

Improve Generator Performance With RF Calibration

INDUSTRY**Semiconductor****SOLUTION****RF Calibration****EQUIPMENT****RF Generators and
Matches****CHALLENGE**

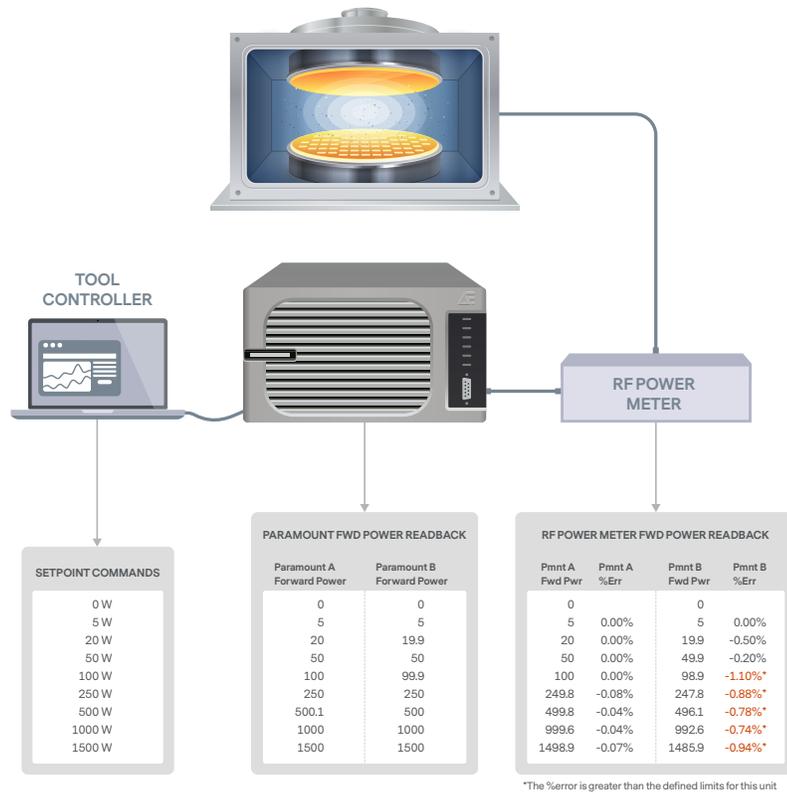
A customer was facing yield differences and varying process results between two different chambers of the same semiconductor processing tool. Both chambers were running the same process recipe with the same model Advanced Energy Paramount RF generator. In this case the customer experienced unplanned tool downtime, plus the added cost of required engineering resources and scrapped wafers when both chambers had to be taken offline to troubleshoot the process issue.

To diagnose the issue, the customer tested both generators on the same chamber using dummy wafers to confirm that each unit was operating within original manufacturer specifications. A power meter was used to read actual RF forward power when operating at varying set point levels.

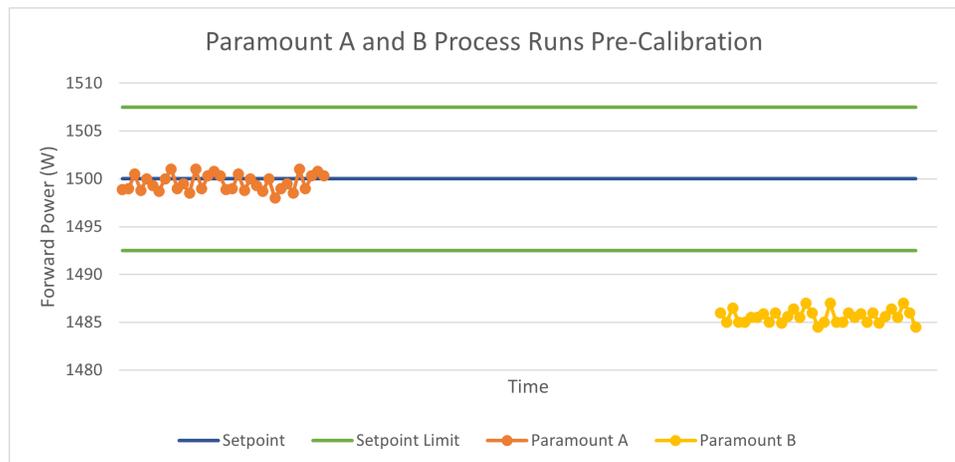
The readings from the RF power meter show that Paramount B was nearly 1% out of setpoint at higher power levels—outside the guaranteed accuracy specifications for the original unit. This indicated an issue with calibration in Paramount B since the unit itself was reporting accurate readings for forward power during the same test. The customer kept the power meter in place at the output of each Paramount and ran the processes on both chambers as normal.

CHALLENGE

The results of the power meter readings are shown below:

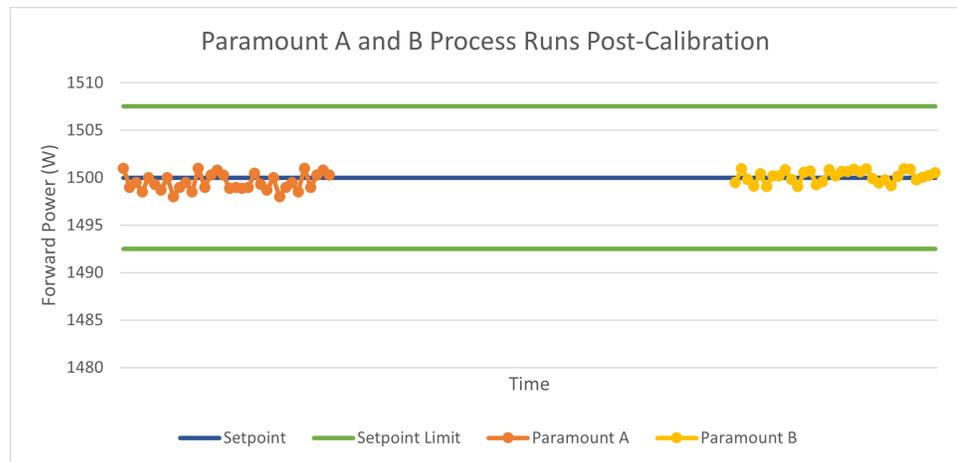


The plot below shows that Paramount B is consistently failing to deliver the power required for the process.



SOLUTION

When reviewing the service history for both units, Paramount A had been returned for service for an unrelated reason the year prior and received a calibration as part of AE’s standard repair process. Every unit that comes through an AE service center for repair is calibrated. Since Paramount B appeared to be performing within normal standards, it had not been returned for service in five years. To solve the problem, the customer sent Paramount B to one of AE’s service centers for calibration. After successful calibration, the customer installed the unit back on its chamber and immediately began producing acceptable results as shown below. Paramount B was now well within defined setpoint limits for the entire process run.



CONCLUSION

Regular calibration of AE RF generators and matches ensures that tool downtime is planned and mitigated and that this precise RF power equipment is always operating within original manufacturer specifications. AE recommends regular calibration every two years, even when a unit does not require additional service. With regular calibration, costly downtime can be avoided.

AE’s calorimeter-based calibration approach guarantees a tighter, more accurate calibration when compared to industry measurement standards. Only AE has the proprietary test software and calibration procedures to ensure your unit meets its original manufacturer specifications every time. AE also offers exchange or spare units that can be installed during the calibration period to maintain tool productivity.

RF CALIBRATION CASE STUDY

AE's robust calibration procedure checks multiple parameters including power setpoint, forward power monitor, reflected power monitor, RF power and impedance, air flow, and RF bias current. Each of these parameters is verified across multiple power levels and load positions. Once the unit has been calibrated, its calibration values are rechecked twice before being written to the unit. The unit's calibration values are stored in its firmware, ensuring accurate results for each unique customer across varying process conditions. This unit's calibration report is shown below.




PARAMOUNT TEST REPORT

PN: 3156320-610
SN: 1528524

UNIT TEST - Calibration and Check

Air Flow Calibration	18.01 degrees C	PASS
RF Bias Current Calibration	I_low=0.5, I_high=4.91	PASS
Analog Port Check		PASS
ADC Power Setpoint Calibration		PASS
ADC Power Setpoint Check		PASS
DAC Forward Power Monitor Calibration		PASS
DAC Reflected Power Monitor Calibration		PASS
RF Power and Impedance Calibration		PASS
DAC Forward Power Monitor Check		PASS
Power Accuracy Check	Error=0.156%	PASS
Power Linearity Check		PASS
Power Profile Check	12.882,13.560,14.238	PASS
DAC Reflected Power Monitor Check		PASS
Diagnostic Calibration		PASS
Miscellaneous Checks		PASS
MAC ID Check	00.0B.47.02.16.47	PASS
Statistics Reset		PASS
EEPROM Dump		PASS

Hipot Test After HASS and Burnin
Tested by ops wc I_{max}=4.68mA, Test - PASS

FINAL TEST - Check

EEPROM Upload		PASS
Analog Port Check		PASS
ADC Power Setpoint Check		PASS



For international contact information,
visit advancedenergy.com

sales.support@aei.com
+1 970 221 0108

PRECISION | POWER | PERFORMANCE

Specifications are subject to change without notice. Not responsible for errors or omissions. ©2021 Advanced Energy Industries, Inc. All rights reserved. Advanced Energy®, and AE® are U.S. trademarks of Advanced Energy Industries, Inc.