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The Yield Management Company
CSD Educational Services

January 12, 1999

CRS 1010 & 1200

CONFOCAL REVIEW STATION

Field Service Engineer

Procedures:

Calibration
Stage Alignment
Optical Alignment
Preventative Maintenance
Installation Manual
.uvconfig File Defined
UNIX Software Install/Management

CRST 300

CRS Calibration Procedures

MAX Z-LIMIT

This procedure is designed to calibrate the maximum "Z" limit for the stage relating to autofocus.

11. Load a bare silicon wafer onto the instrument stage.

***Note: Remember to Load and Unload with the 5X objective only to prevent any damage** to the turret or the stage.

12. Set the software to the following parameters:

13. Objective: 5X

14. Laserline: 488nm

15. Under the heading ***Setup***, select ***Laser Scan Parameter***, change the sample thickness for the proper wafer size. Once changed, select ***O.K.***:

8"	725	
6"	675	US
6"	625	NEC
5"	625	
4"	550	

16. In the ***Review*** screen, select ***Laser / White*** Light image and move the ***Fine Z*** slider bar to 0 (zero).

***Note: Do NOT use the Auto Focus (Coarse or Fine) for this procedure.**

17. Use the joystick control to focus the laser image. Focus is achieved when the laser image on the screen is the brightest. If the laser image shuts off, or goes completely dark, the intensity is too high. This in indicated by the area surrounding "Laser Intensity" turning red. Use the slide bar for Laser Intensity or the Laser up and Laser down arrow keys on the engineering keyboard.

Note: If you are not able to focus using the joystick control, again, DO NOT attempt to autofocus. Instead, do the following:

18. Lower the Review Screen by selecting the "-" in the upper left corner, then Lower. This can also be achieved by simply hitting the "Alt + F3" key from the Review Screen.

a) Select Desktop from the menu that appears after the Review Screen is lowered.

b) Highlight UNIX Shell with the left mouse button, then release to enter the UNIX Shell.

c) In the UNIX shell, type the following... jot /usr/uv/.uvconfig

d) Under the section, Stage_Spec, look for a line that displays:

max_z_um= 7217 7355 7354 7361 7183

11. The numbers listed are the previously learned Max Z Limits. The numbers correspond, from left to right, to the 5X, 20X, 50X, 100X, 150X objectives. If you have other objectives than the ones listed above, the numbers correspond to your particular objective scheme.

12. Increase the number from the present value to 8000. Once done, select, File and Save or by pressing "Alt + S".

13. Click anywhere on the upper most horizontal bar of the Review Screen and select Config.

14. Click on the selection Misc. Under this heading, in the bottom, left corner, click on the button labeled Reread Config. By selecting this button, you are telling the system to re-read the .uvconfig file. This will cause the system now use the parameters that you have just changed. Finally, select Quit.

15. Focus again using the joystick control. Once focused, select Maintenance from the top menu bar.

16. Select the option, Manual Stage Control. Once selected, you will see a new window appear. Select the Z axis. Then, select the button labeled Report Pos. To the right of the Report Position, you will have displayed a numerical value. Write this value in your notes. Use the table below as a guide of what to do.

17. Repeat steps 4 to 7 for each additional objective on the system.

Note: Before switching objectives, lower the stage by joystick Z control.

Example:

Objective	Reported Position	Max Z Limit	
5X		64927	7247
20X	64892	7243	
50X	62657	7016	
100X	64626	7216	
150X	63337	7085	

18. Take the number from the reported position and multiply it by .1016. Then add the wafer thickness value plus 50 microns. (Once the stage autofocus has been done, later in this procedure, the fine focus is set to the center of its range. 50 will allow the fine focus go to the Fine Z limit.) This will give you the new Z Limit Position.

Calculate:

X .1016 + 725 + 50 = 7247

Where:

X is the Reported Position from Step 7 for which ever objective you are calculating.

19. X is a constant factor that changes the physical steps of the stepper motor in the Z stage into microns.

725	is the wafer thickness for a 150mm wafer
50	is a "safety band margin"
7247	is the new Max Z Limit

20. Lower the ***Review Screen*** again ***(Alt +F3)***, and select the **UNIX Shell** window. In ***.uvconfig***, under ***Stage Spec***, change the numbers for ***max_z_um*** to the calculated values you obtained in Step 26. If you closed the .uvconfig previously, simply type the following command at the UNIX prompt: ***jot /usr/uv/.uvconfig***

Example:

	5X	*20X*	*50X*	*100X*	*150X*
max_z_um=	7247	7243	7016	7216	7085

21. Select File, then Save to save the new calculated values into .uvconfig.

22. In the Review Screen, select Config, Misc., ReRead Config, then Quit.

23. To verify the limit, using the 5X Objective, move the fine Z slider bar to 0. From the focus postiion, move the laser image to the upper limit stop by joystick Z control. Go to ***Maintenance***, ***Manual Stage Control***, choose ***Z*** Axis, click on ***Z Dist Fr Config.*** This number should reflect the wafer thickness, plus the 50 μm safety factor.

24. For other objectives, **repeat Step 13. The wafer** thickness should be this number minus 50.

Example:

	5X	*20X*	*50X*	*100X*	*150X*	
Z Dist Fr Config	675	675	675	675	675	675
		- 50				

625 = Wafer thickness used for the calculation in Step 27.

End of procedure. Do not unload the wafer as it will be used in the following procedure.

PARCENTRICITY

This procedure is designed to calibrate the stage enabling a feature to remain in the field of view when the objective magnification is changed.

1. Lower the ***Review Screen*** again ***(Alt +F3)***, and select the **UNIX Shell** window. In ***.uvconfig***, under ***object_spec***, change the numbers for ***objective_x offset um=*** and ***objective_yoffset_um*** to 0 (see example below). If you closed the .uvconfig previously, simply type the following command at the UNIX prompt: ***jot /usr/uv/.uvconfig***

Example:

objective_xoffset_um= 0 0 0 0 0
objective_yoffset_um= 0 0 0 0 0

2. Select ***File***, then ***Save*** to save the new values into .uvconfig.

3. In the ***Review Screen***, select ***Config***, ***Misc.***, ***ReRead Config***, then ***Quit.***

4. Select the maximum objective of the system.

5. Select a feature on the wafer that is easily recognizable and center it on the cross hair. A corner of a die is usually a good feature to help with these alignments. Position the corner of the die or feature so the cross hair is aligned to the feature. In the lower, left window (***wafer map***) update the stage coordinates by selecting ***update***. ***Record*** the ***X*** and ***Y*** positional ***value*** for this objective in your notes.

6. ***Select*** the preceding objective. ***Position*** the same feature under the cross hair in the same location as it was at the higher objective. Once again, in the ***wafer map window***, select the ***update*** button to update the positional information. ***Write*** the ***X*** and ***Y*** values for this objective in your notes. ***Repeat this step for the remaining objectives***. (See example below).

Example:

Obj	X Value	Delta	Y Value	Delta
5X	1829	0	-3503	0
20X	1885	56	-3830	-327
50X	1899	70	-3897	-394
100X	1898	69	-3920	-417
150X	1835	6	-3920	-417

Where: The X and Y values from each objective are subtracted from the X and Y values fo the 5X objective to determine the offset entered in the Delta field.

7. Lower the ***Review Screen*** again ***(Alt +F3)***, and select the **UNIX Shell** window. In ***.uvconfig***, under ***object_spec***, change the numbers for ***objective_x offset um=*** and ***objective_yoffset_um*** to the values calculated for the delta field above (see example below). If you closed the .uvconfig previously, simply type the following command at the UNIX prompt: ***jot /usr/uv/.uvconfig***

Example:

objective_xoffset_um= 0 56 70 69 6
objective_xoffset_um= 0 -327 -394 -417 -417

8. Select ***File***, then ***Save*** to save the new calculated values into .uvconfig.

9. In the ***Review Screen***, select ***Config***, ***Misc.***, ***ReRead Config***, then ***Quit.***

10. To verify you have completed this procedure successfully, in the Review Menu, position a feature under the cross hairs. As you change to the various objectives, insure the feature relatively remains in the same place (under the cross hairs). It is important to have polarity correct when doing the offset calculation. If you do not have the polarity correct, you coul see a drift of the feature as you change the objectives.

End of procedure. Do not unload the wafer as it will be used in the following procedure

PARFOCALITY

This procedure is designed to calibrate the focus across the various objectives. When an objective is selected, the objective will be in focus after selection. This procedure is using the premise that the bare silicon wafer used in the previous procedure is still on the instrument stage. If the wafer was unloaded, reload it at this time.

1. Select the ***5X Objective*** in the Review Screen.

2. Move the ***Fine Z*** slider bar to ***zero***.

3. Use the ***joystick Z control*** to focus the image on the screen.

4. Along the top menu bar, select ***Maintenance*** by moving the cursor onto the heading and holding the left mouse button down to select.

5. Select the ***Manual Stage Control*** option under Maintenance. Under Manual Stage Control, select the ***Z Axis***. To the right of the axis menu, select ***Report Pos***. A number will then be displayed to the right of this field. Write this number in your notes. Once, documented, select ***Quit***.

6. Repeat Steps 2 to 4 for each additional objective and write down the position number in your notes. See the example below.

Example:

Objective	Report Pos	Z Change	Calculated Offset
5X	63805	0	0
20X	65658	1853	188265
50X	65648	1843	197249
100X	65712	1907	193751
150X	65824	2019	205130

Where:

Reported Position: Actual position of the stage
Z Change: Distance each objective is from the reference. The reported position for the 5X Objective is used as the reference number for the remaining objectives.
Calculated Offset: The Z change value multiplied by 101.6 (constant factor that converts the stage movements into nanometers).

7. Subtract the reported position value for the 5X Objective from each of the reported position values for the subsequent objectives. This will give you a "***Z Change***" value calculated from the initial position of the 5X Objective.

8. Multiply this ***Z Change*** value calculated in Step 6 by ***101.6*** to obtain the ***Calculated Offset*** of each objective.

9. Lower the ***Review Screen*** again ***(Alt +F3)***, and select the **UNIX Shell** window. In ***.uvconfig***, under ***Objective_ Spec***, change the numbers for ***objective_offset_nm*** to the calculated values you obtained in Step 8. If you closed the .uvconfig previously, simply type the following command at the UNIX prompt: ***jot /usr/uv/.uvconfig***

Example ***objective_offset_nm = 0 188265 197249 193751 205130***

10. Select ***File***, then ***Save*** to save the new calculated values into .uvconfig.

11. In the ***Review Screen***, select ***Config***, ***Misc***., ***ReRead Config***, then ***Quit***

12. To verify proper calibration, locate a defect on the wafer that is currently loaded onto the stage. Focus this defect on the laser image. Cycle through the various objectives observing that the defect remains in focus as each objective is selected.

End of procedure. Unload the patterned wafer at this time.

LASER INTENSITY MATRIX

This procedure is designed to calibrate the Laser Intensity / Attenuator Filter for best image.

1. Using a bare wafer, select the following:

   Objective: *5X*
   Wavelength: *458 nM*

2. Focus the image in the laser window using the manual Z joystick control.

3. Adjust the intensity of the laser by moving the Laser Intensity slider bar with the mouse, or by using the Laser up and down keys on the engineering keyboard, until the image is comfortably bright. The ideal situation is not to have excessive amounts of white in the image. A nice golden color is preferable.

Note: If the laser intensity reading (PMT Gain) is too high, or "streaking" is observed in the laser image, select a less attenuated filter.

4. Select ***Maintenance*** from the main menu bar. Under ***Maintenance***, ***select LON Diagnostics***. To select a different attenuation, click on the button labeled, ***Laser Attenuation*** and select a different attenuator from the list provided. Once selected, adjust the laser intensity again to obtain an image that is pleasing to the eye. Notice that shadows and streaking disappear as you select a different filter. Choose the attenuator and laser intensity value that provides the best laser image possible. Note the ***Laser Intensity*** and ***Attenuator*** in your notes.

5. Repeat for other ***objectives*** and ***wavelengths***.

6. Write down the intensity reading and the filter in place for each objective at each wavelength as shown below:

Example:

Objective	458	Delta	488	Delta	515	Delta	All	Delta
5X	37/1	0	36/3	-1	39/3	2	39/3	2
20X	48/2	11	25/5	-12	31/5	-6	45/5	8
50X	60/1	23	35/4	-2	35/4	-2	50/6	13
100X	60/1	23	40/2	3	40/2	3	55/5	18
150X	91/1	54	45/1	8	45/1	8	67/3	30

Where:

Under, for example, the 458 wavelength, it is written 37/1. This number corresponds to th laser intensity at the selected attenuator. The laser intensity was at 37 with the first attenuator selected. The delta numbers represent the difference of the laser intensity compared with the intensity found at the 5X Objective, 458 NM wavelength. This number can be negative.

7. Once completing the image quality at all objectives for all wavelengths, lower the ***Review Screen*** again ***(Alt + F3)***, and select the **UNIX Shell** window. In ***.uvconfig***, under ***Confocal_ Spec***, change the numbers for ***laser_atten_at_458line=*** to the attenuator position for each objective you noted in Step 6 (see example below). If you closed the .uvconfig previously, simply type the following command at the UNIX prompt: ***jot /usr/uv/.uvconfig***

Example:

	5X	20X	50X	100X	150X
laser_atten_at_458line=	**1**	**2**	**1**	**1**	**1**
laser_atten_at_488line=	**3**	**5**	**4**	**2**	**1**
laser _atten_at_515line=	**3**	**5**	**4**	**2**	**1**
laser _atten_at_allline=	**3**	**5**	**6**	**5**	**3**

8. Again, in ***.uvconfig***, under ***Confocal_spec***, find the area for ***objective_spec*** and insert the delta's obtained in Step 6.

Example:

	5X	20X	50X	100X	150X
object_laser_int_458_offset=	0	11	23	23	54
object_laser_int_488_offset=	-1	-12	-2	3	8
object_laser_int_515_offset=	2	-6	-2	3	8
object_laser_int_allline_offset=	2	8	12	18	30

9. Select ***File***, then ***Save*** to save the new calculated values into .uvconfig.
10. In the ***Review Screen***, select ***Config***, ***Misc.***, ***ReRead Config***, then ***Quit.***

Additional Notes:

- Filter position:

1	2	3	4	5	6
Pos1	Low	Pos 3	Med	Max	High (H)

- In ***File***, ***Recipe***, ***Laser Param***, change ***laser intensity*** to ***37 (@458nM),*** then save the recipe.
- When switching to a different wavelength, make sure you perform an auto focus.
- If streaking appears on the image, select the next higher attenuated filter.

WHITE LIGHT INTENSITY MATRIX

1. Load a pattern wafer. Turn the **Laser/WL** button to **WL Only**. This will turn off the laser imaging off.

2. At 5X, adjust the ***camera intensity*** slider bar so that the white light image is comfortably bright. Record the camera intensity.

3. In the main menu bar, select ***Maintenance***. Under Maintenance, select ***LON Diagnostics*** Click on the ***White Light*** section to change the filter used. For each objective and filter, repeat Step 2. Note the intensities in your notes similar to the ones shown below.

Example:

Obj	All	Delta	Yellow	Delta	Dim	Delta	Poll	Delta
5X	141	0	100	-41	255	114	215	74
20X	147	6	125	-16	255	114	215	74
50X	131	-10	110	-31	255	114	205	64
100X	131	-10	120	-21	255	114	255	114
150X	151	10	130	-11	255	114	255	114

Note: In the table above, the delta values listed are the intensity for each objective at that particular filter subtracted from the value for the 5X objective / All filter. This number is used as your reference. It is ok to obtain a negative number after the subtraction.

4. Once completing the image quality at all objectives for all filter positions, lower the ***Review Screen*** again ***(Alt +F3)***, and select the **UNIX Shell** window. In ***.uvconfig***, under ***object_spec***, change the numbers for ***objective_camera_int_all_offset=*** to the a delta values calculated from the data in Step 3 (see example below). If you closed the.uvconfig previously, simply type the following command at the UNIX prompt: ***jot /usr/uv/.uvconfig***

Example:

```
Objective_camera_int_all_offset= 0 6 -10 -10 10
Objective_camera_int_pol_offset= 74 74 64 114 114
Objective_camera_int_yel_offset= -41 -16 -31 -21 -11
Objective_camera_int_dim_offset= 114 114 114 114 114
```

5. Select ***File***, then ***Save*** to save the new calculated values into .uvconfig.

6. In the ***Review Screen***, select ***Config***, ***Misc***., ***ReRead Config***, then ***Quit.***

7. In the ***main menu bar***, select ***File***, ***Recipe***, ***Laser Param*** and change the ***camera intensity*** to ***141***. Then ***save*** the recipe.

   Additional Notes: Depend on A-stop value. Non ADC uses 100, where ADC uses 150.

End of Procedure.

CALIBRATE SYSTEM (X, Y, Z SIZING)

Calibrating the system is a complicated procedure. It is assumed that the person performing calibration is familiar with the operation of the system and can load wafers and obtain surfaces data. In the .uvconfig file there is a calibration factor for each objective and each XY resolution setting of the laser image. Usually it is sufficient to calibrate at one objective and resolution setting and carry the number across to the other objectives and resolutions. This procedure will be described as well as the procedure for checking other objectives and resolution settings.

In .uvconfig the calibration table appears as follows.

```
confocal_z_res = 12.20
confocal_x_amp_obj0 = 1426 713 357 178
confocal_x_amp_obj1 = 1426 713 357 178
confocal_x_amp_obj2 = 1426 713 357 178
confocal_x_amp_obj3 = 1426 713 357 178
confocal_x_amp_obj4 = 1426 713 357 178
confocal_y_amp_obj0 = 1426 713 357 178
confocal_y_amp_obj1 = 1426 713 357 178
confocal_y_amp_obj2 = 1426 713 357 178
confocal_y_amp_obj3 = 1426 713 357 178
confocal_y_amp_obj4 = 1426 713 357 178
```

The first line is the calibration factor for the Fine Z axis. The next 10 lines are calibration of the X and Y scan per objective. 5 lines for the X and 5 for the Y. Notice there are four columns for each objectives. These are the four XY Resolution settings, 100%, 50%, 25%, and 12.5% respectively. Notice that the numbers in each line are identical. Typically this is how the calibration will come out. The value of the objective magnification is taken into account in the measurement formula so no adjustment is required per objective. The calibration factor per objective is there for cases when an objective's magnification is not exactly right or when more accuracy is required. The calibration per XY resolution is similar. Typically we calibrate at the largest scan size and divide the calibration by two for each subsequent scan size. (e.g. 1426/2=713, 1426/4=357, 1426/8=178.) We typically calibrate using 10.0 micron spheres at the 100x objective and 100% largest scan size, then find the calibration factor for other scan sizes by dividing by two and carrying the same numbers across all objectives. (Other objective and scan sizes are of course checked after calibration.) This is the procedure which will be detailed below. The procedure is similar using other sphere sizes, objectives or scan sizes.

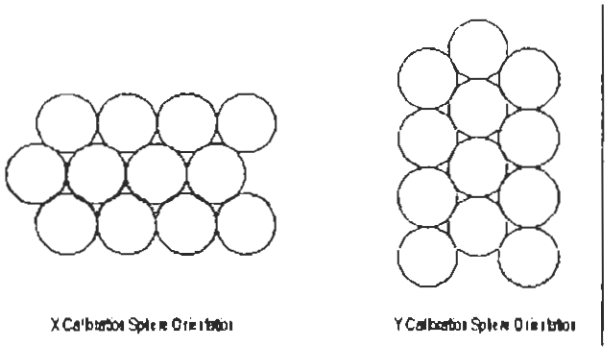
Notice in the table of calibration data the objectives are referred to as obj0, obj1, etc. This is because the objective powers are configurable and will vary from system to system. Before calibrating you should be familiar with what objectives are loaded in the system.

The basic calibration procedure is to measure latex spheres which have a known size, usually 10.0 um and 2.019 um. If the system is not calibrated, when spheres are measured the measurement value is something other than 10.0 um. To correct the measurement divide the measurement value obtained by the latex sphere size (10.0 um). Multiply this number by the

current calibration factor for the objective/resolution setting used to obtain the new calibration factor. Enter the new calibration factor in the table and take the measurement again. This time the measurement should be more accurate. Repeat the procedure if the measurement is out of specification. Calibrating X and Y axes require one measurement method and calibrating Z requires another so the procedures will be described separately.

X or Y Calibration This measures center to center distance of touching spheres.

1. Obtain a slide with 10.0 micron latex spheres deposited on it.
2. Place a "dummy" wafer, preferably an aluminum blank in a cassette slot.
3. Using the Manual Robot Control mode, get the wafer from the slot. This will move the wafer from the cassette to the robot area.
4. Using a drop of isopropyl alcohol, secure the slide on the wafer. Try to make sure the area with the spheres on it is near the center of the wafer. This will make it easier to find spheres.
5. Again, using the Manual Robot Control mode, put the wafer on the stage. (Don't go to the pre-aligner, this is unnecessary and dangerous.)
6. Using the wafer map move the stage to 0,0 coordinates.
7. Slowly move the stage up in the Z axis using the Joystick. Do Not use the Stage Autofocus function at any time during this procedure because the system may not see the slide and this could cause the stage to crash into an objective. If the slide was placed with the spheres near the center of the wafer you should be able to see the spheres as the slide comes into focus.
8. Increase the magnification by moving the objective power up incrementally until you can make out the spheres. Usually 20x or 50x works well to find spheres to work with. Don't go up to a very high power objective because you'll have to search for suitable spheres first.
9. Moving the stage in X and **Y** axes, look for spheres suitable for calibration. If you are calibrating the X axis you need to find spheres touching end-to-end in the **X** axis and to calibrate Y you need spheres touching end-to-end in the Y axis. This is shown in the drawing below.
10.



X Calibration Sphere Orientation Y Calibration Sphere Orientation

11. Once you find spheres which are oriented properly you can move up to the 100x objective. (Be careful when positioning the stage at 100x since the working distance is only 100 um.)

12. At 100x objective with the XY Resolution set to 100, set the Fine Z Position near the center of its range and very carefully move the Joystick Z control until the spheres are in focus.
13. Move the Fine Z control through the focus range of the spheres. You should see the laser image change as you move the spheres through the focal plane. At one point you should see a bright spot in the center of the spheres. Set the Fine Z stage so this spot is as small and bright as possible.
14. Set the number of slices to minimum (5).
15. In the Fine Z control box click on the "S" for start position and "F" for finish position without moving the Fine Z stage at all. This sets for taking a Surface with minimal movement of the Fine Z stage.
16. Take a surface (Click the "Surf" button).
17. Once the surface is complete, select a 2D, XY Cut Plane Window with its Cursor set to Size mode and place it in the largest window. You may have to set this up.
18. Measure the distance between two adjacent sphere centers. This is done by placing the rubber band box so its edges cross the bright spot at the center of the spheres.
19. Get the measurement value from the area to the right of the image. If you are calibrating X use the horizontal value and if you are calibrating Y use the vertical value.
20. Divide the value measured by 10.0 (the Sphere size) to obtain the correction factor.
21. Select Calibration from the maintenance menu. A dialog box appears with the current calibration data at the top and selectors at the bottom
22. Select the objective and scan size you are working with, in this case 100x and 100%. A word of caution, selecting and objective or scan size not only selects the calibration data for adjusting but also switches the objective in to place or changes the scanner resolution, so make sure you select the proper objective and scan size. When an objective and scan size is selected, two slider bars for adjusting calibration appear with the current calibration factor as the center value.
23. Select the bar for the axis you are calibrating and multiply the current calibration factor times the correction factor found in step 19 to get the new calibration factor.
24. Slide the slider bar for the axis you are calibrating over to the new calibration factor. Note: the new calibration factor may be out of the slider bar range. If this is the case slide the bar over as far as possible and save the data to file. Then the slider bar will change to the data you saved as the center position. Continue sliding over until you reach the new calibration factor.
25. Once the calibration factor is entered on the slider bar save the file by clicking on the Save button.
26. Re-measure the spheres and repeat steps 19-24 until the measurement is within specifications (±2%).
27. Once the measurement is within specification divide the 100% calibration factor by two to obtain the new calibration factor for the 50% XY resolution setting at 100x. Divide the 100% number by four to obtain the calibration factor for the 25% XY resolution setting and so on. Enter these numbers by selecting the appropriate XY resolution setting and adjusting the X or Y amplitude slider bar as appropriate.

28. Copy the numbers obtained at the 100x objective over to the other objectives by selecting the objectives and resolutions and adjusting the X or Y amplitude.
29. Once the entire table is complete click the Save button to save the calibration data to disk.
30. Check the calibration at other objectives and XY resolution settings by switching objectives and resolution and measuring the spheres. At some settings smaller spheres may be required (10um for 100%, 50% and 2.019um for 25%, 12%). Normally measurements will be within specification but if not some small adjustments may be necessary at the other objectives and resolution settings. If so follow the same procedure to correct the initial 100x, 100nm measurement.

Z Calibration This measures distance from the glass to the top of the spheres.

11. Follow steps 1 through 8 in the X or Y Calibration procedure to load the spheres.

12. Moving the stage in X and Y axes, look for spheres which are suitable for Z calibration. The best are those aligned in the Y axis (as shown in the drawing above, labeled Y Calibration Sphere Orientation) with a column of spheres exposed on one side., such as the column on the far right of the drawing.

13. Move up to the 100x objective (Be careful when positioning the stage when the 100x objective is in place.) and center the spheres in the field of view. You should have a column of spheres on one side of the screen with blank slide on the other and the transition close to the center of the screen.

14. Set the Fine Z Stage control near its midrange (about 25) and move the Coarse Z Stage with the joystick until the spheres are in focus. (Be extremely careful not to move up too far because the Z Stage crash limits don't work when using a slide on top of a wafer.)

15. Move the Fine Z Stage through the entire focus range of the spheres. You should see the slide come into focus when the Fine Z is moved up. As you move the stage down the spheres will move through focus until you see the top of the spheres which appear as a large patch. Adjust the Laser Intensity at the brightest point so there is no saturation.

16. Set the number of slices to maximum (128).

17. Move the Fine Z Stage back to the point slightly above where the slide surface is in focus (up). This slide is in focus when the blank area with no spheres becomes bright. Move up slightly past this area to find the starting point for the surface.

18. Click the "S" button to set the surface start point.

19. Move the Fine Z Stage down through the sphere focus range until you see the top of the sphere come into focus and continue to move until the top of the sphere just goes out of focus.

20. Click the "F" button to set the surface finish point.

21. Click the Surface button to acquire a surface.

22. Move the windows around so you have a small 2D, XY Cut Plane Window with a Cut cursor and a large 2D, XZ Cut Plane Window with a size cursor.

23. Move the cursor in the XY Window until it crosses the center of a sphere. You should see the profile in the XZ Window change as the cursor is moved. Be sure you leave the cursor on the very center of the sphere or the highest point of the sphere.

24. In the XZ Window you should see the profile of the sphere which looks like a vertical rectangle with a round top. Along the X axis you should see about half of the view show a roughly straight line which is the slide itself. Place the sizing cursor around the profile of the sphere (you are only concerned with the vertical size).

25. Read the measurement from the status bar on the side (the vertical reading).

26. Divide 10.0 (the Sphere size) by the value measured to obtain the correction factor.

27. Multiply this correction factor by the calibration factor in the .uvconfig file (confocal_z_res) to obtain the new calibration factor. The calibration factor is the first line of the section of the .uvconfig shown earlier in this procedure.

28. Exit the uv program.

29. Use the jot editor to change the calibration factor in the .uvconfig factor (don't forget to save the file).

30. Run the uv program again and check the measurement in Z (you can use the Re-Load config option on newer software versions). If it is off repeat the procedure to fine tune the calibration factor. Note there is only one calibration factor for the Z measurement since this is calibrating the Fine Z Stage, not the optics.

KLA Tencor

The Yield Management Company

CRS 1010 & 1200

CONFOCAL REVIEW STATION

Stage Calibration Procedure

April 20, 1998

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Adjusting CRS NEAT Stage Accuracy

Introduction

The **KLA Tencor** Confocal Review Station includes an XYZ stage that positions wafers under the microscope to inspect defects. The accuracy of positioning the stage relative to the microscope is critical to the speed with which defects can be found and identified. This document addresses the process of making software-based adjustments to provide repeatable and precise positioning of the XYZ stage in all dimensions. No two stages are mechanically identical at the scale of semiconductor measurments, but the CRS instrument is capable of measuring the deviations and can be set to counteract them.

The XY stage is a three-piece stage consisting of a lower (stationary) piece, a center piece that moves in the Y direction, and an upper piece that moves in both X and Y. The lower carriage is the Y axis, and the upper is the X axis. Because of the three piece design, the orthogonality is machined into the center piece and is not adjustable (either deliberately or accidentally). The X and Y axes use 5mm pitch ballscrews, ball nuts with adjustable preload to eliminate backlash, and 400 step/revolution stepper motors with divide-by-50 microstepping drives. The resultant step resolution is 0.25 microns, nominally, and linear encoders with 0.5 micron resolution are side-mounted to each axis.

The **KLA Tencor** uv software provides several correction factors for the XY stage.

- Orthogonality parameters
- Scaling parameters for the X-and Y axes
- Non-linear mapping parameters

These parameters together allow the software to compensate for a variety of movement and positioning errors in the mechanical stage components, and to guarantee orthogonal movement of the wafer, with correct scaling and positioning, all to high accuracy. The orthogonality and scaling parameters are used in simple linear correction formulae. Non-linear mapping of the X and Y axes is based on a table of their errors measured at individual points along the axes. The result is a piecewise linear transformation interpolated between the test points. All these parameters are entered into the `.uvconfig` configuration file.

Note that all corrections (except orthogonality) are applied to an axis based on the position of that axis; there are no corrections for errors due to coupling of the axes (an error in X that is a function of the Y axis position, for example). In general, the X axis is more accurate than the Y axis because its encoder is closer to the wafer surface where inspection occurs. One possible source of errors that require stage mapping is non-flatness of the surface that the stage is mounted to. Always be sure that the bottom of the stage and the surface it mounts to are clean and free of burrs. Another significant source of error is temperature: the current method of dealing with this is to allow the system to warm up for an hour or two and to do the calibration operations relatively quickly to avoid the effects of thermal distortions.

Deskew Considerations

A fourth accuracy correction occurs as part of the normal inspection process of wafers, in the "deskew" operation. During deskew, the measured die size is forced to match the die size specified in the wafer map; this is done by measuring the distance between die corners across the wafer and applying a stretch factor to **both the X and Y axes** to make the die size appear correct. The angle of the wafer with respect to the stage travel is also measured and software corrections are created to make the stage coordinates parallel to the die sides or streets. The stretch factor and angle are measured automatically when the first two deskew points are accepted in the deskew procedure. The difference between the scale stretching done as part of stage calibration and the scale stretching done in deskew is that deskew must apply to both X and Y, whereas stage calibration can apply different stretch factors to each axis. The stretch specified in deskew is applied to the stage after the stretch from stage calibration, so the resultant stretch factor is the product of the two sources.

It may be important in certain cases to remove the stretch factor due to deskew, and this is done by pressing the "Deskew Off" button in the deskew window.

The deskew operation is intended to correct **minor** errors in the equipment; if large motions are required to find the second or third deskew points, there is probably a mismatch between the wafer and the wafer map. In particular, the second deskew point should be brought into the field of view using Y axis motion only - if a large X excursion is required, the X die pitch in the wafer map must be significantly incorrect (some small motion in X is acceptable).

In the process of performing accuracy tests, the success of the deskew operation is critical. In order to improve deskew accuracy, the operator can use higher power objectives to locate the die corners more accurately. It is important to use the same objective for the first and second deskew points, so that parcentricity errors between objectives do not contribute to deskew errors. The third deskew point should be measured with the objective that will be used to measure stage accuracy with the map. The first and second deskew points are used to calculate axis stretching and rotation; the third deskew point is used to establish the origin of the wafer coordinate system. In real-world wafer maps, it is not uncommon for the third deskew point to be at a different location from the first two (for example, the first two might be lower-left die corners, and the third might be an upper right die corner). Adjusting and accepting the third deskew point is exactly the same as doing a "map offset" operation during the review operation: it adjusts the origin of the wafer coordinate system to make the current location correct for the current target. During accuracy testing, the map offset operation should only be done at the center of the wafer - it is not fair to bias the errors to one side of the wafer by doing a "map offset" near the edge.

About Reference Wafers

In the stage calibration procedure, the stage is going to be matched to a reference wafer and a wafer map. The map will contain the coordinates of several die corners around the wafer, and the basis for the calibration is that the map coordinates are accurate. There are several ways to obtain such a map, with varying degrees of accuracy.

The best way is to use a wafer and map that were created by the customer on the defect scanning machine (Tencor, KLA, etc.) that will be used with the CRS. This is the best possible source for a reference map because the customer doesn't want the CRS to be "accurate", what he really wants is for it to match the errors of his defect scanner so that defects always show up in the field of view of the CRS (note, however, that some scanners have poor coordinate accuracy, so judgment is recommended).

The second best source of a reference wafer is one of a batch of wafers purchased by ***KLA Tencor*** from a scrap wafer vendor. All of the wafers in the batch should be the same pattern at the same process level, so that the die sizes are as close to identical as is reasonable for current semiconductor technology (better than 1 micron), and the streets should be orthogonal. A single map is made for all the wafers by measuring the die pitch of a few of the wafers on one or more "known good" review stations or defect scanners.

The third best way to make a reference wafer is to use an single wafer of unknown heritage, measure the die pitch on a single machine of unknown accuracy, and use the result to calibrate that same machine. This last method is not as bad as it sounds because the CRS stage is a fundamentally robust system, because averaging is used, and because the errors to be corrected are small. However, as in all testing, it is best to use the same reference standards wherever possible, to limit the number of variables in the problem.

Note that the only information needed to make a map is the die pitch in X and Y. If you can get the pitch by having the wafer scanned by the customer's defect scanner, so much the better. The following steps allow the operator to create a reference map for a given wafer using the ***KLA Tencor*** machine. Larger wafers are better for reference purposes. Use an 8 in. wafer, unless the customer has a particular reason for using a smaller wafer. The user is advised to mark the wafer (using a felt-tip pen on the periphery of the wafer) and save the map to a floppy so that the reference information is preserved. Recording the serial number is an alternative to marking the wafer, but it is best to make a reference wafer look obvious.

Procedure for Creating a Reference Wafer:

Apply power to the system and allow it to warm up for two hours to stabilize its dimensions.

1. Check that the X axis stage parameters in the .uvconfig file are set to their nominal values:

   ```
   x_resolution = 0.25
   x_encoder_res = 0.50
   ```

2. Save the `.uvconfig` file, close it, exit the uv application and re-start it. This is to **guarantee** that the correct XY resolution is being used in the program.
3. In the ***Deskew*** window of the uv program, click on ***Deskew Off*** to remove any deskew corrections.
4. Load the reference wafer into the system with ***Flat 0*** set in the ***Cassette*** window.
5. Locate a first die corner at the extreme left hand side of the wafer and record its coordinates as (X_0, Y_0). Measure the coordinates by bringing the feature under crosshairs on the video screen using a 50X objective, then clicking on the wafer map to update the current XY coordinates displayed there.

6. **Mag down** to the 5X objective and follow the wafer street from the first die corner to a second die corner on the extreme right hand side of the wafer using the joystick. Count the number of die traversed as the wafer is moved so that the distance per die can be calculated. Mag back up to 50X and record the coordinates of the second die corner as (X_1, Y_1).

7. Calculate the X die pitch as

$$X_{pitch} = \frac{\sqrt{(X_0 - X_1)^2 + (Y_0 - Y_1)^2}}{\#Xdie} \quad \text{(EQ 1)}$$

where *#Xdie* is the number of die traversed going from left to right on the wafer.

8. Unload the wafer and re-load it with ***Flat 90*** in the cassette window. This rotates the wafer 90 degrees so that the Y die pitch can be measured using the X axis of the CRS (recall that the X axis should be more accurate than the Y axis). This is the only instance where wafer rotation should be used to measure a Y axis feature using the X axis of the stage.

9. Repeat steps 5 and 6, recording (X_2, Y_2) as the coordinates of the new die corner on the left hand side of the wafer, (X_3, Y_3) for the die on the right side, and #Ydie as the number of complete die encountered as the wafer is traversed. The Y die pitch is then

$$X_{pitch} = \frac{\sqrt{(X_2 - X_3)^2 + (Y_2 - Y_3)^2}}{\#Ydie} \quad \text{(EQ 2)}$$

10. Unload the wafer and set ***Flat = 0*** in the cassette window.

11. Enter the X and Y die pitch into a new KLA wafer map. A new KLA map can be created by clicking on **File** from the header bar, then **Wafer Map**, and **Clear Map**. A window pops up with various options for the new map; choose ***KLA***, the appropriate size (***8"*** probably), and select a ***flat angle*** of zero degrees. Click on ***OK***. Click on **Setup** on the header bar, then ***EditWaferMap***, and enter the measured die pitch in the appropriate fields of the resultant window. Be sure that ***Flat Down*** is selected. Enter a registration point of (0,0), enter a ***slot number*** and a ***slot ID*** ("`test`" is a good ID), then click on ***Enter to List***. Click on ***OK*** to accept this information.

12. Add a few defects to the file by clicking on ***Edit Defect*** in a status window, then clicking on ***Append Defect*** twice. The location of the defects is not important. The idea is just to have some defect data in the file to establish the format of defect entries. Save the map by clicking on **File** on the header bar, then ***Wafer Map***, entering an appropriate name in the space provided, and clicking on ***Save***. Table 1 on the next page is an example of the format of the new file that will result.

13. Edit the resultant KLA map (using the `jot` editor, for example) by editing and adding lines to specify the die corners to be used for calibration. Table 2 shows a map after editing, using a die pitch of 6545.1 µ × 15441.0 µ. The defect locations that are entered depends on the actual wafer and its die pitch. The coordinates of die corners are being used as defect locations. The defect locations are specified in die coordinates, including a die number (XINDEX, YINDEX) and the coordinates relative to the die corner (XREL, YREL). For die corners, the relative coordinates are always (0, 0), and the die number specifies how many die offset from the central (0, 0) die to go.

    For routine stage acceptance testing, a pattern of eight die corners equally spaced around the periphery of the wafer can be used. For example, defects 2 through 9

```
FileVersion 1 0;
InspectionStationID "" "__" "__";
SampleType WAFER;
ResultTimestamp 09-15-93 07:10:00;
LotID "           ";
SampleSize 1 150;
SetupID "__" 09-15-93 07:10:00;
StepID "__";
SampleOrientationMarkType FLAT;
OrientationMarkLocation DOWN;
DiePitch 6.545100e+03 1.544100e+04;
DieOrigin 0.000000 0.000000;
WaferID "test";
Slot 8;
SampleCenterLocation 0.000000e+00 0.000000e+00;
ClassLookup 4
   0 "UnClassified"
   1 "Big hole"
   2 ".3 um scratch"
   3 ".5 um scratch"
InspectionTest 1;
AreaPerTest 200000000.0;
DefectRecordSpec 12 DEFECTID XREL YREL XINDEX YINDEX XSIZE YSIZE DEFECTAREA DSIZE
 CLASSNUMBER TEST IMAGELIST ;
DefectList
  1 3.469500e+03 6.441000e+03  -5  -2 10.000000 10.000000 100.000000 100.000000 0 1 0
  2 3.469500e+03 6.441000e+03  -5  -2 10.000000 10.000000 100.000000 100.000000 0 1 0;
SummarySpec 5 TESTNO NDEFECT DEFDENSITY NDIE NDEFDIE ;
SummaryList
 1 1 6.0 1 1;
EndOfFile;
```

TABLE 1. New KLA map

in Table 2, on the next page, are suitable. For stage mapping purposes, a pattern that includes all the die corners in a "cross" provides as many measurement points as possible in the X and Y directions.

Calibrating the XY Stage

With a reference wafer and a reference map, the stage calibrations can be performed. Corrections will be applied for orthogonality and scale errors, in that order, and then stage mapping will be applied if necessary. Note that stage mapping is not always required.

It is possible to adjust existing settings of stage corrections, but for simplicity, this procedure assumes that the settings will be set back to zero before the corrections are calculated. The procedure to adjust existing settings is left to the interested reader. It is definitely possible to adjust one setting without resetting all the others, but the user is cautioned to make sure to check accuracy after all the corrections are installed.

Correcting Orthogonality

Orthogonality refers to the angle between the X and Y axes of travel. The procedure involves measuring the location of die corners at the ends of the central X and Y

```
FileVersion 1 0;
InspectionStationID "" "__" "__";
SampleType WAFER;
ResultTimestamp 09-15-93 07:10:00;
LotID "                ";
SampleSize 1 150;
SetupID "__" 09-15-93 07:10:00;
StepID "__";
SampleOrientationMarkType FLAT;
OrientationMarkLocation DOWN;
DiePitch 6.545100e+03 1.544100e+04;
DieOrigin 0.000000 0.000000;
WaferID "test";
Slot 8;
SampleCenterLocation 0.000000e+00 0.000000e+00;
ClassLookup 4
   0 "UnClassified"
   1 "Big hole"
   2 ".3 um scratch"
   3 ".5 um scratch"
InspectionTest 1;
AreaPerTest 200000000.0;
DefectRecordSpec 12 DEFECTID XREL YREL XINDEX YINDEX XSIZE YSIZE DEFECTAREA DSIZE
CLASSNUMBER TEST IMAGELIST ;
DefectList
1 0.000000e+00 0.000000e+00    0    0 100.000000 100.000000 10000.000000 10000.000000 0 1 0
2 0.000000e+00 0.000000e+00    9    0 10.000000 10.000000 100.000000 100.000000 0 1 0
  3 0.000000e+00 0.000000e+00  -10    0 10.000000 10.000000 100.000000 100.000000 0 1 0
  4 0.000000e+00 0.000000e+00    0    3 10.000000 10.000000 100.000000 100.000000 0 1 0
  5 0.000000e+00 0.000000e+00    0   -4 1.000000 1.000000 1.000000 1.000000 0 1 0
  6 0.000000e+00 0.000000e+00    6    2 10.000000 10.000000 100.000000 100.000000 0 1 0
  7 0.000000e+00 0.000000e+00    6   -3 10.000000 10.000000 100.000000 100.000000 0 1 0
  8 0.000000e+00 0.000000e+00   -6   -3 10.000000 10.000000 100.000000 100.000000 0 1 0
  9 0.000000e+00 0.000000e+00   -7    2 10.000000 10.000000 100.000000 100.000000 0 1 0;
SummarySpec 5 TESTNO NDEFECT DEFDENSITY NDIE NDEFDIE ;
SummaryList
 1 1 6.0 1 1;
EndOfFile;
```

TABLE 2. KLA map with die corners

streets, and calculating the apparent angle between them. Both the wafer and the stage have X and Y axes that are very close to 90°; the procedure measures the angle difference between the wafer and the stage, and that difference is assumed to be stage orthogonality error. Note that the wafer will not be loaded perfectly onto the XY stage, so there will in general be a small rotation of the wafer with respect to the stage. There are other (perfectly acceptable) ways to measure and/or correct stage orthogonality, but the exact procedures are left to the interested reader. In all cases, it is important to check the results after entering a correction into the `.uvconfig` file. Note that the correction is applied only to programmed moves, not to joystick motions, so the joystick is useless for verifying orthogonality corrections.

Procedure for Correcting Orthogonality

1. In the `.uvconfig` file, set the `stg_orthogonality_deg` to zero, and save the file.
2. Re-load the `.uvconfig` file into the uv application by clicking on **Config** on the header bar, then **Misc** and ***ReRead Config***. Finally, re-initialize the XYZ stage by clicking on **Maintenance** on the header bar, then **Manual Stage Control**, then ***Init Stage***.
3. Load a reference wafer map and the reference wafer into the system. Do not perform a deskew operation. Measure the XY coordinates of the die corners of the extreme top, bottom, left, and right dies on the wafer. The coordinates are measured by bringing the die corner under dead center of a crosshair on either the white light or laser screen, and then clicking on the wafer map to generate the current XY coordinates in the readout of the wafer map window. The location of

the crosshair is not important, but it is important to use the crosshair consistently, with the same objective (50X is suggested) for each die corner. The exact die used for each entry is also not important, but it is critical that the two die in a pair be on the same street. Enter the coordinates into a table like the one below:

Die Position	X Coordinate	Y Coordinate
Top	X_{top}=	Y_{top}=
Bottom	X_{bottom}=	Y_{bottom}=
Left	X_{left}=	Y_{left}=
Right	X_{right}=	Y_{right}=

4. Calculate the angles (in degrees) between the X and Y streets and the X and Y axes of the stage as follows:

$$\theta_X = (180/\pi)\text{atan}((Y_{right} - Y_{left})/(X_{right} - X_{left})) \quad \text{(EQ 3)}$$

$$\theta_Y = (180/\pi)\text{atan}((Y_{top} - Y_{bottom})/(X_{top} - X_{bottom})) \quad \text{(EQ 4)}$$

Assuming the wafer has been loaded approximately parallel to the stage axes, these two angles should be small, i.e. less than a degree.

5. Calculate the orthogonality error as the difference between the two angles calculated in step 3:

$$\theta_{error} = \theta_x - \theta_y \quad \text{(EQ 5)}$$

This angle should be very small, i.e. less than 0.1 degree in magnitude.

6. Enter the result from step 4 into the `.uvconfig` file as the `stg_orthogonality_deg` setting, and save the file.
7. Check the result as described in the next section.

Procedure for Checking Orthogonality

1. Reload the `.uvconfig` file and re-initialize the XYZ stage as described earlier.
2. Load the reference wafer and map into the system (if it isn't loaded already).
3. Perform a deskew operation on the reference wafer.
4. Select the uppermost die corner on the wafer map, and click on ***GoTo Selected*** in the WaferMap window. Center the die corner under the crosshairs on the screen at 50× and click anywhere on the wafer map to update the current position readout in the WaferMap window. Record the current X position as X_{top_meas}. Calculate the X axis error:

$$X_{top_err} = X_{top_meas} - X_{top_nom} \quad \text{(EQ 6)}$$

where X_{top_nom} is the X position specified in the reference map, and X_{top_meas} is the measured X position. Do not bother with the Y coordinate for this operation.

5. Select the lowermost die corner on the wafer map, and click on ***GoTo Selected*** in the WaferMap window. Center the die corner under the crosshairs on the screen and click anywhere on the wafer map to update the current position readout in the WaferMap window. Record the current X position as X_{top_meas}. Calculate the X axis error:

$$X_{bottom_err} = X_{bottom_meas} - X_{bottom_nom} \quad \text{(EQ 7)}$$

where X_{bottom_nom} is the X position specified in the reference map, and X_{bottom_meas} is the measured X position.

6. The signature of an orthogonality error is an X axis error of opposite sign at the top and bottom of the wafer (after a deskew operation). If X_{top_err} is the opposite sign from X_{bottom_err} as measured in step 5 above, then the orthogonality can be improved. Very small errors (1 or 2um) will be difficult to correct.

Stretching the Y axis

Currently there is no reason to apply a correction factor to the X axis (the deskew operation takes care of it). The Y axis should be corrected after an orthogonality correction has been entered. Stretch factors are implemented in `.uvconfig` by entering smaller or larger numbers for the encoder and step resolutions so that the system travels larger or smaller distances (respectively) to get to a target position.

Stretching the Y axis

1. This can only be done after making sure that the orthogonality is correct. Then a deskew operation must be performed before continuing this procedure.
2. Select the uppermost die corner on the wafer map, and click on ***GoTo Selected*** in the WaferMap window. Center the die corner under the crosshairs on the screen at 50× and click anywhere on the wafer map to update the current position readout in the WaferMap window. Record the indicated Y axis position of the die corner as Y_{top_meas}.
3. Select the lowermost die corner on the wafer map, and click on ***GoTo Selected*** in the WaferMap window. Center the die corner under the crosshairs on the screen and click anywhere on the wafer map to update the current position readout in the WaferMap window. Record the indicated Y axis position of the die corner as Y_{bottom_meas}
4. Calculate the stretch factor as follows:

$$Stretch = (Y_{top_meas} - Y_{bottom_meas})/(Y_{top_nom} - Y_{bottom_nom}) \quad \text{(EQ 8)}$$

where Y_{top_nom} and Y_{bottom_nom} are the top and bottom Y coordinates of the die corners from the reference wafer map.

5. Apply the stretch correction to the `.uvconfig` file. If this is the first time the procedure is performed, the file will contain the line

   ```
   y_encoder_res = 0.5
   ```

   Whatever the value is, multiply it by the stretch calculated above, and enter the new value in the file. Set `y_resolution` to half this value. Save the `.uvconfig` file.
6. Exit the uv application program and restart it to load the new encoder resolution.

Checking Y-axis Stretch

1. Load the reference map and map, and perform a deskew operation.
2. Select the topmost die corner in the defect list, and click on ***GoTo Selected***. Bring the die corner under the cross hairs at 50× and read the Y axis current position by clicking on the wafer map and reading the current position indication. Record the position as Y_{top_meas}.
3. Select the bottom die corner in the defect list, and click on ***GoTo Selected***. Bring the die corner under the cross hairs at 50× and read the Y axis current posi-

tion by clicking on the wafer map and reading the current position indication. Record the position as Y_{bottom_meas}.

4. Calculate the Y error at the top die as:

$$Y_{top_err} = Y_{top_meas} - Y_{top_nom}, \quad \text{(EQ 9)}$$

where Y_{top_nom} is the nominal Y position of the top die in the reference map.

5. Calculate the Y error at the bottom die as:

$$Y_{bottom_err} = Y_{bottom_meas} - Y_{bottom_nom}, \quad \text{(EQ 10)}$$

where Y_{bottom_nom} is the nominal Y position of the bottom die in the reference map.

6. If Y_{top_err} and Y_{bottom_err} have opposite signs, then the accuracy can be improved by stretching (or shrinking) the Y axis. Small errors of 1 or 2um will be difficult to correct. Stretching applies a correction that is proportional to Y position, so if the top and bottom die have equal but opposite nominal Y positions, any stretch correction will change their measured positions equally. If Y_{top_err} and Y_{bottom_err} have the same sign, then further accuracy improvement will require stage mapping.

Stage Mapping

After all the previous procedures have been executed correctly, it is still possible that there are significant residual stage errors. The final correction feature available is stage mapping, which allows the system to stretch or shrink an axis differently at different positions within its travel. It works by recording the actual positions of equally spaced features (die corners) on a reference wafer, forcing the system to position correctly at those points, and interpolating in between. This last correction corrects errors in the X direction that are a function of the X axis position (the same for Y); it does not correct errors in the Y axis that are a function of X position, such as straightness or orthogonality errors.

If the system moves the stage too far in the positive direction to visit the top die, then moves the stage too far in the negative direction to visit the bottom die, then we can shrink the axis so it doesn't travel as far to reach the nominal defect positions. But if the system moves the stage too far to reach one defect, and not far enough to reach another, then no amount of stretching or shrinking is going to make both positions correct. It will be necessary in this case to perform stage mapping.

Mapping the Stage

1. Stage mapping again requires a reference wafer and map; the smaller the die pitch, the better, for this procedure. The system should have no stage mapping information in the .uvconfig file when this procedure is started (the "`tage_map_x_grid_size` and `stage_map_y_grid_size` should be set to zero in `.uvconfig`). If there is old stage mapping information in `.uvconfig`, comment out the stage mapping lines, save the file, then exit the uv application and restart it.
2. Load the wafer map and load the wafer into the system. Click on the ***Deskew Off*** button in the Deskew window.
3. Locate the intersection of the central X and Y streets of the wafer and record its position so that it is easier to find later. With deskew turned off, the (0,0) stage position should put the central die in the field of view; the lower left hand corner of that die can be used as the central intersection.

4. Follow the central X street all the way over to the left hand side of the wafer and find the corner of the leftmost die on that street. **Mag up** to 50×.
5. Going from left to right across the wafer, measure the X coordinate of the corner of each die on the central X street. Record the coordinates as X_1, X_2, X_3, ...
6. Return to the central intersection, mag down to 5X, and use the joystick to move down the street in the Y direction to the lowest die on the central Y street. Mag up to 50X.
7. Going from the bottom of the wafer to the top, measure the Y coordinate of each die on the central Y street. Record the coordinates as Y_1, Y_2, Y_3, ...
8. Before entering the measured coordinates into the .uvconfig file, check the data by calculating differences (X_2- X_1), (X_3- X_2), (X_4- X_3), etc. and verify that there are no "wild" points that might be caused by a test die or a bad measurement along the street that was chosen (there should be small differences in the measured die spacing commensurate with the size of the errors that are to be corrected). If a test die falls along the chosen street so that one of the measurements cannot be taken, just average the two measurements around it and use the result to replace the bad measurement.
9. Enter the measurements into `.uvconfig`: enter the X pitch as `stage_map_x_grid_size`, and the measured X values as `stage_map_x_grid_6position`. Do the same for the Y axis. The result should look similar to the following:

```
stage_map_x_grid_size = 8178.21
stage_map_x_grid_6position =  -67043 -58864 -50685 -42507 -34327 -26148
stage_map_x_grid_6position = -17968  -9789 -1611 6566 14745 22922
stage_map_x_grid_6position =  31098 39275 47452
stage_map_y_grid_size = 6933.0
stage_map_y_grid_6position =  -65271 -58338 -51405 -44469 -37534 -30599
stage_map_y_grid_6position =  -23664 -16729 -9796 -2862 4069 11002
stage_map_y_grid_6position =  17934  24866 31798 38729 45661
```

Each line for the measured values can have up to six entries, but it can have less than six. The number of measurements for X and Y can be different.

10. Check your numbers again!! The hardest thing about stage mapping is transcribing the numbers correctly. You can calculate differences again to make sure there are no points out of line. Save the result, exit the application and restart it.
11. Check the result: load the reference wafer and map, deskew the wafer and measure the errors for each defect. If the stage mapping is effective, the excessive errors measured before stage mapping should be brought within specification. If this is not true, there are two choices: the mapping measurements and entries in `.uvconfig` can be painstakingly checked, or a reference map can be created, as described earlier in this document, with defect locations at all the die corners measured in steps 5 and 7 of this section, then those die corners can be reviewed to observe where the stage mapping goes awry. Remember, the mapping should force the system to be accurate at the locations where measurements were taken, so it should be straightforward to see where it goes wrong.

The Yield Management Company
CSD Educational Services

April 20, 1998

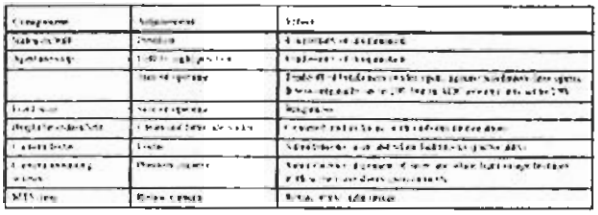
CRS 1010 & 1200

CONFOCAL REVIEW STATION

Optical Alignment Procedure

Full Laser Alignment Procedure

It is important to observe the correct order of steps in this alignment procedure, since there are dependencies between elements. For example, the polarization of the laser cannot be correctly adjusted to the beamsplitter cube until after the cube is correctly positioned.



Tools

- Jigs
- Target objective
- Hex key set
- Flat end jeweler's screwdriver

System State

Remove optical path covers, lenses (10×, collimator, field lens, and scan lens) and pinhole. No attenuator filter (wheel at 1stPos), no laser line filter (wheel at ALL).

Laser Stability

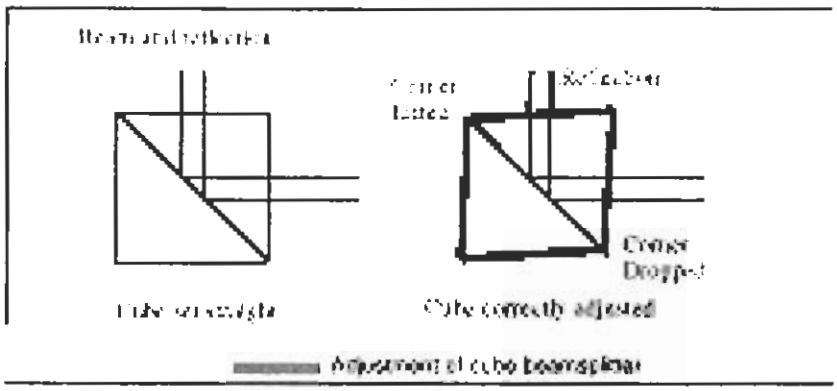
Turn laser on and let laser run for 30 minutes in idle mode before proceeding.

Steering Mirrors

Align beam to first pair of jigs, one after the laser attenuation filter wheel, and one before the laser line select filter wheel. Each mirror is rotated to the correct position so that it turns the beam by 90°, and slid to bring the beam into alignment with the holes in the jigs, vertically for the first mirror, and horizontally for the second.

Cube

Align reflected beam to second pair of jigs, one after the cube, and the other after the collimator. There are three adjustment screws on top of the cube. The ideal adjustment sets the reflecting surface at 45° to the beam, but the front surface of the cube not exactly perpendicular, so that there is a visible reflection of laser light from the cube just outside the laser aperture. The idea is to rotate the cube slightly, lifting one corner and dropping the diagonally opposite corner, while keeping the reflecting surface in the same plane, as in the following greatly exaggerated diagram, where the cube is viewed from above.



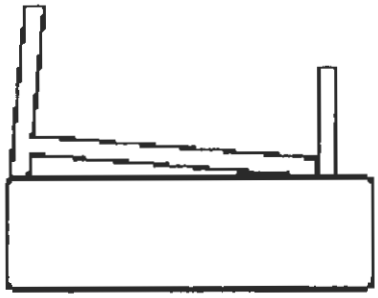
Place a card before the cube and note that it blocks the return beams to the laser. Place the card after the cube to block the return beam from the rest of the system and isolate the reflection from the cube. It is important to have the filter wheels turned to empty slots, so that they do not contribute reflections of their own.
This deliberate misalignment creates a mismatch between the polarization of the return beam and the polarizing splitter cube, resulting in slightly less light going through to the PMT, and more being reflected back to the laser. As long as this return beam is also not on the axis of the laser, no harm is done. Tighten the set screw when the adjustment is correct.

Laser Height And Rotation

Polarization is set for minimum punchthrough and thus maximum reflection at the beamsplitter cube. Loosen laser clamps and rotate to determine position of minimum light at the beamstop. Set height to 10.00 cm ± .05 cm from top of laser to top of steering mirror plate above, or 8.73 cm ± .05 cm to bottom of plate. (The plate is 0.5 in., or 1.27 cm, thick.) Slide laser tube up or down to adjust. Tighten clamps over mylar bands on laser tube when both adjustments are correct.

Scan mirrors

Stop motion of scan mirrors by setting the amplitudes of their motion to 0 in the **Maintenance and Calibration** window. The rest position of the mirrors is in the center of their motion.
Hold a card at an angle directly above the scan mirror assembly so that the laser beam is visible. Check that the beam is centered on the page scan mirror (the larger mirror, below) so that it covers the line scan mirror (the smaller mirror, above) and there is a narrow band of light all around the shadow of the line scan mirror. If not, check whether the mirror motors have been slid on axis. This adjustment should never be made, but such things can happen.
Align beam to last jig, in the space where the scan lens assembly has been removed. Loosen the clamp on one mirror, rotate to adjust without sliding on axis, and tighten the clamp. Then do the same for the other mirror. Repeat as necessary until the beam is centered in the hole.
WARNING: This jig should be placed flat on the plate below, but it can be incorrectly positioned as in Figure 14. This mispositioning directs the beam off the splitter.



45° splitter

Move the stage out of the way, and move a card up and down below the objective to check whether laser and white light beams are parallel (distance between centers of beams remains constant). Insert 45° target jig in place of objective lens. Adjust mirror angle and tilt so that beams are parallel and laser hits target spot. On each axis there is a set screw and an adjustment screw, both with hex heads.

10×

Install 10× lens. Align beam to second pair of jigs. The lenses in this assembly introduce some misalignment which has to be corrected before continuing. Straighten lens in both tilt (up and down) and yaw (side to side).

Pinhole

Install pinhole, and defocus it (Z dimension, along optical axis) completely. Center (X and Y dimensions) using screw adjustments, so that light comes through pinhole. Bring pinhole to focu continuing X and Y adjustments to keep beam centered on it. When the pinhole is slightly off center, it cuts off the laser beam on one side. When it is on axis but not at the focal point, it cuts the beam evenly all around and introduces rings by reflection. In a perfect alignment, the entire beam passes through the 25μ hole creating a single, uniform, round spot.

Collimator

Install and align to second pair of jigs using screw adjustments. Remove jigs and test with a card. Beam should have the same width close to the collimator and close to the scan mirrors. This occurs when the lens is at its focal length from the pinhole. Adjust by sliding on mount as necessary. Secure with two flathead set screws, at 45° underneath. This is best done with a jeweller's screwdriver.

Field Lens And Scan Lens

Insert. At this point, the instrument should produce laser images from a wafer.

45° splitter

Set zoom to 8. Using maximum laser attenuation filter and no white light filter, center laser light patch in white light image. Switch to the yellow filter when done to avoid overexposure of the video sensor.

Set flat angle

Using a pattern wafer, align wafer to stage so that the cursor in the laser image runs straight along wafer streets when moving with the joystick. This is done by first estimating the Y deviation (positive up, negative down) for a certain X motion (positive to the right, negative to the left), both measured using the on-screen distance scales or determined from the die sizes on the wafer. Then the angle of rotation, in degrees, is . This angle can be subtracted from the flat finder offset in `.uvconfig` to bring the wafer into alignment.

Example: If X motion of 100 μ results in Y being off by 3 μ, the calculation is . If the angle had been set to

```
flat_finder_offset_deg = 1.553
```

then the new value is , and the new line in `.uvconfig` should be

```
flat_finder_offset_deg = -0.1655
```

For simplicity, the flatfinder offset can be set to 0 to start with, and the negative of the calculated rotation entered afterwards.

θ 180 π/( ) Y Δ X Δ/( ) atan =

1.718 180 π/( ) 3 100/( ) atan =

1.553 1.718 – 0.1655 – =

Splitter, fine adjustment

Using a pattern wafer, correct the tilt of the splitter so that the laser image is not rotated. Move the stage out of the way and correct the angle of the splitter so that the laser beam is parallel to the white light beam.

Scan mirrors, fine adjustment

Using a target objective at 150×, rotate scanners so that the laser image cursor is aligned with the center of the target.

Collimator, fine adjustment

Test laser light uniformity by moving the fine Z adjustment up and down with the joystick. Ideally, it should be possible to adjust the laser intensity to produce a nearly uniform gold color across the screen at focus, with the center very slightly brighter than the edges. The nonuniformity of illumination is strongest with the 5× objective, and decreases with increasing magnification. On moving the stage up or down with the joystick, the color should fade uniformly around the edges, leaving the brightest spot still in or near the middle of the image.

If the bright spot moves in a curve and does not reach the center, the 45° beamsplitter tilt is off. This should not happen if the procedure has been followed correctly to this point. If the bright spot moves straight across the field, it can be adjusted with the collimator. When the procedure above has been followed, the adjustment in the Y direction should be nearly perfect, so that the bright area moves horizontally on the screen when moving the stage vertically. Adjust collimator on horizontal to minimize this shift. It should be at worst barely visible at maximum magnification. At lower magnification, which images a wider field of view, the nonuniformity will be more evident. Current calibration procedures cannot reduce this effect to invisibility.

PMT optics The first PMT turning mirror should direct the return beam to the center of the diverging lens. The position of this lens should be adjusted to direct the beam to the center of the second

PMT turning mirror, which should center the beam on the PMT. The diverging lens should spread the beam across the whole face of the PMT.

White Light Alignment Procedure

Uniformity

When white light illumination is not uniform, lines in the white light image are bright on one edge and dark on the other. Spaces show the opposite effect, with dark edges on the side where lines are bright, and bright edges on the side where lines are dark.
The causes of the problem can be
- Incorrect positioning of the halogen bulb
- Incorrect positioning of the brightfield cube
- an off-center aperture stop

Halogen bulb

Turn up the plastic cover on the halogen lamp housing so that the frosted diffuser lens is visible. Center the image of the filament in the diffuser using the radial and axial knobs on the lamp housing.
Load a patterned wafer into the machine using normal operating procedures. The autofocus operations will not work because the laser interlocks are open. Manually focus on the wafer using the joystick and the lowest power objective available.
Loosen the radial thumbscrew on the lamp socket and rotate the lamp socket to obtain the most uniform illumination of the sample, as indicated by the white light image of the wafer. Snug down again on the radial thumbscrew. Adjust the axial thumbscrew to obtain the most uniform illumina' of the sample.
These adjustments are moving the position of the lamp filament with respect to the optics train. Repeat the adjustments until the illumination is optimized. Tighten the radial thumb-screw afterwards.

Brightfield/darkfield cube

Switch the brightfield/darkfield actuator between positions from the **LONDiagnos-tics** screen to make sure that it moves through its full travel. If not, follow standard procedure to lubricate and maintain the brightfield/darkfield actuator.

Aperture Stop

If the brightfield actuator mechanism is working correctly, adjust the aperture stop. Load a wafer with lines and spaces which exhibit the illumination misalignment problem.
At 100×, focus on one or more lines or other structures. Set the aperture stop lever to full open manually, or set the aperture position to 0 in the LON screen. Set the field stop lever to full open. Adjust illumination brightness as necessary. Set the aperture stop lever to full close, or set the aperture position to 160 in the LON screen. Adjust illumination brightness as necessary.
Using an Allen wrench, loosen the **right hand** aperture stop centering screw 1/4 turn. The right hand screw is the one nearest the **back** of the machine. Using an allen wrench, tighten the **left hand** aperture stop centering screw 1/4 turn. The left hand screw is the one nearest the **front** of the machine. Observe the image. If the illumination problem is worse, reverse the procedure, loosening the left hand screw and tightening the right hand screw 1/4 turn each time, until the illumination

problem is minimized. In either case, be careful not to turn the screws too far. One full turn in either direction should be the maximum adjustment required. Vertical adjustment is not possible at this time.

Image Parcentricity

Load a patterned wafer. Bring it into focus using the joystick. Center a well-defined feature such as a die corner in the laser image window. Loosen the four screws on the camera plate just enough so that the camera can be moved slightly. Move the plate to center the feature in the white light video monitor. Tighten the screws when done, being careful not to shift the camera. Repeat if necessary. Examine the video image of a vertical line on the sample and see if the line appears as vertical on the screen. Any error is easiest to see when the line is near the edge of the viewing window. If the line is not vertical, loosen the set screw on the MTV adapter and rotate the camera until the image orientation is correct. Tighten the screw when adjustment is complete.

Note: This adjustment can be made correctly only if the flatfinder offset angle has been correctly set, so that the wafer is known to be aligned accurately with the stage.

Image parfocality

Load a patterned wafer. Switch to 20× or 50× objective. Select **Laser and White Light** mode. Select 488 nm wavelength. Bring the laser image into focus using the joystick. Use the camera focus adjustment ring to bring the white light image into focus.

Calibrate the tool, According to the Calibration Procedure

KLA Tencor

The Yield Management Company

CRS 1010 & 1200

CONFOCAL REVIEW STATION

Preventive Maintenance

April 20, 1998

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CSD Educational Services

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Recommended Intervals for Preventive Maintenance of CRS

The following table summarizes the preventive maintenance (PM) procedures for the Confocal Review Station (CRS) to be performed by a KLA-Tencor Field Service Engineer or authorized customer personnel. The tests can be done by anyone who has successfully completed CRS CSE Level I training. Carrying out procedures to correct some kinds of fault requires CRS CSE Level II training.

WARNING Attempting to perform service procedures without proper training can seriously damage the CRS, cause it to operate erratically or fail, or cause serious injury.

Interval	Procedure Name	Description	Duration (minutes)
Weekly	1 Wipe Down	Wipe down the exterior of the machine	5
	2 Backup Data	Copy essential files to floppy disk	5
	3 Check Disk Space	Verify 25% space available	1
	4 Contact Surface Cleaning	Clean chucks and robot end effector	5
Monthly	5 Laser Life	Test laser current	5
	6 Cover Interlock Check	Verify cover interlock integrity	10
Quarterly	7 Robot Alignment	Wafer handling test	15
	8 Robot Interlock Check	Verify robot interlock operation	5
4 Months	9 Bulb Change	Install new white light halogen bulb	30
6 Months	10 Power, Air, and Vacuum	Measure voltages and pressures	90
	11 Inner Frame isolation	Check stage isolation supports	5
	12 LON Communications	Verify that LON is functioning	5
	13 Image parcentricity	Laser and white light image registration	10
	14 Image quality	Dirt, scratches, uniformity, and fringes	30
	15 Parfocality	Z stage offset when changing objectives	3
	16 Autofocus	Test autofocus at several locations and settings	30
	17 Stage flatness	Vertical displacement on wafer surface	15
	18 Stage accuracy	Test repeatability of stage positioning	15
	19 Laser image X linearity	Verify consistency of width measurements	15
	20 Laser XYZ Calibration	Check for accuracy of measurement	30
	21 Wafer Cycling	Check for consistent robot action	30
	22 Power Switches	Check interlocks and ground straps	30 ~ 120
	23 Cycle Power	Verify consistent bootup	60
	24 Printers	Make test prints	5
Each PM	25 Comments	Anything worth noting	

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Safety Warnings

Every attempt has been made to minimize the hazards presented to the user during normal operation of the KLA-Tencor Confocal Review Station. However, as with most semiconductor equipment, operators and service personnel should always be aware of the machine, its operational status, and its environment. Please contact KLA-Tencor if you have any questions concerning safety.

Safety Interlocks

The laser, the robot, and other components of the CRS can be hazardous to any unauthorized person who removes the covers of the machine and defeats the safety interlocks which would otherwise shut down the laser or the robot. Authorized personnel are factory Field Service Engineers and user personnel who have completed the required service training at KLA-Tencor. The major hazards are

- Intense laser light.
- Pinch points between the frame or covers of the machine and mechanical subsystems, especially the robot and the XYZ stage. There are other pinch points around shutters and other parts.
- High voltage AC and DC power supplies and wiring.

KLA-Tencor will not be responsible for injuries caused by unauthorized user personnel defeating the interlocks.

Laser Safety

The CRS contains a class IIIb Argon ion laser rated at 25 milliwatts. Removing the covers of the machine could cause exposure to hazardous laser light levels. The machine has interlocks on some of its covers, so that opening the covers opens the switches and causes automatic shutdown of the laser. These interlocks can be defeated to give service personnel access for maintenance and repair. It is the responsibility of service personnel to make sure that no one is exposed unnecessarily to high intensity laser light, and to restore the interlocks correctly after servicing the machine.

The wafer door opens automatically for the robot to place a wafer on the stage. The wafer door is electrically interlocked with a shutter which closes automatically to cut off laser light whenever the door is open. When the door closes, the shutter is automatically removed from the beam path.

Robot Interlocks

If the plastic robot cover is removed, it releases an interlock which shuts off power to the robot. Similarly, the robot cannot move when there is no cassette on the cassette plate. In normal operation these two interlocks make it impossible for a person to reach into the robot's operating envelope while the robot can move.

High Voltage

Components of the CRS use voltages up to 1000 VDC and 240 VAC. Access to and servicing of all internal components is by factory-authorized personnel only. The user manual and service manual specify when it is necessary to shut down, turn off, and lock out the AC power supply, so that customer service personnel will not be exposed unnecessarily to hazardous voltages within the instrument.

Emergency Power Off

In an emergency the power to the machine can be removed by pressing the Emergency Power Off (EPO) switch. The EPO removes the 24V power from the contactor, opening the contacts and removing all power from the system. The EPO button locks in and will not permit powering up the system until it is unlocked by rotating it counterclockwise.

Operator's Console

The robot and its working envelope must be clearly visible from the operator's console.

Moving Parts

A robot handler in the CRS moves wafers between the exterior (a wafer cassette on the cassette plate or the option SMIF interface) and the interior of the machine (a prealigner, and the XYZ stage). The robot's working area is completely enclosed by a Plexiglas barrier. If the barrier is opened in normal operation, the robot automatically shuts down. However, service personnel can activate the robot with the cover off. Special care is necessary to make sure that no persons or objects are in the robot's operating envelope when the robot is activated, and that the robot is deactivated before undertaking service procedures, such as stage cleaning, within its operating envelope.

Much of the instrument is attached to a floating internal frame mounted on pneumatic vibration isolators. The floating internal frame can move freely within the cover and creates possible pinch points between floating components and the covers or external frame. Externally accessible floating components include the cassette platform, the robot, and the flat finder.

Many moving parts inside the instrument create possible hazards, including motors, shutters, and the XYZ stage. Access to components inside the machine with system power on is restricted to authorized service personnel.



Weekly Checklist

Customer	Location
Model	Region
CRS Serial Number	Maintenance Person

Procedure Name	*Description*	*Duration (minutes)*
1 Wipe Down	Wipe down the exterior of the machine	5
2 Backup Data	Copy essential files to floppy disk	5
3 Check Disk Space	Verify 25% space available	1
4 Contact Surface Cleaning	Clean chucks and robot end effector	5
25 Comments	Anything worth noting	

1 Wipe Down

Initial when completed_____

2 Backup Data

Initial when completed_____

3 Check Disk Space

Initial when completed_____

4 Clean robot end effector, and stage and prealigner chucks

Initial when completed_____

25 Comments

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Procedure 1: Wipe Down

weekly, 5 minutes

Gently clean the plastic robot safety cover with a cleanroom-compatible cleaning cloth and water. Gently clean the exterior of the machine with a cleanroom-compatible cleaning cloth and a dilute solution of isopropyl alcohol. The user should check with KLA-Tencor before using other solvents or cleaning solutions.

DANGER: The solution of isopropyl alcohol is flammable, and must be kept from sparks, flame or heat.

Initial when completed_____

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Procedure 2: Backup Data

weekly, 5 minutes

To avoid the loss of critical data files during the preventive maintenance process, be sure to back them up to the floppy diskette

Place a blank floppy disk in the drive within the drive bay.

Lower the application by clicking on the small square at the extreme upper left and selecting Lower. Open a shell window.

Run the BACKUP shell (batch) file. In version 2.4 of the software, the file is located in `/usr/people/uv/Install/Secure`. It copies the following essential directories and files to floppy disk.

`/etc/fstab`	File system table
`/etc/hosts`	Hosts
`/etc/printcap`	Printer capabilities
`/etc/sys_id`	System ID
`/etc/exports`	Network
`/etc/gateways`	Network
`/etc/init.d/network`	Network
`/usr/uv/.uvconfig`	CRS configuration
`/usr/uv/.keyfile`	Installed options
`/usr/people/uv/uv1000`	Shell file to clean up system and start uv application
`/usr/people/uv/.sgisession`	SGI Indy session parameters
`/usr/uv/*/*.rcp`	User recipes
`/usr/uv/*/data/*.rcp`	User recipes

Label diskette:

Weekly backup

CRS#_____

Date_____

Initial when completed_____

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Procedure 3: Check Disk Space

weekly, 1 minute

Confirm that the available disk space is at least 25%, that is, that the main partition is no more than 75% full.

Use the command

```
df -k
```

to check free disk space. It returns a listing of the size (in K) and usage statistics for each disk partition. For example, the screen may show

```
/usr/uv>df -k
Filesystem                  Type  kbytes     use    avail %use  Mounted on
/dev/root                    efs   24143   17082     7061  71%  /
/dev/usr                     efs  942147  895072    47075  95%  /usr
/dev/rdsk/fds0d2.3.5hi       dos    1423     162     1261  11%  /floppy
/usr/uv>
```

The `/dev/usr` partition mounted on `/usr` holds application data files, and is the one of interest here. The `%use` column shows that this partition is 95% full (47M free out of 942M). The most common reason for an overfull drive is that there are too many image files stored there. If the drive is too full, any data files that are not currently in use should be moved elsewhere, and data files known to be of no further use should be deleted.

Free space in main partition %_____

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Procedure 4: Clean robot end effector and chucks

weekly, 5 minutes

The backs of wafers come into contact with the robot end effector, the XYZ stage chuck, and the prealigner chuck. Keeping them clean reduces contamination of the wafers that could be transferred to the front of other wafers in the cassette.

Warning The robot can cause serious injury. These procedures must be done with the CRS turned off.

Cleaning the robot end effector

Use a cleanroom compatible clean wipe and a cleaning solution of either isopropyl alcohol or water to wipe the robot end effector.

Initial when completed_____

Cleaning the prealigner chuck

Initialize the robot to move it as far out of the way as possible. A special tool is provided for cleaning the chucks. Fit a fresh cleaning sleeve on the tool, and use isopropyl alcohol or water to wipe the surface of the chuck.

Initial when completed_____

Cleaning the XYZ stage chuck.

- Initialize the robot to move it as far out of the way as possible.
- Select a microscope turret position containing no objective if possible. This would be the 00 position on the Objective button in the LaserScan window. If there is no open position, select the lowest power objective, usually 5x.
- Select the LonDiagnostics item on the Maintenance menu. This opens the LON Diagnostics window.
- Click on the WaferDoor button, which is roughly in the middle of the window, to open the wafer door.
- With the wafer door open, use the chuck cleaning tool to wipe the surface of the stage chuck. Be careful not to touch any of the microscope objectives.
- Click on the WaferDoor button to close the wafer door.

Initial when completed_____

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Monthly Checklist

Customer	Location
Model	Region
CRS Serial Number	Maintenance Person

Procedure Name	Description	Duration (minutes)
5 Laser Life	Test laser current	5
6 Interlock Check	Verify cover interlock integrity	10
25 Comments	Anything worth noting	

5 Laser Lifetime Current Test

CurrMonitor	

6 Laser interlocks

Top Cover Interlock Check	P / F
Upper Wafer Door Switch Check	P / F
Lower Wafer Door Interlock Check	P / F

25 Comments

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Procedure 5: Laser Lifetime Current Test

monthly, 5 minutes

On the Maintenance menu, select LonDiagnostics. Set Laser Run/Idle to Run. Set the laser power to 25 mW by dragging the Laser Power(mW) slider (middle left of the LonDiagnostics window) all the way to the right. Select the node 1 Laser Power Control in the LON stations window, then select 20 CurrMonitor in the variables window. The result, shown under NV Status, should be in the range from 14 to 22. When the CurrMonitor variable is near the top of this range, the laser tube is close to the end of its life (est. 1000 hours or 40 days remaining) and a replacement should be scheduled.

CurrMonitor	

Set laser power back to 6 mW when done.

Initial when completed_____

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Procedure 6: Laser interlocks

monthly, 10 minutes

Check the top cover interlocks to be sure that they shut off the laser power supply, and that they can be defeated.

After the laser is shut off by an interlock, it can be restarted by resetting its circuit breaker on the DC power module.

P / F

Check the Upper Wafer Door switch in Maintenance:LonDiagnostics. Select station 11 Solenoid Control, then the 7 Doorstat variable. Use the Wafer Door menu in the Solenoid Control section, near the bottom of the window, to open and close the wafer door. Verify that the Doorstat variable toggles between 0 (open) and 1 (closed).

P / F

Check the lower wafer door interlocks individually by manually depressing them to ensure that they shutter the laser.

P / F

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Quarterly Checklist

Customer	Location
Model	Region
CRS Serial Number	Maintenance Person

Procedure Name	Description	Duration (minutes)
7 Robot Alignment	Wafer handling test	15
8 Interlock Check	Verify robot interlock operation	5
25 Comments	Anything worth noting	

7 Robot Alignment Check

Wafer Size	100	125	150	200
Size Indicator	P / F	P / F	P / F	P / F
Cassette Present Indicator	P / F	P / F	P / F	P / F

Trial	In FOV?	ΔX	ΔY
1	P / F		
2	P / F		
3	P / F		
4	P / F		
5	P / F		
Maximum			

	Vacuum	
Cassette	Top slot	Bottom
	P / F	P / F

Prealigner	0°	90°	180°	270°
	P / F	P / F	P / F	P / F

Stage

	Pos	Neg
X Limits	P / F	P / F
Y Limits	P / F	P / F
Z limits	P / F	P / F

Z-limits to objectives gaps to wafer

Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
P / F	P / F	P / F	P / F	P / F

8 Robot Interlock Test

Robot Cover Interlock	P / F
Wafer Cassette Interlock	P / F

Comments

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Procedure 7: Robot Alignment Check

quarterly, 15 minutes

Before testing the robot, check that for each wafer size, the appropriate size indication is displayed on the system console, in the control window over the wafer map (left side, below center). Check that the system correctly detects removal of the cassette.

Wafer Size	100	125	150	200
Size Indicator	P / F	P / F	P / F	P / F
Cassette Present Indicator	P / F	P / F	P / F	P / F

Using the Ultrapointe Standard Wafer Set, check the flat finder repeatability by observing that the system loads the wafer onto the XYZ stage with the flat in the appropriate orientation. Locate a readily identifiable feature on the wafer (such as a die corner, or the apex of the wafer notch), record its coordinates, and check that the feature remains within the field of view (FOV), using the lowest power objective, each time the wafer is loaded from the cassette. Use this technique to check the repeatability five times; record the stage displacement required to bring the feature back to dead center each time and note the maximum movement required.

Trial	In FOV?	ΔX	ΔY
1	P / F		
2	P / F		
3	P / F		
4	P / F		
5	P / F		
Maximum			

Check the wafer handling from the cassette to the flat finder and stage for at least the uppermost and lowest slots of each cassette size. Verify that vacuum is applied and released at the right time, so that there is no noise on picking up or placing the wafers. Also check that the robot adequately clears wafers above and below chosen position. Finally, check that wafers are replaced far enough into the cassette so that they can be repeatedly loaded without causing a flat finder error resulting from excess alignment error. Ensure that the system is adjusted so that there is no rubbing between the wafer and cassette when wafers are moved, and that wafers are loaded properly onto the flat finder and XYZ stage.

Some of the stage parameters are set by the operating software, others should be set in the stage controller before the PM process is initiated. Check the parameters after running the operating software. This is because the operating software may alter parameter settings that the operator has manually entered into the stage controller.

	Vacuum	
Cassette	Top slot	Bottom
	P / F	P / F

Prealigner

0°	90°	180°	270°
P / F	P / F	P / F	P / F

Stage

	Pos	Neg
X Limits	P / F	P / F
Y Limits	P / F	P / F
Z limits	P / F	P / F

Z-limits to objectives ..... gaps to wafer

Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
P / F	P / F	P / F	P / F	P / F

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Procedure 8: Robot Interlock Test

quarterly, 5 minutes

Activate the robot and observe its motion.

Remove the robot cover and give a robot command. Verify that the robot does not move, and that an error message appears on the screen.

P / F

Replace the robot cover and remove the wafer cassette. Give a robot command, and verify again that the robot does not move and an error message appears.

P / F

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4 Month Checklist

Customer	Location
Model	Region
CRS Serial Number	Maintenance Person

Procedure Name	Description	Duration (minutes)
9 Bulb Change	Install new white light halogen bulb	30
25 Comments	Anything worth noting	

Initial when completed_____

25 Comments

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Procedure 9: Halogen Bulb Change

4 month intervals, 30 minutes

WARNING Never touch a new bulb with bare fingers. Open one end of the bag it comes in so that the prongs stick out, and hold it by the bag until it is inserted.

1. Turn off the machine using the shutdown procedure.

2. Release the top cover of the machine by unscrewing the four quarter-turn captive screws, one at each corner of the top cover. Carefully lift off the cover and place it aside in a clean and safe place.

WARNING Changing the Halogen bulb requires taking off the top cover of the machine and manipulating the lamp housing on the optics plate. The top cover is interlocked with the laser power supply and should cause the laser to shut off when the cover is removed. It cannot be turned back on until the interlocks are closed and power is cycled. The top cover interlocks are defeatable, but under no circumstances are customer service personnel authorized to defeat the laser interlocks. If at any time, the customer service personnel are aware of laser radiation (intense blue green light) while the top cover of the instrument is removed, the instrument should be immediately powered off and a service call placed to KLA-Tencor service.

3. Wait at least fifteen minutes for the lamp housing to cool down.

WARNING The Halogen bulb used for white light illumination gets extremely hot during normal operation. Take care before handling the bulb or the lamp housing that sufficient time has been allowed after powering off the system to allow the lamp components to cool.

4. Identify the white light lamp housing-it is a rectangular housing, off-white in color, with black louvers facing up to allow heat to escape. The lamp housing is on the optics plate immediately beneath the top cover. The lamp socket is a cylindrical object that fits into the side of the lamp housing and carries the power cord for the lamp.

5. There are two thumbscrews attached to the lamp socket. One of them protrudes radially from the socket and is used to adjust and lock the angular position of the lamp. The other protrudes axially from the socket and is used to adjust the axial position of the lamp. Loosen the radial thumbscrew and observe that the socket can now be rotated within the lamp housing.

6. Rotate the lamp housing clockwise until it contacts a stop, then pull the socket out axially. The path straight out is blocked, so it is necessary to turn the socket at an angle in order to remove it completely. Try to avoid contact between bulb and housing.

7. The bulb is held in its socket by gold contacts. Press down on the long lever arms of the gold contacts to release the bulb; pull the bulb out of its socket while the levers are depressed.

8. **Do not touch a new bulb with your bare fingers.** Always use a cloth or the bag the bulb came in, or wear gloves. Failure to do so will contaminate the bulb, leading to premature failure. Install the new bulb (generic part number: FCR 12V; contact KLA-Tencor Service) by depressing the socket levers while pressing the bulb into the socket. Remove bag.

9. Replace the socket and bulb in the lamp housing.

10. Snug down on the radial thumbscrew to hold the socket in place and turn on the system. Turn the plastic cover up so that the frosted diffuser lens is visible. Center the image of the filament in the diffuser.

11. Load a patterned wafer into the machine using normal operating procedures. The autofocus operations will not work because the laser interlocks are open.

12. Manually focus on the wafer using the joystick and the lowest power objective available.

13. Loosen the radial thumbscrew on the lamp socket and rotate the lamp socket to obtain the most uniform illumination of the sample, as indicated by the white light image of the wafer. Snug down again on the radial thumbscrew.

14. Adjust the axial thumbscrew to obtain the most uniform illumination of the sample. These adjustments are moving the position of the lamp filament with respect to the optics train.

15. Repeat steps 13 and 14 until the illumination is optimized. Tighten the radial thumbscrew when completed.

16. Replace the top cover of the machine and screw in the four quarter turn fasteners that hold it to the machine frame. This operation closes the laser interlocks.

17. Perform normal shutdown and restart. Cycling the power should bring back the laser.

Initial when completed_____

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6 Month Checklist

Customer	Location
Model	Region
CRS Serial Number	Maintenance Person

Procedure Name	Description	Duration (minutes)
10 Power, Air, and Vacuum	Measure voltages and pressures	90
11 Inner Frame Isolation	Check stage isolation supports	5
12 LON Communications	Verify that LON is functioning	5
13 Image parcentricity	Laser and white light image registration	10
14 Image quality	Dirt, scratches, uniformity, and fringes	30
15 Parfocality	Z stage offset when changing objectives	3
16 Autofocus	Test autofocus at several locations and settings	30
17 Stage flatness	Vertical displacement on wafer surface	15
18 Stage accuracy	Test repeatability of stage positioning	15
19 Laser image X linearity	Verify consistency of width measurements	15
20 Laser XYZ Calibration	Check for consistent robot action	30
21 Wafer Cycling	Check for consistent robot action	30
22 Power Switches	Check interlocks and ground straps	30 ~ 120
23 Cycle Power	Verify consistent bootup	60
24 Printers	Make test prints	5
25 Comments	Anything worth noting	

10 Measure Power, Air, and Vacuum

The main transformer is jumpered for _____VAC.

With an input line voltage of _____VAC,

the voltage measured at the internal outlet is _____VAC.

AC outlet voltage

VAC Test at Rear Panel	Range	Reading
External Exhaust	200-240 VAC	
Aux 1	120 VAC	
Outlet Strip	120 VAC	
Accessories	120 VAC	

DC outlet voltage

VDC Tests	Range	Reading
at Frame Grabber		
+ 12 VDC (Fans)	10.8 to 13.2 VDC	
+ 5 VDC Analog	4.90 to 5.10 VDC	
-5.2 VDC Analog	-5.30 to -5.10 VDC	
+ 5 VDC Digital	4.9 to 5.1 VDC	
at Terminal Blocks TB204 & TB205		
+ 5 VDC	4.75 to 5.25 VDC	
+ 12 VDC	10.8 to 13.2 VDC	
+ 15 VDC	13.5 to 16.5 VDC	
15 VDC	-16.5 to -13.5 VDC	
120 VDC	108 to 132 VDC	

Air pressure and vacuum pressure.

Pressure	Nominal	Reading
Air	65 psig (base system) 80 psig (with SMIF option)	
Vacuum	20" Hg	

11 Stage Isolation Supports

Inner frame sits square and level	P / F
None of the isolators are sitting down.	P / F
Isolator pressure should be at least 65 psig.	P / F
At 0 psig inner frame sits down on its pads without pinching cables or impacting other components.	P / F
Robot arm clears facia panel with the air pressure reduced.	P / F

Frame Location	Gap
Front Left	
Front Right	
Rear Left	
Rear Right	

12 LON Communications

Node	Firmware Version
1 Laser Power Controller	
5 Bright Field/Dark Field Controller	
9 Turret/Optics Controller	
2 Camera Filter Wheel	
4 Laser Attenuation Filter Wheel	
3 Laser Line Select Filter Wheel	
8 PMT Preamp	
11 Solenoid Controller	
6 Page Scanner Controller	
7 Fast Z Controller	
10 Cassette Switch Input	
12 Aperture Controller	
13 Docking Controller	
14 Mask Controller	

13 Image Parcentricity

Offset	Laser/WL	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
X						
Y						
Θ						

14 Image Quality

	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
Laser BF	D S U F	D S U F	D S U F	D S U F	D S U F
Laser DF	D S U F	D S U F	D S U F	D S U F	D S U F
WL BF	D S U F	D S U F	D S U F	D S U F	D S U F
WL DF	D S U F	D S U F	D S U F	D S U F	D S U F

15 Image Parfocality

FineZ autofocus displacement	

16 Autofocus

Coarse

Perform Stage Focus at each objective and laser line					
Laser line	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
458 nm	P / F	P / F	P / F	P / F	P / F
488 nm	P / F	P / F	P / F	P / F	P / F
515 nm	P / F	P / F	P / F	P / F	P / F
ALL	P / F	P / F	P / F	P / F	P / F

Fine

Fine-Z position should remain in mid-range (15-35)					
Laser line	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
458 nm	P / F	P / F	P / F	P / F	P / F
488 nm	P / F	P / F	P / F	P / F	P / F
515 nm	P / F	P / F	P / F	P / F	P / F
ALL	P / F	P / F	P / F	P / F	P / F

At 100X, 488, Zoom 1, hit Fine AF 15 times and ensure good focus every time.

Initial when completed_____

17 Stage Flatness

0°

Wafer	Action	Fine Z	COW±15
Center	CZ & FZ	RefValue>	
Right	FZ		P / F
BotRight	FZ		P / F
Bottom	FZ		P / F
BotLeft	FZ		P / F
Left	FZ		P / F
TopLeft	FZ		P / F
Top	FZ		P / F
TopRight	FZ		P / F

180°

Wafer	Action	Fine Z	COW±15
Center	CZ & FZ	RefValue>	
Right	FZ		P / F
BotRight	FZ		P / F
Bottom	FZ		P / F
BotLeft	FZ		P / F
Left	FZ		P / F
TopLeft	FZ		P / F
Top	FZ		P / F
TopRight	FZ		P / F

18 Stage Accuracy

Position	Delta X	Delta Y	Status
1			P / F
2			P / F
3			P / F
4			P / F
5			P / F
6			P / F
7			P / F
8			P / F
9			P / F

19 Laser Image X Linearity

FOV Position	Size	
Left		Spread>
¼ left		
Center		Average>
¼ right		
Right		% spread>

20 Laser XYZ Calibration

Axis	Zoom	Sphere	Measure	Status
X	1	10		P / F
X	2	10		P / F
X	4	5		P / F
X	8	5		P / F
Y	1	10		P / F
Y	2	10		P / F
Y	4	5		P / F
Y	8	5		P / F
Z		10		P / F

21 Wafer Cycling

50 wafers. Initial when completed_____

22 Power Switches

Emergency Machine Off Cannot power on	P / F
Power Off Cannot power on	P / F
External Interlock/ Remote EMO	P / F
Ground Strap	P / F
Signal Cables	P / F
Controller Mounting Plates	P / F

23 Cycle Power

15 Power cycles (ensure proper boot up).

Initial when completed_____

24 Printers

Digital Printer checked and attached P / F

Video Printer checked and attached P / F

25 Comments

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Procedure 10: Power, Air, and Vacuum

six month intervals, 90 minutes

The main transformer is jumpered for _____VAC.

With an input line voltage of _____VAC,

the voltage measured at the internal outlet is _____VAC. Access the internal outlet by removing the lower front cover, and carefully pulling out the Indy computer and the NEAT stage controller.

With an AC outlet tester, measure the voltage at the following VAC outlets:

VAC Test at Rear Panel	Range	Reading
External Exhaust	200-240 VAC	
Aux 1	120 VAC	
Outlet Strip	120 VAC	
Accessories	120 VAC	

With a DC outlet tester, measure the voltage at the following VDC outlets:

VDC Tests	Range	Reading
at Frame Grabber		
+ 12 VDC (Fans)	10.8 to 13.2 VDC	
+ 5 VDC Analog	4.90 to 5.10 VDC	
-5.2 VDC Analog	-5.30 to -5.10 VDC	
+ 5 VDC Digital	4.9 to 5.1 VDC	
at Terminal Blocks TB204 & TB205		
+ 5 VDC	4.75 to 5.25 VDC	
+ 12 VDC	10.8 to 13.2 VDC	
+ 15 VDC	13.5 to 16.5 VDC	
15 VDC	-16.5 to -13.5 VDC	
120 VDC	108 to 132 VDC	

At the Frame Grabber, the middle pin is the ground. Terminal Block TB204 is on the side of the power supply. Terminal block TB 205 is on the optical bay.

Check the air pressure and vacuum pressure and record the readings.

Pressure	Nominal	Reading
Air	65 psig (base system) 80 psig (with SMIF option)	
Vacuum	20" Hg	

Procedure 11: stage isolation supports

6 month intervals, 5 minutes

Before performing this procedure, remove the wafer, if any, from the stage, and set the objective to 5X. This is to prevent damage when the stage rises above its normal position as pressure is restored to the isolators.

Check that the inner frame sits square and level inside the system and that none of the isolators are sitting down. Isolator pressure should be at least 65 psig. Reduce air supply pressure to 0 psig and verify that the inner frame sits down on its pads without pinching cables or impacting other components.Then, check that the robot arm clears facia panel with the air pressure reduced.

Inner frame sits square and level	P / F
None of the isolators are sitting down.	P / F
Isolator pressure should be at least 65 psig.	P / F
At 0 psig inner frame sits down on its pads without pinching cables or impacting other components.	P / F
Robot arm clears facia panel with the air pressure reduced.	P / F

Frame Location	Gap
Front Left	
Front Right	
Rear Left	
Rear Right	

Restore air pressure when finished

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Procedure 12: LON Communications

6 month intervals, 5 minutes

Check the Local Operating Network (LON) node firmware versions in LON Diagnostics for each node. Select LonDiagnostics from the Maintenance menu. Select each LON node in turn, and for each one, select the 1 Firmware Version variable and record the value returned under NV Status.

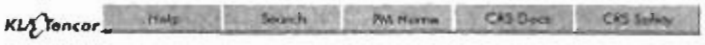
Slow response, longer than 5 seconds, indicates a LON board failure. A returned version number of 0 indicates a LON board or interconnect failure. In the case of an interconnect failure, all boards past that point will fail. This list is in the order of nodes in the LON, but is numbered according to the list in the LonDiagnostics window.

Node	Firmware Version
1 Laser Power Controller	
5 Bright Field/Dark Field Controller	
9 Turret/Optics Controller	
2 Camera Filter Wheel	
4 Laser Attenuation Filter Wheel	
3 Laser Line Select Filter Wheel	
8 PMT Preamp	
11 Solenoid Controller	
6 Page Scanner Controller	
7 Fast Z Controller	
10 Cassette Switch Input	
12 Aperture Controller	
13 Docking Controller	
14 Mask Controller	

LON nodes 12 and 13 are for the SMIF option, and do not appear if it is not installed. 14 Mask is for the light tower option.

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Procedure 13: Image Parcentricity

6 month intervals, 10 minutes

By simultaneously viewing the white light and laser images of a wafer, verify that a feature in the center of the laser image crosshairs aligns with the center of the white light image crosshairs and that the two images are aligned with respect to angularity. Make sure Laser and White Light FOVs are registered.

Offset	Laser/WL	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
X						
Y						
Θ						

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Procedure 14: Image Quality

six month intervals, 30 minutes

Check screen images for Dirt, Scratches, Uniformity and Fringes (circle letter when debasement observed).

	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
Laser BF	D S U F	D S U F	D S U F	D S U F	D S U F
Laser DF	D S U F	D S U F	D S U F	D S U F	D S U F
WL BF	D S U F	D S U F	D S U F	D S U F	D S U F
WL DF	D S U F	D S U F	D S U F	D S U F	D S U F

Check printed image quality by printing once each from

Laser Screen (100×, Zoom 8)

White Light Video (Highest power objective)

Initial when completed_____

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Procedure 15: Image Parfocality

6 month intervals, 3 minutes

Using the lowest power objective, stage autofocus the corner of a die (or similar feature) in laser image at 488 nm wavelength. Change to 100X or highest power objective and record the Fine-Z autofocus displacement required to bring feature into focus without performing a coarse-Z stage autofocus or using joystick.

FineZ autofocus displacement	

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Procedure 16: Autofocus

6 month intervals, 30 minutes

Check that the system autofocuses properly at nine locations (center, N, E, S, W, NE, SE, SW, NW) on any of the test wafers and with the Fine-Z slider at any location. Check both the stage autofocus and the Fine-Z-autofocus for all wavelengths and objectives in BF or DF, as noted in the tables below.

Coarse

Perform Stage Focus at each objective and laser line					
Laser line	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
458 nm	P / F	P / F	P / F	P / F	P / F
488 nm	P / F	P / F	P / F	P / F	P / F
515 nm	P / F	P / F	P / F	P / F	P / F
ALL	P / F	P / F	P / F	P / F	P / F

Fine

Fine-Z position should remain in mid-range (15-35)					
Laser line	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
458 nm	P / F	P / F	P / F	P / F	P / F
488 nm	P / F	P / F	P / F	P / F	P / F
515 nm	P / F	P / F	P / F	P / F	P / F
ALL	P / F	P / F	P / F	P / F	P / F

At 100X, 488, Zoom 1, hit Fine AF 15 times and ensure good focus every time.

Initial when completed_____.



Procedure 17: Stage Flatness

6 month intervals, 15 minutes

Use a bare wafer to check the stage flatness. Set the objective to 100x, the laser scan to Zoom1 and the laser line to 488 nm. Load wafer at 0°. Focus the laser image on the surface of the wafer roughly at its center. Adjust the coarse Z-stage and the Fine-Z so the wafer is in focus and the Fine-Z is at the center of its travel. Without moving the coarse Z-stage, move to the extremes of the wafer in X and Y (four locations), and adjust the Fine-Z axis to bring the wafer back into focus. Record the Z displacement required to bring the wafer back into focus. Reload the same wafer at 180° and repeat test. Average out of flatness for the chuck should be better than ±10 µm.

0°

Wafer	Action	Fine Z	COW±15
Center	CZ & FZ	RefValue>	
BottomRight	FZ		P / F
BottomLeft	FZ		P / F
TopLeft	FZ		P / F
TopRight	FZ		P / F

180°

Wafer	Action	Fine Z	COW±15
Center	CZ & FZ	RefValue>	
Right	FZ		P / F
BotRight	FZ		P / F
Bottom	FZ		P / F
BotLeft	FZ		P / F
Left	FZ		P / F
TopLeft	FZ		P / F
Top	FZ		P / F
TopRight	FZ		P / F

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Procedure 18: Stage Accuracy

6 month intervals, 15 minutes

Use standard pattern wafer and map. Measure and note deviations. After deskew, a calc map offset is performed using the check point closest to the center of the wafer. Then review operations are performed by moving to each checkpoint and measuring the delta X and delta Y from FOV center.

Position	Delta X	Delta Y	Status
1			P / F
2			P / F
3			P / F
4			P / F
5			P / F
6			P / F
7			P / F
8			P / F
9			P / F

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Procedure 19: Laser Image X Linearity

6 month intervals, 15 minutes

Using the calibration wafer, verify that the X size of a given feature does not vary when it is viewed at different locations on the laser image. Measure feature across the laser FOV. This is checked for the X direction be locating a feature all the way to the left in the laser image. A surface is taken and the horizontal size of the feature measured in a 2D window and recorded. Then another surface is taken and measured with the feature all the way to the right.

FOV Position	Size	
Left		Spread>
1/4 left		
Center		Average>
1/4 right		
Right		% spread>

If spread is more than 5%, adjust scan linearity.

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Procedure 20: Laser XYZ Calibration

6 month intervals, 30 minutes

Laser imaging XYZ calibration is tested using latex spheres at 100X. The testing is done with 10 µm and 5 µm latex spheres, as noted in the table below. For the X and Y directions, the basic procedure is to image a tightly packed cluster of spheres and check the center-to-center distance between two contacting spheres. Note that the operator must scan the substrate to find spheres that make contact in the X and Y direction to make measurements in these directions. For the Z axis, a single sphere is imaged, and its surface profile used to measure the distance from the substrate to the top of the sphere. The Z measurement is performed at three locations: the top, bottom, and middle of the Fast Z-Axis travel, to assure linearity of the Fast Z-Axis.

Axis	Zoom	Sphere	Measure	Status
X	1	10		P / F
X	2	10		P / F
X	4	5		P / F
X	8	5		P / F
Y	1	10		P / F
Y	2	10		P / F
Y	4	5		P / F
Y	8	5		P / F
Z		10		P / F

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Procedure 21: Wafer Cycling

6 month intervals, 30 minutes

A total of 50 wafers are to be cycled through the machine without failure.

Initial when completed_____

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Procedure 22: Power Switches

6 month intervals, 30~120 minutes

Check that the machine cannot be turned on when either the EMO or the POWER OFF switch is depressed or when the external interlock jumper is removed. Ensure that ground straps are properly fastened with star washers. Ensure that all signal cables are fastened with hardware. Ensure that controller mounting plates are securely retained.

Emergency Machine Off Cannot power on	P / F
Power Off Cannot power on	P / F
External Interlock/ Remote EMO	P / F
Ground Strap	P / F
Signal Cables	P / F
Controller Mounting Plates	P / F

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Procedure 23: Cycle Power

6 month intervals, 60 minutes

15 power cycles (ensure proper boot up).

Initial when completed_____

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Procedure 24: Printers

6 month intervals, 5 minutes

Prints from the SGI and video are produced to ensure that the unit and printers are configured properly and that communication is working.

Digital Printer checked and attached	P / F
Video Printer checked and attached	P / F

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Procedure 25: Comments

Note any unusual faults or error conditions not covered by these procedures. Examples include extraneous objects found inside the instrument, or software failures encountered while performing PM.

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The Yield Management Company

CRS 1010 & 1200
CONFOCAL REVIEW STATION
Installation Guide

April 20, 1998

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CSD Educational Services

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Chapter 1 Preparing CRS For Installation

Pre-installation Qualification Checklist

(U.S.A ONLY)

Your attention to the detailed information found in the **Planning Section** and the **Environment Requirements Section** of the Pre-Installation Documentation will minimize delays and expenses during the installation of your instrument. It is the responsibility of the customer to provide the correct power socket within reach of the CRS's power cord, and also air and vacuum lines of suitable length with the correct connectors for both the CRS and the supply fittings.

Important Notice

The unpacking and installation must be done by a **KLA-Tencor** representative. The following Requirements must be met before a representative will be scheduled. *Please instruct your Receiving department NOT to open the crate upon receipt.*

❒	TEMPERATURE	15–24°C (59–75°F)
❒	AIR QUALITY	Clean room, recommended Class 100 or cleaner
❒	AC POWER	Alternating current, single phase. 240/220/208/200 volts (factory configured). Current is 3 amps @ 208 volts. Cord is 3-conductor, 10 gauge, 10 feet long, non-terminated, with locking NEMA plug. Safety interlock is optional.
❒	VACUUM	20 inches (508 mm) Hg minimum constant vacuum for the system with a flow rate of 0.5 cfm (14.2 l/min) minimum. Fitting is one ¼-inch female NPT with ¼-inch tube quick disconnect.
❒	PRESSURE	Air or nitrogen, 80 psi minimum with a flow rate of 3 cfm (14.2 l/min). Fitting is one ¼-inch female NPT with ¼-inch tube one-touch.
❒	REMOTE COOLING	Connections are two each, 3.5-inch flexible duct. Flow rate is 400 cfm (11.3 m/min). Heat output is 14,000 BTU/hr (main system only). 10 feet of 3.5 inch ducting is provided.
❒	FLOOR	Must be level and capable of supporting 1255 lbs (570 kg)
❒	SPACE	Requires 24 inches of unobstructed space around the system for user and service clearance. The power input panel at the rear of the machine must be at least 3' from the wall. An 8' × 11' area is suitable for both the CRS instrument and the operator's workstation.

When all requirements are met, please fax the form on the next page to the **KLA-Tencor** Product Services Administrative Assistant to arrange for installation.

CRS 1010 Installation Scheduling Form

We have made all necessary preparations for installing the KLA-Tencor CRS 1010 which we have received. It is in its crate ready for moving to the clean room.

Signature _____

Name _____

Date _____

Company Name _____

Company Address _____

_____

Person to Contact: _____

Telephone No.: _____

Fax No.: _____

E-mail address: _____

Please sign and fax this form to KLA-Tencor Product Services Department at (408) 875-2828. Attention: Product Services Administrative Assistant

Planning for Installation

Planning

Please review all CRS 1010 system information contained in the pre-installation Documentation before planning your site installation. The installation procedure will take approximately three days from beginning to end, barring any unforeseen disruption. Training takes an additional two days. Please be sure you have the time and work force available at the scheduled time of installation.

Equipment Delivery

Check the shipping crate very carefully for any signs of visible damage at the time of receipt. If there is any damage or if the shock indicators caution of possible damage, note any problems, in writing, before signing for the delivery. **This must be done, with the delivery person on site, at the time of delivery.**

Contact Service Department, product services Administrative Assistant or the Dispatcher at 1-800-722-6775 if there is any indication of possible damage.

Do NOT unpack the CRS 1010 system until your site is fully prepared and the ***KLA Tencor*** Representative is on site.

Note: Save the shipping materials for future transportation of the instrument. The CRS 1010 system must be shipped in the same container to properly protect its mechanical components.

Installation

You will need all of the requirements listed below:

Pre-Installation Qualification Checklist—Found in Chapter 5 of this Installation Guide. Your site must meet all of the requirements listed on this form before the installation will be scheduled. Please have this form, filled out and signed, available to present to the ***KLA Tencor*** Field Service Engineer upon arrival.

Forklift—Capable of transporting the CRS 1010 system from the receiving area to the clean room. Must be able to support the weight of the system (approximately 1255 pounds (570 kg)

Work force—Two or three people, available at the scheduled time of installation, to assist in moving the CRS 1010 system from the receiving area to the clean room.

Training—Provided at the time of installation, requires an additional two days. The recommended class size is four students with a maximum of eight. The training is designed to familiarize your engineers and operators with the basic operation of the CRS 1010 system.

Environment Requirements

(U.S.A. ONLY)

Temperature

Normal operating temperature is 15–24°C, ±2° (59–75°F, ±3.6°.

Clean Room

It is recommended to operate the CRS 1010 system in a Class 100 or cleaner environment.

Relative Humidity

35–65 % relative humidity.

Electrical Power

Main System:

Type:	Alternating current, single phase
Voltage:	240/220/208/200 volts (factory configured)
Current	30 amps @ 208 volts
Cord:	3-conductor, 10-gage 10 feet long, non-terminated
Safety Interlock:	Optional

Accessories:

Type:	Alternating Current, single phase
Voltage:	AC 120 volts, 10-15 Amps (depending on options)

Vacuum

20 inches (508 mm) Hg minimum constant vacuum for the CRS 1010 system with a flow rate of 0.5 CFM minimum (14.2 l/m). Fitting is 1/4 inch female NPT with 1/4 inch tube quick-disconnect.

Pressure

Air or nitrogen, 80 psi minimum with a flow rate of 3 cfm (85 l/min) minimum. Fitting is 1/4 inch female NPT with 1/4 inch tube one-touch.

Remote Cooling

Connections are two each of 3.5 inch flexible duct. Flow rate is 400 cfm (11.3 m^3/ BTU/hour (main system only). 10 feet of 3.5 inch ducting is provided.

External Vibrations

Requirements:

0 < 5 Hz	1 µm p-p
5 < 10 Hz	4 µm p-p
10 < 50 Hz	6 µm p-p
> 50 Hz	2 µm p-p

Floor

The floor must be flat and rigid and capable of supporting the weight (1255 lbs/570 kg) of the system.

System Location ond Service Access

The CRS 1010 system should be located within the work area to provide normal hallway passage in font of the system without interference with the operator. 24 inches user and service access is required around the system.

Physical Characteristics

Weight

• Main System:	1255 lbs	570 kg
• 13-inch Video Monitor:	37 lbs	17 kg
• 17-inch Computer Monitor	55 lbs	25 kg
• 20-inch Computer Monitor	81 lbs	37 kg
• Codonics NP-1600 Printer	60 lbs	27 kg
• Sony UP-5500 Printer	23 lbs	10 kg

Shipping Weight

• System Crate:	1852 lbs	840 kg
• Accessory Crate: varies with options	370 lbs	168 kg maximum

CRS 1010 System Dimensions

- Main System:
  35.5 inches (90 cm) in depth
  47.5 inches (121 cm) in width
  60.0 inches (152 cm) in height
- 13-inch Video Monitor:
  16.3 inches (41 cm) in depth
  13.6 inches (35 cm) in width
  13.5 inches (34 cm) in height
- 17-inch Computer Monitor:
  17.7 inches (45 cm) in depth
  15.7 inches (40 cm) in width
  16.1 inches (41 cm) in height
- 20-inch Computer Monitor:
  19.7 inches (50 cm) in depth
  18.5 inches (47 cm) in width
  18.5 inches (47 cm) in height
- Codonics NP-1600 Printer:
  21 inches (53 cm) in depth
  17 inches (43 cm) in width
  12 inches (31 cm) in height
- Sony UP-5500 Printer:
  18.8 inches (48 cm) in depth
  16.8 inches (42 cm) in width
  6 inches (13 cm) in height

Shipping Crate Dimensions

- System Crate:
  64 inches (1626 cm) in depth
  48 inches (1220 cm) in width
  73 inches (1852 cm) in height
- Accessory Crate:
  48 inches (1220 cm) in depth
  48 inches (1220 cm) in width
  34 inches (864 cm) in height

Figure 1. CRS 1010
Isometric View

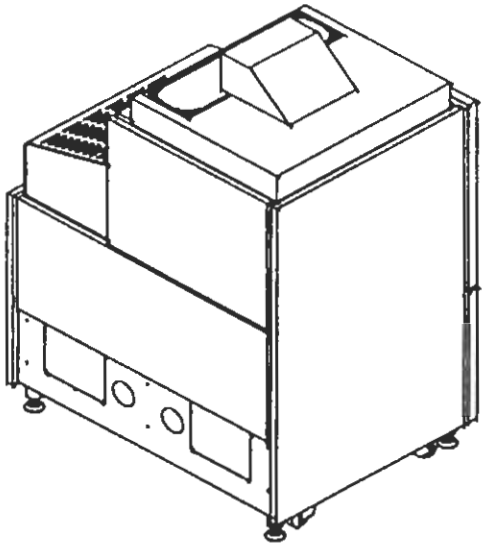


Figure 2. CRS 1010
Top View

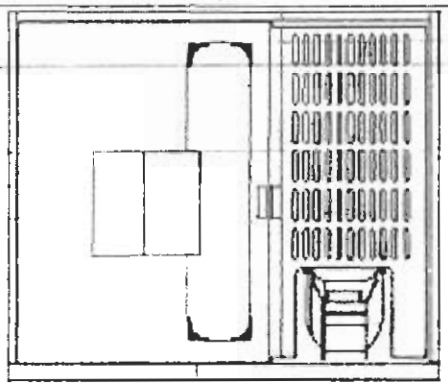


Figure 3. CRS 1010
Front View

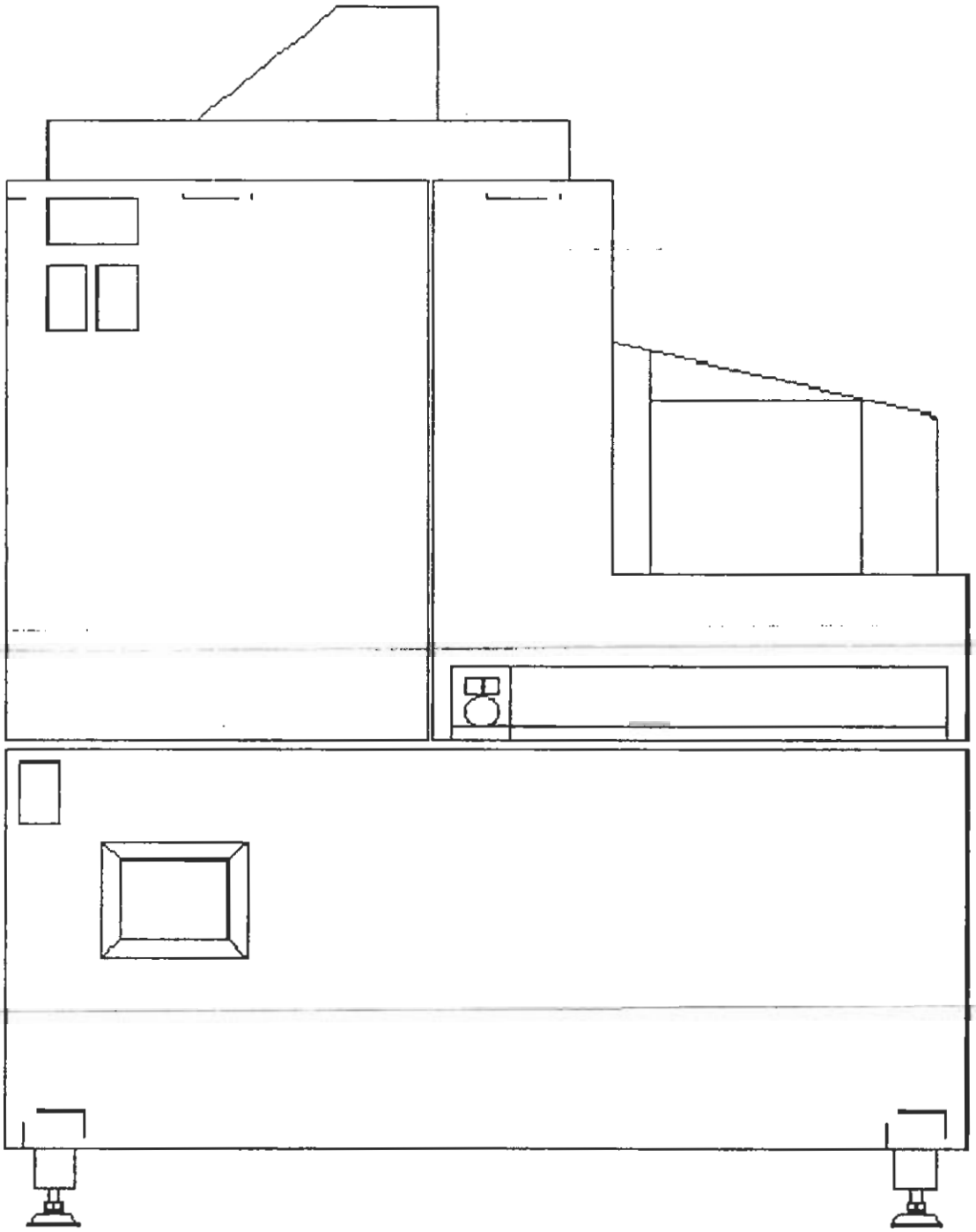


Figure 4. CRS 1010
All Dimensions are in Inches

Figure 5. CRS 1010
All Dimensions are in Inches

Chapter 2 CRS Preparation For Shipment

Scope

In a normal first installation, the CRS is prepared for shipment at the factory. This procedure is provided in case a CRS must be moved to a new site.

The following describes the necessary pre-shipment preparation to perform on the Model 1010 CRS system and componentry. This procedure covers unit shutdown to crating. It is followed by a shipping check list to ensure all required items are shipped.

Procedure

1. With the **uv** program running change turret to a position with no objective, in ***Wafer Map Window Set***

Set X and Y to 0 and perform a ***GoTo***, and lastly use joystick to move coarse Z all the way down.

Exit the **uv** program at this time. Click on the **System** menu bar in the upper left corner of screen.

With mouse button depressed move down to the **System shutdown** bar and release mouse button.

Answer ***yes*** to system shutdown window and wait for ***Ready To Shut Unit Off*** window. Depress red Off button next to drive bay door on unit. Turn off system and video monitors. Turn off any printers or other accessories.

2. Unplug main power to unit. Disconnect all signal and power cables from back of unit and individual components. DO NOT REMOVE VACUUM OR AIR AT THIS TIME. Remove hose clamps from exhaust hoses from back of unit and external cooling box. Remove hoses. Remove external interlock connector and SCSI terminator.

3. This step and others that follow require the cleaning of components with alcohol dampened clean room cloths. Cloths are to be replaced as soiled. Allow components to air dry thirty minutes before packaging. Wipe clean each cable, coil cables neatly and place in a clean plastic bag. Remove connector from main power cable. Wipe cable clean. Coil power cable and tywrap. Tape coiled power cable to utility panel out of the way. Wipe clean external interlock connector, SCSI terminator and any other smaller components. Put cleaned parts in clean plastic bag. Wipe clean keyboard, mouse, pad and joystick. Place items individually into clean plastic bags.

4. Wipe clean each monitor. If a permanent cable is attached wipe clean and tywrap. Pack monitors in original packaging. DO NOT TAPE SHUT BOXES AT THIS TIME.

5. Wipe clean any other components such as optional exhaust box and hoses, locator plates and/or printers. If printers remove any paper, film, color cartridges or any other such items. Install any shipping clamps or retainers (consult printers manual for any recommended shipping instructions as these may vary). Pack components in original packaging material. If none, place items into clean plastic bags.

6. Remove robot panels. Place screws into a small clean plastic bag. Wipe clean panels and place individually into clean plastic bags. Put small bag of screws into one of these bags.

7. Remove top, left side, lower right, upper right, lower front and lower rear panels.

8. Turn the main breaker to the "OFF" position. Ensure stage controller thumbwheels are set to 000.

9. Carefully disconnect vacuum from unit. DO NOT REMOVE AIR AT THIS TIME. Using a metric allen wrench carefully remove end effector from robot arm. Be sure not to drop the small hardware into unit. Using a permanent marker draw a small dot on robot link where end effector attaches to indicate direction of end effector. Place screws, washers, o-ring and screen into small clean plastic bag. Wipe clean end effector. Package end effector and small bag by sandwiching between cut to size layers of foam followed by cardboard. Tape together to secure. Using a permanent marker write "end effector and screws" on outside of cardboard. Wipe clean vacuum coupling and place in clean plastic bag.

10. Line up robot arm links together and tywrap together just snug using several tywraps linked together.

11. Align stage axis together by moving stage by hand in X and Y positions. Wipe clean the two shipping clamps provided by the manufacture and install.

12. Carefully drop the air pressure to the isolators to 40lbs at the regulator. Install the four inner frame shipping brackets. It may be necessary to increase or decrease the isolator pressure to aid in the installation. Drop the air pressure to 0lbs. Inspect proper installation by ensuring that a small gap is between isolator pad and inner frame. Repeat this step as necessary. Turn off supply air.

13. Wait for all regulators to read 0 lbs and disconnect Air from unit.

14. Depress two plastic buttons on front of SGI and remove front panel. Unlatch hard disk by moving lever on bottom of hard disk. Remove hard disk from unit. Replace SGI front panel. Pack hard disk in original packaging.

15. Install tape drive shipping cardboard and 3 1/2" ship disk (floppy disk acceptable).

16. Inspect inside of unit for any foreign debris that might have been missed or shaken loose. Clean as required. Also ensure all controller skid retainers are fastened properly.

17. Replace all panels removed at step 5.

18. Loosen jam nuts on leveling feet and screw feet in as far as possible and retain with jam nut.

19. Place all manuals and paper work into a clean plastic bag.

20. Pack all loose components from previous steps into cardboard boxes (two or three required depending on configuration and options). Use anti-static foam for filler or layering as required. DO NOT TAPE BOXES SHUT AT THIS TIME.

21. Review unit configuration. Ensure all items are listed on shipping check list. If not add to "misc." section. Review shipping check list "X" each box as items are accounted for.

22. Tape all boxes shut for shipment. Use a permanent marker to note cardboard box contents of boxes packed from step 20.

23. The unit is now ready to be crated by the professional packaging company. Follow the steps listed below to ensure proper handling:

A) Double wrap unit itself in clean room. Place first moisture barrier layer over unit under clean hood. Roll unit up ramps onto shipping pallets.

B) Ensure desiccant is placed under unit prior to final sealing.

C) After each bag sealing inspect all seams for gaps, misalignment, etc.

D) Prior to placing top on crate I tape "CLASS 100 PACKAGING" labels on each side of bagged unit.

E) Ensure all "THIS SIDE UP" arrows and indicators are up in crate II. Also ensure the weight is distributed properly and that the more delicate items are on top.

F) After all crates are packaged place the original shipping list in a shipping envelope on crate I and a copy is in an envelope on crate II.

G) Ship the CRS.

Shipping Check List

Unit S/N _____

Date _____

Crate I

Instrument Only (Main breaker off) Double wrapped (Class 100) and strapped down

- Stage, robot and lower frame are locked in place, feet up
- Hard disk removed
- End effector removed
- Locator plate installed
- Robot panels removed
- Shipping retainers installed in drives

Four "Class 100" packaging labels on each side of unit wrapping

Original packaging list in holder on outside of crate

Crate II

- 16" Monitor (19" Optional)
  In original box and packaging (No Class)
- Video Monitor
  In original box and packaging (No Class)
- Video Printer (Optional)
  In original box and packaging (No Class)
- Film for Video Printer Qty _____Packs _____Shts per pack (Optional)
- Graphics Printer (Optional)
  In original box and packaging (No Class, with ship lock in place)
- Film for Graphics Printer Qty _____Packs _____Shts per pack (Optional)

Below items placed in accessory box(es) wrapped (No Class)

- External Exhaust Box
- Hoses (2x @ 12') and clamps (8x)
- Keyboard
- Mouse/pad (Trackball optional)
- Manuals
- Bound KLA Tencor CRS
- Equipe robot w/teach and parameter values listed
- SGI Set and SGI Monitor
- Sony Video Monitor
- Joystick

- External interlock jumper
- Printer Ethernet tee and terminator
- Active SCSI terminator
- END effector
- Hard disk
- Backup installation tape and Config disk
- All cables for unit
- Miscellaneous:

Chapter 3 CRS Installation Checklist

Installation Checklist

1. **Un-crating the system:**
   Crate not damaged.
   Tip and tell and shock indicators OK.
2. **System installation:**
   IS on isolation mount
   E-drawer brackets removed and guides installed.
   Inspection Station leveled
   X stage clamps removed
3. **Facilities hook-up:**
   Power / line conditioner connected
   Air / nitrogen line purged and connected
   Vacuum connected
   Exhaust hoses connected
   Cables connected
4. **System powerup:**
   AC voltage checked
   EPO checked
   Power supplies verified
5. **Calibration check:**
   System will initialize
   PCNFS time zone and addresses setup
   Learned customer cassettes
   Verify calibrations

Chapter 4 Uncrating The Crs 1010

System Crate:

1. Make sure the system is forklifted to a place where it can be rolled into the fab while still in the crate. The system itself is not designed to be lifted by a forklift.
2. First remove the bolts from around the bottom of the crate. Then the clamps from the front panel.
3. Now put the front panel down so the ramps can be unbolted from the inside of the panel.
4. Remove the top shell of the crate. This will require two people, and space above or next to one side.
5. The bolts on the bottom supports can now be removed and the 2x6 boards taken off from the ends of the system. This may require a hammer to remove any nails connecting them to the side rails.
6. The bottom of the bags must be cut away to allow access for the wheels. Cut away just the bottom of the bag so not too much of the system is exposed to the non-cleanroom environment. The desiccant packs should be taken out now as well. There will be several, in between the outer and inner bags.
7. Note which way the casters are turned. Place the ramp on the correct side of the base so the wheels can turn in the direction they are already set to in order to roll the system down the ramps.
8. The ramps should be lined up with the wheels at 8¾" from the side support to the edge of the ramp. Place the lip of the ramps into the slots on the base to lock them in position.
9. At least two people will be required to roll the machine down the ramps. The system weighs approximately 1300 lbs.
10. The system can now be rolled into the equipment pre-cleanroom and the first bag removed. Then wipe down the inner bag. Once in the cleanroom the inner bag can be removed and the system itself can be wiped down.

Accessories Crate:

1. Remove the top cover and one of the sides.
2. Remove 2x4s as necessary to access equipment.
3. The monitors, printers, and other items can be removed.

Customer provides:

1. Stand for monitors, keyboard, and joystick
2. Table for printer(s)
3. Four 115V outlets
4. Power adapter for main power cord—208V NEMA three-prong locking socket in U.S, or other as ordered.
5. Network information
6. Vacuum (20 in. Hg)
7. compressed air (80 psi)
8. Vacuum and air lines with correct connectors for local supplies and for CRS
9. Two exhaust ports

Chapter 5 Customer Acceptance

A detailed QC audit by manufacturing is done before shipment. These tests are designed for the final checkout of the system after installation at the customer site. If the CRS passes all of the tests in this chapter, it can be handed over to the customer with full confidence. If something has gone wrong in shipment so that the unit fails any of these tests, the full checkout and adjustment procedures are provided in the next chapter and in the Optical Alignment Procedure, Stage Calibration Procedure, and Robot Calibration Procedure. If it is necessary to make any adjustments, the tests in this chapter should be repeated, and any further adjustments made, until the unit passes all acceptance tests.

System Number		Date Started	
Customer		Date Completed	

Test Materials

- KLA Tencor patterned test wafers
- Latex sphere standards
- Standard 200mm (8 in.) cassette plus other standard sizes specified by customer.
- Standard size test wafers, with flat and/or notch, size(s) specified by customer. 200mm (8 in.) used if not otherwise specified

EXCEPTIONS _____

Customer		KLA Tencor	
Signature		Signature	
Date		Date	

Tests

1. Robot Performance
   a Cycle wafers using customer cassette and plate, using all slots in cassette.
2. Prealigner Performance
   a Confirm proper alignment at all orientations of notch/flat (0°, 90°, 180°, 270°)

0°	90°	180°	270°
P / F	P / F	P / F	P / F

b Do stage center offset
Using test wafer, confirm prealignment repeatability (<400 µ up to 6", and <800 µ for 8")
Load wafer
Prealign
Locate first deskew point
Increase magnification to 100×
Note position
Unload
Repeat five times
Determine spread

	X-axis	Y-axis
1		
2		
3		
4		
5		
Maximum		
Minimum		
Spread		

3. Stage Operation

a Stage Positioning Accuracy(±10 µ)
Load wafer map
Load test wafer
Perform 3 point deskew
Go to first test location (corner of die)
Measure and note deviation for locations 1 through 9

	X-axis	Y-axis
1		
2		
3		
4		
5		
6		
7		
8		
9		
Max Error		

4. Autofocus
Select Laser Line
Perform stage focus at lowest power objective
Switch to next objective
Note Z hight from slider bar
Repeat for each laser line (458, 488, 515, ALL)

a Coarse
Stage focus at each objective and laser line Pass/Fail

	5 X	20 X	50 X	100 X	150 X
458 nm	P / F	P / F	P / F	P / F	P / F
488 nm	P / F	P / F	P / F	P / F	P / F
515 nm	P / F	P / F	P / F	P / F	P / F
ALL	P / F	P / F	P / F	P / F	P / F

b Fine
Stage focus at each objective and laser line Pass/Fail

	5 X	20 X	50 X	100 X	150 X
458 nm	P / F	P / F	P / F	P / F	P / F
488 nm	P / F	P / F	P / F	P / F	P / F
515 nm	P / F	P / F	P / F	P / F	P / F
ALL	P / F	P / F	P / F	P / F	P / F

5. White Light Image Quality

a Observe pattern using all objectives, bright field, polarizer, and dark field (when applicable) Pass/Fail

	5 X	20 X	50 X	100 X	150 X
BF	P / F	P / F	P / F	P / F	P / F
DF	P / F	P / F	P / F	P / F	P / F

b Print white light photo at highest objective

6. Laser image quality

a Observe pattern using all objectives, bright field, and dark field. Pass/Fail

b Note any observable image imperfections

	5 X	20 X	50 X	100 X	150 X
BF	P / F	P / F	P / F	P / F	P / F
DF	P / F	P / F	P / F	P / F	P / F

c Obtain live laser image of test pattern for all laser zoom settings using high-eslt objective.
Note any observable image imperfections.

d Set range and obtain surface images at all zoom settings.
Note any observable image imperfections.

7. Z Calibration

   a Confirm Z Calibration
   Using highest objective and Zoom X1, obtain surface data on 10µm spheres.
   Using profile feature, measure height of sphere cap above substrate.
   Measured height must be ±5%.
   Print screen with measurement data

	Actual	Measure	Error	Error%
Zoom X1				

8. XY Calibration

   a Confirm XY Calibration
   Using highest objective and each Zoom, obtain surface data on 10µm spheres. At some settings smaller spheres will be required.
   Select the 2D XY Cut Plane Window with the cursor set to Size mode.
   Measure distance between spheres by placing "Rubber Band Box" so its edges cross the bright spot at the center of the spheres.
   Measured height must be ±5%.
   Print screen with measurement data.

X Axis	Actual	Measure	Error	Error%
Zoom X1				
Zoom X2				
Zoom X4				
Zoom X8				

Y Axis	Actual	Measure	Error	Error%
Zoom X1				
Zoom X2				
Zoom X4				
Zoom X8				

9. XY Resolution Detection

   a Using 0.22µm spheres in live laser scan.
   Observe and resolve single spheres
   Observe and resolve double (contacting) spheres
   Observe and resolve triple (contacting) spheres
   Print screen

   b Using 0.10µm spheres in live laser scan.
   Observe and resolve single spheres
   Print screen

10. Z Resolution Detection

   a Surface Displacement
   Observe flat surface area
   Translate the fine Z stage
   Observe reflectivity change for each step after allowing for backlash.

Chapter 6 Tests and Adjustments

Purpose

This procedure describes the full set of tests and adjustments for the KLA Tencor Confocal Review Station. If any faults are observed in the unit during installation and acceptance testing, it is important to go through this complete procedure in order to find their causes and to uncover any other faults that may be masked.

For most of these tests you must be able to acquire laser and white light images. The procedure is written in the order in which the steps should be completed. If for some reason a step cannot be completed (shortages, failed parts, etc.), it is possible to move ahead in the testing but be sure to consider the impact of performing a step out of order. There are dependencies between steps, so that some adjustments cannot be made correctly unless certain preceding steps have been followed.

The results of this procedure should be recorded on the Installation Test Data Sheet.

Requirements

- CRS
- Shortage List from system if it exists
- Cable BOM
- DVM
- Vacuum Gauge and Needle valve
- Test Wafers and Cassettes
- Floppy Disk
- Backup Tape
- Serial Port Test Cable (straight through, not null modem)
- Codonics Printer w/ Paper and Cables
- White Light Video Printer w/ Paper and Cables
- NEAT Stage Calibration Procedure
- Optical Calibration Procedure
- Installation Test Data Sheet

Tools

The following items are required to service the Confocal Review Station:

- Kodak lens paper
- Hemostats
- Acetone or Methanol, HPLC Spectroscopic Grade
- Compressed clean dry air or nitrogen
- Jeweler's precision screwdriver set.
- #0 Flat blade screwdriver
- Inch Allen ball driver set, Bondus BLX12 (.05" - 5/16")
- Metric Allen ball driver set, Bondus (0.5 to 5 mm)
- 10.5 mm open ended wrench or small crescent wrench
- 4" Diagonal cutter pliers
- Fine tip needle nose pliers
- Midget 10 pc. combination wrench Set (5/32" - 7/16")
- RTV. silicon glue (small tube)

- Clean room compatible plastic Q-tips
- M3 thread beam splitter cube removal tool (1.5" long screw will work)
- Small pill boxes for spare screws/washers/etc.
- Utility knife and spare blades
- Wire ties
- Small Flashlight (AA Mini-Maglight)
- Extra-fine tip Sharpie (REQUIRED for optics adjustments)
- Digital multimeter (Tek DMM150 or better)
- Spare batteries
- 1.2 GB Optical cartridge - Maxoptics p/n 2015383RW (ADC sites only)
- Four (4) 3.5" HD floppies (Maxell MF2HD recommended per Ultrapointe Spec.)

Use only HPLC "PHOTREX" Spectrophotometry Grade Acetone or Methanol to clean the optics. Blow off the optics with compressed clean dry air or nitrogen. Lesser grades of solvent will leave residues on the surface and in-fact may leave the optics dirtier than when you started to try to clean it.

Recommended solvents may be obtained from J.T. Baker under the following part numbers:

Part Number	Quantity	Description
9069-01	500 ml	Methanol, "PHOTREX" Reagent 99.9%, lot analyzed.
9010-01	500 ml	Acetone, "PHOTREX" Reagent 99.6%, lot analyzed.

Solvents have limited shelf life. Do not purchase these materials in bulk as they will degrade with age.

Procedure

Preliminary

1. Read Log Book

A Log Book should be kept with the system and updated for every fault, every repair, and every scheduled maintenance. If there is no log book, start one. Include copies of preinstallation documents such as configuration, BOM, shortage list, acceptance documents, and any others describing the system.

Read the log book for the system to familiarize yourself with any unusual occurrences which may have come up. Record the progress of the installation, including any faults found and their corrections.

2. Check System Assembly and Shortage List

Check the manufacturing shortage list for the system. Attach a dated copy to the Installation Test Data Sheet.

3. Record Equipment Model and Serial Numbers

Make sure that there is a record in the system log book of the model number and serial number of all third party equipment in the system. This includes but is not limited to the items listed in the following table. Enter this information in the Data Sheet.

Item	Model Number	Serial Number
SGI Computer		
NEAT Stage and Controller		
Equipe Robot		
Equipe Prealigner		
Equipe Controller		
White Light Power Supply		
Laser		
Laser Power Supply		
Sony Camera		
Page Scanner Mirrors and Controller		
Codonics Printer		

4. Record Circuit Board Revisions and Serial Numbers

Record the Revision, Serial Number and Programmable IC Information on the Data Sheet and in the log book, if this has not been done previously.

LON Node	Revision	Serial Number	Programmable IC
1 Laser Power			
5 Bright Field/Dark Field			
9 Turret/Optics			
2 Camera Filter Wheel			
4 Laser Attenuation Filter Wheel			
3 Laser Line Select Filter Wheel			
8 PMT Preamp			
11 Solenoid			
6 Page Scanner			
7 Fast Z			
10 Cassette Switch input			
12 Aperture			
13 Docking (optional)			
14 Mask (optional)			

The LON nodes appear above in the order of the menu in **LONDiagnostics**, with numbers in the order of physical connection. Nodes 12 and 13 are for the SMIF option, and do not appear if it is not installed. 14 Mask is for the light tower option.

Mechanical

5. Check SDPFG Cooling Fans Function

Check that the Fans on the SDP Frame Grabber cover are functioning and that the air coming out is not too hot.

6. Check Blowers Function

Check that the blowers are operating and that the air exhaust is not too hot.

7. Check Inner Frame Isolation

Inspect around the inner frame to make sure no cables are making contact or interfering with the movement of the inner frame. Rock the inner frame slightly to make sure it is free to move without contacting other parts, and that it recovers from disturbance quickly.

8. Test Vacuum Sensors

Reduce the system vacuum until the software indicates inadequate house vacuum; record the vacuum reading. With a wafer on the robot end effector, and the vacuum turned on, observe the state of the robot vacuum sensor LED. Slowly reduce the system vacuum until the robot indicates no vacuum; record the result. With proper vacuum load a wafer into the system. Read chuck vacuum status, which should be 1. Unload the wafer and read chuck vacuum status again. It should be 0.

System Vacuum Cutoff_____ in Hg.

Robot Vacuum Cutoff_____ in Hg.

Chuck Vacuum Status checked: ____

Electrical

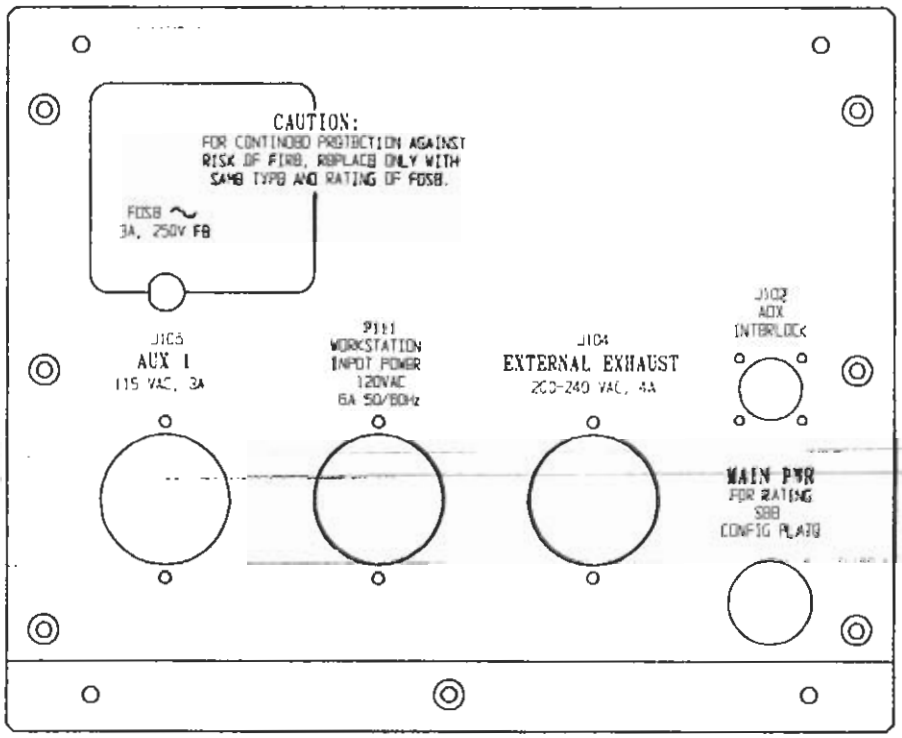
9. Check Value of Internal and External Fuses

Check the value of the all fuses in the system.

Description	Quantity	Designations
AC 3A 250V FB	1	
AC 1A 250V FB	1	
DC 630 mA FB	1	F202
DC 1A FB	1	F201
DC 3A 250V FB 5mm×20mm	1	F203
DC 5A 250V FB 5mm×20mm	1	F205
DC 6.3A FB	3	F205 F206 F207

10. Check AC Voltage at Rear Panel and Outlet Strip

Check the AC Voltage at the rear panel J104 (External Exhaust), J106 (Aux 1) and J107 (Aux 2). Check the polarity and Grounding of J106 and J107 either with an outlet tester or by verifying the proper voltages at each pin with respect to ground. If the outlet tester is not available, the shorter slotted pin is the Hot lead and should have 120 VAC potential with respect to ground, the longer slotted pin is Neutral and should have 0 VAC potential with respect to ground. Check for 0 ohms from the ground lead to the chassis. Perform the same measurements at the internal Outlet Strip.



Record all readings on the Data Sheet.

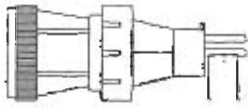
11. Check EPO, Power Off Switch and External Interlock



Make sure the SGI Computer is shut down properly before performing this test. Turning off the power without closing files can damage the file system.

Individually test the EPO (left), Power Off Switch and external interlock . When the system is on pressing either the Power Off or EPO or removing the Jumper (jumper shown at left on next page, socket on AC panel shown above) from the External Interlock should shut the system down.

When either switch is depressed or when the external interlock jumper is removed, pressing the power on switch must not energize the system.



12. Adjust DC Voltages at SDP/FG

WARNING: This procedure requires opening the DC Module which exposes potentially lethal voltages. Use caution when performing this procedure. Before starting, shut the system down completely.

The SDP frame grabber has the most critical voltage requirements. It is important to adjust the +5 VDC Digital and the +/-5 VDC Analog Power Supplies at the SDP Frame Grabber PCB's power input connector for maximum accuracy.

Open the front panel of the DC Module to gain access to the power supplies. The ±5 VDC Analog Power Supply is in the middle stack of power supplies. Remove the +5 VDC Digital supply to gain access to it. Place the +5 VDC supply where it will not short to anything. Once the +5 VDC Digital supply is removed you can reach the adjustment pots on the ±5 VDC Analog supply.

Remove the SDP Frame Grabber Cover to access the power input connector pins. The test points are as follows:

Analog Ground	Pin 3 or 7
+5 VDC Analog	Pin 4
-5 VDC Analog	Pin 8
Digital Ground	Pin 2 or 6
+5 VDC Digital	Pin 1

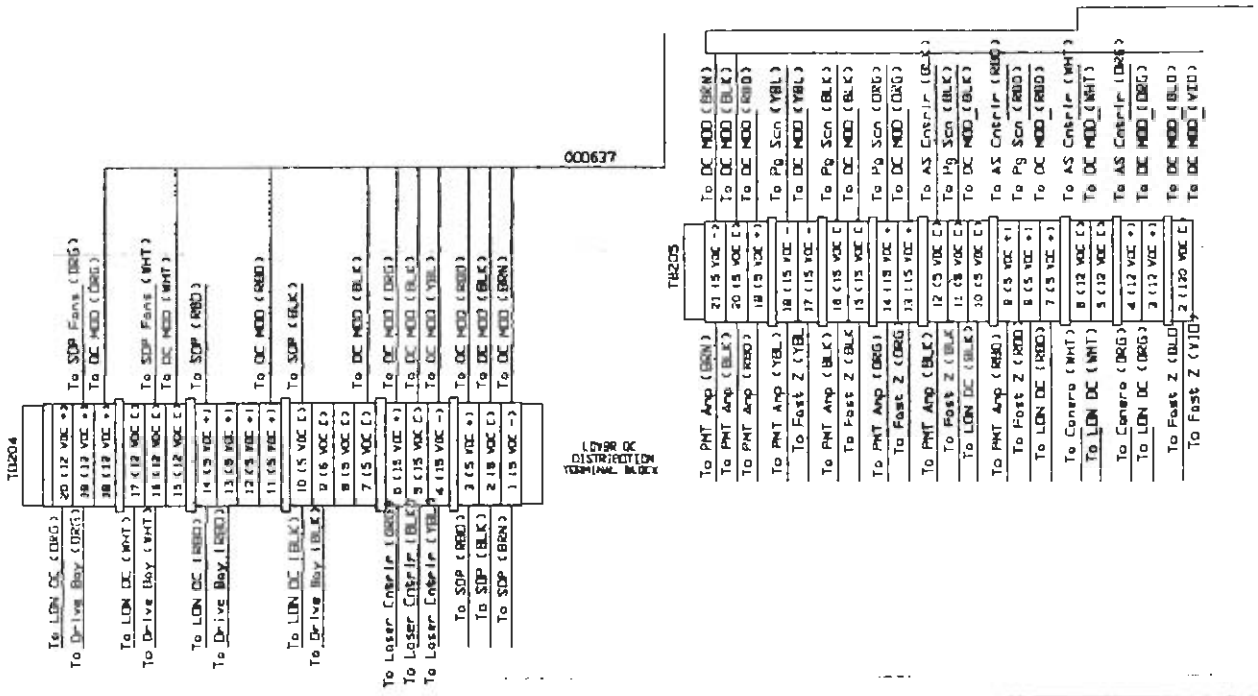
Adjust

+5 VDC Analog to 5.00 VDC, ± 2%
-5 VDC Analog to -5.20 VDC, ± 2%
+5 VDC Digital to 5.00 VDC, ± 2%

13. Check DC Voltages at TB 205 and TB204

Check the voltages at TB 205 and 204 for proper adjustment. TB 205 is the Terminal Block on the optics platform beside the turret. TB 204 is the Terminal Block behind the SGI computer above the outlet strip. Check and record the voltages on the data sheet. The Figure below shows where to attach the meter leads for measurement.

Note: TB 204 connections are numbered left to right. TB 205 connections are numbered from the back of the machine to the front.



14. Ground Strap on Laser PS and Robot

Check that the Ground Straps are installed on the Laser Power Supply and Robot. Install if necessary.

15. Perform Electrical Safety Checks (Ground Continuity and Dielectric)

This test uses special equipment to verify that the system's high VAC electrical distribution is in specification. There are two parts to this test, High Voltage Dielectric Breakdown and Ground Continuity. The first test applies a high voltage to the power input connector for 60 seconds and tests for insulation breakdown, shorts or arcs. The second test applies a high current through the ground connector and system chassis to verify that the chassis is properly grounded. The tests are performed automatically by the equipment but proper setup is very important. If the tester is not available these tests must be skipped.

In order to test the complete high VAC distribution we must energize the main contactor but the main power cord is connected to the test equipment so we must use an external 24 VDC power supply connected through the External Interlock connector on the rear panel to energize the contactor.

- Shut the CRS down.
- Unplug the main power cord from its outlet and plug it into the automatic tester.
- Connect the large alligator clip from the tester to the CRS chassis.
- Remove the jumper plug from the External Interlock connector on the rear panel and connect the test power supply in its place.

- Plug in the Test power supply.
- Make sure all 208 VAC circuit breakers (CB101, CB102, CB103, CB104, CB105) are on.
- Press the green front panel switch. You should hear the contactor switch and the LED in the green switch should light.
- Make sure the tester is set up properly for the test.
- Press the start switch on the DC Input tester (dielectric breakdown). The voltage meter should increase slowly to 1400 VDC and the current meter should read less than 3.5 milliamps.
- Press the start switch on the Ground Continuity tester. 25 Amps should be applied and you should observe less than 0.1 ohms for the ground continuity reading.
- Record the readings on the Data Sheet.

Optical Setup

16. Set up Camera

Remove the side panel from the Camera to gain access to its controls. Set the White Balance and the Automatic Gain Control to Off.

17. Check White Light Video Monitor

Check the cables going to the White Light Video Monitor. Make sure the S-Video cable is seated securely and that the Composite Video cable goes to the "A" input. Switch the front panel from Y-C to A and check that there is video with both settings. (The A video is slightly noisy.) Note: the connections described above refer to the Sony 13" Monitor in use at the time of writing this procedure. Any other monitor should have similar connections.

SGI Indy and peripherals

18. Check that System Software Revision is current

Verify that the Software Revision on the system is the current release. Check with the Software Department if necessary. Also check the current SGI Operating System Revision.

To check the Software Revision, simply run the software and check the Login Screen. The simplest way to check the SGI Operating System Version is to select ***Tool/ Release Notes*** from the ***ToolChest*** on the Main Screen. (Lower the uv software first).

Computer Setup

19. Set the Time and Date on the SGI Computer

Check the time and date on the SGI from the `uv` program. The time and date are displayed at the lower left of the window. If the time and date are not correct they must be set from the Unix shell. The syntax for the command is

```
date mmddhhmm
```

where mm is the two digit month entry, dd is the two digit day entry, hh is the two digit hour entry and mm is the two digit minute entry. For example, to change the date and time to 2:05 PM on July 22, enter `date 07221405`. Notice that the hour entry is in 24 hour format.

20. Check Floppy and Tape Drive Access

This test will verify the functionality of the Tape Backup Drive and Floppy Drive. The tape cartridge and floppy disk you use for this test must not have valuable data on them because data may be lost.

Tape Drive.

1. Insert a Tape (one which can be completely overwritten).
2. Select **System**, in the ***ToolChestWindow*** at the top left hand corner of the screen. From the subsequent screens select ***Confidence Tests***, select ***Tape***, select ***QIC150#7***, select ***Test***.
3. Select ***Accept***, when given the ***Data to be Destroyed*** message.
4. When the ***Passed with Flying Colors*** message appears, select ***Continue***.
5. If this message does not appear then the test failed.
6. Rerun the test after corrections are made.

Floppy Drive.

1. Bring up a Shell window by selecting ***Tools*** in the ***ToolChestWindow*** at the top left hand corner of the screen and selecting **Shell** from the menu which pops up.
2. If there is a Floppy in the drive type `eject` in the shell window.
3. Type `killall msdosd` in the shell window.
4. Select ***System***, in the ***ToolChestWindow*** at the top left hand corner of the screen. select ***Confidence Tests***, select ***Floppy***, select ***FloppySCSI#3***, select ***1.44Mb***, select ***Test*** from the subsequent screens.
5. Insert a Floppy (one which can be completely overwritten) and select ***Accept***.
6. Select ***Accept*** when given the ***Data to be Destroyed*** message.
7. When the ***Passed with Flying Colors*** message appears, select ***Continue***.
8. If this message does not appear then the test failed. Rerun the test after corrections are made.
9. When testing of the Floppy is complete, bring up a shell and type `msdosd -a`

21. Install and Test Codonics Printer

If the customer configuration ealls for a Codonics printer it must be installed and tested. Unpack and set up the printer per the instructions in the manual which comes with the printer. Be sure to remove any shipping brackets.

Load the paper and print media and make the connection to the network connector on the back of the CRS. One or two transceivers may be required to make the connections depending on what type of network cable you are using.

Once the network connection is made you must set up the network ID number on the Codonics printer. An IBM PC compatible keyboard is required to do this. An IBM PC compatible video monitor is useful but not required.

Connect the keyboard to the appropriate port on the rear panel of the Codonics printer and power cycle the printer. After a few minutes you should here 3 beeps. Once you have heard the beeps, hit the escape key and then type `i` *return*. Type the network ID provided by the network administrator, and *return*. Type the numbers carefully

especially if you are not using the video monitor and are typing blind. Once you have entered the network ID you should hear a beep that sounds like a telephone ring. At this point the printer is ready to communicate and the keyboard can be removed.

To verify that the printer is communicating over the network properly, open a Unix shell and type the command `ping codonics`. This will test transmit and receive functions of the Codonics printer. You should see several lines of status information appear. The last part of the line shows transmit time required and it should be less than 5 msec. If no status lines appears check the network setup on the CRS and Codonics printer. If the status lines appear and the transmit time is less than 5 msec then press **Control-C** to stop the ping test.

Once the communication has been tested you can print an image. Get a good image on the screen and select the Print menu. After several seconds a dialog box appears. Press **OK**. After several seconds the network light on the Codonics printer should start blinking, followed by the processor light. Later the status indicator should start counting up to 25 as the print is being made and finally the print should come out. If there are any problems with this consult the Codonics printer manual or request help from engineering.

22. Install and Test White Light Video Printer

If the Customer Configuration calls for a White Light Video Printer it should be installed and tested. Because of the variety of printers available the exact setup cannot be described here. Unpack the printer and follow the user manual for the printer to set it up. Normally we bring the White Light S-Video from the rear panel of the CRS to the S-Video input connector of the printer then connect a cable from the printer S-Video output connector to the Video monitor.

Once the connection is made get a good white light image on the CRS and print a picture of it. If there are any problems consult the manual which came with the printer or check with engineering.

LON

23. Check LON Node Communication Function

When the uv program is started it performs a check of the Local Operating Network (LON) and reports an error if communication is lost to any node. To check the LON further, enter **LONDiagnostics** from the **Maintenance** menu. Check the firmware version of each node by selecting the node name from the list and selecting the ***Revision*** network variable. Problems with a node will show up as slow response or a return value of 0 for the software version.

The following list is in the order of physical connection of nodes in the LON, but is numbered according to the list in the LonDiagnostics window.

Node	Firmware Version
1 Laser Power Controller	
5 Bright Field/Dark Field Controller	
9 Turret/Optics Controller	
2 Camera Filter Wheel	
4 Laser Attenuation Filter Wheel	
3 Laser Line Select Filter Wheel	
8 PMT Preamp	
11 Solenoid Controller	
6 Page Scanner Controller	
7 Fast Z Controller	
10 Cassette Switch Input	
12 Aperture Controller	
13 Docking Controller	
14 Mask Controller	

LON nodes 12 and 13 are for the SMIF option, and do not appear if it is not installed. 14 Mask is for the light tower option.

24. Check Cassette Size & Present Switches

Check in LON Diagnostics that when the switches are closed the network variables reflect the proper values. A hardware warning message should also appear. The following table shows switch position verses cassette size.

Switch 1	Switch 2	Size
Off	Off	6"
On	Off	4"
Off	On	5"
On	On	8"

Robot

25. Check Robot Controller Firmware Version

Use teach pendant or eqt software in terminal mode to read the firmware version numbers. The command is VER.

26. Check Robot Communication Function

Make sure the robot is communicating with the SGI computer. This is most easily done by clicking on the ***Reset*** button in the ***Cassette*** window on the main uv screen. If the communications link is OK this will cause the robot to begin its initialization sequence. If not the button will simply go gray for about 5 minutes while waiting for a time-out.

27. Check Robot Function

Ensure that the Robot responds properly to the teaching functions using the eqt software or the Equipe Teach Pendant.

28. Adjust Wafer Handling

Adjust the robot as described in the Robot Alignment Procedure for the stage, prealigner, cassette (station B, up to 6 in., and C, 8 in.) and SMIF, if present. Test wafer handing (load/unload) in top two and bottom two slots of cassettes of every size available at the site.

29. Check Load/Unload of primary wafer size

Find the customer's primary wafer size and test wafer handling in all slots for this size. Cycle wafers overnight using the Wafer Load/Unload Test function in the Maintenance menu. If the customer's wafer size cannot be determined use 8 in.

Laser

30. Check Laser Interlock

Test to ensure that both top interlock switches function. The laser interlock switches are located on the frame of the system under the top panel. When the cover is removed the switches open and the laser will go off. To turn the laser back on pull both switches up to the defeated position and power cycle the laser by pulling out the Laser circuit breaker plunger, waiting about 5 seconds and pressing the plunger back in.

Once the laser is back on, one at a time, depress the interlock switches which are mounted on the top frame and confirm their function. First depress the front switch. The laser should go off and a Hardware Warning message should appear on the monitor. Pull the front switch out (to defeat it) and power cycle the laser supply to get the laser on again. Depress the back switch. Again, the laser should go off and the Hardware Warning should appear. Pull the back switch out and power cycle the laser power supply.

31. Check Laser Overtemp

Disconnect the power cord for the blowers from the rear panel outlet. Observe the laser light and time how long it takes for the laser to shut off. This should be 2–5 minutes. When the laser shuts off, check that a hardware warning appears on the computer monitor.

If the laser has not shut down in 5 minutes, manually shut the laser off by pulling out the laser circuit breaker at the DC Module Front Panel. Whether the unit passes or fails the test, immediately re-connect the exhaust blower power cord to cool the laser, but **do not** turn the laser back on at this time. Let the blowers run with the laser off for at least 5 minutes before restarting the laser.

Record the time required for the laser to shut off on the data sheet. In case of failure, it will be necessary either to fix the cause of the problem before proceeding. The failure could be in the laser overtemp heat sensor, the laser power LON controller board, the LON, or the laser.

32. Check Single Line Laser Power Monitor Function

Check the power of the laser at each individual line. This is best done in **LONDiagnostics**. Make sure the laser is in run mode. Set the Line Select Filter Wheel to the line required and set the laser power to 6 mw. Select the ***PMT Amp*** from the Node list and select the ***Read Laser Power*** network variable. The value that is displayed is the A/D converter count for the Laser Power Diode A/D channel. It is a value of 0 to 255. Record the reading from the single-line laser power monitor for the wavelength and power settings shown on the data sheet. If any of the readings indicate saturation (reading = 255 counts), reduce the laser power enough to obtain a non-saturated reading and record the power command and counts returned at the Power monitor.

33. Check Laser Current vs. Power

Enter **LONDiagnostics** Mode and close the Laser Shutter. Select the ***Laser Node***, then select the ***PowerCmd*** Network Variable and enter 128 (correspondings to 25 milliwatts of Laser Power), in the ***Output NV Value*** box. Press (click on) the ***Send to LON*** button on the screen. Select the ***CurrMonitor*** Network Variable and the Laser Current value will appear on the screen. Divide the value by the conversion factor of 2.3052 to get the current in amps, and record this result on the data sheet. If the current required to deliver 25 milliwatts of Laser Power is greater than 6.5 Amps (a Laser Current value of 15.0), the value for a new laser, the laser should be adjusted or replaced.

34. Check Laser Power Control

Using a target with high reflectivity and high contrast, such as the edge of an aluminum layer, verify that the brightness of the laser image can be varied by changing laser intensity.

Optical components

35. Check PMT Control Function

Verify that adjusting the PMT High voltage changes the intensity of the Laser image. Open the **LONDiagnostics** window and click on the ***PMT*** Button to open its control window. Adjust the ***PMT Voltage*** slider bar while observing laser image intensity. Note that the image gets brighter as the PMT Voltage control number gets lower. Finally, check that the PMT shuts itself off when the image intensity is saturated across the screen (too much gain), and that it recovers when the PMT gain is re-set.

36. Check Turret Function

Some turrets have failed to operate properly so this test is very critical. Since the turret is difficult to replace it should be tested very thoroughly as early in the test cycle as possible. The test is somewhat difficult so we should discuss the background of turret control.

The turret has two sensors for each objective. One sensor, known as the Objective Sensor, tells the controller that the turret is in the general vicinity of an objective. The other sensor, known as the Click Sensor, tells the controller that the turret is centered on the objective. There is a mechanical detent in the turret ring which locks the turret in place when it is centered on an objective. Both of these sensors are active low, so when an objective is in place the network variables associated with each sensor should report 0.

When the turret is moved from one position to another, the controller counts objective sensor signals until it reaches the destination objective's objective sensor. When this is reached it slows the motor down (by a modified PWM motor drive signal) and checks for the click sensor. When the click sensor goes low the motor stops and the turret is centered by the detent locking it into place. In some turrets we have found that when all 5 objectives are loaded, the turret moves so slowly that the turret never reaches the detent. The symptom this causes is lack of repeatability when moving from one objective to another and back.

There is a network variable called ***step_del*** (step delay) which controls the off time for the motor when it is searching for the click sensor at an objective. This network variable is normally set to 15. Some turrets require this value to be set lower to speed up the turret motion and some require it to be set higher to slow down the turret.

To test the function of the turret you must test each objective individually. This is done most easily from **LONDiagnostics**. Select an objective. Check that the Click Sensor status is 0. Center a recognizable feature in the field of view.

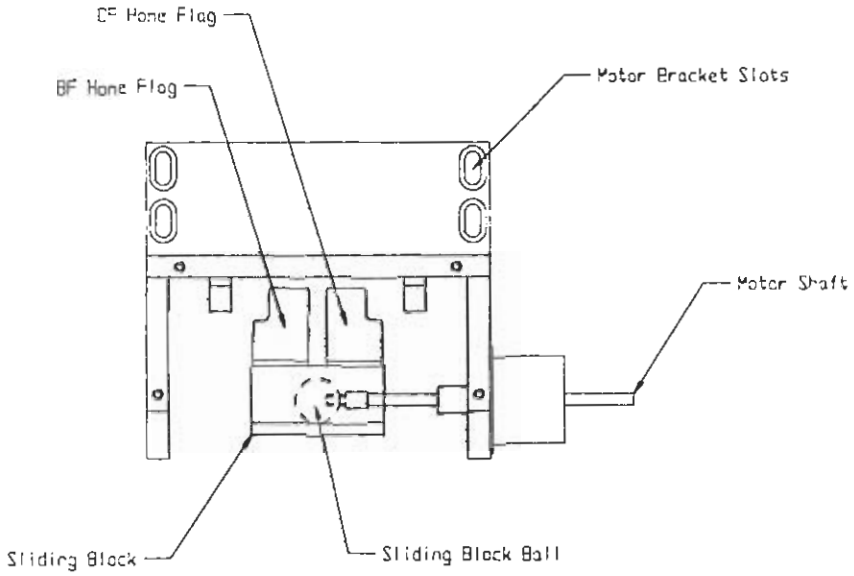
The objectives are arranged on a wheel, usually in order of magnification. For example: 5×, 20×, 50×, 100×, 150×. Going upward in this order, after 150× comes 5×, ang going downward, after 5× comes 150×.

Move to the next objective downward from this objective, then move back. Make sure the feature is still exactly in the center and check the click sensor network variable to make sure its 0. Repeat this 5 times at each objective. Next test moving upward and back. Problems with centering the feature are more noticeable at higher power objectives with their smaller fields of view.

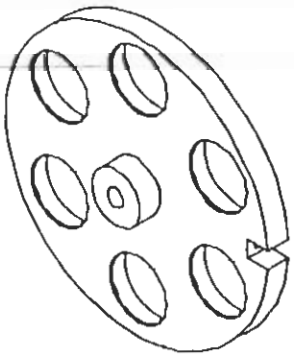
37. Check BF/DF Controller Function

Verify that the Bright Field/Dark Field switcher operates normally with no binding or photo switch contact. This is best done through the normal operating screen with the BF/DF motor cover removed. Using the ***Laser Image*** window cycle between ***Bright Field*** and ***Dark Field***. Make sure there is no binding of the switch or motor

lead screw. Also check that the flags (drawing below) for the position photosensors do not come in contact with the switches.



38. Adjust Filter Wheel Home Position (all 3 wheels)



Set the Home switch flag on all three Filter Wheels—Laser Line Select (left), Laser Attenuation, and White Light. When the Filter Wheel is at the Home position (position 6) the flag should be centered in the photo sensor. In the **LONDiagnostics** window select the filter wheel which you are adjusting. Select the ***PositionCmd*** network variable. Type the value 6 in the ***Output*** network variable text box and click the mouse on the ***Send To LON*** button. This should cause the filter wheel to perform its Home function. Check the Flag position. If it is not centered in the photo sensor, loosen the set screw which holds the wheel on the motor shaft and rotate the wheel until the flag is centered. Re-tighten the set screw.

Repeat the procedure for the other two filter wheels.

39. Check White Light Intensity Control Function

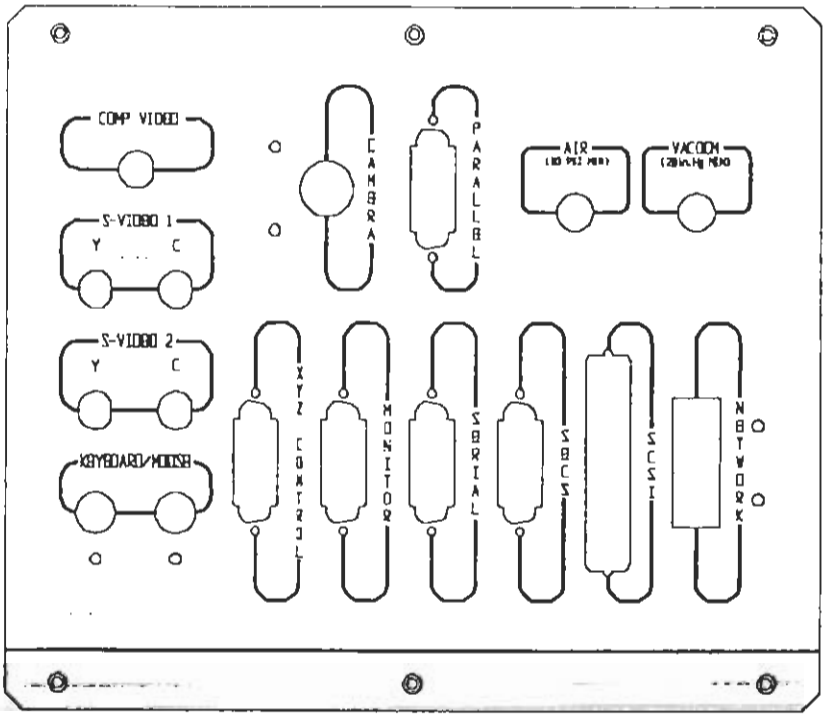
Check that the ***Camera Intensity*** slider bar on the laser window adjusts the White Light Illuminator brightness. The minimum brightness should occur at about 50 on the slider bar with the maximums brightness at 255. As the slider bar is adjusted a volt meter attached to the front of the white light power supply should deflect (4V at 50 and 12V at 255).

NEAT Stage and Controller

40. Check NEAT External Serial Ports

Test the external serial ports for communication. On the rear panel of the CRS system (below) connect a straight through (not null modem) DB-25 Male to DB-25 Female

cable from the SECS port to the serial connector just to its left. A ribbon cable works well.



From the SGI computer run two unix shells (blue screens). In one shell type the command `testneat 0` and in the other shell type the command `testneat 1`. In the first shell type any normal text and press the return key. Move to the other shell and press the return key. The text which you initially typed in the first window should appear (spaces will appear as 20). Now type any text in the second window and press return. Return to the first window and press return. The text which you typed in the second window should appear.

Note: If the 3 port NEAT communication is used the rear panel ports should be temporarily installed for this test.

41. Check NEAT Joystick Function

Ensure the stage joystick operation is normal in all three axes. Make sure the movement is not too fast or too slow (check this at all objectives). Make sure the stage does not creep in any axis when the X/Y–Z toggle switch is in either position.

42. Adjust NEAT Stage Joystick Zero

The figure below shows the internal wiring of the Joystick. The key point to notice is that the Y and Z axes share a single potentiometer (pot) which is varied by the joystick handle. The switch on the joystick which is set to either XY or Z determines which of these axes has access to the pot as should be evident from the figure.

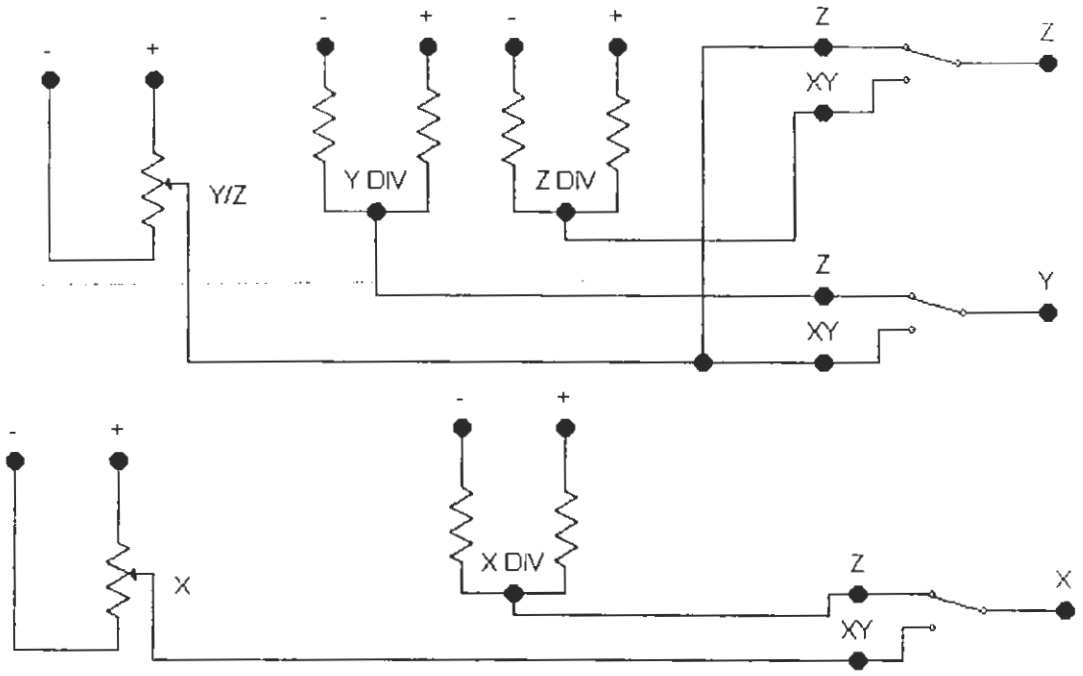


Figure 6. Joystick Internal Wiring

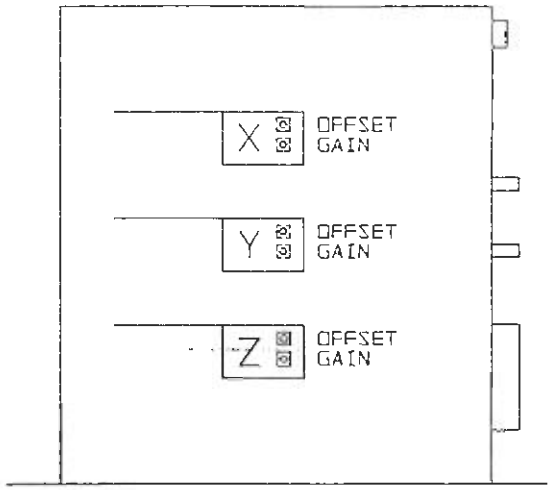
When an axis does not have access to the pot it is said to be de-selected. For a de-selected pot the switch routes the axis analog signal to a voltage divider which should null the signal going to the axis.

The key to joystick calibration is adjusting the physical centering of the potentiometer to match the voltage divider output when the joystick is in the center position. In general, for adjusting joystick zero position, the physical position of the pot slider mechanism should be adjusted when the axis is selected. When the axis is de-selected the controller offset pot should be adjusted. The adjustment should be made so the joystick reading reported back is 0 ±5 counts.

To adjust the physical position of the joystick pot you must remove the six feet from the bottom of the joystick assembly and remove the screws to open it up. You should see the screws which hold the pot in place. Loosen the screws and adjust the pot then tighten it back down.

The controller offset and gain pots are on a board inside the controller. Each axis has its own board with two pots for joystick adjustment. This is shown in the diagram below.

Warning There are **lethal** voltages inside the NEAT controller. Use extreme caution when making adjustments with the cover removed from the neat controller.



CONTROLLER SIDE VIEW

It is assumed that the person performing calibration is familiar with the `testrs2` program used for communicating with the NEAT controller as well as the NEAT command set. The commands for initiating communication with each individual axis are as follows:

```
X: testrs2 0 96          (wu 1)
Y: testrs2 1 96          (wu 2)
Z: testrs2 3 96          (wu 3)
```

X Axis Adjustment.

1. De-select the X axis (move the switch to the Z position).
2. Read the joystick value using the NEAT `rj` command.
3. If the reading is more than 5 counts away from 0 in either direction, adjust the offset pot for the X axis to bring the reading as close to 0 as possible.
4. Select the X axis.
5. Read the joystick value while the joystick is in the "dead stick" (center) position.
6. Adjust the physical centering of the pot to bring the value under 5 counts and within 5 counts of the de-selected reading.
7. Switch back and forth between Z and X/Y positions while monitoring the joystick value and make sure both readings are less than 5 (absolute value) and are within 5 counts of each other.
8. With the X axis selected move the joystick to the maximum position left and right while monitoring the value. The maximum values should be + and - 120 counts or more.
9. If the maximum values are less than 120 adjust the X controller gain pot to get at least 120 and then repeat the zero adjustment.

Y and Z Axes Adjustment.

1. Deselect the Z axis

2. Read the joystick value and adjust controller offset pot to bring this value under 5 counts.
3. De-select the Y axis.
4. Read the joystick value for the Y axis and adjust the controller offset pot to bring this value under 5.
5. Select the Y axis and record the dead stick reading.
6. Select the Z axis and record the dead stick reading.
7. Physically adjust the centering of the joystick pot to bring both Y and Z dead stick readings below 5 counts. Note: if this adjustment is not obtainable you may be required to offset the adjustments in steps 2 and 4 slightly to achieve this value.
8. Switch back and forth between Z and X/Y positions while monitoring the joystick value for both the Y and Z axes and make sure both readings are less than 5 (absolute value) and are within 5 counts of each other.
9. With the Y axis selected move the joystick to the maximum position left and right while monitoring the value. The maximum values should be + and - 120 counts or more.
10. If the maximum values are less than 120 adjust the Y controller gain pot to get at least 120. Then repeat the zero adjustment.
11. With the Z axis selected move the joystick to the maximum position left and right while monitoring the value. The maximum values should be + and - 120 counts or more.
12. If the maximum values are less than 120 adjust the Z controller gain pot to get at least 120. Then repeat the zero adjustment.

43. Check NEAT Stage Function

NOTE: This test is dangerous if not performed correctly, because stage flatness and Z stage limits have not been set yet. Use the lowest power (shortest) objective only, to maintain maximum distance between the objective and the stage.

Set lowest power objective. Make sure that the XYZ stage functions as expected.

Check

- ***Stage Initialization***
- ***Move to Home*** function in the **Manual Stage Control** window.
- Moving the stage using the uv wafer positioning window. Check all three axes.

44. Check Stage Cable Interference

Using Manual Stage Control move the stage to its extreme (0 to 800000) positions in X and Y axes and make sure the motor and encoder cables don't rub or interfere with movement. Pay close attention to the cables touching the mounting plate and to the cables on the stage itself.

45. Set up NEAT Controller Values

Using the `testneat` program, check the internal control parameters for each axis of the XYZ stage. The stage controller is accessed differently if it is configured for single-port communication or three-port communication.

If single-port communication is used the command is `testneat 3`. The X, Y, and Z axes are accessed with the commands `WU1`, `WU2`, and `WU3` respectively.

If three port communication is used running `testneat` is slightly more complicated. You must run testneat separately for each axis. To access the X access type the command `testneat 0` and enter the command `WU1`. When finished type **Control-C** to exit testneat. To access the Y axis the command is `testneat 1` and when `testneat` is running type `WU2`. To access the Z axis the command is `testneat 3` and when testneat is running type `WU3`.

To set each value in the table below type the two or three character command shown in parentheses followed by the new value as required. To check the acceleration and velocity values type `rv` (report values). This will display all the current values in the same order they appear in the table. To check the other values type `rd` (report defaults). A mnemonic describing each setting is displayed.

The joystick deadstick reading is read by the command `rj`. It should be checked on each axis with the X/Y–Z switch in both positions. Both readings should be under 5 and the difference between the readings should be under 5. If this is not the case adjust as described in the Stage Calibration Procedure.

Once all parameters are set two commands must be issued. The first is `jz` (joystick zero) which sets an offset so the deadstick joystick reading is interpreted as zero. The second is `sd` (set defaults) which writes the current parameters to EEPROM so they are not lost when the power is turned off. It is very important that these commands be issued on each axis.

Finally set the thumbwheel switch to position 0 on each axis.

X and Y Axes:

NEAT Parameter	Value
*Initial Velocity (vi)	20016
*Final Velocity (vf)	599904
*Acceleration (ac)	960364
*Deceleration (ac -)	960364
Jog Initial Velocity (ji)	20016
Jog Final Velocity (jf)	99936
Jog Acceleration (ja)	500204
Jog Deceleration (ja -)	4021527
Joystick Deadband (jd)	15
Deadstick reading (XY position)	<5
Deadstick reading (Z position)	<5
Difference	<5
Limit Stop (LSD)	disabled
Mnemonic Expansion (MED)	disabled
Move Finished (MFE)	enabled
Idle Current (ICD)	disabled

Z Axis:

NEAT Parameter	Value
*Initial Velocity (vi)	14400
*Final Velocity (vf)	186912
*Acceleration (ac)	196881
*Deceleration (ac -)	196881
Jog Initial Velocity (ji)	14400

Jog Final Velocity (jf)	72000
Jog Acceleration (ja)	360014
Jog Deceleration (ja -)	4021527
Joystick Deadband (jd)	15
Deadstick reading (XY position)	<5
Deadstick reading (Z position)	<5
Difference	<5
Limit Stop (LSD)	disabled
Mnemonic Expansion (MED)	disabled
Move Finished (MFE)	enabled
Idle Current (ICD)	disabled

46. Set Up NEAT Z-Stage Limits

1. Start with the 5× objective and the 488 nm laser line. Load a bare wafer.

   Warning When Z-Limit has not been set, load and unload wafers at 5× (the shortest objective) only.

2. In **Laser Scan Parameters**, change ***sample thickness*** to the wafer thickness.

8 in.	725 µ	
6 in.	675 µ	US
	625 µ	NEC
5 in.	625 µ	
4 in.	550 µ	

   For a 6 in. wafer, enter 675 µ for the sample thickness.

3. Move the ***Fine Z*** slider bar to 0.

   Warning Do not use ***Auto Focus*** (neither Coarse nor Fine).

4. Use the joystick Z control to focus the laser image.

   If it is not possible to focus, go to the UNIX shell. Type

   ```
   jot /usr/uv/.uvconfig
   ```

   Under `stage_spec`, find the line for `max_z_um`. For example, it could read

   ```
   max_z_um= 7217 7355 7354 7361 7183
   ```

   Increase the first number, which sets the height for the 5× objective, to `8000`. Then **Save** in `jot`, and return to the uv application window. Go to **Config, Misc.**, ***ReRead Config.***, ***Quit***.

5. After focussing, go to **Maintenance, Manual Stage Control**, select ***Z axis***, ***Report Pos.*** and note the value.

6. For objective 20×, 50×, 100×, 150×, repeat steps 3 to 5.

   Warning: Before switching objectives, lower the stage using the joystick Z control.

To convert from the position reported to the values to enter in .uvconfig, multiply by 0.1016 and then add 650 (wafer thickness plus 25

Example:

	Report Pos		Max Z Limit
5X	64927	* 0.1016 + 650 =	7247
20X	64892	* 0.1016 + 650 =	7243
50X	62657	* 0.1016 + 650 =	7016
100X	64626	* 0.1016 + 650 =	7216
150X	63337	* 0.1016 + 650 =	7085

7. In `.uvconfig`, under `stage_spec`, change the numbers in the max_z_um line. Continuing the example above, the line would read:

   ```
   max_z_um = 7247 7243 7016 7216 7085
   ```

8. **Save** in `jot`, go to **Config, Misc,** ***ReRead Config***, then ***Quit***.
9. Check Z_limit.

   At 5×, move the ***Fine Z*** slider bar to 26. Focus the laser image using the joystick Z control.

   Go to **Maintenance, Manual Stage Control**, choose ***Z***, and click on ***Z_Dist_Fr_ConfigLimit***.

10. For other objectives, repeat step 8. Verify that the wafer thickness is close to this number minus 25.

Test the limits at each objective by performing a Stage Autofocus with the wafer door open and a wafer on the stage. There should be a gap between the wafer and the objective. Record the limits on the data sheet.

Z_Dist_Fr_ConfigLimit	5×	20×	50×	100×	150×
	651	651	651	651	651

47. Check Stage Limit Switches

Operation of all limit switches is verified by driving the stage axes to their extreme ends of travel using programmed moves and checking that the controller does not attempt to drive the stage further into the limit switch. Check Limit Switch function by moving to points above and below normal travel (use 900,000 for the positive limit and -20,000 for the negative limit). The stage should stop moving when you move to these positions if the limits are working properly. There should be no metal to metal contact at the ends of travel. Use the NEAT command rl to check the limit switch status, it reports back - for the negative limit and + for positive limit.

48. Check Stage Z-Axis Backlash

Using a the laser display, measure the backlash in the coarse Z-Axis mechanism using a 50× or lower power objective. Bring a wafer into focus on the laser display by moving the Z-Axis slowly up (always move in the same direction so as not to enter a region of backlash). With the wafer in focus, use small relative move commands to bring the Z-Axis down while observing Z-motion on the laser display. Record how much commanded movement is required to get the Z-Axis to actually move, as indicated by focus changes in the laser display. The Z-Axis may respond initially to commands before entering a backlash region, so be sure to move at least a total of 50 microns from focus. The fine Z-Axis may be used to keep the wafer in focus during this test. Maximum backlash to be less than 4µ.

49. Check Coarse Z Shift

Using a patterned wafer with tall features or 10µ spheres slowly move through focus with joystick at 100×. Observe in both laser and white light images that there is not a perceivable shift in X or Y while moving through focus. Measure and record. Less than 5µ is acceptable.

50. Adjust Stage Flatness

Measure Z height at the center of the wafer and the four corners of the stage. Adjust the stage leveling screws so that when moving to the four corners of the stage and focusing, the wafer can be focused without moving the coarse Z stage and with less than 10µ movement of the fine Z stage.

There are four adjustment screws, at the corners of the stage. Adjustments should be made to both of a pair of diagonally opposite screws at the same time, raising one corner and lowering the other, in order to avoid stressing the stage and thereby bending it. This gives two perpendicular axes for adjustment. If the stage surface is flat but not level, the difference between the Z height at the center and at diagonally opposite corners will be equal in magnitude and opposite in sign. If the surface is bent, the magnitudes will be different. Releasing stress by loosening an adjustment screw should allow the stage to return to flatness, since these stresses are in the elastic range.

51. Check Fine Z Control Range

Check that the Fine Z Stage has movement throughout its entire range. This is done by obtaining a Laser image and checking that movements of one count make a difference in the laser intensity of the image at the top and bottom of the travel. The Joystick is used in conjunction with the Fast Z control to focus the sample.

Note maximum travel indicated on top of the slider bar on the screen, which must be greater than 50µ. Also verify that focusing is smooth and travel at the "top end" has not been lost. To do this, focus a pattern and step up the slider in 0.1µ increments, refocusing with joystick at each step until the entire range has been gone through. Calibration has not been performed yet so this number is not accurate; it is only an indication of full travel.

Optical Calibration

52. Clean Optics

Carefully inspect the laser and white light image at all settings (wavelengths, magnifications, filters, bright/darkfield, etc.) for dirt, scratches, non-uniformity, fringing or other defects. If any appear, determine the source and clean as described in the Optical Alignment Procedure.

Check screen images for Dirt, Scratches, (non-) Uniformity, and Fringes (circle letter when debasement is observed).

458 nm

	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
Laser BF	D S U F	D S U F	D S U F	D S U F	D S U F
Laser DF	D S U F	D S U F	D S U F	D S U F	D S U F
WL BF	D S U F	D S U F	D S U F	D S U F	D S U F
WL DF	D S U F	D S U F	D S U F	D S U F	D S U F

488 nm

	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
Laser BF	D S U F	D S U F	D S U F	D S U F	D S U F
Laser DF	D S U F	D S U F	D S U F	D S U F	D S U F
WL BF	D S U F	D S U F	D S U F	D S U F	D S U F
WL DF	D S U F	D S U F	D S U F	D S U F	D S U F

515 nm

	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
Laser BF	D S U F	D S U F	D S U F	D S U F	D S U F
Laser DF	D S U F	D S U F	D S U F	D S U F	D S U F
WL BF	D S U F	D S U F	D S U F	D S U F	D S U F
WL DF	D S U F	D S U F	D S U F	D S U F	D S U F

53. Check White Light Image

Normal Illumination

Adjust the Camera Intensity through its entire range to check that it can be adjusted from software. There is no adjustment below about 50 with the current white light power supply. Check the image with the standard wafer. Observe that the illumination is uniform across the field of view. Check for any dirt in the optics (and clean as necessary as described in the Optical Alignment Procedure). Check all objectives and record the results on the data sheet.

Dark Field Illumination

By looking at a random pattern on a wafer, check that the edges of features are appropriately highlighted when darkfield illumination is selected. Check that both horizontal and vertical features are highlighted. This feature is available only for those objective lenses with darkfield illumination capability. Check that the mechanism moves smoothly from BF to DF and back. Check the image quality at all objectives which have darkfield capability. Record the results on the data sheet.

54. Check Composite Video and S-Video Output

Composite Video Output

On the front panel of the White Light Video Monitor switch to the composite video input. Check the White Light image quality at several positions on the wafer at different objectives, filters (modes) and in both White Light Only and Laser/White Light modes.

S-Video Output

On the front panel of the White Light Video Monitor switch to S-Video input and perform the same tests as described above.

55. Adjust Optics

If the instrument generates good images with uniform illumination, procede to the next step. Otherwise, adjust the optics as described in the Optical Alignment Procedure.

56. Adjust Orthogonality

This adjustment will determine a factor to adjust for errors in orthogonality of the NEAT stage. This is very important for proper positioning of defects. The proeedure is as follows.

1. Obtain a test wafer with die patterns that are known to be orthogonal.
2. Move the stage to the lower left corner of the die on the left edge of the wafer, nearest to 0 in the Y axis.
3. Record the X/Y coordinates as LeftX and LeftY respectively.
4. Move to the lower left corner of the die on the right edge of the wafer in the same row as step 2.
5. Record the X/Y coordinates as RightX and RightY respectively.
6. Move to the lower left corner of the top row die nearest to 0 in the X axis.
7. Record the X/Y coordinates as TopX and TopY respectively.
8. Move to the lower left corner of the bottom row die in the same column as step 6.
9. Record the X/Y coordinates as BottomX and BottomY respectively.
10. Calculate the horizontal angle in degrees by the formula

$$\theta_H = \left(\frac{180}{\pi}\right)\text{atan}\frac{Y_{right} - Y_{left}}{X_{right} - X_{left}} \qquad \text{(EQ 1)}$$

11. Calculate the vertical angle tangent by the formula

$$\theta_V = \left(\frac{180}{\pi}\right)\text{atan}\frac{X_{top} - X_{bottom}}{Y_{top} - Y_{bottom}} \qquad \text{(EQ 2)}$$

12. Calculate the `stg_orthogonality_deg` value as $\theta_E = \theta_H - \theta_V$, and enter this value in the `.uvconfig` file. For example:

```
stg_orthogonality_deg = 0.0523
```

57. Adjust Flat Finder Offset Parameter

This parameter adjusts for offsets in the placement of the wafer on the stage after pre-aligned setting. These are caused by slight offsets in the placement of the prealigner in relationship to the stage. When this parameter is out of adjustment the wafer pattern shifts in the Y axis when moving in the X axis. The value can be set to any number in the range of ±2.5°. The number is internally rounded off to steps of .125° (1/8 °) which is the resolution of the prealigner. The procedure to calculate this offset is as follows.

1. Set the `flat_finder_offset_angle` parameter in the `.uvconfig` file to 0.000 degrees.
2. Load a patterned wafer.
3. Move the stage to the lower left hand corner of a die on the left edge of the wafer and record the X and Y positions as LeftX and LeftY.

4. Move the stage to the lower left hand corner of a die on the right edge of the wafer on the same row and record the positions as RightX and RightY.
5. Calculate the parameter in degrees using the formula:

$$\theta = \left(\frac{180}{\pi}\right)\text{atan}\frac{Y_{right} - Y_{left}}{X_{right} - X_{left}}$$

6. Enter the value calculated in step 5 in the `flat_finder_offset_angle` parameter in the `.uvconfig` file.
7. Update the system using the button in the ***Config/Misc*** window and reload the wafer.
8. Check the accuracy by moving from the left edge of the wafer to the right edge of the wafer. The die pattern should not move in the Y axis.

58. X, Y, Z sizing

In the `.uvconfig` file there is a calibration factor for each objective and each XY resolution setting of the laser image. Usually it is sufficient to calibrate at one objective and resolution setting and carry the number across to the other objectives and resolutions. This procedure will be described as well as the procedure for checking other objectives and resolution settings.

In `.uvconfig` the calibration table appears in this form.

```
confocal_z_res =  12.20
confocal_x_amp_obj0 = 1426  713   357  178
confocal_x_amp_obj1 = 1426  713   357  178
confocal_x_amp_obj2 = 1426  713   357  178
confocal_x_amp_obj3 = 1426  713   357  178
confocal_x_amp_obj4 = 1426  713   357  178
confocal_y_amp_obj0 = 1426  713   357  178
confocal_y_amp_obj1 = 1426  713   357  178
confocal_y_amp_obj2 = 1426  713   357  178
confocal_y_amp_obj3 = 1426  713   357  178
confocal_y_amp_obj4 = 1426  713   357  178
```

The first line is the calibration factor for the Fine Z axis. The next 10 lines are calibration of the X and Y scan per objective, with 5 lines each for X and Y. Notice there are four columns for each objective. These are the four XY Resolution settings, 100%, 50%, 25%, and 12.5% respectively, corresponding to ***Zoom1***, ***Zoom2***, ***Zoom4***, and ***Zoom8***. Notice that the numbers in each line are identical. Typically this is how the calibration will come out.

The value of the objective magnification is taken into account in the measurement formula so no adjustment is required per objective. The calibration factor per objective is there for cases when an objective's magnification is not exactly right or when more accuracy is required. The calibration per XY resolution is similar. Typically we calibrate at the largest scan size and divide the calibration by two for each subsequent scan size. (e.g. 1426/2=713, 1426/4=357, 1426/8=178.) We typically calibrate using 10.0 micron spheres at the 100x objective and 100% largest scan size, then find the calibration factor for other scan sizes by dividing by two and carrying the same numbers across all objectives. (Other objective and scan sizes are of course checked after calibration.) This is the procedure which will be detailed below. The procedure is similar using other sphere sizes, objectives or scan sizes.

For greatest precision, the measurement is made using different size spheres for each zoom factor, thus:

1	10µ
2	5µ
4	2µ
8	1µ

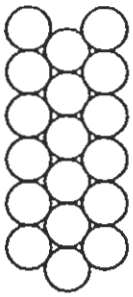
Notice in the table of calibration data the objectives are referred to as obj0, obj1, etc. This is because the objective powers are configurable and will vary from system to system. Before calibrating you should be familiar with what objectives are loaded in the system.

The basic calibration procedure is to measure latex spheres which have a known size, usually 10.0µ and 2.019µ. If the system is not calibrated, when spheres are measured the measurement value is something other than 10.0µ. To correct the measurement divide the measurement value obtained by the latex sphere size (10.0µ). Multiply this number by the current calibration factor for the objective/resolution setting used to obtain the new calibration factor. Enter the new calibration factor in the table and take the measurement again. This time the measurement should be more accurate. Repeat the procedure if the measurement is out of specification. Calibrating X and Y axes require one measurement method and calibrating Z requires another so the procedures will be described separately.

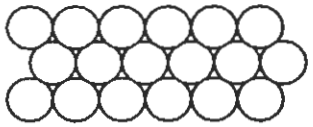
X or Y Calibration. This measures center to center distance of touching spheres.

1. Obtain a slide with 10.0 micron latex spheres deposited on it.
2. Place a "dummy" wafer, preferably an aluminum blank, in a cassette slot.
3. Using the Manual Robot Control mode, get the wafer from the slot. This will move the wafer from the cassette to the robot area.
4. Using a drop of isopropyl alcohol, secure the slide on the wafer. Try to make sure the area with the spheres on it is near the center of the wafer. This will make it easier to find spheres.
5. Again, using the Manual Robot Control mode, put the wafer on the stage. (Do not go to the prealigner. This is unnecessary and dangerous.)
6. Using the wafer map move the stage to 0,0 coordinates.
7. Slowly move the stage up in the Z axis using the Joystick. **Do not use the Stage Autofocus function** at any time during this procedure because the system may not see the slide and this could cause the stage to crash into an objective. If the slide was placed with the spheres near the center of the wafer you should be able to see the spheres as the slide comes into focus.
8. Increase the magnification by moving the objective power up incrementally until you can make out the spheres. Usually 20× or 50× works well to find spheres to work with. Do not go up to a very high power objective because you will have to search for suitable spheres first.
9. Moving the stage in X and Y axes, look for spheres suitable for calibration. If you are calibrating the X axis you need to find spheres touching end-to-end in the

X axis and to calibrate Y you need spheres touching end-to-end in the Y axis. This is shown in the drawing below.



Y Calibration
Sphere Orientation



X Calibration
Sphere Orientation

10. Once you find spheres which are oriented properly you can move up to the 100× objective. (Be careful when positioning the stage at 100× since the working distance is only 100µ.)
11. At 100× objective with the XY Resolution set to 100, set the Fine Z Position near the center of its range and very carefully move the Joystick Z control until the spheres are in focus.
12. Move the Fine Z control through the focus range of the spheres. You should see the laser image change as you move the spheres through the focal plane. At one point you should see a bright spot in the center of the spheres. Set the Fine Z stage so this spot is as small and bright as possible.
13. Set the number of slices to minimum (5).
14. In the Fine Z control box click on the ***S*** for start position and ***F*** for finish position without moving the Fine Z stage at all. This sets the software for taking a Surface with minimal movement of the Fine Z stage.
15. Take a surface (Click the ***Surf*** button).
16. Once the surface is complete, select a ***2D, XY Cut Plane*** window with its cursor set to ***Size*** mode and place it in the largest window. You may have to set this up.
17. Measure the distance between two adjacent sphere centers. This is done by placing the rubber band box so its edges cross the bright spot at the center of the spheres.
18. Get the measurement value from the area to the right of the image. If you are calibrating X use the horizontal value and if you are calibrating Y use the vertical value.
19. Divide the value measured by 10.0 (the Sphere size) to obtain the correction factor.
20. Select **Calibration** from the **Maintenance** menu. A dialog box appears with the current calibration data at the top and selectors at the bottom
21. Select the objective and scan size you are working with, in this case 100× and 100%. A word of caution: selecting an objective or scan size not only selects the calibration data for adjusting but also switches the objective in to place or changes the scanner resolution. Be careful to select the proper objective and scan size. When an objective and scan size is selected, two slider bars for adjusting calibration appear with the current calibration factor as the center value.

22. Select the bar for the axis you are calibrating and multiply the current calibration factor times the correction factor found in step 19 to get the new calibration factor.
23. Slide the slider bar for the axis you are calibrating over to the new calibration factor. Note: the new calibration factor may be out of the slider bar range. If this is the case slide the bar over as far as possible and save the data to file. Then the slider bar will change to the data you saved as the center position. Continue sliding over until you reach the new calibration factor.
24. Once the calibration factor is entered on the slider bar save the file by clicking on the ***Save*** button.
25. Re-measure the spheres and repeat steps 19–24 until the measurement is within specifications (±2%).
26. Once the measurement is within specification divide the 100% calibration factor by 2 to obtain the new calibration factor for the 50% XY resolution setting at 100×. Divide the 100% number by 4 to obtain the calibration factor for the 25% XY resolution setting and by 8 for 12.5%. Enter these numbers by selecting the appropriate XY resolution setting and adjusting the X or Y amplitude slider bar as appropriate.
27. Copy the numbers obtained at the 100× objective over to the other objectives by selecting the objectives and resolutions and adjusting the X or Y amplitude.
28. Once the entire table is complete click the ***Save*** button to save the calibration data to disk.
29. Check the calibration at other objectives and XY resolution settings by switching objectives and resolution and measuring the spheres. At some settings smaller spheres may be required (10m for 100%, 50% and 2.019m for 25%, 12%). Normally measurements will be within specification, but if not some small adjustments may be necessary at the other objectives and resolution settings. If so, follow the same procedure to correct the initial 100×, 100µ measurement.

Z Calibration. This measures distance from the glass to the top of the spheres.

1. Follow steps 1 through 8 in the X or Y Calibration procedure to load the spheres.
2. Moving the stage in X and Y axes, look for spheres which are suitable for Z calibration. The best are those aligned in the Y axis (as shown in the drawing above, labeled Y Calibration Sphere Orientation) with a column of spheres exposed on one side, such as the column on the far right of the drawing.
3. Move up to the 100× objective (Be careful when positioning the stage when the 100x objective is in place.) and center the spheres in the field of view. You should have a column of spheres on one side of the screen with blank slide on the other and the transition close to the center of the screen.
4. Set the ***Fine Z Stage*** control near its midrange (about 25) and move the Coarse Z Stage with the joystick until the spheres are in focus. **Warning:** Be extremely careful not to move up too far because the Z Stage crash limits do not apply when viewing a slide on top of a wafer.)
5. Move the Fine Z Stage through the entire focus range of the spheres. You should see the slide come into focus when the Fine Z is moved up. As you move the stage down the spheres will move through focus until you see the top of the spheres which appear as a large patch. Adjust the Laser Intensity at the brightest point so there is no saturation.
6. Set the number of slices to maximum (128).

7. Move the Fine Z Stage back to the point slightly above where the slide surface is in focus (up), so that the focal plane is just below the surface of the slide. This slide is in focus when the blank area with no spheres becomes bright. Move up slightly past this area to find the starting point for the surface.
8. Click the "S" button to set the surface start point.
9. Move the Fine Z Stage down through the sphere focus range until you see the top of the sphere come into focus and continue to move until the top of the sphere just goes out of focus.
10. Click the "F" button to set the surface finish point.
11. Click the Surface button to acquire a surface.
12. Move the windows around so you have a small ***2D, XY Cut Plane*** window with a Cut cursor and a large ***2D, XZ Cut Plane*** window with a size cursor.
13. Move the cursor in the ***XY*** window until it crosses the center of a sphere. You should see the profile in the ***XZ*** Window change as the cursor is moved. Be sure you leave the cursor on the very center of the sphere or the highest point of the sphere.
14. In the ***XZ*** window you should see the profile of the sphere which looks like a vertical rectangle with a round top. Along the X axis you should see about half of the view show a roughly straight line which is the slide itself. Place the sizing cursor around the profile of the sphere (you are only concerned with the vertical size).
15. Read the measurement from the status bar on the side (the vertical reading).
16. Divide 10.0 (the Sphere size) by the value measured to obtain the correction factor.
17. Multiply this correction factor by the calibration factor in the `.uvconfig` file (`confocal_z_res`) to obtain the new calibration factor. The calibration factor is the first line of the section of the `.uvconfig` shown earlier in this procedure.
18. Use the `jot` editor to change the calibration factor in the `.uvconfig` file. Save.
19. ***Re-Load Config***. If the Z calibration is off, repeat the procedure to fine tune the calibration factor. Note there is only one calibration factor for the Z measurement since this is calibrating the Fine Z Stage, not the optics.

59. Adjust Objective Parfocality

The objectives are parfocal when changing from one to another does not change the focus. In order to achieve this, a Z-axis offset must be set for each objective. This is because the focal distances of the objectives in the turret cannot be made exactly equal. The offset is entered in the `.uvconfig` file, under `objective_spec`. It is entered using the following format:

```
objective_offset_nm=o1, o2, o3, o4, o5
```

where `o1`, `o2`, etc. refer to the objective position offsets. Objective 1 (usually 5x) is the reference so its value should always be 0.

Using `jot` to edit `.uvconfig`, record the current numbers for the offset then set all the parfocality numbers to 0. Run `uv` and select the 5× objective and set the Fine Autofocus to 0. Focus the image carefully using the Z joystick. Make sure the stage is moving up when movement is stopped. Enter **Manual Stage Control** mode, select the ***Z axis*** and select the ***Report Position*** function. Record this value.

Move the stage down with the Joystick and select the next higher objective. Again, focus carefully using the Z joystick making sure to stop when the stage us moving up. Record the Z stage position (obtained from **Manual Stage Control**) for this objective. Repeat this for the other objectives.

To determine the offsets subtract the 5× Z Stage value from the higher objective Z Stage values. Multiply this number (which is in motor steps) by 101.6 to obtain the value in nanometers. Enter this number into the appropriate place in the `.uvconfig` file.

Check the objective parfocality by setting the objective to 5× and the Fine Z Stage to 25.00. Focus a wafer using the joystick Z control, then move to successively higher objectives. When a higher power objective is selected the turret is moved and an Autofocus is performed using the Fine Z Stage. Note the number for the Fine Z Stage Position at each subsequent objective, which should be 25±10µ.

60. Adjust Laser/White Light Parcentricity

Parcentricity is the alignment of the laser and white light images so that the same feature is under the cursor in both windows.

Select a feature and center it in the White Light Monitor field of view. The feature should also be centered in the Laser image field of view. If it is not, loosen the camera mounting screws just enough so that the camera can be moved. Position the camera so that the feature is aligned identically in both windows.

By simultaneously viewing the white light and laser images of a wafer, verify that the laser images the center portion of the white light image and that the two images are aligned angularly. If there is an angular offset, loosen the collar on the camera mount and rotate it so that the images are aligned identically.

Set the system for simultaneous viewing (white light and laser image). Focus on the surface of a flat reflective target using the laser image. Verify that the surface is also in focus on the white light image. Switch to white light only and verify that focus does not change. Adjust the camera focus if necessary.

61. Adjust Objective Parcentricity

Objective Parcentricity refers to the ability to view a feature in the center of the field of view when moving from one objective to another. As the turret is moved from objective to objective the optics path is not perfectly aligned so there is some shift of the image and a feature will appear to move around. To correct this there are stage offsets in the `.uvconfig` file for the X and Y axis indicating how far the stage must move, in microns, to re-center a feature when changing objectives. The numbers are referenced to the lowest power objective (Position 1).

The offsets appear in the `.uvconfig` file under the `objective spec` section in the following form:

```
objective_xoffset_um = 0   0   -200 234 0
objective_yoffset_um = 0   0    120  99  0
```

The values shown are for a typical system with 3 objectives. The first line is the X axis stage offsets in microns, the second line is the Y axis stage offsets in microns. Each line has 5 offsets, for objective 1 through 5. The first offset is the reference so it is always 0. In the example above only objectives 1, 3 and 4 are in use so these are the only offsets used. Unused objective positions have an offset of 0.

The easiest method to calculate objective parcentricity offsets is to first set all the values to 0 in the `.uvconfig` file then check the offsets and put the values into the .uvconfig file. This is detailed in the following procedure.

1. Using the `jot` editor, enter 0 for all 5 offsets in the `.uvconfig` file parameters for `objective_xoffset_um` and `objective_yoffset_um`.
2. Save the file and run the uv program again.
3. Load a wafer and find a feature which is easily recognized.
4. Center it in the field of view at the lowest power objective.
5. Note the Stage X and Y positions reported on the screen.
6. Move to the next highest objective. The feature will probably have moved and it may even be out of the field of view.
7. Find the feature again, and move it to the center of the screen.
8. Note the X and Y positions for this objective.
9. Repeat steps 6 through 8 for the remaining objectives.
10. To calculate the offset for each objective subtract the X and Y positions at the lowest power from its X and Y position. Be careful to pay attention to the sign of the answer.
11. Again using the `jot` editor, enter the new values for the X and Y offsets. the order of objective offsets are obj1, obj2, obj3, obj4, obj5. If an objective slot is not used in your system enter 0 as a place holder for its offset.
12. Save the `.uvconfig` file and reload it in uv.
13. Check the new parcentricity by finding the feature and centering it at the lowest power objective (obj1) then switching in progressively higher objectives. The feature should remain close to the center of the field of view through the range of objectives.

62. Check Volume & Surface Acquisition

Obtain a laser image at 100×of a suitable particle or defect. Using the laser window, setup and take a surface and volume of data to make sure these functions work. This test only checks basic software functionality. For information on how to set up the system for Surface and Volume Acquisition, check the System User's Manual.

Surface Acquisition: Verify that a volume data set can be reduced to a surface using a patterned wafer.

Volume Acquisition: Verify that a volume data set can be acquired and displayed using a patterned wafer.

63. Check Laser Image Illumination Uniformity

This test is somewhat subjective so it must be done carefully. You must verify that the optics are aligned properly to achieve optimum laser image uniformity. A bare silicon or other non-patterned wafer shows up any problems with laser uniformity best.

Load a non-patterned wafer and check the image at the lowest power objective. Ideally the laser image would be all one color and intensity at the lowest objective. If this is not achievable make sure that the bright spot is centered in the field of view. Move the stage slowly up and down with the joystick, and observe whether the bright spot moves. Check this at all wavelength settings then move throughout the range of objectives and check all wavelengths at each one.

If the image shows significant nonuniformity, correct it using the Optical Alignment Procedure.

64. Test Laser Scan Linearity

Using a patterned wafer that has highly regular features in X and Y, verify that the size of a given feature does not vary when it is viewed at different locations on the laser image. For example, if a pattern of uniformly spaced vertical lines is viewed, they should all appear the same size, and a given line should not change thickness when it is moved from left to right on the screen.

The proeedure is as follows:

1. Obtain a good laser image on a reference wafer at the highest power objective.
2. Find a vertical line feature about one micron wide.
3. Move the line to the left side of the Laser Image field of view.
4. Measure the size of the line (this is most easily done by placing a paper on the screen and marking the edges of the line, and then measuring the paper.)
5. Move the line to the right by a distance of about 1/5th of the field of view and measure the line again.
6. Continue to move the line and measure it until you have measured the line at various places across the entire field of view for a total of 5 measurements.
7. Calculate the spread of the measurements (maximum minus minimum). The spread must be less than 5 % of the measurement value.

65. Adjust Laser Attenuator and Intensity per Line and Objective

The laser attenuator is used to drop the laser power of the stronger lines (wavelengths). Otherwise the return signal is so strong that the PMT must be operated at very low gain with degraded response. The result is streaking in the laser image. This procedure sets the minimum attenuation which will eliminate streaking, and the laser power which provides the clearest illumination.

Before starting verify that the attenuator filters are arranged properly. Go to the LON Diagnostics window and set the Laser Attenuator filter wheel to no attenuation (Position 1). Use the slider labeled Laser Power to adjust the PMT for a bright laser image. Switch the Laser Attenuator filter wheel to progressively higher settings (Low, Medium, High, and Max). The laser image should get darker as each filter is switched in. If not, install the filters properly before proceeding.

To check or select a different laser attenuation filter, go to **Maintenance, LON Diagnostics, *Laser Attenuation, Pos***. The order of laser attenuation filters on the menu is

Filter position:	1	2	3	4	5	6
Name	Pos 1	Low	Pos 3	Med	Max	High (H)

Position 3 is not used. The order of filters on the laser attenuation wheel, from no attenuation (no filter) to greatest attenuation, is:

1	Pos 1
2	Low
4	Med
6	High
5	Max

The attenuator per line and objective settings are configured in a table in the `confocal spec` section of the `.uvconfig` file as follows:

```
laser_atten_at_458line = 1 1 1 1 1
laser_atten_at_488line = 1 1 1 1 1
laser_atten_at_515line = 1 1 1 1 1
laser_atten_at_Allline = 1 1 1 1 1
```

There are 5 settings for each wavelength, one per objective, in the order of Obj1, Obj2, Obj3, Obj4, Obj5.

The Laser Intensity setting adjusts the PMT gain for optimum image clarity for a given sample. The Laser Intensity offset values are set up in the `confocal spec` section of the `.uvconfig` file as in the following table:

```
obj_Laser_int_458_offset =  0 0 5 20 0
obj_Laser_int_488_offset =  0 0 5 20 0
obj_Laser_int_515_offset =  0 0 5 20 0
obj_Laser_int_all_offset =  0 0 5 20 0
```

1. It is easiest to adjust the attenuation by starting with all positions set to 1 or no attenuation. If this is not the case use the `jot` editor to change all attenuator values to 1.
2. Load a patterned wafer into the system and obtain an image at the lowest power objective.
3. Switch to the 458 wavelength selection.
4. Obtain a good image on a patterned section of the wafer and check for streaking.
5. If streaking is present, open the **LON Diagnostics** window.
6. Switch to progressively higher attenuators until the streaking disappears. Check for streaking in bright field and dark field. Note: you will probably have to increase the PMT voltage as attenuators are switched in to obtain a nice bright image. Do this from the ***PMT*** section of **LON Diagnostics** by decreasing the PMT Voltage parameter.

7. Once a good image with no streaking is achieved record the attenuator setting on the data sheet.
8. Adjust the laser power so that the image is gold colored, and record the laser power value.
9. Move up to the next highest objective and repeat steps 4 through 8.
10. When you have completed all objectives at the 458 wavelength setting move to the next wavelength setting and repeat steps 4 through 9. Complete for 488 nm, 515 nm, and ALL.
11. When settings for all wavelengths and objectives have been recorded, use the `jot` editor to enter the attenuator values. Be sure to enter the numbers in the proper spot for each objective. If an objective is not loaded enter a 1 in its place for no attenuation.
12. Calculate the Laser Intensity offsets. The 458 nm wavelength, Obj1 setting is used as the reference value, so its offset is 0. This is the upper left number in the table. To calculate the offsets it is easiest to start with a table which is used to enter the actual Laser Intensity settings.

Line/Objective	Obj1	Obj2	Obj3	Obj4	Obj5
458					
488					
515					
All					

13. To obtain the offset value for the `.uvconfig` table at a given wavelength and objective, subtract the 458 wavelength, Low power objective Laser Intensity setting from the wavelength and objective value you are calculating. Note that some values are positive and some are negative.
14. Use the `jot` editor to enter the offsets calculated in step 10 into the table in `.uvconfig`. Enter 0 for the value for any unused objective location.
15. In **File**, **Recipe**, ***Laser Param***, change the laser intensity to the value for the 5× objective and 458 nm laser line. Then ***Save*** the recipe.

66. Adjust Bright Field/Dark Field Intensity Offset

This offset is similar to the offset per wavelength and objective from the step above except there is only one parameter. This will let the system automatically adjust the laser intensity when switching from bright field to dark field mode.

This parameter appears in the `confocal spec` section of the `.uvconfig` file as follows:

```
laser_inten_dark_field_offset = -8
```

Start with the value set to 0. Obtain a good image in Brightfield (Normal) mode. Note the Laser Intensity setting. Switch to Darkfield mode, and adjust the Laser Intensity to achieve the same brightness you had in Brightfield mode. Subtract the Brightfield mode Laser Intensity setting from the darkfield mode setting to obtain the value and enter it into `.uvconfig`.

67. Check Coarse and Fine Stage Autofocus and Adjust Parameters

In the Laser Scan Parameters window there are settings for the Laser Intensity value used during Stage Autofocus for each wavelength setting.

Make sure the wafer thickness is set properly in the ***Laser Scan Parameters*** window (this is critical for autofocus). The SEMI standard nominal thickness for a 6 in. wafer is 625 microns. To set this select **Laser Scan Parameters** from the **Settings** menu. A window opens which has the ***Wafer Thickness*** settings. Adjust the setting to the proper thickness for size of wafer to be used.

Size	Thickness
4 in./100 mm	550
5 in./125 mm	625
6 in./150 mm US	625
6 in./150 mm NEC	675
8 in./200 mm	725

TABLE 1.

Setting the Stage Autofocus Intensity is done by successive approximations. In the upper left corner of the ***Laser Scan Parameters*** window are four values, usually set in the range of 25–50. Get a laser image on a typical wafer at 50× or 100× with the wavelength set to 488 nm. Click the stage autofocus button and observe the laser image. On a successful stage autofocus you should see bright flashes in the laser image as the stage is moved through focus. If the Stage Autofocus Intensity is set properly, the wafer should be in focus when the function is complete. If the wafer is not in focus when the Stage Autofocus is complete, move the stage in the Z axis using the joystick until it is in focus. The direction you move to focus the wafer will tell you which way of adjust the Stage AF Intensity parameter. If the you moved the stage down to focus the parameter is too low. If you moved the stage up to focus the parameter is too high. Adjust the parameter accordingly until the Stage AF works properly at 488 nm. Switch to the other wavelengths and repeat the tests. Once all wavelengths are working properly, record the Stage AF Intensity settings on the data sheet.

Check that the system autofocuses properly at a variety of locations. Check both the coarse stage autofocus and the fine fast-Z autofocus for all wavelengths at each objective position in both BF and DF. Record the results (pass/fail) on the data sheet.

68. Adjust White Light Intensity per Objective and Filter

This is similar to the adjustment above. When switching from objective to objective some adjustment of the white light camera intensity is required. There is a table in the `.uvconfig` file which stores the offset per Objective and Filter. In normal operation these offsets allow the software to adjust the Camera Intensity automatically when the operator switches objectives or operating modes.

The offsets appear in the `.uvconfig` file in the following form

```
objective_camera_int_all_offset = 0 0 20 30 0
objective_camera_int_pol_offset = 70 0 90 100 0
objective_camera_int_yel_offset = 20 0 40 50 0
objective_camera_int_dim_offset = 50 0 70 80 0
```

The four lines correspond to the 4 white light filter settings, All, Polarizer, Yellow and Dim. Recent systems with Gemini optics have a notch filter, which uses the All

settings. Each filter line has 5 values for Obj1, Obj2, Obj3, Obj4 and Obj 5. All of the values are referenced to the 5×, All Pass setting. Any unused objective position values should be set to 0.

These parameters are most easily adjusted from the **LON Diagnostic** window. It is easiest to start with the parameters set to 0. Create a table as was done when setting the Laser Intensity per Line and Objective to enter the Camera Intensity values at each setting.

Filter/Objective	Obj1	Obj2	Obj3	Obj4	Obj5
All					
Polarizer					
Yellow					
Dim					

The steps to determine the offsets are as follows:

1. Load a patterned wafer.
2. Obtain a white light image at the lowest power objective with the filter set to All. It is critical to make sure that the image is focused very well.
3. Adjust the Camera Intensity for a bright image without saturation. This is a subjective measurement. At this setting of the white light image (5×, All Pass) you may need to set the Camera Intensity to minimum.
4. Record the Camera Intensity in the table.
5. Switch to the next higher objective.
6. Be sure the image is in focus. Since at this point the Stage and Fine autofocus have been tested the fine Autofocus should work.
7. Adjust the Camera Intensity until you achieve the same brightness level you had in step 3, and record this value in the table.
8. Repeat steps 5 through 7 for the remaining objectives.
9. Switch to the next camera filter and the lowest power objective and repeat steps 3 through 8 until you have checked all wavelengths and objectives.
10. To obtain the offset value for the `.uvconfig` table at a given wavelength and objective, subtract the All Pass filter, Low power objective Camera Intensity setting from the wavelength and objective value you are calculating.
11. Use the `jot` editor to enter the offsets calculated in step 10 into the table in `.uvconfig`. Enter 0 for the value for any unused objective location.
12. Record the values on the data sheet.

69. Check Image Stability, Vibration, Noise, Etc.

This test is somewhat subjective and requires great care. Check both the laser and white light images for any movement in any axis (X, Y, Z or a combination of any of these). The Laser Image is most susceptible to vibration and noise so it should be inspected very carefully.

The most rigorous test of the Laser Image is at the highest power objective at Zoom8, where any vibration or instability is amplified as much as possible. Set the laser image to this mode and observe a small feature. You should see no movement in the X or Y axis. The Laser Intensity should not fluctuate (fluctuations in Laser Intensity usually are an indication of vibration). Although rigorous testing of the Laser Image

is performed at the highest zoom, do not overlook the lower XY resolution and objective settings.

Look for noise in the Laser Image. This can come in a variety of forms. Pixel fluctuation (small pinpoints of light flickering) can be an indication of a problem in the PMT or Frame Grabber. Long horizontal "streaks" are sometimes an indication of a weak or miss-aligned laser. Short streaks indicate that a higher laser attenuation should have been set in step 68, Set Laser Attenuation.

Any abnormalities in either the laser or white light image which are not understood should be brought to the attention of a qualified engineer.

70. Check Gray Scale for Missing Codes and Missing Pixels

Take Volumes and Surface Images on the reference wafer. Check the Volume and Surface images in 2D views (and 3D for Surface). Verify that the images look correct and there are no missing codes in the laser image digitization by viewing a portion of a wafer that results in a smooth transition from a low intensity to a high intensity. Check that there are no abrupt changes in the gray scale that would result from missing bits in the digitizer.

In the volume images check to ensure there are no black pixels in otherwise colored areas (missing pixels).

Both problems described here are subtle so inspect the images carefully. Also check the images for any other abnormalities.

71. Verify Wavelength Selection

This is a final check of the laser image after all adjustments have been made. At this point in the procedure all laser imaging parameters should be adjusted. This test checks that they were adjusted properly.

On the reference wafer, verify that viable images can be obtained on all three wavelengths. Check that the video noise is not excessive, that reasonable PMT voltages produce an image, and that DC offsets in the image are not too large. Check on all objectives in BF and DF. Note any excessive alignment or laser intensity offsets when changing between wavelengths.

72. Verify Parameters in `.uvconfig`

At this point in the test most of the parameters in the `.uvconfig` file have been adjusted. Some of the parameters, however, are not adjusted but simply have default values which should be checked or can be set for customer preference. It is beyond the scope of this procedure to completely describe the `.uvconfig` file.

This is the list of parameters which should be checked. It is not a complete listing of the `.uvconfig` file. Note that the numbers are examples only, and are not the actual contents of the `.uvconfig` file. Any line with a "#" character in front is a comment line describing some aspect of the file. Lines followed by a "*" are already adjusted as part of this procedure.

```
#confocal scan calibration: resolution in nanometers
#PMTAMP: offset= -10 to 20, range=80 to 120
```

```
#laser_white_sw_cube_1_0 = 0 for WhiteLight with cube IN
confocal_spec = 21
confocal_xy_res = 100.00 50.00 25.00 12.50
confocal_z_res = 13.70 *
confocal_x_amp_obj0 = 3550 1775 888 444 *
confocal_x_amp_obj1 = 3550 1775 888 444 *
confocal_x_amp_obj2 = 3550 1775 888 444 *
confocal_x_amp_obj3 = 3550 1775 888 444 *
confocal_x_amp_obj4 = 3550 1775 888 444 *
confocal_y_amp_obj0 = 4080 2040 1020 510 *
confocal_y_amp_obj1 = 4080 2040 1020 510 *
confocal_y_amp_obj2 = 4000 2040 1020 510 *
confocal_y_amp_obj3 = 4080 2040 1020 510 *
confocal_y_amp_obj4 = 4080 2040 1020 510 *
laser_pwr_at_line = 125 30 100 0
laser_atten_at_458line = 1 1 1 1 1 *
laser_atten_at_488line = 2 2 2 1 1 *
laser_atten_at_515line = 2 2 2 2 1 *
laser_atten_at_Allline = 4 4 4 2 2 *
laser_inten_dark_field_offset = -8 *
pmtamp_min_offset_n_range = 0 90
white_light_dark_field_power = 200
laser_white_sw_cube_1_0 = 0

#online: 1=yes, 0=no
# res is um/step
# port: 0=port1, 1=port2, -1=none
# auto-focus intensity for 458 488 515 all
stage_spec = 24
port_number = 4
x_online = 1
y_online = 1
z_online = 1
x_resolution = 0.2500000
y_resolution = 0.2500000
z_resolution = 0.1016000
x_encoder_res = 0.5000000
y_encoder_res = 0.5000000
z_encoder_res = 0.1016000
max_z_um = 6360 6734 6775 6777 6744 *
stage_af_zero = 50
stage_af_inten = 45 40 30 35 *
xy_200mm_level_zoffset = 40 40
xy_center_offset_um = -3957 -2188
joystick_gain = 10 7 3 1 1
joystick_z_gain = 1 1 1 1 1
stage_angle_tangent = 0.00300000
flat_finder_offset_deg = 0.00000000
stg_orthogonality_deg = 0.00000000 *
fine_af_offset = 0
fine_af_algorithm = 5
stg_xy_init_final_spd_acc_um = 10000 150000 250000
stg_af_lo_mag_algorithm = 1
```

```
#port: 0=port1, 1=port2, 2=GMIportA, -1=none
robot_spec = 2
port_number = 2
456inch_wafer_flat_size_deg = 29.000 29.500 29.500

#Objective spec: 1st line= label, 2ndLine = nominal power
objective_spec=  5   20   50   100   150
objective_power= 5.0 20.0 50.0 100.0 150.0
objective_na= 0.30 0.55 0.85 0.95 0.95
objective_offset_nm = 0 364196 395643 396450 364902 *
objective_xoffset_um = 0 -43 -74 -88 -51 *
objective_yoffset_um = 0 -85 -100 -74 -86 *
objective_camera_int_all_offset = 0 0 0 10 80 *
objective_camera_int_pol_offset = 150 150 100 100 180 *
objective_camera_int_yel_offset = 0 10 40 30 100 *
objective_camera_int_dim_offset = 60 80 100 120 180 *
obj_laser_int_458_offset = 0 5 10 20 30
obj_laser_int_488_offset = -14 -10 -5 -5 10 *
obj_laser_int_515_offset = -20 -19 -18 -5 -3 *
obj_laser_int_All_offset = -16 -12 -9 -10 4 *
cam_mode_norm_use_dim = 1 0 0 0 0 *

lon_spec
turret_step = 5
filter_wheel_delay_laser_line = 600
filter_wheel_delay_laser_atten = 600
filter_wheel_delay_cam_filter = 600
cam_filter_ap_pos_5_or_6 = 5

system_spec
laser_saver_minutes = 5
kla_deskew_die_offset = 2
cfg_next_die_position = 0
enable_bin_image_tx = 0
zrange_search_num_steps = 44
zrange_search_laser_gain = 8.5
```

Refer to the CRS User's Manual appendix B for adjusting any parameter which has not been adjusted at this point. For the most part the default settings are appropriate but each parameter should be checked. The list above is current at the time of writing this procedure but the configuration file changes on some software upgrades. Be careful that any new parameters are configured properly.

Once the parameters are entered copy the `.uvconfig` file off to a floppy disk for backup purposes.

Baffles and Panels

73. Install Baffle

At this point all adjustments are complete so the Inner Air Baffle can be installed. Install it and recheck the image for vibration or instability.

74. Install Panels and Labels and Check all Labels

Install all outer panels and attach their ground straps. Check all system labels.

Chapter 7 Installation Test Data Sheet

Equipment Model and Serial Numbers

Make sure that there is a record in the system log book of the model number and serial number of all third party equipment in the system. This includes but is not limited to the items listed in the following table.

Item	Model Number	Serial Number
SGI Computer		
NEAT Stage and Controller		
Equipe Robot		
Equipe Prealigner		
Equipe Controller		
White Light Power Supply		
Laser		
Laser Power Supply		
Sony Camera		
Page Scanner Mirrors and Controller		
Codonics Printer		

Circuit Board Revisions and Serial Numbers

Record the Revision, Serial Number and Programmable IC Information here and in the log book, if this has not been done previously.

LON Node	Revision	Serial Number	Programmable IC
1 Laser Power			
5 Bright Field/Dark Field			
9 Turret/Optics			
2 Camera Filter Wheel			
4 Laser Attenuation Filter Wheel			
3 Laser Line Select Filter Wheel			
8 PMT Preamp			
11 Solenoid			
6 Page Scanner			

LON Node	Revision	Serial Number	Programmable IC
7 Fast Z			
10 Cassette Switch input			
12 Aperture			
13 Docking (optional)			
14 Mask (optional)			

SDP Frame Grabber Fans

Not too hot. P / F

Check Blower Function

Not too hot. P / F

Check Inner Frame Isolation

Cables P / F

Rock inner frame. P / F

Test Vacuum Sensors

System Vacuum Cutoff_____ in Hg.

Robot Vacuum Cutoff_____ in Hg.

Chuck Vacuum Status with wafer P / F Without wafer P / F

Check Value of Internal and External Fuses

Check the value of the all fuses in the system.

Description	Quantity	Designations	Result
AC 3A 250V FB	1		P / F
AC 1A 250V FB	1		P / F
DC 630 mA FB	1	F202	P / F
DC 1A FB	1	F201	P / F
DC 3A 250V FB 5mm×20mm	1	F203	P / F
DC 5A 250V FB 5mm×20mm	1	F205	P / F
DC 6.3A FB	3	F205 F206 F207	P / F P / F P / F

AC Voltage

Check the AC Voltage at the rear panel J104 (External Exhaust), J106 (Aux 1) and J107 (Aux 2). Check the polarity and Grounding of J106 and J107 either with an outlet tester or by verifying the proper voltages at each pin with respect to ground. If the outlet tester is not available, the shorter slotted pin is the Hot lead and should have 120 VAC potential with respect to ground, the longer slotted pin is Neutral and should have 0 VAC potential with respect to ground. Check for 0 ohms from the ground lead to the chassis. Perform the same measurements at the internal Outlet Strip.

Ground lead/chassis, 0 Ω P / F

Outlet	Voltage	Polarity	Ground
J104 Exhaust		P / F	P / F
J106 Aux 1		P / F	P / F
J107 Aux 2		P / F	P / F
Outlet Strip H27			
SGI		P / F	P / F
White Light Power		P / F	P / F
Robot		P / F	P / F
Spare		P / F	P / F
Dist. Amp.		P / F	P / F
Camera		P / F	P / F

EPO, Power Off Switch and External Interlock

EPO shut down P / F

EPO switch in, cannot turn on P / F

Power Off Switch shut down P / F

Remove jumper shut down P / F

Jumper removed, cannot turn on P / F

DC Voltages at SDP/FG

Adjust and record

+5 VDC Analog to 5.00 VDC, ± 2% _____
-5 VDC Analog to -5.20 VDC, ± 2% _____
+5 VDC Digital to 5.00 VDC, ± 2% _____

DC Voltages at TB 205 and TB204

Connection	Nominal	Measured
TB204-1	12 VDC +	
TB204-2	12 VDC +	
TB204-3	12 VDC +	
TB204-4	12 VDC C	
TB204-5	12 VDC C	
TB204-6	12 VDC C	
TB204-7	5 VDC +	
TB204-8	5 VDC +	
TB204-9	5 VDC +	
TB204-10	5 VDC +	
TB204-11	5 VDC C	
TB204-12	5 VDC C	
TB204-13	5 VDC C	
TB204-14	5 VDC C	
TB204-15	15 VDC +	
TB204-16	15 VDC C	
TB204-17	15 VDC -	

Connection	Nominal	Measured
TB204-18	5 VDC +	
TB204-19	5 VDC C	
TB204-20	5 VDC -	
TB205-1	5 VDC -	
TB205-2	5 VDC C	
TB205-3	5 VDC +	
TB205-4	15 VDC -	
TB205-5	15 VDC -	
TB205-6	15 VDC C	
TB205-7	15 VDC C	
TB205-8	15 VDC +	
TB205-9	15 VDC +	
TB205-10	5 VDC C	
TB205-11	5 VDC C	
TB205-12	5 VDC C	
TB205-13	5 VDC +	
TB205-14	5 VDC +	
TB205-15	5 VDC +	
TB205-16	12 VDC C	
TB205-17	12 VDC C	
TB205-18	12 VDC +	
TB205-19	12 VDC +	
TB205-20	120 VDC C	
TB205-21	120 VDC +	

Note: TB 204 connections are numbered left to right. TB 205 connections are numbered from the back of the machine to the front

Ground Strap on Laser PS and Robot

Initial when done.

Laser Power Supply_____

Robot_____

Electrical Safety Checks

High Voltage Dielectric Breakdown, <3.5 mA at 1400 VDC

Record value_____

Ground Continuity, < 0.1 at 25 A

Record value_____

Set up Camera

Remove the side panel from the Camera to gain access to its controls. Set the White Balance and the Automatic Gain Control to Off.

White Light Video Monitor

S-Video Cable seated _____

Composite Video seated at A input _____

S-Video image P / F

A image P / F

System Software Revision

Software Revision #_____

SGI Operating System Revision #_____

Time and Date on the SGI Computer

Initial when done.

Time correct_____

Date correct_____

Check Floppy and Tape Drive Access

Tape Drive P / F

Floppy Drive P / F

Codonics Printer

Network connection made_____

network ID number ____.____.____.____

Network ID number entered_____

ping status P / F

ping time, <5 msec P / F

Print image P / F

White Light Video Printer

Connection_____

Print P / F

LON Communication

Node	Firmware Version
1 Laser Power Controller	
5 Bright Field/Dark Field Controller	
9 Turret/Optics Controller	
2 Camera Filter Wheel	
4 Laser Attenuation Filter Wheel	
3 Laser Line Select Filter Wheel	
8 PMT Preamp	
11 Solenoid Controller	
6 Page Scanner Controller	
7 Fast Z Controller	

10 Cassette Switch Input	
12 Aperture Controller	
13 Docking Controller	
14 Mask Controller	

Check Cassette Size & Present Switches

Switch 1	Switch 2	Size	Value
Off	Off	6 in	
On	Off	4 in	
Off	On	5 in	
On	On	8 in	

Robot Controller Firmware Version

Version_____

Check Robot Communication Function

Initializes on Reset P / F

Check Robot Function

Robot responds properly to the teaching functions P / F

Wafer Handling

Size	Function	Result
8 in (200 mm)	Load 1 2 24 25	P / F
	Unload 1 2 24 25	P / F
6 in (150 mm)	Load 1 2 24 25	P / F
	Unload 1 2 24 25	P / F
5 in (125 mm)	Load 1 2 24 25	P / F
	Unload 1 2 24 25	P / F
4 in (100 mm)	Load 1 2 24 25	P / F
	Unload 1 2 24 25	P / F

Load/Unload of primary wafer size

Cycle wafers overnight P / F

Check Laser Interlock

Front switch
Laser turns off P / F
Hardware Warning message P / F

Back switch
Laser turns off P / F
Hardware Warning P / F

Check Laser Overtemp

Laser shut off (2–5 minutes) P / F

Time_____

Hardware warning P / F

Single Line Laser Power Monitor Function

Wavelength	Laser Power	*Read Laser Power*
458 nm	6 mw or_____	
488 nm	6 mw or_____	
515 nm	6 mw or_____	

Check Laser Current vs. Power

CurrMonitor Network Variable_____

Current_____(=***CurrMonitor***÷2.3052)

<6.5 A P / F

Check Laser Power Control

P / F

PMT Control Function

Adjusting the PMT High voltage changes the intensity of the Laser image P / F

PMT shuts itself off when the image intensity is saturated P / F

PMT recovers when the PMT gain is re-set P / F

Turret Function

Objective	Mag	Upward	Downward
1		P / F	P / F
2		P / F	P / F
3		P / F	P / F

Objective	Mag	Upward	Downward
4		P / F	P / F
5		P / F	P / F

BF/DF Controller

No binding P / F

No photo switch contact P / F

Flags do not contact switches P / F

Filter Wheel Home Positions

Flags centered in Home position

Laser Line Select P / F

Laser Attenuation P / F

White Light P / F

White Light Intensity Control Function

Camera Intensity slider adjusts the White Light brightness P / F

Power supply voltage

(4V at 50) Reading_____

(12V at 255) Reading_____

NEAT External Serial Ports

`testneat 1 to testneat 2` P / F

`testneat 2 to testneat 1` P / F

NEAT Joystick Function

Joystick motion

Objective	X	Y	Z
1	Fast Slow OK	Fast Slow OK	Fast Slow OK
2	Fast Slow OK	Fast Slow OK	Fast Slow OK
3	Fast Slow OK	Fast Slow OK	Fast Slow OK
4	Fast Slow OK	Fast Slow OK	Fast Slow OK
5	Fast Slow OK	Fast Slow OK	Fast Slow OK

Joystick creep

	X	Y	Z
X/Y	P / F		
Z			

NEAT Stage Joystick Zero

Deadstick joystick readings. Should be 0±5 counts.

	X/Y Selected	Z Selected
X axis reading		
Y axis reading		
Z axis reading		

Maximum levels. Should be <-120 or >120.

	Left	Right	Up	Down
Z axis selected				
X/Y axis selected				

Check NEAT Stage Function

Stage Initialization P / F

Move to Home function in the **Manual Stage Control** window P / F

Moving the stage using the uv wafer positioning window.

X P / F

Y P / F

Z P / F

Check Stage Cable Interference

	X	Y
0		
800000		

NEAT Controller Values

X and Y axes

NEAT Parameter	Value
*Initial Velocity (vi)	20016
*Final Velocity (vf)	599904
*Acceleration (ac)	960364
*Deceleration (ac -)	960364
Jog Initial Velocity (ji)	20016
Jog Final Velocity (jf)	99936
Jog Acceleration (ja)	500204
Jog Deceleration (ja -)	4021527
Joystick Deadband (jd)	15
Deadstick reading (XY position)	<5
Deadstick reading (Z position)	<5
Difference	<5
Limit Stop (LSD)	disabled
Mnemonic Expansion (MED)	disabled
Move Finished (MFE)	enabled
Idle Current (ICD)	disabled

Maximum travel >50µ P / F

Step up the slider in 0.1µ increments, refocusing with joystick at each step until the entire range has been gone through. P / F

Clean Optics

Dirt, Scratches, (non-) Uniformity, and Fringes (circle letter when debasement is observed).

458 nm

	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
Laser BF	D S U F	D S U F	D S U F	D S U F	D S U F
Laser DF	D S U F	D S U F	D S U F	D S U F	D S U F
WL BF	D S U F	D S U F	D S U F	D S U F	D S U F
WL DF	D S U F	D S U F	D S U F	D S U F	D S U F

488 nm

	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
Laser BF	D S U F	D S U F	D S U F	D S U F	D S U F
Laser DF	D S U F	D S U F	D S U F	D S U F	D S U F
WL BF	D S U F	D S U F	D S U F	D S U F	D S U F
WL DF	D S U F	D S U F	D S U F	D S U F	D S U F

515 nm

	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5
Laser BF	D S U F	D S U F	D S U F	D S U F	D S U F
Laser DF	D S U F	D S U F	D S U F	D S U F	D S U F
WL BF	D S U F	D S U F	D S U F	D S U F	D S U F
WL DF	D S U F	D S U F	D S U F	D S U F	D S U F

White Light Image

Normal Illumination

Objective	50–255	Uniform
1	P / F	P / F
2	P / F	P / F
3	P / F	P / F
4	P / F	P / F
5	P / F	P / F

Dark Field Illumination

Mechanism moves smoothly from BF to DF and back P / F

Edges of features highlighted in darkfield illumination

Horizontal features P / F

Vertical features P / F

Check Composite Video and S-Video Output

Composite Video Output

White Light image quality at several positions on the wafer at different objectives, filters (modes) and in both White Light Only and Laser/White Light modes P / F

S-Video Output

Same tests P / F

Optics

Good images with uniform illumination P / F

Orthogonality

`stg_orthogonality_deg` value_____

Flat Finder Offset Parameter

flat_finder_offset_angle_____

Moving from the left edge of the wafer to the right edge of the wafer, the die pattern should not move visibly in the Y axis P / F

X, Y, Z sizing

confocal_z_res = _____
confocal_x_amp_obj0 = _____ _____ _____ _____
confocal_x_amp_obj1 = _____ _____ _____ _____
confocal_x_amp_obj2 = _____ _____ _____ _____
confocal_x_amp_obj3 = _____ _____ _____ _____
confocal_x_amp_obj4 = _____ _____ _____ _____
confocal_y_amp_obj0 = _____ _____ _____ _____
confocal_y_amp_obj1 = _____ _____ _____ _____
confocal_y_amp_obj2 = _____ _____ _____ _____
confocal_y_amp_obj3 = _____ _____ _____ _____
confocal_y_amp_obj4 = _____ _____ _____ _____

Objective Parfocality

objective_offset_nm= _____ _____ _____ _____ _____

Objective	Z position	Offset, Steps	Offset, nm (multiply by 101.6)	FineZ after Autofocus (25±10µ)
1		0		0
2				
3				
4				
5				

Laser/White Light Parcentricity

Feature can be centered in both Laser and White Light fields of view P / F

Adjust Objective Parcentricity

objective_xoffset_um = 0 _____ _____ _____ _____
objective_yoffset_um = 0 _____ _____ _____ _____

Volume & Surface Acquisition

Surface Acquisition: Verify that a volume data set can be reduced to a surface using a patterned wafer P / F

Volume Acquisition: Verify that a volume data set can be acquired and displayed using a patterned wafer P / F

Laser Image Illumination Uniformity

	458	488	515
1	P / F	P / F	P / F
2	P / F	P / F	P / F
3	P / F	P / F	P / F
4	P / F	P / F	P / F
5	P / F	P / F	P / F

Laser Scan Linearity

Location	Width
Left edge	
Left	
Center	
Right	
Right edge	

Spread of the measurements (maximum minus minimum)_____

The spread must be less than 5 % of the measurement value. P / F

Laser Attenuator and Intensity

The order of filters on the laser attenuation wheel, from no attenuation (no filter) to greatest attenuation, is:

1	Pos 1
2	Low
4	Med
6	High
5	Max

Position 3 is not used. The attenuator per line and objective settings are configured in a table in the `confocal spec` section of the `.uvconfig` file as follows:

```
laser_atten_at_458line = ___ ___ ___ ___ ___
laser_atten_at_488line = ___ ___ ___ ___ ___
laser_atten_at_515line = ___ ___ ___ ___ ___
laser_atten_at_Allline = ___ ___ ___ ___ ___
```

Laser Intensity settings.

Line/Objective	Obj1	Obj2	Obj3	Obj4	Obj5
458					
488					
515					
All					

```
obj_Laser_int_458_offset = 0 ___ ___ ___ ___
obj_Laser_int_488_offset = ___ ___ ___ ___ ___
obj_Laser_int_515_offset = ___ ___ ___ ___ ___
obj_Laser_int_all_offset = ___ ___ ___ ___ ___
```

File, Recipe, ***Laser Param,*** set laser intensity to the value for the 5× objective and 458 nm laser line. Then ***Save*** the recipe. Initial when done. _____

Adjust Bright Field/Dark Field Intensity Offset

Brightfield (Normal) Laser Intensity _____

Darkfield mode Laser Intensity _____

Subtract the Brightfield mode Laser Intensity setting from the darkfield mode setting to obtain the value for

`laser_inten_dark_field_offset = _____`

Coarse and Fine Stage Autofocus

Once all wavelengths are working properly, record the Stage AF Intensity settings on the data sheet.

	458	488	515	All
Stage AF Intensity				

Test Coarse and Fine Z stage positioning at several locations for each setting (Objective, Laser Line, BF/DF).

	458 BF	458 DF	488 BF	488 DF	515 BF	515 DF	All BF	All DF
1	P / F	P / F	P / F	P / F	P / F	P / F	P / F	P / F
2	P / F	P / F	P / F	P / F	P / F	P / F	P / F	P / F
3	P / F	P / F	P / F	P / F	P / F	P / F	P / F	P / F
4	P / F	P / F	P / F	P / F	P / F	P / F	P / F	P / F
5	P / F	P / F	P / F	P / F	P / F	P / F	P / F	P / F

Adjust White Light Intensity per Objective and Filter

Camera Intensity values

Filter/Objective	Obj1	Obj2	Obj3	Obj4	Obj5
All					
Polarizer					
Yellow					
Dim					

```
objective_camera_int_all_offset = 0 ___ ___ ___ ___
objective_camera_int_pol_offset = ___ ___ ___ ___ ___
objective_camera_int_yel_offset = ___ ___ ___ ___ ___
objective_camera_int_dim_offset = ___ ___ ___ ___ ___
```

Check Image Stability, Vibration, Noise, Etc.

Set the highest power objective at Zoom8. Observe a small feature in the laser image. There should be no visible movement in the X or Y axis. P / F

The Laser Intensity should not fluctuate P / F

Noise in the Laser Image P / F

Pixel fluctuation (small pinpoints of light flickering) P / F

Long horizontal streaks P / F

Short streaks P / F

Any other abnormalities _____

_____

_____

_____

Check Gray Scale for Missing Codes and Missing Pixels

Volume Image looks correct P / F

Surface images looks correct P / F

Missing codes in the laser image digitization, in smooth transition P / F

In volume images, no black pixels in otherwise colored areas P / F

Any other abnormalities _____

_____

_____

_____

Verify Wavelength Selection

Check for video noise (N), reasonable PMT voltage (P), and DC offsets not too large (D). Mark any faults found.

Objective	458	488	515
BF 1	N P D	N P D	N P D
BF 2	N P D	N P D	N P D
BF 3	N P D	N P D	N P D
BF 4	N P D	N P D	N P D

Objective	458	488	515
BF 5	N P D	N P D	N P D
DF 1	N P D	N P D	N P D
DF 2	N P D	N P D	N P D
DF 3	N P D	N P D	N P D
DF 4	N P D	N P D	N P D
DF 5	N P D	N P D	N P D

Noteanyexcessivealignmentorlaserintensityoffsetswhenchangingbetweenwavelengths.

Parameters in `.uvconfig`

Parameters checked_____

Install Baffle

Inner Air Baffle installed_____

Recheck the image

for vibration P / F

for instability P / F

Install Panels and Labels and Check all Labels

Install all outer panels and attach their ground straps_____

Check all system labels_____

KLA Tencor

CRS Installation Acceptance

System #		Customer	
Software		Location	
Start Date		Date Complete	

These tests are designed for final checkout of the system
(after a detailed QC audit by manufacturing)
after installation at the customer site.

TEST MATERIALS:

I. Tencor standard patterned test wafer with test map.
II. Latex sphere standards for XYZ calibration.
III. Cassette for the size wafer specified by the customer
(with 25 dummy wafers for the cycle test)

Customer		FSE Engineer	
Signature		Signature	
Date		Date	

1) ROBOT PERFORMANCE

Cycle 1000 wafers using customer cassette and plate using all wafers available with the one defect review setting.

Wafer Size	Orientation
300mm	0°

Date	# of Cycles	Total # of Wafers	Status
			P☐ / F☐

2) PRE-ALIGNER PERFORMANCE

Load wafer for each setting and visually verify the notch alignment.

0°	90°	180°	270°
P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐

Using test wafer, confirm prealignment repeatability (≤ 800µm)
Load wafer
Locate the first deskew point
Use the 50x objective to align cross-hairs on deskew point
Perform and Record Stage Center Offset:

X-AXIS	Y-AXIS
µm	µm

Update and Note reference position
Unload Wafer
Repeat five times
Determine spread

	X AXIS	Y-AXIS
Reference	µm	µm
1	µm	µm
2	µm	µm
3	µm	µm
4	µm	µm
5	µm	µm
Maximum	µm	µm
Minimum	µm	µm
Spread	µm	µm

3) STAGE OPERATION

Load wafer map
Load test wafer
Perform 3 point deskew using 100x objective.
Go to the first test location using the 100x objective
Measure and note the deviations* for the locations 1 through 9

	X-AXIS	Y-AXIS
1	µm	µm
2	µm	µm
3	µm	µm
4	µm	µm
5	µm	µm
6	µm	µm
7	µm	µm
8	µm	µm
9	µm	µm
Max Error	µm	µm

* Note: if deviation is more than 10um perform stage accuracy calibration

4). AUTOFOCUS

Coarse

Perform stage focus at each objective and Laser line

Laser line	5x	20x	50x	100x	150x
458 nm	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐
488 nm	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐
515 nm	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐
ALL	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐

Fine

Select Laser Line
Perform stage focus at lowest objective
Switch to next objective
Note position of Fine-Z slider bar
Repeat for each Laser Line (Fine-Z should be in mid-range: 25 +/- 10)

Laser line	5x	20x	50x	100x	150x
458 nm	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐
488 nm	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐
515 nm	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐
ALL	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐

5) WHITE LIGHT IMAGE QUALITY

Observe pattern using all objectives, bright field, and dark field.
Make a printout of image at highest objective.

	5x	20x	50x	100x	150x
BF	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐
DF	P☐ / F☐	P☐ / F☐	P☐ / F☐	N / A	N / A

6) LASER IMAGE QUALITY

Observe pattern using all objectives, bright field, and dark field.
Obtain an image at each zoom setting for 100x
Do a surface at each setting and note any imperfections
Make a printout of image at highest objective.

	5x	20x	50x	100x	150x
BF	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐
DF	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐	P☐ / F☐

7) Z CALIBRATION

Using 100x objective and ZOOM x 1, obtain surface data on 10µm spheres.
Using profile feature, measure the height of the sphere caps above substrate.
Measured height must be ± 10%.
Print screen with measurement data.

	Actual	Measure	Error	% Error
ZOOM x 1	µm	µm	µm	%

8) XY CALIBRATION

Using 100x objective and each ZOOM, obtain surface data on calibration spheres.
Select the 2D XY Cut Plane window with the cursor set to Size mode.
Measure the distance between spheres using the "Rubber Band Box".
Set the edges to the bright spot at the center of spheres that are aligned correctly.
Measurements must be ± 10%.
Print each screen with the measurement data.

X Axis	Actual	Measure	Error	% Error
ZOOM x 1	µm	µm	µm	%
ZOOM x 2	µm	µm	µm	%
ZOOM x 4	µm	µm	µm	%
ZOOM x 8	µm	µm	µm	%

Y Axis	Actual	Measure	Error	% Error
ZOOM x 1	µm	µm	µm	%
ZOOM x 2	µm	µm	µm	%
ZOOM x 4	µm	µm	µm	%
ZOOM x 8	µm	µm	µm	%

9) XY RESOLUTION

a) Using 0.22µm spheres in live laser scan.
Observe and resolve single spheres. P ☐ / F ☐
Observe and resolve double (contacting) spheres. P ☐ / F ☐
Observe and resolve triple (contacting) spheres. P ☐ / F ☐
Do a surface image and print the screen. P ☐ / F ☐

b) Using 0.10µm spheres in live laser scan.
Observe and resolve single spheres. P ☐ / F ☐
Do a surface image and print the screen. P ☐ / F ☐

10) Review test

If possible obtain customer wafer and review file for that wafer.
Stage center offset must be done for each scanning machine to be verified.
Perform a full deskew and drive to several defects to verify operation.

P ☐ / F ☐

NOTES:

Description
Contents of the configuration file as used by Ver 2.4 LIS system software
7 April 98

.uvconfig

1.0 Introduction:

The file: */usr/uv/.uvconfig* contains all software configuration information. It is an ASCII file that can be edited by using the *jot* editor. Currently, the .uvconfig contains the following parameters:

1.1 screen spec
1.2 user spec
1.3 confocal spec
1.4 stage spec
1.5 robot spec
1.6 objective spec
1.7 Ion spec
1.8 system spec
1.9 camera interface spec
1.10 sequence screen spec
1.11 user screen spec
1.12 function key definitions
1.13 stage mapping spec
1.14 adc config spec
1.15 annotation spec
1.16 light tower spec
1.17 inspex socket spec

The general format of .uvconfig is:

Each line is at most 80 character long, characters after this limit are ignored.
Lines that start with # are treated as comments.
Empty line is also treated as comment.
Every non-comment line is expected to be in the form of: key_word = values

1.1 Screen spec:

line 0: screen_spec = n

n = number of lines that follows.

line 1: screen_name = name

name = descriptive name of the screen..

line 2+: window_spec = WindowTypeKey xStart ystart width height

WindowTypeKey is one of the following:

slices	surface
cassette	rt_confocal (laser window)
defect_map	referenceImg
text_status	microscope

196A

xStart, yStart, width, and height are in screen pixels, in the range of x: 0 to 1262, y: 0 to 913. These are less than 1280x1024, because of the border and top/bottom displays.

Example:

```
screen_spec = 15
screen_name = 1L + 3S
window_spec = slices          310 3   90  38
window_spec = slices          401 3   90  38
window_spec = cassette        492 3   90  38
window_spec = rt_confocal     583 3   90  38
window_spec = defect_map      674 3   90  38
window_spec = referenceImg    765 3   90  38
window_spec = slices          856 3   90  38
window_spec = text_status     947 3   90  38
window_spec = surface         1038 3  90  38
window_spec = sequence_stat   1129 3  90  38
window_spec = slices          3   5   300 300
window_spec = microscope      3   310 300 300
window_spec = text_status     3   615 300 300
window_spec = surface         310 45  950 867
```

1.2 User_spec:

line 0: user_spec = n

n = number of lines that follows

line 1+: name directory password privilege

name is the name of the user

directory is the name of the user's directory from /usr/uv

password can be alphabet or number, or a single '*' for none.

privilege is either 's' for service, 'a' for administrator, or nothing for operator level access.

Example:

```
user_spec = 2
bruce bruce abc   s
joe           joe         *
```

1.3 Confocal_spec:

line 0: confocal_spec

Keyword identifies this group

line 1: confocal_xy_res = aa bb cc dd

Numbers for the four scan resolutions, x1, x2, x4, x8 using 100x objectives. Only 2 decimal points accepted.

aa,bb,cc,dd are nominal resolutions.

line 2: confocal_z_res = ee

actual fineZ step size, in nanometers..

line 3: confocal_x_amp_obj0 = m n o p
line 4: confocal_x_amp_obj1 = m n o p
line 5: confocal_x_amp_obj2 = m n o p
line 6: confocal_x_amp_obj3= m n o p
line 7: confocal_x_amp_obj4 = m n o p
line 8: confocal_y_amp_obj0 = m n o p
line 9: confocal_y_amp_obj1 = m n o p
line 10: confocal_y_amp_obj2 = m n o p
line 11: confocal_y_amp_obj3 = m n o p
line 12: confocal_y_amp_obj4 = m n o p

for all objectives, and page-scan XY amplitudes.
numbers are in integer, for the 4 scan resolutions, These are the actual page-scan x amplitude used to get the nominal XY resolution.

line 13: laser_pwr_at_line = xx yy zz nn

For each of the 4 laser line choices, the laser power lever is specified here.
xx = laser power setting for the 458 line, yy zz nn are for 488, 515, and ALL. range is 0 to 125 for 0 to 25mw.

line 14: laser_atten_at_458line = xx yy zz mm nn
line 15: laser_atten_at_488line = xx yy zz mm nn
line 16: laser_atten_at_515line = xx yy zz mm nn
line 17: laser_atten_at_Allline = xx yy zz mm nn

For each of the 4 laser line and 5 objective choices, the laser power filter selection is specified here.
xx = laser power attenuation filter position setting for the first objective position, yy zz mm nn are for second, third, fourth and fifth. The range is 1 to 6. 1 = no attenuation, 2 = minimum, 3 = no attenuation, 4 = medium, 5 = max. attenuation, 6 = high attenuation.

line 18: laser_inten_dark_field_offset = n Not used To Much

Compensate for the differences in laser intensity when switching between bright and dark field.

line19: pmtamp_min_offset_n_range = xx yy

xx is the minimum gain, can be -10 to 10. This is the gain sent to hardware if user selects 0 in LaserIntensity slider.
yy is the range of LaserIntensity slider. The LaserIntensity slider always display a range of 100, internally, 100 is linearly mapped into yy. yy can be between 80 to 120.

line 20:pmtamp_command_zero = n

determines a Zero signal for the PMT. Default = 146. Use a value of 128. This will produce better results.

line 21: white_light_dark_field_power = n 255

the number n is the camera intensity used in dark field.

line 22: laser_white_sw_cube_1_0 = n N/A for 14 systems

n = 0: the beam splitter cube is always in, no switching between laser/white light mode changes.

196C

n = 1: beam splitter is in for laser, out for white light. This setting degrade system throughput and reliability. This value is used on only older systems.

line 23: use_white_light_aperture_control = n

n = 0: if white light aperture control is NOT used.

n = 1: if automated aperture controller hardware is installed,

line 24: white_light_aperture_step_limit = n

n = the aperture stop limit, default = 150

line 25: white_light_5x_pixel_res_um = n

Pixel resolution is used for white light autodeskew. This value is used to inform the system the size of the pixels in microns on the white light screen. This enable to system to correct for misalignment by moving the stage in microns based on number of pixels the feature is out of alignment.

line 26: surface_grass_threshold = n

The threshold used to determine any surface area to be "grass" and thus eliminated. Default n = 0, threshold operation is turned off.

line 27: laser_488_notch_cam_filter_01 = n

n = 0: 488 notch filter not used

n = 1: 488 notch filter used

Notch filter is used in Gemini Optics upgrade for ADC. This will enable gemini optics if installed.

line 28: laser_atten_polarizer = n

Using Polarizer for laser attenuation instead of laser attenuation filter wheel.

n = 0: filter wheel

n = 1: polarizer

line 29: polarizer_travel_limit = 100

Travel limit for the polarizer

Example:

```
confocal_spec
confocal_xy_res = 100.00 50.00 25.00 12.50
confocal_z_res =  13.35
confocal_x_amp_obj0 = 4000 2000 1000 500
confocal_x_amp_obj1 = 4000 2000 1000 500
confocal_x_amp_obj2 = 4000 2000 1000 500
confocal_x_amp_obj3 = 4000 2000 1000 500
confocal_x_amp_obj4 = 4000 2000 1000 500
confocal_y_amp_obj0 = 3520 1760 880 440
confocal_y_amp_obj1 = 3520 1760 880 440
confocal_y_amp_obj2 = 3520 1760 880 440
confocal_y_amp_obj3 = 3520 1760 880 440
confocal_y_amp_obj4 = 3520 1760 880 440
laser_pwr_at_line = 125 30 100 0
laser_atten_at_458line = 2 1 1 1 1
laser_atten_at_488line = 4 4 2 1 1
laser_atten_at_515line = 4 4 2 2 1
```

```
laser_atten_at_Allline = 4 3 2 1 1
laser_inten_dark_field_offset = -8
pmtamp_min_offset_n_range = 0 90
pmtamp_command_zero = 128
white_light_dark_field_power = 255
laser_white_sw_cube = 0
use_white_light_aperture_control = 1
white_light_aperture_step_limit = 150
white_light_5x_pixel_res_um = 2.0000
surface_grass_threshold = 1
laser_488_notch_cam_filter_01 = 0
laser_atten_polarizer = 0
polarizer_travel_limit = 100
```

1.4 Stage_spec

line 0: stage_spec = n

n = number of lines that follows

line 1: port_number = n

n = -1 no stage.

n = 0,1,2,3 single rs232 port on SGI port 1,2,3, or 4.

n = 4 use 3 rs232 to communicate to the stage, SGI port 1/2/4 connected to X/Y/Z axis.

line 2: x_online = a

line 3: y_online = b

line 4: z_online = c

a, b, c: 0 = offline, 1 = online

line 5: x_resolution = xx

line 6: y_resolution = yy

line 7: z_resolution = zz

line 8: x_encoder_res = xe

line 9: y_encoder_res = ye

xx, yy, zz are microns per motor step

xe, ye are microns per encoder step.

line 10: max_z_um = aa bb cc dd ee

aa bb cc dd ee are the maximum Z stage travel limits, in microns for each objective.

line 11: stage_af_zero = xx

xx is the dark level set during coarse autofocus

line 12: stage_af_inten = aa bb cc dd

intensity values to autofocus for 458/488/515/ALL laser lines

line 13: xy_200mm_level_zoffset = xx

xx is the Z position difference for a travel of a 200mm wafer, in micron. The system will autofocus if the stage travels xx microns in x or y direction.

line 14: joystick_gain = aa bb cc dd ee

XY Joystick gain settings for all objectives are specified here. Range = 1 - 500

line 15: joystick_z_gain = aa bb cc dd ee

Joystick gain of Z axis for all objectives. Range = 1 - 500

line 16: flat_finder_offset_deg = xx

the angle correction required to make wafer load at a straight position, streets are exactly vertical or horizontal. Default is 0.0, typical value is less than +/- 0.5

line 17: stg_orthogonality_deg = xx

The angle between the stage's X and Y axes is machined into the stage and can not be changed. Adjustment of this angle, however, can be made in software to compensate for differences in tolerance. The degrees of XY orthogonality, expressed in degrees from 90 is specified here.

line 18: fine_af_algorithm = n

n = 4: for non ADC systems average of Patch

n = 3: for ADC systems See AutoRevs

line 19: stg_xy_init_final_spd_acc_um = xx yy zz Don't change

xx is the initial xy speed, yy is the final speed, and zz is the acceleration of the xy axis for any programmed moves, all in microns.

line 20: stg_af_lo_mag_algorithm = n

affects only low power objectives, i.e.: 5X and lower

n can be 0, 1, or 2.

n = 0: old stage autofocus algorithm, to be used only for systems with fast Z board version 1.6 or older.

n = 1: new stage autofocus algorithm, this is a more reliable algorithm, but requires fast Z board firmware version 1.7 or newer. 23

n = 2: no stage autofocus, instead, move to Z limit, less 150 microns.

line 21: fine_af_pscan_y_amp_256 = 1700 850 425 212 Patch Scan Line Scan Vs Patch Scan

line 22: fine_af_pscan_y_amp_512 = 3400 1700 850 425

line 23: fine_af_pscan_y_start_256 = 1844 1844 1844 1844

line 24: fine_af_pscan_y_start_512 = 1844 1844 1844 1844

For patch scan fine autofocus. These number should not be changed without first consulting the factory.

line 25: fine_af_prog_p_scanner_1_0 = n

n = 0: patch scan fine auto focus is to be disabled

n = 1: patch scan hardware is installed, and the patch scan is desired

line 26: stage_controller_type = n

n = 0: Single Axis controller

n = 1: Multi-Axis controller

line 27: fine_af_continuous_01 = n

Not Used

line 28: fine_af_conti_parameters_time_step = aa bb

Not Used

line 29: fine_af_adc_shift = n

Stage movement in microns away from defect in the Y Axis for Autofocing. Minimum distance is 50µ recommended 100 µ. Positive and Negative values accepted.

line 30:delay_before_cap_100th_sec = n

Delay before capturing an image after stage movement. This delay allows for stage To Stabalize be for Cap. Image

line 31: x_encodercnt_loadpos_mask = n

Specifies the Stage X Load/Unload Position for the Mask system. Move the stage to the desired Load/Unload position, Read the x encoder count in the Manual Stage dialog box, Input the value in this field.

Example:

```
stage_spec = 32
port_number = 3
x_online = 1
y_online = 1
z_online = 1
x_resolution = 0.2500
y_resolution = 0.2500
z_resolution = 0.1016
x_encoder_res = 0.5000
y_encoder_res = 0.5000
max_z_um = 6950 6900 6950 6990 6500
stage_af_zero = 90
stage_af_inten = 58 40 40 40
xy_200mm_level_zoffset = 100
joystick_gain = 500 125 50 25 17
joystick_z_gain = 500 125 50 25 17
flat_finder_offset_deg = 0.25
stg_orthogonality_deg = 0.0000000
fine_af_algorithm = 4
stg_xy_init_final_spd_acc_um = 5000 150000 250000
stg_af_lo_mag_algorithm = 1
fine_af_pscan_y_amp_256 = 1700 850 425 212
fine_af_pscan_y_amp_512 = 3400 1700 850 425
fine_af_pscan_y_start_256 = 1844 1844 1844 1844
fine_af_pscan_y_start_512 = 1844 1844 1844 1844
fine_af_prog_p_scanner_1_0 = 1
stage_controller_type = 1
fine_af_continuous_01 = 0
fine_af_conti_parameters_time_step = 10 250
fine_af_adc_shift = 0
delay_before_cap_100th_sec = 50
x_encodercnt_loadpos_mask = 203489.000000
```

1.5 Robot spec:

line 0: robot_spec = n

n = number of lines that follows

line 1: port_number = n

n = -1, 0,1,2,3

-1 = no robot

0,1,2,3 = SGI port 1,2,3,4

line 2: 456inch_wafer_flat_size_deg = xx yy zz

The minimum wafer flat angle size, in degrees for the 4, 5 and 6 inch wafers. If one uses single flat wafer exclusively, xx,yy,zz can all be set to 0.5 degrees. If, however, two flat (major and minor) wafers are expected,

then xx yy and zz should be set to angle that is half way between the major and minor flats.

line 3: robot_interlock_1_or_0 = n

n = 0: off/disabled

n = 1: on/enabled

when the robot interlock is on, the robot will not respond if the cassette and/or the robot cover are not in place.

line 4: robot_type_1_or_0 = n

n = 0: Mecs

n = 1: Equipe

line 5: smif_option_04568 = n

n = 0: NoSmif

n = 4: 4" Smif

n = 5: 5" Smif

n = 6: 6" Smif

n = 8: 8" Smif

line 6: option_26slot_cass12_1_or_0 = n1 n2

n = 0: 25slots,

n = 1: 26slots

n1 field is for the cassette plate position

n2 field is for the smif position

line 7: smif_material_portid = 0

Port id for the Smif Assembly

Example:

```
robot_spec = 7
port_number = 2
456inch_wafer_flat_size_deg = 29.000 34.500 34.500
robot_interlock_1_or_0 = 0
robot_type_1_or_0 = 1
smif_option_04568 = 0
option_26slot_cass12_1_or_0 = 0 0
smif_material_portid = 0
```

1.6 Objective Specs

line 0: objective_spec = aa bb cc dd ee

aa, bb, cc, dd, ee are text labels for the name of each objective

line 1: objective_power = p1 p2 p3 p4 p5

nominal power of the objectives

line 2: objective_na = n1 n2 n3 n4 n5

nominal Numerical Aperture of the objectives

line 3: objective_offset_nm = o1 o2 o3 o4 o5

Z stage distance movement after each objective change. The first objective is used as reference, so that o1 should be zero(0), Unused objectives should also be zero.

line 4: objective_xoffset_um = ox1 ox2 ox3 ox4 ox5

line 5: objective_yoffset_um = oy1 oy2 oy3 oy4 oy5

Stage XY movement after each objective change. The first objective is used as reference, so that ox1 and oy1 should be zero(0), Unused objectives should also be zero.

line 6: objective_camera_int_all_offset = aALL bALL cALL dALL
line 7: objective_camera_int_pol_offset = apol bpol cpol dpol
line 8: objective_camera_int_yel_offset = ayel byel cyel dyel
line 9: objective_camera_int_dim_offset = adim bdim cdim ddim

The amount of relative camera intensity adjustment for each objective/camera filter.

line 10: objective_camera_int_458_offset = 0 0 0 0 0

Not Used

line 11: objective_camera_int_488_offset = 0 0 0 0 0

The amount of relative camera intensity adjustment for each objective with Gemini optics

line 12: objective_camera_int_515_offset = 0 0 0 0 0

Not Used

line 13: use_camera_notch_filter_01 = n

Not Used

line 14: obj_Laser_int_458_offset = a458 b458 c458 d458 e458
line 15: obj_Laser_int_488_offset = a488 b488 c488 d488 e488
line 16: obj_Laser_int_515_offset = a515 b515 c515 d515 e515
line 17: obj_Laser_int_ALL_offset = aALL bALL cALL dALL eALL

The amount of relative laser intensity adjustment for objective changes at 458/488/515/ALL laser lines. a458 should be zero(0).

line 18: cam_mode_norm_use_dim = n1 n2 n3 n4 n5

Indicate the use of the dim filter per objective.
n = 0: using all-pass camera filter in normal camera mode.
n = 1: using dim camera filter in normal camera mode.

Example:

```
objective_spec = 5    20    50    100    150
objective_power = 5 20 50 100 150
objective_na = 0.13 0.46 0.80 0.95 0.95
objective_offset_nm = 0 23456 48400 48400 95230
objective_xoffset_um = 0.00 99.00 200.00 234.00 250.00
objective_yoffset_um = 0.00 171.00 120.00 99.00 76.00
objective_camera_int_all_offset = 0 0 10 20 65
objective_camera_int_pol_offset = 50 0 60 80 160
objective_camera_int_yel_offset = 20 0 40 50 120
objective_camera_int_dim_offset = 0 0 0 0 0
objective_camera_int_458_offset = 0 0 0 0 0
objective_camera_int_488_offset = 0 0 0 0 0
objective_camera_int_515_offset = 0 0 0 0 0
use_camera_notch_filter_01 = 1
obj_Laser_int_458_offset = 0 -5 -4 4 22
obj_Laser_int_488_offset = 0 6 9 -3 1
obj_Laser_int_515_offset = 1 7 2 -3 4
obj_Laser_int_All_offset = -3 0 1 -5 -4
```

```
cam_mode_norm_use_dim = 0 0 0 0 0
```

1.7 Lon Specs

Turret problems

miscellaneous configuration for the LON network.

line 0: lon_spec

line 1: turret_step = xx

15 or 60 or 128 for new system (look for click

xx = turret step delay, set to 60

line 2: cam_filter_ap_pos_5_or_6 = 5

use filter wheel position 5 or 6 as the ALL-PASS position. Using position 5 improves the camera filter wheel response time, but require new camera filter wheel firmware changes.

line 3:lon_diag_button_name_node_nv_values = ButtonName NodeName NVName Value1 Value2

This initializes a test button to appear in the LON Diagnostic Window. This button will toggle between two values.

For Example toggling the aperture between values 120 and 150.

Needed Information. Button Name = Aperture test ; node = 12 – Aperture Ctrl; nv = 5 -- position cmd; values 120 and 150.

The string would look like this:

lon_diag_button_name_node_nv_values = ApertureTest 12 5 120 150

Example:

```
lon_spec
turret_step = 60
cam_filter_ap_pos_5_or_6 = 5
lon_diag_button_name_node_nv_values = Aperture 12 5 120 150
```

1.8 System Specs

line 0: system spec

line 1: laser_saver_minutes = xx

xx = the minutes of no mouse/key click before putting laser to idle, white light intensity to 0 and PMT gain to minimum. Any mouse click/key will restore previous settings.

line 3: save_backup_map_minutes = xx

Specifies the number of minutes to periodically save the current wafer map to the file /usr/uv/data/backup.map. Data can be recovered by loading the back.map from the system directory and renaming the file to its original map name. A value zero will disable the backup map saving feature.

line4: cfg_next_die_position = n

n = 0: below the current die

n = 1: left of current die

n = 2: top of current die

n = 3: right of current die

line 5: enable_bin_image_tx = n

n = 0: disable the saving of images in binary form.

n = 1: enable the saving of Laser Images in binary form, in tiff format. Images in this form are 24 bit color images of the live laser window. This will place a SaveFrame button in the laser window.

line 6: zrange_search_num_steps2 = nn

nn = the number of steps in the ***SetZ*** procedure. default is 44 steps. The step size is fixed at 30 micro steps(approximately 0.5 microns per step.) Scan speed is about 13 steps per second.

line 7: zrange_search_laser_gain = x

where x is in the range of 7.0 to 13.0.
This is the fine tune adjustment mapping between laser intensity setting and the resultant image intensity. If this value is too low or too high, user may need to perform the SetZ function to get a reliable optimal laser intensity setting.

line 8: recipe_auto_load_option = n

The option to automatically load the recipe, based on defect map loaded:
n = 0: means user load the recipe manually.
n = 1: auto load recipe using the first 5 character in the product ID as file name.
n = 2: the first 7 characters in product ID.
n = 3: the first 5 characters in the lot ID.
n = 4: the first 7 characters in lot ID.
n = 5: the first 5 characters in process ID
n = 6: the first 7 characters in process ID

line 9: recipe_auto_load_option2 = n

Second auto recipe load option. n = same as above values.

line 10: rcp_autoload_map_match1 = ####################
line 11: rcp_autoload_map_match2 = ####################

Matching file names to recipe names for auto load

line 12: uv_name_for_remote = stringxx
line 13: uv_name_for_remote2 = stringxx
line 14: uv_name_for_remote3 = stringxx
line 15: uv_name_for_remote4 =stringxx
line 16: uv_name_for_remote5 = stringxx
line 17: uv_name_for_remote6 =stringxx
line 18: uv_name_for_import = stringxx

LIS always uses the fixed directory for NFS access: /REMOTE, /REMOTE2, /usr/uv/REMOTE3, ... and /usr/uv/IMPORT. Inside of the uv program, the label can be customized with the name "stringxx" for remote, remote2, etc. and import .

line 19: w_light_camera_intensity_gain = n

****

line 22: wafer_edge_exclusion_um_4568 = 1000 1000 1000 1000

Excludes defects from the wafer map x microns from the edge of the wafer

line 23: rs232_expand_dev_name = dev/ttyd05

rs232 communication path

line 24: search_delay_10ms_cts = 100 in milliseconds

Delay in search pattern for next move

line 25: lo_light_option_1_0 = 0 For wafers sensitive to light like photo resist

0 = Disables low light option

1 = Enable low light option

Low light option is used for limiting laser/White light exposure to wafer surface. Some materials are sensitive to Laser and white light. For example : imaging undeveloped photoresist.

line 26: lo_light_timeout_seconds = 0

The time allowed to expose sensitive area before closing laser shutter and dimming White light intensity.

line 27: lo_light_acq_laser_pwr_ct = 125 30 100 0

Laser power setting to use for different wavelength while using lo_laser_option, 6 cts per milliwatt

line 28: autodeskew_img_capture_delay =30

Time for the stage to settle after autofocus before capturing images.

line 29: system_wafer_mask = 0

0=wafer system

1=mask system

Line numbering off

line 27. system_mask_query_port_num = 0

For Mask system only

line 28. system_mask_get_map_choice = 0

For Mask system only

line 29. system_mask_lmark_duv6 = 8015.000000 16020.000000 144015.000000 16020.000000

For Mask system only

line 30. system_mask_lmark_iln6 = 12000.000000 19855.000000 140450.000000 19905.000000

For Mask system only

line 31. system_mask_lmark_iln5 = 9999.680664 10779.630859 117049.953125 10829.505859

For Mask system only

line 30: system_gem_option = 0

0 = GEM /SECS communication off

1 = GEM /SECS communication on

line 31: system_gem_ppload_option = 0

0 = GEM load process program load off

1 = GEM load process program load on

line 32: lpa_map_name_waf_id_offset = 0 LBM

Offset in character position of wafer map name that identifies the wafer number. LPA/DES Maps only.

For example: tenc7000-2ch14000-0000006-ephaa7cw.01

The offset would be 25 for wafer id 6

line 33: system_light_tower_option = 0

0 = system light tower not enabled

1 = system light tower enabled

line 34: numdef_lessfields = 64000

Specifies the number of defects, above which

5 defect fields instead of the usual 8 fields, will be displayed in the defect listbox This is used to slow down the SGI Motif library's listbox memory leak

line 35: user_defect_tags_enable = n

Turns the user defect tags feature on (1) and off (0). This value can also be set from the configuration dialog box.

line 38: print_queue_enable = 0

Images that are captured using the save dialog box or automatic image capture will be placed in a queue to be printed at a later time. Only 8 images are allowed in the print queue. New images will write over the oldest image in the queue .

line 39: use_ref_wl_intensity = 0

Uses captured intensity for autodeskew images. Reccommended to leave disabled

line 40: store_warn_limit_percentage = 100

A pop dialog box will be displayed when the hard drive space has reached a percent usage.

line 41: imgsavelog_enable = 0

All images captured will be placed in the image log. Image log contains image name and inspection information.

line 42: imgsavelog_pathname = /usr/uv/data/IMGSAVE.LOG

Pathname and filename for image log.

line 43: imgsavelog_max_size = 500000

Maximum file size for image log.

line 44: mapimgbackup_enable = 0

Copy all maps and images capture to a directory called /usr/uv/BACKUP

line 45. mapimgbackup_purge_freq_hr = 24.000000

The frequency that file are deleted from the /usr/uv/BACKUP directory(should not exceed 72 hours)

line 46. unclassified_save_warn = 0

line 47. sony_printer_rs232_port = 0

The rs232 port use for connecting the Sony printer to the SGI workstation. (used for White Light Annnotation only)

line 48. sony_printer_baud_rate = 9600

Baud rate for the Sony printer. (used for White Light Annnotation only)

line 49. defcode_autoload_enable = 0

Enables the loading of defect code tables automatically based on process id. Defect code tables must be saved in the system directory.

line 50. system_300mm = 0

Used for 300mm systems

line 51. enable_absent_remotes = 0

Enables access to the remote directories if they are not listed in /etc/fstab and are not mounted.

Example:

```
system_spec
laser_saver_minutes = 5
save_backup_map_minutes = 10
kla_deskew_die_offset = 1 0
```

```
cfg_next_die_position = 0
enable_bin_image_tx = 0
zrange_search_num_steps2 = 50
zrange_search_laser_gain = 9.0
recipe_auto_load_option = 0
recipe_auto_load_option2 = 0
rcp_autoload_map_match1 = ####################
rcp_autoload_map_match2 = ####################
uv_name_for_remote = Remote
uv_name_for_remote2 = Remote2
uv_name_for_remote3 = Remote3
uv_name_for_remote4 = Remote4
uv_name_for_remote5 = Remote5
uv_name_for_remote6 = Remote6
uv_name_for_import = Import
w_light_camera_intensity_gain = 0.50
wafer_edge_exclusion_um_4568 = 1000 1000 1000 1000
rs232_expand_dev_name = /dev/ttyd05
search_delay_10ms_cts = 100
lo_light_option_1_0 = 0
lo_light_timeout_seconds = 0
autodeskew_img_capture_delay = 30
system_wafer_mask = 0
system_mask_query_port_num = 0
system_mask_get_map_choice = 0
system_mask_lmark_duv6 = 8015.000000 16020.000000 144015.000000
16020.000000
system_mask_lmark_iln6 = 12000.000000 19855.000000 140450.000000
19905.000000
system_mask_lmark_iln5 = 9999.680664 10779.630859 117049.953125
10829.505859
system_gem_option = 0
system_gem_ppload_option = 0
lpa_map_name_waf_id_offset = 0
system_light_tower_option = 0
numdef_lessfields = 64000
user_defect_tags_enable = 0
print_queue_enable = 0
use_ref_wl_intensity = 0
store_warn_limit_percentage = 100
imgsavelog_enable = 0
imgsavelog_pathname = /usr/uv/data/IMGSAVE.LOG
imgsavelog_max_size = 500000
mapimgbackup_enable = 0
mapimgbackup_purge_freq_hr = 24.000000
unclassified_save_warn = 0
sony_printer_rs232_port = 0
sony_printer_baud_rate = 9600
defcode_autoload_enable = 0
system_300mm = 0
enable_absent_remotes = 0
```

1.9 Camera communication Spec

line 0: camera_interface_spec
line 1: port_number = -1
line 2: camera_type = 0

CameraType: no rs232, Optronics,Sony930,Optronic-w-caption,Sony950=0,1,2,3,4

line 3: camera_color_bal_458_red_blue = 0 0
line 4: camera_color_bal_488_red_blue = 0 0
line 5: camera_color_bal_515_red_blue = 0 0
line 6: camera_color_bal_all_red_blue = 0 0
line 7: camera_color_bal_wl_red_blue = 0 0
line 8: camera_color_bal_holo488_red_blue = 0 0

Red and Blue color balance numbers. Used to correct camera white balance for white light image.

Example:

```
# Camera communication Spec
# CameraType: no rs232, Optronics,Sony930,Optronic-w-
# caption,Sony950=0,1,2,3,4
camera_interface_spec
port_number = -1
camera_type = 0
camera_color_bal_458_red_blue = 0 0
camera_color_bal_488_red_blue = 0 0
camera_color_bal_515_red_blue = 0 0
camera_color_bal_all_red_blue = 0 0
camera_color_bal_wl_red_blue = 0 0
camera_color_bal_holo488_red_blue = 0 0
```

1.10 Sequence screen specification

This section specifies the screen layout of the sequence steps

line 0: sequence_screen_spec
line 1: screen_name = stringxx

where stringxx is one of the following:

manual	sequence start screen
LoadWafer	load wafer screen
Deskew	deskew screen
Review	defect review screen
Volume	volume screen
Surface	surface screen
DCS	DCS screen
ADC	ADC screen

line 2: window_spec = stringyy xx yy xsize ysize

Same format as in 1.1 screen spec

line 3: stringzz

option parameters for the specific window

line 4: window_spec = stringyy xx yy xsize ysize
line 5: stringzz

more windows

line n

Example:

```
sequence_screen_spec
sequence_name = Deskew
window_spec = slices        4 2 90 36
slices = 1 1 120 2 0
window_spec = slices      4 40 90 36
slices = 1 1 120 2 0
window_spec = surface    4 78 90 36
surface = 1 1 30 0 0 0
window_spec = cassette   4 116 90 36
window_spec = surface      4 154 90 36
surface = 1 1 30 0 0 0
window_spec = referenceImg 4 192 90 36
window_type = slices     4 230 90 36
slices = 1 1 120 2 0
window_spec = text_status 4 268 90 36
text_status = 5
window_spec = microscope 120 2 334 303
window_spec = text_status 4 307 450 301
text_status = 2
window_spec = defect_map 4 610 450 303
window_spec = rt_confocal 458 3 800 674
window_spec = sequence_stat 458 680 800 233
```

1.11 User defined screen specification

User can define a set of system wide screens from within the UV program. These user defined screens are stored here.

line 0: user_screen_spec
line 1: screen_name = stringxx

stringxx is the name of the screen, and is used as label in the top menu inside the UV program

line 2: window_spec = stringtyy xx yy xsize ysize

Same format as in B2 screen spec

line 3: stringzz

option parameters for the specific window

line 4: window_spec = stringtyy xx yy xsize ysize
line 5: stringzz

more windows

Example:

```
user_screen_spec
screen_name = jim
window_spec = slices        4 2 90 36
slices = 1 1 120 2 0
```

```
window_spec = slices      4 40 90 36
slices = 1 1 120 2 0
window_spec = surface    4 78 90 36
surface = 1 1 30 0 0 0
window_spec = cassette   4 116 90 36
window_spec = surface      4 154 90 36
surface = 1 1 30 0 0 0
window_spec = referenceImg 4 192 90 36
window_type = slices     4 230 90 36
slices = 1 1 120 2 0
window_spec = text_status 4 268 90 36
text_status = 5
window_spec = microscope 120 2 334 303
window_spec = text_status 4 307 450 301
text_status = 2
window_spec = defect_map 4 610 450 303
window_spec = rt_confocal 458 3 800 674
window_spec = sequence_stat 458 680 800 233
```

1.12 Function key definitions

```
# Function key definitions
function_key_definition
function_key_index_n_Name = 0 Unload
function_key_functions = 23
function_key_index_n_Name = 1
function_key_functions =
function_key_index_n_Name = 2
function_key_functions =
function_key_index_n_Name = 3 Save
function_key_functions = 57
function_key_index_n_Name = 4 MapOffset
function_key_functions = 21
function_key_index_n_Name = 5 RedoDeskew
function_key_functions = 20
function_key_index_n_Name = 6 DefectCode
function_key_functions = 41
function_key_index_n_Name = 7 OtherDie
function_key_functions = 19
function_key_index_n_Name = 8 WL/Laser
function_key_functions = 14
function_key_index_n_Name = 9 BF/DF
function_key_functions = 13
function_key_index_n_Name = 10 CoarseAF
function_key_functions = 3
function_key_index_n_Name = 11 FocusOffset
function_key_functions = 56
```

1.13 Stage mapping

A stage mapping algorithm is added to the LIS software version 2.0, to improve the defect location positioning accuracy. This feature corrects the stage's individual XY axis linear encoder irregularities by matching the encoder to a calibration standard at regular interval. If the calibration standard is accurate then the encoder will be accurate at those interval. Within the interval, a linear interpolation is used to

image. When the image is captured, an file is sent back to the Ultrapointe containing an optical disk ID and frame ID. The field 'annote_dentech_timeout' specifies the timeout used in waiting for the file from the Dentech. The field 'annote_linex_field_size' specifies the type of annotation and its length for line 'x' in the annotation file.

```
#Annotation Spec
#eg. annote_dentech_timeout = x
# x is the Number of Seconds
#eg. annote_line1_field_size = a b
# a is the Field type for this line
# b is the Number of Characters for this field
#Field types available:
#   0 Blank line
#   1 ToolID
#   2 MapName
#   3 Operator
#   4 WaferSize
#   5 ProductID
#   6 LotID
#   7 ProcessID
#   8 WaferID
#   9 SlotNum
#  10 DefectNum
#  11 XPos
#  12 YPos
#  13 XSize
#  14 YSize
#  15 XDieNum
#  16 YDieNum
#  17 DefectCode
#  18 UserAnnotation
annotation_spec
annote_dentech_timeout = 10
annote_line1_field_size = 1 20
annote_line2_field_size = 2 20
annote_line3_field_size = 3 20
annote_line4_field_size = 4 17
annote_line5_field_size = 5 20
annote_line6_field_size = 6 20
annote_line7_field_size = 7 20
annote_line8_field_size = 8 20
annote_line9_field_size = 9 17
annote_line10_field_size = 10 17
annote_line11_field_size = 11 17
annote_line12_field_size = 12 17
annote_line13_field_size = 13 17
annote_line14_field_size = 14 17
annote_line15_field_size = 15 17
annote_line16_field_size = 16 17
annote_line17_field_size = 17 17
annote_line18_field_size = 18 50
```

```
annote_line19_field_size = 0 0
```

1.16 Light Tower configuration specs

line 0: light_tower_spec

Keyword identifies this group

line 1: light_tower_initialization =(r) (a) (g) (b) (bz)
line 2: light_tower_process_active =(r) (a) (g) (b) (bz)
line 3: light_tower_process_executing =(r) (a) (g) (b) (bz)
line 4: light_tower_process_complete =(r) (a) (g) (b) (bz)
line 5: light_tower_process_pause =(r) (a) (g) (b) (bz)
line 6: light_tower_idle =(r) (a) (g) (b) (bz)
line 7: light_tower_equipment_down =(r) (a) (g) (b) (bz)
line 8: light_tower_engineering_mode =(r) (a) (g) (b) (bz)
line 9: light_tower_uvexit =(r) (a) (g) (b) (bz)
line 10: light_tower_alarm_on_hazardous = (r) (a) (g) (b) (bz)
line 11: light_tower_alarm_on_warning = (r) (a) (g) (b) (bz)
line 12: light_tower_material_port_empty = (r) (a) (g) (b) (bz)
line 13: light_tower_communicating = (r) (a) (g) (b) (bz)
line 14: light_tower_remote_control = (r) (a) (g) (b) (bz)

The five positions are for the colors on the light tower and buzzer:
Red Lamp(r), Amber Lamp(a), Green Lamp (g), Blue Lamp(b), and Buzzer (bz)
There are 6 states for each light :
0 = Lamp off
1 = Lamp on
2 = Lamp flashing at the rate defined in SEMI S8-95 (50msec. on time with 3 to 10 flashes per second)
3 = Lamp flashing at a slow programmable rate
4 = Lamp flashing at a fast programmable rate
5 = No change from the previous state

line 15: light_tower_slow_flash_time = 2000

Time in milliseconds that the light is on 50% duty cycle

line 16: light_tower_fast_flash_time = 1000

Time in milliseconds that the light is on 50% duty cycle

line 17: light_tower_alarm_on_time = 10

Time audible buzzer is on in seconds.

Example:

```
# Light Tower configuration specs
light_tower_spec
light_tower_initialization = 0 0 0 0 0
light_tower_process_active = 0 0 0 0 0
light_tower_process_executing = 0 0 0 0 0
```

```
light_tower_process_complete = 0 0 0 0 0
light_tower_process_pause = 0 0 0 0 0
light_tower_idle = 0 0 0 0 0
light_tower_equipment_down = 0 0 0 0 0
light_tower_engineering_mode = 0 0 0 0 0
light_tower_uvexit = 0 0 0 0 0
light_tower_alarm_on_hazardous = 0 0 0 0 0
light_tower_alarm_on_warning = 0 0 0 0 0
light_tower_material_port_empty = 0 0 0 0 0
light_tower_communicating = 0 0 0 0 0
light_tower_remote_control = 0 0 0 0 0
light_tower_slow_flash_time = 2000
light_tower_fast_flash_time = 1000
light_tower_alarm_on_time = 10
```

```
#Inspex Socket Spec
inspex_socket_spec
1. inspsock_dbhostname = inspexdb
2. inspsock_portnum = 2048
3. inspsock_directorymap = /usr/uv/None
4. inspsock_directoryimg = /usr/uv/None
5. inspsock_PastNDaysLotRange = 7 LOT12345*
```

Procedure to Install Software on a new Hard Disk,
For the Ultrapointe 1000 / 1200/ 500/ 1010/ 1010A
3/23/98

Note: If one is preparing a hard disk for the Field, the installation computer **must match** the destination computer.

Follow sections A.1 through A.3 if one wishes to install the **IRIX 5.2** operating system.
Follow sections B.1 throught B.3 if one wishes to install the **IRIX 4.0.5H** operating system

A1. Format the hard disk.
A2. Install 3 out of 4 SGI CD-ROMs for IRIX 5.2 operating system
A3. Install the Application Tape and Make various setups
OR
B1. Format the hard disk.
B2. Install the System Tape for IRIX 4.0.5H operating system
B3. Install the Application Tape and Make various setups

Ver 4.0.5 - Y2K
Ver 5.2 Non Y
Ver 5.3 - Y2K

A.1 To Format the HardDisk, IRIX 5.2

0. Skip these steps, if formatting is not required.
1. Shutdown the computer, power off the computer
2. Connect the CD-ROM drive to the computer's SCSI port
3. Turn on the CD-ROM drive,
4. Insert the CD-ROM named 'Irix 5.2' into the CD-ROM drive.
5. Bring up the System Maintenance Menu by:
   Powering on the system.
   Pressing the Esc key, when the message 'Stop for Maintenance' appears.
6. When the System Maintenance Menu appears,
   Type: 5 this to selectsOption 5, *EnterCommand Monitor*
7. Type: boot -f dksc(0,4,8)sashARCS dksc(0,4,7)stand/fx.ARCS
   where the number 4 is to be **replaced** by the actual SCSI ID of the CD-ROM drive.
   This number ranges from 2 to 7.
8. When it asks if you require extended mode with all options available?
   Type: yes
9. In response to the prompt: "device-name" , Type dksc
   "ctrl #" , Type 0
   "drive #" , Type 1
10. Type: auto
11. Wait approximately 30 minutes. When the fx> prompt appears,
    Type: exit
12. When the system maintenance menu appears,
    Type: 2 to select Option 2, Install System Software

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A.2 To Install the SGI System Software, IRIX 5.2

1. Connect the CD-ROM drive to the computer's SCSI port
2. If the computer is an **Indigo** R4000/R4400,
   insert the CD-ROM named 'Irix 5.2' into the CD-ROM drive.
   OR
   If the computer is an **Indy**, insert the CD-ROM named 'Irix 5.2 for R4600' into the drive
3. Bring up the System Maintenance Menu by:
   Powering on the system.
   Pressing the Esc key, when prompted.
4. Load in the installation program by:
   Selecting Option 2 (***Install System Software***) at the System Maintenance Menu.
   Select Local CD-ROM option, Select Install, Select Continue.
5. Wait for the Installation program to load.
6. If the installation program asks if it's OK to make New File Systems,
   Answer Yes, each time, otherwise go to the next step.
7. When the Installation Menu appears:
   Type 'list'
8. Type 'install eoe2.man.bsdlpr'
9. Type **'install eoe2.sw.bsdlpr'** (For Codonics Printer)
10. To specify which software **NOT** to install,
    Type: r demos*
    Type: r inventor_eoe*
    Type: r showcase*
    Type: r systour*
11. Type 'go'
12. After the 'Inst> prompt ' reappears,
    Remove the 'Irix 5.2 OR Irix 5.2 for Indy R4600' CD-ROM
    Insert the 'Network File System 5.2' CD-ROM
13. Type 'list'
14. Type 'go'
15. After the 'Inst> prompt ' reappears,
    Remove the 'Network File Systems 5.2' CD-ROM
    Insert the 'Galileo, Indigo2, Indy 3.0.1' CD-ROM
16. Type 'list'
17. Type 'go'
18. After the 'Inst> prompt ' reappears,
    Remove the 'Galileo, Indigo2, Indy 3.0.1' CD-ROM
    Type 'quit'
19. Answer ***Yes*** to the Restart prompt.
20. Login as root
    Select System, Select System Shutdown, Select OK
    Wait until the computer is ready to be turned off. Turn off the computer.
21. Reattach the computer's SCSI port to the access the Tape, and Floppy drives again.
22. Turn on the computer.

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A.3 To Install the Ultrapointe Application Software, IRIX 5.2

1. **Add a user named 'uv'** by:
   Login as '*root*' by double-clicking on the root Icon
   Select *System*, in the *ToolChestWindow* at the TopLeftHandCorner of the screen.
   Select the System Manager
   Double click on the *Users Manager* Icon.
   Select *Add*.
   Type 'uv' as the login name. Select OK
   Click on Yes for Primary user.
   Click on Yes for Privileged user.
   Type in 0000 for *UserID*. (This gives 'uv' superuser privileges).
   Select *ksh* for Irix Shell
   Select OK, Select Close, Select File, Select Quit.
2. **Bring up a *ShellWindow*** by:
   Selecting *Desktop*, in the *ToolChestWindow* at the TopLeftHandCorner of the screen.
   Select *Unix Shell*
3. Login as 'uv' by: Typing 'login uv'
4. Load the InstallApplication Tape into the TapeDrive.
5. Type 'tar xv'. (This program will extract files from the Tape onto the HardDisk)
6. Login once again by:
   Typing 'login uv'
7. Execute **ONE** of the following command file (script) by:
   Typing 'InstallApplic52R4' for **Irix 5.2 and Indigo R4000/R4400**
   OR
   Typing 'InstallApplic52Indy' for **Irix 5.2 and Indy**
   A reboot will occur as the last step of the command file.
8. **Setup the session management** by:
   Login as the uv icon
   Select elan, select the copy option, select OK
9. **Setup automatically logging in** by:
   Select SystemManager
   Double click on Login Setup
   Select automatically login
   Type 'uv' as the user
   Select OK, Select File, Select Quit
10. **Setup the Serial Ports** by:
    Select System, in the ToolChestWindow in TopLeftHandCorner of the screen
    Select the SystemManager
    Select Port Setup
    Click on Serial Port1 if it does NOT say it's Available, then click on Disconnect.
    Click on Serial Port2 if it does NOT say it's Available, then click on Disconnect.
    Select Close, Select File, Select Quit

11. **Setup the Networking** by:

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Connect the computer to the network.
Select System, in the ToolChestWindow in TopLeftHandCorner of the screen
Select the SystemManager
Double click on the Networking Setup Icon
Change the interface's name to the desired hostname, eg. hood2
Change the IP address to the desired address, eg 127.0.2.22
Turn on Networking for this port.
Turn on the setup for advanced networking
Turn on the NFS
Select OK, Select OK to changes accepted, Select OK to reboot

BIAC
If there is no w/c Display and no other possibilities - Do #13 again!

12. If this system needs to be on the **manufacturing network:**
Login as '*uv*' by double-clicking on the uv Icon
In a Blue *Unix Shell*, Type: 'InstallMfgNetwork'
13. ~~If this system has the integrated white light video option:~~
Setup the White Light Video by:
1. In a Blue *Unix Shell*, Type: vcp
2. Select File, Select Restore factory settings.
3. Set Input Source to the correct setting: SVideo **OR** Composite
4. For the **Indigo**: Set Sync to Slave
5. Select Utilities, Select Live video input, Click once to make the video appear.

6a. For the **Indigo**:
Select Pro, Select Analog video input, Select Composite Y/C, Set Prefilter on
Select Pro, Select Analog video input, Select All.
Move the Horizontal position slider bar so that the live video appears centered
OR

6b. For the **Indy**:
Select Pro, Select AnalogVideoInput, Select SignalControls, Set Prefilter on

7. Select File, Select Save current setting.
8. Select File, Select Quit
9. In the Live Video Window, click on the top left corner, Select exit.

14. If this system has the 1Gig Optical disk option:
Setup the 1Gig Optical disk by:
Typing 'InstallOpticalMax' for the MaxOptix optical drive
OR
Typing 'InstallOpticalPinn' for the Pinnacle optical drive
15. Fill in the current version of uv that manufacturing has: uv Version# V2._____
Fill in the **lastest** version of uv that the keymaker has: uv Version#: V2._____
16. By following the steps described in: **Procedure to request for a Keyfile**
16.1 Obtain a **keyfile**,
16.2 **If** a later version of uv (application software) exists,
obtain it by requesting for the **Distribution package** (floppies)
16.3 Install the keyfile
16.4 Install the latest Distibution package (floppies)
17. Use the default .uvconfig by Typing: ~ use a Floppy Backup not default manuf added features
cp /usr/uv/.uvconfigdefault /usr/uv/.uvconfig

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B.1 To Format the HardDisk and Increase the Swap Space, IRIX 4.0.5H

0. Skip these steps, if formatting is not required AND the total swap space is at least 70 Meg.
1. Shutdown the computer, power off the computer
2. Connect the Tape drive to the computer's SCSI port
3. Turn on the Tape drive,
4. Insert the Tape named 'InstallSystem' into the Tape drive.
5. Bring up the System Maintenance Menu by:
   Powering on the system.
   Pressing the Esc key, when the message 'Stop for Maintenance' appears.
6. When the System Maintenance Menu appears,
   Type: 5 to select Option 5, ***EnterCommand Monitor***
7. Type: boot -f tpsc(0,7)(fx.ARCS) if the CPU is an **R4000**
   OR
   boot -f tpsc(0,7)(fx.IP12) if the CPU is an **R3000**
   where the number 7 is to be **replaced by the actual SCSI ID of the Tape drive.**
   This number ranges from 2 to 7.
8. When it asks if you require extended mode with all options available?
   Type: yes
9. In response to the prompt: "device-name" , Type dksc
   "ctrl #" , Type 0
   "drive #' , Type 1
10. Increase the swap space by 30Meg to a total of 70Meg, by
    Typing: repartition
    Typing: resize
    In respone to Continue?, Type: yes
    In response to partition to change, Type: swap
    In response to partitioning method, Type: megabytes
    In response to size in megabytes, Type: 70
    In response to use new partition layout, Type: yes
    At the prompt "fx/repartition" reappears, Type: ..

11. Format the Disk by:
    Typing 'format'.
12. Wait approximately 30 minutes. When the fx> prompt appears,
    Type: exit
13. When the system maintenance menu appears,
    Type: 2 to select Option 2, Install System Software

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B.2 To Install the SGI System Software, IRIX 4.0.5H.

1. Connect the Tape drive to the computer's SCSI port
2. Insert the tape named 'InstallSystem Tape' into the tape drive.
3. Bring up the System Maintenance Menu by:
   Powering on the system.
   Pressing the Esc key, when prompted.
4. Load in the installation program by:
   Selecting Option 2 (***Install System Software***) at the System Maintenance Menu.
   Select Local Tape option, Select Install, Select Continue.
5. Wait for the Installation program to load.
6. If the installation program asks if it's OK to make New File Systems,
   Answer Yes, each time, otherwise go to the next step.
7. When the Installation Menu appears:
   Type 'list'
8. Type 'install eoe2.man.bsdlpr'
9. Type **'install eoe2.sw.bsdlpr'** (For Codonics Printer)
10. Type 'go'
11. After the 'Inst> prompt ' reappears,
    Type 'go' once again.
    This is to install the maintenance software.
12. After the 'Inst> prompt ' reappears,
    Type 'quit'
13. Answer *Yes* to the Restart prompt.
14. Login as root

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B.3 To Install the Ultrapointe Application Software, IRIX4.0.5H

IMPORTANT: Version 2.3 is the last software version compatible with IRIX 4.0.5H!

1. **Add a user named 'uv'** by:
   Login as '*root*' by double-clicking on the root Icon
   Select *System*, in the *ToolChestWindow* at the TopLeftHandCorner of the screen.
   Select the System Manager
   Double click on the *Users* Icon.
   Select *Add*.
   Type 'uv' as the login name.
   Select *Yes* in response to Show detailed info
   Type in 0000 for *UserID*. (This gives 'uv' superuser privileges).
   Select *Other* for Shell
   Type in '/bin/ksh' for the *ShellName*
   Select 'On' for Workspace
   Select 'On' for Autologin
   Select Accept, Select Quit, Select Quit.
2. **Bring up a *ShellWindow*** by:
   Selecting *Tools*, in the *ToolChestWindow* at the TopLeftHandCorner of the screen.
   Select *Shell*
3. Login as 'uv' by Typing 'login uv'
4. Load the InstallApplication Tape into the TapeDrive.
5. Type 'tar xv'. (This program will extract files from the Tape onto the HardDisk)
6. **Login** once again by:
   Typing 'login uv'
7. Execute a command file (script) by:
   Typing: InstallApplic405R4 if the CPU is an **R4000**
   OR
   InstallApplic405R3 if the CPU is an **R3000**
   A reboot will occur as the last step of the command file.
8. **Setup the Serial Ports** by:
   Select System, in the ToolChestWindow in TopLeftHandCorner of the screen
   Select the SystemManager
   Double click on the Serial Ports Icon
   Select Serial Port1, Select Off, Select Accept
   Select Serial Port2, Select Off, Select Accept
   Select Quit, Select Quit

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9. Setup the **Floppy Drive** by:
   Select System, in the ToolChestWindow at the TopLeftHandCorner of the screen.
   Select the System Manager
   Double click on the Disks&Files Icon
   Double click on the DosFloppy Icon (if it's not present, double click on the /FLOPPY Icon)
   In response to mount files at this directory, Type: **/FLOPPY**
   Select Mounted
   Select Yes for ShowDetailedInfo
   Select Yes for Mount during system startup
   Select Accept, Select Quit, Select Quit

10. **Setup the Networking** by:
    Connect the computer to the network.
    Select System, in the ToolChestWindow in TopLeftHandCorner of the screen
    Select the SystemManager
    Double click on the Networking Icon
    Double click on the Local Workstation Icon
    Change the Hostname to the desired hostname, eg. hood2
    Change the IP address to the desired address, eg 127.0.2.22
    Turn on TCP/IP.
    Turn on the NFS
    Select Accept
    In response to Ready to Shutdown and Restart the system, Select Accept.

12. If this system needs to be on the **manufacturing network**:
    Login as '*uv*' by double-clicking on the uv Icon
    In a Blue *Unix Shell*, Type: 'InstallMfgNetwork'

13. Fill in the current version of uv that manufacturing has: uv Version# V2._____
    Fill in the **lastest** version of uv that the keymaker has: uv Version#: V2._____

14. By following the steps described in: **Procedure to request for a Keyfile**
    14.1 Obtain a **keyfile**,
    14.2 **If** a later version of uv (application software) exists,
    obtain it by requesting for the **Distribution package** (floppies)
    14.3 Install the keyfile
    14.4 Install the latest Distibution package (floppies)

15. Use the default .uvconfig by Typing:
    cp /usr/uv/.uvconfigdefault /usr/uv/.uvconfig

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Procedure for New System Keyfile Request
3/23/98

The following procedure is used for new systems on the manufacturing floor.

1. Upon receiving a PO (or reasonable facsimile thereof), Laura will fill out the header information and check the options under the "Request" column. If a unreleased version of software is required, then the version number will be specified in the appropriate box.
2. The form will be circulated for signatures (along with the Sales Order) to Sales and Marketing. If an unreleased version of software is specified, then an Engineering signature is also required.
3. The form is given to the KeyMaker who creates a floppy & hard disk per the configuration. The KeyMaker checks the configuration and signs the form. The KeyMaker should also enter the ID number for the SGI Indy.
4. During final test, a representative from manufacturing checks the config and signs.
5. During customer acceptance, a field support representative verifies the configuration and signs the form.
6. The orignal signed form is given to Laura. Copies go to manufacturing and field service.

Procedure for Keyfile Change Request

The following procedure is used for changes in the field.

1. The requestor fills out all of the header information including SGI ID number.
2. The requestor must also specify the current configuration of the tool (based on field data or original sales order).
3. The requestor fills out the newly requested configuration. If a PO has been placed for a specific option, then a copy of the PO should be attached to the form.
4. The requestor must also give a "reason for request".
5. The requestor then circulates the form for the appropriate signatures.
6. Once all the signatures have been obtained, the form is given to the KeyMaker. The KeyMaker generates the floppy and/or hard disk per the requested configuration. When completed, the form is signed.
7. A second individual (other than the KeyMaker) must verify the configuration and sign the form.
8. When the form is completed, the floppy and form are given to the requestor. Copies of the form should go to the requestor, field service, and the software group. The original should be placed in the sales order file.

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3.7 According to its Label, type in the corresponding command:

Make52UVFloppyPart1	(for Disk1)
Make405UVFloppyPart1	(for Disk2)
Make52R4DriverFloppy	(for Disk3)
Make52IndyDriverFloppy	(for Disk4)
Make405R4DriverFloppy	(for Disk5)
MakeUVFloppyPart2	(for Disk7)

3.8 wait until the floppy drive has stop moving.

3.9 Type: sync
eject

3.10 Write protect the floppy

3.11 Repeat Procedure 3.5-3.10 until all required diskettes have been made.

4. Along with the floppies, **remind** the requestor to obtain from **DocControl**, the following:

4.1 **Software V2.x Release Notes**

4.2 **Procedure to install a Software Upgrade**

4.3 Optional: Procedure to setup NFS

Procedure for Floppy Duplication
3/23/98

There are 7 different floppy disks:

Disk 1: uv V2.x, for Irix 5.2 **Part 1**
Disk 2: uv V2.x, for Irix 4.0.5 **Part 1**
Disk 3: Device drivers for Irix 5.2, R4000
Disk 4: Device drivers for Irix 5.2, Indy
Disk 5: Device drivers for Irix 4.0.5, R4000
Disk 7: uv V2.x **Part 2**

Find out what **Operating system** and what **CPU** the destination unit has.

	R4000 / R4400	Indy	R3000
Irix 5.2	Disks 1,3,7	Disks 1,4,7	Disk 1,7
Irix 4.0.5	Disks 2,5,7	-	Disk 2,7

Using the above table, make copies from the indicated master floppies
To make floppy disks copies, use the diskcopy command.
For example, Type: DISKCOPY B: B:
Insert the source diskette when prompted
Insert the destination diskette when prompted

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Tape Duplication

Tapes are duplicated using 2 tape drives.

1. Shutdown the computer. Power off the computer.
2. Set the source tape drive's SCSI ID to 7 (switch at the back of the drive)
3. Set the destination tape drive's SCSI ID to 6.
4. Attach the 2 Tape drives to the computer's SCSI port (daisy chain method)
5. Make sure there is a SCSI terminator attached.
6. Insert the source and destination tapes into their respective drives.
7. Power on both tape drives
8. Power on the computer
9. Login as 'uv'
10. In a Blue Screen,
    Type: dd if=/dev/rmt/tps0d7nr of=/dev/rmt/tps0d6nr
11. Wait until the computer prompt reappears, **AND** the tape drive stops moving.
12. Remove the tapes.
13. Shutdown the computer. Power off the computer.
14. Detach the 2 tape drives.
15. Make sure there is a SCSI terminator attached.
16. Power on the computer.

Procedure to make a Backup Application Tape
3/23/98

Make a **Backup Application Tape**, which is to be **shipped with the system** by:

1. **As the last step in QC,**
   Obtain a blank QIC-150 format tape (at least 250 MegaBytes).
2. Label the tape, similar to the following:

   Ultrapointe Corp.
   Install Application Tape V2.x
   1/4/97

3. Turn the write protect knob until the tape is writeable.
   The arrow should point **away** from the word 'safe'
4. Insert the tape into the tape drive, move the lever until the tape is locked into the drive.
5. In a Unix shell (Blue screen), Type:
   tar cv /usr/people/uv /usr/uv - / Etc Apps. Backup
6. Wait until the prompt returns **AND** the tape drive has stopped moving.
7. Move the lever until the tape is free.
8. Remove the tape
9. Write protect the tape. The arrow should point towards the word 'safe'
10. The Backup Application tape as well as the floppy containing .uvconfig should be shipped with the system.

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Procedure to Troubleshoot Network, Floppy Drive, Disk Drive, Printer, Bootup, etc: 3/23/98

Note: This is only a brief overview

Network

1. If "Procedure to Setup NFS" has **not** been done,
   please perform this procedure now.
2. ping the remotehost
   if one can't, then check for loose coaxial connections at
   the 2 terminators, at all tees, and at all tranceivers.
3. type df
   3.1 if there is no entry for the remote filesystem (eg. REMOTE thru REMOTE6),
   Type: mount -at nfs
   3.2 if there is a big number for the remote filesystem
   Type: umount -at nfs
   Type: mount -at nfs
   3.3 check for a valid **/etc/fstab** file
   type df again, to check
4. Note: Rebooting the SGI will umount and mount automatically.

Floppy Drive:

1. if one can't read the floppy,
   make sure there is a floppy disk in the floppy drive
2. type: hinv,
   if there is no entry for "Disk drive: removable media",
   then do **1 or all** of the following **until** typing 'hinv' will show an entry
   for the floppy drive.
   2.1 If there is no **SCSI terminator** attached to the end of the SCSI bus
   (last SCSI device), then attach the SCSI terminator and **reboot** the computer.
   2.2 Check for **loose SCSI cable** connections. **Reboot** the computer if any are found.
   2.3 Power down the computer, reseat the floppy drive in the slot,
   and power up the computer
   2.4 Power down the computer, check for **dc power** to the floppy drive
3. type: df
   if there is no entry for **/floppy (OR /floppy2** when Pinnacle OpticalDrive present),
   3.1 type: chkconfig mediad on
   type: mediad -a
   3.2 type again to check for entry for floppy drive: df
4. if there is a Pinnacle OpticalDrive, **but** there is no entry for **/floppy2**,
   type: InstallOpticalPinn
   else if there is no Pinnacle OpticalDrive, **but** there is an entry for **/floppy2**
   type: DeInstallOptical

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Hard drives (primary or 2nd):

1. Assuming the /etc/fstab has been edited
   to mount the 2nd hard drive during reboot.
2. type hinv,
   if there is no entry for "Disk drive: unit N on SCSI controller 0",
   then do **1 or all** of the following **until** typing 'hinv' will show an entry for
   for the disk drive.
   2.1 If there is no **SCSI terminator** attached to the end of the SCSI bus,
   (last SCSI device), then attach the SCSI terminator and **reboot** the computer.
   2.2 Check for **loose SCSI cable** connections. **Reboot** the computer if any are found.
   2.3 Power down the computer, reseat the hard drive in the slot,
   and power up the computer
3. type hinv again to check

Printer:

1. Type: uv1000,
   to clean out the print queue.
2. Reboot the printer, wait until the printer is ready.
3. From a blue Unix screen, verify one can ping the printer:
   3.1 Type: ping PrinterHostName
   3.2 After 5 seconds, quit by Typing: Ctrl-c
   3.3 There should be 0% packet loss.
   3.4 Check **hardware** and the **network**.
   3.5 Repeat the test until there is 0% packet loss.
4. Print from inside the uv program.
5. From a blue Unix screen,
   Verify the file /usr/tmp/screen.rgb has just been generated,
   by checking its date and time.
6. Type: lpq -Pnp1
   Verify the response indicates that a print is being processed,
   OR if the print has finished being processed, the response indicates 'no entries'
7. Verify the file /etc/printcap contains the correct PrinterHostName

Bootup:

1. If one cannot bootup,
   1.1 try verifying SCSI IDs, SCSI terminator, removing SCSI devices,
   disabling drive's internal SCSI terminations.
   one could only have the 1st hard disk left on the SCSI bus
   use the command '**hinv**' to check for hardware device recognition.

1.2 press esc key, at startup, to go into command monitor mode
   type '**single**' to bootup in single user mode
   type '**df**' to check if the hard disk is full
   remove unused files in the **/REMOTE** and **/REMOTE2** directories.
   1.3 if one can not mount a filesystem or partition, try repairing it.
   type: **fsck** /dev/dsk/dks0d3s6
   where in this example, 3 is the SCSI ID and 6 is the partition.
   then try mounting the filesystem again.

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2. If there is strange behavior detected,
   2.1 verify the is only 1 line, with the hostname, in the file **/etc/sys_id**
   this 1 line should end with a carriage return.
   2.2 verify there the computer's hostname is in the file **/etc/hosts**
   2.2 verify that **/etc/fstab** contains valid information
   2.3 verify the following items are **on** with **chkconfig**
   network, nfs, pcnfsd, windowsystem, mediad
   the following items are **off**: timed, yp
3. If one has to kill the uv application, type: **killall uv**
4. If the application does not start automatically from bootup,
   4.1 check the **login setup** within the **system manager**
   4.2 check /usr/people/uv/**.sgisession** calls on uv1000
   4.3 check /usr/people/uv/**uv1000** calls on uv
   4.4 check /usr/people/uv/**uv** exists
   4.5 there are backup versions of uv in the /usr/people/uv/**Install** directory
   4.6 check there is a valid /usr/uv/**.keyfile**
   type: **rdkey**

Procedure to Disable Options after Installation
3/23/98

After Install, Disable files for install only & that the Tool has those systems ordered

For New systems, there are 2 keyfiles instead of 1:

.keyfile	Sales order options Enabled plus Options Enabled for **full** functionality testing.
.keyfileAfterInstallation	Sales order options Enabled

The .keyfile will be used until the installation at the customer site has been completed.

After installation, in a Unix shell (BlueScreen), Type:

cp /usr/uv/.keyfileAfterInstallation /usr/uv/.keyfile

Note: If the customer has purchased the all options, then the 2 keyfiles would be the same.

Procedure to install a Software Upgrade or Keyfile
3/23/98

1.1 If uv is running, exit out of uv.
1.2 Insert the diskette into the drive.
The Diskette should be automatically mounted.
If Not **and this is IRIX 4.0.5**:
select the System Manager, select Disks&Files, Select DosFloppy,
Type in /FLOPPY for the mount directory, Select Mounted,
Select ShowDetailedInfo, Select Yes for 'Mount At Startup', Select Accept.
1.3 Wait until the Floppy Drive's Green Light flashes several times and then turns off. This should take approximately 10 seconds.

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1.4 Bring up a BlueScreen by:
Selecting Tools in the ToolChestWindow at the TopLeftHandCorner of the screen.
Select Shell.

1.5 Move the mouse inside the BlueScreen and
Type **login uv**

1.6 Type **UpgdFlop**

1.7 Make sure there is a message indicating we are upgrading to the correct version.

1.8 Wait until the Upgrade Installation is finished.

1.9 If one is installing device drivers, the computer will reboot and the floppy will be ejected automatically.
Otherwise, Type **eject**

Procedure to setup NFS
3/23/98

A. Overview:

The LIS uses NFS over TCP/IP and Ethernet for its network communication.
With NFS,

1. A **remote** computer's directory can be **mounted** underneath 1 of the LIS's **local** directory.
   Thereafter, if the LIS reads or writes to this directory,
   it is actually reading and writing on the remote computer's hard drive.
2. A local directory on the LIS can be **exported** to the **remote** computer,
   so that the remote computer can **mount** it.
   Thereafter, if the remote computer reads or writes to **its** mounted directory,
   it is actually reading and writing onto the LIS's hard drive.

B. Directory Names:

1. The LIS has 6 directories, named **REMOTE** thru **REMOTE6**,
   each of which can be used to mount a remote computer's directory underneath.
2. The LIS has 1 directory named **IMPORT**, which can be exported to a remote computer,
   for it to mount.
3. **REMOTE** and **REMOTE2** are located under the / directory.
   IMPORT, and **REMOTE3** thru **REMOTE6** are located underneath the **/usr/uv** directory.
   We will use **REMOTE** and **REMOTE2** in the following examples, even though any of the other remote directories can be used.

C. Different Configurations:

The LIS could interface with the remote database using 1 of the following
3 configurations:

C1. LIS could read defect files from the **REMOTE** directory,
and then write back reviewed files to a **subdirectory** under **REMOTE**.

C2. LIS could read defect files from the **REMOTE** directory,
and then write back reviewed files to the **REMOTE2** directory.

C3. LIS could read defect files from the **IMPORT** directory,
and then write back reviewed files to the **REMOTE** directory.

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D. Databases:

Typically, Tencor, Inspex, Hitachi, LPA, Knights, Dentech would use configuration C1.
Typically, KLA would use configuration C3.

E. Setup Procedure:

1. Connect Hardware:

   Ask the system administrator to connect the LIS and Codonics printer to the same network as the database. This is using either 10Base2/ThinNet/Coaxial/BNC cabling or 10BaseT/TwistedPair cabling.

2. Obtain Network hostnames and IP addresses:

   Obtain the following hostnames and IP addresses from their network system administrator.

   2.1 Obtain for the LIS:

   hostname: [illegible]149

   IP address: 73.1.40.1

   Note: **Replace** any future reference to **ultrahostname** in this procedure, with the hostname just obtained for the LIS

   2.2 Obtain for the Codonics printer:

   hostname: w1521

   IP address: 73.25.5.21

   Note: **Replace** any future reference to **codonicshostname** in this procedure, with the hostname just obtained for the Codonics printer

   2.3 Obtain the hostname and the IP address for the database.

   hostname: Codonic1

   IP address: 73.1.49.2

   Note: **Replace** any future reference to **databasehostname** in this procedure, with the hostname just obtained for the database

   2.4 Add 3 lines to the **/etc/hosts** file using the jot editor, **similar** to the following, but with the valid IP addresses and hostnames obtained in steps 2.1-2.3

   198.93.209.134ultrahostname
   198.93.209.135codonicshostname
   198.93.209.130databasehostname

3. Obtain the following from the sysadmin:

   3.1 Database's directory name for LIS to access: _____

   3.2 **If** we are using configuration C3 (from above), then inform the sysadmin that **ultrahostname:/usr/uv/IMPORT** is the directory for the database to mount, and it is where the LIS will read in files.

4. LIS's hostname:

   4.1 **If** there is a new LIS hostname, GO TO replace the hostname in the file **/etc/sys_id** with the new one. Make sure there is a newline after the hostname. (eg. 2 lines in the file)

   4.2 Reboot the LIS right after this step by Typing: **reboot**

5. Test the hardware connection

   5.1 Type: ping databasehostname Address or name

   5.2 After 5 seconds, quit by Typing: Ctrl-c

   5.3 There should be 0% packet loss.

   5.4 Check hardware, and repeat the test until there is 0% packet loss.

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6. Codonic's hostname:

6.1 **If** there is a new Codonics hostname,
replace all references to 'codonics' in the file **/etc/printcap** with the new hostname.
eg. existing: rm=codonics:rp=2
modify this to: rm=newcodonicshostname:rp=2

7. Verify NFS is running:

7.1 Type: chkconfig network on
7.2 Type: chkconfig nfs on
7.3 Type: ps -e | grep nfsd
Verify that a line containing 'nfsd' appears.

8. REMOTE directory setup:

8.1 Verify that the /REMOTE directory exists, given the correct permissions, and is empty.
Use the following commands if needed:
mkdir /REMOTE create
chmod +rwx /REMOTE give the correct permissions
rm /REMOTE/filename remove the file *filename*

8.2 Add a line to the file **/etc/fstab** similar to the following line:
(The file specifies which remote directories to be automatically mounted at bootup)
databasehostname:/DataDir /REMOTE nfs rw,intr,soft,bg 0 0
where DataDir should be **replaced** with the DirectoryName obtained in Step 3.1

8.3 Reboot system after editing the /etc/fstab file by Typing: **reboot**

9. REMOTE2 directory setup:

9.1 **If** we are using configuration C2, repeat step 8, but for the /REMOTE2 directory.

10. IMPORT directory setup:

10.1 **If** we are using configuration C3 (from above) continue,
otherwise **skip to step 11.**

10.2 Verify that the /usr/uv/IMPORT directory exits, and is given the correct permissions.
Use the following commands if needed:
mkdir /usr/uv/IMPORT create
chmod -R +rwx /usr/uv/IMPORT give the correct permissions

10.3 Add a line to the file **/etc/exports** similar to the following line:
/usr/uv/IMPORT databasehostname case important

10.4 To make modifications effective,
Type: exportfs -a
this makes the imported data accessable to outside

F. Additional Setup Considerations:

Normally, the above setup procedure would be adequate.
If there are still networking problems, then one can try 1 or more of the following:

1. From the sysadmin, obtain the name of the user on the remote database.
With the SystemManager, add a regular user to the LIS,
which has the same UserName as the remote database user.
2. **If** the LIS is separated from the database by a router or gateway,
2.1 Obtain the correct netmask from the sysadmin.
Modify the netmask using the SystemManager.

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2.2 Obtain the routername from the sysadmin.
Use the databasehostname obtained from above.
Add a line at the end of the file **/etc/init.d/network** similar to the following line:
route add **-host** databasehostname **routername metric** 1
2.3 Add the routername with its IP address to the file /etc/hosts

How many gateways to go thru to get to administrator.

G. Preconfiguring Directories for Saving Map/Image:

1. One can use a FunctionKey to save a map and/or image to preconfigured directories.
2. This preconfiguring of directories is done inside the recipes.
   Modify the recipe for the current database, in order to specify the directories in which to save the maps and the images.
3. If there are other databases, modify their recipes, in order to specify the directories in which to save the maps and the images.
4. The preconfigured map directory is also where the map is saved,
   when one has reached the end of a Lot of wafers,
   or when one has clicked on the defect code listbox, with the SaveMap/Img mode on.

H. Application Note:

1. In the FileAccessDialogBox, there are labels for IMPORT,
   and REMOTE thru REMOTE6. One could customized these label names.
   eg. DATABASE_READ and DATABASE_WRITE
   To make this customization, modify the following lines in **/usr/uv/.uvconfig**
   uv_name_for_import, uv_name_for_remote, etc.
2. In the FileAccessDialogBox, subdirectories are displayed with the word 'Directory' next to them. In order to display the subdirectory's contents, just use the mouse to click on the subdirectory name.

I. FunctionalityTest:

1. Start up the uv program, and read in a defect file provided by the database.
2. Modify a few defect codes, and write back the reviewed defect file into the specified directory, for the database to read in.
3. Verify the database has accepted these modified defect codes.

J. Making uv non-root

1. **Skip** the following, if one has an Optical Drive.
   uv needs to be root, in order to work with the optical drive.
2. Use the SystemManager to modify uv's UserID from 0000 to 1234
3. Type: su
   Type: chown -R uv /usr/people/uv
   Type: chown -R uv /usr/uv
   Type: chmod +rw /dev/ul*
   Type: exit
4. Re-check with Functionality Test above.

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Procedure for a Hard Disk / Computer Swap for Indy
3/23/98

At Ultrapointe:

1.1 Fill in the form: **Procedure to Request for a Keyfile ...**
Request for the items: **Keyfile** and **NewHardDisk**
1.2 Submit this form to manufacturing.
1.3 In return, obtain a New Hard Disk (with software installed),
and a Keyfile Floppy.
1.4 Obtain a 250MB 1/4" QIC-150 tape to be used for data transfer
1.5 If the customer is running beta software which is more recent
than the current released software, obtain a beta software floppy.
1.6 Obtain a spare 3.5" 1.44MB DOS floppy.
1.7 **Bring along the entire document:**
Software Related Procedures for Manufacturing and Field Service

At Customer Site:
Old computer

2.1 If uv is running, exit out of **uv**.
2.2 Login as uv by:
Typing **login uv**
2.3 Write-enable the tape.
Insert the tape into the tape drive. Move the lever, to lock in the tape.
2.4 Copy over the directory /usr/uv from **Old** Hard Disk to the tape by:
Typing **tar cv /usr/uv**
2.5 **Wait until the prompt returns AND the tape drive has stopped moving.**
2.6 Remove the tape. Write-protect the tape.
2.7 To **backup** files for the new computer,
one can save the following files onto the spare floppy
Note: for .uvconfig and .keyfile, copy them to an 8.3 DOS filename
and restore them to their original name afterwards.
/usr/uv/.uvconfig **/usr/uv/.keyfile**
/etc/hosts **/etc/sys_id** **/etc/fstab** **/etc/exports**
/etc/printcap **/etc/gateways** **/etc/init.d/network**
2.8 Swap computers.

New computer

3.1 Restore data from the old hard disk by:
Inserting the tape into the tape drive
Typing: **tar xv**
3.2 Wait until until the prompt returns **AND** the tape drive has stopped moving.
Remove the tape.
3.3 With the **keyfile** floppy, install the keyfile by following the procedure:
Procedure to install a Software Upgrade
3.4 **If necessary**, install beta software by following the procedure:
Procedure to install a Software Upgrade
3.5 Follow the procedure:

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Procedure to Disable Options after Installation

3.6 If this system has **WhiteLight Video**, set it up by following step A.3.13 in the procedure:
Procedure to Install Software on a New Hard Disk

3.7 Run uv to make sure everything is OK.

3.8 If NFS was previously setup, follow the procedure **Procedure to setup NFS** to re-establish the network connection
Refer to the saved files on the spare floppy for any required information.

Procedure for a Hard Disk Swap for Indigo
3/23/98

At Ultrapointe:

1.1 Fill in the form: **Procedure to Request for a Keyfile ...**
Request for the items: **Keyfile** and **NewHardDisk**

1.2 Submit this form to manufacturing.

1.3 In return, obtain a New Hard Disk (with software installed), and a Keyfile Floppy.

1.4 Bring along the entire document:
Software Related Procedures for Manufacturing and Field Service

At Customer Site:

2.1 If uv is running, exit out of uv.

2.2 Shutdown the computer (Select System, Select SystemShutdown), then power off the computer.

2.3 Put the **Old** Hard Disk in the **Second** Slot
If there is a SCSI ID selector, set it to 2

2.4 Put the **New** Hard Disk in the **First** Slot
If there is a SCSI ID selector, set it to 1

2.5 Power on the computer

2.6 The 2nd HardDisk's Filesystem should automatically be mounted:
Double check by typing: df
and seeing that **/disk2usr** and **/disk2** are mounted
If not, mount the 2 partitions using the Disk Manager.

2.7 Login as uv by:
Typing **login uv**

2.8 Make sure there is no Directory on the **New** Hard Disk named **/usr/uv**

2.9 Copy over the directory /usr/uv from **Old** Hard Disk to the **New** Hard Disk by:
Typing **cp -r /disk2usr/uv /usr**

2.9 Copy over the following files from **Old** Hard Disk to the **New** Hard Disk:
/usr/uv/.uvconfig **/usr/uv/.keyfile**
/etc/hosts **/etc/sys_id** **/etc/fstab** **/etc/exports**
/etc/printcap **/etc/gateways** **/etc/init.d/network**
Note: Double-check that one is using the correct pathnames.
eg. cp /disk2usr/uv/.uvconfig /usr/uv/.uvconfig
cp /disk2/etc/hosts /etc/hosts

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2.10 **Skip this step, if one already has the old keyfile.**
With the **keyfile** floppy, install the keyfile by following the **last portion** of the procedure:
'Procedure to request for a Keyfile'

2.11 Follow the procedure:
'Procedure to Disable Options after Installation'

2.12 If this system has **WhiteLight Video**, set it up by following step A.3.13 in the procedure:
'Procedure to Install Software on a New Hard Disk'

2.13 Run uv to make sure everything is OK.

2.14 If NFS was previously setup, follow the procedure **'Procedure to setup NFS'** to re-establish the network connection.

2.15 Shutdown the computer, then turn off the computer.

2.16 Remove the 2nd hard disk (Old Hard Disk)

2.17 Bring back the Old Hard Disk.

Procedure for software setup of Optical Drive / Disks
3/23/98

A. Installation:

If the external Optical Drive has **Not** been installed yet,
follow the procedure: **'External Optical Drive Hardware Installation Procedure'**
This procedure will refer to the setting up of the SGI files for Optical Drive access.
To reiterate here, one just:

A.1 Type: **login uv**

A.1 Type: **DeInstallOptical**

A.2 Insert the accompanying floppy disk, wait 10 seconds.
Type: **UpgdFlop**

A.3 Type: **InstallOpticalPinn** for the Pinnacle drive
OR
Type: **InstallOpticalMax** for the Maxoptix drive

B. De-Installation:

B.1 If one wishes detach or turn off the optical drive,
Type: **DeInstallOptical**

C. Formatting:

C.1 Make sure the **write protect switch** on the optical disk is in the **unprotect** mode.

C.2 Insert the optical disk into the drive.

C.3 Wait until the amber light turns off for the Pinnacle
OR the green light turns on for the Maxoptix
Approximately 10 seconds.

C.4 Unmount any optical filesystem:
Type: **umount /OPTICAL**

C.5 Setup the disk:
Type: **formatoptics**

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C.6 Wait until the blue light turns off for the Pinnacle
OR the green light stays on for the Maxoptix,
AND wait for the computer prompt (/usr/people/uv) to reappear.
Approximately 40 seconds.
C.7 Press the eject button on the drive.
C.8 Flip the optical disk around to the second side.
C.9 Repeat steps C1 thru C9 for the second side.

D. Repair filesystem:

D.1 If one **needs** to fix a corrupted filesystem on the optical disk,
Type: **repairoptics**

Procedure to setup the Ultrapointe - Dentech interface
3/23/98

A. Background for the Ultrapointe-Dentech VARS interface:

Ultrapointe LIS <-----> Dentech UserStation <-----> Dentech Server
<-----> Database

1. User on the LIS, presses the SaveFunctionKey.
LIS's SaveDialogBox will appear, with the options of
EntireScreen, WhiteLight, 2D, 3D, Dentech[Use A/B Switch to SelectImageType],
or Dentech[Input More Annotation].

2A.If the user selects Dentech[Input More Annotation],
then the DentechDialogBox will appear and
1. Display the standard annotation, of which a configured subset,
can be sent to the Dentech:
ToolID, MapName, OperatorName, WaferSize, ProductID, LotID, ProcessID,
WaferID, Slot#, Defect#, XYPosition, XYSize, XYDieNumbers, DefectCode.
2. Prompt user to input additional annotation. Max is 50 characters.
3. Prompt user to switch between W/L or SGI screen (A/B switch),
and then press Save button.

2B.If the user selects Dentech[Use A/B Switch to SelectImageType],
no DentechDialogBox will appear,
but the configured set of annotation will still be sent to the Dentech.

3. LIS sends the annotation file named 'varsdata.int' to Dentech.
Dentech UserStation reads the file, and starts the image capture.

4. LIS waits for an image to be captured by Dentech,
and then waits for a file named 'varsdsfm.int' to be sent from Dentech.
This file contains the DiskID(5numerics) followed by the FrameID(5numerics).
LIS reads and moves this file to 'varsdsfm.bak'.
The turnaround timeout is configurable between 1-60 seconds.

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5. LIS puts the FrameID and DiskID
   (along with the SlotID, DefectXY, ActualXY, WaferID, etc) in the
   Tencor map (per Tencor image record spec) which is sent back to the database.

B. Hardware connection:

An A/B switch is used to switch between WhiteLight capture or EntireScreen capture
WhiteLight capture: Dentech accepts s-video, via a video amp.
EntireScreen capture: Dentech has a scan converter which accepts the SGI monitor signals.

C. Setup for keyfile:

The Dentech option has to be enabled in the keyfile

D. Setup on the LIS for NFS:

Dentech will be mounting the LIS directory named /usr/uv/dentech.
The following is a brief description of NFS for Dentech.
For a more complete description of NFS, please refer to the 'Procedure to setup NFS'.

1. Obtain the Dentech's **hostname** and **IP address** from the system administrator.
2. Add a line to the **/etc/hosts** file by using the jot editor.
   This line is similar to the following, but with the **obtained IP address and hostname**:
   123.45.6.789 DentechHostname
3. Export a directory named **/usr/uv/dentech** to the Dentech by:
   3.1 Type: mkdir /usr/uv/dentech
   3.2 Type: chmod -R +rwx /usr/uv/dentech
   3.3 Add the following line to the /etc/**exports file**,
   but with the **obtained Denteeh's hostname**.
   /usr/uv/dentech DentechHostname
   3.4 Type: exportfs -a
4. Give **write permissions** to everyone for new files by:
   4.1 Add the line: umask 000
   to the **end** of the **/usr/people/uv/.profile** file
   4.2 Add the line: umask 000
   to the **/usr/people/uv/.sgisession** file
   Place it right **above** the line with /usr/people/uv/uv1000 &
5. Add a user named '**vars**' by:
   Select System, in the ToolChestWindow at the TopLeftHandCorner of the screen.
   Select the User Manager
   Select Add
   Type '**vars**' as the login name. Select OK
   Select 'ksh' for Irix Shell
   Select OK, Select Close.

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E. Setup in .uvconfig for Turnaround timeout and Annotation format:

Under the Annotation spec in the file /usr/uv/.uvconfig one needs to configure:

1. Turnaround Timeout:

This timeout is the **maximum time** the LIS will wait for the Dentech, to capture an image, and return the associated Optical DiskID and FrameID.
eg. annote_dentech_timeout = **x**
Set **x** to a value between 1 and 60 seconds.
Typically, one would set **x** to double the average turnaround time.

2. Annotation File Format:

The user specifies which of the following fields are to be sent to Dentech.
The fields should match up with what's been setup on the Dentech Server side.
There are **19** lines, each of which is similar to the following:
eg. annote_line1_field_size = **a b**
where '**a**' ranges between 0-18, and it indicates the field type.
where '**b**' ranges between 0-50, and it indicates the maximum number of characters for this field.

FieldType	FieldName	Example
0	Blank	
1	ToolID	ultrapointe
2	MapName	wafer.map
3	Operator	fred
4	WaferSize	200 mm
5	ProductID	abcde
6	LotID	fghij
7	ProcessID	klmno
8	WaferID	pqrst
9	SlotNum	15
10	DefectNum	10234
11	XPos	10234 um
12	YPos	-5678 um
13	XSize	1 um
14	YSize	3 um
15	XDieNum	10
16	YDieNum	-5
17	DefectCode	501
18	UserAnnotation	Comments up to 50 chars

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Procedure to setup the Tektronix printer / Milan printserver
3/23/98

Note: This is only a brief summary
Please refer to the Printer/PrintServer documentation for more details

1. **Hardware:**
   Type: **uv1000**,
   Then **exit** of the uv program.
   Power cycle the Tektronix printer.
The PrintServer is the Milan box.
   Connect PrintServer's front SCSI port to
   Tektronix's parallel port.
   Connect the network's coaxial cable to
   the PrintServer's back coax connector.
   Back's dip switches are **DOWN-UP** for coaxial cable.
   Front's dip switches are **UP-DOWN**
   Power cycle the print server, by removing,
   and then reattaching its power cable.

2. **Check if Installation of PrintServer software is required:**
   Type: **ll /usr/people/uv/milan**
   if there are printer files installed already,
   skip to next step 3.
   Type: **mkdir /usr/people/uv/milan**
   Type: **cd /usr/people/uv/milan**
   Insert TCP/IP Floppy #1
   Type: **tar xvf /dev/rdsk/fds0d3.3.5hi**
   Wait until the floppy drive stops moving
   Type: eject
   Insert TCP/IP Floppy #2
   Type: **tar xvf /dev/rdsk/fds0d3.3.5hi**
   Wait until the floppy drive stops moving
   Type: eject

3. **Type: ./install.sh**
   A menu system will appear. We will be using 3 of these options.
   They are **Remove** a printer, **Configure** a printserver/printer,
   Install a printer.

4. **Remove any printers:**
   Select the **lpd** option
   Select the **Remove** option in the menu system
   remove **tekcolor**

5. **jot /etc/printcap**
   delete **everything** and leave **only** a newline in the file
   save and close file

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6. jot /etc/hosts
if there exists an entry for tektron, comment it out by inserting the '#' character as the 1st character in the entry line.

7. **Configure the printserver/printer:**
Select the **lpd** option
Select the **Configure** option in the menu system
Set PrintServer's hostname to **tektron**
Set print queue to **tekcolor**
Set spool directory to **/usr/spool/tekcolor**
For the system type, select the option for tektron's IP address x.x.x.x (not the option for SGI).
Type in tektron's Ethernet address, in the form of **xx:xx:xx:xx:xx:xx**
The Ethernet number is located on the bottom of the print server (small box).
Set tektron's IP address to the given IP address in the form of **x.x.x.x**

8. **Install a printer:**
Select the **lpd** option
Select the **Install** option in the menu system
Set PrintServer's hostname to **tektron**
Set print queue to **tekcolor**
Set spool directory to **/usr/spool/tekcolor**
For the system type, select the option for **SGI.**
- we are using **Host** software, not Remote
- we are using **Parallel**, not Serial
- we are using **Postscript**
- set **No** for printing ASCII Postscript
- set **No** for printing Banners

9. **Type: lpq -Ptekcolor**
The correct response should be No Entries,
otherwise repeat the above steps

10. **Tektronix software:**
cd /usr/lib/print/Tek
./add_4511 tekcolor tektron
Answer **Yes** for checking print queue
Answer **Yes** for adding printer to **lp** subsystem
Answer **3** for Tektronix Phaser IISD
Answer **Yes** for default printer
Answer **Yes** for test print

11. **Type: uv1000**
Test out the printer
Select **Kodak**
Select OK

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