S-1160 SERIES

General Purpose Analytical Probe Station

The Signatone S-1160 Series is designed to support a broad range of precision probing applications, including hybrids, MCM's, wafers, and packaged parts. With its comprehensive suite of optional accessories, and available 4", 6", and 8" wafer chucks and stages, the S-1160 is the ideal multi-purpose analytical platform, and the industry standard price and performance leader.

PERFORMANCE, QUALITY, VALUE

SIGNATONE®

Advanced Microprobing Solutions Since 1968

SIGNATONE

S-1160 Series

General Purpose
Analytical Probe
Station

S-1160 OPERATION MANUAL

LETTER FROM THE PRESIDENT

Dear Customer:

Congratulations; you have purchased a SIGNATONE S-1160 series, 1 micron, analytical Probe Station. We have taken extra care to design, manufacture, test, and ship this Prober to you in such a manner that it will give long and quality service.

This manual includes a number to picture description of the function of the controls for the Prober, and a discussion of the use of the many accessory parts available to assist you. If you find the Prober does not function per specification upon receipt at your facility, or the instructions are unclear, please call me personally at (408) 848-2851. I am anxious to help ensure you get the service you deserve from this product. If I am not immediately available, please leave a message so I can return your call, or ask for one of our qualified service technicians.

In addition to the accessories discussed in this manual, SIGNATONE will announce, in the next year, several new products to assist in detailed analytical probing. I plan to send a description of the new products to you as soon as the announcement comes. If you have a need for accessories or features not presently available, please let me know. We are always interested in new ideas from our customers.

Thank you again for purchasing from SIGNATONE. We are truly anxious to give you good service.

Sincerely,

L. Brent Dickson
President

WARRANTY

WARRANTY DISCLAIMER. Signatone warrants only to Customer that the Products will comply with Product specifications and that the Products will operate properly under proper use and normal conditions without defects in parts or labor that prevent such operation for a period of 12 months after the individual Product shipment dates. (except Probe-tips and Probe tip Holders) Minor defects or deviations from Product specifications that do not materially affect such operation will not constitute a breach of warranty or a failure to meet specifications. Signatone warrants only to Customer that the Services will be promptly performed in a competent manner. THERE ARE NO OTHER WARRANTIES THAT EXTEND BEYOND THE PRODUCT SPECIFICATIONS AND DESCRIPTION CONTAINED IN THE CONTRACT. COMPANY DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY THAT THE PRODUCTS ARE MERCHANTABLE OR THAT THE PRODUCTS ARE FIT FOR A PARTICULAR USE OR PURPOSE EVEN IF THE PARTICULAR USE OR PURPOSE IS DISCLOSED TO COMPANY IN ADVANCE.

LIMITED REMEDIES FOR BREACH OF WARRANTY. Defective Products may be returned to Company freight prepaid only after obtaining a Return Material Report Number from Company. If after testing and inspection, any such returned Product is determined by Company to be defective, Company shall promptly repair or replace the Product and return it to Customer freight prepaid. CUSTOMER HAS NO OTHER REMEDY FOR BREACH OF WARRANTY OR FAILURE TO MEET PRODUCT SPECIFICATIONS.

LIMITATIONS OF LIABILITY AND DAMAGES. COMPANY SHALL NOT BE LIABLE FOR INJURY TO ANY PROPERTY OTHER THAN THE PRODUCTS AND IN NO EVENT SHALL COMPANY BE LIABLE FOR ANY DIRECT OR INDIRECT, CONSEQUENTIAL, INCIDENTIAL OR SPECIAL DAMAGES.
INDEMNITY BY CUSTOMER. Customer shall defend and indemnify Company against any claims that are based upon any subsequent resale of the Products by Customer or upon any sale by Customer of any of its products that contain the products.

PATENT AND TRADEMARK INFRINGEMENT DEFENSE AND INDEMNITIES.
Company shall with the cooperation of Customer defend and indemnify Customer against any claims that the manufacture or sale of the Products by Company or that the ordinary use of the Products by Customer constitutes a violation or infringement of US patents (except process patents) or trademarks. Customer shall defend and indemnify Company against any claims that use or combination of the Products by Customer with any materials or products not sold by Company constitutes a violation or infringement of any US or foreign patents covering the use or combination of the Products by Customer. Customer shall defend and indemnify Company against any claims that manufacture or sale of Products manufactured to Customer specifications constitutes a violation or infringement of any US or foreign patents or trademarks. SALE OF THE PRODUCTS BY COMPANY CONVEYS NO EXPRESS OR IMPLIED LICENSE UNDER ANY PATENT OWNED OR CONTROLLED BY COMPANY.

II. UNPACKING AND SET-UP

A. UNPACKING / SPACE

After the crate has been opened, carefully lift the Prober by the base. **DO NOT LIFT BY PLATEN OR BY THE CHUCK**. Lift by the base casting and the base of microscope. Clear a space on a solid table, which will hold the 125-pound weight of the Prober.
The actual dimensions of the Prober are: 20.5" Deep, X 26.5" Wide, X 22" High, with the microscope in place. Approximately 2" extra is required in depth direction to allow for Microscope "Y" travel & cables, and approximately 6" extra in width to allow for easy use.

If the system is to be used with a High Powered microscope at high magnification, the table should be placed on a solid, vibration-free floor. At high magnifications, all microscopes are sensitive to room vibration, therefore, if the Prober is placed in an environment where vibrations occur, such as an upper floor of a building, etc., a vibration table may be required

B. UTILITIES

The only outside utility required for the Prober is a vacuum source through a 1/4" line of plastic or metal. The vacuum is used to hold the wafer, optional vacuum-base micropositioners, and the socket-card adapter in place, so the flow of vacuum is extremely small. We have specified 20" mercury pressure at .1CFM.

The microscope light requires 175 Watts at 120V (Fuse = 2.0 AMP SLO-BLO). Please check the rating on the microscope power box to be sure of proper voltage.

C. MOUNTING MICROSCOPE

If you have purchased a High Powered microscope (Mitutoyo Fine Scope or Leica Microzoom-2) from SIGNATONE, a portion of the mounting bracket is fixed to the back of the focus mechanism. Remove the 4 ea. 6/32X1/2" socket-cap screws from the microscope mount. Hold the microscope against the front part of the microscope mount, and carefully screw in the 4 screws. Tighten snugly with an Allen wrench. Plug the microscope light cord into a power supply. Turn on the light and adjust focus under LOWEST power until a clear image of the wafer chuck is obtained.

If you purchased a microscope from another source, both halves of the microscope mount have been shipped. Please remove the 4 ea. 6/32X1/2" socket-cap screws, freeing the post of the mount which attaches directly to the microscope. Mount the post on the back of the microscope using the 4 socket-cap screws furnished, then proceed as described above.

In the event that the microscope cannot be focused on the chuck surface due to the setting of the microscope mount, remove the microscope and loosen the 4 socket-cap

screws in the long slots on the microscope mount, adjust the position of the microscope mount appropriately and re-attach the microscope.

If you have purchased the Stereozoom type microscope, the mounting plates described above are absent, and in their place is a block with a 1/2” diameter hole and a large thumb-screw. Insert the post of the focus section of the microscope into the hole and tighten the thumbscrew.

III. Operation

A. USE OF CONTROLS

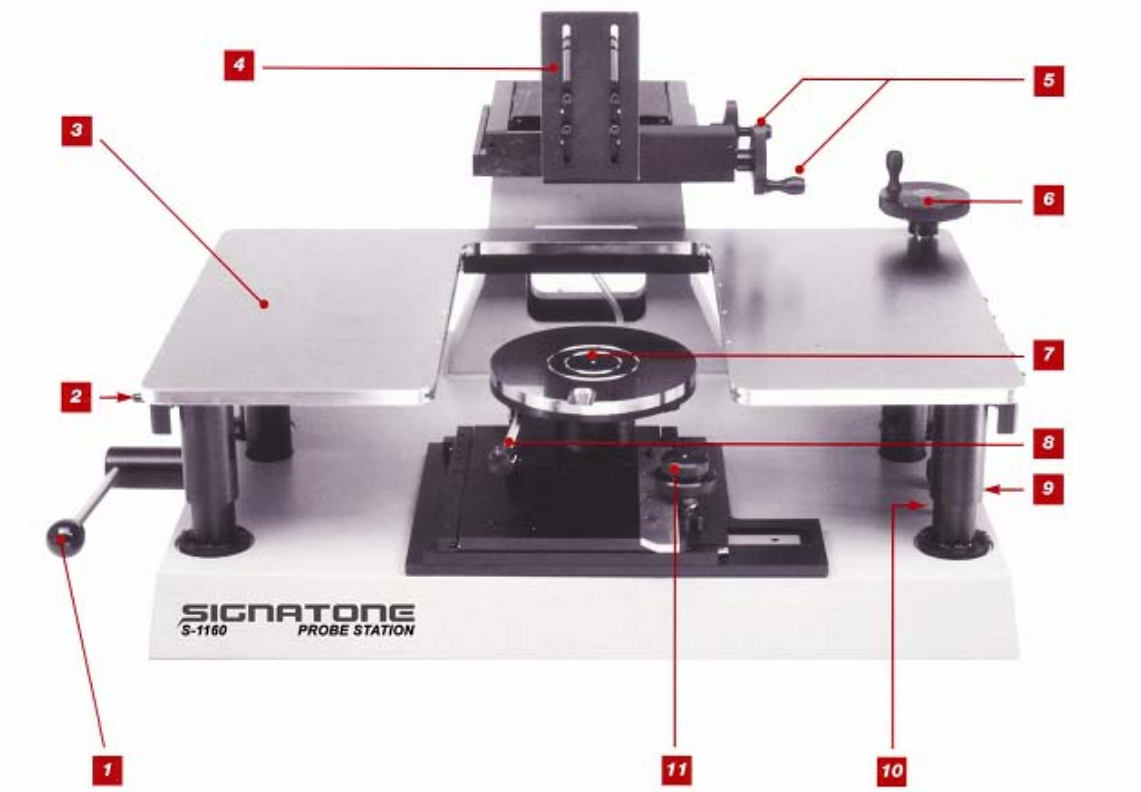

Figure 1 S-1160 Controls

1. **Linear Platen Lift**. This lever raises and lowers the platen up to 1/2” in a linear motion. This is a coarse motion for making contact or removing contact of probe tips with wafer surface. The probe tips are held either by a micropositioner or a probe card, both of which are mounted to the platen. A friction stop allows for continual vertical positioning of the platen. The platen lift is used for lifting the probe tip and indexing the wafer being probed to a new position, then lowering the probe tip.

2. **Vacuum Ports and Signal Connections**. Five vacuum ports on each side of the platen connect to vacuum based micropositioners. The signal jacks are color-coded phone tip jacks & or BNC’S with a coaxial wire connected to the banana jack/binding post or corresponding BNC at the rear of the Probe station.

3. **Large Steel Platen**. The steel platen is ground flat and planerized to the chuck and will accept up to 10 vacuum base or magnetic base micropositioners and a probe card adapter.

4. **Microscope Mount**. This mount is adjustable and permits easy modification for mounting hot or cold chucks.

5. **X-Y Microscope Stage**. This stage is easily moved with a Course & Fine X-Y motion. 6" of X-Y Course movement allows scanning of large areas without lifting the probe tips. 2" of X-Y fine adjust is excellent for positioning the microscope over small geometry's.

6. **Fine Platen Adjustment**. The control knob, in conjunction with the linear platen lift (Item 1) controls the vertical position of the platen, and therefore, controls the probe tips. The fine adjust allows for careful overdrive of probe tips, and is particularly useful when probing with a probe card. In addition, the adjust knob will raise and lower the platen approximately 2" in height to allow for probing samples of various thickness' on the chuck surface without changing probe tip holders, micropositioner settings, etc. For instance, to change from probing a 20-mil thick wafer to probing a packaged device with a socket card, one should note that the surface of the packaged device is approximately 1/2" higher than the wafer surface. The necessary adjustment then, is made by first raising the microscope, turning knob #6 to raise the platen and probe tips prior to inserting the sample.

7. **Vacuum Chuck**. The 6" vacuum chuck permits 3" to 6" wafers to be held and probed. The 8" Vacuum chuck permits 4" to 8" wafers to be held and probed. The chuck is nickel-plated brass.

8. **Rotation Lever**. This lever will rotate the chuck 360 degrees, making it very easy to align, with probe cards in place.

9. **Vacuum Port Damper Knob**. When the micropositioner vacuum-hold button is released, the micropositioner may be moved. However, there should still be some drag. This knob controls the amount of drag, and may be set to the users desired feel.

10. **Chuck Vacuum Switch**. The toggle switch toggles the chuck vacuum on and off, for holding the sample or fixture to the chuck.

11. **X-Y Stage Control Knobs**. The X-Y stage is a rack-and-pinion gear assembly with high resolution positioning. The compound knob permits easy moving of the chuck in both directions at the same time. The X motion stage travels 1.125" per knob revolution, and the Y motion stage travels 1.6" per knob revolution. There should not be any noticeable X or Y backlash, or play, in the controls.

B. PROBING WITH MICROPOSITIONERS

The SIGNATONE micropositioners are described in section IV (accessories). Vacuum-hold or magnetic-hold micropositioners are available. Vacuum-hold is preferable because the vacuum can be released, allowing gross movements without over correcting the strong force of the magnetic-hold type. Either hold-down method will give a stable and firm platform for the micropositioner. The choice of probe holder and probe tip type is a matter of customer preference, and the options are described in section D. Probing at high magnifications requires that the sharp probe tip be placed under a microscope objective, which is approximately 1/2" above the silicon wafer. The objective will be pivoted to change the magnifications of the microscope. Therefore, the probe holder should be bent to provide a low profile, and a "Z" type probe tip should also be used.

Probing is straight forward if the following guidelines are used:

1. Center the sample on the wafer chuck and adjust the platen and microscope height such that the probe tips are out of contact slightly above the sample

2. Center the microscope stage and the area of interest of the sample under the microscope.
3. Turn the microscope to the lowest magnification. With the gross movement, bring probe tip into center of field-of-view. The micropositioner drives should also be centered.

4. Bring the probe tip down to a near proximity of the surface of the sample so that it will remain visible at higher magnifications.

5. Increase the magnification by either the zoom method or by rotating the turret, changing the objectives, and then re-center the probe tip in your field-of-view.

6. Repeat step 5 until the probe tip is visible at the desired magnification, then carefully position the probe tip over the area of interest and lower it for contact. Contact can be determined when the probe tip slides laterally. Care should be taken NOT to overdrive sharp probe tips because they will either bend or damage the wafer.

C. PROBE CARDS AND MICROPOSITIONERS

The S-1160 is designed to use a probe card adapter, S-4710. The probe card adapter is mounted to the upper surface of the platen and holds the probe card above the chuck, such that the probe tips protrude underneath the platen. Care should be taken when mounting the probe card to ensure adequate vertical clearance is allowed above the sample surface, by adjusting the 'fine' platen knob #6. The probe card is mounted by loosening the screws on the probe card adapter and then sliding the probe card in the under side of the adapter, above the wafer surface, on rails provided. The probe card should be seated in the socket in the back of the adapter, and then the screws re-tightened. Because the S-1160 is a manual Prober, no probe card rotation is required.

The microscope should be centered above the hole in the probe card at low magnification, and the wafer rotated, using the rotation lever, until it is aligned with the probe card. At this point the platen and probe card are carefully lowered to make contact with the wafer by using the ‘fine adjustment knob #6. Standard probe cards are designed to have approximately .003” of overdrive.

Many probe cards have a large number of probes. Therefore, one needs to be careful to align all probes with the appropriate contact pads. The alignment can be checked by focusing on the contact pads at high magnification and moving the microscope around to check each pad. If a Stereozoom microscope is used, a Ring Illuminator is recommended (SEE section IV) to eliminate confusing shadows. With the probe card in contact with the wafer surface, the device may be activated. Additional probes can be used to analyze the operation of the circuit by following the procedure described in using micropositioners. Generally, an active probe (SEE section IV G) would be used so that the presence of the Prober does not effect (the electrical loading) the operation of the device. Care must be taken in placement of additional probe tips so that damage to the probe card or probe tips is prevented. Additionally, care must be taken when raising the probe tips or probe card above the wafer surface, to prevent collision with the microscope objective.

IV. ACCESSORIES

Included in this section are written descriptions to assist you in selecting and using the various accessories available for the S-1160 Prober. For more information please visit our website at: **www.Signatone.com**

A. MICROPOSITIONERS

S-926/S-931 Both the S-926 and the S-931 are designed with many features, which allow probing of micron and sub-micron geometries. They are made from precision machined aluminum and brass. Both feature true linear X-Y-Z motion with 100 threads per inch drives. Designed to be versatile and fit on most probe stations, the S-926 and S-931 have an excellent range of set-up motion and three different style heads to choose from.

S-725 The S-725 is designed for general purpose probing of LSI circuits and hybrids. The independent, 80 threads per inch motion allow accurate positioning to 5 microns. The .5-inch scanning area allows positioning on even the largest circuits and flexibility in probing hybrids.

S-750 The model S-750 was developed specifically for contacting larger areas (Pads). Its small size and simple design make it easy to place many probes down on one device & where platen space is limited

B. PROBE HOLDERS AND PROBE TIPS

The probe holder is the brass connector between the micropositioner and probe tip. It is made of brass to be malleable, and a good electrical conductor. Several lengths and configurations are available as described in this section.

C. MICROSCOPES

1. Two general types of microscopes are used for probing. For magnifications higher than 105X, use the compound, Leica Microzoom or Mitutoyo Fine scope or A-Zoom. The Leica & Mitutoyo microscopes are characterized by having several objectives mounted on a turret. Changing objectives changes the magnification. The magnification can be calculated by multiplying the objective magnification by the body (including any zoom magnification) by the eyepiece magnification. Each objective has a numerical aperture, which is related to its resolving power. AS a general rule, images of magnifications more than 1500 times the NA of the objective tend to “wash-out” or become empty; meaning, in general, a bigger image, but little more detail is seen. As an example, the Leica Microzoom standard 50X objective has a NA of .45. Images at 500X magnification are fairly crisp, but in the range of 700X the image becomes very soft. Therefore, the use of high magnification eyepieces to increase the magnification gives limited results. The A-Zoom (offered by ready Products)

includes one objective with a 40-1 Zoom capability. This allows a large range of magnification without moving or turning the objective position.

SIGNATONE offers the Leica Microzoom, Mitutoyo Fine scope, compound microscopes, and the Ready products A-Zoom.

2. The Stereozoom microscope is characterized by having long working distances, approximately 3 inches, and a zoom capability, which gives magnifications of the zoom power times the eyepieces used. The lower priced Stereozoom microscopes have indirect illumination, and therefore, you see a dark filled image with no color at magnifications from 8X to 80X. The Leica Stereozoom 7 has a coaxial light source, which gives a light filled image and magnifies between 15X and 105X if 15X eyepieces are used.

3. In addition to the coaxial light source built into the Stereozoom 7 or compound microscopes, both incandescent Nicolas Illuminators and fluorescent Ring Illuminators are available. The ring illuminator mounts directly to the bottom of the microscope and presents a ring of light to the probing area, which eliminates shadows. (Highly recommended for use with probe cards.)

D. S-4710 PROBE CARD ADAPTER

The probe card adapter is used to mount all standard 4 1/2" and 5 1/2" wide probe cards to the platen of the S-1160 Prober. Standard models are available in 5" or 6" lengths with 48 to 72 pin connectors. Please call the factory for probe card adapters of wider dimensions, or double ended connectors, etc.

E. TRANSFERABLE HOT CHUCK SYSTEM

The transferable Hot Chuck System combines SIGNATONE's intelligent Temperature Controllers with our 4,6, or 8" Thin/Transferable Hot Chucks to create a quick and simple way to probe wafers at elevated temperatures on your existing probe station. The chuck will typically heat from 30C to 300C in 6-10 minutes (cooling time dependent on chuck Size), and cool from 300C to 30C in 6-10 minutes.

The gold or nickel-plated hot chuck is held by vacuum onto the probe station and requires no mounting hardware (Vacuum Hold Down). This unique hot chuck can easily be transferred from one probe station to another. A continuous cooling line at the base of the chuck prevents heat transfer to the probe station. These hot chucks are available with a variety of controller packages.

F. ACTIVE PROBE SYSTEM

This system, made by Picoprobe, is most popular. It includes the following: SP-12 active probe arm, power supply, a 1 micron, a 3 micron, and a 5 micron active probe tips, and a choice of micropositioner mounting. The high input impedance amplifier is placed approximately 1/4" from the probe tip to reduce circuit loading by stray capacitance, leakage, etc.

G. VIDEO SYSTEMS

1. A 14” color monitor system includes a 14” Sony color monitor, color camera and focal tube adapter for the microscope.
2. A 20” color monitor system includes a 20” Sony color monitor, color camera and focal tube adapter for the microscope.

H. VIBRATION TABLES

SIGNATONE offers vibration tables made by Kinetic Systems Corp., plus various tabletop vibration feet, etc. Please call the factory for information.