

University of Minnesota Nano Fabrication Center

Standard Operating Procedure

Equipment Name: Four Point Probe

Coral Name: four-point-probe

Revision Number: 2

Model: Veeco FPP5000

Revisionist: Tony Whipple

Location: Bay 1

Date: 20 Mar 2020

1 Description

The four point probe measures thin film or doped silicon surface resistance values. This can measure small samples to whole 4 " (100 mm) wafers.

2 Safety

The safety item beyond the normal electrical hazards as this system does use electrical power.

3 Restrictions/Requirements

All Trained users can use the system.

4 Required Facilities

The systems us electrical power.

5 Definitions

Four point probe equation: $\rho = RT$

Where: ρ = slice resistivity (ohm-cm)

R = sheet resistivity (ohm/sq.)

T = thickness (mils, m, A)

6 Setup

Power up:

1. Turn on power switch on the rear of the machine.
2. Press CLEAR after the display lights up

7 Operating Instructions

To make a measurement:

1. Place sample in holder face down
2. Place the holder on the stage with the portion to be measured over the probes (small hole).
3. Close the lid and gently press down until the measurement is complete.

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Processing Results:

-If you want to find resistance (V/I), depress the V/I switch and just close the lid to get the readout.

-If you want to find the sheet resistivity ($R = \rho/T$), depress the SHEET switch and close the lid to get the readout.

-If you want to find the slice resistivity ($\rho = RT$), programming IS NECESSARY and you must input the thickness as a constant. Start off by finding the sheet resistivity and then follow below.

- a) Depress **SLICE** switch
- b) Depress **PROG** switch
- c) Enter the thickness and the units
- d) Depress **STORE** switch
- e) Depress **PROG** switch and that is your answer

-If you want to find the thickness ($T = \rho/H$), programming IS NECESSARY and you must input the slice value as a constant. Start off by finding sheet resistivity and then follow below.

- a) Depress **THICK** switch
- b) Depress **PROG** switch
- c) Enter the slice resistivity and the units
- d) Depress **STORE** switch
- e) Depress **PROG** switch

Programming of constants (Standard Procedure):

1. Press option to be used
2. Press **PROG**
3. Enter constant (don't forget exponent or units).
4. Press **STORE**
5. Press **PROG**

System. Power Down

1. Return the sample holder to the case and put the case away.
2. Turn off the power switch.

7 Problems/Troubleshooting

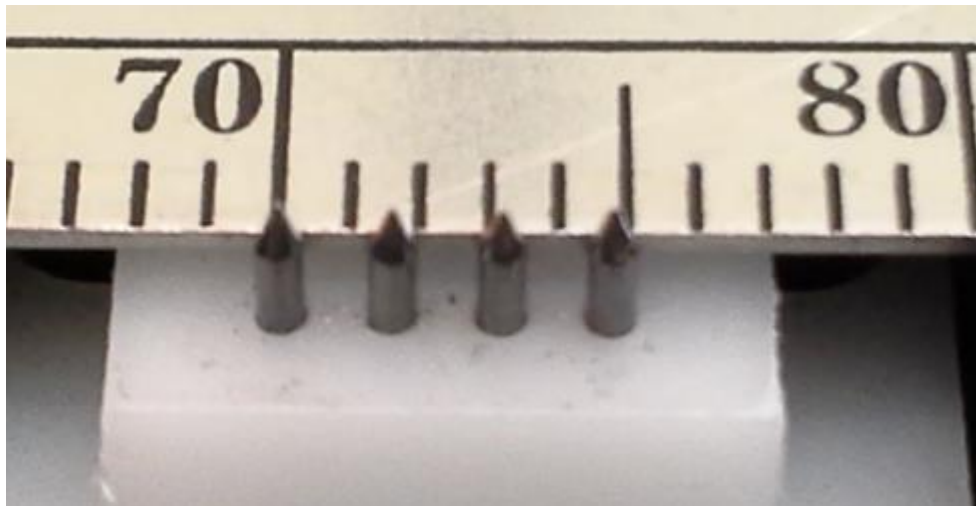
1. A value that is not a useful number, check to see if it is an error code. Most likely you can just re-try again, making sure your sample is making contact with all of the four probe tips.

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Appendix

<u>Metal</u>	<u>Resistivity (uOhm-cm)</u>
Aluminum	2.6548
Chromium	12.9
Copper	1.6730
Gold	2.35
Lead	20.648
Molybdenum	5.2
Nickel	6.84
Palladium	10.8
Platinum	10.6
Silver	1.59
Tantalum	12.45
Tin	11.0
Titanium	42.0
Tungsten	5.65
Zinc	5.916



Tip spacing is set at 62.5 mils (1587.5 um)

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Error Code	Description	Display After Clear
E 01	Retest Attempted while probe interlock is open	Previous Reading
E 02	Probe interlock is opened while a measurement in progress	Display read five 8's
E 03	Display Exponent overflow or underflow exponent greater 9 or exponent less 9	Cannot Clear Error Code
E 04	Store attempted without completing entry of the new constant in PRGM mode	Previously programmed constant
E 05	Penetrate Switch Depressed while Penetrate Mode internally disabled	Previous Reading
E 06	Normal and Reverse V/I Disagree by more than 10%	Normal V/I Sheet, Slice, and Thickness
E 07	Arithmetic Error produced as a result of a geometric correction measurement	Cannot Clear Error Code
E 21 Thru E 40	Electronic Failure while attempting to make a measurement	Display reads five 8's
E 51 Thru E 57	Self Test Errors	Display reads five 8's

Error code list from the manufacture – Error E 06 is common, try remeasuring if needed.