Veeco

Metrology Group
A Subsidiary of Veeco Instruments, Inc.
602 East Montecito Street, Santa Barbara, California 93103
(850) 963-4431 FAX (805) 965-0522

Trouble Shooting
and Maintenance
Manual

V-Series Profiler

Maintenance and
Troubleshooting Manual

P/N 333978 (Standard)
P/N 333979 (Cleanroom)

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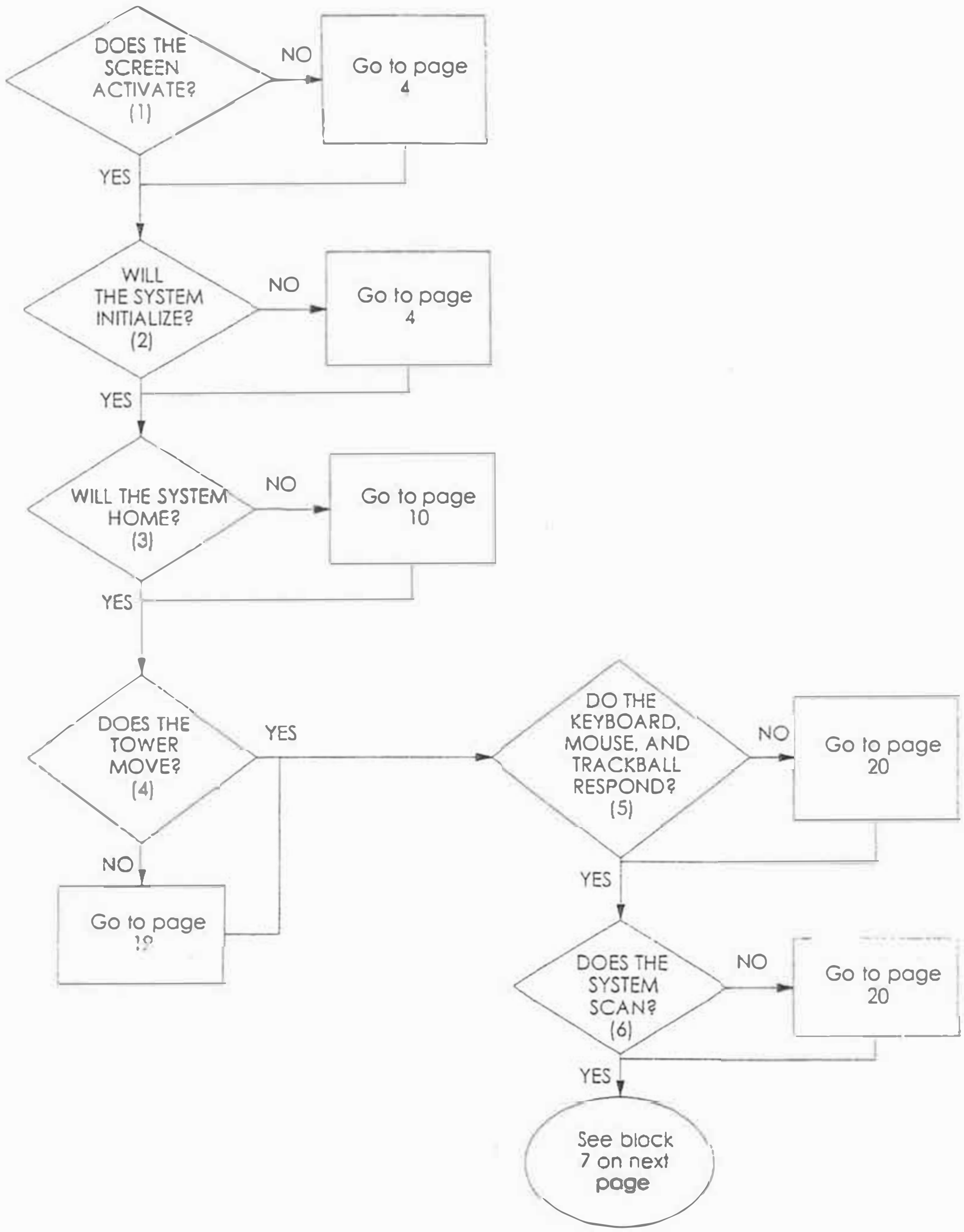
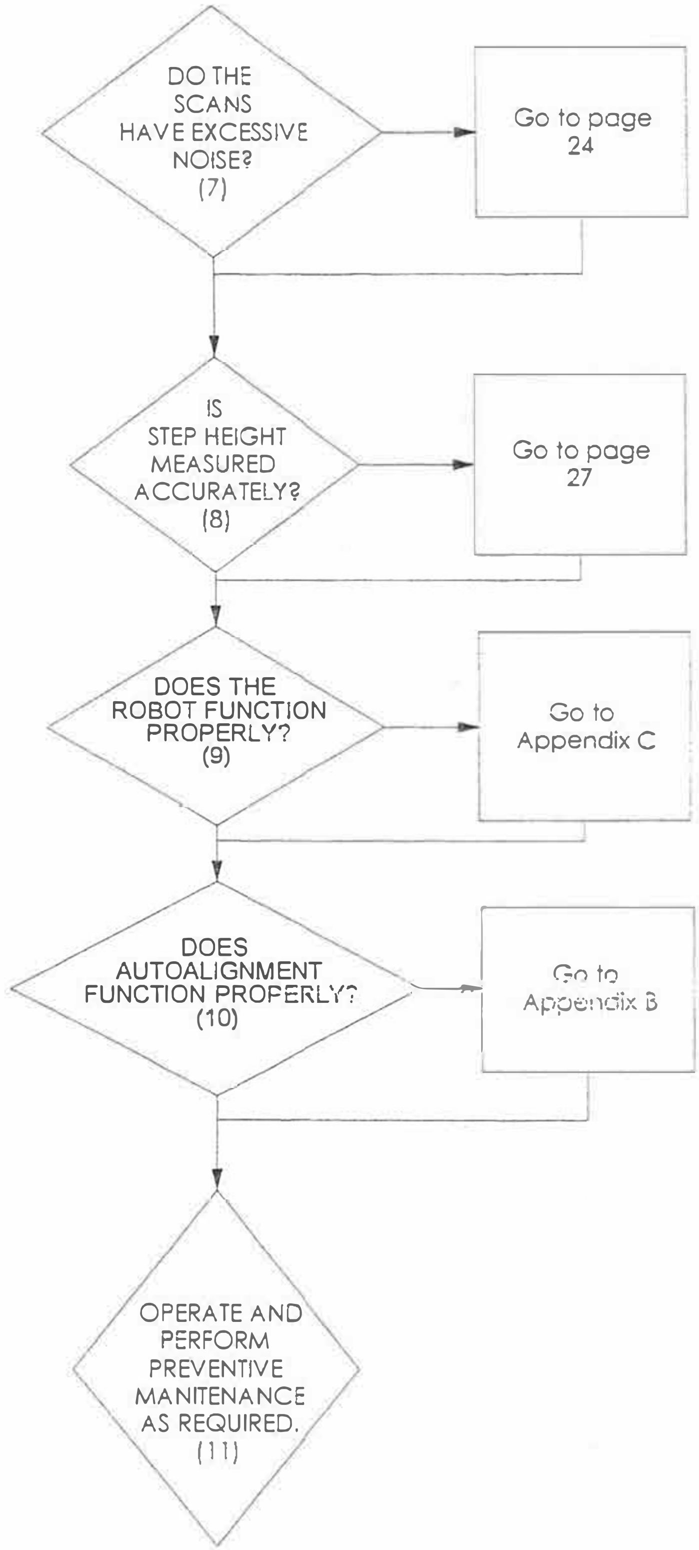
CHAPTER 1
TROUBLESHOOTING PROCEDURES

TROUBLESHOOTING GUIDE FOR THE DEKTAK 8200

(Call Veeco Instruments Field Service at (805)963-4431for assistance.)



TROUBLESHOOTING GUIDE (CONT'D)

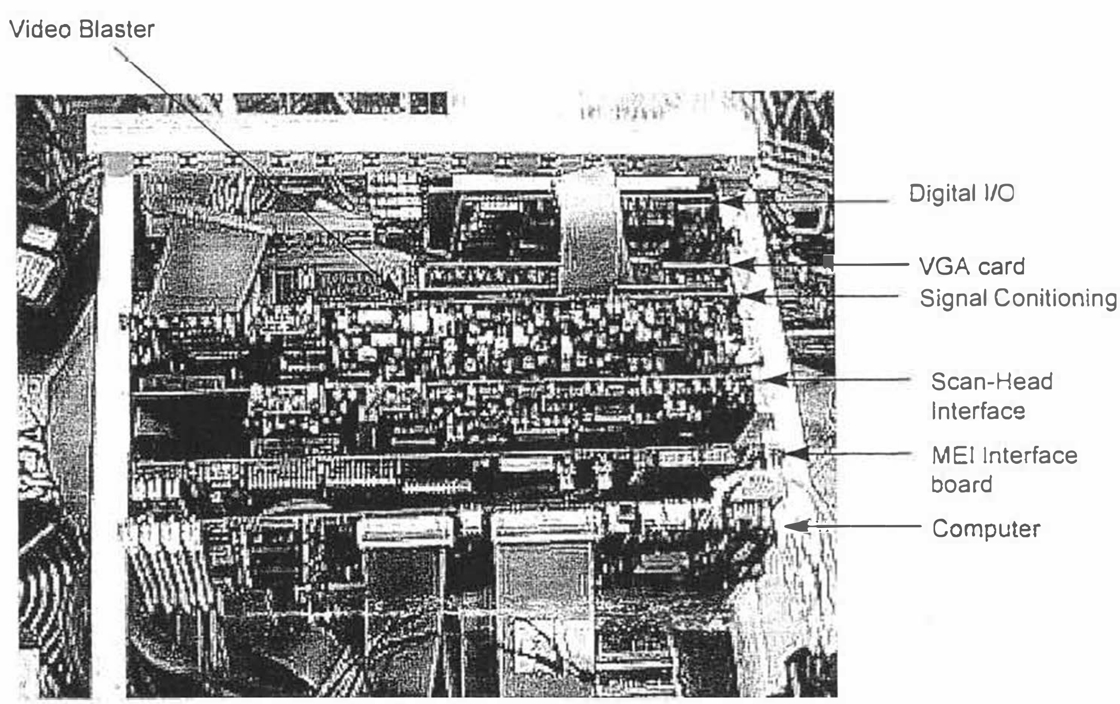


1.1 - If the Monitor Does Not Activate, Then......

.1 Verify that the monitor is plugged-in and reasonably adjusted - look at the brightness and contrast controls.

.2 Verify that the monitor cable is connected.

.3 Verify that the VGA card is firmly seating in the E-Box. See figure 1.1.1 for the location of the VGA card.



BASIC E-BOX CONFIGURATION

FIGURE 1.1.1

.4 If these remedies are not successful, replace the monitor.

1.2 - If the System Does Not Initialization, Then.....

(Attempt to initialize the system after every few steps to verify the status of the system condition)

.1 Make sure that the emergency-off switch is pulled-out.

.2 Verify that all system modules are turned ON. These include:

- The main power switch (circuit breaker) accessed by opening the right-front door of the system.

  The Cybeq, SMIFF electronics boxes (if the system has a loader or SMIFF environment) found underneath the profiler base. These sub-systems are found by removing the side panels on the right-side of the system.

- The green courtesy switch directly below the emergency-off should be turned-on.

.2 Other power connections:

- Verify that the power cords for all equipment located in the lower section of the system are plugged into the power strip on the rear-right-hand-side inside the bottom portion of the system. The right-side panel must be removed to access the power strip.

.3 Power down and verify that all cards in the E-box are firmly seated. This should have been checked during installation.

.4 Check that the following cables are firmly connected on the system:

- The cables leaving the right-hand-side of the E-Box:

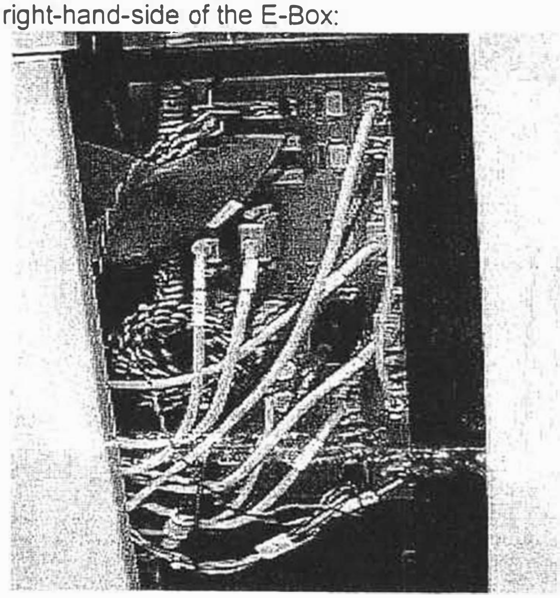


FIGURE 1.2.4A: Cables exiting side of E-Box

- The cables entering the rear of the profiler: (accessible by removing the rear panel of the system)

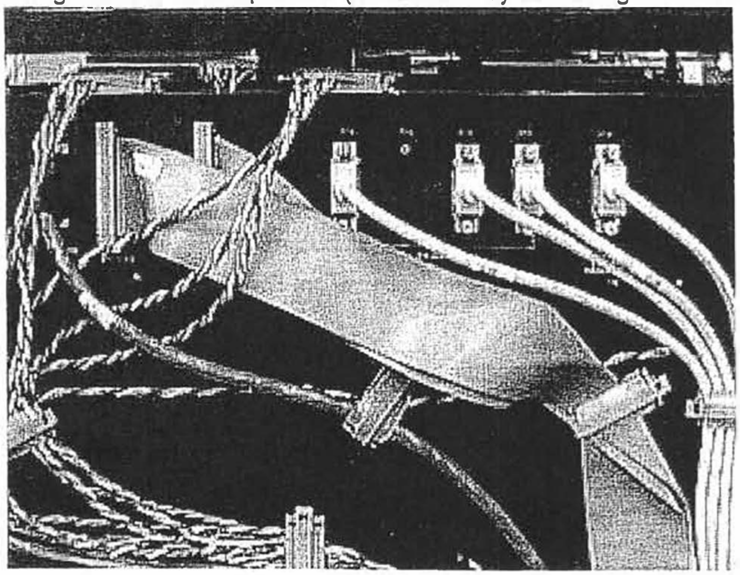


FIGURE 1.2.4B

- Connectors on the back side of figure 1.2.4B

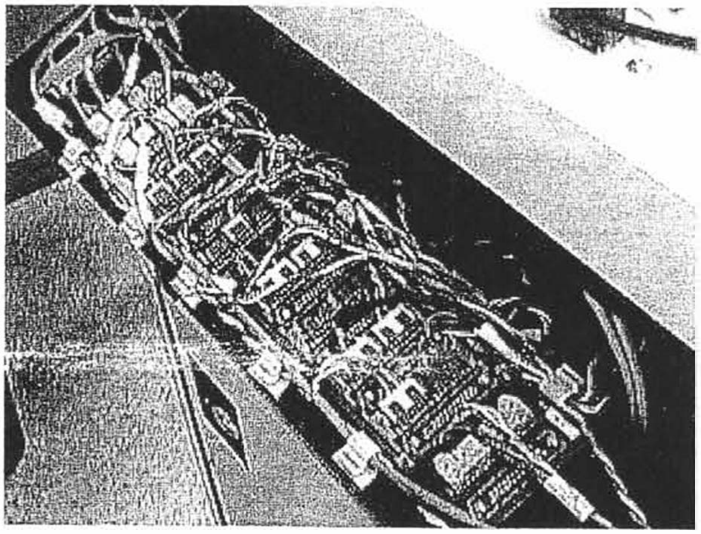


FIGURE 1.2.4C BACK-SIDE OF REAR CABLE PANEL

.5 Checking Power

Locate the "Power Good" line. It is the orange conductor on the connection block shown in figure 1.2.5 below. Measure its voltage with respect to any black conductor in the block.

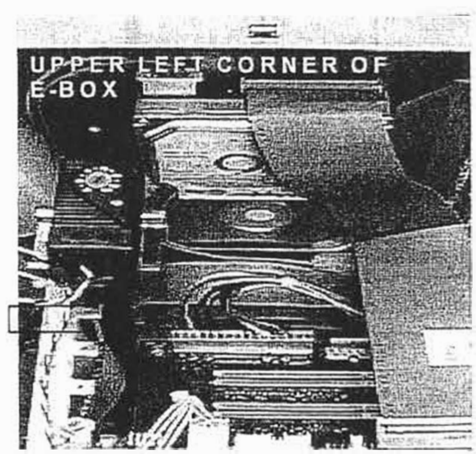


FIGURE 1.2.5A - LOCATION OF "POWER-GOOD" LINE

- If the voltage on the Power Good line is 5V then proceed to the next section - the power supply is good. If not, either the power supply is malfunctioning, or there is a short in the 5V bus of the system:

  A. You may disconnect the red wires from the 5V (Red wire) lugs on the power supply, place a 25W 1Ω resistor. If 5V can be measured across the resistor, then the power is O.K. Go to step B. If not, replace the power supply.

  B. Turn the system OFF and check the continuity between the 5V (red) line and ground (black wire) on the system. If the resistance is not approximately 52Ω, then use schematic 333405 to trace and locate the short in the 5V bus line. If the continuity is good, then you must turn the system ON and systematically locate the module on the 5V bus line that is taking down the 5V power supply. See table 1.2.5C, page 8.

- Check other voltage levels at the terminal blocks at the bottom of the E-Box per table 1.2.5B. If any voltage level is incorrect, use table 1.2.5C to locate bad modules.

COLOR CODE FOR TERMINAL BLOCK VOLTAGES

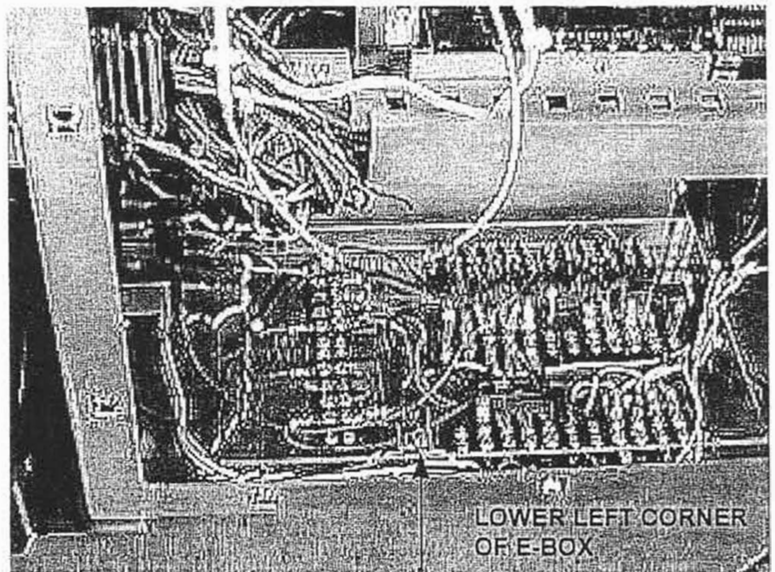
COLOR	VOLTAGE	NOTES
Yellow	+12	
Blue	-12	
Violet	+24	
Red	+5	
Black	Ground	
Grey	Ground	
Green	Ground	
White	-5V	(One location only, from power transistor at terminal block to motherboard input power strip)

TABLE 1.2.5B

P/N	MODULE NAME	5	-5	12	-12	24
		OPERATING VOLTAGES				
333433	Ass'y, Lamp Driver			x		
010017	Floppy Drive	x		x		
50[illegible]444	Fan			x		
565011	650 Power amp PCB			x	x	
333142	Modified servo Amp					x
333167	Vacuum Solenoid			x		
	Computer card cage	x	x	x	x	
	Status Light Tower					x

TABLE 1.2.5C - OPERATING VOLTAGES OF E-BOX MODULES

- After replacement of any module, re-verify that the correct voltage level appears at the terminal block in question. See figure 1.2.5D, page 9 for the location of the terminal blocks.



Location of transistor supplying
-5V to Motherboard in card cage.

Figure 1.2.5D - Terminal block location in E-Box

.6 Computer Function Verification.

Indicators of a motherboard problem include:

A. No boot-up (hard drive controller)
B. Floppy drive non functional - drive or controller problem
C. No video - dead bus
D. General protection fault messages appearing in Windows.
E. Dialogue windows reporting communication errors during normal system operation.
F. Failure to print - printer port dead.

Should any of these problems occur:

1. Remove all cards from the card cage except the single-board computer and the VGA card. See Figure 1.1.1 for the location of the computer and the video card in this card-cage.

2. Find the **Monitor** cable on the side of the E-Box. See figure 1.2.4A for the general location of the monitor cable. Connect this cable directly to the VGA card in the card cage.

3. Power up the system to see if the system computer operates. If it does, then replace the other interface cards in the card cage, one-by-one to locate the problem. If the computer does not operate, then replace modules in this order: (Verify computer operation after replacement of a module.)

   A. The single-board computer.
   B. The back-plane.

- Should results be inconclusive after step 3, call Veeco Field Service at (805) 963-4431.

1.3 - If the System Does Not "Home", Then....

Note the following summary of the contents of this section:

1.3.1	What to do for seized stage(s).	Page 10
1.3.2	Verifying cable connections.	Page 10
1.3.3	Limit switch verifications.	Page 10
1.3.4	Troubleshooting the Tower, Level, and Theta Motors.	Page 12
1.3.5	Troubleshooting the Base, Scan, and Bridge motors.	Page 16

.1 Turn the scan, y, and (for V300 series) bridge axes by hand to make sure that they are not mechanically bound. A bound axis may require replacement. Follow the appropriate replacement instructions as listed in the table of contents as necessary.

.2 Check cables as specified in section 1.2.4., page 5.

.3 **Checking limit switches**: False limit switch status can stall the software. Check table 1.3.3 for a list of limit switches and their appropriate status signals. These signals can be monitored on the E -Box interface board (schematic 333158). The E-box interface board is shown in figure 1.1.1, page 4.

TABLE 1.3.3 A

		PIN #'S				
LOCATION	CONNECTOR#	+ LIMIT	- LIMIT	HOME	POWER	GROUND
Stage	J11			4	1	5
Scan	J10	2	3	4	1	5
Base	J9	2	3	4	1	5
Bridge	J8	2	3	4	1	5
Level/Roll	J13	2	3		1	5
Tower	J12	2	3		1	5

NOTES: All levels are TTL

TABLE 1.3.3 - LOCATION OF LIMIT SWITCH CONNECTION ON THE E-BOX INTERFACE BOARD

Place a piece of paper or other thin opaque material between the emitter/receiver on any of the above limit switches. The logic level of the +LIMIT, -LIMIT, or HOME should change state from (LOW-to-HIGH) or vice-versa. Check the continuity of signal and power cables if the switch status does not change. Each limit switch has three wires: RED is 5V power, BLACK is ground, and the third wire (red or brown) is the limit switch signal. Signal levels can be probed using a DVM and pick probes at the limit switch itself. To trace the signals back to the PAB board and servo amps, do the following:

1. Monitor signals at the E-Box interface board per table 1.3.3
2. Use dwg 333158 to locate the pin on PP2 or PP3 relating to the signal to be traced for the (note that limit signals enter on J8 - J14 that have pin assignments below):

Pin	Assignment
1	+5V
2	Postive Limit Signal
3	Negative Limit Signal
4	Home
5	Ground

Table 1.3.3B: Pin assignments for limit switch connectors

3. To trace the limit signals down to the E-Box, use the following table to locate limit switch signals on the dual-in-line connectors (see figure 1.3.4B, page 14):

Axis	Function	Connecto	Pin#
Theta	Home	PP2	19
Scan	Home	PP2	27
"	-Limit	PP2	29
"	+Limit	PP2	31
Base	Home	PP2	35
"	-Limit	PP2	37
"	+Limit	PP2	39
Bridge	Home	PP2	43
"	-Limit	PP2	45
"	+Limit	PP2	47
Level	-Limit	PP3	37
"	+Limit	PP3	39
Tower	-Limit	PP3	45
"	+Limit	PP3	47

Table 1.3.3C
Location of Limit Switch signals on the Dual-In-Line Connectors

Note: Limit switch signals for the Base, Scan, and Bridge axes terminate at the servo amps (see dwg 333262 for pin-outs.

Do not replace the power supply unless step 1.2.5, page 7 indicates that it is bad. The 5V power supply level is also easily checked at TP1 and TP3 (at the top of the E-Box Interface Board).

.4 **Checking the Tower, Level, and Theta Motors Electrically:** Turn to Appendix A and run the MEI "Set-Up" program. In the program, select the appropriate axis and run a **Repeat** move. This will allow you to probe circuitry while the motors are activated.

Select the appropriate axis in the set-up program per the following table:
While the selected stage is commanded to run, verify that the following signal appears on connectors J3,4,and 5 of the E-box interface card shown in figure 1.2.4C:

Axis Name	Power*	MEI Axis #	Location (on 333158)
Theta Stage	+/-10V (full speed)	3	J3
Tower Motor	+/-10V (full speed)	4	J4
Level/Roll Motor	+/-10V (full speed)	5	J5
Bridge	24V PWM	0	J0
Y- Axis	24V PWM	1	J1
Scan Axis	24V PWM	2	J2

***Measure power signal between DC+ (PIN 1) and RTN (PIN 2) per schematic 333158, connectors J0 - J5**

Table 1.3.4A - AXIS POWER SIGNALS

If the motor of the selected axis is running reasonably, then electrically, everything is fine. If not, then turn to the flowchart on the next page.

Check power going into the PAB board in the E-box:

The yellow and blue wires found at the input power connector of the PAB should be at ±12V.
If they are not, then these cables can be easily traced top the terminal block at the bottom of the E-box (fig, 1.2.4C) and then back to the power supply. Replace components as required.

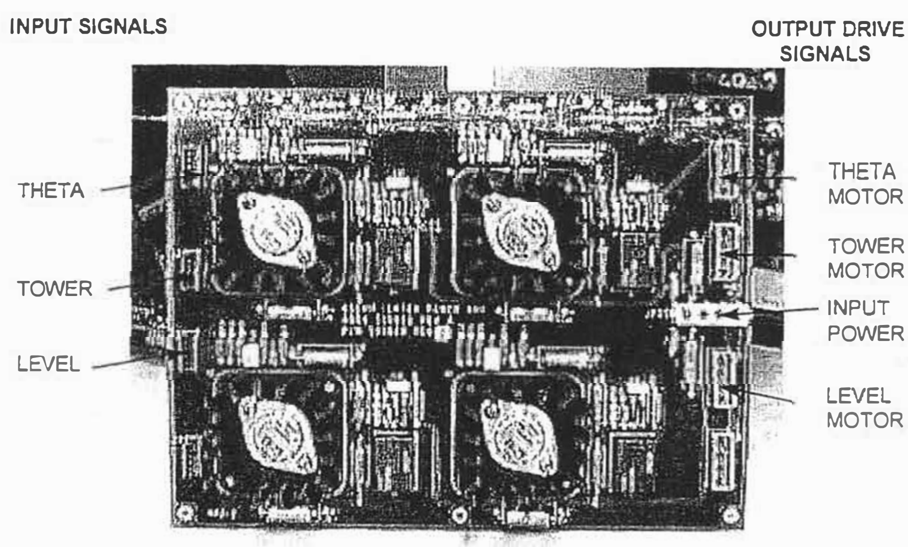
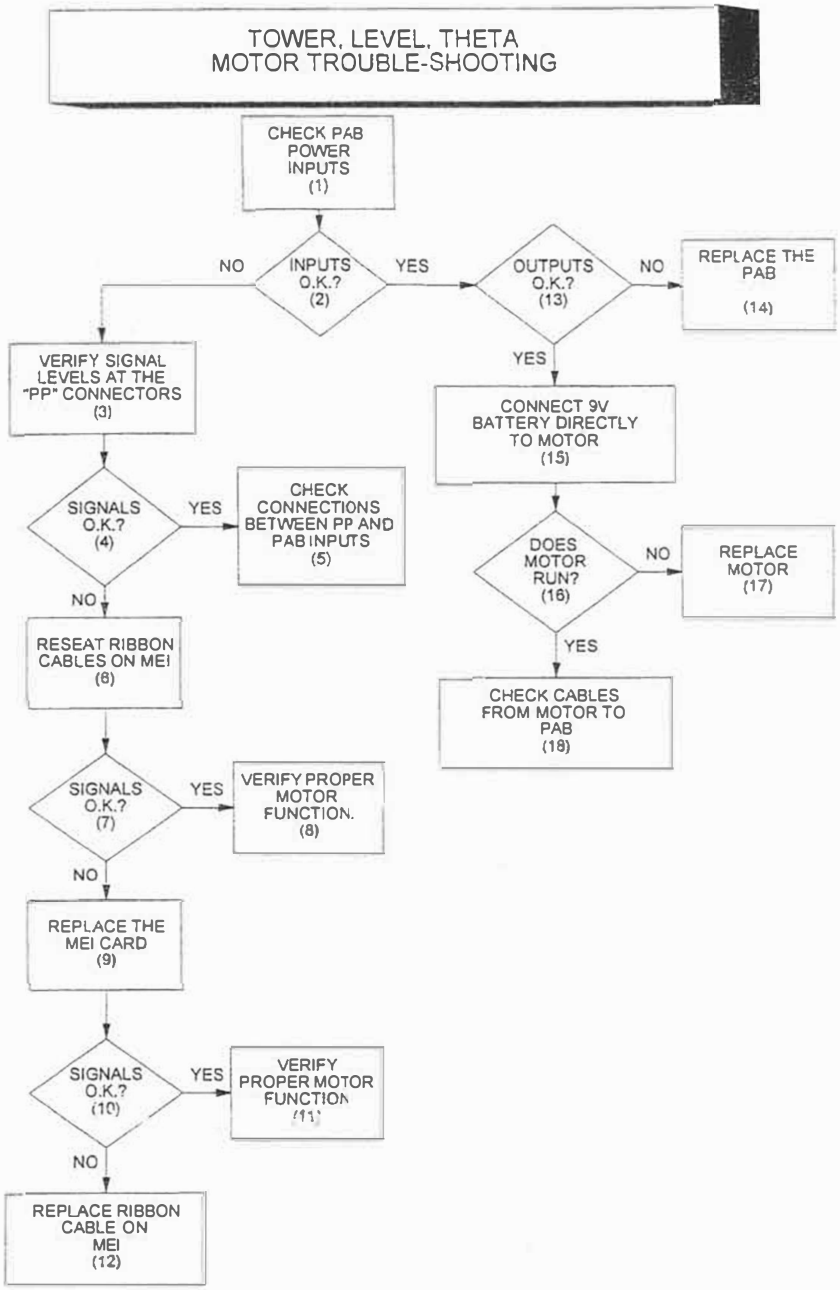


Figure 1.3.4A - PAB in E-Box



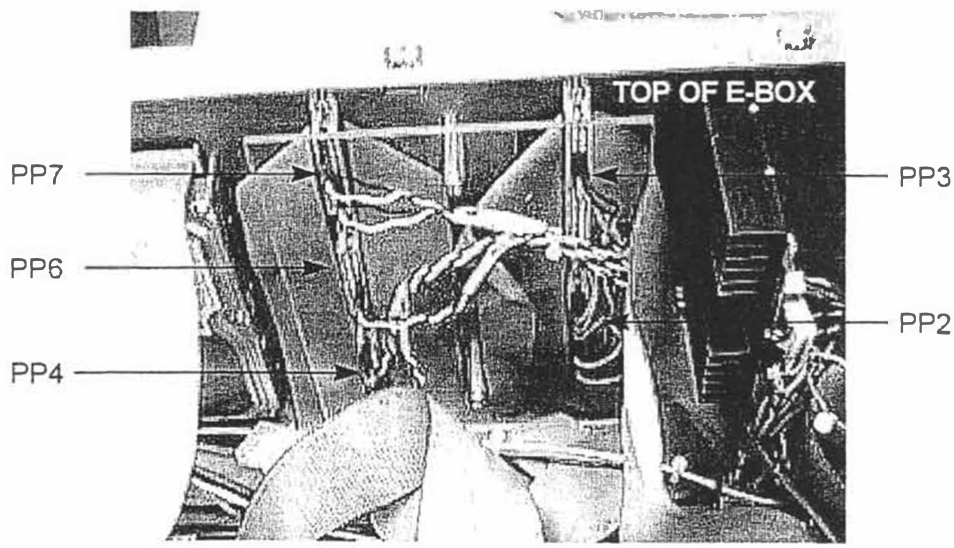
1
There are four conductors coming on each PAB input connector:

Color	Function
White	+/- 10V speed signal
Black	Ground
Black	Ground
Orange	Amp Enable (High TTL Active)

TABLE 1.3.4B - MOTION SIGNALS FOR TOWER, THETA, AND LEVEL MOTORS

2
While running the stages in the MEI Set-up program, these signals can be measured on the PAB board itself . Measure these signals by inserting a long metal probe (a pick) . If any of these signals are not present, then it must be determined if the problem is in the cables, or the MEI controller. If these signals are O.K., then proceed to step **13**. If not go to step **3**.

3
The input signals to the PAB are from the MEI board via the ribbon connector. Signals are tapped out of the ribbon cable by the dual-in-line connectors shown in the figure below. The following table below describes where to find the signals on these connectors. The various signals per each motor can be found per the following tables 1.3.4A ,Band C, and figure 1.3.4B:



DUAL-IN-LINE CONNECTORS

FIGURE 1.3.4B - LOCATION OF IN-LINE CONNECTORS

Axis	Connecto	Color	Pin#	Function
Theta	PP2	Orange	3	Amp Enable
Theta	PP2	Black	4	Ground
Theta	PP7	Black	14	Ground
Theta	PP7	White	22	Speed Signal
Tower	PP3	Orange	15	Amp Enable
Tower	PP3	Black	16	Ground
Tower	PP4	Black	1	Ground
Tower	PP4	White	9	Speed Signal
Level	PP3	Orange	11	Amp Enable
Level	PP3	Black	12	Ground
Level	PP4	Black	14	Ground
Level	PP4	White	22	Speed Signal

TABLE 1.3.4C - PIN ASSIGNMENT FOR MOTOR SIGNALS

4
If the signals are O.K., then a problem with the system is that there is a missing connection between the dual-in-line connectors and the PAB. Check these cables thoroughly per table 1.3.4C (**5**) If not, then go to step **6**, the problem is between the MEI controller and the ribbon cables.

6
Re-seat the cables on the MEI controller. If the signals are O.K.(**7**), then re-verify the function of the motor (**8**). If the signals are not O.K., then replace the MEI card (**9**)

NOTE: It will be much easier to try replacing the MEI card FIRST, then replacing the cable(s) if necessary.

10
If the signals are still not good, then replace the ribbon cable(**12**). If they are good then verify proper motor function (**11**).

13
Check the outputs of the PAB board. If the inputs are good, and the outputs bad, then remove the output connectors on the PAB and recheck them. If the outputs are not good, then replace the PAB (**14**). If they are good, then proceed to step 15 to check functionality of the motor.

15
Connect a (new) 9V battery to the inputs of the motor with clip-leads. The level and theta motor connectors can be accessed at the scan stage interface board (figure 1.3.4C). The tower motor has a red/black lead that can be accessed at the top of the tower. If the motor runs, then check to continuity of the motor power connection all the way back to the output of the PAB board.

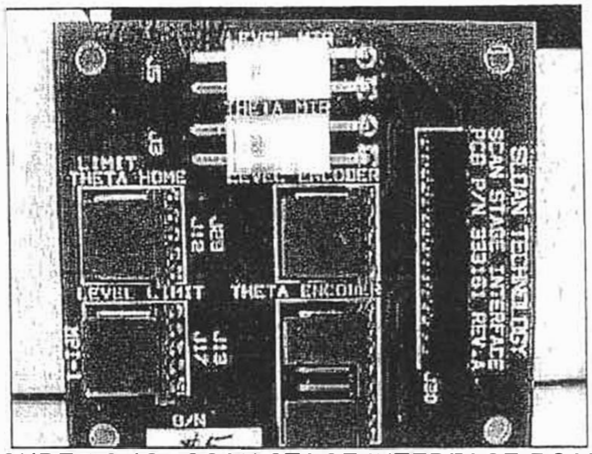


FIGURE 1.3.4C - SCAN STAGE INTERFACE BOARD (CONNECTORS FOR LEVEL AND THETA MOTORS ARE TWO TOP CONNECTORS)

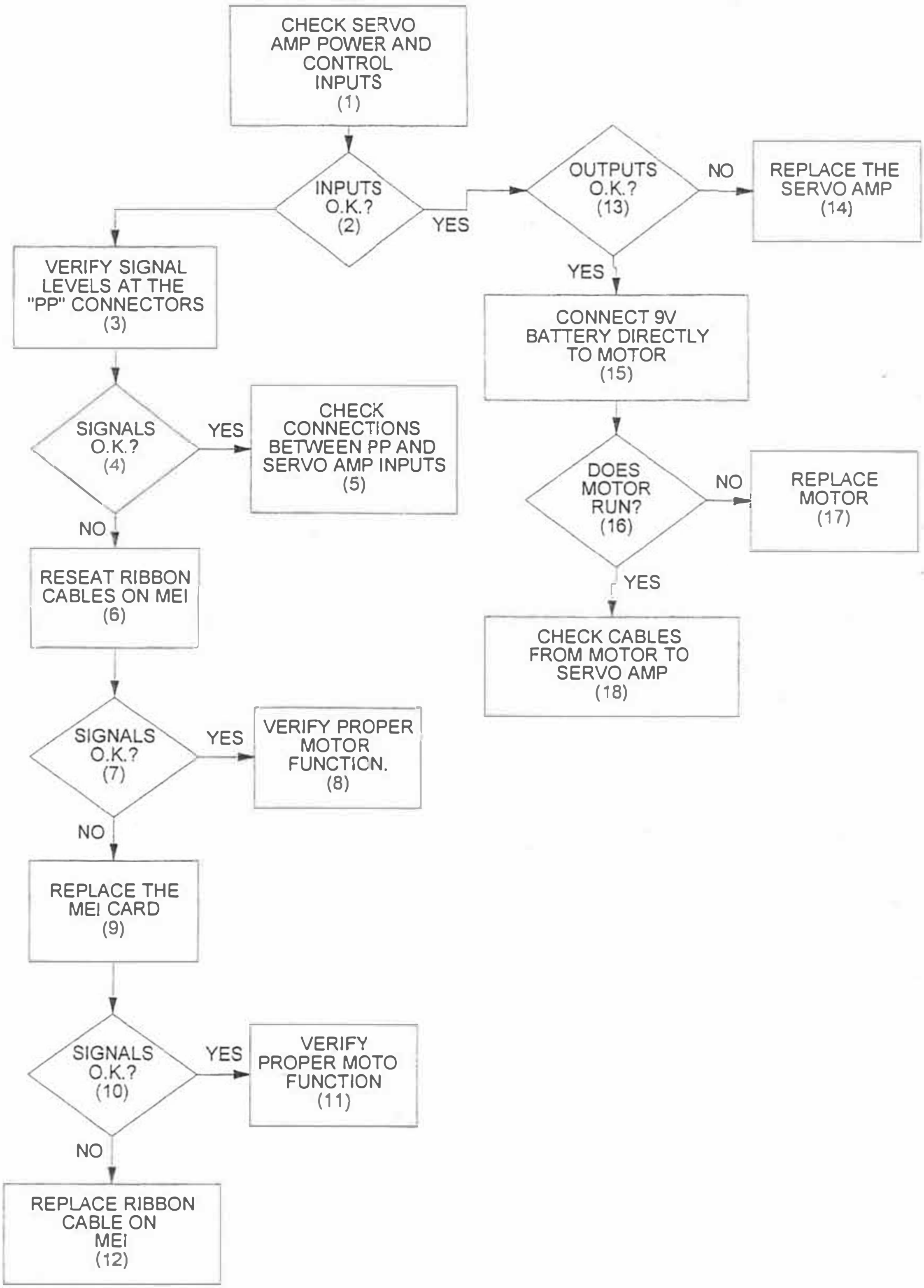
16
If the motor does not run, then it should be replaced **(17)**. If it does run, then check the continuity of the cabling from the motor back to the PAB outputs using dwgs. 333267, 333403 and table 1.3.4C **(18)**. Note that for dwg 333267, the following axis numbers refer to these stages:

#	Axis
0	Bridge
1	Y
2	Scan
3	Theta
4	Tower
5	Level

TABLE 1.3.4D - Axis numbers and their assignments

.5 Checking the bridge, scan, and Y-axis motors electrically: follow the flowchart on the next page:

SCAN, BASE, AND BRIDGE MOTOR TROUBLE-SHOOTING



1
Verify that the violet wire entering the servo amplifier is 24V.Use a "pick" to probe the wires entering the power connectors. Measure while the power is still plugged into the servo board. Measure with respect to ground (black wire). The violet conductors are easily traced back to the terminal block (see fig 1.2.5D.page 9.). If 24V is present, then proceed to step **2**. If not try disconnecting the power connector from the servo amp and retaking the measurement. If 24V is present, then the servo amp is shorted and must be replaced. If 24V is not present, then the problem is the power supply or the wires from the power supply to the servo amp. Trace the violet wires back to the terminal block, then to the power supply. Try to measure 24V at both locations. Replace wires/power supply as necessary.

Check the input signals to the servo amp board. Refer to dwg. 333262. Both the "Fault" and "Reset" lines are not applicable to this system, so disregard them. Positive limit, negative limit and amp enable lines are all TTL high active.

Drive motors will operate when the limit switch logic levels are low and the "amp enable" line is high. Check the limit switch operation per section 1.3.3.

The white wire at the servo amp input should range between ±10V when the motor is running. The orange wire (amp enable) line should be TTL high. These signals are located at the dual-in-line connectors as follows:

Axis	Connecto	Color	Pin#	Function
Scan	PP2	Orange	7	Amp Enable
Scan	PP2	Black	8	Ground
Scan	PP7	Black	1	Ground
Scan	PP7	White	9	Speed Signal
Base	PP2	Orange	11	Amp Enable
Base	PP2	Black	12	Ground
Base	PP6	Black	14	Ground
Base	PP6	White	22	Speed Signal
Bridge	PP2	Orange	15	Amp Enable
Bridge	PP2	Black	16	Ground
Bridge	PP6	Black	9	Ground
Bridge	PP6	White	1	Speed Signal

Table 1.3.5A: Base, scan, and bridge motor signals

4
If these signals are present, check/repair cable continuity between the dual-in-line connectors and servo-amplifier cards **(5)**. Replace the ribbon cable as necessary. Once signals are present, verify they appear at the servo amp inputs. Go to step **11** if the inputs are now correct. If the signals are not present, then proceed to step **6**.

6
Re-seat the cables at the MEI controller. If the input signals are now present at the servo amplifier inputs**(7)** then verify proper output signals from the servo amplifier **(11)**. If the signals are still not present, then go to step **8**.

8
Replace the MEI card and re-verify servo-amp inputs **(9)**. If the input signals are now present, go to step **11**, and if not, go to step **10**.

10
Replace the ribbon cables on the MEI card. If the servo amp signals are still not present, then recheck all work. If the signals are present, go step **11**.

11
The outputs of the servo amp card are shown on schematic 333267, find axes 0.1, and 2. The functional assignments for these wires appears below:

Color	Function
Violet	Servo Amp Power +24V
Black	Servo Amp Return
Shield	Shield
Clear	Motor Signal 24V PWM
Black/w slip-on connector	Motor Return

Do not disconnect the connectors from the motor while taking the measurement. An easy way to determine if the problem is caused by the motor or servo amplifier is to swap connectors from one servo amp to another (turn power off first before attempting this). If the motor now functions then the suspected servo amp needs to be replaced **(12)**. After replacing it make sure to tune it with the MEI software in Appendix A. If the motor still does not function, then return all cables to their original locations and go to step **13.**

13
Connect a new 9V battery to the suspicious motor. If it runs **(14)** then check cables from the motor to the servo amp **(16)**. If it does not run, then replace the motor **(15)**.

1.4 If the Tower Doesn't Move Then....
(Use this section only if the system successfully reaches HOME" at start-up)

.1 Verify that the stylus is not "sticking". The tower will not move if the LVDT has not gone through null.

.2 Remove the gear inspection window found at the top and side of the tower assembly as in figure 1.4.1.

.3 Verify that the lead-screw gear has not been pushed all the way to the top (this may occur has crashed into the theta stage). Refer to figure 1.4.1. If the gear has been pushed up then proceed as follows:

A. Inserting a screw-driver into the teeth of the horizontal tower lead-screw and try lightly tapping it loose.

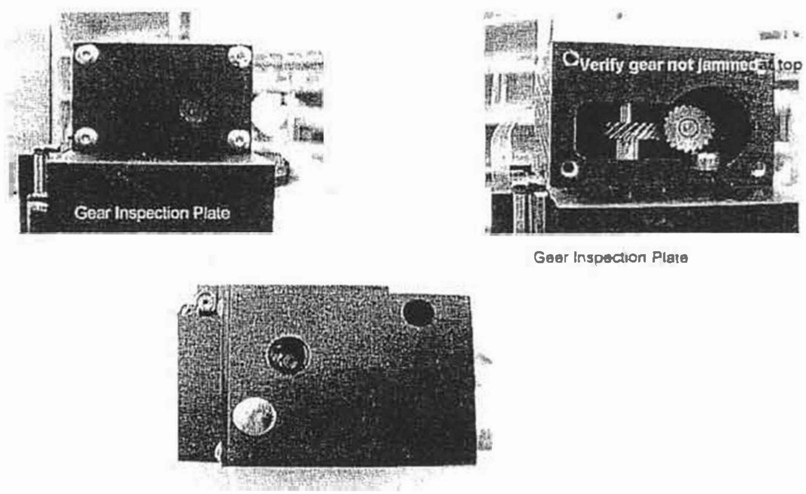
B. If "A" was not effective, then support the nose assembly of the system by placing a support beneath it. Loosen the motor mounting screws slightly and gently rock the nose assembly up/down until the horizontal gear can be positioned at the same height as the motor gear. Securely tighten the motor mount screws after this has been done.

.4 Disconnect the electrical connector and connect a new 9V battery to it. Observe if motor moves.

If motor moves, then:

- Check the limit switch signals per 1.3.3, pages 10 - 11. Correct limit-switch function as necessary.
- Check the power signals to the motor per section Tower, Level, and Theta Motor Troubleshooting Flowchart on page 13. Replace cables, interface boards as necessary.

.4 If the motor can be operated from system software, and the tower assembly will not move after successfully completing "B", then the tower drive unit of the system must be replaced by a Veeco service engineer.



Gear Inspection Plate

Access holes to remove motor/gear

(Top-view of Tower)

Figure 1.4.1 - Tower Assembly

1.5- If the Keyboard, Mouse, Trackball Don't Respond, Then....

.1 Check the Keyboard and mouse connectors (especially if keyboard errors are displayed on the monitor at boot-up).

1.6- If the System Doesn't Scan, Then....

.1 Observe tower operation and follow section 1.4 if the tower is not working properly.

.2 Check operation of the Scan axis limit switches (section 1.3).

.3 Refer to the Optics alignment Section, this manual to verify that null is reached when the tower and stylus are down.

.4 Check the coaxial cable coming from the LVDT Preamplifier card for continuity.

.5 Operation of the scan-head interface card Requires running Dektak Diagnostic software): See step .6.

- Check the X-Axis motor signals using section 1.5.
  - A. Exercise scan axis using MEI software from Appendix A.
  - B. Check limit switches per section 1.3.3.

.6 Checking Signal Conditioning Board functions.

•First, load the Diagnostics software per instructions below:

WARNING: FOLLOW INSTRUCTIONS EXACTLY AS WRITTEN FOR USING THE DIAGNOSTIC SOFTWARE. IT IS POSSIBLE TO RENDER THE INSTRUMENT USELESS BY MAKING INCORRECT ENTRIES IN THIS SOFTWARE. SERVICE CALLS REQUIRED TO RECOVER FROM IGNORING THESE INSTRUCTION ARE NOT COVERED BY THE WARRANTY.

- If the Dektak Diagnostic Program is not present on the system in icon for, do the following:

1. Go to the Dektak program group.
2. Select **File**, then **New** from the Porgram Manager.
3. You should see the following dialogue window:

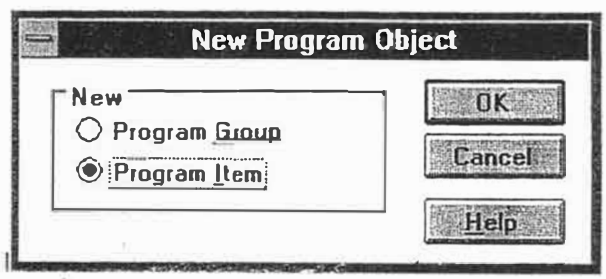


Figure 1.6.1

Select "Program Item" , then click on the "O.K." button. The dialogue box below will appear:

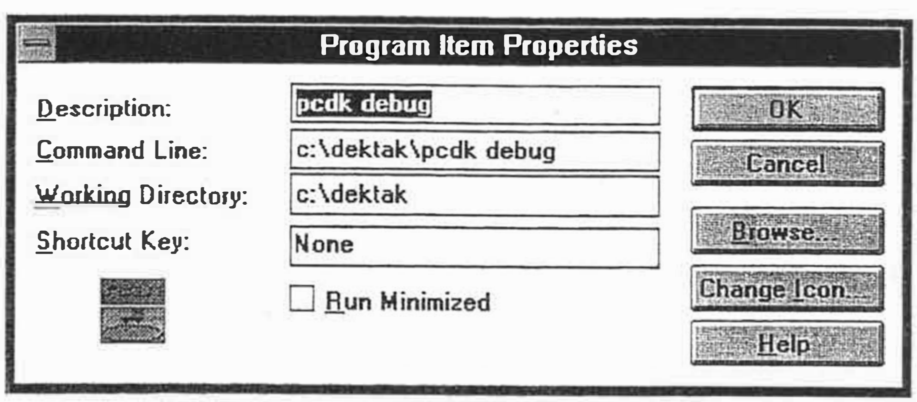


Figure 1.6.2

Verify that the first three (3) lines are entered exactly as they are above. You may select any icon desired.

After clicking on the O.K. button, a new icon in the Dektak program group will appear. It will have the same description as was entered in the description line above.

When clicking on this icon, the same Dektak system program will run command , with the exception that the **Diag** will have an expanded menu.

- Now, check the signal conditioning board functions of Force, LVDT, and illumination:

A. Signal Conditioning Board Diagnostics:

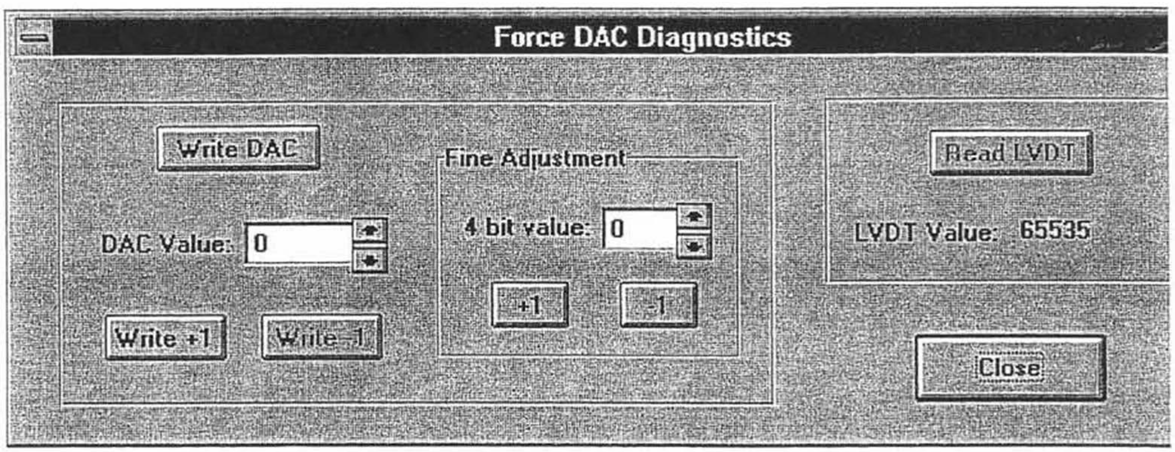


Figure 1.6.3

1. Select **Diag** then **Force DAC Diagnostics** from the Dektak Main menu. Make sure that the tower is in the "UP" position before attempting the following steps:

2. In DAC value, highlight the current entry and replace it with 180 and click on **"Write DAC"**. If the LVDT level did not change that, then use the keys **"Write +1"** and **"Write -1"** to determine the setting that sends the LVDT from 0 to 65535 or vice-versa. Typical systems will have the LVDT value switch with a value between 170 and 200. If the DAC value at which the LVDT switches values is not in this range, then adjust the force coil drive circuit as follows:

   A. Locate the signal conditioning board (P/N 333451) in the E-Box (see figure 1.1.1 on page 4.)

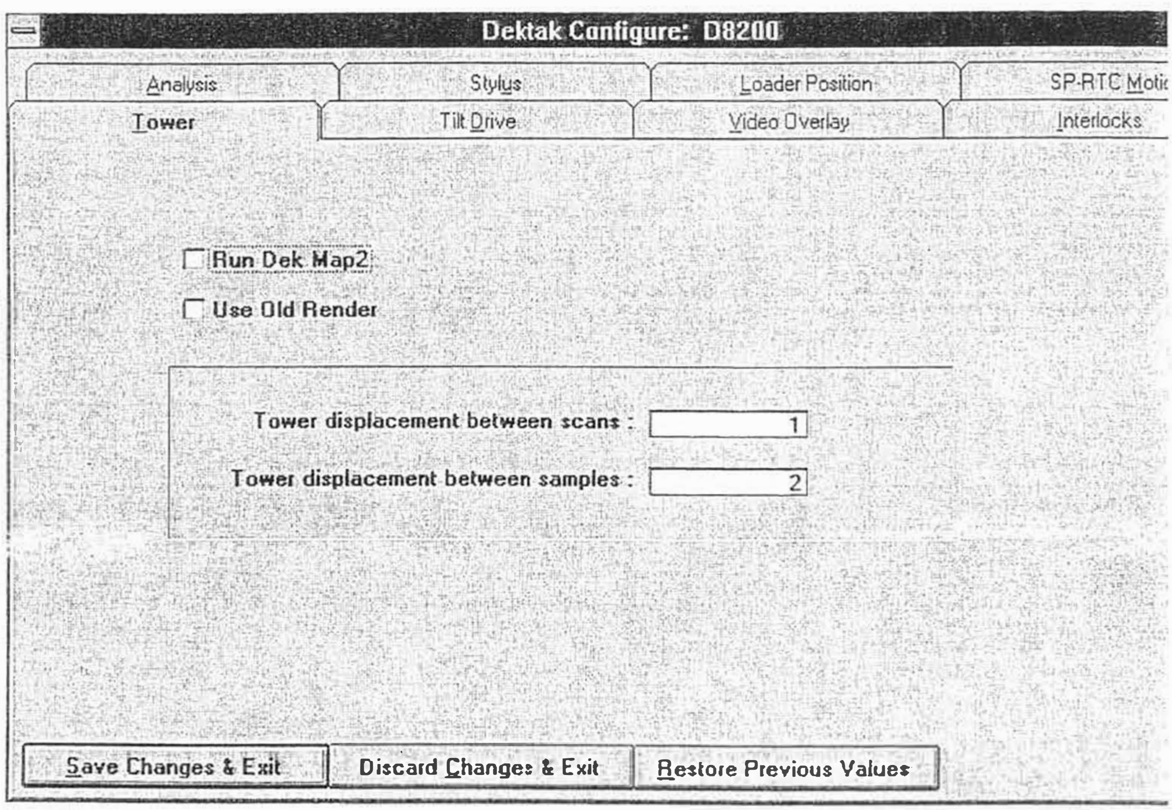
   B. Find the adjustable pot R9 on the board (note: TP2 is the force coil signal). Adjust CW if the trip DAC value for LVDT -switching is too high, or CCW if the DAC value is too low.

3. Verify that the motion of the LVDT is not bound. To do this, click on **"Write +1"** and **"Write-1"** to verify that an equal number of bit values will switch the LVDT readout from 0-65532, then from to 65523 -0. If there is a significant difference when approaching the switching DAC value from one direction to the other, check for any mechanical interference with the stylus. If none is

found, then the nose will require replacement. The suspect nose should be sent back to the factory for refurbishment.

- In the DekTak program group (Windows Program Manager), double-click on the configuration editor icon:

Observe the following display (select each folder tab to view all system settings):



Now, select each folder in this program, and compare the settings to those recorded during your first preventive maintenance activity (turn to the Preventive Maintenance section for details).

1.7 - *If the Scans Have Noise, Then...*

NOTE: It is difficult to illustrate the many manifestations of noise in general since every user may have unique requirements. This section is meant to illustrate basic ideas of where to find the sources of noise. Before proceeding to use this procedure, verify

A. Tightness of mounting screws on the Y-Axis, Scan Axis, Theta Stage, Nose, and Tower. If any loose is found, tighten it and re-try the scan before continuing. Do not overlook the flex attachment of the theta stage to the scan drive.

B. Verify that no wires or vacuum lines are rubbing against any moving mechanics. This is especially important around the encoder section of the scan drive and the tower.

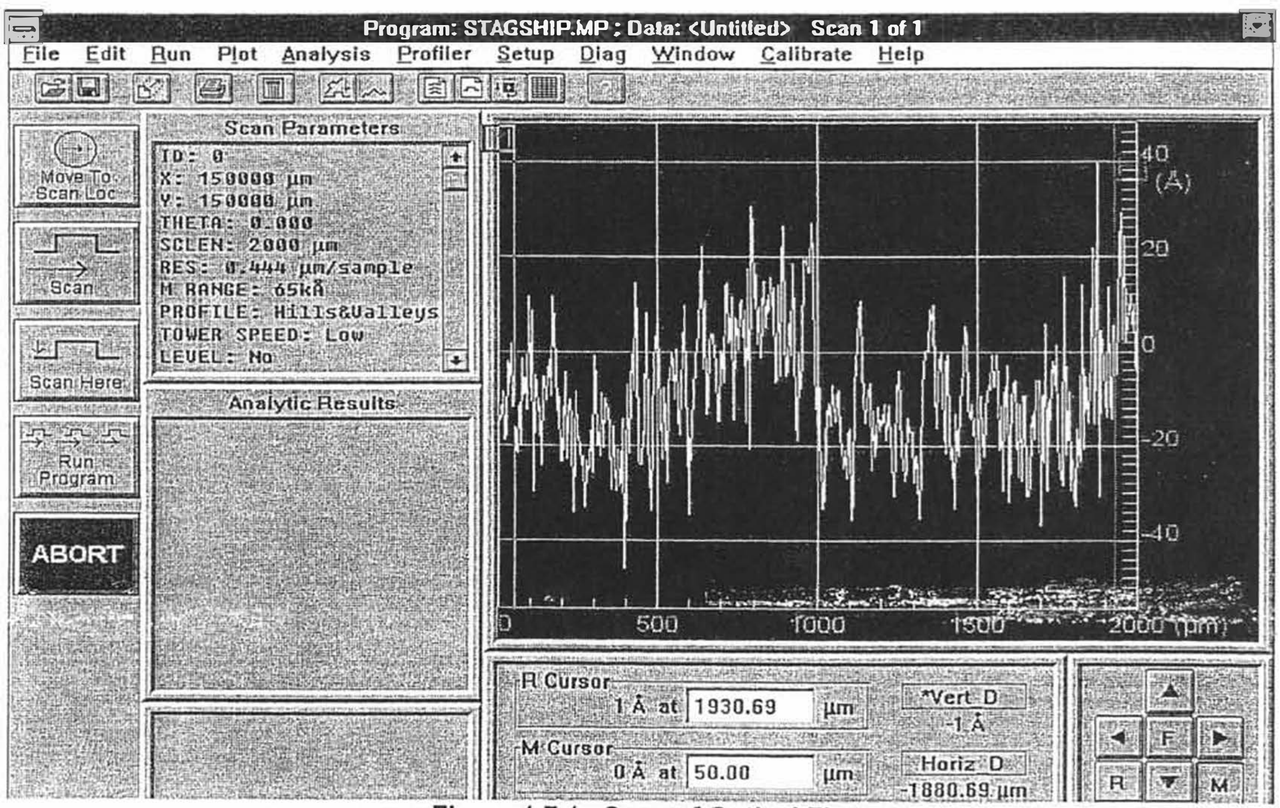


Figure 1.7.1 - Scan of Optical Flat

NOTE: We refer to a **Baseline** in this procedure. It can be approximated by drawing a line through the center of the plot. Below are some non-normal baseline shapes that indicate problems:

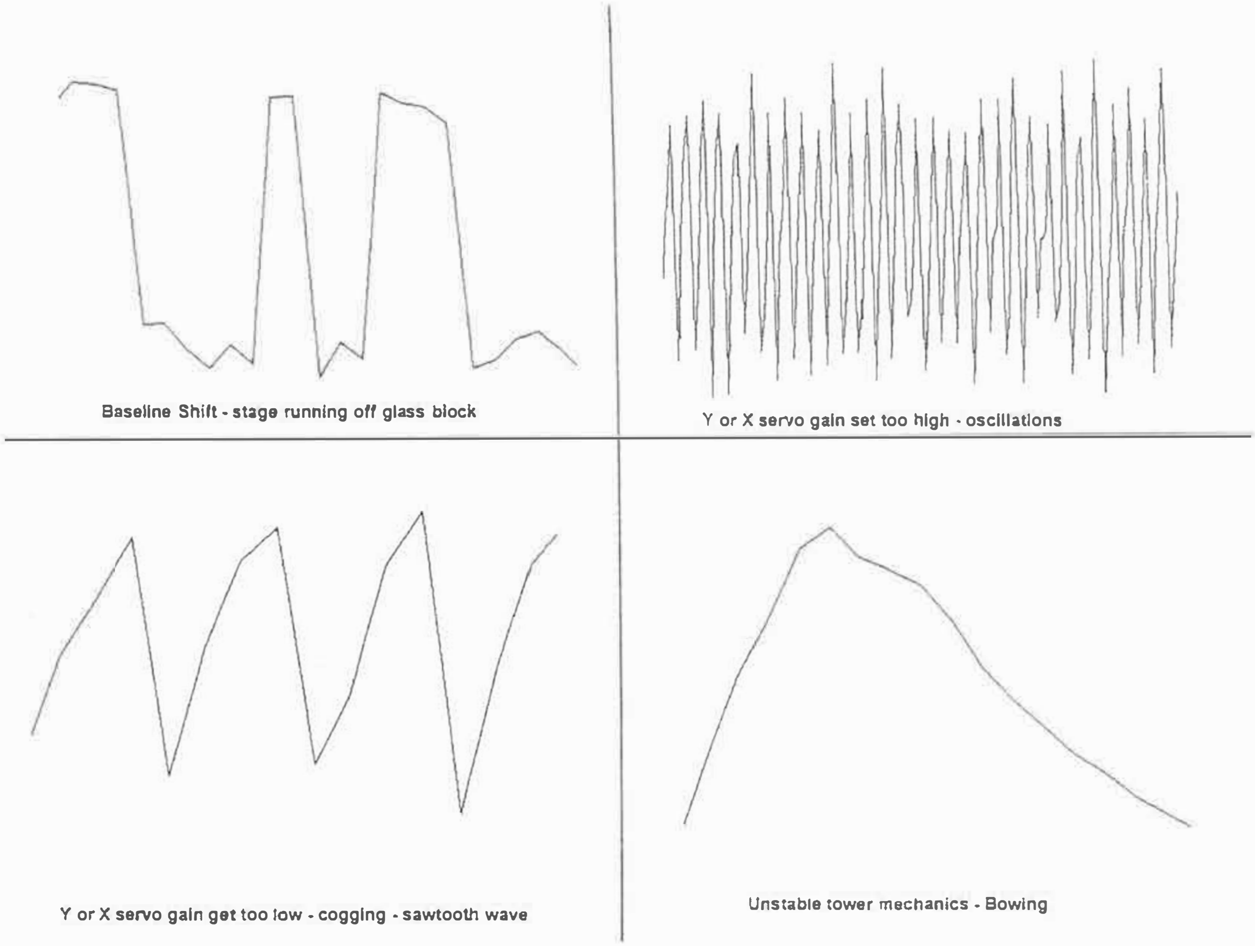


Figure 1.7.2 - Non-normal Baseline Shapes and Their Causes

.1 - Non-normal Baseline Shapes

If the scans taken on your instrument have any of the following features, then noise may be compromising the accuracy of your instrument. Figure 1.7.1 shows a typical scan on an optical flat. It is normal scan. Figure 1.7.2 illustrates what may cause several types of non-normal baseline shapes.

- **Baseline Shifts** - Usually caused by the theta stage running off the glass block. Observation of this type of noise may require removal/replacement of the theta stage per section 2.3 of the replacement procedures section of this manual of this manual.
- **Oscillations** Most common cause for oscillations is the servo amplifier gain too high. A remedy that should correct this problem is to:
  - A. Go to the Dektak program group.
  - B. Open SBC.INI
  - C. Lower the SHIFT and Slow scan SHIFT one number (i.e. from -4 to -5).
- **Sawtooth** See remedy for Oscillations.

- **Bowing** This can be due to an unstable tower. Try tightening all the screws on the tower assembly(check Y and X axis mounting hardware too). Cleaning/replacement of The tower assembly of the tower ass'y in the preventive maintenance section may be necessary.

- **Periodic - Features** A scan of 10mm in length should be run to detect this problem. Look like dips and bumps, spikes, or sine-waves in the baseline. This could be caused by a worn or eccentric components of the scan drive. A replacement scan drive is recommended.

- **High baseline** - can be caused by:

  A. Dirty glass or Teflon pads under theta stage. Clean glass and clean (or replace) Teflon pads per section 2.3.2 in the replacement procedures.

  B. LVDT rubbing on the coil. Go to section 1.6 to verify that the LVDT can move freely

- **Low Frequency Noise** - Check the air-isolators as follows: (especially if the systems has been moved).

  - Verify that the system is floating on its air cylinders. For proper function, the system should be supplied with 65 PSI of air pressure. The pressure may be reading the Vacuum input gage located on the rear panel of the system in the lower-left corner.

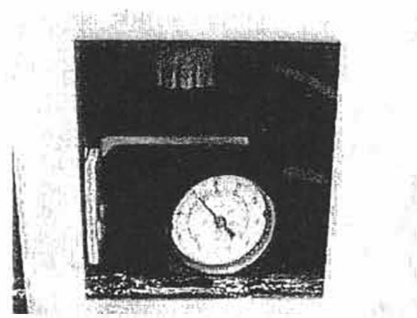


Figure 1.7.3 - Vacuum Input Pressure Gauge

Verify that the system is level. Check with a bubble-level in both the side/side and front/rear directions.

- Verify that the air isolator adjustment arms are properly adjusted directly underneath the profiler. To access the adjustment arms, remove the side panels from the system. Adjust the arms via the knurled-head screw to achieve "floating" of the profiler:

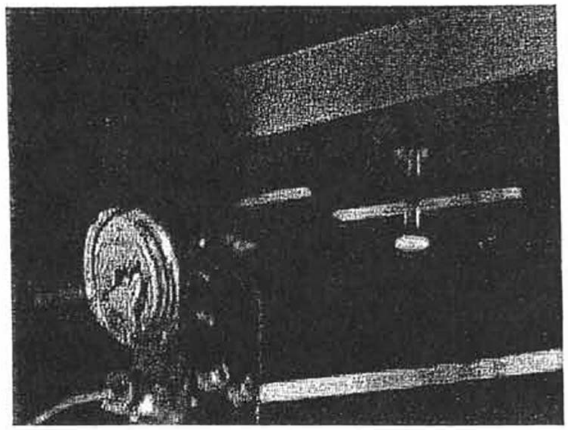


Figure 1.7.4 - Isolator Adjustment Arm

- Removal of the theta stage may become necessary to replace worn or contaminated Teflon pads. Follow replacement procedure section 2.3.2for replacement of the pads.

- Verify that the sample is stationary on the sample stage. This can be accomplished via use of the vacuum ports situated on the sample stage. For systems supplied with vacuum, make sure that:

- Under **Profiler** in the Dektak main menu, select **Vacuum On**.

- Check (by touch, if possible) that the sample is being held fast to the surface.

- Other methods (tape) may be needed to hold the sample stationary if vacuum is unavailable on the system.

.2 High Ra Measurements

.1 Stylus pressure too low. Try to slightly increase the stylus pressure to eliminate the problem.

.2 Chipped stylus - verify the condition of the stylus by running it over a step-height standard. If the features on the plot are not square, then the stylus needs to be replaced. Use a 50 um scan for the assessment.

1.8 - If Step Are Not Being Accurately Measured, Then....

.1 Verify Software Calibration

.2 Read section 8 of your V-Series Operation Manual to program a scan on a calibration sample.

.3 Perform the steps in Section 10 for calculating the average step height of a scan .

.4 Follow the instructions on page 133 of the operation manual to verify the vertical calibration.

1.9 - See Appendix C if the Robot Does Not Properly Function.

1.10 - See Appendix B if the Auto-alignment Does Not Function Properly.

CHAPTER 2
REPLACEMENT / ADJUSTMENT PROCEDURES

Removal and Disassembly of the Y-Axis

Figure 2.4.1 - This section is dedicated to Gilbert Short....Significant contributor to procedure content.

NOTE: **IF YOUR INTENT IS TO REPLACE THE ENCODER. IT CAN BE REMOVED WITHOUT DISTURBING THE Y-AXIS. REMOVE THE SCREWS SHOWN IN FIG. 9. ALSO, REMOVE THE SCREWS AT EITHER END OF THE LINEAR ENCODER (LOCATED BENEATH THE LEAD-SCREW.**

NOTE: **REMOVAL OF THE Y-AXIS ON A V-SERIES SYSTEM REQUIRES SERVICE FROM A VEECO SERVICE ENGINEER SPECIFICALLY TRAINED IN THE INSTALLATION OF A Y-AXIS. DO NOT ATTEMPT TO REMOVE/REPLACE THE Y- AXIS WITHOUT PROPER TRAINING.**

.1 The Y-Axis will be under a cover (Figure 1) Remove the screws on both the front and rear of the cover so that it can be removed.

.2 Figure 2 shows the Y-Axis mounted in a system. Note the location of the front and back supports, as well as the leadscrew nut cover/glass block attachment. To begin, removing the lead-screw, remove the screws at the back support (figure 3).

.3 Remove the two screws holding the Y-Axis to the Glass-block assembly (figure 4).

.4 Remove the two screws attaching the front support to the motor bracket (see figure 2B).

.5 Loosen (either or both) motor coupling screws (figure 5).

.6 The lead-screw can now be removed from the system. The lead-screw assembly should appear as the one in figure 6.

NOTE: **IF YOUR INTENT IS TO CHANGE THE Y-AXIS MOTOR. THEN REMOVE IT AT THIS POINT (AFTER DISCONNECTING THE ELECTRICAL LEADS) . SIMPLY REMOVE THE MOUNTING SCREWS ON THE MOTOR SUPPORT AND REMOVE IT FROM THE SYSTEM.**

.7 To remove the front support from the lead-screw, loosen the set-screw on figure 7. Keep track of the brass bushing beneath the set-screw.

.8 To remove the front support bearing, use two wrenches to hold the lead-screw and the bearing nut from which the set-screw was just removed. See figure 8. The bearing nut fits within a sleeve. Remove the sleeve with the nut.

.9 Disassembly is complete at step .7 for field purposes.

2.2 Re-assembly and Installation of the Y-Axis

.1 Reverse the steps of section 2.1 with the following recommendations:

A. Verify (and clean as necessary) that there is no oil or debris on any new replacement parts.

B. When re-installing the bearing-nut (reversal of step .7), do not over-tighten the nut. Lightly tighten the nut so that when the lead screw is turned, a smooth ball-bearing action inside the bearing is felt. Over-tightening the nut will result in a rougher bearing operation in which grinding can be felt when the lead-screw is turned by hand.

C. Do not completely tighten the hex-head screws holding any of the support brackets until alignment verification and adjust (next paragraph of this procedure) is completed.

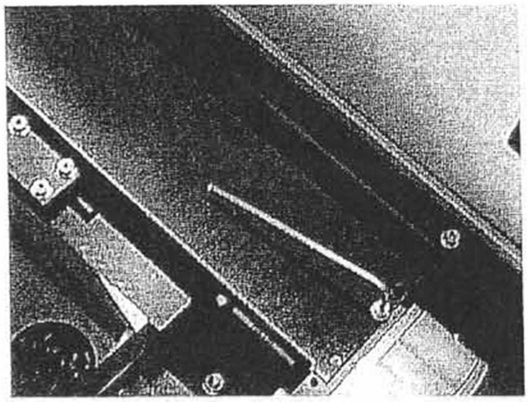
.2 Alignment procedure for a newly installed Y-Axis

Proceed to section 4. After section 4, perform the following verifications:

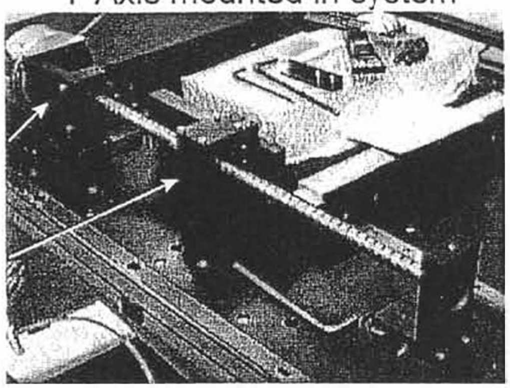
.2 Perform the hysteresis performance and adjustment procedures section 3.1.2.
.3 Perform axes calibration procedure, section 3.1.3.
.4 Perform center of rotation verification and adjustment, section 3.1.5.

Lead-screw cover

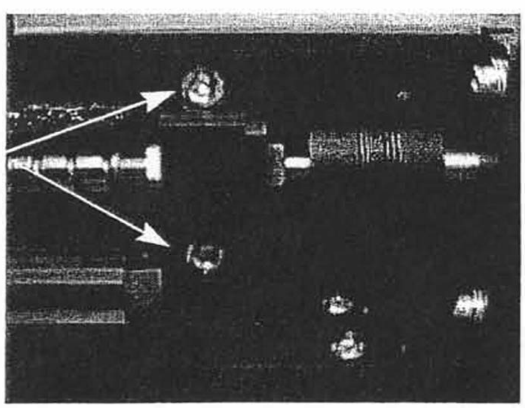
1



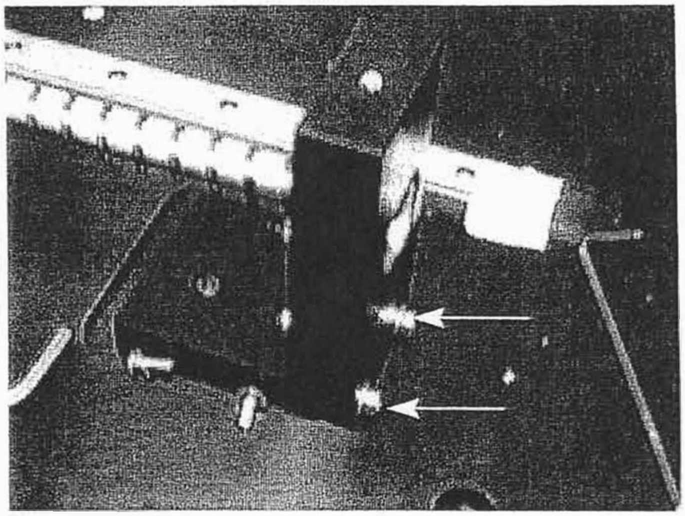
2A Y-Axis mounted in system



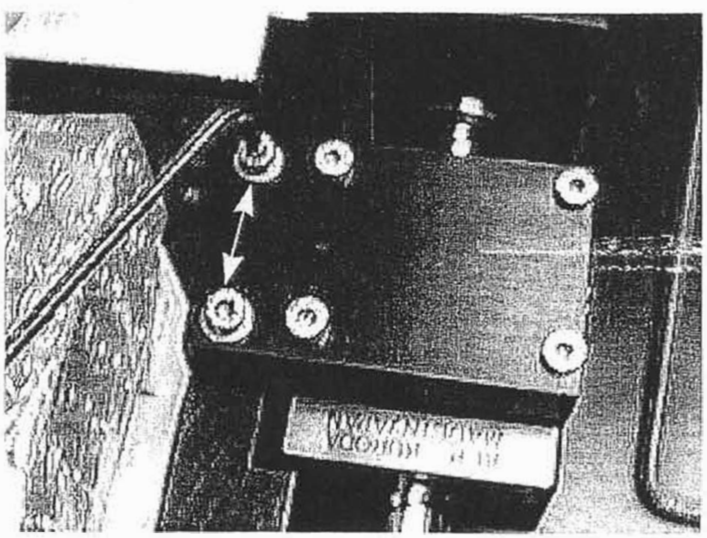
2B



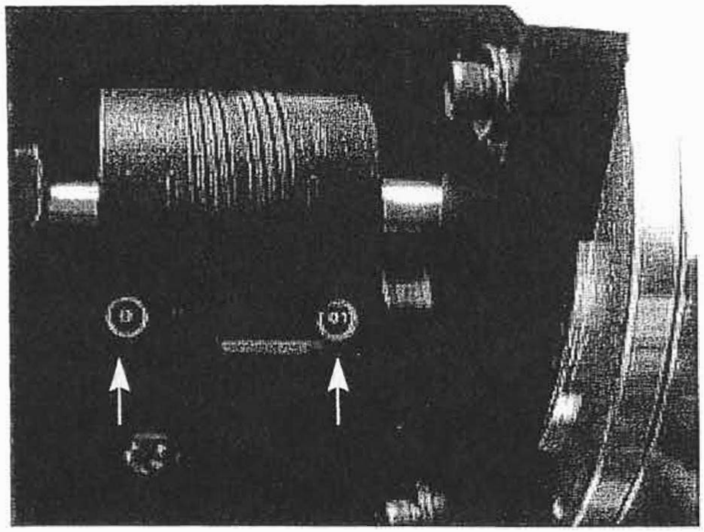
3 Screws securing the back mount



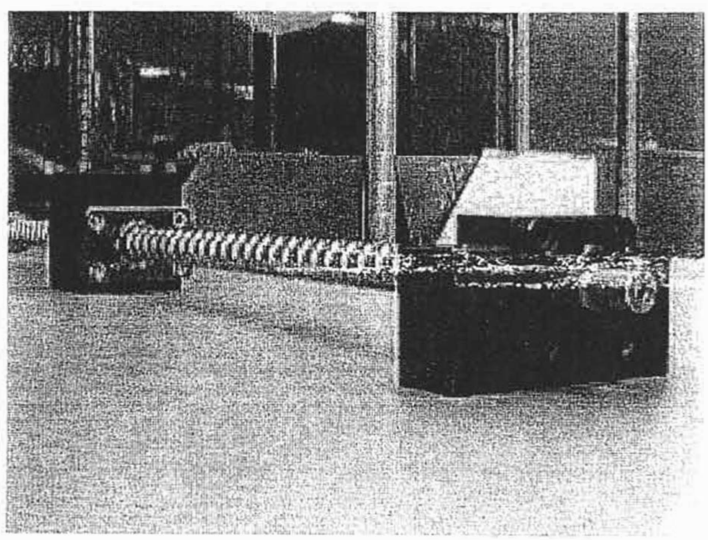
4 Screws securing Y-Axis from glass block



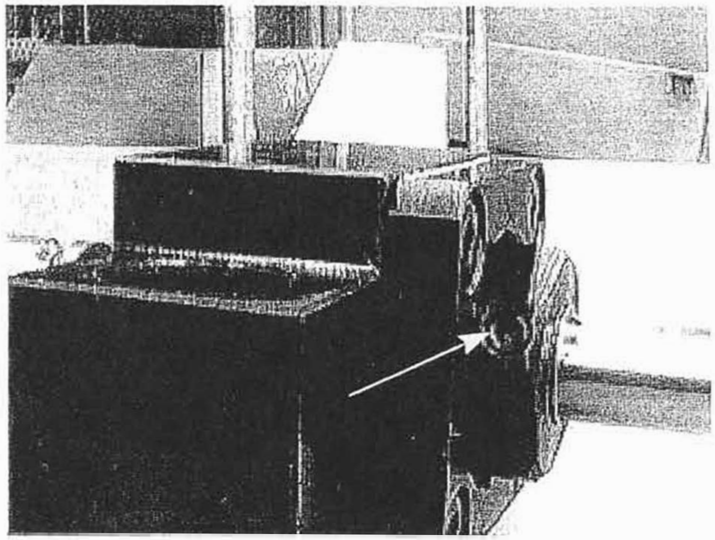
5 Motor coupling screws



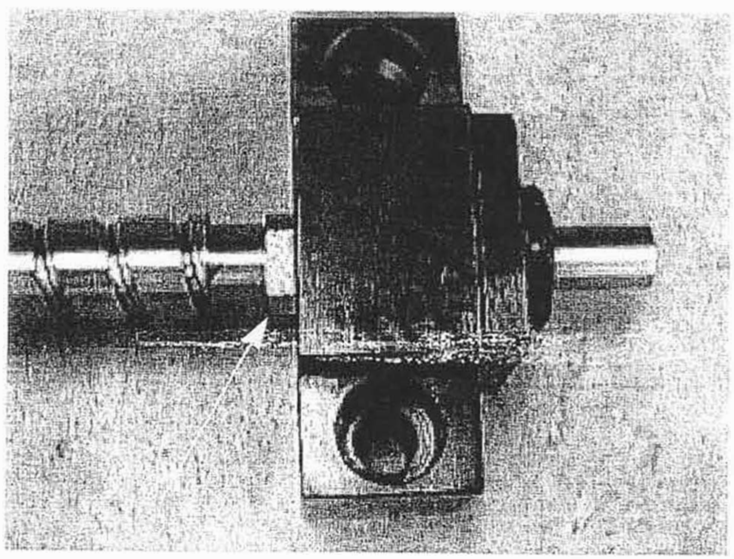
6 Fully-removed Y-axis ass'y w/o motor and coupling



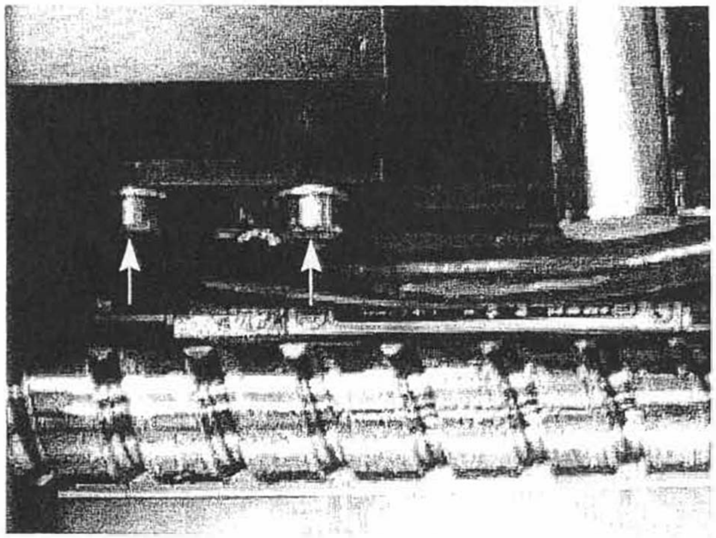
7 Set-screw releasing front mount from lead-screw



8 Leadscrew flat for wrench



9 Screws attaching Y-Axis to Glass Block Ass'y



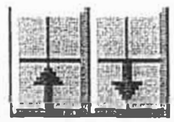
TOP VIEW

2.3 Removal/Replacement Theta Stage Components

2.3.1 Removal of Theta Stage

Needed Equipment:

-	Hex Wrench set	-	600A Grit Sandpaper
-	Isopropyl alcohol (IPA)	-	Teflon Pads
-	Lint-free cloth	-	Acetone

.1 While in the main program, select the load icon  (arrow pointing down) to position the theta stage to a position convenient for its removal.

.2 Simultaneously press <Alt><Close> to leave the main program

NOTE: IF THE MACHINE IS NOT FUNCTIONING, TURN OFF SYSTEM POWER, THEN TURN THE Y-AXIS BY HAND TO BRING THE THETA STAGE TO THE FRONT OF THE MACHINE.

.3 Remove the chuck from the stage by removing the three screws from the center of the chuck.

.4 Remove the 2 screws cable cover. The stand-offs holding the screws are shown in figure 2.3.1.

.5 Locate the screws holding the theta stage to the scan drive. Note their position:

A. V200 models have the theta stage mounted on the center four holes.
B. V300 models have their theta stage mounted in the four right-most threaded holes in the scan drive.

NOTE THE POSITION OF THE SCAN DRIVE IN THE SYSTEM YOU ARE WORKING ON.

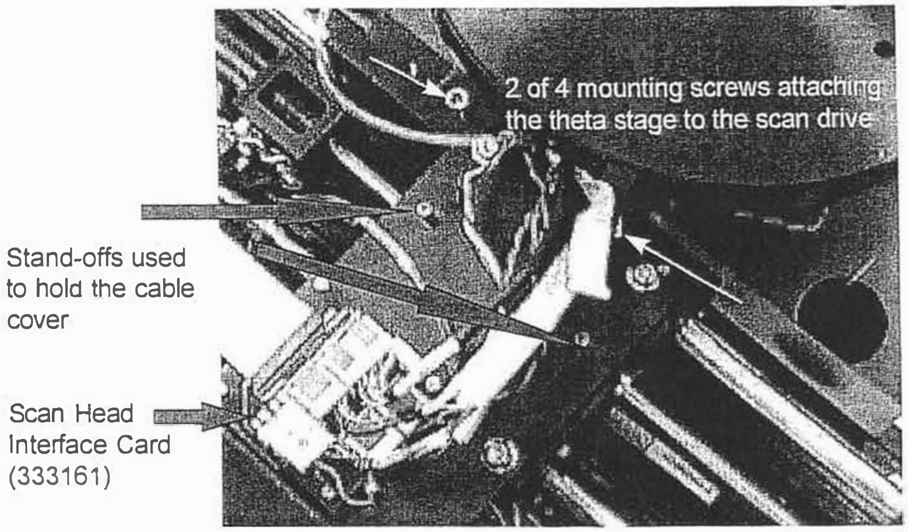


Figure 2.3.1

.5 Unplug the connectors on the back of the scan drive. Each Cable is labeled with the connector that it mates with on the scan drive interface board (333161). Cables must be reconnected in the proper order when the stage in re-installed!

.6 Carefully remove the vacuum line (if the system is equipped with a vacuum chuck).

.8 Hold the stage with both hands. Raise slightly from the glass block surface (at an angle). <u>Gently</u> pull it forward. **Place the stage in a safe location, upside down, with lint-free cloth protecting the Teflon pads.**

<u>2.3.2 Teflon Pad Replacement</u>

.1 Remove the old Teflon pads from the bottom of the stage. Remove any residual adhesive with acetone.

.2 Install the new Teflon pads (grain of the pads should be perpendicular to the motor case).

.3 Sanding the Teflon pads with 600A sandpaper...

- Place sandpaper on a flat surface (preferably a granite plate).
- Lift the stage on the sandpaper and swipe it across in a straight line, perpendicular to the grain on the Teflon pads 1-2 times.

- Clean off any dust on the stage bottom with a lint-free cloth and isopropyl alcohol.

2.3.3 Scan Stage Installation

.1 Clean the entire surface of the glass block with isopropyl alcohol and a lint-free cloth.

.2 Locate the mounting holes in theta stage flex mount appropriately for the model of system (see step 2.3.1.5). Line-up the mounting plate holes over the flex mount and the holes in the scan drive. Verify that the base of the theta stage lines-up with the glass block. Install and tighten the mounting screws.

.3 Reconnect all of the electrical cables.

.4 Reconnect the vacuum line into the quick disconnect.

.5 Carefully run the theta stage cables (removed in step 2.3.1.5) toward the rear of the theta stage to ensure that the cables will fit under the cover plate when it is re-attached to the system.

.6 Place the chuck back onto the stage.

.7 Wipe away any visible contamination on either side of the glass plate with a lint-free cloth.

.8 Perform "Hysteresis Performance Verification", section 3.1.2.

.9 Perform 'Calibration of a New Axis, sect. 3.1.4.

.10 Perform Center of Rotation Verification/Adjustment, section 3.1.5.

2.4 Removal / Replacement of the Scan Drive

2.4.1 Removal of the Scan Drive

.1 Perform section 2.3.1, "Removal of the Theta Stage", before attempting to remove the scan stage.

.2 Remove the scan face interface card support bracket shown in figure 2.4.4.

.3 Remove the cover on the scan drive as shown in figure 2.4.1.

.4 Use a combination of a closed-end wrench and the appropriate allen key wrench to loosen the mounting screws shown in figures 2.4.2 and 2.4.3. Note that figure 2.4.3 shows only 6 of the 8 mounting screw locations.

.5 Remove all electrical cables for the scan motor, limit and encoder signals. All of these cables are clearly labeled. Note routing of the cables per figure 2.4.6. The straps holding the cables to the rear metal shield can be released by pulling them down. Note the routing of the cables before removing them. The cables for the replacement scan drive need a similar routing when it is installed. Once the straps have been opened and the cable removed from them, disconnect the connectors shown in figure 2.4.5.

2.4.2 Installation of a Replacement Scan Drive

.1 Place the new scan drive in place above the mounting holes. Install the mounting screws loosely in position.

.2 Apply light pressure on the assembly to the back and left (with respect to the front of the system). Tighten down the screws.

.3 Re-route and reconnect the scan motor, limit, and encoder cables as they were orignally found (see figure 2.4.6).

.4 Re-connect the vacuum line.

.5 Re-attach the support bracket holding the scan stage interface card.

.6 Perform section 2.3.3, Scan Stage Installation.

.7 Perform "Hysteresis Performance Verification", section 3.1.2.

.8 Perform 'Calibration of a New Axis, sect. 3.1.3.

.9 Perform Center of Rotation Verification/Adjustment, section 3.1.5.

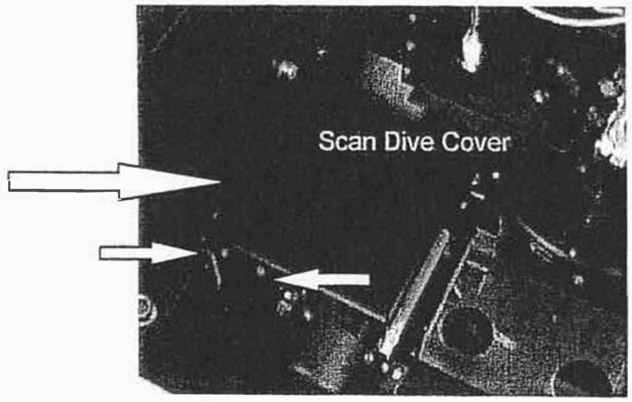


Figure 2.4.1 - Scan Drive Cover

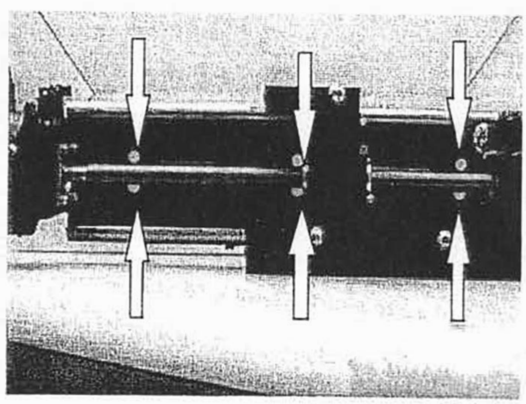


Figure 2.4.2 - Mounting Screw Locations (see blow-up in fig. 2.4.3).

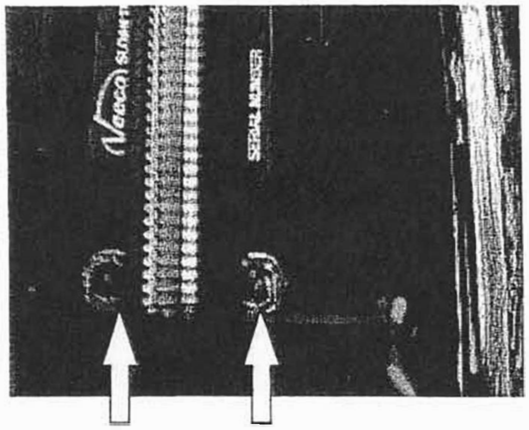


Figure 2.4.3 - Mounting Screws

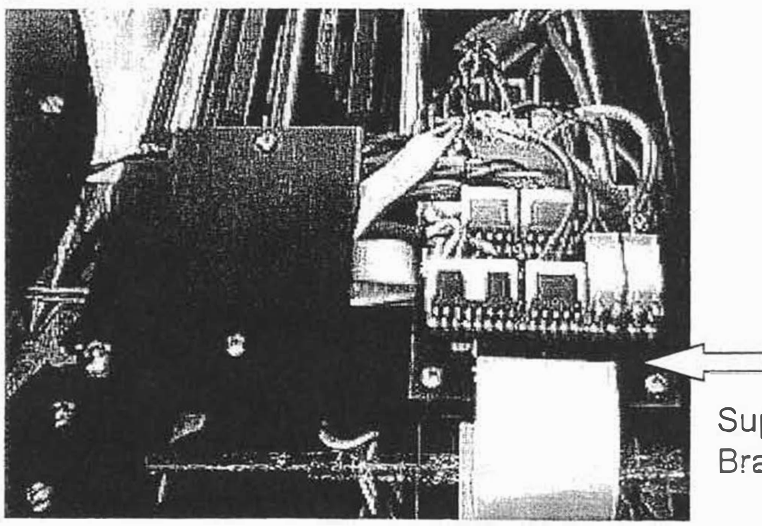


Figure 2.4.4 - Scan Head Interface Board and Support Bracket

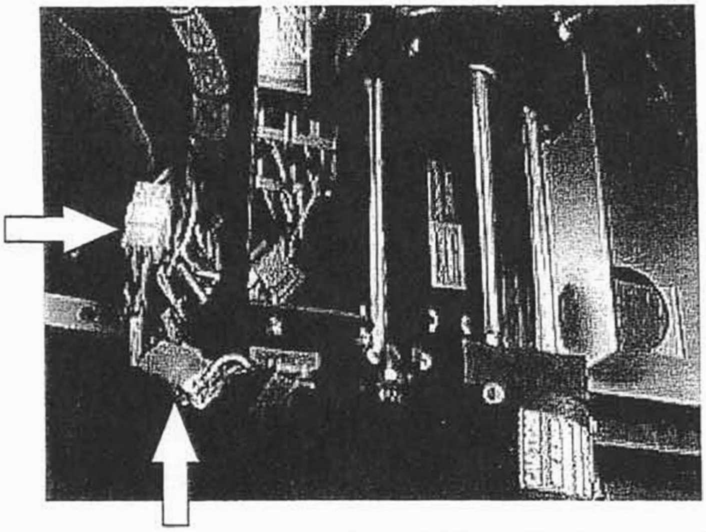


Figure 2.4.5 - Location of Electrical connectors for the scan drive. Located in back of shield.

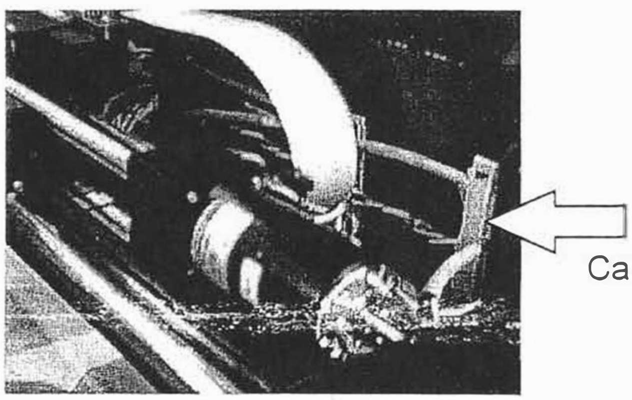


Figure 2.4.6 - Cable routing and quick-release cable harness

2.5 Removal and Replacement of the Bridge Leadscrew, Encoder, and Motor

2.5.1 The bridge assembly consists of a motor, leadscrew, encoder, and motor.

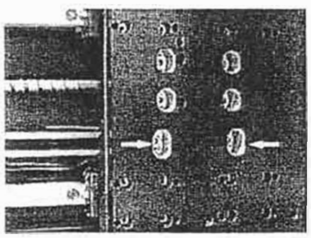
2.5.2 To remove the motor:

A. Loosen the compression coupler from the motor and slip it down the leadscrew.
B. Loosen the 4 bolts holding on the motor. It may be necessary to remove the position sensors to access the rear two bolts holding on the motor.

2.5.3 To replace the motor, simply position it and bolt it in. No alignment of the axis should be needed if the other mechanics were not disturbed.

2.5.4 To remove the encoder:

A. The nose of the system must be removed.



B. The bottom two bolts on the nose mounting plate must be ⇐ removed:

C. Two bolts at each end of the encoder must be removed. The screw heads are accessible from the bottom side of the bridge.

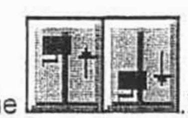
D. Two cable clamps: 1 at the center of the bridge, and one at the far left side of the encoder hold down the encoder cable. Once these are removed, the encoder and cable can be removed from the bridge by sliding it to the right and angling it out.

E. Reverse steps A-D to install a new encoder.

<u>2.6 Stylus Replacement</u>

<u>2.6.1 Required Materials:</u>

- Review materials needed for the **Focus, Null, and Stylus/Reticule Alignment** Procedure

.1 Raise the tower to its full **UP** position by clicking on the  icon (up arrow).

.2 Exit windows gracefully, and turn the entire system **OFF**.
.3 Place a piece of lint-free tissue on the sample stage to catch the currently installed stylus.
.4 Locate the stylus retaining screw (can be viewed from the front cover door of the profiler).

.5 Note the general position of the old stylus before removing it. This may help greatly in reducing The extent of null,focus, and alignment adjustments required after the new stylus is installed.

.6 Remove the old stylus from the system by pulling gently down on it.
.7 Install the new stylus by placing its base on the nose mounting magnet.

.8 Once the stylus is installed, turn the system ON and re-enter the DekTak program.

.9 Assess the need of a possible optics adjustment. To do this:

- Load sample with easily observable horizontal and vertical features.
- Command a Tower Down.
- Zoom-in and out, and note any stylus "wandering " when going from high-low-high magnification.

One of three conditions will prevail at this time:

A. Details on the sample are sharp in the center 1/3 of the screen. The stylus does not wander when zooming the optics. Stylus falls in the center of the reticule when commanding the stylus down. In this case, you are done with the installation.

B. Details in the center 1/3 of the screen are not in focus and/or, the stylus wanders when zooming the optics. Perform the Focus, Null, and Stylus Alignment procedure, page 49.

C. The stylus does not land in the center of the reticle when commanding the stylus down. The image is in Focus and the stylus does not wander when zooming the optics. In this situation it is easiest to reposition the software reticule as follows:

.10 Mount a sample on the center of the sample stage and command the system to load.

.11 From the main menu, select **SetUp**, then **stylus reticule....align**.

.12 Answer OK to the dialogue box. The system will tower and stylus down, then display both the video image and a green "X". Using the roller-ball, center the green X symmetrically on the stylus/reflection image. Double - click the left button of the mouse 2 times when you are satisfied that the "X" is well centered.

.13 Answer "YES" to the dialogue box.

2.6 Illuminator Replacement

.1 Bring the sampling stage to the unload position.
.2 Tower-Up.
.3 Exit windows (gracefully).
.4 Turn the system OFF.
.5 Remove the two top screws on the assembly and remove the illuminator cover.
.6 Remove the old light element with tweezers.
.7 Carefully remove the new light element from its packing box with tweezers - **DO NOT TOUCH THE LIGHT ELEMENT WITH YOUR HANDS!**

.8 Install the new element by fully inserting it into the sockets. Then, bend the element leads approximately 1/8" in the direction of the sampling stage.

.9 Replace the cover. Turn on the system, and open the Dektak program.

.10 Place detailed sample on the sample stage and load it.

.11 Tower down. Verify that the image is shadow-free. If it is not, use the small socket-head adjustment screws located on the side of the illuminator assembly to adjust the light direction.

2.5.5 Removal/Replacement of the Bridge Leadscrew

A. Remove the top four screws in the plate shown above.
B. Loosen the motor coupler and slide it towards the motor.
C. Loosen the four bolts mounting the bridge leadscrew to the bridge.
D. Remove the right side plate of the bridge and pass the old lead screw through the opening.

E. To replace the leadscrew, reverse the above steps above, but do not completely tighten the mounting bolts from C or the top screws from A. leadscrew will have to be aligned per the alignment procedure section 4.

3.1.2 Hysteresis Performance Verification for a Newly Installed Axis

Needed Equipment:
Reticule-flat - Thin Film Technologies P/N SKRR-535

After installation of the new axis is complete, run a hysteresis test on the axis installed. It is suggested to use a hysteresis measurement flat (Thin FilmTechnologies P/N SKRR-535) to determine the machine hysteresis performance. The flat has a straight and 45°angled step feature on it. Clean the flat thoroughly with isopropyl alcohol. Place the flat on the sample table, then locate the angled and straight step features on the flat.

.1 - Use an angled step pattern for this verification.

.2 Set-up...

- Select **Window**, then **Scan Routines** in the main program window.

- Create a scan with the following parameters:
  1. Scan length = 500 µm.
  2. Duration - 13 sec.
  3. M-Range - 65kÅ
  4. Profile - Peak and Valley
  5. Stylus force (appropriate for customer's sample and stylus)

- Through the sample positioning window, create a scan with a location that will have its step 50-100 µm from the beginning of the scan. Zoom in the optics to a maximum setting as an aid in setting up the scan . Once determined, zoom in on the step itself. With the screen crosshairs, determine the length from the start of the scan it takes to detect 50% of the step height.

- Select **Window**, then **Automation Program** from the Dektak main program window.
- Select **Edit** , then **Copy-to-Range.** Copy from range 2 to 3.

- Double click on scan #1, then when the scan set-up window appears, double-click on "Location".

- Enter "0" for the Y (or X, theta) location parameter. Click on **OK** at the bottom right corner of the screen.

- Select **Window**, then **Automation Program** from the Dektak main program window.

- Double click on scan #3, then when the scan set-up window appears, double-click on "Location".

Enter "300,000" for the Y (200,000 for X, or 45 for theta) location parameter. Click on **OK** at the bottom right corner of the screen.

.3 Running the Verification...

*Select **Window**, then **Automation Program**, from the Dektak main window.
- Click on Scan #2 in the list in the upper right hand side of the screen.
- Select **Profiler**, then **Go To Scan Location** in the Dektak main window.
- Select **Run**, then **Scan**......and pay attention to the following on the scan plot:

- Watch the stylus and scan plot. When it is apparent that the stylus has gone past the step and a bit beyond it, Click on the ABORT button.

- Using the crosshairs and zoom-box on the plot screen, select the region of the plot just before and after the step, and replot this until the bottom axis of the plot display reads in graduations of 1-2 µm.

Position the horizontal crosshair to approximately 50% of the step height, then read and record the location where the vertical axis intersects the bottom scale on the Hysteresis Evaluation Form.

.5 Select **Window**, then **Automation Program**, from the Dekak main window.
.6 Click on Scan #1 in the list in the upper right hand side of the screen.
.7 Select **Profiler**, then **Go To Scan Location** in the Dektak main window.

.8 Repeat running of scan #2 at the "*" (step 3).
.9 Select **Window**, then **Automation Program**, from the Dektak main window.
.10 Click on Scan #3 in the list in the upper right hand side of the screen.
.11 Select **Profiler**, then **Go To Scan Location** in the Dektak main window.
.12 Repeat running of scan #2, at the "*" (step .3)

.13 Repeat steps 5-12 four more times and fill in the hysteresis evaluation form at the end of this procedure.

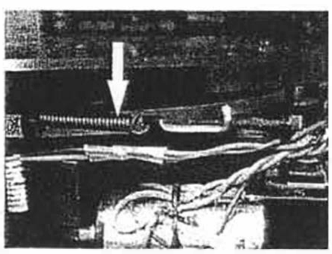
.14 If the hysteresis measurement indicates a problem, per the spec on page 48, try the following:

For Y Axis: a. Check that the screws on the front, rear, and glass block mounts are tight. Attempt the hysteresis test again.

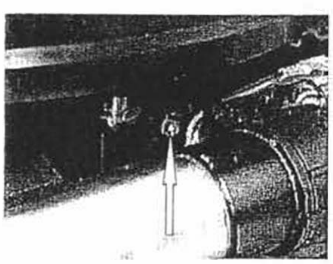
b. Verify that the 90° angles formed at the from brackets are accurate. First attempt is to loosen and re-tighten screws. Second attempt is verify with gage blocks. Attempt the hysteresis test again.

Scan Drive: Slight re-adjusment of the bushing may solve the problem Replace the Y-Axis components if these actions do not remedy the problem.

Theta Drive:



a. Adjust the rubber-coated theta shaft adjuster to its approximate half- way position.



b. Turn the theta wheel adjustment all the way in, then back 1 turn.

c. Attempt the hysteresis test again.
d. Replace the theta drive belt
e. Attempt the hysteresis test again.

STAGE HYSTERESIS EVALUATION FORM

MACHINE S/N: ____________
AXIS: ____________

SCAN #2 READINGS	(um)	Delta from last reading
INITIAL READING:		
A		
B		
A		
B		
A		
B		
A		
B		
A		
B		

		MAX DELTA
		MIN DELTA
		DELTA RANGE (MAX - MIN)

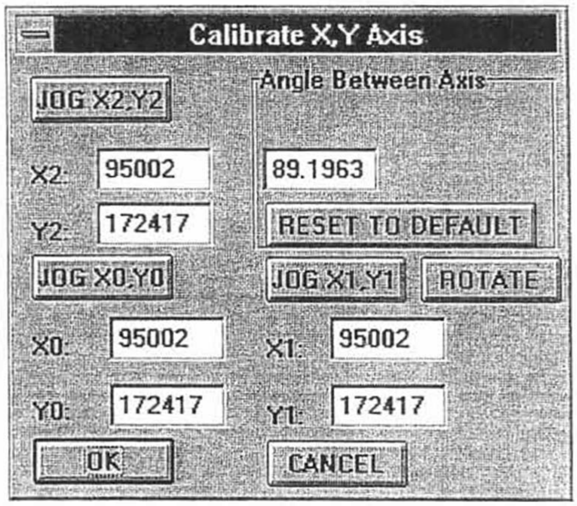
'A' = SCAN AT LOCATION 2 AFTER COMING FROM LOCATION 1
'B' = SCAN AT LOCATION 2 AFTER COMING FROM LOCATION 3

PERFORMANCE SPECIFICATION:
(DELTA RANGE)
< 1 um (Y-Axis, Scan Axis)
< 3 um (Theta Stage)

3.1.3 Calibration of a New X,Y-Axis (For Theta Axis, see section 3.1.4)

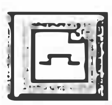
Needed Equipment: Reticule: Model "Cal-A", from Applied Image Inc

Set-Up:



.1 Select **Set-up**, then **Theta Resolution**, and enter .001 for Theta Resolution.

.2 Select **Set-Up**,then **Backlash Parameters**, and set all values to 0.

.3 Click on the scan icon , click on **Tower Speed**, select the **Low** setting, and then click on **OK.**

.4 Place a **clean** reticule flat on the sample stage.
.5 Load the reticule flat into the profiler
.6 Zoom into high magnification.

.7 Tower down, and hand-center the reticule image onto the software reticule. NOTE: Try anchoring the reticule flat with tape - loosely attach the flat to the stage with the tape.

.8 (For leveling sample) Make fine adjustments in centering the reticule flat to the software reticule.

.9 Bring up the sample positioning window, click on the video portion, and move the reticule flat to a featureless location. Perform a partial 500 µm scan in this area. To save time, you may press the abort 25 - 50% into the scan.

.10 Position the R and M cursors on the trace. Select **Profiler**, then **Autolevel Scan Direction**.

.11 Command the system to load the sample with the load/unload icon.

Running the calibration:
(It is suggested to calibrate BOTH x and y axes even if only one axis has been installed.

.1 Select **Calibrate**, then **Calibrate X,Y Axes** if not already done.

.2 Choose a feature on the software reticle to line up with the x (or y) axis on the reticle flat.

.3 Select **Window**, then **Sample Positioning** and click on the video portion of the display with the trackball. Position the reticle flat so that it is approximately centered on the software reticle.

For the Y-Axis:
Choose a feature on the software reticle to line up with the y (vertical) axis on the reticle flat.

.4 Select **Window**, then **Sample Positioning** and click on the video portion of the display with the trackball. Position the reticle to line up with the chosen feature (horizontal) on the software reticle.

.5 Click on **JOG X0, Y0.**

.6 Move the reticule flat with the roller ball **vertically** until the second large division of the reticle flat appears. NOTE: WHEN USING THE TRACKBALL TO MOVE THE Y AXIS, TRY AS MUCH AS POSSIBLE NOT TO MOVE THE X (Scan) AXIS. Click on **X1, Y1**.

For the X (Scan) Axis:
Choose a feature on the software reticle to line up with the x (horizontal) axis on the reticle flat.

.8 Select **Window**, then **Sample Positioning** and click on the video portion of the display with the trackball. Position the reticle flat to line up with the chosen feature (horizontal) on the software reticle.

.9 Click on **JOG X0, Y0.**

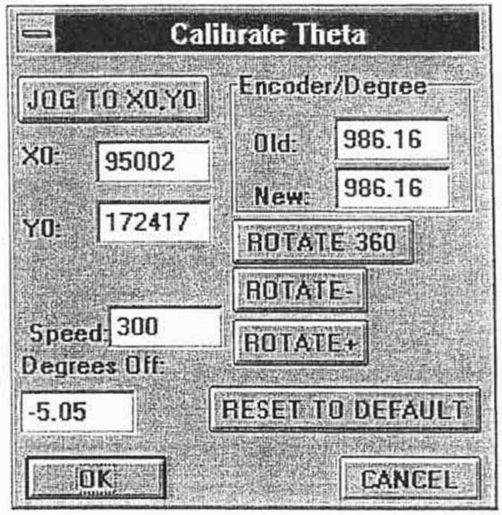
.10 Move the reticule flat with the roller ball **horizontally** until the second large division of the reticle flat appears. NOTE: WHEN USING THE TRACKBALL TO MOVE THE X AXIS, TRY AS MUCH AS POSSIBLE NOT TO MOVE THE Y AXIS. Click on **X2, Y2**.

.11 The **"Angle Between Axis"** should now read 90 ± 1°. If it does not, then go back to step Repeat this section until the system reads the correct angle (if necessary).

.12 Go to section 3.1.5, page 52 to find the center of rotation.

3.1.4 Theta Calibration

.1 Select **Calibrate**, then **Theta Calibration**. The dialogue box below will appear:



.2 Select **JOG TO X0, Y0**. Move the reticule flat toward the right side of the screen to the fifth large division. Locate the reticule flat pattern to the 2nd quadrant of software reticule as in the figure below (suggested). Select **JOG TO X0, Y0** once more to fix the position. Set the speed to 100.

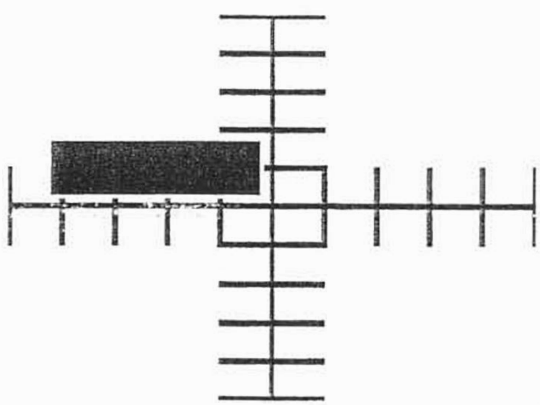


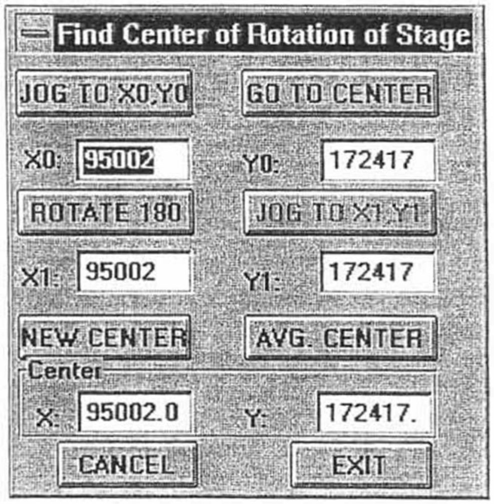
Figure 3.1.4.2 - Suggested Positioing of Reticule With Respect To Feature

.3 Click on **Rotate 360**, then wait for the theta stage to stop moving. Ideal performance will place the reticule flat in its starting positicn.

.4 If the reticule is not placed in the starting position, use the ± ROTATE buttons to place the reticule there. Click on OK when done.

3.1.5 - Finding the Center of Rotation (Applicable to Scan, Y, and Theta Axes)

.1 Approximate Determination of the Center of Rotation...



.2 After theta, x, and y-axes have been calibrated, the center of rotation of the theta stage can be accurately determined.

.3 Click on **JOG X0, Y0**, then move the reticule flat down. Locate the software reticule on the fourth or fifth large division line.

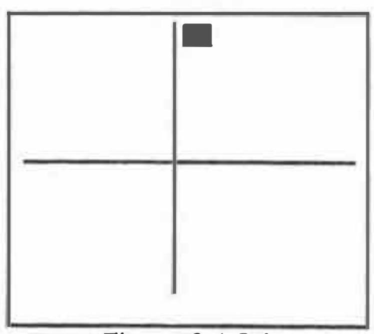


Figure 3.1.5.1

.4 When the software reticule has been positioned so that it is aligned on the reticule flat, click on **JOG X0, Y0** once more.

.5 Click on **ROTATE 180.** The relative position of the alignment featured will be as illustrated below:

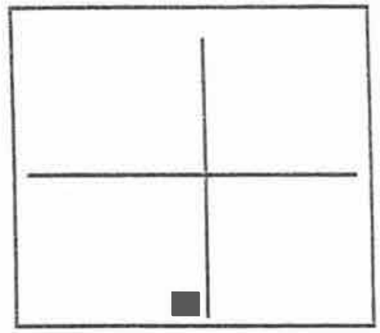


Figure 3.1.5.2

.6 Click on the **JOG X1, Y1**, then use the trackball to position the reticule flat on the same software reticule feature that was used in step 3. Click on **JOG X1, Y1** once more.

.7 Click on **GO TO CENTER**. The profiler will position the sample on its calculated center of rotation. This may not fall on the center of the reticule (make sure to check this with high magnification). The next few steps will "fine tune" the determination of the center of rotation.

3.1.6 Refined Determination of the Center of Rotation

Perform the following for **each axis separately** under high magnification - Zoom-in all the way:

.1 Find a feature that is relatively easy to see and is close to the axis.

.2 Select Profiler, then click on **Rotate.** When the dialogue window appears, adjust the speed bar to the middle of its range, then enter 180 and click on **OK.** When the theta stage stops moving, the feature should be symmetrically positioned similarly to figures 3.1.5.1 AND 3.1.5.2.

.3 If the feature is not positioned symmetrically after rotation, close the **Rotate** window, click on the video screen , and move half way to the location visually observed to be symmetrical. Click on the video screen once more to deactivate the roller-bail. Carefully note the position of the observed feature for figure 3.1.5.1, page 46.

.4 Once again, select **Profiler**, then **Rotate.** Enter in -180 in the degree section and press **OK.** Check to see if the observed feature is located symmetrically from its previous location.

.5 Iterate on steps .2 -.4 if the feature does not locate symmetrically. If the observed feature now locates symmetrically, then verify the next axis if not already done. If both axes have been checked, then move to step 6.

.6 Select **Print**, then **Calibration Factors**. for a hard-copy of the calibration information just determined. Save this information in case it ever has to be re-entered into the machine.

4.0 Alignment of a New Y or Bridge Axis.

Note: Alignment of axis hardware can involve re-alignment of many mechanical components. This is a difficult exercise that may require the skill of Veeco manufacturing personnel to successfully complete this exercise.

4.1 The Dektak program group contains the MEI Tuner utility. This software can be used to program axis motion and provide graphs of motor input voltage as a function of distance. The graphs can be used to determine if the leadscrew observed is aligned properly.

4.2 Initial settings:

Axis	Kp	Ki	Kd	A FF	V FF
0	1024	32	4096	0	0
1	1024	32	4096	0	0

Upon starting the MEI tuner program, a number of parameters must be verified to be correct. The parameters for the system reside in SBC.INI in the Dektak program group. The numbers above are for reference only. The numbers in the SBC.INI file are organized per axis number. The Bridge is axis 0 and the y axis is axis 1. These numbers must be entered before continuing with this procedure. Only one set of numbers (for an axis) can be entered at a time. The table above shows the numbers to be the same for both axes 1 and 0.

The numbers for positions, velocity, acceleration, etc. will be entered per the appropriate steps in this procedure.

Once all the numbers have been entered, a sequence of window buttons must be clicked to start the stage moving. The sequence (referred to as the "run sequence" in the procedure below) is:

- Click Run/Idle until RUN appears to the right.
- Click Enable
- Click on GO (or Repeat)

4.3 End Tuning an Axis

- Enter the appropriate axis number.
- Click on Run/Idle until Idle appears.

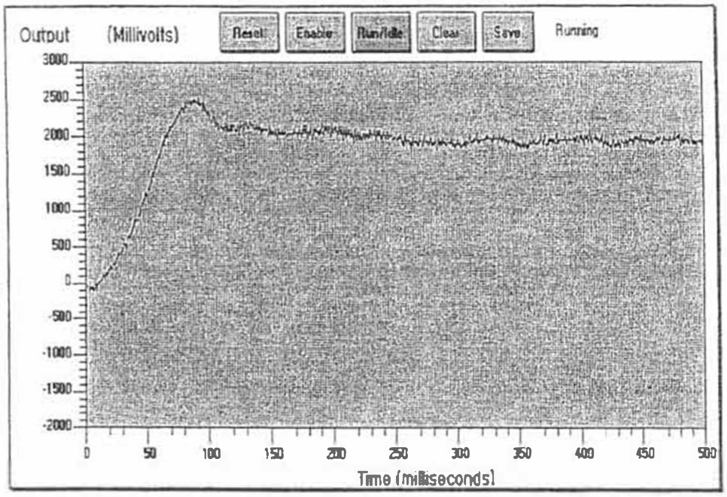
- Physically pull the stage to the left (for the bridge) or to the rear of the baseplate (for the Y-axis) until the end sensor light is off.

- Enter the following numbers in the MOTION box in the MEI window:

Position 1	0
Position 2	100,000
Velocity	100,000
Acceleration	100,000
Jerk	0
Dwell	2000

- Set the time bar on the lower right-hand corner of the MEI window to about 1 second.
- Execute the run sequence as described above.

A display as the one below should appear on the screen if the axis is properly aligned:



Note that the start-up voltage is about 2.5 V on this example. A properly aligned axis should have no more than 3 V start-up voltage. The excursions after the voltage settles should not exceed ± 0.3V. Loosen the mounting hardware and repeat motion until performance shown to the right is attained.

To tune the other end of the axis, click on STOP (if using the REPEAT motion). Then:

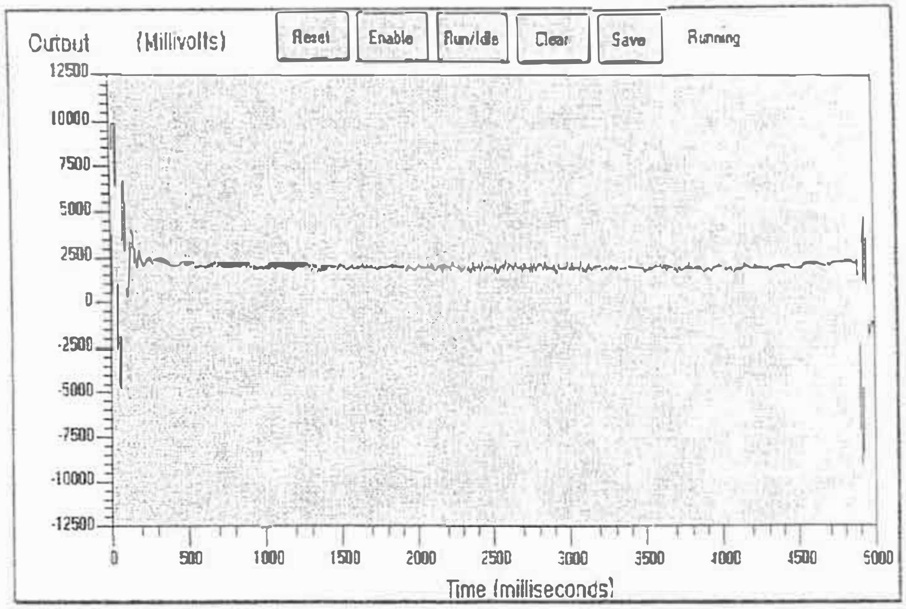
- Press the Run/Idle button until "idle" is displayed on the screen.
- Physically move the stage to the other end of its travel.
- Change the Position 2 number to -100,000.
- Execute the run sequence.
- Loosen mounting screws and adjust the axis as necessary.

4.4 Verification of End-to-End Alignment

- Once both ends of the axis appear to be aligned change the motion numbers on the MEI screen to the following:

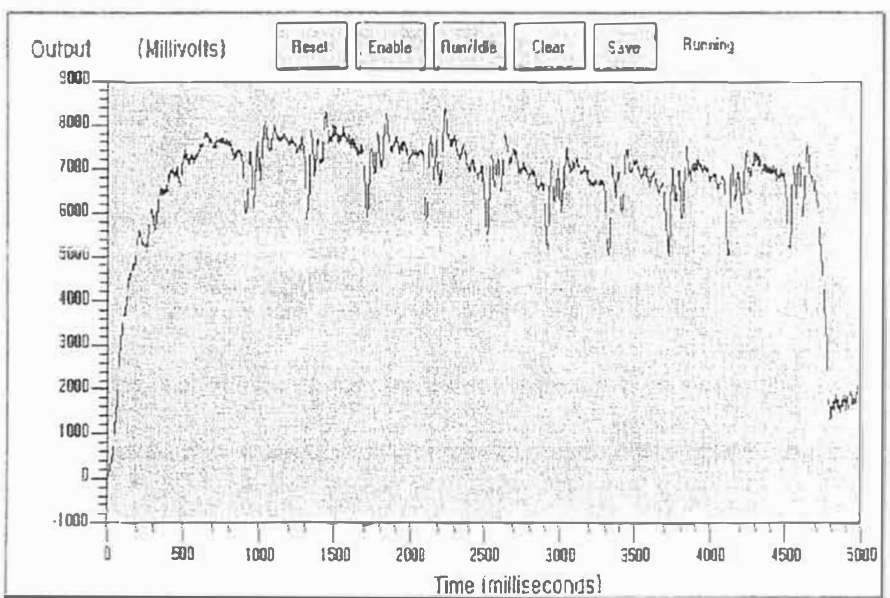
Position 1	0
Position 2	1,000,000
Velocity	200,000
Acceleration	10,000,000
Jerk	0
Dwell	2000

- Set the time scale bar on the MEI window to the extreme right-hand position (5 seconds in duration).
- Click the Run/Idle button on the screen until "Idle" is displayed on the screen. Physically move the stage to the extreme left (bridge axis) or extreme rear (y-axis) position.
- Execute the run sequence. The following display should be observed (next page):



Voltage excursion after settling should not exceed +/- 1V. If this occurs, stop motion, loosen mounting software, and restart motion until hardware has been adjusted to sufficiently reduce the excursions.

An example of unacceptable excursions is illustrated below. Additional once-around inertia resulting from a side force on the lead screw is causing this to occur. Mounting hardware should be loosened and then re-tightened (one-end to the other - in steps) to eliminate this from occuring.



Evidence of misalignment requires that all mounting hardware be thoroughly examined to be sure that it has been properly assembled. This includes:

- All screws are tight (check this first - it may be the easiest fix!)
- All right-angle assemblies must be checked for true right angles. The first action should be to loosen, then tighten these assemblies. Checking angles with gage blocks may become necessary.
- End brackets could apply side pressure to the leadscrew. Loosening and re-tightening these parts could reduce voltage excursions.
- All hardware attaching the leadscrew nut to the stages should be loosened and re-tightened to verify they are not contributing to voltage excursions

YOUR NOTES

CHAPTER 3
OPTICS ALIGNMENT

3.2 Optics Alignment/Focus/Null Procedure

NOTE: Read the Introduction and the Procedure Overview if unfamiliar with this procedure.

3.2.1 Introduction

The goal of this procedure is to simultaneously achieve these three settings:

1. Focus
2. Null
3. Stylus/reticule alignment. See fig. 6, pg 67.

- The Optics will be focused when the center third of the video screen displays clear images while at high magnification.
- Null is a condition that, while in the "Tower Down" position, the stylus is at the center of its measurement travel. Methods for verifying this condition are to follow.
- Stylus/Reticle alignment enables the operator to precisely locate features in relation to where a scan will be performed. This is especially important in situations when it is desired to make multiple scans on many samples (where de-skew or alignment will be required to develop a scan program).
- Set the profiler scan type to peak and valley for all optics adjustments. Select WINDOWS, then SCAN ROUTINES to find where to make the setting.

3.2.2 This procedure is applicable when these components are adjusted/replaced:

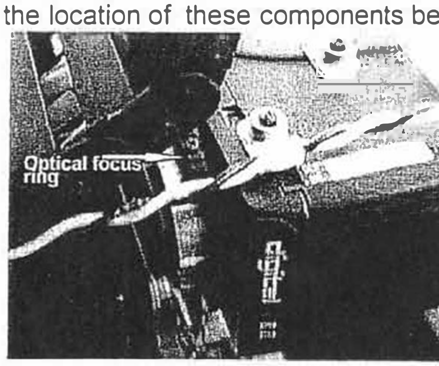
- Stylus/nose.
- Illuminator.
- Tower.
- Theta stage.

3.2.3 The key components effecting the goal of having focus, null, and stylus/reticule alignment are:

• Illuminator	(fig. 3)
• Optics column focus adjustment.	(fig. 4,5)
• Double eccentric on optics.	(fig. 2)
• CCD camera focus adjust	(fig. 1)
• Z-axis micrometer (on the nose).	(fig. 3)
• X/Y axis (on the nose) .	(fig. 3)
• X/Y axis micrometer adjust .	(fig. 3)

Familiarize yourself with the location of these components before proceeding.

Figure 1: CCD camera focus ring. ⇒



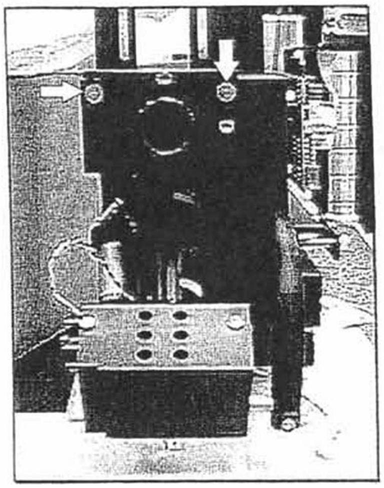


Figure 2: Location of double eccentrics.

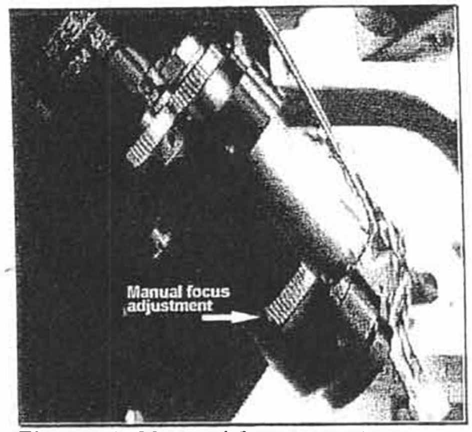


Figure 4: Manual focus system

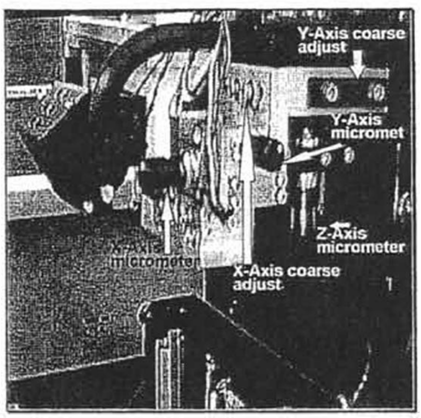


Figure 3: Optics Assembly

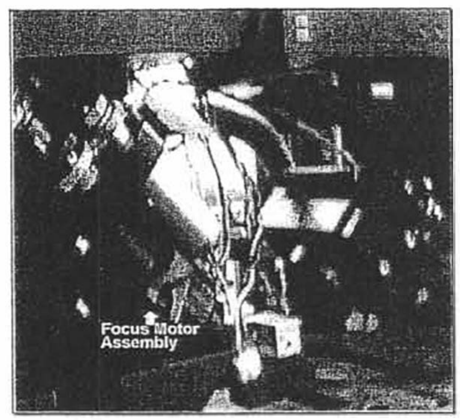


Figure 5: Motorized Focus System

3.2.4 The function of each of these key components is as follows:

- *Illuminator:* Must be positioned to evenly illuminate the sample without sample features casting shadows on the image.
- *Optics column adjustment ring:* Adjusts the focal length of the optics column. Is used for fine focus adjustments for high magnification.
- *Z-axis micrometer:* Used for fine vertical adjustments of the nose ass'y (the nose ass'y resides on the tower.
- *X/Y- axis micrometers* : Used for fine side-side/front-back adjustments of the nose position.
- *X/Y Axis adjustment coarse adjust (on the nose ass'y of all units):* Used to coarsely adjust the nose in the X/Y plane. Primary function is for positioning the stylus tip to the optics center-line.
- *Optics double eccentric:* Positions the video camera CCD with respect to center of the CRT. Appears to shift the stylus/sample image with respect to the reticule on the CRT. It can also be used to focus the system when in low magnification mode.

- *X/Y Axis adjustment coarse adjust (on the nose ass'y of all units):* Used to coarsely adjust the nose in the X/Y plane. Primary function is for positioning the stylus tip to the optics center-line.
- *Optics double eccentric:* Positions the video camera CCD with respect to center of the CRT. Appears to shift the stylus/sample image with respect to the reticule on the CRT. It can also be used to focus the system when in low magnification mode.

3.2.5 Procedure Overview

- **Verify/adjust illuminator...Set optics column focus ring**
  Even and shadow-free illumination will be verified by viewing a detailed sample while being viewed in the sample positioning window. Adjustments to the illuminator will be made as necessary. Once this has been verified, the focus ring on the optics column will be set to its center position allowing for fine focus adjustments that may be needed later in the procedure.

- **Determination of tower vertical height for focus**
  With optics zoomed to high magnification, lower the tower and the stylus. The tower will now be close to its final running location in the Z-axis, if focus is reasonable established. If not in focus, make small adjustments with the optics focus ring.

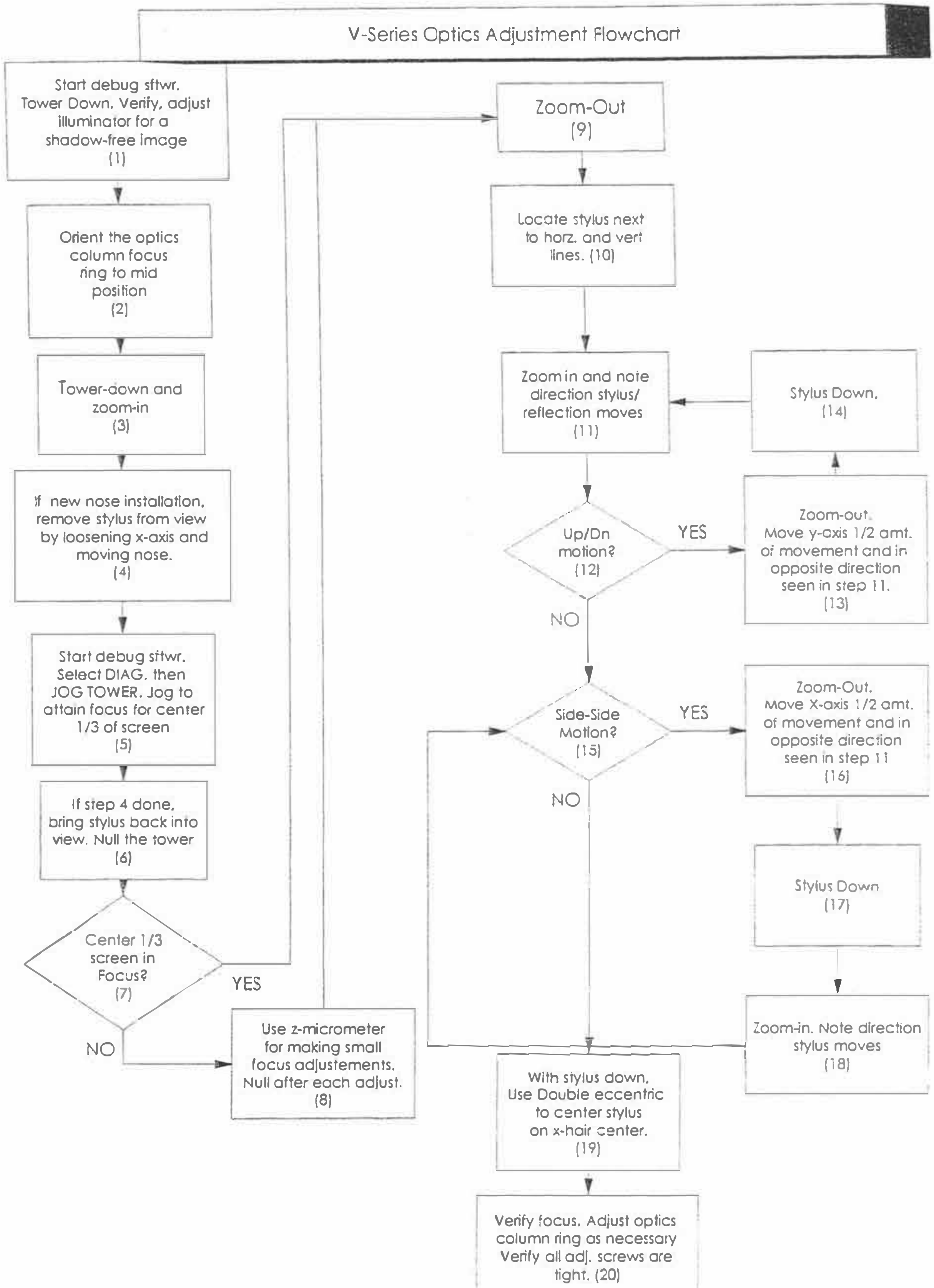
- **Establishing a new null for the tower...**
  The stylus will now be commanded down. Changing the system probably resulted in a new tower setting to achieve focus, so, a new null (see explanation for "null" below) will have to be established via the Z-axis micrometer. If the stylus/sample image needs to be re-focused after the new null has been found, the optics column ring will be used to focus (small adjustment). See figures 4 and 5.

- **Null** - Center position of stylus travel. The stylus can swing both + and - from its null position. The full range of motion is measured as ± 32767 counts corresponding to ± 10V.

- **Positioning the stylus tip to optics center...**
  The next step will position the stylus tip to the center line of the optics. The X-Y position of the nose will be adjusted. Once this part of the procedure is completed, the stylus will not appear to "wander" when zooming in/out. Since it is important to have stylus/reticle alignment to determine where a scan will start/stop, precise alignment is important in developing scan routines.

.6 **Adjust video camera ccd to center stylus on reticule...**
Once null and focus occur simultaneously, the double eccentric will be used to move the image of the stylus and sample into the center of the reticule. One axis at a time will be adjusted to achieve the stylus/reticle alignment.

.7 **Final focus...**
Small adjustments to the focus should be made, when needed, by adjusting the optics column focus ring while zoomed in (high magnification).


V-Series Optics Adjustment Flowchart
Start debug sftwr. Tower Down. Verify, adjust illuminator for a shadow-free image (1)
Orient the optics column focus ring to mid position (2)
Tower-down and zoom-in (3)
If new nose installation, remove stylus from view by loosening x-axis and moving nose. (4)
Start debug sftwr. Select DIAG, then JOG TOWER. Jog to attain focus for center 1/3 of screen (5)
If step 4 done, bring stylus back into view. Null the tower (6)
Center 1/3 screen in Focus? (7)
YES
NO
Use z-micrometer for making small focus adjustements. Null after each adjust. (8)
Zoom-Out (9)
Locate stylus next to horz. and vert lines. (10)
Zoom in and note direction stylus/ reflection moves (11)
Up/Dn motion? (12)
YES
NO
Zoom-out. Move y-axis 1/2 amt. of movement and in opposite direction seen in step 11. (13)
Stylus Down. (14)
Side-Side Motion? (15)
YES
NO
Zoom-Out. Move X-axis 1/2 amt. of movement and in opposite direction seen in step 11 (16)
Stylus Down (17)
Zoom-in. Note direction stylus moves (18)
With stylus down, Use Double eccentric to center stylus on x-hair center. (19)
Verify focus. Adjust optics column ring as necessary Verify all adj. screws are tight. (20)

3.2.6 Procedure Text

(Refer to symbol numbers from the flowchart on the preceding page)

NOTE: **1. This procedure may take more than one attempt to be successfully completed.**

2. When loosening mechanics in making adjustments, leave them "semi-tightened". When final tightening is required, "wandering" will be reduced to a minimum.

(1)Start the debug software.....

To start the debug software, click on the debug software icon in the Program Manager if this icon does not exist, follow these steps to start the Dektak debug software program:

1 Configuring the system to run debug mode:

- Go to the program icon to run the Dektak (in the Dektak program group). Select the icon, then in the upper right corner, select FILE, the PROPERTIES.

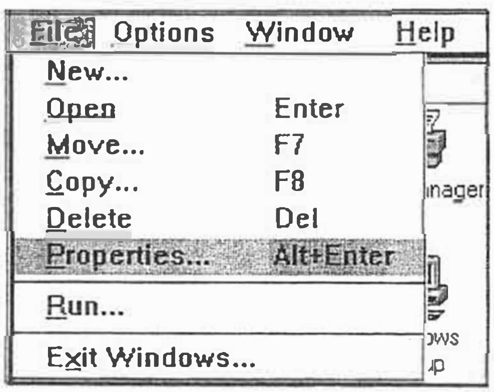


Figure 1

You will see another window describing the program linked to the icon. Make sure that it appears as below:

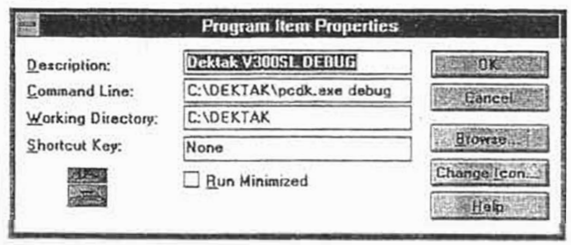


Figure 2

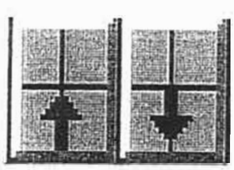
- Verify that the command line in the file properties is as shown in figure 2. If not, then record what they are, and change them appropriately.

NOTE: Change the program properties back to the original setting after servicing the robot. Do not leave the configuration in debug. The customer will have access to files that can compromise the operation of the system if changed.

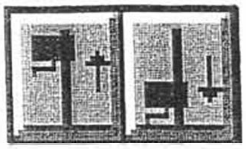
- Click on O.K. when the configuration is correct.

Verify Adjustment for a Shadow-Free Image.....

Place a detailed sample on the sampling stage and command the system to load (click on the "up"arrow):

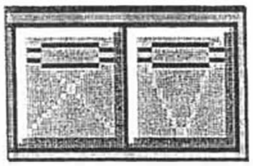


Once the system has loaded the sample, command the tower down (click on the "down arrow"):



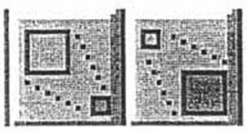
In viewing the image on the video screen, determine if the image is evenly illuminated with a minimum of dark shadows. Illuminator adjustment may not be necessary if the illuminator has not been changed from its original factory position. If it has, then follow the illuminator lamp replacement procedure in section 10.0.

(2) Orient the Optics to Mid-Position Adjustment



To orient the optics focus ring, turn the ring clockwise until it stops. Count the number of revolutions needed to turn the wheel counter-clockwise until it stops. Turn the wheel clockwise to half its travel. If the system has a motorized focus ⇐ feature, use the icon to position the focus ring approximately ½ way through its travel.

(3) Tower Down, Zoom-In (4)



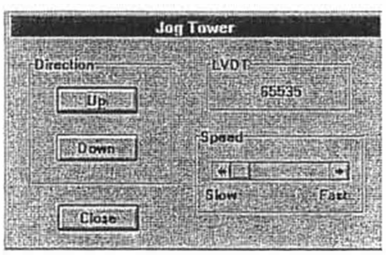
Zoom-In completely by clicking on the tool-bar icon (right-hand box in illustration).

(4) If New Nose Installation, Remove Stylus from View

If this is a new nose installation, remove the stylus from the field-of-view by loosening the X-axis screws and sliding the nose slightly to the left or right. See fig 6. If not installing a new nose, skip this step.

(5) Focus the Center 1/3 of Screen

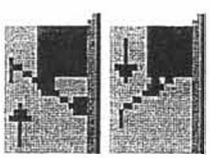
Use the Jog Tower window in the Dektak debug program to adjust the tower to attain focus in the center third of the screen. Select **DIAG**, then **JOG TOWER**. The window:



Adjust the position of the tower until the center 1/3 of the screen is in focus. To determine the best position, locate some vertical features on the display (e.g. closely-spaced lines), then position the tower until their center portion appears to be focused.

(6) Bring Stylus into View, Null the Tower

The goal of this step is to have the optics focused while achieving electrical null of the stylus. It is preferable to use an oscilloscope to measure the null, but null can also be achieved and verified without the scope.



Bring the stylus back into view by adjusting the x-axis mechanics if it was removed from view in step 4. Lower the stylus on the sample by clicking on the "down" arrow:

Method A - Adjusting Null With an Oscilloscope..

1. Turn off the system. Open the E-Box .
2. On the Signal conditioning board (333450) - attach scope x-probe to TP6 (ch.1) and scope y- probe to TP5 (ch. 2).Set the scope to x-y mode operation (on the time base knob). With the machine turned on and the optics in focus, adjust the position of the nose by loosening the set-screw on the z-axis micrometer (fig.3) and turning it until the trace approximates a vertical line on the scope screen.

3. If the scope trace looks more like a vertical ellipse, there are two adjustments to verify and adjust:

    A. Adjust R1 of the LVDT pre-amp board same board to achieve a thinner trace. It is possible to close the trace all the way to become a line. The board is mounted vertically on the side of the tower.

    B. While observing the scope trace, use the jog tower window to move the lead-screw VERY slightly until the scope trace rotates to 45°. If the trace approximates an ellipse, adjust R89 of the signal conditioning board to close the trace down to a line. Jogging the tower in the opposite direction should also show a tight ellipse at 45° in the opposite direction.

Method B - Adjusting Null Without an Oscilloscope...

1. Use the jog tower window command dialogue to observe the real-time readout of the LVDT.

2. Loosen the lock screw on the Z-Axis micrometer . Adjust the real time value to between 20,000 and 40,000. This will closely approximate a "null" while in focus.

3. Tighten down the z-axis micrometer locking screw and verify that the reading is still between 20,000 and 40,000.

(8) Fine Focus Adjustment with Optics Ring
Use the Z-micrometer for making any fine adjustments to the focus. Raise and lower the tower to "re-null" the system after the adjustment.

(9) Zoom-Out
Use the Zoom - Out icon to zoom the optics out on the system.

(10) Locate Stylus Next To Horizontal/Vertical Feature
Loosen the nose X-axis hold-down screws. Move the nose X-axis to align the stylus to the vertical line on the reticule or any other convenient horizontal and vertical lines. Tighten the screws firmly.

(11) Zoom-in and Note Up/Dn, Side/Side Translation of Stylus Image
Use the Zoom-in icon to zoom-in the optics on the system. Observe the relative motion of the stylus/stylus reflection with respect to the reticule on the screen. Write down the type of motion (up/dn, or side/side) and describe as up, down, left, and/or right. **If this step is done after a y-axis adjustment and no Up/Dn motion is observed, then tighten the Y-axis screws and repeat this step. If no motion is observed after tightening the screws, go to step 15.**

(12) Was Up/Dn Motion of Stylus Observed?
If there was vertical motion of the stylus with respect to the reticule in step **11** then go to step **13** else go to step **15**.

(13) Adjustment if Vertical Motion Observed
Zoom out, noting the amount of Up/Down motion. Loosen the hold-down screws on the Y-axis and move it 1/2 the way back from the position it moved from.

(14) Lower the Stylus to Prepare for Performing (11)
Lower the stylus using the appropriate commands. Return to step **11**.

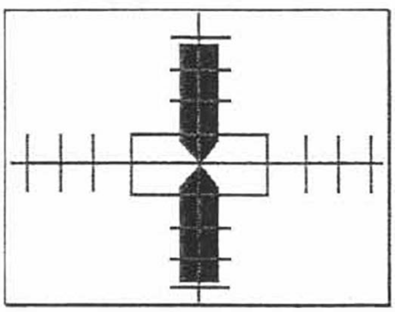
(15) Was Side/Side Motion Observed in (11)
Was there any side-side motion observed in step 11? If so, go to step 16, else go to step 19. **If this step is done after a X-axis adjustment and no side-side motion is observed, then tighten the X-axis screws and repeat this step. If no motion is observed after tightening the screws, go to step 19.**

(16) Adjustment if Side/Side Motion Observed
Zoom out, noting the amount of Up/Down motion. Loosen the hold-down screws on the X-axis and move it 1/2 the way back from the position it moved from.

(17) Stylus Down in Preparation to Recheck Side/Side Motion After Adjustment
Stylus down.

(18) Recheck of Side/Side Motion
Zoom-in and observe any stylus motion with respect to the reticule. Return to step 15.

(19) Centering the Stylus on the Reticule
Use the optics double eccentric adjustment (one axis at a time) to center the stylus on the reticule cross-hairs. Result should look like figure 6.



(20) Final Focus Adjustment
Verify that the system is still in focus at the center 1/3 of the screen. Adjust the focus on the optics column ring if necessary.

Note: Tighten down all hardware after final adjustments are complete. Verify that optical alignment and null are satisfactory after tightening is complete.

Figure 6 - Stylus/Reticle Alignment

YOUR NOTES:

CHAPTER 4

PREVENTIVE MAINTENANCE

The 8200 profiler and the Cybeq prealigner are the only items requiring preventive maintenance.

3.1 REQUIRED MATERIALS (KEEP THESE ITEMS IN ONE LOCATION):

ITEM	WHEN NEEDED
Items needed for profiler....	
1. Klübersynth GE 46-1200	Lubrication of Scan or Y-axis leadscrew.
2. Lint-free cloth	Cleaning the Y-Axis leadscrew.
Items needed for prealigner....	
3. Porous cloth (Oriel P/N 4908) or equivalent	Cleaning optical filter and lens as needed
4. Isopropyl alcohol (95% sol'n) reagent grade (or equivalent)	" " " " "
5. Acetone (reagent grade)	" " " " "
6. Duster (Oriel P/N 4905) or equivalent	" " " " "
7. Lens tissue	" " " " "
8. Cotton swabs (wood stem)	" " " " "
9. Loctite cleaning solvent (P/N 76820)	Replacement of vacuum chuck cover
10. Loctite PRI SM 454 adhesive	" " " " "
11. Cybeq vacuum chuck cover (P/N 0122-1580)	" " " " "

3.2 PROFILER - PREVENTIVE MAINTENANCE

NOTE: MAINTENANCE PERSONNEL MUST BE FAMILIAR WITH MACHINE OPERATION IN WINDOWS.

NOTE: Run the Dektak Configuration Editor to fill out the configuration windows at the end of this section. Doing this will assure knowledge of the exact configuration that your system was set to during delivery. This record will be valuable during future repair/service calls.

To run the program, double-click on the icon:

In the Dektak program group, scroll through the tabs, and fill in the spaces at the end of this section.

3.2.1 DAILY MAINTENANCE

1. **MINIMIZE VIBRATION** and **SHOCK** to the system while it is in operation.
2. **RAISE** the **TOWER BEFORE** making **GROSS SAMPLE POSITIONING CHANGES** by hand.
3. **LOWER** the **TOWER ONLY** when there is a **SAMPLE IN PLACE**.
4. **NEVER DISTURB** a **SAMPLE WHILE** it is **BEING SCANNED**.
5. The **TOWER** should be in the "**UP**" position when the system is not in use, even if power is **ON**.
6. **TURN OFF** the **LAMP** when it is **NOT** being **USED**.
7. **CLOSE SCAN HEAD DOORS** when **NOT IN USE**.
8. **VERIFY** that the **PROFILER FLOATS** on the **AIR ISOLATION SYSTEM**. Items to check if profiler is not floating:
   A. Air pressure IS 15psi above pressure required to lift profiler.

   B. Sensor arm adjustments underneath the isolation table:
   NOTE:Lifting profiler arm may will result in need for robot reprogramming!
9. **KEEP** the instrument **CLEAN**. Key components pay top attention to are:
   A. Rotary stage surface
   B. Glass Block (clean with IPA and a lint-free cloth)
   C. Stylus

(carefully clean with a soft, small brush and IPA when contamination is observable on the video screen. BE ESPECIALLY CAREFUL WITH LOW-FORCE HEADS!)

Since any contamination can significantly degrade measurements, maintaining clean operating conditions is very important.

3.2.2 POSITIONER CYCLING

1. Exercise the scan and "Y" stages daily (run from limit-to-limit) to maintain leadscrew lubrication.The best way to do this is to go into the sample-positioning window, and:

- Double-click on the wafer icon that appears in the lower left-hand corner.
- Position the crosshair about 1/4" away from the side and bottom of the wafer window. Double-click the roller device.
- Wait for the "ready" message to appear in the lower left corner of the monitor.
- Position the crosshair in the next clockwise (or counter-clockwise) corner and repeat steps B and C until the positioners have been placed at each corner location 2-3 times.

3.2.3 LONG TERM MAINTENANCE SCHEDULES

1. Positioner Lubrication
   Please follow the schedule:

POSITION LUBRICATION SCHEDULE			
	Light Use	Moderate Use	Heavy Use
Axis			
Scan	60 days	45 days	30 days
Y	120 days	90 days	60 days
Light Use	= < 2 hours/day		
Moderate Use	= between 2-8 hours/day		
Heavy Use	= > 8 hours/day		

2. Cleaning the Y-axis Leadscrew

   Before applying lubricant to the Y-axis, clean the lead-screw as follows:

- In the sample positioning window, locate the sample mounting surface to the far left and rear corner of the profiler.
- Carefully remove the cover of the Y-axis leadscrew.
- Maximize the wafer icon at the bottom left corner of the machine.

- Position the cross-hair at the top-right corner of the wafer/positioning window and double-click the left button of the roller-ball. The sample-positioning surface should move to the left-front corner of the profiler.

- Hold a lint-free cloth on the leadscrew while it turns. BE CAREFUL TO AVOID THE NUT! Continue to hold it there while moving the crosshair to the bottom-right corner of the wafer/positioning window. Double-click the left button of the roller-ball to activate the Y-axis.

- Repeat steps 5 and 6 until the length of the lead screw has been cleaned

- Apply Klübersynth GE 46-1200 lubricant to the leadscrew in the following manner.

3. Method for applying lubrication to the Y-axis

   - Apply a thin line of lubricant sparingly. Do not allow the applicator to form drops on the leadscrew assembly. Over-lubrication will result in oil contaminating other areas of the profiler.

4. Method for applying lubrication to the Scan-Axis:

   - Method of application is the same as for the Y-axis, except the scan stage should be moved from side-to-side (use the roller-ball to go from the right to left corner on the wafer positioning window) to expose the entire length of the scan leadscrew.

5. Software Calibration (Perform once monthly)
   - In the main Dektak window, select the "Calibrate" command, then select "Vertical Calibration." A dialogue box containing calibration instructions will be displayed.

6. Perform a step-height repeatability test (run 10X) and calculate σ of repeatability. A new system should have $\sigma < 7.5$ Å.:

Scan conditions:	**Force: 10 mg.** **Length: 400 μm** **Time: 10 secs.** **Measure before/after step with 20 μm bandwidth (cursor width)** **(level)** **(save program)**

7. Perform baseline scan of at least 100mm (or longer) to verify that the total indicated run-out of the system is less than 600 Å.

Note: A system will have to be cleaned and /or lubricated when it does not pass these tests. There is a new and preferred lubricant to apply to the axes of the system. It is Klübersynth GE 46-1200. I would suggest that this lubricant be applied to the V200 in San Jose. The lubrication should be changed per EO 14409.

3.3 PREALIGNER PREVENTIVE MAINTENANCE

1. Precautions

- Disconnect power from the prealigner before servicing
- Never handle the prealigner form the optics house assembly
- Avoid touching optical component surfaces
- Avoid placing any loose items on top of the prealigner assembly

3.4 Bi-Monthly Maintenance

- Clean the upper surface of the vacuum chuck cover with a lint-free cloth (Oriel P/N 4908)
- Verify/adjust vacuum chuck pressure to a minimum of 20 in. Hg.
- Inspect optical filter and lens for cleanliness
- If cleaning is needed, see Step 3.2.4
- Preferred cleaning method for optics: Use clean, dry air (Oriel P/N 4905 or equivalent) to blow off the optics.
  CAUTION: KEEP CAN TURNED UPRIGHT!
- Prepared to remove contamination with an optical tissue, wrapped around a Q-Tip, and sparingly wetted with isopropyl alcohol. **SEE NEXT STEP.**
- Gently wipe the optical surface in a circular motion.
- With another tissue and Q-Tip, gently wipe the optical surface in one direction using a mild circle-eight pattern.
- Remove any remaining residue by repeating Step 3.2.4.4 (the last step) with acetone.

3.5 3-6 MONTH INTERVAL MAINTENANCE

1. Replacement of Vacuum Chuck Cover

- Remove the old cover
- Clean the chuck surface with Loctite P/N 76280 solvent
- Apply 2 drops of Loctite instant adhesive PRI SM 454 on the cover surface intended to contact the bottom surface of the chuck. Place adhesive at opposite locations. **DO NOT ALLOW THE ADHESIVE TO SPREAD TO THE UPPER SURFACE OF THE CHUCK!**

- When installing the cover, align the holes in the cover with the grooves in the chuck.

3.6 PREVENTIVE MAINTENANCE LOG

Suggested Lubrication Schedule (Days)

Usage	==>	Low	Moderate	High
Scan-Axis		30	45	60
Y-Axis		60	90	120

Usage Definitions:

Low	< 2 hours/day
Moderate	2-8 hours/day
High	> 8 hours/day

Scan Axis Lubrication Dates

____
____
____
____
____
____
____

Y-Axis Lubrication Dates

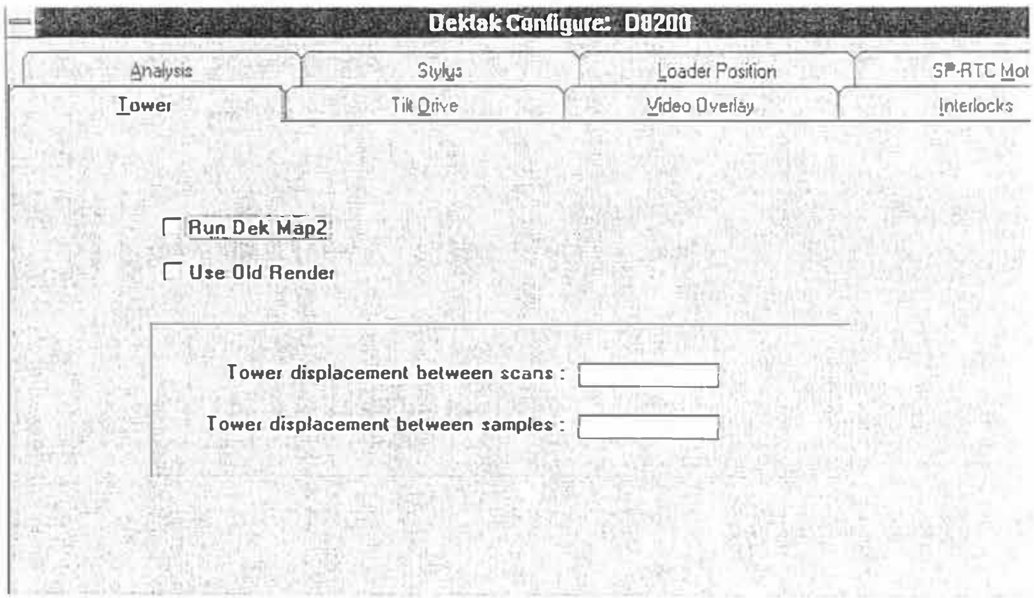
____
____
____
____

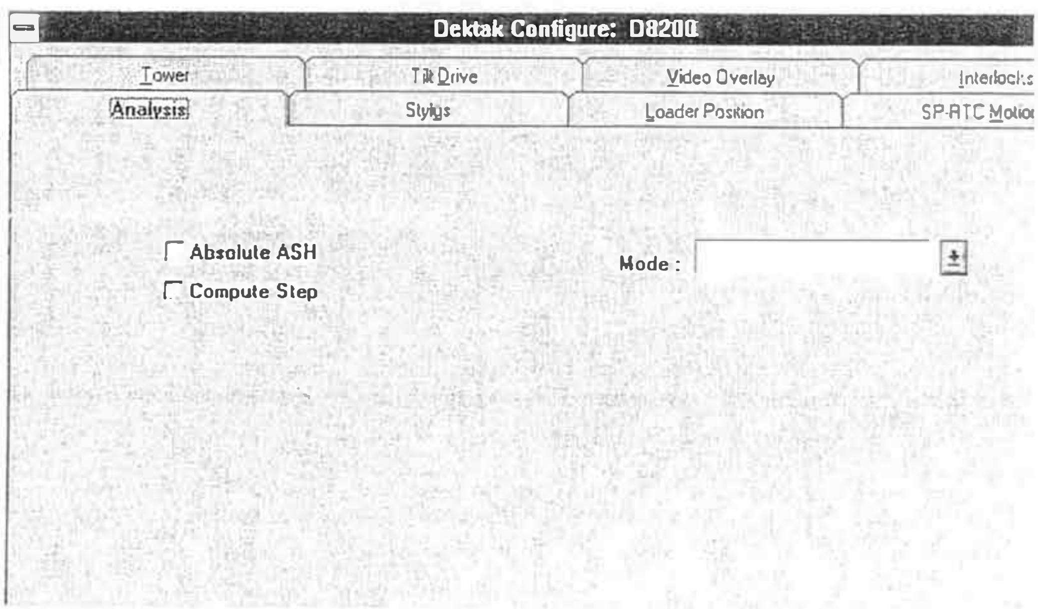
SOFTWARE CALIBRATION DATES
(Suggested Monthly)

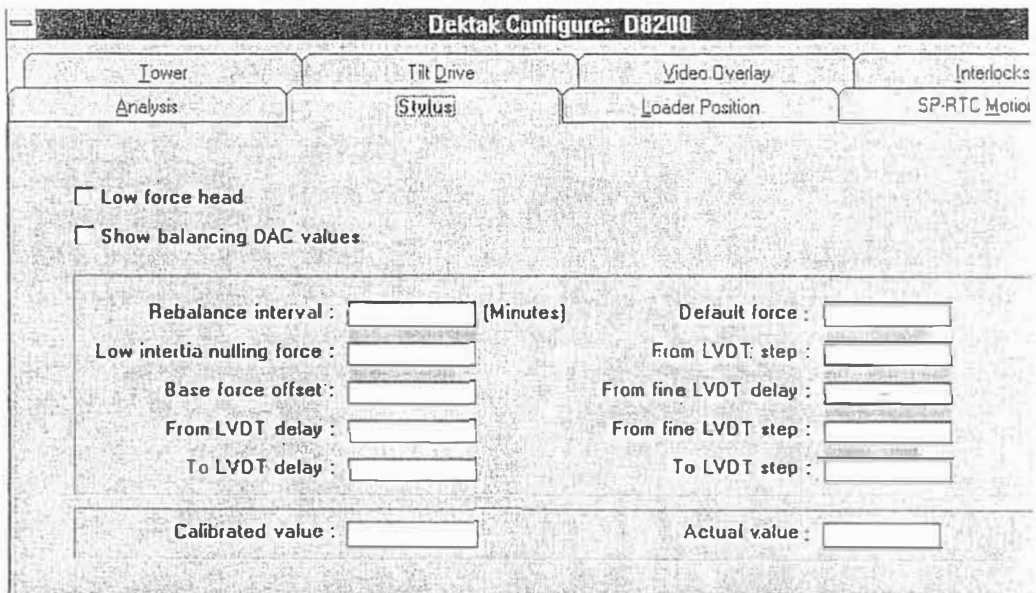
____
____
____
____
____
____
____
____

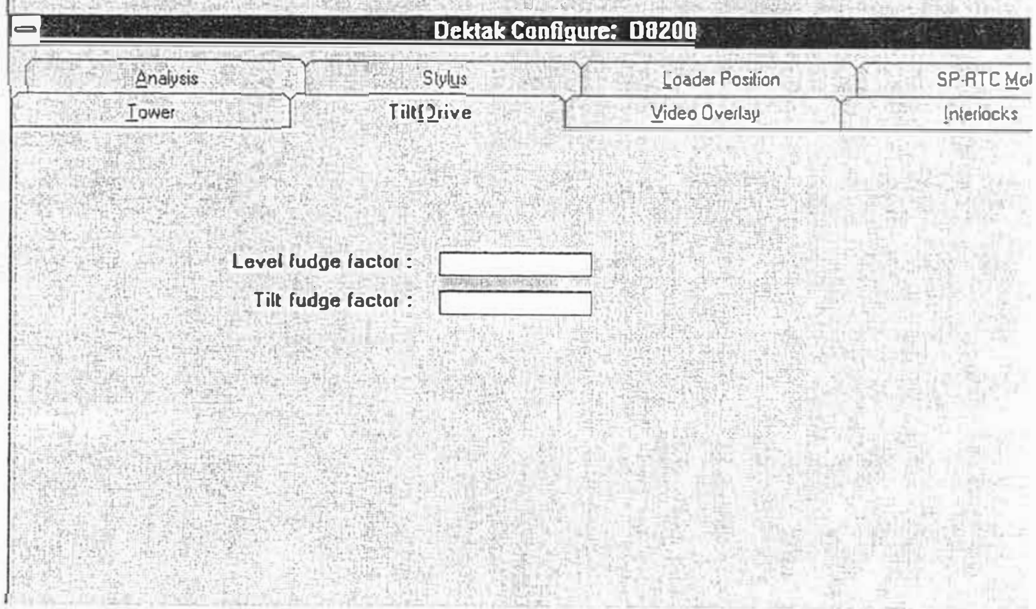
3.7 SOFTWARE CONFIGURATION WINDOWS

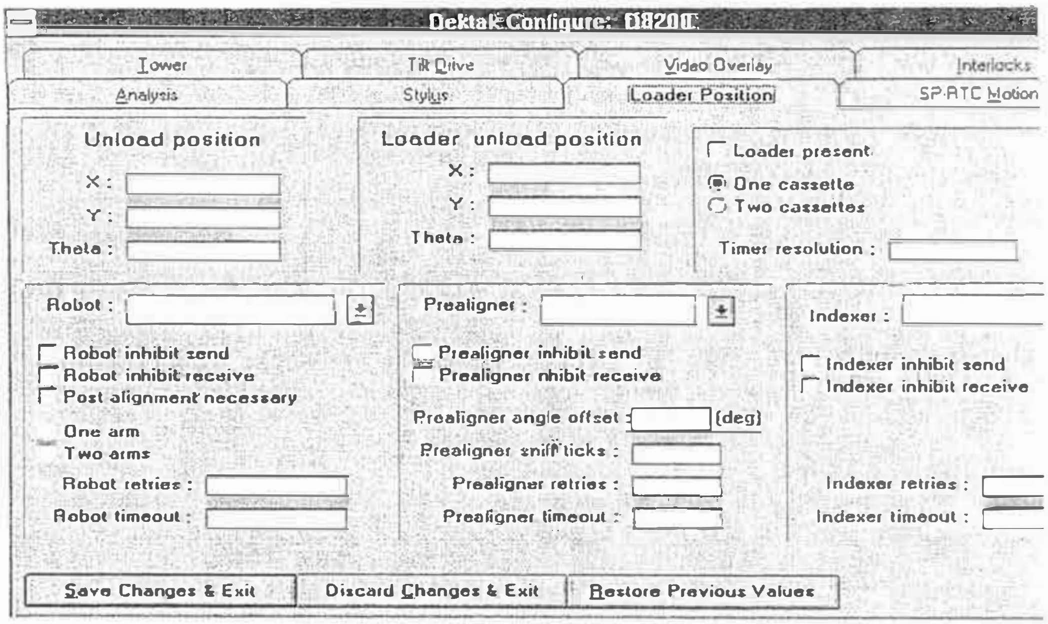
Fill out the following blank spaces for future reference of system configuration.

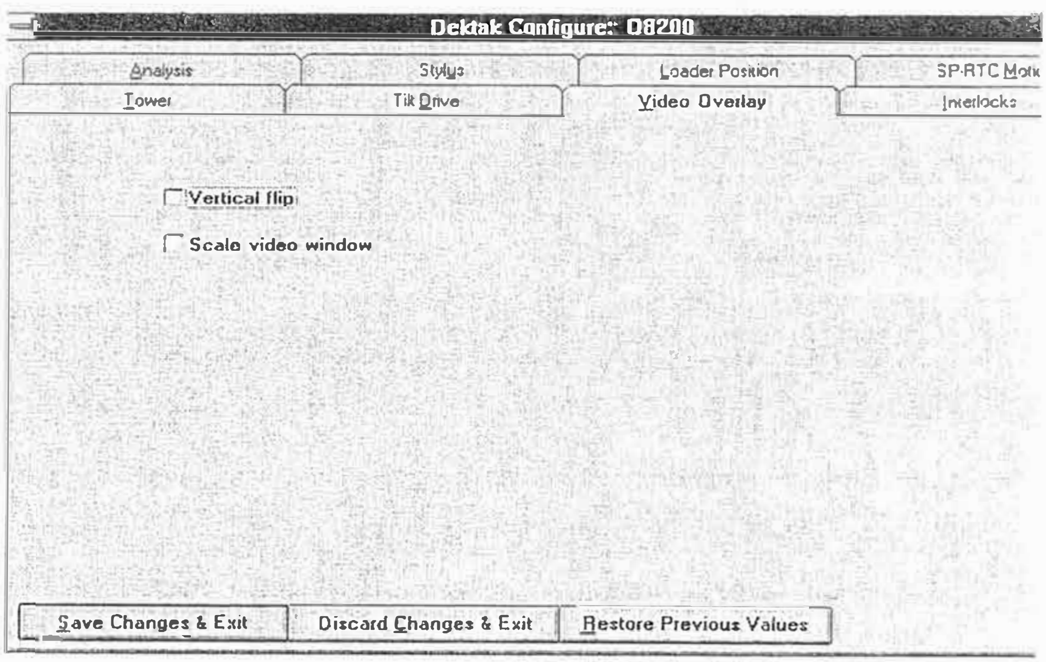


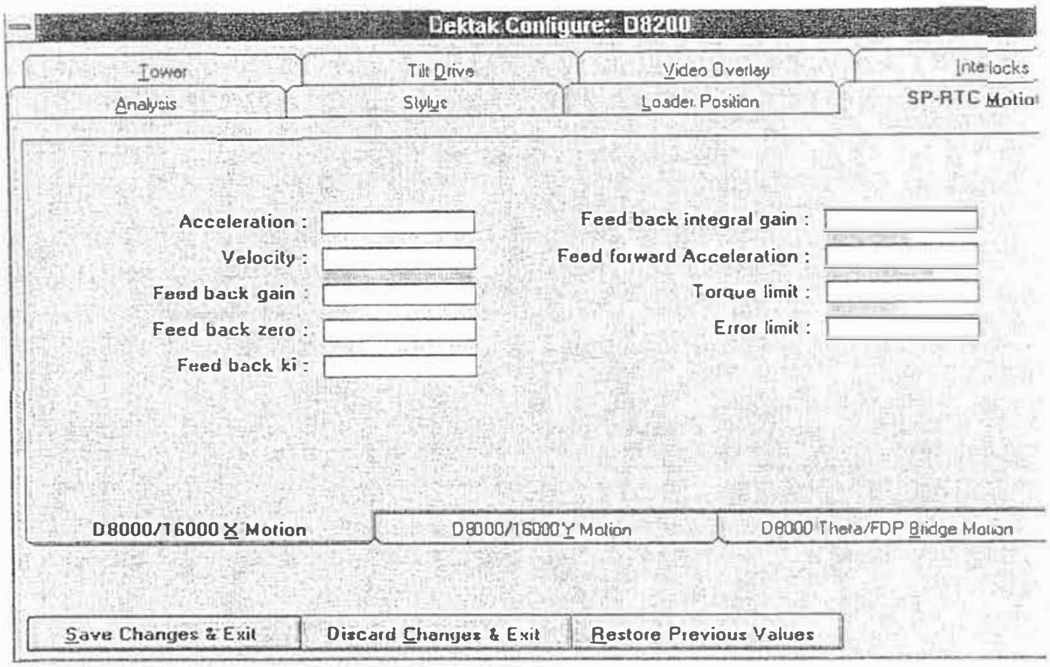


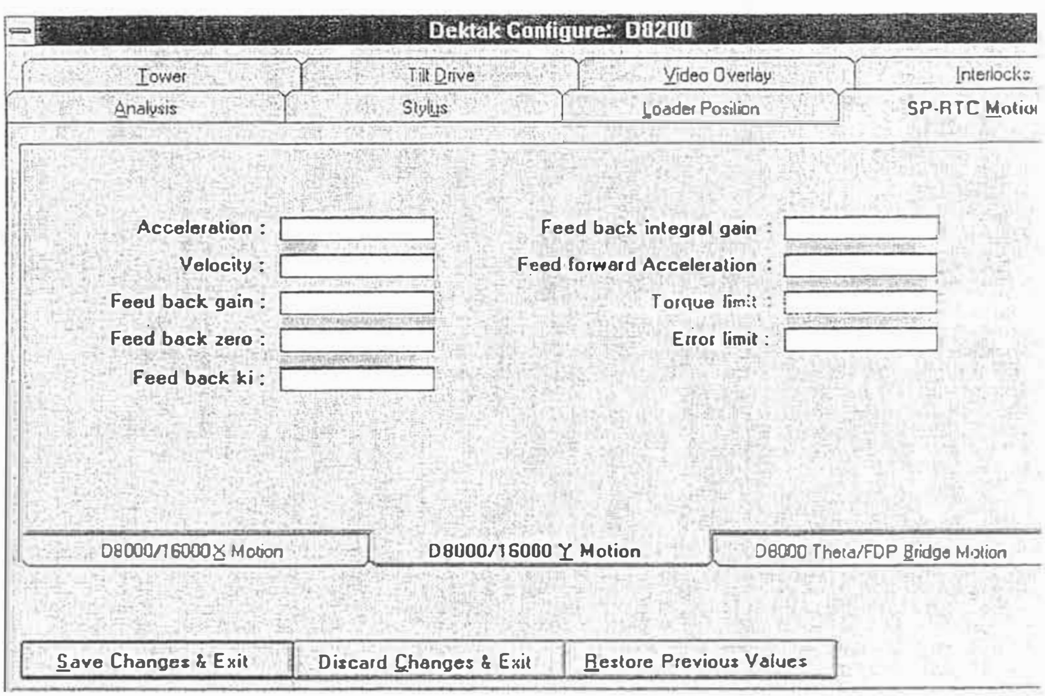

Dektak Configure: D8200
Tower
Tilt Drive
Video Overlay
Interlocks
Analysis
Stylus
Loader Position
SP-RTC Motio
Low force head
Show balancing DAC values
Rebalance interval :
(Minutes)
Default force :
Low intertia nulling force :
From LVDT step :
Base force offset :
From fine LVDT delay :
From LVDT delay :
From fine LVDT step :
To LVDT delay :
To LVDT step :
Calibrated value :
Actual value :

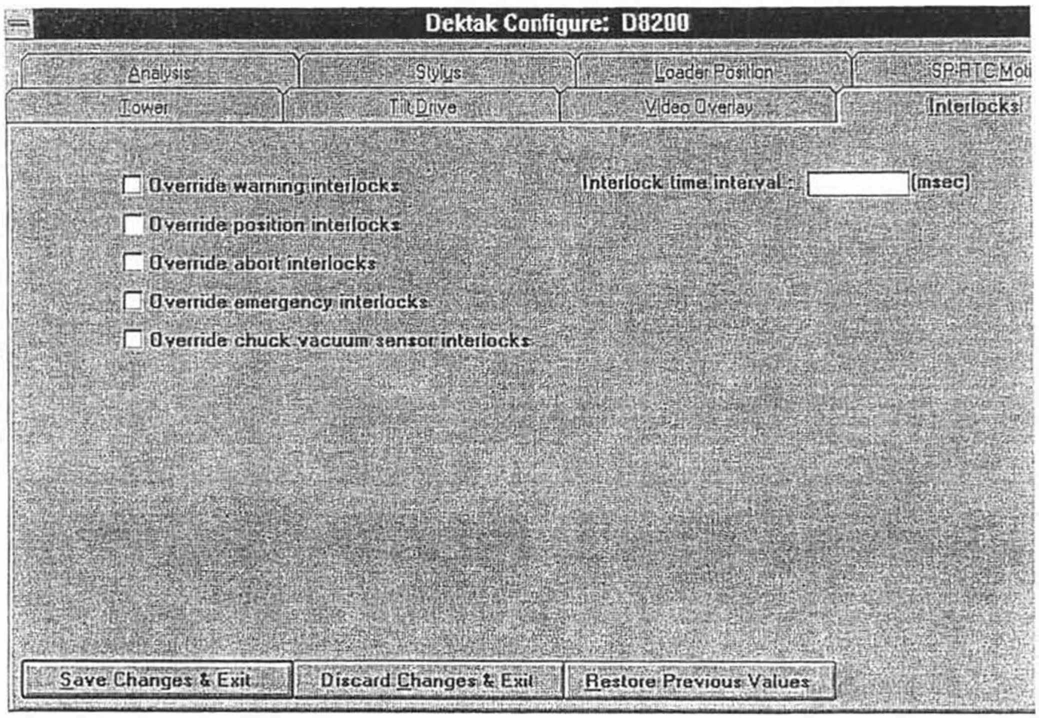

Dektak Configure: D8200
Analysis
Stylus
Loader Position
SP-RTC Mo
Tower
Tilt Drive
Video Overlay
Interlocks
Level fudge factor :
Tilt fudge factor :


Dektak Configure: D8200
Tower
Tilt Drive
Video Overlay
Interlocks
Analysis
Stylus
Loader Position
SP-RTC Motion
Unload position
X :
Y :
Theta :
Loader unload position
X :
Y :
Theta :
Loader present
One cassette
Two cassettes
Timer resolution :
Robot :
Robot inhibit send
Robot inhibit receive
Post alignment necessary
One arm
Two arms
Robot retries :
Robot timeout :
Prealigner :
Prealigner inhibit send
Prealigner nhibit receive
Prealigner angle offset : (deg)
Prealigner sniff ticks :
Prealigner retries :
Prealigner timeout :
Indexer :
Indexer inhibit send
Indexer inhibit receive
Indexer retries :
Indexer timeout :
Save Changes & Exit
Discard Changes & Exit
Restore Previous Values


Dektak Configure: D8200
Analysis
Stylus
Loader Position
Tower
Tilt Drive
Video Overlay
Interlocks
Vertical flip
Scale video window
Save Changes & Exit
Discard Changes & Exit
Restore Previous Values


Dektak Configure: D8200
Tower
Tilt Drive
Video Overlay
Interlocks
Analysis
Stylus
Loader Position
SP-RTC Motio
Acceleration :
Velocity :
Feed back gain :
Feed back zero :
Feed back ki :
Feed back integral gain :
Feed forward Acceleration :
Torque limit :
Error limit :
D8000/16000 X Motion
D8000/16000 Y Motion
D8000 Theta/FDP Bridge Motion
Save Changes & Exit
Discard Changes & Exit
Restore Previous Values


Dektak Configure: D8200
Tower
Tilt Drive
Video Overlay
Interlocks
Analysis
Stylus
Loader Position
SP-RTC Motio
Acceleration :
Velocity :
Feed back gain :
Feed back zero :
Feed back ki :
Feed back integral gain :
Feed forward Acceleration :
Torque limit :
Error limit :
D8000/16000 X Motion
D8000/16000 Y Motion
D8000 Theta/FDP Bridge Motion
Save Changes & Exit
Discard Changes & Exit
Restore Previous Values


Dektak Configure: D8200
Analysis
Stylus
Loader Position
SP-RTC Moti
Tower
Tilt Drive
Video Overlay
Interlocks
Override warning interlocks
Override position interlocks
Override abort interlocks
Override emergency interlocks
Override chuck vacuum sensor interlocks
Interlock time interval :
[msec]
Save Changes & Exit
Discard Changes & Exit
Restore Previous Values

YOUR NOTES

CHAPTER 5
SPARE PARTS

Veeco Sloan Technology: Spare Parts List for V-Series Profilers

044209	Camera, Color, Panasonic
085574	Monitor, 15", Color
085590	Printer, OM426
333300	Scan Drive Assembly, V300Si
333301	Scan Drive Assembly, V200Si
333080	Scan Drive Encoder Cable Assembly
333081	Scan Drive Motor Cable Assembly
333196	Theta Motor Cable Assembly
333198	Theta Encoder Cable Assembly
333336	Level Motor and Encoder Cable Assembly
048772	Ball Screw Support Unit
048780	Linear Way, 640mm Long, Y Axis, 2 per Unit
333085	Y Drive Encoder Cable Assembly
333154	Leadscrew (both X and Y Axes)
333261	Y Drive Motor Cable Assembly
010007	Power Supply, 4 Outputs
010017	Floppy Drive, 3-1/2"
010058	Hard Drive, 3-1/2" IDE/AT
010224	Motion Control PCB
010243	Video Blaster PCB
010256	Pentium Single Board Computer
333412	Modified Servo Amplifier
333413	I/O Card Assembly
333433	Lamp Driver Assembly
333450	Signal Interface PCB Assembly ("Combo Board")
565011	Power Amp PCB
140229	Modified Lamp, Zoom Optics
508240	Proximity Sensor
665116	Pre-Amp PCB Assembly
333069	Tower Motor Cable Assembly
665050	Low Inertia Stylus Assembly, Version 2.0
085283	Lubricant, Leadscrew
333972	Manual, V200SI
333973	Manual, Clean Room, V200Si
333174	Shipping Bracket, Tower
333183	Shipping Bracket, Base, 2 per Unit
333202	Shipping Bracket, Y Stage
333302	Shipping Bracket, Stage
333327	V Series Crate
048773	Linear Way, 480mm, IKO (Bridge), 2 per Unit
333048	Drive Motor Cable Assembly (X Drive)
333970	Manual, V300SI
333971	Manual, Clean Room, V300SI

Cybeq Spare Parts List

Per4mer 6100 Robotic Transfer Mechanism
R-Axis Assembly

Level 1: Recommended Spare Parts

Item	Cybeq Part No.	Part Description	Qtys Per Sngl Arm	Qtys Per Dual Arm
		9-Inch Travel:		
1	0125-0081	PCB ASM, R-Axis Limit, Rbt	1	2
2	0125-0077	PCB ASM, R-Axis Sensor, Rbt	1	1
3	0125-0114	Motor, 12VDC, w/Encoder	1	2
4	0125-0136	Hose, Twin, 13.25" Lg	1	1
5	0125-0137	Hose, Twin, 12.25" Lg	1	1
6	1260-0446	Belt, Timing, .18"W 280 Grv	1	2
7	1260-0445	Belt, Timing, .12"W 140 Grv	1	2
8	1190-2260	Bearing, Radial	2	4
9	1220-0503	Ring, Retaining	1	2
		13.4-Inch Travel:		
1	0125-0081	PCB ASM, R-Axis Limit, Rbt	1	2
2	0125-0077	PCB ASM, R-Axis Sensor, Rbt	1	1
3	0125-0114	Motor, 12VDC, w/Encoder	1	2
4	0125-0144	Hose, Twin, 17.50" Lg	1	1
5	0125-0143	Hose, Twin, 16.50" Lg	1	1
6	1260-0449	Belt, Timing, .18"W 390 Grv	1	2
7	1260-0448	Belt, Timing, .12"W 195 Grv	1	2
8	1190-2260	Bearing, Radial	2	4
9	1220-0503	Ring, Retaining	1	2

Per4Mer 6100 Robotic Transfer Mechanism Z-Axis Assembly Level 1: Recommended Spare Parts			
Item	**Cybeq Part No.**	**Part Description**	**Qty**
1	0125-0522	PCB ASM, Robot Interface	1
2	0125-0205	Motor, Modified	1
3	0125-0224	PCB ASM, Z-Sensor	1
4	1260-0447	Belt, Timing, 100 Grv	1
Level 2: Recommended Spare Parts			
Item	**Cybeq Part No.**	**Part Description**	**Qty**
1	0125-0219	Vacuum Sensor, Mod.	1
2	0125-0234	ASM, Brake, Electric	1
3	1170-2282	Valve, Solenoid	1
4	1190-2263	Bearing, Flange	6
5	1190-2264	Bearing, H-Plate	16

Per4Mer 6100 Robotic Transfer Mechanism Theta-Axis Assembly Level 1: Recommended Spare Parts			
Item	**Cybeq Part No.**	**Part Description**	**Qty**
1	0125-0265	Plate, Slider Stop	1
Level 2: Recommended Spare Parts			
Item	**Cybeq Part No.**	**Part Description**	**Qty**
1	0125-0053	PCB ASM, Theta Interface	1
2	0125-0291	ASM, Vacuum Elbow	1

Per4Mer 6100 Robotic Transfer Mechanism
Controller Assembly

Level 1: Recommended Spare Parts

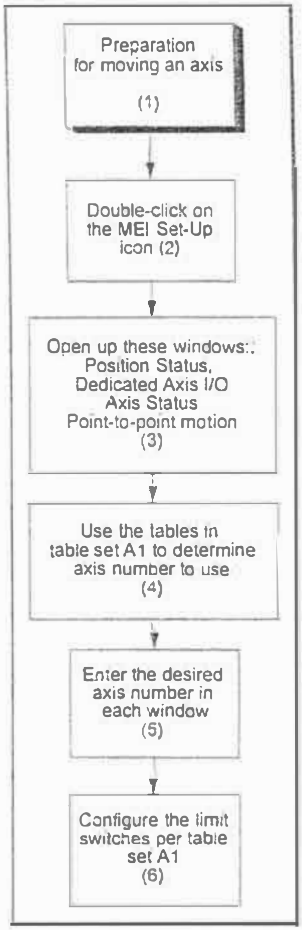
Item	Cybeq Part No.	Part Description	Qty
1	3030-0764	ASM, Motor Controller Amplifier	1
2	3030-0766	PCB ASM, M1/M2 Servo Motor Control	1
3	3030-0765	PCB ASM, M3/M4 Servo Motor Control	1
4	0125-0182	PCB ASM, CPU	1
5	0125-0473	PCB ASM, Robot Controller I/O	1
6	3030-0763	Motor Controller, Linear	3
7	3090-0030	Fuse, 5Amp	5
8	3090-0080	Fuse, 3Amp	5
9	0125-0476	Power Supply Module	1

Level 2: Recommended Spare Parts

Item	Cybeq Part No.	Part Description	Qty
1	0125-0494	PCB ASM, Interface	1
2	0125-0537	PCB ASM, Display	1
3	0125-0349	Switch, Pushbutton, (E-Stop)	1
4	3380-1206	Switch, 2-Pole, 3-Pc Set	1

APPENDIX A
RUNNING MEI SOFTWARE

- Start The MEI Set-Up Program



(1, 2) Click on the MEI Set-Up icon in the Dektak program group.

(3)
- Press F2 for the Position Status window.
- Press F3 for the PC-DSP Axis Status window.
- Press Alt-D for the Axis Dedicated I/O window.

- Select MOTION, then POINT-TO-POINT MOTION for specifying limits for stage motion.

Position Status	Axis Dedicated I/O
PC-DSP Axis Status	Two-Point Motion

The windows can be positioned with the mouse by clicking on the upper edge of the window and dragging it while the left mouse button is held down. Position the windows for easy observation

(4) Use the tables on the following two pages to determine the axis number to be exercised. The axis number appears in parentheses after the axis name.

(5) On the top command bar of the MEI set-up program, select CONFIGURE, then LIMIT SWITCH CONFIGURATION.

(6) Configure the limit switch settings per the axis to be serviced by entering the axis number and configuring the limit switches using information on the next two pages unber "Limit Switch Configurations":

Point-to-point motion.....

Axis # Description	0 Bridge	1 Y-Axis	2 Scan Axis	3 Theta Stage	4 Tower	5 Level
Delay	0	0	0	0	0	0
Position 1	See procedure	See procedure	See procedure	See procedure	See procedure	See procedure
Position 2	See procedure	See procedure	See procedure	See procedure	See procedure	See procedure
Velocity	100,000	100,000	100,000	50,000	50,000	50,000
Acceleration	100,000	100,000	100,000	25,000	25,000	25,000
Jerk	0	0	0	0	0	0

Limit switch
Configuration…..

Bridge (0)	Low Active	High Active	Stop	E-Stop	Abort	No Action
Positive Limit		x				x
Negative Limit		x				x
Home						x
Device Fault						x
Amp Enable			N/A	N/A	N/A	N/A

Y-Axis (1)	Low Active	High Active	Stop	E-Stop	Abort	No Action
Positive Limit		x				x
Negative Limit		x				x
Home						x
Device Fault						x
Amp Enable			N/A	N/A	N/A	N/A

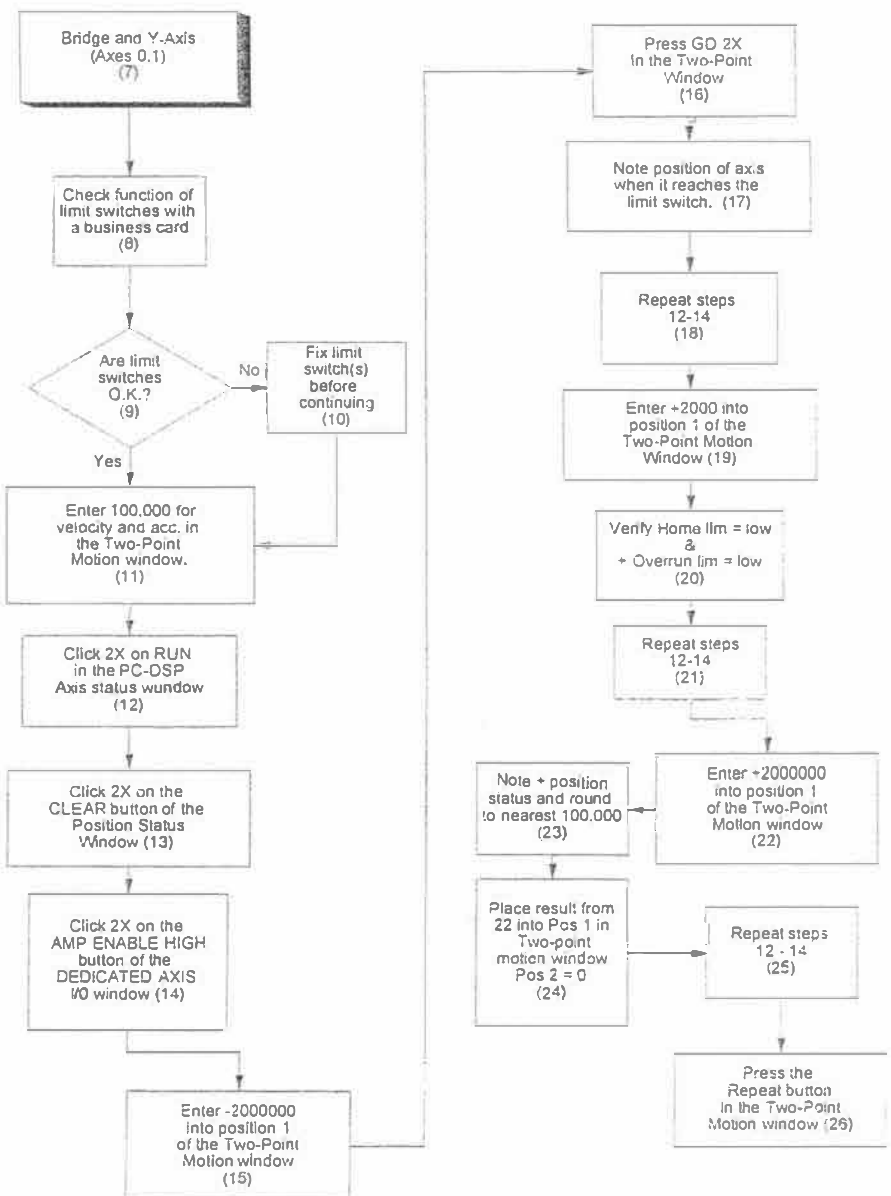
Scan Axis (2)	Low Active	High Active	Stop	E-Stop	Abort	No Action
Positive Limit		x				x
Negative Limit		x				x
Home						x
Device Fault						x
Amp Enable			N/A	N/A	N/A	N/A

Theta (3)	Low Active	High Active	Stop	E-Stop	Abort	No Action
Positive Limit	x					x
Negative Limit	x					x
Home	x					x
Device Fault						x
Amp Enable			N/A	N/A	N/A	N/A

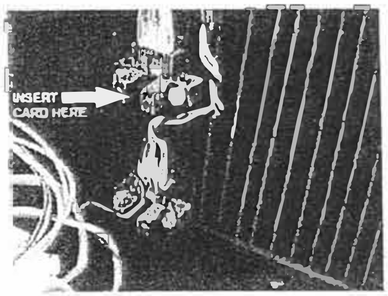
Tower (4)	Low Active	High Active	Stop	E-Stop	Abort	No Action
Positive Limit	x			x		
Negative Limit	x			x		
Home						x
Device Fault						x
Amp Enable			N/A	N/A	N/A	N/A

Level (5)	Low Active	High Active	Stop	E-Stop	Abort	No Action
Positive Limit	X			X		
Negative Limit	X			X		
Home						X
Device Fault						X
Amp Enable			N/A	N/A	N/A	N/A

2.0 Programming Bridge and Y-Axis Motion



(8) Check the function of the limit switches with a business card. The lighted indicators should turn-off when the business card is placed to block the limit switch beam.



It is also possible to monitor the system response of the limit switches by going to the AXIS DEICATED I/O window and observing the status of the tested limit switch change from "low" ⇐ to "high". See example to the right.

(9) If the limit switches are O.K., then go to step 11. If not, you must trace limit switch signals and replace hardware as necessary as in section 1.3.3 of the Troubleshooting section of this manual **(10).**

(11) Enter 100,000 for velocity and acceleration in the Two-Point motion window.

(12) Click RUN two times in the PC-DSP Axis status window.

Note: The first time you click on any of the MEI setup program windows activates the window. The second click activates the selection you are making.

(13) Press CLEAR two times in the POSITION STATUS window.

(14) In the AXIS DEDICATED I/O window, press AMP ENABLE two times.

(15) Enter "-2,000,000" in POSITION 1 of the TWO-POINT-MOTION window.

(16) Press GO two times in the TWO-POINT MOTION window.

(17) When the axis reaches the limit switch and stops, note the numerical position of the axis in the POSITION STATUS window.

(18) Repeat steps 12 - 14.

(19) Enter "+2000" into POSITION 1 of the TWO-POINT POSITION window. Repeat step 16.

(20) Verify that the HOME SENSOR and the POSITIVE OVERTRAVEL limit switches are both LOW. If they are not, increase the setting in step 19 and repeat steps 12 - 14 until the LOW condition is met for both limit switches.

(21) Repeat steps 12 - 14.
(22) Enter "+2,000,000" into POSITION 1of the TWO-POINT MOTION WINDOW.

(23) In the POSITION STATUS window, note the numerical position of the axis. Round this off to next lower interval of 100,000.

(24) Place the results of step 23 into POSITION 1 of the TWO-POINT MOTION window. Enter 0 for POSITION 2.

(25) Repeat steps 12 - 14.

(26) Press REPEAT in the TWO-POINT MOTION window.

3.0 Programming Motion for the Scan Axis

Instructions are identical to programming motion in section 2.0 with the following exceptions.

A. Select axis # 2 in the DEDICATED AXIS I/O, POSITION STATUS, TWO-POINT MOTION, and PC-DSP AXIS STATUS windows.

B. Change the number in step 15 to -3,000,000.
C. Change the number in step 19 to 8000.
D. Change the number in step 22 to +3,000,000.

4.0 Programming motion for the Theta Stage.

A. Select axis # 3 in the DEDICATED AXIS I/O, POSITION STATUS, TWO-POINT MOTION, and PC-DSP AXIS STATUS windows.

B. Activate the AMP ENABLE LOW selection in the same window.

C. Verify that the home sensor (and negative overtravel sensor for loader systems) goes LOW when rotating the theta stage chuck by hand. If these sensors are not operational, try steps outlined in the troubleshooting section of this manual, section 1.3.3.

D. In the TWO-POINT MOTION window, set velocity = 25,000, acceleration = 50,000, and JERK = 0.

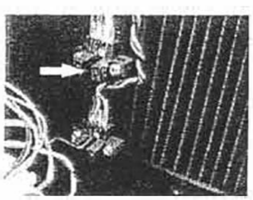
E. Set POSITION 1 = 360,000 and POSITION 2 = 0.
F. Click on RUN in the PC-DSP window two times.
G. Click AMP ENABLE in the DEDICATED AXIS I/O window two times.
H. Click REPEAT in the TWO-POINT MOTION window 2 times.

Motion of the theta stage (0 - 360°) should now be observed.

5.0 Programming Tower Motion

A. Select axis # 4 in the DEDICATED AXIS I/O, POSITION STATUS, TWO-POINT MOTION, and PC-DSP AXIS STATUS windows.

B. In the Dektak program, command TOWER UP.



C. Verify that the POSITIVE OVERTRAVEL sensor is LOW in the AXIS DEDICATED I/O window. Adjust the ⇐ sensor if this condition is not observed.

D. Go to the Dektak debug program. Select DIAG, then JOG TOWER. Move the tower down until the negative overtravel sensor light goes out, or just before the nose contacts the stage. Adjust the negative overtravel sensor if it did not activate before the nose contacts the stage.

E. Command the tower UP in the Dektak program.

F. Clear the POSITION STATUS window in the MEI Set-Up program

G. Set acceleration = 50,000 and velocity = 25,000 in the TWO-POINT MOTION window. Set POSITION 1= -2,000,000, and POSITION 2 = 0.

H. Click on RUN in the PC-DSP window two times.
I. Click AMP ENABLE in the DEDICATED AXIS I/O window two times.
J. Click GO in the TWO-POINT MOTION window .

K. Note the numerical position of the tower in the POSITION STATUS window when the stage stops. Round this number down to the next lowest 100,000. Enter the result into POSITION 1 in the TWO-POINT MOTION window. POSITION 2 = 0.

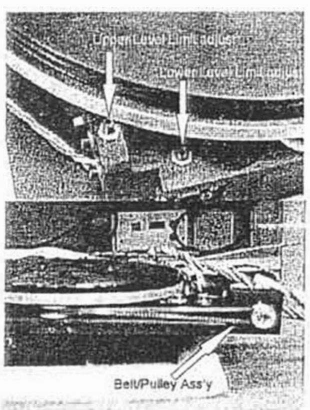
L. Click on RUN in the PC-DSP window two times.
M. Click AMP ENABLE in the DEDICATED AXIS I/O window two times.
N. Click REPEAT in the TWO-POINT MOTION window .

Up/Down motion of the tower should now be observed.

6.0 Programming Level Motor Motion

A. Disable the theta stage amplifier by:
   1. Entering Axis # 3 in the AXIS DEDICATED I/O window.
   2. Pressing AMP ENABLE LOW in the same window.

B. In the Dektak debug program, select PROFILER, then POWER LEVELING. A dialogue box to raise/lower the level of the stage will appear. Pressing LOWER will continuously lower the stage. Selecting RAISE will continuously raise the level.



   1. Click on LOWER. Be ready to click on OK to stop level motor action. Observe ⇐ the belt and pulleys on the level stage. If the motor stops before the belt/pulley start to cog, then the adjustment of the lower level limit switch is functional. If not, then loosen the lock-nut on the lower level limit set screw and move it closer to the limit switch.

   2. Click on RAISE. Be ready to click on OK to stop level motor action. Observe ⇐ the belt and pulleys on the level stage. If the motor stops before the belt/pulley start to cog, then the adjustment of the upper level limit switch is functional. If not, then loosen the lock-nut on the upper level limit switch set screw and move it closer to the limit switch.

C. Go into the MEI set-up program per section 1.0 in this section.

D. Select axis # 5 in the DEDICATED AXIS I/O, POSITION STATUS, TWO-POINT MOTION, and PC-DSP AXIS STATUS windows.

E. Enter the following in the TWO-POINT MOTION window:

Velocity =	25,000
Acceleration =	50,000
Jerk =	0
Position 1 =	-3,000,000
Position 2 =	0

F. Click on RUN in the PC-DSP window two times.
G. Click AMP ENABLE in the DEDICATED AXIS I/O window two times.
H. Click REPEAT in the TWO-POINT MOTION window 2 times.

Continuous up/down motion of the level stage should now be observed.

Appendix B
Auto-alignment Hardware Troubleshooting

The auto-alignment system has the following components:

1.0 Checking the Lamps (see dwg no.333372 for block diagram).

1.1 In the Dektak debug program, select ALIGN, AUTOALIGN, and CREATE AUTOALIGNMENT PROGRAM.

1.2 Select VIEW, then LOW MAGNIFICATION

1.3 Under PREFERENCES, verify that ASSIST MODE is not checked. The window appearing will have a "Stage"button"on the left side of the screen. Clicking on it will reveal the light controls shown to the right of the stage button (below).

Bright Field
⇓

⇑
Dark Field

1.4 View the stage and look for the light coming from the auto-alignment module. With the left (bright field) light symbol selected, click on the DOWN arrow, then the UP arrow of the Lamp Power box, then click on Update Lamp Power. Select the right hand (dark field) side light and do the same. Take note of any failures in the following table:

1.5 When viewing a stage with no sample on it, light from the auto-alignment module should be observable. Note if one or both setting does not result in observable light.

Illumination	Good/Bad
High Mag, Dark Field	
High Mag, Bright Field	
Low Mag, Dark Field	
Low Mag, Bright Field	

1.6 Click on O.K.
1.7 Repeat step 1.2. This time select HIGH magnification.
1.8 Repeat steps 1.3 - 1.5 until all lamps have been tested.

2.0 If the Auto-alignment lamps do not function:

2.1 Lamps are interchangeable. Systems are supplied with one spare bulb.

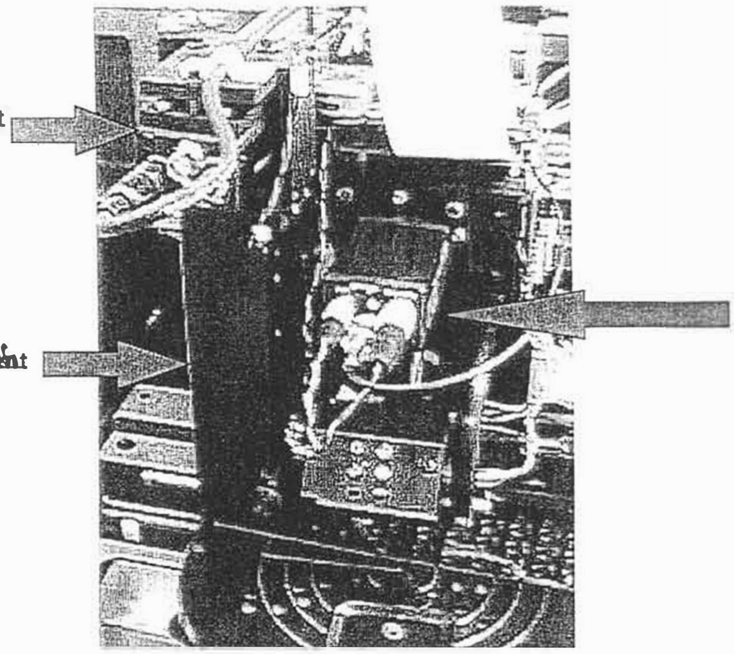


Figure 0 - Profiler with Autoalignment Option

Figure 1 - Auto-alignment system

2.2 Remove the cover from the auto-alignment optics module on the left side of the tower assembly. Observe the optics hardware (pictures in figure 5 of this section).

2.3 Only handle a lamp when wearing a glove or using a cloth to handle it. NEVER TOUCH A LAMP WITH YOUR FINGERS! Remove the lamp from the non-operational position and replace it either with the spare lamp or a known-working lamp from another position.

A. One of two conditions will occur:

- **The lamp illuminates:** Replace the bad lamp. To remove the lamp, gently pull down on it.
- **The Lamp remains OFF:** Use dwg. Nos 564133 and 564134 trace the power signal back to the lamp/solenoid connector.Use dwg ncs.333418/ 333424 to trace the signal from the lamp/solenoid connector to the E-Boxport panel. Finally, the signal can be traced directly to the I/O card using dwg nos. 333417/333423.
- Replace bad cabling if necessary.

- If all cabling appears to be good, replace the I/O card WITH p/n 010238 configured with dwg. nos. 333413/333414 as appropriate.

2.4 Turn on the system and follow these steps:

- Place a detailed sample on the theta stage.
- Select the auto-alignment camera by selecting **Profiler/Set camera.**
- Tower down.
- Adjust the lamp angle until even illumination is achieved.
- Install covers.
- Check functionality by using steps 1.3 - 1.5 (above).

3.0 VIDEO CAMERA, VIDEO BLASTER CARD

.1 Verify that the lamps are functioning per section 1.

.2 If there is no video, follow these steps:

- Place a detailed sample under the scan and auto-alignment cameras.
- Tower up.
- Select the scan camera using **Profiler, Select camera**.

- Move the video coax cable from the scan camera to the auto alignment camera. The same can be accomplished by swapping the video 0/1 cables from the video blaster card inside the E-Box.

- With the tower Up, place your finger under the inner-most portion of the auto-alignment camera and watch the monitor for an image.

.3 If there is no image, check all cables, then replace the auto-alignment camera (P/N 044028) as necessary. If there still is no image, replace the video-blaster card.

4.0 <u>E-Box Motherboard, Cognex Board, Hard Drive</u>

4.1 Power down, check all cables, Power up and let the system re-initialize. Go to 4.2 if the system still does not function.

4.2 Use Alt-F4 to leave windows.

4.3 From the C root directory, type "pvctalk -AS0X0E0000". A "V" prompt will appear.

4.4 Type "DIR" (in capital letters). A directory of stored images (or available space if no images are stored) will appear.

4.5 The E-Box motherboard Cognex board, and SCSI drive are functioning if a directory or space available report appears. If not, go to 4.6.

4.6 Try replacing the drive. You must obtain a Veeco P/N 010080 hard drive and configure it as follows:

A. Make sure that the address jumpers are configured as:

A0	A1	A2
1	0	0

B. Go back to pvctalk. Issue the following commands:

cfs_partition(1,0,16384,-1,0); <return>

cfs_format_hard((“C:”,0,0); <return>

C. If the hard drive was the problem, you will now get a directory or space available report from the system. If not, go to 5.0

5.0 Replacement of the Cognex Card

.1 Power down the system.
.2 Install a new Cognex card (P/N 010238)
.3 Power up the system and verify functionality.

.4 If there still is no video, the E-Box motherboard should be replaced.

6.0 Replacement of the Cognex Mouse

.1 Verify firm cable connections. If still not functioning, go to the next step.

.2 Replace the trackball (power down first).

.3 If still not functional, replacement of the Cognex Processor board and/or the E-Box motherboard may become necessary

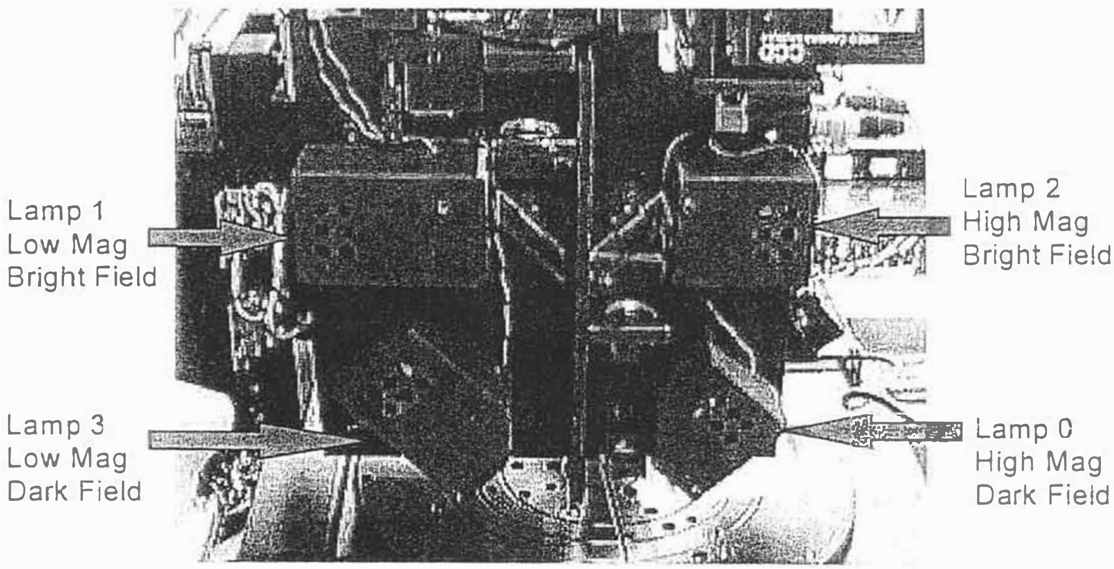


Figure 2 - Auto-alignment lamp locations

YOUR NOTES

APPENDIX C
ROBOT PROGRAMMING

Robot Programming

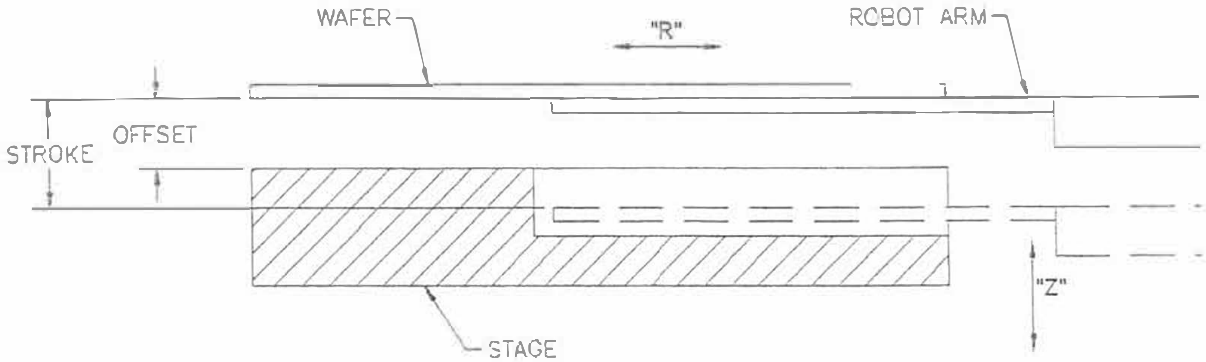
NOTE: This procedure is intended to re-program a robot in a system should the Y-Axis, scan axis, or theta stage is removed and replaced. It is not intended to cover all of the steps for replacing the robot system itself. Robot replacement should be referred to a qualified Veeco service engineer specifically trained to perform robot replacement.

1.0 Needed Equipment:
Appropriate-sized aluminum set-up wafer with hole in the center.

0 Preparation for programming a robot
Familiarize yourself with the following robot nomenclature if not already familiar with robot programming:

1. "**Pitch**" is the distance between wafers in cassette.
2. "**R**" is the movement of the robot arm extending.
3. "**Theta**" is the rotation of the robot
4. "**Z**" is the vertical motion of the robot
5. "**Stroke**" is the total vertical distance required for the robot to pick up or place a wafer on a stage or in a cassette.

6. "**Offset**" is the vertical motion above the stage surface and within the "Stroke" distance.



2.1 Configuring the system to run debug mode:
Go to the program icon to run the Dektak (in the Dektak program group). Select the icon, then in the upper right corner, select FILE, the PROPERTIES.

You will see another window describing the program linked to the icon. Make sure that it appears as below:

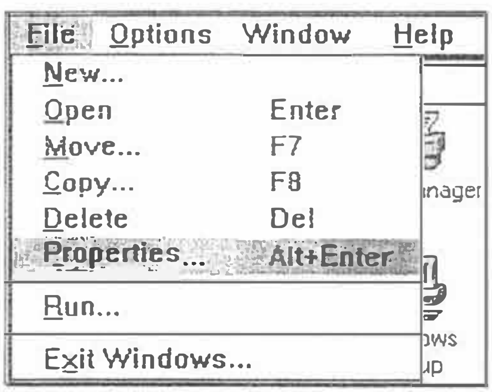


Figure 1

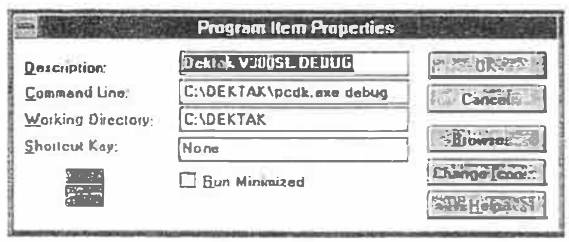


Figure 2

Verify that the command line in the file properties is as shown in figure 2. If not, then record what they are, and change them appropriately.

NOTE: Change the program properties back to the original setting after servicing the robot. Do not leave the configuration in debug. The customer will have access to files that can compromise the operation of the system if changed.

- Click on O.K. when the configuration is correct.

2.2 Start the Dektak debug program.

- Simply double-click on the Dektak icon.

- The system must be set to an "Unload" condition. Select RUN, then MANUAL RECOVER to prepare the system for the next step. This is done to position the stages. You will not be using the Manual/Recover window at this time.

Verify that the interlock switches for the :

- Front door
- Left side access door.
- Dektak top lid.
- Robot cover.

Have been pulled to their fully extended positions if any of these items are opened. Locations of these switches are per the below diagram:

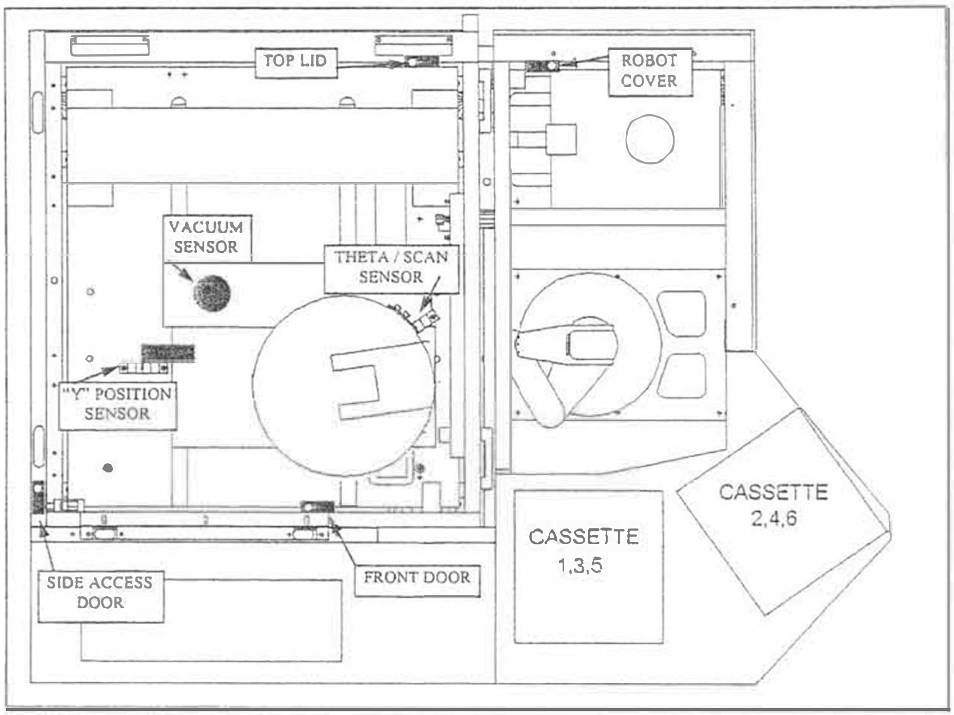


Figure 3: Sensor and interlock switch locations

3.0 Programming the Robot

For our example we will program the robot to handle 200mm wafers on a two open cassette system.

CAUTION! Use only one wafer in the cassette while programming the system. Make sure the wafer is expendable. Use an aluminum wafer with a small hole drilled in the center if possible.

Interlock switch and position sensor adjustments/ programming the robot to the theta stage when in the unload position....

.1 Turn vacuum off by going to the pendant and simultaneously pressing SHIFT + VAC. (vacuum will be turned on when it is needed).

Use the diagrams below to determine the appropriate stages and cassettes to be programmed on the system under service.

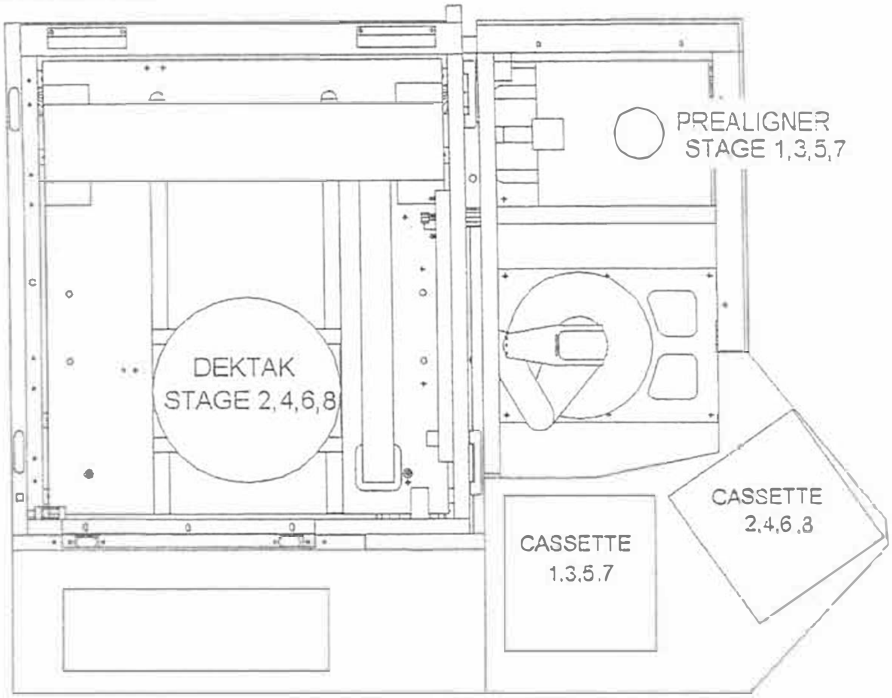


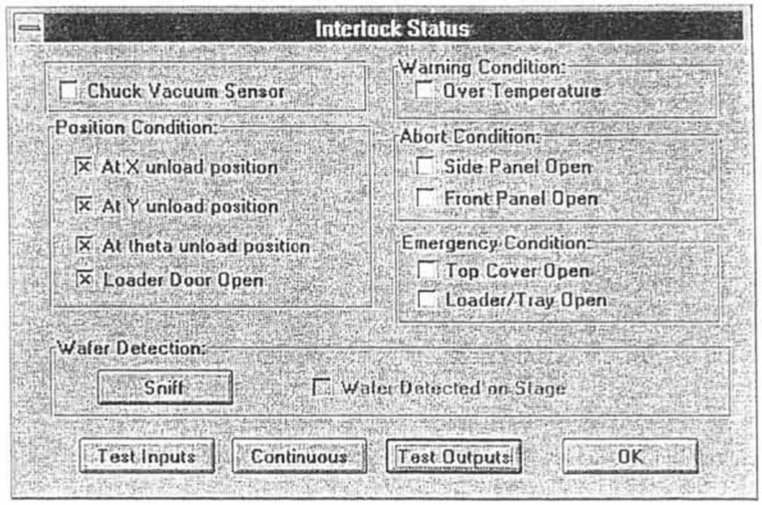
Figure 4: System configuration

	100mm/1	100mm/2	150mm/1	150mm/2	200mm/1	200mm/2	300mm/1	300mm/2
Cassette 1					x	x		
Cassette 2						x		
Cassette 3			x	x				
Cassette 4				x				
Cassette 5							x	x
Cassette 6								x
Cassette 7	x	x						
Cassette 8		x						
Stage 1					x	x		
Stage 2					x	x		
Stage 3			x	x				
Stage 4			x	x				
Stage 5							x	x
Stage 6							x	x
Stage 7	x	x						
Stage 8	x	x						

Table 4: Programs needed per configuration

.3 Preparation of the profiler for programming the robot - setting the position sensors for Y, scan, and theta axes:

In the Dektak debug program, select Run....Manual Recover.... When the window appears, click on DONE. Now, go to DIAG, then TEST OUTPUTS, and select CONTINUOUS. Look for x's in the windows as shown below:



If the indications do not match the window above, adjust the sensors for the scan,Y, and theta (stage) unload position sensors per the instructions below as appropriate:

.4 Scan Axis....

A software adjustment of the scan axis unload position may be necessary (if an "x"does not appear in the interlock status window for the scan axis).

1. In the program manager , double-click on the MEI Set-up Icon .

2. Press O.K. (or press ENTER on the keyboard) as prompted.

3. Once in the program, press F2 for POSITION STATUS. Click on the AXIS box and type in 2. Press ENTER. This allows you to read the position of the scan axis. Also, in this window,click on AMP ENABLE LOW. This allows the scan axis to be turned by hand.

4. Press F3 for DSP Axis Status. Click on the axis box and type in 2. This will allow for the observation of the home sensor status.

5. Turn the scan axis by hand until the Home Sensor status in the DSP Axis Status window goes LOW.

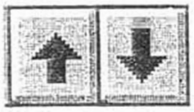
6. Read the position of the axis in POSITION STATUS window.

7. Go back to the Dektak program group in Windows and select (double click on) the SBC.INI icon. Scroll down to x-axis.encoders and record the number (typically15.748). Close the file.

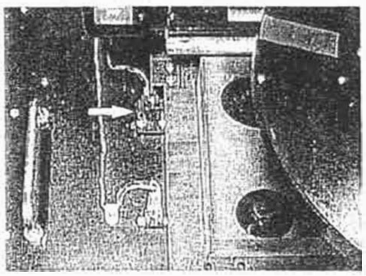
8. Divide the position status number (6) by the encoder number (8). Record the value.
9. Open Dektak.ini in the Dektak program group.

10. Enter the value calculated in (8) into "loader unload position". Save the file, and close it.

.5 Y Axis:



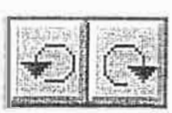
1. If an "x"does not appear in the interlock status window, Use the arrows on the Dektak program toolbar to position the theta stage so that it is centered with respect to the loader and the robot arm door when it is viewed through the loader door.



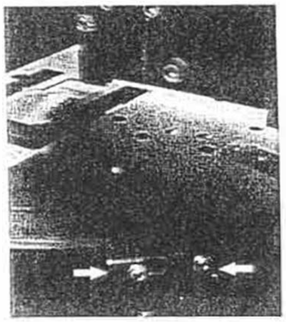
2. Once the theta stage is properly positioned, check the second Y-Axis position sensor (located at the far left side of the base.) Loosen, then move the sensor until the indicator turns ON. Then, move the sensor forward until it just turns OFF. Tighten the sensor mounting screws.
3. Note the number of the Y position in the bottom right corner of the screen (position window).Note this number and enter it in Dektak .ini (in c:\dektak) for the parameter "Loader, Y unload position". Select FILE, then SAVE to save the change.

.6 Stage....

1. In the main command bar of the Dektak debug program, select SET-UP, DEFAULT THETA, then CLEAR.
2. Go to the robot teach pendant and press TEACH.
3. Press PAR+ several times until STAGE 2 appears. (Note, this example is for a 200mm single cassette system. Refer to table 5 to understand the appropriate stages that must be programmed on the particular system you are working on).
4. Press "NXT" until the pendant reads "STROKE". Change the value to read "300". Do this by entering 300, pushing "ENTER" and then "TEMP" The pendant should now read "STROKE = 300.
5. Press "NXT" until the pendant reads "OFFSET". Change the value to read "150".
6. Simultaneously press SHIFT and SERVO OFF on the robot pendant.



7. Manually position the robot arm into the theta stage slot. You may have to ⇐adjust the rotation of the theta stage with the rotation toolbar symbols until the stage slot can line-up with the robot arm.



8. Once the proper orientation of the stage is found, check the interlock status window to verify that the "At theta unload sensor flag around the back side of the theta stage.

⇐ theta stage sensor flag.

9. Loosen the theta stage sensor flag. Have an assistant adjust the position of the flag until an "x" appears in the interlock status window. Tighten the sensor flag screws when the adjustment is complete.

10. Check the robot arm position with respect to the slot in the stage chuck. The top of the robot arm should be at the same level as the chuck surface.

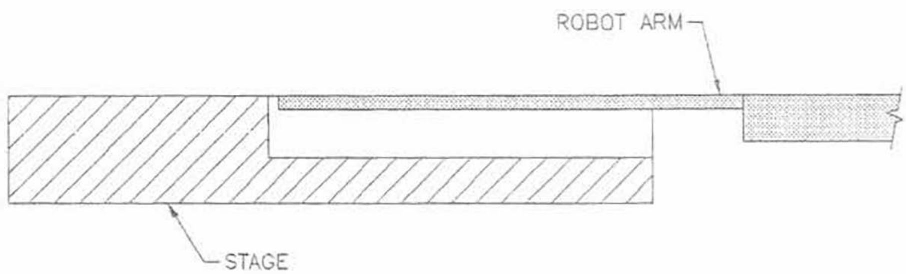


Figure 5: Robot arm alignment with stage chuck

10. Now is a good time to save what you have done up to this point. On the Teach Pendant, simultaneously press SHIFT then LEARN, then simultaneously press SHIFT, TEMP (to permanently learn the position). The robot now has memorized the correct load position for the profiler when it is at its unload position.

.7 Testing the robot at the Dektak stage

1. It is a good idea to slow down the robot speed for safer robot testing. Press "PAR+" until you get to menu item "SPEED / ACC".

2. The pendant should default to "R1" Min = 1

3. Press "FWD" to get to "R1" Max speed. Change Max. speed to 20 by typing 20, enter, temp

4. Press "PAR-" until you get to "STEP STAGE". This will allow you to move the robot through each move one step at a time, to check your programming.

5. Press "FWD" to get to "STAGE 2".

6. Press "NXT" to cycle the robot through each move.

NOTE: The robot requires 6 moves *when* the arm. Steps 2 and 3 do not move. Step 4 moves the robot level with the stage. Step 5 moves above the stage and turns the robot vacuum on. Step 6 retracts the arm.

.7 If the robot hits the stage and stops you will hear 5 quick "Beeps". You can recover the robot by pressing "SERVO ON". Then you should re-teach the robot and Dektak positions. If you are satisfied with what you see, do step 7.6 with a wafer.

8. If you are successful with picking up the wafer, press "PRV" 6 times to put the wafer back on the stage.

4.0 Robot Vacuum Sensor

.1 The robot is equipped with a vacuum sensor. If the robot will abort a pickup for 3 reasons. #1 - The robot arm failed to get a good vacuum hold on the wafer. #2 - The Dektak stage is not level to the robot #3 - The robot sensor is not adjusted to the house vacuum. If the robot fails to get a vacuum hold you may have a bent, dirty or damaged robot arm, or the Dektak stage may not be level. Also check to see if the wafer is clean.

.2 Make sure a clean wafer is in the center of the Dektak stage

.3 Press "AUTO / TEACH"

.4 Press "GET", enter "2" and "ENTER" for the stage number and "0" and "ENTER" for slot number. The robot should go through all the moves automatically to pick up the wafer from the Dektak stage.

.5 If the robot fails to pick up the wafer, check all the items described in paragraph 4.0.1 (above).

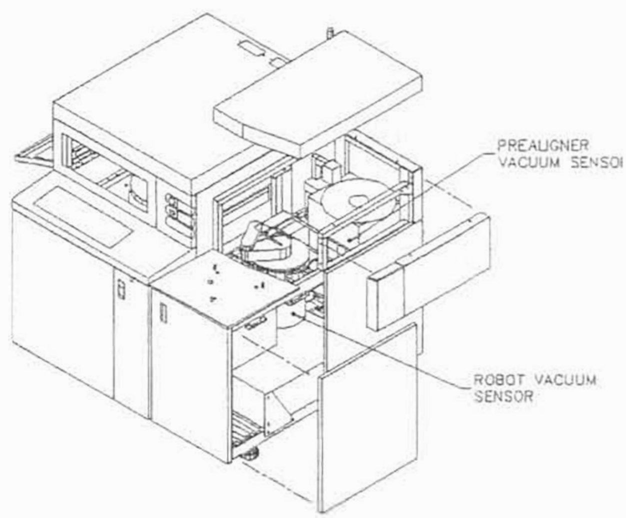


Figure 6

.6 Use a small screwdriver to adjust the robot vacuum sensor. Turn clockwise to make the robot more sensitive, counter clockwise to make it less sensitive. (See figure 6 for robot and Prealigner vacuum sensor locations.)

.7 After the robot has successfully picked up the wafer off the Dektak stage, have the robot place the wafer back onto the Dektak stage. Do this by holding down "SHIFT" and pressing "PUT". Enter "2" for the Dektak stage and "0" for slot number. The robot vacuum is properly adjusted if the robot successfully puts the wafer back on the stage. If the robot does not put the wafer back onto the stage you may need to turn the robot vacuum sensor in the counter clockwise direction.

5.0 Programming the Prealigner.

.1 This is where a wafer with an 1/8th inch hole in the center is useful. Make sure the Dektak stage is in the "Loader Unload" position and make sure the wafer is in the center of the stage.

.2 Make sure the teach pendant is in "Teach" mode by pressing "AUTO/TEACH".

.3 Press "PAR+" until you get to "STAGE"

.4 Press "FWD" until you get to "STAGE 1"

.5 Press "NXT" until the pendant reads "STROKE". Change the value to read "200".

.6 Press "NXT" until the pendant reads "OFFSET". Change the value to read "100"

.7 Press "PAR+" to go to "STEP STAGE"

.8 Press "FWD" until you get to "STAGE 1"

.9 Press "PRV" 6 times to get the wafer off the Dektak stage. *Note. It is important to get the wafer off the stage using the robot.*

.10 Press "PAR-" to get to "STAGE" *NOTE: Positions cannot be taught while in "STEP STAGE" or "STEP CASSETTE".*

.11 Make sure the Robot servos are off. Use your hands to rotate and position the robot arm and wafer over the Prealigner chuck. Do not allow the wafer to move or slip on the robot arm. Use the hole in the center of the wafer to center it on the Prealigner chuck. Move the wafer and robot down until the wafer just touches the Prealigner chuck.

.12 Hold down "SHIFT" and press "LEARN". This inters the "R", "Z" and Theta values for the robot

.13 Now is a good time to save what you have done up to this point. On the Teach Pendant, hold down the "Shift" key and press "TEMP (PERM)" You will hear a "BEEP" noise followed by another "PEEP" about 10 seconds later. The robot parameters you have taught up to this point are now saved in the robot electronics.

.14 Use you hand to move the robot away from the Dektak stage, making sure you do not move the wafer on the robot arm. Now is a good time to save what you have done up to this point. On the Teach Pendant, hold down the "Shift" key and press "TEMP (PERM)" You will hear a "BEEP" noise followed by another "PEEP" about 10 seconds later. The robot parameters you have taught up to this point are now saved in the robot electronics.

.15 Testing of the Prealigner position will come after programming the cassette.

6.0 Programming the cassette.

Caution!* *Use only one wafer in a cassette while programming.

.1 Press "PAR-" until you get to "CASSETTE 1"

.2 If needed, change the count to 25 by entering "25" then "ENTER" then "TEMP".

.3 Press "NXT" until you see "PITCH". Enter a pitch value of 2500 (2500 = .25 inches).

.4 Press "NXT" until you see "STROKE". Enter a stroke value of 100.

.5 Press "NXT" until you see "OFFSET". Enter a value of 40.

.6 Using your hands rotate the robot clockwise to face the cassette. Position the robot and wafer so that it matches the first slot in the cassette. Move the robot arm into the first slot until the wafer is in the cassette, slot 1 and the robot arm is still touching the bottom of the wafer. (See figure 7) There are two methods to achieve this **A and B**.

.7 **(A):** Use your hands to move the robot, making sure you don't hit or move the wafer against the sides of the cassette.

.8 **(B):** Use the arrow keys on the teach pendant to slowly move the wafer into position. NOTE: The robot will move slow when you use the arrow keys. The robot will move fast if you hold the shift key down and use the arrow keys.

.9 Hold down "SHIFT" and press "LEARN" to teach the cassette location.

.10 Move robot arm away from the cassette and remove the wafer. Press the "Shift" key and press "TEMP (PERM)" to save the cassette location.

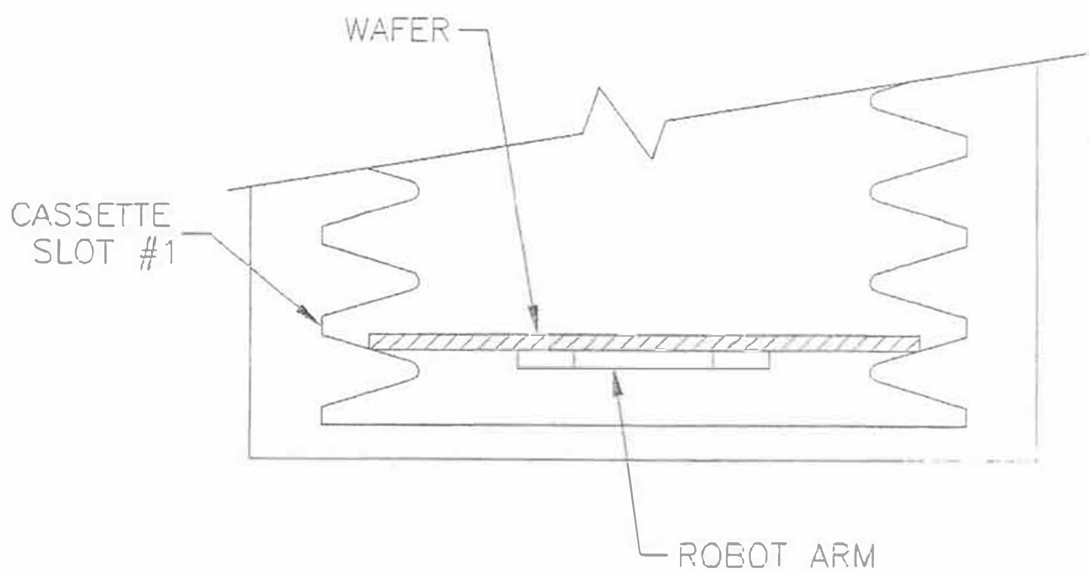


Figure 7

7.0 Testing the cassette location.

.1 It is a good idea to test your cassette programming with no wafers first. Press "PAR+" until you get to "STEP CASSETTE"

.2 Press "FWD" to get to "CASSETTE 1"

.3 The robot uses 4 moves to get a wafer from a cassette.

.4 Move #1 extends the arm under the wafer

.5 Move #2 Moves the arm to touch the bottom side of the wafer. (See figure 7)

.6 Move #3 turns vacuum on and lifts the wafer.

.7 Move #4 removes the arm and wafer from the cassette.

.8 Press "NXT" four times and observe the robot action. If you are no satisfied, re-teach the cassette position by following steps 6.1 through 6.9 or adjust the positions manually by changing the numbers. *NOTE: The "Z" position is as shown in figure 7.*

.9 Slide a wafer into slot #1 and repeat steps 7.3 and 7.4.

.10 Hold down "SHIFT" and press "TEMP (PERM)" to save the new cassette location

8.0 Checking cassette pitch.

.1 A cassette pitch can vary depending on the manufacturer and material so it may be necessary to adjust the pitch. Press "AUTO/TEACH"

.2 Press "START"

.3 Press "GET" and enter "1" for station (Cassette) #1. Enter "1" for slot one. The robot will get the wafer from slot one.

.4 Press "PUT" and enter "1" for station (Cassette) #1. Enter "2" for slot two. The robot will now place the wafer into slot 2. Repeat items 8.3 and 8.4 for all of the slots. The pitch value is accumulative as the robot goes up in slots. What works good for slot two may be to high for slot 25. In this case decrease the pitch value slightly. For example: Change the pitch value from 2500 to 1495.

.5 Return to the teach environment by pressing "AUTO/TEACH".

.6 Save the new numbers when you are satisfied with the pitch values

9.0 Checking the cassette position as it relates to the Prealigner.

.1 First you will need to set up a Loader program. From the Dektak program, select "WINDOW" from the pull down menu and pick "LOADER PROGRAM" (See figure 8)

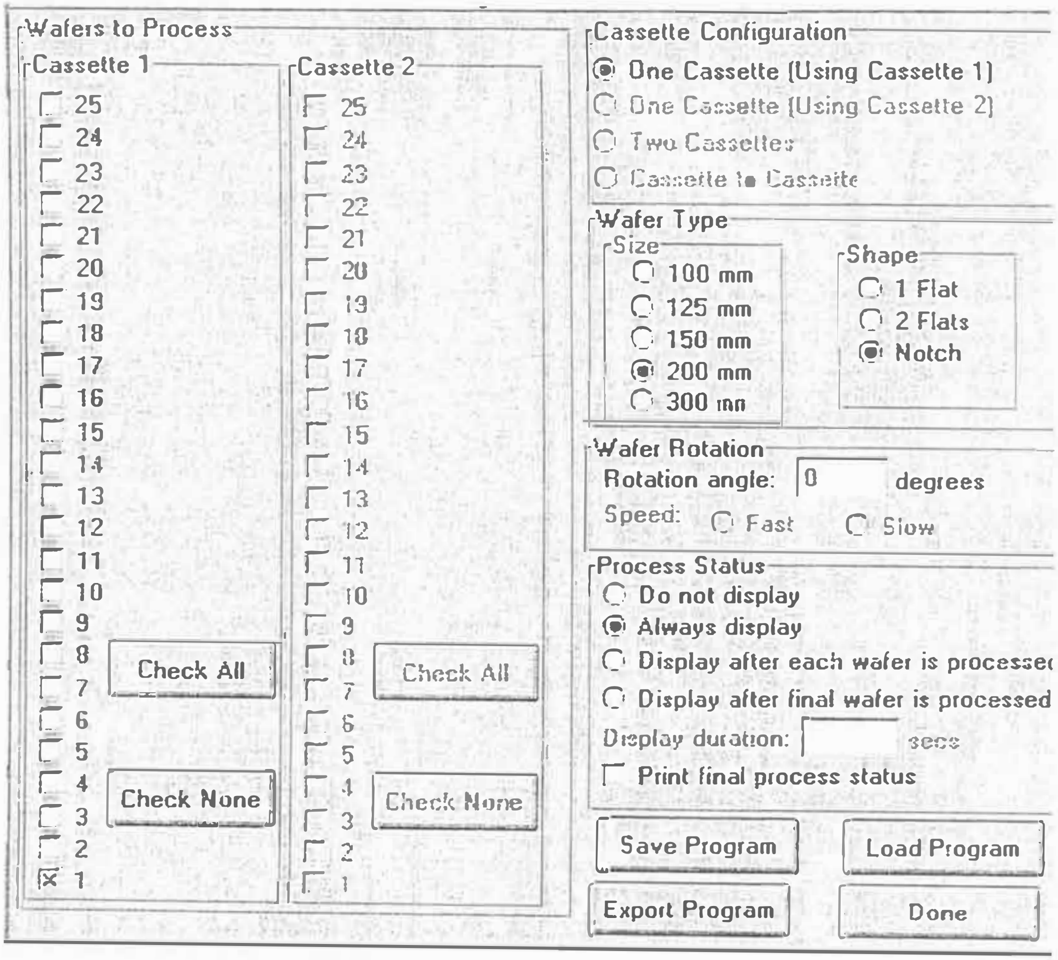


Figure 8

.2 Select wafer #1, Select 200mm wafer diameter and select notch.

.3 Select "Save Program" and give this loader program a name.

.4 Select "Done"

.5 In the Dektak program, select "RUN" in the pull down menu and select "Manual / Recover Robot" (See figure 9)

.6 On the "Get Wafer From:" side select "CASSETTE 1, Slot 1". On the "Put Wafer To:" side select "PREALIGNER" and select "GO". The robot should get the wafer and put it on the Prealigner. The Prealigner should rotate the wafer, find the notch, move the notch to the '0' position and adjust the X and Y positions. There are two conditions that may cause the Prealigner to fail:

.7 The Prealigner has an operating zone of +/- ½ inch. Re-teach the Prealigner settings if you are outside this zone.

.8 Vacuum sensor needs to be adjusted. If the Prealigner does not sense a wafer it will not turn. (See paragraph 4.6 and figure 6 for Vacuum sensor adjustment instructions.)

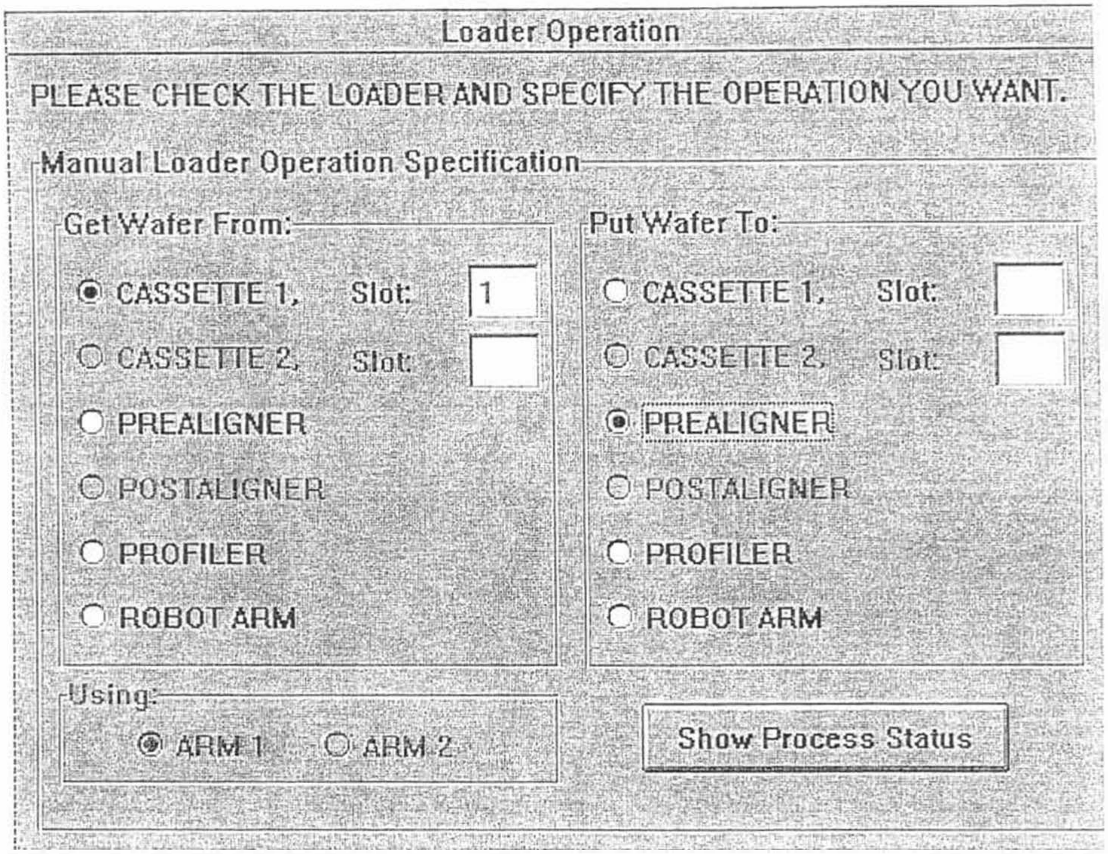


Figure 9

.9 After the wafer has been successfully aligned, select "GO" again ant the robot will put the wafer back into the cassette slot #1.

.10 Repeat paragraph 9.6, This time watching the Prealigner as it adjusts the X and Y positions. Select "GO". After the robot takes the wafer off the Prealigner, the Prealigner chuck will adjust back to it's center position. Watching the chuck move will tell you how to adjust the robot.

.11 If the Prealigner chuck moves back to the right decrease the robot "Theta" value to the cassette.

.12 If the Prealigner chuck moves back to the left increase the robot "Theta" value to the cassette.

.13 If the Prealigner chuck moves from the back to the center increase the "R" value to the cassette.

.14 If the Prealigner chuck moves from the front to the center decrease the "R" value to the cassette.

.15 Change all the values 10 counts at a time and repeat paragraph 9.10 until the wafer spins directly in the center of the Prealigner chuck and requires little or no adjustment.

.16 Hold down "SHIFT" and press "TEMP (PERM)" to save the new cassette location.

10.0 Two Cassette System

.1 Select "AUTO/TEACH" on the teach pendant to get to the teach mode. Press "PAR+" until
.2 you get to "CASSETTE"

.3 Press "FWD" until you get to "CASSETTE 2"

.4 Input all of the same parameters from Cassette 1.

.5 Rotate the robot to face Cassette 2 and press "Read Position". Copy down the Theta location and input that number into the Cassette 2 theta location.

.6 Adjust the cassette 2 location as described in section 6.

.7 Hold down "SHIFT" and press "TEMP (PERM)" to save the new cassette location.

11.0 Final instructions.

.1 Press "RESET". After the robot has finished resetting, press "START".

.2 Move the wafer from place to place to check your programming by using the "Manual / Recover Loader" program.

.3 The Robot system is now ready to be used for 200mm wafers.

12.0 Programming 150mm wafers from a 200mm program

.1 Using the teach pendant, select "AUTO/TEACH" to get into the teach mode

.2 Press "PAR+" until you get to "CASSETTE".

.3 Press "NXT" to scroll through the cassette #1 settings. Write down the "R" and "Theta" values.

.4 Press "FWD" until you get to Cassette #3. *(See Dektak Nomenclature)* Change the "Pitch" value to 1875. Change the "Stroke" value to 100 and the "Offset" value to 80. Change the "R" and "Theta" values to match cassette #1.

.5 Put one 150mm wafer into cassette slot #1. Rotate the robot to face the cassette and move the robot arm into position, just touching the bottom of the wafer. (See figure 7)

.6 Press "Read Position". Input that "Z" value into cassette #3.

.7 Repeat items 12.1 through 12.6 for cassette #4, comparing it to 200mm cassette #2.

.8 Copy Stage #1 (Prealigner) and Stage #2 (Dektak stage) values into Stage #3 (Prealigner) and Stage #4 (Dektak stage) respectively.

.9 Hold down "SHIFT" and press "TEMP (PERM)" to save the new settings.

.10 Make any adjustments required as outlined in section 6.

13.0 Programming a robot for use with a SMIF system

1 . Programming the robot for use with a 150mm and 200mm SMIF is the same as programming for a cassette with one exception: Set the pitch value to "0".

14.0 Programming a robot. Summary.

.1 Turn on Dektak and start PCDK.EXE debug program.

.2 Using teach pendant, push AUTO/TEACH.

.3 "PAR+" to "STAGE 2"

.4 Change "STROKE" value to 300

.5 Change "OFFSET" value to 150

.6 Turn off robot servo.

.7 Move robot into position over Dektak stage.

.8 Adjust Dektak stage to match robot arm.

.9 Set "Loader Unload Position"

.10 Adjust "X", "Y" and Theta sensors.

.11 Teach robot at Dektak stage position.

.12 Save program.

.13 Adjust robot speed to be slow.

.14 Check robot movement at Dektak stage.

.15 Adjust robot vacuum sensor if needed.

.16 Program the Prealigner position.

.17 Program the cassette positions.

.18 Test cassette positions.

.19 Check and adjust cassette pitch.

.20 Check and adjust cassette positions as related to Prealigner.

.21 Program second cassette if needed.

.22 Final check of system.

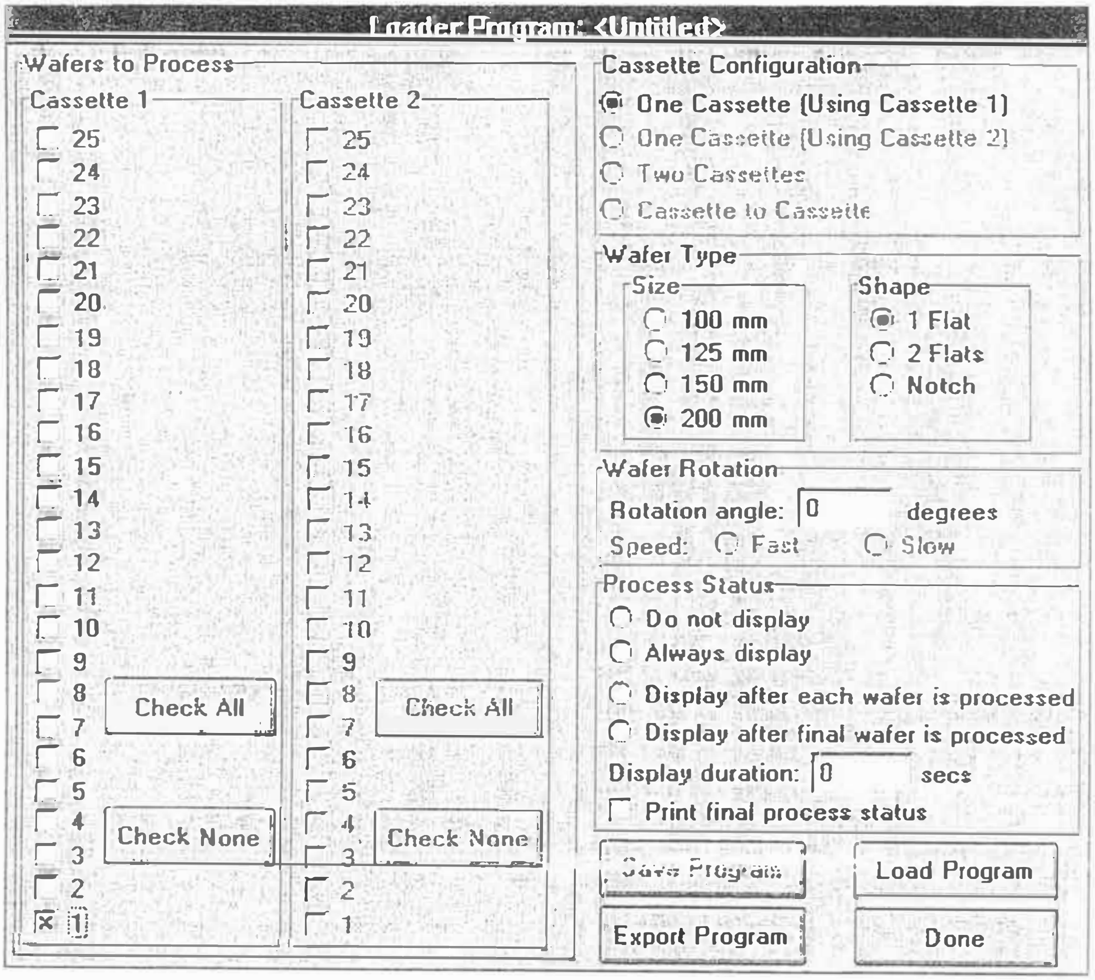
.23 Program 150mm wafers from 200mm program if needed.

Appendix D

Loader / Prealigner Troubleshooting

1.0 Prealigner Troubleshooting

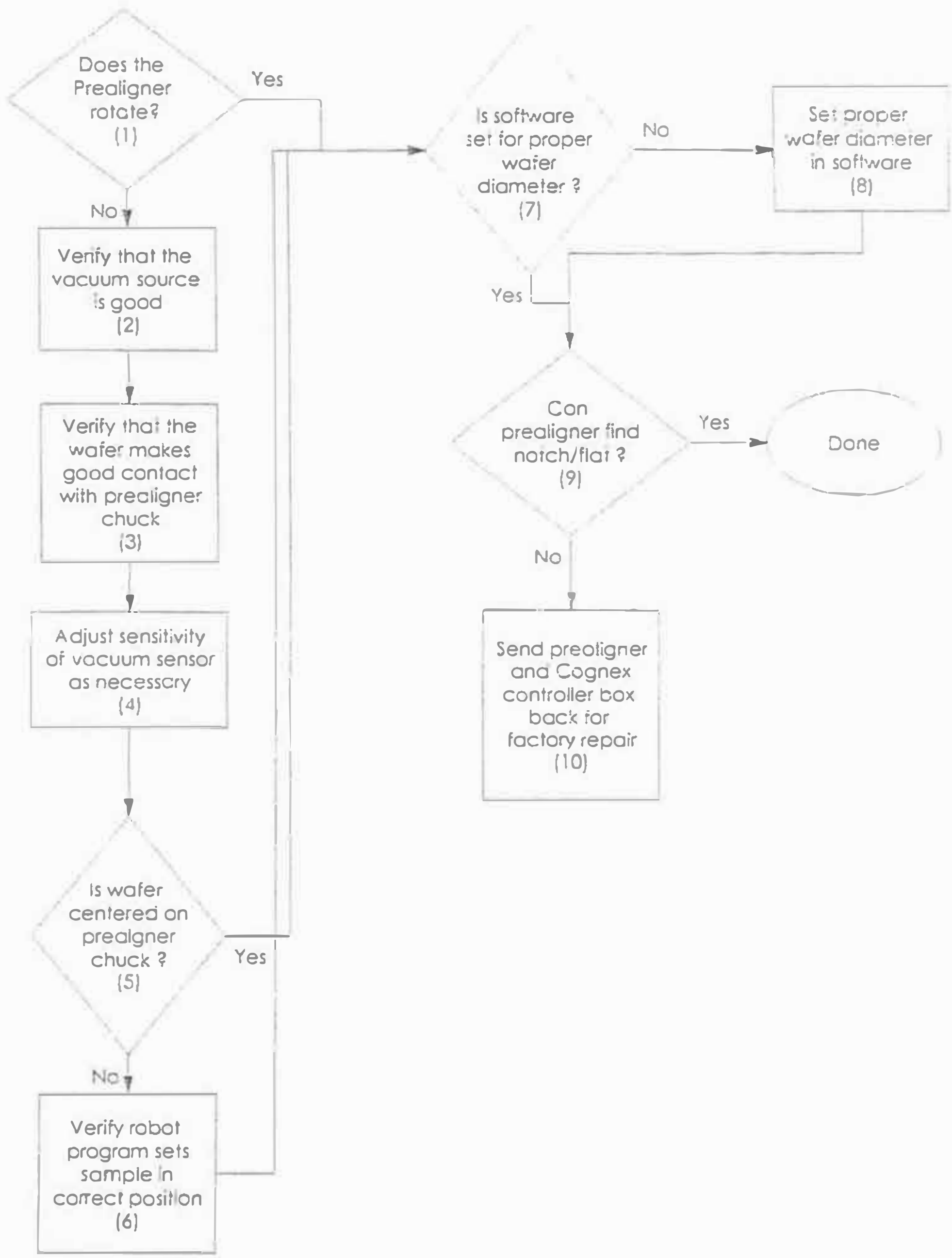
NOTE: Before starting this procedure, verify that the software has been correctly configured for the samples being run. To verify/adjust, select **Run**, then **Loader Program** in the DekTak 8200 main menu. The window will look like:



When correct entries are complete, press"Save Program". A prompt will ask for a program name. after saving the progrm, the above window will return. Click on "Done"

1.1 Review the following flowchart and apply it to your situation. If not familiar with the prealigner, it is suggested to start at the beginning of the flowchart:

Prealigner Troubleshooting Flowchart



1.2 - Flowchart Text

(1) Does the prealigner rotate?
Place a wafer in the cassette. Select **Run,** then **Manual Recover/Loader. GET** the wafer from the **CASSETTE** and **PUT** it on the prealigner. If the wafer is rotated, then go to 7. If not, proceed to 2.

(2) Verify that there is a good vacuum source
Verify that the vacuum source is good by checking it at the front of the system (lower right-hand with the main power switch). Check for vacuum of 24in (60mm Hg). Correct if necessary before proceeding.

(3) Verify that the wafer makes good contact with the prealigner chuck
Visually inspect how the wafer sits on the prealigner chuck. Use a sample that you can touch to verify that the wafer is held down by the vacuum. See the preventive maintenance section for instructions on replacing the prealigner chuck cover. Vacuum problem here is probably cue to poor wafer contact.

(4) Vacuum sensor adjustment
Vacuum sensor is found on the lower corner of the from of the prealigner. It is less sensitive when adjusted CCW. Adjust it as necessary.

(5) Is wafer cetered on prealigner chuck?
As the wafer is taken from the cassette and put on the prealigner, it will automatically be rotated. If there is no perceptible wobble in its rotation then proceed to **7**, otherwise go to **6**.

(6) Wafer centering procedure
Perform steps in section **2.3** below. When completed, go to step 7.

(7,8) Is software set for proper wafer diameter?
Verify that the software is configured for the wafers on the system by selecting **Window**, then **Loader Program**. Select the correct wafer size/notch option then click on **DONE**.

(9) Can the prealigner find the notch (flat)?
If the prealigner now finds the wafer notch/flat, then this procedure is finished. Since all conditions for proper prealigner have been checked, if the prealigner cannot find the notch or flat, it should be returned to the factory for repair. See section 2.10 for prealigner replacement.

2.0 Robot - Failure to Pick-Up Wafer from Cassette

2.1 <u>Preliminary Observations</u>

Please verify the following before proceeding with these instructions:

.1 Is there a wafer in the cassette?

.2 Is the wafer correctly inserted in the cassette (not cross-slotted)

.3 Is the vacuum source functioning (check the front vacuum source)

.4 Is the robot end-effector (arm) damaged? If so, replacement is suggested.

.5 Verify that the cassette is seated correctly on its platform.

2.2 General Troubleshooting

.1 If the conditions in 2.1 are found to be reasonable, and the loader still cannot pick-up a wafer, then it will be necessary to reprogram the robot using the following steps in 2.3.

.2 The variety of loader systems by Veeco Surface Metrology necessitates the following stage numbering convention. Please identify your system and note its stage numbering. Please also note that systems with more that one cassette will have a forward and a right facing cassette per the table below. This information will be important when executing teach commands with the Cybeq pendant:

NUMBERING CONVENTION FOR DEKTAK LOADERS

SYSTEM TYPE	FORWARD CASSETTE	RIGHT-FACING CASSETTE
6"	3	4
8"	1	2

.3 Place a wafer in cassette slot #1.

.4 Press the **AUTO/TEACH** pad on the robot pendant. **TCHRBT** will appear in the upper left hand side of the pendant display.

.5 Press the **PAR +** pad until getting to **STEP CASS.**

.6 Press the **FWD** pad until the appropriate stage number appears on the pendant display.

.7 Press the NXT pad to extend the robot arm under the wafer.

.8 Press the **NXT** once more to raise the end-effector to touch the wafer.

.9 The end-effector should now be touching the bottom of the wafer. If it doesn't then proceed to step 2.10. If it does, press **PRV** 2 times to go back to the robot reset condition (procedure is now complete.

.10 Use the **UP ARROW** pad (⇑) (hold down while looking at bottom of wafer) to lift the end effector to the wafer surface.

.11 Hold the **SHIFT** pad and simultaneously press the **LEARN** pad.

.12 Press the **DOWN ARROW** (⇓) (hold down while looking at bottom of wafer) to move the end-effector away from the wafer.

.13 Press **PAR+** , **PAR-** and **NXT** to retract the robot to home position. Go to step 2.1.15 if only adjusting position for a single cassette system.

.14 If checking more than 1 cassette, press the **FWD** pad to the appropriate number appears to verify the correct positioning of the end-effector at the other cassette positions.

.15 Press the **NXT** pad per the table below to observe its function:

Times Pressed	Observable function
1	Extends robot arm
2	Raises end effector to touch wafer
3	Turns on vacuum and raises wafer
4	Retract wafer from cassette

.16 Review the steps in this section if the robot fails to pick-up the wafer successfully.

.17 Press the **PREV** pad 4 times to get the wafer back into the cassette slot.

.18 Press **PAR**- to go back to the cassette screen .

.19 Simultaneously press **SHIFT,** then **PERM** pads to memorize the new settings.

.20 Press the **RESET** and **START** pads on the pendant.

.21 GO into the DekTak program and select **Run,** then **Reset Loader**.

2.3 Robot - Reprogramming if Wafer Not Correctly Placed on Prealigner (Apparent Wobble)

NOTE: IMPROPER POSITIONING OF WAFER CAN PREVENT PREALIGNER FROM FINDING THE WAFER NOTCH.

.1 Go into the DekTak program, when select **Run**, then **Manual/Recover Loader.**

.2 Make Sure there is a cassette in slot 1.

.3 Select **GET** the wafer from slot 1.

.4 Select **PUT** the wafer on the prealigner.

.5 Press **GO**.

.6 When the wafer is placed on the prealigner, verify any "wobble" the wafer has while rotating. Note the position of the hole in the wafer with respect to the center screw of the prealigner. Note if the robot overshoots/undershoots the front/back position, or if it is skewed to one side.

.7 In the **Manual/Recover Loader** program, select **GET** from prealigner. Note how far the prealigner moves when the robot removes the wafer.

.8 Select **PUT** to cassette 1.

.9 **Adjustment of R (Front-to-back direction):**Press the **Auto/Teach** pad on the pendant.

.10 Press **PAR+** to get to the STAGE menu.

.11 Press **FWD** to get to the appropriate stage number.

.12 Press **NXT** repeatedly until getting to the R menu.

.13 Increase/Decrease R, 100 units at a time, in the direction that will compensate for undershooting/overshooting the center of the prealigner chuck as shown in step 2.3.6. Key in the desired number then press **ENTER**, followed by **TEMP**.

.14 Put the wafer back onto the prealigner via steps 2.3.1 - 2.3.5. Note the relative position of the wafer hole to the center of the prealigner.

.15 **Adjustment of Theta (Side-to-Side direction):** Repeat steps 2.3.1 - 2.3.5 to load the wafer on the prealigner. Note any side-to-side wobble.

.16 Repeat pressing the **NXT** key on the Cybeq pendant until you have scrolled to THETA. Adjust CW/CCW by 20 count increments. Increase the number if the needs to move in a CW manner, and decrease the number if needing to move CCW Key in the desired number then press **ENTER**, followed by **TEMP**.

.17 Run the **Manual/Recover Loader** program to **GET** the wafer from the prealigner and **PUT** it in the cassette.

.18 Verify the CW/CCW counts adjustment by selecting **GET** the wafer from the cassette and **PUT** the wafer on the prealigner.

.19 Iterate 2.3.15 - 2.3.18 until the prealigner finds the notch with little or no apparent wobble.

.20 Repeat steps 2.3.10 - 2.3.12 to get to the R menu. Increase the R value by 20 counts. Simultaneously press **SHIFT,** then **PERM** pads to memorize the new settings.

.21 Press **RESET**, then **START**.

2.4 Robot Not Loading: Stage Position

.1 When the robot does not set the wafer on the stage after prealignment, several areas must be checked:

- Are the interlock switches operating? Close all side panels and doors. If they are needing to be opened, defeat the switches by pulling them to a fully extended position.
- The chuck vacuum sensor thinks that a wafer is present when no wafer is loaded.

See step 2.4.8

- The unload position switches along the y-axis may not be properly adjusted (see picture below). See step 2.4.9.

- The profiler Unload" position may need to be adjusted (will cause condition C). See step 2.4.10.

- Verify that the air isolators are "floating" the profiler. Turn to page 18 of this manual for instructions to fill/adjust isolators if needed.

Before performing C or D, assessment of the situation is necessary to determine if the sensors, or the unload position of the stages need to be adjusted:

.2 On the robot teach pendant, press **AUTO/TEACH**.

.3 Repeatedly press **PAR+** until getting to **STEP STAGE**.

.4 Repeatedly press **FWD** until **STAGE#2**

.5 Press the **PRV** key to position the end effector over the slots of the theta stage.

Once the slots are over (or approximately over) the slots in the theta stage, look straight down. Also, look at the interlock status window (see figure below).

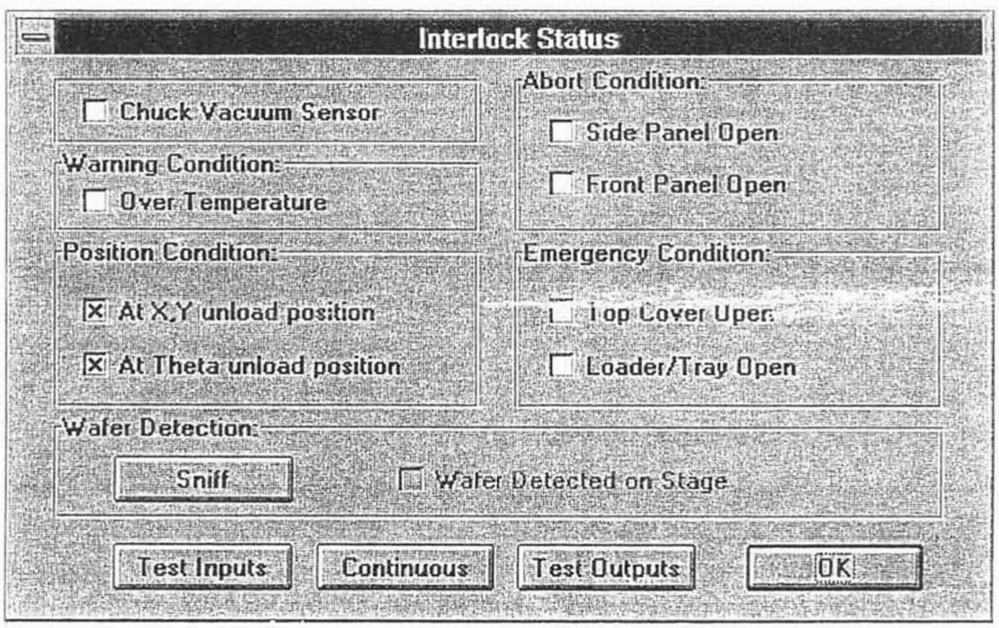


Figure 2.4.2 - Interlock Status Window in DekTak Debug Program

.6 If the status for "Position Condition" in the above window do not have x's in both boxes, then the unload position sensors need to be adjusted (step 2.4.9).

.7 If the end-effector does not line-up with the slots, then go back to the DekTak program sample positioning window. Make adjustments necessary to align the slots with the end-effector forks (step 2.4.4).

.8 Open the left-hand side-door and top of the system. Find the vacuum sensor located at the rear left corner. Click on the "Sniff" button and observe if the wafer has been detected. If there is no wafer, but the system detects one, adjust the vacuum sensor counter-clockwise and press "Sniff" again. Repeat these steps until the system detects the wafer properly.

.9 Load position sensors are located along the Y and Theta stages. These must line-up with blades mounted on the axes. In figure 2.4.2, note the status of the position condition. If either of the status boxes in this section do not have an "x", and the assessment in 2.4.1 indicates the need for adjustment, then adjust the position of the blades/sensor on both unload position sensors to activate status boxes in figure 2.4.2 under " Position Condition".

.10 If step 2.4.1 indicates the need to alter the unload position of the sample stage, then do the following:

A. Enter the sampling position window in the DekTak debug program.

B. Adjust the position of the stages to line the theta stage slots up with the robot end-effector.

C. Record the x,y, and θ values and enter them by selecting **Diag** in the Dektak debug program menu bar, the select **Loader Unload Positions**.

2.5 Adjusting Robot Pitch

.1 If the robot does not seem to move the correct distance between wafers, then the pitch of the robot steps needs to be adjusted.

.2 Obtain several wafers in a cassette.

.3 Using the **Manual/Recover Loader** program, **GET** wafers and **PUT** them on the prealigner. Note the distance that the end-effector maintains as different wafers are selected.

.4 If the distance between wafers appears too small or too large, then the pitch of the robot must be reprogrammed. Start with step 2.5.5.

.5 The typical pitch for a 6" system is 1875. For an 8" system, it is 2500. These numbers must be slightly increased if pitch seems too small, and decreased if pitch is too large. ONLY CHANGE SETTINGS 1 COUNT AT A TIME! Here is how to change the settings:

- Press **Auto/Teach** on the pendant.
- Press **PAR+** until reaching **CASSETTE**.

- Press **NXT** until getting to **PITCH**.
- Press the Up/Dn Arrow to increment the value 1 count at a time.
- Press the <Enter> key.
- Press and hold the **SHIFT** pad, then press the **TEMP** pad.

.6 Go back to the DekTak program and run the **Manual/Recover Loader** program to GET and **PUT** several wafers from the cassette to the prealigner. Verify the correctness of the pitch of the robot.

.7 If satisfied with the robot pitch, go back to the pendant to press **SHIFT-PERM** pads simultaneously, then press **RESET**, and **START**.

2.6 Indications of a Bad Robot Controller Box

.1 When booting-up the system, a bad driver n the Cybeq controller box will cause the system 5 audible beeps.

.2 If the beeps are heard, check to make sure that the EMO switch is pulled to its fully extended position.

.3 If the system still sends the beeps with the EMO switch pulled-out, then there is probably a bad axis board inside the Cybeq controller box.

.4 Remove the left-bottom side skin of the system . Locate the Cybeq controller. Remove the top cover of the box.

.5 With power-On, observe the status light on the axis boards inside the controller. Indicator lights that are OFF indicate a bad controller board that must be replaced. The axis board are all the same and require no special calibration - when a new board is installed the system should be operable.

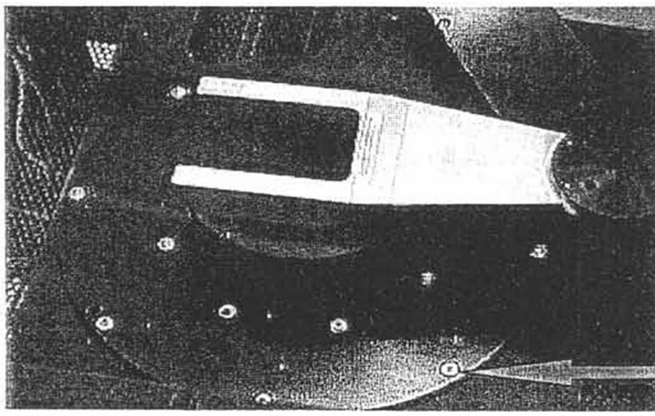
2.7 Robot Replacement

.1 Should a robot ever need to be replaced, it is advisable to save all stored parameters in the system computer. When the new robot is installed, the old parameters can be stored in the new unit, minimizing the amount of work needed to configure the robot to the profiler.

- Close windows and go into DOS mode.
- Go into C:\ROBOT
- Type "Runrobot"

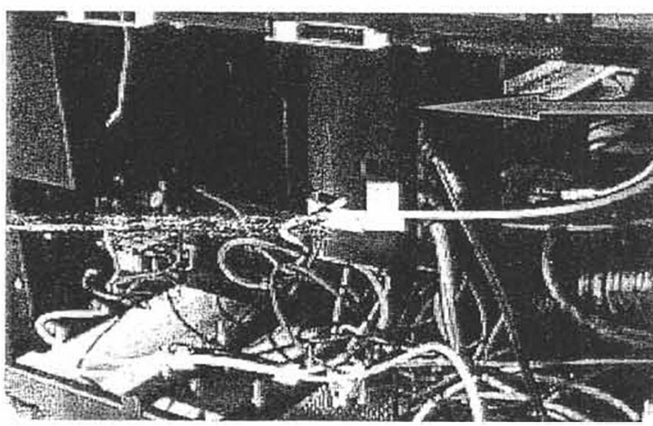
.2 Select "Read Parameter Block. The software will prompt you to enter a name. After the name has been entered, the software will automatically store the parameter block in the directory containing runrobot.exe. Note the name newly stored parameter block. It will be needed to copy parameters to the new robot in 2.8.4.

.3 Removal of robot from system: Note the relative angular placement of the robot in the unit. robot unit itself is attached by the out ring of hex-head screws. See figure 2.7.2 below.



Unbolt outside ring of screws only!

View of robot end-effector and location of mounting screws



Note angular orientation of robot as mounted before removing it.

Side-view of robot with right skin of 8200 removed

Figure 2.7.2 - Robot Removal

.4 Remove all cables from the robot, labeling each one to enable proper installation when the new robot arrives.

.5 Loosen the outer ring of hex-head screws as shown in figure 2.7.2. Lift the robot straight-up and out of the system.

2.8 - Installation of a new Robot

.1 Reverse the unmounting steps of 2.7.3 - 2.7.5.

.2 Go back into DOS and start "RUNROBOT" as described in step 2.7.1.

.3 Select "Write Parameter Block" by highlighting it with the Up/Dn arrow and press <Enter>.

.4 Highlight the parameter block name chosen in step 2.7.1D. Press <Enter>.

.5 Press "Store Parameters Block" to put the parameeters into the non-volatile memory of of the robot (Note: these parameters will be fine tuned in the next section).

2.9 Teaching a New Robot Old Tricks (or how to fine tune a newly installed robot.)

.1 Place a cassette in the cassette platform at the front of the loader.

.2 Perform steps 2.1.4 - 2.1.21 to verify/**adjust** the robot positionig for picking up wafers from the cassette(s). Verify consistent operation using the **Manual/Recover Loader** program.

.3 Perform section 2.3 to verify/adjust robot placement of wafer on the prealigner. Verify consistent operation using the **Manual/Recover Loader** program.V

.4 Perform section 2.4 to verify/adjust the profiler unload position/unload sensor switches. Verify consistent operation using the **Manual/Recover Loader** program.

2.10 <u>Prealigner Replacement</u>

.1 Perform step 2.7.1 to save all robot related system parameters.

.2 The hardware that holds the prealigner to the system is located beneathe the prealigner unit. When all screws are removed and all cables disconeected, the unit can be lifted out of the system.

Prealigner repair also requires removal of the Cybeq controller box located beneath the profiler base in the bottom-left-rear portion of the system.

Remove both units from the system, **leave all cables for both of these units with the system!** Necessary cabling to perform any required repair will be available at the factory.

.3 Reinstall the new controller after repair with system power OFF.

.4 Boot-up the system, and perform steps 2.8.2. - 2.8.5.

.5 Completing the replacement of the prealigner is straight-forward. After installation, perform section 2.3.

YOUR NOTES: