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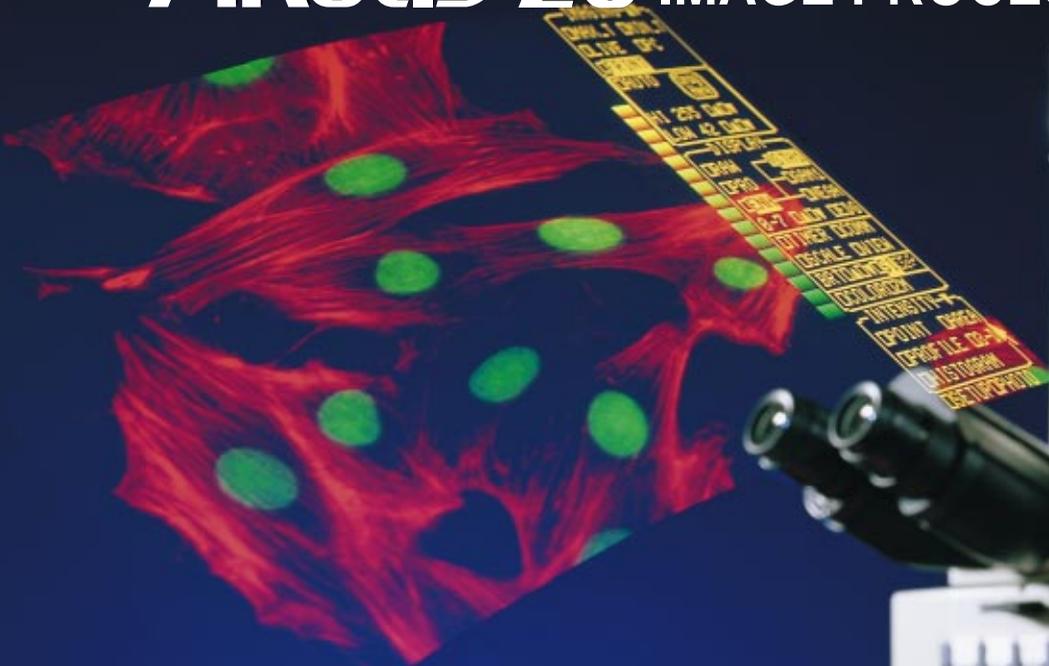
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Image Processing and Analysis System for Optical Microscopes

ARGUS-20 IMAGE PROCESSOR



HAMAMATSU



Video Microscopy Converts Optical Microscope into High-Quality Imaging and Image Analysis System

Despite its limitations, the optical microscope remains an indispensable tool for continuous direct observation of live specimens. The technology of “video microscopy” helps overcome the limitations by converting the optical microscope into a sophisticated system that takes full advantage of digital image enhancement and image analysis.

Video microscopy represents a major breakthrough in optical microscope applications. Powerful digital enhancement capabilities significantly increase the microscope’s effective sensitivity and resolution, while it digitises observed light intensities into suitable for various types of 2d quantitative analysis.

Video microscopy has already achieved wide use in the fields of histology and cell biology, and is now an essential technique for other scientific disciplines as well. It is expected that this technology will serve as the basis of new research methodologies in a wide variety of applications.

The ARGUS-20 Image Processor represents an important advance in video microscopy. The ARGUS-20 provides high-quality image observation and quantitative analysis with a video camera and an optical microscope. The ARGUS-20 Image Processor is especially suitable for observing low-light or low-contrast samples in the presence of phenomena, such as fluorescence and luminescence, which make direct observation with an optical microscope difficult.

Equipped with many other powerful functions necessary for video microscopy, such as the ability to isolate and display the moving portion of the sample under observation, and the ability to superimpose one image on top of another in order to highlight specific areas of interest or change, the ARGUS-20 Image Processor puts state-of-the-art video microscopy at the disposal of the microscopist and biomedical researcher.

Despite its sophistication, the ARGUS-20 is user-friendly. Researchers who are new to video microscopy will find the ARGUS-20 easy to operate, while more seasoned video microscopists will quickly recognize and appreciate its power and versatility.

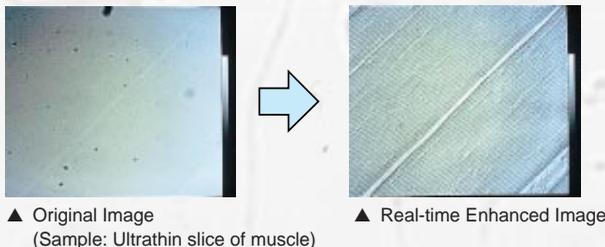
FEATURES

1 High Resolution

The ARGUS-20 allows real-time observation of high-resolution images without loss of original camera resolution. (1024-pixel horizontal resolution)

2 Real-time Contrast Enhancement

Analog contrast enhancement enables clear observation of low-contrast images. Image enhancement can also remove video-camera noise and non-uniformity or un-uniformity illumination.

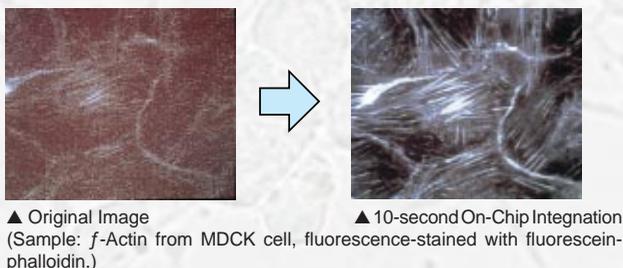


3 Real-time Motion Extraction

Extracts and displays areas of dynamic change within the observed field. Use this feature to map the path of a moving specimen or to display only those areas characterized by rapid change.

4 CCD On-Chip Integration

The optional C2400-75i CCD camera can use arbitrarily extended time exposures to obtain clear image of low-light samples. While conventional CCD cameras are limited to well-lit samples, the C2400-75i also provides excellent imaging of dim fluorescence samples.



5 Photon Counting Imaging

The optional C2400-47 VIM or C2400-35 PI-CCD camera utilizes photon counting to produce images of samples characterized by extremely faint fluorescence or luminescence.

6 Real-time Edge Sharpening

Use this function to extract or further sharpen the edges within the enhanced image.

7 Real-time Image Dividing

This function generates and display a real-time image dividing showing the relative difference between the current input image and a previously recorded background image.

8 Real-time Zooming

Magnify the image by 200 or 400 percent in real time.

9 Split Screen and Superimposition

Display a real-time image together with a still image in split-screen form, or superimpose fluorescence and nonfluorescence images of the same sample area.

10 Scale Bar, Timer, and Comment

Display scale bar, timer, and comments at arbitrary positions on the screen.

11 Length, Area, and Speed Calculation and Display

Display length value, area value, or speed value for a line, shape, or moving object traced by the mouse.

12 Intensity Analysis

Calculate and display the intensity value for any point or rectangular field on the screen, or display a horizontal or vertical intensity profile or three-dimensional intensity distribution. (Maximum intensity resolution is 16 bits.)

13 Multiple Video Input

The ARGUS-20 can accept both NTSC and CCD camera signals as input. It can also drive a CCD camera directly, making for a highly compact system. The ARGUS-20 can also accept a further three video inputs via the RGB input connector, allowing connection to up to five video cameras at once. The video inputs can be switched between using software.

14 Color Video Input

The ARGUS-20 can produce full-color images from analog RGB signals received through its RGB input connector.

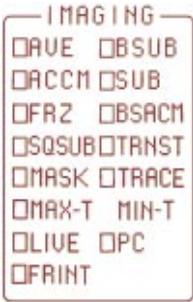
15 Full SCSI Support

The ARGUS-20 provides full SCSI support, enabling easy connection to a Macintosh®, IBM-PC/AT®, or other computer system. Optional software allows the computer to drive the ARGUS-20 and to receive and store ARGUS-20 image data.

APPLICATIONS

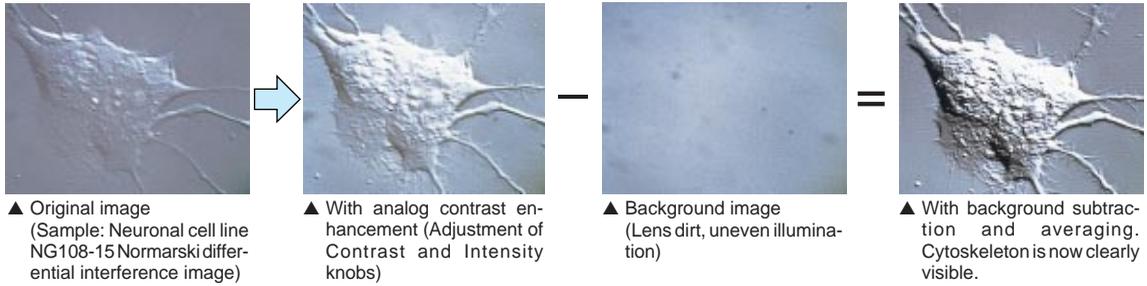
- Observation of cell movements
- Observation of intercellular transport
- Observation of cytoskeleton
- Observation of unstained low-contrast samples
- Observation of fluorescence-stained samples
- Observation of bioluminescence and chemiluminescence
- Micromanipulation monitoring
- Observation of cell cycles
- Observation of cultured tissue
- Observation of gene expression
- Superimposition of fluorescence and nonfluorescence images

IMAGING (Image Processing Commands)



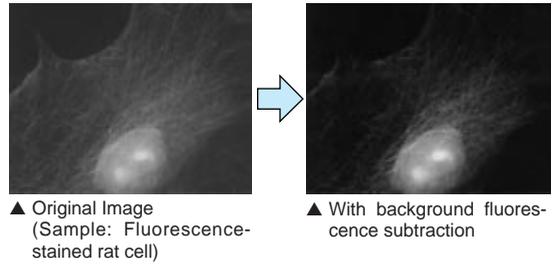
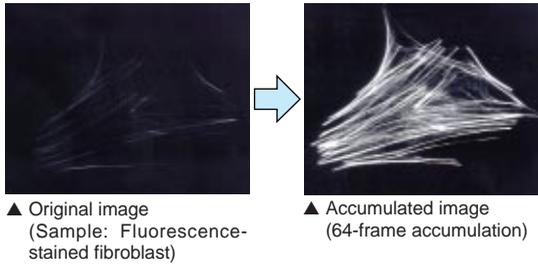
BSUB Real-time Background Subtraction: Subtracts background artifacts such as lens dirt and uneven illumination.

AVE Image Averaging: Raises the S/N ratio by eliminating subtle video-camera noise effects.



ACCM Image Accumulation: Integrates multiple images of stationary sample to produce a clear, well-defined final image.

BSACM Background Subtraction & Accumulation: Combines image accumulation with subtraction of video-camera dark current, background fluorescence, or other such background effects.

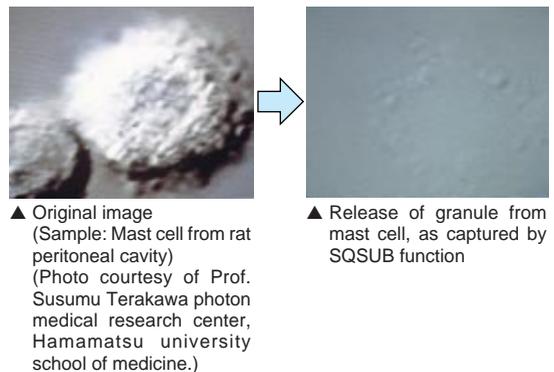
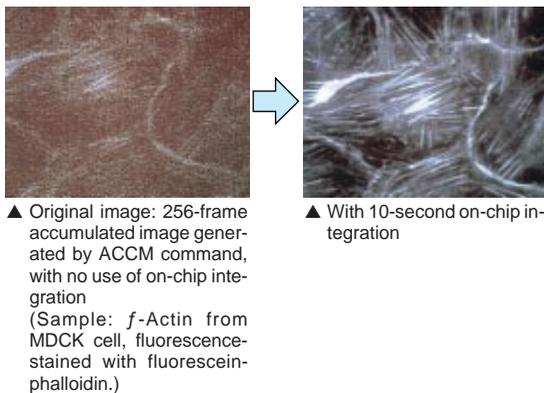


SUB Image Subtraction: Subtracts the input image from a memorized image.

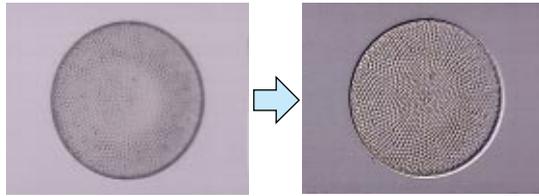
SQSUB Sequential Subtraction: Removes all stationary area from a series of images, so that only moving elements are displayed.

Frint CCD On-Chip Integration: CCD camera integrates data received at each CCD element, enabling extended time exposures for greatly enhanced sensitivity. (Requires use of the C2400-75i CCD camera.)

TRNST Rapid Transition Isolation: Isolates and displays areas of rapid transition, filtering out both stationary areas and areas of slow fluctuation (such as areas characterized by fluorescence fading or slow changes in sample).

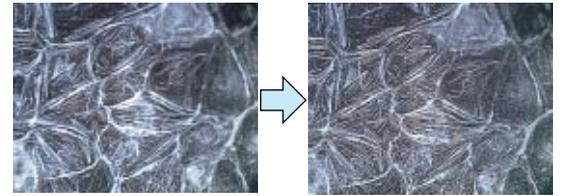


MASK Mask Processing: 3-by-3 matrix spatial filtering of recorded image; used for edge sharpening, shadow enhancement, and noise elimination. (Supports horizontal differentiation, vertical differentiation, H-V differentiation, Laplacian processing, sharpening, and smoothing.) Real-time mask processing is available as an option.



▲ Original image
(Sample: Diatom, with through-illumination)

▲ After H-V differentiation



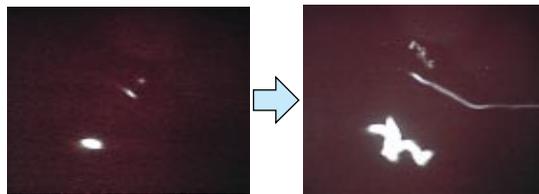
▲ Original image
(Sample: *f*-Actin from MDCK cell, fluorescence-stained with fluorescein-phalloidin.)

▲ With edge sharpening

TRACE Image Trace: Traces trajectories of moving objects.

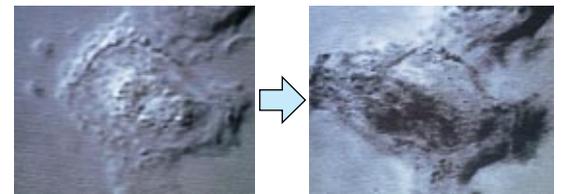
MAX-T Maximum Intensity Trace: Traces trajectories of moving objects brighter than the background.

MIN-T Minimum Intensity Trace: Traces trajectories of moving objects darker than the background.



▲ Original image (1/30-second)
(Sample: Single-cell organism with auto fluorescence)

▲ Trajectory extracted by 1-second maximum intensity trace



▲ Original image
(Sample: Rat macrophage)
(Photo courtesy of Prof. Susumu Terakawa photon medical research center, Hamamatsu university school of medicine.)

▲ Trajectory of internal particles extracted by 5-second minimum intensity trace

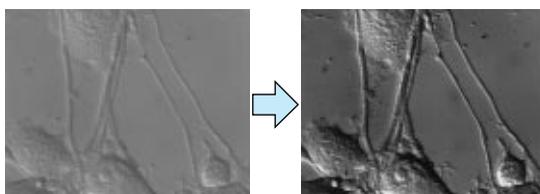
LIVE LIVE: Shows actual real-time image from video camera. Can be used in combination with the ENH function.

PC Photon Counting: Generates image based on count of released photons. (Requires use of the C2400-47 VIM or C2400-35 PI-CCD camera.)

DISPLAY (Display Commands)

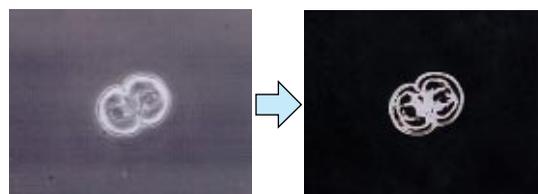


ENH Enhance: Allows interactive enhancement, suppression, or isolation of selected intensity levels on the image. Fourteen different enhancement modes are available, of which any three can be selected for display on the main menu.



▲ Original Image
(Sample: Neuronal cell line NG108-15 Differential interference image)

▲ With enhanced contrast by stretch processing

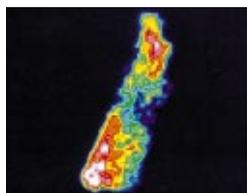


▲ Original image
(Sample: Cosmarium)

▲ After extraction by image slice function (SLC1)

EDG Edge Sharpening: Provides real-time extraction or sharpening of image edges (in horizontal direction)

COLOR Pseudocolor Display: Generates a pseudocolor display. Can display either a single color, or multiple colors representing different intensities on the image.



▲ Pseudocolor fluorescence-intensity distribution of heart cell stained with Fura-2.



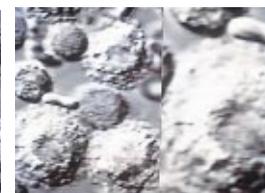
▲ Single-color display of fibroblast stained with rhodamine phalloidin.

DIV Image Division: Produces real-time “ratio image” showing the relative difference between the real-time input image and a previously obtained background image.

SP Split-screen Display: Displays two images together, one at the left of the screen and one at the right.



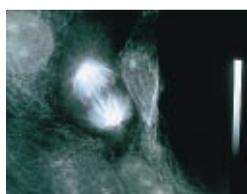
▲ Split display showing prerecorded image next to real-time image. (Sample: Mast cell from rat peritoneal cavity)



▲ Split display of unmagnified and magnified images.

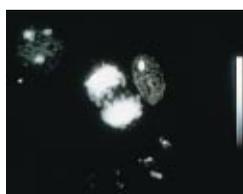
(Photo courtesy of Prof. Susumu Terakawa photon medical research center, Hamamatsu university school of medicine.)

SI Superimposition: Superimposes a real-time image over a prerecorded image. Can be used to superimpose color over a black-and-white image, or to merge two color images.

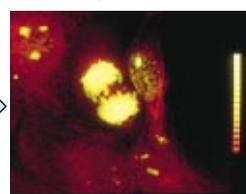


▲ Fluorescence-stained image of animal-cell microtubule

+



▲ Fluorescence-stained image of nucleus



▲ Superimposed image

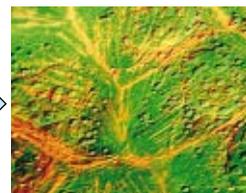


▲ Differential-interference image of MDCK cell

+

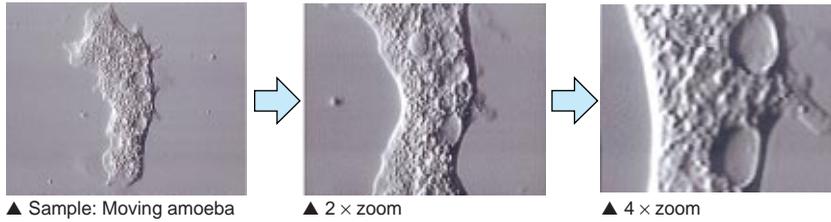


▲ *f*-actin, fluorescence-stained fluorescein-phalloidin



▲ Superimposed image

ZM Real-time Zooming: Magnifies the displayed image by 2 × or 4 ×. Useful for close-up observation of moving objects.



▲ Sample: Moving amoeba

▲ 2 × zoom

▲ 4 × zoom

SCALE Scale Bar:
Displays a scale bar indicating the image dimensions. The scale changes in accordance with the magnification level selected by the VIEW command.

VIEW
Selects one of five preset magnification ratios, and recalibrates the scale bar and measurement functions accordingly.

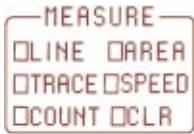


▲ (Sample: Release of histamine from mast cell of rat)
(Photo courtesy of Prof. Susumu Terakawa photon medical research center, Hamamatsu university school of medicine.)

COMM Comment:
Displays one or more prerecorded comments over the image. Up to three comments can be memorized for each image.

TIMER/CLOCK
Displays a timer (hour:minute:second:1/10-sec:1/100-sec). The timer can also be used to show the time of day.

MEASUREMENT (Measurement Commands)



TRACE Measures and displays the length of a traced line.



▲ Measuring the length of a pollen tube extending from a pollen cell.

LINE Measures and displays the linear distance between any two points.

CLR Deletes drawn lines.

AREA Measures the area inside a user-traced border.



▲ Measuring the area within a traced border.
(Sample: Onion epidermal cell)

SPEED Displays velocity of moving object traced by mouse cursor. Displayed results include average velocity and distance.



▲ Real-time indication of velocity of sample.
(Sample: Single-cell organism with auto fluorescence)

COUNT Counts particles.

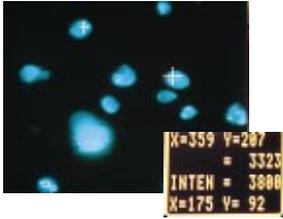


▲ Count of yeast grains.

INTENSITY (Intensity Analysis Commands)

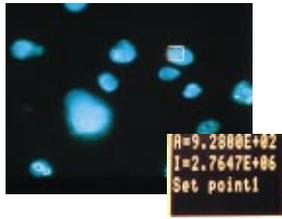
INTENSITY
 POINT AREA
 PROFILE 3D
 HISTOGRAM

POINT Measures the intensity of a point.



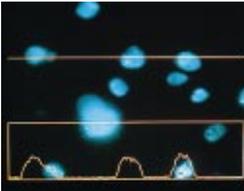
▲ (Sample: Yeast grains, fluorescence-stained with DAPI)

AREA Measures the intensity within an user defined square area.



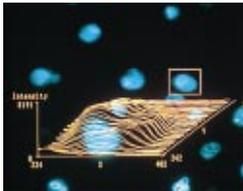
▲ (Same sample as at left.)

PROFILE Displays a profile of the intensity levels along a straight line through the image.



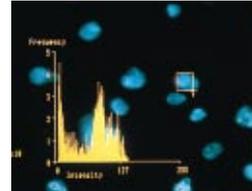
▲ (Same sample as above.)

3D Displays a three-dimensional profile of the intensity levels within a user-defined square.



▲ (Same sample as above.)

HISTOGRAM Displays histogram of intensity levels within a user-defined square.



▲ (Same sample as above.)

SETUP/PHOT (Setup and Image Acquisition Commands)

SETUP PHOT

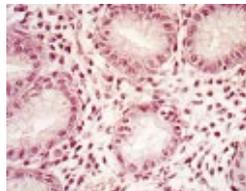
PHOT Removes the menu display and switches to the screen for photographing purpose.

SETUP Sets and stores command parameters and command configuration.

TRIN Sets the trigger input.

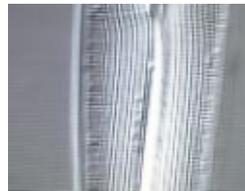
TOUT Sets the trigger output.

VIDO Selects the type of input signal: Video, CCD, or RGB.

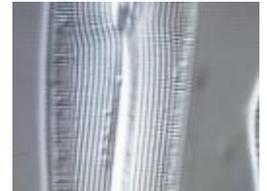


▲ Color camera can be connected to RGB input.

RESO Sets the display resolution. The ARGUS-20 supports up to 1024-pixel horizontal resolution.



▲ 640-pixel horizontal resolution, 4 × zoom (Sample: Diatom)



▲ 1024-pixel horizontal resolution, 4 × zoom (Vertical pattern is clearly defined.)

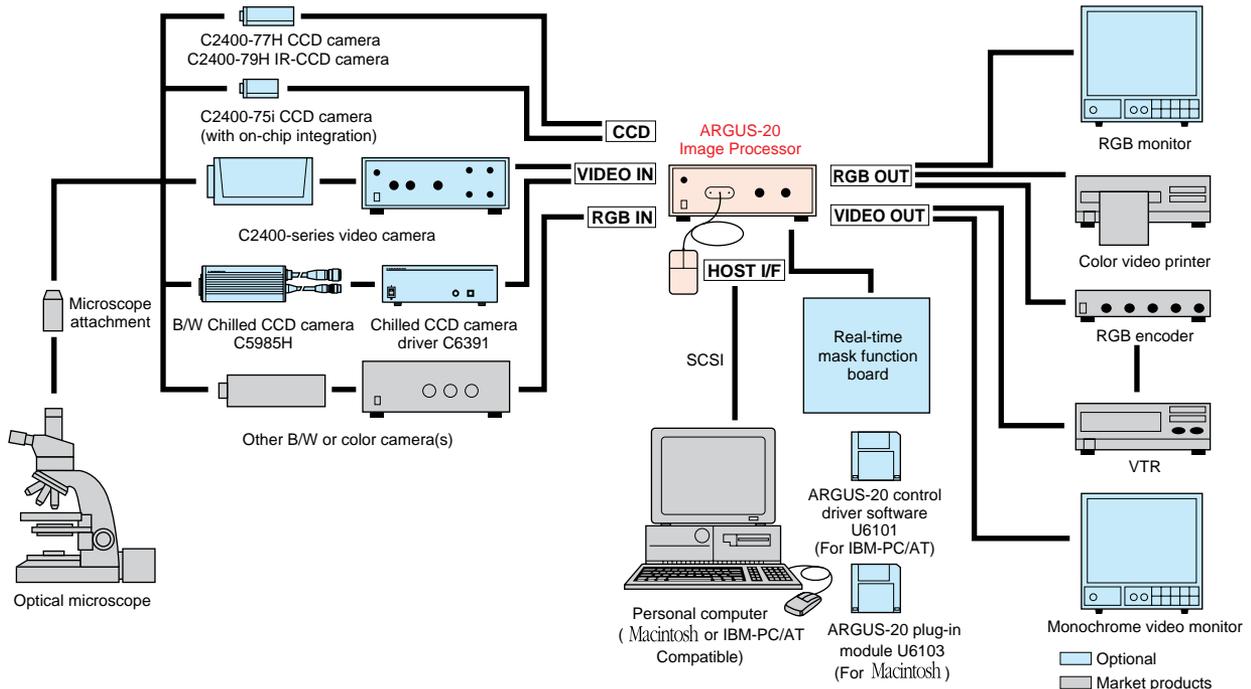


▲ 1:1 display (Image at center of video-camera field.)



▲ 4:3 display (Entire video-camera field.)

SYSTEM CONFIGURATION



STANDARD CONFIGURATION

ARGUS-20 Image Processor	1
Mouse	1
Video cable (3m BNC-BNC)	1
Accessories	1 set
Operation Manual	1

OPTIONAL

• C2400-Series Microscope Video Cameras

The C2400 Series is a special line of video cameras designed for use with optical microscopes under various conditions. Cameras are available for specific wavelengths, sensitivity, and sample mobility.

Type	Name	Application
C2400-01	Chainicon	General microscopic observation
C2400-02	Silicon Vidicon	Visible to near infrared (1100nm)
C2400-03	Infrared Vidicon	Visible to infrared (1800nm)
C2400-05	UV Vidicon	UV (200nm) to visible
C2400-06	Saticon	Observation of bright and fast moving objects
C2400-07	Newvicon	General microscopic observation, high resolution
C2400-08	SIT	Observation of fluorescence
C2400-75	CCD (1/2 inch)	Compact and light weight, Observation of bright and fast moving objects
C2400-77	CCD (2/3 inch)	Compact and light weight, Observation of bright and fast moving objects
C2400-79	IR-CCD (2/3 inch)	Observation of phenomena deep inside a tissue slices using near-infrared (IR-DIC)
C2400-87	ICCD	Observation of fluorescence (low lag)
C2400-47	VIM CCD	Imaging of bio-luminescence and chemi-luminescence
C2400-35	PI-CCD	

• Chilled CCD camera driver : C6391

This is a power supply specifically designed to operate the cooler of the B/W Chilled CCD Camera Head C5985H when used in conjunction with an ARGUS-20 image processor. In addition to the power supply circuit, this camera driver includes an amplifier for the camera gain that is controlled from the front panel.

• M6099-01 Real-time Mask Function Board

Enables real-time spatial filtering by greatly accelerating the execution speed of the ARGUS-20's MASK processing commands.

• Filing/Plug-In Software for IBM-PC/AT Compatible

These software packages allow images from the ARGUS-20 Image Processor to be read by an IBM-PC/AT Compatible.

Product	Model	Contents
Image filing software set	U6798-01	Includes image filing software (U6173-01), SCSI adaptor (A6100), and SCSI cable.
Plug-in set	U6797-01	Includes Photoshop plug-in (U6103-01), IP-Lab plug-in (U6103-03), SCSI adaptor (A6100), and SCSI cable.
Filing software	U6173-01	For image filing. Sold separately as additions to U6797-01 and U6798-01.
Plug-in software	U6103-11	Set containing Photoshop plug-in (U6103-01) and IP-Lab plug-in (U6103-03). Sold separately as additions to U6797-01 and U6798-01.

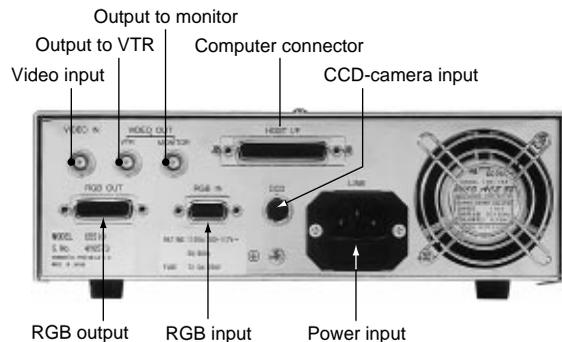
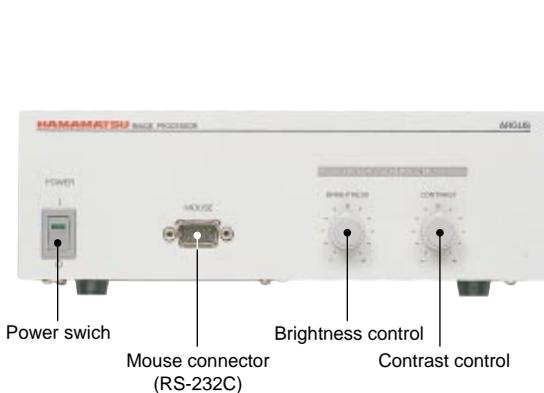
• Filing/Plug-In Software for Macintosh

These software packages allow images from the ARGUS-20 Image Processor to be read by a Macintosh .

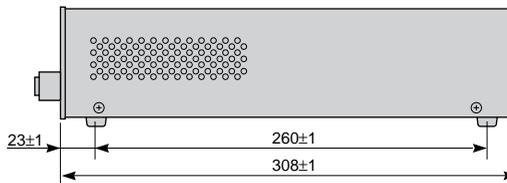
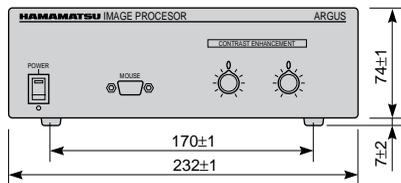
Product	Model	Contents
Image filing software set	U6798	Includes image filing software (U6173), SCSI adaptor (A6100), and SCSI cable for MAC.
Plug-in set	U6797	Includes Photoshop plug-in (U6103), IP-Lab plug-in (U6103-02), SCSI adaptor (A6100), and SCSI cable for MAC.
Filing software	U6173	For image filing. Sold separately as additions to U6797 and U6798.
Plug-in software	U6103-10	Set containing Photoshop plug-in (U6103) and IP-Lab plug-in (U6103-02). Sold separately as additions to U6797 and U6798.

SPECIFICATION

Synch method		EIA (USA)	CCIR (Europe)	
Input signal	H.scanning frequency	15.734 kHz	15.625 kHz	
	V.scanning frequency	59.94 Hz	50.00 Hz	
	Total number of scanning lines	525	625	
	Number of effective scanning lines	483	509	
	Interlace ratio	2:1		
	Aspect ratio of screen	4:3		
Signals		Composite 1.0Vp-p/75 Ω		
Aspect ratio of pixel		2:3 (High-resolution mode) 1:1 (Normal- resolution mode)		
Output signal	For monitor	Composite 1.0Vp-p/75 Ω		
	For VTR or VCR	Composite 1.0Vp-p/75 Ω		
RGB output	RGB signal	0.7Vp-p/75 Ω positive		
	HD,VD,Sync signal	2.0Vp-p/75 Ω negative		
A/D,D/A converter		8 bit approx. 20MHz sampling		
Image memory	Main memory	High-resolution mode	1024 (H) × 483 (V) × 16 bit	1024 (H) × 509 (V) × 16 bit
		Normal-resolution mode	640 (H) × 483 (V) × 16 bit	640 (H) × 509 (V) × 16 bit
	Sub memory	High-resolution mode	1024 (H) × 483 (V) × 16 bit	1024 (H) × 509 (V) × 16 bit
		Normal-resolution mode	640 (H) × 483 (V) × 16 bit	640 (H) × 509 (V) × 16 bit
	Graphic memory	High-resolution mode	1024 (H) × 483 (V) × 4 planes	1024 (H) × 509 (V) × 4 planes
		Normal-resolution mode	640 (H) × 483 (V) × 4 planes	640 (H) × 509 (V) × 4 planes
Operating temperature		0°C to +40°C		
Storage temperature		-10°C to +50°C		
Operating and storage humidity		90% or less (non-condensation)		
Line voltage		100/117/220/240 VAC 50/60Hz		
Power consumption		Approx. 200 VA		



DIMENSIONAL OUTLINE (UNIT: mm)



(Weight: Approx. 4.5kg)

- ★ Macintosh is a registered trademark of Apple Computer, Inc.
- ★ IBM-PC/AT is a registered trademark of IBM Co.
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