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MATRIX 4
Beam Deflection AFM option

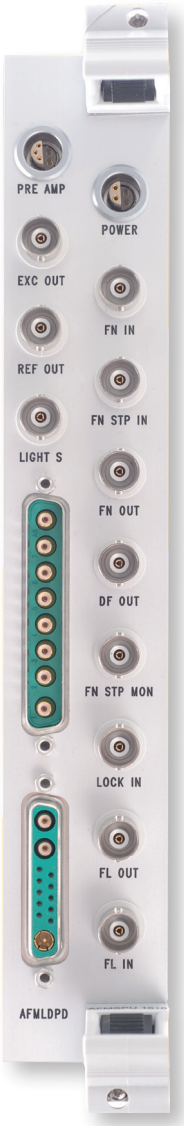
The Scienta Omicron MATRIX4 Beam Deflection AFM Control System with digital PLL is an integral solution for the MATRIX control system and a perfect match with the Scienta Omicron SPM's.

The MATRIX 4 beam deflection AFM package, for both contact and various non-contact force modes, consists of a digital AFM control board including frequency detection, analog signal preamplifiers, light source control, digital processor board, and software modules for AFM operation.

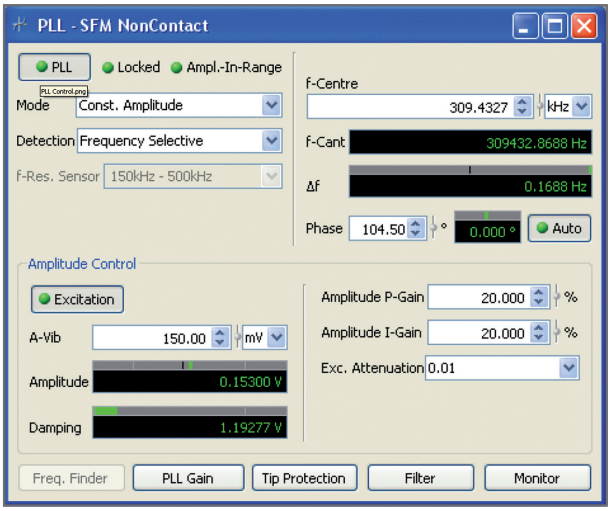
Provided are signal detection mechanisms for beam deflection and interferometer AFM and QPlus AFM. The MATRIX AFM Controller includes a digital phase-locked loop (PLL) that can be run in constant amplitude and constant excitation mode. The integrated solution for the MATRIX Control System increases the flexibility and usability for AFM control and acquisition. The AFM signals including for example the normal force, lateral force, frequency shift, dissipation and Kelvin probe signals are all directly accessible for the software through the MATRIX Bus System with a time resolution in the nanosecond range. For advanced customer experiments there are 6 additional analogue input ports available in the standard configuration, with a further 12 available on request.

Signal-to-Noise Characteristics

The MATRIX AFM Control Board is integrated in the MATRIX Control Unit. Generated digital AFM signals are directly connected with the digital internal bus system for further processing without the need to convert them into analogue signals. Routing signals with external cables is therefore not required. This reduces the risk for noise pick-up and allows working close to the theoretical limit.



MATRIX AFM control board.



PLL window in the MATRIX software.

Measurement Modes

AFM contact modes:
Normal force & lateral force, Force-Distance Curves, Conductive AFM, Piezo Response AFM (PFM)

AFM non-contact modes including:
EFM, MFM, Kelvin Probe (FM & AM Mode), Multi-mode Operation & Spectroscopy, Constant Damping

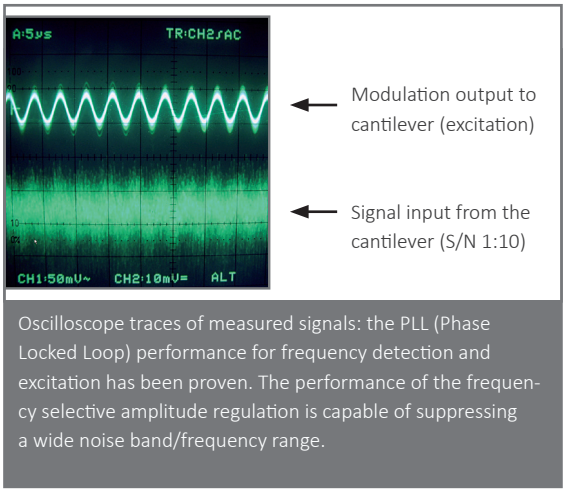
Detection Modes:

- PLL modes (constant amplitude & constant excitation)
- Self-excitation (constant amplitude)

MATRIX 4 Beam Deflection AFM at a glance:

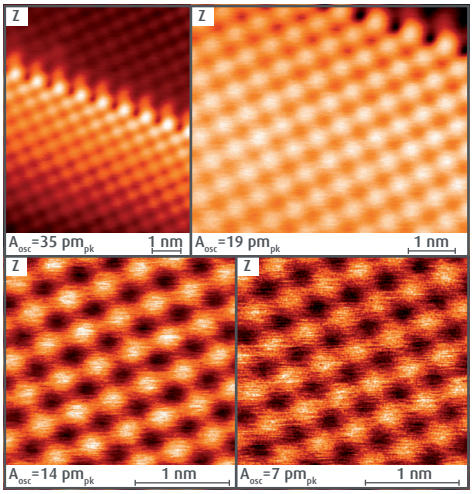
- Flexible and usable for beam deflection QPlus modes
- Integrated Kelvin regulator

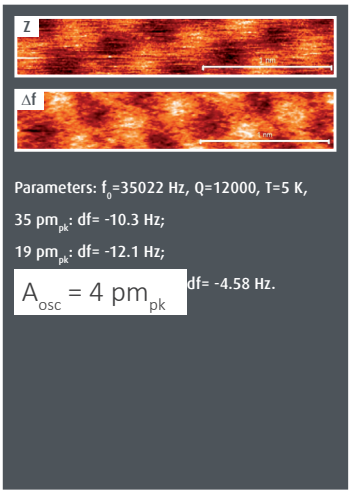
Example for a Stable Oscillation with Signal to Noise 1:10



Oscilloscope traces of measured signals: the PLL (Phase Locked Loop) performance for frequency detection and excitation has been proven. The performance of the frequency selective amplitude regulation is capable of suppressing a wide noise band/frequency range.

NC-AFM with Small Amplitudes on NaCl:





Technical Data

Functions included

TWIN Regulator:
Two independent branches for feedback parameters with independent settings for feedback value and loop gain (i.e. It & Δf, Δf & D (Damping), It & Aux channel, etc.). Integrated controller for KPFM (extra lock-in necessary).

AFM control:
Sensor alignment & control, light source control, resonance/phase curve acquisition, amplitude channel, automatic phase adjustment, tip protection, frequency finder.

AFM contact modes:
Normal & lateral force, force-distance curves, PFM, LFM, C-AFM, SSRM.

AFM non-contact modes:
EFM, MFM, KPFM (FM & AM Mode), SCM, multi-mode operation & spectroscopy, constant damping.

PLL Modes:
Constant amplitude & constant excitation, oscillation amplitudes
< 4 pmpk with QPlus AFM at 5 K, self-excitation (constant amplitude).
- Integrated controller for KPFM (extra lock in needed)
- Remote Interface

The software offers remote access for cont- rolling/integrating external software packages (i.e. LabVIEW) with the MATRIX Automated Task Environment (MATE).

AFM Controller:
Analog Bandwidth:
Contact mode: 0 – 50 kHz
Non-contact mode: 4 kHz – 3 MHz
Input Voltage Noise: 11 nV/sqrt [Hz]
Max. input signal: Contact mode: +/-10 V
Non-contact mode: 3 Vpp
PLL: Demodulation bandwidth: 1 Hz – 2 kHz
Tip Protection

Spectroscopy:
Single point & grid, voltage & z-ramps, varied z-spectroscopy, dual mode spectroscopy, user specific spectroscopy with MATE (MATRIX Automated Task Environment), multiple curves, reversal ramp, modulation switches, trigger signals to synchronize with third party equipment, gap pre-set (parameters VGap, current set point, feedback loop gain can be set to different values for a spectroscopy measurement).

How to contact us:

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