MATRIX V 3.2

Modular hardware and software control concept

MATRIX vs. SCALA

Good arguments to change ...

I-PDF-MATRIX vs Scala_Jul 2015

Introduction
New functions (Atom manipulation)
New functions (Spectroscopy)
New functions (AFM)
New functions (Miscellaneous)
User interface
Data management
Programming
Hardware specs
About us

Dear Reader,

this is an interactive PDF document.

It offers you - orange marked - internal & external links

for better navigation or additional information .

Please click here for the next page

- Has an improved signal to noise level
- Offers a digital scan generator with no electronic drift
- Uses a digital regulator with more functionalities and flexibility
- Offers more measurement channels (a minimum of 24 internal channels plus 6 external channels)
- Offers improved AFM control with a new digital PLL controller
- Uses automated drift correction by image correlation technique
- Offers extended scripting and remote access functions (i.e. using LabView)
- Is flexible for PC model changes
- And more!

See the following pages for details...

Introduction
New functions (Atom manipulation)
New functions (Spectroscopy)
New functions (AFM)
New functions (Miscellaneous)
User interface
Data management
Programming
Hardware specs
About us

Matrix V3.2

The advantages of the MATRIX Control System over its predecessor SCALA are:

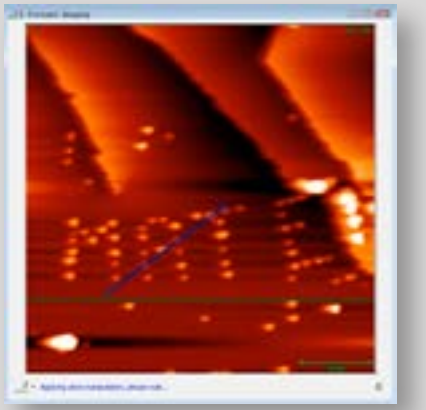
- Easier to use due to a self explanatory graphical user interface (GUI)
- Improved signal to noise level
- Offers a digital scan generator with no electronic drift
- Uses a digital regulator with more functionalities and flexibility
- Offers more measurement channels (a minimum of 24 internal channels plus 6 external channels)
- Offers improved AFM control with a new digital PLL controller
- Uses automated drift correction by image correlation technique
- Offers extended scripting and remote access functions (i.e. using LabView)
- It is flexible for PC model changes
- And more!

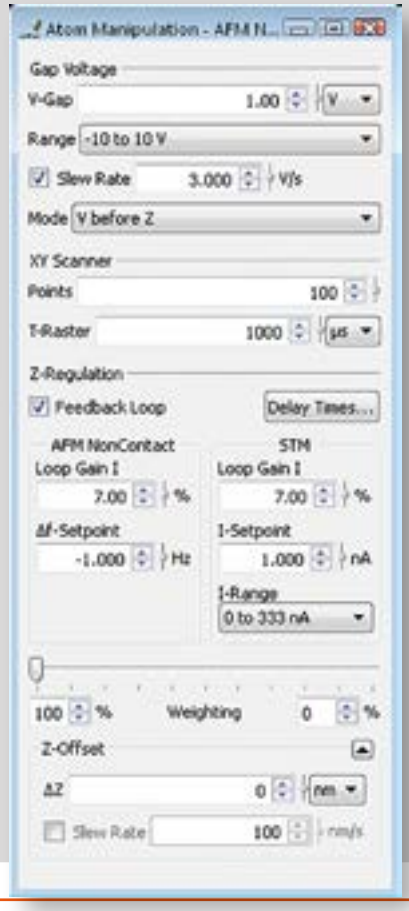
See the following pages for details...

I-PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

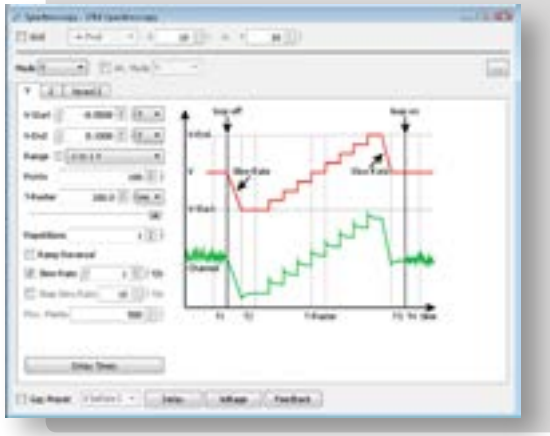
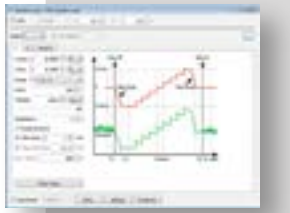
Matrix V3.2	Scala
Atom Manipulation with user defined vectors.	n/a





I-PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
Highly dedicated and flexible spectroscopy module 	Limited functionality and flexibility
Synchronised activation of external modulation inputs with spectroscopy sequence 	Bias modulation always active → visible in topography.

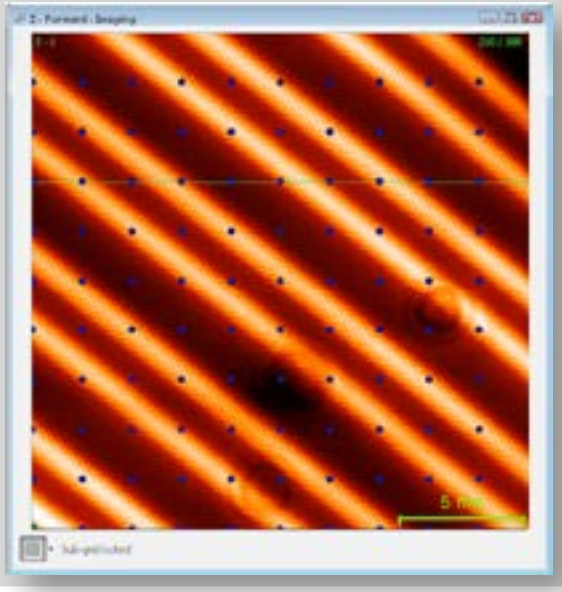
I-PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
Multiple spectroscopy curves at the same position (repeat n times).	n/a
Ramp reversal during spectroscopy measurement (-3 V … +3 V … -3 V)	Only single ramp direction (no reversal in one sequence)
Gap preset: parameters V_{Gap}, current set point and feedback loop gain can be set to alternative values prior to a spectroscopy measurement. This allows to change the tunneling conditions prior to a spectroscopy measurement.	n/a
Optional slew rate on steps for fine adjustment of voltage ramp	Only vertical steps
Very large number of points (>1 M) and long integration time (19 s/point)	4000 pts / 0.164 s/pt

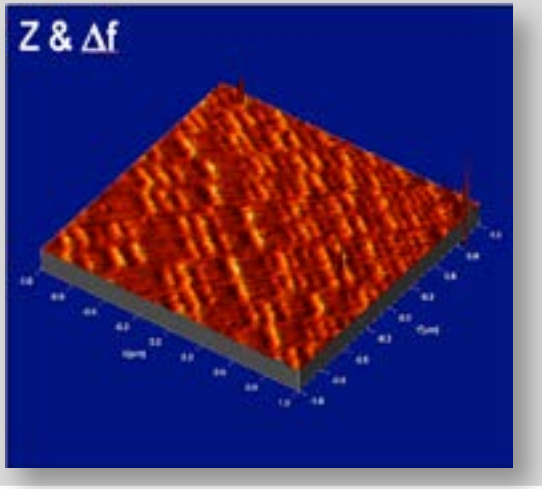
I-PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
Graphically adjustable grid positions 	No graphical representation
Spectroscopy along a graphically defined line	n/a
TTL Trigger outputs for real-time synchronization of spectroscopy with external hardware	n/a

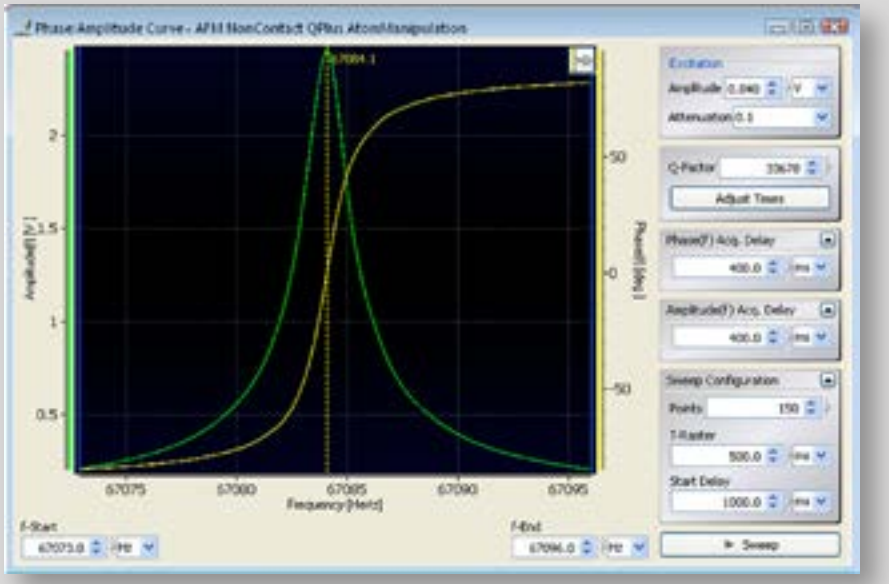
PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
The following items are only available with our PLL extension. Our fully digital PLL provides superior stability and signal-to-noise ratio. It is optimized for small AFM amplitudes.	Analog electronics
MFM modes: - Plane mode (scan on a constant plane with defined tilt) - Z-profiling mode (1st pass: scan topography , 2nd pass: rescan obtained z-profile at defined offset) 	Only plane mode

I-PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
The following modes are available - Constant amplitude mode (PLL active) - Constant excitation mode (PLL active) - Self excitation mode (PLL inactive)	Only self-excitation mode.
Resonance/phase curve acquisition 	n/a

I-PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
Tip protection: the tip is automatically retracted if the amplitude becomes too small or the phase error too large (configurable)	n/a
Integrated controller for Kelvin-Probe Microscopy	n/a
Δf detection bandwidth selection	fixed
Analog monitors for AFM signals awith adjustable calibration	n/a
Live-filtering of AFM data channels	n/a
Amplitude and Phase measurement channels for complete NC-AFM datasets	n/a
Highly accurate Lock-in type amplitude detection for NC-AFM	n/a

I-PDF-MATRIX vs Scala_Jul 2015

Introduction
New functions (Atom manipulation)
New functions (Spectroscopy)
New functions (AFM)
New functions (Miscellaneous)
User interface
Data management
Programming
Hardware specs
About us

Matrix V3.2	Scala
Two-branch regulator. Two feedback parameters can be weighted and used for distance regulation at the same time, for example tunneling current and frequency shift.	n/a
User defined speed for auto approach or loop gain dependent speed. Each mode (STM, AFM) can be set individually.	Fixed speed for STM, loop gain dependent speed for AFM.

I-PDF-MATRIX vs Scala_Jul 2015

Introduction
New functions (Atom manipulation)
New functions (Spectroscopy)
New functions (AFM)
New functions (Miscellaneous)
User interface
Data management
Programming
Hardware specs
About us

Matrix V3.2	Scala
Tip preparation tools (voltage pulse, indentation, combination of both at arbitrary position)	n/a
Up-/Down scans to minimize the effect of piezo creep.	Only most recent SCALA versions.
Separate settings for scan speed and tip relocation speed → tip is safe on sloped surface	Both speeds identical
Line delay function: delay the scan at the beginning of each line (both in forward and backward direction).	n/a

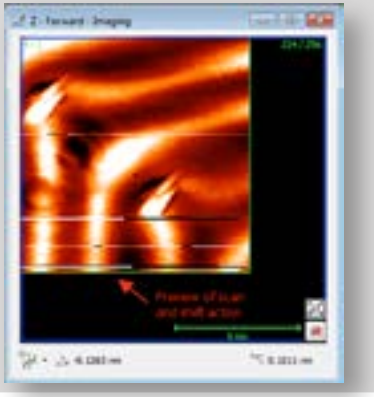
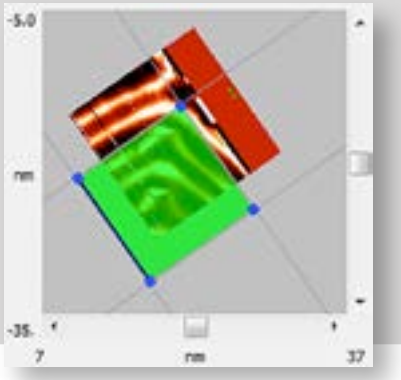
PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
Automated and manual drift correction.	Only manual drift correction.
Adjustable slew rates for V and Z changes	n/a
Prophylactic data storage (to avoid data loss caused by external events during long term measurements)	n/a
Continuous signal vs. time channels. Can be used as an oscillos-cope or FFT tool.	n/a
User-configurable initial sampling delay and oversampling for each channel helps optimizing spectroscopy acquisition.	n/a

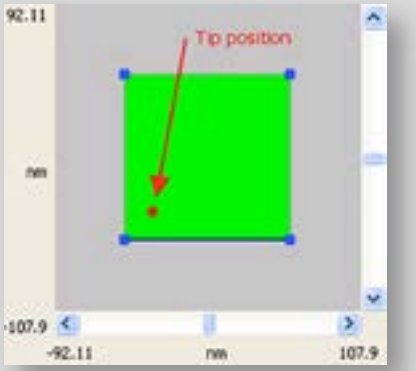
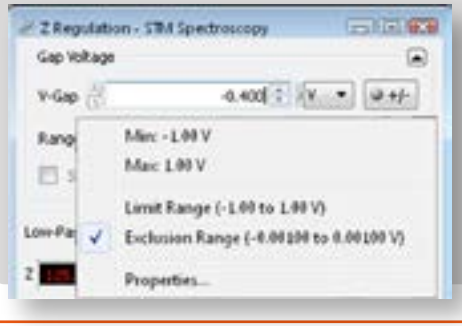
I-PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
Interactive zoom, pan, and rotation directly in the data display by mouse control. 	n/a
Copy scan data to scan control area as navigation aid 	n/a

I-PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
Tip movement visualization 	n/a
Limits and forbidden values can be specified for each numerical control (like tunneling current, gap voltage, scan size etc.) 	n/a

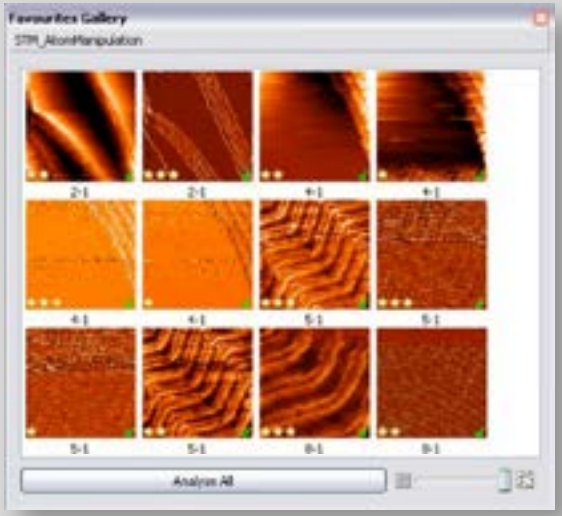
I-PDF-MATRIX vs Scala_Jul 2015

Introduction
New functions (Atom manipulation)
New functions (Spectroscopy)
New functions (AFM)
New functions (Miscellaneous)
User interface
Data management
Programming
Hardware specs
About us

Matrix V3.2	Scala
Supports Window Schemes for alternative window configurations	n/a
Mouse tools (direct interaction with a channel display) 	Mouse tools only for - Single point spectroscopy - Drift compensation
Acceptance of parameter changes in real-time → much smoother experiment control	After completion of scan line

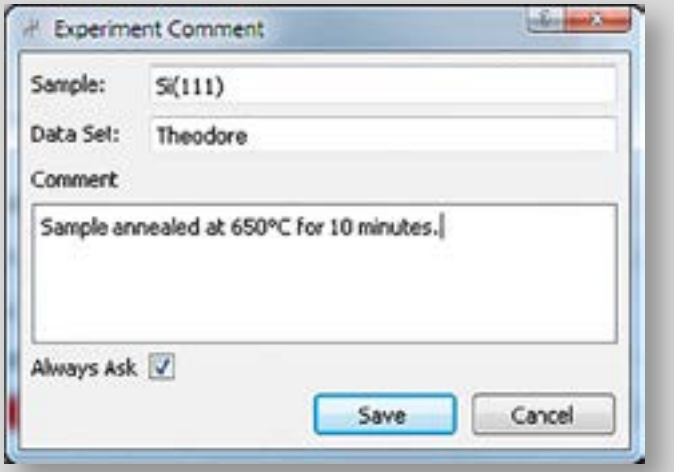
I-PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
Star-rating for easier data retrieval	n/a
Favourites Gallery function for easy access to image processing or browsing 	n/a

I-PDF-MATRIX vs Scala_Jul 2015

Introduction
New functions (Atom manipulation)
New functions (Spectroscopy)
New functions (AFM)
New functions (Miscellaneous)
User interface
Data management
Programming
Hardware specs
About us

Matrix V3.2	Scala
Comment system (global and image-by image). Data can be filtered for comments while browsing 	Only one comment field available. Data cannot be filtered based on comment
Easy Clipboard copy facility for images and curve data	n/a

I-PDF-MATRIX vs Scala_Jul 2015

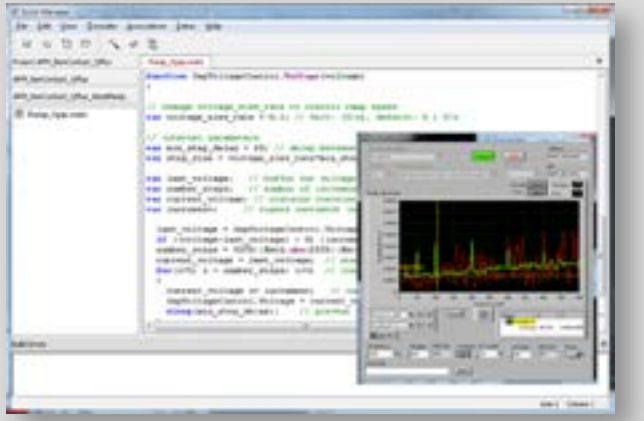
- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
Quick data browsing with Vernissage: - complex filtering for channels, parameters etc. - Mouse Drag and Drop support - Parameter View for instantaneous access to measurement parameters while clicking through a series of images - Table view for fast quantitative overview of data sets - Export facility to different file formats (Bitmap, ASCII, SCALA Pro, etc.) Commandline version for batch processing available	Data browsing with built-in viewer

I-PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
Flexible Experiment Control through MATE programming language - Automation - Experiment modifications during a running experiment - Trigger signals for experiment states (e.g. position reached, scan finished, line finished etc.) - Integrated script programming environment with syntax highlighting and error checking - Easy-to-learn script language based on ECMAScript - Multiple simultaneous scripts and remote software extensions possible	Limited control



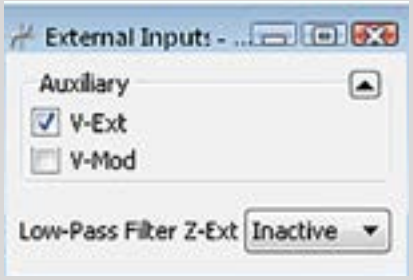
I-PDF-MATRIX vs Scala_Jul 2015

Introduction
New functions (Atom manipulation)
New functions (Spectroscopy)
New functions (AFM)
New functions (Miscellaneous)
User interface
Data management
Programming
Hardware specs
About us

Matrix V3.2	Scala
Remote API for LabView and other external software via C-library with full MATE functionality	n/a

I-PDF-MATRIX vs Scala_Jul 2015

Introduction
New functions (Atom manipulation)
New functions (Spectroscopy)
New functions (AFM)
New functions (Miscellaneous)
User interface
Data management
Programming
Hardware specs
About us

Matrix V3.2	Scala
Software-switchable low pass filters for distance regulation, external bias offset and various AFM monitor signals.	n/a
Software switchable external inputs V_{ext}, V_{mod} and Z_{ext} 	n/a
>24 bit dynamic z-resolution with true 20 bit converter. Z-gain switching not necessary.	16 bit z-resolution → z-gain switching necessary for either full scan range or best resolution.
A/D converter sampling rate: 400 kHz.	100 kHz

I-PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
6 external channels in addition to internal channels (like IT, Z, Δf etc.). Further extensible by additional A/D converter boards.	2 external channels, only 2 simultaneous channels.
Analog output: 2x programmable D/A converter per A/D converter board	n/a
Higher data rates possible (down to 5us/pixel, multiple channels)	10us/pixel + electronic drift/noise
Fully digital scan generation and feedback → much smaller electronic drift in X, Y and Z directions.	Analog scan generation and feedback with intrinsic residual electronic drift in X, Y and Z directions.
High performance bus system with CPU/FPGA/DSP on every board → no performance drop when extending system	Strongly Limited resources

I-PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Matrix V3.2	Scala
Front panel with BNC connector for all relevant analog signals → easy access	Limited BNC monitors at backside
Fast Ethernet connection to PC for long-lived compatibility and replaceability of PC	Proprietory IEEE1394
MATRIX is Windows 7 compatible	Only Windows NT and Windows XP
Fully compatible with Omicron microscopes, adaptor sets for older microscopes available	Only compatible with old instrument types

I-PDF-MATRIX vs Scala_Jul 2015

- Introduction
- New functions (Atom manipulation)
- New functions (Spectroscopy)
- New functions (AFM)
- New functions (Miscellaneous)
- User interface
- Data management
- Programming
- Hardware specs
- About us

Scienta Omicron is the world's leading supplier of analytical UHV-instrumentation solutions in nanotechnology research & development. With a team of more than 150 specialists we provide for:

- Electron Spectroscopy
- Scanning Probe Microscopy
- Thin Film & Tailored Systems
- Service & Engineering

Scienta Omicron in Taunusstein / Germany.

Scienta Omicron GmbH
Limburger Str. 75 • 65232 Taunusstein • Germany
Tel.: +49(0) 6128 / 987 – 0
e-mail: info@scientaomicron.com
Web: www.scientaomicron.de

I-PDF-MATRIX vs Scala_Jul 2015