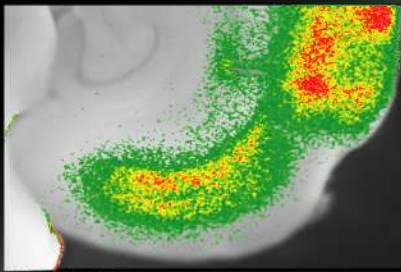


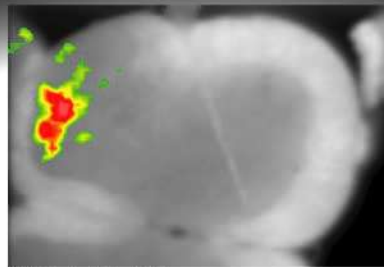
MiCAM SERIES

High Speed and Low-Noise Imaging Systems

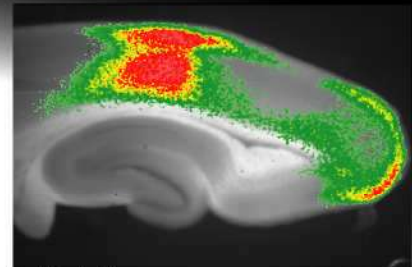
Membrane Potential / Calcium



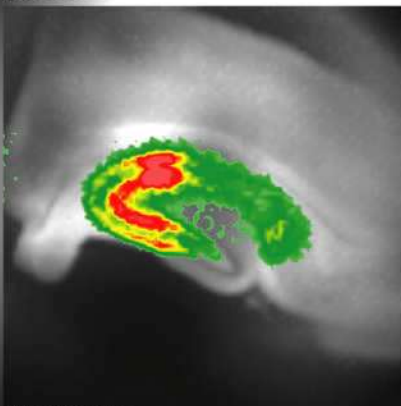
Rat: Brain Slice



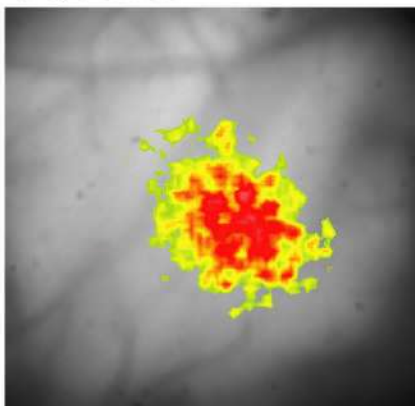
Rat: Spinal Cord Slice



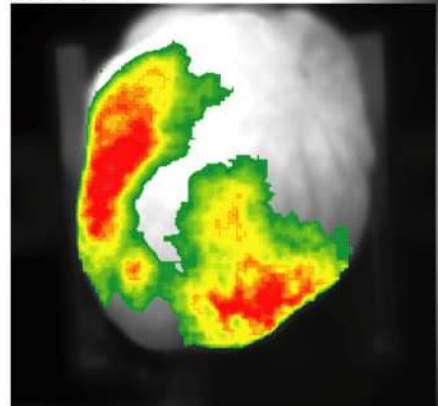
Rat: Brain Slice



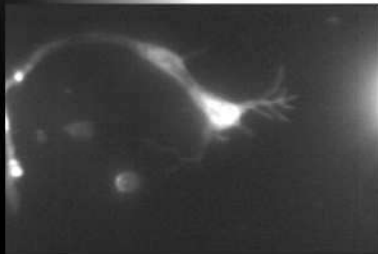
Rat: Brain Slice



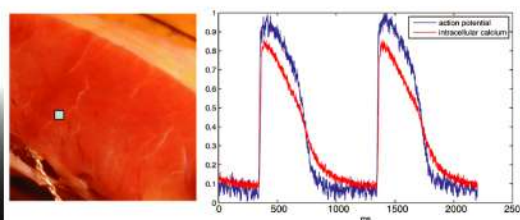
Mouse: Cortex (In Vivo)



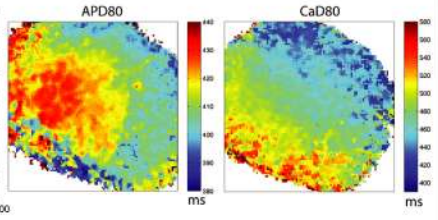
Rat: Isolated Heart



Frog: Neural Stem Cell



Human: Heart (Ventricle) *1



Main Features

High Speed / Low Noise

High Dynamic Range

Synchronized Dual Camera

C-Mount Connection

Various I/O Connectors

Applications

- Membrane Potential Imaging
- Calcium Imaging
- FRET
- Intrinsic Imaging Based on Hemoglobin and Flavoprotein
- Other High Speed Imaging

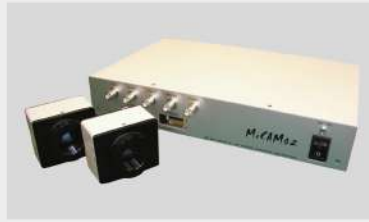
Imaging Systems

Ultra-Fast CMOS Imaging System **MiCAM ULTIMA**



Spatial Resolution: 100x100 pixels
Image Sensor Size: 10mm x 10mm
Maximum Frame Rate: 10,000 frames/sec
Well Depth: 1,500,000 e⁻
S/N Ratio: > 70dB
Built-in Memory: 1GB

Fast CCD Imaging System **MiCAM02-HR**



Spatial Resolution: 40x28 - 376x252 pixels
Image Sensor Size: 6.4mm x 4.8mm
Maximum Frame Rate: 769 frames/sec
Well Depth: < 100,000 e⁻
S/N Ratio: > 60dB
Built-in Memory: 512MB (Option: 1GB)

Fast CMOS Imaging System **MiCAM02-CMOS**

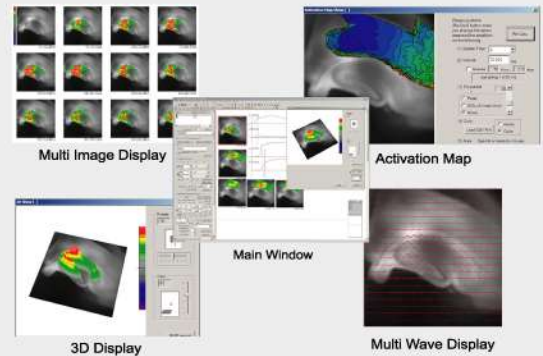


Spatial Resolution: 92x24 - 188x160 pixels
Image Sensor Size: 5.76mm x 4.8mm
Maximum Frame Rate: 5,000 frames/sec
Well Depth: 450,000 e⁻
S/N Ratio: > 68dB
Built-in Memory: 512MB (Option: 1GB)

Software

BV_ANA

BV_Ana is a data analysis software and is included with all of the MiCAM systems. This software has various functions, such as wave display, 3D display, animation display, real-image display, spatial/temporal filter, high-pass/low-pass filter, AVI/TIFF/BMP/CSV file export, etc. The quick analysis ability of recorded data makes it possible for users to do many experiments on a single biological sample under various conditions.



Light Source

HL-151 Halogen Light System **LEX2 High-powered LED**



- Higher and Stable Light Intensity
- 150W Halogen Lamp
- Built-in Shutter
- Shutter Controller
- Variable Shutter Speed



- High Power
- High Stability of Light Intensity (< 0.05% drift in 2 sec)
- Small Fluctuation (< 0.015%)
- Rapid Rise Time (3 msec)

Electrical Stimulator

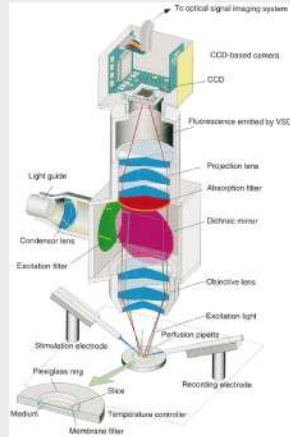
ESTM-8



- 2ch Isolated Outputs / 6ch Outputs
- 4ch Analog Inputs and Other Inputs
- USB Connection to PC
- Software Interface
- Digital Oscilloscope
- Multi-Parameter Discriminator

Fluorescence Microscope

THT Macroscope



Design



Inverted Configuration



for Cardiac Preps

The THT Macroscope is a fluorescence microscope developed for detecting low light fluorescence by capturing an optimal amount of light photons which are emitted from the biological sample. This microscope is a tandem-lens system which combines two Leica lenses with large fluorescence filters in order to maximize the amount of emitted light.

- Extremely High Light Throughput with High N.A Value Lenses and Large Light Path
- Various Types of Microscope Stands and Fluorescence Filters
- For Fast Optical Imaging
- C-mount Camera Port

Beam Splitter

DL-FLSP1



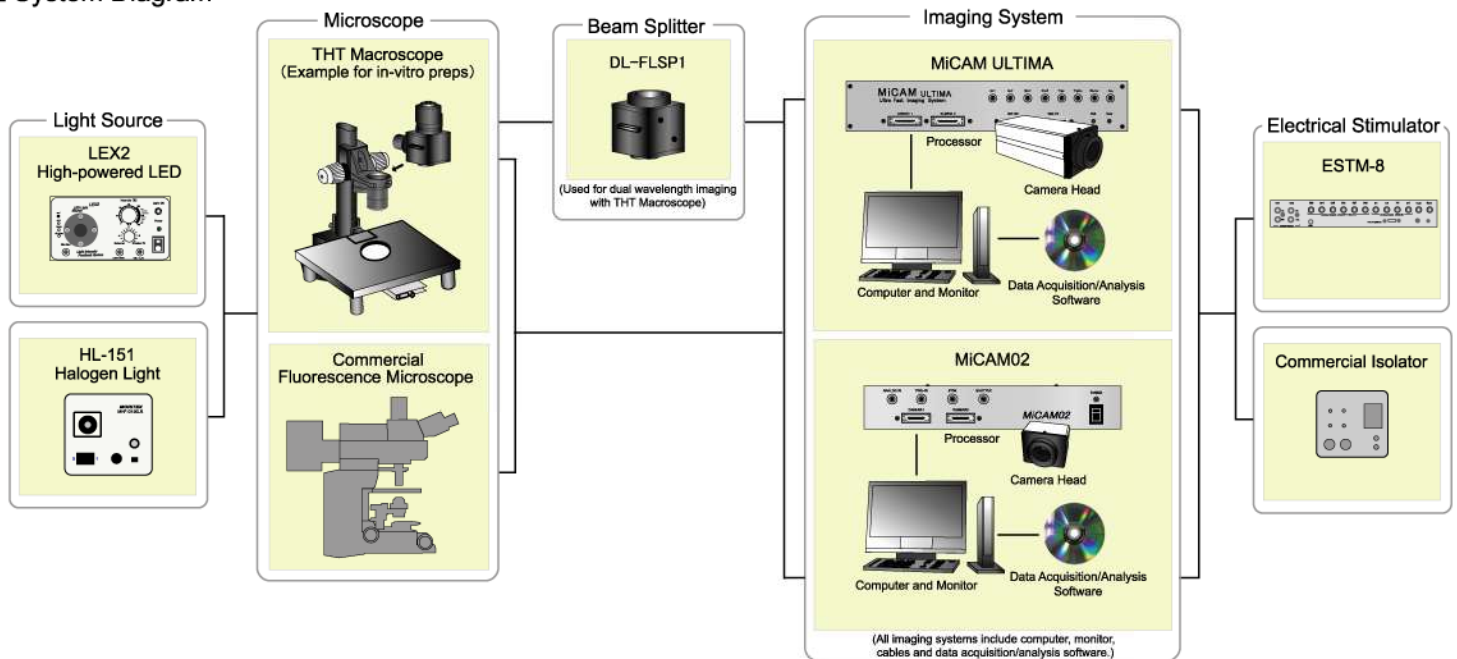
- Two-Channel Simultaneous Imaging
- High Light Throughput
- Camera Position Adjustment with Kinetic Mount for Dichroic Mirror
- Changeable Fluorescent Filters

Complete System



Complete System includes MiCAM imaging system, PC, Monitor, Software for Data Acquisition/Analysis, THT microscope, Light Source and Electrical Stimulator.

System Diagram



■ Specifications for MiCAM series

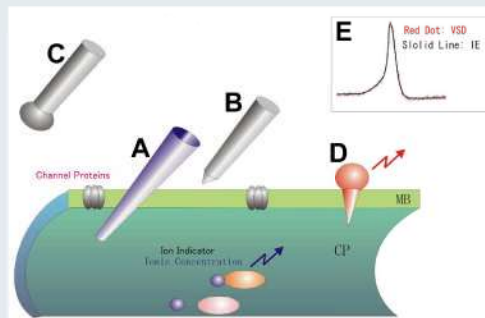
Model	MiCAM ULTIMA-L	MiCAM02-CMOS	MiCAM02-HR
Image Sensor	Original CMOS	Original CMOS	1/2 inch CCD (ICX428ALL)
Actual Sensor Size	10mm x 10mm	5.76mm x 4.8mm	6.4mm x 4.8mm
Spatial Resolution (pixels: H x V)	100 x 100 (fixed)	92 x 24	40 x 28
		92 x 40	88 x 60
		92 x 80	184 x 124
		188 x 160	376 x 252
Temporal Resolution (/frame)	0.1ms - 250.0ms	0.2ms@92x24	1.3ms@40x28
		0.3ms@92x40	2.2ms@88x60
		0.6ms@92x80	3.7ms@184x124
		1.2ms@188x160	7.0ms@376x252
Maximum Recordable Frame Number	20,480 (Option: 40,000)	8,720@ 92x24	21,480@40x28
		8,720@ 92x40	21,480@88x60
		8,720@92x80	5,460@184x124
		4,360@188x160	1,364@376x252
Well-Depth	1,500,000e (Option: 10,000,000e)	450,000e	100,000e@88x60 (H-bin Mode: 6,000e@88x60)
			100,000e@184x124 (H-bin Mode:12,000e@184x124)
Actual Quantum Efficiency	63%@550nm	45%@550nm	75%@550nm
	45%@700nm	38%@700nm	50%@700nm
Dark Noise	230e@0.1ms 80e@1.0ms	150e@1.2ms, 188x160	40e@2.2ms, 88x60 (H-bin Mode:15e@2.2ms, 88x60)
			60e@3.7ms, 184x124 (H-bin Mode:20e@3.7ms, 184x124)
A/D Converter	14bit (16 bit after digital process)	12bit (Data resolution is more than 14bit after digital process)	
Composition	Processor, Camera, Computer, Monitor, Cables, Acquisition/Analysis software 1-Year Software Free Update License		
Output	Programmable (pulse delay, duration, pulse number, interval and so on)		
Analog Inputs	2ch (addl. 6 channels available)	2ch (addl. 2 channels available)	
Other Outputs	Trigger, Shutter, Digital I/O, NTSC Output		
Interface	PCI / PCI Express x1 / USB	PCI / PCI Express x1 / USB	

■ Features of Voltage-Sensitive Dye Imaging

Voltage-Sensitive Dye changes its absorbance and fluorescence light intensity in proportion to membrane potential in neuron/cardiomyocyte stained with the dye. It is possible to visualize their activities in real-time and know where/when/how excitation occurs by utilizing **Voltage-Sensitive Dye** as chemical probe and detecting its change in light intensity with high-speed imaging systems.

■ Methods to Measure Membrane Potential (right figure)

(A) Intracellular Recording, (B-C) Extracellular/Field Potential Recordings, (D) Voltage-Sensitive Dye is a molecular probe and converts membrane potential to fluorescence light intensity by binding to lipid bilayer of membranes. (E) Action potentials measured from squid giant axon. Black continuous line indicates the result from intracellular recording, and red dotted line indicates the result from voltage-sensitive dye imaging.



■ Staining Protocol for Brain Slice Sample

1. Add 1mL of alcohol (ethanol is better than methanol) into the bottle of Di-4-ANEPPS (5mg) directly, and dissolve the dye well.
2. Add 0.5mL of 10% Cremophore-EL solution (v/v in ddH₂O), and dissolve well. This solution, as the stock solution, can be stored in 4 degrees C for 2-3 months.
3. Add 25 micro-L of the stock solution to mixture of 0.5mL of fetal bovine serum (FBS) and 0.5mL of artificial cerebro-spinal fluid (ACSF), and dissolve well. This solution can be the staining solution, which the final concentration of dye is about 0.1mg/mL.
4. Put the slices in a closed staining chamber which can give the condition like interface chamber to a specimen. Drop the staining solution on a tissue slice, and incubate for 20 minutes in room temperature and bubbling ACSF with 5%CO₂-95%O₂ gas to keep the oxygen concentration and humidity.
5. Transfer the stained slice in the recording chamber (submerge) under fluorescence microscope, and start the optical recording after the incubation for 30 minutes.

■ Widely Used Voltage-Sensitive Dyes

Di-4-ANEPPS, Di-2-ANEPEQ, Di-8-ANEPPS, RH795, RH237, RH482, RH414, RH1691, RH1692

■ References

1. Tominaga E et al. "Quantification of optical signals with electrophysiological signals in neural activities of Di-4-ANEPPS stained rat hippocampal slices." : J Neurosci Methods. 2000 Oct 15;102(1):11-23.
2. Efmov IR et al. "Optical imaging of the heart". Circ Res. 2004 Jul 9;95(1):21-33. Review.
3. Entcheva E et al. "Macroscopic optical mapping of excitation in cardiac cell networks with ultra-high spatiotemporal resolution." Prog Biophys Mol Biol. 2006 Oct;92(2):232-57.

*1: Simultaneous calcium and voltage imaging in human ventricle with MiCAM ULTIMA-L dual camera system. Figure shows (left to right): photo of transrural wedge human heart preparation, single pixel recordings of Vm and Ca, maps of action potential duration and calcium transient duration at 80% amplitude.

* Specifications & appearance are subject to change without prior notice due to continuous improvements.

* All products are made in Japan.

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