Proforma™ 300i Series
Measurement for Semi Conducting, Semi Insulating, and Photo Voltaic Wafers

Users Manual

MTI Instruments Incorporated
325 Washington Avenue Extension, Albany, New York 12205 USA
Phone (518) 218-2550 or 800-342-2203 (USA Only)
Fax (518) 218-2506
Web www.mtiinstruments.com
Email sales@mtiinstruments.com
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FCC NOTICES

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the manufacturer's instruction manual, may cause interference with radio and television reception. This equipment has been designed as a Class A digital device of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference, which can be determined by turning the equipment off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Relocate the instrument with respect to the other device.
- Plug the instrument into a different outlet so that the instrument and the other device are on different branch circuits.


Information in this manual is subject to change without notice.

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SAFETY WARNINGS

Warning Symbol Definitions

Electrical Shock/Electrocution Hazard.

DISCLAIMERS

Language Requirements

DISCLAIMER: EU LANGUAGE REQUIREMENTS
This is the Original Instructions version of the User Manual. It is illegal to operate this equipment in a European Union (EU) Member State unless the manual is written in an official language of the Member State. Contact MTI Instruments for the availability of translated manuals.

Use Requirements

DISCLAIMER: USE OTHER THAN INTENDED PURPOSE
Using this product in a manner or a purpose other than the manner or purpose specified by the manufacturer may impair the safety features of this product.

Electrical Shock Hazard Areas

WARNING: ELECTRICAL SHOCK/ELECTROCUTION HAZARD
This equipment is connected to AC mains power. There are no user serviceable parts within the controller box. Do not attempt to open the controller box or insert foreign objects into the box vent openings.
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1 INTRODUCTION

1.1 Proforma™ 300i Series System Description
Proforma 300i utilizes MTI’s Push-Pull Capacitance technology to accurately and reliably measure Semi Conducting, Semi Insulating, and Photovoltaic Wafers up to 300mm.

<table>
<thead>
<tr>
<th></th>
<th>300i</th>
<th>300Gi</th>
<th>300OEMi¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy²</td>
<td>±0.25um</td>
<td>±0.25um</td>
<td>±0.25um</td>
</tr>
<tr>
<td>Repeatability³</td>
<td>±0.25um</td>
<td>±0.25um</td>
<td>±0.25um</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.05um</td>
<td>0.05um</td>
<td>0.05um</td>
</tr>
<tr>
<td>Response Time</td>
<td>60ms</td>
<td>60ms</td>
<td>Custom</td>
</tr>
<tr>
<td>Supported Wafer Sizes</td>
<td>50-300mm</td>
<td>50-300mm</td>
<td>Custom</td>
</tr>
<tr>
<td>Wafer Thickness Range</td>
<td>100-1000um</td>
<td>100-1000um</td>
<td>Custom</td>
</tr>
<tr>
<td>Known Supported Materials⁴</td>
<td>Si, Ge, InP</td>
<td>Si, Ge, GaAs, InP</td>
<td>Si, Ge, InP</td>
</tr>
<tr>
<td>Weight</td>
<td>12.3kg</td>
<td>12.4kg</td>
<td>5.9kg</td>
</tr>
<tr>
<td>Dimensions (LxWxH):</td>
<td>482x330x279mm</td>
<td>482x330x279mm</td>
<td>483x388x89mm</td>
</tr>
<tr>
<td>Temperature (Operational):</td>
<td>15-40ºC</td>
<td>15-40ºC</td>
<td>15-40ºC</td>
</tr>
<tr>
<td>Electrical Input (Voltage):</td>
<td>100-240VAC</td>
<td>100-240VAC</td>
<td>100-240VAC</td>
</tr>
<tr>
<td>Electrical Input (Frequency):</td>
<td>50-60Hz</td>
<td>50-60Hz</td>
<td>50-60Hz</td>
</tr>
<tr>
<td>Electrical Input (Power):</td>
<td>50Watts</td>
<td>50Watts</td>
<td>50Watts</td>
</tr>
<tr>
<td>Data Interfaces:</td>
<td>LCD, RS232, Ethernet, USB</td>
<td>LCD, RS232, Ethernet, USB</td>
<td>RS232, Ethernet</td>
</tr>
</tbody>
</table>

1.2 Proforma™ 300i Series Specifications

1.3 Receiving Inspection Procedure
The Proforma™ 300i series products are shipped from MTII fully assembled and packed in a cardboard carton with foam supports to guard against shipping damage. If a heavy duty shipping case was ordered, the product will be in the heavy duty shipping case and the heavy duty shipping case will be packed in a cardboard carton. Upon receipt, perform the following procedure before using the unit to perform dimensional measurements:

1) Inspect the exterior of the shipping carton. Note any obvious damage. If shipping damage is evident, file a claim with the carrier.

2) Remove the product from the carton and inspect for damage. Do not lift the instrument by grasping the LCD display or upper probe arm assembly.

3) If any problems were found contact MTII at 1-518-218-2550.

¹ The OEM model consists of the acquisition system and probes only. As such, several parameters will be dependant on the custom installation parameters. Contact MTI Instruments to discuss custom applications and expected performance in these applications.

² At constant 22ºC.

³ Within limits of repositioning.

⁴ The ability to measure can vary dependant on several factors (such as bulk resistivity).
Return Shipment Procedure

Please obtain a Returned Materials Authorization (RMA) number via the MTI Instruments web site (http://www.mtiinstruments.com/contactus/salesandservice.aspx). Reference the instrument's name, model and serial numbers on all correspondence. Follow the instructions on the MTI Instruments web site for making a return.

NOTE: Please make sure that an RMA number is obtained prior to returning any product to MTI Instruments. Products that are received at MTI Instruments without an RMA number may be returned without inspection or service.
2 INSTALLATION INSTRUCTIONS

2.1 Handling
Always grip and move the Proforma™ 300i and Proforma™ 300Gi by gripping the lower side panels and bottom of the product. The Proforma™ 300i and Proforma™ 300Gi have an upper probe arm which also supports the display assembly. Do not move or lift the product by the probe arm or the display. Doing so may create a permanent misalignment which will result in a loss of accuracy.

2.2 Environmental Considerations
The performance of the Proforma™ Series products can be affected by temperature variations. For maximum performance, the Proforma™ Series products should be installed in a location where temperature variations are controlled to ±1°C. The unit should not be placed directly in the path of moving air that results from heating and cooling ductwork/vents. A tool used in environments where the temperature changes ±5°C should be calibrated frequently.

Some materials, such as GaAs, have conductivity changes as a result of exposure to infrared light (>700nm). When the Proforma™ 300Gi is to be used to measure materials that are sensitive to infrared light, the unit should be placed away from light sources that produce such light. Sources of infrared light include the sun (through glass), halogen lighting, certain LED diodes, and incandescent lamps. Generally, fluorescent lighting is not a significant source of infrared light.
2.3 System Setup

2.3.1 Proforma™ 300i and Proforma™ 300Gi Setup

The Proforma™ 300i and Proforma™ 300Gi should be placed on a sturdy and rigid surface that is approximately level. The surface should not vibrate or shake. Using the bubble level on the top plate as a reference, adjust the 2 front leveling feet so that the table top is level.

Using a Phillips #1 screwdriver, remove the 3 shipping screws attached at the rear of the unit and place them in the plastic bag that contains the alignment pins.

![Rear Panel Diagram](image-url)
2.3.2 **Proforma™ 300i and Proforma™ 300Gi Tabletop**

2.3.3 The Proforma™ 300i and Proforma™ 300Gi are desktop units with an integrated table. The table is specially ground flat and is constructed of anodized aluminum. Integrated into the table is a bubble level that aids in leveling the product. In addition, holes have been drilled in the table to accommodate the supplied alignment pins. When placed in their proper holes, these alignment pins will center standard wafer between the probes. In addition to measuring standard round wafers, models with serial numbers of the formal XXXXXXXBBXX can also measure 125mm and 156mm PV square wafers. When not in use, the pins can be stored in the holes located on the right rear of the table.

*Red* indicates industry standard imperial sized round wafers (inches).
*Blue* indicates industry standard metric sized round wafers (mm).
*Green* indicates industry standard metric sized square (solar) wafers (mm).

![Figure 2: Table Features](image)

### Wafer Rings

MTI manufactures optional 3 point wafer rings for measuring bow. In addition to the rings indicated in the chart, MTI can manufacture rings to custom sizes. **Bold** indicates industry standard size.

<table>
<thead>
<tr>
<th>Inches</th>
<th>mm</th>
<th>AA Pin location For Bow Ring (mm)</th>
<th>BB Pin location For Bow Ring (mm)</th>
<th>MTI#</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.00</td>
<td>50.8</td>
<td>76.2mm</td>
<td>75mm</td>
<td>8000-6563</td>
</tr>
<tr>
<td>2.25</td>
<td>57.2</td>
<td>100mm</td>
<td>100mm</td>
<td>8000-6616</td>
</tr>
<tr>
<td>3.00</td>
<td>76.2</td>
<td>76.2mm</td>
<td>76.2mm</td>
<td>8000-6552</td>
</tr>
<tr>
<td>3.25</td>
<td>82.6</td>
<td>125mm</td>
<td>125mm</td>
<td>8000-6617</td>
</tr>
<tr>
<td>3.94</td>
<td>100</td>
<td>100mm</td>
<td>100mm</td>
<td>8000-6548</td>
</tr>
<tr>
<td>4.25</td>
<td>108</td>
<td>150mm</td>
<td>150mm</td>
<td>8000-6514</td>
</tr>
<tr>
<td>4.92</td>
<td>125</td>
<td>125mm</td>
<td>125mm</td>
<td>8000-6553</td>
</tr>
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<td>5.91</td>
<td>150</td>
<td>150mm</td>
<td>150mm</td>
<td>8000-6564</td>
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<td>6.02</td>
<td>153</td>
<td>200mm</td>
<td>200mm</td>
<td>8000-6731</td>
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<td>7.87</td>
<td>200</td>
<td>200mm</td>
<td>200mm</td>
<td>8000-6565</td>
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<tr>
<td>11.81</td>
<td>300</td>
<td>300mm</td>
<td>300mm</td>
<td>8000-6979</td>
</tr>
</tbody>
</table>
2.3.5 Proforma™ 300OEMi Controller Setup
The Proforma™ OEMi control unit should be mounted to a sturdy, vibration free location. The suggested orientation is to have the mounting flange at the bottom of the unit. The unit should be placed such that the mounted probe wires can easily reach the controller unit. Care should be taken to guarantee air flow around the unit. Be advised that the unit generates heat and that mounting the unit inside an enclosure could result in a build up of heat which will adversely affect results.

![Drill Diagram for Proforma™ 300OEMi](image)

Figure 3: Drill Diagram for Proforma™ 300OEMi
2.3.6 Proforma™ 300OEMi Initial Probe Setup

MTI recommends a dedicated probe holder which is machined from a material that has a low coefficient of thermal expansion (such as Invar). MTI also recommends using the split cylinder approach to clamping the probes. The standard “D” style push-pull probe used with the Proforma™ 300OEMi has a diameter of 14.86±0.03 (0.585±0.001”) and a length of 33.78±0.3 (1.33±0.01”). The end user must also account for the two exiting cables from the probe which have a minimum bend radius of 18mm (0.7”). The probe holders should guarantee that the probes can be positioned diametrically opposed to each other. Mount the probes in the probe holder such that the witness line on the first probe is aligned to the witness mark on the second probe.

![Diagram of probe dimensions](image)

As an initial setting, mount the probes so that they are approximately at the maximum standoff distance from the measured surface. Note that the initial probe adjustment will be finalized with the system running. Route the probe wires such that they do not come in contact with, nor run parallel to any other electrical wires or field sources.
2.3.7 Electrical Connections

2.3.7.1 AC Mains Connections
The Proforma™ Series products require mains input voltage of 100 to 240VAC, 50 to 60Hz. The power inlet receptacle is a standard IEC 320 C14 connector. Included in the box with the Proforma™ Series of products is a power cord that has an IEC 320 C13 connector at one end and a connector that is consistent with the local power requirements of the initial shipment destination of the product.

2.3.7.2 Serial Port (RS232) Connection
The rear panel has a standard DB9 male serial port connector (RS232). The Proforma™ Series products operate as DTE (Data Terminal Equipment) devices. As a result, when connecting to another device such as a PC, a serial crossover cable is required. Included in the box with the Proforma™ Series products is a serial null modem crossover. The baud rate and the mode configuration is addressed in the software support manual.

2.3.7.3 Ethernet Connection
The Proforma™ Series products can be directly connected to a Local Area Network (LAN) or to local PC via an Ethernet connection. The rear panel has a standard RJ45 Ethernet port. The product software supports both DHCP (Automatic IP assignment) or a Static connection. When connecting to a LAN, a standard Cat 5 or better cable is recommended. When connecting directly to a PC, the Cat 5 cable must be a crossover (null) type cable. The direct PC connection will be configured statically. Configuring for an Ethernet connection is addressed in the software support manual.

2.3.7.4 VGA Port
The rear panel VGA port is provided for diagnostic and factory purposes only. Do not connect a monitor to this product unless instructed to do so by MTI personnel or their representatives.

2.3.7.5 USB Port (Proforma™ 300i and Proforma™ 300Gi)
The Proforma™ 300i and the Proforma™ 300Gi have a single USB port located on the front panel. This port is used with a standard USB flash drive to provide a convenient method to transport measurement data and export the on board manual. This port is also used to import Firmware upgrades.

2.3.7.6 Probe Input Connectors (Proforma™ 300OEMi)
The front panel of the Proforma™ 300OEMi has 4 BNC connectors which connect to the probes. Each one of the probe branches will be labeled (1A,1B for the top probe and 2A,2B for the bottom probe). Simply match up the probe branches with the label on the front panel and make the connection. Note that failing to connect the branches to the correct inputs will cause poor performance.

2.3.7.7 Ground Lug (Proforma™ 300OEMi)
The front panel of the Proforma™ 300OEMi has a single ground lug. Connect this to the probe holder frame using 7/0.2, 30/0.1 (24AWG) or larger wire. The total resistance between the probe holder frame to this ground lug must be less than 0.5Ω. When making the resistance measurement, the use of a 4 point probe or other means to compensate for the resistance probe cables is recommended.

2.3.8 Power Up
Double check all electrical connections. Once the connection check is complete, use the switch on the rear panel to turn the unit on. Typically, the unit will require 30minutes to warm up to operating temperature. If the unit was stored in an area where the space temperature change is significantly different, it may take more than 30 minutes for the mass of the unit to thermally acclimate to the new environment. In order to maintain its constant operating temperature, the unit should remain powered at all times.
3 OPERATIONAL INSTRUCTIONS

3.1 Proforma™ 300i and Proforma™ 300Gi

For the Proforma™ 300i and the Proforma™ 300Gi, all operating parameters are available through the front panel display and interface. The Menu is accessed by pressing the Menu button on the front panel keyboard.

![Proforma™ 300i and 300Gi Front Panel Keyboard](image)

![Proforma™ 300i and 300Gi Display](image)

Figure 5: Proforma™ 300i and 300Gi Front Panel Keyboard

Figure 6: Proforma™ 300i and 300Gi Display
3.1.1 Menu Structure Proforma™ 300i

Figure 7: Proforma™ 300i Menu Structure
3.1.2 Menu Structure Proforma™ 300Gi

Figure 8: Proforma™ 300Gi Menu Structure
3.1.3 Keypad Functions

3.1.3.1 Save
When this button is pressed, data is saved to the location specified in the Setup → Export to Menu.

3.1.3.2 Units
Default: µm
This button toggles between µm (microns or micrometers) or mils (thousandths of an inch). When the display values are changed, all other setting values are converted as well.

3.1.3.3 Zero
Default: Zero Off
When this is selected, the current measured value is subtracted from all subsequent values. This is also known as a Tare function.

3.1.3.4 Menu
This button opens up the top level menu.

3.1.3.5 Back (←)
This button will navigate back one level on the menu tree.

3.1.3.6 Left (←), Right (→), Up (↑), Down (↓) Arrows
These buttons are for navigation on the menu tree. They are also used to enter values, with the left and right arrows navigating significance and the up and down arrows toggling values.

3.1.3.7 Select (✓)
Use this key to select or confirm an entry.

3.1.4 Menu Items

3.1.4.1 Mode
Default: Continuous

3.1.4.1.1 Continuous
Measurements are taken continuously and displayed on the screen. This mode is often used to scan for surface irregularities. It is also used in conjunction with the alignment pins to provide accurate measurements of the center of a wafer.

3.1.4.1.2 5 Point
5 point is commonly used to take a measurement at the center of the wafer (using the alignment pins) and 4 other points on the edge of the wafer located at 90° from each other. 5 point will toggle to the next reading when the ✓ is pressed. At the end of the 5 point reading, pressing the ✓ will cause the statistics for the readings to be displayed (Average, Maximum, Minimum, TotalThicknessVariation, standardDeviation). Pressing the ← key anywhere during the 5 point operation will return the Profoma™ back to the start of the 5 point measurement process.

3.1.4.1.3 Bow
The Profoma™ 300i and the Profoma™ 300Gi products are capable of measuring wafer bow in compliance with ASTM Specification F534 Standard Method for Bow of Silicon Slices. Bow measurements require the use of a 3 point wafer fixture (bow ring), which is available from MTI Instruments.
3.1.4.2 Calibrate
Default STD: +500.000 µm
This adjustment corrects for certain environmental factors which may affect accuracy. It is suggested that the unit be calibrated no less than once daily using a known NIST traceable (or other known standard wafer). NIST traceable calibration standards are available from MTI Instruments. As shown in figure x, the displacement for the top and bottom probes will be added to the known thickness of the wafer to calculate and store a new probe gap value. Details of performing a calibration are located in section 3.1.5.

3.1.4.3 Limits
Default Hi: +999.999
Default Lo: -999.999
High and Low limits can be set. If the wafer thickness is above the high limit, a warning will be displayed. If the wafer thickness is below the low limit, a warning will be displayed. While operating with the ZERO function set, it is possible to get negative thicknesses. Therefore, the limits are signed values. Note that if the diagnostic screen “RawVolts” is set “ON”, the warning will not be displayed.

3.1.4.4 Rounding
Default: On
By default, the Proforma™ series products will round the least significant digit to the left of the decimal place to the nearest 0 or 5. Turning Rounding off displays the least significant digit in its raw form.

3.1.4.5 Setup
3.1.4.5.1 Contrast
The Proforma™ Series product display has been factory set to a contrast value to satisfy most applications. In some ambient lighting conditions, the contrast may need to be adjusted for maximum viewability.

3.1.4.5.2 Ethernet
Default DHCP: Off
Default IP Address: 192.168.168.252
Default Subnet Mask: 255.255.255.000
Default Gateway: 000.000.000.000
Default Show Address: Off
The Proforma™ Series products support connection to the Ethernet. By default, this address is statically assigned. The static address, subnet mask, and gateway can be set thru the user interface. Alternatively, the unit can automatically fetch its network parameters from a network that supports DHCP. The user can determine the IP address by turning on the “Show Address” option.

Normally, the Proforma™ 300i will connect to an external laptop or PC through an Ethernet network. It is possible to create a direct connection to a laptop or PC without using a network, but the user will need to provide an Ethernet crossover (null) cable and manually configure a static network connection on the PC.

3.1.4.5.3 Export
The Proforma™ series products store several files on internal, non-volatile memory. These include the user manual, calibration tables, configuration files, and the boot log. These files can be helpful in diagnosing problems on the system. The export location is defined by the “Export to” setting. Note that some files may not be exportable thru the RS-232 interface.

3.1.4.5.4 Export to
Default: USB Disk
The Export to setting defines where files are written to during an export or save operation. For most applications, the best location to save files is the USB Disk.

3.1.4.5.5 Lamps (Proforma™ 300Gi only)
Default: Auto
The Proforma™ 300Gi can be used to measure wafers that do not require infrared excitation (such as Silicon). When measuring wafers that do not require infrared excitation, it is advantageous to turn off the lamps. Turning off the lamps when they are not needed will increase the expected lifespan of the lamps. Note that the lamps generate a large amount of heat and that turning the lamps on or off may initially affect the accuracy of the reading. To guarantee the highest possible accuracy, it is advisable to allow the system to acclimate for ½ hour after the lamp state has changed and to perform a recalibration after acclimation.

3.1.4.5.6 Raw Volts
Default: Off
Raw Volts is provided as a diagnostic mode. The raw voltage signal does not have a linearization table applied and therefore is not proportionally accurate to displacement. The most common occasion that this setting will be used is when setting the position of the top probe.

3.1.4.5.7 Resolution
Default: 5 Significant Digits
Resolution sets the maximum number of digits that will be displayed on screen.

3.1.4.5.8 RS-232
Default Baud Rate: 57600
Default Format: N,8,1
The Proforma™ Series products support an RS-232 connection to a host computer. Note that the Proforma™ Series products are DTE terminals and will require a null modem connection to attach to a host computer. The RS-232 menu allows the user to both check and set the RS-232 Baud Rate and Format.

3.1.4.5.9 Factory
The Factory setting allows a user reset to the factory default settings. All user settings will be reset, including mode, calibration standard, limits, contrast, IP address, Ethernet Mode, Export to location, Lamp operation (Proform™ 300Gi only), Raw Volts display, Resolution Settings, RS-232 Settings, and Version Display. 2 levels of confirmation are needed to perform a reset to factory default. Once reset to factory default has occurred, the user will be instructed to reset the unit so that the values can be applied. Any user settings will be unrecoverable.

3.1.4.5.10 Update
Via the front panel USB port, the Proforma™ Series products support field reflash of the internal Firmware, updating the internally stored manual, restoring the factory linear tables, or updating the web server files. After the file transfer has occurred, the user will be instructed to reset the unit so that the updated files can be applied. Once the files have been loaded into the system, the previous version of the files cannot be recovered.

3.1.4.5.11 Version
Activating the version function will place the firmware version number on the screen.
3.1.5 Calibration Procedure

3.1.5.1 If the system is not in Continuous Mode, press the MENU button on the front keypad and select Mode. Press the ✓ key. Select Continuous and press the ✓ key.

MODE:Cont.  CAL:500.0

3.1.5.2 Press the MENU button on the front keyboard and select Calibrate. Press the ✓ key.

MODE:Cont.  CAL:500.0

Main Menu
Mode
Calibrate
Limits
Rounding
SetuP
3.1.5.3 The Cal STD selection will be highlighted. Press the ✓ key.

```
MODE:Cont. CAL:500.0 Calibrate

Cal STD
```

3.1.5.4 Using the arrow keys, enter the thickness of the cal standard. Note that the previous value is located at the top center of the screen whereas the new value is the editable number on the right side of the screen.

```
MODE:Cont. CAL:500.0 Cal STD
+702.202
```

3.1.5.5 Place the cal standard between the probes. The positioning pins which were supplied with the Proforma™ 300i and Proforma™ 300Gi may be used to accurately center a standard size wafer. Press the ✓ key. After a few moments, the system will calibrate to the known standard.

```
MODE:Cont. CAL:702.2

702.2µm
```

3.1.6 Operational Modes

3.1.6.1 Continuous

While in Continuous Mode, the measurements and the display are continuously being updated. For maximum accuracy, thickness readings should be taken with the wafer steady and hands not contacting the wafer. To enter Continuous Mode:

3.1.6.1.1 Press the MENU button on the front panel keypad.
3.1.6.1.2 Select Mode and press the ✓ key.
3.1.6.1.3 Select Continuous and press the ✓ key. The screen will display MODE:Cont. in the upper left hand corner.
3.1.6.2 5-Point Mode

5-Point Mode is a special operational mode that is usually used to take measurements at 5 distinct points on a wafer. Typically, these points are at the center, then 0º, 90º, 180º, and 270º. For maximum accuracy, thickness readings should be taken with the wafer steady and hands not contacting the wafer.

To enter 5-Point Mode:

3.1.6.2.1 Press the MENU button on the front panel keypad.
3.1.6.2.2 Select Mode and press the ✓ key.
3.1.6.2.3 Select 5-Point and press the ✓ key. The screen will display MODE:5-Point in the upper left hand corner. The lower left corner will display ENTER to Measure Point #1.
3.1.6.2.4 Place the wafer between the probe at position 1 and press the ✓ key.

3.1.6.2.5 Continue this process until all 5 points are measured. At the end of the fifth measurement, ✓ can be pressed to provide statistics on the measurements. Pressing the BACK key will return the display to the 5 measurements. Pressing ✓ from the statistics screen will begin a new set of 5-Point measurements.
3.1.6.3 **Bow Mode**

The Proforma™ 300i and the Proforma™ 300Gi products are capable of measuring wafer bow in compliance with ASTM Specification F534 *Standard Method for Bow of Silicon Slices*. Bow measurements require the use of a 3 point wafer fixture (bow ring). To perform a BOW measurement:

3.1.6.3.1 Place the wafer in the 3 point wafer fixture, aligning the major flat parallel to the opening in the wafer fixture.

3.1.6.3.2 Slide the fixture with the aligned wafer until the center of the wafer is under the top probe.

3.1.6.3.3 Press the **MENU** button on the front panel keypad.

3.1.6.3.4 Select **Mode** and press the ✔️ key.

3.1.6.3.5 Select **Bow** and press the ✔️ key. The screen will display **MODE:Bow** in the upper left hand corner.

```
MODE:Bow  CAL:500.0

705.2µm
SELECT To Measure Side #1
```

3.1.6.3.6 Press the ✔️ key once. The display will now display 0.00µm.

```
MODE:Bow  CAL:500.0
S1:926.3

0.0 µm
SELECT To Measure Side #2
```

3.1.6.3.7 Remove the fixture and wafer from the probes.

3.1.6.3.8 Turn the wafer over and align the flat in the 3 point wafer fixture identically to the alignment which was used on the first side.

3.1.6.3.9 Slide the 3 point wafer fixture with the wafer under the probe and center the wafer on the probe and press the ✔️ key.

```
MODE:Bow  CAL:500.0
S1:926.3  S1:926.7

0.4 µm
SELECT To Start Bow Measurement
```
3.1.7 Functions

3.1.7.1 Zero

The Zero function will calculate the offset necessary to force one point to a thickness of zero, and then will apply this offset to all subsequent readings. This function can be used in Continuous and 5 Point mode, but not in Bow mode. To utilize this function:

3.1.7.1.1 Place the wafer between the probes.
3.1.7.1.2 Press the **ZERO** key. The Zero offset value will be displayed along with HI and LO fields.

```
MODE: Cont.  CAL: 500.0  ZERO: 505.7
HI: 0.0  LO: 0.0

0.0 μm
```

The ZERO field represents the amount of offset that is being subtracted from the current reading (the offset calculated when ZERO was pressed).

The HI and LO readings indicate the maximum and minimum deviation from the initial (zero) value. The HI and LO functions will only update when the reading is stable (approximately 1 second). As a result, quickly moving the wafer will not result in change in the HI or LO readings.

To exit ZERO mode, press the **ZERO** button again.

3.1.7.2 Keyboard Lock

To prevent inadvertent use, the front panel keyboard of the Proforma™ 300i and Proforma™ 300Gi can be disabled. Within a 3 second window, press , ,  (LEFT, BACK, UP). The screen will display Keyboard Locked. To unlock, enter the same key sequence.
3.1.8 Adjusting the Top Probe

The Proforma™ 300i or Proforma™ 300Gi was shipped with nominal probe spacing to measure wafers between 100µm and 1000µm. By adjusting the top probe, it is possible to measure thicknesses in excess of 1000µm.

3.1.8.1 Remove the single Phillips screw holding the top probe cover.
3.1.8.2 Slide the top cover out. Note that the rear of the cover is engaged by two guide pins.
3.1.8.3 Enter raw volts mode (Setup→Raw Volts→On). The display will now display the voltage reported by the amplifier cards.

![Voltage Display](image)

3.1.8.4 Using a 3/32” hex wrench, loosen the clamp screw, on the right hand side, which secures the top probe. Do not loosen or remove the 3 Phillips heads screws on the side bar.

3.1.8.5 Gently grasp the probe wires and lift the probe so that a median surface calibration standard or median surface gauge block can be placed between the probes.

3.1.8.6 Note that the witness mark on the top probe should face the front panel (i.e. towards the operator). With the median surface between the probes, carefully move the top probe into a position so that the top probe voltage reads 5V±1V.

3.1.8.7 Verify the witness mark on the probe is in the correct location and tighten the clamp screw.

3.1.8.8 Replace the top probe cover.
3.1.8.9 Recalibrate (Calibrate→Cal STD)

![Diagram of Adjusting the Top Probe](image)

Figure 10: Adjusting the Top Probe
3.1.9 Operation With High Bulk Resistivity Wafers (> 10K OHM-CM)

Referring to section 2.3.6, note the witness mark in the top probe, which denotes probe orientation. For most applications, the witness mark will be oriented to the front. In high bulk resistivity applications, the top probe should be turned 180° such that the witness mark is facing the rear of the Proforma™ 300i. The bottom probe will remain in its factory shipped orientation (witness mark to the front). Refer to section 3.1.8 on adjusting the top probe.

When operating in this mode:

- The display may show thickness numbers even when a wafer is not present. This is normal and may vary due to local and daily conditions. When operating in this mode, disregard the display when a wafer is not in the gap.
- In this probe orientation, the Proforma 300i will measure both conductive and high bulk resistivity wafers, however the calibration wafer used must match the type of wafer being measured:
  - For conductive wafer measurement, use a conductive wafer.
  - For high bulk resistivity wafers, use a calibration wafer of the same material type and approximately the same bulk resistivity as the sample test wafer. Note that a doping change, which is typical of a process change, will change the dielectric constant of the material. The Proforma™ 300i must be recalibrated for this type of change. This can be accomplished by creating a new wafer standard using mechanical contact methods and then applying this new standard to calibrate the Proforma™ 300i.
- When measuring high bulk resistivity wafers, the usable measuring range of the PF300i drops to ± 200 um plus the thickness of the calibration wafer. This is due to the probe configuration and the capacitance probe’s fringing fields. If this is unacceptable consider using a solution based on Accumeasure™ D series equipped with MTI Instruments probes designed specifically for dielectric targets.
3.2 Proforma™ 300OEMi

The Proforma™ 300OEMi relies on customer supplied software to control its functionality. Refer to the software manual for more information on how to create software that interfaces with this product.

3.2.1 Setting the final probe gap on the Proforma™ 300OEMi.

As the Proforma™ 300OEMi does not have a display or user interface, it is necessary to interface the controller unit to a PC and adjust the probe gaps via a virtual interface. Refer to the software manual for more information on connecting a Proforma™ 300OEMi to a PC and installing the provided basic support software.

In section 2.3.6, the probes were set to initial conditions. To move them to their final positions, the Proforma™ 300i Data Logger Program will be used.

3.2.1.1 Start the Proforma™ 300i Data Logger Program and connect to the Proforma™ 300OEMi. For help with installing, running, and connection, refer to Software Manual.

3.2.1.2 Make sure the VOLTS radio button is selected.

3.2.1.3 Insert a sample, calibration wafer, or gauge block which is representative of the median thickness that will be measured. The sample used must be larger than the probe and the face of the probes must be covered by the sample.

3.2.1.4 Using whatever adjustment mechanism that the end user provided, carefully move each of the probes, one at a time, to achieve a voltage reading of 5±1V. Make sure that the top and bottom probe witness marks are aligned.

3.2.1.5 Lock down the probe.

3.2.1.6 Calibrate the system. For the Proforma™ 300OEMi, calibration can be achieved by either utilizing the CALIBRATION function on the Proforma™ 300i Data Logger Program or can be done thru the command interface using user provided software.

![Figure 11: Proforma™ 300i Data Logger Program](image)
4 MAINTENANCE

4.1 Cleaning

4.1.1 Product Surfaces.
The surfaces of the Proforma™ 300i series products can be cleaned using a damp, lint free cloth. To prevent electrical shocks, the unit should be turned off when it is being cleaned. Do not use harsh solvents or detergents to clean the equipment.

4.1.2 Probes
Do not use water to clean the probe surfaces. If the probe surfaces become contaminated, isopropyl alcohol with a lint free cloth may be used.

4.1.3 Display
Clean the display with a clean, dry cloth.

4.2 Probe/Amplifier Calibration
The Probe/Amplifier combination is calibrated at the factory. Do not attempt to adjust the amplifier calibration. Annual factory calibration services can be provided by MTI Instruments. Contact MTI Instruments or their representatives for more details.
OTHER METROLOGY PRODUCTS
FROM MTI INSTRUMENTS

3 point reference Bow Rings

Accumeasure™ OEM
High Resolution/Accuracy Capacitive Displacement

MicroTrak™ 3

Laser Triangulation
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