

# ARC2™ SPM Controller – Power, Speed, and Flexibility

*The Asylum Research ARC2 SPM Controller is the most innovative controller for atomic force microscopy. The ARC2, based on the ground-breaking all-digital MFP-3D™ Controller, incorporates improved DACs, high voltage relays, a high speed digital link, and a new design for advanced power and flexibility.*

## *FPGA and Crosspoint Switch – Fast and Flexible*

The ARC2 combines a fast, low noise FPGA and crosspoint switch for powerful signal routing flexibility. This enables nearly limitless controller configurations, easily set within the software.

## *High Performance DACs*

“DAC glitches” are practically eliminated with the ARC2’s new high performance DACs. Performance is typically 10-20x better than DACs currently used in other commercial controllers.

## *Software Controlled Relays*

The ARC2 incorporates new software-controlled, high voltage relays on the X/Y and Z piezo outputs, and for the laser power. This prevents transients upon powering up and increases the life of the piezos. High voltage relays also allow for cleaner thermal noise measurements, especially when using the Asylum Research Extended Z Head (40µm Z scan range).

## *High Speed Digital Link*

All ARC2s come standard with a high speed digital link – ready for the next generation of features and functions.



*The ARC2 SPM Controller combines high performance with ease of use.*



*The hamster knob on the ARC2 can be easily removed from the controller case for operating convenience. The cover to the BNC panel can now be opened or closed (pictured open).*

## *Ready for Solar Applications*

The ARC2 Controller is ideal for one of the growing application areas in AFM – solar. The software can now toggle the SLD on and off quickly (within a few milliseconds) for measurements on light sensitive photovoltaics. This allows conductive AFM data (ORCA™) to be taken during a second pass with the SLD off, preventing

the SLD light from interfering with the current measurement.

## Ergometric Design

The newly designed control box features a smaller footprint with easy accessibility to controls.

- The hamster control wheel can conveniently be removed from the controller so operators can use it closer to where the AFM is located.
- The hamster now has a rotating click wheel that intuitively clicks when a function is changed.
- Power supplies are housed in a pull-out tray for easy accessibility in the field.

## Specifications

### ADCs

- One 16-bit input operating at 5MHz with seven gains and a 16-bit offset (used primarily for cantilever deflection, but also user-accessible).
- Five 16-bit inputs operating at 100kHz (typically three are used for the reading of the X, Y, and Z sensors and two are available for user inputs).

### Frequency Synthesizer

Output from two Direct Digital Synthesizers (DDSs) are summed and are available on one 16-bit, 10MHz DAC.

### Frequency

DC to 2.0MHz in 2mHz increments.

### Amplitude

0 to 20V(p-p) in 0.6mV increments. Amplitude, phase, and frequency of the oscillator can be controlled from software at 100kHz update rates.

### DACs

Six high resolution, ultra low-noise, fast 24-bit channels updated at 100kHz: two high voltage for XY scanning (14kHz bandwidth); one high voltage for Z feedback (117kHz); and three general purpose low voltage (56kHz). Noise levels are 100% factory tested:

- High voltage channels (-10V to +150V):  
Less than 70 $\mu$ V Adev in a 10kHz bandwidth (50 $\mu$ V typ.)

- Low voltage channels (-10V to +10V): Less than 15 $\mu$ V Adev in a 10kHz bandwidth (12 $\mu$ V typ.)

### Dual Digital Lock-ins

Two fully digital lock-ins operating on the fast ADC data stream at 5MHz provide quadrature outputs. Both R/ $\theta$  (amplitude/phase) and I/Q (Rcos $\theta$ / Rsin $\theta$ ) are available in output bandwidths up to 9kHz.

### DSP

Floating point processor running at 80MHz.

### Crosspoint Switch

16x16 digitally controlled "switchboard" for routing signals between the controller's processors, inputs, outputs, DACs and ADCs.

### Digital Q-Control

For cantilevers from 2kHz to 2MHz; typically enhances or suppresses Q by up to 5X.

### USB Computer-to-Controller Communication

#### Laser Power

Software-controlled laser power relay.

#### High Voltage Relays

Software-controlled relays on X, Y, Z high voltage piezo outputs for improved user safety and piezo life.

#### High Speed Bidirectional Digital Link

#### X, Y, & Z High Voltage Outputs

-10 to +150V

#### Computer (minimum)

Dell Precision T3400 mini tower, Dual 160GB SATA RAID1 hard drive configuration, 2.40GHz Quad Core CPU, 3GB RAM, Nvidia 9800GT 512MB video card, video capture card, 16x DVD writer, two 20" LCD screens 1600x1200, (optional 30"), 525W power supply, Windows XP Pro, and IGOR Pro software acquisition and analysis that is user-programmable.

#### ARC2 Bipolar Controller for Home-built SPMs

- The ARC2 Bipolar SPM Controller, configured with +220/-220 VDC power supplies, is ideally suited for home-built piezo tube based SPMs.
- The ARC2 Bipolar SPM Controller, configured with +420/-420 VDC power supplies and ultra low noise electronics, is suited for home-built piezo tube based SPMs, especially low temperature STMs.



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