

GENERAL PROCESS AND OPERATION SPECIFICATION

Veeco FPP 5000 Four Point Probe

I. SCOPE

These procedures apply to the VEECO FPP-5000 4-Point Probe test unit. All maintenance should **follow the procedures set forth in the manufacturer’s maintenance and operations manuals.** **This document is for reference only.** Users must be trained by AggieFab staff before operating this equipment.

II. SAFETY

- a. This machine is connected to **HIGH VOLTAGE**. Be very careful and remain aware of electrical hazards. If you encounter any electrical malfunctions, contact AggieFab staff immediately.
- b. The probe head can easily be damaged. Do not bump anything into the probes.
- c. Users are not allowed to adjust the platen height or clean the probe-head. For any platen or probe-head issues call staff.

III. OPERATION

- a. Enable tool through iLab login. Power switch near back of tool should be in the “ON” position.
 - i. All display lights should be on.
- b. Press “CLEAR” and open lid.
- c. Place the wafer (shiny side down) or samples you wish to probe in the appropriate position on the probes.
- d. Select desired measurement mode.
 - i. Select “V/I”, “SHEET”, “SLICE”, or “THICK” for desired mode. See appendices for specifics on each mode.
 - ii. You can also enable “TYPE” and/or “PEN”.



Figure 1: Display with all lights on and wafer position.



Figure 2: Plastic platen on top of sample

- e. Press PRGM and enter a constant based on measurement mode.
 - i. V/I: constant is “GEOM” for geometry correction factor.
 - ii. SHEET: constant is “GEOM” for geometry correction factor.
 - iii. SLICE: constant is thickness in mil, μ , or A. Programming is NECESSARY.
 - iv. THICK: constant is slice resistivity in Ω -cm. Programming is NECESSARY.
 - v. Note: The unit for the constant you need to input will be lit up in the upper right.
- f. Type in 4-5 numbers, the last one being the x10 exponent number.
 - i. The “+/-” changes the x10 exponent number sign.
 - ii. “CE” will clear the last number and “CLEAR” will clear all numbers.
 - iii. For “SLICE”, you can press “MIL”, “ μ ”, or “A” after entering all numbers to change the unit.
- g. Press “STORE” and turn “PRGM” off.
- h. Close the lid and gently press down until the measurement is complete. Results will be shown on the display.
 - i. If any ‘E’ appears on the display, it means there was an Error. Retry measurement or press “CLEAR”: see more about Errors in appendices.
 - ii. You can press “RETEST” to take another test with the lid still down.
 - iii. For “THICK”, after testing you can change the unit displayed by pressing “MIL”, “ μ ”, or “A”.
- i. When finished, open the lid. Remove your samples and close the lid.
- j. Log out of iLab and record any malfunctions or comments in the log sheet.

IV. SIGNATURES AND REVISION HISTORY

- a. Author of this document: Larry Rehn and Cheng-Chung Chang
- b. Author Title or Role: Technical Manager/Student Lab User
- c. Date: 2/5/21
- d. Original Issue

Approvals:

Technical Manager Signature: Sandra G. Malhotra

Date: January 13, 2022

Revision History:

Revision	Author	Date	Change
Original Issue	Ming-Wei Lin	02/25/2020	
Rev A	Bryce Prucha	01/13/2022	Reformatted and added to operation section, added appendices, and added Errors and Measurement ranges.
Rev B			
Rev C			
Rev D			
Rev E			

Appendix A: Keyboard Description

- a. **V/I** - Displays measured V/I resistance multiplied by programmed GEOM constant
 - a. Outputs resistance in Ω .
 - b. PRGM constant is geometry correction factor.
 - c. For samples with a diameter greater than 2.5 inches, GEOM is 1.
- b. **SHEET** - Displays sheet resistance based on measured V/I.
 - a. Outputs sheet resistivity in Ω/sq .
 - b. PRGM constant is geometry correction factor.
 - c. For samples with a diameter greater than 2.5 inches, GEOM is 1.
- c. **SLICE** - Calculates the bulk resistivity of a slice of layer whose thickness is entered in the PRGM mode.
 - a. Outputs slice resistivity in $\Omega\text{-cm}$.
 - b. PRGM constant is thickness in mil, μ , or A.
- d. **THICK** - Calculates the thickness of a layer of slices whose bulk resistivity is entered in the PRGM mode.
 - a. Outputs measured thickness in mil, μ , or A.
 - b. PRGM constant is slice resistivity in $\Omega\text{-cm}$.
- e. **TYPE** - When selected, a type test is performed.
 - a. This will return P or N for P-type and N-type respectively.
 - b. Invalid or questionable tests are indicated by both P and N being lit.
- f. **PEN** - When selected, a penetrate voltage is applied to the sample.
 - a. Applies a penetrate voltage of 170V, 4 msec pulse to probes through a 10M resistance before test for low contact resistance.
- g. **PRGM** - Put the keyboard into the PRGM mode for entering bulk resistivity or film thickness. Press STORE afterwards to store the input into system memory.
- h. **SELF-TEST** - Performs a system self-test. All lights except FAIL should be on.
- i. **RETEST** - Performs a retest when the previous test failed.
- j. **CONST** - Displays the selected input stored in the memory.
- k. **NUMERICAL KEYS** - To enter the input required for calculation.



Figure 3. Keyboard while turned off

Appendix B: Errors and Measurement Range

Measurement Range (AP-150 and FPP-5000)

PARAMETER	FROM	TO
Sheet resistance range	1.1 mΩ/sq.	450 KΩ/sq.
Slice resistivity range for a 15 mil wafer V/I range	$4.19 \times 10^{-2} \text{ m}\Omega\text{-cm}$	17.1 KΩ-cm
V/I	25mΩ	9.99KΩ
Metallization thickness range for 99.9% pure aluminum	20 Å	243KÅ
Electronic Accuracy	±0.5% for V/I of 5mΩ to 5KΩ at an ambient temperature of 15°C to 30°C	

Specifications are subject to change without notice.

MEASUREMENT RANGE		
PARAMETER	FROM	TO
Sheet resistance range	1.1 mΩ/sq.	450 KΩ/sq.
Slice resistivity range for a 15 mil wafer	$4.19 \times 10^{-2} \text{ m}\Omega\text{-cm}$	17.1 KΩ-cm
V/I range	25 mΩ	99.9 KΩ
Metallization thickness range for 99.9% pure aluminum	20 Å*	243 KÅ*
Electronic Accuracy	±0.5% for V/I of 0.5mΩ to 5 KΩ at an ambient temperature of 15° C to 35° C	±8% for all other measurement ranges up to an ambient temperature of 55° C

POWER 115/230 VOLTS 10% 50/60 HZ. LEAK CURRENT 30 uA/MIN.

Figure 4. Measurement Range for various modes

Error Messages

Error Code	Description
E 01	Retest Attempted with probe interlock open
E 02	Probe interlock is opened while a measurement is in progress.
E 03	Display Exponent overflow or underflow exponent greater 9 or exponent less 9
E 04	Store attempted without completing entry of new constant in PRGM mode
E 05	Penetrate Switch Depressed while Penetrate Mode internally disabled
E 06	Normal and Reverse V/I Disagree by more than 10%
E 07	Arithmetic Error produced as a result of a geometric correction measurement
E 21-40	Electronic Failure while attempting to make a measurement
E 51-57	Self Test Errors