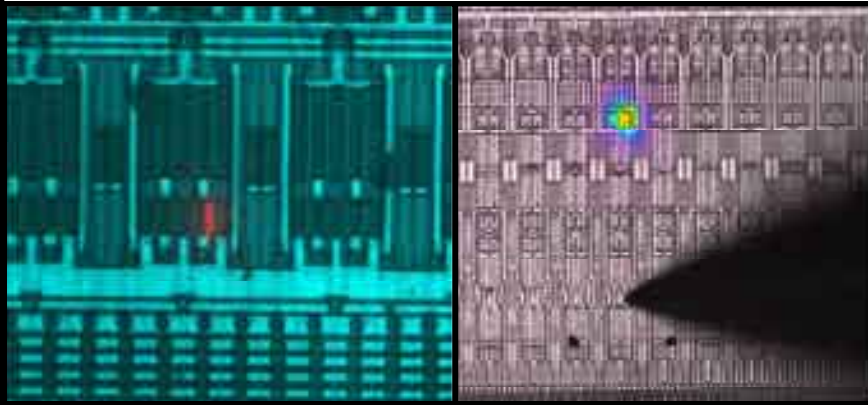


FA-2000™ EMISSION MICROSCOPE

Introduction

The Micromanipulator Company is pleased to introduce the FA-2000™ emission microscope. The FA-2000™ offers a 1.4 million pixel high-resolution low noise camera with super pixel/binning option for higher sensitivity. The fast frame rate allows easy focus and positioning.



Saturated NMOS transistor due to gate short (>1050nm)

FA-2000™ Camera Specifications:

- 1,376H x 1,040V megapixel resolution.
- 2/3" format.
- >70db signal to noise ratio.
- 12 frames per second readout for easy *Focus Mode*.
- 6.7 x 6.7 micron pixels.
- 1/30 second to 50 minute exposure control.

FA-2000™ system



- Super Sensitivity modes can generate shorter exposure times and superpixels up to 26.8 x 26.8 microns in size.
- Two-stage Peltier cooling for high S/N ratio and low dark current.
- 0 - 65,536 grayscale dynamic range (0-4 OD).
- 16-bit file generation.
- Customized electronics to minimize camera electronic noise.
- High relative quantum efficiency.
- Multi-channel, multiple color image display.
- Spectral Response: 280 - 1200nm.
- Readout Frequency: 12.5Mhz.
- Dark Current Noise: 0.1 electron/pixel/ second.
- Read Out Noise: 4-5 electrons.

Sensitivity:

Sensitivity of a CCD sensor is primarily determined by two factors:

- 1) *Quantum Efficiency (QE)*: the number of signal photoelectrons generated within a pixel for a given illumination level.

- 2) *Read Noise*: minimum number of photo- electrons needed to be reliably detected over the camera's inherent noise floor.

A high QE is not the only factor to consider, as the signal must be identifiable from its background in order to be useful. A high *QE* with a poor signal to noise ratio may allow very faint signals to be detected, however, the detected signal may not be distinguishable from the high noise filled background. Therefore, *read noise* plays an important role in determining the final sensitivity of the camera.

Image and Sensitivity Zoom Capabilities

- Maximum pixel density 100,000 per cm².
- Pixel zoom from 6.7 to 26.8 microns pixel via pixel binning.
- High sensitivity zoom for up to 16X increase.

FA-2000™ 32-bit image acquisition features include:

- Camera exposure control from 1/30th second to 50 minutes by 1/30 second increments or custom exposure mode.
- Special *View* mode for focus adjustment.
- *Freeze* button to capture image on-screen with a single button click.



1555 Forrest Way Carson City, NV 89706
info@micromanipulator.com www.micromanipulator.com
Tel: 775-882-2400 Tel: 800-654-5659 Fax: 775-882-7694 Made in the USA

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Specifications subject to change without notice.

- *Movie* mode allows for up to 50 images to be automatically captured with a single button click with selected exposure times and time delays between image captures.
- Automatic exposure settings with user *or* experimentally defined defaults.
- 9 levels of automatic image enhancement: real-time black, white,

and gamma level adjustments.

- Images displayed in gray scale or color.
- Image statistics available on printout.
- Multi-channel image display.
- RESET and CLEAR for quick, single-button movement back to original image.

FA-2000™ 32-bit image enhancement features include:

Zoom/ Pan

- Real time 1X, 2X, 4X and 8X zoom and pan functions.
- Unique “image grab” function for live, on-screen zoom control with single button click while in analysis tools.

Rotate/ Flip

- Adjust rotation of image by one degree increments from -90 to +90 degrees.
- Image Reset button to easily return to original, un-rotated image.
- Flip image vertically.
- Flip image horizontally for backside imaging.

Enhance

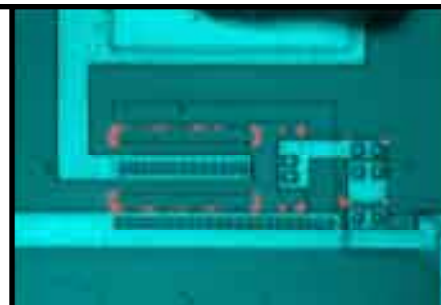
- Real time, one-button click to enhance image print quality by automatically adjusting black, white, and gamma according to image gray scale statistics.
- 9 levels of auto image enhancement.

Annotations

- On-screen annotation function for text, boxes, circles, arrows, lines or freehand sketch. Annotations can be stretched, moved, copied, and zoomed. Six (6) different pen widths, five (5) different pen styles, single or double ended arrows, unlimited fonts, colors and point sizes. Text annotations can be rotated to user-defined angles. Annotations can be placed anywhere inside or outside of image.
- Text can be transparent, or with black or white background for easy identification.
- Unique vertical and horizontal annotation alignment.
- Direct text alignment to the image.
- Unique-editing tool allows for easy text editing with Window display.
- Annotations can be saved as a separate template file or as part of the electronic file.

Filters

- Unlimited image filtering to obtain sharper and clearer images by noise reduction, 3D contour, and/or edge sharpening.
- 3D contour filters can be shadowed in 9 different directions with 9 different intensity levels.
- Unlimited custom filter matrix for user defined algorithms including gradient, high pass, low pass, smooth, Laplace.
- Undo button to remove applied filters step by step.
- RESET button for single click movement back to original image.



Avalanche breakdown on an input pin (650-1050nm)

Image Operations

- Image archiving statistics automatically saved with each image as part of image or separate *.STP file.
- Annotations can be saved as part of image as modified file or as a separate template.
- Data can be printed, or exported via Windows Clipboard, ASCII file, or directly to spreadsheets, word processors, and publication software for further processing.
- Images can be saved using a non-lossy compression algorithm to minimize storage space.
- 3 levels of security with log-in, log-out feature. Tracks total number of prints, total time of use, and last time of use for each user.
- All image acquisition, enhancement, archiving, printing, and analysis features are contained in one interface. No other computer or software package is required.
- All data can be output to a video printer, text printer, Clipboard, or saved as ASCII data for direct importation into popular Windows applications such as Excel, PowerPoint, etc.

Ruler

- Object distance measurement with scaled, calibrated distance measurements between two points of interest.
- X-Y coordinate position with mouse cursor movements.