111111111111111111111111
3.2 11111111111111111111111111
3.4 10101110011011010101011111
3.6 00000110010011011001001000
3.8 00000000000000000000000000
4.0 00000000000000000000000000

7.2.11.7. Set the low mapping angle.
SCAL 12 1 [low angle value]

7.2.11.8. Set the high mapping angle.
SCAL 12 2 [high angle value]

Setup & Integration: 108
7.2.11.9. Auto calibrate the best mapping start position.
MAPH 12

7.2.11.10. MagPre cassette and check the accuracy of returned data.
MAPC 12

7.2.11.11. Save settings.
SAVE
### 7.2.12. Mapping Setup: Cassette Station D

#### 7.2.12.1. Place a full cassette on cassette station D. Remove the wafer in slot 2.

#### 7.2.12.2. Calibrate the mapping set up.
MAPS 13

#### 7.2.12.3. Put the wafer back in slot 2.

#### 7.2.12.4. Map the cassette.
MAPC 13

#### 7.2.12.5. Prompt a return of the mapping data over a specified range of mapping angles.
SCAN 13 -2 4.2

#### 7.2.12.6. Study the returned mapping angles and their corresponding data. Determine if which mapping angles the cassette was correctly mapped. From among the angles that mapped correctly, select a 1 degree range that lies midway between the highest and lowest angles (lowest = 1.4 and highest = 3.2). Use the high and low angles from within this range (low = 1.0 and high = 2.8) in the following procedures.

<table>
<thead>
<tr>
<th>Angle</th>
<th>Binary Code</th>
</tr>
</thead>
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</tr>
<tr>
<td>4.0</td>
<td>00000000000000000000000000000000</td>
</tr>
</tbody>
</table>

#### 7.2.12.7. Set the low mapping angle.  
SCAL 13 1 [low angle value]

#### 7.2.12.8. Set the high mapping angle  
SCAL 13 2 [high angle value]

Setup & Integration: 200
7.2.12.9.  Auto calibrate the best mapping start position, MAPC 13

7.2.12.10. Map the cassette and check the accuracy of returned data, MAPC 13

7.2.12.11. Save settings, SAVE
7.2.13. Setting Wafer Transfer Positions: Cassette Station A

7.2.13.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station A.

7.2.13.2. Map the cassette.
MAPC 10

7.2.13.3. Find the negative limit and move the robot z axis to a position slightly above it.
LJMN 0
MOVA 0 [negative limit + .1]

7.2.13.4. Extend robot paddle 1 into the cassette below wafer 1.
WDOO 10 11

7.2.13.5. Repeatedly raise robot height until vacuum contact with wafer 1 is sensed.
FVAC 10 1 (repeat until contact is made)

7.2.13.6. Remove paddle 1 from the cassette.
WDOO 10 11

7.2.13.7. Establish robot paddle 1 offset. Repeat the following procedure (7.2.13.8. - 7.2.13.13.) until paddle 1 is centered between wafers 1 and 2.

7.2.13.8. Move the robot z-axis to the wafer 2 drop-off height.
WDOO 10 21

7.2.13.9. Disable the robot theta axis motor.
MEBL 1 0

7.2.13.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

7.2.13.11. Adjust paddle 1 offset position.
SCAL 10 6 [± 0.001]

7.2.13.12. Manually swing robot paddle 1 out of the cassette and center it over the robot.

7.2.13.13. Enable the robot theta axis motor.
MEBL 1 1

7.2.13.14. Check / adjust wafer pitch. Repeat the following procedure (7.2.13.15. - 7.2.13.21.) until paddle 1 is centered between wafers 24 and 25.

7.2.13.15. Move the robot z-axis to the wafer 25 drop-off height.
WDOO 10 25 1

7.2.13.16. Disable the robot theta axis motor.
MEBL 1 0

7.2.13.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.

Setup & Integration: 202
7.2.13.18. Adjust the vater pitch.
SCAL 10 17 [±.0001]


7.2.13.20. Enable robot theta-axis.
MEBL 1 1

7.2.13.21. Map the cassette and check results for accuracy.
MAPC 10

7.2.13.22. Save settings.
SAVE

Setup & Integration: 203
7.2.14. Setting Wafer Transfer Positions: Cassette Station B

7.2.14.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station B.

7.2.14.2. Map the cassette.
MAPC 11

7.2.14.3. Find the negative limit and move the robot z axis to a position slightly above it.
LIMIT 8
MOVA 9 [negative limit + .1]

7.2.14.4. Extend robot paddle 1 into the cassette below wafer 1.
WEEO 11 1 1

7.2.14.5. Repeatedly raise robot height until vacuum contact with wafer 1 is sensed.
FVAC 11 1 (repeat until contact is made)

7.2.14.6. Remove paddle 1 from the cassette.
WOOR 11 1 1

7.2.14.7. Establish robot paddle 1 offset. Repeat the following procedure (7.2.14.8. - 7.2.14.13.) until paddle 1 is centered between wafers 1 and 2.

7.2.14.8. Move the robot z-axis to the wafer 2 drop-off height.
WDOO 11 2 1

MIBL 1 0

7.2.14.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

7.2.14.11. Adjust paddle 1 offset position.
SCAL 11 6 [± .003]

7.2.14.12. Manually swing robot paddle 1 out of the cassette and center it over the robot.

MIBL 1 1


7.2.14.15. Move the robot z-axis to the wafer 25 drop-off height.
WDOO 11 25 1

MIBL 1 0

7.2.14.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.

Setup & Integration: 204
7.2.14.18. Adjust the wafer pitch, SCAL 11 17 [t .0001]
7.2.14.20. Enable robot theta-axis, MEBL 11
7.2.14.21. Map the cassette and check results for accuracy, MAPC 11
7.2.14.22. Save settings, SAVE

Setup & Integration: 205
7.2.15. **Setting Wafer Transfer Positions: Cassette Station C**

7.2.15.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station C.

7.2.15.2. Map the cassette.

7.2.15.3. Find the negative limit and move the robot z-axis to a position slightly above it.

```
LIMN 0
MOVA 0 [negative limit + .1]
```

7.2.15.4. Extend robot paddle 1 into the cassette below wafer 1.

```
WEEO 12 1 1
```

7.2.15.5. Repeatedly raise robot height until vacuum contact with wafer 1 is sensed.

```
FVAC 12 1 [repeat until contact is made]
```

7.2.15.6. Remove paddle 1 from the cassette.

```
WOOR 12 1 1
```

7.2.15.7. Establish robot paddle 1 offset. Repeat the following procedure (7.2.15.8. - 7.2.15.13.) until paddle 1 is centered between wafers 1 and 2.

```
WOOD 12 2 1
```

7.2.15.8. Move the robot z-axis to the wafer 2 drop-off height.

```
MEBL 1 0
```

7.2.15.9. Manually swing robot paddle 1 into cassette between wafers 1 and 2.

```
SCAL 12 6 [t .003]
```

7.2.15.10. Adjust paddle 1 offset position.

```
MEBL 1 1
```

7.2.15.11. Manually swing robot paddle 1 out of the cassette and center it over the robot.

```
SCAL 12 6 [t .003]
```

7.2.15.12. Enable the robot theta axis motor.

```
MEBL 1 0
```

7.2.15.13. Check / adjust wafer pitch. Repeat the following procedure (7.2.15.14. - 7.2.15.21.) until paddle 1 is centered between wafers 24 and 25.

```
WEEO 12 25 1
```

7.2.15.14. Move the robot z-axis to the wafer 25 drop-off height.

```
MEBL 1 0
```

7.2.15.15. Manually swing robot paddle 1 into cassette between wafers 24 and 25.

```
SCAL 12 6 [t .003]
```

```
MEBL 1 0
```

Setup & Integration: 206
7.2.15.18. Adjust the wafer pitch.
SCAL 12 17 [± .0001]

7.2.15.19. Manually swing paddle-axis out of cassette and center over robot.

7.2.15.20. Enable robot theta-axis.
MEBL 1 1

7.2.15.21. Map the cassette and check results for accuracy.
MAPC 12

7.2.15.22. Save settings.
SAVE
7.2.16. Setting Wafer Transfer Positions: Cassette Station D

7.2.16.1. Place a cassette with wafers in positions 1, 2, 24 and 25 onto cassette station D.
7.2.16.2. Map the cassette.
MAPC 13
7.2.16.3. Find the negative limit and move the robot z axis to a position slightly above it.
LIMN 0
MOVA 0 [negative limit + .1]
7.2.16.4. Extend robot paddle 1 into the cassette below wafer 1.
WDOO 13 11
7.2.16.5. Repeatedly raise robot height until vacuum contact with wafer 1 is sensed.
FVAC 13 1 (repeat until contact is made)
7.2.16.6. Remove paddle 1 from the cassette.
WOCR 13 11
7.2.16.7. Establish robot paddle 1 offset. Repeat the following procedure (7.2.16.8. – 7.2.16.13.) until paddle 1 is centered between wafers 1 and 2.
7.2.16.8. Move the robot z-axis to the wafer 2 drop-off height.
WDOO 13 21
7.2.16.9. Disable the robot theta axis motor.
MEBL 10
7.2.16.10. Manually swing robot paddle 1 into cassette between wafers 1 and 2.
7.2.16.11. Adjust paddle 1 offset position.
SCAL 13 6 [1 .003]
7.2.16.12. Manually swing robot paddle 1 out of the cassette and center it over the robot.
7.2.16.13. Enable the robot theta axis motor.
MEBL 11
7.2.16.14. Check / adjust wafer pitch. Repeat the following procedure (7.2.16.15. – 7.2.16.21.) until paddle 1 is centered between wafers 24 and 25.
7.2.16.15. Move the robot z-axis to the wafer 25 drop-off height.
WDOO 13 25 1
7.2.16.16. Disable the robot theta axis motor.
MEBL 10
7.2.16.17. Manually swing robot paddle 1 into the cassette between wafers 24 and 25.

Setup & Integration: 208
7.2.18.18. Adjust the wafer pitch.
SCAL 13 17 [± .0001]

7.2.18.19. Manually swing paddle-axis out of cassette and center over robot.

7.2.18.20. Enable robot theta-axis.
MEBL 11

7.2.18.21. Map the cassette and check results for accuracy.
MAPC 13

7.2.18.22. Save settings.
SAVE
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