Sitek *Process Solutions*

"Supplier of High Quality Semiconductor Manufacturing Equipment"

DEKTAK IIA

Surface Profile Measuring System

Operation Manual

Sitek Process Solutions

233 Technology Way Bldg. A-3, Rocklin, CA 95765

(916) 797-9000 Fax (916) 797-9009

www.sitekprocess.com

The following is an abbreviated list of equipment we can supply. Actual equipment availability changes on a daily basis, so please call us with you equipment needs.

Ellipsometers

Gaertner L116 and L117
Plasmos
Rudolph Auto EL II
Rudolph EL III
Rudolph Auto EL IV

Etchers

Applied Materials 8110, 8120, 8130
Applied Materials 8310
Applied Materials 8320
Applied Materials 8330 metal etcher
Branson/IPC 2000 etcher
Branson/IPC 2100 P etcher/stripper
Branson/IPC 3100 and 3100 LP, 12"
Branson/IPC 4000 Dual Barrel

Drytek Drie-102 etcher

Drytek 202 oxide etcher
Gasonics Aura 1000 & 2000 strippers
Gasonics Aura 2001 etcher
LAM Rainbow 4500

LAM 480, 490

LAM 580 oxide etchers
LAM 590 etchers
LAM 690 aluminum etcher, 5"
LFE 1002 PFS/PDE/PDS etcher exposure
Plasmatherm 640 Hex etcher RIE

Plasmatherm PK-2410 Parallel plate

Plasmatherm PK 2430 and PD-2480 RIE
Plasmatherm AMPS 300E RIE
Technics RIE 80, 800, 8000
Tegal 421 plasmaline
Tegal 415 plasma etcher
Tegal 701 poly etcher
Tegal 703 oxide etcher
Tegal 801 & 803 etchers
Tegal 900E etcher

Tegal 901 etcher
Tegal 903 etcher 5"
Tegal 915 Barrel Etcher
Tegal 1511E

Evaporators

Airco-Temescal FC 1800 E-beam evaporator
Airco-Temescal FC-2500 E-beam
Airco-Temescal VES-2500 Filament
Airco Temescal FC 3200 Filament evaporator

Balzer 510 Filament evaporator
CHA MARK 50 E-beam evaporator
CHA SE 600 evaporator
CHA 1000 E-beam evaporator
Davis and Wilder 10-SC 2836 Filament
Varian 3118 Filament evaporator
Varian 3120 E-beam evaporator
Varian 3125 E-beam evaporator

Furnaces

ASM Diffusion Furnaces
Bruce BDF4 Furnace
Tempress 4 stacks

SVG/Thermco 4300 4-stack w/TMX

9001 controller
Thermco MB-71, 80 & 81 Mini-Brutes
Thermco TMX 9000 furnaces
Thermco TMX 9001 4 stack, 5 & 6"

Ion Implanters

Eaton Nova 10-80 implanters
Eaton Nova 10-160 high current implanters
Eaton Nova 3204/3206 implanter
Varian CF4 and DF4 implanter
Varian CF5 and DF5 implanter
Varian 350D implanter 4, 5 & 6"
Varian CF 3000 implanter
Varian 120XP

Leak Detectors

Leybold Hereaus Ultratest F line leak
Triotech G-203 gross leak detector
Leybold Hereaus U100 helium-turbo
Triotech 4001-1A-2 fine leak detector
Varian 936-60
Veeco MS-Series

Mask Aligners

Canon MPA 500 FAB
Cannon PLA 500F aligners
Canon PLA 501F and FA aligners
Canon 521 FA
Canon FPA-1550 MI G-line
KARL SUSS MA56 3" aligner

KARL SUSS MA54 4" GaAs
KARL SUSS MJB-3 aligners
KARL SUSS MJB 55 aligners
Kasper 2001 aligners: 3 or 4"
Perkin-Elmer 240/241 mask aligners
Perkin-Elmer 340/341 mask aligners
Perkin-Elmer 552HT
Perkin-Elmer 600HT, 660HT

Ovens

Blue M's
IMTEC Star 2000 vapor prime oven
Yield eng. LP III vapor prime ovens

Photoresist Tracks & Strippers

DNS tracks
FSI: Atlas, Jupiter and Saturn
Fusion M 126 deep UV flood

Fusion M 150 deep UV flood exposure

Headway D single head spinner

MTI MultiFabs
MTI FlexiFabs
MTI OmniChuck single track coater
MTI Target Track
Semitool ST, S and F Series SRD's
Semix
Solitec Developer
Solitec 4
SVG 8100, 8600 & 8800 Series

Probers

Electroglas 1034X wafer prober
Electroglas 1034X-6 prober, Opt D
Electroglas 2001X probers
Micromanipulator 6000 and 6200
Pacific Western Probe II profilometers
R&K 260 and 300 probe stations
R&K 670 Semi Auto prober
Signatone S450 Semi-Auto with motorized stage/micozoom probes
Signatone S 250 sub-micron analytical prober

Teledyne TAC PR-100 prober
Teledyne TAC PR-53 prober
Wentworth MP900 Probe Station

Reactors

AG Associates RTP systems (210,

410, 4100, 8108)

Applied Materials 2100, 3300, & P5000
System
Applied Materials 7800 and 7810 RP/RPX
ASM PECVD

Wafer & Mask Inspection

Aeronca WIS-150 and WIS-200
Estek WIS-600, 800, 8000, 850, 8500
Nanometrics Nanoline III CD measure
Nanometrics Nanoline IV CD measure
Nanometrics Nanoline V CD measure
Nanometrics Nanoline 50 CD measure
Nanometrics Nanospec AFT 174, 180, 181, 200 & 210

Nikon Optistation 2A & 3A
OSI Microvision VLS-1 CD measure

CSI Microvision VLS-201 inspection station
Tencor Surfscans 100, 164, 4000, 4500, 5000, 5500, 6200, 7000

Wafer & Mask Scrubbers

Kasper 4500 scrubbers
MTI 6300S scrubber

MTI 6700 mask scrubber
MTI Multifab and Flexifab scrubbers
Solitec 1100 scrubber
Solitec 5110 SJ scrubber

SVG 8020 SSC scrubber
SVG 8120 SSC scrubber
SVG 8620 SSC scrubber
Ultratech 602 mask cleaner
Ultratech 603 mask cleaner

Wafer Steppers

GCA 6300 stepper, 5x
GCA 8000 stepper, 5x
GCA 8500 in-line stepper, 5x
Nikon I and G-line steppers
Ultratech 900 standard field stepper
Ultratech 1000 standard
Ultratech 1000 wide field

Wafer Testing

ADE 6033, 6034 and 6035 microsense thickness gauges
Magnetron M700 and 750 4-point probe
MDC CV plotters
Sloan Dektak IA and IIA

Tencor Alpha step 100 profilometers
Tencor Alpha step 200 profilometer
Tencor 100 and 160 Surfscan
Veeco FPP 100, 5000 4-point

Sputtering Systems

Balzer BAK 600 sputtering system
Balzer LLS 801 sputtering system
Balzer BA 510 sputtering system

CPA 9900 and 9930 sputtering system

CPA 9980 sputtering system

MRC 603 sputtering/vertical-load lock
MRC 643 sputtering system
MRC 902M sputtering system
MRC 903A and 903M sputtering

MRC 942-A-2 CTI cryo
MCR 943 3 target in-line sputtering
Perkin-Elmer 2400 and 2400-8L sputtering system

Perkin-Elmer 4400
Perkin-Elmer 4410
Perkin-Elmer 4450
ULVAC MCH-9000
Varian 3120 sputtering systems
Varian 3180 sputtering systems
Varian 3190 sputtering systems

Varian 3290

Let us take the headache out of your next equipment acquisition project. Using our network of hundreds of specialists, we can handle everything from equipment locating and brokerage, to complete system refurbishments. We handle consignment inventory and Fab liquidations as well.

Sitek

Process Solutions, Inc.

"Supplier of High Quality Semiconductor Manufacturing Equipment"

"Provide our customers with quality products at a fair price, while maintaining our *delivery commitments*, *service after the sale* and *honest business practices*."

MTI
Photolithography Tracks

MTI Photolithography Tracks represent a significant portion of the installed Photolithography Track base. Sitek Process Solutions has several ex-MTI employees dedicated primarily to our Photolithography Track rebuilds. We have a substantial inventory of tracks and spare parts for both MultiFab's and FlexiFab's. Our East and West Coast Service Centers are fully capable of on-site service and repairs anywhere in the U.S. and Canada.

Semitool
Spin Rinse Dryers & Spray Solvent Tools

Sitek Process Solutions has focused a great deal of energy on Semitool Products. Our most significant influence in the refurbished market has been on Semitool Spin Rinse Dryers (SRD's) and Semitool Spray Solvent Tools (SST, WST, & WSST). Our inventory is continuously stacked with 4", 5", 6" & 8" capable systems in the "S", "ST" and "F" models. Service and Service Contracts are handled from both the East and West Coast Offices.

Refurbished Systems
Semiconductor Fab Equipment

Our focus is primarily on "Front End" Fab Equipment. Sitek Process Solutions is in regular contact with suppliers of Semiconductor Manufacturing Equipment all over the world. This network of equipment suppliers makes it possible for our company to recognize significant systems. Our experience allows us to buy quality tools at the lowest price possible.

We have over 100 years of combined experience with Semiconductor Manufacturing Equipment and are here to serve you…

233 Technology Way, Building A-3, Rocklin, CA 95765 Phone: 916-797-9000 Fax: 916-797-9009

www.sitekprocess.com

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

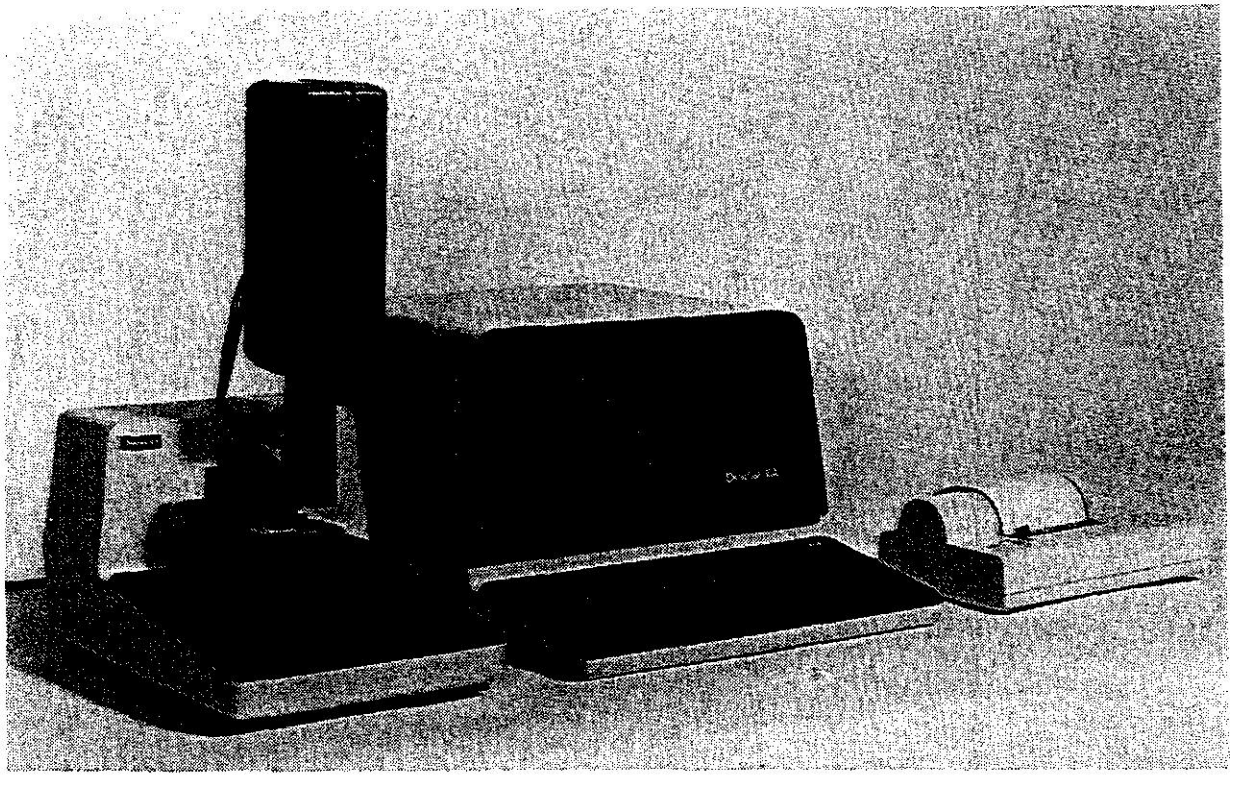

Figure 1-1. DEKTAK IIA

SECTION 1

UNPACKING AND INSTALLATION

ENVIRONMENTAL CONSIDERATIONS

The DEKTAK IIA is a very high precision measuring instrument capable of measuring minute physical surface variations, it is very sensitive to the environment in which it is operated. Depending upon the degree of accuracy required, there are two basic environments recommended.

Normal Operating Conditions

The DEKTAK IIA must be operated in an area free from excessive dust. Vibration levels must be low enough that they cannot be detected by fingertips. The scan head should be covered with the optional environmental shield to eliminate drafts.

Ambient temperatures should be between 18°C and 24°C (64°F to 75°F).

Reference Operating Conditions

For very critical measurements a vibration isolation table may be required. Optional vibration isolatioin tables designed for use with the DEKTAK IIA Scan Head are available (see Appendix A in this manual). The Scan Head should be covered with the environmental shield to eliminate drafts. The system must be allowed to stabilize for at least 15 minutes after it is turned on.

Ambient temperatures should be 21°C ± 1°C, and should have been held within this range continuously for 8 hours preceding operation of the unit.

For optimum instrument operation, AC line filters are recommended.

UNPACKING

The DEKTAK IIA is shipped in three cartons. Each carton contains an instruction sheet describing how to remove the components. These instructions are repeated below.

NOTE

Save all packing materials, should it be necessary to ship or return the equipment.

Accessories Carton

The accessories carton contains the operation manual, the optics assembly, the sample stage, calibration standard, assembly tools, spare lamp, and stylus pressure gauge. The following cables are also included: main power cable, printer cables, video cable, Scan Head cable.

CAUTION

Do not remove stage from protective poly bag until it is time to install it in the Scan Head.

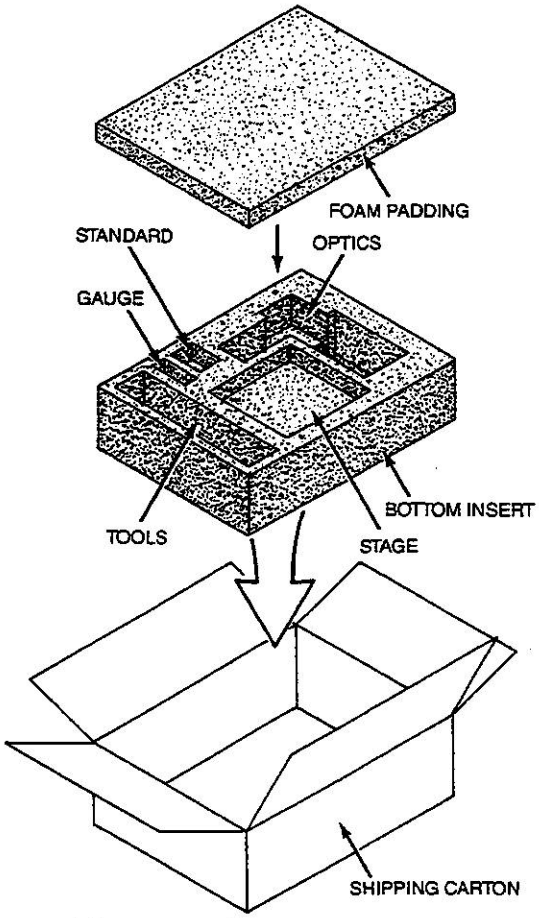

Figure 1-2. Accessories Carton

Scan Head Carton

This carton contains the Scan Head unit. The Scan Head is the most fragile component of the DEKTAK IIA system. It should be unpacked with extreme care.

WARNING

The Scan Head unit weighs approximately 40lbs. To avoid possible injury, two people should unpack the unit. Do not remove Scan head by lifting on stylus arm or damage will result.

To remove the Scan Head unit from the carton, set the carton right-side-up on the floor. Place hands under base of Scan Head and carefully lift out of caarton along with foam inserts. Remove the foam inserts and the poly bag. Carefully set it on a flat, sturdy table. Return all packing material to the carton for storage and future use.

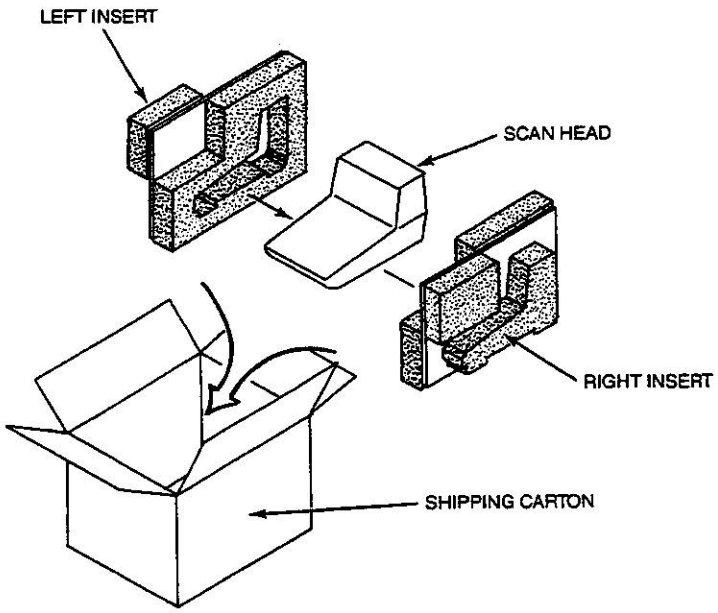

Figure 1-3. Scan Head Carton

Control Console Carton

This carton contains the Control Console and thermal printer. Carefully remove box containing rinter from recess in foam inserts. Reach under the Control Console, between the foam inserts and lift the entire unit, along with the foam inserts, out of the carton. Remove the foam inserts and poly bag from unit. Return all packing material to the carton for storage and future use.

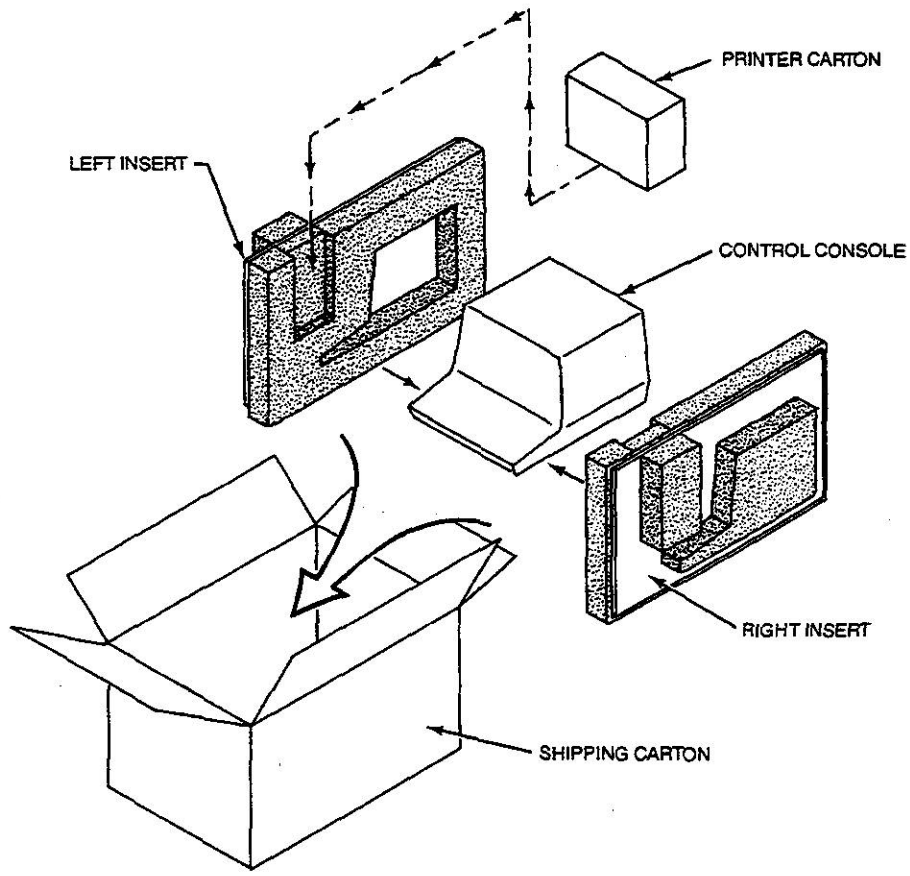

Figure 1-4. Control Console Carton

NOTE

Before proceeding, check each item against the shipping list. If any item is missing, contact Veeco/Sloan Customer Service at (805)963-4431. If anything appears damaged, refer to Claims for Shipment Damage (page 61).

VOLTAGE SELECTION

Power Supply Setting

The power supply has been factory set at the appropriate voltage for the original user facility. If the unit is transferred to a facility where the voltage is different, it will be necessary to change the power supply setting. The procedure to verify or change the power supply setting is as follows:

1. Verify that the main power switch is turned off and the Power Cable is disconnected from its primary power source.

2. The voltage selection board is located on the back of the control console just below the fuse. Pull the fuse lever forward and remove the fuse. Use a pair of needle nose plyers to remove the voltage selection board.

3. There are two power supply settings available: 115/120V and 220V. To set the voltage at 115/120V, install the voltage selection board with the "115/120" printed on the board so that it reads right side up. To set the voltage at 220, turn the board over and install the board with the large "220" printed on the board right side up. Do not attempt to install the board at the "100" or "230/240" voltage settings.

4. Verify that the board is properly installed all the way in and install the appropriate fuse. Use a one amp fuse for 115/120 and a 1/2 amp fuse for 220. Also verify that the appropriate printer is used. If the voltage has been changed, a new printer must be ordered from the factory to operate at the new voltage setting.

CAUTION

Operating this system at the incorrect voltage, or voltage setting, or with the incorrect printer or fuse will cause damage to the instrument

Connectors and Adjustments

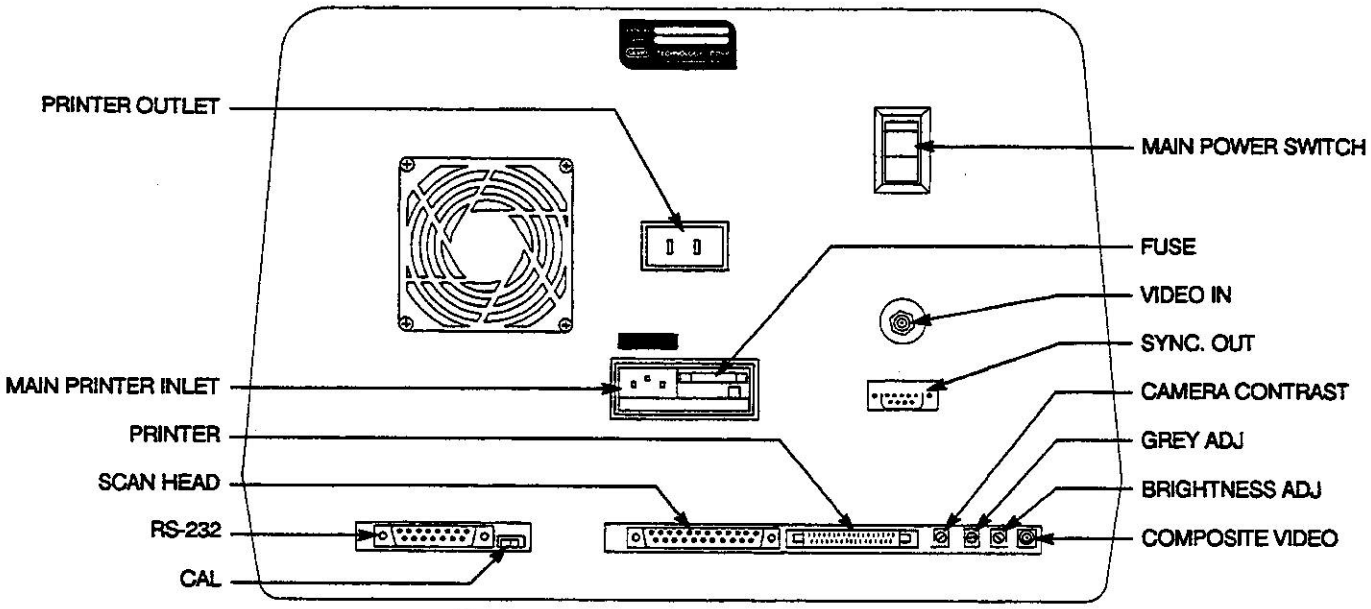

Figure 1-5. Back of Control Console

Printer Outlet	AC power outlet for thermal printer.
Main Power Inlet	Primary AC power inlet for main power cable.
Fuse	Fuse for primary AC power inlet.
Video In	Connector for video camera cable in from Scan Head Optics.
Sync. Out	Connector for syncronization cable out to Scan Head Optics.
RS-232	Connector for RS-232 computer link.
Cal	Calibration switch for software calibration.
Scan Head	Connector for Scan Head logic cable.
Printer	Connector for printer logic cable.
Brightness Adjustment	Used to adjust the monitor's brightness level.
Grey Adjustment	Used to adjust the monitor's grey level.
Camera Contrast	Used to adjust the camera contrast level.
Composite Video	Allows the use of an external monitor.
Main Power Switch	ON/OFF power switch and circuit breaker.

INSTALLATION

Cable Interconnection

1. Verify that the Control Console and printer power switches are in the off position, and that the voltage markings match the available voltage.

2. Connect and secure all cables where indicated in Figure 1-6.

3. Plug in the main power cable to the back of the Control Console and into the proper AC voltage.

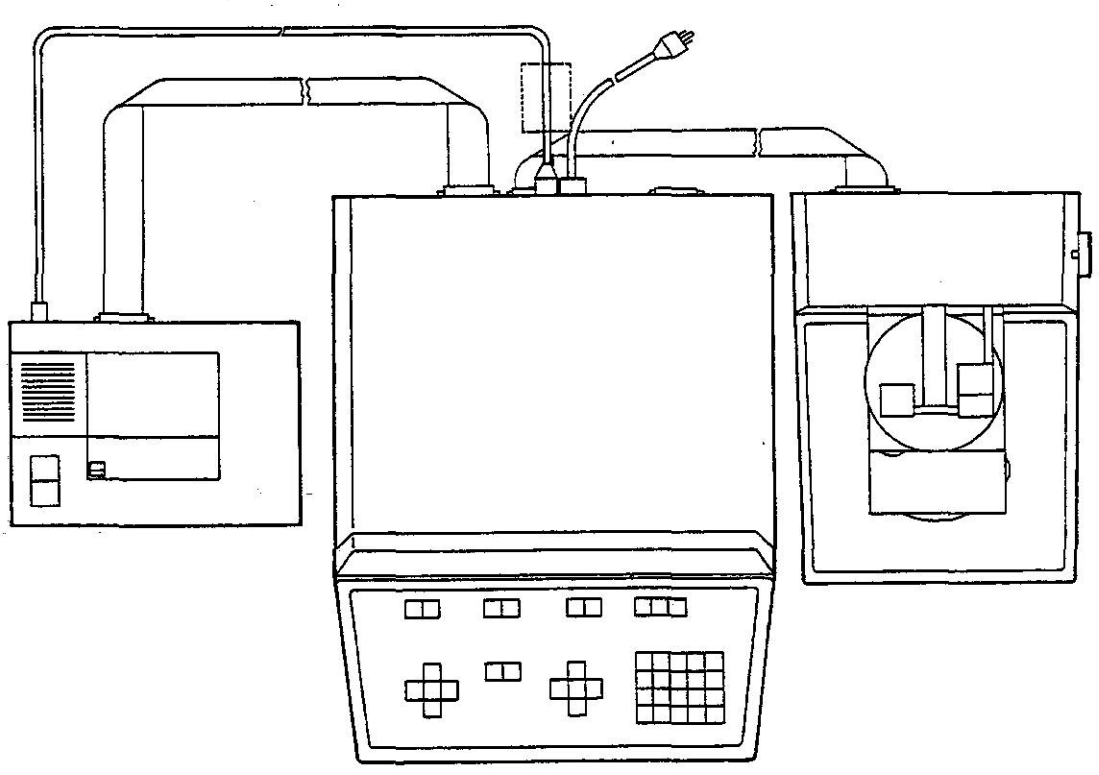

Figure 1-6. System Interconnections

NOTE

The DEKTAK IIA may be operated either with or without the thermal printer installed. The thermal printer may be positioned at a location convenient for the operator next to the control console or on top of the control console to reduce the system's overall footprint.

Preparing Stage For Installation

Remove the stage from the protective poly bag. Use caution in handling the stage.

CAUTION

To avoid damage to the teflon pads, do not allow them to touch any surface other than the surface block.

The stage assembly has three teflon pads which ride on the Scan Head surface block. The left side of the stage has two spring-loaded pads which bear on the side of the surface block. Those on the right are not spring-loaded.

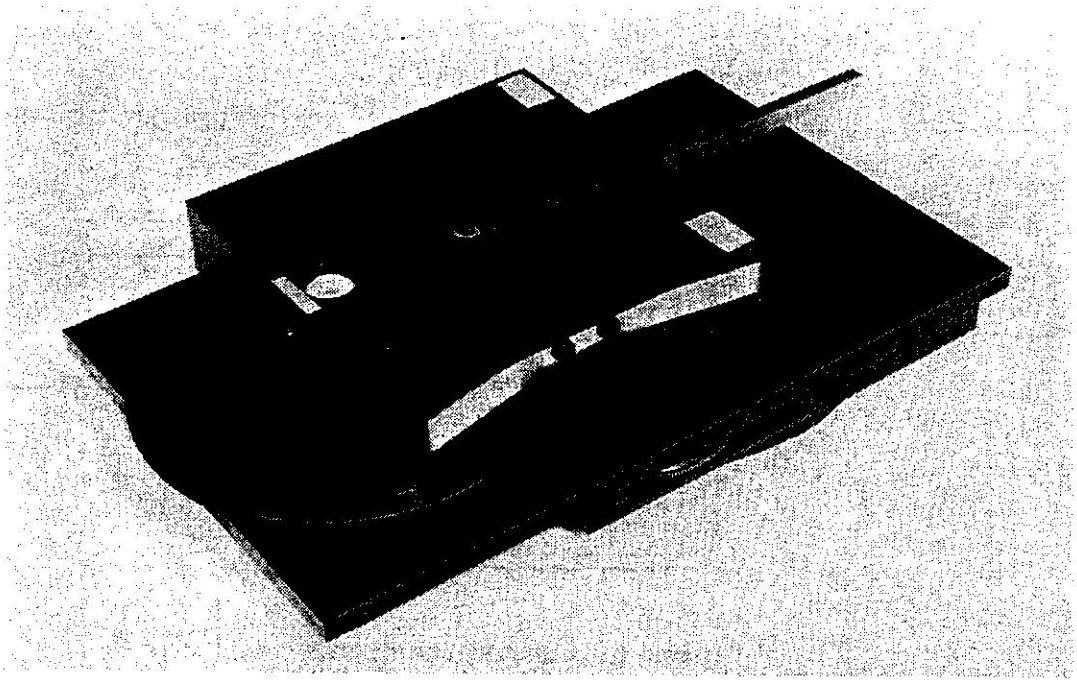

Figure 1-8. Bottom of Stage Assembly

The surface block and stage pads must be cleaned prior to installation.

Stage Cleaning

The stage pads and the surface block must be cleaned with lint-free and abrasive-free tissues moistened with deionized water or laboratory grade alcohol.

CAUTION

Other solvents, such as spectrograde acetone, SHOULD NOT be used since they may attack the adhesives used to mount the teflon pads.

1. Clean the surface block (sides and top), the teflon pads, and around the teflon pads with moistened lint-free tissues. Always wipe new spots with a clean portion of the tissue to avoid transferring contamination to another area.

2. Clean the rack loading block with a clean room swab and laboratory grade alcohol. Buff the cleaned surface block and stage pads with a clean lint free cloth. The cloth should move evenly against a properly cleaned surface. DO NOT touch the teflon pads or the surface block after cleaning; otherwise the procedure must be repeated.

3. Clean the rack and pinion gear with instrument grade "canned air." Hold the can upright and use short bursts to avoid releasing freon.

4. Closely inspect the teflon pad surfaces. Ensure that no debris is embedded in the pads. Check to see that there is no excess adhesive from the pads adhering to any running surface. Inspect the surface block to ensure that there are no scratches or blemishes in the traverse area.

Stage Installation

CAUTION

Before removing or installing the stage, the optics assembly and stylus arm must be fully raised with power on by turning the optics height adjustment knob clockwise.

1. Turn power off.

2. Disengage the rack mechanism by inserting a standard 6" screwdriver into the slotted screw on the rack drive assembly. Turn the screw fully clockwise (Figure 1-9).

3. Hold the stage in your left hand. The bottom of the stage must be facing the top of the surface block.

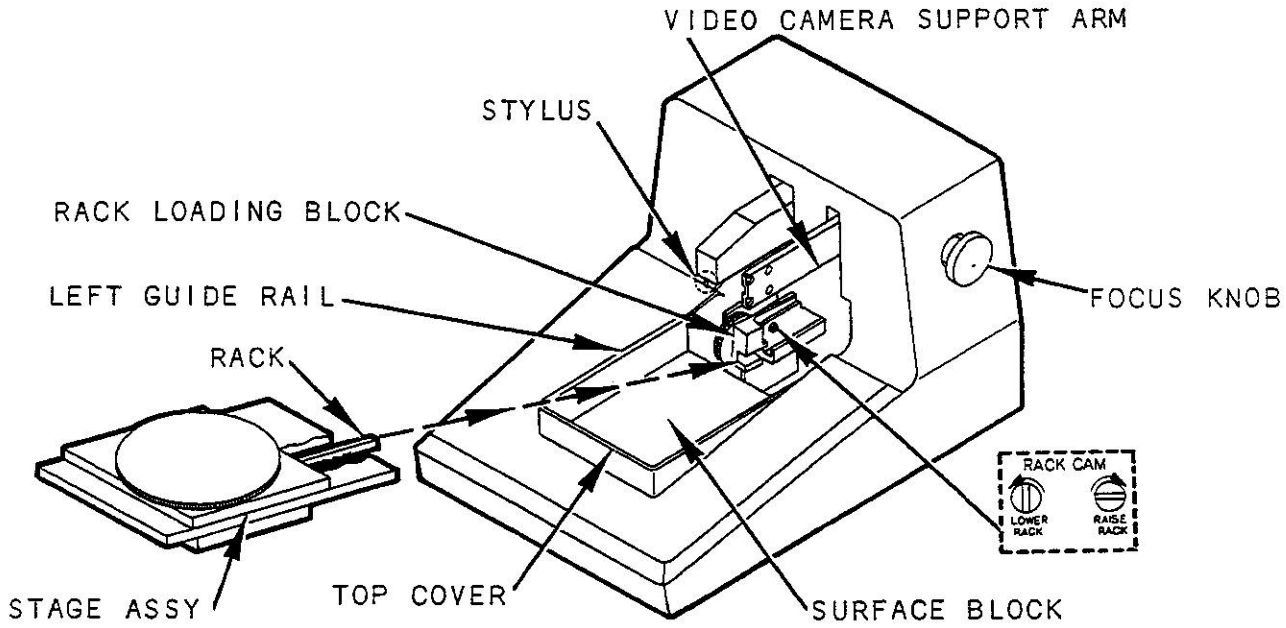

Figure 1-9. Stage Installation

4. Insert the rack into the rack loading block, taking care that the rack does not touch the surface block.

5. Depress the spring-loaded pads against the side of the surface block and carefully lower the stage into the block.

6. Slide the stage all the way back. Then slide it forward all the way to verify that it is free from any binding or contact through the scan travel.

7. Engage the rack mechanism by inserting the screwdriver into slotted screw on rack drive assembly and turning it fully counterclockwise.

8. Remove the stylus protection fixture from the front of the stylus arm by removing the cap screw and carefully pulling the fixture straight out from the stylus arm. Save the stylus protection fixture and screw, to be stored with the DEKTAK IIA shipping materials.

CAUTION

The stylus protection fixture must be installed and the stage must be removed from the Scan Head whenever the Scan Head is boxed or shipped.

Loading Printer Paper

Before loading paper into the printer, the end of the paper must be cut squarely without any jagged edges.

1. Pull the "Printer Head" lever forward to lift the head.

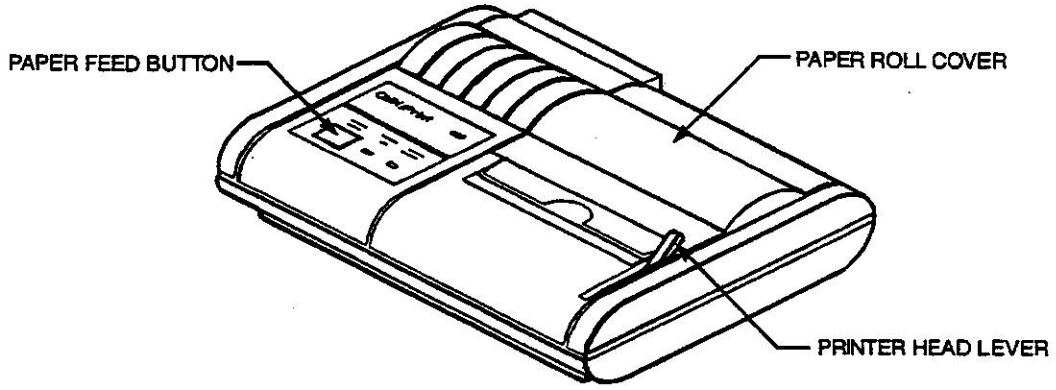

Figure 1-10. Loading Printer Paper

2. Open the paper roll cover (see Figure 1-10). Place the printer paper in the curve of the paper roll cover, with the paper rolling off the bottom of the roll toward the printer. Insert the paper under the rubber platen until the edge appears on the top of the platen.

3. Pull at least two inches of paper through the printer making sure the paper is centered on the platen. Return the "Printer Head" lever to the back position.

4. Hold the end of the threaded paper so it remains outside when closing the paper roll cover.

5. Turn on the DEKTAK IIA power switch. Press and hold the "Paper Feed" button and turn on the printer. The printer should begin the "Self Test" mode. The paper should feed out smoothly. Any adjustments can be made by moving the "Printer Head" lever forward and adjusting the paper position.

NOTE

Change printer paper immediately after the end of roll warning lines are sighted to avoid roll bindup problems.

Any DEKTAK IIA with a serial number of 2844 or higher is factory programmed to operate with the Omni 426 printer shipped with the unit. Earlier Omni printer models such as the Omni 40 or 42, will only work with a DEKTAK IIA with a serial number of 2843 or less.

70X Video Camera Installation

NOTE

If the DEKTAK IIA is equipped with the optional 35-200X Video Zoom Camera, see Appendix B for installation.

1. With the main power off, raise optics support arm to the full up position by turning the optics height adjustment knob on the side of the Scan Head clockwise.

2. Remove the four #4-40 cap screws from the Optics Assembly.

3. Lay optics assembly on top of the Scan Head and connect the lamp cable. (See Figure 1-7)

4. With Optics Assembly nearly positioned, guide the lamp cable into the groove in the optics support arm.

5. Position the Optics Assembly and install the four #4-40 cap screws. Tighten until snug.

6. Slide any excess cable towards the back of the optics support arm, pressing it into the groove.

7. Recheck the assembly. There should be no gap between the optics support arm and the recess in the Optics Assembly.

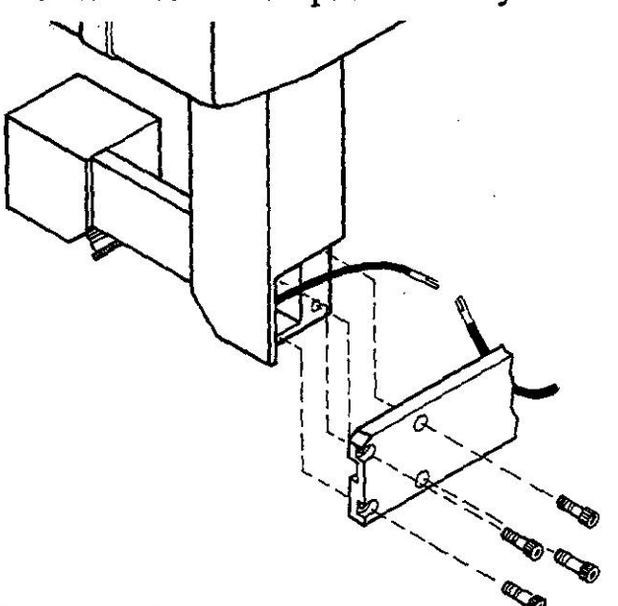

Figure 1-7. 70X Video Optics Assembly

Optics Checkout

The optics assembly has been adjusted for parfocal length and focus at the factory. It should not require additional adjustment unless it shifted during transport. To determine if this adjustment is required, follow these instructions below:

1. Turn on Main Power Switch located at the back of the control console. The stylus arm should automatically raise to the upper most position and stop. If the sample illuminator lamp does not light up, turn power off and recheck the lamp cable connection.

2. Once the DEKTAK IIA is powered up, the sign on message should be displayed (see Figure 4-1). If the display is not visible, adjust the monitor brightness control located on the back of the control console.

3. Press the **PROG** key on the keyboard. The sign on message will clear and the Scan Program Menu screen will appear (see Figure 4-2).

4. Place a substrate (sample or calibrated standarad) on the stage under the stylus. Press the **VIDEO** key twice and adjust the optics height adjustment knob up or down until a clear image appears. Press **VIDEO** again and the graphics display will be superimposed over the substrate display.

5. Lower the stylus by using the $\triangle\nabla$ (stylus up/down key).

6. Adjust the optics height adjustment knob until the stylus and the stylus shadow meet at the approximate center of the CRT.

7. Because the video camera is positioned at a 45° angle to the sample surface, a horizontal focal plane is evident on the video image. The area within this focal plane provides the sharpest video image. Therefore, the point where the stylus sample surface meets should be located within the focal plane.

8. If the DEKTAK IIA is equipped with the 35-200X Zoom Optics Option, the magnification is adjusted by rotating the barrel of the camera lens.

CAUTION

To avoid damage to the stylus assembly, always raise stylus arm and optics assembly to the full up position when the unit is not in use, even if left on.

SECTION 2

GENERAL INFORMATION

INTRODUCTION

The DEKTAK IIA is an advanced surface profile measuring system which accurately measures vertical features ranging in height from 131 microns to 50 angstroms on a wide variety of substrate surfaces.

Principle of Operation

Measurements are made electromechanically by moving the sample beneath a diamond-tipped stylus. The high precision stage moves a sample beneath the stylus according to a user-programmed scan length and speed. The stylus is mechanically coupled to the core of an LVDT (Linear Variable Differential Transformer). As the stage moves the sample, the stylus rides over the sample surface. Surface variations cause the stylus to be translated vertically. Electrical signals corresponding to the stylus movement are produced as the core position of the LVDT changes respectively. An analog signal proportional to the position change is produced by the LVDT, which in turn is conditioned and converted to a digital format through a high precision, integrating analog to digital converter. The digitized signals from a single scan are stored in computer memory for display, manipulation, measurement, and print. Stored programs that can be readily changed make the DEKTAK IIA ideal for both production and laboratory use.

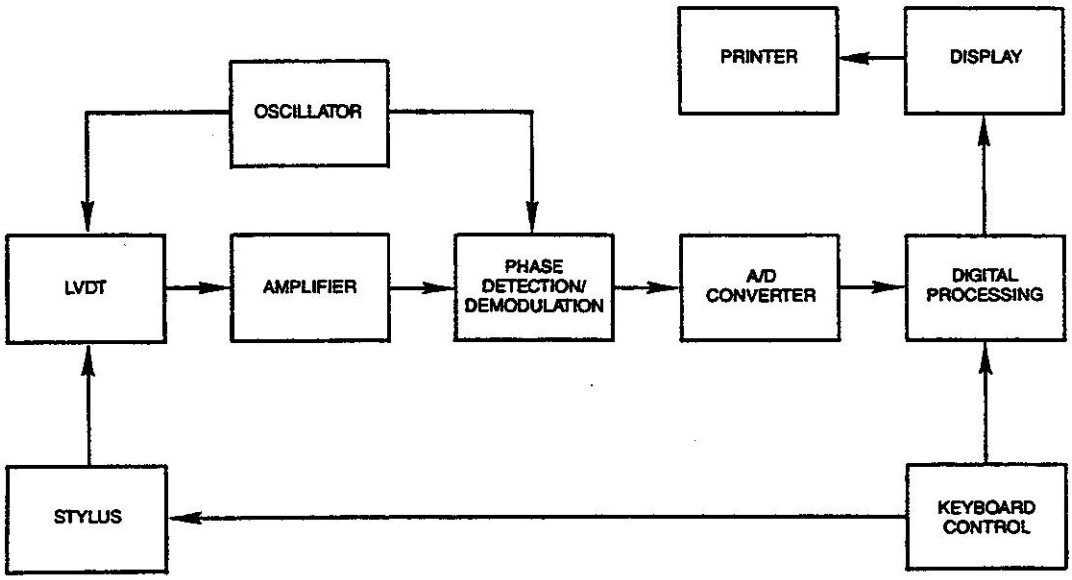

Figure 2-1. Block Diagram of DEKTAK IIA

CONFIGURATION

The DEKTAK IIA is a microprocessor-based stylus profiler. The operating system is in permanent memory (PROM); program variables are stored in battery-powered RAM. The battery is sized to retain program data for three weeks without external power.

The control console's keyboard includes keys to control the scan head, measure the acquired data and print out the results. The instrument is designed to perform routine measurements and analysis with easily remembered single keystrokes in a highly structured format. Versatility is retained for non-routine measurements and analysis by data and cursor manipulation.

The DEKTAK IIA video monitor is a nine-inch monochrome CRT which displays programs and graphics. It can also be used to view the substrate either alone or with the graphics superimposed.

Precision Scan Head

The DEKTAK IIA precision Scan Head unit contains the mechanical and optical components for sample placement, sample viewing, scanning and measurement. The analog electronics contained in the Scan Head positions the stylus arm, drives the sample stage, and provides a signal proportional to the vertical movement of the stylus. A 70X video camera permits viewing of the sample measurement area.

X-Y Stage

A very high precision sample stage performs the scan and permits X-Y positioning with 360 degree theta rotation.

Thermal Printer

The thermal printer produces full-sized printouts in less than 15 seconds. These printouts provide a graphic record of measurement and program data for future reference and/or reproduction.

Stylus

A 12.5 micron radius, diamond tipped stylus permits accurate profile measurements in a wide range of applications. User programmable stylus force from 1 to 40mg allows profiling on soft or hard surfaces.

OPERATION OVERVIEW

Scan Program Menu

The DEKTAK IIA Scan Program Menu consists of nine individual parameters plus time and date, which are selected using the arrow keys on the keyboard. Parameters such as scan length, scan speed, and auto leveling can all be preprogrammed. Up to nine Scan Program Menus are available to be preprogrammed and stored for various applications. Repetitive measurements requiring identical scan parameters can be performed with a single keystroke.

Sample Positioning

The sample is placed in the rear center of the sample stage and positioned for scanning using the video camera and the stage translation and rotation thumbwheel controls. For fast sample positioning of like samples in a production environment, user designed fixturing can be attached to the rotary stage using the four tapped holes provided.

Scanning

After a sample is positioned, the operator presses a single key which initiates and completes a scan as well as displaying the profile on the screen. The Video Monitor allows the operator to view both the physical scanning of the sample and the plotting of the data simultaneously. At the end of the scan, the stylus automatically retracts and the stage returns to the home position. The system is immediately ready for the next scan.

Profile Manipulation and Measurement

An initial profile may require leveling, zero referencing and software magnification to zoom-in on an area of interest. Measurement is a continuous process and is facilitated by simple movements of the Reference and Measurement cursors. Surface noise can be smoothed using the built-in noise band routine.

Data Display

The plotting screen displays ID#, time, date, scan length, and scan speed. Also indicated are both the vertical and horizontal distances between the cursor/trace intercepts as well as the distances from the vertical and horizontal "zero" grid lines.

Analytical Functions

In addition to routine step height measurements, the DEKTAK IIA provides built-in analytical functions for measuring Area-Under-the-Curve, Arithmetic Average Roughness, Average Height, Maximum Height, of selected segments of the trace, defined by the movable cursors.

Boundary Magnification

Following a sample scan, the operator can modify boundary locations to magnify portions of the trace. These new boundary locations can be stored through the "SAVE" function and recalled at any time.

Printing

When the desired profile is displayed and a permanent record is desired, a printout can be made with a single keystroke.

HORIZONTAL RESOLUTION

The horizontal resolution of the DEKTAK IIA is determined by the scan speed and length. There are three speed ranges: Low, Medium and High. The scan length is selectable from 50 microns to 30 millimeters.

The scan data is taken at a constant rate of 40 samples per second. Therefore, the maximum time for a scan is:

* 3.125/seconds High
* 12.5/seconds Medium
* 50/seconds Low

The Low Speed range has a maximum of ten stage speeds; the Medium Speed range has a maximum of eight stage speeds; the High Speed range has a maximum of six stage speeds. Figure 2-2 shows the horizontal resolution for any given scan length and speed. The following formula may be used to determine the number of data points for any given scan length and speed.

$$\#\ \text{Data Points/Scan}\ (\mu m) = \frac{\text{Scan Length}\ (\mu m)}{\text{Horizontal Resolution}\ (\mu m)}$$

	LOW SPEED		MEDIUM SPEED		HIGH SPEED	
SCAN LENGTH IN MICRONS	HORIZONTAL RESOLUTION (µM/SAMPLE)	NUMBER OF SAMPLES	HORIZONTAL RESOLUTION (µM/SAMPLE)	NUMBER OF SAMPLES	HORIZONTAL RESOLUTION (µM/SAMPLE)	NUMBER OF SAMPLES
50	0.05	1000	0.1	500	0.25	200
51-100	0.1	500-1000	0.2	250-500	0.5	100-200
101-200	0.2	500-1000	0.4	250-500	1.0	100-200
201-500	0.5	400-1000	1.0	200-500	2.5	80-200
501-1,000	1.0	500-1000	2.0	250-500	5.0	100-200
1,001-2,000	2.0	500-1000	4.0	250-500	10	100-200
2,001-5,000	5.0	400-1000	10	200-500	25	80-200
5,001-10,000	10	500-1000	20	250-500	50	100-200
10,001-20,000	20	500-1000	40	250-500	N/A	N/A
20,001-30,000	50	400-600	N/A	N/A	N/A	N/A

Figure 2-2. Theoretical Horizontal Resolution

STYLUS SIZE CONSIDERATIONS

A stylus surface profiler measures the actual physical surface of sample. In certain analyses, stylus size and shape should be taken into consideration.

The radius of the standard diamond stylus is 12.5 microns (0.0005 inch). The standard stylus meets most all requirements for the majority of applications. Some applications, however, may require either a larger or smaller tip radius.

NOTE

Reducing the stylus tip radius increases the point pressure on the sample and may require the force to be reset. Tracking force may be adjusted from 10mg to 50mg.

Four optional styli with radii of sub-micron, 2.5 microns, 5 microns, and 25 microns are available for applications which require very high horizontal resolution or measurement of very soft films.

Also available are styli with tips of 12.5 microns x 100 microns and 12.5 microns x 200 microns for special applications.

SCAN SPEED VS. STYLUS FORCE

When using a low stylus force, the stylus may tend to lift off the surface if a large step is encountered at higher scan speeds. In applications where a light stylus force is required, it is recommended that low or medium scan speed be used at the shortest possible scan length.

TECHNICAL SPECIFICATIONS

Measurement Display Range:	200 to 655,000 Angstroms
Vertical Resolution:	5 Angstroms (0.5mm)
Scan Length:	50 microns to 30mm
Scan Speed Ranges:	Low, Med, High
Leveling:	Manual, two-point programmable or cursor leveling
Stylus (Std):	Diamond, 12.5 micron radius
Stylus Tracking Force:	Adjustable from 10mg to 50mg (0.1mN to 0.4 milliNewtons)
Maximum Sample Thickness:	20mm (0.75 inches)
Sample Stage Diameter:	127mm (5 inches)
Sample Stage Translation: (from center)	X Axis, ± 10mm (± 0.4 inches) Y Axis, + 10mm, -70mm (+ 0.4 inches, -2.77 inches)
Sample Stage Rotation:	Continuous 360°
Maximum Sample Weight:	0.5Kg (1 lb)
Power Requirements:	115/220Vac, 50-60Hz @ 67w
Warm-up Time:	15 minutes recommended for maximum stability
Operating Temperature:	21° C ± 3° C 70° F ± 5° F

Sample Viewing

Video Microscope:	70X Solid State Video Camera
Optional Zoom Magnification:	35X to 200X
Sample Illumination:	Variable intensity white light; IR & UV blocked

Dimensions

Control Console:	15.8"W x 20.2"D x 10.8"H (40.1cm x 51.3cm x 27.4cm)
Scanning Head:	10.3"W x 14"D x 10.5"H (26.2cm x 35.6cm x 26.7cm)
Thermal Printer:	10.3"W x 7.5"D x 3.8"H (26.2cm x 19.1cm x 9.7cm)

Shipping Weights

Control Console Carton:	47 lbs (21.34 kg)
Scanning Head Carton:	29 lbs (13.17kg)
Accessories Carton:	19 lbs (8.63 kg)

OPTIONS/ACCESSORIES

See Appendix A in the back of this manual for a complete list of Options and Accessories for the DEKTAK IIA.

SECTION 3
KEYBOARD FUNCTIONS

Key	*Function*
VIDEO	Controls three video display modes: video, video/graphics overlay and graphics.
△▽	(STYLUS UP/DOWN) Raises and lowers the stylus.
PROG	Used to access the program menus.
SCAN	Initiates/aborts a scan.
PRINT	Initiates a printout of the CRT display.
SEND	Transmits display data via the RS-232 interface.
LEVEL	Levels a trace according to the R and M cursor/trace intercepts. The R cursor/ trace intercept will automatically be zeroed.
ZERO	Zeros the trace at the R cursor/trace intercept along the horizontal grid line.
REPLOT	Replots the trace in scale when leveling, zeroing, or selecting new boundary locations.

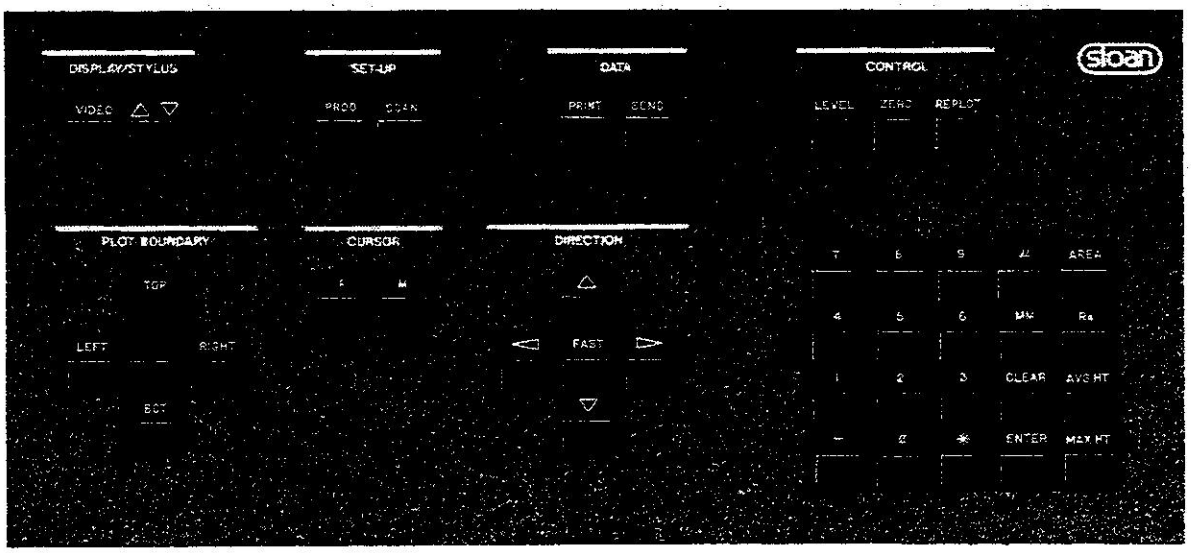

Figure 3-1. Keyboard

Key	*Function*
TOP **LEFT RIGHT** **BOT**	(TOP, BOTTOM, LEFT, RIGHT PLOT BOUNDARIES) Specifies a boundary for positioning. Used in conjunction with the direction keys or numeric values entered.
R	(REFERENCE CURSOR) Specifies the reference cursor as the cursor to be moved. Used in conjunction with the direction keys or numeric values entered. Numerical entry will also change the value in the Scan Program Menu
M	(MEASUREMENT CURSOR) Specifies the measurement cursor as the cursor to be moved. Used in conjunction with the direction keys or numeric values entered. Numerical entry will also change the value in the Scan Program Menu.
△ ◁ ▷ ▽	(ARROW KEYS) for cursor, boundary, software reticle, and/or prompt positioning.
FAST	Speeds up software reticle, boundary or cursor movement.

NOTE

To move software reticle, cursors or boundaries in the fast mode, press and hold the appropriate arrow key and then the FAST key.

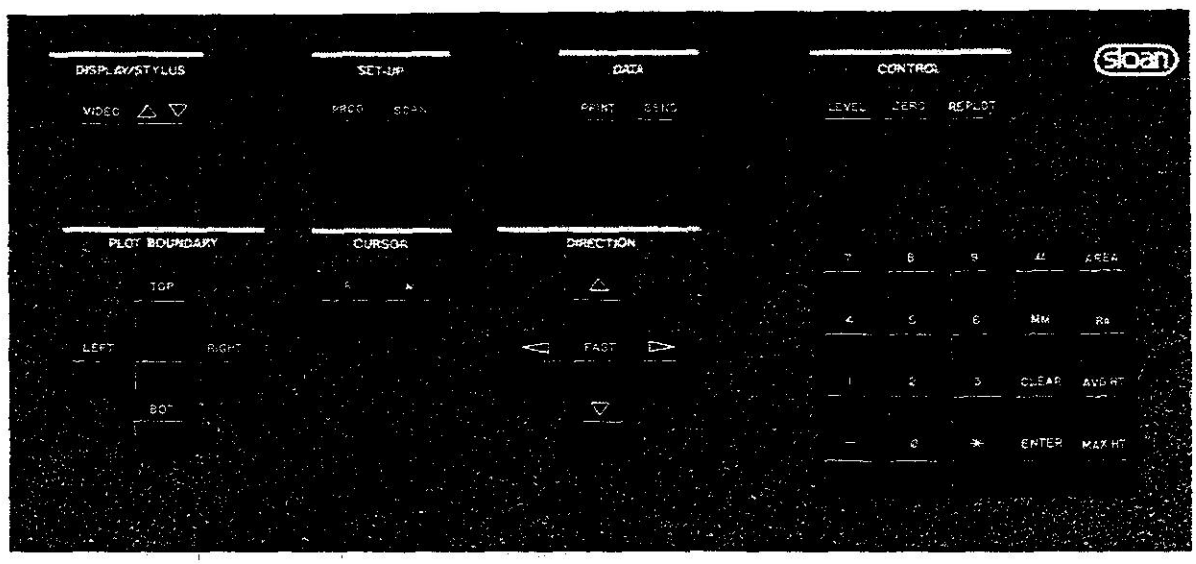

Figure 3-2. Keyboard

Key	*Function*
0-9	(ZERO-NINE) Used in specifying numeric values for programming parameters, cursors, and boundaries.
-	(MINUS SIGN) Used for specifying negative values for top and bottom boundary positions.
*****	(ASTERISK) Used in conjunction with a numeric code to select a special function, i.e., (*1) noise band, (*0) calibration.
μ	(MICRONS). Enter μ after a number to indicate its value in microns.
MM	(MILLIMETERS) Enter MM after a number to indicate its value in millimeters.

NOTE

A unit of measure needs to be specified only when entering the scan length or a value for Auto Leveling, cursors or boundaries that cannot be assumed by the DEKTAK IIA.

CLEAR	Erases any numeric data keyed in but not yet entered.
ENTER	Enters specified numeric data.
AREA	(AREA UNDER THE CURVE) Calculates the integrated area of the profile between R and M cursors. **Trace must be leveled and zeroed.**
RA	(AVERAGE ROUGHNESS) Calculates the arithmetic average roughness of a surface between the R and M cursors. Per ANSI B46.1-1978 and NBS 902.
AVG HT	(AVERAGE HEIGHT) Calculates the average height of a profile between R and M cursors. Trace must be leveled and zeroed.
MAX HT	(MAXIMUM HEIGHT) Calculates the distance of the two furthest data points in the vertical dimension between the cursors.

SECTION 4

OPERATION

POWER ON

1. Power on the DEKTAK IIA. The following will be displayed:

Figure 4-1. Sign on Message

If the sample or stage image appears in the background, Press **VIDEO** until the sign-on message shows against a uniform gray background.

2. Raise the optics tower until the stylus is approximately one inch off the stage surface.

3. Press **PROG**. The DEKTAK IIA Scan Program Menu will appear (see Figure 4-2).

NOTE

To enter current time and date on the Scan Program menu, move the prompt to Time & Date using the arrow keys. Set the time based on a 24-hour clock and press ENTER. Then set the current month/date/year and press ENTER. The time and date will be correctly displayed on all scan profiles.

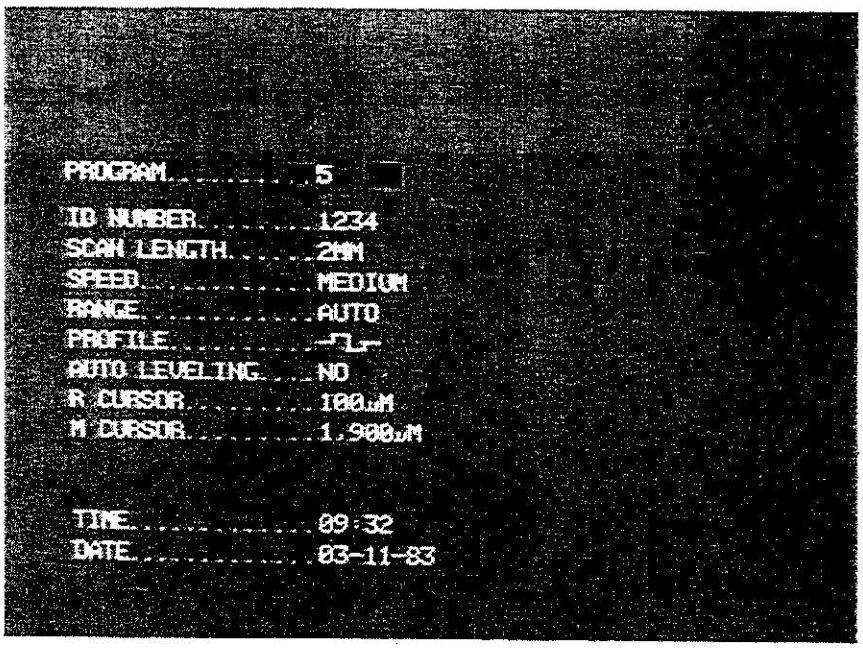

Figure 4-2. Typical Scan Program Menu

PROGRAMMING

The Scan Program Menu is the operator interface for instructing the DEKTAK IIA how the scan should be run, and how the results are to be presented. Up to nine different programs can be stored in the DEKTAK IIA. The programs are battery-backed up and remain programmed when the power is off.

Other than the SCAN ID, which is user-determined, the selection of the rest of the parameters are described in this section. Use the arrow keys to position the prompt and make the selection from the alternatives available or key-in the numeric values desired. The following pages outline step-by-step instructions for sample positioning, scan programming, and making a scan.

Scan Program

Enter a **1** into Scan Program. After each parameter is selected, press **ENTER.**

NOTE

> **Units of measure need not be keyed in along with the numerical value if the DEKTAK IIA can assume the correct units.**

Scan Length

Scan lengths are available from 30 microns (µm) to 50 millimeters (mm). Key in **1,ENTR.** This sets the scan length for 1mm which is ideal for a trace of the calibration standard.

Speed

Three scan speeds are available: Low, Medium, and High. Low speed provides high horizontal resolution measurements. High speed saves time, but offers lower resolution. Medium speed is often acceptable for most applications. For a given scan length, the lower the speed, the greater the number of data points taken. Select *Medium* and press **ENTER.** (See Figure 2-2 for a complete list of scan lengths and speeds.)

Range

This parameter provides a choice between the Auto Ranging feature and a user determined display range. A user determined range can be helpful if several like samples are to be profiled and printed out at the same range allowing a visual comparison. The maximum display range is 655KA. Selecting the Auto Ranging feature automatically ranges the profile to fill 80% of the display. For this application, move the prompt to *Auto* and press **ENTER.**

Profile

Three different profiles are available, depending upon the sample surface characteristics and the measurement range to be selected:


(Valleys) Provides 90% of the Measurement Range below the zero horizontal grid line.


(Hills and Valleys) Provides 50% of the Measurement Range above the zero horizontal grid line and 50% below.


(Hills) Provides 90% of the Measurement Range above the zero horizontal grid line.

The profile setting is important. It scales the Measurement Range according to the profile selected.

If the surface characteristics of the sample are not well known, or if the stage or sample is possibly out of level, select Hills and Valleys () for most applications.

For this application, select and press **ENTER**.

Auto Leveling

This is used to automatically level a scan where two scan reference points lie on the same plane. For example, in Figure 4-6, 100um and 700um lie on the same plane, whereas 10um and 400um do not. The first two values could be used to auto level. The second two could not. For the purpose of this initial exercise on the instrument, select *No*, press **ENTER**.

Reference Cursor

This sets the horizontal position of the reference cursor and is very useful for measurements on multiple, identical samples or multiple identical measurement locations on the same sample. The cursor position can be moved later as necessary, so it is not critical to position it at this time. Key in **100** and press **ENTER**.

Measurement Cursor

This sets the horizontal value for the measurement cursor in an identical manner to the reference cursor. The measurement cursor should be set at a value greater than the reference cursor. For this application, key in **900**, and press **ENTR**.

SAMPLE POSITIONING - CALIBRATION STANDARD

Sample positioning is achieved by turning the thumbwheels located on the front of the sample stage (see Figure 4-4). The rotary table provides a full 360 degree rotation of the sample. The left, front thumbwheel moves the stage left and right along the X-axis. The thumbwheel to the right moves it back and forth along the Y-axis.

1. Move the stage forward along the Y-axis, by turning the right thumbwheel clockwise, until the calibration standard can be placed near the center, rear of the stage as shown in Figure 4-3.

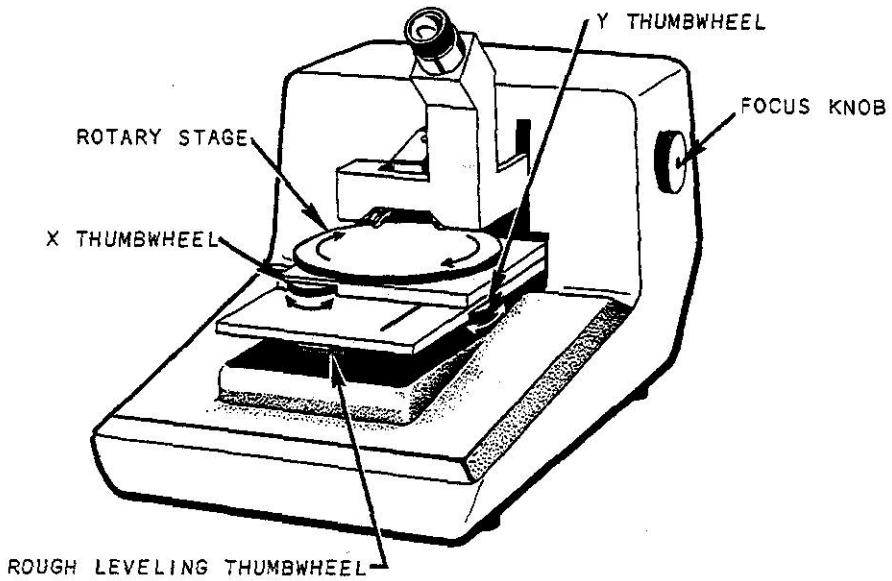

Figure 4-3. Stage

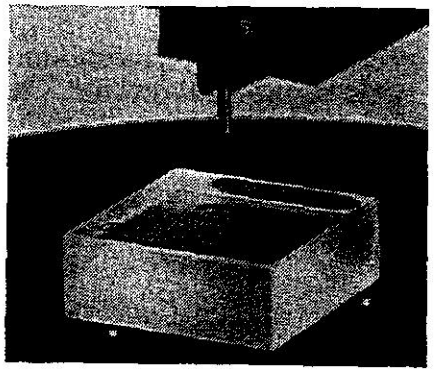

Figure 4-4. Positioning the Calibration Standard

2. Use the X and Y thumbwheels to move the stage until the standard is positioned below the stylus (Figure 4-4).

3. Press the **VIDEO** key until the calibration standard image appears on the video monitor. Adjust the large black focus knob on the side of the Scan Head to bring the video image into focus.

4. Press △▽. The stylus will lower on to the calibration standard.

5. Using the X-Y thumbwheels position the calibration standard until the video display matches Figure 4-5.

NOTE

The video image is rotated 90 degrees clockwise. When the left thumbwheel is used to move the standard left or right along the X-axis, the image on the video monitor moves up and down respectively. Likewise, when the right thumbwheel is used to move the standard forward or back along the Y-axis, the image on the video montitor moves right and left across the screen.

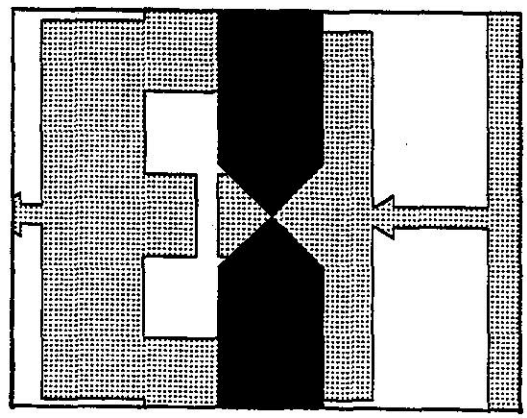

Figure 4-5. Video Display of Surface Image

6. Once the stylus is correctly positioned on the calibration standard, press △▽ again to raise the stylus. The instrument is now ready to make a scan.

MAKING A SCAN

The DEKTAK IIA's unique video/graphics overlay feature allows the operator to view the video image only, the graphic display only, or both simultaneously. The stylus stays in view throughout the entire scan, so features recorded on the graphic profile can be correlated to the actual features on the sample surface. To view the sample surface and graphic profile simultaneously, press the **VIDEO** key until the Scan Program Menu is superimposed over the video image of the calibration standard. The procedure for performing a scan is as follows:

1. Press the Scan key.
2. The stylus will lower.
3. An initial profile will be plotted on the screen as the scan commences.
4. Upon completion of the scan, the stylus will raise automatically.
5. The sample stage will automatically return to the home position.

The DEKTAK IIA will immediately replot the original scan using the autoranging feature that was programmed into the Scan Program Menu. The autoranging feature scales the graphic boundaries so that the profile occupies 80% of the graphic area of the screen. (Figure 4-6.)

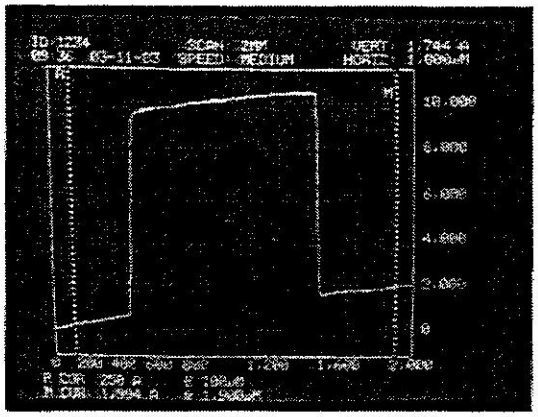

Figure 4-6. Typical Calibration Standard Profile

NOTE

If the initial trace touched either the top or the bottom of the screen before the completion of the scan, the standard is more than 327KA out of level. The stage must be manually leveled (see Page 37).

The following identifies and describes the fields displayed on a scan profile.

Field	*Description*
Id:	Scan identification number.
	Time and date of scan (may be modified in Scan Program Menu Figure 4-2).
Scan:	Scan length (50um-30mm).
Speed:	Scan Speed (Low, Medium, or High).
Vert:	The vertical distance based on the point to point difference between the R Cursor/trace intercept and the M Cursor/trace intercept.
Horiz:	Horizontal distance between the R Cursor and the M Cursor.
R Curs:nn@xx	Vertical and horizontal location of the R Cursor with respect to the vertical and horizontal zero grid lines.
M Curs:nn@xx	Same as above, except with respect to the M Cursor.
	When a cursor or boundary is being moved, its location is displayed at the lower right of the screen.

LEVELING

Manual Leveling

Manual coarse leveling is an important aspect of the DEKTAK IIA operation. The closest possible manual leveling will ensure the best instrument performance. The manual leveling thumbwheel (see Figure 4-3) levels the stage about a pivot axis directly centered below the stylus. This allows for sample surfaces not parallel to the reference surface block to be leveled (perpendicular to the stylus).

1. Press the **SCAN** key.

As the stage is moving and a trace is being generated on the screen, turn the leveling thumbwheel until the profile trace is tracking in a horizontal line. Clockwise rotation raises the trace and counterclockwise will lower the trace.

2. Press **SCAN** again.

The profile must appear totally within the graphic boundaries to achieve the minimum acceptable manual leveling. If not, repeat the manual leveling procedure above.

NOTE

For maximum performance of this instrument, it is very important to manually level the sample surface as level as possible.

Cursor Leveling

Before accurate step height measurements can be made, a reference must be established. For the calibration standard, the quartz surface is used as the reference. All measurements are made in relationship to this surface. The two cursors were programmed in the beginning of our example at approximately the correct points on the quartz. If one or both cursors appear to be on a rough spot, move the cursors slightly by pressing **REF** or **MEAS** then use the arrow keys to reposition the cursor.

Press **LVL**. The screen will be replotted with both the R Cursor intercept and the M Cursor intercept positioned at the horizontal zero grid line with the trace leveled.

Auto Leveling

If two correct leveling points are known, these values can be entered into the Auto Leveling parameter of the Scan Program Menu. All scans will now be leveled at these two points automatically after the scan has been completed.

Press **PRGM.** Move the prompt to the Auto Leveling parameter. Since the scan will start on the quartz surface, go over the step, and finish on the quartz surface, leveling points can easily be determined. Since the scan starts on the quartz, the first leveling point can be 0. And since it finishes on the quartz, the second leveling point can be 1000. Enter 0 and 1000.

Press **SCAN.** The initial trace will be out of level, however, the replotted trace will be automatically leveled.

MAKING A MEASUREMENT

Once the trace has been adequately leveled, an accurate measurement can be obtained.

1. Press **MEAS.**
2. Using the left arrow key , move the M Cursor to the middle of the top of the step.
3. Press **REF.**
4. Using the right arrow key , move the R Cursor to the base of the step.

The difference between the R cursor and the M cursor intercept is the step height. This height is automatically displayed in the upper right corner of the CRT, labeled "*Vert:*" (see Figure 4-7).

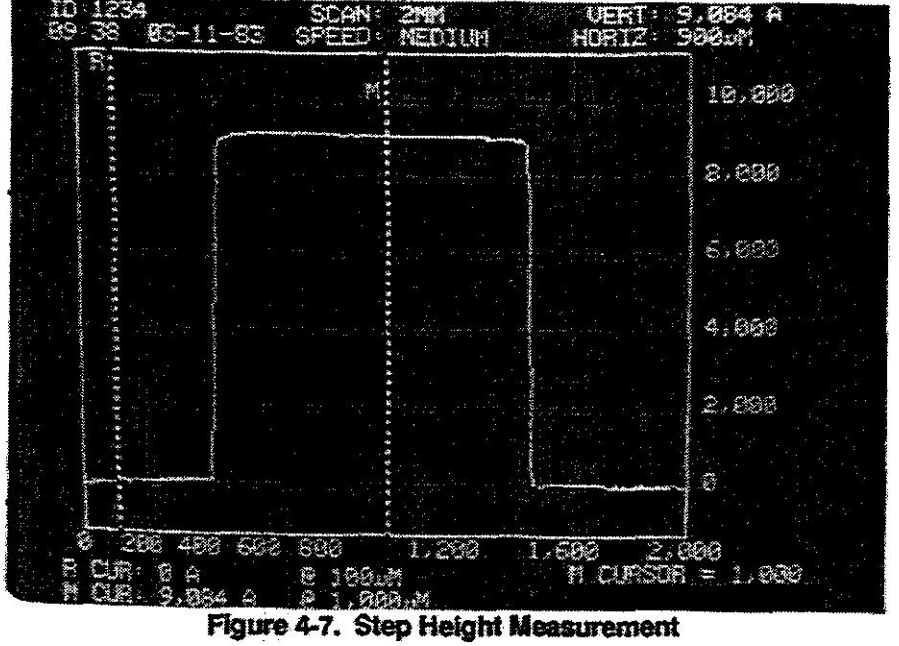

Figure 4-7. Step Height Measurement

SETTING THE ZERO POINT

Any point on the trace may be selected as the zero point.

1. Press **REF.**

2. Using the right arrow key, move the R Cursor to a position on top of the step. Press **ZERO.**

The screen will replot with the trace in the original position but the vertical scale will be rescaled in the negative direction (Figure 4-8). Move the R cursor back to the base of the step and press **ZERO** again.

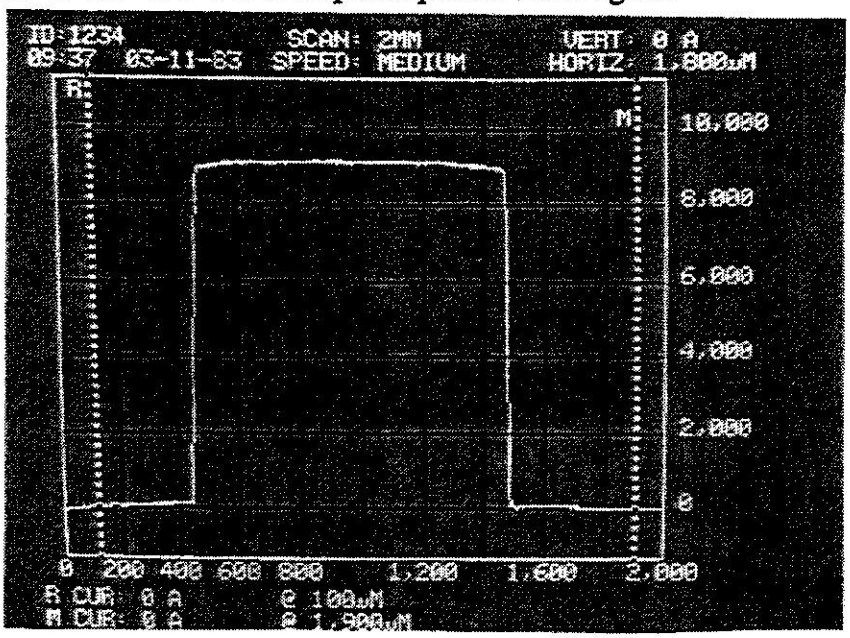

Figure 4-8. Setting the Zero Point

Numeric Cursor Entry

Cursor positions may be entered numerically in the graphics mode (as opposed to moving it with an arrow key) for leveling, making measurements, or setting the zero point. This also changes the Reference and Measurement Cursor values in the Scan Program Menu.

1. Press **REF** and **200,ENTR.** The R Cursor will move to the 200 micron grid location and the Reference Cursor value will automatically be changed to 200 microns in the Scan Program Menu.

2. Press **MEAS** and **500,ENTR.** The M Cursor will move to the 500 micron grid location and the Measurement Cursor value will automatically be changed to 500 microns in the Scan Program Menu.

3. Press **PRGM** and notice the R and M Cursor values are the same as the values just entered.

4. Press **RPLT** to display the scan.

MAGNIFYING A TRACE

To magnify an area of interest, press **LEFT** and use the right arrow key to bring the left boundary near the leading edge of the step. Repeat the procedure using the **RIGHT**, **BOT** and **TOP** keys along with the appropriate arrow keys until the screen looks like Figure 4-9.

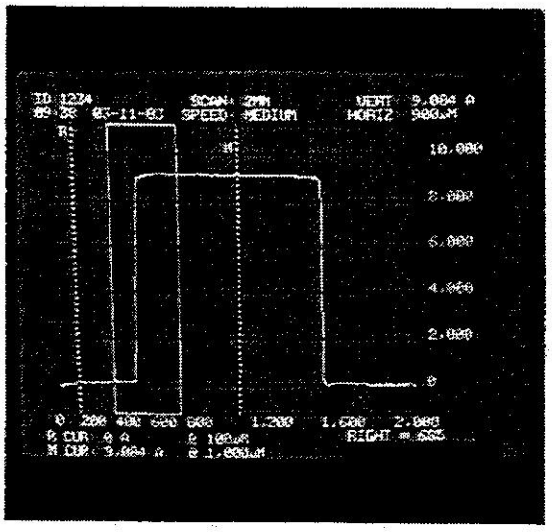

Figure 4-9. Moving the Boundaries

Press **REPLOT**. Figure 4-10 shows the replotted profile of Figure 4-9. The graph is rescaled, and the profile has been magnified to allow easy measurement.

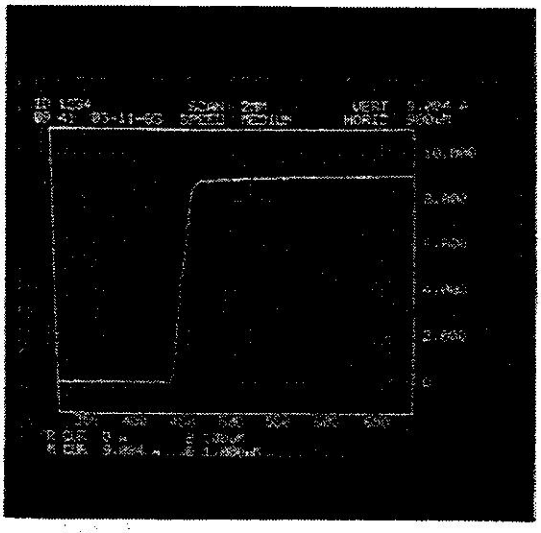

Figure 4-10. After REPLOT

Numeric Boundary Entry

Boundary locations can be entered numerically as well as moving them with the arrow keys. The original trace may be redisplayed by numerically entering the boundary locations from the one millimeter scan.

1. Press **LEFT.** In the lower right-hand corner of the display, the current left boundary positions will be displayed along with a black box (prompt) below. Using the numeric key pad, program in **0** and press **ENTER.**

2. Press **RIGHT**, key in 1000 and press ENTER.

3. Press **TOP**, key in 11,000 and press ENTER.

4. Press **BOT**, key in -1000 and press ENTER.

5. Press **REPLOT.** A display similar to Figure 4-9 will be displayed.

The top and bottom boundaries work in the same fashion.

PRINTOUT

A printout of any CRT display can be generated by the thermal printer. Pressing **PRINT** will print the entire graphics display (Figure 4-11).

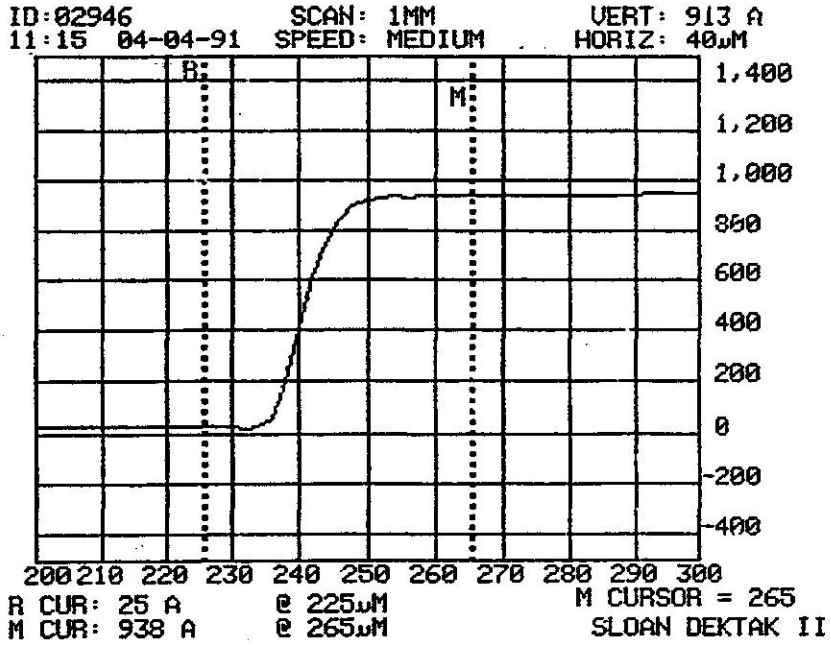

Figure 4-11. Printout Data - Full Screen

The basic DEKTAK IIA operating procedures for sample positioning, programming, and making a scan are now complete. This general technique is used in various scan applications involving films of different hardnesses, textures, and thicknesses.

SECTION 5

ANALYTICAL FUNCTIONS

INTRODUCTION

In many applications, it is important to know more than step height information. The DEKTAK IIA has four standard analytical functions. Pressing any of the analytical function keys will display the result in the lower right-hand corner of the screen. It is important that the cursors are carefully placed before the analytical functions are selected as they will effect the result.

ARITHMETIC AVERAGE ROUGHNESS

(Termed Ra,AA,CLA.) See Figure 5-1. Used to calculate the average roughness associated with fine irregularities in the surface texture. The R and M cursors are used to define the area of the profile where the calculation will be made.

Pressing the **RA** key calculates the Ra measurement by determining a mean line or centerline through the trace. The software then computes the average deviation from the centerline and displays the result in the lower right-hand corner of the CRT.

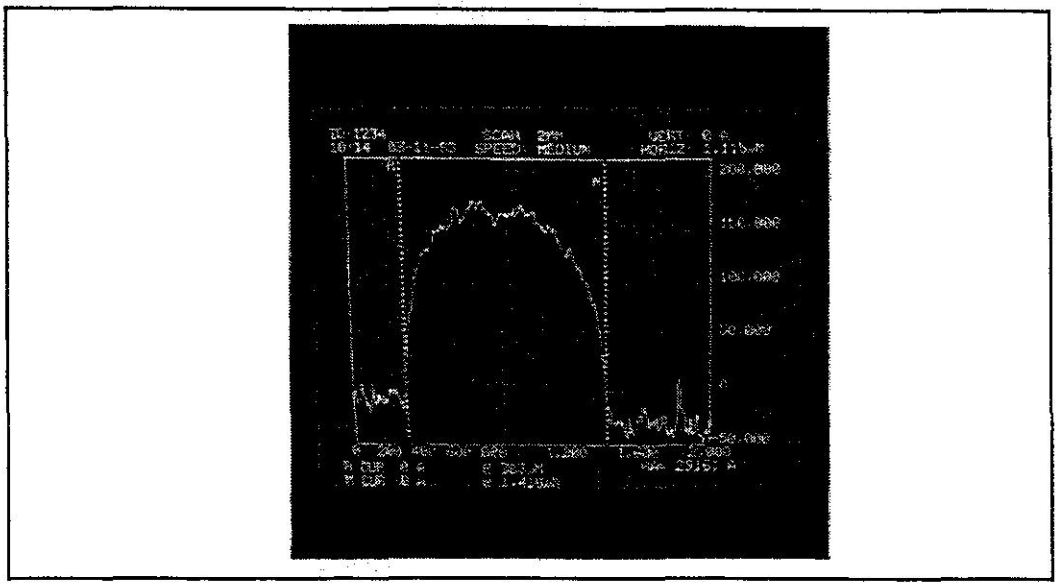

Figure 5-1. Ra

Cut-off wave lengths to eliminate waviness from the actual roughness are not predetermined by the DEKTAK IIA software. To minimize the introduction of substrate waviness in Ra measurement the cursors should be positioned at the recommended spacing according to the corresponding scan lengths below.

Cut-Off Length (L)*		Scan Length	
mm	microns	mm	microns
0.08	80	0.4- 2	400- 2,000
0.25	250	1.5- 5	1,500- 5,000
0.80	800	2.4- 8	2,400- 8,000
2.5	2,500	5- 15	5,000- 15,000
8.0	8,000	16- 025	16,000- 25,000

*ANSI B46.1. 1978

MAXIMUM HEIGHT

Pressing the **MAX HT** key provides a Total Indicated Reading -- TIR. Used to measure the maximum vertical distance between the lowest and highest data points located between the R and M cursors (see Figure 5-2).

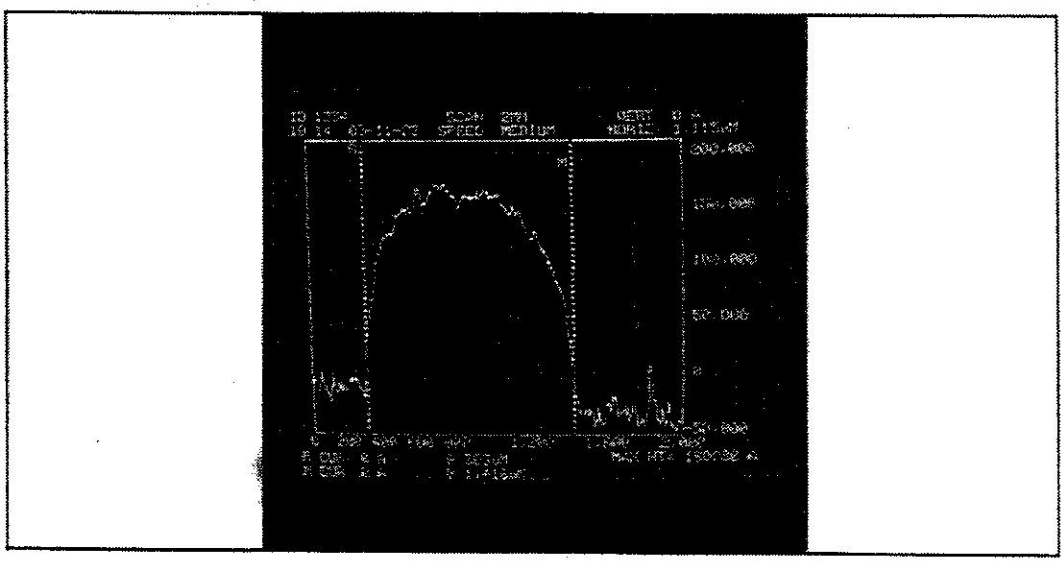

Figure 5-2. Maximum Height

AVERAGE HEIGHT

Pressing the **AVG HT** key calculates the average profile height between the R and M cursors with respect to the horizontal zero grid line (see Figure 5-3). The profile must be leveled prior to pressing the **AVG HT** key.

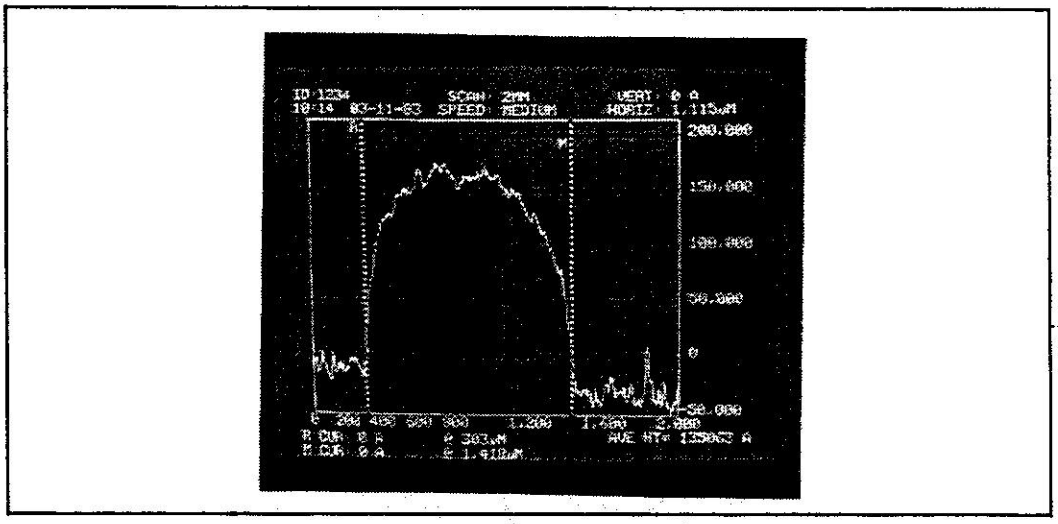

Figure 5-3. Average Height

AREA-UNDER-THE-CURVE

Pressing **AREA** computes the area of a profile between the R and M cursors with respect to the horizontal zero grid line (see Figure 5-4). The profile must be leveled before using this function key. If the profiled shape is above the horizontal zero grid line, its area is displayed in square microns as a positive value. If the profiled shape is below the horizontal grid line, its area is displayed as a negative value.

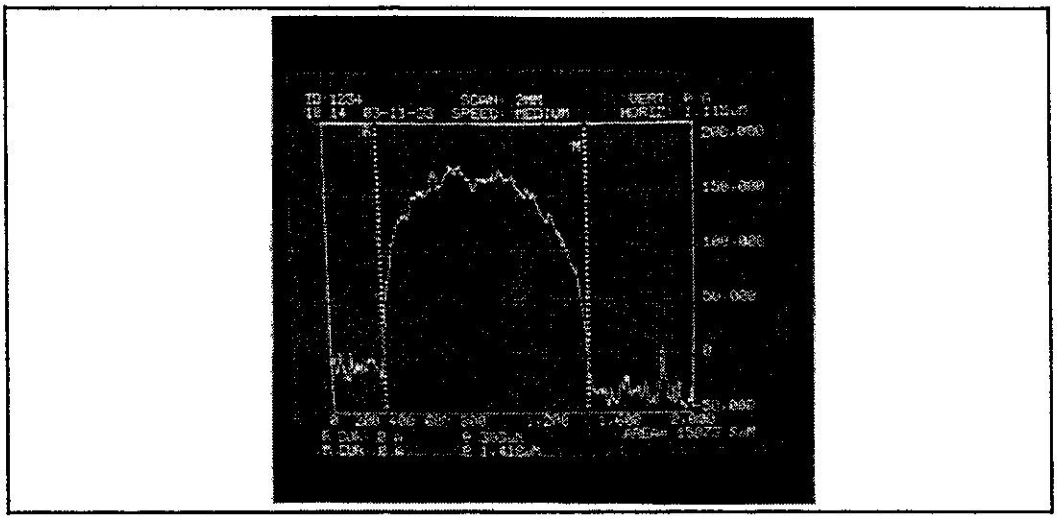

Figure 5-4. Area

SMOOTHING

The smoothing function or noise band is used to reduce high frequency, low amplitude noise on a trace. Some applications involve films deposited over rough substrates. This substrate roughness "transfers" to the film surface, which can make measurements difficult or questionable. In the following example, a scan was run on a metallic substrate which produced the plot shown in Figure 5-5.

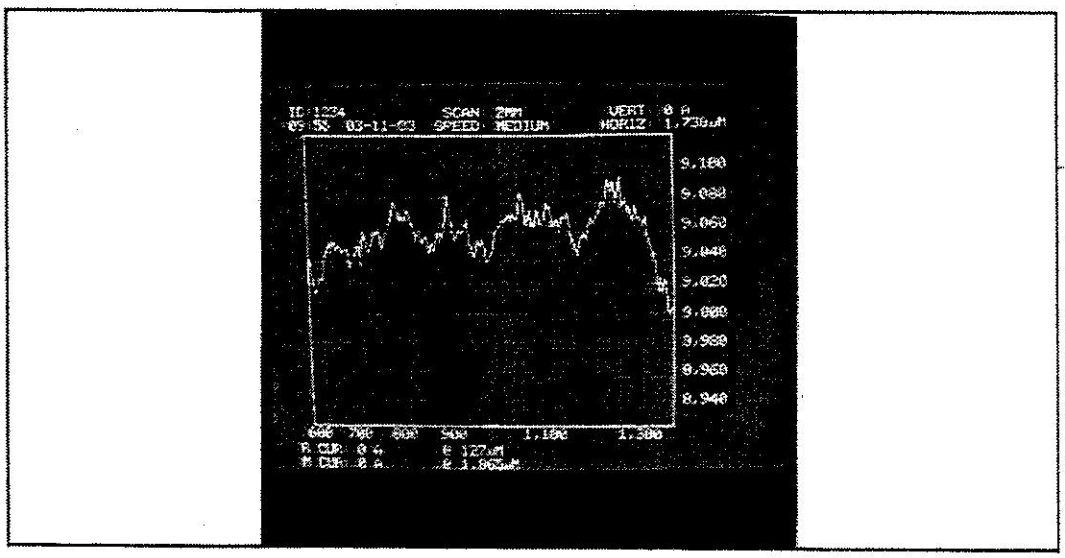

Figure 5-5. Before Smoothing

Prior to smoothing a trace, the maximum peak to valley distance of the high frequency, low amplitude noise must be determined. The maximum height function can be used to determine the noise band to be entered. To obtain the Maximum Height calculation, position the cursors about the area to be smoothed and press the **MAX HT** key. The maximum height between the cursors will be displayed in the lower right of the CRT. The noise band should be equal to or slightly greater than half the maximum height value (i.e., if the maximum height is 100 the noise band should be entered at 50).

To initiate the smoothing function after a scan has been completed:

1. Press the * key and the 1 key. The prompt area at the bottom of the screen will show the present noise band (if any) and will prompt for new parameters.

The values entered will determine the number of data points used in a user-selected vertical dimension. These data points are applied to a least squares plynomial to compute a single weighted data point.

2. Once the appropriate band is determined, use the numeric keys to enter that value and press the **ENTER** key.

3. The trace will then be smoothed and replotted on the screen (see Figure 5-6). The legend "smoothed trace" will be displayed, vertically, along the left of the display. the original unsmoothed trace can be redisplayed by pressing the * key and the **2** key.

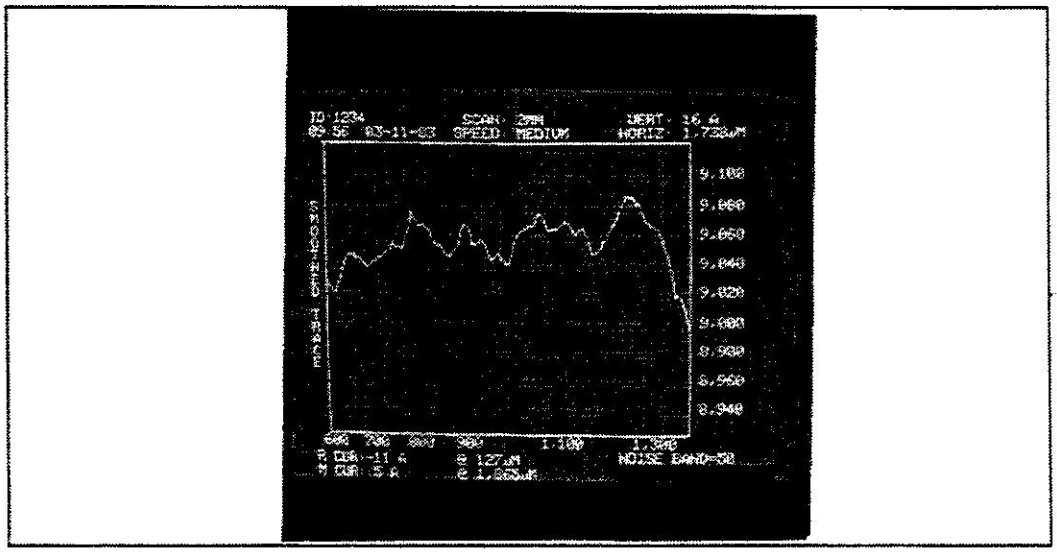

Figure 5-6. After Smoothing

Description of Smoothing Function

The smoothing function smoothes all data within the specified noise band by examining each data point in turn and comparing it with the previous and following points.

Five consecutive data points are used in the smoothing calculation and if they lie within the specified noise band, a running calculation is started. A first-order curve is fitted to all consecutive points lying within the noise band. As new points are examined, the routine calculates the new value of each point by looking at the four closest points that lie within the band.

When the algorithm encounters a point that lies outside the band, the calculation is interrupted. The new point is left "as is" and becomes and center point of a new noise band. If the next five points are within the new band, the calculation is restarted. If subsequent points lie outside the band, they will be plotted "as is," and each becomes a new reference point. This technique is desirable to straight filtering as the slope of the profile is maintained.

SECTION 6

MAINTENANCE AND REPAIRS

CARE AND HANDLING

Like any precision instrument, the DEKTAK IIA requires care in handling and operation. The following recommendations should be followed.

1. If possible, leave the power switch ON permanently. Otherwise, allow the DEKTAK IIA to warm up for approximately 15 minutes after the unit has been turned on.

2. Always raise the stylus before making gross adjustments in the sample position.

3. Position the sample so that the stylus is the only part of the stylus arm that touches the sample.

4. Always keep the instrument covered when the DEKTAK IIA is not in use. An optional environmental shield is recommended for the Scan Head.

5. Never connect or disconnect any cables when power is on.

6. Do not lower the stylus without the stage assembly in place.

7. Do not move a sample during a scan.

8. Avoid vibration and shock during measurements. (A common source of this is an operator or observer touching or striking a surface close to the instrument or the instrument itself during a scan.)

9. Always raise stylus arm and optics assembly to the full up position when the system is not in use, even when power is left on.

Stage Cleaning

Perform the cleaning procedure at least once a month to ensure repeatable measurements. Environmental conditions may require more or less frequent cleaning. Always cover the Scan Head when the DEKTAK IIA is not in use. See Section 1, Page 10 for cleaning procedure. The stage must be removed prior to cleaning. See Page 59 for stage removal instructions.

SOFTWARE CALIBRATION

The DEKTAK IIA should be calibrated periodically (at least once a month). The cleaning procedure outlined on Page 10 must be performed prior to calibration.

1. Turn the power on and allow a few minutes for the electronics to stabilize.

2. Press **PROG** to enter the Scan Program Menu.

3. Select any scan program number and enter the parameters in Figure 6-1.

4. Locate the CAL switch on the back of the control console (below the fan) and switch it to the CAL position.

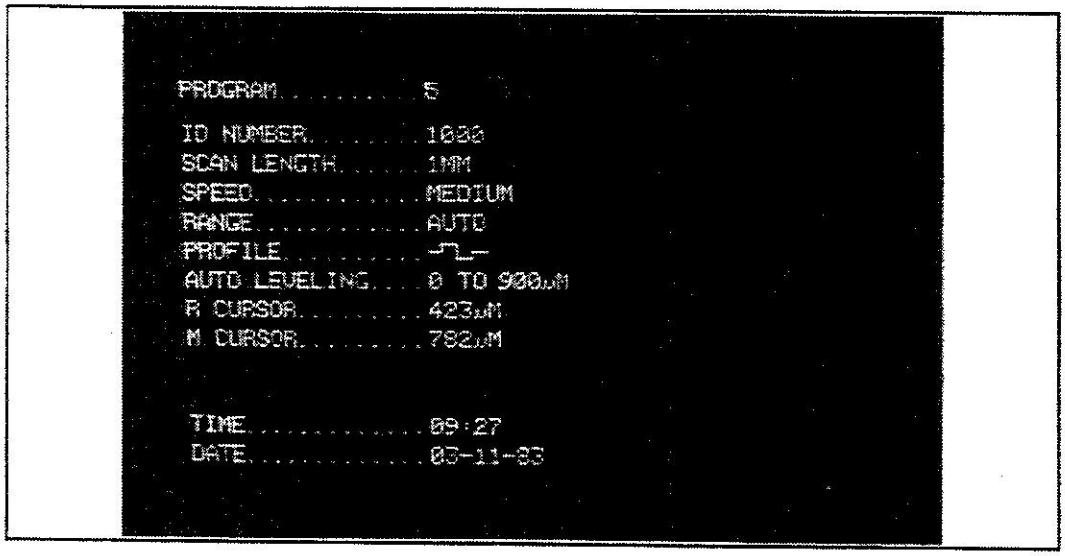

Figure 6-1. Typical Scan Program Parameters for Calibration

NOTE

The instruments should be calibrated in the same profile ( ) in which the actual measurements are to be made.

5. Place the appropriate Calibration Standard on the sample stage, lower the stylus and position it as shown in Figure 6-2.

6. Raise the stylus and press **SCAN**.

7. When the scan is completed, the resulting profile may be out of level. The stage needs to be manually leveled (refer to Section 4, Page 37).

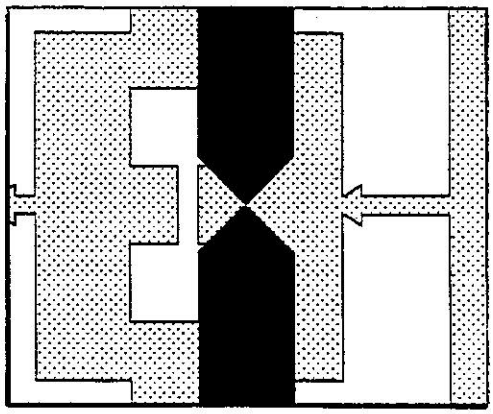

Figure 6-2. Stylus/Step Positioning

NOTE

It is imperative that the sample be leveled as much as possible prior to calibration.

8. Once the stage is manually leveled, position the two cursors anywhere along the base of the step. Press **LEVEL** and **ZERO** to cursor (software) level and zero the trace.

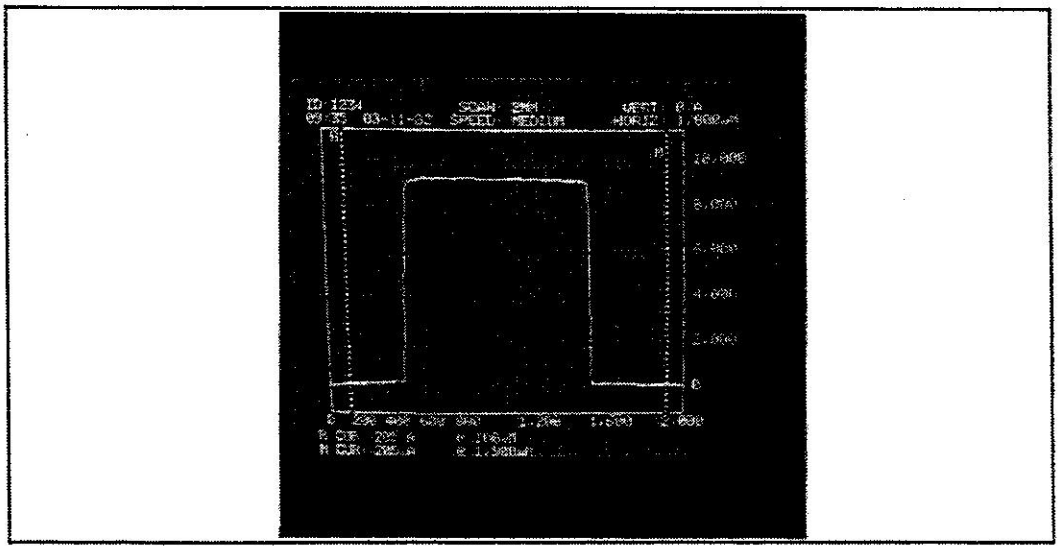

Figure 6-3. Leveled Scan

9. Position the M cursor on the step, no closer than 50 microns from either edge.

10. Enter * and 0 (numeric keypad). A calibration prompt will appear at the lower right of the CRT.

11. Key-in the certified height value on the calibration standard case, and press enter. The trace will be replotted and rescaled as specified.

NOTE

The software calibration function will accept a calibration change of ±5% from the reading obtained from the calibration standard measurement. A larger calibration change may indicate a fault or instability in the instrument that requires a service engineer to correct.

STAGE SPEED CALIBRATION

When a scan is limited, the computer specifies the stage speed. If the stage speed is not calibrated properly, the scan length will be shorter or longer than the distance specified in the program menu. The procedure below should be followed, at most, every forty hours.

1. Program the DEKTAK IIA for a 6-mm scan at low speed. Scan the calibration standard so that both guard bands appear, and LEVEL and ZERO the trace. The left rising edges of the first and second guard bands are precisely 4,000 microns apart.

2. Place the R cursor at the rising edge of the first guard band and the M cursor at the rising edge of the second guard band. If the horizontal difference between the R and M cursor settings (HORIZ -- upper right-hand corner of the screen) is 4,000 microns (plus or minus 50 microns) the calibration is correct.

3. If HORIZ is slightly out of the plus or minus 50 micron range, repeat the procedure to make sure the R and M cursors are positioned at the same points on the step rise. (The R and M cursor vertical readings should be reasonably close to one another.) If several trials indicate that the reading is truly off, go the next step.

4. If several trials indicate that the reading is truly off, contact your nearest Veeco service engineer to have the instrument adjusted.

ADJUSTING STYLUS TRACKING FORCE

After checking the stylus tracking force, it may be determined that the force needs to be altered. Prior to changing the force, verify that the stylus is raised and the stylus force gauge is rremoved from the stage.

1. With power on, use focus knob to lower stylus arm until the stylus tip is approximately 1/4" above the stage.

2. Turn power off.

3. Turn focus knob to raise optics assembly to upper most position and stop. This will give you room to remove the two capscrews on top of the stylus arm.

4. Remove the stylus arm cover, note there are two slot head screws under the cover. The linearity adjustment screw is preset at the factory to determine the tension with which the stylus is held against its pivots, and should not require adjustment.

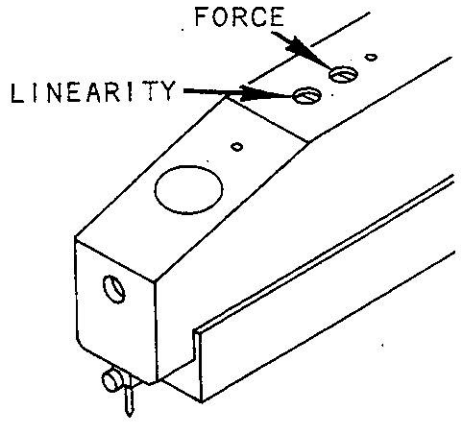

Figure 6-4. Stylus Force Adjustment Screw

5. The rearmost of the two screws that are exposed is the force screw (Figure 6-4). Using a slot-head screwdriver, adjust the force screw. To decrease the tracking force, turn the force screw counterclockwise. to increase the tracking force turn, turn the force screw clockwise. The force screw should be turned only slightly, and then the force rechecked.

CAUTION

The force screw should not have to be turned more than a quarter turn. Turning more than a half turn may damage the stylus mechanism.

6. After any adjustments are made, the stylus force must be rechecked by turning the power on, raising the stylus arm to the up position, and lowering the stylus onto the gauge. The adjust procedure may have to be repeated to obtain the desired stylus force.

7. Once the stylus tracking force has been adjusted satisfactorily, replace the stylus arm cover and the two slot head screws.

CHECKING STYLUS TRACKING FORCE

The stylus tracking force is preset at the factory at 50 mg. Determining the tracking force requires the stylus force gauge shown in Figure 6-5.

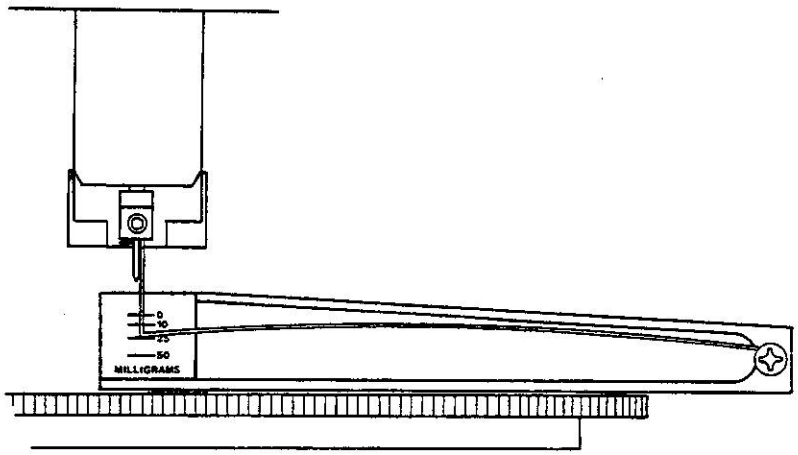

Figure 6-5. Stylus Force Gauge

1. With power on, turn the focus knob to raise the microscope to its full up position.

2. Place the gauge on the stage with tip of the wire gauge directly under the stylus holder. The spring should contact the holder just in back of the stylus, but should not contact the stylus arm cover.

3. Press (stylus up/down key). The stylus will lower and deflect the wire gauge down on the scale to give the accurate stylus force.

STYLUS REPLACEMENT

All DEKTAK IIA styli have the same shank size. They differ only in the radius of the diamond tip. Proceed as follows to remove and/or replace a stylus.

CAUTION

The stylus suspension system is delicate.

1. Raise the stylus by raising optics to the full up position using the Focus Knob on the side of the Scan Head.

2. Turn off the DEKTAK IIA.

3. Place a piece of lint-free tissue on the sample stage to catch the existing stylus.

5. Use a .035 Allen wrench (provided in the Stylus Replacement Kit) to loosen the stylus retaining screw. One and one-half turns should be sufficient.

6. If the stylus does not drop free, gently pull it straight down with a pair of tweezers.

7. Remove the replacement stylus from shipping capsule. Use a pair of tweezers to install it in the stylus arm, with the flat to the of the instrument. A mirror is provided in the Stylus Replacement Kit to help locate the stylus shank hole. Gently push the stylus up until the top is flush with the top of the stylus holder.

8. Using a .035 Allen wrench, tighten the retaining screw until snug.

CAUTION

Gently tighten the stylus retaining screw. The threads are very fine, so use extra care not to overtighten.

9. Check and adjust stylus tracking force as needed.

STYLUS CLEANING

The stylus should be inspected regularly for dust and particles that may cling to it. Contaminates may be visibly detected by viewing the magnified stylus image on the video monitor, as the stylus is raised and lowered. The stylus can be cleaned with a fine brush or a lint free swab. Brush gently without exerting undue force on the stylus. Isopropyl alcohol may also be used to aid in cleaning.

ILLUMINATOR LAMP REPLACEMENT

NOTE

If system is equipped with the optional 35-200X Zoom Optics, see Appendix B for illuminator lamp replacement.

The lamp is typically good for one thousand hours. A spare lamp bulb is included in the spare parts kit. To avoid future delays, always order another spare bulb when replacing a burned out lamp.

CAUTION

Do not touch lamp while power is on. The bulb is extremely hot.

1. With main power on, raise the stylus arm and the optics to the full up position using Optics Height Adjustment Knob on the side of the Scan Head.
2. Turn off the DEKTAK IIA.
3. Remove the screw attaching the cover plate to side of the illuminator and remove the cover plate.
4. Using the 0.035" Allen (hex) wrench provided, loosen the lamp set screw. Three turns should be enough.
5. Using tweezers, pull both the lamp and socket up and out. If the lamp and socket do not pull out easily, loosen the set screw another turn or two.

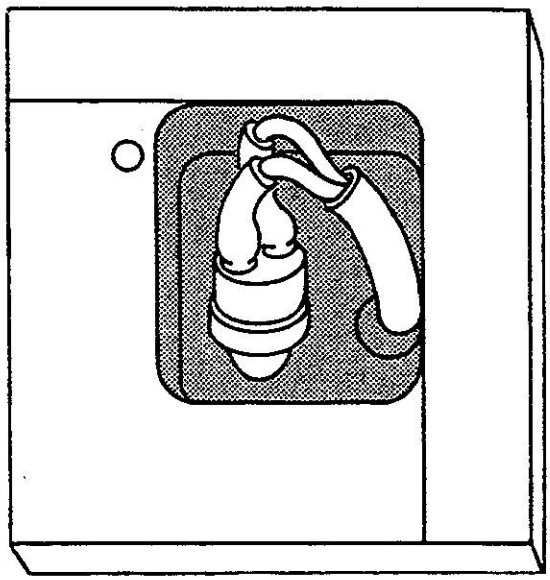

Figure 6-6. Illuminator Lamp Replacement

6. Remove the old bulb with tweezers and put in a new bulb. Turn the DEKTAK IIA power on to check the new bulb. If the bulb does not light up, check the lamp connector in the microscope support arm.

7. Adjust the lamp for uniform illumination by placing a piece of paper on the sample stage. With the lamp on, push the sockete and lamp into the optics base and note the light pattern. The lamp may have to be rotated 180 degrees and reinserted to obtain the optimum illumination.

8. Holding the lamp in position with tweezers, tighten the set screw. Note that the set screw seats against the lamp, take care not to overtighten.

9. Replace the illuminator cover plate.

ERROR MESSAGES

If there are error messages on the screen at the lower right corner, try the following:

1. *"A/D ERR."* This signifies that the analog information generated by the stylus circuitry is not being converted to digital data within a specified time period. The most probable cause is that the Scan Head Cable is not connected to the Control Console and/or the Scan Head. Check and scan again.

2. *"STY DWN ERR."* This signifies that the stylus mechanism has not stabilized on the sample surface within a predetermined time limit. Reduce the travel distance between the stylus and sample surface by lowering the optics assembly with the Focus Knob and try again. If this error message persists, the stylus force or stylus linearity may need adjustment.

3. *"STY UP ERR."* This error message signifies that the styous will not return to the up position at the conclusion of the scan. The stylus is apparently stuck in the down position and unable to swing freely. Power off the DEKTAK IIA. Power up and retry.

4. *"STAGE ERR."* This signifies that the stage has not returned to the "Home" position within one minute after the conclusion of a scan. In all likelihood, the rack loading block has not been "cammed down," and is thus not engaging the pinion gear. Or, the rack has not activated for the first optical sensor. Verify that the stage has been properly installed with the rack engaged. Refer to Section 1 of this manual for stage installation instructions.

NOTE

If any of the above conditions cannot be corrected, and the error message persists, contact the Veeco/Sloan Service Center for qualified assistance.

MAJOR REPAIRS

WARNING

The Control Console and/or Scan Head should NEVER be opened when connected to the primary power source. Major service should only be performed by Veeco Service Engineers.

The DEKTAK IIA cannot be readily repaired after major component failures without the assistance of specialized test equipment and software routines. If the instrument cannot be repaired at the user facility, it must be shipped to a Veeco Service Center. Refer to page 60 or the Service Center address nearest your facility.

Before calling the Veeco Service Center, check the following:

1. Has the circuit breaker tripped?
2. Are all cables properly connected and free of obvious damage?
3. Is the power cord connected properly?
4. Does the stylus move up and down when you turn the Optics Height Adjustment Knob on the of the Scan Head?

RETURNS

If your instrument needs to be shipped to a Veeco Service Center, the following procedure must be followed:

Stage Removal

1. Raise the optics to the upper-most position.
2. Turn the power switch off.
3. Reinstall the stylus protection fixture on the stylus arm.
4. Use a slotted screw driver to disengage the rack loading mechanism.
5. Carefully lift the stage up and out being careful not to hit the stylus.

Repacking

1. Turn on the power.
2. Lower the optics to the lowest position and stop.
3. Turn off the power.
4. Raise the optics 3/4".
5. Disconnect each of the cables.
6. Repack the DEKTAK IIA in the reverse of unpacking instructions in Section 1, Pages 2-5.

WARRANTY

All new catalog-listed standard equipment sold and/or manufactured under Veeco's labels, is warranted by Veeco to be free of defects in material and workmanship if properly operated and maintained. This warranty covers the cost of necessary parts and labor (including, where applicable, field service labor and field service engineer transportation) during the warranty period.

The warranty period is one (1) year.

Warranty period takes effect upon date of shipment. Except as excluded below, these warranties extend to parts which are manufactured by persons other than Veeco which are components of standard catalog items. Purchased equipment incorporated into any item supplied by Veeco will be covered by manufacturer's warranty.

Expendable items, including but not limited to styli, lamps, and fuses, are specifically excluded from the foregoing warranties and are not warranted. All used Equipment is sold on an "as is, where is" basis without warranty, express or implied.

Equipment made or modified to Purchaser's specifications on special order shall carry the above warranties with respect to material and workmanship, but shall be specifically excluded from any other warranties, express or implied, including those related to performance specifications, and any special components shall only carry the original manufacturer's warranties.

Warranty Claims

Veeco's obligation under these warranties is limited to repairing or replacing at Veeco's option defective non-expendable parts. Veeco's obligation shall not extend to defects that do not impair service. No claim will be allowed for any defect unless Veeco has received notice of the defect within thirty days following its discovery by Purchaser.

Claims for Shipment Damage

No claim will be allowed for Equipment damaged in shipment sold under standard terms of F.0.B. Factory. Within thirty days of Purchaser's receipt of Equipment, Veeco must receive notice of any defect which Purchaser could have discovered by prompt inspection of Equipment. In any event, Veeco shall have the option of inspection at Purchaser's premises or at Veeco's plant, before allowing or rejecting the claim.

Warranty Eligibility

To be eligible for the above warranties, Purchaser must perform preventative maintenance in accordance with the schedule set forth in the Operation and Maintenance Manual provided. Veeco assumes no liability under the above warranties for Equipment or system failures resulting from improper operation, improper preventative maintenance, abuse or modifications of the equipment or system from the original configuration.

NOTE

This warranty is in lieu of all other warranties, expressed or implied and constitutes fulfillment of all of Veeco's liabilities to the purchaser. Veeco does not warrant that the system can be used for any particular purpose other than that covered by the applicable specifications. Veeco assumes no liability in any event, for consequential damages, for anticipated or lost profits, incidental damages or loss of time or other losses incurred by the purchaser or any third party in connection with systems covered by this warranty or otherwise.

Service

Field Service is available nationwide. Service and installations are performed by factory trained Veeco service engineers.

Contact your nearest Veeco sales/service office, for prompt service.

WESTERN REGION	CENTRAL REGION	EASTERN REGION
Veeco Instruments Inc. 3350 Scott Blvd., #3902 Santa Clara, CA 95054 Attn: Service Center (408)982-0600	Veeco Instruments Inc. 10480 Markison Road Dallas, TX 75238 Attn: Service Center (214)349-8482	Veeco Instruments Inc. Terminal Drive Plainview, NY 11803 Attn: Service Center (516)349-8300

APPENDIX A

DEKTAK IIA OPTIONS, ACCESSORIES AND REPLACEMENT PARTS

OPTIONS

Item	*Description*	*Part No.*
Video Zoom Optics	Provides 35-200X Video Zoom Optics capabilities for DEKTAK IIA sample viewing.	139692
Enviornmental Shield	Provides protection from air currents and small contaminants that can adversely affect instrument accuracy when making critical measurements.	140144
Vibration Isolation Table	Specifically designed to isolate the DEKTAK IIA Scan Head from external vibration. Does not require air supply.	085615
Clean Room Instruction Manual	Printed on ultra-low particulate, extractable, and sodium level clean room paper. Moisture-proof polyethylene binder, with plastic rings to eliminate metallic contamination.	140325
Stylus Replacement Kit	Recommended for changing styli. Includes reusable changing fixture, and all necessary tools in a handy storage tray.	139344

ACCESSORIES

Item	*Description*		*Part No.*
	Color Code	Size	
Styli	Black	25 micron radius	139307
	Red	12.5 micron radius	139117
	Orange	5 micron radius	139308
	Gray	2.5 micron radius	139309
	Green	Sub-micron radius	139331
Calibration Standards Set	Five Calibration Standards. Nominal 200A, 500A, 1KA, 5KA, and 50KA measurements.		138375
Individual Calibration Standards	Nominal 200A measurement		138365
	Nominal 500A measurement		138366
	Nominal 1KA measurement		138367
	Nominal 5KA measurement		138368
	Nominal 10KA measurement		138369
	Nominal 50KA measurement		138370
	Nominal 100KA measurement		138371
Individual Calibration Standards (VLSI)	Nominal 180A measurement		085350
	Nominal 440A measurement		085351
	Nominal 880A measurement		085352
	Nominal 4500A measurement		085353
	Nominal 9400A measurement		085354

REPLACEMENT PARTS

Thermal Printer Paper	For Omni 426 printer only	085542
Thermal Printer Paper	For Omni 40 or 42 printers only	085549
Clean Room Printer Paper	For Omni 426, 40, or 42 printers	085556
Illuminator Lamp	Standard Optics Lamp	040525
	Zoom Optics Lamp	140229

SERVICES AVAILABLE

Maintenance Agreements/Service Contracts

Factory Recertification of any Sloan Calibration Standard(s)

APPENDIX B

ZOOM OPTICS RETROFIT KIT OPTION

INSTALLATION

The Zoom Optics assembly attaches to its support arm with four #8-32 cap screws. This assembly has been prealigned at the factory and careful installation will ensure this alignment is maintained.

1. Mount Zoom Optics assembly to its support arm with four #8-32 cap screws (see Figure B-1). Register the assembly against the arm with the notch on the zoom bridge firmly against the support arm and the end of the support arm firmly against the plate on the zoom bridge. Plug lamp cable connectors together.

2. Connect camera cables to console.

3. Turn power on.

4. Lower optics with focusing knob on right side of Scan Head until sample is in focus. Adjust zoom at minimum magnification for ease of focusing.

5. Lower the stylus with stylus up/down key.

6. The stylus image should be within 1" to 1½" of the center of CRT. Adjust vertical position with focusing knob on side.

7. Increase magnification, the stylus image should remain in basically the same position on the CRT.

8. If the stylus image is not in proper position throughout the zoom range, the mounting screws holding the zoom to the support arm should be loosened and the assembly repositioned until it is in position.

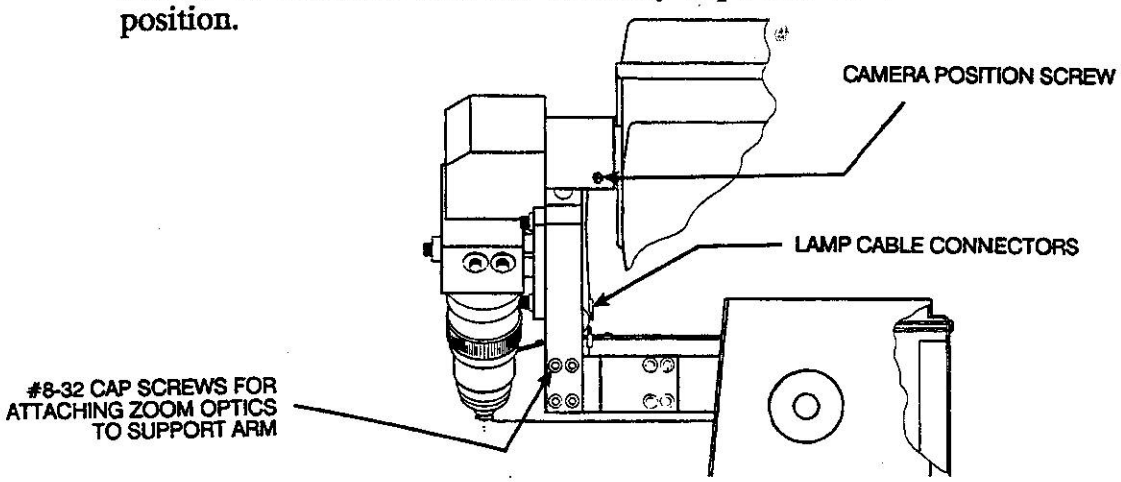

Figure B-1. Zoom Optics Installation

ADJUSTMENTS

If proper alignment cannot be obtained, make the following adjustments:

1. To adjust the stylus position up and down on the CRT, loosen the four #8-32 cap screws (see screws "A") and twist zoom assembly clockwise or counterclockwise as necessary. Tighten screws.

2. To adjust the stylus position right and left on the CRT. loosen the two #8-32 cap screws (see Figure B-2) and adjust front or back by turning #8-32 cap screw in front. Tighten screws.

3. To focus the zoom, turn knurled brass knobs behind zoom objective to move zoom in or out of optical axis.

4. To adjust the camera so the image remains in focus during zooming, loosen the #8-32 cap screw (see Figure B-1) holding the camera and reposition it as necessary. Tighten screw.

The illumination is provided by a light source to left of the sensor/stylus. The light source is adjusted so that the stylus will lower and come to rest in the center of the illuminated field. However, in some cases it may be necessary to readjust the light source slightly to improve the contrast of the image. To readjust the light source lamphouse slightly loosen the screw behind the lamphouse. This will allow the lamphouse to rotate on its support post. After finding the best position, retighten the screw.

WARNING

The high intensity lamp can quickly burn permanent images into the vidicon tube. Always defocus the zoom optics when not in use.

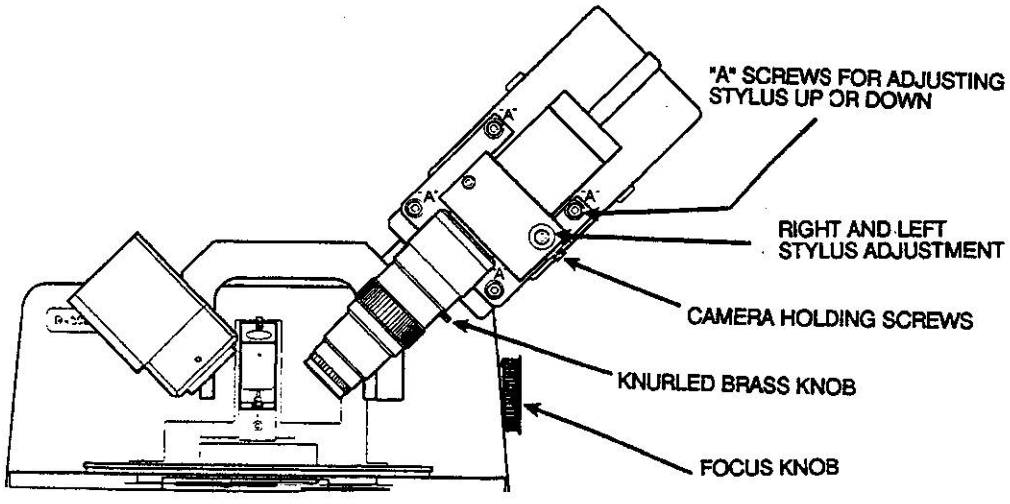

Figure B-2. Zoom Optics Adjustments

ILLUMINATOR LAMP REPLACEMENT

CAUTION

Do not touch lamp while power is on. The bulb is extremely hot.

1. Raise the stylus arm by raising the optics to the full up position using Optics Height Adjustment Knob.
2. Turn off the DEKTAK IIA.
3. Remove the screw attaching the cover plate to side of the illuminator and remove the cover plate.
4. Pull the lamp straight out.
5. Place a new bulb in the socket and check the reference dimension. For optimum illumination, set the bulb filament parallel to the filter (see Figure B-3). If the new lamp does not light, check the lamp wire connection at the rear of the optics bridge.
6. Replace the illuminator cover plate.

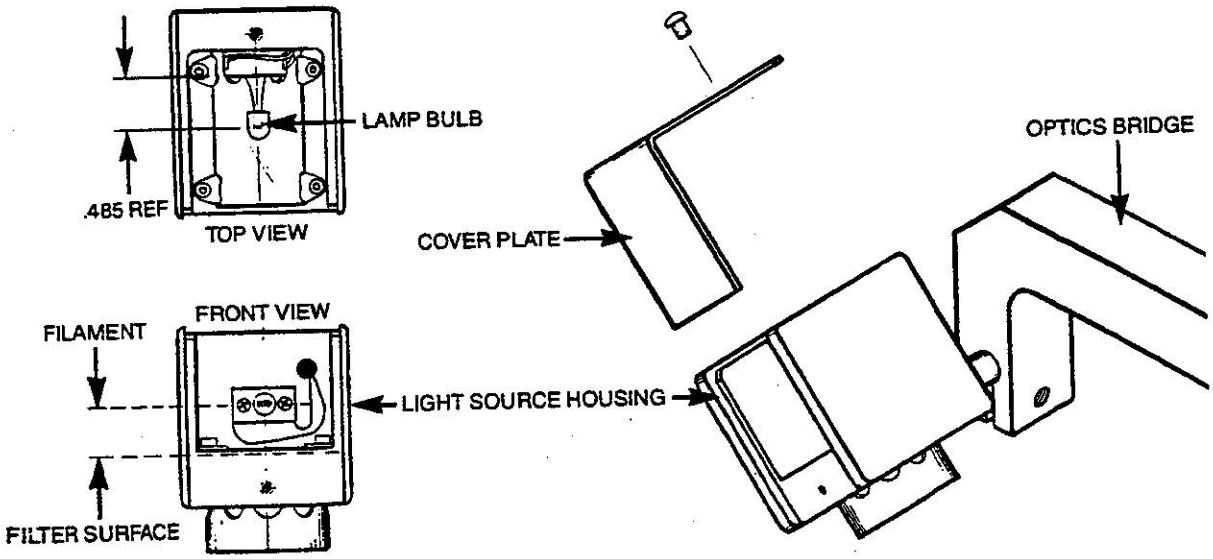

Figure B-3. Illuminator Lamp Replacement

APPENDIX C

RS232-C DATA TRANSMISSION

The DEKTAK IIA comes with an RS232-C computer interface. This allows all scan or program data to be transmitted to a host computer for further analysis or mass storage. This appendix describes the operation of the RS232 interface.

The output is described first, followed by descriptions of the system parameters. The appendix concludes with instructions on changing baud rate (9600 is standard).

DATA TRANSFER

When the **SEND** key is pressed, program or scan data is sent to the user's device on the RS232-C interface.

When the DEKTAK IIA is in the program mode, displaying one of the nine possible programs, the **SEND** function transmits all the program parameters in force, as shown in Figure C-1.

When the DEKTAK IIA is in the graphics display mode (as after a scan), the scan parameters and all of the data points are transmitted, as shown in Figure C-2.

```
     SLOAN DEKTAK II

PROGRAM          5
ID NUMBER        0
SCAN LENGTH      2MM
SPEED            MEDIUM
RANGE            AUTO
PROFILE          +325KA TO -325KA
AUTO LEVELING    NO
R CURSOR         1833uM
M CURSOR         1052uM

TIME             11:26
DATE             04-04-83
```

Figure C-1. Program Mode Transmission

If the left and right boundaries of the displayed trace are moved, and the trace replotted or magnified to expand an area of interest, the data transmitted is the displayed data, followed immediately by all the data taken (see Figure C-3).

The data sent is ASCII data and variable block length bounded by carriage return, line feed (CR-LF; ASCII:OD, OA HEX).

SYSTEM CHARACTERISTICS

The DEKTAK IIA's RS232-C interface is a transmit-only configuration (Interface Type A). Referring to the drawing of the connector, here are the pin designations and signal descriptions:

Pin Number	Signal Name	Description
1	PGND	Protective Ground
2	TD	Transmitted Data
5	CTS	Clear to Send
6	DSR	Data Set Ready
7	SGND	Signal Ground

Protective Ground

This pin is electrically bonded to the instrument or equipment frame. It may also be connected to Signal Ground.

Transmitted Data (TD)

Direction is to the data communication equipment. The DEKTAK IIA is DTE device. Signals on this circuit are generated by the data terminal equipment, the DEKTAK IIA. Signals are held in the marking condition during intervals between characters or words, and at all times when data is being transmitted.

Clear to Send (CTS)

The direction is from the data communication equipment. An "off" condition is an indication to the DEKTAK IIA that it should not transmit data. The "on" condition is an indication that the communication channel can accept on the Transmitted Data Circuit.

SLOAN DEKTAK II

ID NUMBER	0	VERT:	-0A
TIME	11:48	HORIZ:	8845uM
DATE	04-04-83		
SCAN LENGTH	10MM	R CUR	0A @ 0uM
SPEED	MEDIUM	M CUR	0A @ 8845uM

** DISPLAY DATA **

LEFT = 0

260	429	584	671	770	858	915	982	1032	1096
9059	21277	20699	12107	3790	1602	1404	1396	1399	1375
1370	1330	1314	1300	1290	1281	1267	1245	1240	1241
1254	1218	1186	1196	1168	1155	1172	1268	3320	5186
5351	5334	5311	5320	5387	5304	5246	5217	5208	5193
5178	5180	5181	5163	5147	5141	5131	5118	5109	5097
5102	5103	5093	5078	5049	5799	5535	5065	4985	4976
5091	5858	5190	5037	5132	5108	5042	5012	5002	4999
4989	4995	4992	4967	4953	4946	4946	4924	4924	4920
4931	4940	4937	4943	4962	4958	4957	4937	3793	1483
922	879	873	859	855	830	815	796	775	950
2949	11122	3157	882	780	802	816	805	802	818
804	802	772	767	750	715	693	690	766	746
719	729	726	711	692	687	702	700	700	998
1267	719	639	627	619	602	593	599	607	599
619	1130	3018	4296	4600	4637	4634	4627	4627	4627
4638	4656	4688	4656	4633	4641	4628	4612	4582	4572
4548	4557	4568	4569	4585	4656	4580	4534	4535	4535
4562	4550	4553	4558	4563	4562	4561	4553	4539	4538
4662	4795	4615	4577	4565	4576	4576	4580	4608	4702
5156	5224	4954	4798	4732	4717	4770	4757	4702	5167
5104	2697	1149	4639	3345	2029	1729	1625	1523	1464
1393	1395	1387	1370	1360	1338	1335	1352	1400	1456
2091	1578	1178	1107	1060	1060	1049	1033	1023	1020
1011	1003	1028	1020	1032	1034	1032	1038	1007	998
1020	996	1011	1033	1022	999	998	1013	1045	1082
1130	1214	1188	2028	4001	4996	5275	5359	5354	5336
5287	5238	5232	5225	5292	5594	5431	5199	5115	5074
5052	5034	5024	5019	4981	4949	4941	4926	4921	4911
4901	4935	5010	4907	4730	4688	4647	4619	4648	4591
4562	4550	4522	4489	4460	4433	4429	4430	4459	4445
4412	4445	4579	4637	4545	4472	4448	4391	4352	4461
4561	4396	3964	2040	528	247	213	196	209	174
151	150	155	205	169	149	130	128	138	126
108	116	166	182	113	68	50	37	39	58
50	33	20	26	49	64	1420	2934	812	421
295	243	222	200	191	196	204	202	193	189
178	188	208	223	230	584	2576	3910	4194	4207
4221	4214	4210	4232	4230	4225	4212	4222	4232	4216
4199	4200	4202	4187	4187	4188	4184	4191	4193	4193
4187	4171	4161	4150	4210	4900	4976	4600	4360	4246
4181	4172	4173	4157	4155	4145	4212	4204	4149	4131
4130	4116	4113	4110	4122	4136	4136	4140	4140	4128
4127	4131	4131	4129	4056	2778	579	52	14	-11
-3	-1	4	8	19	-4	-11	-3	-1	-0
7	5	-0	-0	5	-2	-4	-4	2	39
20	18	20	47	134	3655	6703	6955	6931	6907
6874	6900	6884	6878	6911	6880	6861	6881	6826	6834
6827	7084	6728	6193	6084	6102	6079	6413	8714	10226
10399	10330	10341	10274	10224	10246	10213	10196	10178	10175

RIGHT = 10000

Figure C-2. Graphics Display Mode Data Transmission

SLOAN DEKTAK II

ID NUMBER 0
TIME 11:49
DATE 04-04-83
SCAN LENGTH 10MM
SPEED MEDIUM

VERT: -0A
HORIZ: 8845uM

R CUR 0A @ 0uM
M CUR 0A @ 8845uM

** DISPLAY DATA **

LEFT = 5100

999	998	1013	1045	1082	1130	1214	1188	2028	4001
4996	5275	5359	5354	5336	5287	5238	5232	5225	5292
5594	5431	5199	5116	5074	5052	5034	5024	5019	4981
4949	4941	4926	4921	4911	4901	4935	5010	4907	4730
4688	4647	4619	4648	4591	4562	4550	4522	4489	4460
4433	4429	4430	4459	4445	4412	4445	4579	4637	4545
4472	4448	4391	4352	4461	4561	4396	3964	2040	528
247	213	197	209	174	151	150	155	205	

RIGHT = 6693

** ALL DATA **

260	429	584	671	770	858	915	982	1032	1096
9059	21277	20699	12107	3790	1602	1404	1396	1399	1375
1370	1330	1314	1300	1290	1281	1267	1245	1240	1241
1254	1218	1186	1196	1168	1155	1172	1268	3320	5186
5351	5334	5311	5320	5387	5304	5246	5217	5208	5193
5178	5180	5181	5163	5147	5141	5131	5118	5109	5097
5102	5103	5093	5078	5049	5799	5535	5065	4985	4976
5091	5858	5190	5037	5132	5108	5042	5012	5002	4999
4989	4995	4992	4967	4953	4946	4946	4924	4924	4920
4931	4940	4937	4943	4962	4958	4957	4937	3793	1483
922	879	873	859	855	830	815	796	775	950
2949	11122	3157	882	780	802	816	805	802	818
804	802	772	767	750	715	693	690	766	746
719	729	726	711	692	687	702	700	700	998
1267	719	639	627	619	602	593	599	607	599
619	1130	3018	4296	4600	4637	4634	4627	4627	4627
4638	4656	4688	4656	4633	4641	4628	4612	4582	4572
4548	4557	4568	4569	4585	4656	4580	4534	4535	4535
4562	4550	4553	4558	4563	4562	4561	4553	4539	4538
4662	4795	4615	4577	4565	4576	4576	4580	4608	4702
5156	5224	4954	4798	4732	4717	4770	4757	4702	5167
5104	2697	1149	4639	3345	2029	1729	1625	1523	1464
1393	1395	1387	1370	1360	1338	1335	1352	1400	1456
2091	1578	1178	1107	1060	1060	1049	1033	1023	1020
1011	1003	1028	1020	1032	1034	1032	1038	1007	998
1020	996	1011	1033	1022	999	998	1013	1045	1082
1130	1214	1188	2028	4001	4996	5275	5359	5354	5336
5287	5238	5232	5225	5292	5594	5431	5199	5115	5074
5052	5034	5024	5019	4981	4949	4941	4926	4921	4911
4901	4935	5010	4907	4730	4688	4647	4619	4648	4591
4562	4550	4522	4489	4460	4433	4429	4430	4459	4445
4412	4445	4579	4637	4545	4472	4448	4391	4352	4461
4561	4396	3964	2040	528	247	213	196	209	174
151	150	155	205	169	149	130	128	138	126
108	116	166	182	113	68	50	37	39	58
50	33	20	26	49	64	1420	2934	812	421
295	243	222	200	191	196	204	202	193	189
178	188	208	223	230	584	2576	3910	4194	4207
4221	4214	4210	4232	4230	4225	4212	4222	4232	4216
4199	4200	4202	4187	4187	4188	4184	4191	4193	4193
4187	4171	4161	4150	4210	4900	4976	4600	4360	4246
4181	4172	4173	4157	4155	4145	4212	4204	4149	4131
4130	4116	4113	4110	4122	4136	4136	4140	4140	4128
4127	4131	4131	4129	4056	2778	579	52	14	-11
-3	-1	4	8	19	-4	-11	-3	-1	-0
7	5	-0	-0	5	-2	-4	-4	2	39
20	18	20	47	134	3655	6703	6955	6931	6907
6874	6900	6884	6878	6911	6880	6861	6881	6826	6834
6827	7084	6728	6193	6084	6102	6079	6413	8714	10226
10399	10330	10341	10274	10224	10246	10213	10196	10178	10175

Figure C-3. Magnified Trace

Data Set Ready (DSR)

The direction is from the data communication equipment. This signal is used to indicate the state of the local data set. An "on" condition indicates that the local data communications equipment is connected to the communications channel.

NOTE

The DEKTAK IIA has the DSR signal internally jumpered in the "on" state. To tie this signal to the communication interface, follow the steps under interconnections in this appendix.

Signal Ground (SGND)

This conductor establishes the common ground reference potential for all interchange circuits.

ELECTRICAL SIGNAL CHARACTERISTICS

For data interchange, the signal is considered in the marking condition when the voltage is more negative than -3 volts (with respect to signal ground). The signal is considered in the spacing condition when the voltage is more positive than +3 volts.

For timing and control signals, the function is considered "on" when the voltage is more positive than +3 volts, and considered "off" when the voltage is more negative than -3 volts. The following table summarizes this information.

Notation	Interchange Voltage	
	Negative	Positive
Binary State	1	0
Signal Condition	Marking	Spacing
Function	off	on

MESSAGES

Five messages are displayed in conjunction with the send command. They are:

1. SEND or SEND or SEND
   9600 1200 300

   This message tells the user that the instrument is sending data and the baud rate at which it is being send. The baud rate is factory set at 9600, baud rates of 12 and 300 are also available.

2. SENT or SENT or SENT
   9600 1200 300

   This message tells the user that the DEKTAK IIA has completed the transmission of its data.

3. NO
   HRDWR

   No hardware. This tells the user that his DEKTAK IIA does not have circuitry installed for communication. This could also be an indication that there is a hardware failure within this circuitry.

4. WRONG
   JUMPR

   Wrong jumper. This tells the user that the baud rate jumper is not properly installed (See Figure C-5 for proper installation).

5. RS232
   TIMOUT

   This time-our message tells the user that the attached data communication equipment does not want to receive any data or there may not be any equipment attached to the DEKTAK IIA.

NOTE

If CTS (Clear To Send) or DSR (Data Set Ready) is "off" for more than 10 seconds during data transmission, the DEKTAK IIA will time-out and abort the SEND command.

DATA TRANSFER RATE

The rate at which asynchronous data is transferred is determined by the baud rate. Three baud rates are available: 300, 1200, and 9600. These can be selected internally in the DEKTAK IIA, as shown below. The DEKTAK IIA is shipped with a baud rate of 9600.

Interconnections

Changing the baud rate and modifying the RS232-C connector requires disassembling the DEKTAK IIA Console. The steps required are discussed below.

NOTE

These steps should be performed by a Veeco/Sloan Representative. However, authorization to enter the instrument without voiding the warranty can be obtained by calling the factory for an authorization number.

1. Be sure the power switch is off and the power cord is removed.
2. Remove all cables from the console's back panel.
3. Remove all seven cover screws from the bottom of the console. The console should not be tilted, or rested on its back or side. Remove the screws from the bottom by extending the console over the edge of the worktable, one side at a time. Note that an additional six screws appear through the cover. Do not remove these now.
4. Carefully slide the console cover away from the rear panel. When the cover has been removed about halfway, reach through the CRT bezel and unplug the keyboard cable from the main PC board. Then slide the housing off the rest of the way.
5. The baud rate can now be changed by referring to the Figure C-4.
6. To access the RS232-C connector, remove the six flat head screws from the console. (Do not tilt or rest the console on its back or side.) This allows removal of the monitor assembly from the PC board assembly.
7. Carefully tilt the chassis back and unplug the four connectors at the back of the main PC board. The monitor assembly can now be fully removed from the PC board assembly.
8. Change the interface connector as required, following Figure C-5.
9. To reassemble the console, reverse the steps above.

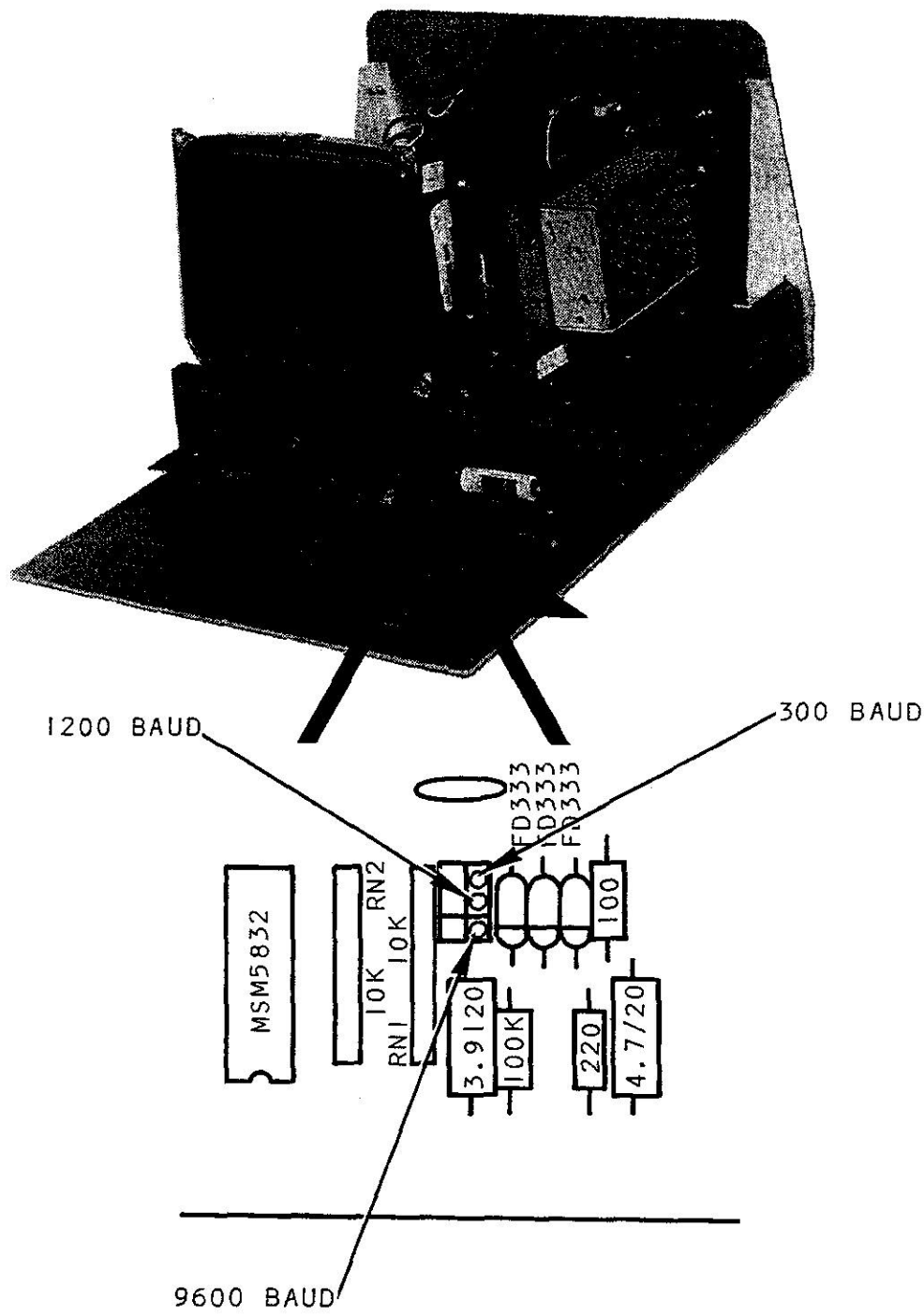

Figure C-4. Baud Rate Selection

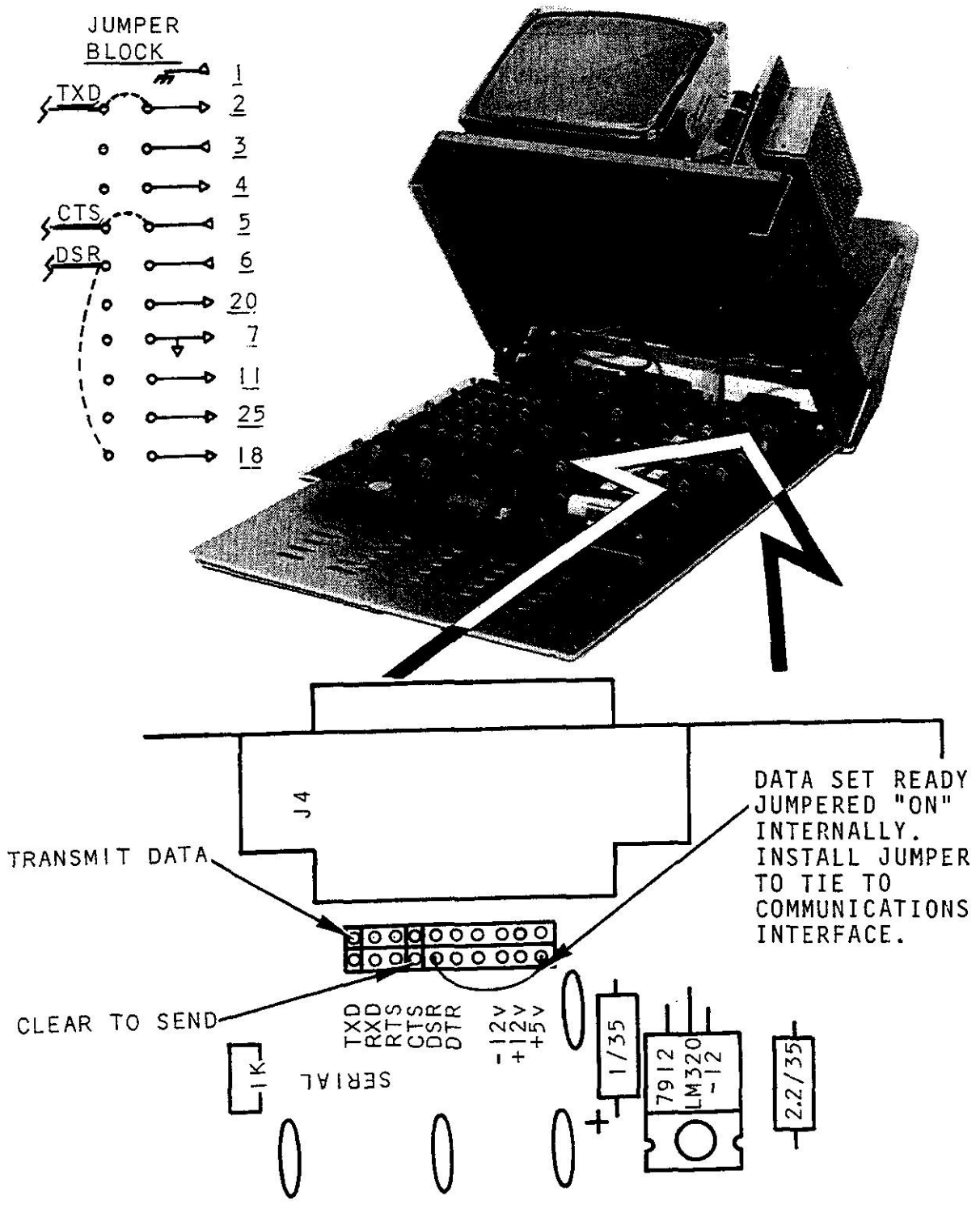

Figure C-5. RS232-C Interconnection

ANSWERS TO COMMONLY ASKED QUESTIONS

1. *How can the host computer tell DEKTAK when it's ready to receive?*

   It's necessary to tie the data set ready (DSR) signal to the communications interface.

2. *How much storage do I need?*

   10 Kbytes for a regular trace
   18 Kbytes for a "magnified" trace

3. *Can multiple DEKTAK IIA's be connected to a host computer?*

   The host computer must have multiple ports, sufficient buffer storage, and be able to establish priorities.

4. *How many bits per word?*

   8

5. *What parity is used?*

   None

6. *How many stop bits are used?*

   2

7. *What tells the host computer that the transmission is completed?*

   No special code is used, so you'll need to time it. If more than a few milliseconds have elapsed without reception of data, it is safe to assume that transmission is over.

8. *What hardware is used for serial interface?*

   The Intel 8251 USART chip.

9. *Can we operate at a different data transfer rate?*

   As long as it's one of the 300, 1200, or 9600 baud rates. All other rates are out.

10. Computer is Intel 8085 chip.

11. Analytical functions are not sent.

INDEX