

# CHAPTER 8

# IMAGING SYSTEM

|                          |      |
|--------------------------|------|
| Industrial Cameras       | 8.2  |
| High Sensitivity Cameras | 8.10 |
| NIR Cameras              | 8.22 |
| Mid To Far IR Camera     | 8.24 |
| Microscopes              | 8.26 |
| Video Zoom Lenses        | 8.28 |
| Telecentric Zoom Lenses  | 8.40 |
| Illuminators             | 8.42 |
| Video Lenses             | 8.44 |

## CHAPTER 8 IMAGING SYSTEM

# 2600 COMPACT MONOCHROME CCD CAMERA REINFORCE FOR MECHANICAL SHOCK TOLERANCE



## APPLICATIONS

- Image Processing
- Machine Vision
- Test and Measurement
- Laboratory
- Robotic Mechanisms
- Transportation Systems
- Surveillance
- Access Control

## ORDERING INFORMATION

| 26X           | 2 -      | X                | X              | 0          | X/                    | XXX             |
|---------------|----------|------------------|----------------|------------|-----------------------|-----------------|
| Format        | Power    | Sync Option      | Optical Filter | Unassigned | Options               | Lenses          |
|               | 2 12 VDC | 1 Crystal 0 None | 0 None         |            | 0 None                | Consult factory |
| 2 1/2" RS-170 |          | 2 Genlock        | 1 IR           |            | 3 Elec. Iris (RS-170) |                 |
| 5 1/2" CCIR   |          |                  |                |            | 4 DC Iris             |                 |
|               |          |                  |                |            | 5 Elec. Iris (CCIR)   |                 |

## SPECIFICATIONS

### Pick up Device

1/2" Interline transfer, enhanced sensitivity with microlens sensor

### Resolution

RS-170: 580 HTVL

CCIR: 560 HTVL

### Picture Elements

RS-170: 768 (H) x 494 (V)

CCIR: 752 (H) x 582 (V)

### Synchronization

Internal: Crystal

External: H&V, async reset, optional external genlock

### Electronic Shutter

1/60 to 1/10,000 switch selectable

### Signal-to-Noise

55dB (gain 0, gamma 1)

38dB (gain 20 dB, gamma 1)

### Gamma

.45 to 1.0 continually variable

### AGC

20 dB range, auto or manual control

### Integration

2-16 fields

Auto Lens Output

Reference video or DC drive

### Lens Voltage

11 VDC

### Sensitivity

Full Spectrum IR Filter

Full video, no AGC:

.065 fc (65 lux) .25 fc (2.5 lux)

80% video, AGC on:

.005 fc (.05 lux) .018 fc (.18 lux)

30% video, AGC on: .

.002 fc (.02 lux) .01 fc (.1 lux)

### Input Power Requirement

12 VDC, 3.6 W

115 VAC, 50/60 Hz

### Lens Mount

C/CS

### Ambient Temperature Limits

-4° F (20° C) to 140° F (60° C)

### Relative Humidity

to 95% non-condensing

### Shock

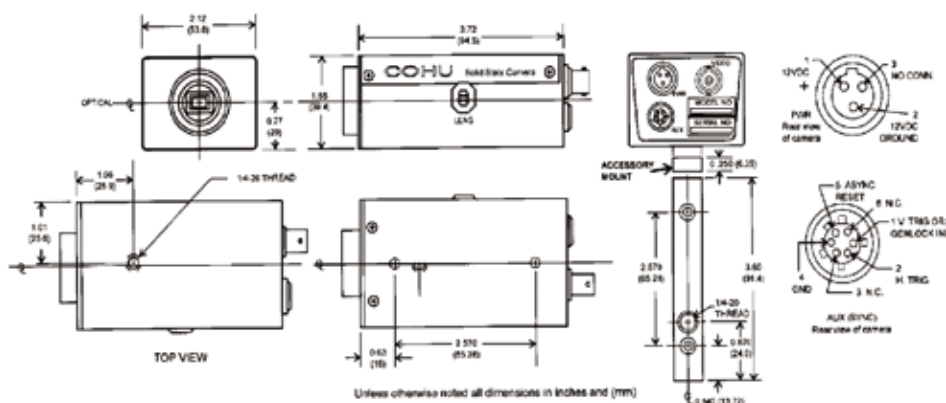
30 g's, 11mS duration, 3 axes

### Mounts

1/4-20 female, top and bottom, with accessory mounting base (included)

### Weight

<8oz (230 g) without lens



# CHAPTER 8 IMAGING SYSTEM

## 2700 SERIES VERY LOW LIGHT LEVEL CCD CAMERA

### SPECIFICATIONS



### APPLICATIONS

- Surveillance
- Industrial Inspection
- Low-light Observations
- X-Ray Applications

### ELECTRICAL

#### Sensor

1/2" (6.4mm x 4.8mm)

#### Actual Pixels

768 x 494 (RS-170);  
752 x 582 (CCIR)

#### Resolution

580 HTVL (RS-170);  
560 HTVL (CCIR)

#### Sensitivity

Full video, max gain, AGC off:

Standard: 0.0012 lux  
Extended: 0.0009 lux

80% video, max gain, AGC off:

Standard: 0.0010 lux  
Extended: 0.0007 lux

#### Shutter

Switchable 1/60 (1/50 CCIR) to  
1/100,000 sec

#### Gain

Auto/manual 0 to 46 db

#### SNR

58 dB max; gain 0

### Image Processing

Gamma fixed at 0.6 (1 or 0.45); no  
sharpness circuit; field mode only

### Lens Drive

Both auto and DC iris interfaces  
included

### Sync

Crystal; or line lock; external  
based on adjustable reference

### Power

24 VAC or 115 VAC, 23W(2740)  
12 VDC, 2.7 W(2710)

### MECHANICAL

#### Dimensions

2.84" (D) x 1" (W) x 1" (H)  
(less lens)

### Weight

250 grams

### Lens

C/CS mount

### Connector

39-pin Bendix, Shrader pressure  
charge valve, pressure relief(2740)  
Hirose HR10A-10R-12PC(2710)

### ENVIRONMENTAL

#### Temperature

-20° to 60°C operating;  
-30° to 85°C storage

### REGULATORY

FCC/CE Class B

### ORDERING INFORMATION

27X X-X X X X / XXXX

#### Dual gain monochrome camera

Enclosure

- 1 - Indoor
- 4 - 4.5" Environmental enclosure

Power Configuration

- 2 - 12 VDC
- 4 - 24 VAC
- (4.5" environmental enclosure only)
- 5 - 115 VAC
- (4.5" environmental enclosure only)

Sync

- 1 - Internal crystal
- 2 - Line lock (4.5" environmental enclosure  
phase adjust)

Iris options

- 0 - Auto/DC iris
- 3 - Electronic iris

Format

- 2 - 1/2" (RS-170), standard sensitivity
- 3 - 1/2" (RS-170), extended near-IR sensitivity

Accessories

- 0 - None
- 1 - Test cable CTC-31 (indoor only)
- 2 - Accessory kit (indoor only)
- 3 - Test cable & accessory kit (indoor only)
- 4 - ID generator (4.5" environmental enclosure only)
- 5 - Fiber optic (4.5" environmental enclosure only)
- 6 - ID generator & fiber optic video

Lenses

Select from a wide range of manual iris lenses that suit your ap-  
plication.

Consult your sales representative.

Note: Accessory kit/contains wrench, power connector,  
mounting block, and C/CS lens adapter.

CHAPTER 8 IMAGING SYSTEM

2900 SERIES ULTRA SMALL MONOCHROME MACHINE VISION CAMERA



- High performance video specifications
- Small size, light weight
- Extra rugged construction withstands high shock and vibration
- Manual gain adjustment for precision imaging
- Secure dipswitches discourage tampering
- Easily integrates with other vision system components and software
- Single Hirose connector for fast, tight connection
- Quality, reliability, and respon-siveness of Cohu Electronics
- Competitively priced

ORDERING INFORMATION

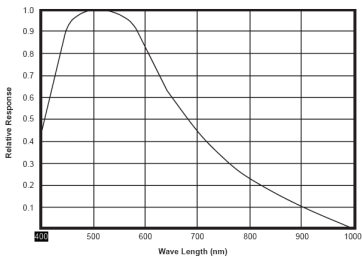
| 29X                                                                                                                                        | 2 -      | X                              | 0              | 0          | X/      | XXX                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------------|----------------|------------|---------|--------------------------------------------------------------------------------------------|
| Fomat                                                                                                                                      | Power    | Sync Option                    | Optical Filter | Unassigned | Options | Lenses                                                                                     |
| 2 1/2" RS-170<br>5 1/2" CCIR                                                                                                               | 2 12 VDC | 2 Crystal, H&V,<br>async reset | 0 None         |            | 0 None  | Your Cohu representa-<br>tive offers a wide range of<br>lenses for many applica-<br>tions. |
| <b>Accessories</b><br>1310398-212 Hirose mating connector<br>8427-7 Mounting Block, top or bottom<br>8368-4 115 VAC to 12 VDC power supply |          |                                |                |            |         |                                                                                            |

SPECIFICATIONS

ELECTRICAL

Format  
1/2" monochrome  
Pixels  
RS170: 768 H x 494 V  
CCIR: 752 x 582 V  
Pixel cell size  
RS170: 8.4 µm x 9.8 µm  
CCIR: 6.6 µm x 8.3 µm  
Synchronization  
Internal sync generator, External H&V,  
async reset  
Scanning  
RS170: 2:1 interlace, 525 lines/60 fields/  
30 frames  
CCIR: 2:1 interlace, 625 lines/50 fields/  
25 frames  
Integration  
2 or more fields externally controlled  
Sensitivity  
Full video: .65 lux / .065 fc

Min. illumination  
0.05 lux  
Gamma  
1.0  
SNR  
>56 dB  
Power input  
12 VDC, 2.7 W  
Power consumption  
225 mA  
Spectral Response



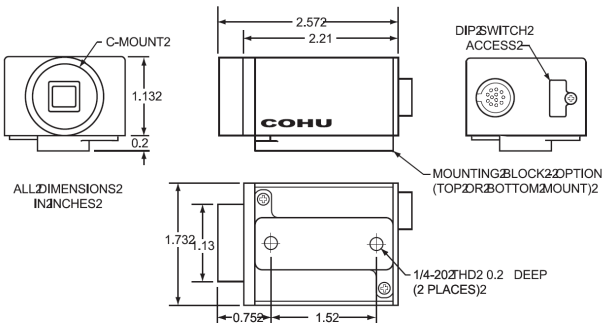
MECHANICAL

Dimensions  
see illustration  
Weight  
3.5/95 g (less lens)  
Camera mount  
two each -20 & 8-32 female inline on optional  
mounting block  
Lens mount  
C mount, integral to case  
Color  
black standard; other colors quoted  
Connectors  
12 pin Hirose  
ENVIRONMENTAL  
Operating temp.  
4°F/-16°C to 120°F/49°C  
Shock  
30 G, 11 ms duration  
Vibration  
8 G (10 Hz – 150 Hz)



Let ONSET help you solve your vision system requirements. Besides high performance cameras, we can integrate lighting, image capture devices, and custom mounting hardware.

Ask your Cohu representative for details.



Specifications subject to change without notice.

## CHAPTER 8 IMAGING SYSTEM

3600 SERIES SMALL MACHINE VISION  
COLOR CCD CAMERA

## SPECIFICATIONS

## ELECTRICAL

## Sensor

1/2" color (6.4 mm x 4.8 mm)

## Active Pixels

768 H x 494 V

## Pixel Size

1/2": 8.4  $\mu$ m x 9.8  $\mu$ m

## Resolution

460 H X 350 V TV Lines

## Sensitivity

3 lux faceplate illumination minimum gain

## Shutter

Auto or Manual Exposure

1/60 to 1/50,000 second

## Integration

Selectable to 8.5 seconds with freeze frame option

## Gain

Auto or Manual Gain Control 0-32 db

## SNR

48-db max

## Output

NTSC or PAL composite and S-Video

## White Balance

Auto or manual white balance (2500 to 9500K)

## Sync

Internal crystal

## Input Power

2.5 W @ 5 VDC (500 mA)

4.2 W @ 12 VDC (350 mA)

## MECHANICAL

## Dimensions

2.5" (L) X 1" (W) X 1" (H)

## Lens Mount

C/CS; sensor can be moved up to 3" from main electronics

## Weight

250 grams, 9.1 oz.

## ENVIRONMENTAL

## Operating Temperature

-20°C to 70°C operating, -30°C to 85°C storage.

## Vibration (less lens)

.001 g2/Hz from 1 Hz to 10 Hz .075 g2/Hz from 10 Hz to 2000 Hz 1 hour in any axis per MIL-STD-810E, 516.3

## Shock (less lens)

10 g, 11ms, any axis under non-operating conditions, per MIL-STD-810E, 514.3, categories 1,4,5,6,8,9,10

## APPLICATIONS

- Pharmaceutical production
- Medical imaging
- Food processing
- Printing

## GUI set up for precision and convenience.

A graphical user interface provides precise set up of the camera. Flash memory maintains last setting.

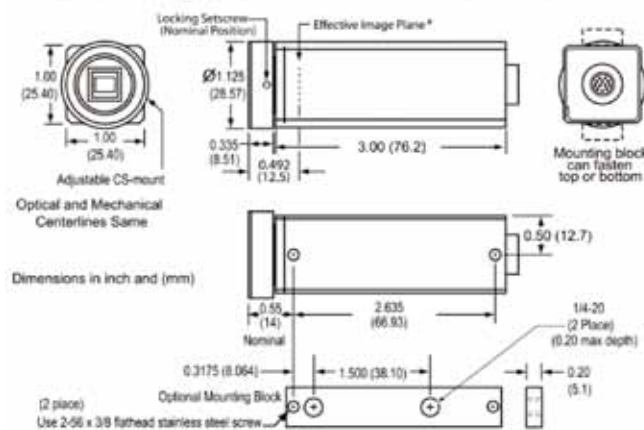
- Internal Sync
- External Trigger – for snapshot mode
- Backlight Control
- Gamma Select
- White Balance - auto/manual adjust
- Exposure - automatic, shutter and gain selectable, integration and gain selectable.
- Aperture Correction - horizontal and vertical adjustment.
- Image Manipulation - Digital zoom, pan, scroll, rotate, freeze, Y/C invert, color bars, color/mono.



## ORDERING INFORMATION

| 361X - 1XXX / XXXX                                         |
|------------------------------------------------------------|
| Color DSP high-resolution camera for interior installation |
| <b>Power</b>                                               |
| 1 - 5 VDC                                                  |
| 2 - 12 VDC                                                 |
| <b>Sync</b>                                                |
| 1 - Crystal                                                |
| <b>Iris</b>                                                |
| 0 - Manual                                                 |
| 1 - Auto (12 VDC version only)                             |
| 3 - DC (12 VDC version only)                               |
| <b>Sensor Format</b>                                       |
| 2 - 1/2" NTSC/S-video, 460 HTVL                            |
| 5 - 1/2" PAL/S-video, 460 HTVL                             |
| <b>Accessories</b>                                         |
| 0 - None                                                   |
| 1 - Test cable CTC-32                                      |
| 2 - Accessory kit*                                         |
| 3 - Test cable & accessory kit                             |
| <b>Lenses</b>                                              |
| 0000 - None                                                |
| A003 - 3.7mm F1.6, 1/2" format, CS mount manual iris lens  |
| A006 - 6mm F1.4, 1/2" format, CS mount manual iris lens    |
| A013 - 12mm F1.4, 1/2" format, CS mount manual iris lens   |
| EH04 - 3.7mm F1.6, 1/2" format, CS mount auto iris lens    |
| EH06 - 6mm F1.4, 1/2" format, CS mount auto iris lens      |
| EH13 - 12mm F1.4, 1/2" format, CS mount auto iris lens     |
| ES04 - 4.2mm F1.6, 1/2" format, CS mount auto iris lens    |
| ES08 - 8mm F1.4, 2/3" format, C mount auto iris lens       |
| ES12 - 12.5mm F1.4, 1" format, C mount auto iris lens      |
| ES16 - 16mm F1.4, 2/3" format, C mount auto iris lens      |
| ES25 - 25mm F1.4, 1" format, C mount auto iris lens        |
| ES75 - 75mm F1.8, 1" format, C mount auto iris lens        |

\* Optical path includes 0.031" (0.8) thick BK-7 flat glass and 0.213" (5.4) thick multilayer quartz optical low-pass filter. Actual image plane is 0.81" (2.1) behind effective image plane.





## CHAPTER 8 IMAGING SYSTEM

## 6100 SERIES MEGAPIXEL FIREWIRE CAMERA



## APPLICATIONS

- Biomedical inspection
- Materials Research
- Metrology
- Process inspection

## Megapixel Imager

The 6100 Series camera utilizes a state-of-the-art sensor with a 1360 x 1024 active pixel array. The pixel cell size is 4.65  $\mu$ m.

## 12-bit depth

This feature provides greater gray scale values of the video image for more accurate image reproduction and adjustment.

## ROI Scanning.

The 1360 x 1024 pixel array can be digitally manipulated by most

brands of visual analysis software to provide "region of interest" (ROI) scanning in the vertical plane. ROI selection allows the camera to process a single region of an image, leaving other regions unchanged, to focus processing and analysis on part of an image, which allows faster readouts.

## SPECIFICATIONS

## ELECTRICAL

## CCD Sensor

1/2" format; 4.65 (H) x 4.65 micron (V) C lens mount

## Active pixels

1360 x 1024

## Resolution

1024 H x 1024 V lines

## Sensitivity

3.0 lux (at faceplate full video with min. gain and 1/30 second exposure)

## Frame rate

4 fr/sec at full resolution; 15 fr/sec for 256 lines/frame

## Shutter

Programmable 1/15 to 1/20,000 sec. plus integration

## Integration

Up to 5 seconds

## Gain

Programmable manual 0 to 30 db

## Signal-to-noise ratio

60 db max dynamic range

## Image Processing

Gamma fixed at 1.0; mirror imaging and ROI

## Video Output

IEEE-1394A IIDC [D-cam] compliant [16-bit format]

## Sync

Internal with optional opto-isolated hardware or software trigger

## Controls

Gain, Shutter, Offset, Frame Rate, ROI Window via D-cam registers

## Power

12 VDC (8 to 30VDC IEEE-1394A compatible) <3W

## MECHANICAL

## Size

See illustration. This camera's optical and mechanical interface is identical to the Cohu 2600 Series camera

## Weight

<454 g

## Connectors

IEEE-1394A [6-wire] Video/Control/Power  
RJ-45 [10-wire] Opto-isolated trigger in/ 4 control discretes out

## Lens mount

C mount, integral to case

## Color

black standard; other colors quoted

## Connectors

12 pin Hirose

## ENVIRONMENTAL

## Operating Temperature

-5 to 60° C operating; -20 to 70° C storage

## Humidity

<95% non-condensing

## Shock

80g [IEC 68]

## Vibration (less lens)

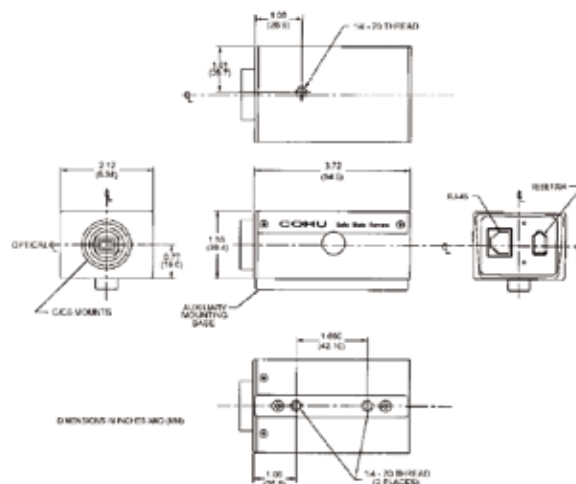
8g [IEC 68]

## REGULATORY

FCC/CE CISPR11 Class B plus  
EN61000-4-3, -4-6, -4-8  
interference immunity tests

## ORDERING INFORMATION

|                           |                                                                                                                                                                                                                                            |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                           | 6112 - 1 0 0 0 / XXXX                                                                                                                                                                                                                      |
| Megapixel FireWire camera |                                                                                                                                                                                                                                            |
| Power                     | 2 - 12 VDC                                                                                                                                                                                                                                 |
| Output                    | 1 - Monochrome, IEEE 1394                                                                                                                                                                                                                  |
| Options                   | 000 - None                                                                                                                                                                                                                                 |
| Lenses                    | AL06 - 2/3" 6.5 mm, f1.8<br>AL07 - 2/3" 8 mm, f1.4<br>AL12 - 1" 12.5 mm, f1.4<br>AL15 - 2/3" 16 mm, f1.4<br>AL16 - 2/3" 16 mm, f1.4<br>AL25 - 1" 25 mm, f1.4<br>AL26 - 2/3" 25mm, f1.6<br>AL50 - 1" 50 mm, f1.4<br>AL51 - 2/3" 50 mm, f2.8 |



# CHAPTER 8 IMAGING SYSTEM

## 7700 SERIES 1004 × 1004 PIXEL CCD CAMERA



### SPECIFICATIONS

#### ELECTRICAL

Format: 1/2" color or monochrome (Model -3000 monochrome only)

**Pixels:** 1004 x 1004

**Total Pixels:** >1.008 million

**Pixel Cell Size:** 7.4  $\mu\text{m}$  x 7.4  $\mu\text{m}$

#### Output Characteristics:

Camera Link: 10-bit depth @ 30 FPS (full resolution)

FireWire: 8-bit depth @ 30 FPS

(full resolution), or 10-bit depth @ 15 FPS (full resolution).

Frame rate is defined by exposure time, partial readout, data width, and network traffic

**Synchronization:** Internal sync crystal, external trigger

#### Shutter Control:

Camera Link: Fixed shutter: exposure time preset by camera setting

- Implicit lines: 1–512 line interval in 10 steps

- Explicit lines: 1–65,000 line interval (line interval = 33.2  $\mu\text{sec}$ .) Multiple frames: 1–65,000 frame intervals (frame rate = 33.3 msec.)

FireWire: 1/25,000 sec. to 870 sec. in 1999 nonlinear steps.

Camera Link & FireWire: Pulse width shutter (Snapshot mode only): Exposure determined by pulse width of externally applied trigger

#### Integration:

Externally controlled  
Sensitivity: 4.0 lux (no shutter, 1/30 sec.)

**Gamma:** 1.0, fixed

**Gain:** 0 to 34 dB

**SNR:** >58 dB

#### Spectral Response:

See illustration at right. Consult factory for extended UV sensitivity

**Power Input:** 12 VDC, 8.4W

**Power Consumption:** <700 mA

#### Lens Mount:

C/CS mount, integral to case

#### Connectors:

Power: 3-pin power

CameraLink: 26-pin MDR

### MODES OF OPERATION

#### Video Mode:

Free running, asynchronous

#### Snapshot Modes:

Captures single image, 1/25,000 sec to infinity, initiated externally by applied trigger signal or via serial command. Exposure determined by pulse width of external trigger.

Full Resolution: Camera Link: 10-bit depth @ 30 FPS. FireWire: 8-bit depth @ 30 FPS, or 10-bit depth @ 15 FPS

Partial Readout: Define single position for start of active readout in groups of four lines

#### Gain & Offset Control:

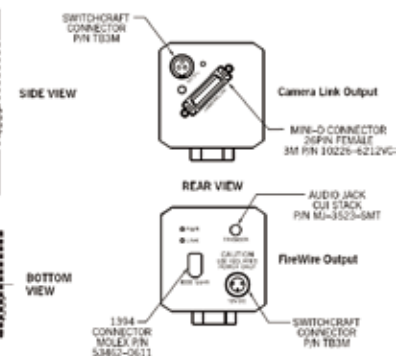
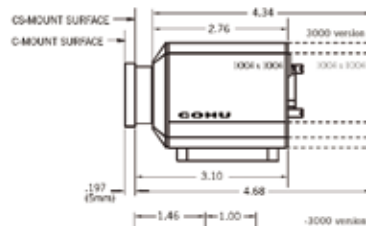
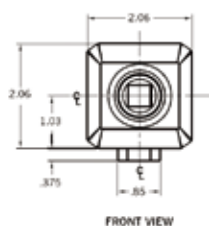
Gain: Video amplifier gain setting of 320 values

Offset: Video black level setting of 1024 values

#### Shutter Control:

Fixed: Exposure time preset by camera setting

Variable: Software controlled, 1/25,000 sec. to 870 sec.



### APPLICATIONS

- Precision machine vision
- Sorting and gauging
- Calibration & Test
- Inspection
- Dot code reading
- Medical Imaging

### ORDERING INFORMATION

| 77 X 2- X000 /XXXX                    |  |
|---------------------------------------|--|
| 77 - 1/2" 1004 x 1004 pixel camera    |  |
| Format                                |  |
| 1 - 1/2" monochrome                   |  |
| 2 - 1/2" color                        |  |
| 3 - 1/2" monochrome uv-enhanced       |  |
| Power                                 |  |
| 2 - 12 Vdc                            |  |
| Output                                |  |
| 2 - Camera Link                       |  |
| 3 - FireWire (monochrome format only) |  |
| Lenses                                |  |

Your Cohu representative offers a wide selection of lenses to meet your imaging criteria.

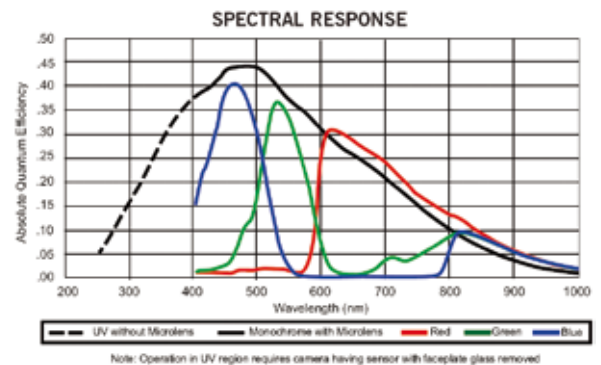
#### Accessories

8368-4 CameraLink power supply

8385-5 FireWire power supply

8430-0 CameraLink accessory kit: mounting block with 1/4"-20 thread, power connector, and hex key

8469-7 FireWire accessory kit: mounting block with 1/4"-20 thread, power connector, trigger connector and hex key



### MECHANICAL

Dimensions: see illustration

#### Weight:

< 12 oz./340 g (less lens)

**Camera Mount:** two each 1/4-20

## CHAPTER 8 IMAGING SYSTEM

## 7800 SERIES COMS CAMERA FOR MACHINE VISION



## SPECIFICATIONS

## Format

2/3" monochrome, color, or extended IR CMOS

## Pixels

1280 x 1024

## Total pixels

>1.3 million

## Pixel cell size

6.7  $\mu\text{m}$  x 6.7  $\mu\text{m}$

## Pixel clock

40 MHz

## Synchronization

Internal sync crystal, external trigger

## Electronic shutter

High speed global:

1/10,000 sec. to 1/4 sec.

## Partial Scan/Region of Interest

Position adjustable in X and Y

## Frame Rate

27 fps @ full frame resolution

>27 fps @ smaller regions of interest

## Sensitivity (1/30 shutter)

5.0 lux color

4.5 lux mono

2.5 lux extended IR

## Gamma

.45 – 1.0, selectable

## Gain

Manual, 0 to 18 dB, externally controlled

## SNR

48 dB, 1/30 shutter at min. gain

## Spectral Response

See illustration

## Power input

5 Vdc

## Power consumption

<210 ma

## Video Output

8- or 10-bit, CameraLink format, horizontal (line) drive, vertical (frame) drive, and Pixel Clock

## Microprocessor Control

Via video connector: all adjustments software controlled through non-volatile registers; programmable logic and firmware can be upgraded via internal port; preset configurations supported

## Gain and Offset Control

Gain: Video amplifier gain setting for 9 values Offset: Video black level setting for 47 values

## MECHANICAL

## Dimensions

see illustration

## Weight

2.47 oz./70 g (less lens)

## Camera mount

One 1/4-20

## Lens mount

C mount, integral to case

## Connectors

Power: Hirose 4-pin power

CameraLink: 26-pin MDR

MODES OF OPERATION

## Trigger Operation

- Software trigger
- External trigger
- Video Acquisition

## Full Frame

Free Running: Continuous operation

- Snap Shot: Image capture initiated externally by applied trigger signal or via software serial command

## Partial Frame (Region of Interest)

User can select individual or multiple vertical or horizontal lines

User can select specific region of interest by selecting specific X and Y pixel arrangements.

- Free Running: Continuous operation at an increased frame rate relative to size of ROI

- Snapshot: Captures ROI images initiated by a trigger or serial command.

## APPLICATIONS

- Test & Inspection
- Biometrics
- 27 frames per second at 1280 x 1024 pixel resolution
- OCR/DCR
- Interior surveillance
- 100 frames per second at 640 x 480 pixel resolution

## ORDERING INFORMATION

78XX-2000/XXXX  
CMOS Machine Vision Camera

## FORMAT

- 3 - Mono 8-bit
- 4 - Color 8-bit
- 5 - Extended IR 8-bit
- 6 - Mono 10-bit
- 7 - Color 10-bit
- 8 - Extended IR 10-bit

## POWER CONFIGURATION

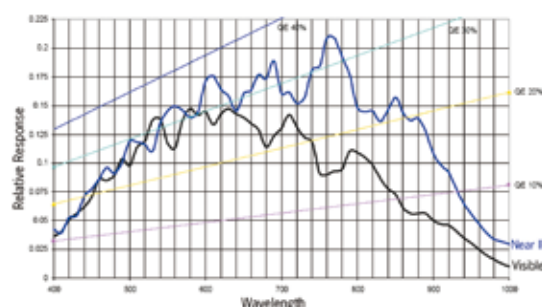
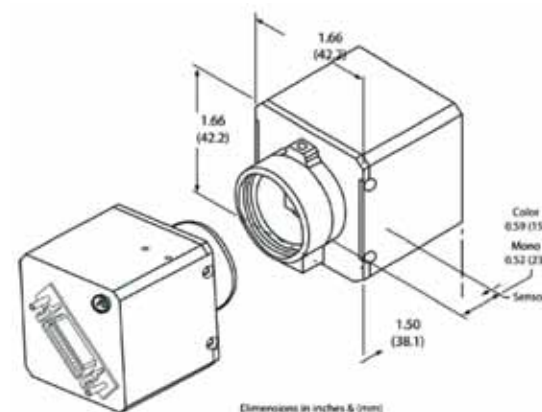
- 6 - 5 VDC
- 7 - 115 VAC/5 VDC power pack

## OUTPUT

- 2 - Camera Link

## LENSES

The flexibility of this camera allows for a wide selection of lenses. Consult with your Cohu or lens representative for choices.





# CHAPTER 8 IMAGING SYSTEM

## 7890 SERIES GIGE MEGAPIXEL IMAGING SYSTEM



This camera is suitable for a wide range of high speed machine vision applications including test, inspection, OCR/DCR reading, and biomedical applications.

The camera sensor is based on the IBIS-5 suite, providing a 2/3" 1280 x 1024 progressive scan format at user-selectable speeds: 27 frames per second at 1280 x 1024 pixel resolution or 100 frames per second at 640 x 480 pixel resolution.

### SPECIFICATIONS

#### Image Sensor Format

2/3" CMOS Progressive Scan

#### Image Sensor Options

Color (RGB Bayer Pattern)

Mono

Mono Ext IR

#### Total pixels

>1.3 million

#### Active Pixels

1280 x 1024

#### Pixel cell size

6.7  $\mu$ m x 6.7  $\mu$ m

#### Maximum Data Rate/Clock Rate

40MPS/40 MHz

#### Frame Rate/Frame Readout Time

27 fps @ 1280 x 1024 / 36 ms

100 fps @ 640 x 480 / 10 ms

1657 fps @ 100 x 100 / 0.6ms

#### Sensitivity (1/38 Second)

Color: 5 fc @ faceplate

Mono: 0.45 fc @ faceplate

Mono Ext IR: 0.25 fc @ faceplate

#### Gamma

1.0

#### Gain

0 to 18 dB, externally controlled

#### SNR

>48 dB

#### Spectral Response

See illustration

#### Synchronization

Internal sync crystal

#### Electronic shutter

Global: 1/10,000 sec. to 1/38 sec.

#### Exposure Time

Sets sensor exposure time;

Range 7 to 15; (10 = 1ms, 15 = 26.2ms)

#### Gain Raw

Sets sensor gain value

(Range 0 to 10; 0 = unity gain)

#### Black Level

Sets sensor black level offset

(Range = 0 to 46; default = 2)

#### Sensor Offset X Coordinate

Sets the ROI horizontal offset

(Range = 0 to (1280 – width))

#### Sensor Offset Y Coordinate

Sets the ROI vertical offset

(Range = 0 to (1024 – height))

#### Reset

Returns settings to factory default

### MECHANICAL

#### Dimensions (H x W x D)

2.4" x 2.4" x 1.7" (61 x 61 x 43.2)

#### Weight

4.8 oz. (140 g) less lens

#### Camera mount

One 1/4-20

#### Lens mount

C mount, integral to case

#### Connectors

Power: Hirose 4-pin power

Ethernet: RJ45ELECTRICAL

#### Power Options

5 Vdc @ <500 ma

115Vac via external power supply (pn 8470-5)

### REGULATIONS

FCC Class A; CE; EN61000-4-3, 6, 8

### ENVIRONMENT

#### Operating Temperature

-20 to 70C

#### Humidity

20-90% non-condensing

#### Vibration/Shock

12g (per IEC68)/40G any axis (per IEC48)

### ACCESSORIES

#### GIGE PC Option Cards

7411503-001, PCI

7411504-001, PCI Express

#### Software Developers Kit (SDK)

8157-6

#### Power Supply

8470-5

### ORDERING INFORMATION

#### 7890 GigE MegaPixel Camera

789x-x000/xxxx

#### Power Options

6 - 120 Vac(via 8470-5)

7 - 5 Vdc

#### Sensor Options

3 - Mono, 2/3" CMOS 1280x1024

4 - Color, 2/3" CMOS 1280x1024

5 - Ext IR Mono, 2/3" CMOS 1280x1024

#### Lens Options

0000 - No Lens

AM09 - 9 mm

AM12 - 12 mm

AM16 - 16 mm

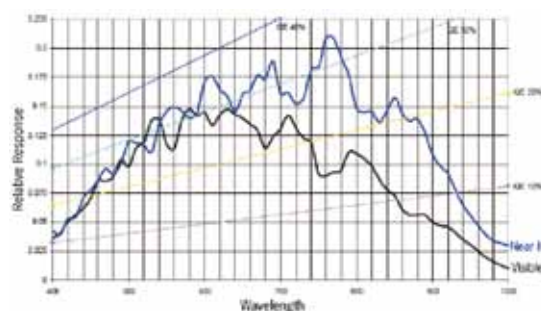
AM25 - 25mm

AM35 - 35mm

AM50 - 50mm

AM75 - 75mm

### Spectral Response



### IMAGE OUTPUT

#### Digital Interface Format

IEEE 802.3 1000baseT

GigE Vision

#### Programming Interface

GenICam

#### Data Throughput

Up to 1 Gb/s,

### USER CONFIGURATION & CONTROL

#### ROI Width

Range 8 to 1280 pixels in steps of 8

#### ROI Height

Range 1 to 1024 pixels in steps of 1

#### Acquisition Mode

Send Image Continuous or Single Frame

#### Acquisition Start

Starts frame acquisition

## CHAPTER 8 IMAGING SYSTEM

## HIGH SENSITIVITY CAMERAS

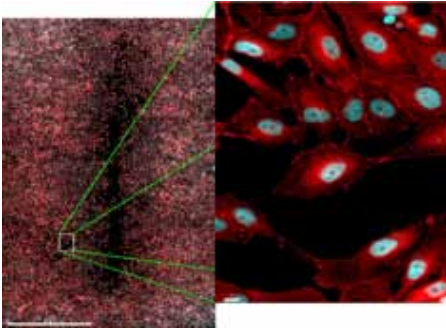
**DVC camera products and solutions**

Whatever your requirements, DVC has a solution that will meet your needs. We serve a wide variety of customers involved in quantitative imaging applications including fluorescence, high-content screening, electron microscopy, industrial, homeland security, and aerospace imaging. Don't hesitate to give us a call with any questions you might have or to discuss specific configurations.

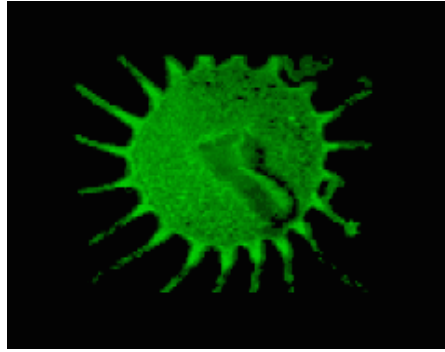
**HIGH SENSITIVITY CAMERAS SELECTION GUIDE**

|                                             |                                      |                             |                                     |                                                         |                                                             |                                                       |
|---------------------------------------------|--------------------------------------|-----------------------------|-------------------------------------|---------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------|
| <b><u>DVC-16000</u></b><br><b>Dual-port</b> | Low noise, 16 megapixel              | 12-bit monochrome           | Kodak KAI-16000 interline CCD       | 20MHz/40MHz readout single/dual port                    | 4872x3248 pixels<br>Variable binning and region of interest | 3.5 FPS at full resolution<br>7.7 FPS at 4x4 binning  |
| <b><u>DVC-4000D</u></b><br><b>Dual-port</b> | Low noise, 4 megapixel               | 12-bit, color or monochrome | Kodak KAI-04022 interline CCD       | 20MHz/40MHz readout single/dual port                    | 2048x2048 pixels<br>Variable binning and region of interest | 14.5 FPS at full resolution<br>38 FPS at 4x4 binning  |
| <b><u>DVC-4000A</u></b>                     | Low noise, 4 megapixel               | 12-bit, color or monochrome | Kodak KAI-04022 interline CCD       | 20MHz/40MHz readout                                     | 2048x2048 pixels<br>Variable binning and region of interest | 8 FPS at full resolution<br>25 FPS at 4x4 binning     |
| <b><u>DVC-2000</u></b>                      | Low noise, 2 megapixel               | 12-bit, color or monochrome | Kodak KAI-2020 interline CCD        | 20MHz/40MHz readout                                     | 1600x1200 pixels<br>Variable binning and region of interest | 18 FPS at full resolution<br>78 FPS at 8x8 binning    |
| <b><u>DVC-1500</u></b>                      | Low noise, High-speed, 1.4 megapixel | 12-bit, color or monochrome | Sony ICX285 ExViewHAD interline CCD | Enhanced near-infrared sensitivity, 20MHz/40MHz readout | 1392x1040 pixels<br>Variable binning and region of interest | 23 FPS at full resolution<br>120 FPS at 8x8 binning   |
| <b><u>DVC-1412</u></b>                      | Low noise, 1.4 megapixel             | 12-bit, color or monochrome | Sony ICX285 ExViewHAD interline CCD | Enhanced near-infrared sensitivity                      | 1392x1040 pixels                                            | 10 FPS at full resolution<br>100 FPS at 16x16 binning |

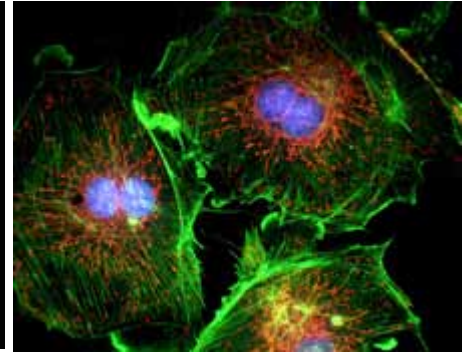
# APPLICATIONS OF HIGH SENSITIVITY CAMERAS



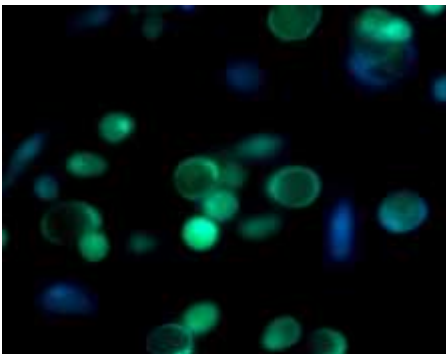
High Content Screening



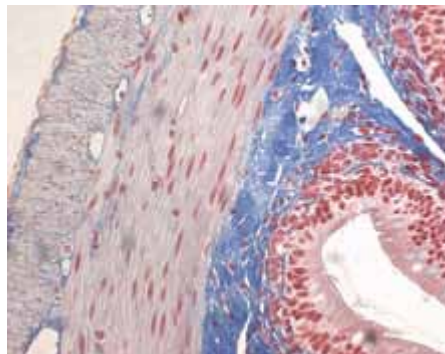
Confocal Microscopy



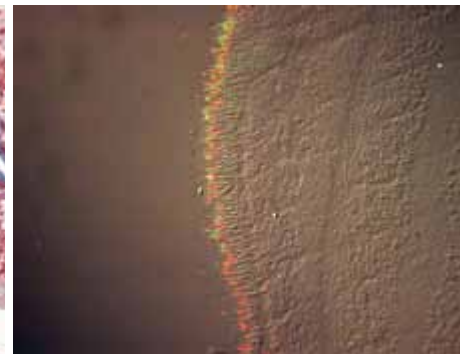
Fluorescence Microscopy



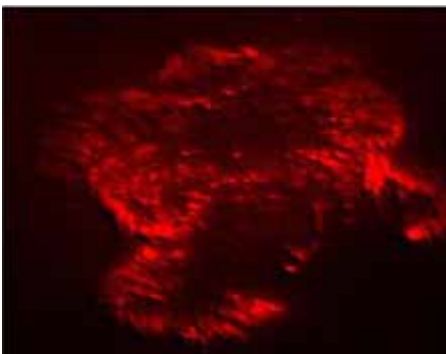
Ca ++ ion Imaging



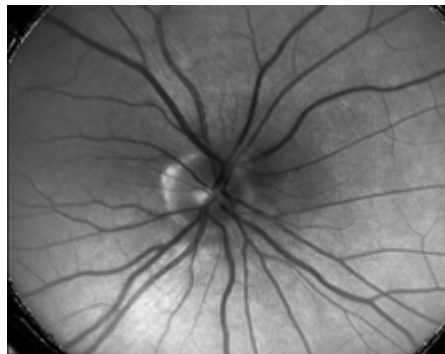
Bright Field Microscopy



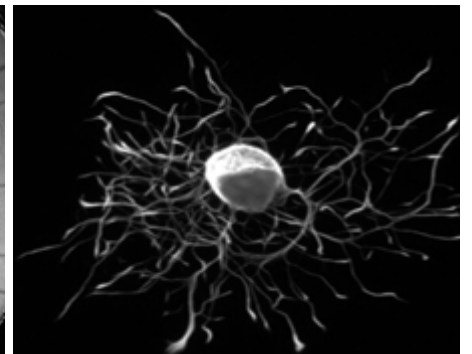
DIC



TIRF (Using Intensicam)



Ophthalmic Imaging



Neuroscience

## CHAPTER 8 IMAGING SYSTEM

## 16-MEGAPIXEL MONOCHROME DIGITAL CAMERA



## Features

- High QE CCD: >45% @500nm
- Interline, Progressive Scan CCD
- No Mechanical Shutter
- 12-Bit Digitization
- Low Read Noise
- High Signal to Noise Ratio
- DVCView™: Image Capture and Control Software
- CE / UL / CUL / FCC Certified
- 16-Megapixel Resolution
- Variable, On-chip Region of Interest and Binning
- Flexible Exposure and Readout Modes
- Single or Dual-tap Readout: 40 and 20 MHz
- "F" Lens Mount
- Software and External Asynchronous Triggers
- Windows/Linux API
- One-piece Optical Coupling with Internal Light Baffle

## Description

The DVC-16000M is a 16-megapixel, high sensitivity digital camera that utilizes the Kodak KAI-16000 progressive-scan, interline CCD sensor. With 7.4 micron square pixels, very low noise, and a peak quantum efficiency of 45%, the DVC-16000M is the camera of choice for demanding scientific and industrial applications.

The DVC-16000M has four basic operating modes: streaming overlapped exposure, streaming non-overlapped exposure, edge-triggered single-frame snapshot, and variable pulse-width exposure.

The DVC 16000M is fully supported in our multi platform SDK which enables the streamlined integration. The DVC-16000M is fully supported in our multi-platform SDK, which enables the streamlined integration of all DVC products into any system. The DVCView™ real-time viewing and image capture application also provides complete support for the DVC-16000M.



## SPECIFICATIONS

### CCD

|               |                                                    |
|---------------|----------------------------------------------------|
| Active Pixels | 4872 X 3248                                        |
| Pixel Size    | 7.4 $\mu\text{m}$ X 7.4 $\mu\text{m}$ (sq. format) |
| Imager Size   | 43 3mm (diagonal)                                  |
| Aspect Ratio  | 3:2                                                |
| Peak QE       | >45%                                               |
| Full Well     | 30,000e- @ 20 MHz                                  |
|               | 20,000e- @ 40 MHz                                  |

### Digital Video

|                       |                                          |       |       |
|-----------------------|------------------------------------------|-------|-------|
| I/O                   | 12-bit dual-port Camera Link             |       |       |
| A/D Converter 1       | 12-bit single or dual-port, 20 or 40 MHz |       |       |
| A/D Converter 2       |                                          |       |       |
| Read Noise            | 14e- @ 20 MHz                            |       |       |
| Binning               |                                          | 20MHz | 40MHz |
|                       | 1X1 4872 X 3248                          | 2.0   | 3.5   |
| selected examples,    | 2X2 2436 X 1624                          | 3.5   | 5.5   |
| dual-port frame rates | 3X3 1624 X 1083                          | 4.6   | 6.8   |
|                       | 4X4 1218 X 812                           | 5.5   | 7.7   |
|                       | 4X20 1218 X 162                          | 10.1  | 11.5  |
| ROI                   |                                          | 20MHz | 40MHz |
|                       | 2048 X 2048                              | 3.0   | 4.8   |
| selected examples,    | 1024 X 1024                              | 4.8   | 7.0   |
| dual-port frame rates | 512 X 512                                | 7.0   | 9.1   |
|                       | 256 X 256                                | 8.9   | 11.6  |

### Electrical

|               |                      |
|---------------|----------------------|
| Input Voltage | 110/220 VAC 50/60 Hz |
| Power         | <5 Watts             |

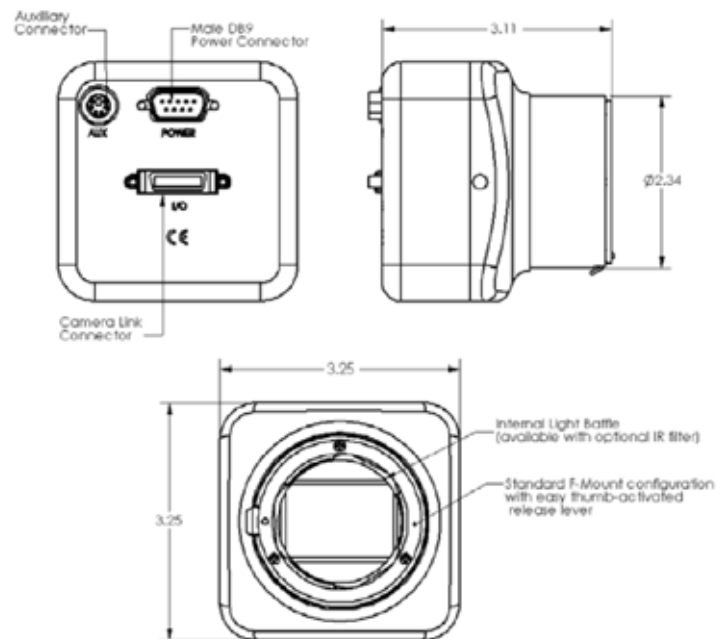
### Mechanical

|                  |                                    |
|------------------|------------------------------------|
| Size             | 3.25" (H) X 3.25" (W) X 3.11" (L)  |
| Weight           | 18 ozs. (505 grams)                |
| Lens Mount       | F-mount with internal light baffle |
| Camera Mount     | 1/4" X 20 Standard Tripod mount    |
| Camera Connector | Camera Link....MDR-26              |
| Power Connector  | DB-9M                              |

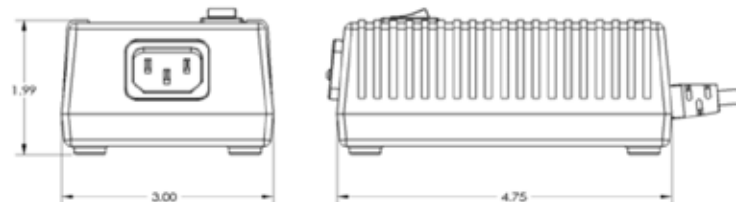
### Camera Control

|                        |                            |
|------------------------|----------------------------|
| Gain Control Range     | 35 dB                      |
| Offset Control (black) | 0% to 6% in 256 steps      |
| Exposure Range         | 85 $\mu\text{s}$ to 1 hour |

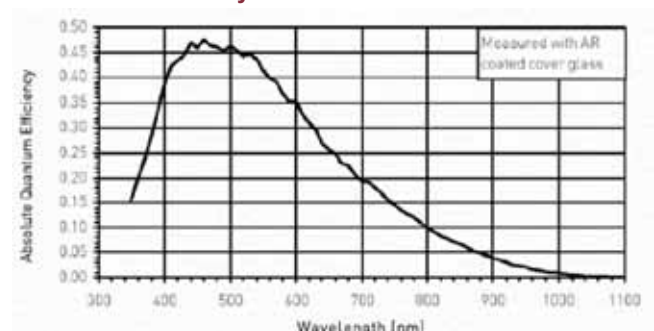
### 16000M



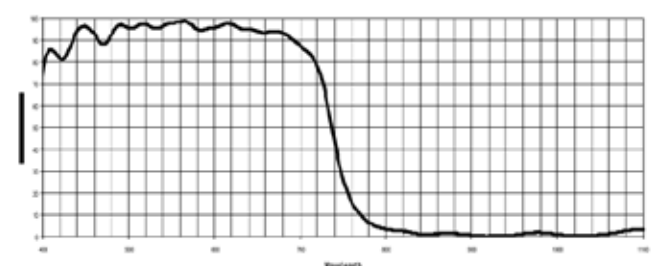
### Switchmode Power Supply



### CCD Quantum Efficiency



### IR FILTER RESPONSE



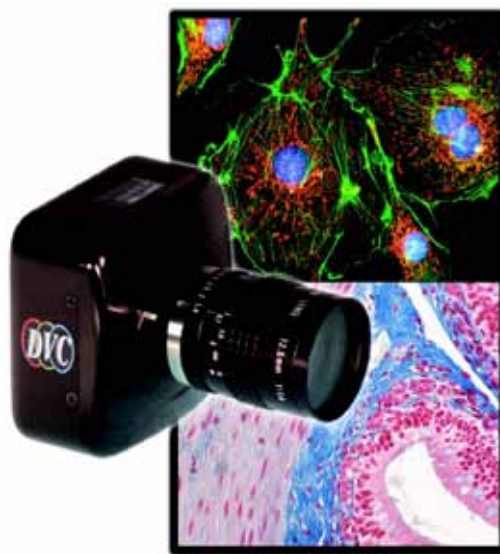


## CHAPTER 8 IMAGING SYSTEM

## 1.4 MEGAPIXEL 12-BIT DIGITAL CAMERA



DVC-1412AM-00



DVC-1412AC-00



DVC-1412AM-MS

**Features**

- High QE CCD: >62% @550nm
- Mega-pixel Resolution: 1392 (H) X 1040 (V) X 12 bits
- Fast Readout: 18 MHz
- Low Read Noise: 8e- @ 18MHz
- Optional, Retrofittable TE Cooler: -20OC (no fan required)
- Long Term Exposure: Up to 15 minutes
- High Signal to Noise Ratio: >65dB
- User Adjustable Region of Interest
- Selectable Binning Modes: 1x1, 2x2, 4x4, 8x8
- Programmable Scan: 18 MHz, 9MHz
- Output Configuration: FireWire/CameraLink/LVDS
- DVCViewU: Image Capture and Control Software
- Multi Platform API/SDK Available
- Asynchronous Reset: with multiple fast/shutter modes
- Ultra-stable In-camera Digitization
- No Mechanical Shutter Required
- CE / UL / CUL / FCC Certified
- Interchangeable 4-position Filter Wheel Module
- Precision Stepper Motor Design
- Software Control of Filter Position, Speed & Exposure
- Optional Gen III Intensified Model

**Description**

The DVC-1412 is a high resolution, high sensitivity digital camera utilizing a Sony ICX285AL Mega-pixel 2/3" scan interline CCD sensor. The CCD sensor has a particularly high QE peaking in the 500-600nm region of the spectrum resulting in higher sensitivity for most applications. RGB color is derived by use of an on-sensor Bayer filter pattern that minimizes light and resolution losses. The highly stable optical mount utilizes adjustable C-mount coupling to provide critical system focusing adjustments.

A removable module equipped with a four-position Multi-spectral f filter wheel is integrated within a modified monochrome DVC-1412A camera housing (both TE-cooled and Intensified versions are available). The filter module can be supplied with high quality RGB optical filter sets, with custom application sets or with the new Qdot™ filters. It is designed such that the filters can be easily removed and replaced with the user's choice of 1" filters. The entire module, comprising the wheel, filters, motor and electronics, can easily be removed from the camera housing. This facilitates the use of different multispectral f filter sets, according to the user's applications. A tool is provided for the easy removal and replacement of filters within the module.

The camera is supplied with DVCview™, a Windows 2000/XP or Mac OS X software program for real-time viewing and image capture. DVCview™ allows the user to control all camera functions including variable ROI readout to provide faster frame rates without loss of resolution.

Also included are image averaging and background correction. DVCview™ provides 5 user-programmable single-click application controls.

This camera is supported by many popular 3rd party programs. The camera is available with either Firewire, CameraLink or LVDS output which is interfaced to the computer via a single multi-pinned cable.



# CHAPTER 8 IMAGING SYSTEM

## 2 MEGAPIXEL 12-BIT DIGITAL CAMERA



**DVC-2000C**



**DVC-2000M-T1**

- High QE CCD: >55% @ 500nm
- 2 Megapixel Resolution: 1600 X 1200
- Interline Progressive Scan CCD
- 12 Bit Digitization
- Dual A/D Converters : 40 and 20 MHz
- Low Read Noise
- Optional 1-Stage or 2-Stage TE Coolers
- "C" Lens Mount
- Long Term Exposures: > 1 hour
- High Signal to Noise Ratio
- Variable, On-chip Region of Interest and Binning
- Flexible Exposure and Readout Mode
- Gigabit Ethernet or CameraLink Interface
- DVC View?: Image Capture and Control Software
- SDK for Windows and Linux
- Software and External Asynchronous Triggers
- No Mechanical Shutter Required
- CE/UL/CUL/FCC Certified
- RoHS Compliant

The DVC-2000 is a high resolution, high sensitivity digital camera utilizing a Kodak KAI-2020 progressive scan interline CCD sensor. The quantum efficiency of the CCD peaks in the 500-600nm region of the spectrum, resulting in optimum sensitivity for most applications.

The Camera has four basic operating modes: streaming overlapped exposure, streaming non-overlapped exposure, edge-triggered single-frame snapshot, and variable pulse-width exposure. Two independent A/D converters offers the user selection of CCD readout rates for lowest noise or highest speed.

RGB color is derived by use of an on-sensor Bayer filter pattern that minimizes light and resolution. The highly stable optical mount utilizes adjustable C-mount coupling to provide critical system focusing adjustments.

The camera is supplied with DVCview™, a Windows 2000/XP software program for real-time viewing and image capture. DVCview™ allows the user to control all camera functions including variable ROI readout to provide faster frame rates without loss of resolution. Also included are image averaging and background correction. DVCview™ provides 5 user-programmable single-click application controls. A multi-platform SDK is available to developers, streamlining integration of all DVC cameras via the

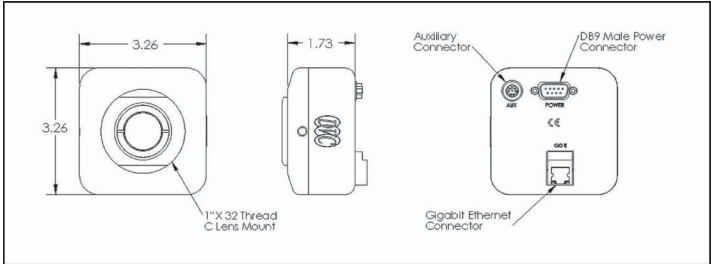
| CCD           | interline CCD                          |
|---------------|----------------------------------------|
| Active Pixels | 1600 X 1200                            |
| Pixel Size    | 7.4µm X 7.4µm                          |
| Imager Size   | 5.92 mm (diagonal)                     |
| Aspect Ratio  | 4:3                                    |
| Peak QE       | >55%                                   |
| Full Well     | 38,000e – @ 20MHz<br>20,000e – @ 40MHz |

| Digital Video       |                                       |       |       |
|---------------------|---------------------------------------|-------|-------|
| I/O                 | 12 bit CameraLink or Gigabit Ethernet |       |       |
| A/D Converter 1     | 20 MHz @12 bits                       |       |       |
| A/D Converter 2     | 40 MHz @12 bits                       |       |       |
| Read Noise          | 12e- @ 20 MHz                         |       |       |
| Binning             |                                       | 20MHz | 40MHz |
| (selected examples) | 1X1 1600 X 1200                       | 9     | 118   |
|                     | 2X2 800 X 600                         | 17    | 32    |
|                     | 4X4 400 X 300                         | 32    | 53    |
|                     | 8X8 200X 150                          | 52    | 78    |
| ROI                 |                                       | 20MHz | 40MHz |
| (selected examples) | 800 X600                              | 18    | 32    |
|                     | 400 X300                              | 32    | 54    |
|                     | 200 X 150                             | 54    | 81    |

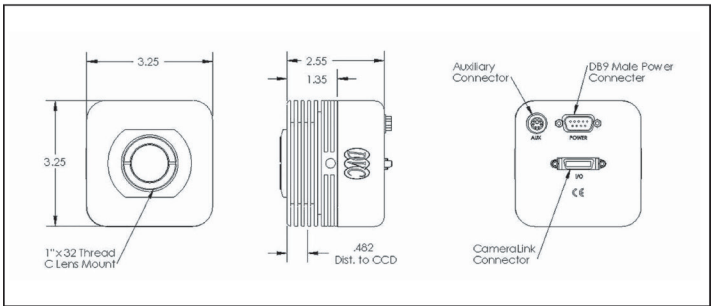
| Electrical    |                      |
|---------------|----------------------|
| Input Voltage | 110/220 VAC 50/60 Hz |
| Power         | <5 Watts             |

| Camera Control         |                       |
|------------------------|-----------------------|
| Gain Control Range     | 35 dB                 |
| Offset Control (black) | 0% to 6% in 256 steps |
| Exposure Range         | 50 µs> 1hour          |

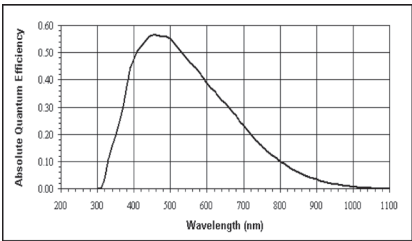
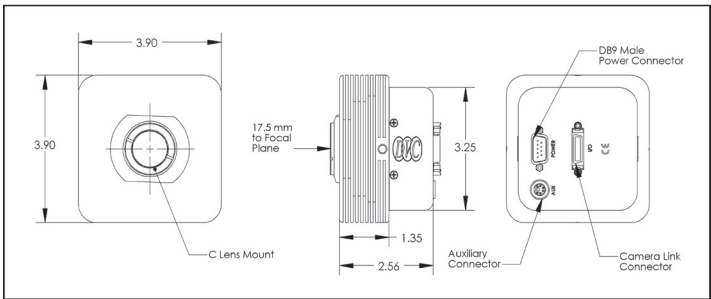
2000C/2000M (shown with Gigabit Ethernet connector)



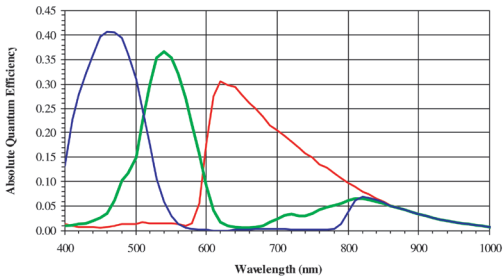
2000C-T1/2000M-T1 Cooled (shown with Cameralink connector)



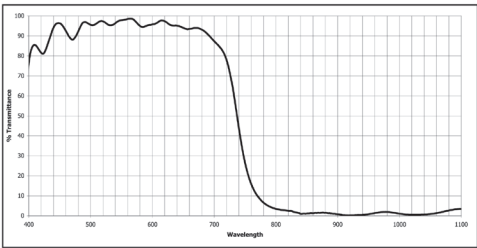
2000C-T2/2000M-T2 Cooled (shown with Cameralink connector)



CCD Quantum Efficiency



CCD Quantum Efficiency



IR Filter Response

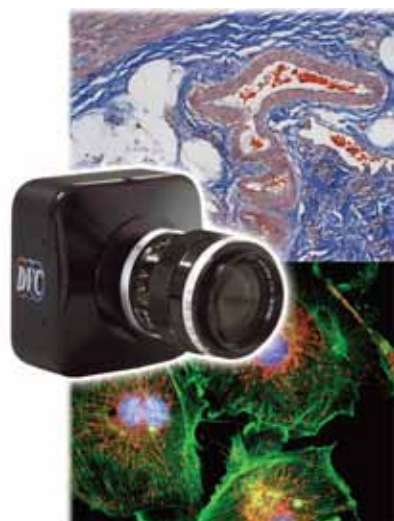


# CHAPTER 8 IMAGING SYSTEM

## 4 MEGAPIXEL 12-BIT DIGITAL CAMERA



**DVC-4000M-T2**



**DVC-4000C**

- High QE CCD:>55%@500nm
- 1.4 Megapixel Resolution: 2048 X 2048
- Interline Progressive Scan CCD
- 12 Bit Digitization
- Dual A/D Converters : 40 and 20 MHz
- Low Read Noise
- Optional 1-Stage or 2-Stage TE Coolers
- "C" Lens Mount
- Long Term Exposures: > 1 hour
- High Signal to Noise Ratio
- Variable, On-chip Region of Interest and Binning
- Flexible Exposure and Readout Modes
- Software and External Asynchronous Triggers
- DVC View?:Image Capture and Control Software
- SDK for Windows and Linux
- No Mechanical Shutter Required
- CE/UL/CUL/FCC Certified
- RoHS Compliant

### Description

The DVC-4000 is a high resolution, high sensitivity digital camera utilizing a Kodak KAI-4021 progressive scan interline CCD sensor. The quantum efficiency of the CCD peaks in the 500-600nm region of the spectrum, resulting in optimum sensitivity for most applications.

The DVC-4000 has four basic operating modes:streaming overlapped exposure, streaming non-overlapped exposure,edge-triggered single-frame snapshot, and variable pulse-width exposure. Two independent A/D converters offers the user selection of CCD readout rates for lowest noise or highest speed. RGB color is derived by use of an on-sensor Bayer filter pattern that minimizes light and resolution. The highly stable optical mount utilizes adjustable C-mount coupling to provide critical system focusing adjustments.

DVCview™ application software is provided with the camera for real-time viewing and Image capture. A multi-platform SDK is available to developers, streamlining integration of all DVC cameras via the DVC APL.

# CHAPTER 8 IMAGING SYSTEM

| CCD           | KAI-4021 progressive scan              |
|---------------|----------------------------------------|
| Active Pixels | 2048 X 2048                            |
| Pixel Size    | 7.4um X 7.4um(sq.format)               |
| Imager Size   | 21.43 mm (diagonal)                    |
| Aspect Ratio  | 1:1                                    |
| Peak QE       | >55%                                   |
| Full Well     | 38,000e – @ 20MHz<br>20,000e – @ 40MHz |

## Digital Video

|                     |                                       |
|---------------------|---------------------------------------|
| I/O                 | 12 bit CameraLink or Gigabit Ethernet |
| A/D Converter 1     | 20 MHz @12 bits                       |
| A/D Converter 2     | 40 MHz @12 bits                       |
| Read Noise          | 12e- @ 20 MHz                         |
| Binning             | 20MHz 40MHz                           |
| (selected examples) | 1X1 2048 X 2048 4 8                   |
|                     | 2X2 1024 X 1024 14 40                 |
|                     | 4X4 512 X 512 8 15                    |
|                     | 4X20 512X 100 25 55                   |
| ROI                 | 20MHz 40MHz                           |
| (selected examples) | 1024 X 1024 8 15                      |
|                     | 512 X 512 15 26                       |
|                     | 256 X 256 25 30                       |

## Electrical

|               |                      |
|---------------|----------------------|
| Input Voltage | 110/220 VAC 50/60 Hz |
| Power         | <5 Watts             |

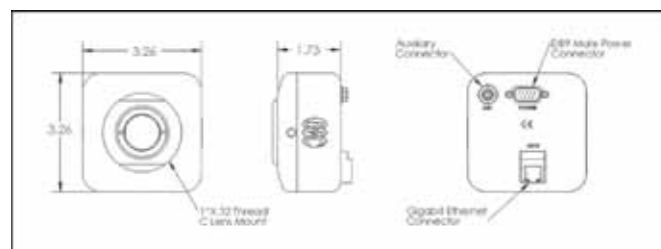
## Mechanical

|                   |                                 |
|-------------------|---------------------------------|
| Size              | 3.25"(H)X3.25"(W) X1.73"(L)     |
| W/T1 COOIER       | 3.25"(H)X3.25"(W) X2.56"(L)     |
| W/T2 COOIER       | 3.90"(H)X3.90"(W) X2.57"(L)     |
| Weight            | 18ozs.(505grams)                |
| W/T1 COOIER       | 30ozs.(900grams)                |
| W/T2 COOIER       | 38ozs.(1077grams)               |
| Lens Mount        | C-mount                         |
| Camera Mount      | 1/4" X 20 Standard Tripod Mount |
| Camera Connectors | CameraLink or Gigabit Ethernet  |
| Power Connecto    | DB-9M                           |

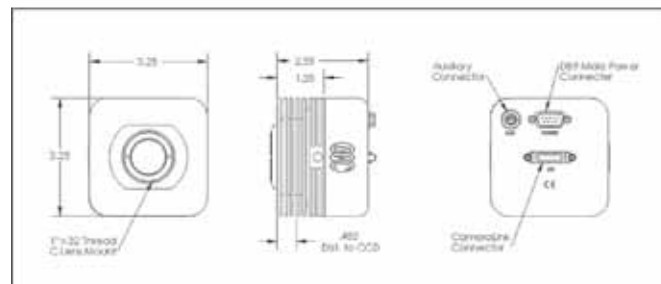
## Camera Control

|                        |                       |
|------------------------|-----------------------|
| Gain Control Range     | 35 dB                 |
| Offset Control (black) | 0% to 6% in 256 steps |
| Exposure Range         | 60 us> 1hour          |

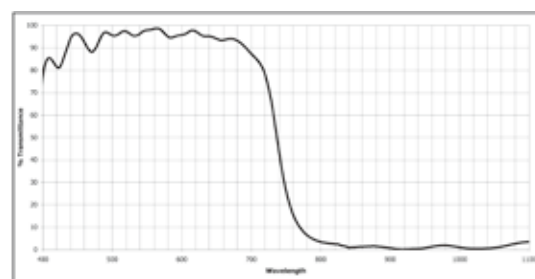
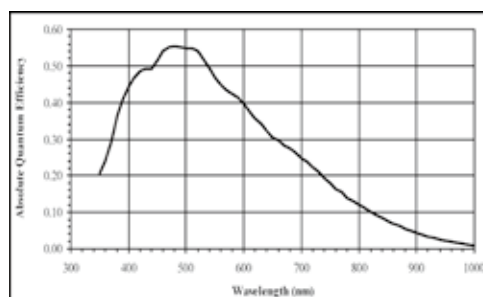
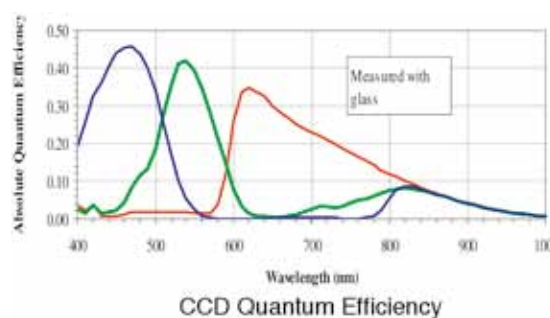
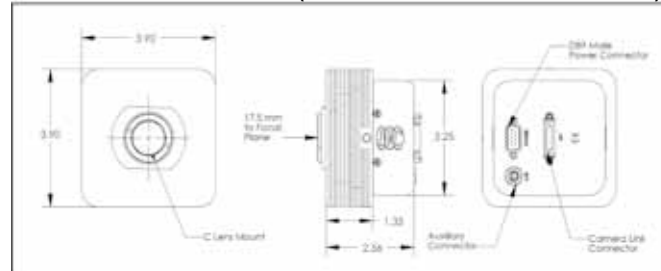
## 4000M/4000C(shown with Gigabit connector)



## 4000M-T1/4000C-T1 Cooled (shown with Cameralink Connector)



## 4000M-T2/4000C-T2 Cooled (shown with Cameralink Connector)



## CHAPTER 8 IMAGING SYSTEM

## 10-BIT PCI BUS HIGH RESOLUTION CAMERA



- High QE CCD:>55%@500nm
- 1.4 Megapixel Resolution: 1392 X 1040
- Interline Progressive Scan CCD
- 12 Bit Digitization
- Dual speed readout : 40 and 20 MHz
- Low Read Noise
- Optional 1-Stage or 2-Stage TE Coolers
- "C" Lens Mount
- Long Term Exposures: > 1 hour
- High Signal to Noise Ratio
- Variable, On-chip Region of Interest and Binning
- Flexible Exposure and Readout Mode
- Gigabit Ethernet or CameraLink Interface
- DVC View?:Image Capture and Control Software
- SDK for Windows and Linux
- Software and External Asynchronous Triggers
- No Mechanical Shutter Required
- CE/UL/CUL/FCC Certified
- RoHS Compliant

**Description**

The DVC-1500M is a versatile , high-performance digital camera with functions tailored to high throughput scientific and industrial applications. It is capable of both high-speed readout(40 MHz pixel rate) and low noise readout(20 MHz pixel rate) at 12 bit.It utilizes a SONY ICX285AL progressive scan interline CCD.

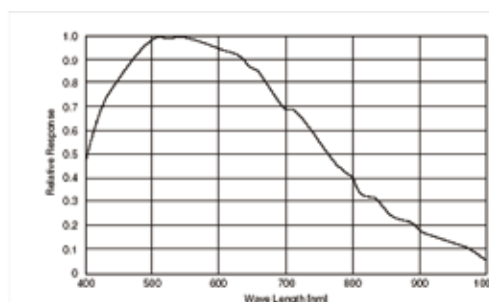
The high quantum efficiency of the CCD peaks in the 500-600nm region of the spectrum.. The DVC-1500M has fore basic operation modes:streaming overlapped exposure,streaming non-overlapped exposure,edge-triggered single-frame snapshot,and variable pulse-width exposure. Each mode can be operated at either 20 or 40 MHz and can support variable binning and region of interest operation allowing users to match the needs of their application.

DVCView? application software is provided with the camera for real-time viewing and image capture. A multi-platform SDK is available to developers, streamlining integration of all DVC cameras via the DVC APL.

| CCD           | ICX258 2/3" progressive scan            |
|---------------|-----------------------------------------|
| Active Pixels | 1392 (H) X 1040 (V)                     |
| Pick Up Area  | 8.98 mm X 6.71 mm (2/3" optical format) |
| Pixel Size    | 6.45 mmX 6.45 mm(sq.format)             |
| Aspect Ratio  | 4:3                                     |
| QE            | >62%                                    |
| Full Well     | 16,000e-(1X1)<br>32,000e-(Bin 2X2)      |

| Digital Video I/O | 12 bit CameraLink or Gigabit Ethernet |
|-------------------|---------------------------------------|
| A/D Converter 1   | 20 MHz @12 bits                       |
| A/D Converter 2   | 40 MHz @12 bits                       |
| Read Noise        | 12e- @ 20 MHz                         |

|                          |           | 20MHz       | 40MHz |
|--------------------------|-----------|-------------|-------|
| Binning                  | 1X1       | 1392 X 1040 | 12.2  |
|                          | 1X2       | 1392 X 520  | 22.8  |
| (selected exam- 2X2      | 696 X 520 | 22.8        | 41.3  |
| ples)                    | 3X3       | 464 X 346   | 32.1  |
|                          | 4X4       | 348X 260    | 43.2  |
|                          |           |             | 76.7  |
|                          |           | 20MHz       | 40MHz |
| ROI                      | 800 X 512 | 22.6        | 40.4  |
| (selected exam- 400 X256 |           | 38.9        | 65.0  |
| ples)                    | 200X 128  | 61.0        | 93.1  |



CCD Quantum Efficiency

# CHAPTER 8 IMAGING SYSTEM

## INTENSIFIED 12-BIT DIGITAL CAMERA

- High QE CCD: >62% @550nm
- Megapixel Resolution: 1392 (H) X 1040 (V) X 12 bits
- Fast Readout: 18 MHz
- Low Read Noise: 5-7 e<sup>-</sup> @ 9MHz
- High Sensitivity: 1X10<sup>-8</sup>fc Faceplate at 10 f/sec
- Long Term Exposure: Up to 15 min
- User Adj. Region of Interest: 100 f/s for 16xN ROI
- Selectable Binning Modes: 1x1, 1x2, 2x2, 4x4, 8x8
- Progressive Scan
- Optional Output Configuration
- C-View™: Image Capture and Control Software
- Asynchronous Reset: w/fast shutter SNAPSHOT mode
- Ultra-stable In-camera Digitization
- Precision Opto-mechanical Mount
- No Mechanical Shutter Required
- CE / UL / CUL / FCC Certified

| Intensifier          | 18mm Gen III proximity focus intensifier tube               |
|----------------------|-------------------------------------------------------------|
| QE                   | >35% Quantum Efficiency from 500 to 800 nm                  |
| Sensitivity          | 1x10 <sup>-8</sup> fc Sensitivity (faceplate) @2854K, 10fps |
| Photocathode         | GaAs photocathode, std spectral response 450 to 900 nm      |
| Intensifier Life     | >10,000 hrs @10 <sup>-5</sup> fc or lower                   |
| Geometric Distortion | < 1%                                                        |
| Resolution           | 64 lp/mm                                                    |
| Gating               | 50 ns to 98 ms                                              |

| CCD                     | 2/3" progressive scan interline CCD |
|-------------------------|-------------------------------------|
| Active Picture Elements | 1392 (H) X 1040 (V)                 |
| Pick Up Area            | 8.98 mm X 6.71 mm (2/3" format)     |
| Picture Element Size    | 6.45 um X 6.45 um (square format)   |
| Aspect Ratio            | 4:3                                 |
| QE                      | >62% @ 550 nm                       |
| Full Well               | 18,000e-36,000e-(1X1) (Bin 2X2)     |

| Digital Video output:          |                                        |            |       |       |
|--------------------------------|----------------------------------------|------------|-------|-------|
| Optional I/O                   | •12 bit RS-422/RS-644 (LVDS)           |            |       |       |
|                                | •12 bit CameraLink (CL)                |            |       |       |
|                                | •12 bit IEEE-1394A (Firewire)          |            |       |       |
| Readout Rates                  | 18 MHz, 9 MHz, 4.5 MHz, 2.25 MHz       |            |       |       |
| Read Noise                     | 5-7e <sup>-</sup> @ 9 MHz              |            |       |       |
| Binning                        | Resolution                             | Frames/Sec |       |       |
| 1X1                            | 1392 X 1040                            | 10.2       |       |       |
| 1X2                            | 1392 X 520                             | 20         |       |       |
| 2X2                            | 696 X 520                              | 20         |       |       |
| 4X4                            | 348 X 260                              | 39         |       |       |
| 8X8                            | 174 X 130                              | 68         |       |       |
| ROI/Frames Per Second          | 512X512                                | 256X256    | 64X64 | 16X16 |
|                                | 19                                     | 32         | 70    | 100   |
| Signal to Noise                | >65 dB, at min. gain                   |            |       |       |
| CCD Sensitivity                | 0.018 fc @ 0 dB gain, 10 f/sec 0       |            |       |       |
| (light required for full scale | .001 fc @ max gain, 10 f/sec           |            |       |       |
| output; without IR Filter)     | 0.0004 fc @ 0 dB gain, 10 sec exposure |            |       |       |

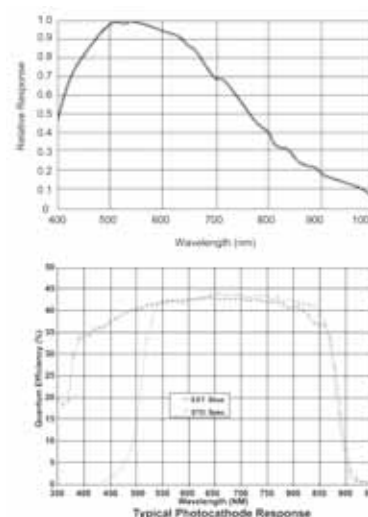


### Description

The DVC-1412 Intensicam is a monochrome, high resolution, high sensitivity, intensified digital camera utilizing an 18 mm Proximity Focus Gen III intensifier tube, fiber-optically coupled to a 2/3 inch, 1392 x 1040, high QE interline CCD.

The compact and lightweight design is particularly well suited for coupling to precision optical instruments without compromising imaging performance or stability. The Intensicam employs an adjustable C-Mount and is compatible with all C-Mount lenses providing a 1\_ image format.

Intensicam is uniquely designed to be fully controllable via software running on a Windows or Macintosh computer platform. The camera is supplied with an all-new C-View™, a PC based Software program for real-time viewing and image capture. C-View™ includes an integrated camera control panel which encompasses all camera control functions, including variable ROI readout to provide faster frame rate without loss of spatial resolution; 5 user programmable single-click application controls; plus TWAIN and Image Pro drivers to facilitate ease-of-use with popular imaging programs. The camera output and controls are interfaced to the computer interface via a single multipinned cable, which can be configured for LVDS, CameraLink, or Firewire operation.





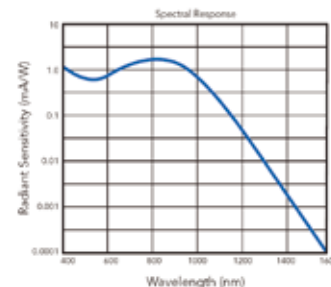
# CHAPTER 8 IMAGING SYSTEM

## INFRARED VIEWER



### APPLICATIONS:

- Observation of GaAs laser diodes and IR LEDs
- Beam alignment (e.g. Nd:YAG, Ti: Sapphire)
- Thermal imaging of objects 600°C (1112°F) and hotter
- View in-the-dark processes
- Forensic analysis of inks, pigments
- Sub-surf wafer inspection (Si, GaAs)



### CONVERTS 0.41-1.5μm RADIATION TO VISIBLE

ElectroViewer 7215 is a high-performance, hand-held Infrared Viewer designed to meet the requirements of viewing in the near-IR wavelength range. Unlike any other infrared imaging device, the ElectroViewer delivers an

image that is remarkably bright. And with focusing as close as 3 inches, the ElectroViewer is the perfect tool for in-the-lab and in-the-field.

- Excellent image quality
- Bright, high-contrast image
- Focuses as close as 3"
- Adjustable iris included
- Accepts C-mount lenses
- Interfaces to CCTV cameras
- Rugged and shock-proof design

### OPERATION

The ElectroViewer is powered by pressing and maintaining the push-button switch. The objective lens, adjusted for objects at distances from 3" to infinity, brings the scene into sharp focus, producing a bright, green fluorescent image seen through the eyepiece.

High-resolution images are generated in accordance with the incident intensity of the radiation and the S-1 spectral responsivity of the photocathode material (see Spectral Response characteristic)

The ElectroViewer image output can either be viewed directly using the adjustable eyepiece included or can be attached to a CCTV camera with the 7215-202 CCTV Relay Lens accessory (optional, thus effectively extending the CCTV camera's response range to beyond 1.3μm!

### SPECIFICATION

|                           |                           |
|---------------------------|---------------------------|
| Input Photocathode        | Input Photocathode        |
| Output Fluorescent Screen | Output Fluorescent Screen |
| Output Resolution         | Output Resolution         |
| Peak Emission Wavelength  | Peak Emission Wavelength  |
| Responsivity@1.06μm       | Responsivity@1.06μm       |
| Object Distance           | Object Distance           |
| Field of View             | Field of View             |
| Battery Life              | Battery Life              |
| Battery Type              | Battery Type              |
| Size (L W H)              | Size (L W H)              |
| Weight w/o Lens           | Weight w/o Lens           |



Option: 7215-202 camera accessory

| ITEM                           | PART NO. | DESCRIPTION                                                                                                       |
|--------------------------------|----------|-------------------------------------------------------------------------------------------------------------------|
| ElectroViewer 7215             | 914646   | Selected to detect 20mW/cm <sup>2</sup> @1.3μm. Includes a 25mm objective lens, eyepiece, and 9V alkaline battery |
| ElectroViewer 7215P            | 914646   | Selected to detect 50mW/cm <sup>2</sup> @1.5μm. Includes a 25mm objective lens, eyepiece, and 9V alkaline battery |
| Switch Option                  |          | Toggle ON/OFF switch replaces push button in above models                                                         |
| AC Option                      |          | Viewer has additional AC adapter jack in parallel with 9V battery terminals.                                      |
| CCTV Relay Lens                | 914644   | Interfaces with 1/2" CCTV cameras                                                                                 |
| Extension Tube Set             | 908007   | Reduces minimum object distance to 1-2"                                                                           |
| Close-up Lens Set              | 908005   | Attaches to filter thread of 25mm lens and reduces minimum object distance to about 2"                            |
| Wide Angle Objective Lens      | 908001   | 16mm F1.6 (no iris)                                                                                               |
| 2X Telephoto Objective Lens    | 908004   | 50mm F1.8                                                                                                         |
| 5X Objective Lens              | 908000   | 135mm F2.8                                                                                                        |
| 1/2X to 3X Zoom Objective Lens | 908006   | 12.5-75mm F1.2                                                                                                    |
| Carrying/Storage Case          | 902017   | Foam-lined case for storage and transport                                                                         |
| Visible Light Cut Filter       | 902031   | Mounts on 25mm Lens filter thread                                                                                 |
| Filter Holder                  | 909000   | Captures any 1" filter onto 25mm objective lens                                                                   |
| 1" Long Pass Filters           |          | Select cut-on wavelength (nm): 700, 750, 800, 850, 900, 950, 1000, more                                           |
| 1" Short Pass Filters          |          | Select cut-off wavelength (nm): 700, 750, 800, 850, 900, 950, 1000, more                                          |
| 1" Band Pass Filters           |          | Select center wavelength (nm): 700, 710, ..., 1050, 1060, more                                                    |
| 1" Band Pass Filters           |          | Select optical density: 0.1, 0.2, ..., 0.9, 1.0, 1.5, 2.0, 3.0, more                                              |

# CHAPTER 8 IMAGING SYSTEM

## NEAR INFRARED CAMERA



The MicronViewer 7290A and 7290AX models combine many unique features and benefits in one versatile and affordable camera: broad spectral response (400nm to over 2µm), excellent sensitivity and resolution, RS-170 60Hz or CCIR 50Hz video output, a variety of optional lenses and filters, and fixed-mount or handheld configurations, as well as extended-response versions!

- Accepts a variety of C-mount objective lenses
- Integral optical filter slide permits use of 25mm long-pass, short-pass, band-pass or neutral density filters
- 3-position manual gain or auto gain
- Standard video output: RS170 (60Hz) or CCIR (50Hz)
- Gen-lock input
- Tripod mount
- High-performance, lead-oxysulfide vidicon, 9.5 x 12.7mm
- imaging detector

### SPECIFICATIONS

|                       |                                                                                 |                           |                                                                                                        |
|-----------------------|---------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------|
| Spectral Sensitivity  | 0.4 to 1.9 µm (7290A, 7290AX);<br>0.4 to 2.2 µm (7290A-06, 7290AX-06)           | Voltage Requirement       | 12-15VDC (7290A, 7290AX); Rechargeable battery and recharger (7290AX)                                  |
| Horizontal Resolution | Up to 700 TV lines (7290A, 7290AX);<br>Up to 650 TV lines (7290A-06, 7290AX-06) | Size (LxWxH)              | 9"x 4"x 3" (22x10x7 cm)                                                                                |
| Dynamic Range         | 100:1 (7290A, 7290AX);<br>50:1 (7290A-06, 7290AX-06)                            | Weight                    | 1.13kg, 2.5lb. (7290A);<br>1.52kg, 3.2lb. (7290AX)                                                     |
| Scanned Area          | 9.5x12.7mm 2                                                                    | Mounts                    | 1.0"-32 lens C-mount thread;<br>¼"-20 UNC-2B tripod mount on base<br>Filter Slide accepts 25mm filters |
| Damage Threshold      | 1mW/cm 2 (CW), 10mJ (pulsed)                                                    | Ambient Temperature Range | Operating: -20°C to +50°C (-4°F to +122°F)<br>Storage: -54°C to +70°C (-65°F to +158°F)                |
| Decay Lag after 50ms  | 45-60%                                                                          | Gain Control              | Three manual positions or automatic                                                                    |
| Sweep Rate            | RS-170 (7290A, 7290AX);<br>CCIR (7290A-E, 7290AX-E)                             | Shading Correction        | Internal control                                                                                       |
| Scanning              | 2:1 interlace                                                                   | Sensitivity (target)      | Internal control                                                                                       |
| Signal-to-Noise Ratio | 55db (p-p/rms) or better                                                        | Video Output Connector    | BNC                                                                                                    |
| Deflection Distortion | ±2% in circle of picture width                                                  | Sync Input Connector      | BNC                                                                                                    |
| Synchronization       | Internal/Genlock (composite)                                                    | Power Connector           | 4-pin                                                                                                  |
| Power                 | 6W, 500mA                                                                       |                           |                                                                                                        |

### ORDERING INFORMATION

| ITEM                                | PART NO. | DESCRIPTION                                                                                                                                   |
|-------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 7290A MicronViewer                  | 914007   | Fixed-mount camera with RS-170 60Hz video output. No lens. Requires AC power supply                                                           |
| 7290AX MicronViewer                 | 914059   | Fixed-mount camera with RS-170 60Hz video output. Includes 1X 25mm Objective Lens rechargeable shoulder pack and AC adapter/battery recharger |
| Option -06: Extended spectral range |          | Extends the sensitivity range of the standard camera to 2.2µm                                                                                 |
| Option -E: CCIR video format        |          | Video format is CCIR 50Hz                                                                                                                     |
| 1X Objective Lens                   | 914566   | 25mm F1.3 with integral iris diaphragm                                                                                                        |
| 2X Objective Lens                   | 903020   | 50mm F1.4 with integral iris diaphragm                                                                                                        |
| 0.5X-3X Zoom Objective Lens         | 908006   | 12.5-75mm F1.2 with integral iris diaphragm                                                                                                   |
| Extension Tube Set                  | 908007   | Set of spacers that fit between lens and camera permitting close focusing                                                                     |
| 1" Long Pass Filters                |          | Select cut-on wavelength (nm): 700 750 800 850 900 950 1000 more                                                                              |
| 1" Short Pass Filters               |          | Select cut-off wavelength (nm): 700 750 800 850 900 950 1000 more                                                                             |
| 1" Band Pass Filters                |          | Select center wavelength (nm): 700 710 ... 1050 1060 more                                                                                     |
| 1" Neutral Density Filters          |          | Select optical density: 0.1 0.2 ... 0.9 1.0 1.5 2.0 3.0 more                                                                                  |
| G25 Filter Slide (extra)            | 914260   | Holder for 1" filters                                                                                                                         |
| 9" Bench-top Monitor                | 911000   | 120VAC black and white                                                                                                                        |
| 9" Bench-top Monitor                | 911002   | 240VAC black and white                                                                                                                        |
| 6' Video Cable                      | 911001   |                                                                                                                                               |
| Camera Power Supply                 | 905026   | for 120VAC includes 6' cord                                                                                                                   |
| Camera Power Supply                 | 905027   | for 240VAC includes 6' cord                                                                                                                   |

# CHAPTER 8 IMAGING SYSTEM

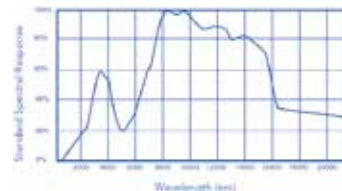
## MID TO FAR INFRARED CAMERA



- -10°C to 500°C Calibration (14°F to 932°F)
- Real-time software support
- 0.08°C Sensitivity
- 2% accuracy
- Broadband (3 to 14  $\mu\text{m}$ ) Imaging Option
- USB 2.0 High-Speed Serial Output

### BENEFITS

- Broadest requirements can be met
- Make intelligent decisions based on object temperatures
- Eliminates frame grabbers
- See fine thermal details
- Flexibility to image various light sources
- Application-specific software packages



Electrophysics' PV320T is a calibrated thermal camera incorporating a high resolution (320x240) uncooled focal plane array and advanced features including a USB 2.0 highspeed digital output and automatic image calibration (AIC). The PV320T delivers accurate object temperature

measurement up to 500°C (932°F) and excellent image quality.

Operate the PV320T as a stand-alone, video-based system with on-camera controls, or interface the camera with Velocity Radiometric, our powerful real-time image acquisition and analysis software application. Connect the camera to any USB 2.0-enabled PC platform and run Velocity Basic and display real-time images on any PC and control the camera remotely. The compact PV320T in its rugged, all-metal alloy chassis is currently in operation in many demanding applications around the world.

### PV320T-Fixed Lens IR Camera



### PV320L-Lens Changeable IR Camera



### SPECIFICATIONS

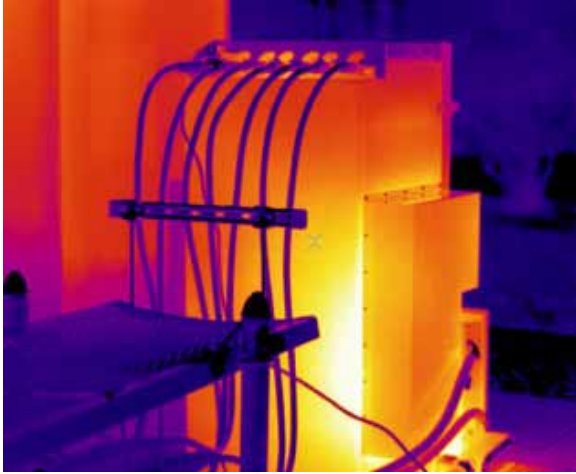
|                                     |                                                               |                                       |                                                                                     |
|-------------------------------------|---------------------------------------------------------------|---------------------------------------|-------------------------------------------------------------------------------------|
| Sensor                              | Uncooled BST                                                  | Internal/External Synchronization     | Included                                                                            |
| Detector Type/<br>Spectral Response | 8–12 $\mu\text{m}$ : PV320T<br>3–12 $\mu\text{m}$ : PV320T-BB | Voltage                               | 12 VDC on 2.5mm power slug;<br>110–240 VAC / 50–60Hz on included<br>AC power supply |
| Pixel Size                          | 48.5 x 48.5 $\mu\text{m}$                                     | Power Consumption                     | <10 watts nominal                                                                   |
| Thermal Sensitivity                 | 0.08°C                                                        | Camera Control                        | USB 2.0                                                                             |
| Resolution                          | 320x240 pixels                                                | Video Output Connector                | BNC                                                                                 |
| Focus                               | Manual                                                        | Real-time Digital Output<br>Connector | USB 2.0 High Speed                                                                  |
| Video Palettes (in camera)          | 4 color, 2 grayscale                                          | On-camera Control                     | 4-button panel, ON/OFF                                                              |
| Zoom (in camera)                    | 2x                                                            | Operating Temperature                 | 0°C to 50°C (32°F to 122°F)                                                         |
| Real-time Digital Output            | USB 2.0                                                       | Storage Temperature                   | -20°C to 60°C (-4°F to 140°F)                                                       |
| Video Output                        | NTSC (PAL optional)                                           | Humidity                              | 0 to 95% non-condensing                                                             |
| Object Temperature Range            | -20°C to 500°C (-4°F to 932°F)                                | Size (LxWxH)                          | 14 x 11.4 x 11.4 cm                                                                 |
| Emissivity Adjustment               | Variable from 0.1 to 1.0                                      | Weight                                | 1.2kg (3 lb.)                                                                       |
| Correction                          | Reflected ambient                                             | Power                                 | 2.5mm DC power plug                                                                 |
| Measurement                         | Ambient temp and lens temp                                    | Tripod Mount                          | 1/4" to 20 TPI                                                                      |
| Dynamic Range                       | 12 bits                                                       |                                       |                                                                                     |
| Frame Rate                          | 30Hz: PV320T<br>25Hz: PV320TE                                 |                                       |                                                                                     |

### ORDERING INFORMATION

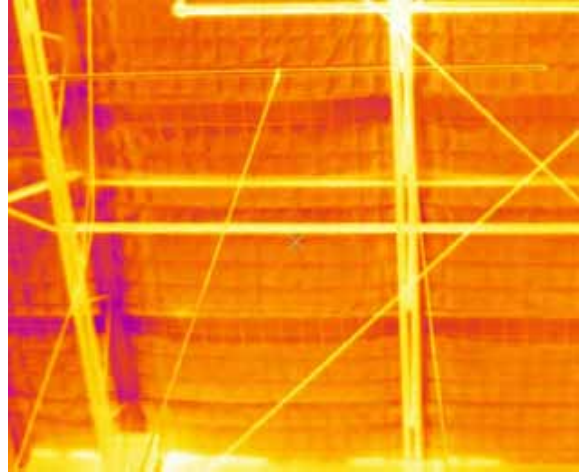
| ITEM                              | PART NO. | DESCRIPTION                                                |
|-----------------------------------|----------|------------------------------------------------------------|
| PV320T (NTSC)                     | 914339   | Includes 60Hz camera with 35mm lens and AC power supply    |
| PV320TE (PAL)                     | 914340   | Includes 50Hz camera with 35mm lens and AC power supply    |
| PV320T-BB (NTSC)                  | 914447   | Same as PV320T except with lens coated 3–12 $\mu\text{m}$  |
| PV320TE-BB (PAL)                  | 914448   | Same as PV320TE except with lens coated 3–12 $\mu\text{m}$ |
| Velocity Software-Basic           | 914376   |                                                            |
| Velocity Software-Advanced        | 914377   |                                                            |
| Velocity Software-Radiometric     | 914378   |                                                            |
| Velocity Software-Toolkit VB      | 914381   |                                                            |
| Velocity Software-Toolkit C++     | 914380   |                                                            |
| Velocity Software-Toolkit LabView | 914379   |                                                            |
| Carrying Case                     | 914384   |                                                            |

# CHAPTER 8 IMAGING SYSTEM

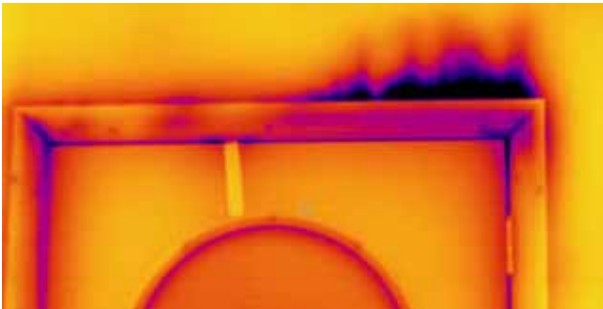
## APPLICATIONS OF FAR INFRARED CAMERA



Electrical and Electro-mechanical Inspection, Predictive Maintenance



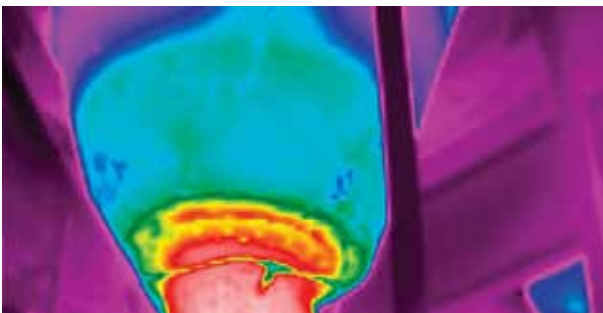
Moisture and Mold Detection, Roof Inspection



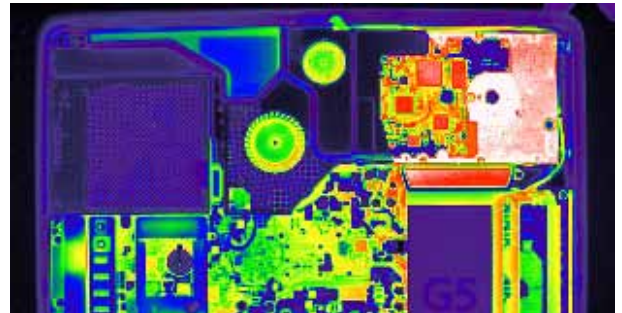
Energy Audits



Process Monitoring, Automation



Refractory Condition Monitoring



R&D Inspection and Testing



# CHAPTER 8 IMAGING SYSTEM

## AUTOMATED PROBING MICROSCOPES



### Reinforced With A Full Array of Accessories to Meet Your Every Optical Need

A-Zoom2 Microscopes have been designed to incorporate a wide variety of accessories to maximize the versatility of your probe station and analytical system. Whether used as a stand-alone manual research and inspection instrument, or integrated into an OEM's Probing Station, A-Zoom2 can be outfitted to meet

a variety of optical requirements.

Choose from...

- A variety of optimized Optem® High-Resolution Objectives
- Single- and Dual-Objective Slider Mounts for added flexibility
- Proportionate and Digital Remote Controllers for automation
- Heavy-Duty Focus Blocks for added stability
- Lamplink™ Illuminator/Power Supplies



### Proportionate and Digital Remote Controllers

A-Zoom2 offers a number of Proportionate and Microprocessor Digital Controllers for fully automated remote control of any combination of zoom, focus, and illumination on your A-Zoom2.



**Optimized for Use With Optem® High-Resolution, Infinity-Corrected Objectives**



### Heavy-Duty Focus Blocks

To further ensure optical stability and minimize vibration, specify a Heavy-Duty Focus Block for your A-Zoom2.



### Lamplink™ Illuminator/Power Supply

Each A-Zoom2 comes completed with a Lamplink light source.



True 10:1 Continuous Zoom  
140X – 1400X Magnification  
Range when used with  
Optem® 10X Objective



True 40:1 Continuous Zoom  
with 33% Gain in Low Power  
Field-of-View  
75X – 3000X  
Magnification Range  
when used with  
Optem® 10X Objective

60% Gain in NA for added resolution and greater light-efficiency when used with Optem® 5X, 10X, or 20X High-resolution Objectives  
Manual or Motorized Zoom, Focus, Illumination and Camera Functions Parfocal and Parcentric for Throughput Gains  
Eyepiece-Equipped and Laser-Ready Models  
Single- and Dual-Objective Slider Mounts

### SPECIFICATIONS

| Infinity-Corrected Objective | Working Distance | Visual Magnification | Visual Field-of-View (Ø) | Video Field-of-View       |
|------------------------------|------------------|----------------------|--------------------------|---------------------------|
| Optem 5X                     | 34mm             | 70X - 700X           | 3.4 - 0.34mm             | 2.1 x 2.8 - 0.21 x 0.28mm |
| Optem 10X                    | 19mm             | 140X - 1,400X        | 1.7 - 0.17mm             | 1.0 x 1.3 - 0.10 x 0.13mm |
| Optem 20X                    | NA               | 280X - 2800X         | 0.9 - 0.09mm             | 0.5 x 0.7 - 0.05 x 0.07mm |

| Infinity-Corrected Objective | Working Distance | Visual Magnification | Visual Field-of-View (Ø) | Video Field-of-View       |
|------------------------------|------------------|----------------------|--------------------------|---------------------------|
| Optem 5X                     | 34mm             | 70X - 700X           | 3.4 - 0.34mm             | 2.1 x 2.8 - 0.21 x 0.28mm |
| Optem 10X                    | 19mm             | 140X - 1,400X        | 1.7 - 0.17mm             | 1.0 x 1.3 - 0.10 x 0.13mm |
| Optem 20X                    | NA               | 280X - 2800X         | 0.9 - 0.09mm             | 0.5 x 0.7 - 0.05 x 0.07mm |

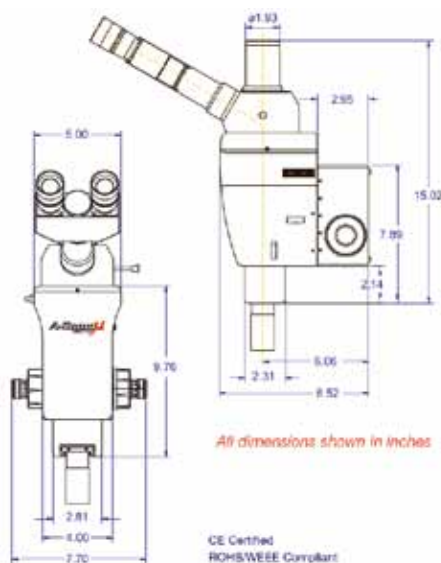
# CHAPTER 8 IMAGING SYSTEM

## ANALYTICAL PROBING MICROSCOPES

### A-Zoom Micro Configuration Options

#### A-ZOOM MICRO HEAD AND EYEPIECE OPTIONS

- 58-01-00-000...Fixed Trinocular Head (38mm ISO port),  
2.75X, 78mm eyepiece extender
- 58-01-25-000...Fixed Trinocular Head (38mm ISO port),  
2.75X, 130mm eyepiece extender
- 58-01-50-000...Fixed Trinocular Head (38mm ISO port),  
1.8X, 35mm eyepiece extender
- 58-02-00-000 ..... Fixed Binocular Head,  
2.75X, 78mm eyepiece extender
- 58-02-25-000 ..... Fixed Binocular Head,  
2.75X, 127mm eyepiece extender
- 58-02-50-000 ..... Fixed Binocular Head,  
1.8X, 35mm eyepiece extender
- 58-03-00-000 ..... Tilting Trinocular Head,  
2.75X, 127mm Erecting eyepiece extender
- 58-03-25-000 ..... Tilting Binocular Head  
2.75X, 127mm Erecting eyepiece extender
- 58-04-00-000 ..... 38mm ISO Camera port ONLY
- SPECIFY THE OPTEM OBJECTIVE TO MEET YOUR SPECIFIC IMAGING NEEDS.



### Camera Flexibility

Standard 38mm ISO port provides camera flexibility to meet most any probe imaging requirement.

### Matching Fields

Achieve matching eyepiece and on-screen fields-of-view across the entire 7:1 zoom when you equip your standard A-Zoom Micro with 1/2-inch cameras.

### On-board LED Illumination

Adjustable 10-watt LED provides crisp contrast for both eyepiece and video viewing without the need for external light source.

### Heavy-Duty Focus Block

The Heavy-duty focus block offers 50mm precision travel to establish fine-focus and provide a stable mounting interface for most any probe station.

### Single-Objective Design

In keeping with its field-proven heritage, A-Zoom Micro features a space efficient and user friendly single-objective design to eliminate cumbersome nose turret manipulation and improve throughput. Select from a widerange of Optem Objectives to meet your specific requirements.



### Trinocular Head Options

A-Zoom Micro comes standard with a fixed trinoc head and 10X eyepieces, offering 50/50 or 100% uni-directional, erect image transmission. Binocular, tilting-eyepiece and cameraonly head options are available with a variety of eyepieces to meet your specific imaging needs.

### Ergonomic Design

All magnification adjustments are located along right side of instrument and can be easily adjusted with a single hand.

### Extended Magnification

Instantaneously double your magnification range for quick and easy viewing flexibility using the 2X slider.

### 7:1 Optical Zoom

Engage precision optomechanics with a smooth, graduated zoom dial for precision field-of-view adjustment across an expansive single-objective magnification range.

### Maximize Working Space

The unique single-objective design and compact lower housing combine to offer 360° probe tip access maximizing work space, safeguarding your specimen and maintaining environmental chamber integrity. Optem Objectives further increase space with a generous 95mm parfocal distance from objective shoulder to object plane.



### SPECIFICATIONS

| Infinity-Corrected Objective      | Working Distance | Visual Magnification | Visual Field-of-View (Ø) | Video Field-of-View Low | Video Field-of-View High |
|-----------------------------------|------------------|----------------------|--------------------------|-------------------------|--------------------------|
| Optem 5X High Res 28-20-44-000    | 34mm             | 54X-381X             | 4.0-0.58mm               | 2.4x3.2                 | 0.35x0.46mm              |
| Optem 10X High Res 28-20-45-000   | 19mm             | 109X-762X            | 2.0-0.29mm               | 1.2x1.6                 | 0.17x0.23mm              |
| Optem 20X High Res 28-20-46-000   | 13mm             | 218X-1525X           | 1.0-0.14mm               | 0.6x0.8                 | 0.09x0.12mm              |
| Optem 2x M-Plan Apo 28-21-02-000  | 34mm             | 22X-152X             | 10.1-1.44mm              | 6.1x8.1                 | 0.87x1.15mm              |
| Optem 5x M-Plan Apo 28-21-05-000  | 34mm             | 54X-381X             | 4.0-0.58mm               | 2.4x3.2                 | 0.35x0.46mm              |
| Optem 10x M-Plan Apo 28-21-10-000 | 34mm             | 109X-762X            | 2.0-0.29mm               | 1.2x1.6                 | 0.17x0.23mm              |
| Optem 20x M-Plan Apo 28-21-11-000 | 20mm             | 218X-1525X           | 1.0-0.14mm               | 0.6x0.8                 | 0.09x0.12mm              |
| Optem 50x M-Plan Apo 28-21-50-000 | 13mm             | 545X-3812X           | 0.4-0.06                 | 0.24x0.32               | 0.03x0.05                |

# CHAPTER 8 IMAGING SYSTEM

## ADVANCED ZOOM IMAGING



### SPECIFICATION

#### Fetura 12.5:1 Platform\*

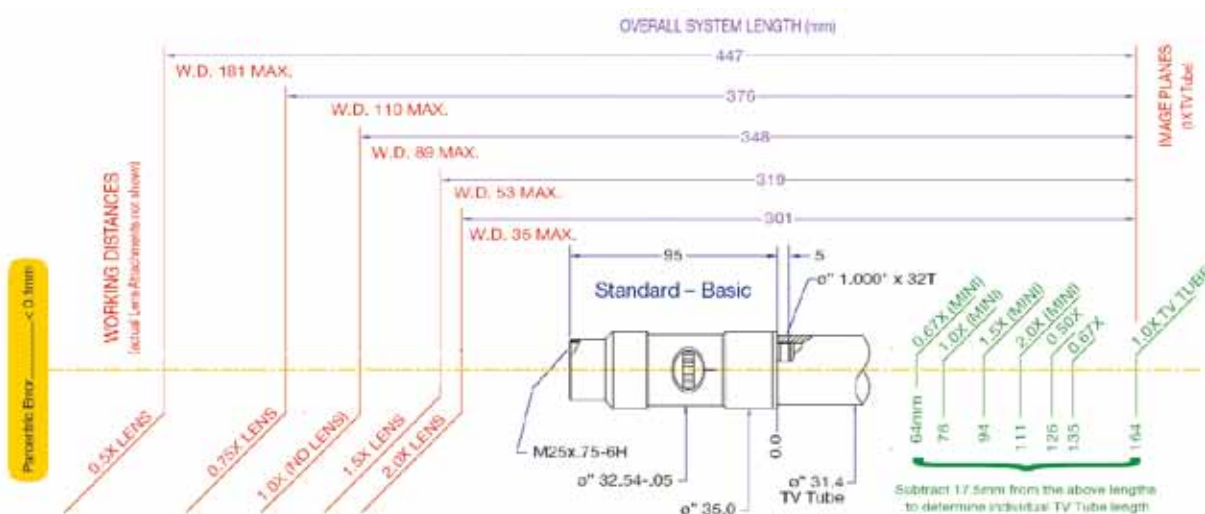
|                                              |                        |
|----------------------------------------------|------------------------|
| Numerical Aperture Range                     | 0.019 – 0.10           |
| Magnification Range (nominal)                | 0.52 – 6.5             |
| Depth-of-Field Range                         | 1.4 – 0.055            |
| Transmission:                                |                        |
| 480nm                                        | 91.11%                 |
| 550nm                                        | 92.43%                 |
| 650nm                                        | 91.80%                 |
| Wavelengths                                  | VIS: 486nm-650nm       |
| Zoom Magnification Repeatability (low mag.)  | 0.02%                  |
| Zoom Magnification Repeatability (high mag.) | 0.06%                  |
| Parcentration at image plane (low mag.)      | ± 2 µm                 |
| Parcentration at image plane (high mag.)     | ± 6 µm                 |
| Zoom Speed (low mag. to high mag.)           | < 1 sec.               |
| Service Life Expectancy                      | ≥1,000,000 zoom cycles |
| Acceleration Tolerance (any orientation)     | £ 1G up to 50Hz        |
| PC Control Interface                         | USB 2.0                |
| Power Requirements                           | US, Europe, UK         |
| Materials                                    | ISO 14644-1 compliant  |





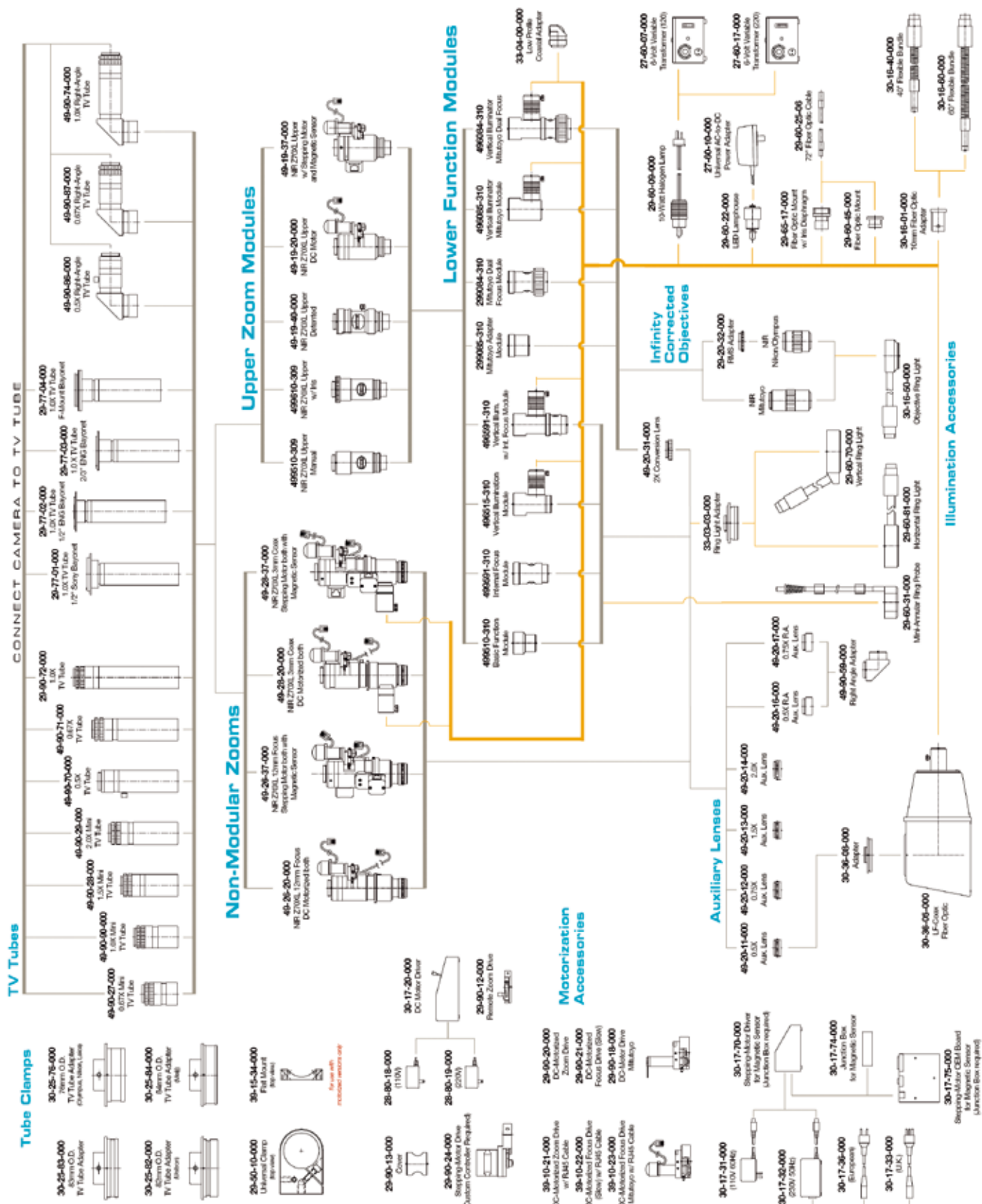
# CHAPTER 8 IMAGING SYSTEM

## 7:1 OPTICAL NIR 620-2000nm SYSTEM



**NOTES:** 1) Magnification (no Lens Attachments, 1X TV Tube) = 0.75X thru 5.25X. 2) N.A. (no Lens Attachments, 1X TV Tube) = 0.024 thru 0.080.

3) Field coverage depends on Lens Attachments, zoom settings, Adapter and camera format. 4) All measurements and working distances indicated in (mm) unless otherwise noted.

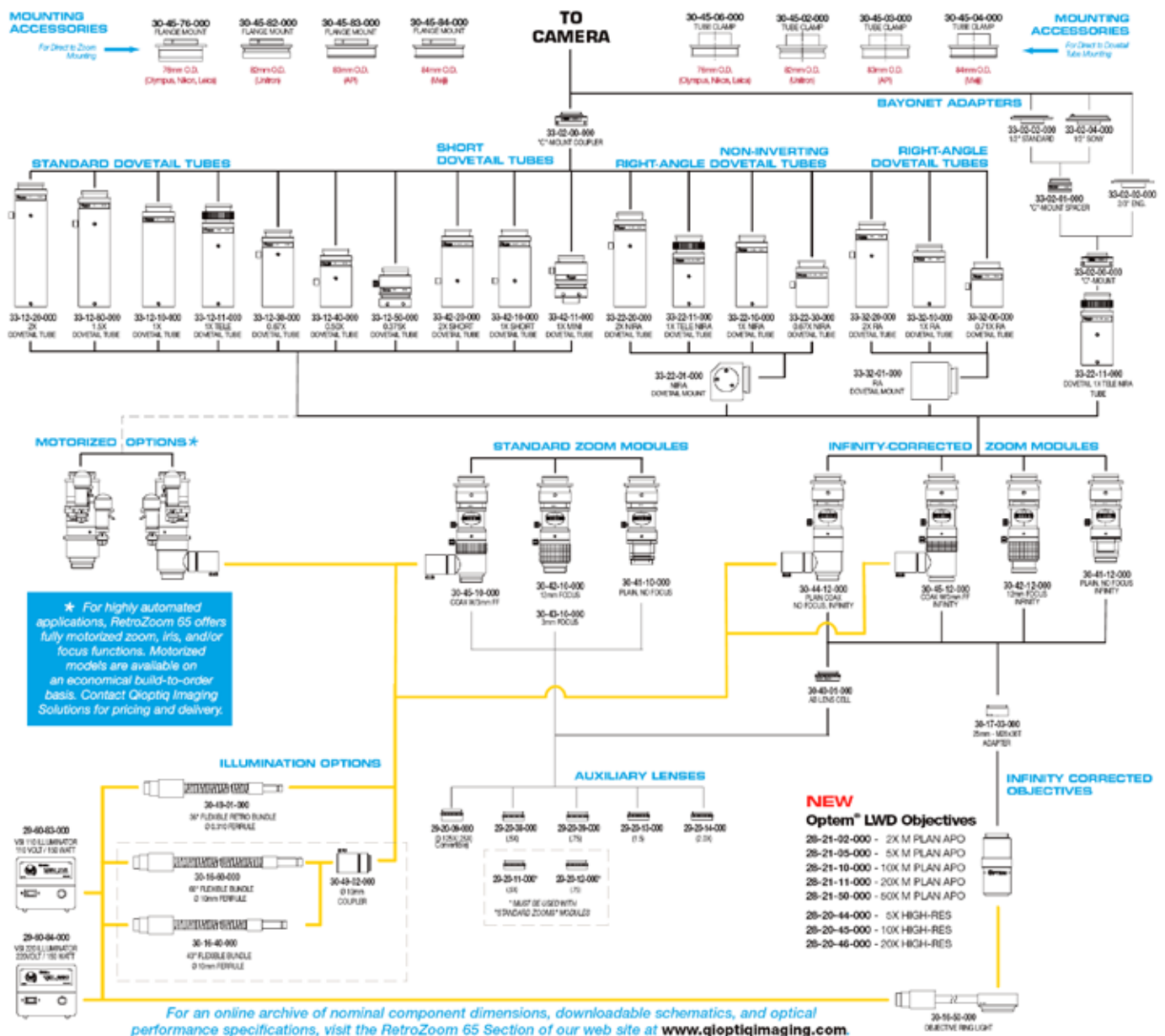


## CHAPTER 8 IMAGING SYSTEM

# 6.5 :1 ZOOM LENS SYSTEM



# CHAPTER 8 IMAGING SYSTEM





# CHAPTER 8 IMAGING SYSTEM

## 12.5:1 ZOOM LENS SYSTEM



### SPECIFICATION

|                           |                 |
|---------------------------|-----------------|
| Zoom Range                | 12.5:1          |
| Magnification Range       | 0.52 – 6.5X     |
| Resolution                | 57 – 300 lp/mm  |
| Numerical Aperture        | 0.019 – 0.10    |
| Depth-of-Field            | 1.57 – 0.057 mm |
| Field-of-View (Low-Mag.)  | 9.23 x 12.31 mm |
| Field-of-View (High-Mag.) | 0.74 x 0.98 mm  |
| Working Distance          | 89 mm           |



### Components of Functional Zoom 125C

- TV Tube (Top Magnification)
- Upper Zoom Module
- Lower Function Module
- Auxiliary Lens (Bottom Magnification)



# CHAPTER 8 IMAGING SYSTEM

## 7:1 ZOOM LENS SYSTEM



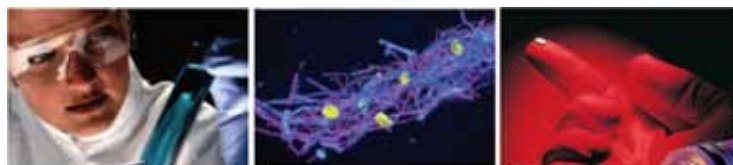
### SPECIFICATION

|                           |                |
|---------------------------|----------------|
| Zoom Range                | 7:1            |
| Magnification Range       | 0.75 - 5.25X   |
| Resolution                | 72-240 lp/mm   |
| Numerical Aperture        | 0.0240-0.080   |
| Depth-of-Field            | 0.98 - 0.09 mm |
| Field-of-View (Low-Mag.)  | 6.40 × 8.53 mm |
| Field-of-View (High-Mag.) | 0.91 × 1.22 mm |
| Working Distance          | 89 mm          |





# 16:1 OPTICAL ZOOM SYSTEM



## LabVIEW™ VI's

For system integrators working from the LabVIEW platform, Optem Zooms now offer a VI library permitting seamless assimilation of our Stepper Motorized options.

## DC Motor Models

DC Motors allow continuous movement throughout either the zoom or focus range. Two ports in the back of the Motor Driver accept both zoom and focus motorized functions.



## MOTORIZING YOUR ZOOM 160

The Zoom 160 Optical System can be specified with built-in motorized zoom, and/or focus functions. Choose from a variety of motorization and control options to best suit your specific application.

### Stepper Motor Models

All Stepper Motor equipped Zoom 160s feature Hall-Effect Sensors. This engineering improvement ensures pinpoint mechanical accuracy and repetition for automated applications, and presents a smaller zoom barrel clearance diameter for improved space efficiency in OEM integrations.

Zoom 160 can be specified in motorized configurations that facilitate computerized control of the Zoom and Focus functions. Stepper Motors permit discrete movement (steps) in fine increments. Homing Sensors are standard on Zoom 160 Stepper Motor models and provide a "zero" position for repeating locations. This permits pre-programming of setups for multiple work pieces.

### Stepper Motor Controller



A Stepper Motor Controller is designed to operate the Stepper Motors. Manual operation is available through the use of individual "rocker" switches. Each axis has its own speed control. RS232 operation is implemented through a serial port and a Windows GUI. Software is provided for use with Windows 9X, 2000, XP or NT.

## OEM Stepper Motor Board

The use of an OEM Board replaces the Stepper Motor Controller box. The OEM Board has all connections on-board and is available with a code library for modification of functions. Zoom 160 OEM Controller Board connections are detailed in the diagram below.



## REQUIRED COMPONENTS

Every operational Zoom 160 Optical System requires the following base components:

### C-Mount or Bayonet Coupler

Attaches the camera to the dovetail tube

### Dovetail TV Tube

Positions the camera at the proper distance from the zoom (rear conjugate)

### Upper Zoom Module

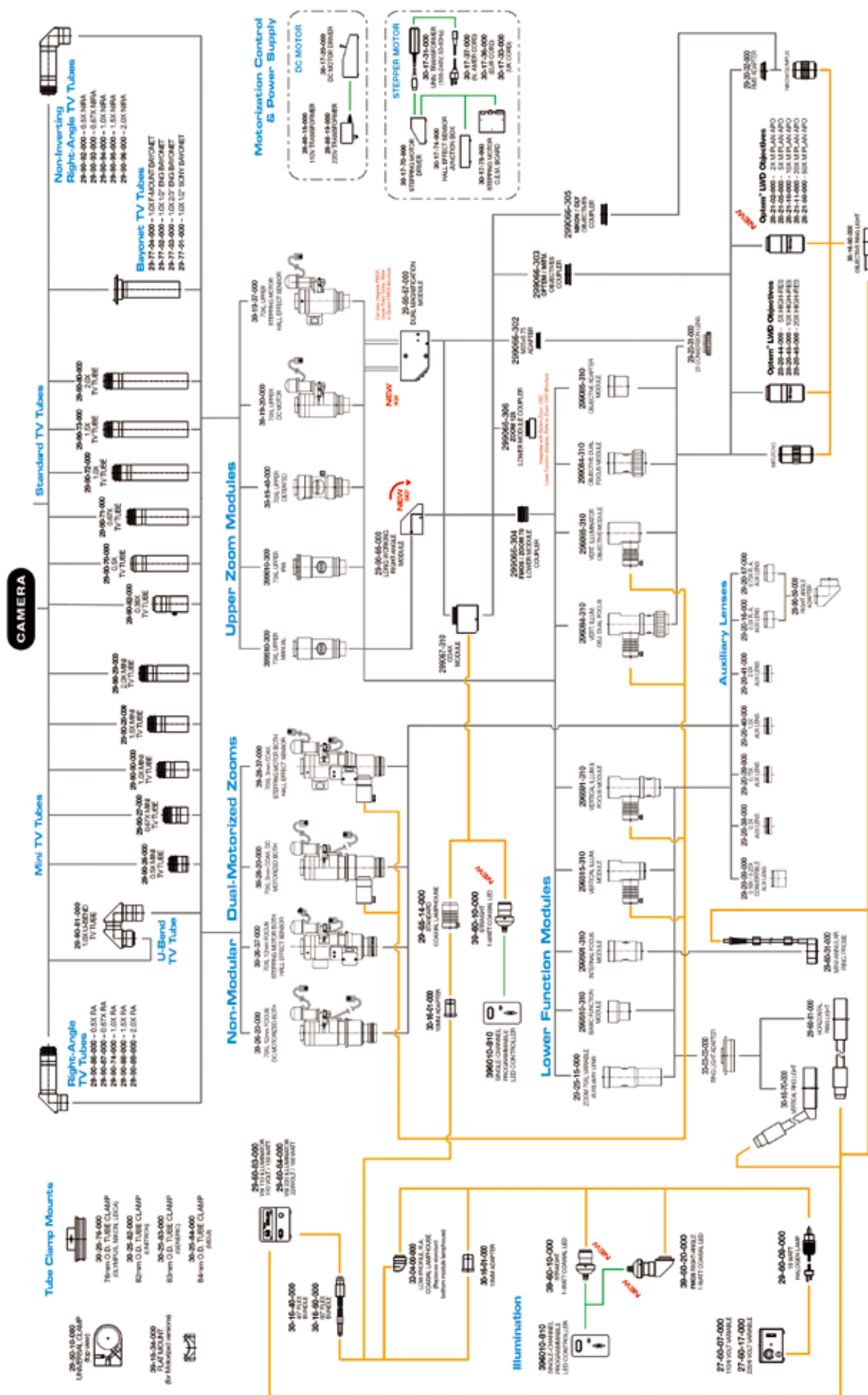
Contains the core zoom mechanics

### Lower Function Module

Houses internal focus and coaxial illumination options

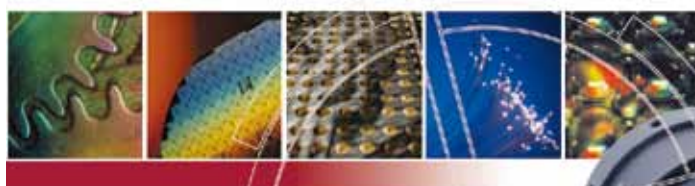
### Objective Lens

Transmits image to the zoom at "infinity"



## CHAPTER 8 IMAGING SYSTEM

## TELECENTRIC 10:1 OPTICAL SYSTEM

**The Physics of Telecentricity**

A Telecentric cone of rays emanating from an object point remains perfectly perpendicular to the object plane across the entire field-of-view.



In contrast, a conventional lens has cones which are not perpendicular and thus produce parallax. Consider figures 1 and 2. In figure 1, all three locations (A, B & C) will measure the same size. However, in figure 2, A, B & C will all appear the same size to the camera, but in reality, are all different sizes.

**0.75X Tube for 1/3" Cameras**

The 0.75X TV Tube is designed to provide optimal imaging when used with a 1/3" camera. In addition, the small size of the 0.33" camera format allows the 1.0X and 1.38X TV Tubes to be used when the application calls for supplementary magnification at the camera.

**1.0X Tube for 1/2"**

Cameras The 1.0X TV Tube provides optimal imaging when used with a 1/2" format camera. If additional magnification is required at camera, the 1.38X TV Tube can be integrated. However, use of the 0.75X TV Tube will cause undesirable vignetting.

**1.38X Tube for 2/3" Cameras**

Intended for use with the largest of the compatible camera formats, the 1.38X is the only TV Tube capable of covering the 2/3" format cameras without any vignetting.

**C-Mount Coupler**

T-Zoom 100 TV Tubes feature a dovetail backend connection and therefore require the C-Mount Coupler to attach a camera to your system. A video camera can then be mounted to the standard 1.00" x 32 C-threads on the Coupler.







## CHAPTER 8 IMAGING SYSTEM

## NEW-THE LED 80 RING ILLUMINATOR



THE NEW LED 80 RING LIGHT REPRESENTS A NEW STANDARD IN LED MICROSCOPE RING LIGHTS FROM TECHNIQUIP, AN INDUSTRY LEADER IN INNOVATIVE "MADE IN THE USA" PRODUCTS.

## LED 80 RINGLIGHT PRODUCT FEATURES

360° shadow-free illumination

Built and tested in the USA

80 high brightness LEDs

Supplied with controller and universal power supply

6500° K CCT (approx). Other color temperatures available

At just over 4" diameter and just over 1" thickness the LED 80 offers the most compact profile on the market

Machined aluminum alloy housing for durability

The multi-function controller adjusts the intensity and controls 8 x 10 LED segments

Universal power 100-240VAC 50/60Hz

3 point soft tipped mount for secure mount. Can mount to larger diameter microscopes

Silent, no vibration operation

Standard model fits 1.25" - 2.6" (32-66mm) lenses

Energy Efficient: Maximum power consumption 18 watts

High Power: Provides illuminance equivalent to 150 watt halogen illuminator coupled to fiber optic ring light

The LED 80 works with entire line of TechniQuip's AN style microscope adapters

The LED 80 ring can be detached from its cable when a microscope needs to be moved

The LED 80 uses a standard HDMI cable, the most compact cable on the market for this application

Private labeling available upon request

## PHOTOMETRICS

| Working Distance (inches) | TYPICAL ILLUMINANCE (Footcandles) |             |             |                           |
|---------------------------|-----------------------------------|-------------|-------------|---------------------------|
|                           | Flourescent Ring                  | LED 40 Ring | LED 80 Ring | 150 watt Fiber Optic Ring |
| 3.5                       | 1020                              | 4010        | 4280        | 10030                     |
| 4.0                       | 850                               | 4030        | 5300        | 8230                      |
| 4.5                       | 700                               | 3600        | 5800        | 6450                      |
| 5.0                       | 570                               | 3120        | 5700        | 5400                      |
| 5.5                       | 500                               | 2650        | 5400        | 4400                      |
| 6.0                       | 140                               | 2190        | 5010        | 4020                      |

# CHAPTER 8 IMAGING SYSTEM

## FOI-150/250 FIBER OPTIC ILLUMINATOR



### THE FOI 150 AND 250 FIBER OPTIC ILLUMINATOR

PROVIDES A DURABLE,  
RELIABLE, LOW HEAT  
AND HIGH INTENSITY  
LIGHT SOURCE FOR A  
WIDE RANGE OF USE  
ONLY FROM TECHNIQUIP,  
AN INDUSTRY LEADER IN  
INNOVATIVE "MADE IN THE  
USA" PRODUCTS.

### ILLUMINATOR SELECTION GUIDE

| PART #                                    | FOI-150                               | FOI-150A                              | FOI-150-REM                           | FOI-250                               |
|-------------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Front Panel Electronic Brightness Control | Standard                              | Standard                              | N/A                                   | Standard                              |
| Remote Electronic Brightness Control      | N/A                                   | N/A                                   | Standard                              | N/A                                   |
| Input Voltage                             | Specify<br>(available in all formats) | Specify<br>(available in all formats) | Specify<br>(available in all formats) | Specify<br>(available in all formats) |
| Power Rating                              | 150 Watts                             | 150 Watts                             | 150 Watts                             | 250 Watts                             |
| Filter Holder                             | Available                             | Available                             | Available                             | Available                             |
| Standard Color                            | Beige                                 | Beige                                 | Beige                                 | Beige                                 |
| Optional Colors                           | Black (call for others)               | Black (call for others)               | Black (call for others)               | Black (call for others)               |
| Standard Lamp                             | EKE                                   | EJA                                   | EKE                                   | ELC                                   |
| Standard Light Guide Aperature            | 5/8 inch<br>(other sizes available)   | 5/8 inch<br>(other sizes available)   | 5/8 inch<br>(other sizes available)   | 5/8 inch<br>(other sizes available)   |
| Width                                     | 7.0 in. / 18 cm                       | 7.0 in. / 18 cm                       | 7.0 in. / 18 cm                       | 7.0 in. / 18 cm                       |
| Depth                                     | .5 in. / 19 cm                        | 7.5 in. / 19 cm                       | 7.5 in. / 19 cm                       | 7.5 in. / 19 cm                       |
| Height                                    | 6.5 in. / 17 cm                       | 6.5 in. / 17 cm                       | 6.5 in. / 17 cm                       | 6.5 in. / 17 cm                       |
| Weight                                    | 7.5 lbs. / 3.4 kg                     | 7.5 lbs. / 3.4 kg                     | 7.5 lbs. / 3.4 kg                     | 7.5 lbs. / 3.4 kg                     |

### ILLUMINATOR LAMP SELECTION GUIDE

| PART #                   | EKE      | EJA   | ELC    |
|--------------------------|----------|-------|--------|
| Color Temperature        | 3250     | 3350  | 3400   |
| Voltage                  | 21 V     | 21 V  | 24V    |
| Lamp Life (Hours)        | 200-2000 | 40-50 | 50-200 |
| Power Rating (Watts)     | 150      | 150   | 250    |
| Approx. Shipping Weight. | 1 oz.    | 1 oz. | 1 oz   |

# CHAPTER 8 IMAGING SYSTEM

## VIDEO LENSES



### 4-12mm IR(Infrared) lens

| ITEM NUMBER | Imager Size | Mount Type | F.L.   | IRIS       | IRIS TYPE   | REMARKS |
|-------------|-------------|------------|--------|------------|-------------|---------|
| 12VM412ASIR | 1/2"        | C-mount    | 4-12mm | F1.2-CLOSE | Manual      | AS/IR   |
| 12VG412ASIR | 1/2"        | C-mount    | 4-12mm | F1.2-360   | DC motor    | AS/IR   |
| 12VA412ASIR | 1/2"        | C-mount    | 4-12mm | F1.2-360   | Video motor | AS/IR   |

### 10-40mm IR(Infrared) lens

| ITEM NUMBER  | Imager Size | Mount Type | F.L.    | IRIS       | IRIS TYPE   | REMARKS |
|--------------|-------------|------------|---------|------------|-------------|---------|
| 13VM1040ASIR | 1/3"        | CS-mount   | 10-40mm | F1.4-CLOSE | Manual      | AS/IR   |
| 13VG1040ASIR | 1/3"        | CS-mount   | 10-40mm | F1.4-360   | DC motor    | AS/IR   |
| 12VM1040ASIR | 1/2"        | C-mount    | 10-40mm | F1.4-CLOSE | Manual      | AS/IR   |
| 12VG1040ASIR | 1/2"        | C-mount    | 10-40mm | F1.4-360   | DC motor    | AS/IR   |
| 12VA1040ASIR | 1/2"        | C-mount    | 10-40mm | F1.4-360   | Video motor | AS/IR   |

### 20-100mm lens

| ITEM NUMBER | Imager Size | Mount Type | F.L.     | IRIS       | IRIS TYPE | REMARKS |
|-------------|-------------|------------|----------|------------|-----------|---------|
| 13VM20100AS | 1/3"        | CS-mount   | 20-100mm | F1.6-CLOSE | Manual    | AS      |
| 13VG20100AS | 1/3"        | CS-mount   | 20-100mm | F1.6-360   | DC motor  | AS      |

### Ultra Wide IR Lens

| ITEM NUMBER | Imager Size | Mount Type | F.L.  | IRIS       | IRIS TYPE | REMARKS |
|-------------|-------------|------------|-------|------------|-----------|---------|
| 13FM22IR    | 1/3"        | CS-mount   | 2.2mm | F1.2-CLOSE | Manual    | IR      |
| 13FG22IR    | 1/3"        | CS-mount   | 2.2mm | F1.2-360   | DC motor  | IR      |
| ITEM NUMBER | Imager Size | Mount Type | F.L.  | IRIS       | IRIS TYPE | REMARKS |
| 13FM28IR    | 1/3"        | CS-mount   | 2.8mm | F1.2-CLOSE | Manual    | IR      |
| 13FG28IR    | 1/3"        | CS-mount   | 2.8mm | F1.2-360   | DC motor  | IR      |
| 13FM04IR    | 1/3"        | CS-mount   | 4mm   | F1.2-CLOSE | Manual    | IR      |
| 13FG04IR    | 1/3"        | CS-mount   | 4mm   | F1.2-360   | DC motor  | IR      |
| 13FM06IR    | 1/3"        | CS-mount   | 6mm   | F1.2-CLOSE | Manual    | IR      |
| 13FG06IR    | 1/3"        | CS-mount   | 6mm   | F1.2-360   | DC motor  | IR      |
| 13FM08IR    | 1/3"        | CS-mount   | 8mm   | F1.2-CLOSE | Manual    | IR      |
| 13FG08IR    | 1/3"        | CS-mount   | 8mm   | F1.2-360   | DC motor  | IR      |

### High Resolution Vari-Focal Lens:

| ITEM NUMBER  | Imager Size | Mount Type | F.L.     | IRIS       | IRIS TYPE   | REMARKS |
|--------------|-------------|------------|----------|------------|-------------|---------|
| 13VM2812ASII | 1/3"        | CS-mount   | 2.8-12mm | F1.4-CLOSE | Manual      | AS      |
| 13VG2812ASII | 1/3"        | CS-mount   | 2.8-12mm | F1.4-360   | DC motor    | AS      |
| 13VM550ASII  | 1/3"        | CS-mount   | 5-50mm   | F1.4-CLOSE | Manua       | AS      |
| 13VG550ASII  | 1/3"        | CS-mount   | 5-50mm   | F1.4-360   | DC motor    | AS      |
| 13VM308AS    | 1/3"        | CS-mount   | 3.0-8mm  | F1.0-CLOSE | Manual      | AS      |
| 13VG308AS    | 1/3"        | CS-mount   | 3.0-8mm  | F1.0-360   | DC motor    | AS      |
| 13VA308AS    | 1/3"        | CS-mount   | 3.0-8mm  | F1.0-360   | Video motor | AS      |

### Mega-Pixel-Compatible Vari-Focal Lens:

| ITEM NUMBER | Imager Size | Mount Type | F.L.     | IRIS       | IRIS TYPE | REMARKS |
|-------------|-------------|------------|----------|------------|-----------|---------|
| M13VM246    | 1/3"        | CS-mount   | 2.4-6mm  | F1.2-CLOSE | Manual    | MP/AS   |
| M13VG246    | 1/3"        | CS-mount   | 2.4-6mm  | F1.2-360   | DC motor  | MP/AS   |
| M13VM308    | 1/3"        | CS-mount   | 3.0-8mm  | F1.0-CLOSE | Manual    | MP/AS   |
| M13VG308    | 1/3"        | CS-mount   | 3.0-8mm  | F1.0-360   | DC motor  | MP/AS   |
| M13VM550    | 1/3"        | CS-mount   | 5-50mm   | F1.4-CLOSE | Manual    | MP/AS   |
| M13VG550    | 1/3"        | CS-mount   | 5-50mm   | F1.4-360   | DC motor  | MP/AS   |
| M12VM412    | 1/2"        | C-mount    | 4.0-12mm | F1.4-CLOSE | Manual    | MP/AS   |
| M12VG412    | 1/2"        | C-mount    | 4.0-12mm | F1.4-360   | DC motor  | MP/AS   |

MP: Mega Pixel Lens

IR: Infrared Lens

AS: Aspheric Lens