

COHU, INC. ELECTRONICS DIVISION

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Corporate/Division Headquarters and Manufacturing Facility
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Mailing Address: P.O. Box 85623, San Diego, CA 92186-5623

A leading U.S. manufacturer of quality television products, Cohu, Inc., Electronics Division, is the oldest continuing manufacturer of closed circuit television cameras and systems in the world. We represent a single source for diverse CCTV products for the sciences, industry, and government. Applications include surveillance and security systems, high resolution cameras, miniature cameras, general purpose, environmental, low light level, machine vision, and many more.

This catalog represents our current line of CCTV cameras and equipment. Our unique model numbering system allows for specific cameras to be designated with a variety of options included. You will find this system explained under the ordering information for each camera series. If, however, you do not find a camera listed that describes your specific needs, you are encouraged to contact the factory and discuss your needs with one of our applications

engineers. What you desire may already be available, or it may be possible to custom design a camera to fulfill your requirements.

Cohu is dedicated to satisfying our customer needs by bringing to the market high performance quality products which incorporate the very latest in technology and features—designed to provide years of satisfying service.



The Great American Name in CCTV Advancements

85-06 (7/90) July 1990 Printed in U.S.A.

Thank you . . .

for your interest in Cohu video cameras and camera systems.

The enclosed literature will help you identify the exact Cohu camera or system for your requirement.

Should you need additional information, or if you wish to notify us of a change of address, please use the attached postage-paid reply card, or call us at (619) 277-6700.

We look forward to supporting you on your current project and with all your CCTV camera and system requirements.

Thank you,

Cohu, Inc., Electronics Division

COHU

Cohu, Inc., Electronics Division
5755 Kearny Villa Road • San Diego, California 92123
Telephone (619) 277-6700 • FAX: (619) 277-0221

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Telephone (_____) _____

☐ Please change my address as noted above.

☐ I need additional information. My area of interest is: _____

☐ Please have a sales representative contact me.

Comments: _____

WARRANTY

Cohu, Inc., Electronics Division warrants equipment manufactured to be free from defects of material and workmanship. Any part or parts will be repaired or replaced when proven by Cohu examination to have been defective within two years from date of shipment to the original purchaser for standard CCD cameras and one year from date of shipment to the original purchaser for intensified CCD cameras and all other Cohu manufactured products. All warranty repairs will be performed at the factory or as otherwise authorized by Cohu in writing. Transportation charges to Cohu shall be prepaid by purchaser. This warranty does not extend to Cohu equipment subjected to misuse, accident, neglect, or improper application, nor repaired or altered by other than Cohu or those authorized by Cohu in writing.

Television image pickup tubes, image intensifiers, lenses and products manufactured by companies other than Cohu are warranted by the original manufacturer. *This warranty is in lieu of all other warranties express or implied. Cohu shall not be liable for any collateral or consequential damages. A Return Authorization Number (R.A.#) must be obtained from Cohu prior to returning any item for warranty repair or replacement.*



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*Designed for
OEMs!*

BOARD LEVEL MONOCHROME CCD CAMERA

1100 SERIES

**High Performance 1/2" or 1/3" On-Chip-
Microlens Interline Transfer Imager**

The Cohu board-level CCD camera has been designed to fit the needs of OEM customers who require high performance video in a compact package. The 1100 Series features a resolution of 768 (H) x 494 (V) active pixels, internal crystal or external synchronization, and 2 to 16 field/8 step integration or shuttering to 1/10000.

Configuring the 1100 Series for custom purposes is quite easy. A flexible cable allows for virtually any orientation of the sensor with respect to the control board. Measuring less than 2" x 4", this feature/size combination is ideal for machine vision and image processing applications.

The 1100 Series cameras feature a 1/2"-format on-chip microlens sensor, which improves sensitivity and provides increased dynamic range while reducing lag, blooming and dark current. For video applications prone to streaking problems, a 1000:1 overload capability allows transmission of clear video signals even when bright incidental light is present in the scene.

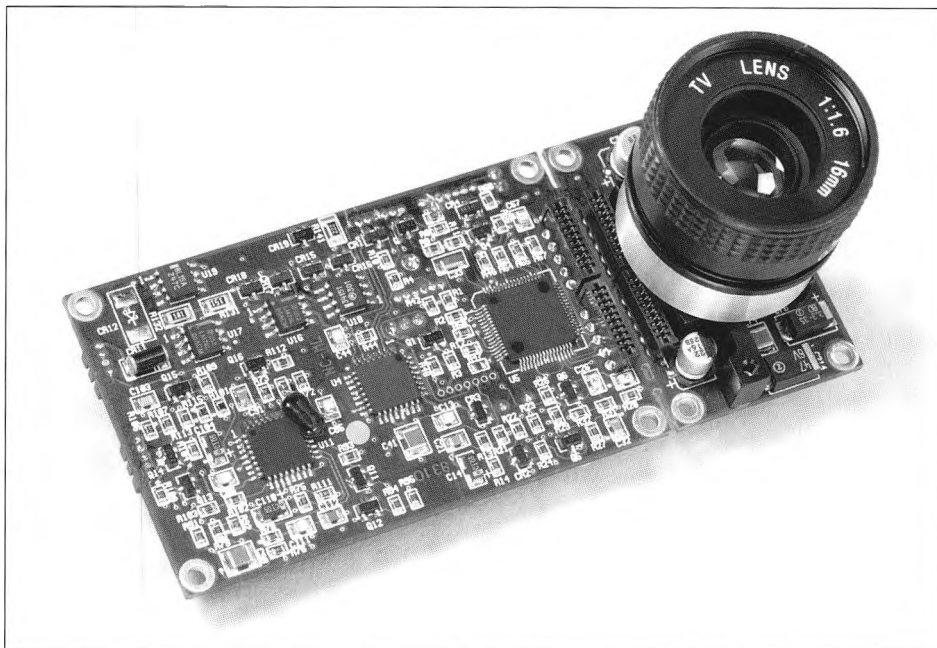
Both RS-170 and CCIR cameras have 20 dB of AGC for high sensitivity in low light-level applications.

This single board camera synchronizes from an internal crystal, or external horizontal/vertical source.

Asynchronous reset accepts an external trigger input to reset the camera to the beginning of the vertical interval (field 1, line 1). The first field of video information reads out 9.5 horizontal lines after triggering.

Four modes of operation can be selected: field (interlace and non-interlace), and frame (interlace and non-interlace). The integration time in the field mode is 16.6 ms for each field. Interlace mode sums two rows of pixels from each line, thus increasing the sensitivity. The non-interlace mode uses only field one, or one-half (242) the number of vertical pixels. The advantage of non-interlaced is using the same field of pixels every 1/60 second for repeatability. The integration time of each field in the frame (interlace) mode is 33.3 ms, for a vertical resolution of 485 pixels. Operating in the frame interlace mode and strobing will achieve full frame resolution of fast moving objects.

Cohu is ISO-9001 certified.



The Cohu 1100 Series Board Level Camera puts high performance in a small package.

Cohu offers option boards that greatly expand the capabilities of the 1100 Series. These boards easily plug into the control board. Options include:

- Line Lock Sync - accepts 12 VAC reference input and synchronizes the camera to the phase of the line frequency.
- External Sync - accepts genlock input (composite horizontal/vertical sync) to synchronize the camera to the externally-supplied reference.
- Electronic Iris - automatically controls the integration of the sensor from 1/60 sec. to 1/15,000 sec. to compensate for changing scene illumination. This control smoothly steps through the entire range.
- Special Reset - allows resetting the camera and determining integration time with an external pulse. Integration time ranges from a minimum of 650 μ S to a maximum limited only to the operator's subjective analysis of video information versus the rise in dark current.
- DC Iris - control auto iris lenses that do not have circuitry integral to the lens (aspherical).

FEATURES AND BENEFITS

- **High Resolution** — for better definition, error-free results
- **1/2" or 1/3" On-chip-microlens Interline Transfer Imager** virtually eliminates overload streaking, improves dynamic range and sensitivity.
- **Wide Dynamic Range** permits operation over a broad range of light levels.
- **High Signal-to-Noise Ratio** for clear, noise-free video.
- **Shutter** 1/60 to 1/10000 (8 steps)
- **Integration** from 2 to 16 fields
- **Field or Frame Modes**
- **1000:1 Overload Capability** permits incidental light overloads up to ten times that of other CCD cameras.
- **Custom Mechanical Configurations** to support your design.

APPLICATIONS

- Image Processing
- Machine Vision
- Process Control
- Quality Control
- Image Analysis

1100 SERIES BOARD LEVEL MONOCHROME CCD CAMERA

ORDERING INFORMATION

11X 2— X X X / XXXX

Lens

Format	Power	Sync Options	Optical Filters	Mounts	Options	Lens Options
2 1/2" RS-170	2 12 VDC, Standard	1 Crystal/H&V Drive/Async	0 None	0 None	0 None	Please consult factory for lens selections.
5 1/2" CCIR		Reset (Standard)		1 CS	3 Electronic Iris - RS-170*	
3 1/3" RS-170		2 Genlock (revert to crystal)		2 C/CS	4 DC Lens Drive	
6 1/3" CCIR		4 Special Reset			5 Electronic Iris - CCIR*	

* For manual lens only. Do not use with fluorescent lighting.

SPECIFICATIONS

ELECTRICAL

Pick up Device

1/2" or 1/3" Interline transfer, microlens sensor

Active Picture Elements

RS-170: 768 (H) x 494 (V)
CCIR: 752 (H) x 582 (V)

Pixel Cell Size - RS-170

1/2": 8.4 μ m (H) x 9.8 μ m (V)
1/3": 6.35 μ m (H) x 7.4 μ m (V)

Pixel Cell Size - CCIR

1/2": 8.6 μ m (H) x 8.3 μ m (V)
1/3": 6.5 μ m (H) x 6.25 μ m (V)

Total Pixel Elements

RS170: 811 (H) x 508 (V)
CCIR: 795 (H) x 596 (V)

Resolution

RS170: 580 horizontal TVL, 350 vertical TVL
CCIR: 560 horizontal TVL, 450 vertical TVL

Synchronization

H & V
Crystal (RS-170A)
Asynchronous reset

Shutter

1/60 to 1/10000

AGC

20 dB range, auto or manual control

Signal-to-Noise

>55 dB (Gain 0, Gamma 1)
38 dB (Gain 20 dB, Gamma 1)

Gamma

.45 to 1.0, continually variable

Integration

2 - 16 fields

Lens Mount

C or CS (not included)

Auto Lens Output

Reference video provided to control auto-iris lenses

Sensitivity

	1/2"	1/3"
Full video, No AGC:	.065 fc	.087 fc
	.65 lux	.87 lux
80% Video, AGC on:	.005 fc	.006 fc
	.05 lux	.06 lux
30% Video, AGC on:	.002 fc	.003 fc
	.02 lux	.03 lux

Power

12 VDC, 3.6 W max. Standard;
115/230 VAC adapter optional

MECHANICAL

Dimensions

See illustration

Weight

1.50 oz. (44 g) without lens

Ambient Operating Temperature Limits

-20° to 60° C (4° - 140° F)

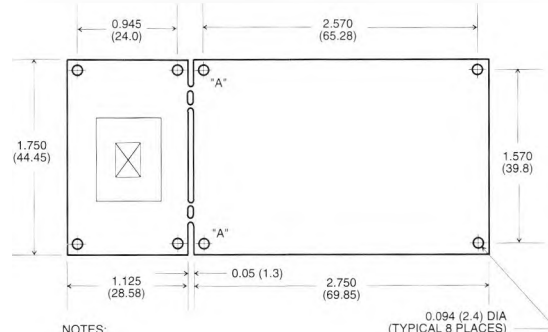
Relative Humidity

to 95% non-condensing

Shock

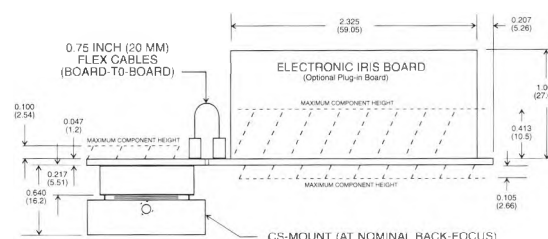
15 g's any axis, non-operating condition, per MIL-E-5400T

DIMENSIONS



NOTES:

1. All dimensions in inches and (mm)
2. PC board is 0.047 (1.2) thick
3. A 1/2 or 1/3 inch sensor is centered on its board area
4. Mounting holes are 0.094 (2.4) diameter with 0.175 (4.44) diameter pads. Pads are grounded except for holes "A" (2 places)



NOTES:

1. All dimensions in inches and (mm)

COHU RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.



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COHU
Cohu, Inc./Electronics Division

Compact!

2100 SERIES

MONOCHROME CCD CAMERA

**High Performance 1/2" On-Chip-Microlens
Interline Transfer Imager**

The new Cohu 2100 Series camera has been designed for the surveillance professional who demands a small camera of unequalled performance at a competitive price. In a package measuring only 1.5"(H) x 3.75"(D) x 2"(W), you get 580 horizontal line resolution, microlens sensor technology for dramatic sensitivity and dynamic range, and a price comparable to cameras with only half the performance.

This feature/size combination makes it ideal for indoor surveillance installations, or for outdoor use when housed in a Cohu environmental enclosure.

The features of the 2100 Series give it versatility, reliability, and value. Rugged, solid state construction provides high resistance to shock and vibration. An electronic shutter allows the camera to track rapidly moving subjects.

Mounting holes on the top and bottom of its housing mean easy installation, while its neutral color allows it to unobtrusively blend into the surroundings.

APPLICATIONS

- Surveillance
- Covert Installations
- Access Control
- Transportation Systems
- Gaming
- Robotic Vehicles
- Loss Prevention
- Image Processing



For size, features, and price, the Cohu 2100 Series is the ideal surveillance and security camera.

The 2100 Series camera features a 1/2"-format on-chip microlens sensor, which improves sensitivity and dynamic range, while reducing dark current, lag, and blooming. For video applications prone to streaking problems, a 1000:1 overload capability allows incidental light overloads up to 10 times that of other cameras.

RS-170 and CCIR models are available, and both have 20 dB of AGC for high sensitivity in low light-level applications.

Electronic iris provides eight f-stops of automatic light control. This electronic shutter provides control from 1/60 to 1/15,000 second. This is of particular importance when the images are fast-moving or the camera is mounted on a vibrating source.

From board-level design to its cast aluminum enclosure, you can expect the highest performance and value from the Cohu 2100 Series CCD camera.

FEATURES AND BENEFITS

- **High Performance** — for clear images and positive identification
- **1/2" On-chip-microlens Interline Transfer Imager** dramatically improves dynamic range and sensitivity and virtually eliminates overload streaking
- **High Sensitivity** permits operation over a broad range of light levels.
- **High Signal-to-Noise Ratio** for clear, noise-free video.
- **"C" or "CS" Lens Mount** expands your choice of lenses.
- **Choice of RS-170 or CCIR Models**
- **1000:1 Overload Capability** permits incidental light overloads up to ten times that of other CCD cameras.
- **Two-Year Warranty**
- **Made in U.S.A.** — direct factory support
- **It's a Cohu CCTV camera** — your assurance of quality, dependability, industry recognition, customer service, and ISO-9001 certification.

2100 SERIES MONOCHROME CCD CAMERA

ORDERING INFORMATION

21 X	2 -	X	X	0	X /	XXXX
Format	Power	Sync Option	Optical Filter	Unassigned	Options	Lenses
2 1/2" RS-170	2 12 VDC	1 Crystal	0 None		0 None	The versatility of this camera allows for a wide selection of lenses. Consult your Cohu representative for the lens that best suits your application.
5 1/2" CCIR		2 Genlock (revert to crystal)	1 IR		3 Elec Iris (RS-170)	
					4 DC Iris	
					5 Elec. Iris (CCIR)	

Accessories:

8364-4: 12 VDC power supply

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

55 dB (gain 0, gamma 1)
38 dB (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 (per lens)

Lens Voltage

11 VDC

Input Power Requirement

12 VDC, 3.6 W
115 VAC, 50/60 Hz

Lens Mount

C/CS

Auto Lens Output

Reference video or DC drive (per lens)

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)

Ambient Temperature Limits

-4° F (-20° C) to 140° F (60° C)

Relative Humidity

to 95% non-condensing

Shock

30 g's, 11 mS duration, 3 axes

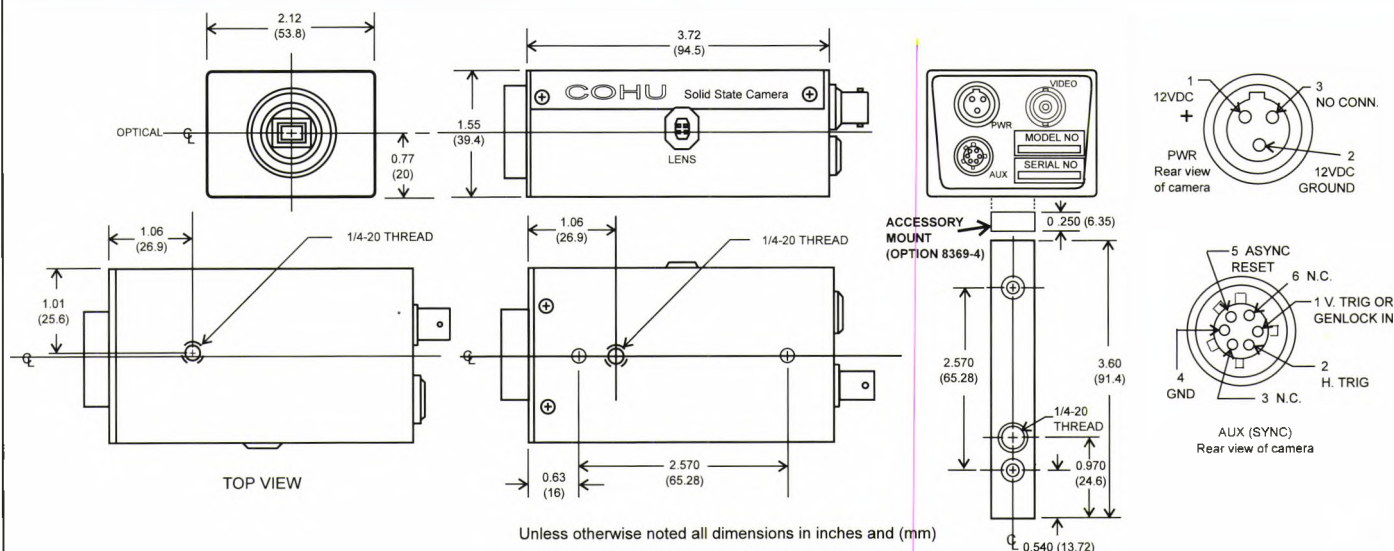
Mounts

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

Weight

<8 oz (230 g) without lens

DIMENSIONS



ISO-9001 Certified

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COHU
Cohu, Inc./Electronics Division

HIGH PERFORMANCE MONOCHROME ENVIRONMENTAL CCD CAMERA

2130 SERIES

Cohu's 2130 Series is the new environmentally secure version of the popular Cohu 2100 Series monochrome camera, but with an important difference. The newly designed housing has 40% less surface area and nearly half the weight of other environmental cameras. This is a significant consideration when a project must factor in wind loading and installation costs. Its redesigned base provides even faster, easier mounting to poles and pan and tilts.

The CCD camera features special on-chip microlens sensor technology that dramatically increases sensitivity while offering excellent monochrome picture clarity and reliability.

The 2130 Series cameras provide 580 TV lines of horizontal resolution - a significant performance edge for critical applications such as surveillance, wide area detection and traffic management.

For video applications prone to streaking problems, the microlens sensor provides a 1000:1 overload capability, which allows transmission of clear video signals, even when bright, incidental light is present in the scene. Its adjustable integration feature allows the operator to see more clearly in areas of low light level.

The 2130 Series High Performance CCD cameras' is designed to reduce maintenance costs, too. The sealed and pressurized environmental enclosure provides maximum protection against rain, snow, dust, humidity, chemical pollutants, extreme temperatures, and other environmental hazards. Its standard internal heater protects the camera to -22° F without using mechanical fans or blowers. Also standard is an indicator that provides an on-screen notice to the operator should the housing be damaged, causing a loss of pressure. These features are often expensive options on cameras with lesser specifications.

The 2130 Series monochrome camera comes with a 2-year warranty.



The Cohu 2130 Series offers high performance in a small, 3.5" diameter housing.

FEATURES AND BENEFITS

- **Superior Resolution** - 580 horizontal TV lines for sharper images
- **Enhanced Sensitivity** provides usable video images down to .02 lux
- **Improved Mounting Base** installs faster on poles, pan and tilts, and two styles of sunshields for top or bottom mounting
- **1/2" On-Chip Microlens Interline Transfer CCD** dramatically increases sensitivity and virtually eliminates blooming
- **Sealed, Pressurized Environmental Housing** with 5 psi dry nitrogen protects camera electronics
- **Low Pressure Indicator** in housing relays message to monitor screen
- **Two Year Warranty**
- **Internal Heater** allows camera to be installed in extreme low temperatures
- **RS-170 or CCIR**
- **High Signal-to-Noise Ratio** provides better dynamic range
- **1000:1 Overload Capability** permits incidental light overloads up to ten times that of other CCDs
- **AGC** with Peak-to-Average Adjustment for clear images in varying light levels

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Cohu, Inc./Electronics Division

SPECIFICATIONS

ELECTRICAL

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

55 dB (gain 0, gamma 1)

38 dB (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 (per lens)

Lens Voltage

11 VDC

Input Power Requirement

12 VDC, 3.6 W

115 VAC, 50/60 Hz

Lens Mount

C/CS

Auto Lens Output

Reference video or DC drive (per lens)

Lens Voltage

11 VDC

ENVIRONMENTAL

Ambient Temperature Limits Operating

-40° to 60° C (-40° to 140° F) with heater

Storage:

-30° to 70° C (-22° to 157° F)

Humidity

Up to 100% relative humidity

Vibration (less lens)

Sine vibration from 5 to 60 Hz with 0.082 inch total excursion (15 g's @ 60 Hz). Random

vibration from 60 to 1000 Hz, 5 g's rms (0.027g²/Hz) without damage

Shock (less lens)

Up to 15 g's, 11 ms, in any axis under non operating conditions, MIL-E-5400T, paragraph 3.2.24.6

EMI

FCC rules, Part 15, Subpart J, for Class A devices

Withstands exposure to sand, dust, fungus, and salt atmosphere, per MIL-E-5400T, paragraph 3.2.24.7, 3.2.24.8, and 3.2.24.9

SENSITIVITY

Full video, No AGC:

Full Spectrum

.065 fc (.65 lux)

80% Video, AGC on:

.005 fc (.05 lux)

30% Video, AGC on:

.002 fc (.02 lux)

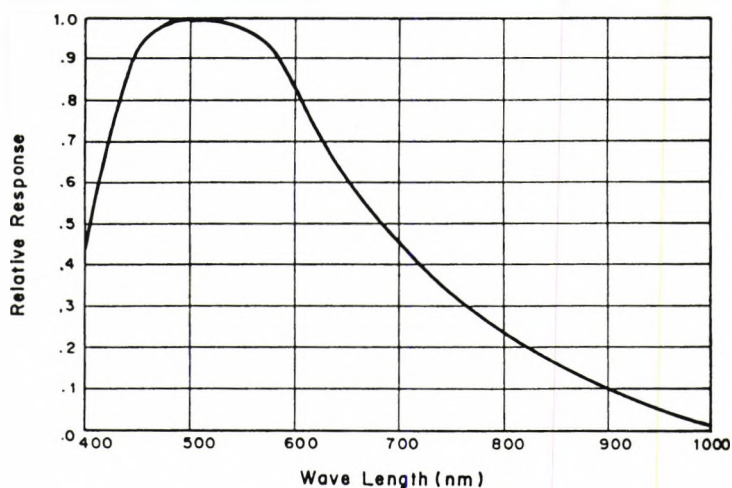
With IR Filter

0.25 fc (2.5 lux)

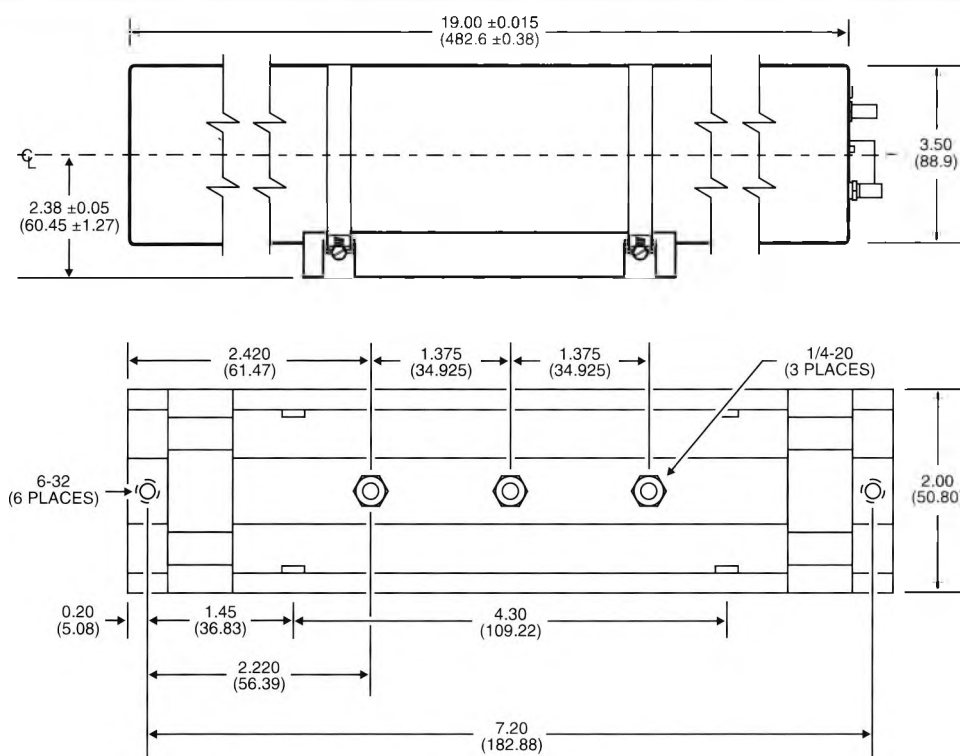
0.025 fc (0.25 lux)

.008 fc (0.08 lux)

SPECTRAL RESPONSE



DIMENSIONS



ALL DIMENSIONS IN
INCHES AND (MM)

MECHANICAL

Dimensions

Please see dimensional drawings.

Weight less lens)

3 lb. (1.35 kg)

Lens Mount

"CS" or "C" mount

Housing Mount

1/4-20 threaded holes; Allows enclosure to be rotationally oriented in 90° increments

Purge/Relief Fitting

Schrader purge fitting, 20 psi relief valve

SOURCE I.D. GENERATOR

The Optional Programmable Source ID Generator is a built-in electronic circuit which allows written messages to be superimposed over images displayed on CCTV monitors. Text is made up of block letters 28 horizontal TV lines in height. The letters are white with a black outline for maximum legibility.

Up to two lines of text (24 characters per line, including spaces) can be stored in non-volatile memory. Text can be placed at the top or bottom of the monitor screen, and can be updated from a computer or a dumb terminal, making this a real-time updatable programmable ID generator. Stored text, which typically provides information such as the location of individual cameras in multi-camera systems, will be continuously displayed until it is updated.

Three alarm messages of one line each are available to provide indication of alarms, such as loss of housing pressure, etc.

FIBER OPTIC TRANSMISSION

The 2130 Series camera is available with an optional fiber optic transmitter. Fiber optic transmission provides superior signal quality and security without the effects from ground loops, EMI, or crosstalk.

In addition, fiber optic transmission is the ideal choice for installations where there are long cable runs. Fiber lines are smaller and lighter than copper, and are easier to install.

A matching receiver for the signals is available in either modular or rackmount configurations.

Your Cohu Representative can assist in determining the specification for your system.

2130 SERIES MONOCHROME CCD CAMERAS

ORDERING INFORMATION

213X Configuration	-X Sync	-X Optical Filter	-X Iris Drive	-X Module Options	/XXXX Lenses
3 CCIR, 230 VAC, 50/60 Hz input power	2 Genlock revert to crystal, RS-170	0 None 1 IR Filter	0 Auto Iris (Ref. Video)	0 None	Auto Iris EH04
5 RS-170, 115 VAC, 50/60 Hz input power	3 Phase Adjust linelock, RS-170		1 DC Iris Drive (for motorized DC drive lenses only)	1 Fiber Optic xmtr, RS-170	1/2", 3.7mm, F1.6 EH06
	6 Genlock revert to crystal, CCIR			2 Programmable ID Generator, RS-170 & PAL	1/2", 6mm, F1.2 EH13
	7 Phase Adjust linelock, CCIR			3 Programmable ID Generator and Fiber Optic xmtr, RS-170	1/2", 12mm, F1.4 EH35
				8 Fiber Optic Transmitter, CCIR	2/3", 35mm, F1.4 ES05
				9 Programmable ID Generator and Fiber Optic xmtr, CCIR	2/3", 4.8mm, F1.8 ES08
					2/3", 8mm, F1.4 ES16
					2/3", 16mm, F1.4 Z06G
					1/2", 6:1 zoom, 8- 48mm, F1.4

OPTIONS

- **Programmable Source ID Generator** permits incorporation of detailed messages on monitor screens
- **Fiber Optic Transmitter** for transmission of the video signal over long distances without interference or signal loss
- **Wide Selection of Lenses**
- **Sunshields** for bottom mount (SS-122) or top mount (SS-222)

Special Service and Manufacturing Cohu welcomes OEM inquiries for special products and configurations to better serve particular requirements. Some examples are custom painting and silk-screening, logos, special filters lens supports and mounting solutions, and special adjustments. Discuss your requirements with a Cohu representative.



ISO-9001 Certified
Cohu, Inc./Electronics Division
 PO Box 85623 • San Diego, CA 92186
 Telephone: (619) 277-6700 • Fax: (619) 277-0221

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DIGITAL OUTPUT MONOCHROME CCD CAMERA

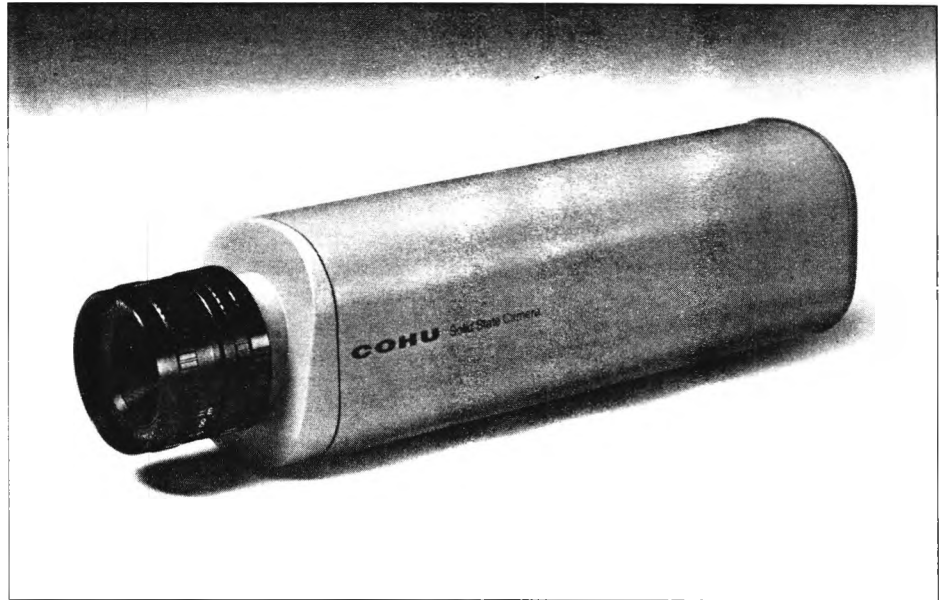
MODEL 4110

**For Image Processing
Without Pixel Jitter**

Cohu's new Model 4110 Digital Video Camera is the first and only digital output CCD camera to combine a high-performance defect-free sensor and affordability in a single package. Designed to support both existing and future digital imaging applications, this exciting new camera is the culmination of close collaboration between Cohu and both users and manufacturers of image processing equipment.

The Model 4110 produces a digital output byte for each pixel and shares a pixel clock directly with the frame memory of the image processor board. The design eliminates the phase-lock-loop or genlock circuits usually employed with conventional analog to digital front end circuitry. This breakthrough allows an accurate digital reproduction of each pixel to be transferred to the processor and virtually eliminates pixel jitter. Imaging system noise is further reduced by moving the sensitive analog front end circuitry into the camera and away from the high-noise environment associated with the host computer's digital computing circuitry. The result is a much higher system Modulation Transfer Function (MTF) from the camera sensor to the image processor.

The new Model 4110 helps digitizer manufacturers conserve board space, providing room for additional functions and features.



Cohu Model 4110 Digital Video Monochrome CCD Camera

The Model 4110 is a vastly superior image acquisition camera for use with measurement systems. The virtual elimination of pixel jitter, the near perfect geometry of the CCD sensor array, and the optimum MTF efficiency make the 4110 the smart choice for dimensional measurement systems. The improved signal-to-noise ratio and broad dynamic range of true 8-bit precision, combined with the elimination of clamping, auto gain, post filtering, and auto black circuitry, make the Model 4110 the best

choice for photometric purposes.

The Model 4110 uses a half-inch format, 739 x 484 sensor array. By using an image processing board with the same or greater processor memory, the Model 4110 will yield a higher system resolution than can be achieved with conventional analog cameras on similar systems.

Designed and manufactured in U.S.A., the rugged and highly reliable Model 4110 is backed by a two-year warranty.

APPLICATIONS

- **Measurement**
- **Image Processing**
- **Machine Vision**
Pattern recognition
Non-contact measurement
Inspection
- **Microscopy**
- **Medical Imaging**
- **Robotics**
- **Laboratory Research**
- **Remote Sensing**

FEATURES AND BENEFITS

- **Highly Accurate Measurements** due to elimination of pixel jitter
- **Improved System Efficiencies** resulting from in-camera A/D conversion
- **Noise Reduction** resulting from advanced design features
- **Preservation of Near-Perfect Array Geometry** due to direct correspondence between sensor elements and processor memory
- **No Audible Noise** — no array movement, no electromechanical components
- **Real Time, RS-170 Speed** at 14.31818 MHz clock
- **Maximized Resolution** due to improved MTF
- **Cost Effective** — priced well below cameras with similar capabilities.
- **1/2" Format CCD 739x484 Frame Transfer Array, Blemish-Free Sensor**
- **Simultaneous Analog Video Output**
- **Electronic Shutter** reduces blurring of fast-moving objects

Designed and Manufactured in the U.S.A.

COHU
INC.
ELECTRONICS DIVISION

MODEL 4110 DIGITAL OUTPUT MONOCHROME CCD CAMERA

SPECIFICATIONS

ELECTRICAL

Imager

Single CCD using frame transfer method

Active Pickup Area

6.4 x 4.8 mm (1/2-inch format)

Resolution

739(H) x 484(V) active picture elements

Sensitivity

2850 K faceplate illumination.

See Table 1.

Contrast Variation

<5% overall at gamma 1, gain 0 dB

Video Output - Analog

1.0 V p-p @75 ohms, unbalanced

Video Output - Digital

8-bit parallel differential; RS-422 receiver recommended with 100 ohm termination

Gamma

1.0

Signal-to-Noise Ratio

Digital output: Effective 8 bits

Analog output: 56 dB at gamma 1, 8 MHz bandwidth, unweighted

Electronic Shutter

Selectable: 1/1000 second, 1/2000 second, and 1/60 second (normal integrate field period)

Asynchronous Reset Mode

Vertical reset async operation

Clock Options

Master: 2 modes, differential

output: 14.31818 MHz or 10 MHz

Slave: differential input: 3.5 to 14.3 MHz

Power Requirements

+15VDC \approx 750ma

-15VDC \approx 500ma

+5VDC \approx 1 amp

115VAC \pm 10%, 60 Hz, with Cohu external power supply

ENVIRONMENTAL

Ambient Temperature Limits

Operating: -10 to 50 °C

(14 to 122° F)

Storage: -30 to 70 °C

(-22° to 157° F)

Humidity

Up to 95% relative humidity

Vibration (less lens)

5 to 60 Hz with 0.082 inch total

excursion (15 g's @ 60 Hz). From

60 to 1000 Hz, 5 g's rms random vibration without damage

Shock (less lens)

Up to 15 g's in any axis under nonoperating conditions,

MIL-E-5400T, paragraph 3.2.24.6

Altitude

Sea level to equivalent of

3,048m/10,000 feet (508mm/20 inches of mercury)

MECHANICAL

Dimensions

See Figure 1.

Lens Mount

"C" mount, 16mm format, for 1/2" format image plane

Camera Mount

1/4-20 threaded holes. See Figure 1

Connectors

BNC Connector: Analog Video Out

Switchcraft TB5M: Power In

Tex Tech HDT-44-S: Digital Video

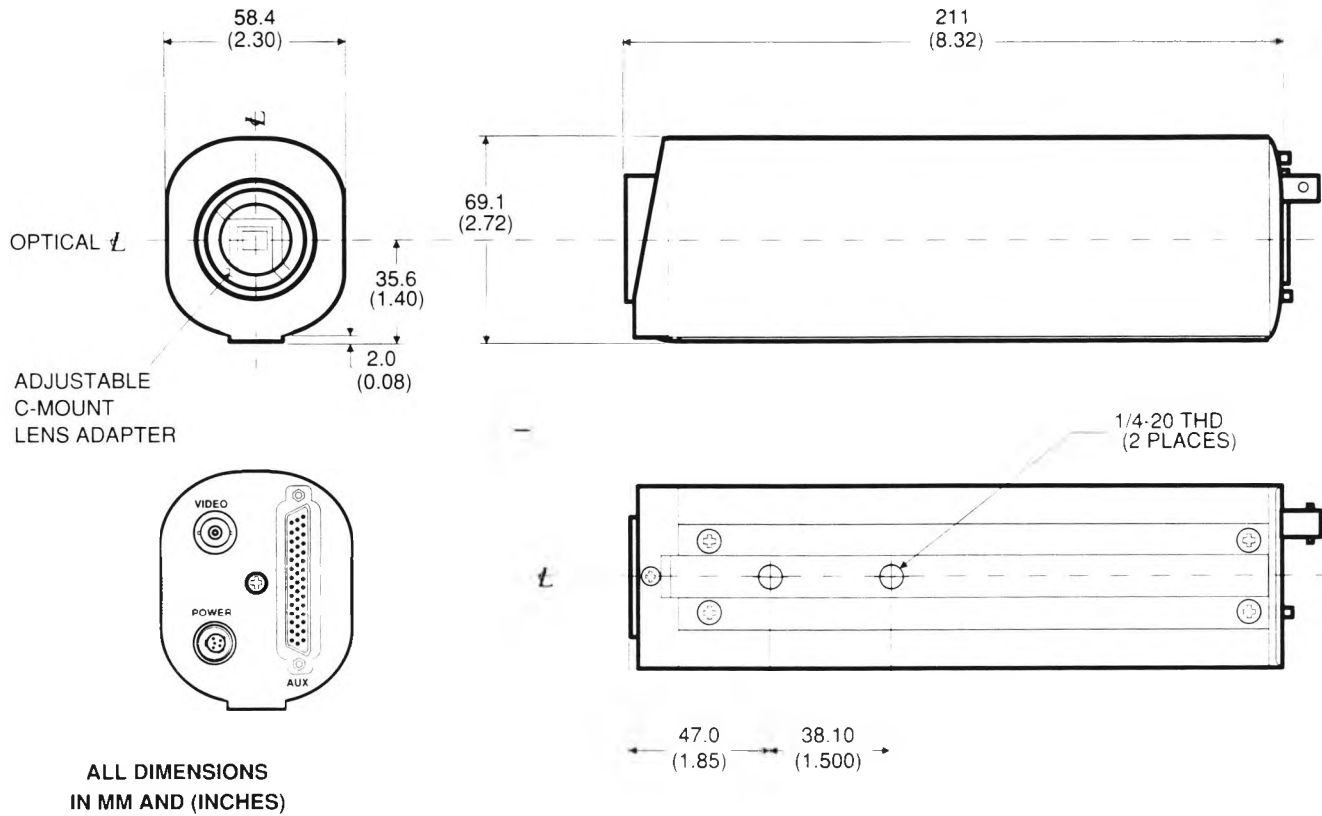
SENSITIVITY

	With IR Filter	Without IR Filter
Full Video (unity gain)	0.38 fc (3.8 lux)	0.04 fc (0.4 lux)
Low Gain (6 dB)	0.16 fc (1.6 lux)	0.017 fc (0.17 lux)
High Gain (20 dB)	0.032 fc (0.32 lux)	0.0034 fc (0.034 lux)
Usable Picture*	0.010 fc (0.10 lux)	0.0012 fc (0.012 lux)

* Defined at 30% video level, high gain.

Table 1

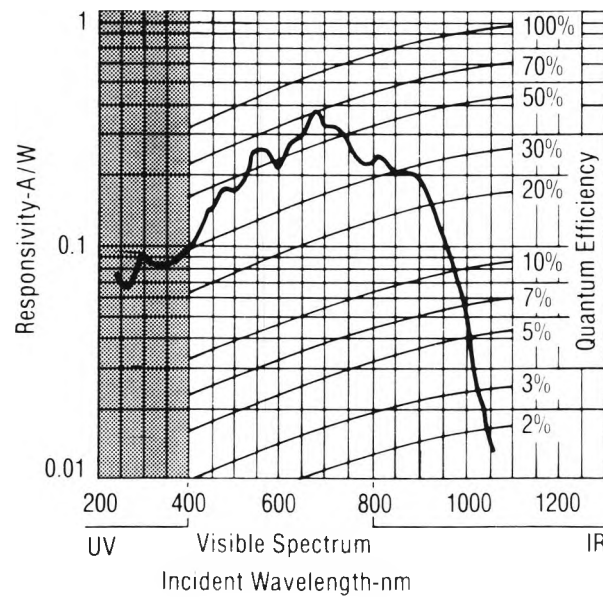
DIMENSIONS



Cohu Model 4110

Figure 1

SPECTRAL RESPONSE



SHADED AREA INDICATES SPECTRAL RESPONSE WITH FACEPLATE REMOVED OR WITH A QUARTZ FACEPLATE INSTALLED. PLEASE CONSULT FACTORY FOR PRICES

MODEL 4110 DIGITAL OUTPUT MONOCHROME CCD CAMERA

ORDERING INFORMATION

411X	—	X	X	XX	/	XXXX
Power Options		Clock Options	Filter Options	Special Options		Lens Options
0 ± 15v DC and +5v (w/o External Power Supply) 5 115v AC (With External Power Supply)		1 14.31818 MHz Clock (Master) 2 10 MHz Clock (Master) 3 14.3 MHz (Slave) 4 10 MHz (Slave) 5 Externally Selectable 14.3 MHz Master/Slave	0 No I.R. Filter 1 With I.R. Cutoff Filter	00 No Camera Cable 01 44-pin to 37-pin interface cable, 10 ft * 02 44-pin to 25-pin interface cable, 10 ft * * Special pinouts and cable lengths can be specified by customer.		0000 None Manual Iris Lenses AL04 4.5mm, f/2.0 (2/3")* AL06 6.5mm, f/1.8 (2/3")* AL08 8mm, f/1.4 (2/3")* AL12 12.5mm, f/1.4 (1") AL16 16mm, f/1.4 (2/3") AL26 25mm, f/1.6 (2/3") AL51 50mm, f/1.8 (2/3") AL75 75mm, f/1.8 (1") * Wide angle. Please consult factory for other lens selections.

COHU RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE

COMPATIBLE IMAGE PROCESSING BOARDS

Compatible image processing boards are available from the following manufacturers, listed in alphabetical order:

Coreco
 Saint Laurent, Quebec
 Phone: (800) 361-4914
 From Canada: (514) 333-1301

Dipix
 Ottawa, Ontario
 Phone: (800) 724-5929
 From Canada: (613) 596-4942

Epix, Inc.
 Northbrook, IL
 Phone: (708) 498-4002

Imaging Technology, Inc.
 Woburn, MA
 Phone: (800) 532-3500

Imagraph
 Chelmsford, MA
 Phone: (508) 256-4624

Matrox
 Dorval, Quebec
 Phone: (514) 685-2630

Perceptics Corporation
 Knoxville, TN
 Phone: (615) 966-9200

Recognition Concepts
 Carson City, NV
 Phone: (800) 243-8724

Tecon
 Redmond, WA
 Phone: (800) 232-5220

Univision Technologies, Inc.
 Burlington, MA
 Phone: (617) 221-6700

IMPROVED PERFORMANCE!

Enhanced Signal-to-Noise Ratio (56 dB)
Greater Sensitivity (to 0.04 Lux)

CCIR SOLID-STATE MONOCHROME CCD CAMERA

MODEL 4710

High Resolution,
High Sensitivity and Low Noise

Cohu's Model 4710 solid-state cameras now offer even better performance for applications requiring low noise, high resolution and high sensitivity. Improved signal-to-noise characteristics result in a quieter picture, and better immunity to potentially harmful noise disturbances. The new Model 4710 also makes high resolution pictures attainable without geometric distortion, lag or image retention. The blemish-free imager provides pixel-to-pixel contrast variation of less than 5%.

Closely matching the sensitivity of standard silicon target imaging tubes, the Model 4710 CCD (Charge Coupled Device) image sensor uses the frame transfer method with over 400,000 picture elements and an active imaging area of 6.4mm by 4.8mm (1/2-inch format). Automatic Gain Control (AGC) adds further sensitivity for use under widely varying light conditions.

In addition to its superior performance, the new Model 4710 represents the ultimate in quality construction. Designed and manufactured in the U.S.A., these rugged CCD cameras have become the international standard for performance and reliability.

Available with a wide range of options, the Model 4710 is compact, lightweight and energy efficient. It is the ideal CCD camera for machine vision, image processing, robotics, process control, microscopy, and many other scientific and industrial applications.



Cohu Model 4710

FEATURES AND BENEFITS

- **High Resolution** for better definition of details, error-free results.
- **High Sensitivity** permits operation over a broad range of light levels.
- **Enhanced Signal-to-Noise Ratio** for clean, noise-free video.
- **Frame Transfer Imager** for minimized blooming characteristics.
- **No Lag or Image Retention** for fast, clean, precise images.
- **Zero Geometric Distortion** for consistent corner-to-corner linearity.
- **Low Power Consumption** for flexible system integration, energy savings, and minimal dissipation.
- **Adjustable C Mount** for maximum adaptability.
- **Quality, State-of-the-Art Design and Construction** for total, solid-state reliability and long life.
- **Wide Range of Options** for flexible system integration.
- **Auto Black** for maximum effective dynamic range.
- **AGC with Peak-Average Adjustment** for clear images in varying light level applications.
- **Blemish-Free Imager** for quality, blemish-free image.
- **IR Sensitive** for use in IR applications.

APPLICATIONS

- **Machine Vision**
 - Pattern Recognition
 - Non-Contact Measurement and Inspection
 - Bar Code Reading
 - Image Processing
- **Robotics**
 - Automated Visual Control
- **EMI Environments**
 - Subways
 - High Voltage Areas
 - Linear Accelerators
 - NMR Units
- **Remote Piloted Vehicles**
 - Land Based, Aircraft, Submersibles
- **Microscopy**
- **Medical Imaging**

Designed and manufactured in U.S.A.

COHU
Cohu, Inc./Electronics Division

MODEL 4710 CCIR SOLID-STATE MONOCHROME CCD CAMERA

SPECIFICATIONS

ELECTRICAL

Imager

Single CCD using frame transfer method

Image Area

6.4 x 4.8mm (corresponding to 1/2" tube)

Active Picture Elements

699(H) x 576(V)

Number of Picture Cells

732(H) x 290(V)

Cell Size

9.2 μm (H) x 16.8 μm (V)

Resolution

Horizontal 525 TV lines

Vertical > 415 TV lines

Sensitivity

See Table 1, below.

Contrast Variation @ 25°C

<5% overall

Scanning System

CCIR, 2:1 interlaced

Video Output

1.0 Vp-p 75 ohms unbalanced

Gamma

0.5 or 1.0 jumper selectable

AGC

6dB variable gain (peak-average adjustable)

Jumper-selectable — on/off

Auto Lens Drive

Peak-average adjustable
(Separate auto lens video eliminates AGC/auto lens interaction)

Signal-to-Noise Ratio @ 25°C

56dB (gamma 1, gain 0 dB),
unweighted, 8MHz bandwidth

Auto Black

Maintain set-up level at 7.5 + 5
IRE units if picture contains at
least 10% black

Power Options

AC or DC 12V \pm 10%
AC or DC 24V \pm 5% (optional)
AC or 220/240V \pm 10%, 50Hz
with wall transformer

Power Consumption

4.2W

Grey Scale

Renders all shades of grey on
EIA TV resolution chart, 1956

ENVIRONMENTAL

Ambient Temperature Limits

Operating: -10° to 50°C
(14° to 122°F)

Storage: -30° to 70°C
(-22° to 157°F)

Humidity

Up to 95% relative humidity

Vibration

5 to 60Hz with 0.208cm/0.082
inches total excursion (15 g's @
60Hz); from 60 to 1,000Hz, 5 g's
rms random vibration without
damage

Shock

30 g's in any axis under non-
operating conditions per
MIL-E-5400T, paragraph 3.2.24.6

Altitude

Sea level to equivalent of
3,048m/10,000 feet
(508mm/20 inches of mercury)

MECHANICAL

Dimensions

See Figure 1.

Weight (less lens)

450 grams/15 ounces

Camera Mount

1/4 - 20 threaded holes

Lens Mount

"C" Mount

Lens

See Ordering Information.

Connectors

BNC Connector — Video out
Switchcraft TB4M — Lens Drive
Switchcraft TB3M — Power in
Hirose SR30-10R-6S (Auxiliary)

SENSITIVITY 2850K FACEPLATE ILLUMINATION

	With IR Filter	Without IR Filter
Usable with AGC	0.2 Lux (.02 fc)	0.04 Lux (.004 fc)
Full Video, Non-AGC	1.5 Lux (.15 fc)	0.25 Lux (.025 fc)
Full Video, AGC	0.7 Lux (.07 fc)	0.12 Lux (.012 fc)

Table 1

DIMENSIONS

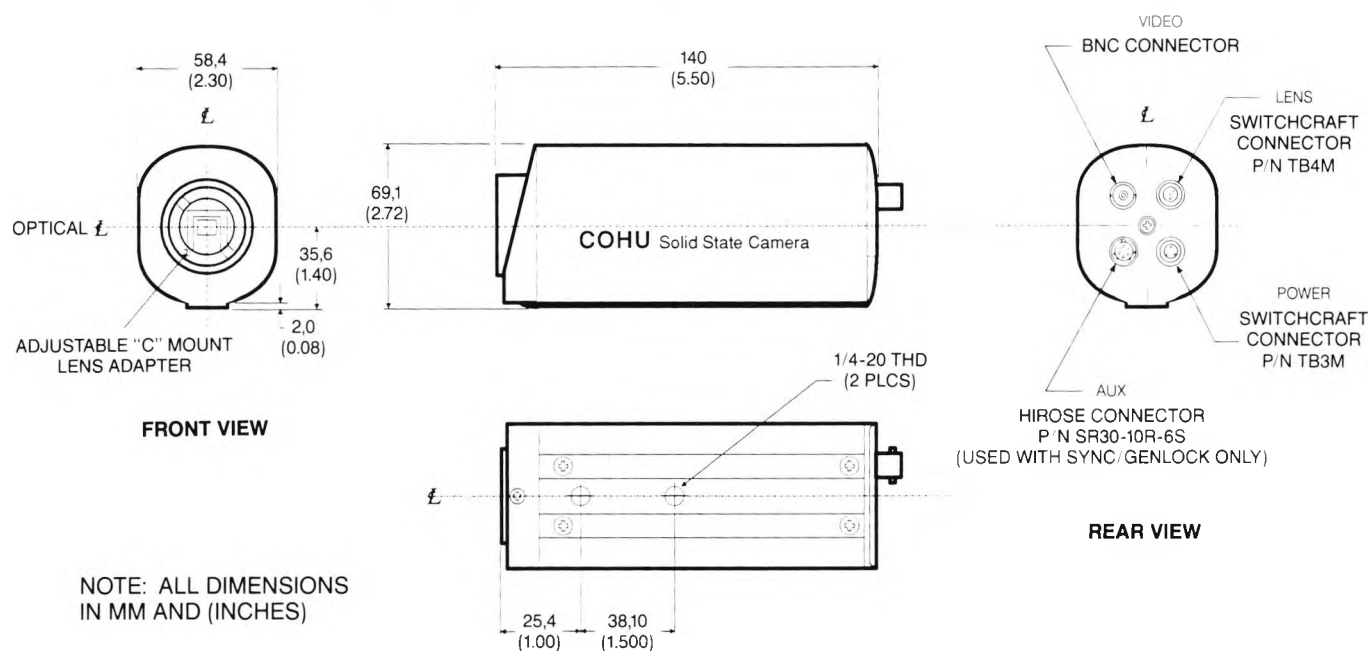
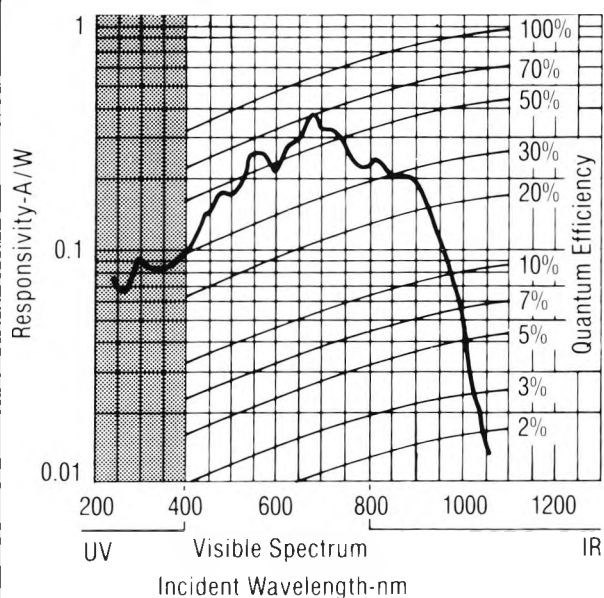


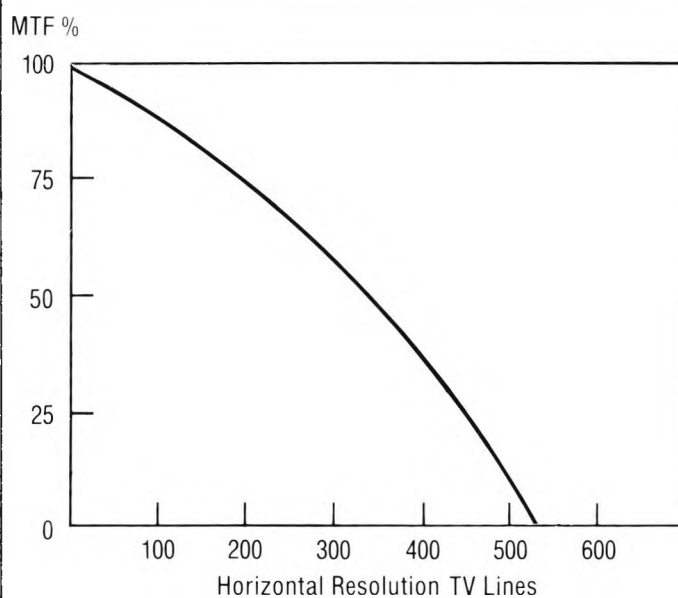
Figure 1

SPECTRAL RESPONSE



SHADED AREA INDICATES SPECTRAL RESPONSE WITH FACEPLATE REMOVED OR WITH A QUARTZ FACEPLATE INSTALLED. PLEASE CONSULT FACTORY FOR PRICES

MODULATION TRANSFER FUNCTION CURVE



MODEL 4710 CCIR SOLID-STATE MONOCHROME CCD CAMERA

ORDERING INFORMATION

471X

—

X

XXX

/

XXXX

Power Options

- 2 12V ac 50 Hz or dc
- 3 220/240V ac, 50 Hz
- 4 24V ac 50 Hz or dc

Sync Options

- 2 Genlock, revert to crystal
- 3 Genlock, revert to line lock
- 5 CCIR Crystal
- 7 H & V Drive

Optical Filter

- 000 None
- 100 IR Filter

Lens Options

- 0000 None

Manual Iris Lenses

- A014 12mm, f/1.2, 1/2"
- AL04 4.5mm, f/2.0, 2/3"
- AL06 6.5mm, f/1.8, 2/3"
- AL08 8mm, f/1.4, 2/3"
- AL09 9mm, f/1.3, 2/3"
- AL16 16mm, f/1.4, 2/3"
- AL26 25mm, f/1.6, 2/3"
- AL51 50mm, f/1.8, 2/3"

Auto Iris Lenses

- ES04 4.2mm, f/1.8, 1/2"
- ES06 6mm, f/1.2, 1/2"
- ES08 8mm, f/1.4, 2/3"
- ES13 12mm, f/1.2, 1/2"
- ES16 16mm, f/1.4, 2/3"
- EH35 35mm, f/1.4, 2/3"

Please consult factory for other lens selections.

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OPTIONAL FEATURES

SYNC OPTIONS

The standard sync board contains a crystal-controlled oscillator to generate a 13.375 MHz reference frequency. A sync generator IC shapes the repetitive timing pulses used to control the movement of charge frames on the sensor board. This board also contains circuits to generate blanking, clamp, and sync pulses. These signals combine with the video signal on the video board to produce composite CCIR monochrome video.

The genlock board contains additional circuits to receive external input signals, including composite video, composite sync, and horizontal and vertical drive. These inputs are processed and supplied as reference signals to the genlock oscillator. In the absence of an externally applied signal, the camera is either crystal-locked or line locked, depending on the position of the crystal/line lock jumper. In the Line Lock Mode, the camera synchronizes to an external 50 Hz reference derived from the AC power line. In the CCIR Crystal Mode, the internal crystal-controlled oscillator provides back-up. The H and V Drive Input option allows the camera to synchronize to externally supplied horizontal- and vertical-drive signals.

POWER OPTIONS

The Model 4710 camera requires AC or DC 12V or 24V input power. For operation from a 220/240 VAC 50 Hz power source, an optional AC power pack is available.

OPTICAL FILTER

The Model 4710 is designed to be IR sensitive. For use in applications with undesirable IR conditions, the optional IR filter will cut off at 650nm.

LENS OPTIONS

In addition to the lenses listed above, Cohu provides a complete selection of lenses for specialized applications. Our applications engineers will help you determine the proper field-of-view, focal length, lens speed (f-stop), and size (image sensor format) for your application.

SPECIAL FEATURES

Cohu welcomes the opportunity to provide special features to better serve your particular application. Some examples of special features already provided include custom painting, silk screen and logo; remote head with 6' cable; imager faceplate removal for laser applications; imager tilt with customer-specified degree; and special connector pin configurations. Please contact Cohu for other special features.

NEW!

SOLID-STATE CCIR MONOCHROME CCD CAMERA

MODEL 4750**High Resolution
High Sensitivity**

Cohu's Model 4750 solid state monochrome CCD cameras are cost effective general purpose cameras ideally suited for applications that require both high sensitivity and high resolution. High resolution pictures are attainable without geometric distortion, lag, or image retention. The 1/2" format CCD (charge coupled device) image sensor of the Model 4750 generates sensitivity that closely matches that of standard silicon target imaging tubes. These capabilities, along with its inherent rugged design and minimal maintenance, make this camera superior to many existing CCD or tube cameras.

Weighing just 450 grams, the Model 4750 is ideally suited for a broad range of security/surveillance applications. To provide high sensitivity in low-light areas, the Model 4750 features automatic gain control (AGC). The Model 4750 uses the frame transfer method and over 400,000 picture elements to generate a high-resolution image.

As with all Cohu CCD cameras, the Model 4750 is designed and manufactured in the U.S.A. A leading U.S. manufacturer of closed-circuit television cameras for over 40 years, Cohu is based in San Diego, California.



Cohu 4750 Series CCIR Monochrome CCD Camera

FEATURES AND BENEFITS

- **High Resolution** with 1/2-inch format sensor for sharper images
- **High Sensitivity** improves image in low light levels
- **Zero Geometric Distortion** for consistent corner-to-corner linearity
- **Frame Transfer Imager** for minimized blooming characteristics
- **No Lag or Image Retention** for fast, clean, precise images
- **Wide Range of Options** for flexible system integration
- **AGC with Peak-Average Adjustment** for clear images in varying light conditions.
- **Low Power Consumption**
- **High Signal-to-Noise Ratio** provides better dynamic range
- **Auto Black** for contrast enhancement
- **Quality, State-of-the-Art Design and Construction** for total, solid-state reliability and long life
- **IR Sensitive** for use in IR applications.

APPLICATIONS

- **Perimeter Security**
- **General Surveillance**
- **Traffic Safety and Control**

Designed and manufactured in U.S.A.

COHU
INC.
ELECTRONICS DIVISION

MODEL 4750 CCIR MONOCHROME CCD CAMERA

SPECIFICATIONS

ELECTRICAL

Pickup Area

6.4 x 4.8 mm (1/2-inch format)

Active Picture Elements

699(H) x 576(V) (frame transfer)

Number of Picture Cells

732(H) x 290(V)

Cell Size

9.2μm(H) x 16.8μm(V)

Resolution

Horizontal 525 TV lines

Vertical >415 TV lines

Sensitivity

2850 K faceplate illumination.

See Table 1.

Video Output

1.0 V p-p @75 ohms, unbalanced

Gamma

0.5 or 1.0 jumper selectable

AGC

6 dB variable gain, jumper selectable on/off, peak-average adjustable

Power Consumption

4.2W

Auto Black

Maintain set-up level at 7.5 ± 5 IRE units if picture contains at least 10% black

Signal-to-Noise Ratio

52 dB at gamma 1, 0 dB

8 MHz bandwidth, unweighted

58 dB at gamma 1, 0 dB

weighted, CCIR

Auto Lens Drive Signal

Peak-average characteristic tracks

AGC adjustment to eliminate

AGC/auto lens interaction.

Synchronization

CCIR crystal, 13.375 MHz clock output (standard)

Genlock, external sync with crystal

zero crossing line lock back-up

(jumper selectable)

External H & V drive

Power Requirements

AC 230V $\pm 10\%$, 50 Hz (optional, with wall transformer)

AC/DC 12V $\pm 10\%$

AC/DC 24V $\pm 5\%$ (optional)

ENVIRONMENTAL

Ambient Temperature Limits

Operating: -10 to 50 °C

(14 ° to 122 ° F)

Storage: -30 to 70 °C

(-22 ° to 157 ° F)

Humidity

Up to 95% relative humidity

Vibration (less lens)

5 to 60 Hz with 0.082 inch total

excursion (15 g's @ 60 Hz). From

60 to 1000 Hz, 5 g's rms random

vibration without damage

Shock (less lens)

Up to 15 g's in any axis under

nonoperating conditions,

MIL-E-5400T, paragraph 3.2.24.6

Altitude

Sea level to equivalent of

3,048m/10,000 feet (508mm/20

inches of mercury)

MECHANICAL

Weight (less lens)

450 grams (15 ounces)

Dimensions

Please see Figure 1.

Camera Mount

1/4 - 20 threaded holes

Lens Mount

"C" mount, 16mm format

Connectors

BNC connector - Video Out

Switchcraft TB4M - Lens Drive

Switchcraft TB3M - Power In

Hirose SR30-10R-6S - Auxiliary

SENSITIVITY

With IR Filter

Without IR Filter

Full Video, AGC Off

0.12 fc (1.2 lux)

0.010 fc (0.10 lux)

Full Video, AGC On

0.06 fc (0.6 lux)

0.005 fc (0.05 lux)

Usable Picture, AGC On

0.02 fc (0.2 lux)

0.002 fc (0.02 lux)

Table 1

DIMENSIONS

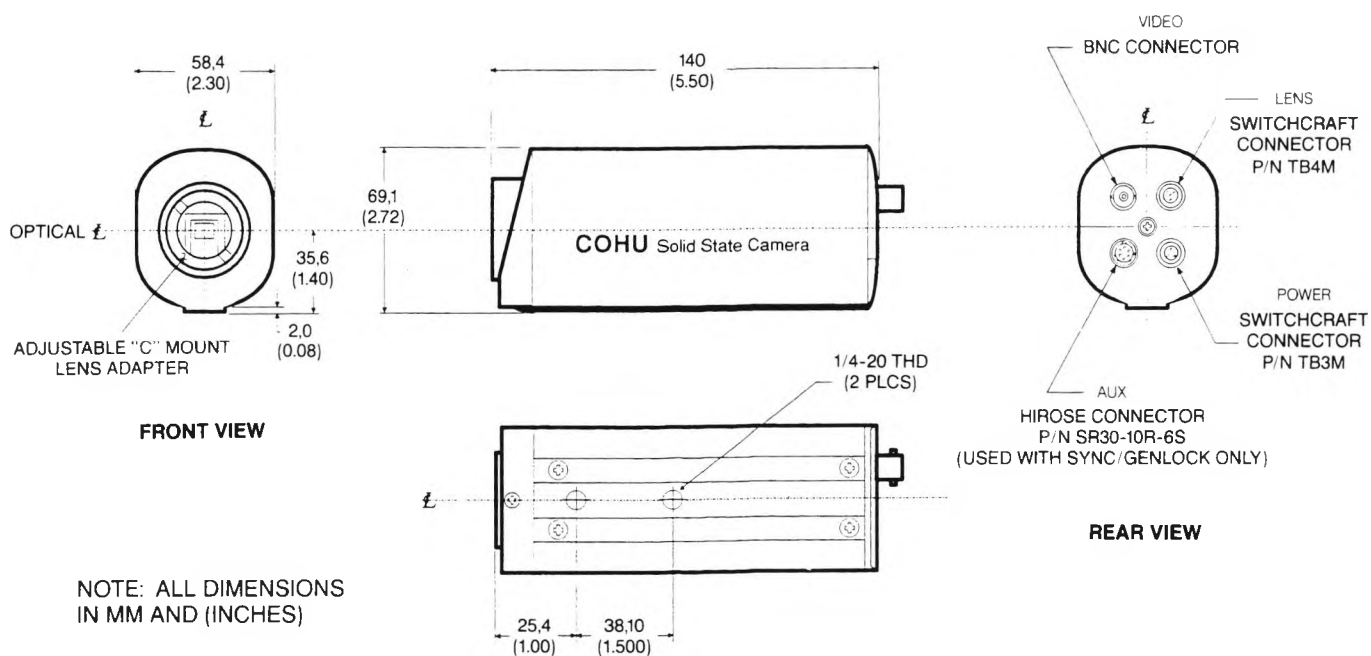
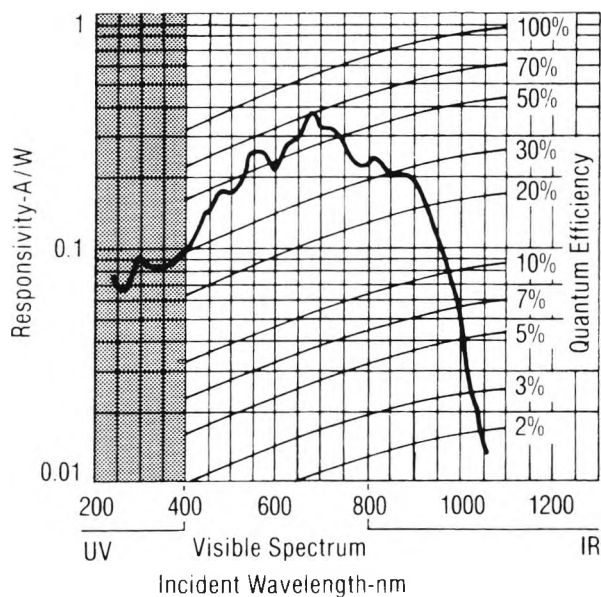
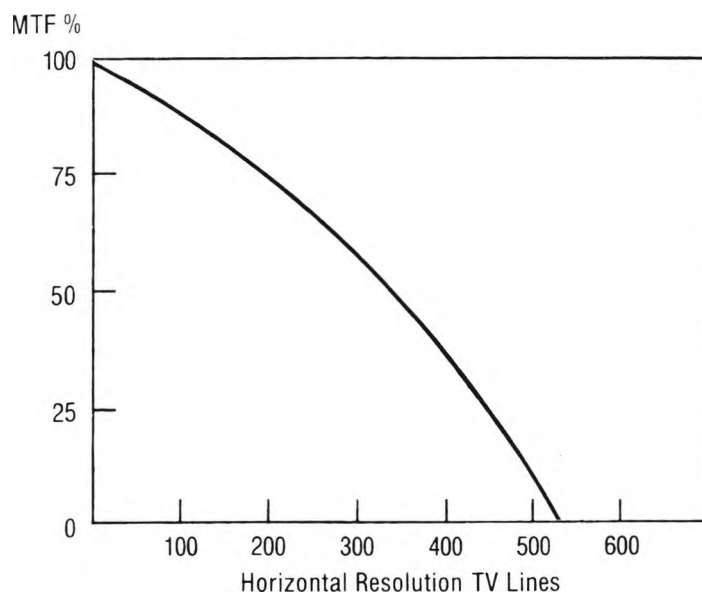


Figure 1

SPECTRAL RESPONSE



MODULATION TRANSFER FUNCTION CURVE



SHADED AREA INDICATES SPECTRAL RESPONSE WITH FACEPLATE REMOVED OR WITH A QUARTZ FACEPLATE INSTALLED. PLEASE CONSULT FACTORY FOR PRICES.

MODEL 4750 CCIR MONOCHROME CCD CAMERA

ORDERING INFORMATION

475X

X

XXX

XXXX

Power Options

- 2 12V AC/DC 50Hz
- 3 230V AC, 50 Hz
- 4 24V AC/DC

Sync Options

- 2 Genlock
(Revert to crystal)
- 3 Genlock
(Revert to linelock)
- 5 CCIR Crystal
- 7 External H & V Drive

Optical Filter

- 000 None
- 100 IR Filter

Lens Options

- 0000 None

Manual Iris Lenses

- AL04 4.5mm, f/2.0 (2/3")
- AL06 6.5mm, f/1.8 (2/3")
- AL08 8mm, f/1.4 (2/3")
- AL09 9mm, f/1.3 (2/3")
- AL16 16mm, f/1.4 (2/3")
- AL26 25mm, f/1.6 (2/3")
- AL51 50mm, f/2.8 (2/3")
- AL75 75mm, f/1.8 (1")

Auto Iris Lenses

- ES05 4 8mm, f/1.8 (2/3")
- ES06 6mm, f/1.2 (1/2")
- ES08 8mm, f/1.4 (2/3")
- ES13 12 mm, f/1.2 (1/2")
- ES16 16mm, f/1.4 (2/3")
- ES28 28mm, f/1.2 (1/2")
- ES35 35mm, f/1.4 (2/3")

Please consult factory for other lens selections.

COHU RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

OPTIONAL FEATURES

SYNC OPTIONS

The genlock board contains circuits to receive external input signals, including composite video, composite sync, and horizontal and vertical drive. These inputs are processed and supplied as reference signals to the genlock oscillator. In the absence of an externally applied signal, the camera is either crystal-locked or line locked, depending on the position of the crystal/linelock jumper. In the Linelock Mode, the camera synchronizes to an external 50 Hz reference derived from the AC power line. In the CCIR Crystal Mode, the internal crystal-controlled oscillator provides back-up. The H & V Drive Input Option allows the camera to synchronize to externally supplied horizontal- and vertical-drive signals.

IR FILTER

The 4750 Series is designed to be IR sensitive. For use in applications with undesirable IR conditions, the optional IR filter will cut off at 650 nm.



ADVANCED
VIDEO
TECHNOLOGY
Made in the U.S.A.

RS-170 MONOCHROME FRAME TRANSFER CCD CAMERAS

4800 SERIES

**High Resolution
High Sensitivity**

Cohu's 4800 Series RS-170 Monochrome Frame Transfer CCD cameras are ideal for applications that require both high resolution and high sensitivity. Currently installed in thousands of sites around the world, they support a wide range of security/surveillance and electronic imaging applications.

4800 Series CCD cameras are available in three different housings. The 4810 Series housing is designed for non-environmental security/surveillance, image processing, and other scientific or industrial applications. The 4830 Series and 4860 Series Environmental CCD Cameras are designed for harsh environment applications. They consist of a 4810 Series camera and lens installed in either a three-inch-diameter or six-inch-diameter sealed and pressurized environment-resistant housing. The six-inch housing will accommodate virtually any size zoom lens. An explosion-proof housing is also available as an option.

4800 Series cameras provide high resolution pictures without geometric distortion, lag, or image retention. They provide sensitivity comparable to that of standard silicon target image tube cameras, and very low contrast variation. These capabilities, along with their reliable, rugged design and low maintenance, make 4800 Series cameras the ideal solu-



Cohu 4800 Series Frame Transfer CCD Cameras

tion for high performance video requirements.

4800 Series cameras are designed and manufactured in U.S.A., and are backed by a full two-year warranty.

Cohu is uniquely positioned to respond quickly to special engineering

requests for custom or modified products. We also offer complete system engineering services.

A leading U.S. manufacturer of video cameras and systems for over 40 years, Cohu is based in San Diego, California.

FEATURES AND BENEFITS

- **Sealed, Pressurized Environmental Models** withstand exposure to extreme temperatures, sand, dust, fungus, and salt atmosphere.
- **High Resolution** with $\frac{2}{3}$ -inch format frame transfer image sensor for sharper images
- **High Sensitivity** improves image in low light levels.
- **Zero Geometric Distortion** for consistent corner-to-corner linearity
- **No Lag or Image Retention** for fast, clean, precise images
- **Wide Range of Options** for flexible system integration
- **Two-Year Warranty**
- **AGC with Peak-Average Adjustment** for clear images in varying light conditions.
- **High Signal-to-Noise Ratio** provides better dynamic range.
- **Auto Black** for contrast enhancement
- **Quality, State-of-the-Art Design and Construction** for total, solid-state reliability and long life
- **IR Sensitive** for use in IR applications
- **Over 367,000 Picture Elements**
- **Made in U.S.A.** — direct factory support, parts availability
- **Adjustable "C" Mount** for maximum lens adaptability

APPLICATIONS

- **Security/Surveillance**
Perimeter Security
Government and Military Facilities
Unmanned Storage Facilities
Nuclear Power Plants
Hazardous Waste Management
Correctional Facilities
- **EMI Environments**
Subways
High Voltage Areas
Linear Accelerators
NMR Units
- **Transportation Management**
Traffic Safety and Control
Bridges and Tunnels
Mass Transit
Airports and Train Stations
Fare Collection Points
- **Image Processing**

Designed and Manufactured in U.S.A.

COHU
Cohu, Inc./Electronics Division

4800 SERIES MONOCHROME CCD CAMERAS

SPECIFICATIONS

ELECTRICAL

Imager

Single CCD using frame transfer method

Pickup Area

8.8 x 6.6 mm ($\frac{2}{3}$ -inch format)

Active Picture Elements

754(H) x 488(V) (frame transfer)

Cell Size

11.5 μ m(H) x 27 μ m(V)

Resolution

Horizontal 565 TV lines

Vertical >350 TV lines

Sensitivity

2850 K faceplate illumination.

See Table 1 on back page.

Contrast Variation @25°C

<5% overall

Video Output

1.0 V p-p @75 ohms, unbalanced

Gamma

0.5 or 1.0 jumper selectable

Gray Scale

Renders all shades of gray on EIA

TV resolution chart, 1956

AGC

6 dB variable gain (peak-average adjustable)

Jumper selectable, On/Off.

Auto Black

Maintain set-up level at 7.5 ± 5 IRE units if picture contains at least 10% black

Signal-to-Noise Ratio @25°C

50 dB at gamma 1, 0 dB gain

8 MHz bandwidth, unweighted

55 dB at gamma 1, 0 dB gain, weighted

Auto Lens Drive Signal

Peak-average characteristic tracks

AGC adjustment to eliminate

AGC/auto lens interaction.

Synchronization

EIA RS-170 crystal, 14.31818 clock output (standard)

Genlock, external sync with crystal or line lock back-up (jumper selectable)

Phase adjustable line lock

(4830/4860 Series only)

External H & V drive

Power Requirements

AC/DC 12V $\pm 10\%$

AC/DC 24V $\pm 5\%$

AC 115/230V $\pm 10\%$, 50/60 Hz with wall transformer for 4810

Power Consumption

4.2W

4830 Heater: 35W

4860 Heater: 50W

4810 SPECIFICATIONS

ENVIRONMENTAL

Ambient Temperature Limits

Operating: -10 to 50°C

(14° to 122°F)

Storage: -30 to 70°C

(-22° to 157°F)

Humidity

Up to 95% relative humidity

Vibration (less lens)

5 to 60 Hz with 0.082 inch total

excursion (15 g's @ 60 Hz). From

60 to 1000 Hz, 5 g's rms random

vibration without damage

Shock (less lens)

Up to 30 g's in any axis under

nonoperating conditions,

MIL-E-5400T, paragraph 3.2.24.6

Altitude

Sea level to equivalent of

3,000m/10,000 feet (500mm/20 inches of mercury)

MECHANICAL

Weight (less lens)

450 grams (15 ounces)

Dimensions

Please see dimensional drawings

Camera Mount

$\frac{1}{4}$ - 20 threaded holes

Lens Mount

"C" mount, 16mm format

Connectors

BNC connector - Video Out

Switchcraft TB4M - Lens Drive

Switchcraft TB3M - Power In

Hirose SR30-10R-6S - Auxiliary

4830 & 4860 SPECIFICATIONS

ENVIRONMENTAL

Ambient Temperature Limits

Operating:

-10 to 60°C (14 to 140°F)

-40 to 60°C (-40 to 140°F)

with optional heater

Storage:

-30 to 70°C (-22 to 157°F)

Ambient Air Pressure

Two atmospheres (sea level) to

equivalent of 100,000 feet (3,000

meters), exceeding MIL-E-5400T

paragraph 3.2.24.2, Class 3

Humidity

Up to 100% relative humidity,

MIL-E-5400T paragraph 3.2.24.4.

Equipped with standard Schrader tank valve (purge fitting) on camera housing to allow camera to be purged with dry nitrogen or other moisture eliminators, and to maintain housing interior at approximately 5 psi.

Vibration — 4830

50 to 60 Hz with 0.020 inches total

excursion (3.5 g's @ 60 Hz). From

60 to 1,000 Hz, 3 g's rms random

vibration without damage

Vibration — 4860

0.03 inches total excursion from 5 to

30 Hz; peak random vibrations of

5 g's from 30 to 1,000 Hz without

damage or degradation

Shock

30 g's in any axis under non-

operating conditions per MIL-E-

5400T paragraph 3.2.24.6.

Air Contaminants

Withstands exposure to sand, dust,

fungus, and salt atmosphere, per

MIL-E-5400T, paragraph 3.2.24.7,

3.2.24.8, and 3.2.24.9

Explosion

MIL-E-5400T, paragraph 3.2.24.10

Acoustic Noise

Operates in extremely high acoustic

noise environment (150 dB), e.g.,

close proximity to high thrust

rocket engine

Underwater Operation

Camera operates to 60 feet in depth

(18 meters) with factory installed

connector option

MECHANICAL

Weight (less lens)

4832 — 3 lbs.

4835 — 4 lbs

4860 — 14 lbs.

Type of Lens

A full range of C-mount fixed, auto-iris, and zoom lenses is available.

Purge/Relief Fitting

Pressure relief valve (4860 only)

Pressurized Fitting

Standard Schrader Valve

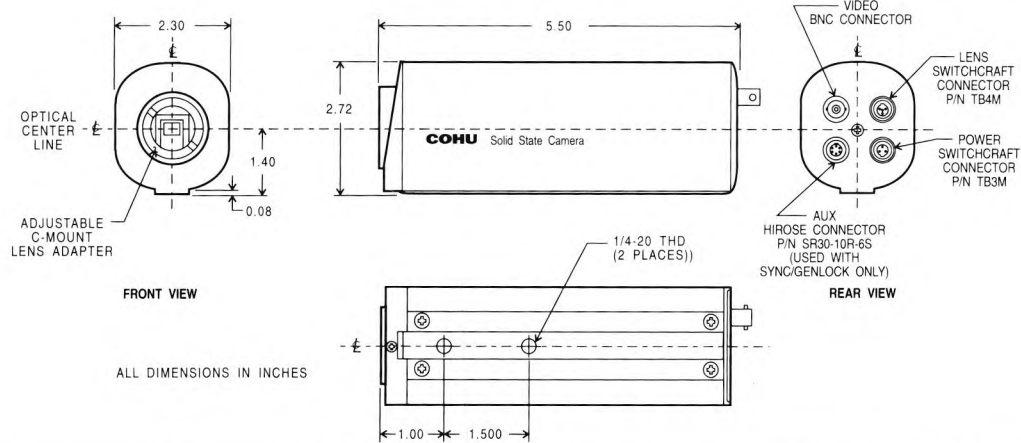
Rear Plate Connectors

4830 — Bendix PT07C-14-18P

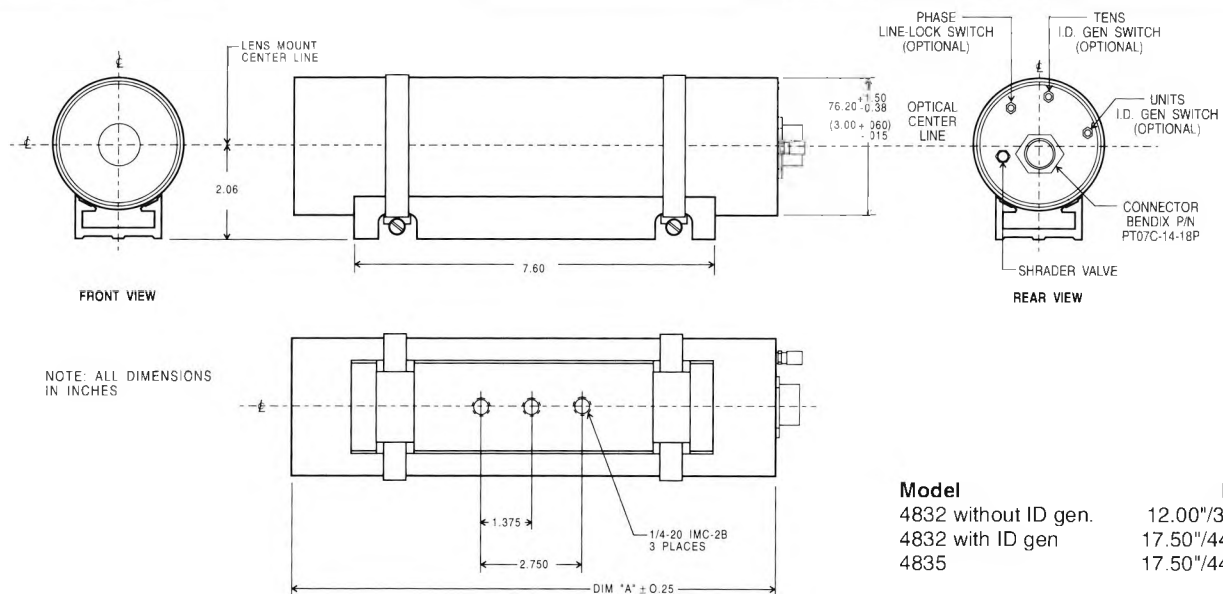
4860 — Bendix PT07C-20-39P

(Mating Connector Supplied. All functions controlled through single connector.)

4810 SERIES DIMENSIONS

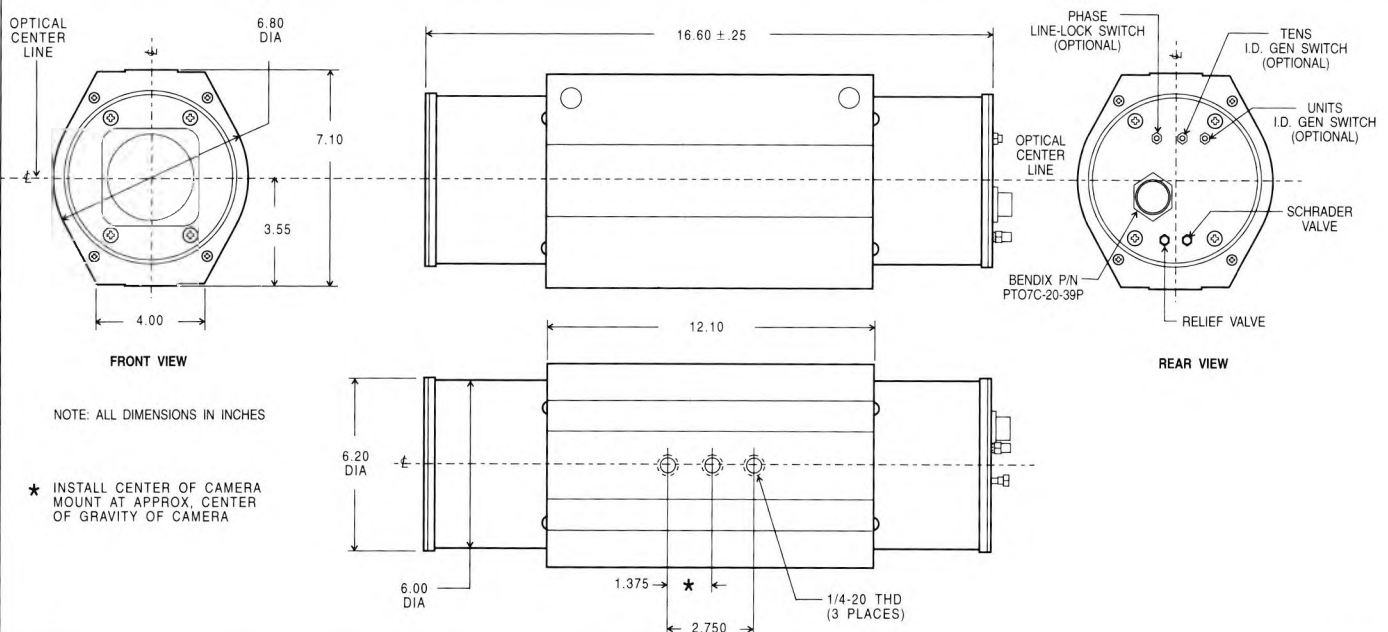


4830 SERIES DIMENSIONS



Model	DIM. "A"
4832 without ID gen.	12.00"/304.8 mm
4832 with ID gen	17.50"/444.50mm
4835	17.50"/444.50mm

4860 SERIES DIMENSIONS



4800 SERIES MONOCHROME CCD CAMERAS

ORDERING INFORMATION

48X	X	—	X	X	XX	/	XXXX	X
Housing Options	Power Options		Sync Options	Optical Filter	Option Boards		Lens Options	Other Options
1 General Purpose 3 3" Environmental 6 6" Environmental 7 UL Classified Explosion Proof CHX	2 12V ac/dc 4 24V ac/dc 5 115V ac, 60 Hz (4810 Series supplied with ac wall adapter)		2 Genlock (Revert to crystal) 3 Genlock (Revert to line lock) 4 Phase Adjustable Line Lock (4830 and 4860 ac models only) 5 RS-170 Crystal 7 External H & V Drive	000 None 100 IR Filter	00 None *40 Bright Light Limiter *50 Source I.D. Generator *54 Source I.D. Generator and Bright Light Limiter * 4830/4860 only		0000 None Manual Iris Lens (4810 Series Only) AL09 9mm, f/1.4, 2/3" AL12 12mm, f/1.4, 1" AL16 16mm, f/1.4, 2/3" AL25 25mm, f/1.4, 1" AL50 50mm, f/1.8, 1" AL75 75mm, f/1.8, 1" Auto Iris Lens ES05 4.8mm, f/1.8, 2/3" ES08 8mm, f/1.4, 2/3" ES12 12.5mm, f/1.4, 1" ES16 16mm, f/1.4, 2/3" ES25 25mm, f/1.4, 1" EH35 35mm, f/1.4, 2/3" ES50 50mm, f/1.8, 1" EH75 75mm, f/1.8, 1" **Zoom Lenses (4860 Series Only) Z06J 6:1, 11.5—10mm, f/1.4, 2/3" P06J 6:1 with presets, f/1.4, 2/3" Z10H 10:1, 10—100mm, f/1.4, 2/3" P10J 10:1 with presets, f/1.4, 2/3"	L Low Temperature Operation For Sunshields 4830, use SS-300 4860, use SS-522 For Remote Control Use 2380-090 CA-246 (4830 cable) CA-294 (4860 cable)



All models UL listed except 4835 and 4865

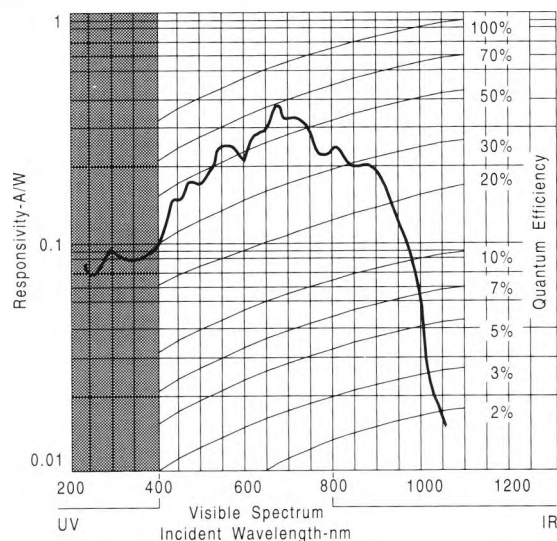
** Available on 24V ac models only as an "ER". Please consult factory for other lens selections.

COHU RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

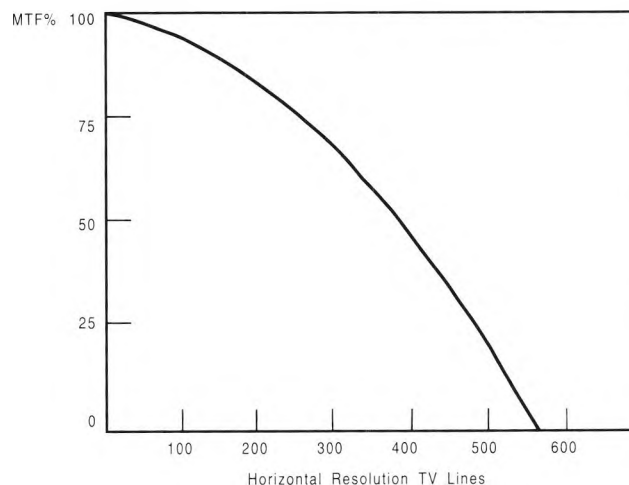
SENSITIVITY		
	With IR Filter	Without IR Filter
	0.2 fc (2 lux) 0.07 fc (0.7 lux) 0.02 fc (0.2 lux)	0.02 fc (0.2 lux) 0.007 fc (0.07 lux) 0.002 fc (0.02 lux)

Table 1

SPECTRAL RESPONSE



MODULATION TRANSFER FUNCTION



**TWO-YEAR
WARRANTY!**

SOLID-STATE CCD MONOCHROME CAMERA

MODEL 4810

**High Resolution and
High Sensitivity**

The Model 4810 solid-state cameras are ideal for applications that require both high resolution and high sensitivity. High resolution pictures are attainable without geometric distortion, lag or image retention. The 2/3-inch format CCD (Charge Coupled Device) image sensor of the Model 4810 generates sensitivity that closely matches standard silicon target imaging tubes. These capabilities, along with its inherent rugged design and minimal maintenance, make Cohu's Model 4810 superior to existing CCD or tube cameras.

Weighing just 15.5 ounces, the Model 4810 is suited for numerous applications including machine vision, image processing, robotics, process control and microscopy.

Automatic gain control (AGC) is incorporated in Cohu's Model 4810 to provide high sensitivity for use in low-light areas. The 4810 utilizes the frame transfer method and over 365,000 picture elements to generate a high resolution image with a contrast variation of <5%. Low power consumption allows flexible system integration and easy operation.



Cohu Model 4810 Solid-State CCD Monochrome Camera

OPTIONS

- **Synchronization**
Genlock/Crystal
Genlock/Line Lock
Phase Adjust Line Lock
RS-170 Crystal
External H & V Drive
- **IR Filter**

FEATURES

- **High Resolution**
754(H) x 488 (V) Picture Elements
- **High Sensitivity**
(to .007fc/.07 Lux)
- **Auto Black for Wide Dynamic Range or Manual Adjustable**
- **AGC with Peak-Average Adjustment or Fixed Gain with Manual Adjustment**
- **Zero Geometric Distortion**
- **Selectable Gamma**
- **No Lag or Image Retention**
- **Low Power Consumption**
- **Blemish-Free Sensor**
- **Over 365,000 Picture Elements**
- **Adjustable C Mount**

APPLICATIONS

- **Machine Vision**
Pattern Recognition
Non-Contact Measurement and Inspection
Bar Code Reading
Image Processing
- **Robotics**
Automated Visual Control
- **EMI Environments**
Subways
High Voltage Areas
Linear Accelerators
NMR Units
- **Remote Piloted Vehicles**
Land Based, Aircraft, Submersibles
- **Microscopy**
- **Medical Imaging**
- **Security/Surveillance**

4810 SERIES MONOCHROME CCD CAMERAS

SPECIFICATIONS

ELECTRICAL

Imager

Single CCD using frame transfer method

Pickup Area

8.8 x 6.6 mm ($\frac{2}{3}$ -inch format)

Active Picture Elements

754(H) x 488(V) (frame transfer)

Cell Size

11.5 μ m(H) x 27 μ m(V)

Resolution

Horizontal 565 TV lines
Vertical >350 TV lines

Sensitivity

2850 K faceplate illumination.
See Table 1 below.

Contrast Variation @25°C

<5% overall

Video Output

1.0 V p-p @75 ohms, unbalanced

Gamma

0.5 or 1.0 jumper selectable

Gray Scale

Renders all shades of gray on EIA
TV resolution chart, 1956

AGC

6 dB variable gain (peak-average adjustable)
Jumper selectable, On/Off.

Auto Black

Maintain set-up level at 7.5 \pm 5 IRE units if picture contains at least 10% black

Signal-to-Noise Ratio @25°C

50 dB at gamma 1, 0 dB gain
8 MHz bandwidth, unweighted
55 dB at gamma 1, 0 dB gain, weighted

Auto Lens Drive Signal

Peak-average characteristic tracks
AGC adjustment to eliminate
AGC/auto lens interaction.

Synchronization

EIA RS-170 crystal, 14.31818 clock output (standard)
Genlock, external sync with crystal or line lock back-up (jumper selectable)
External H & V drive

Power Requirements

AC/DC 12V \pm 10%
AC/DC 24V \pm 5%
AC 115/230V \pm 10%, 50/60 Hz with wall transformer

Power Consumption

4.2W

ENVIRONMENTAL

Ambient Temperature Limits

Operating: -10 to 50 °C
(14° to 122° F)

Storage: -30 to 70 °C
(-22° to 157° F)

Humidity

Up to 95% relative humidity

Vibration (less lens)

5 to 60 Hz with 0.082 inch total excursion (15 g's @ 60 Hz). From 60 to 1000 Hz, 5 g's rms random vibration without damage

Shock (less lens)

Up to 30 g's in any axis under nonoperating conditions,
MIL-E-5400T, paragraph 3.2.24.6

Altitude

Sea level to equivalent of 3,000m/10,000 feet (500mm/20 inches of mercury)

MECHANICAL

Weight (less lens)

450 grams (15 ounces)

Dimensions

Please see dimensional drawings

Camera Mount

$\frac{1}{4}$ - 20 threaded holes

Lens Mount

"C" mount, 16mm format

Connectors

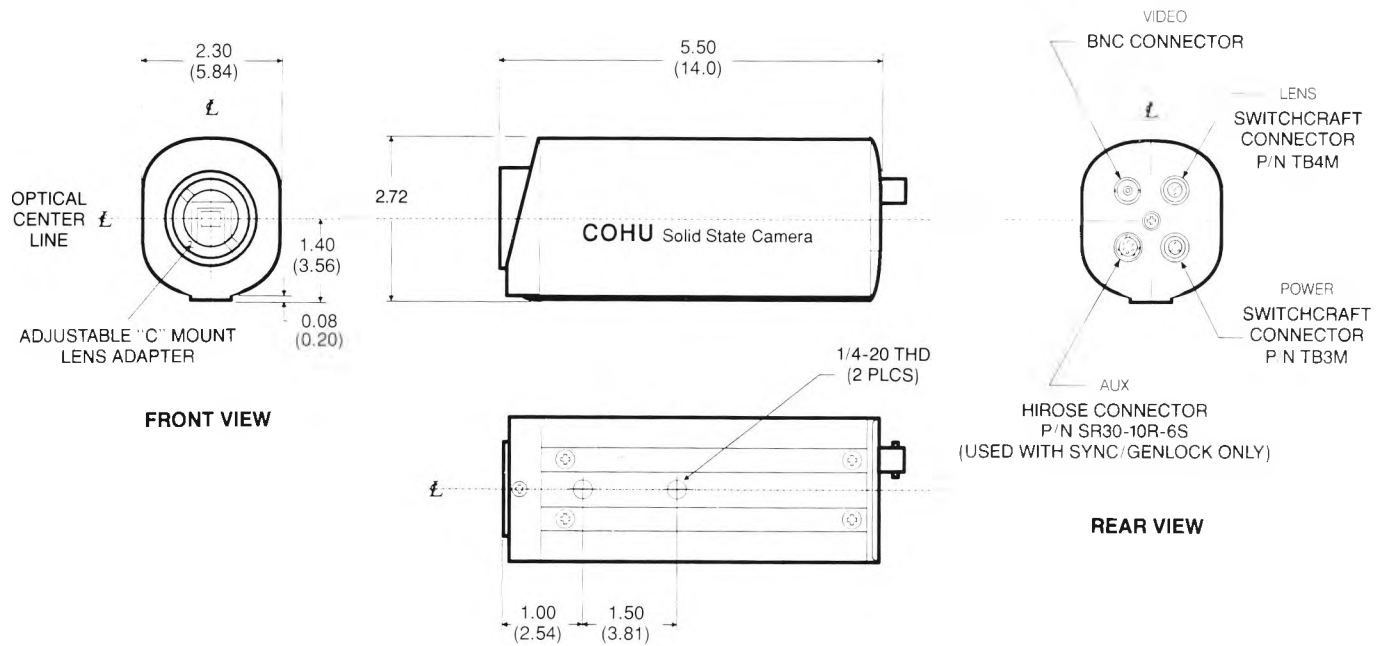
BNC connector - Video Out
Switchcraft TB4M - Lens Drive
Switchcraft TB3M - Power In
Hirose SR30-10R-6S - Auxiliary

SENSITIVITY

	With IR Filter	Without IR Filter
Full Video, AGC Off	0.2 fc (2 lux)	0.02 fc (0.2 lux)
80% Video, AGC On	0.07 fc (0.7 lux)	0.007 fc (0.07 lux)
30% Video, AGC On	0.02 fc (0.2 lux)	0.002 fc (0.02 lux)

Table 1

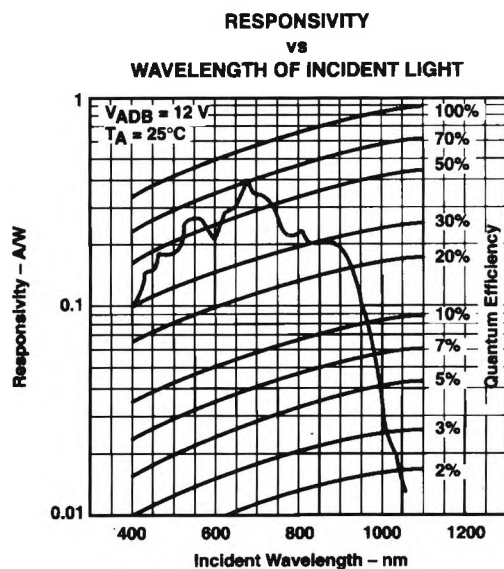
DIMENSIONS



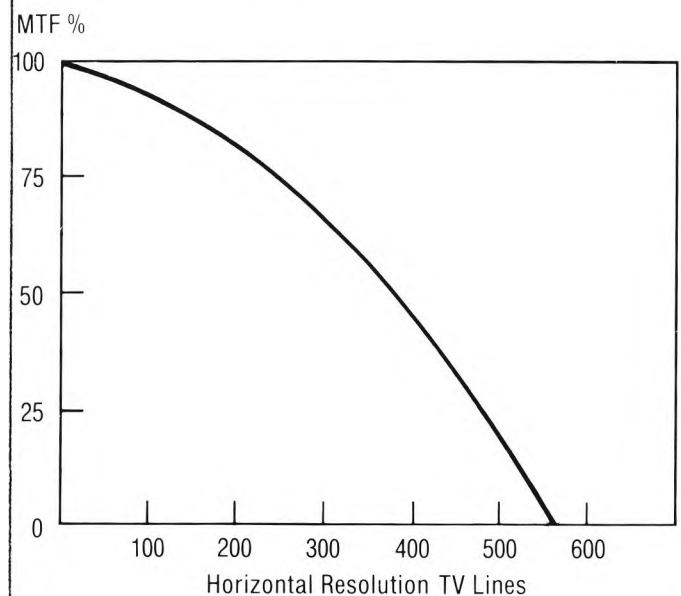
NOTE: ALL DIMENSIONS IN INCHES AND (CM).

Figure 1

SPECTRAL RESPONSE



MODULATION TRANSFER FUNCTION



MODEL 4810 SOLID-STATE MONOCHROME CCD CAMERA

ORDERING INFORMATION

481X

—

X

XXX

/

XXXX

Power Options

- 2 12V ac/dc
- 4 24V ac/dc
- 5 115V ac, 60 Hz

Note: 12V and 24V models include power mating connector. Model 4815 is the same as Model 4812 with an external 12V dc power pack.

Sync Options

- *2 Genlock
(Revert to crystal)
- *3 Genlock
(Revert to linelock)
- 5 RS-170 Crystal
- *7 H & V Drive

* Includes Genlock, line lock, external H & V drive, and clock output

Optical Filter

- 000 None
- 100 IR Filter

Lens Options

- 0000 None
- Manual Iris Lenses**
- AL09** 9mm, f/1.4, 2/3"
- AL12** 12.5mm, f/1.4, 1"
- AL16** 16mm, f/1.4, 2/3"
- AL25** 25mm, f/1.4, 1"
- AL50** 50mm, f/1.4, 1"
- AL75** 75mm, f/1.8, 1"

Auto Iris Lenses*

- ES08** 8mm, f/1.4, 2/3"
- ES12** 12.5mm, f/1.4, 1"
- ES16** 16mm, f/1.4, 2/3"
- ES25** 25mm, f/1.4, 1"
- ES50** 50mm, f/1.8, 1"
- EH75** 75mm, f/1.8, 1"

* Auto iris lenses require lens connector P/N 1310356-104, which must be ordered separately when customer supplies own lens.



Warranty: Two years on CCD cameras, one year on lenses.

COHU RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

OPTIONAL FEATURES

POWER OPTIONS

The Model 4810 camera requires AC or DC 12V or 24V input power. For operation from a 115/230 VAC 50/60 Hz power source, an optional AC power pack is available.

OPTICAL FILTER

The Model 4810 is designed to be IR sensitive. For use in applications with undesirable IR conditions, the optional IR filter will cut off at 650nm.

LENS OPTIONS

In addition to the lenses listed above, Cohu provides a complete selection of lenses for specialized applications. Our applications engineers will help you determine the proper field-of-view, focal length, lens speed (f-stop), and size (image sensor format) for your application.

SYNC OPTIONS

The standard sync board contains a RS-170 crystal-controlled oscillator to generate a 14.31818 MHz reference frequency. A sync generator IC shapes the repetitive timing pulses used to control the movement of charge frames on the sensor board. This board also contains circuits to generate blanking, clamp, and sync pulses. These signals combine with the video signal on the video board to produce composite monochrome video.

The genlock board contains additional circuits to receive external input signals, including composite video, composite sync, and horizontal and vertical drive. These inputs are processed and supplied as reference signals to the genlock oscillator. In the absence of an externally applied signal, the camera is either crystal locked or line locked, depending on the position of the crystal/line lock jumper. In the Line-Lock Mode, the camera synchronizes to an external 60 Hz reference derived from the AC power line. In the RS-170 Crystal Mode, the internal crystal-controlled oscillator provides back-up. The H and V Drive Input option allows the camera to synchronize to externally supplied horizontal- and vertical-drive signals.

SPECIAL FEATURES

Cohu welcomes the opportunity to provide special features to better serve your particular application. Some examples of special features include a 10dB S/N increase for 60dB total signal-to-noise ratio; custom painting, silk screen and logo; remote head with 6' cable; imager faceplate removal for laser applications; imager tilt with customer-specified degree; and special connector pin configurations. Please contact Cohu for other special features.



5755 Kearny Villa Road • San Diego, CA 92123
Phone: (619) 277-6700 • FAX: (619) 277-0221

COHU
Cohu, Inc./Electronics Division

**MICROLENS SENSOR
TECHNOLOGY!**

HIGH PERFORMANCE MONOCHROME CCD CAMERA

4910 SERIES

**High Resolution
1/2" On-Chip-Microlens Interline Transfer**

The 4910 Series High Performance Monochrome 1/2" CCD Cameras from Cohu offer high resolution and high sensitivity for use in a broad range of security/surveillance, scientific, and industrial video applications.

The 4910 Series cameras feature a 1/2"-format on-chip microlens sensor, which reduces dark current, lag, and blooming, while improving dynamic range and spectral characteristics. For video applications prone to streaking problems, a 1000:1 overload capability allows transmission of clear video signals even when bright incidental light is present in the scene.

The 4910 Series design also incorporates a removable trim plate for side panel access to controls such as gamma, electronic shutter, and gain.

Available in RS-170 and CCIR models, the 4910 Series cameras feature 26 dB of AGC for high sensitivity in low light-level applications. They are rugged, yet lightweight and compact, making them ideal for easy system integration. And 4910 Series cameras are backed by a full two-year warranty.

A leading U.S. manufacturer of closed circuit video cameras and systems for more than 40 years, we welcome requests for special products and complete CCTV systems.

APPLICATIONS

- **Security/Surveillance**
Military Installations
Nuclear Power Plants
Hazardous Waste Management
Traffic Management
Airports
Mass Transit Systems
Radar Tracking Systems
- **Image Processing**
- **Machine Vision**
- **Process Control**
- **Quality Control**
- **Image Analysis**



Cohu 4910 Series Monochrome 1/2" High Performance Interline Transfer CCD Camera

FEATURES AND BENEFITS

- **High Resolution** — for better definition, error-free results
- **Side-Panel Controls** provide convenience and precision
- **1/2" On-chip-microlens Interline Transfer Imager** virtually eliminates overload streaking, improves dynamic range
- **Eight-Speed Electronic Shutter** reduces blurred images of fast-moving objects
- **High Sensitivity** permits operation over a broad range of light levels
- **Choice of Synchronization Options** for greater versatility
- **High Signal-to-Noise Ratio** for clear, noise-free video
- **Asynchronous Reset** provides random vertical reset capability for production line applications
- **Optional Electronic Iris** automatically controls exposure from 1/60 sec. to 1/15,000 sec.
- **Blemish-Free Imager** — no dead pixels
- **Made in U.S.A.** — direct factory support
- **1000:1 Overload Capability** permits incidental light overloads up to ten times that of other CCD cameras
- **No Lag or Image Retention** — provides fast, clean, precise images
- **Zero Geometric Distortion** for consistent corner-to-corner linearity
- **26 dB AGC** for increased sensitivity at low light levels
- **Optional IR Filter**
- **"C" or "CS" Lens Mount** expands your choice of lenses
- **Top or Bottom Mounting** for easy installation
- **State-of-the-Art Design and Construction** for total, solid-state reliability and long life
- **Choice of RS-170 or CCIR Models**
- **Two-Year Warranty**

4910 HIGH PERFORMANCE MONOCHROME CCD CAMERA

ELECTRICAL

Image Area

6.4 x 4.8 mm (corresponding to 1/2" image tube)

Active Picture Elements

RS-170: 768H x 494V

CCIR: 752H x 582V

Imager Type

On-chip microlens sensor interline transfer CCD

Cell Size

RS170: 8.4 x 9.8 microns

CCIR: 8.6 x 8.3 microns

Resolution

RS170: 580 horizontal TVL, ≥ 350 vertical TVL

CCIR: 560 horizontal TVL, 450 vertical TVL

Sensitivity (faceplate) @2850 K

Please see Table 1.

Electronic Shutter

Eight steps from 1/50 or 1/60 to 1/10,000 second (1/50 or 1/60, 1/125, 1/250, 1/500, 1/1,000, 1/2,000, 1/4,000, 1/10,000 second)

Integration

Integration period controllable through external input pulse
Grab pulse output
Field (1/60 or 1/50 second) or Frame (1/30 or 1/25 second) integration selected by internal jumper

Video Output

1.0 V p-p @75 ohms, unbalanced

Gamma

variable 0.45 to 1.0

AGC

26 dB, variable gain

Signal-to-Noise Ratio

≥ 56 dB at gamma 1, gain 0 dB

38 dB at gamma 1, AGC On

Auto Lens

Separate lens video ratio tracks
AGC peak/average adjustment to eliminate AGC/auto lens interaction

Power: +15V, 35 mA maximum

Synchronization

Genlock, revert to variable phase line lock with zero crossing detector

Genlock, revert to crystal

Crystal Lock

H & V Drive

Asynchronous Reset

Internal Clock Speeds

RS170: 28.6363 MHz

CCIR: 28.375 MHz

Power Requirements

12V ac or dc (standard)

24V ac or dc (optional)

115V ac (optional on RS-170 models, includes wall transformer and connector)

230V ac (optional on CCIR

models, includes wall transformer and connector)

4.2 watts dc power consumption

LED Power Indicator, Green

MECHANICAL

Dimensions (less lens)

Please see Figure 1.

Weight (less lens)

18.5 ounces (0.52 kg)

Lens Mount

"CS" mount, 16mm format

"C" mount with adapter (furnished)

Camera Mounts

1/4 - 20 threaded holes, top and bottom

Connectors

Video (BNC)

Power (2 circuit screw terminal)

Lens (3 pin Mini-DIN)

External Sync (8 pin DIN)

Pin 1. External Vertical Trigger In

Pin 2. External Sync/Horizontal

Trigger In

Pin 3. Grab Pulse Out (-)

Pin 4. Ground

Pin 5. Ground

Pin 6. Vertical Reset In

Pin 7. Grab Pulse Out (+)

Pin 8. Integrate Input

ENVIRONMENTAL

Ambient Temperature Limits

Operating: -20 to 60°C (-4 to 140°F)

Storage: -30 to 70°C (-22 to 187°F)

Humidity

Up to 95% relative humidity

Vibration

Sine vibration from 10 to 2,000 Hz, 5G peak, all 3-axis, 1/2 hour per axis per MIL-E-54007, para.

3.2.24.5.1.2, fig. 2, curve IIIA.

Random vibration from 10-2,000 Hz, 11G RMS all 3-axis, 1/2 hour per axis, meets MIL-E-5400T, para 3.2.24.5.1.2A, category 6.

Shock

Up to 15 G in any axis under nonoperating conditions.

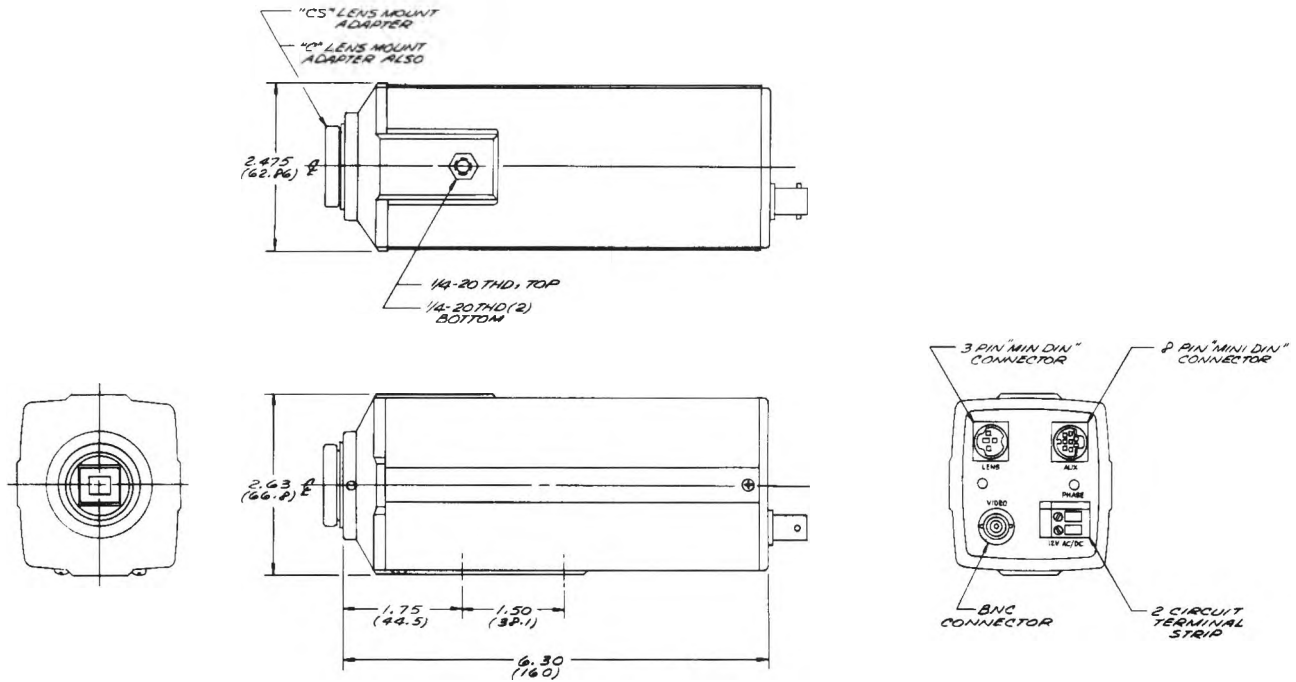
SENSITIVITY

	Full Spectrum	With IR Filter
Full Video, No AGC	0.065 fc (0.65 lux)	0.25 fc (2.5 lux)
80% Video, AGC On	0.002 fc (0.02 lux)	0.01 fc (0.1 lux)
30% Video, AGC On	0.0004 fc (0.004 lux)	0.0015 fc (0.015 lux)

Table 1

This model has been tested and found to comply within the FCC limits for Class "B."

4910 SERIES DIMENSIONS



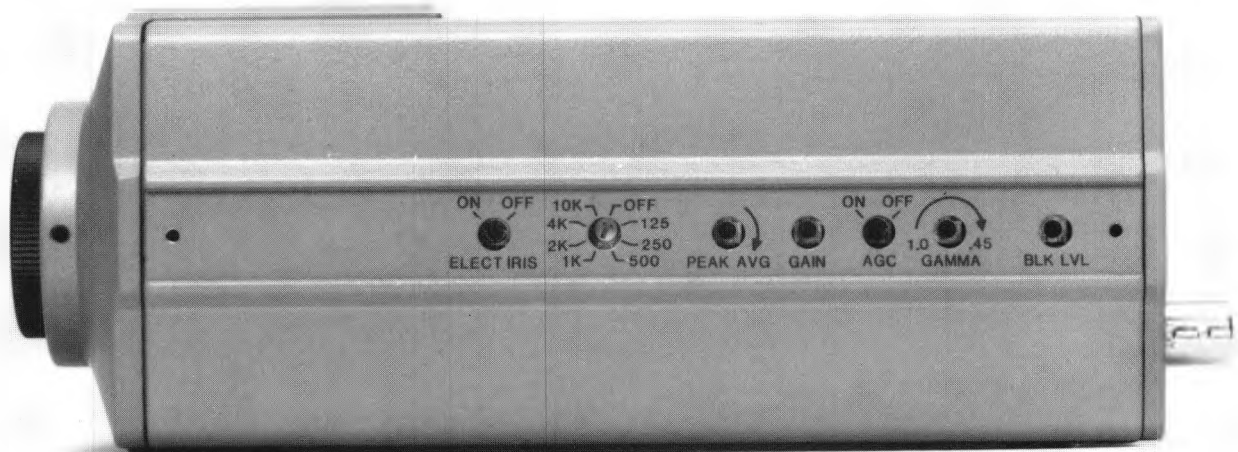
NOTE: DIMENSIONS IN INCHES (MM)

Figure 1

SIDE PANEL CONTROLS

An easily removable trim plate allows access to the following side-panel controls:

- Electronic Iris ON/OFF
- Eight-Step Shutter Timing
- AGC Peak/Average
- Gain
- AGC ON/OFF
- Gamma
- Black Level



4910 SERIES HIGH PERFORMANCE MONOCHROME CCD CAMERA

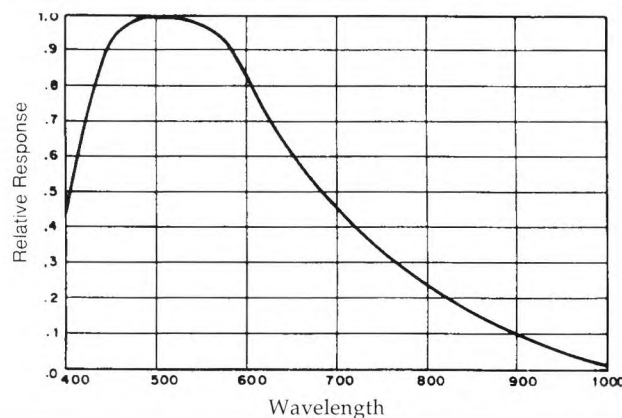
ORDERING INFORMATION

491X— X X X X / XXXX

Power Options	Sync Options	Optical Filters	Options	Module Options	Lens Options
2 12V ac or dc 3 230V ac, 50 Hz, with ac wall adapter (CCIR Models) 4 24V ac or dc 5 115V ac, 60 Hz, with ac wall adapter (RS-170 Models)	2 Genlock* (revert to crystal) RS-170 3 Genlock* (revert to variable phase line lock) RS-170 4 Asynchronous Reset RS-170 5 Genlock* (revert to crystal) CCIR 6 Genlock* (revert to variable phase line lock) CCIR 7 Asynchronous Reset CCIR * Genlock can be composite sync or separate H & V Drive	0 None 1 IR Filter (Non-removable)	0 None (Standard TV Rate) 1 Frame Mode 3 Electronic Iris* * Electronic Iris option is designed for use with manual iris lenses only. With this option, the camera operates in the field integration mode. Use of the electronic iris defeats electronic shutter positions	0 None.	Manual Iris, CS Mount A003 3.7mm, f/1.6, 1/2" A006 6mm, f/1.4, 1/2" A013 12mm, f/1.4, 1/2" Manual Iris, C Mount *AL04 4.5mm, f/2.0, 2/3" *AL08 8mm, f/1.4, 2/3" AL16 16mm, f/1.4, 2/3" AL25 25mm, f/1.4, 1" AL50 50mm, f/1.4, 1" AL75 75mm, f/1.8, 1" * Wide Angle Auto Iris, CS Mount EH04 3.7mm, f/1.6, 1/2" EH06 6mm, f/1.4, 1/2" EH13 12mm, f/1.4, 1/2" Auto Iris, C Mount ES04 4.2mm, f/1.8, 1/2" ES05 4.8mm, f/1.8, 2/3" ES08 8mm, f/1.4, 2/3" ES12 12.5mm, f/1.4, 2/3" ES16 16mm, f/1.4, 2/3" ES25 25mm, f/1.4, 1" EH35 35mm, f/1.4, 2/3" ES50 50mm, f/1.4, 1" EH75 75mm, f/1.8, 1" Please consult factory for other lens selections.

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SPECTRAL RESPONSE



**Performance and
Reliability!**

HIGH-PERFORMANCE MONOCHROME ENVIRONMENTAL CCD CAMERAS

4940 SERIES

**High Resolution
1/2" On-Chip Microlens Sensor**

The 4940 Series High Performance Monochrome Environmental CCD Cameras from Cohu combine advanced video technology and rugged reliability for peak performance in harsh-environment security/surveillance applications.

The 4940 Series cameras feature a high-sensitivity on-chip microlens interline transfer imager, which reduces dark current, lag, and blooming while improving dynamic range and spectral characteristics. For video applications prone to streaking problems, a 1000:1 overload capability allows transmission of clear video signals even when bright incidental light is present in the scene.

The 4940 Series High Performance Monochrome CCD Cameras' 4.5" sealed and pressurized environmental housing provides maximum protection against rain, snow, dust, humidity, chemical pollutants, extreme temperatures, and other hazards.

Optional features include a fiber optic transmitter and a programmable source ID generator. An internal heater for low temperature operation is standard on all 115V models.

The 4940 Series High Performance CCD cameras are backed by a full two-year warranty. Cohu welcomes requests for special products and complete CCTV systems.

APPLICATIONS

- **Intelligent Vehicle-Highway Systems/Traffic Management**
- **Mass Transit Systems**
- **Security/Surveillance**
- **Military Installations**
- **Airports**
- **Industrial Process Monitoring**
- **Nuclear Power Plants**
- **Hazardous Waste Management**
- **Radar Tracking Systems**



Cohu 4940 Series High Performance Monochrome Environmental CCD Camera

FEATURES AND BENEFITS

- **Sealed, Pressurized Environmental Housing** protects against harsh environmental conditions
- **On-Chip Microlens Interline Transfer Imager** improves sensitivity, virtually eliminates overload streaking, and improves dynamic range.
- **High Resolution** — for better definition, error-free results
- **High Sensitivity** permits operation over a broad range of light levels.
- **Choice of Synchronization Options** for greater versatility
- **High Signal-to-Noise Ratio** for clear, noise-free video
- **Optional Fiber Optic Transmitter and Source I.D. Generator**
- **Made in U.S.A.** — direct factory support
- **Two-Year Warranty**
- **Internal Heater** for low temperature operation
- **1000:1 Overload Capability** permits incidental light overloads up to ten times that of other CCD cameras.
- **No Lag or Image Retention** — provides fast, clean, precise images
- **Zero Geometric Distortion** for consistent corner-to-corner linearity
- **26 dB AGC** for increased sensitivity at low light levels
- **Optional IR Filter**
- **"C" or "CS" Lens Mount** expands your choice of lenses.
- **State-of-the-Art Design and Construction**

4940 SERIES HIGH PERFORMANCE MONOCHROME CCD CAMERA

SPECIFICATIONS

ELECTRICAL

Image Area

6.4 x 4.8 mm (corresponding to 1/2" image tube)

Active Picture Elements

RS-170: 768H x 494V

CCIR: 752H x 582V

Imager Type

On-chip microlens sensor interline transfer CCD

Cell Size

RS170: 8.4 x 9.8 microns

CCIR: 8.6 x 8.3 microns

Resolution

RS170: 580 horizontal TVL, 350 vertical TVL

CCIR: 560 horizontal TVL, 450 vertical TVL

Sensitivity (faceplate) @2850 K

Please see Table 1.

Electronic Shutter*

Eight steps from 1/50 or 1/60 to 1/10,000 second (1/50 or 1/60, 1/125, 1/250, 1/500, 1/1,000, 1/2,000, 1/4,000, 1/10,000 second)

Video Output

1.0 V p-p @75 ohms, unbalanced

Gamma

Variable 0.45 to 1.0

AGC*

26 dB, variable gain

Signal-to-Noise Ratio

≥56 dB at gamma 1, gain 0 dB

38 dB at gamma 1, AGC On

Auto Lens

Separate lens video ratio tracks
AGC peak/average adjustment to eliminate AGC/auto lens interaction
Power: +15V, 100 mA maximum

Synchronization

Genlock, revert to variable phase adjustable line lock with zerocrossing detector

Genlock, revert to crystal

Crystal Lock

Internal Clock Speeds

RS170: 28.6363 MHz

CCIR: 28.375 MHz

Power Requirements

12V ac, 50/60 Hz

24V ac, 50/60 Hz

115V ac, 50/60 Hz

230V ac, 50/60 Hz

Power Consumption (by module)

4.2 watts camera

40 watts heater

1.5 watts lens

MECHANICAL

Dimensions

Please see Figure 1.

Weight (less lens)

10.8 pounds, (4.9 kg)

Lens Mount

"CS" mount, 16mm format

"C" mount with adapter (furnished)

Housing Mount

1/4-20 threaded holes

Connectors

Please see Figure 1.

ENVIRONMENTAL

Ambient Temperature Limits

Operating:

-20 to 60 °C (-4 to 140 °F);

-40 to 60 °C (-40 to 140 °F) with heater

Storage:

-30 to 70 °C (-22 to 157 °F)

Humidity

Up to 100% relative humidity

Vibration

Sine vibration from 5 to 60 Hz with 0.082 inches total excursion (15 g's @ 60 Hz). Random vibration from 60 to 1,000 Hz, 5 g's rms (0.027g²/Hz without damage).

Shock (less lens)

Up to 15 g's, 11ms, in any axis under nonoperating conditions, MIL-E-5400T, paragraph 3.2.24.6

Altitude

Sea level to equivalent of 3,000m/10,000 feet (508mm/20 inches of mercury)

Air Contaminants

Withstands exposure to sand, dust, fungus, and salt atmosphere, per MIL-E-5400T, paragraph 3.2.24.7, 3.2.24.8, and 3.2.24.9

Explosion

MIL-E-5400T, paragraph 3.2.24.10

Acoustic Noise

Can withstand environments greater than 150 dB continuously for 30 minutes

EMI

FCC rules, Part 15, Subpart J, for Class A devices

Shock

Up to 15 g's in any axis under nonoperating conditions, MIL-E-5400T, paragraph 3.2.24.6

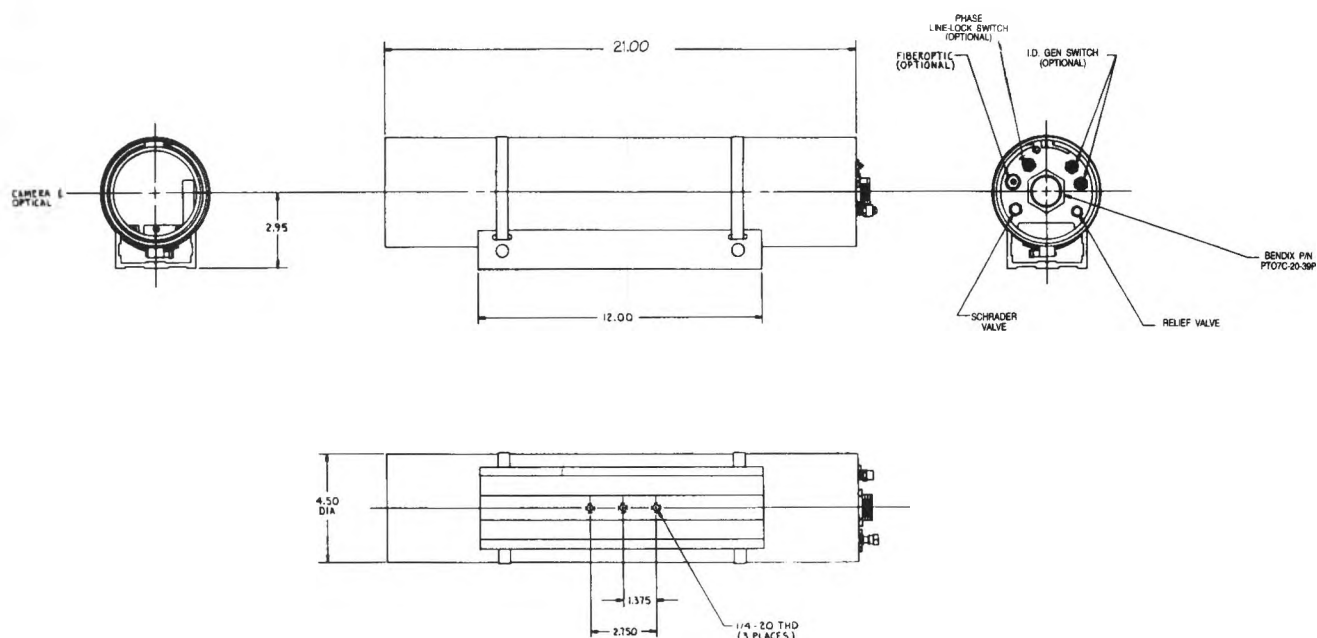
SENSITIVITY

	Full Spectrum	With IR Filter
Full Video, No AGC	0.065 fc (0.65 lux)	0.25 fc (2.5 lux)
80% Video, AGC On	0.002 fc (0.02 lux)	0.01 fc (0.1 lux)
30% Video, AGC On	0.0004 fc (0.004 lux)	0.0015 fc (0.015 lux)

Table 1

This model has been tested and found to comply within the FCC limits for Class "B."

4940 SERIES DIMENSIONS



NOTE: DIMENSIONS IN INCHES (MM)

Figure 1

CONNECTOR CONFIGURATIONS

Pin	Function
A	12/24V ac in
B	Reserved for Position Reference Return
C	75 Ω Sync Termination
D	Reserved for Focus Position
J	Video Ground
K	Video Out
L	Ground (Overall Cable Shield)
M	External Sync In
N	Ground (Sync Coax Shield)
P	Ground (Lens Conductors Shield)
R	Zoom In
S	Focus In
T	Iris In
U	Ground (Zoom, Focus, Iris Common)
V	115V ac Camera Power, 60 Hz, Low
W	115V ac Camera Power, High
X	AC Ground
Y	Reserved for Zoom Position
Z	Ground
b	Reserved for Position Reference
c	Auto/Manual Iris Select
d	12/24V ac In
e	RXD (Programmable ID Generator)
f	Ground
h	TXD (Programmable ID Generator)
i	TXD (Programmable ID Generator)
k	Ground (Programmable ID Generator)
m	Heater Power, 115V ac Low
n	RXD (Programmable ID Generator)
r	Heater Power, 115V ac High

PROGRAMMABLE SOURCE ID GENERATOR

The optional Programmable Source ID Generator is a built-in electronic circuit which allows written messages to be superimposed over images displayed on CCTV monitors. Using a computer and RS-422 serial communication, a user types messages that will then appear on the monitor. Text is made up of block letters 28 horizontal TV lines in height. The letters are white with a black outline for maximum legibility. There are two modes of operation, as follows:

1. ID Mode: Up to two lines of text (24 characters per line, including spaces) can be stored in non-volatile memory. Text can be placed at the top or bottom of the monitor screen, and can be updated from a computer or a dumb terminal, making this a real-time updatable programmable ID generator. Stored text, which typically provides information such as the location of individual cameras in multi-camera systems, will be continuously displayed until it is updated.

2. Menu Mode: In this mode, up to 12 lines of 24 characters can be entered into volatile memory without affecting data stored in the ID Mode. A computer is required to enter data in this mode.

Special cables or connectors are available for programming the Programmable Source ID Generator. Please consult factory for details.

4940 SERIES HIGH PERFORMANCE MONOCHROME CCD CAMERA

ORDERING INFORMATION

494X — X X X / XXXX

Power Options*

- 2 12V ac, 50/60 Hz
- 3 230V ac, 50/60 Hz**
- 4 24V ac, 50/60 Hz
- 5 115V ac, 50/60 Hz

* Heater for Low Temperature Operation is standard on 115V models. Heater on 12V and 24V models is a special order feature. Please consult factory.

**Please consult factory for availability.

Sync Options & Video Format

- 2 RS-170 Genlock (revert to crystal)
- 3 RS-170 Genlock (revert to phase adjustable line lock)
- 5 CCIR Genlock (revert to crystal)
- 6 CCIR Genlock (revert to phase adjustable line lock)

Optical Filters

- 0 None
- 1 IR Filter (non-removable)

Camera Options

- 0 Standard TV Rate (Field Integration Mode)

Module Options

- 0 None
- 1 Fiber Optic Transmitter
- 2 Programmable I.D. Generator
- 3 Programmable I.D. Generator and Fiber Optic Transmitter (See notes on page 3.)

Lens Options

Auto Iris, CS Mount
EH04 3.7mm, f/1.6, 1/2"
EH06 6mm, f/1.4, 1/2"
EH13 12mm, f/1.4, 1/2"

Auto Iris, C Mount
ES04 4.2mm, f/1.8, 1/2"
ES05 4.8mm, f/1.8, 2/3"
ES07 8mm, f/1.4, 2/3"
ES08 8mm, f/1.4, 2/3"
ES12 12.5mm, f/1.4, 2/3"
ES13 12mm, f/1.2, 1/2"
ES16 16mm, f/1.4, 2/3"
ES25 25mm, f/1.4, 1"
EH35 35mm, f/1.4, 2/3"
ES50 50mm, f/1.4, 1"
EH75 75mm, f/1.8, 1"

Zoom Lenses
Z06R 6:1, f/1.0, 1/2"
***P06R** 6:1, f/1.0, 1/2"
Z10S 10:1, f/1.2, 1/2"
***P10S** 10:1, f/1.2, 1/2"
***Note:** These lenses include follower pots.

Please consult factory for other lens selections.

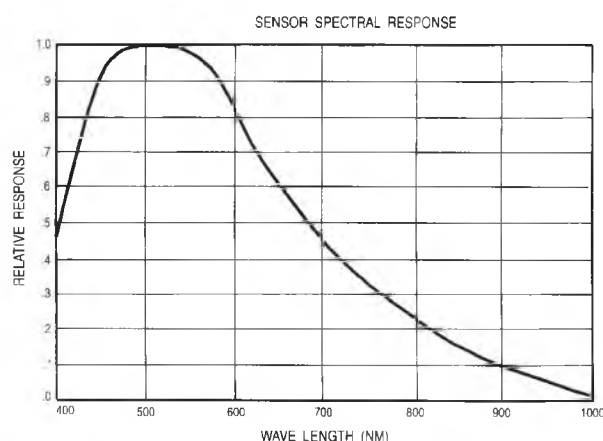
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NOTES ON STANDARD FEATURES

Electronic Shutter: Internal switches select shutter speeds or the number of integration fields, and enable or disable the external ON/OFF control of the internally-selected shutter or integration mode. These switches are set at the factory prior to sealing and pressurizing the environmental housing. The standard factory settings disable the external ON/OFF control and provide 1/60 second shutter speed. The switches can be set differently at the factory to customer specifications, or in the field by removing the camera from the housing.

AGC Peak/Average adjustment is made via an internal control, which is set at 0.45 at the factory prior to sealing and pressurizing the environmental enclosure. Customer may specify different setting.

SPECTRAL RESPONSE



ISO-9001 Certified

Cohu, Inc./Electronics Division

5755 Kearny Villa Road • San Diego, CA 92123

Telephone: (619) 277-6700 • FAX: (619) 277-0221



COHU
 Cohu, Inc./Electronics Division



ADVANCED
VIDEO
TECHNOLOGY
Made in the U.S.A.

FIRST GENERATION INTENSIFIED MONOCHROME CCD CAMERA

5510 SERIES

**High Reliability, High Sensitivity,
For Low Light Level Applications**

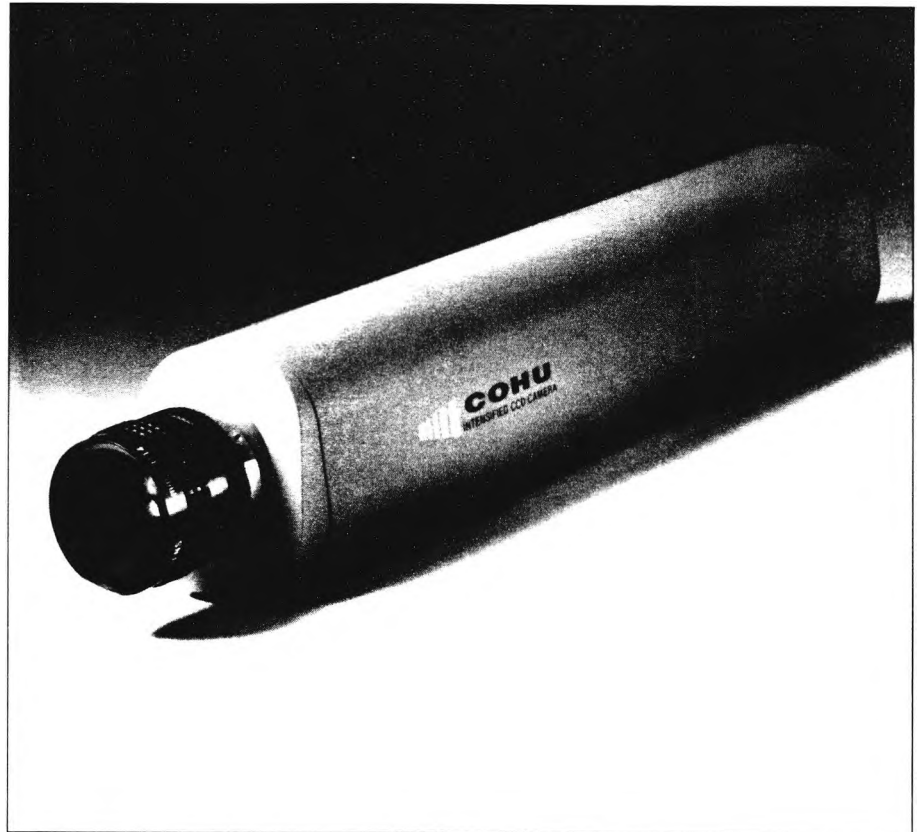
Designed for reliable, long-life operation in applications characterized by low light levels, the 5510 Series first generation intensified CCD camera provides a number of advantages over SIT cameras traditionally used for LLL applications.

The 5510 Series Intensified CCD (ICCD) camera uses a first generation image intensifier which is fiber-optically coupled to the CCD image sensor to provide clear images, even when a scene illumination is extremely limited.

When compared to high-maintenance SIT cameras, the 5510 Series ICCD camera offers significantly greater dependability because the camera employs a solid-state CCD image sensor. The camera is also smaller, consumes less power, and exhibits less lag than an SIT camera.

The 5510 camera is available in standard, as well as in sealed, pressurized environmental housings.

Designed and manufactured in the U.S.A., the 5510 Series is the ideal camera for economical, reliable, low light level video requirements.



Cohu 5510 Series Intensified Monochrome CCD Camera

FEATURES AND BENEFITS

- **High Sensitivity** improves image in low light levels.
- **Low Lag** for fast, clean, precise images.
- **High Signal-to-Noise Ratio** provides better dynamic range
- **Low Power Consumption** for flexible system integration, energy savings, and minimal dissipation.
- **Selectable AGC** allows better control under varying light conditions.
- **Made in U.S.A.** - direct factory support.
- **High Resolution** for sharper images.
- **Auto Black** for contrast enhancement.
- **Adjustable C Mount** for maximum adaptability.
- **Suitable Replacement for SIT Cameras**
- **RS-170 and CCIR Models**
- **Solid State Design** for long life and reliability.
- **Available in sealed, pressurized environment-resistant housings** for use in outdoor and hostile environments.

APPLICATIONS

- **Security/Surveillance**
 - Airports
 - Mass Transit
 - Power Plants
 - Military Installations
- **Microscopy**
- **Medical Imaging**
- **Machine Vision**
- **Image Processing**

Designed and manufactured in U.S.A.

COHU
Cohu, Inc./Electronics Division

5510 SERIES FIRST GENERATION INTENSIFIED CCD CAMERA

SPECIFICATIONS

ELECTRICAL

IMAGE INTENSIFIER

18 mm. Gen 1. electrostatic demagnifying 1" input image format

Geometric Distortion

≤ 6% within a circle not to exceed picture height

Spectral Response

S 25

IMAGER

Frame transfer CCD, 1/2" format

Active Picture Elements

RS-170: 739(H) x 484(V)

CCIR: 699(H) x 576(V)

Cell Size

RS-170: 8.5μm(H) x 19.5μm(V)

CCIR: 9.2μm(H) x 16.8μm(V)

GENERAL

Resolution (TV lines)

RS170: 480 horizontal, 350 vertical

CCIR: 460 horizontal, 400 vertical

Sensitivity

2854 K faceplate illumination.

80% video: 0.00005 fc. No

AGC: 5 x 10⁻⁴. With 6dB gain: 2.5 x 10⁻⁴

Usable picture: 0.000015 fc at 30% video

Gamma

0.5 or 1.0 jumper selectable

Auto Black

Maintain set-up level at 7.5±5 IRE units if picture contains at least 10% black

Signal-to-Noise Ratio @25°C

42 dB, unweighted, with AGC off and high voltage low, at .005 fc faceplate illumination (typical)

AGC

>20 dB, jumper selectable on/off

Auto Lens Drive Signal

Peak-average characteristic tracks AGC adjustment to eliminate AGC/auto lens interaction

Synchronization

EIA RS-170 crystal, 14.31818 MHz (or CCIR crystal 13.375 MHz)

clock output (standard)

Genlock, external sync with crystal or zero crossing linelock back-up (jumper selectable)

Linelock

External H & V drive

Video Output

1.0 V p-p @75 ohms, unbalanced

Power Requirements

AC or DC 12V ±10% or 24V ±10%

AC 115V ±10% or 230V ±10% with wall transformer

ENVIRONMENTAL

Ambient Temperature Limits

Operating: -10 to 50 °C
(14° to 122° F)

Storage: -30 to 60 °C
(-22° to 140° F)

Altitude

Sea level to equivalent of 3,048m/10,000 feet (508mm/20 inches of mercury)

Humidity

Up to 95% relative humidity

MECHANICAL

Weight (less lens)

Less than 2.5 lbs

Dimensions

11.78" (L) x 2.30" (W) x 2.72" (H)

Lens Mount

"C" mount

Connectors

BNC connector - Video Out

Switchcraft TB4M - Lens Drive

Switchcraft TB3M - Power In

Hirose SR30-10R-7S - Auxiliary

Camera Mount

1/4 - 20 threaded holes

ORDERING INFORMATION

55X

Housing

X

Power Options

— X

Sync Options

X

Optical Filter

X

Option Boards

X

Format

/ XXXX

Lens Options

1 General Purpose

2 12V ac/dc 60Hz

3 230V ac 50 Hz

4 24V ac/dc 60Hz

5 115V ac 60 Hz

2 Genlock/Crystal

3 Genlock/Linelock

7 External H & V Drive/Crystal

0 None

00 None

0 RS-170 (EIA)

5 CCIR

0000 None

Auto Iris ND (T-1500)

Spot

EH12 12.5mm, f/1.4

EH25 25mm, f/1.4

EH50 50mm, f/1.4

EH75 75mm, f/1.8

NOTE
6" environmental housings available as special option
Please consult factory

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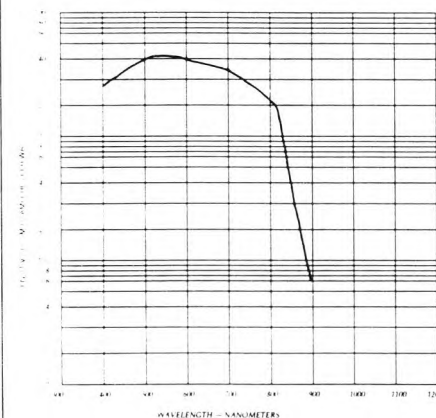
Please consult factory for other lens selections

OPTIONAL FEATURES

SYNC OPTIONS

The genlock board contains circuits to receive external input signals, including composite video, composite sync, and horizontal and vertical drive. These inputs are processed and supplied as reference signals to the genlock oscillator. In the absence of an externally applied signal, the camera is either crystal-locked or line locked, depending on the position of the crystal/linelock jumper. In the Linelock Mode, the camera synchronizes to an external 50 or 60 Hz reference derived from the AC power line. In the Crystal Mode, the internal crystal-controlled oscillator provides back-up. The H & V Drive Input Option allows the camera to synchronize to externally supplied horizontal- and vertical-drive signals.

SPECTRAL RESPONSE



RS-170 MONOCHROME 1/2" CCD CAMERA

6310 SERIES

**High Resolution
High Sensitivity**

Cohu's 6310 Series Monochrome CCD cameras are high performance cameras which employ a unique high resolution frame transfer imager to provide an economical alternative to comparably priced cameras with much lower resolution and sensitivity. They provide high resolution pictures without geometric distortion, lag, or image retention, and sensitivity comparable to that of standard silicon target image tube cameras. These performance features, along with rugged design and low maintenance, make 6310 Series cameras an excellent value for a wide range of security/surveillance applications.

Weighing just 15 ounces, 6310 Series cameras feature 20 dB Automatic Gain Control (AGC) to provide high sensitivity in varying light conditions.

As with all Cohu CCD cameras, 6310 Series cameras are designed and manufactured in the U.S.A. and are backed by a two-year warranty. For assistance in selecting the proper camera for your application, please call Cohu at (619) 277-6700 and ask to speak with one of our experienced Applications Engineers.



Cohu 6310 Series Monochrome CCD Camera

FEATURES AND BENEFITS

- **High Resolution** with 1/2" format frame transfer image sensor with over 350,000 active picture elements
- **High Sensitivity** improves image in low light levels
- **Zero Geometric Distortion** for consistent corner-to-corner linearity
- **No Lag or Image Retention** for fast, clean, precise images
- **Wide Range of Options** for flexible system integration
- **Low Power Consumption** for flexible system integration, energy savings, and minimal dissipation
- **20 dB AGC with Peak-Average Adjustment** for clear images in varying light conditions.
- **High Signal-to-Noise Ratio** provides better dynamic range
- **Auto Black** for contrast enhancement
- **Quality, State-of-the-Art Design and Construction** for total, solid-state reliability and long life
- **IR Sensitive** for use in IR applications.
- **Over 350,000 picture elements**
- **Made in U.S.A.** — direct factory support, parts availability
- **Two-Year Warranty**

APPLICATIONS

- **Security/Surveillance**
 - Government Facilities
 - Environmental Monitoring
 - Power Plants
 - Banks
 - Retail Stores
 - Unmanned Storage Facilities
 - Parking Garages
 - Office Buildings
 - Correctional Facilities
- **Transportation Safety and Control**
 - Bridges and Tunnels
 - Mass Transit
 - Airports and Train Stations
 - Fare Collection Points
- **Teleconferencing**
- **Image Processing**

Designed and manufactured in U.S.A.

COHU

Cohu, Inc. / Electronics Division

ISO-900 Certified

6310 SERIES RS-170 MONOCHROME 1/2" CCD CAMERA

SPECIFICATIONS

ELECTRICAL

Imager

Single CCD using frame transfer method

Pickup Area

6.4 x 4.8 mm (1/2-inch format)

Active Picture Elements

739(H) x 484(V) (frame transfer)

Cell Size

8.5 μ m(H) x 19.5 μ m(V)

Resolution

Horizontal 550 TV lines

Vertical >350 TV lines

Sensitivity

2850 K faceplate illumination.

See Table 1.

Contrast Variation @ 25°C

<15%

Video Output

1.0 V p-p @75 ohms, unbalanced

Gamma

0.5 or 1.0 jumper selectable

AGC

Jumper selectable, On/Off.

Peak-average adjustable 20 dB

Power Consumption

4.2W

Auto Black

Maintain set-up level at 7.5 \pm 5 IRE units if picture contains at least 10% black

Signal-to-Noise Ratio

56 dB at gamma 1, AGC off

8 MHz bandwidth, unweighted

Auto Lens Drive Signal

Peak-average characteristic tracks

AGC adjustment to eliminate

AGC/auto lens interaction.

Synchronization

EIA RS-170 crystal, 14.31818 clock output (standard)

Genlock, external sync with crystal line lock back-up (jumper selectable)

External H & V drive

Power Requirements

AC/DC 12V \pm 10%

ENVIRONMENTAL

Ambient Temperature Limits

Operating: -10 to 50 °C

(14° to 122° F)

Storage: -30 to 70 °C

(-22° to 158° F)

Humidity

Up to 95% relative humidity

Vibration (less lens)

5 to 60 Hz with 0.082 inch total

excursion (15 g's @ 60 Hz). From

60 to 1000 Hz, 5 g's rms random

vibration without damage

Shock (less lens)

Up to 30 g's in any axis under

nonoperating conditions,

MIL-E-5400T, paragraph 3.2.24.6

Altitude

Sea level to equivalent of

3,000m/10,000 feet (500mm/20

inches of mercury)

MECHANICAL

Weight (less lens)

425 grams (15 ounces)

Dimensions

Please see Figure 1.

Camera Mount

1/4 - 20 threaded holes

Lens Mount

"C" mount

Connectors

BNC connector - Video Out

Switchcraft TB4M - Lens Drive

Switchcraft TB3M - Power In

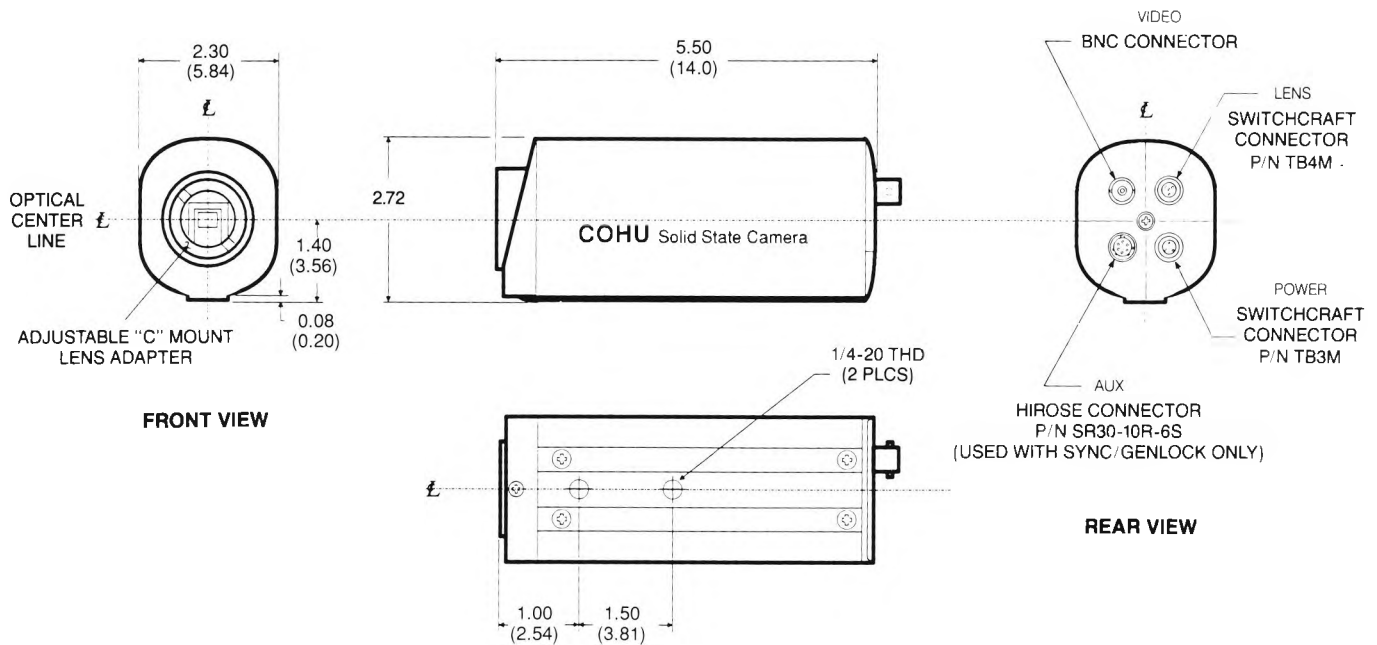
Hirose SR30-10R-6S - Auxiliary

SENSITIVITY

	With IR Filter	Without IR Filter
Full Video, AGC Off	0.40 fc (4.0 lux)	0.03 fc (0.3 lux)
90% Video, AGC On	0.036 fc (0.36 lux)	0.0027 fc (0.027 lux)
Usable Picture (30% Video, AGC On)	0.0012 fc (0.012 lux)	0.0009 fc (0.009 lux)

Table 1

DIMENSIONS

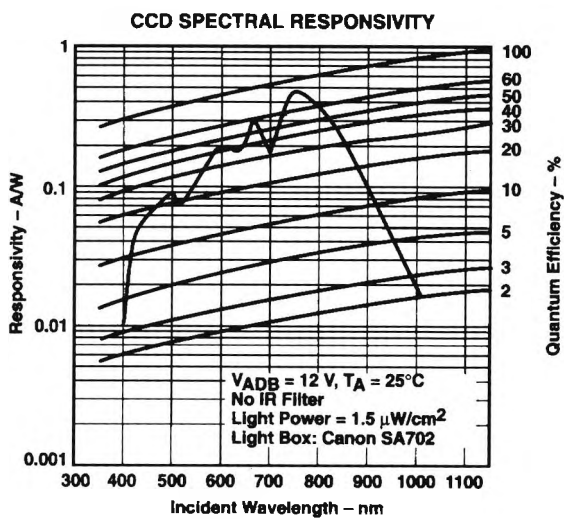


NOTE: ALL DIMENSIONS IN INCHES AND (CM).

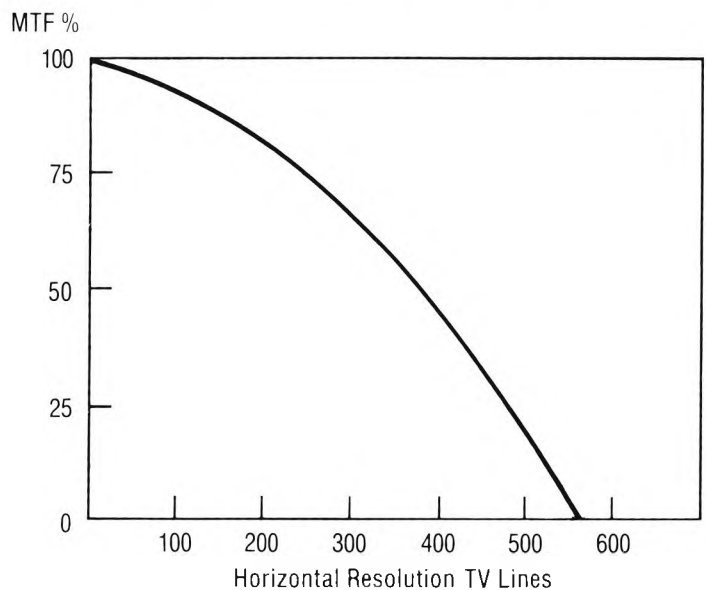
Figure 1.

Cohu 6310 Monochrome CCD Camera

SPECTRAL RESPONSE



MODULATION TRANSFER FUNCTION



6310 SERIES RS-170 MONOCHROME 1/2" CCD CAMERA

ORDERING INFORMATION

631X	— X	X	X	X	— XXXX
Power Options	Sync Options	Optical Filter	Option Boards	Video Format	Lens Options
2 12V ac/dc 5 115V ac, 60 Hz (with ac wall adapter)	2 Genlock (Revert to crystal) 3 Genlock (Revert to linelock) 5 RS-170 Crystal 7 External H & V Drive (Revert to crystal)	0 None 1 IR Filter (See IR transmission curve, below.)	0 None	1 RS-170	Manual Iris, C Mount *AL04 4.5mm, f/2.0, 2/3" *AL06 6.5mm, f/1.8, 2/3" *AL08 8mm, f/1.4, 2/3" A014 12mm, f/1.2, 1/2" AL16 16mm, f/1.4, 2/3" AL26 25mm, f/1.6, 2/3" AL51 50mm, f/2.8, 2/3" * Wide Angle

Auto Iris, C Mount**
ES04 4 2mm, f/1.8, 1/2"
ES05 4 8mm, f/1.8, 2/3"
ES08 8mm, f/1.4, 2/3"
ES13 12mm, f/1.2, 1/2"
ES16 16mm, f/1.4, 2/3"
EH35 35mm, f/1.4 (2/3")

**** Auto iris lens mating
 connectors supplied
 with lens. Those
 customers supplying
 their own auto iris lenses
 must order connector
 separately.**

Please consult factory
 for other lens selections.

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OPTIONAL FEATURES

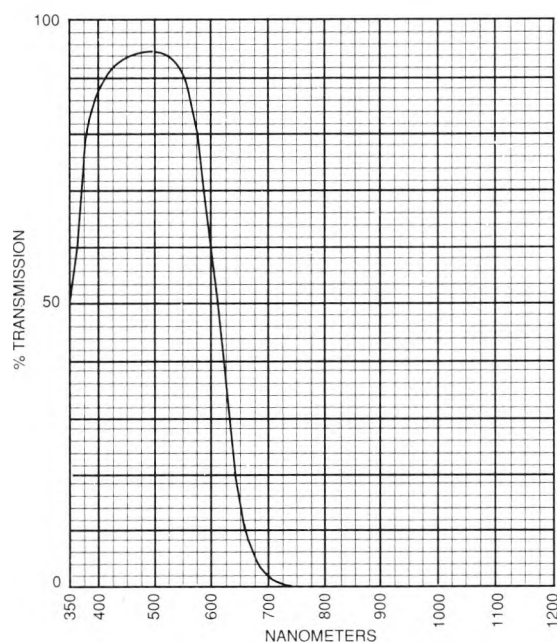
SYNC OPTIONS

The genlock board contains circuits to receive external input signals, including composite video, composite sync, and horizontal and vertical drive. These inputs are processed and supplied as reference signals to the genlock oscillator. In the absence of an externally applied signal, the camera is either crystal locked or line locked, depending on the position of the crystal/linelock jumper. In the Linelock Mode, the camera synchronizes to an external 60 Hz reference derived from the AC power line. In the Crystal Mode, the camera synchronizes to the internal crystal-controlled oscillator. The H&V Drive Input option allows the camera to synchronize to externally supplied horizontal and vertical drive signals.

IR FILTER

The 6310 Series is designed to be IR sensitive. For use in applications with undesirable IR conditions, the optional IR filter will be cut off at 650 nm.

TRANSMISSION OF IR FILTER



PROGRESSIVE SCAN INTERLINE TRANSFER CCD CAMERA

6600 SERIES

The new Cohu 6600 Series progressive scan monochrome camera combines the best features of interline transfer CCD sensors with advanced non-interlaced progressive scan technology.

In progressive scan mode, the camera operates at a 1/30 second rate and outputs the horizontal lines in direct sequential order.

The 6600 Series also provides the fast shuttering, high sensitivity, and anti-blooming qualities of a 1/2" format interline transfer sensor and adds the ability to image an entire frame, in a temporally and spatially coherent format. This reduces motion artifacts due to the sequential imaging of odd and even fields, and eliminates the need for a strobe light to stop action. The sensor employs special on-chip microlens technology for excellent sensitivity and minimal blooming. It utilizes square pixels in a 659 (H) x 494 (V) array. The 1/2" format supports a wide variety of lenses and optical systems.

Integration can be accomplished either by selecting the number of fields (2-16) or time. The number of fields can be internally set or selected by an external command through the auxiliary connector. Control of time is limited only by the viewer's subjective analysis of image quality, and is operated through the auxiliary connector as well.

The 6600 Series camera provides full frame progressive scan with RS-170 signal output. Video output can be interlaced RS-170 through two BNC connectors each operating at 30 frames per second, or progressive scan through one BNC connector at 30 frames per second. Standard interlaced RS-170 or non-interlaced progressive scan monitors are used to display the output signal.

Cohu provides comprehensive video solutions to your imaging requirement. Call us for applications assistance. OEM inquiries are welcome.



The Series 6600 Progressive Scan Camera from Cohu

APPLICATIONS

Its specifications, features, and competitive pricing make the Series 6600 ideal for any application requiring detailed video imaging of a fast moving object. These are just a few of the many applications that will benefit from incorporating progressive scan CCD cameras into an imaging system:

- Machine vision
- Pattern and character recognition
- High speed inspection
- Transportation corridor monitoring
- Radiography
- Food and agricultural inspection
- Bar code scanning

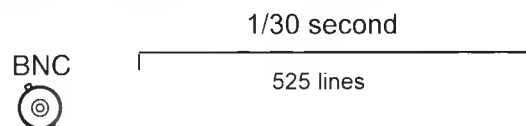
FEATURES AND BENEFITS

- Shutter mode to reduce blurring of moving objects
- Full frame progressive scan
- Automatic gain and exposure control for variable lighting conditions
- Square pixels for precise image measurements
- Asynchronous reset from external pulse for camera reset
- Remote shutter and scan control through Aux. connector
- Simultaneous odd/even frame exposure
- Low noise and high sensitivity
- Integration control via internal switches or through Aux connector

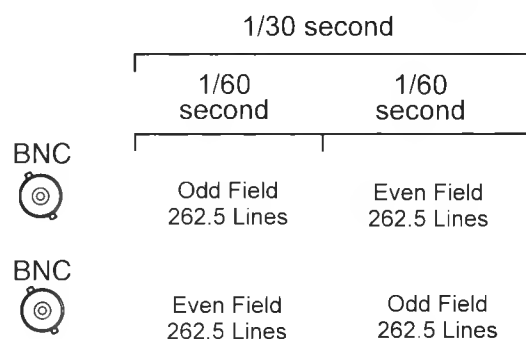
COMPARISON OF PROGRESSIVE SCAN TO INTERLACED FORMATS

The scene displayed on a TV monitor is created by 525 horizontal lines scanned across the screen. The camera producing the scene also has horizontal lines on its image sensor. The difference between the Progressive Scan format and standard Interlaced format is how the lines are provided as an output for use, whether for viewing on a monitor or other purpose. In the progressive scan mode, the lines scan down the screen in sequential order until all lines have appeared. This method occurs in 1/30 second through one connector. In the interlaced mode, the full image is presented in two passes, with each pass called a "field" of 262.5 lines. The odd lines are scanned down the screen, with space left between them for the even lines, followed by a scan of the even lines. Each field is output in 1/60 second through one connector. Using a frame grabber, both fields (odd and even) can be captured at the same time, then output one after the other to provide the full image on the screen. By using both connectors and a two channel frame grabber, it is possible to have odd and even fields available that were integrated in the same 1/60 second period, thus producing a 1/60 second progressive scan. These stored fields can then be output from the frame grabber either as a 525 line sequential (progressive) scan format, or as an interlaced format with two fields of 262.5 lines each.

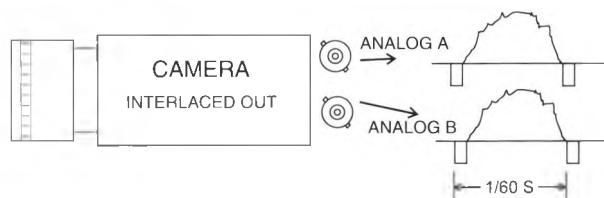
PROGRESSIVE SCAN FORMAT



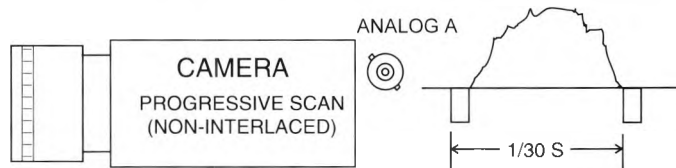
INTERLACED FORMAT



SIGNAL OUTPUT CHARACTERISTICS



This illustration shows 60 frames/second through two connectors. It requires an external frame store device and internal or external sync. This application will capture an image of a fast moving object with high resolution.



This illustration shows 30 frames/second in the progressive scan mode, with output through one connector. Sync is internal or external. Image two fields simultaneously for full vertical resolution.

OPERATING MODE SELECT

Aux Pin 10 / Switch 1	1/30 or 1/60 select	Low/on		High/off	
		1/30 (PROGRESSIVE SCAN)		1/60 (INTERLACED)	
Aux Pin 6 / Switch 5	Internal/external sync	Low/on	High/off	Low/on	High/off
		Internal sync	External sync	Internal sync	External sync
Aux Pin 9 / Switch 2	Normal/Asynchronous reset	Low/on	High/off	Low/on	High/off
		Normal operation	Asynch. reset	Normal operation	Asynch. reset
Switch 4 only	Normal or Direct reset	Default High		Default Low	
		Direct reset		Normal reset	
Switch 3 only	V reset or H&V reset	Low/on		High/off	
		Vertical reset		H&V reset	

Shaded areas designate an unavailable function.

First three function choice rows in table can be enabled either from the auxiliary connector or by internal DIP switches. The bottom two function choice rows are selected only by internal DIP switches.

Low/high refers to the state of related pins on the auxiliary connector. ON/off is the equivalent for the internal switches

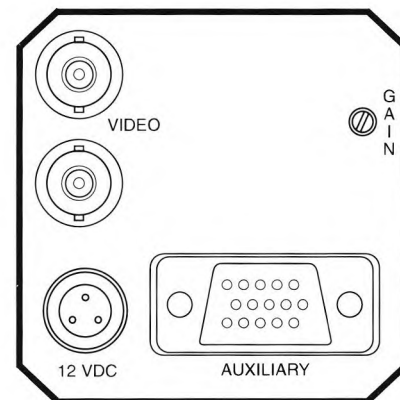
AUXILIARY PIN CONFIGURATION

PIN NO.	NAME	FUNCTION
1	Shutter / Integrate control inputs	Shutter / integration control inputs.
2		Each input has a related internal switch If any internal switch is set ON (low) a control line cannot select high
3		See Shutter / Integration table
4		
5		
6	Internal / external sync	Select sync source: internal or external (H & V external trigger inputs)
7	Integration*	Low state produces integration for duration of being held low
8	Gain control	Input for control of camera gain when an internal switch is set to manual
9	Normal / asynchronous reset	Select normal (internal) or asynchronous reset from an external source (pin 12 on the Aux connector is the trigger input)
10	1/30 or 1/60 select	Select frame rate: 1/30 (non-interlaced) or 1/60 (interlaced)
11	--	Reserved
12	Asynchronous reset	Asynchronous reset input. Triggers on negative-going edge
13	Vertical trigger	Vertical trigger input, ac coupled (Requires external sync mode select)
14	Ground	Ground
15	Horizontal trigger	Horizontal trigger input, ac coupled (Requires external sync mode select)

Note: Pins 1-5 (shutter) and 6, 9, 10 (sync) can be overridden by internal switches that, when set to ON, pull the input low. All pins are inputs, except 11 (not used) and 14 (ground).

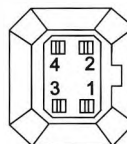
*Use "Shutter Off" for integration controlled by Aux. pin 7.

REAR PANEL CONNECTORS



LENS CONNECTOR

Mating view of pins looking at side of camera



PIN	FUNCTION	
	Auto Iris	Dc Iris
1	+11.3	Damper Low
2	Lens Video	Damper High
3	Ground D	Iris Dc Voltage
4	Ground D	Ground D

SHUTTER/INTEGRATION CONFIGURATION

Function	Aux-pins / Switches					Shutter Speed
	1	2	3	4	5	
Off	x	x	x	high/off	high/off	Shutter off*
Flickerless	x	x	x	low/on	low/on	1/100 s
Shuttering	low/on	low/on	low/on	low/on	low/on	1/10000 s
	high/off	low/on	low/on	low/on	high/off	1/4000 s
	low/on	high/off	low/on	low/on	high/off	1/2000 s
	high/off	high/off	low/on	low/on	high/off	1/1000 s
	low/on	low/on	high/off	low/on	high/off	1/500 s
	high/off	low/on	high/off	low/on	high/off	1/250 s
	low/on	high/off	high/off	low/on	high/off	1/125 s
	high/off	high/off	high/off	low/on	high/off	1/60 s
Integration	low/on	low/on	low/on	high/off	low/on	16 fields
	high/off	low/on	low/on	high/off	low/on	14 fields
	low/on	high/off	low/on	high/off	low/on	12 fields
	high/off	high/off	low/on	high/off	low/on	10 fields
	low/on	low/on	high/off	high/off	low/on	8 fields
	high/off	low/on	high/off	high/off	low/on	6 fields
	low/on	high/off	high/off	high/off	low/on	4 fields
	high/off	high/off	high/off	high/off	low/on	2 fields

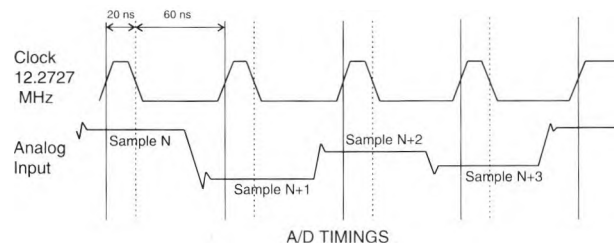
*Shutter is 1/30 s in 1/30 s mode (progressive scan), and 1/60 s in 1/60 s mode (interlaced). Low/on and high/off designates condition of aux connector input/shutter switch (S2 on main board). X designates "don't care." All inputs are pulled high to +5 V; however, any shutter switch set to the (low) overrides the related external input.

6600 SERIES PROGRESSIVE SCAN CAMERA

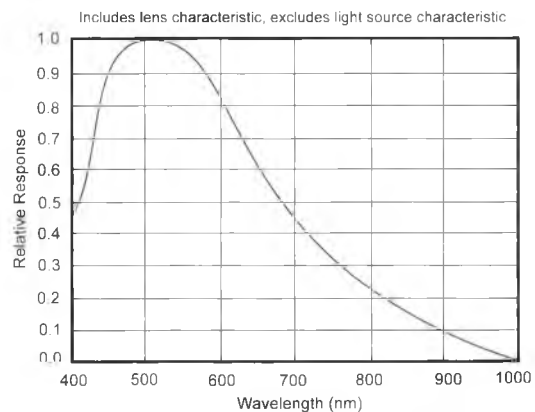
SPECIFICATIONS

Imager	Monochrome, 1/2" format, interline transfer square pixel CCD with pixel array of 659 (H) x 494 (V)
Format	Selectable, interlaced, (RS-170 1 Vp-p) or non-interlaced at 60 frames per second through two connectors, (1 Vp-p), or 30 frames per second through one connector, (1 Vp-p)
Pixels	659 X 494
Resolution	480 (H) x 480 (V) TVL
Cell size	9.9 μ m
Sync	Internal Crystal/async reset, External H&V
Sensitivity	At faceplate. Full video, no AGC: 4 lux; 80% video, AGC on 0.10 lux
Gain	AGC/Manual adjustable up to 30 dB. External control for manual gain
S/N Ratio	Greater than 56 dB (gain 0 dB, gamma 1, in a 0-6 MHz bandwidth)
Gamma	Adjustable .45 to 1.0
Integration	Switch or external selectable 8-step shutter, (1/60 sec. to 1/10,000). External control of shutter mode, shutter speed, H&V, async reset and integration through the Aux. connector
Lens Mount	C/CS
Lens Drive	Switch selectable auto iris drive (video), or DC iris drive. (DC level)
Weight	11 oz. without lens
Power	12 VDC.
Mount	1/4-20 female thread, top and bottom of housing in line with optical axis.
Humidity	Up to 95% relative humidity (non-condensing)
Vibration	Per Mil-STD-810 (E) Method 514.4. Categories 1,4,5,8,9 and 10 (less lens)
Reliability	MTBF: 20,000 hours (less lens)
Shock	No damage to 30 g, 11 ms duration (less lens). No crash hazard to 75 g, 11 ms duration less lens).
Altitude	Sea level to 3,000 meters/10,000 ft. (508 mm/20" Hg.)

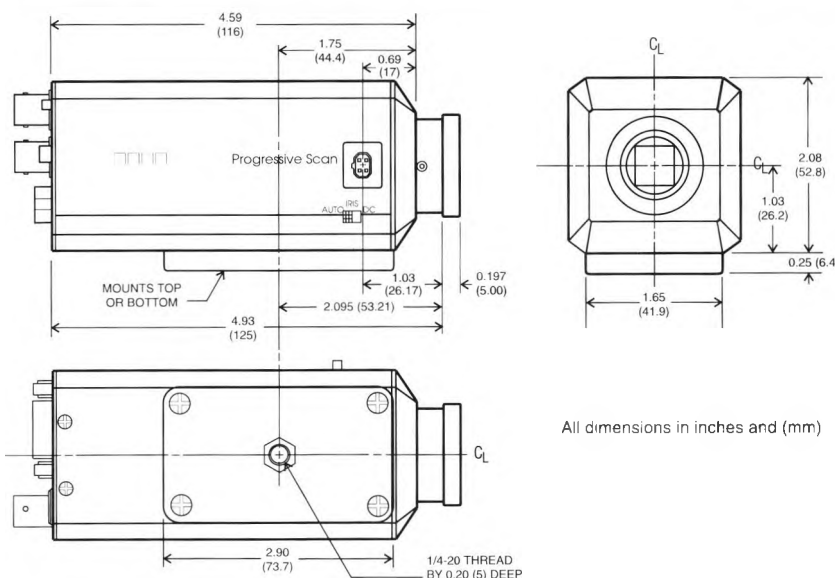
A/D TIMING WAVEFORMS



SPECTRAL RESPONSE



DIMENSIONS



All dimensions in inches and (mm)

ORDERING INFORMATION

Camera

6600 Series Monochrome Progressive Scan Camera. Includes Auxiliary Connector, Power Connector, and Lens Connector
6612-1000/0000

Accessories

12 VDC Power Supply 8368-4

Lenses

This camera supports a wide variety of lenses. Contact your Cohu representative for a full list.



Designed and made in the U.S.A. by
Cohu, Inc./Electronics Div.
P.O. Box 85623 San Diego, CA 92186-5623
Tel: 619/277-6700 Fax: 619/277-0221

COHU



ULTRA-HIGH-RESOLUTION MONOCHROME CCD CAMERAS

8410 & 8420 SERIES

**850 TV Lines Resolution
1134 x 486 Picture Elements**

The 8410 and 8420 Series are *full-frame* frame-transfer RS-170 monochrome video cameras which provide ultra-high-resolution images for a broad range of scientific, industrial, and security/surveillance applications. They employ a unique blemish-free image sensor which provides *true interlace* video output for exceptional picture quality.

Because the 8410 and 8420 Series' image sensor has two independently addressable field memories, the camera can be operated in several different modes. In addition, the frame transfer imager has contiguous pixels. A high-bandwidth video-processing circuit makes full use of the resolution of the imager, while allowing options such as Automatic Gain Control and Auto Black Control.

Independent addressing of each field memory provides flexibility for different modes of operation. In the normal mode, the camera provides true interlace with 486 lines per frame and 1134 pixels per line. After a 1/60-second exposure of the 486 active lines in the imaging area, one field of 243 lines becomes video; the other 243 lines are discarded. A subsequent 1/60-second exposure produces the additional lines to complete the frame.



Cohu 8410/8420 Series High Resolution Monochrome CCD Camera

The low-light sensitivity mode utilizes pseudo interlace by summing two adjacent lines after a 1/60-second exposure time. The alternate summing of lines provides two different fields for each frame, with a 2:1 gain in light sensitivity.

In the dual field mode, both fields are exposed simultaneously for 1/30

second and stored on-chip. This results in a frame with the higher vertical resolution associated with true interlace but without the time-dependent image offset that occurs with normal-mode operation. In this mode, higher sensitivity is achieved at the expense of greater lag.

FEATURES AND BENEFITS

- **High Resolution** — 850 horizontal TV lines for sharper images
- **Over 550,000 Active Picture Elements** — 1134 x 486 array
- **High Sensitivity** permits operation over a wide range of light levels
- **Two Independently Addressable Field Memories** allow full-frame vertical resolution in all modes of operation
- **True Interlace Operation** for true high-resolution images
- **Built-In Blooming Protection** eliminates "washed-out" images caused by bright incidental light
- **Low Power Consumption**
- **Two Year Warranty**
- **Auto Black** for contrast enhancement
- **2/3" Format Blemish-Free Frame Transfer Sensor with Contiguous Pixels**
- **Virtual Phase Sensor Technology** provides high blue response, low dark signal, uniformity and single-phase clocking
- **20 dB AGC with Peak-Average Adjustment** for clear images in varying light level applications
- **Made in U.S.A.** — rugged, reliable design, quality components, direct factory support.

APPLICATIONS

- **Scientific**
Microscopy
Image Processing
Machine Vision
Robotics
Mapping
- **Industrial**
Security/Surveillance
Aerial Recognizance
Transportation Management

8410 & 8420 SERIES ULTRA-HIGH-RESOLUTION CCD CAMERAS

SPECIFICATIONS

ELECTRICAL

Imager

Full-frame frame transfer CCD

Image Area

8.8 x 6.6 mm (2/3" format)

Active Picture Elements

1134(H) x 486(V)

Sensitivity (Full Video, AGC Off)

Normal Mode: 0.035 lux

Low-Light Mode: 0.013 lux

Dual-Field Mode: 0.013 lux

S/N Ratio

45 dB (gamma 1, gain 0 dB,
aperture flat)

Horizontal Resolution

850 TV lines

Vertical Resolution

Normal Mode: 486 lines true
interlace

Dual-Field Mode: 486 lines true
interlace

Low-Light Mode: 350 lines pseudo
interlace

Exposure

Normal Mode: 1/60 second

Low Light Mode: 1/60 second

Dual Field Mode: 1/30 second

Video Output

1.0 V p-p, 75 ohm,
unbalanced

Contrast Variation

<5 %

Gamma

0.5 to 1

AGC

20 dB, peak/average adjustable

Manual Gain

20 dB variable

Auto Black

Maintain setup level at 7.5 ± 5 IRE
units if picture contains at least
10% black

Synchronization

Crystal lock (21.477 MHz), Genlock,
line lock

Power Requirements

+15V dc, 285 mA steady state,

800 mA startup (100ms)

-15V dc, 140 mA steady state,

800 mA startup (100 ms)

5V dc, 205 mA steady state

2500mA startup (100 ms)

(For line lock, 12V ac, 60 Hz,

<1 mA steady state, 1 mA startup)

115V ac, $\pm 10\%$, 60 Hz, with

external power supply

ENVIRONMENTAL

Ambient Temperature Limits

Operating: -20 to 50°C

(-4° to 122°F)

Storage: -30 to 70°C

(-22° to 157°F)

Humidity

Up to 95% relative humidity

Vibration (less lens)

5 to 60 Hz with 0.082 inch total
excursion (15 g's @ 60 Hz). From

60 to 1000 Hz, 5 g's rms random
vibration without damage

Shock (less lens)

Up to 15 g's in any axis under
nonoperating conditions,

MIL-E-5400T, paragraph 3.2.24.6

Altitude

Sea level to equivalent of
3,048m/10,000 feet (508mm/20
inches of mercury)

MECHANICAL

Dimensions

Please see dimensional drawings.

Weight (less lens)

Less than 48 ounces (12 V model)

Lens Mount

"C" mount adapter furnished

Connectors

BNC connector—Video Out

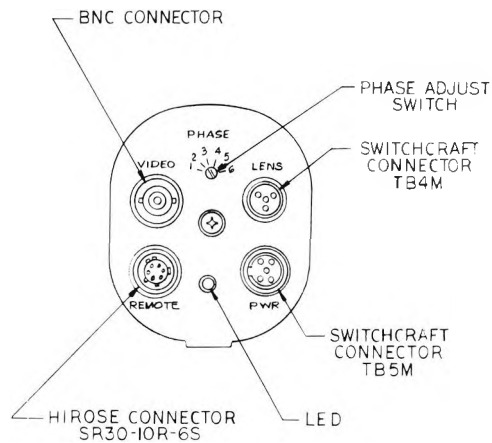
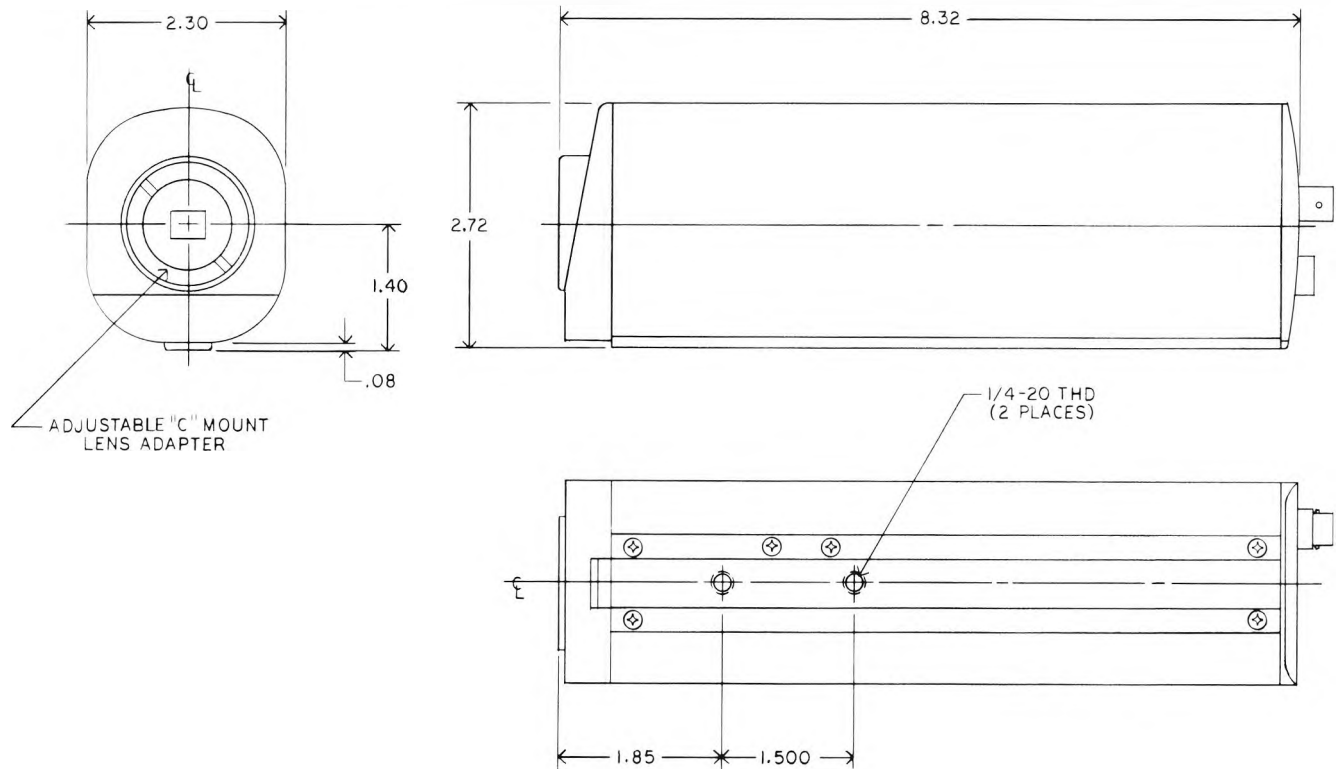
Switchcraft TB5M—Power In

Hirose SR30-10R-6S—Remote

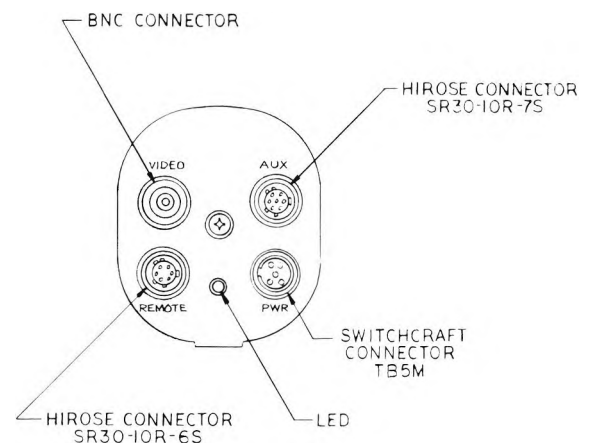
Switchcraft TB4M—Lens Drive
(8410 only)

Hirose SR30-10R-7S—Auxiliary
Output (8420 only)

8410 & 8420 SERIES DIMENSIONS



8410 Series Industrial



8420 Series Scientific

8410 & 8420 SERIES ULTRA-HIGH-RESOLUTION CCD CAMERA

ORDERING INFORMATION

84X	X	—	X	X	X	/ XXXX
Housing Options	Power Options		Sync Options	Optical Filter	Video Format	Lens Options
1 Indoor Industrial	0 Requires external ±15V dc, +5V dc (12V ac for line lock)		2 Genlock (revert to crystal)	0 None	10 RS-170 (EIA)	0000 None
2 Indoor Scientific	5 115V ac with external power supply		3 Genlock (revert to phase adjustable line lock)	1 I.R. Filter (for general use)		Manual Iris Lenses AL09 9mm, f/1.3 (2/3") AL12 12.5mm, f/1.4 (1") AL16 16mm, f/1.4 (2/3") AL25 25mm, f/1.4 (1") AL50 50mm, f/1.4 (1") AL75 75mm, f/1.8 (1")
			4 Phase adjustable line lock	2 I.R. Filter (for microscope use)		Auto Iris Lenses (for use on 8415 Series only) ES08 8mm, f/1.4 (2/3") ES12 12.5mm, f/1.4 (1") ES16 16mm, f/1.4 (2/3") ES25 25mm, f/1.4 (1") ES50 50mm, f/1.4 (1") ES75 75mm, f/1.8 (1")
			5 Crystal			Please consult factory for other lens selections.
			7 External H & V Drive			

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SPECIAL FEATURES

Cohu welcomes the opportunity to provide special features to better serve your particular application. Some examples of special features are: custom painting, silk screen and logo; special filters; and special lens supports and mounting configurations. Please contact Cohu concerning these or other special features.

CONNECTOR CONFIGURATIONS

LENS (8410 ONLY)

1	Lens Video
2	Chassis Ground
3	Power
4	Ground

REMOTE

1	Composite Sync Input
2	Select C (Future)
3	Vertical Reset (Future)
4	Horizontal Reset (Future)
5	Select Low-Light Mode
6	Select Dual-Field Mode
7	Ground

AUX (8420 ONLY)

1	Pixel Clock Output (-)
2	Pixel Clock Output (+)
3	Blanking (+)
4	Blanking (-)
5	Composite Sync Out (+)
6	Composite Sync Out (-)

POWER

1	-15V
2	+15V
3	60 Hz
4	+5V
5	Ground

COLOR
CCD CAMERAS

NEW!

HIGH PERFORMANCE COLOR CCD CAMERA

1300 SERIES

**NTSC/PAL 1/2" On-Chip-Microlens
Interline Transfer Imager**

Cohu's new 1310 Series High Performance Color Cameras offers the ultimate in color vibrancy, picture clarity, and reliability. With a resolution of 460 horizontal lines (450 PAL), and a size measuring only 4" x 2" x 2", the 1300 Series combines the performance edge with a compact size for critical applications such as security, surveillance, and traffic management.

Special on-chip microlens sensor technology dramatically increases sensitivity while reducing blooming. Conveniently located adjustment pots make set up easy and fast. Gain, color balance, and externally-controlled integration setting are available on the back panel. An optional electronic iris feature is available that eliminates the need for an auto iris lens under most lighting conditions.

Designed and manufactured in the U.S.A., the 1300 Series cameras pack traditional Cohu engineering and technology excellence into a small and affordable enclosure. Cohu, Inc./Electronics Division is ISO-9001 certified.

APPLICATIONS

- Surveillance
- Perimeter Security
- Access Control
- Traffic Surveillance
- Bridges and Tunnels
- Inspection and Toll Plaza
- Transportation
- Mass Transit Systems



The Cohu 1300 Series features high performance color video in an exceptionally small enclosure.

FEATURES AND BENEFITS

- On Chip Microlens Interline Transfer Sensor provides high sensitivity and reduces blooming and transfer smear
- High Resolution - up to 460 horizontal TV lines (NTSC) for sharper images
- Small Size - only 4" x 2" x 2"
- Integration - externally controllable for low light imaging
- Standard Auto Iris - Electronic iris and DC iris optional
- Convenient Rear Panel Function Controls for precision adjustment
- High Signal-to-Noise Ratio provides clear, noise-free images
- 1000:1 Overload Capability prevents light overloads that cause blooming
- AGC for clear images in varying light conditions
- Optional crystal genlock or phase adjustable linelock synchronization
- C and CS lens mounts
- Optional top mounting accessory
- Made in U.S.A. - direct factory support
- Two Year Warranty
- Meets FCC Class B requirements

1300 HIGH PERFORMANCE COLOR CCD CAMERA

SPECIFICATIONS

ELECTRICAL

Imager

Single interline transfer CCD with matrix filter (cyan, yellow, magenta, green)

Image Area

6.4 x 4.8 mm (1/2" format)

Active Picture Elements

NTSC: 768 (H) x 494 (V)

PAL: 752 (H) x 582 (V)

Resolution

NTSC: 460 horizontal TV lines

350 vertical TV lines

PAL: 450 horizontal TV lines

415 vertical TV lines

Sensitivity (3200K faceplate illumination)

6.5 lux at full video, AGC off

0.3 lux at 80% video, AGC on

.08 lux at 30% video, AGC on

Shutter

Internal DIP switch, 1/60 to 1/10,000, 8 steps

Electronic Shutter (Optional)

1/60 to 1/15,000 sec. auto-compensates for scene illumination

Integration

Externally controllable 1/60 to 16 sec.

Gamma

0.6

AGC

0-20 dB (on/off), selectable (local/remote)

Signal-to-Noise Ratio

46 dB (AGC off, NTSC with 4.5 MHz filter)

Video Output

Encoded NTSC and PAL, 1 V p-p @ 75 ohms, unbalanced composite,

Auto Lens Output

Controls auto iris lens

DC Iris Option

Controls aspherical lens

Color Balance

Automatic, through-the-lens type, less than 10 IRE units unbalance from 2850 to 5800 K;

Local/Remote Manual White Balance

Synchronization Options

NTSC or PAL, crystal, genlock, or phase adjust linelock

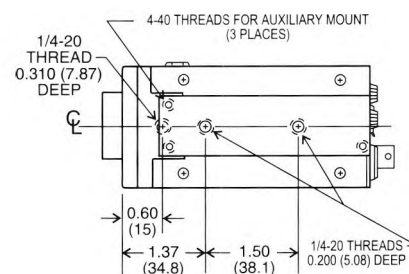
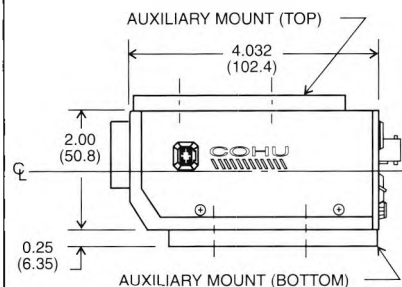
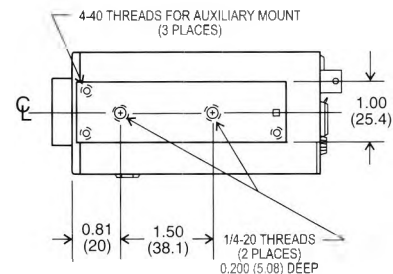
Power Requirements

12 VDC or 12 VAC

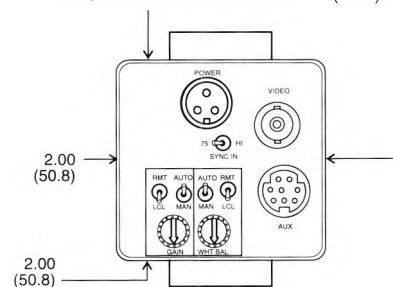
Power Consumption

7.5 W

DIMENSIONS



All dimensions in inches and (mm)



Rear panel enlarged for clarity

ENVIRONMENTAL

Ambient Temperature Limits

Operating: -20° to 50° C, -4° to 122° F

Storage: -30° to 70° C, -22° to 157° F

Humidity

Up to 95% relative, non condensing

Vibration (less lens)

Per Mil-STD-810(E), Method 514.4, Categories 1, 4, 5, 8, 9, 10

Shock (less lens)

No damage to 30 g, 11 ms duration

No crash hazard to 75 g, 11 ms duration

NEW! This camera is available in 3" and 4 1/2" sealed and pressurized environmental enclosures. Contact your Cohu representative for full information.

MECHANICAL

Weight (less lens)

10 oz., (280 g.)

Lens Mount

C/CS standard

Camera Mounts

1/4-20 female, top and bottom

Connectors (NTSC and PAL)

Video Out: BNC

Lens Drive: 4 pin

Power In: 3 pin connector

Remote: 8 pin mini-DIN

Rear Panel Adjustments

AGC on/off/remote

Manual Gain Control

Auto/Manual/Remote White Balance select

Manual White Balance adjust

ORDERING INFORMATION

13X

Configuration

2 - NTSC (60 Hz)

5 - PAL (50 Hz)

X

Power Option

2 - 12 VDC

7 - 12 VAC

-X

Sync

1 - NTSC XTAL

2 - NTSC Genlock

3* - NTSC Phase Adjust LL

5 - PAL XTAL

6 - PAL Genlock

*Requires Power Option 7

X

Iris Options

0 - Auto Iris

3 - Elec. Iris NTSC

4 - DC Iris

5 - Elec. Iris PAL

00

Unassigned

/XXXX

Lens Options

0000 None

Manual Iris/CS

A003 3.7 mm, f1.6, 1/2"

Contact factory for full lens selection.



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COHU
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NEW!

HIGH PERFORMANCE COLOR ENVIRONMENTAL CCD CAMERA

1330 SERIES

**1/2" On-Chip Microlens
Interline Transfer Sensor**

Cohu's 1330 Series is the leader in high resolution, environmentally secure CCD cameras.

The 1330 Series cameras provide 460 TV lines (450 PAL) of horizontal resolution - a significant performance edge for critical applications such as surveillance and traffic management.

Special on-chip microlens sensor technology dramatically increases sensitivity while offering excellent color vibrancy, picture clarity, and reliability.

For video applications prone to streaking problems, the microlens sensor provides a 1000:1 overload capability, which allows transmission of clear video signals, even when bright, incidental light is present in the scene.

The 1330 Series High Performance CCD cameras' sealed and pressurized environmental enclosure provides maximum protection against rain, snow, dust, humidity, chemical pollutants, extreme temperatures, and other environmental hazards. The newly designed housing has 40% less surface area and nearly half the weight of other environmental cameras. This is a significant consideration when a project must factor in wind loading and installation costs. Its redesigned base provides fast, easy mounting to poles and pan and tilts. The standard internal heater protects the camera to -40° F/-40° C without using mechanical fans or blowers. Also standard is an indicator that provides an on-screen notice to the operator should the housing be damaged, causing a loss of pressure. These features are often expensive options on cameras with lesser specifications.

The Cohu 1330 Series color camera is built in the U.S.A. and comes with a 2-year warranty.



The Cohu 1330 Series offers high performance in a small, 3 1/2" diameter housing.

FEATURES AND BENEFITS

- **Superior Resolution** - 460 NTSC/450 PAL horizontal TV lines for sharper images
- **1/2" On-Chip Microlens Interline Transfer sensor** dramatically increases sensitivity and virtually eliminates blooming
- **Low Pressure Indicator** in housing relays message to monitor screen
- **Sealed, Pressurized Environmental Housing** with 5 psi dry nitrogen
- **Improved Mounting Base** installs faster on poles, pan and tilts
- **Two types of sunshields** for top or bottom mount
- **Internal Heater** allows camera to operate in extreme low temperatures
- **NTSC or PAL**
- **Two Year Warranty**
- **Made In U.S.A.** for direct factory support

OPTIONS

- **Programmable Source ID Generator** for detailed messages on monitor screens
- **Fiber Optic Transmitter** for transmission of the video signal over long distances without interference or signal loss
- **Wide Selection of Lenses**
- **Sunshields** for bottom mount (SS-122) or top mount (SS-222)

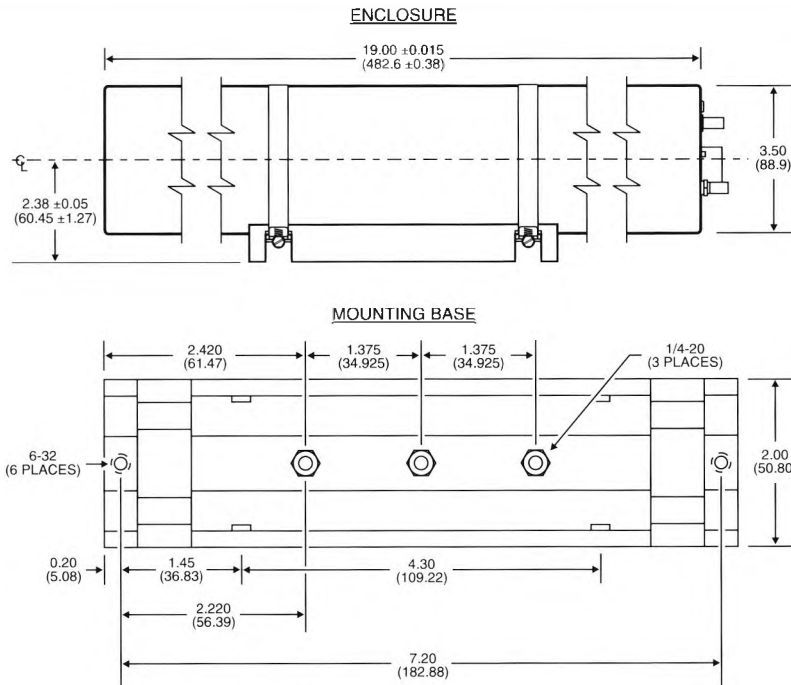
Designed and manufactured in U.S.A.

ISO-9001 Certified

COHU
Cohu, Inc./Electronics Division

1330 SERIES COLOR CCD CAMERAS

DIMENSIONS



ALL DIMENSIONS IN INCHES AND (MM)

MECHANICAL/ENVIRONMENTAL

Weight less lens)

3 lb. (1.35 kg)

Lens Mount

"CS" or "C" mount

Housing Mount

1/4-20 threaded holes, 3 each; Allows enclosure to be rotationally oriented in 90° increments

Purge/Relief Fitting

20 psi relief valve

Ambient Temperature Limits, Operating

-40° to 60° C (-40° to 140° F)

Storage:

-30° to 70° C (-22° to 157° F)

Humidity

Up to 100% relative humidity (per MIL-E-5400T, para. 3.2.24.4)

Vibration (less lens)

MIL-STD-810E, task 5.1.4.1, Categories 1 & 3

Shock (less lens)

Up to 30 g's, 11 ms, in any axis under non operating conditions, MIL-E-5400T, paragraph 3.2.24.6

Regulatory Approvals

FCC Part 15, Subpart J, VDE Class B, enclosure to NEMA 4, IP65, IP66

Withstands exposure to sand, dust, fungus, and salt atmosphere, per MIL-E-5400T, paragraph 3.2.24.7, 3.2.24.8, and 3.2.24.9

ELECTRICAL SPECIFICATIONS

Imager

Single interline transfer CCD with matrix filter (CYMG)

Image Area

6.4 x 4.8 mm (1/2-inch format)

Resolution

NTSC: 460 H x 350 V TVL

PAL: 450 H x 415 V TVL

Picture Elements

NTSC: 768 (H) x 494 (V)

PAL: 752 (H) x 582 (V)

Sensitivity

Full video, AGC off: 6.5 lux

80% video, AGC on: 0.3 lux

30% video, AGC on: 0.08 lux

Gamma

0.6

AGC

0-20 dB

Signal-to-Noise Ratio (AGC Off)

48 dB (NTSC with 4.5 MHz filter)

Video Output

NTSC or PAL 1 V p-p @75

ohms, unbalanced

Auto Lens Operation

Peak-average AGC

adjustment to eliminate

AGC/auto lens interaction

Color Balance

Through-the-lens type,

<10 IRE units unbalanced

from 2850 to >5800 K.

Remote auto/manual white

balance

Synchronization

Genlock or Phase Adjust Line Lock; with controls on rear of environmental housing

Input Power Requirements

115 VAC, 50/60 Hz

230 VAC, 50/60 Hz

Power Consumption

15W, heater off; 35 W, heater on

ORDERING INFORMATION

133X Format	-X Sync	0 NA	X Lens Drive	X Module Option	/XXXX Lens
3- PAL, 230VAC, 50/60 Hz input power	2- Genlock revert to crystal - NTSC	0- Auto iris	0- Auto iris	0- None	Auto Iris
5- NTSC, 115 VAC, 50/60 Hz input power	3- Phase adjust linelock - NTSC	1- DC Iris*	1- DC Iris*	1- Fiber optic xmtr, NTSC	EH04 1/2", 3.7mm, F1.6
	6- Genlock revert to crystal - PAL			2- Programmable ID Generator, NTSC and PAL	EH06 1/2", 6mm, F1.2
	7- Phase adjust linelock - PAL			3- Programmable ID Generator and fiber optic xmtr, NTSC	EH13 1/2", 12mm, F1.4
				8- Fiber optic xmtr, PAL	EH35 2/3", 35mm, F1.4
				9- Programmable ID Generator and fiber optic xmtr, PAL	ES05 2/3", 4.8mm, F1.8
					ES08 2/3", 8mm, F1.4
					ES16 2/3", 16mm, F1.4
					Zoom
					Z06G 1/2", 6:1 zoom, 8-48mm, F1.4

Sunshields: For bottom mount (SS-122), or top mount (SS-222)

ISO-9001 Certified

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COHU
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NEW!

HIGH PERFORMANCE COLOR CCD CAMERA

2200 SERIES

**NTSC/PAL, Y-C, RGB 1/2" On-Chip-
Microlens Interline Transfer Imager**

Cohu's new 2200 Series High Performance Color Cameras offers the ultimate in flexibility, features, color vibrancy, picture clarity, and reliability. With a resolution of 460 horizontal lines (450 PAL), and a size measuring only 4" x 2" x 2", the 2200 Series combines the performance edge with a compact size for industrial and scientific applications such as machine vision, medical analysis, and metrology.

The Model 2200 can offer simultaneous NTSC (or PAL), Y-C, and RGB outputs to simplify image processing and display. Special on-chip microlens sensor technology dramatically increases sensitivity while reducing blooming.

Gain, asynchronous reset, color balance, and externally-controlled integration setting are easily accessed. Optional features include RGB, genlock, electronic iris, and automatic or sample and hold white balance.

All Cohu cameras are manufactured in the U.S.A. and come with a two-year warranty and the support of experienced Applications Engineers to help make sure you achieve everything you expect from your camera.

Cohu is ISO-9001 certified.

APPLICATIONS

- Machine Vision
- Medical Analysis
- Portrait Studio
- Agricultural Processing
- Microscopy (low light)
- Inspection
- Optical Measurement



Get a feature-rich, high performance camera in a compact, lightweight package with a Cohu 2200.

FEATURES AND BENEFITS

- On Chip Microlens Interline Transfer Sensor provides high sensitivity and reduces blooming and transfer smear
- High Resolution - up to 460 horizontal TV lines for sharper images
- Small Size - only 4" x 2" x 2"
- Integration - externally controllable for low light imaging
- Asynchronous Reset
- Rear Panel Controls for precision adjustment
- High Signal-to-Noise Ratio provides clear, noise-free images
- 1000:1 Overload Capability prevents light overloads that cause blooming
- Manual Gain and Color Balance
- Optional crystal genlock
- C lens mount standard, CS optional
- Optional top or bottom mounting accessory
- Made in U.S.A. - direct factory support
- Two Year Warranty
- Meets FCC Class B and VDE Class B requirements

2200 HIGH PERFORMANCE COLOR CCD CAMERA

SPECIFICATIONS

ELECTRICAL

Imager

Single interline transfer CCD with matrix filter (cyan, yellow, magenta, green)

Image Area

6.4 x 4.8 mm (1/2" format)

Active Picture Elements

NTSC and RGB/60:

768 (H) x 494 (V)

PAL and RGB/50:

752 (H) x 582 (V)

Resolution

NTSC/Y-C 460 horizontal TV lines

RGB/60: 350 vertical TV lines

PAL/Y-C 450 horizontal TV lines

RGB/50: 415 vertical TV lines

Sensitivity (3200K faceplate illumination)

6.5 lux at full video, AGC off

0.3 lux at 80% video, AGC on

.08 lux at 30% video, AGC on

Shutter

Internal DIP switch, 1/60 to 1/10,000, 8 steps

Electronic Iris (Optional)

1/60 to 1/15,000 sec. auto-compensates for scene illumination

Integration

1/60 to 16 fields (active high)

Gamma

0.6

Gain AGC/Manual

0-20 dB (on/off), selectable (local/remote)

Signal-to-Noise Ratio

46 dB (AGC off @ 6.5 lux 4.5 MHz filter)

Video Output

Encoded NTSC and PAL: 1 V p-p @

75 ohms, unbalanced composite;

S Video Y: 1 V p-p @ 75 ohm

S Video C: .285 V p-p

RGB (per channel): 0.714 V p-p @ 75

ohms, unbalanced; sync on green,

0.4 V p-p @ 75 ohms unbalanced

Auto Lens Output

Non-AGC video, DC iris drive optional

Color Balance

Automatic, through-the-lens type, less than 10 IRE units unbalanced from 2850 to 5800 K;

Local/Remote Manual White Balance

Synchronization Options

NTSC or PAL: crystal, asynchronous reset

RGB: Genlock, H&V drive (optional)

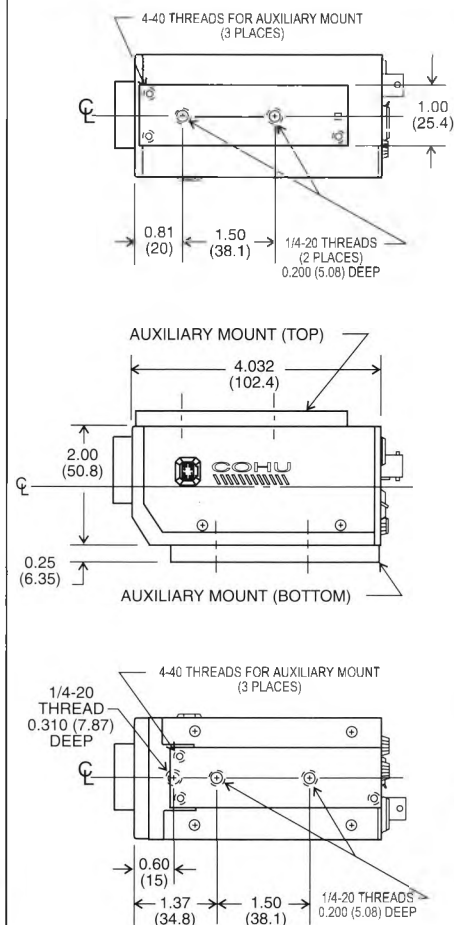
Power Requirements

12 VDC $\pm 10\%$

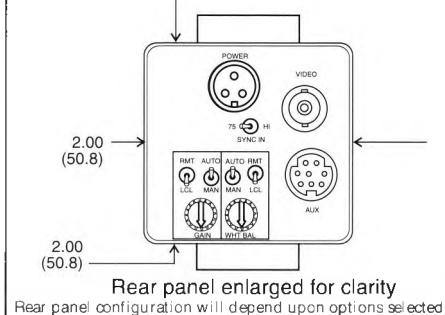
Power Consumption

6 W

DIMENSIONS



All dimensions in inches and (mm)



ENVIRONMENTAL

Ambient Temperature Limits

Operating: -20° to 50° C, -4° to 122° F

Storage: -30° to 70° C, -22° to 157° F

Humidity

Up to 95% relative, non condensing

Vibration (less lens)

Per Mil-STD-810(E), Method 514.4, Categories 1, 4, 5, 8, 9, 10

Shock (less lens)

No damage to 30 g, 11 ms duration

No crash hazard to 75 g, 11 ms duration

MECHANICAL

Weight (less lens)

10 oz., (280 g.)

Lens Mount

C/CS standard

Camera Mounts

1/4-20 female, top and bottom

Connectors

Video Out: BNC; Y-C/RGB: 12 pin Aux

Lens Drive: 4 pin connector

Power In: 3 pin connector

Aux: 12 pin connector

ORDERING INFORMATION

22X

X

-X

X

X

X

/XXXX

Format

2 - 1/2" NTSC/Y-C

3 - 1/3" NTSC/Y-C

5 - 1/2" PAL/Y-C

6 - 1/3" PAL/Y-C

Power Option

2 - 12 VDC

Sync

1 - XTAL

Async Reset

2 - Genlock

H&V Drive

Iris Options

0 - Auto Iris

3 - Elec. Iris*

4 - DC Iris

Color

0 - Manual white bal.

2 - Auto white bal.

3 - Sample & hold

4 - RGB output

Unassigned

0

Lens Options

0000 None

Contact your Cohu representative or the factory for full lens selection.

* For manual iris lenses only.



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COHU DSP

3500 Series High Performance CCD Color Camera

Use the Cohu 3500 Series DSP camera for its outstanding picture quality as well as the versatile functions that digital signal processing can offer:

- Digitally processed signal with analog output for clear, consistent images
- 8:1 digital zoom (remote controllable) allows image enlargement on a monitor
- Auto backlight compensation keeps images clear in the presence of strong incidental light
- Adjustable Edge enhancement for crisper horizontal and vertical edges
- Auto tracking or sample and hold white balance for precise exposure in both changing or static lighting conditions
- Integration and shuttering (remote controllable) for optimum exposure control
- Remote/Local camera setup and control for fast, convenient, and accurate user interface to the camera. Remote control can be with standard PC
- Built-in alphanumeric character ID generator for easy scene identification
- Auto or manual gain control up to 21 dB
- Made in U.S.A. by Cohu means product reliability and total customer support

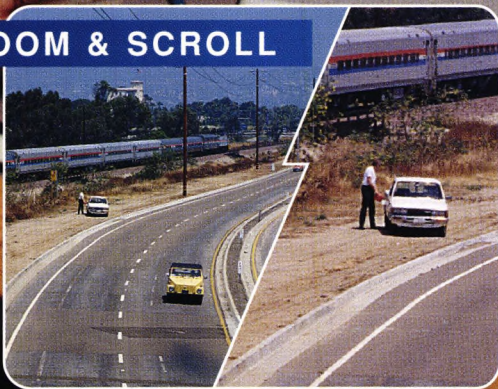
REMOTE SETUP & CONTROL



BACKLIGHT COMPENSATION



ZOOM & SCROLL





The 3500 Series high performance CCD color camera utilizes Digital Signal Processing (DSP) to bring a new level of technology and performance to surveillance and imaging systems. This multi-purpose camera packages an interline transfer sensor imager and on-chip microlens sensor technology with advanced digital signal processing to produce an image of clear, sharp definition in a wide variety of lighting conditions. In addition, special features not found on ordinary cameras are now possible that extend the range of imaging possibilities.

Setup and control of the 3500 Series camera is achieved manually through an easily-accessible side panel or remotely via an RS-232/RS-422 interface on the back panel. The remote control function, with Windows™-based graphical user interface, can be operated from a personal computer using Cohu supplied software. A special feature, distinctive to the 3500 Series camera, allows the operator to store different camera modes and settings, such as backlight compensation or manual gain, as presets. These camera presets can then be recalled from the menu to address different conditions.

Two sensor options, 1/4" or 1/2", expand your selection of lenses to achieve the highest performance and magnification for the application.

The Series 3500 DSP camera is available in Cohu's environmentally secure housing that today's surveillance conditions demand. Consult your Cohu representative for sealed and pressurized housing options.

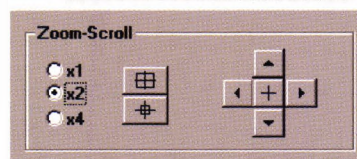
Backlight Compensation:

The Series 3500 keeps images clear and discernable even in the presence of strong incidental light. The backlight compensation setting increases the gain within the AGC range to expand the visibility of the dark areas within the scene.



Digital Zoom and Scroll:

Selected portion of a scene can be digitally enlarged to better view details from a distance.



Remote Setup and Control:

Camera operation from a remote PC is a powerful control feature for the operator.

All setup and control features of the Cohu 3500 Series DSP Camera can be controlled with a standard PC via an RS-232/RS-422 link to the back of the camera.

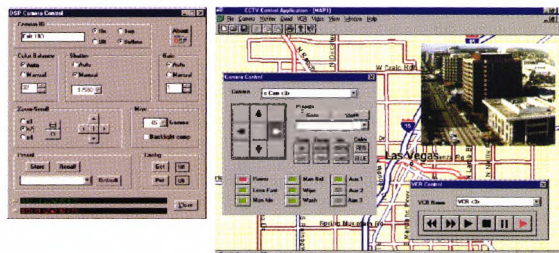
Camera functions can also be operated from buttons located behind a conveniently located side panel.

Up to nine presets can be stored, each containing a unique set of operating modes and setup parameters. The presets can be recalled remotely to instantly adapt the Series 3500 to changing conditions or requirements.



System Control:

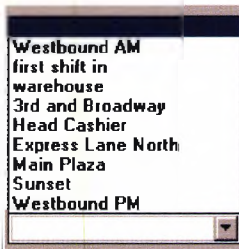
The camera control screen can be integrated with a Cohu CCR camera control receiver and CAMS 2.1 system software.



Assign camera identification, including 18 character on-screen display

Zoom and Scroll with only a mouse click

Store up to nine preset camera functions, and change them as needs require



DSP Camera Control

Camera ID: ☒ On ☐ Off ☐ Top ☒ Bottom

Color Balance: ☒ Auto ☐ Manual

Shutter: ☐ Auto ☒ Manual

Gain: ☒ Auto ☐ Manual

Zoom-Scroll: ☐ x1 ☒ x2 ☐ x4

Misc: Gamma ☐ Backlight comp

Preset:

Config:

☐ STX 01 cZm2 87 ETX ☐ STX 01 cZm2 87 ETX

Manual

Optimize camera setting for the scene

Gamma

Light comp

Fast and easy configuration of many cameras within the same system

Verify comm line status instantly

3500 Series High Performance CCD Color Camera

Sensor

1/4" or 1/2" Interline transfer CCD with matrix filter (CYMG)

Active picture elements

NTSC: 768 (H) x 494 (V)

PAL: 752 (H) x 582 (V)

Cell Size

1/2" NTSC: 8.40 μ m H x 9.80 μ m V

1/4" NTSC: 4.75 μ m H x 5.55 μ m V

1/2" PAL: 8.60 μ m H x 8.30 μ m V

Input Power

12 \pm 0.2 VDC, <0.4 V ripple

Resolution

NTSC/YC: 470 (H) x 350 (V) TVL

PAL/YC: 460 (H) x 415 (V) TVL

Frame Rate

NTSC: 30 f/sec PAL: 25 f/sec

Sensitivity (3200 K faceplate illumination)

1/4" sensor: 10 lux @ full video, AGC off; 0.8 lux @ 80% video, AGC on; 0.3 lux @ 30% video, AGC on

1/2" sensor: 5 lux @ full video, AGC off; 0.4 lux @ 80% video, AGC on; 0.15 lux @ 30% video, AGC on

Shutter

1/60 sec (1/50 sec PAL) to 1/8,000 sec, manually or automatically controlled

Shutter Mode

Allows automatic electronic shuttering to limit bright light

Synchronization

Crystal

Gain

AGC/Manual, selectable; 21 dB AGC range

Gamma

0.3 to 1.0 selectable in 8 steps

Auto Backlight Compensation

Compensates for contrast variations of backlit scenes

Digital Zoom

8:1 zoom, steps or variable

Integration

Control via menu, remote serial interface; or external pulse. Requires external frame store

Signal to Noise Ratio

>48 dB (minimum gain, unweighted, 6 MHz filter)

Video Outputs (Analog)

NTSC or PAL in composite or S-video (Y-C)

Auto Lens Output

Video or DC Iris Drive (selectable)

White Balance

Manual; local & remote control, through the lens sample and hold, through the lens auto tracking

Lens Mount

C/CS

Dimensions

See illustration

Weight

14.5 oz./406 g. (without lens)

Remote Control

RS-232 and RS-422 selectable serial interface to PC; GUI provides setup and user control of DSP functions

Local Control

Four momentary buttons with on-screen menu; menu provides setup and user control of DSP functions

Operating/Setup Parameters

(remote or local control)

Gamma	Brightness
Color Balance	Contrast
Shutter/Integration	Average Picture level
Gain	Pregain
Zoom/Scroll	Color/Monochrome
Backlight Compensation	Positive/negative Image
Color Saturation	

Temperature Limits

Operating: -20° C (-4°F) to 70° C (158° F)

Humidity

To 95% relative, non-condensing

Connectors

Composite Video: BNC; YC: 4 circuit mini DIN; Remote Control: 15 pin "D"; Lens Drive: 4 circuit Chuomusen; Power: Switchcraft TB4M

ID Generator

18 characters

Approvals

FCC: Class B; CE: CISPR 22 Class B IEC 1000-2, -3, -4i

ORDERING INFORMATION

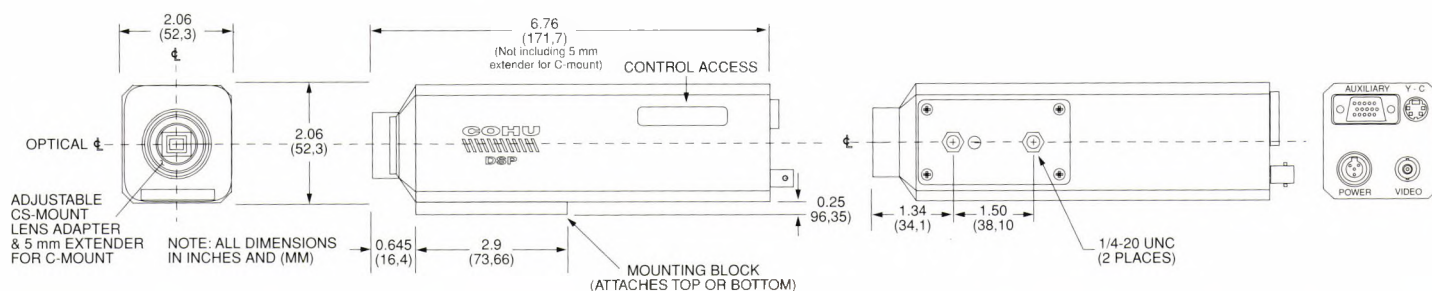
- 3512-1000 1/4" NTSC, crystal sync, 12 VDC power
- 3522-1000 1/2" NTSC, crystal sync, 12 VDC power
- 3582-5000 1/2" PAL, crystal sync, 12 VDC power

LENSES

The versatility of this camera allows for a wide selection of lenses. Consult your Cohu Representative or Applications Engineer for guidance.

ACCESSORIES

- 8405-3 Programming Software
- CTC-28 RS-232 Camera to Computer Cable
- 8399-5 115 VAC to 12 VDC power supply



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3500 Series 7-97
Printed in U.S.A.

HIGH PERFORMANCE COLOR CCD CAMERAS

8210 SERIES

NTSC/Y-C, RGB Models
On-Chip Microlens Sensor

Cohu's 8210 Series High Performance Color CCD cameras offer the ultimate in color vibrancy, picture clarity, and reliability. They employ a half-inch interline transfer sensor with on-chip microlenses for exceptional sensitivity and minimal blooming. Y-C video outputs on NTSC models allow you to record high resolution images on Super VHS media. RGB models are also available.

For video applications prone to streaking problems, the microlens sensor provides a 1000:1 overload capability, which allows transmission of clear video signals, even when bright, incidental light is present in the scene.

8210 Series cameras feature convenient side-panel access to electronic shutter, integration, gain, and other camera controls. An optional electronic iris eliminates the need for an auto iris lens in most lighting conditions.

All Cohu cameras are made in the U.S.A. and backed by a two year warranty. Cohu facilities are ISO-9001 certified.

OEM and special design requests are welcome.



The Cohu 8210 Series color camera offers exceptional picture clarity.

FEATURES AND BENEFITS

- **Superior Resolution** - 460 horizontal TV lines for sharper images
- **NTSC/Y-C Output** for S-VHS recording
- **On-chip Microlens Interline Transfer Imager** dramatically increases sensitivity and virtually eliminates blooming
- **Selectable Integration** for low light video
- **Zero Geometric Distortion** ensures precision measurement
- **Color Lock** for consistent color rendition in multi-camera applications
- **Two Year Warranty**
- **Made In U.S.A.** for direct factory support
- **High Signal-to-Noise Ratio** provides better dynamic range
- **Eight-Speed Electronic Shutter** reduces blurring of fast moving objects

APPLICATIONS

- **Image Processing**
Medical
Industrial
- **Security/Surveillance**
Perimeter Security
Traffic Safety and Control
General Surveillance
- **Microscopy**
- **Machine Vision**
Pattern Recognition
Non-Contact Measurement
3-D Imaging
Inspection
- **Robotics**

8210 SERIES HIGH PERFORMANCE COLOR CCD CAMERAS

SPECIFICATIONS

ELECTRICAL - NTSC/Y-C MODELS

Imager Single interline transfer CCD with matrix filter (CYMG)	Signal-to-Noise Ratio (AGC Off) 48 dB (NTSC with 4.5 MHz filter) 48 dB (Y output with 6 MHz filter)
Image Area 6.4 x 4.8 mm (1/2-inch format)	Video Outputs Encoded: NTSC 1 V p-p @75 ohms, unbalanced, composite S-VHS Video (contact factory) Y: 1 V p-p @75 ohms, unbalanced, composite; C: 0.285 V p-p
Active Picture Elements 768(H) x 494(V)	Auto Lens Operation Peak-average characteristic tracks AGC adjustment to eliminate AGC/auto lens interaction
Resolution Horizontal 460 TV lines Vertical 350 TV line	Color Lock Burst phase adjustment, Horizontal phase adjustment
Sensitivity 3200 K faceplate illumination. 6.5 lux at full video, AGC Off. 0.5 lux at 80% video, AGC On.	Color Balance Through-the-lens type, Less than 10 IRE units unbalance from 2850 to >5800 K
Electronic Shutter External switch selectable, on/off. Internal switch selectable, 1/60 sec- ond (off) to 1/10,000 second in 8 steps	Synchronization NTSC Color lock standard
Integration External switch selectable, on/off. Internal switch selectable, 2 to 16 fields (8 steps). Grab pulse avail- able	Power Requirements 12V ac or dc (standard); 115V ac with optional wall transformer
Gamma 0.5	Power Consumption 4.5W, camera only
AGC 0-20 dB, Internal peak-average adjustment	

ENVIRONMENTAL

Ambient Temperature Limits Operating: -20 to 50°C (-4° to 122° F) Storage: -30 to 70°C (-22° to 157° F)
Humidity Up to 95% relative humidity
Vibration (less lens) Sine vibration from 5 to 2000 Hz, 5 g's peak, all 3-axis, 1/2 hr. per axis, per MIL-E-5400T, para. 3.2.24.5.1.2, fig. 2, curve IIIa. Random vibration from 10 to 2000 Hz, 11 g's rms, all 3-axis, 1/2 hr. per axis, per MIL-E-5400T, para. 3.2.24.5.1.2, category 6.
Shock (less lens) Up to 15 g's, 11ms, in any axis under non operating conditions, MIL-E-5400T, paragraph 3.2.24.6

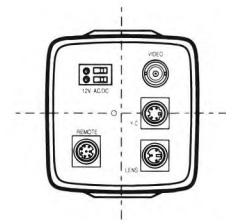
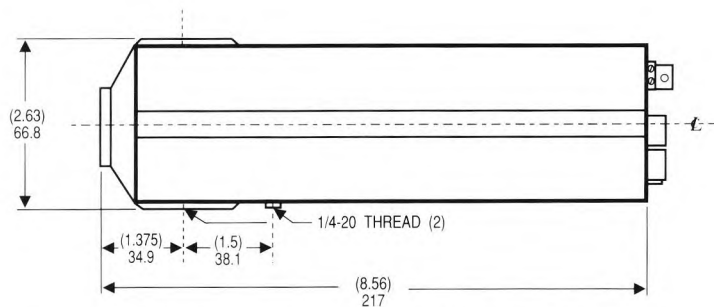
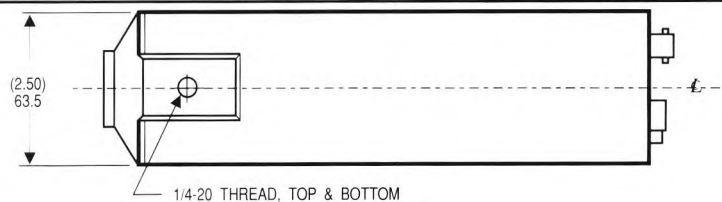
ELECTRICAL - RGB MODELS

Imager Single interline transfer CCD with matrix filter (CYMG)	Video Outputs RGB per channel: 0.714 V p-p @ 75 ohms, unbal- anced; sync on green, jumper se- lectable Sync: 0.4 V p-p @ 75 ohms, unbal- anced
Image Area 6.4 x 4.8 mm (1/2-inch format)	Synchronization Genlock, H&V drive
Active Picture Elements 768(H) x 494(V)	Power Requirements 12V ac or dc (standard); 115V ac with optional wall transformer
Resolution Horizontal 450 TV lines	Power Consumption 4.5W, camera only
Sensitivity 3200 K faceplate illumination. 13 lux at full video, AGC Off. 1.1 lux at 80% video, AGC On.	
Electronic Shutter External switch selectable, on/off. Internal switch selectable, 1/60 second (off) to 1/10,000 second in 8 steps	
Integration Switch selectable, 2 to 16 fields (8 steps). Grab pulse available	
Gamma 0.5 or 1.0	
AGC 0-20 dB, Peak-average adjustment	

MECHANICAL

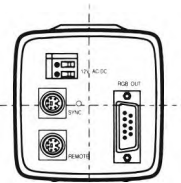
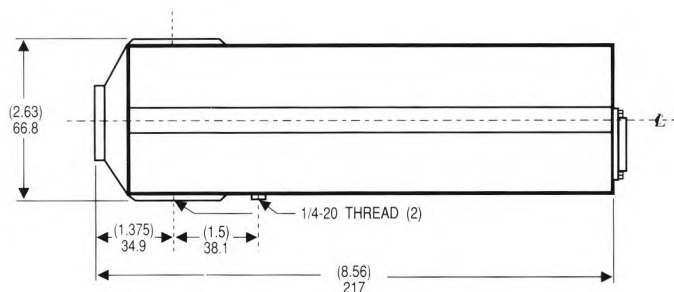
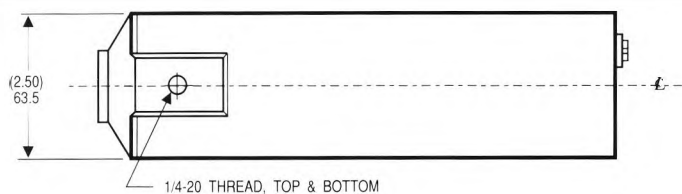
Dimensions See drawings
Weight (no lens, 12 V model) 23 oz. (.65 g)
Lens Mount CS standard, C adapter fur- nished
Connectors (NTSC/Y-C) Video Out: BNC Y-C: 4 circuit mini-DIN Lens Drive: 3 circuit mini-DIN Power In: 2 circuit terminal strip Remote: 8 circuit mini-DIN
Connectors (RGB) Video: BNC Remote 1: 8 circuit mini-DIN Sync: 7 circuit mini-DIN Power In: 2 circuit terminal strip RGB Out: 9 circuit D-sub
Side Panel Adjustments (NTSC) Shutter/Off/Integrate 8-position shutter/integrate AGC on/off AGC Peak/Average Auto/Manual/Remote White Balance Select White Balance
Side Panel Adjustments (RGB) Shutter/Off/Integrate 8-position shutter/integrate AGC peak/average AGC/manual/remote select Gain Adjust Vertical Phase Adjust Horizontal Phase Adjust

DIMENSIONS OF NTSC/Y-C MODELS



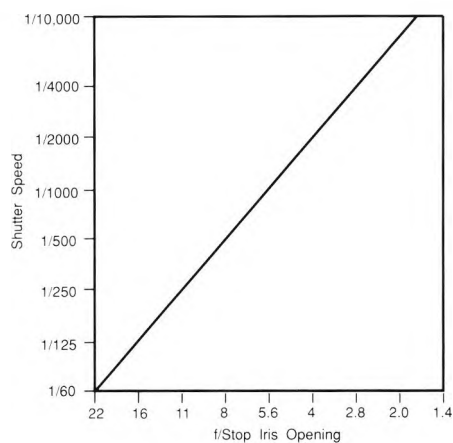
NOTE: UNLESS OTHERWISE DESIGNATED, ALL DIMENSIONS IN MM AND (INCHES)

DIMENSIONS OF RGB MODELS

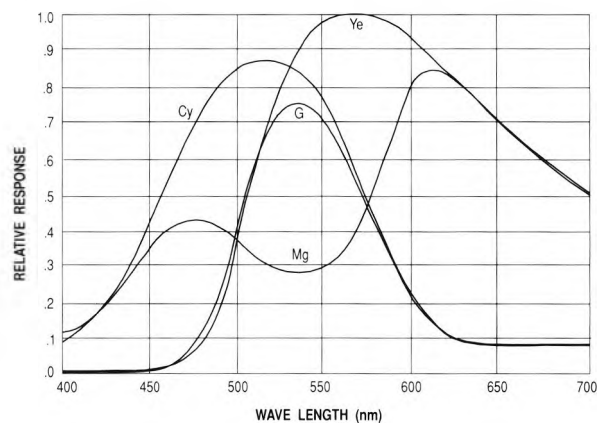


NOTE: UNLESS OTHERWISE DESIGNATED, ALL DIMENSIONS IN MM AND (INCHES)

TYPICAL f/STOP VS. SHUTTER



MATRIX FILTER COLOR RESPONSES



8210 SERIES HIGH PERFORMANCE COLOR CCD CAMERAS

ORDERING INFORMATION

821X —
Power

- 2 12V ac/dc, 50/60 Hz
- 4 24 Vac, 24-28 VDC
- 5 115 Vac

X
Format

- 1 NTSC/Y-C
- 2 RGB

XXX
Options

- 000 None
- 300 Electronic Iris
Electronic iris is available
only in NTSC/Y-C format;
not available in RGB.

/

XXXX
Lens Options

- 0000 None
- Auto Iris, CS Mount
- EH04 3.7mm, f1.6, 1/2"
- EH06 6mm, f1.4, 1/2"
- EH13 12mm, f1.4, 1/2"

- Auto Iris, C Mount
- ES05 4.8mm, f/1.8, 2/3"
- ES06 6mm, f/1.2, 1/2"
- ES08 8mm, f/1.4, 2/3"
- ES16 16mm, f/1.4, 2/3"
- ES25 25mm, f/1.4, 1"

- Manual Iris Lenses
- AL04 4.5mm, f/2.0, 2/3"
- AL06 6.5mm, f/1.8, 2/3"
- AO03 3.7mm, f/1.6, 1/2", CS mount
- AO06 6mm, f/1.4, 1/2" CS mount

COHU RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

CONNECTOR CONFIGURATION

NTSC MODELS

Lens

- 1 Power
- 2 Lens Video
- 3 Ground
- Y-C
- 1 Y-Ground
- 2 C-Ground
- 3 Y
- 4 C

Remote

- 1 Auto/Man. White Bal
- 2 White Balance
- 3 Sync/Video In
(color lock)
- 4 Shutter On/Off
- 5 +5
- 6 Ground
- 7 Ground
- 8 Grab Pulse

RGB MODELS

Remote

- 1 Blue level
- 2 Red level
- 3 Sync/Horizontal In
- 4 Shutter On/Off
- 5 +5
- 6 Vertical In
- 7 Ground
- 8 External Gain
- Sync
- 1 Grab Pulse
- 2 Vertical Drive Out
- 3 Horizontal Drive Out
- 4 Clock Out
- 5 Ground

RGB

- 1 Ground
- 2 Ground
- 3 R
- 4 G
- 5 B
- 6 NC
- 7 Sync
- 8 NC
- 9 NC



ADVANCED
VIDEO
TECHNOLOGY
Made in the U.S.A.

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**Microlens Sensor
Technology**

HIGH PERFORMANCE COLOR ENVIRONMENTAL CCD CAMERA

8240 SERIES

Cohu's 8240 Series is the leader in high resolution, environmentally secure CCD cameras. Special on-chip microlens sensor technology dramatically increases sensitivity while offering excellent color vibrancy, picture clarity, and reliability. The rugged, 4.5" diameter environmental housing is designed to stand up to even the harshest weather conditions.

The 8240 Series cameras provide 460 TV lines of horizontal resolution - a significant performance edge for critical applications such as security, surveillance, and traffic management.

For video applications prone to streaking problems, the microlens sensor provides a 1000:1 overload capability, which allows transmission of clear video signals, even when bright, incidental light is present in the scene.

The 8240 Series High Performance CCD cameras' sealed and pressurized environmental enclosure provides maximum protection against rain, snow, dust, humidity, chemical pollutants, extreme temperatures, and other environmental hazards.



The Cohu 8240 Series offers high performance in a rugged housing.

FEATURES AND BENEFITS

- **Superior Resolution** - 460 horizontal TV lines for sharper images
- **On-Chip Microlens Inter-line Transfer** dramatically increases sensitivity and virtually eliminates blooming
- **Sealed, Pressurized Environmental Housing** protects against harsh weather conditions
- **Internal Heater** allows camera to be installed in the coldest of climates
- **Selectable Integration** for low light video
- **Zero Geometric Distortion** ensures precision measurement
- **Color Lock** for consistent color rendition in multi-camera applications
- **Two Year Warranty**
- **Made In U.S.A.** for direct factory support
- **High Signal-to-Noise Ratio** provides better dynamic range

OPTIONS

- **Programmable Source ID Generator** permits incorporation of detailed messages on monitor screens
- **Fiber Optic Transmitter** for transmission of the video signal over long distances without interference or signal loss
- **Choice of Voltages**
- **Two-Digit Source ID Generator**
- **Special Engineering Revisions**

8240 SERIES HIGH PERFORMANCE COLOR CCD CAMERAS

SPECIFICATIONS

ELECTRICAL

Imager

Single interline transfer CCD with matrix filter (cyan, yellow, magenta, green)

Image Area

6.4 x 4.8 mm (1/2-inch format)

Active Picture Elements

768(H) x 493(V)

Resolution

Horizontal 460 TV lines

Vertical >350 TV lines

Sensitivity

3200 K faceplate illumination.

6.5 lux at full video, AGC Off.

0.5 lux at 80% video, AGC On.

Electronic Shutter*

External switch selectable, on/off.

Internal switch selectable, 1/60 second (On) to 1/10,000 second in 8 steps

Integration*

External switch selectable, on/off.

Internal switch selectable, 2 to 16 fields (8 steps).

Gamma

0.5

AGC*

0-20 dB

Internal peak-average adjustment

Signal-to-Noise Ratio (AGC Off)

48 dB (NTSC with 4.5 MHz filter)

Video Outputs**Encoded: NTSC**

1 V p-p @75 ohms, unbalanced, composite

S-VHS Video (wiring requires**Engineering Revision):**

Y: 1 V p-p @75 ohms, unbalanced, composite

C: 0.285 V p-p

Auto Lens Operation

Peak-average characteristic tracks

AGC adjustment to eliminate

AGC/auto lens interaction

Color Lock

Burst phase adjustment

Horizontal phase adjustment

Color Balance

Through-the-lens type

Less than 10 IRE units unbalance from 2850 to >5800 K

Synchronization

EIA RS-170 crystal, color lock standard

Power Requirements

12V ac or dc (standard), 115V ac

Power Consumption

4.5W, camera only

54.5 W, camera with heater

* Please see Standard Features section on back cover.

ENVIRONMENTAL

Ambient Temperature Limits

Operating:

-20 to 50 °C (-4° to 122° F)

-40 to 50 °C (-40° to 122° F) with optional heater

Storage:

-30 to 70 °C (-22° to 157° F)

Humidity

Up to 100% relative humidity

Vibration (less lens)

Sine vibration from 5 to 60 Hz with

0.082 inch total excursion (15 g's

@ 60 Hz). Random vibration from

60 to 1000 Hz, 5 g's rms

(0.027g²/Hz) without damage

Shock (less lens)

Up to 15 g's, 11ms, in any axis

under nonoperating conditions,

MIL-E-5400T, paragraph 3.2.24.6

Altitude

Sea level to equivalent of

3,000m/10,000 feet (508mm/20

inches of mercury)

Air Contaminants

Withstands exposure to sand, dust,

tungus, and salt atmosphere, per

MIL-E-5400T, paragraph 3.2.24.7,

3.2.24.8, and 3.2.24.9

Explosion

MIL-E-5400T, paragraph 3.2.24.10

Acoustic Noise

Can withstand environments

greater than 150 dB continuously

for 30 minutes

EMI

FCC rules, Part 15, Subpart J, for

Class A devices

Withstands exposure to sand, dust,

fungus, and salt atmosphere, per

MIL-E-5400T, paragraph 3.2.24.7,

MECHANICAL

Dimensions

Please see dimensional drawings.

Weight (including 10:1 zoom lens)

11 pounds, 2 ounces (115V model)

Lens Mount

"CS" or "C" mount

Housing Mount

1/4-20 threaded holes

Allows enclosure to be rotationally

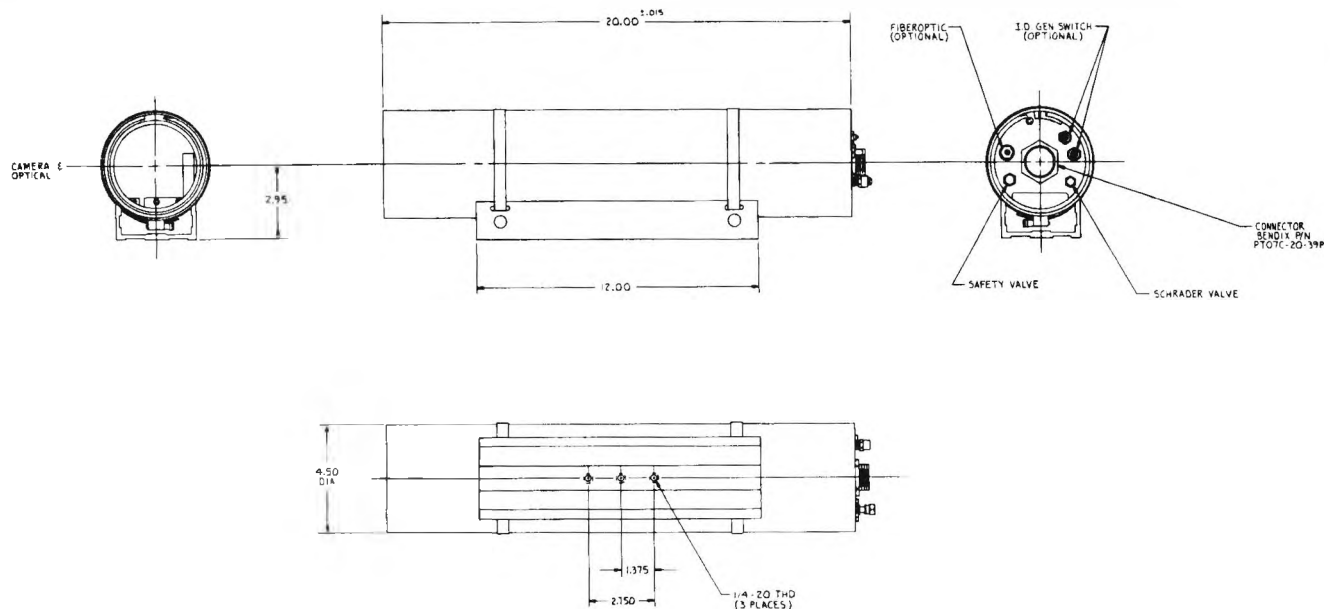
oriented in 90° increments

Purge/Relief Fitting

Schrader purge fitting

20 psi relief valve

8240 SERIES DIMENSIONS



NOTE: DIMENSIONS IN INCHES and (CM).

PIN CONFIGURATION

JI	PIN FUNCTION	JI	PIN FUNCTION
A	12/24 VAC POWER	a	PROG ID RXD -
B	REFERENCE RETURN	b	POSITION REFERENCE
C	EXT SYNC TERM.	c	AUTO/MAN IRIS SELECT
D	FOCUS POS F/B	d	12/24 VAC POWER
E	PROG ID RXD+	e	N/C
F	AUTO/MAN WHITE BAL.	f	GROUND
G	REM. SHUTTER ON/OFF	g	+5 VDC OUT
H	N/C	h	TXD -
J	VIDEO GROUND	i	TXD +
K	VIDEO OUT	j	REM WHT BAL (MAN.)
M	EXT. SYNC IN	k	N/C
N	GROUND	l	N/C
P	GROUND	m	115 VAC NEU. HEATER
R	ZOOM	n	N/C
S	FOCUS	p	N/C
T	IRIS	q	N/C
U	LENS COMMON	r	115 VAC LINE HEATER
V	115 VAC NEU. POWER		
W	115 VAC LINE POWER		
X	GROUND		
Y	POS F/B, ZOOM		
Z	GROUND		

For reference only. Always consult the maintenance manual for complete information.

PROGRAMMABLE SOURCE I.D. GENERATOR

The optional Programmable Source ID Generator is a built-in electronic circuit which allows written messages to be superimposed over images displayed on CCTV monitors. Using a computer and RS-422 serial communication, a user types messages that will then appear on the monitor. Text is made up of block letters 28 horizontal TV lines in height. The letters are white with a black outline for maximum legibility. There are two modes of operation, as follows:

1. **ID Mode:** Up to two lines of text (24 characters per line, including spaces) can be stored in non-volatile memory. Text can be placed at the top or bottom of the monitor screen, and can be updated from a computer or a dumb terminal, making this a real-time updatable programmable ID generator. Stored text, which typically provides information such as the location of individual cameras in multi-camera systems, will be continuously displayed until it is updated.

2. **Menu Mode:** In this mode, up to 12 lines of 24 characters can be entered into volatile memory without affecting data stored in the ID Mode. A computer is required to enter data in this mode.

8240 SERIES HIGH PERFORMANCE COLOR CCD CAMERAS

ORDERING INFORMATION

824X	—	X	XXX	/	XXXX	X
Power Options		Configuration	Module Options		Lens Options	Special Options
2 12V ac, 50/60 Hz		1 NTSC	000	None	0000 None	L Low Temperature Operation
4 24V ac, 50/60 Hz		(Note: Y-C, RGB and PAL configurations available as engineering revisions. Please consult factory.)	010	Fiber Optic Transmitter	Auto Iris, CS Mount EH04 3.7mm, f1.6, 1/2" EH06 6mm, f1.4, 1/2" EH13 12mm, f1.4, 1/2"	SS-425 Sunshield
5 115V ac, 50/60 Hz			052	Programmable Source ID Generator	Auto Iris, C Mount ES05 4.8mm, f/1.8, 2/3" ES08 8mm, f/1.4, 2/3" ES16 16mm, f/1.4, 2/3" ES25 25mm, f/1.4, 1" EH35 35mm, f/1.4, 2/3"	For remote control and other accessories, please consult the factory.
			053	Programmable Source ID Generator & Fiber Optic Transmitter	Zoom Lenses (1/2") Z06R 6:1, 8—48mm, f1.0 Z10R 10:1, 8—80mm, f1.2 P06R 6:1 with presets, f1.0 P10R 10:1 with presets, f1.2	

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NOTES ON STANDARD FEATURES

Electronic Shutter/Integration: Internal switches select shutter speeds or the number of integration fields, and enable or disable the external ON/OFF control of the internally-selected shutter or integration mode. These switches are set at the factory prior to sealing and pressurizing the environmental housing. The standard factory settings disable the external ON/OFF control and provide 1/60 second shutter speed. The switches can be set differently at the factory to customer specifications, or in the field by removing the camera from the housing.

AGC Peak/Average adjustment is made via an internal control, which is set at the factory prior to sealing and pressurizing the environmental enclosure. Customer may specify different setting upon ordering.

SPECIAL FEATURES

Cohu welcomes the opportunity to provide special features to better serve your particular requirement. Some examples of special features are:

Y-C (S-VHS) Output for VCR compatibility

RGB and PAL formats

Custom painting, silkscreen, and logo

Special filters, lens supports, and mounting solutions

Special adjustment of AGC peak/average control

Customer-specified setting of Electronic Shutter or Integration mode switches



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REMOTE HEAD
CCD CAMERAS

HIGH PERFORMANCE REMOTE-HEAD MONOCHROME CCD CAMERA

4980 SERIES

**Cable Length to 100 Feet
On-Chip-Microlens Imager**

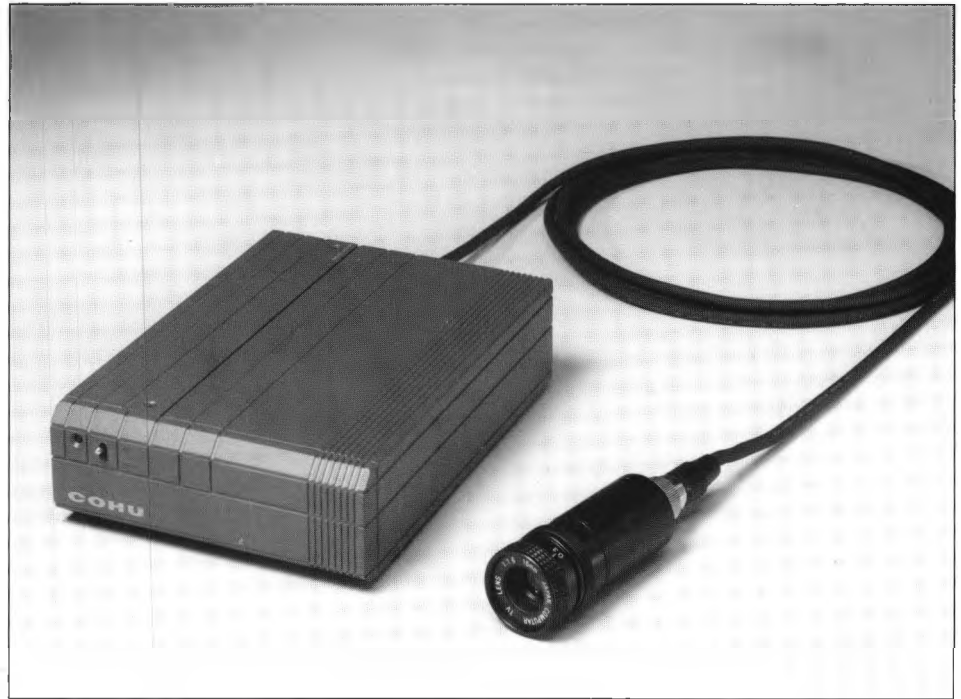
Cohu's new 4980 Series High Performance Monochrome Remote-Head CCD Cameras are the perfect solution for video applications requiring high performance in a compact package. The lightweight mini-remote head is easily incorporated into microscopes, medical instruments, and machine vision systems, and is ideal for specialized security/surveillance applications.

Available in RS-170 and CCIR models, these high resolution cameras employ a half-inch format interline transfer imager with on-chip microlenses for unparalleled sensitivity and minimal blooming. For additional sensitivity in low-light conditions, they provide 26 dB AGC and variable field/frame integration capabilities.

For video applications prone to streaking problems, the sensor provides a 1000:1 overload capability, which allows transmission of clear video signals even when bright incidental light is present in the scene.

4980 Series cameras are backed by a full two-year warranty. They're rugged, yet lightweight and compact — ideal for easy system integration. For easy access to camera controls, they have a removable trim plate on the camera control unit.

This camera is available in color models. Please request literature on Cohu's 8280 Series. We welcome requests for special products and complete CCTV systems.



The mini-remote head can be separated from the CCU by up to 100 feet of cable.

FEATURES AND BENEFITS

- **Compact, Lightweight Mini-Remote Head** — only 1.125" diameter means maximum flexibility for end users or OEMs
- **Variable length cable** up to 100 feet between head and CCU
- **Camera Head Connector** for complete interchangeability better definition, error-free results
- **High Resolution** — for better definition, error-free results
- **On-Chip-Microlens Interline Transfer Imager** dramatically increases sensitivity and virtually eliminates streaking and blooming.
- **Eight-Speed Electronic Shutter** reduces blurred images of fast-moving objects.
- **Choice of Synchronization Options** — Asynchronous reset, genlock, H & V drive, line lock, or crystal
- **High Signal-to-Noise Ratio** for clear, noise-free video
- **Optional Electronic Iris** automatically controls exposure.
- **Asynchronous Reset** provides random vertical reset capability for production line applications.
- **Made in U.S.A.** — direct factory support
- **1000:1 Overload Capability** permits incidental light overloads up to ten times that of other CCD cameras.
- **No Lag or Image Retention** — provides fast, clean images
- **Zero Geometric Distortion** for consistent corner-to-corner linearity
- **26 dB AGC** for increased sensitivity at low light levels
- **Optional IR Filter**
- **Field or Frame Integration** — for added sensitivity in low-light-level imaging applications
- **Choice of RS-170 & CCIR Models**
- **Two-Year Warranty**
- **Special Configurations** for OEMs and end users

APPLICATIONS

- **Image Processing**
- **Machine Vision**
- **Microscopy**
- **Endoscopy**
- **Process Control**
- **Quality Control**
- **Image Analysis**
- **Security/Surveillance**

4980 SERIES HIGH PERFORMANCE REMOTE-HEAD CCD CAMERA

SPECIFICATIONS

ELECTRICAL

Image Area

6.4 x 4.8 mm (corresponding to 1/2" image tube)

Active Picture Elements

RS-170: 768H x 494V

CCIR: 752H x 582V

Imager Type

Interline transfer CCD
with on-chip microlenses

Cell Size

RS170: 8.4 x 9.8 microns

CCIR: 8.6 x 8.3 microns

Resolution

RS170: 580 horizontal TVL,
350 vertical TVL

CCIR: 560 horizontal TVL,
450 vertical TVL

Sensitivity (faceplate) @2850 K

0.65 lux at full video, AGC off
0.02 lux at 80% video, AGC on
0.016 lux at 30% video, AGC on

Electronic Shutter

Eight steps from 1/50 or 1/60 to 1/10,000
second (1/50 or 1/60, 1/125, 1/500, 1/1,000,
1/2,000, 1/4,000, and 1/10,000 second)

Integration

Integration period controllable through
external input pulse
Grab pulse output
Field (1/60 or 1/50 second) or Frame (1/30
or 1/25 second) integration selected by
internal jumper

Video Output

1.0 V p-p @75 ohms, unbalanced

AGC

26 dB, variable gain

Signal-to-Noise Ratio

50 dB at gamma 1, gain 0 dB

Auto Lens

Separate lens video signal tracks AGC
peak/average adjustment to eliminate
AGC/auto lens interaction
Power: +15V, 35 mA maximum

Gamma

Variable 0.45 to 1.0

Synchronization

Genlock, revert to variable phase line
lock with zero crossing detector
Genlock, revert to crystal
Crystal Lock
H & V Drive
Asynchronous Reset
Internal Clock Speeds
RS170: 28.6363 MHz
CCIR: 28.375 MHz

Power Requirements

12V ac or dc (standard)
115V ac (optional on RS-170
models, includes wall
transformer and connector)
230V ac (optional on CCIR
models, includes wall
transformer and connector)
4.2 watts dc power consumption
LED Power Indicator, Green

MECHANICAL

Dimensions (less lens/cable)

Camera Head: 1.125" dia. x 2.00"
length (28.57 x 50.8 mm)
CCU: 1.7" (H) x 5.0" (W) x 6.9" (D)
(43.2 x 127 x 175.3 mm)

Weight

Camera Head: 4 ounces (113 grams)
CCU: 27.5 ounces (780 grams)
Cable: 1/2 ounce/ft. (45 grams/m)

Lens Mount

Adjustable "C" mount

CCU Controls

Electronic Shutter
AGC peak/average
AGC On/Off
Manual Gain
Gamma
Sharpness

CCU Connectors

Video (BNC)
Camera Head (15 pin "D" subminiature)
Power (2 circuit screw terminal)
Lens (3 pin Mini-DIN)
External Sync (8 pin DIN)
Pin 1. Ext. Vertical Trigger In
Pin 2. Ext. Sync/Horizontal Trigger In
Pin 3. Grab Pulse Out (-)
Pin 4. Ground
Pin 5. Ground
Pin 6. Vertical Reset In
Pin 7. Grab Pulse Out (+)
Pin 8. Integrate Input

ORDERING INFORMATION

498X —	X	X	X	X	XXXX
Power Options	Sync Options	Optical Filters	Options	Cable Length	Lens Options
2 12V ac or dc	2 Genlock (revert to crystal) RS-170	0 None	0 Field Mode	1 10 Feet	Manual Iris, C Mount
3 230V ac, 50 Hz, with ac wall adapter (CCIR models)	3 Genlock (revert to line lock) RS-170*	1 IR Filter (Non-removable)	1 Frame Integration Mode	2 25 Feet	*AL04 4.5mm, f/2.0, 2/3"
4 24VAC/VDC	4 Asynchronous Reset RS-170		3 Electronic Iris*	3 50 Feet	*AL08 8mm, f/1.4, 2/3"
5 115V ac, 60 Hz, with ac wall adapter (RS 170 models)	5 Genlock (Revert to crystal CCIR)			4 100 Feet	AL16 16mm, f/1.4, 2/3"
	6 Genlock (revert to line lock CCIR)*				AL25 25mm, f/1.4, 1"
	7 Asynchronous reset (CCIR)				AL50 50mm, f/1.4, 1"
					* Wide Angle
					Auto Iris, C Mount
					ES04 4.2mm, f/1.6, 1/2"
					ES05 4.8mm, f/1.8, 2/3"
					ES08 8mm, f/1.4, 2/3"
					ES12 12.5mm, f/1.4, 1"
					ES16 16mm, f/1.4, 2/3"
					ES25 25mm, f/1.4, 1"
					EH35 35mm, f/1.4, 2/3"
					ES50 50mm, f/1.4, 1"
					EH75 75mm, f/1.8, 1"
					Other lenses are available. Please consult factory.

COHU RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE

ENVIRONMENTAL

Ambient Temperature Limits

Operating: -20 to 60 °C
(-4° to 140° F)
Storage: -30 to 70 °C
(-22° to 157° F)

Humidity

Up to 95% relative humidity

Vibration

Sine vibration from 5 to 2,000 Hz,
5 g's peak, all 3-axis, 1/2 hr. per
axis per MIL-E-5400T, para
3.2.24.5.1.2, fig. 2, curve IIIa.
Random vibration from 10 to 2,000 Hz,
11 g's rms, all 3-axis, 1/2 hr.
per axis, per MIL-E-5400T, para
3.2.24.5.1.2, category 6.

Shock

Up to 15 g's in any axis under
nonoperating conditions



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COHU
Cohu, Inc./Electronics Division

HIGH PERFORMANCE REMOTE-HEAD MONOCHROME CCD CAMERA

4990 SERIES

**High Sensitivity
On-Chip-Microlens Imager**

Cohu's new 4990 Series High Performance Monochrome Remote-Head CCD Cameras are the perfect solution for video applications requiring high performance in a compact package. The lightweight remote head is easily incorporated into microscopes, medical instruments, and machine vision systems, and is ideal for specialized security/surveillance applications.

Available in RS-170 and CCIR models, these high resolution cameras employ a half-inch format HAD interline transfer imager with on-chip microlenses for unparalleled sensitivity and minimal blooming. For additional sensitivity in low-light conditions, they provide 26 dB AGC and variable field/frame integration capabilities.

For video applications prone to streaking problems, the sensor provides a 1000:1 overload capability, which allows transmission of clear video signals even when bright incidental light is present in the scene.

4990 Series cameras are backed by a full two-year warranty. They're rugged, yet lightweight and compact — ideal for easy system integration. For easy access to camera controls, they have a removable trim plate on the camera control unit.

Cohu has been a leading U.S. manufacturer of closed circuit video cameras and systems for over 40 years. We welcome requests for special products and complete CCTV systems.

APPLICATIONS

- Image Processing
- Machine Vision
- Microscopy
- Endoscopy
- Process Control
- Quality Control
- Image Analysis
- Security/Surveillance



Cohu 4990 Series Monochrome High Performance Interline Transfer CCD Camera

FEATURES AND BENEFITS

- **Compact, Lightweight Remote Head** — maximum flexibility for end users or OEMs
- **High Resolution** — for better definition, error-free results
- **On-Chip-Microlens Interline Transfer Imager** dramatically increases sensitivity and virtually eliminates streaking and blooming.
- **Eight-Speed Electronic Shutter** reduces blurred images of fast-moving objects.
- **High Sensitivity** permits operation over a broad range of light levels.
- **Choice of Synchronization Options** for greater versatility
- **High Signal-to-Noise Ratio** for clear, noise-free video
- **Asynchronous Reset** provides random vertical reset capability for production line applications.
- **Optional Electronic Iris** automatically controls exposure
- **Made in U.S.A.** — direct factory support
- **1000:1 Overload Capability** permits incidental light overloads up to ten times that of other CCD cameras.
- **No Lag or Image Retention** — provides fast, clean images
- **Zero Geometric Distortion** for consistent corner-to-corner linearity
- **26 dB AGC** for increased sensitivity at low light levels
- **Optional IR Filter**
- **Field or Frame Integration** — for added sensitivity in low-light-level imaging applications
- **State-of-the-Art Design and Construction** for total, solid-state

4990 SERIES HIGH PERFORMANCE REMOTE-HEAD CCD CAMERA

SPECIFICATIONS

ELECTRICAL

Image Area

6.4 x 4.8 mm (corresponding to 1/2" image tube)

Active Picture Elements

RS-170: 768H x 494V

CCIR: 752H x 582V

Imager Type

Interline transfer CCD
with on-chip microlenses

Cell Size

RS170: 8.4 x 9.8 microns

CCIR: 8.6 x 8.3 microns

Resolution

RS170: 580 horizontal TVL,
350 vertical TVL

CCIR: 560 horizontal TVL,
450 vertical TVL

Sensitivity (faceplate) @2850 K

0.65 lux at full video, AGC off
0.05 lux at 80% video, AGC on

Electronic Shutter

Eight steps from 1/50 or 1/60 to 1/10,000
second (1/50 or 1/60, 1/125, 1/500, 1/1,000,
1/2,000, 1/4,000, and 1/10,000 second)

Integration

Integration period controllable through
external input pulse
Grab pulse output
Field (1/60 or 1/50 second) or Frame (1/30
or 1/25 second) integration
selected by internal jumper

Video Output

1.0 V p-p @75 ohms, unbalanced

AGC

26 dB, variable gain

Signal-to-Noise Ratio

≥56 dB at gamma 1, gain 0 dB
38 dB at gamma 1, AGC On

Auto Lens

Separate lens video signal tracks AGC
peak/average adjustment
to eliminate AGC/auto lens
interaction
Power: +15V, 35 mA maximum

Gamma

Variable 0.45 to 1.0

Synchronization

Genlock, revert to variable phase line
lock with zero crossing
detector
Genlock, revert to crystal
Crystal Lock
H & V Drive
Asynchronous Reset
Internal Clock Speeds
RS170: 28.6363 MHz
CCIR: 28.375 MHz

Power Requirements

12V ac or dc (standard)
115V ac (optional on RS-170
models, includes wall
transformer and connector)
230V ac (optional on CCIR
models, includes wall
transformer and connector)
4.2 watts dc power consumption
LED Power Indicator, Green

MECHANICAL

Dimensions (less lens)

Camera Head: 1.50" dia. x 2.00"
length (38.1 x 50.8 mm)
CCU: 1.7"(H) x 5.0"(W) x 6.9"(D)
(43.2 x 127 x 175.3 mm)

Weight

Camera Head (less lens and
cable): 4 ounces (113 grams)
15' Remote Cable: 17 ounces
(483 grams)
CCU: 27.5 ounces (780 grams)

Lens Mount

Adjustable "C" mount

CCU Controls

Electronic Shutter
AGC peak/average
AGC On/Off
Manual Gain
Gamma
Sharpness

Connectors

Video (BNC)
Power (2 circuit screw terminal)
Lens (3 pin Mini-DIN)
External Sync (8 pin DIN)
Pin 1. External Vertical Trigger In
Pin 2. External Sync/Horizontal
Trigger In
Pin 3. Grab Pulse Out (-)
Pin 4. Ground
Pin 5. Ground
Pin 6. Vertical Reset In
Pin 7. Grab Pulse Out (+)
Pin 8. Integrate Input
Camera Head (15 pin "D"
subminiature)

ORDERING INFORMATION

499X	—	X	X	X	XXXX
Power Options		Sync Options	Optical Filters	Options	Lens Options
2 12V ac or dc		2 RS170 Genlock/revert to crystal	0 None	00 None (Standard TV Rate)	Manual Iris, C Mount
3 230V ac, 50 Hz, with ac wall adapter (CCIR models)		3 RS170 Genlock/revert to phase adjust line lock	1 IR Filter (Non- removable)	10 Frame Inte- gration Mode	*AL04 4.5mm, f/2.0, 2/3"
4 24V ac, 24V-28 V dc		4 RS170 Async reset		30 Electronic Iris*	AL16 16mm, f/1.4, 2/3"
5 115V ac, 60 Hz, with ac wall adapter (RS -170 models)		5 CCIR Genlock/revert to crystal			AL25 25mm, f/1.4, 1"
		6 CCIR Genlock/revert to phase adjust line lock			AL50 50mm, f/1.4, 1"
		7 CCIR Async reset			* Wide Angle
					Auto Iris, C Mount
					ES04 4.2mm, f/1.6, 1/2"
					ES05 4.8mm, f/1.8, 2/3"
					ES08 8mm, f/1.4, 2/3"
					ES12 12.5mm, f/1.4, 1"
					ES16 16mm, f/1.4, 2/3"
					ES25 25mm, f/1.4, 1"
					ES50 50mm, f/1.4, 1"
					EH75 75mm, f/1.8, 1"
					Other lenses are available. Please consult factory.

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ENVIRONMENTAL

Ambient Temperature Limits

Operating: -20 to 60 °C

(-4° to 140° F)

Storage: -30 to 70 °C

(-22° to 157° F)

Humidity

Up to 95% relative humidity

Vibration

Sine vibration from 5 to 2,000 Hz,
5 g's peak, all 3-axis, 1/2 hr. per
axis per MIL-E-5400T, para
3.2.24.5.1.2, fig. 2, curve IIIa.

Random vibration from 10 to 2,000 Hz,
11 g's rms, all 3-axis, 1/2 hr.
per axis, per MIL-E-5400T, para
3.2.24.5.1.2, category 6.

Shock

Up to 15 g's in any axis under
nonoperating conditions



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**TWO-YEAR
WARRANTY**

REMOTE-HEAD MONOCHROME FRAME-TRANSFER CCD CAMERAS

6400 & 6700 SERIES

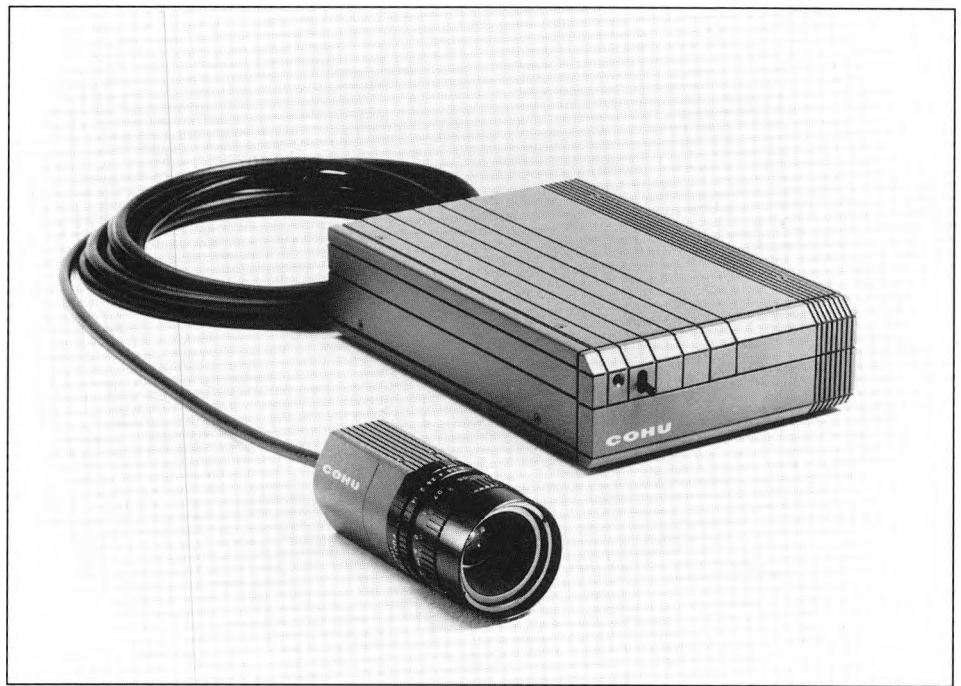
**Compact, Lightweight
Electronic Shutter**

Cohu's Monochrome Remote-Head Frame-Transfer CCD Cameras offer all the outstanding performance characteristics of Cohu's 4800 and 4700 Series standard monochrome frame-transfer cameras, with the added benefits of a two-piece configuration, electronic shutter, and enhanced signal-to-noise characteristics. The lightweight remote camera head is ideally suited for mounting on microscopes, robots, and other equipment with size and weight limitations.

Both the 6400 Series RS-170 and the 6700 Series CCIR cameras provide high resolution and high sensitivity. The blemish-free CCD sensor provides pixel-to-pixel contrast variation of less than 5%, with zero geometric distortion and no lag or image retention.

Connected to the camera control unit by an integral 15-foot cable, the remote camera head weighs only 113 grams, and measures only 38mm in diameter and 51mm in length.

As with all Cohu CCD cameras, the 6400 and 6700 Series cameras are designed and manufactured in U.S.A., and are backed by a full two-year warranty.



Cohu 6400 Series Remote-Head Monochrome Frame Transfer CCD Camera

APPLICATIONS

- Microscopy
- Machine Vision
- Medical Imaging
- Process Control
- Quality Control
- Image Analysis
- Security/Surveillance

FEATURES AND BENEFITS

- **Compact, Lightweight Remote Head** — maximum flexibility for end users or OEMs
- **High Resolution** — for better definition, error-free results
- **Two-Speed Electronic Shutter** reduces blurred images of fast-moving objects.
- **High Sensitivity** permits operation over a broad range of light levels.
- **Genlock, H & V Drive, Pixel Clock Outputs** for machine vision interface
- **High Signal-to-Noise Ratio** for better dynamic range.
- **Auto Black** for contrast enhancement
- **100% Blemish-Free Frame-Transfer Image Sensor** — no dead pixels.
- **Made in U.S.A.** — direct factory support
- **No Lag or Image Retention** — provides fast, clean images
- **Zero Geometric Distortion** for consistent corner-to-corner linearity
- **Selectable AGC Ranges** for better control under varying light conditions
- **Optional IR Filter**
- **State-of-the-Art Design and Construction** for high performance, reliability and long life
- **Choice of RS-170 & CCIR Models**
- **Two-Year Warranty**
- **15' Remote Cable** facilitates system design and installation.
- **Special Configurations** for OEMs and end users

Designed and Manufactured in U.S.A.

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6400 & 6700 SERIES REMOTE-HEAD FRAME-TRANSFER CCD CAMERAS

SPECIFICATIONS

ELECTRICAL

Imager Type

Single CCD using frame-transfer method

Image Area

6.4 x 4.8 mm (corresponding to 1/2" image tube)

Active Picture Elements

RS-170: 755H x 242V

CCIR: 699H x 288V

Cell Size

RS170: 8.5(H) x 19.5 (V) microns

CCIR: 9.2(H) x 16.8(V) microns

Resolution

RS170: 550 horizontal TV lines, 350 vertical TV lines

CCIR: 525 horizontal TV lines, 415 vertical TV lines

Sensitivity (faceplate) @2850 K

0.25 lux at full video, AGC off

0.009 lux at 80% video, AGC on

Contrast Variation

<5% overall at gamma 1, gain 0 dB

Electronic Shutter

Switch selectable, 1/1,000 second, 1/2,000 second, and Off

Video Output

1.0 V p-p @75 ohms, unbalanced

AGC

Switch selectable, Off/Low Gain/High Gain

Peak-average adjustable

Low Gain: 0 - 6 dB

High Gain: 0 - 20 dB

Auto Black

Maintain set-up level at 7.5 ±5 IRE units if picture contains at least 10% black

Signal-to-Noise Ratio

≥56 dB at gamma 1, gain 0 dB

38 dB at gamma 1, AGC On

Auto Lens

Separate lens video signal tracks
AGC peak/average adjustment to eliminate AGC/auto lens interaction

Power: +9V, 100 mA maximum

Gamma

0.5 or 1.0 jumper selectable

Synchronization

Genlock, revert to crystal

Genlock, revert to phase adjustable line lock

External H & V Drive

Internal Clock Speeds

RS170: 14.31818 MHz

CCIR: 14.375 MHz

Power Requirements

4.5 watts dc (without lens)

MECHANICAL

Dimensions (less lens)

Camera Head: 1.50" dia. x 2.00" length (38.1 x 50.8 mm)

Cable: 15 feet (4.57 meters)

CCU: 1.7"(H) x 5.0"(W) x 7.3"(D)
(43.7 x 127 x 189 mm)

Weight

Camera Head (less lens and cable): 4 ounces (113 grams)

Remote Cable: 17 ounces (483 grams)

CCU: 29 ounces (822 grams)

Lens Mount

Adjustable "C" mount, 16mm format

Connectors

BNC connector — Video Out

Switchcraft TB4M — Lens Drive

Switchcraft TB3M — Power In

Hirose SR30-10R-7S — Auxiliary

ENVIRONMENTAL

Ambient Temperature Limits

Operating: -10 to 50°C (14 to 122°F)

Storage: -30 to 70 °C (-22 to 157°F)

Humidity

Up to 95% relative humidity

Vibration

5 to 60 Hz with 0.082 inch total excursion (15 g's @ 60 Hz). From 60 to 1,000 Hz, 5 g's rms random vibration without damage.

Shock (less lens)

Remote head: Up to 30 g's.

CCU: Up to 15 g's in any axis under nonoperating conditions, MIL-E-5400T, paragraph 3.2.24.6

Altitude

Sea level to the equivalent of 3,000 meters or 10,000 feet (508mm/20 inches of mercury)

ORDERING INFORMATION

6X Video Format	1X Power Options	— Sync Options	X Optical Filters	XXX / XXXX Lens Options
4 RS-170 (EIA)	2 12V ac or dc	2 Genlock (revert to crystal)	000 None	Manual Iris, C Mount
7 CCIR	3 230V ac, 50 Hz, with ac wall adapter (CCIR models)	3 Genlock (revert to phase adjustable line lock)	100 IR Filter (non-removable)	*AL04 4.5mm, f/2.0, 2/3"
	5 115V ac, 60 Hz, with ac wall adapter (RS-170 models)	7 External H & V Drive (revert to crystal)		*AL08 8mm, f/1.4, 2/3"
				AL09 9mm, f/1.4, 2/3"
				AL16 16mm, f/1.4, 2/3"
				AL26 25mm, f/1.6, 2/3"
				AL51 50mm, f/1.8, 2/3"
				* Wide Angle
				Auto Iris, C Mount
				ES04 4.2mm, f/1.6, 1/2"
				ES06 6mm, f/1.2, 1/2"
				ES08 8mm, f/1.4, 2/3"
				ES13 12mm, f/1.2, 1/2"
				ES16 16mm, f/1.4, 2/3"
				ES25 25mm, f/1.4, 1"
				EH35 35mm, f/1.4, 2/3"
				NOTE: Auto iris lenses require auto iris cable assembly 8352-1, to be ordered separately.

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**On-Chip
Microlens Sensor**

HIGH PERFORMANCE COLOR REMOTE-HEAD CCD CAMERAS

8290 & 8390 SERIES

**NTSC/Y-C, PAL/Y-C, or RGB
On-Chip Microlens Sensor**

Cohu's new 8290 and 8390 Series High Performance Color Remote-Head CCD Cameras are the perfect solution for applications requiring high performance in a compact package. The lightweight remote head is easily incorporated into microscopes and machine vision systems, and is ideal for specialized security/surveillance applications.

Available in NTSC/Y-C, PAL/Y-C, and RGB models, these high resolution cameras use on-chip microlens HAD sensor technology, which enhances dynamic range and sensitivity while reducing vertical smear.

An easily removable trim plate on the camera control unit provides convenient access to electronic shutter timing, integration, AGC, and white balance controls.

Designed and manufactured in the U.S.A., 8290 and 8390 Series High Performance Color Remote-Head CCD Cameras are backed by a two-year warranty. OEM engineering requests are welcomed.



Cohu High Performance Color Remote-Head CCD Camera

FEATURES AND BENEFITS

- **Compact, Lightweight Remote Head** — for easy installation and operation
- **On-Chip Microlens Sensor** enhances sensitivity and dynamic range, reduces vertical smear
- **High Resolution** — 460 horizontal TV lines for sharper images
- **High Sensitivity** — permits operation over a wide range of light levels
- **Convenient External Adjustments** for control of shutter speed, integration period, AGC, and other critical parameters
- **Zero Geometric Distortion** ensures precision measurement.
- **Two Year Warranty**
- **Choice of Video Formats** — including Y-C and RGB outputs for specialized applications
- **Eight-Speed Electronic Shutter** reduces blurring of fast-moving objects
- **Selectable Integration Periods with Grab Pulse** — for low light level microscopy applications.
- **1000:1 Overload Capability** permits incidental light overloads up to ten times that of other CCD cameras
- **AGC with Peak-Average Adjustment** for clear images in varying light level applications
- **Made in U.S.A.** — direct factory support, quality design and construction.

APPLICATIONS

- **Microscopy**
- **Image Processing**
Medical and Industrial
- **Machine Vision**
Pattern Recognition
Non-Contact Measurement
3-D Imaging
Inspection
- **Robotics**
- **Computer Graphics**
- **Remote Sensing**
- **Mapping**
- **Teleradiology**
- **Quality Control**
- **Teleconferencing**
- **Security/Surveillance**

Designed and manufactured in U.S.A.

COHU
Cohu, Inc./Electronics Division

8290 AND 8390 SERIES REMOTE-HEAD COLOR CCD CAMERAS

SPECIFICATIONS

ELECTRICAL — NTSC AND PAL MODELS

Imager

Single interline transfer CCD with matrix filter (cyan, yellow, magenta, green)

Image Area

6.4 x 4.8 mm (1/2" format)

Active Picture Elements

NTSC/Y-C: 768(H) x 493(V)

PAL/Y-C: 752(H) x 582(V)

Resolution

NTSC/Y-C: Horizontal 460 TV lines
Vertical 350 TV lines

PAL/Y-C: Horizontal 460 TV lines
Vertical 415 TV lines

Sensitivity

3200 K faceplate illumination.
6.5 lux at full video, AGC Off.
0.55 lux at 80% video, AGC On.

Electronic Shutter

Switch selectable, 1/60 second (off)
to 1/10,000 second (8 steps)

Integration

Switch selectable, 2 to 16 fields
(8 steps). Grab pulse available

Gamma

0.5

AGC

0-20 dB
Peak-average adjustable

Signal-to-Noise Ratio (AGC Off)

48 dB (NTSC with 4.5 MHz filter)
45 dB (PAL with 5 MHz filter)

Video Outputs

Encoded: NTSC and PAL
1 V p-p @75 ohms, unbalanced,
composite

S Video:

Y: 1 V p-p @75 ohms, unbalanced,
composite
C: 0.285 V p-p

Auto Lens Output

Peak-average characteristic tracks
AGC adjustment to eliminate
AGC/auto lens interaction

Color Lock

Burst phase adjustment
Horizontal phase adjustment

Color Balance

Through-the-lens type
Less than 10 IRE units unbalance
from 2850 to >5800 K

Synchronization

NTSC or PAL crystal, color lock
standard

Power Requirements

12V ac or dc (standard)
115V ac, 60 Hz for NTSC models
(optional, with wall transformer)
230V ac, 50 Hz for PAL models
(optional, with wall transformer)

Power Consumption

4.5W

ENVIRONMENTAL

Ambient Temperature Limits

Operating: -20 to 50 °C
(-4° to 122° F)

Storage: -30 to 70 °C
(-22° to 157° F)

Humidity

Up to 95% relative humidity,
non-condensing

Vibration (less lens)

5 to 60 Hz with 0.082 inch total
excursion (15 g's @ 60 Hz). From
60 to 1000 Hz, 5 g's rms random
vibration without damage

Shock (less lens)

Up to 15 g's in any axis under
nonoperating conditions,
MIL-E-5400T, paragraph 3.2.24.6

Altitude

Sea level to equivalent of
3,000m/10,000 feet (508mm/20
inches of mercury)

MECHANICAL

Dimensions

Please see dimensional drawings.

Weight

Camera Control Unit (12 V model):
36 ounces (1000 grams)
Camera Head (less lens and cable):
4 ounces (113 grams)
15' Remote Cable: 17 ounces (483
grams)

Lens Mount

Adjustable "C" mount

Connectors

Please see dimensional drawings

Top Panel Adjustments

Shutter/Off/Integrate
8-Position Shutter/Integrate Switch
AGC On/Off *
AGC Peak/Average Adjustment
Auto/Manual/Remote White Balance
Switch *
White Balance Adjustment*
Horizontal Phase/Color Lock*
SC Phase Switch*
SC Phase Adjustment*
AGC/Manual/Remote**
Gain**
Vertical Phase Adjustment**
Horizontal Phase Adjustment**

* NTSC/Y-C and PAL/Y-C Models
Only

** RGB Models Only

ELECTRICAL — RGB MODELS

Imager

Single interline transfer CCD with matrix filter (cyan, yellow, magenta, green)

Image Area

6.4 x 4.8 mm (1/2-inch format)

Active Picture Elements

RGB/60: 768(H) x 493(V)

RGB/50: 752(H) x 582(V)

Resolution

RGB/60: Horizontal 460 TV lines
Vertical 350 TV lines

RGB/50: Horizontal 460 TV lines
Vertical 415 TV lines

Sensitivity

3200 K faceplate illumination.
6.5 lux at full video, AGC Off.
0.55 lux at 80% video, AGC On.

AGC

0-20 dB
Peak-average adjustable

Gamma

0.5 or 1.0

Electronic Shutter

Switch selectable, 1/60 second (off)
to 1/10,000 second (8 steps)

Integration

Switch selectable, 2 to 16 fields
(8 steps); grab pulse available

Power Requirements

12V ac or dc (standard)
115V ac 60 Hz (optional, with wall
transformer)
230V ac 50 Hz (optional, with wall
transformer)

Power Consumption

4.5W

Video Outputs

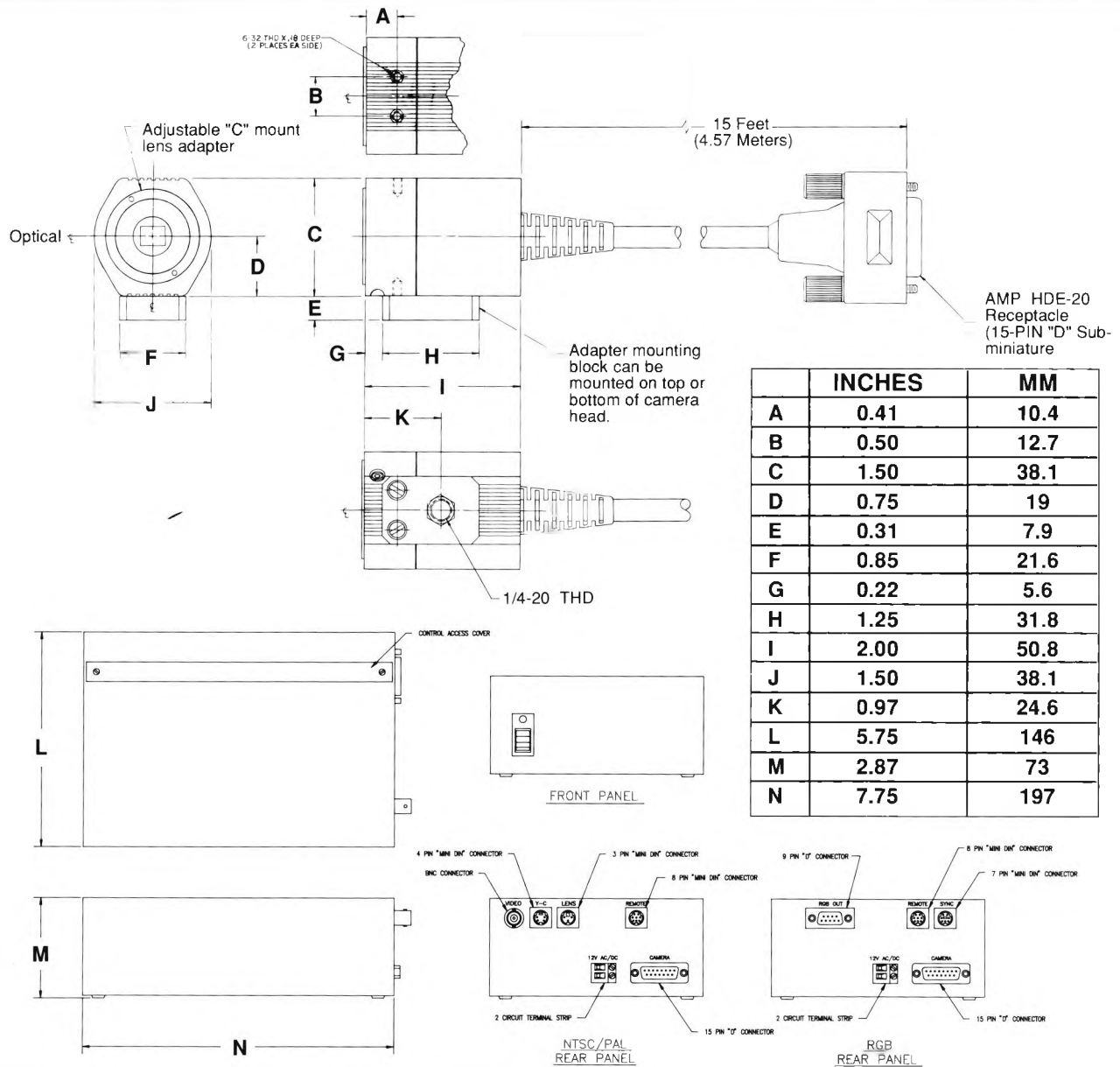
RGB, per channel: 0.714 V p-p
@75 ohms, unbalanced; sync
on green, jumper selectable

Sync: 0.4 V p-p @75 ohms,
unbalanced

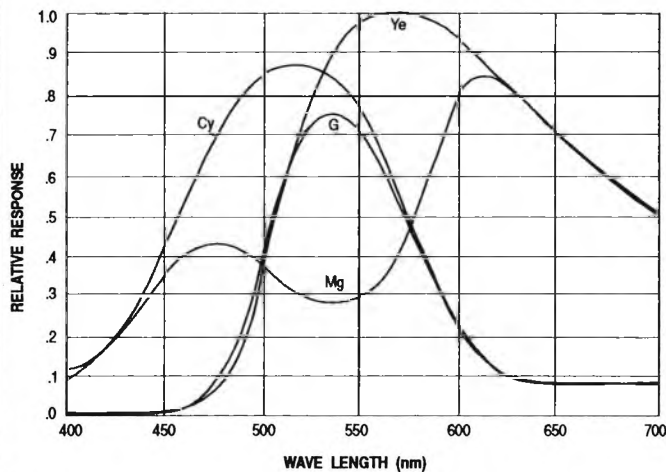
Synchronization

Genlock, H & V drive

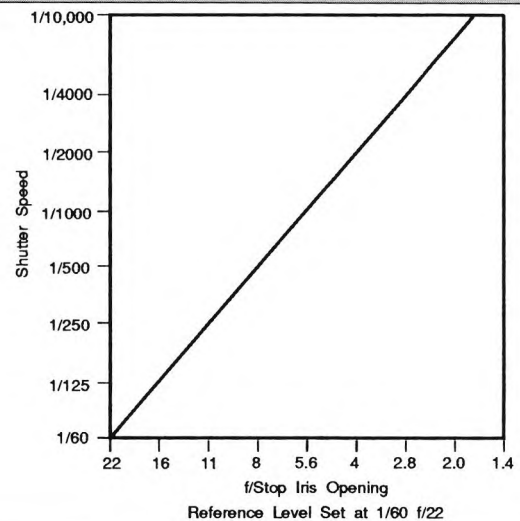
DIMENSIONS



MATRIX FILTER COLOR RESPONSES



TYPICAL f/STOP VS. SHUTTER



8290 AND 8390 SERIES REMOTE-HEAD COLOR CCD CAMERAS

ORDERING INFORMATION

8X9

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XXXX

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XXXX

Format Options

- 2 NTSC Format (60 Hz)
- 3 PAL Format (50 Hz)

Power Options

- 2 12V ac/dc
- 3 230V ac, 50/60 Hz, with wall transformer, (8390 Series only)
- 4 24V ac/dc, 50/60 Hz
- 5 115V ac, 50/60 Hz, with wall transformer (8290 Series only)

Configuration Options

- 1000 NTSC/Y-C or PAL/Y-C
- 2000 RGB/60 or RGB/50

Lens Options

- 0000 None

Manual Iris, C Mount

- AL04 4.5mm, f/2.0, 2/3"
- AL06 6.5mm, f/1.8, 2/3"
- AL08 8mm, f/1.4, 2/3"
- A014 12mm, f/1.2, 1/2"
- AL16 16mm, f/1.4, 2/3"
- AL25 25mm, f/1.4, 1"
- AL50 50mm, f/1.8, 1"

Auto Iris, C Mount*

- ES05 4.8mm, f/1.8, 2/3"
- ES08 8mm, f/1.4, 2/3"
- ES16 16mm, f/1.4, 2/3"
- EH35 35mm, f/1.4, 2/3"

PLEASE NOTE: Cohu welcomes the opportunity to provide special features to better serve your particular requirement. For example, custom painting, silkscreen and logo for OEM customers and special connector pin configurations can be ordered. Please contact Cohu for details.

* Customers supplying their own auto Iris lenses must order lens connector separately. Please consult factory.

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NTSC & PAL CONNECTOR CONFIGURATIONS

LENS

- 1 Power
- 2 Lens Video
- 3 Ground

Y-C

- 1 Y—Ground
- 2 C—Ground
- 3 Y
- 4 C

REMOTE

- 1 Auto/Man
- 2 White Balance
- 3 Sync/Video In
- 4 Shutter On/Off
- 5 +5
- 6 Ground
- 7 Ground
- 8 Grab Pulse

RGB CONNECTOR CONFIGURATIONS

REMOTE 1

- 1 Blue Level
- 2 Red Level
- 3 Sync/Horizontal In
- 4 Shutter On/Off
- 5 +5
- 6 Vertical In
- 7 Ground
- 8 External Gain

SYNC

- 1 Grab Pulse
- 2 V Drive Out
- 3 H Drive Out
- 4 Clock Out
- 5 Ground

RGB

NOTE: The RGB connector layout is directly compatible with Targa[®], Vista[®], and other image capture boards.

- 1 Ground
- 2 Ground
- 3 R
- 4 G
- 5 B
- 6 NC
- 7 Sync
- 8 NC
- 9 NC



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**DSP and Enhanced
Dynamic Range**

DIGITAL COLOR SIGNAL PROCESSING CAMERA

DSPX-2000 / DSPE-2000

**NTSC or PAL Remote Head
1/2" Interline Transfer Imager**

The DSPX digital color camera from Cohu combines the advanced technology and benefits of digital signal processing with vastly superior intrascene dynamic range to deliver high performance unmatched by other cameras. While typical color cameras deliver 48 dB, Cohu's digital camera, with unique processing algorithms, provides as much as 72 dB.

This camera system consists of a miniature remote head attached to the camera control via plug-in cable, making it ideal for use in environments where small camera head size and light weight are critical. A lighted power switch and tactile-response menu selection buttons make the front panel controls easy to operate.

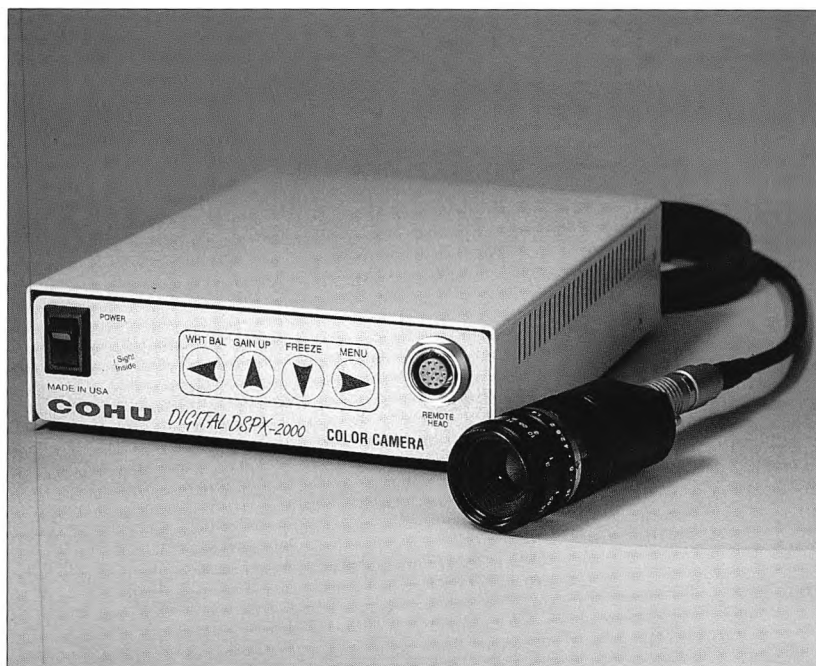
The DSPX and DSPE utilizes a state of the art VLSI (Very Large Scale Integration) digital video processor chip that emulates the human eye's ability to perceive detail in high contrast lighting environments. It has 450 lines NTSC (470 PAL) resolution and 768 (H) X 494 (V) (752 H x 582 V PAL) active pixels. This capability offers the best video imaging system available for such applications as microscopy, endoscopy, machine vision, robotics, process control, and specialized surveillance.

Features can be menu controlled via easy to use push-button selections, or remotely via RS-232.

The DSPX-2000 acquires images in two channels, each with different properties, and merges them into one image. Using a built-in dual gain or dual shutter function, the resulting image has a wider dynamic range, more accurate color reproduction, and less noise.

The remote head utilizes a 1/2" interline transfer color sensor equipped with microlens technology for added sensitivity.

The product can be provided as a board set to OEMs for integration into your packaging. Cohu welcomes requests for custom mechanical and/or electrical configurations.



The new DSPX-2000 is attractively packaged and comes with a full complement of features.

FEATURES

- **Wide Dynamic Range** up to 72 dB provides high detail video images in even the most extreme lighting conditions
- **Edge Enhancement** sharpens transition for increased light/dark definition
- **Normal or Dual Mode** for simultaneous video processing via two separate gain paths
- **Integrated Time/Date Generator**
- **Freeze Frame** to grab and hold an image
- **Simple and Convenient Control** using front panel or PC interface
- **Character Generator** for titles or commentary
- **Dual Shutter** smoothly transitions across the full range, automatically adjusting to changing light conditions
- **2 Year Warranty**
- **Made in U.S.A.**

TOTAL FEATURE CONTROL VIA FRONT PANEL OR RS-232

The DSPX/DSPE menu tree makes it simple and intuitive to achieve the highest possible performance from the camera. From the menu system you can activate all the features and options of the camera using four function keys. Alternately, the camera can be operated remotely via PC with an RS-232 connection.

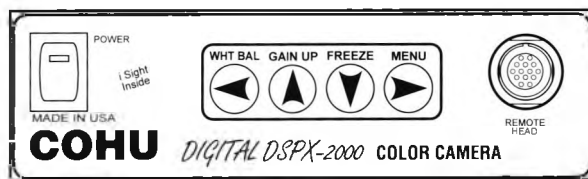
Menus are superimposed on the displayed image on the screen. The commands can open other menus, toggle options, or change variable parameters. Other commands are either toggle options, or variable parameters.

Color:	Control the white balance and color parameters of the camera.
Setup:	Enable automatic functions of the camera, change its configuration, recall saved presets, save new presets, and access the Advanced Setup menu.
Adjustment:	Display variable parameters by which an image produced by the camera can be fine tuned.
White Balance:	Set white balance and color parameters of the camera
Tracking:	Runs an algorithm to predict which areas of the picture are white, then adjusts the white balance accordingly. The Tracking operation is continuous.
Indoor/Outdoor:	Select from a variety of preset color temperatures
Color Adjust:	Modify manually the color level and phase.
Phase:	Shift the phase of the colors (hue) so the displayed image colors match the natural appearance of the pictured object(s).
Level:	Set the color level saturation
Setup:	Enable automatic functions of the camera, change its configuration, recall saved presets, save new presets, and access the Advanced Setup menu
Mode:	Select the operation mode of the camera
Auto Shutter:	Toggle the Auto Shutter function on and off for optimal shutter speed for the existing light conditions
AGC:	Toggle the AGC function on and off to determine the optimal gain for the existing light conditions
Auto Black:	Set black level according to the darkest area of the image. This is especially useful for hazy images.

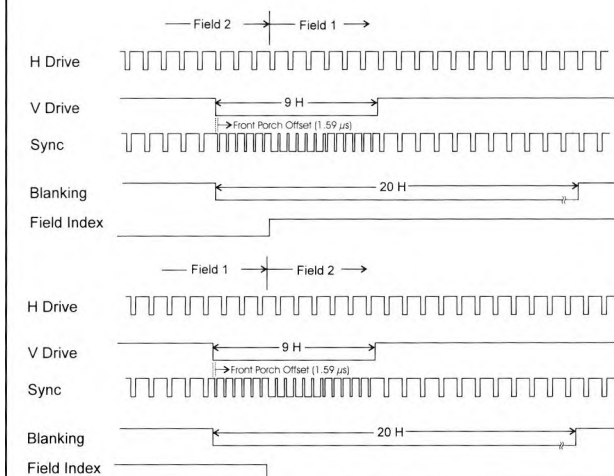
When you choose Exit in any menu, the menu system is turned off but the choices you made remain in effect. The complete set of current parameters is saved and will be loaded each time you turn on the camera, until the next time that setup is changed.

The menu system is manipulated by the arrow keys. The right arrow enters the menus, selects (or activates) a command, enters a submenu or toggles options. If the option is a variable parameter, the right or left arrow will adjust the parameter. The Up/Down arrows move up and down the menus.

Gamma:	Adapt the gamma of the displayed picture to the type of monitor in use to compensate for nonlinear response of the monitor screen.
Recall:	Retrieve a previously saved setup, or return to the factory default setup parameters.
Save:	Save the current setup to be used in the future.
Dual Gain:	Continuously sample image in two channels: one with low gain and one with high gain. The images are combined and the result is an image with a dynamic range of over 60 dB. Details in bright and dark areas become much more visible than with a typical CCD camera.
Dual Shutter:	Sample image alternately in Short and in Long Shutter (25/30 times per second Short and 25/30 times per second Long). The sampled images are combined and the result is an image with a dynamic range of over 72 dB, making details in bright and dark areas much more visible than with a typical CCD camera.
Normal:	Camera operates as a digital video camera with normal dynamic range.
Statistics Weight:	Increase or decrease the relative effect of particular areas of the image on the visibility of the picture. If, for instance, you have a bright background that caused the foreground image to appear dark, you can decide to ignore the bright areas, or to give more weight to the dark areas.
Adjustment:	Display variable parameters which can be changed to fine tune the image that the camera produces. The items listed in this menu change according to the modes and choices made in other menus, and include brightness, DR limit, gain, saturation, shutter, and sharpness.

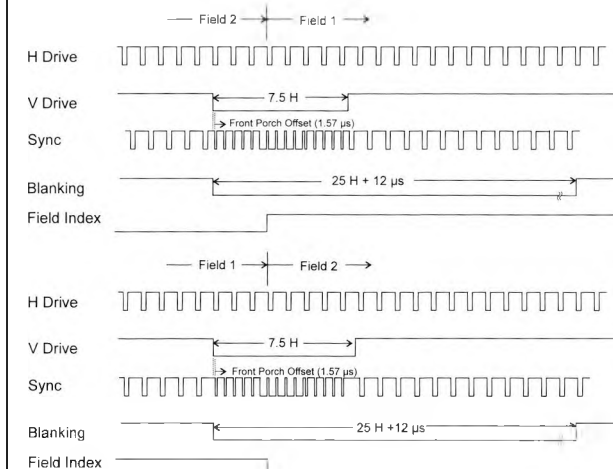


DIGITAL OUTPUT NTSC TIMING



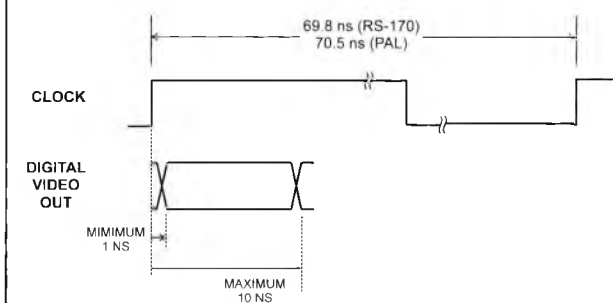
Timing diagram for the DSPX-2000 appears above. Note the separate diagrams for the even and odd fields.

DIGITAL OUTPUT PAL TIMING



Timing diagram for the DSPE-2000 appears above. Note the separate diagrams for the even and odd fields.

SIGNAL REFERENCE TO CLOCK



This timing diagram shows the relationship of the clock output signal to the availability of the video output signal in the DSPX-2000 and DSPE-2000.

SPECIFICATIONS

ELECTRICAL

Imager

PAL or NTSC, 1/2" single interline transfer microlens sensor CCD with CYMG matrix filter

Active Pixels

NTSC: 768 (H) x 494 (V)
PAL 752 (H) x 582 (V)

Resolution

NTSC: 460 HTVL x 350 VTVL
PAL: 450 HTVL x 415 VTVL

Sensitivity

Full video, AGC off: 6.5 lux
80% video, AGC on: 0.5 lux

Electronic Shutter

User selectable: 1/50 (PAL) or 1/60 (NTSC) to 1/30,000 second (NTSC or PAL)

Gamma

color, monochrome, linear

AGC

adjustable range to 24 dB

Signal To Noise

54 dB (with 4.5 MHz filter)

Outputs

RGB: 0.714 V p-p at 75 ohm, sync on (per channel)

Composite: 1 V p-p at 75 ohm

Y: 1 V p-p at 75 ohm

C: 0.285 V p-p

Digital: 24 bit RGB, pixel clock, HD, VD, C sync, C blank, FLD (TTL level)

RS-232

9600 baud, 1 stop, no parity

Power Requirement 12 VDC, +/- 5%

Power Consumption <18 W

DIMENSIONS

CCU and head: See dimensional drawing
Cable: 10 ft./3 m x .20"/mm dia.

MECHANICAL

Weight

CCU: 1.8 lb. (0.8 kg)

Camera Head: 1.15 oz. (49 g)

2.2 meter remote head cable: 5.5 oz. (156 g)

C, with CS adapter available

Lens Mount

Connectors

Video: BNC

Y/C: 4-pin mini DIN

RGB/Sync: D9

Remote Head: 14 pin Lemo

Digital Video: D37

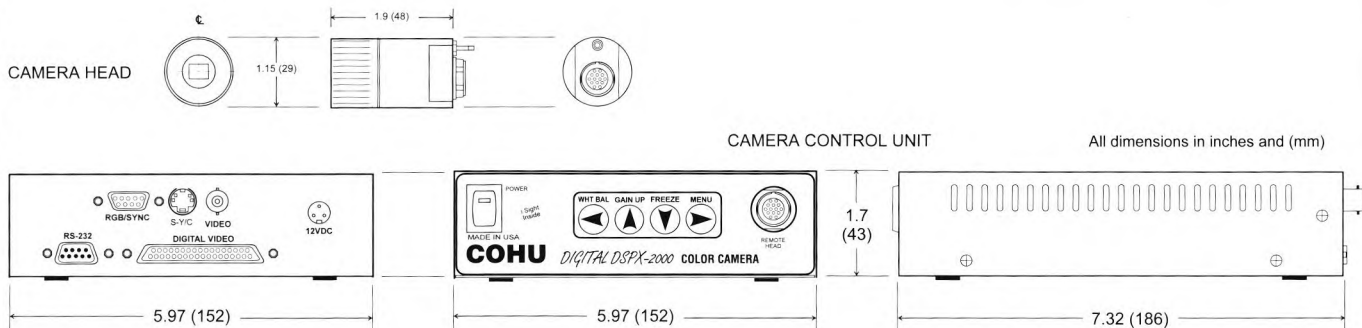
RS-232: D9

Power: 3 pin

Regulatory Approvals

FCC, Class B; VDE, Class B; CE: ESD, RF Susceptibility, Fast Transients, and Emissions

DIMENSIONS



ORDERING INFORMATION

CONTROL UNIT, REMOTE HEAD, AND CABLE

DSPX-2000	NTSC/RGB/Y-C with 10 ft./3m cable
ER3019X	Monochrome (RS-170) version of DSPX
DSPE-2000	PAL/RGB/Y-C with 10 ft/3m cable
ER-3019E	Monochrome (CCIR) version of DSPE

ACCESSORIES

8385-5	Power Supply 115 VAC to 12 VDC
CTC-17	Y-C cable, S-VHS-6, 6 ft./1.85m
CTC-24	RS-232 control cable assembly, 6 ft./1.85m
CTC-25	RGB output cable assembly, male, 6 ft./1.85m
CTC-26	RGB output cable assembly, female, 6 ft./1.85m
8383-6	Mounting Block for camera head

AUXILIARY HEADS AND CCU, ORDERED SEPARATELY

8383-2	NTSC camera head, no cable
8383-3	PAL camera head, no cable
8383-4	NTSC Camera Control Unit - NTSC/Y-C/RGB
8383-5	PAL Camera Control Unit - PAL/Y-C/RGB
8383-7	10 ft (3 m) remote head cable, NTSC or PAL

LENSES

The versatility of this camera allows for many types of standard and specialty lenses. Its "C" and "CS" mount attaches to most standard scopes and appliances. Please consult your Cohu representative for lens selection guidance.



ISO-9001 Certified
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COHU
Cohu, Inc./Electronics Division

**NEW! With Surge
Protection!**

MICROPROCESSOR CAMERA CONTROL SYSTEM

MPC SERIES

**For Color or Monochrome
CCTV Systems**

The Microprocessor Camera Control (MPC) System has been designed and manufactured by Cohu to reduce the cost of CCTV system installations and improve command and control for security/surveillance operations.

The MPC can reduce total equipment and installation costs by up to 20% for systems that exceed 1,000 feet in distance (cameras to monitors). For systems that reach 5,000 feet, the savings are 50% or more compared to traditional multi-conductor cable systems. This is accomplished by installing lower-cost individual video and control cables and by eliminating separate control units.

The MPC makes use of state-of-the-art technology with flexibility to fit most users' custom needs. A standard mini-system of one-camera site control is expandable to 223 camera sites, 32 monitors, and 32 multi-operator Master and Remote stations. Larger system configurations are available upon request.

The MPC utilizes a microprocessor-based CPU, and controls the following: Camera and Monitor selection, lens operation (iris, focus, and zoom functions), and all pan/tilt commands. Digital control signals are transmitted from the MPC by one or more of three formats: RS-422 serial-data balanced line, RS-232 serial line, or DTMF signals over a twisted pair. The MPC transmitter is compatible with existing systems where receivers utilize one of these transmission formats.

The MPC incorporates the latest technology in surge protection to protect power and data inputs against voltage surges caused by lightning and other sources.

Options available to the user are the Preset Option and the Camera Video Switching Option. The Preset Option controls up to 10 preset positions for each camera. The camera video switching Option allows manual switching or random camera sequencing of up to 16 cameras per monitor for as long as 60 seconds per camera. In addition to these, autoscans, color, and bright light limiter control options are also available. For additional information on expansion capabilities, options, and accessories, consult the Cohu Applications Engineering Group in San Diego or your local Cohu representative.



Typical MPC System Components: Camera on Pan/Tilt Unit, Microprocessor Control Unit, Preset Panel, CPU Receiver Box, RS422 Distribution Unit

FEATURES

- Controls up to 223 camera sites
- Expand to 31 remote operator stations
- Compatible with RS-422, RS-232, DTMF
- Operator control of pan/tilt, lens functions
- Digitized control signals
- Operator programmable
- Distances up to 5 miles (8 km) with shielded twisted pair
- Power and data line surge protection

OPTIONS

- Preset control for up to 10 positions
- Autoscans, color and bright light limiter controls
- Video switching/sequencing
- RS-422 balanced-line service
- Multiple RS-232 ports

MPC — MICROPROCESSOR CAMERA CONTROL SYSTEM

THE MPC SYSTEM

The Cohu microprocessor control (MPC) system provides the latest technology in a computer controlled system. Programming and operating the MPC system is simple and requires no special training.

The MPC control system includes master control panels, remote control panels, preset control panels, control receivers, and RS-422 distribution units. Commands to the control receivers at the camera site are via a single twisted pair cable (shielded if preferred) using RS-422 digital data or optional DTMF or by other communication channels if RS-232. All of the units in the system may be connected in a "daisy chain," or by the use of an RS-422 distribution unit, in a "star" pattern with up to ten legs.

Cameras, monitors and limited camera selection access can be assigned to a specific MPC station with our unique systems approach.

The standard control priority is first call up priority. When the camera site is in use, a busy indicator is illuminated on the numeric display readout.

THE MPC MASTER CONTROL PANEL

The MPC master control panel performs as the system CPU.

The functions performed include:

- 1) polling remote control panels for command/camera selection input,
- 2) routing operator commands to correct control receiver, 3) controlling video switchers, 4) implementing commands received via RS-232, 5) implementing control priority, 6) setting system parameters such as the RS-422 baud rate, 7) non-volatile storage of camera sequence and camera selection data, 8) selection of data transfer (RS-422 2-way, RS-422 1-way, or DTMF) for each camera site,
- 9) implementing functions unique to a particular system (such as priority lockout or camera/monitor access assignment) that may be defined to implement non-standard requirements on a system by system basis, 10) RS-232 (single or dual), and 11) DTMF control.

Other system options may be tailored as appropriate for any user system.

THE MPC CONTROL PANEL

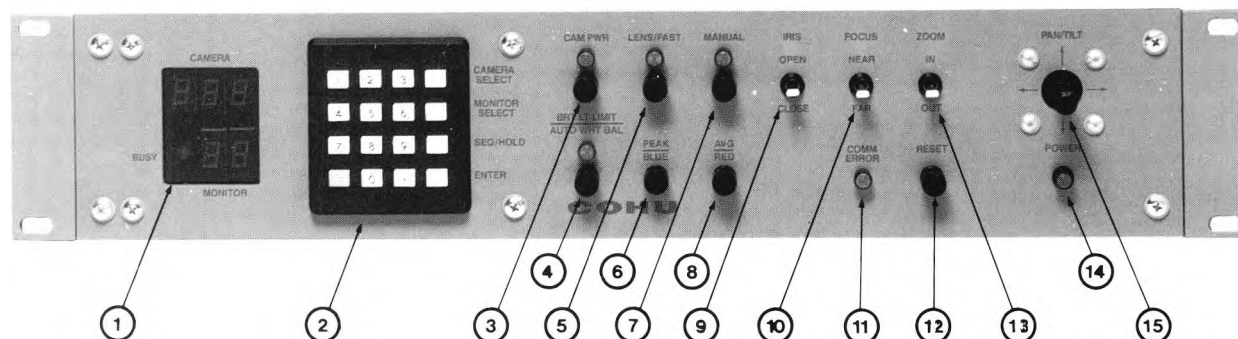
The MPC master control panel and MPC remote control panels serve as operator control units. The MPC control panel is designed for fast, efficient use with little operator training. The layout and clearly designated functions provide the operator quick command and control.

A digital keypad is used to enter monitor/camera selection, sequence programming, sequence/hold commands, and system parameter programming (master only). A numeric display indicates the camera and monitor selection. The busy LED indicator illuminates if the camera is already under control by another operator.

A joystick is used for pan/tilt control, toggle switches for zoom, focus and iris, and push button switches and LED status indicators for camera power, lens speed, and automatic/manual iris select.

Up to three auxiliary push buttons and LED indicators are also available as options for control of bright light limit on/off, peak/avg adjust, auto color balance on/off, manual white balance, or other user defined controls.

COMMAND/CONTROL FOR SELECTED CAMERA SITE



1. NUMERIC DISPLAY

CAMERA
Indicates camera site selected
BUSY
Indicates camera site in use
MONITOR
Indicates which monitor the selected camera out is being directed to

2. PUSHBUTTON KEYPAD

Provides selection of:
CAMERA SELECT KEY
Activates camera selection function
MONITOR SELECT KEY
Activates monitor select function
ENTER KEY
Completes the selection function

3. CAMERA POWER

Starts and stops sequence
C KEY
Clears the selection function
0-9 KEYS
Numeric input for selection function

4. BRIGHT LIGHT LIMITER/AUTO WHITE BALANCE

B&W—turns bright light limiter on/off. Lamp indicates bright light limiter on.
Color—select auto or manual white balance. Lamp indicates auto.

5. LENS/FAST

Select lens speed for focus and zoom functions. Lamp on indicates fast mode.

6. PEAK/BLUE

B&W—adjusts peak average toward peak.
Color—adjusts more blue in manual white balance.

7. MANUAL

Select automatic/manual iris selection. Lamp on indicates manual control mode.

8. AVERAGE/RED

B&W—adjusts peak average toward average
Color—adjusts more red in manual white balance

9. IRIS OPEN-CLOSE

Opens and closes lens iris when MANUAL mode is activated

10. FOCUS NEAR-FAR

Controls lens focus.

11. COMM ERR LAMP

Communication error—indicates communication failure with camera control receiver.

12. RESET SWITCH

Restarts the microprocessor

13. ZOOM IN-OUT

IN brings subject closer on monitor, OUT moves it farther away.

14. POWER LAMP

Green indicates the control panel has power. (On-Off switch is on rear panel.)

15. PAN/TILT JOYSTICK

Moving joystick to any position through a full 360° activates the panning (right-left) and/or tilting (up-down)

MPC CONTROL RECEIVER

The MPC control receiver receives command data from the MPC master control panel and decodes the command data, performs error checking, and acts on valid data to drive the pan/tilt unit (if applicable) and camera controls.

MPC PRESET CONTROL PANEL

The preset control panel installed near the MPC control panel provides push buttons for operator call-up and programming of presets. LEDs display status of preset positions.

MPC RS-422 DISTRIBUTION UNIT

The RS-422 distribution unit provides for ten twisted pair connections for MPC system data communication to control receivers and remote control panels if a single daisy chain is not convenient.

SPECIFICATIONS

ELECTRICAL

Input Voltage

- (a) 105-130V ac, 50/60 Hz
- (b) 210-260V ac, 50/60 Hz

Input Power

Control Panel: 20 Watts
Receiver: 25 Watts, exclusive of camera, heater, and pan/tilt power
Preset Panel: 0.025 Watts (from control panel)

RS-422 Dist. Unit: 15 Watts

Surge Protection

Power Line: 20 joules, peak current 2500 amps
Data Line: 100 amps for 1 ms half value pulse width

ENVIRONMENTAL

Ambient Temperature Limits

Operating:
Control Panel: 0 to 50 °C (32° to 122° F)
Receiver: -40 to 60 °C (-40° to 140° F)
Preset Panel: -10 to 50 °C (14° to 122° F)

RS-422 Dist. Unit: -20 to 60 °C (-4° to 140° F)

Storage:

Control Panel and Receiver: -40 to 85 °C (-40° to 185° F)
Preset Panel: -30 to 70 °C (-22° to 157° F)
RS-422 Dist. Unit: -54 to 70 °C (-65° to 157° F)

Ambient Air Pressure

Sea level to equivalent of 10,000 feet (3,000m)

Humidity

Control Panel: 95% relative
Receiver: 100% relative

Vibration

5 to 30 Hz with 0.03 inches total excursion. From 30 to 1,000 Hz, with peak random vibrations of 5 g's without damage or degradation

Shock

15 g's in any axis under non-operating conditions. MIL-E-5400T, paragraph 3.2.24.6

MECHANICAL

Dimensions

Control Panel: 3.5"H x 12.5"D x 19.0"W (8.9cm x 26.7cm x 48.3cm)

Receiver:

5.4"H x 10.0"D x 13.5"W (13.3cm x 25.4cm x 34.3cm)

Preset Panel:

1.72"H x 8.25"D x 19.0"W (4.4cm x 21.0cm x 48.3cm)

RS-422 Dist. Unit

1.72"H x 8.20"D x 19.0"W (4.4cm x 20.8cm x 48.3cm)

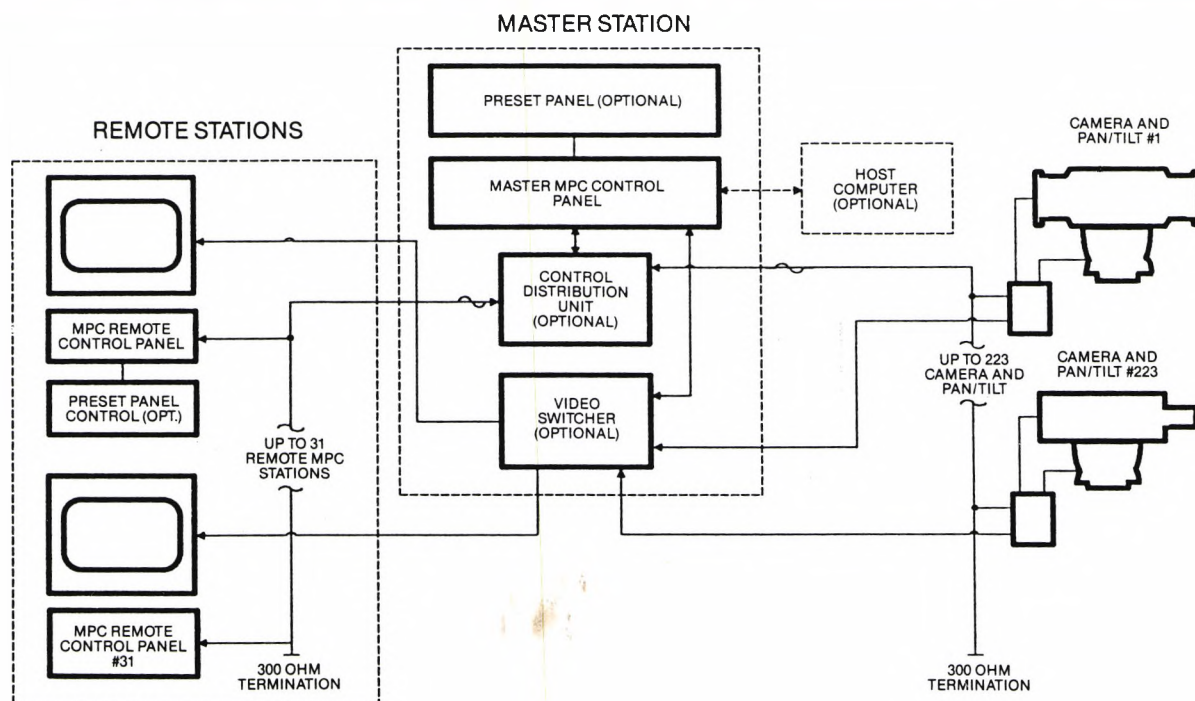
Weight

Control Panel: 10.4 lbs. (4.7 kgs)
Receiver: 17.8 lbs. (8.1 kgs)
Preset Panel: 2.3 lbs (1.02 kg)
Rs422 Distribution Unit: 4.2 lbs (1.9 kg)

Enclosure

Control Panel, Preset Panel, RS-422 Dist. Unit: 19" (48.3cm) rack mount
Receiver: NEMA-4 weatherproof box

TYPICAL MPC SYSTEM



MPC — MICROPROCESSOR CAMERA CONTROL SYSTEM

ORDERING INFORMATION

CONTROL PANEL

MPC	-	X	-	X		XX	/	XX/---/XX
System		Panel Configuration		Input Power		Front Panel Options (*)		System Options (As required)
MPC		M Master R Remote		0 None 1 115 VAC, 50/60 Hz 2 230 VAC, 50/60 Hz		00 Basic MPC (0) 01 Bright Light Limiter(1) 02 BLL/Peak/Avg (3) 03 Auto Scan (1) 04 White Balance (3) 05 BLL/Peak/Avg/White Balance (3)		51 Preset+ 52 RS-232, Single° 53 RS-232, Dual° 54 Video Switcher, Parallel° 56 DTMF°

* Number of positions required for options --- 3 Positions Max.
+ Master or Remote
° Master Only

Note: Multiple Options require slash (/) between numbers

CONTROL RECEIVER

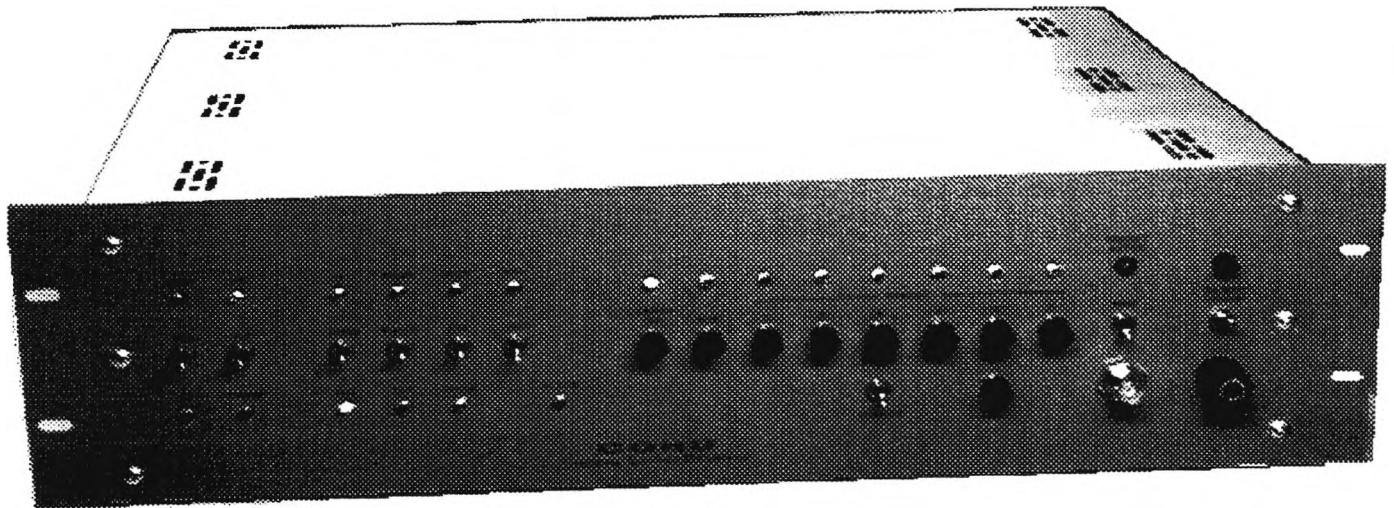
MPC-D	-	X		X		X	/	XX
System		Input Power		Camera Power		Pan/Tilt Power		Options (As required)
MPC-D		1 115 VAC, 60 Hz 2 230 VAC, 50/60 Hz		1 115 VAC 2 230 VAC 4 12 VAC 5 12 VDC 6 24 VAC 7 24 VDC		0 None 1 115 VAC 2 230 VAC 3 115 VDC 6 24 VAC		56 DTMF

AUXILIARY EQUIPMENT & CABLES

MPC	-	XX	-	XXX
System		Configuration		Auxiliary Equipment Cables
MPC		AE Auxiliary Equipment CA Cable		000 None 001 Preset Panel 102 RS-422 Distribution Unit (115 VAC, 60 Hz) 202 RS-422 Distribution Unit (230 VAC, 50/60 Hz) 234 Master Control Panel to RS-422 Distributor Unit 236 Control Receiver to Camera 237 Control Receiver to Vicon Pan/Tilt 238 Control Receiver to Pelco Pan/Tilt (with-PP opt.) 239 RS-232 Type (Null Modem) 240 Master Control Panel to Remote Control Panel Remote Control Panel to Remote Control Panel 241 Control Panel to Preset Panel 242 Remote Control Panel to RS-422 Distribution Unit 243 Control Receiver to RS-422 Distribution Unit 244 Master Control Panel to Control Receiver 245 Control Receiver to Pelco Pan/Tilt (without-PP opt.)

CAMERA CONTROL RECEIVER

FOR ATMS APPLICATIONS



GENERAL DESCRIPTION

The Camera Control Receiver (CCR) receives RS-422/RS-232 commands from the master control panel (in remote mode) or from the front panel switches (in local mode), interprets the commands, and sends the proper control signals to the camera and pan/tilt unit.

A front panel toggle switch selects either the remote mode or the local mode. When the CCR is in local mode, no remote command from the host/control panel is accepted except the query status command. A main chassis wiring harness interconnects all circuit groups of the CCR.

COHU

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OPERATION

GENERAL

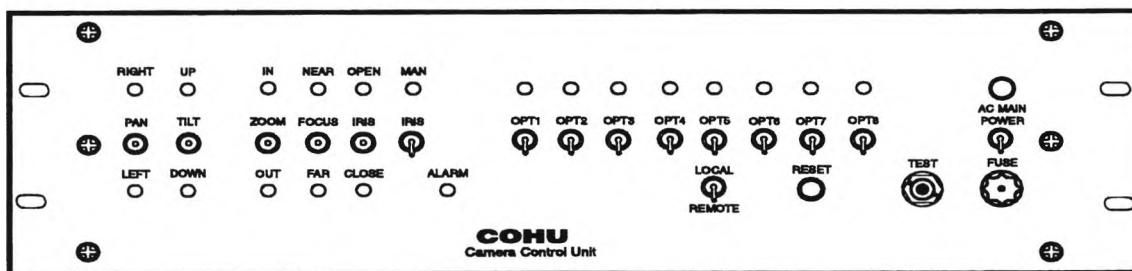
The Camera Control Unit (CCU) is normally controlled by the RS-422/RS-232 port. However, for maintenance, troubleshooting, or other reasons the CCU can be placed in local control mode so that the front panel controls become active. The front panel LOCAL /REMOTE switch selects the control mode.

Three features on the front panel are active at all times. They are not selectable by the LOCAL/REMOTE switch:

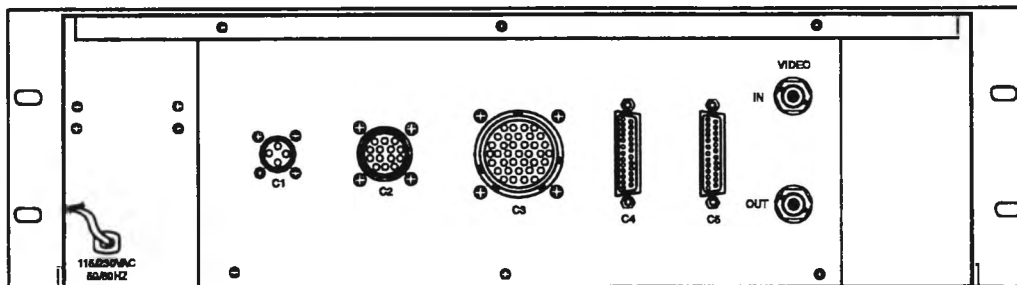
- AC MAIN POWER switch and indicator
- FUSE (ac input power)
- TEST connector (BNC video output)

When LOCAL is selected on the front panel the master control panel has no control over the CCU.

FRONT PANEL CONTROLS



Front panel



Rear panel

AUTOMATIC DIAGNOSTIC FEATURE

A diagnostic automatically occurs during power up or after a RESET. This diagnostic uses the front panel LEDs to provide an indication of proper circuit operation. These groups of LEDs are: (1) PAN and TILT, (2) ZOOM, FOCUS, IRIS, and (3) PRESET.

ELECTRICAL CHARACTERISTICS

The CCR consists of the following elements, mounted on the chassis:

- A switch/indicator board mounting the majority of front panel switches and indicators for use by the operator.
- A switching power supply board delivering +5 V dc, +/- 12 V dc, and +24 V dc to components in the CCR.
- A camera control receiver board acting as a main control interface between:
 - The master control panel and the camera, pan/tilt unit (in remote mode).
 - The front control panel and the camera, pan/tilt unit (in local mode).

The following functions describe the control functions of the camera control receiver board:

In Remote mode: Obtaining commands from (or directed through) the master control panel via RS-422/RS-232 interface. This command is then decoded to generate all drive signals for the camera, lens, pan/tilt, ID generator, preset position, and option control relay.

In Local mode: Obtaining commands from the front panel switches and performing the above remote functions except generating the drive signals for ID generator and preset position.

A front panel control board acts as a local control panel to control basic functions of the camera, pan/tilt unit, and one optional auxiliary control relay.

A 115 V ac power surge suppression, EMI filter, and front panel fuse delivers ac power to the components within the CCU.

A front panel power on/off switch turns the CCU ON/OFF. When the CCU is turned ON, the front panel AC MAIN POWER green LED indicator is also turned ON.

MECHANICAL CHARACTERISTICS

The CCR measures 5" high x 14" deep x 17" wide (a standard 2 RU space). The front panel cover is 5.25" high. The majority of circuits for the CCR mount on three subassemblies attached to the two side panels and to the back of the front panel. A top cover can be removed to gain access to the interior of the unit.

POWER REQUIREMENTS

The CCR requires 115 V ac, 60 Hz input power. This is applied through a permanently attached line cord on the rear panel.

Input power routes through filtering, a front panel fuse, a front panel on/off switch, and then to the switching power supply. An ac feed is tapped off the output of the main ac fuse and is itself fused. This fuse mounts internally on the left side panel inside the chassis. The circuit provides ac power for camera operating voltage, camera heaters, and pan/tilt operating voltages.

SPECIFICATIONS

ELECTRICAL

Control method	Microprocessor controlled. Front panel RESET switch provided on the Camera Control Receiver (CCR)
Control functions	Pan, tilt, zoom, focus, iris, pressure loss, ID generator, sync loss,
Local/remote ctl	A front panel switch selects either LOCAL control (CCR panel has control via its front panel switches) or REMOTE control (the system master control panel has control)
Source ID Gen	Two lines of 24 alphanumeric characters superimposed on video at top or bottom of screen. Non additive mixing used. Characters stored in non-volatile memory. Characters are positioned on monitor screen in response to command from Master
Front Panel	See table 3-1 and figure 3-1 for front panel controls
Low Press. Alarm	CCR responds to low pressure in associated camera and sends status to master control panel when CCU status is sent a query
Vid Sync loss alarm	CCR detects video sync loss from associated camera and sends status to master control panel
Front Panel Alarm	A front panel ALARM light illuminates for either loss of pressure, loss of sync, or to indicate CCR in LOCAL mode
Voltages	Zoom, Focus, Iris: Each internally selectable for 12 V dc, 9 V dc (standard), or 5 V dc operation
Pan/Tilt voltage	115 V ac, 60 Hz, 0.5 A minimum, 1 A maximum
Presets	10 presets available for control of pan, tilt, and focus (6 controllable from front panel switches)
Auxiliary Function	One independently controlled relay with SPST 10 amp contact available at separate rear panel AUX connector
Power	115 V ac 60 Hz, 85 Watt

MECHANICAL

Weight	9 LB 8 oz (431 grams)
Mounting	19 inch rack mount, 5.25 inch vertical space
Inputs and Outputs	7 rear panel, 1 front panel for video test purposes
Fuse	1 on front panel for the ac input; 2 internal (1 on dc power supply, 1 for camera and pan/tilt outputs)
Power on indicator	Front panel green AC MAIN POWER indicator

ENVIRONMENTAL

Temp. Limits	-20° to 60° C (4° to 140° F)
Relative Humidity	Up to 95%, noncondensing

DESIGNED AND MANUFACTURED IN THE U.S.A. ★ ISO-9001 CERTIFIED

COHU, INC./ELECTRONICS DIV.

PO BOX 85623 SAN DIEGO, CA 92186

Telephone: 619/277-6700 Fax: 619/277-0221

CCTV MOUNTING EQUIPMENT

MOUNTS AND ACCESSORIES

Cohu offers a selection of light-, medium-, and heavy-duty mountings for CCTV cameras and monitors. Indoor and outdoor versions are available to suit the environment of the intended application. Each unit has been designed for dependability and long life.

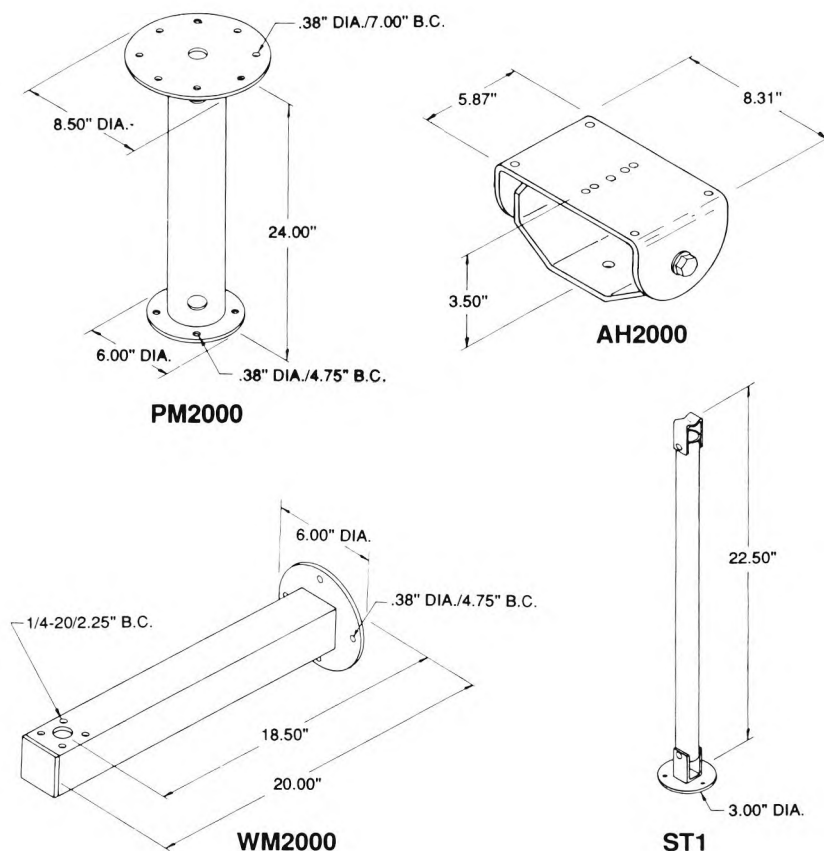
Where an adjustable head is required, be sure to include its separate model number when ordering the basic mount.

If you need assistance in determining the proper accessories for your particular CCTV installation, please call your Cohu representative, or call the factory and ask to speak with one of our experienced applications engineers.



Model PM2000 Pedestal Mount and WM2000 Wall Mount With Model AH2000 Manually Adjustable Pan/Tilt Head Adapter

PM2000, WM2000, AH2000, and ST1 DIMENSIONS



SPECIFICATIONS

WM2000 WALL MOUNT

The WM2000 is a universal wall arm mount designed for wall mounting medium- to heavy-duty pan/tilts or heavy-duty camera enclosures. The WM2000 will support loads of up to 75 lbs. When used with an optional ST1 support strut, maximum load capacity is increased to 150 lbs.

PM2000 PEDESTAL MOUNT

The PM2000 is a universal pedestal mount designed for use with all medium- and heavy-duty pan/tilts. Its aluminum construction ensures load capacity up to 125 lbs. ST1 struts can be used to increase horizontal stability in windy areas. The PM2010 is the same as the PM2000 except it is 10" high.

AH2000 HEAD ADAPTER

The AH2000 adjustable head adapter is designed for use with WM2000 and PM2000 mounts. It provides 360° horizontal movement. For certain installation applications, the AH2000 can be used alone.

INDOOR/OUTDOOR MOUNTS AND ACCESSORIES

PEDESTAL AND WALL MOUNTS

CM1700 LIGHT-DUTY MOUNT

The CM1700 is a light-duty low-cost universal mount primarily designed for ceiling or pedestal mounting. It can also be used as a wall mount. The CM1700 features an easily adjustable ball/swivel head for camera positioning and is finished in black anodized and beige enamel. Its 6.75" stem supports up to 10 lbs.

CM1400/PM14 WALL MOUNT

Designed for interior use in banks, offices and similar installations, the CM1400/PM14 will easily accommodate light-duty cameras and other equipment up to 20 lbs. This economical mount measures 9.75" from the base to its mounting point, and is made of die-cast aluminum. The CM1400 features an easily adjustable ball/swivel head which allows unlimited pan rotation and 90° tilt down angle. The PM14 is identical to the CM1400 except that it has an adapter plate in place of the ball/swivel head.

EM1400 WALL MOUNT

This light duty wall mount is designed for use with light- to medium-weight cameras and camera enclosures up to 20 lbs. It features a 9.71" die-cast aluminum arm with an adjustable head which allows mechanical positioning of the camera or enclosure.

EM22 and MM22 ENCLOSURE MOUNTS

For loads up to 40 lbs., the EM22 Wall Mount and the MM22 Pedestal/Ceiling Mount are economical solutions. Both mounts have fully adjustable swivel heads and are made of sturdy cast aluminum. The EM22 measures 16.50" from base to mounting point; the MM22 measures 6.86" in height.

MOUNTING ACCESSORIES

PAN/TILT ADAPTER PLATES

The PA2000 is the adapter plate for medium-duty pan/tilts and scanners and the PA2010 will adapt to all heavy-duty pan/tilts. Both are for use with the WM2000 Universal Wall Mount.

POLE MOUNT ADAPTERS

The PA100 Series Pole Mount Adapters permit the use of a standard wall mount when installation of CCTV equipment is required on a pole. Lightweight and easily installed, the rugged one-piece aluminum construction provides a strong, stable mounting surface for the accessory equipment. The Model PA100 is designed for use with CM1400, EM22, and EM1400 mounts. Minimum pole diameter is 1.5". Model PA102 is for use with WM2000 mounts, and requires a pole with a 3" minimum diameter. The SPA102 Pole Mount Adapter is for use with the ST1 Support Strut in installations requiring additional support; minimum pole diameter is 3 inches.

PARAPET MOUNT ADAPTER

Model PP100 Parapet Mount Adapter eliminates the expense and hazards of installing and servicing CCTV equipment mounted on parapets. Supporting up to 175 lbs., the PP100 fastens to the inside of the parapet and is rotatable a full 360° so the equipment can be installed and serviced in safety from the rooftop. It can be installed on any parapet wall at least 18" high, and is compatible with most wall mounts.

CORNER MOUNT ADAPTERS

Model CM100 Corner Mount Adapters are compatible with WM2000 Wall Mounts. In installations requiring the addition of an ST1 Support Strut, a Model SCM100 Corner Mount Strut Adapter must also be used.

COHU RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.



5755 Kearny Villa Road • San Diego, CA 92123
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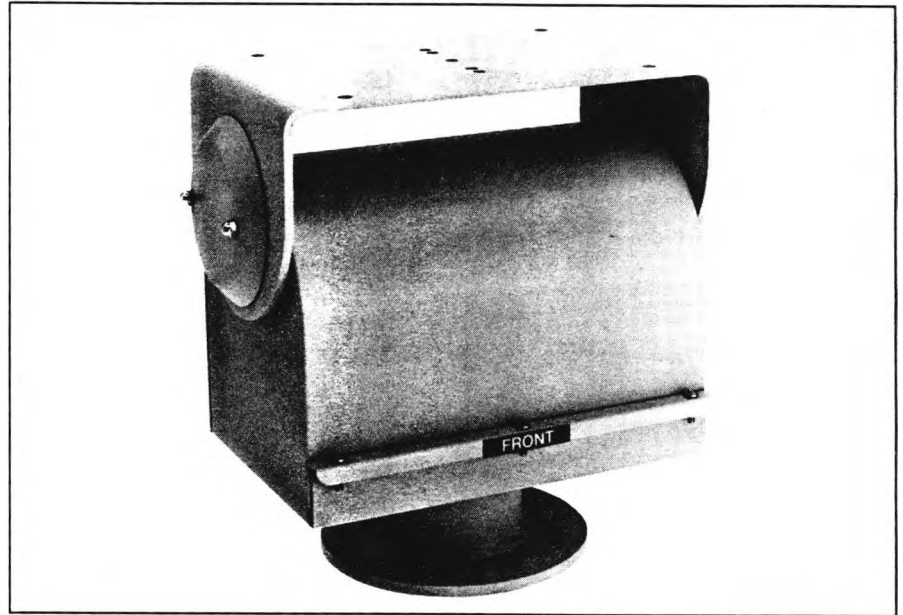
CCTV REMOTE POSITIONING DEVICES

PAN AND TILT UNITS

Cohu offers a selection of pan and tilt units for a wide array of applications and environmental conditions. Outdoor units are built to withstand harsh conditions such as rain, snow, and extreme temperatures. Some indoor applications may require environmental pan and tilt units due to extreme conditions.

In selecting the proper unit for your application, the most important consideration is weight. Be sure to include the total weight of the camera/lens package. Also, be sure to factor in high winds and other conditions that might put additional strain on the unit.

For assistance in determining the correct equipment for your application, please call your Cohu representative, or call the factory and ask to speak with one of our experienced applications engineers.



Model PT550P Medium Duty Outdoor Pan and Tilt Unit

PT175-24P LIGHT DUTY

- **Indoor/Outdoor Operation**
- **Inverted Operation**
- **External Limit Adjustment**
- **Pan**
0—355° movement in horizontal plane at 9°/second $\pm 1^\circ$ (No-load condition)
- **Tilt**
 $\pm 90^\circ$ movement in vertical plane at 3°/sec. $\pm 0.5^\circ$ (No-load condition)
- **Maximum Load**
20 lbs. at 5" from tilt table surface to center of gravity
- **Gearing**
Chain and sprocket pan drive; worm gear tilt drive
- **Input Voltage**
24V ac, 50/60 Hz
- **Power Requirements**
Running: 0.47 amp, 30.8 VA
Starting: 1.81 amps, 43.5 VA
- **Construction**
Aluminum casting and plate, all internal parts corrosion protected
- **Temperature**
-10°F to 140°F (-23°C to 60°C)
- **Weight**
18 lbs (8.1 kg)

PT270P MINI PAN/TILT

- **For Indoor Operation**
- **Inverted Operation**
- **External Limit Adjustment**
- **Pan**
0—355° movement in horizontal plane at 9°/second $\pm 1^\circ$ (No-load condition)
- **Tilt**
 $\pm 90^\circ$ movement in vertical plane at 3°/sec. $\pm 0.5^\circ$ (No-load condition)
- **Maximum Load**
15 lbs. at 5" from tilt table surface to center of gravity
- **Gearing**
Chain and sprocket final drive
- **Input Voltage**
115V ac, 50/60 Hz or 24V ac, 50/60 Hz (Model PT270-24P)
- **Power Requirements**
24V units: 0.74 amp (running)
115V units: 0.13 amp (running)
- **Construction**
Aluminum plate, all internal parts corrosion protected
- **Temperature**
-10°F to 140°F (-23°C to 60°C)
- **Weight**
9 lbs (4 kg)

PT550P MEDIUM DUTY

- **For Outdoor Operation**
- **Easy Serviceability**
- **Inverted Operation**
- **Dynamic Braking for Instantaneous Stopping**
- **Adjustable Worm Gear Final Drive to Prevent Drift and Minimize Backlash**
- **Pan**
0—355° movement in horizontal plane at 6°/second $\pm 1^\circ$ (No-load condition)
- **Tilt**
 $\pm 90^\circ$ movement in vertical plane at 3°/sec $\pm 0.5^\circ$ (No-load condition)
- **Maximum Load**
40 lbs. at 5" from tilt table surface to center of gravity
- **Input Voltage**
115V dc
- **Power Requirements**
0.88 amp, 102 VA maximum
- **Construction**
Aluminum plate, all internal parts corrosion protected
- **Temperature**
-10°F to 140°F (-23°C to 60°C)
- **Weight**
22 lbs (9.9 kg)
- **Preset Position Option**

Designed and manufactured in the U.S.A.

COHU
INC
ELECTRONICS DIVISION

PAN AND TILT UNITS

SPECIFICATIONS

PT570P MEDIUM DUTY

- **For Outdoor Operation**
- **Easy Serviceability**
- **Inverted Operation**
- **External Limit Adjustment**
- **Adjustable Worm Gear Final Drive to Prevent Drift and Minimize Backlash**
- **Pan**
0—355° movement in horizontal plane at 6°/second $\pm 1^\circ$ (No-load condition)
- **Tilt**
 $\pm 90^\circ$ movement in vertical plane at 3°/sec. $\pm 0.5^\circ$ (No load)
- **Maximum Load**
40 lbs. at 5" from tilt table surface to center of gravity
- **Input Voltage**
115V ac, 50/60 Hz or 24V ac, 50/60 Hz (Model PT570-24P)
- **Power Requirements**
24V units: 1.8 amps running, 2.70 amps maximum
115V units: 0.36 amps running,
- **Construction**
Aluminum plate, all internal parts corrosion protected
- **Temperature**
-10°F to 140°F (-23°C to 60°C)
- **Weight**
22 lbs (9.9 kg)
- **Preset Position Option**

PT1250P HEAVY DUTY

- **Indoor/Outdoor Operation**
- **Easy Serviceability**
- **Rugged Construction**
- **Explosion-Proof Models**
- **External Limit Adjustment**
- **Adjustable Worm Gear Final Drive to Prevent Drift and Minimize Backlash**
- **Pan**
0—355° movement in horizontal plane at 6°/second $\pm 1^\circ$ (No-load condition)
- **Tilt**
 $\pm 90^\circ$ movement in vertical plane at 3°/sec. $\pm 0.5^\circ$ (No load)
- **Maximum Load**
100 lbs. at 5" from tilt table surface to center of gravity
- **Input Voltage**
115V ac, 50/60 Hz; 220V ac option for Explosion-Proof Models); 115V dc (Model PT1250DC)
- **Power Requirements**
Standard 115V ac models: 0.70 amps running, 1.20 amps
Explosion-Proof Models: 1.0 amp running, 1.48 amps maximum
115V dc models: 0.66 amps running, 1.0 amp maximum
- **Construction**
Aluminum casting and plate, all internal parts corrosion protected
- **Temperature**
-10°F to 140°F (-23°C to 60°C)
- **Weight**
55 lbs (25 kg)
- **Preset Position Option**

PT2000L EXTRA HEAVY DUTY

- **Outdoor Operation**
- **Dynamic Braking for Instantaneous Stopping**
- **Rugged Construction**
- **External Limit Adjustment**
- **Adjustable Worm Gear Final Drive to Prevent Drift and Minimize Backlash**
- **Pan**
0—355° movement in horizontal plane at 6°/second $\pm 1^\circ$ (No-load condition)
- **Tilt**
 $\pm 90^\circ$ movement in vertical plane at 6°/sec. $\pm 0.5^\circ$ (No load)
- **Maximum Load**
150 lbs. at 5" from tilt table surface to center of gravity
- **Input Voltage**
115V dc
- **Power Requirements**
Running: 2.4 amps, 276 VA
Starting: 3.6 amps, 414 VA
- **Construction**
Aluminum casting and plate, all internal parts corrosion protected
- **Temperature**
-10°F to 140°F (-23°C to 60°C)
- **Weight**
110 lbs (50 kg)
- **Preset Position Option**

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PRESET POSITION OPTION

The Preset Position Option is a position feedback modification which allows pan and tilt to be automatically positioned to various preset positions. This feature requires the use of a Cohu MPC Microprocessor Control System or related equipment

ALPHANUMERIC DISPLAY SYSTEM

SID-100 & UDC-111

Cohu's Model SID-100 Source ID Generator is designed to provide positive identification of the source of the video signal displayed on a monitor screen. The more cameras utilized in a closed-circuit television system, the more desirable it is to be certain you know which camera view is being observed. Typical applications include security/surveillance, airport ground traffic control, penal institutions, mass transit facilities, and other complex monitoring operations.

A 16-character alphanumeric display is produced by each SID-100 Source ID Generator and superimposed on the appropriate video image. Each character is 28 TV lines high and is derived from a standard 5x7 dot matrix. The particular display information is programmed into an erasable EPROM using a PROM programmer. This information is inserted into the video signal by raising the appropriate portions of the signal to whiter-than-white voltage levels without overdriving the monitor. Vertical position of the display is determined by jumper selection and horizontal position is determined by the potentiometer. Once installed, the programmed ID is automatically displayed with its associated video signal.

EPROMs are installed in the appropriate SID-100 Source ID Generator boards which are, in turn, installed into an 18-board capacity Model UDC-111 rackmountable display chassis. EPROMs may be erased with an ultra-violet light EPROM eraser. Programming of EPROMs is available from Cohu. In addition, Cohu can provide, as a special ER feature, a PROM programmer and PC-compatible software to enable user programming.

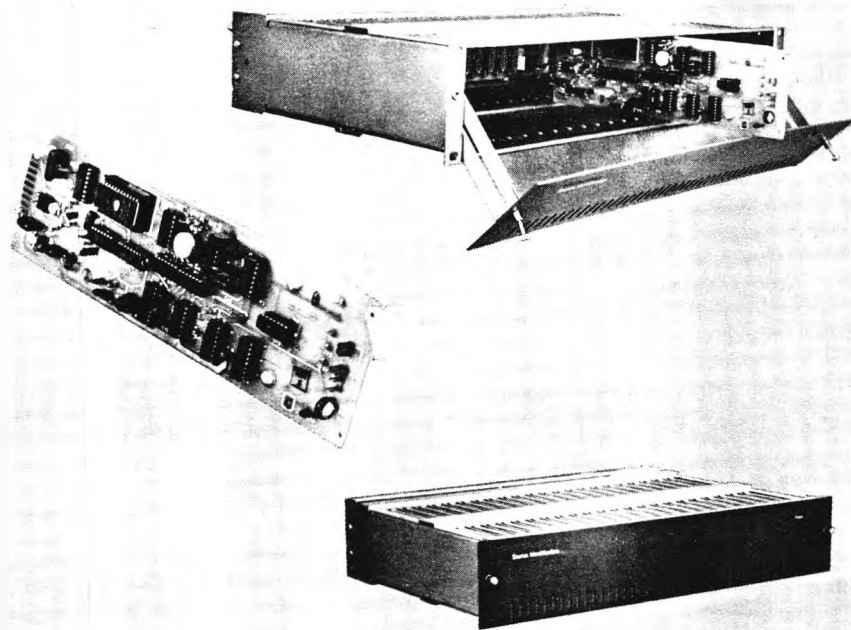
ELECTRICAL

Each Source ID Generator board separates the composite sync from the video input for use in providing timing for its digital logic and memory circuits. Display information

is inserted into the video output without distorting any other signal characteristics. Any Source ID Generator board may be removed without disturbing the video signal. The SID-100 is compatible with all closed-circuit television systems utilizing either EIA standard RS-170 or CCIR specifications.

MECHANICAL

Up to 18 individual SID-100 boards may be installed in a Cohu Model UDC-111 rackmountable chassis, which fits in a standard 19" rack with a 3.5" panel height. Video is cabled to and from the chassis through 36 BNC connectors located on the back panel.



Shown clockwise from top: The Cohu SID-100 Source ID Generator and UDC-111 chassis; the UDC-111 chassis; and the SID-100 module.

FEATURES

- Video source identification at a glance
- 16-character white alphanumeric display
- Field programmable
- Display location on monitor screen, jumper selectable
- Capatible with EIA RS-170 and CCIR specifications
- Up to 18 separate Source ID Generator boards in a single 19" rackmount chassis

SID-100 & UDC-111 — ALPHANUMERIC DISPLAY SYSTEM

SPECIFICATIONS

ELECTRICAL

Input Power

115 VAC/20 W (18 modules installed)

Input Signal Level

-4 dB; nominal 1.0 V p-p composite video, EIA RS-170 (CCIR special order only)

Characters

Alphanumeric; 28 lines high; white

Number of Characters

16 per module, including blanks

MECHANICAL

Chassis Dimensions

19.0" x 13.0" x 3.5"
(48.26 cm x 33.02 cm x 8.89 cm)

Chassis Connectors

36 BNC Type Connectors

Number of ID Generator Modules per Chassis

Up to 18, maximum

ENVIRONMENTAL

Ambient Temperature Limits

Operating: 0° to 50°C (32° to 122°F)

Storage: -40° to 85°C (-40° to 185°F)

Ambient Air Pressure

Sea level to equivalent of 10,000 feet (3,048 m) above sea level (24.4 cm of mercury)

Humidity

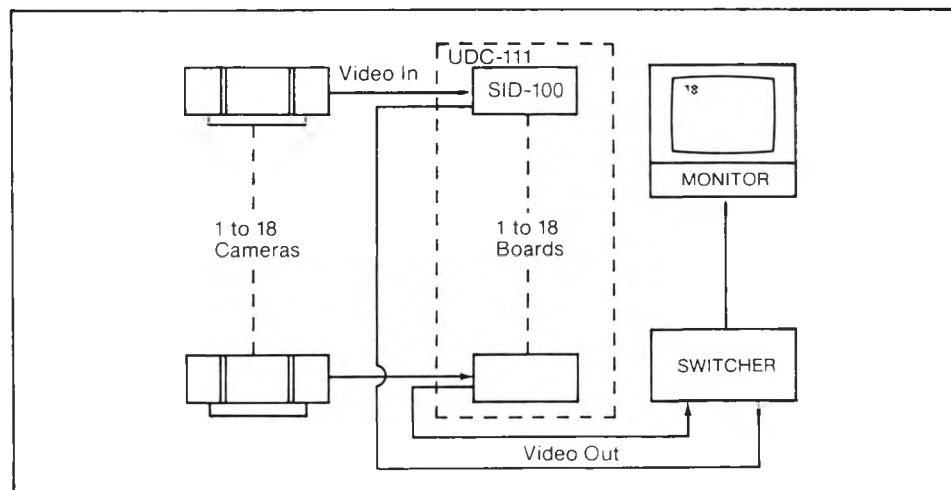
95% relative humidity (without condensation)

Shock

15 g's in any axis under non-operating conditions, MIL-E-5400R, para. 3.2.24.6.

ORDERING INFORMATION

MODEL NUMBER	DESCRIPTION
SID-100	Source ID Generator Module (specify EPROM programmed or unprogrammed)
UDC-111	Display Chassis, with power supply



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HIGH RESOLUTION CCTV MONITORS

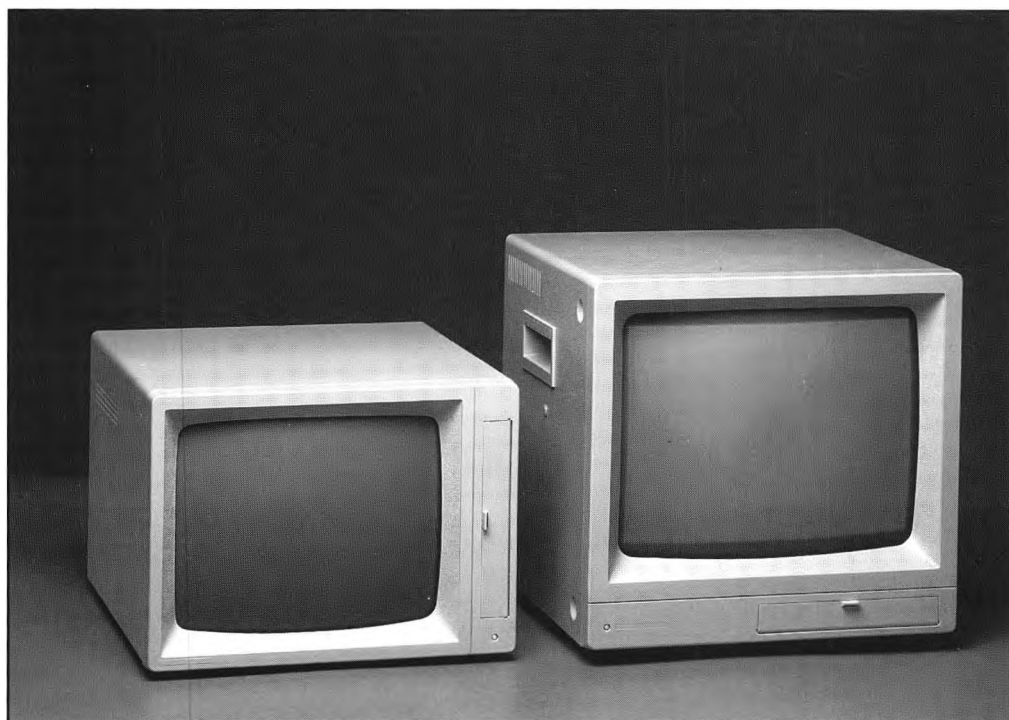
9600C SERIES

Monochrome Monitors

Cohu 9600C Series monochrome monitors are high quality, high performance raster scan displays built to international performance standards. They give stable and reliable performance for virtually every surveillance, industrial, medical, or educational CCTV application. They are extremely rugged, with exceptional geometry, and an average MTBF of 60,000 hours.

Cohu 9600C monitors are offered in 9", 12", 15", 17", and 23" (diagonal) models with P4 white phosphor anti-glare faceplate standard and feature a minimum center resolution of 1000 TV lines.

A full selection of rack, ceiling, and wall mounts is available.



Cohu offers a range of monitors to fit nearly every CCTV application.

STANDARD FEATURES

- **Variable scanning** to ensure signal reliability
- **High resolution** linear grey scale (16 discernible levels of black and white)
- **Rugged** metal case construction
- **Easy access** front panel controls
- **BNC connectors** for loop through of multiple monitors
- **UL, FCC, and CSA listed** for 120 V models
- **4:3 aspect ratio**
- **Switchable picture size** from 105% to approx. 85%
- **Composite Input** compatible with any EIA standard RS-170 input (0.5 - 2 V p-p)
- **Differential Input Amplifier** provides increased common mode rejection better than 40 dB up to 6 V p-p
- **Switchable Power Supply** for 110/220/240 V operation; 50/60 Hz 525/60 NTSC and 625/50 CCIR scan operations

MOUNTING ACCESSORIES

9609C/RBL or RBR

Rack mounting kit for 9609 monitors to fit standard EIA equipment rack. Holds one 9609C or two side by side with the blank panel removed. Color: brown. Dimensions: 18.97" (482 mm) W x 8.75" (222 mm) H.



9617C/R

Rack mounting kit for one 9617C monitor, with access door at bottom. Color: brown. Dimensions: 18.97" (482 mm) W x 15.74" (400 mm) H.



9615C/R

Rack mounting kit for one 9615C monitor. Model 1915/R places access door at right (shown). Color: Brown. Dimensions: 18.97" (482 mm) W x 12.20" (310 mm) H.



9617C/YC or 9623C/YC

Ceiling mount for suspended 9617C and 9623C monitors. Fits standard 1.5" steel pipe and fittings (not included). Comes complete with mounting studs and allows monitor to tilt to desired angle. Color: black.

9617C/YW or 9623C/YW

Wall mount bracket for use with 9617C and 9623C monitors. Color: black.



COHU
Cohu, Inc./Electronics Division

9" AND 12" HIGH RESOLUTION MONOCHROME MONITORS

Maximum Resolution

1050 TV lines at 31.5 KHz

1024 pixels at 36 KHz

Bandwidth

30 MHz -3 dB @ 25 V

Horizontal Frequency

15.5 - 40.0 KHz

Vertical Frequency

40-90 Hz

Power

90-264 VAC, 50/60 Hz

User Controls

On/Off
Horizontal Centering
Vertical Centering
Brightness
Contrast
Vertical Linearity
Vertical Size
Horizontal Size
Focus
Sub-brightness

Interfaces

1. One BNC input, 75 ohm terminated
2. Two BNC inputs, with loopthrough, A/B switchable from front panel.

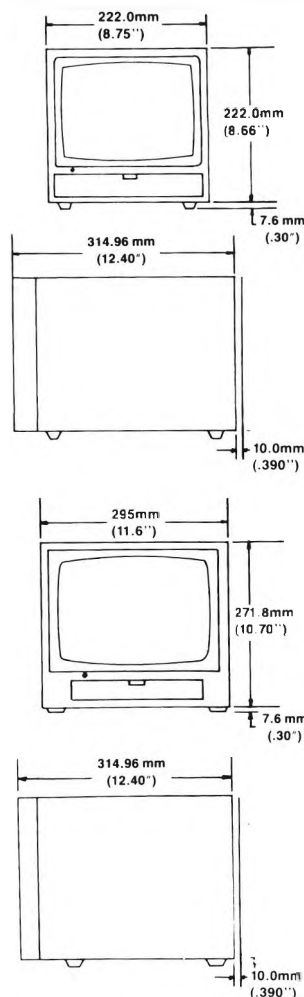
Weight

9": 12 lb. (5.45 kg)

12": 19 lb. (8.64 kg)

Dimensions

As illustrated



15" AND 17" HIGH RESOLUTION MONOCHROME MONITORS

Maximum Resolution

1000 TV lines at center

800 TV lines at corner

Bandwidth

30 MHz

Horizontal Frequency

15.5 - 16 KHz

Vertical Frequency

50-70 Hz

Power

90-270 VAC, 50/60 Hz

User Controls

On/Off
Horizontal Centering
Vertical Centering
Brightness
Contrast
Vertical Size
VTR Switch
A/B Switch

Interfaces

A/B BNC inputs, with loopthrough, auto terminating

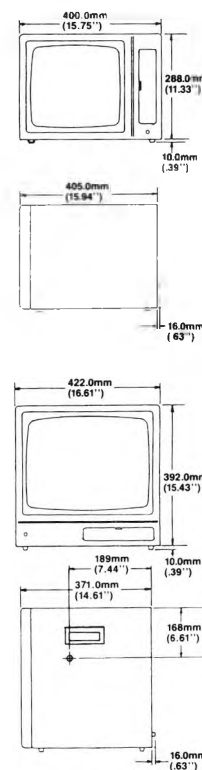
Weight

15": 10.8 lb. (14 kg)

17": 37.5 lb. (17 kg)

Dimensions

As illustrated



23" HIGH RESOLUTION MONOCHROME MONITORS

Maximum Resolution

1000 TV lines at center

Bandwidth

30 MHz

Horizontal Frequency

15 - 40 KHz

Vertical Frequency

45-90 Hz

Power

90-270 VAC, 50/60 Hz

User Controls

Same as above

Interfaces

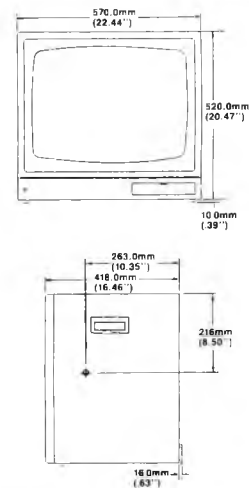
A/B BNC inputs, with loopthrough, auto terminating

Weight

66 lb. (30 kg)

Dimensions

As illustrated



ORDERING INFORMATION

96

9600 C Series

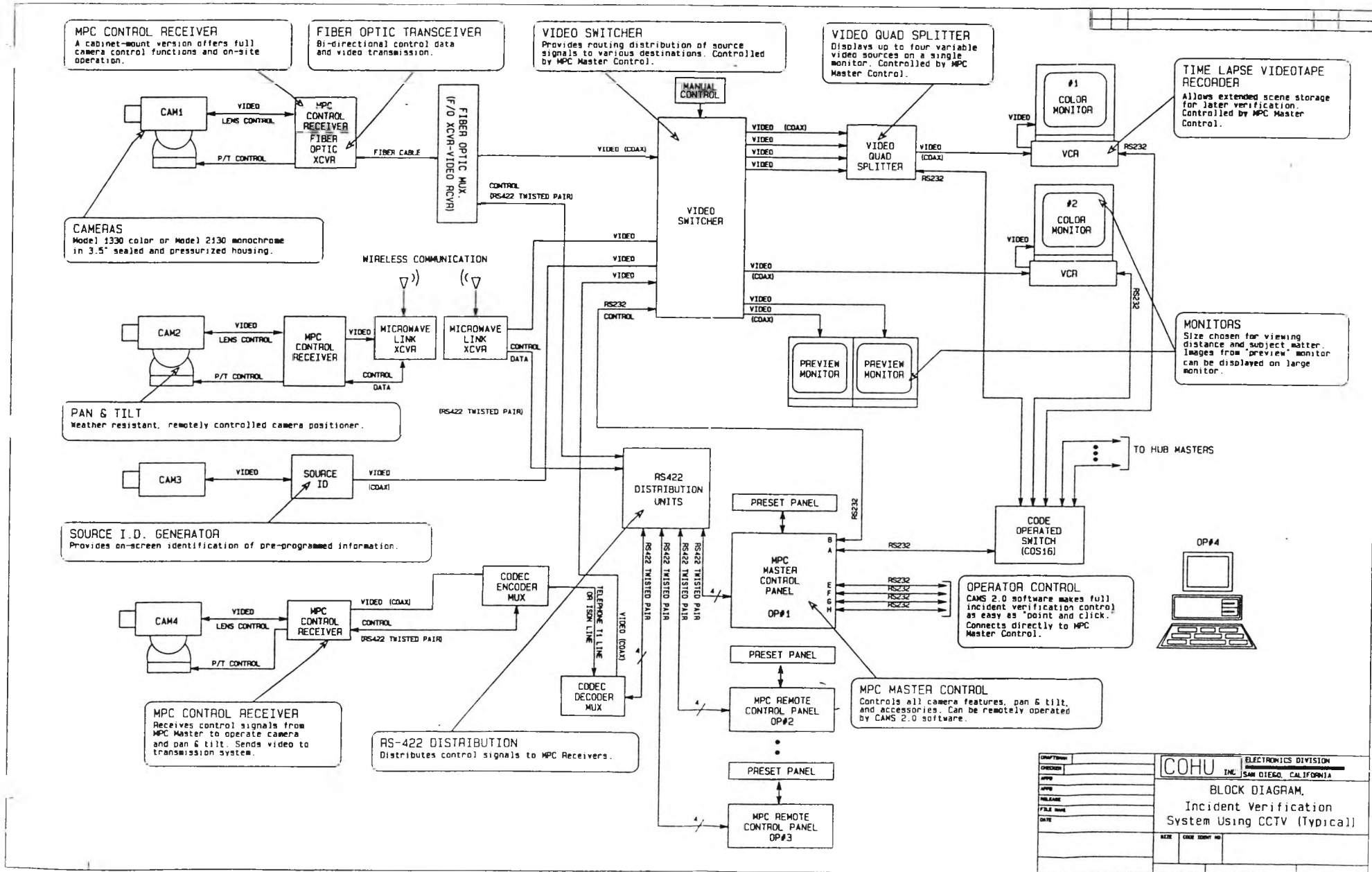
XXC

/

09 9" Tube
12 12" Tube
15 15" Tube
17 17" Tube
23 23" Tube

X

C Mounted in standard cabinet
R 19" rack mount assembly
2R Dual rack mount for 9" monitor
RBL Rackmount with blank left panel
RBR Rackmount with blank right panel
YC Yoke mount for ceiling installation (17" and 23" only)
YW Yoke mount for wall installation (17" and 23" only)



CCTV CONTROL SYSTEM
PART LIST
(TYP.)

<u>PART NUMBER</u>	<u>DESCRIPTION</u>
<u>CAMERA</u>	
1300 in 3 ½" HSG Modeling TBD	Camera, ½" or ⅓" color in 3 ½ HSG.
2100 in 3 ½" HSG Modeling TBD	Camera, ½" or ⅓" monochrome in 3 ½ HSG.
4945-3002/P10S	Camera, ½" monochrome CCD in 4 ½ " pressurized environmental housing, 8-80mm lens with presets, 115VAC, 60Hz, NTSC, programmable source ID, low temperature heater, RS170 Gen. lock revert to phase adjust line lock.
8245-1052/P10S	Camera, ½" color CCD in 4 ½ " pressurized environmental housing, 10:1 zoom lens, 115VAC, 60Hz, NTSC, programmable source ID, low temperature heater, lens follower pot for presets.
8245-1052/Z10S	Camera, ½" color CCD in 4 ½ " pressurized environmental housing, 10:1 zoom lens, 115VAC, 60Hz, NTSC, programmable source ID, low temperature heater.
8245-1052/EH35	Camera, ½" color CCD in 4 ½ " pressurized environmental housing, 35mm f1/4 2/3" lens, 115VAC, 60Hz, NTSC, programmable source ID, low temperature heater.
<u>MPC CONTROL RECEIVER</u>	
MPC-D-113/ER2613A	MPC Control Receiver, 115VAC operation, 115VAC to a camera, 115VAC to pan&tilt, a fiber optic transceiver for bidirectional RS422 Control Data/bidirectional audio/transmitted video.

CCTV CONTROL SYSTEM
PART LIST (Cont.)
(TYP.)

<u>PART NUMBER</u>	<u>DESCRIPTION</u>
MPC-D-113	MPC Control Receiver, 115VAC operation, 115VAC to a camera, 115VAC to pan&tilt, RS422 bidirectional communication.
ER2221B	MPC Control Receiver, rack mounted, local controls panel, 115VAC 60Hz

SOURCE ID

SID-100	Source ID Generator Module, 115VAC 60Hz.
UDC-111	Display Chassis, with power supply.

FIBER OPTIC MODULE

FiberOptions

2246D-T/1B44	Fiber Optic Module, transmitted video, bidirectional audio and RS422 control data on a single 62.5 μ fiber, ST connector.
2246D-R-R/1B44	Fiber Optic Module, received video, bidirectional audio and RS422 control data on a single 62.5 μ fiber, ST connector, rack-mounted.
517R	Rack-mount card cage.
517EPS	Power supply for 517R cage, 115VAC 60Hz.
2243D-T/1B44	Fiber Optic Module, transmitted video, bidirectional RS422 control data on a single 62.5 μ fiber, ST connector.
2243D-R-R/1B44	Fiber Optic Module, received video, bidirectional RS422 control data on a single 62.5 μ fiber, ST connector, rack mounted.

CCTV CONTROL SYSTEM
PART LIST (Cont.)
(TYP.)

<u>PART NUMBER</u>	<u>DESCRIPTION</u>
<u>VIDEO SWITCHER</u>	
<u>Dynair</u> DYNASTY	Video Switcher, maximum of 100 video inputs and 20 video outputs, 115VAC 60Hz.
<u>Vicon</u> V56X8-ICPS	Matrix 44 Switcher, prepack maximum of 56 video inputs and 8 video outputs, dedicated monitor and keyboard, Time/Date/Title, and System Setup, 115VAC 60Hz.
V4480SCC-HD	Matrix 44 Switcher Card Cage, up to 16 V4410S-HD Switcher Cards.
V4410S-HD	Video Switcher Card, up to 8 video inputs.
V4410S-HDR	Video Switcher Card for Monitor Expansion.
V4430ACEC-HD	Address Decoder Card, decodes and routes CPU control signals.
<u>PAN&TILT</u>	
<u>Pelco</u> PT570P/PP/HB	Pan&Tilt, 115VAC 60Hz, Presets follower pot, Heater Blanket.
<u>Vicon</u> V390APTW/VPP	Pan&Tilt, 115VAC 60Hz, Presets follower pot.
<u>RS422 DISTRIBUTION UNIT</u>	
<u>Vicon</u> V1200X-DL	RS422 Distribution Unit, 115VAC 60Hz (4 wires).

CCTV CONTROL SYSTEM
PART LIST (Cont.)
(TYP.)

<u>PART NUMBER</u>	<u>DESCRIPTION</u>
<u>Cohu</u> MPC-AE-102	RS422 Distribution Unit, 115VAC 60Hz (2 wires).
<u>VIDEO QUAD SPLITTER</u> <u>Robot</u> MV94	Video Quad Splitter, 115VAC 60Hz.
<u>VIDEO TAPE RECORDER</u> <u>Gyr</u> TLC1800-232	VCR, RS232 control, 115VAC 60Hz
TLC1800-S12MP,TDS	VCR, RS232 control, time lapse recorder and search, 115VAC 60Hz.
<u>CODE OPERATED SWITCH</u> <u>BlackBox</u> SW056A/RM056	Code Operated Switch-16 (COS16), rack mounted, RS232 switch, 16 outputs, 115VAC 60Hz.
<u>ALARM INTERFACE BOX</u> ER1151E	Alarm Interface Box, maximum of 32 inputs and 32 outputs, contact closed, RS232 control, 115VAC 60Hz.
<u>AUDIO PATCH PANEL</u> ER2758	Audio Patch Panel, maximum of 56 inputs, 115VAC 60Hz.
<u>MPC MASTER CONTROL PANEL</u> MPC-M-104/51/ER2757	MPC Master Control Panel, Camera White Balance feature, Presets Interface, eight RS232 communication ports, 115VAC 60Hz.

CCTV CONTROL SYSTEM
PART LIST (Cont.)
(TYP.)

<u>PART NUMBER</u>	<u>DESCRIPTION</u>
MPC-M-104/51/53	MPC Master Control Panel, Camera White Balance feature, Presets Interface, dual RS232 communication ports, 115VAC 60Hz.
MPC-M-100/51/53	MPC Master Control Panel, use with Monochrome Cameras 2100 and 4900 series, Presets Interface, dual RS232 communication ports, 115VAC 60Hz.
<u>MPC REMOTE CONTROL PANEL</u> MPC-R-104/51	MPC Remote Control Panel, Camera White Balance feature, Presets Interface, 115VAC 60Hz.
<u>MPC PRESET PANEL</u> MPC-AE-001	MPC Preset Control Panel, 10 Control Presets, 115VAC 60Hz.
<u>CODEC</u> <u>Enerdyne Technologies</u> ENC1000R5	Codec Encoder with T1/or ISDN mux, RS422 interface, 115VAC 60Hz.
DEC1000R5	Codec Decoder with T1/or ISDN mux, RS422 interface, 115VAC 60Hz.
<u>PC GUI SOFTWARE</u> ER2759	DOS based Camera Control Software. The control features include: PC, MPC Master, COS 16, Alarm Interface box, VCR, Video Quad Splitter, MPC Receiver.

CCTV CONTROL SYSTEM
PART LIST (Cont.)
(TYP.)

<u>PART NUMBER</u>	<u>DESCRIPTION</u>
ER2825B	DOS based Camera Control Software. The control features include: PC, MPC Master, MPC Receiver.
CAMS 2.0.	Windows based Camera Administration and Monitoring Software. The control features include: PC, MPC Master, VCR, Video Quad Splitter, Maps, MPC Receiver.

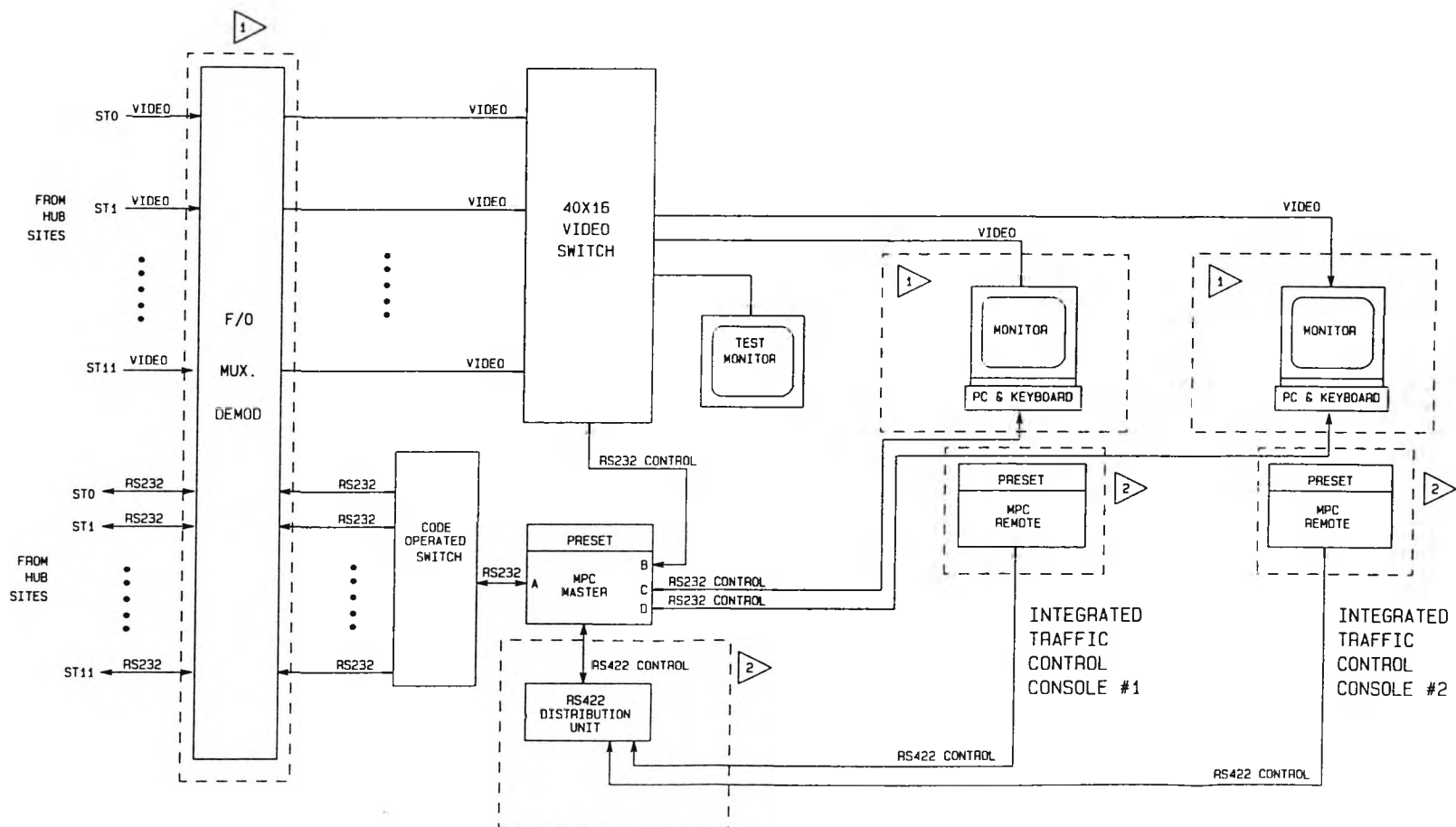
INTERFACE CABLES

The following listed cables are most common used cables. For more details and proper cables required for systems installation, please consult Cohu Application Engineers.

MPC-CA-236A, B, or C	Cable Assy., Camera to the MPC-D Receiver
MPC-CA-294A, or B	Cable Assy., Camera to the ER221B Receiver.
MPC-CA-237A, or B	Cable Assy., Vicon P/T to the MPC-D Receiver.
MPC-CA-238A, or B	Cable Assy., Pelco P/T (with Preset Pot) to the MPC-D Receiver.
MPC-CA-245A	Cable Assy., Pelco P/T (without Preset Pot) to the MPC-D Receiver.
ER2221AF	Cable Assy., Vicon P/T to the ER2221B Receiver.
ER2221H	Cable Assy., Pelco P/T to the ER2221B Receiver.
MPC-CA-241	Cable Assy., MPC Master/Remote Control Panel to Preset Control Panel.
MPC-CA-239	Cable Assy., MPC Master Control Panel to PC, COS16 (RS232 null modem type).
MPC-CA-245A	Cable Assy., Pelco P/T (without Preset Pot) to the MPC-D Receiver.

CCTV CONTROL SYSTEM
PART LIST (Cont.)
(TYP.)

<u>PART NUMBER</u>	<u>DESCRIPTION</u>
ER/2261/ER2254/ER2254A	Cable Assy., MPC Master Control Panel to Vicon Video Switcher.
671744-803	Cable Assy., MPC Master Control Panel to Dynair Video Switcher.
MPC-CA-234	Cable Assy., MPC Master Control Panel to RS422 Distr. Unit (2 wires).
MPC-CA-242	Cable Assy., MPC Remote Control Panel to RS422 Distr. Unit (2 wires).
MPC-CA-243	Cable Assy., MPC Control Receiver to RS422 Distr. Unit (2 wires).
ER2047A	Cable Assy., MPC Master/Remote Control Panel to RS422 Distr. Unit (4 wires).
ER2047B	Cable Assy., MPC Control Receiver to RS422 Distr. Unit (4 wires).
671744-807	Cable Assy., RS422 Distr. Unit to RS422 Distr. Unit (4 wires) daisy chain.
671744-808	Cable Assy., Fiber Optic Xcvr to RS422 Distr. Unit (4 wires) and Audio Patch Panel.
671744-801	Cable Assy., Video Quad Splitter to COS16.
671744-805	Cable Assy., MPC Master Control Panel to Alarm Interface box (RS232 modem type).
671744-810	Cable Assy., VCR to COS16.



2 OPTIONAL EQUIPMENT

1 SUPPLIED BY OTHERS

DESIGNED BY	P. T. RAY	COHU INC. ELECTRONICS DIVISION SAN DIEGO, CALIFORNIA BLOCK DIAGRAM, NORTH-SOUTH EXPRESSWAY CENTRAL TRAFFIC CONTROL
CHECKED BY		
DATE		
FILE NO.	0963AP1 SCH	
DATE	5/17/96	
SHEET 1 OF 2		REV D 05157 7410745-963

CCTV Equipment

Remote Camera Site

CCTV Camera Assembly

For this project, each camera assembly shall consist of the following fully compatible components:

- * Solid State Color Camera
- * Motorized Zoom Lens
- * Pressurized Camera Enclosure
- * Sunshield

Solid State Color Cameras - The camera assemblies shall be assembled and tested in accordance with these specifications prior to delivery to the jobsite. Factory testing documentation shall be furnished to the Project Manager. Camera assemblies shall be delivered to the jobsite as a complete unit.

Individual components of the camera assembly shall conform to the specifications contained in the following sections. Solid state CCD (charged coupled device) color cameras shall be provided for this project. The camera shall be a COHU Model 8245 or equivalent (at the minimum), and shall meet or exceed the following specifications:

Color system	NTSC standard (525 Horizontal lines at 60hz) 2:1 Interlace
Image sensor	1/2" Format interline transfer CCD (6.4mm X 4.8mm) - 768(H) X 493(V) pixels
Horizontal Scan Rate	15.734kHz
Vertical Scan Rate	59.94Hz
Horizontal Resolution	Minimum 460 horizontal television lines from composite video output
Vertical Resolution	Minimum 350 vertical television lines from composite video output

CCTV Camera Assembly

Video Output	1.0 volt peak to peak +/- 3dB.75ohm
Face Plate	6.5 lux - full video output (AGC off)
Illumination	0.55 lux - 80% IRE video output (AGC On)
	0.08 lux - 30% IRE video output (AGC On)
Geometric Distortion	0% Geometric Distortion 4:3 aspect ratio
Signal to Noise Ratio	Greater than 48 dB Rating - automatic gain control off
Color Temperature Control Range	2850 to 5800 K
Power Requirements	115 Vac
Power Consumption	4.5 Watt Maximum
Lens Mount	CS/C
Electronic Shutter	1/60 to 1/10000 sec.. 8 increments

A power supply shall be integrated into the camera enclosure to allow the camera to be powered from the 120 VAC power supplied from the control receiver.

The camera shall be specifically designed to operate under low light conditions and shall function satisfactorily over a wide range of dynamic lighting conditions ranging from low light to full sunlight.

A 24 character programmable alphanumeric source I.D. generator will be provided and installed as an integral part of the camera assembly. The camera shall have the capability to superimpose two lines of 24 horizontal characters for camera identification on the video image. While characters with a black border shall be provided. Each character shall be 28 TV lines in height. Display programming shall be accomplished from the computer control center with a city supplied DOS based P.C. computer through the CCTV Master Controller, P.C. Computer software to be provided by Contractor.

CCTV Camera Assembly (Cont.)

A low enclosure pressure warning shall be provided when the pressure drops below 2 psi. When low pressure is detected, the words "Low Camera Pressure" shall be superimposed on the video image.

CCTV Motorized Zoom Lenses

The zoom lenses provided for this project shall be motorized 10:1 zoom lenses. The lenses shall meet the following optical specifications:

Focal Length	8 to 80mm(10x)
Aperture	f1.8
Mounting	C Mount
Format	1/2"
Iris	- Automatic with Manual Override

The operating voltages of the zoom lenses shall be compatible with the outputs of the control unit provides. Each lens shall include a neutral density spot filter. Positional feedback shall be provided to allow presets.

All lens motors shall be slip clutch protected to prevent damage due to overload.

CCTV Pressurized Enclosures

CCTV Pressurized Enclosures - The cameras shall be installed in pressurized enclosures. The enclosures shall be cylindrical, with outside dimensions of 22" (L) X 5" (Dia.) maximum. Each enclosure shall be provided with a mounting for attachment to the pan and tilt unit.

The enclosures shall be fabricated from corrosion resistant aluminum, and finished in a beige or neutral color of weather resistant enamel. The front of the enclosure shall be tempered glass.

The enclosures shall be purged of air and pressurized with dry nitrogen. Each enclosure shall have a Schrader valve for pressurization and a pressure relief valve. A pressure tight multiconductor MS-type cable connector shall be provided for connection of the camera and zoom control cable.

The enclosures shall meet or exceed the following environmental specifications:

Temperature	-20 to + 50 degrees C
	- 4 to +122 degrees F

CCTV Pressurized Enclosures (Cont.)

Humidity	100%, MIL-E5400T, para 3.2.24.4
Altitude	0 to 10,000 MIL-E-5400R, para 3.2.24.2
Submersion Pressure	35 foot depth
Vibration	Swept 5-15 hz, 2 inch amplitude; 15-200 hz, 3G; Random 30-100HZ, 50 peak
Shock	30G, axis, MIL-E-5400R, para 3.2.24.5 (fixed lens)
Sand&Dust	MIL-E-5400R, para 3.2.24.7
Fungus	MIL-E-5400T, para 3.2.24.8
Salt Atmosphere	MIL-E-5400T, para 3.2.24.9
Explosion	MIL-E-5400T, para 3.2.24.10
Acoustic Noise	+15dB

Sunshield - A sunshield shall be supplied and installed on each camera to protect the camera from direct sunlight. The sunshield should be mounted on the camera using 1/4-20 bolts.

Pan and Tilt Unit

The pan and tilt units shall be designed for use in outdoor applications, and shall be constructed to allow maintenance of the unit without removal from the installed site. The units shall be fully compatible with all other CCTV system components included in this specification. The pan and tilt unit shall be installed with camera stop positions as directed by the Project Manager. Position feedback shall be provided to allow presets. Camera enclosures shall be mounted directly to the mounting plates of the pan/tilt units at all locations.

The pan and tilt units provided shall meet or exceed the following specifications:

Pan	350 degrees, 6 degrees(+/- 1) / sec
Tilt	+/- 90 degrees, 3 degrees(+/- 1) /sec

Pan and Tilt Unit

Maximum Load	40 lbs maximum
Motors	continuous duty, instantaneous reversing, with dynamic braking
Input Voltage	115 VAC.50/60 Hz
Limit Switches	Pan-5 Amp. 10 million cycle Tilt-5 Amp. 10 million cycle
Temperature	-23 to +60 degrees C -10 to +140 degrees F

The pan and tilt units shall have a mounting base 6 inches in diameter with four 0.38 inch diameter holes equally spaced on a 4.75 inch diameter bolt circle.

All internal parts shall be corrosion protected. The pan and tilt units shall have a beige or neutral textured semi-gloss exterior finish. The finish shall match the camera enclosure in color.

Camera Mounting Assembly

Each pan and tilt unit shall be mounted on the existing traffic signal mast arm by means of a camera mounting assembly. The camera mounting assembly shall consist of the equipment necessary to mount the pan and tilt unit onto the existing traffic signal mast arm. The Contractor shall submit mounting details and/or shop drawings (to be approved by the engineer) indicating how the camera mounting assembly shall be connected to the pole. The contractor shall incur complete responsibility for the integrity of all mounting structures.

CCTV Camera Control Receiver (CCR)

A CCTV Camera Control Receiver (CCR), including pan and tilt driver, shall be installed in the traffic signal controller cabinet (Type "P" cabinet) at each camera location (see plans). The Camera Control Receivers shall be modular and 19" rack mountable.

The unit shall transmit and receive bi-directional RS-422 control signals to and from the master control panel over fiber optic cable. The control receiver shall provide the drive signals to the camera, lens, and the pan and tilt functions, and transmit status information over the RS-422

CCTV Camera Control Receiver (CCR) Cont.

back to the master control panel for processing. The Camera Control Receiver will have a fiber optic transceiver installed to transmit video and two-way RS-422 to the master control unit over a single fiber optic cable. The CCTV control receiver shall pass through the RS-422 data to download the alpha numeric data enclosed in the CCTV camera assembly. ST type connectors shall be provided.

The Control Control Receiver (CCR) will operate from a 115 VAC 60 Hz power source and distribute the power to the camera and pan and tilt unit. The control receiver shall meet or exceed the following specifications:

Electrical

Input Voltage 115 +/- 12 VAC.50/60 Hz

Mechanical

Size (Maximum) 6" high X 10" deep X 15" wide

Weight (Maximum) 25 lbs (11.3kg)

Environmental

Ambient Temperature Limits

Operating -40 to +140 F (-40 to +60 C)

Storage -40 to +185 F (-40 to +85 C)

Ambient Air Pressure Sea level to the equivalent of 10.00 ft (3048 m)]

Humidity 95% relative (housed in a weatherproof enclosure)

Vibration 5 to 30 Hz with .03 inches total excursion. From 30 to 1,000 Hz with peak random vibrations of 5 G's

Shock 15 G's on all axis under non-operating conditions per MIL-E-5400 T, Paragraph 3.2.24.6.

The control receivers provided should be fully compatible with the CCTV master controller and the camera assemblies provided. As a minimum, the control receivers shall provide the following functions:

Zoom In	Pan Left	Speed Slow
Zoom Out	Focus Near	Speed Fast
Pan Up	Focus Far	Camera Power On
Pan Down	Iris Open	Camera Power Off
Pan Right	Iris Close	Ten Presets

Each control receiver shall provide a toggle switch for the local control of each of the above functions with the exception of speed slow and fast.

Site selection shall be accomplished from the camera panels located in the Signal Central with future secondary access from remote panels as determined by the City.

CONTROL CENTER

CCTV Master Controller

A CCTV Master Controller shall be provided in 19" rack assembly with power supply. The central controller unit (Master Controller) shall be rack mounted at the Computer Control Center site (City Hall) and shall meet the requirements described in these specifications. The unit shall be equipped with an RS-232 port and shall be fully compatible with the camera equipment controlled in the field. Control of the Master Controller shall be possible via a front panel keyboard, or via remote control panels. The Master Controller shall include all special firmware that may be required to provide the functionality as described in these specifications. The CCTV Master Controller shall be allowed to be configured as more than one hardware component. All components of the Master Controller shall be from the same manufacturer and designed to operate together.

The CCTV Master Controller shall be microprocessor based, with the capability of controlling up to 220 camera sites, 30 monitors, and 30 remote control systems. It will be capable of selecting and controlling up to 10 pan/tilt and zoom lens preset positions for each camera location when the preset control panel option is utilized. The Master Controller shall communicate with the control receivers via fiber optic cable. The Master Controller shall be able to communicate via RS-232 with peripheral devices such as video switchers, video cassette recorders (future option), alarm systems (future option), modems, and control and monitoring computers. The master controller shall function as needed as a pass through, switching mechanism, and master control center for the camera control system and associated commands. The central control unit shall accept all control commands issued from either the master control panel, or external PC work stations. The external work stations will not be provided as part of this system.

The central controller unit shall route all commands to the appropriate device (remote controller unit, control receiver, video switch, etc.). The camera control commands to the individual remote control receivers shall be via RS-422

communications channels converted to transmission over multi-mode fiber optics. These channels will be fed through bi-directional fiber optics transceivers. The CCTV central controller unit shall receive location and direction (pan/tilt positioning) information from each of the video cameras as they are being controlled and shall pass such data directly to an RS-232 serial data interface. The central controller unit shall be fully compatible with the control receivers and the camera assemblies provided. Monitor selection shall also be accomplished via the front panel keyboard master control panel.

714a.024 CCTV Master Controller

The Master Control Panel shall have the following operator control features:

- Numeric Display
- Numeric Keypad
- Camera Power Switch and LED Status Indicator
- Lens Sped Switch and LED Status Indicator
- Manual/Auto Iris Switch and LED Status Indicator
- Bright Light Limiter/Auto White Balance Switch and LED Status Indicator (optional)
- Peak/Average or Red/Blue Adjustment Switches (optional)
- Iris Open/Close Toggle Switch
- Focus Near/Far Toggle Switch
- Zoom In/Out Toggle Switch
- Reset Switch
- Pan and Tilt Joystick Control
- Auto Scan for Pan and Tilt Unit
- Preset Position Control Panel
- 115 VAC/220 VAC Operating Voltage (optional)
- Window Washer/Wiper Control (optional)
- Video Switcher Interface

The master controller shall meet the following specifications:

Electrical

Input Voltage 115 +/- 12 VAC, 50/60 Hz

Mechanical

Size 3.5" high X 12" deep X 19" wide

Weight 7 lbs.

Environmental

Ambient Temperature Limits

Operating -32 to 122 F (-36 to + 50 C)

Storage -40 to 185 F (-40 to + 85 C)

Ambient Air Sea level to the equivalent of

Pressure	10,000 ft (3048m).
Humidity	95% relative
Vibration	5 to 30 Hz with .03 inches total excursion. From 30 to 1,000 Hz with peak random vibrations of 5 G's.
Shock	15 G's on all axis under non-operating conditions per MIL-E-5400T. Paragraph 3.2.24.6.

CCTV Master Controller

The Master Controller shall handle all aspects of the user control and prioritization. The Master Controller unit shall control access of the CCTV system when conflicts arise concerning camera selection and control. The first stage of the prioritization shall be to apply a basic first come, first serve priority to the users as they request camera control. The central controller unit shall additionally provide a mechanism to ensure that the Signal Central operator wanting to control a CCTV camera shall have the ability of investigating a priority-override for the camera.

The central controller unit shall have the capability of sequencing the displays of the remote cameras on selected monitors. Sequencing shall be fully programmable with respect to camera selection, sequence, monitor output, and dwell time. The system shall have the capability of programming up to four independent sequences to be displayed on separate monitors simultaneously.

7814a.024 CCTV Switcher

A CCTV camera video switcher shall be rack mounted adjacent to the CCTV Master Controller. This switcher must be fully compatible with all other components of the CCTV system. The video switcher will be a microprocessor-based switching unit that automatically routes video signals from a requested camera to a specified monitor. The CCTV camera video switcher shall be controlled by the CCTV Master Controller and shall allow manual switching or random camera sequencing. The video switcher shall allow up to 8 inputs (CCTV cameras) and 2 outputs (monitors). The CCTV switcher shall meet all of the environmental requirements of the CCTV Master Controller.

CCTV Distribution Unit

A CCTV Distribution unit shall be rack mounted adjacent to the CCTV Master Controller and the CCTV switcher. The distribution unit shall be fully compatible with all other components of the CCTV system, and shall allow a star pattern communication interface between the Master Controller and up to ten control receivers via fiber optic transceivers. The CCTV distribution unit shall meet all of the environmental requirements of the CCTV Master Controller.

Fiber Optic Transceivers

Fiber optic transceivers shall be capable of transmitting both video and two-way control data signals (RS-422) over a single fiber optic cable. For each camera a fiber optic receiver card will be provided at the Computer Control Center. ST type connections shall be provided.

Preset Panel

A preset control panel shall be rack mounted adjacent to the CCTV Master Controller, the CCTV switcher, and the CCTV distribution unit. This unit will provide push buttons for operator call-up and programming of up to 10 presets for each camera in the field. The preset panel must be fully compatible with all other components of the CCTV system. The CCTV distribution unit shall meet all of the environmental requirements of the CCTV Master Controller.

Color Monitor

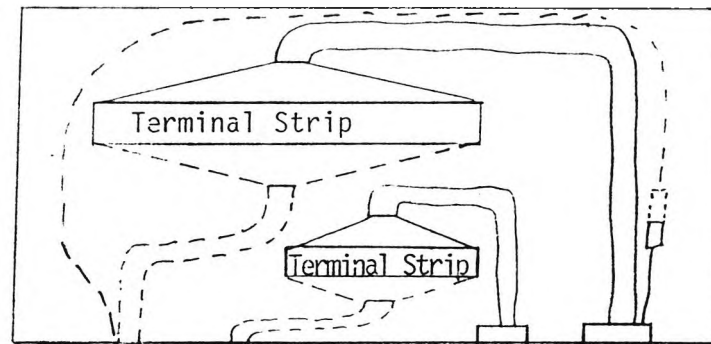
Two 19 inch color monitors shall be provided and installed at the control site. The monitor shall be wall-mounted using wall mount brackets and a platform of suitable size. The monitor shall have the following characteristics:

- A-B-VTR Inputs
- 460 Lines Horizontal Resolution
- Audio Speaker
- Blue Gun Only
- Pulse Cross
- Underscan
- Internal/External Sync
- Tally Light
- Automatic Degauss
- Comb-Notch Filter
- Sharpness Control
- Keyed Back Porch Clamping
- B&W Color Switch
- 8 Pin VTR Cable (6')

CA236 Weatherproof camera cable assembly with right angle connector.

CA238 Weatherproof pan-tilt cable assembly.

Junction Box
See detail at
right.



NEMA-4
Box

MS3102E-20-29S
Bulkhead Connector
Mates with Pan-
Tilt cable
assembly.

MS3102E28-21S
Bulkhead connector.
Mates with camera
cable assembly.

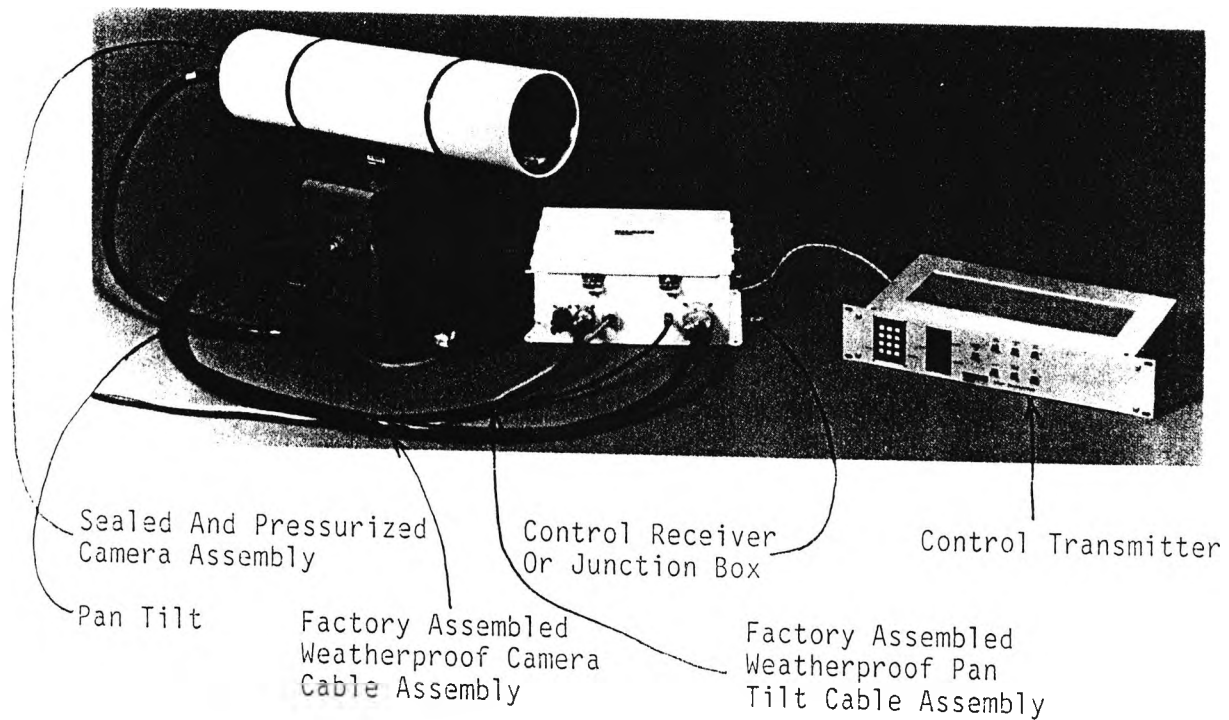
Multi-conductor Cables
To Control Receiver

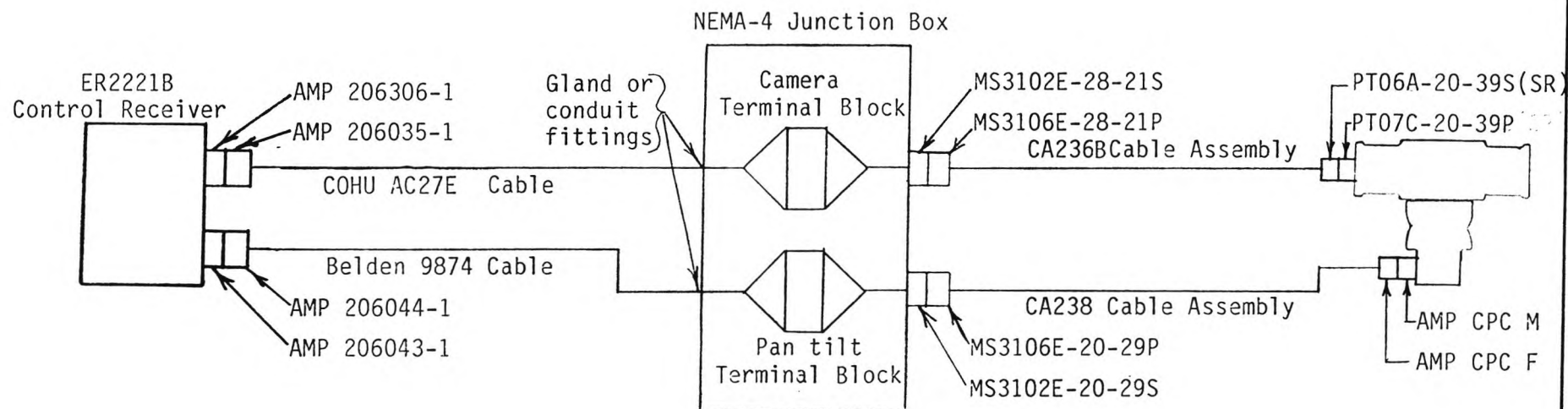
Roadside 334 Cabinet

CODEC
CSU/DSU
Control Receiver

COHU INC
ELECTRONICS DIVISION
CODE IDENT NO. 05157
PROPOSAL NO.
DATE
DFTSMN
ENGR
DWG NO

TYPICAL EQUIPMENT INTERCONNECTION



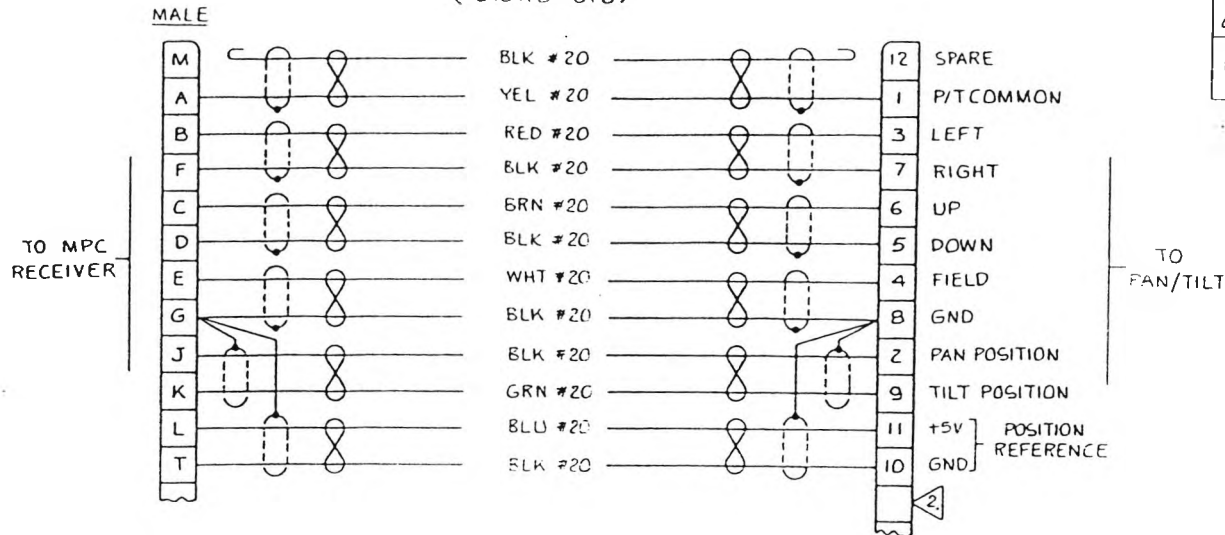


COHU Part Number

MS3106E-28-21P	0310077-507	\$69
MS3106E-20-29P	0310077-511	\$56
MS3102E-28-21S	0310078-510	\$59
MS3102E-20-29S	0310078-514	\$28

COHU <small>INC</small> ELECTRONICS DIVISION <small>SAN DIEGO CALIFORNIA</small>	
CODE IDENT NO. 05157	
PROPOSAL NO.	
DATE July 19, 1993	
DFTSMN	
ENGR Gary Kuntz	
DWG NO	

BELDEN 9874
(7610110-010)



DATE	APPROVED	DESCRIPTION	REVISIONS
12/14/74	1	WIRE BLK #20 (T/D-BACK) WAS PT 550-P, PT 570-P, PT 1250-P, PT 1250-DC-PP WAS PT 1250-DC. ADDED PT 1250-P-PP.	
12/14/74	2	ON F/D, PT 570-P-PP WAS PT 570-P, PT 1250-DC-PP WAS PT 1250-DC. ADDED PT 1250-P-PP.	
12/14/74	3	ON F/D, DELETED PT 1250-P FROM USABLE NOTE.	
12/14/74	4	ON F/D, DELETED PT 1250-P FROM USABLE NOTE.	

CA238	CONNECTOR MALE	CLAMP OR BUSHING	CONNECTOR FEMALE	CLAMP OR BUSHING	CONNECTOR KEYING PLUG LOCATION
-1	MS3106E-20-29P (0310077-511)	SUPPLIED WITH CONNECTOR	△	△	TO BE DETERMINED
-2	MS3108E-20-29P (0310069-505) (RIGHT ANGLE)	SUPPLIED WITH CONNECTOR	△	△	TO BE DETERMINED

THIS CABLE CAN BE USED WITH THE FOLLOWING PAN/ TILTS :

PT 550-P-PP
PT 570-P-PP
PT 1250-P-PP
PT 1250-DC-PP

SEE TABLE CA238 FOR KEY POSITION.

THE FOLLOWING PARTS ARE SUPPLIED WITH P/T UNITS :

CONNECTOR — AMP P/N 206037-1
KEYING PLUG — 200821-1
BUSHING — 54011-1
CLAMP — 206070-1
CONN CONTACTS — 6659B-1 (18-14GA) CRIMP TYPE
OR AMP P/N 66181-1 (18-16GA) SOLDER TYPE

NOTES: UNLESS OTHERWISE SPECIFIED

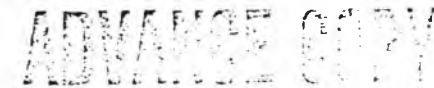
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DIMENSIONS IN 11 ARE METRIC (MM)		DRAFTSMAN Y.N. 10-29-85	
TOLERANCES ARE		CHECKED VFW	
INCHES		APPROVED W. WIND 10-29-85	
HOLE TOLERANCES		RELEASE EM 3379	
INCHES		DO NOT SCALE DRAWING	
HOLE TOLERANCES		SIZE CODE IDENT NO.	
INCHES		C 05157	
HOLE TOLERANCES		SCALE NONE	
INCHES		SHEET 1 OF 1	

COHU INC. ELECTRONICS DIVISION
DANBURG, CALIFORNIA

CABLE ASSEMBLY,
MPC RECEIVER TO COHU PAN/TILT
CA 238

REF 9087992

4760/4860



COHU INC		ELECTRONICS DIVISION	
		SECRET CALIFORNIA	
CABLE ASSEMBLY, MPC RECEIVER TO CAMERA CA 236			
SIZE	CODE IDENT NO		
C	05157	7411236	
SCALE	1/16" = 1"	SHEET	1 OF 1

- NOTES: UNLESS OTHERWISE SPECIFIED

INGREDIENTS FOR A CLOSED CIRCUIT TELEVISION SYSTEM

James D. Walrod

Cohu Inc. Electronics Div.

San Diego, CA

ABSTRACT

Two critical elements of most security systems are surveillance and intrusion alarm assessment. These elements are implemented largely with closed circuit television (CCTV) systems. This paper will present many of the different types of ingredients available as commercial off-the-shelf items and discussion of a sample CCTV system.

INTRODUCTION

CCTV systems vary widely from the very simple to very complex. The equipment required for the simplest system is a video camera, a coaxial cable, and a video monitor. The equipment required for even the most complex system may be categorized as follows:

1. Video cameras
2. Video monitors
3. Video switching equipment
4. Video transmission equipment
5. Control systems
6. Control data transmission equipment
7. Miscellaneous equipment

The following discussion will be focused on the operational characteristics of the different system elements rather than all of the performance specifications. At the time of design, the system specifications should be based on detailed system requirements, which in turn sets the minimum specifications for the system components.

Video cameras

Video cameras are available in many different varieties. Some of the more important variations to consider are:

1. Monochrome or color
2. Intensified or non-intensified
3. Tube or CCD

4. Fixed focal length or zoom lens
5. Environmental or non-environmental

Color cameras have the obvious advantage over monochrome cameras, also called black and white (B/W), that the video has color information. In addition to presenting a picture that we are more used to, the added information such as the shirt color of an intruder could be important. One important thing to consider is that color cameras require full spectrum illumination (such as incandescent) for proper color rendition.

The comparative advantages of monochrome cameras are:

1. Somewhat more sensitivity
2. Higher resolution
3. May be used with larger variety of illumination (including infra-red)
4. Less cost

If it is not possible or desirable to have enough illumination on the scene for a monochrome camera, an intensified camera may be used. The intensified camera uses an image intensifier to boost the light applied to the sensor. This allows camera use to light levels equivalent to that on a clear moonless night with only starlight as the illumination source. The intensified camera has the following disadvantages:

1. Higher cost
2. Lower signal-to-noise ratio (noisier picture)
3. Lower resolution
4. Much shorter life (as compared to the non-intensified version)

The shorter life is due to the burns that develop over time in the intensifier. However, if illumination is not possible, the intensified camera is the only way to get a picture at all.

Until a few years ago, the video sensors available were all vacuum tubes with various types of

sensor material. Today's marketplace has solid state sensors that have low enough cost and high enough performance characteristics that these solid state sensors have virtually replaced the tube type sensors in security/surveillance applications. The most common type of sensor currently in use is the frame transfer CCD (charge-coupled-device) sensor. The frame transfer CCD type of camera has proven to be an excellent replacement for the one-inch silicon target tube cameras used so extensively in security CCTV systems over the years.

In situations where the area needing CCTV coverage is fixed, a camera with a fixed focal length lens and a fixed position mount can be used. For example, the cameras covering the clear zone between a double fence perimeter might use 50 millimeter (mm) lenses and be mounted on the light poles. Other situations may require a pan/tilt/zoom (PTZ) camera utilizing a remote controlled mount (pan/tilt unit) and zoom lens, such as inside the perimeter, for visual tracking of an intruder.

If cameras are to be subjected to weather or other types of harsh environment, or just to be more tamper-resistant, the non-environmental camera may be installed in an environmental enclosure or an environmental camera may be used. Environmental cameras are typically purged and pressurized with dry nitrogen which keep moisture and other corrosive sources away from the camera electronics and lens.

Consideration of these parameters for selection of the proper camera to fit the operational and reliability requirements is very important to achieve the desired results for the least cost, both initial and maintenance.

Video monitors

The variations in video monitors are:

1. Monochrome or color
2. Screen size
3. Mounting

To display color video, a color monitor should be used. To display monochrome video, either a monochrome monitor or a high resolution color monitor may be used. The screen size depends on how far from the observer the monitor screen will be. A monitor very near (two to three feet) may have as small as a 9-inch (diagonal) screen. A monitor at a distance of eight to ten feet or farther may be 21 inches or more. Monitors may be on tables, mounted

in consoles, or hung on a wall or from the ceiling. The important thing is to place the monitor at the proper distance to enable the maximum detail of interest to be seen.

Video switching

In systems where a monitor is to be able to display more than one camera, some sort of video switching is required. The main categories of video switchers are:

1. Manual
2. Sequencing
3. Matrix

Manual switchers are used for manual selection of one of several cameras to a monitor. A manual switcher may be simply mechanical switches. If the video lines must loop through and go elsewhere, an electronic switcher would be required for isolation between the switcher inputs and output.

Sequential switchers are used in much the same way as the manual switcher except they are capable of automatically switching from one camera video to the next in a sequential fashion. The time that the cameras are displayed before switching to the next camera (commonly called dwell time) is usually adjustable from about one second to 30 seconds or more. If the cameras need to be displayed on more than one monitor, then an electronic manual switcher or sequential switcher for each monitor is required.

Typically, if there are more than two monitors or switching is being controlled by more than one operator, a matrix switcher is used. A matrix switcher allows selection of any input (ie. camera) to any or all outputs (ie. monitors and/or VCR's). Matrix switchers are usually configured so as to be expandable by adding switch card frames, switch cards, and/or output cards. Matrix switchers are available in various sizes starting at about 8 X 8 (eight inputs and eight outputs) to about 256 X 32. Larger switchers can be configured for unique applications as required.

Video transmission

The transmission of the video from one place to another (ie, the camera site to the control room) are commonly via the following mediums:

1. Coaxial cable
2. Microwave link
3. Fiberoptic(FO) cable

The most economical and most common video transmission medium is coaxial cable. For distribution within a building or short runs from camera sites RG-59 is commonly used. For longer runs RG-11 (with foam dielectric) is used. Due to the cable characteristic, the higher frequencies are attenuated by the cable. For very long runs, an equalizer is required to boost the high frequency components back to the original value.

In applications where running a cable is not desired or feasible and a line of sight path is present, a microwave link may be used. Different models are available for use based on cost, path distance, and frequency band availability. In most cases an FCC license is required for the path.

If a cable may be used and coaxial cable is not a good choice due to distance, conduit space, interference, ground loops, or security, then multimode FO cable and equipment works very well for video transmission. FO equipment cost is very sensitive to the distance and each transmission path must be analyzed for proper selection to optimize the design. The lowest cost FO equipment will typically handle runs of about three kilometers using 50 micron multimode fiber. More expensive equipment and single mode fiber allows runs of 30 miles or more.

For the transmission of many video signals from one point to another, the best way for years has been analog frequency multiplexing and transmission over a coaxial cable (also known as a broad band coax). The video signals are amplitude or frequency modulated onto VHF carriers, summed together in combiners, and injected onto the cable. At the receive end the signal from the cable is split up and demodulated to regenerate the video signals. If the length of the coaxial cable is sufficient, equalizing line amplifiers are used along the cable run. The broad band coax is similar to the CATV cable television systems going to many homes.

Recent advances in broad band lasers have made possible the FO equivalent of the broad band coax. Instead of injecting the combined carriers into a coaxial cable, they are input to a broad band laser transmitter and sent to a FO receiver via a single mode fiber. The advantage of this approach is that the fiber is smaller and easier to install and no line amplifiers are required.

The transmission of video for 30 to 40 miles or even farther is possible using digital techniques. Slow scan transmission systems that digitize a frame of

video and transmit the frame over a telephone line or an optical fiber has been in common use for teleconferencing for years. However, the slow scan approach is not very useable for security as the time required to send the frame is several seconds. However, 45 Megabit codecs can send essentially real time video over a data line or over optical fiber. Multiplexers are available that can accept the outputs from up to 24 codecs thereby allowing transmission of 24 digitized video signals over a single fiber. A large disadvantage of this approach for now is the cost of the codecs and the multiplexers.

System control

Control systems take inputs from control panels, serial ports, or via contact closures to control various system components:

1. Video switcher(s)
2. PTZ camera sites
3. Recording devices

Operators may control the system using a specialized control panel or from a terminal to a host computer. Cameras may be switched to monitors manually or by sequencing. Video switching may also occur automatically based on input from the host computer or alarm inputs via contact closure or serial port.

PTZ cameras may be controlled by an operator, from a host computer, or automatically based on alarm inputs in the same way as the video switching discussed previously. The following functions are examples of controlled features:

1. Pan
2. Tilt
3. Zoom
4. Focus
5. Iris (auto and manual)
6. Camera on/off
7. Preset PTZF positions
8. Other auxiliary functions

Communications between the operator control panels and the PTZ camera site control receivers is typically a serial link via twisted pair or other transmission medium. If the data line is not connected to the control system components in a "daisy chain", some control systems require a data distribution unit for fanout to several legs of a "star" configuration.

Control data transmission

The transmission of the control data from one place to another (ie, the control room to the camera sites) may be done using any of the techniques used for video. The most common transmission method of via twisted pair(s). If the video is via multimode fiber, the control data is commonly sent to the camera site on the same fiber as the video is being sent from the camera site.

Miscellaneous

For mounting cameras and monitors on walls, ceilings or poles, mounts are available in a variety of shapes and sizes. Most of them are adjustable to allow various mounting angles.

Video storage may be performed using video cassette recorders (VCR), digital frame memory (with internal digitizing), optical disk, or hard disk (as part of a computer with digitizing capability). A standard VCR can record up to two hours of real time video on a single cassette. A time-lapse VCR does not record every frame and may record "snapshots" for up to 480 hours, or may be changed to real time recording on demand (such as an alarm condition). Recently available is the S-VHS VCR. The S-VHS format allows higher resolution of video recording by using a different recording technique.

Many CCTV systems have components or operating scenarios that require that all video signals be synchronized. Sync generators and sync distribution equipment is available for this purpose. The dominant method to date has been to send a sync signal to every camera to "genlock" the camera to the reference. Since the sync signal is about the same as video with a black scene, the transmission methods are identical. An alternate method of synchronizing the videos that may be appropriate in some systems is to use digital frame synchronizers such as those used in broadcasting. If the cameras are all monochrome, using "line lock" to synchronize the video to the AC power is much less costly and adequate for most applications.

If there are many cameras in the system, rapid scene identification is enabled by using video source identification (SID) equipment. The SID inserts numerical or alphanumeric characters into the video for display on a monitor. The SID character generators may be in the camera, modules between the camera and video switcher, or modules after the video

switcher. Each system has an optimum method of SID for that system.

In CCTV systems that are used primarily for alarm assessment, the video from the cameras may not be monitored on a continuous basis. Video loss detection equipment is available to detect camera or video transmission line failure or sabotage. The loss detectors typically output a contact closure for monitoring by the alarm monitoring system.

There are many types of alarm sensors available. One type that senses activity by analyzing the video is a video motion detector. This equipment uses two basic techniques, analog and digital. The analog motion detector is much less expensive than the digital type, but must be used on scenes where there is normally no movement such as indoors. The digital versions available utilize algorithms to allow use outside where such things as moving clouds, trees, and other non-human activity is present.

Sample CCTV system

In the system shown in Figure 1, there are 18 fixed cameras and 38 PTZ cameras located on a perimeter and around the facility. Four nine-inch monitors are mounted in the Control Center Console along with an MPC Remote Control Panel. The MPC Remote has a front panel keypad and display which allow the operator to manually select the desired camera scene, sequencing pattern and dwell time. The Control Center also has three 19" racks for mounting of the remaining CCTV equipment. The rack equipment includes the Fiber Optic Transmitters/Receivers, Sync Generator and Video Distribution Amplifiers, Video Loss Detectors, 64X8 Video Switcher, Time/Date Titrer, four VCR's and an MPC Master Control Panel. Normally, the switcher is controlled by the operator at the Console using the MPC Remote. For maintenance purposes, the MPC Master may also be used for camera selection.

As the figure shows, all video, sync, and data communication transmission outside of the Control Center is via fiber optic cable. At the Control Center, the camera signals are converted back to composite video and fed to the Video Loss Detectors and the Video Switcher. In the event of a loss of video from one or more cameras, the Video Loss Detector will signal the Alarm Monitoring system to annunciate the appropriate alarm.

The outputs of the Video Switcher are fed to the Time/Date Titrer (TDT) which superimposes the cur-

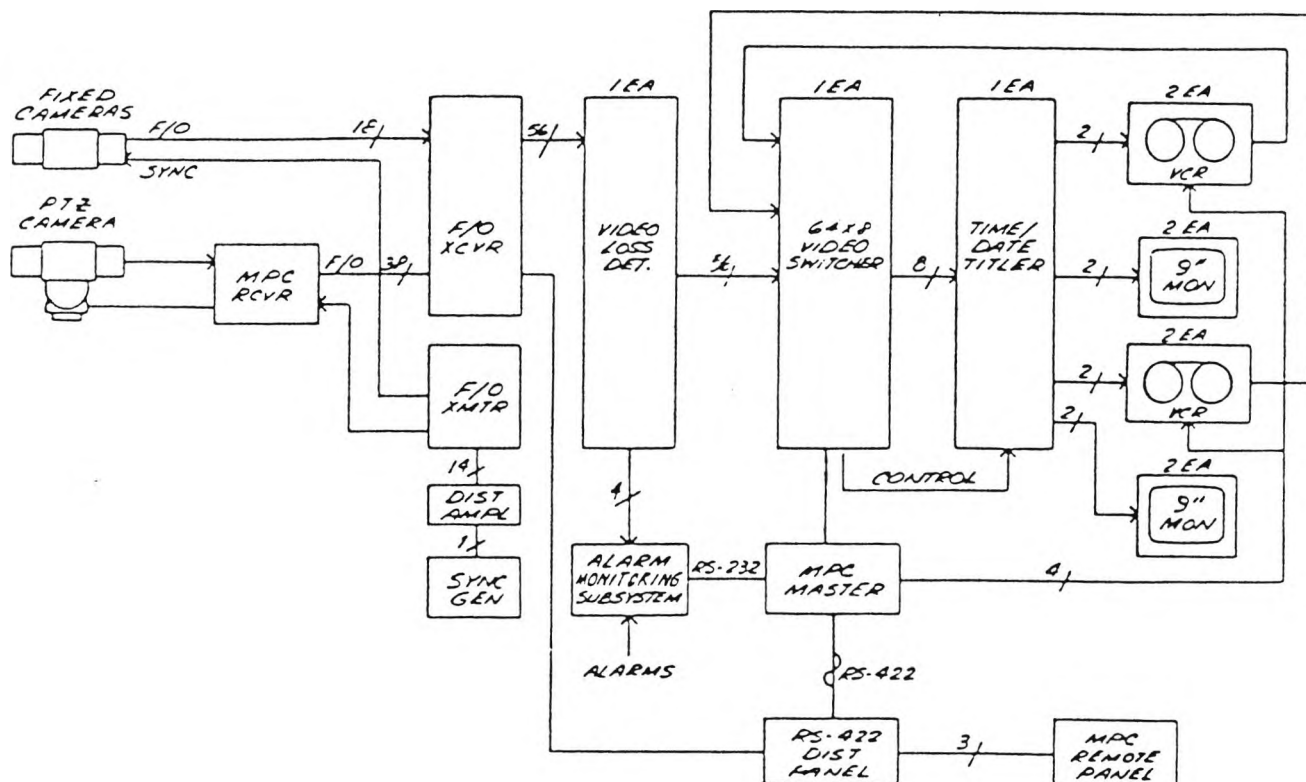


Figure 1. CCTV System

rent time, date and alpha-numeric camera ID onto the composite video. Thus, the selected camera ID is visible to the operator when viewing a particular scene. The TDT has eight outputs which drive four monitors and four VCR's.

In a non-alarm condition, three of the monitors are used for sequencing of certain cameras while the other may be used for manual selection of the desired camera. When an alarm occurs, the Alarm Monitoring system sends an alarm message via an RS-232 interface to the MPC Master which then switches the corresponding camera to a monitor for assessment of the alarm by the operator. Subsequent alarms are stored by the MPC Master in an alarm queue. The operator must acknowledge and release an alarm in order to remove it from the queue. This will cause the released

alarm to be removed from the pending monitor display and replaced by the next alarm scene in the queue. This is repeated until all pending alarms have been acknowledged and released by the operator.

System Design

CCTV systems vary widely in application and operational parameters. After initial operational requirements are determined, a preliminary design can be performed. Then a process of review and redesign should occur with much cooperation between operations and design groups. It is very important to optimize the design according to system operational characteristics, system size (including expansion requirements) and cost.

COHU FIBEROPTIC TRANSMISSION SYSTEMS

Reference: Fiberoptic Systems Drawings 1 & 2

Fiberoptic (F/O) Systems Description

GENERAL

The following fiberoptic transmission systems provide a broad over view of the types of F/O systems Cohu has integrated with our cameras and system support equipment. These systems are primarily used outdoors incorporating Cohu's sealed and pressurized environmental enclosures operated with our microprocessor control (MPC) system. However, Cohu has supported a full range of other manufacture's camera enclosures and controls with our F/O camera configurations. The strength of our System Engineering group and our manufacturing facility, located in San Diego, allows us to quickly adapt to your needs. This is one of the benefits of working with an American manufacturer of CCTV cameras.

Cohu installs the fiberoptic transmitter directly into the environmental camera enclosures or the camera/pan tilt control box located adjacent to the camera site. This eliminates the need for additional F/O junction boxes, cable adapters which minimizes installation cost.

The primary camera housings are Cohu's sealed and pressurized 3" or 6" outside diameter (O.D.) environmental enclosures. These housings provide for maximum protection against all indoor and outdoor environmental hazards. Non-environmental, indoor, camera housings may also be configured with F/O transmitters. However, this is not the most widely applied system design. Indoor systems are usually non-integrated with stand alone F/O transmitters installed out of sight in ceiling crawl spaces, junction boxes or in centralized F/O transmitter station.

The primary design criteria for Fiber Optic (F/O) Transmission Systems are:

1. Transmission Environment
2. Transmission Distance
3. System Configuration
 - A. F/O Video
 - B. F/O Video and Hardwired Control Data
 - C. Video and Control Data over Separate Fibers
 - D. Video and Control Data over a Single Fiber
 - E. Multiple Videos over a Single Fiber

1. Transmission Environment.

One of the first benefits derived from the installation of a F/O system is the elimination of cable interference caused by ground loops, electronic inductance, resistance and nuclear radiation. The use of F/O is always recommended when high levels of electronic noise is present. Another spin-off of a fiber optic system is that it is very secure.

Prior to the advent of F/O, parties could intercept electronic transmission via the emanations from the cable. This is not possible with F/O cables since the light waves do not radiate energy as electronic signals do.

2. Transmission Distance.

Including fiber optics in a system design always adds cost to an otherwise less expensive equipment list. Often this first glance at cost may seem to make a fiber system a non-cost-competitive system alternative. This is very true. In most small, short run applications in a low-noise environment it is not cost effect to include fiber optics. It is less expensive to run standard RG59 coax cable a few hundred feet than it is to include F/O transmitters, receivers and cable.

However, the distance which standard coax cable can transmit the signal is limited. Video degradation increases as the coax cable length increases. RG59 coax cable is limited to a transmission distance of 500-750 feet. Longer cable lengths may be achieved with different coax cables. As an example, Cohu utilizes RG11 foam coax cables for distances up to 3000 feet. However, to insure proper system operation, video equalizers and power amplifiers often need to be installed long before the maximum cable transmission distance is reached. The additional expenditures will often offset the initial higher cost of a fiber optic system.

In fiber optics applications distance between the F/O receiver and transmitter is important. It must be clearly defined in the system description. It is critical to select the proper F/O transmitter and receiver for each application. As the transmission distance increases either a greater amount of light needs to be generated at the transmitting sight or a more sensitive receiver must be used. The amount of light which is available at the receiving site is affected by the transmission distance, type of transmitters, type of cable and the quantity and quality of cable connection and splices.

To compensate for longer cable lengths, different types of transmitters are used. These F/O transmitters will transmit different wavelengths of light from different types of light sources.

The most common form of fiber optic transmitters are light emitting diodes (LED). They are primarily used in short to medium cable distances. Longer cable runs and multiplex signals often utilize laser diodes.

The F/O transmitters are designed to be used with various types of F/O cable. The two most common types of cable are 50/125 and 62.5/125 micron. The 50 and 62.5 refer to the diameter of the glass core. It is this glass core through which light passes. The 62.5 is quickly becoming the industry standard as it is more efficient than the smaller 50 micron cable. The 125 refers to the outside diameter of the cladding which surrounds the glass core. The cladding is a second layer of glass which protects the fiber. The type and thickness of the cladding determines the amount of light which escapes from the glass core.

The other major factor affecting a fiber optic transmission system is the number of cable connectors and splices. Each connection and splice reduces the amount of light available at the receiving end. All these factors are taken into consideration in what is referred to as the Optical Loss Budget. The Optical Loss Budget is a measurement of how much light can be lost due to transmission distance, cable type and the number of splices and connectors and still have sufficient light to be used by the receiver to produce a usable video signal.

3. System Configuration

System A. F/O Video

This is the simplest and least expensive F/O system. The configuration would be utilized with cameras with fixed focal length lens and when no remote control of the camera is required.

System B. F/O Video, Hardwired Control Data

When pan/tilts and zoom lenses are utilized in a CCTV system, control signals from the Cohu microprocessor control system (MPC) must be transmitted to and from each camera location. This is normally accomplished with a shielded twisted pair. The RS422 data signals may travel to and from the MPC control receiver located at the camera site. The MPC control receiver receives the encoded control signals and decodes them and provides the drive voltages to the camera, zoom lens, and pan/tilt.

Cohu installs the F/O transmitters into the MPC control receivers when they are used in a system. This particular configuration is often the most cost effective means of obtaining all the benefits of F/O video in a CCTV control system. The shielded twisted pair may loop through each of the control receivers and should be terminated with a 150 ohm termination. The longest cable run can not exceed 8.04km (5 miles without repeaters).

System C. Video and Control Data Over Separate Fibers

This is the most utilized F/O system configuration. It combines all the positive attributes for a F/O for both the video and data signals. This configuration allows the installing contractor to run a single 3 or 4 fiber F/O cable to the camera sight. Please note that it is advisable to always run extra unused fiber in the F/O cable.

The video F/O network is the same as the System A + B. However, the RS422 data signals are transmitted to and from camera sites via a bidirectional data transceiver. Transceiver is a term used for a device which can simultaneously transmit and receive information. Bidirectional transceiver are relatively costly for small short haul systems. However, as the cable gets longer, the cost and the system performance will offset the initial equipment expenditure.

System D. Video and Control Data Over a Single Fiber

This system configuration reduces the cable requirements to a single F/O conductor. It is primarily used when cable diameters, installation peculiarities, pre-existing cable conditions and extremely long cable runs are part of the design criteria.

The fiber optics in this configuration include a bidirectional coupler. This device transmits and receives the video and bidirectional data simultaneously by reflecting the light to multiple receivers and the electronically separating the different signals.

Another method of combining multiple signals on a single F/O cable is called Wave Division Multiplexing. This method transmits different signals at different wavelengths of light that do not interfere with each other. This method is often used when transmitting more than one video signal in the same direction.

The single cable design is the most expensive of all of the direct line F/O options. However, it is often one of the most effective means to provide F/O control to a remote location.

System E & F. Multiple Videos Over a Single Fiber

Transmitting multiple video signals over a single fiber is particularly attractive when there are numerous camera clusters located far from the control site.

There are several methods which can be employed to transmit multiple videos over a single fiber. The frequency modulated configuration (as shown in System E) is one popular method accomplishing this task. Several manufacturers of fiber optic equipment offer a standard product which accepts RS170 composite video inputs and converts them to frequency modulated (FM) carrier frequencies. The electronic carrier frequencies are converted to a optical signal and transmitted over a single fiber.

Amplitude modulation (AM) is another means of transmitting multiple video over a single fiber. The overall performance specifications of this system is not as high as the FM system. However, the difference has little consequence in normal traffic monitoring or general security applications. AM systems do offer greater flexibility in the security system design. A larger number of videos can be transmitted over a single fiber. Twenty or more videos can be transmitted over a single fiber with the addition of individual modulators and demodulators for each video signal.

The video signals are received at the control site and demodulated to standard RS170 composite video and processed through any standard CCTV video switching network and viewed on standard CCTV monitors.

An alternative design modulates the video signals on television carrier frequencies. After the F/O receivers convert the signals back to the modulated video signals they may be viewed on any standard television set. This system would be similar to your home cable TV system where you would change channels to view the different camera locations.

Cohu Fiber Optic Transmission Systems
page 6 of 6

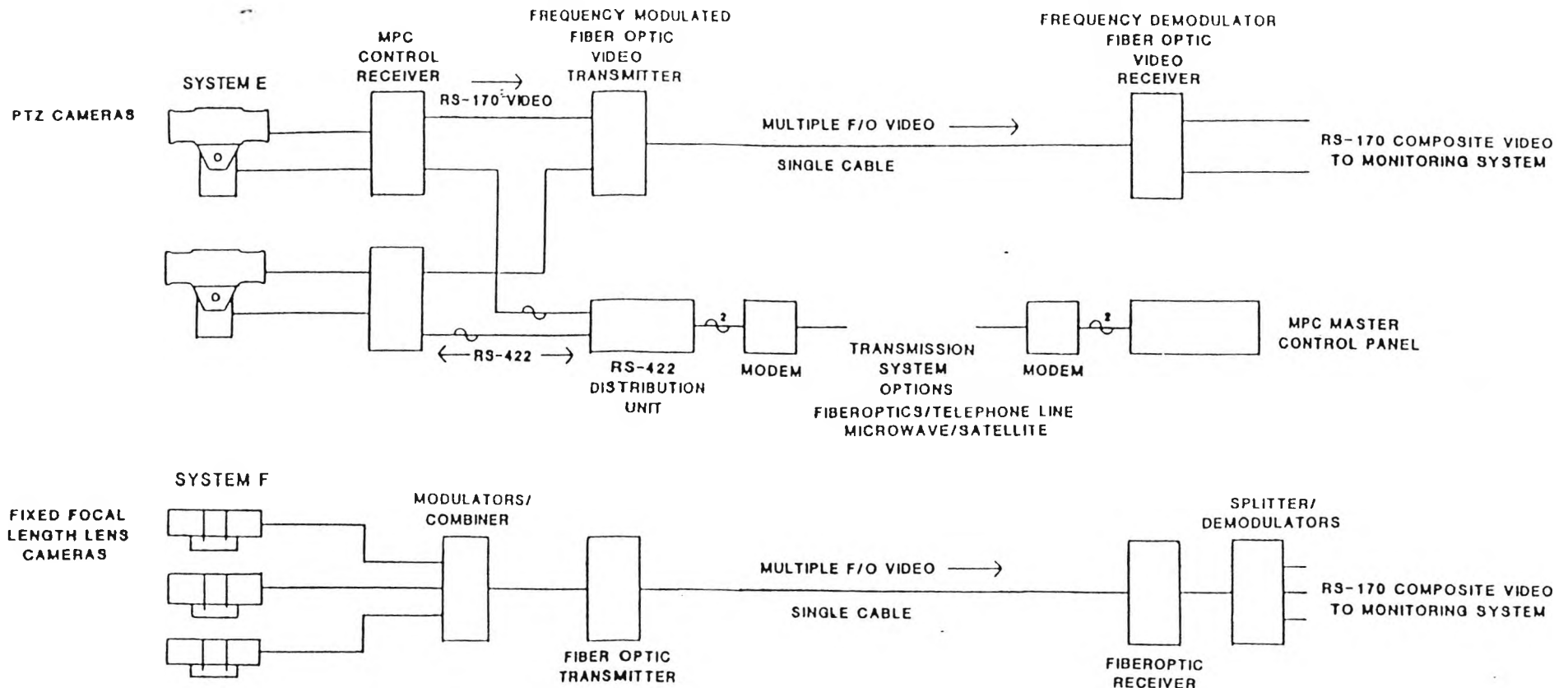
The advantage of this design is that it eliminates many pieces of monitoring equipment. Demodulator, video switchers and switch control are not necessary since the monitor are linked directly to the output of the F/O receivers.

The control signals for cameras with pan/tilt and zoom lens requirements could also be transmitted over fiber optic cable, although this is not the most cost effective means to perform the control functions. The most common method of transmitting the control functions is over existing telephone lines. The operator need only select the camera site by using the numerical keypad on the MPC Master Control Panel. The MPC Master has the capability to automatically dial up the appropriate location, check status, perform the desired control maneuvers and clear the line when finished.

Cohu Application Engineers are prepared to assist you in obtaining the necessary types of F/O equipment to ensure optimum system performance. The strength and experience of our Systems Engineering Group, and our Customer Service Department guarantees system operation.

Contact Cohu Application Engineering today at (619) 277-6700 to take advantage of our 43 years experience in manufacturing high quality, American made CCTV cameras and electronic equipment.

FIBER OPTIC VIDEO WITH CONTROL DATA

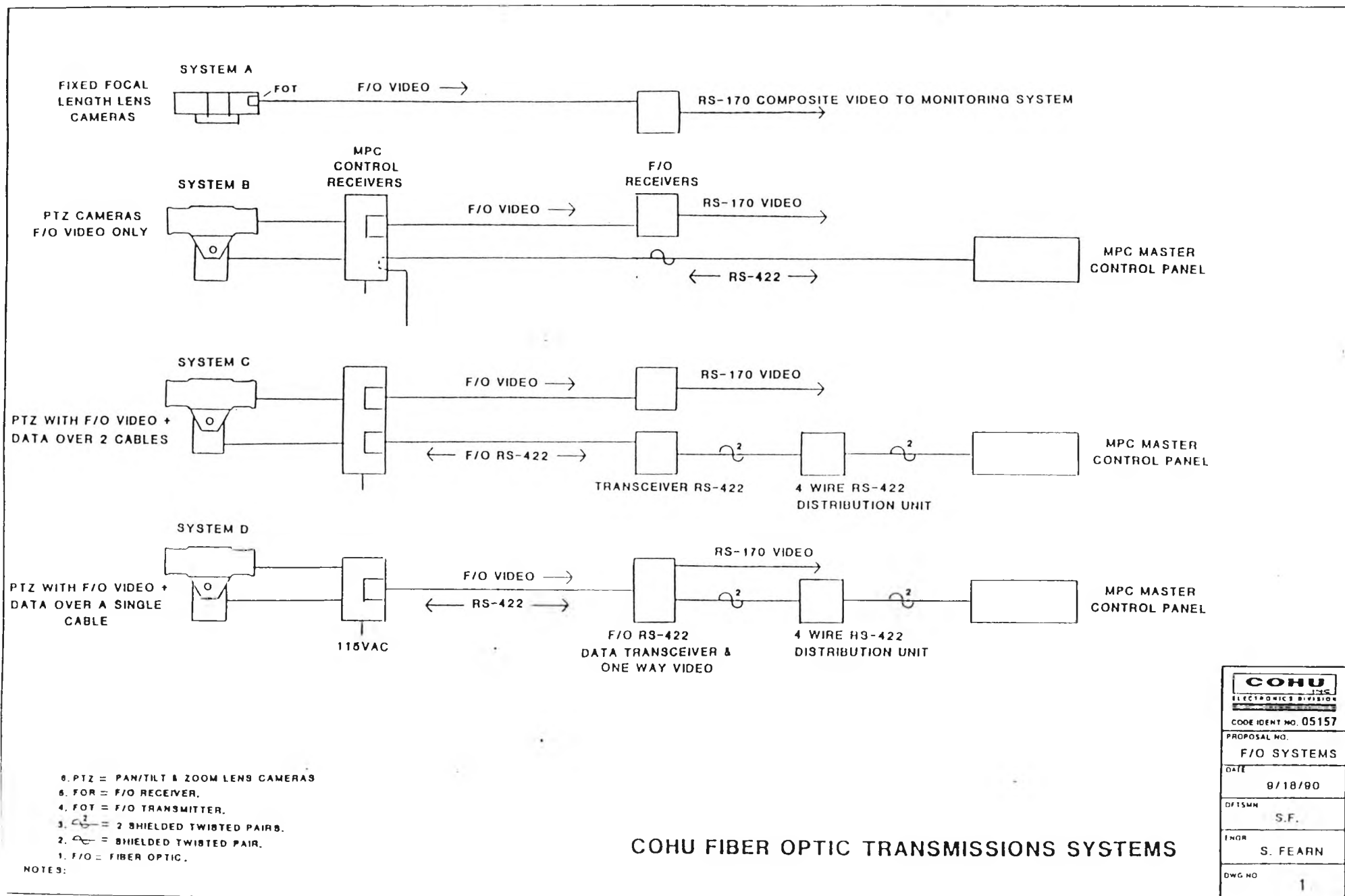


4. = 2 SHIELDED TWISTED PAIRS.
 3. = SHIELDED TWISTED PAIR.
 2. PTZ = PAN/TILT & ZOOM LENS.
 1. F/O = FIBEROPTICS.

NOTES:

COHU MULTIPLE VIDEO / SINGLE FIBER OPTIC CABLE TRANSMISSION SYSTEMS

COHU ELECTRONICS DIVISION	
CODE IDENT NO 05157	
PROPOSAL NO.	
F/O SYSTEMS	
DATE	8/18/90
DESIGN	8.F.
ENGR	8. FEARN
DWG NO	2



COHU FIBER OPTIC TRANSMISSIONS SYSTEMS

COHU ELECTRONICS DIVISION	
CODE IDENT NO. 05157	
PROPOSAL NO.	
F/O SYSTEMS	
DATE	8/18/80
DFTSMN	S.F.
ENGR	S. FEARN
DWG NO	1

SAMPLE

FIBER OPTIC VIDEO & HARDWIRED CONTROL CCTV SYSTEM DESCRIPTION

Reference: F/O System Drawing 3

I. GENERAL

The Cohu CCTV system includes 73 cameras (20 pan/tilt zoom [PTZ] and 53 fixed) with expansion capability to 223 camera locations. The system is configured with fiber optic video transmission equipment, video matrix switching, time, date and camera ID generators and a microprocessor controlled (MPC) system. The MPC system has data distribution, PTZ control, video switcher control, preset memory, and interface to a alarm system computer. The MPC Master control panel located at the Central Guard Station (CGS) monitors and controls switching operations initiated at the Satellite Guard Stations. The MPC is capable of controlling up to 32 Satellite Guard Stations.

II. SYSTEM DESCRIPTION

A. Video Path

The outdoor fixed and the PTZ cameras view scenes as desired. The output from the fixed cameras are transmitted to the Central Guard Station via fiber optic transmitters installed in the environmental enclosures. The PTZ cameras transmit video signals to their respective MPC control receivers. The video is transmitted to the Central Guard Station (CGS) via fiber optic transmitters installed in the control receivers.

The fiber optic (F/O) cables are routed to the fiber optic receiver station located in the CGS. The composite video outputs from the F/O receivers are connected to the 128X16 matrix video switch via RG59B/U coax cable.

The matrix video switcher receives the 128 possible video outputs and switches them to 12 of the 16 possible video outputs.

The video switcher outputs are routed to the time date and camera ID generator. This unit superimposes camera identification time date and alphanumeric titles onto the video signal. The outputs of the ID generator are connected to the monitors located within the CGS or to the fiber optic transmitter for transmission to the dedicated Satellite Guard Station (SGS).

The fiber optic cables are routed to the individual Satellite Guard Stations. The fiber optic receivers located at each station convert the fiber optic signals to standard composite video which is displayed on the Guard Station monitors.

B. System Control

System control is available from the MPC master and remote control panels. The operator at the Central Guard Station's master control panel can call up any camera from any location and display it on any monitor in the CGS or any of the SGS's. The SGS's MPC remote control panels will be programmed to only control the selection of cameras located within their security coverage.

The preset panel associated with each MPC control panel allows programming and selection of preset PTZ camera positions. All control signals are transmitted via RS-422 except the control of the video switcher and the ID generator. The video switcher and the ID generator are controlled with logic levels via a ribbon cable.

The master control panel controls the video switcher and transmits commands to the MPC control receivers at the PTZ camera site via a shielded twisted pair. The commands from the MPC remote control panels are received by the master control panel and are distributed to the video switcher or the PTZ camera locations via a distribution unit.

The addressed MPC control receivers decodes RS422 provides the drive voltages to the pan/tilt and camera lens. The Control Receiver also controls functions such as camera power, manual/auto iris and any other auxiliary control features. The MPC control receivers are connected to the RS422 distribution unit via a single shielded twisted pair. The MPC control receivers located within a given security zone may be connected in series and terminated at the end of each individual run.

III. OPERATION

A. No Alarm

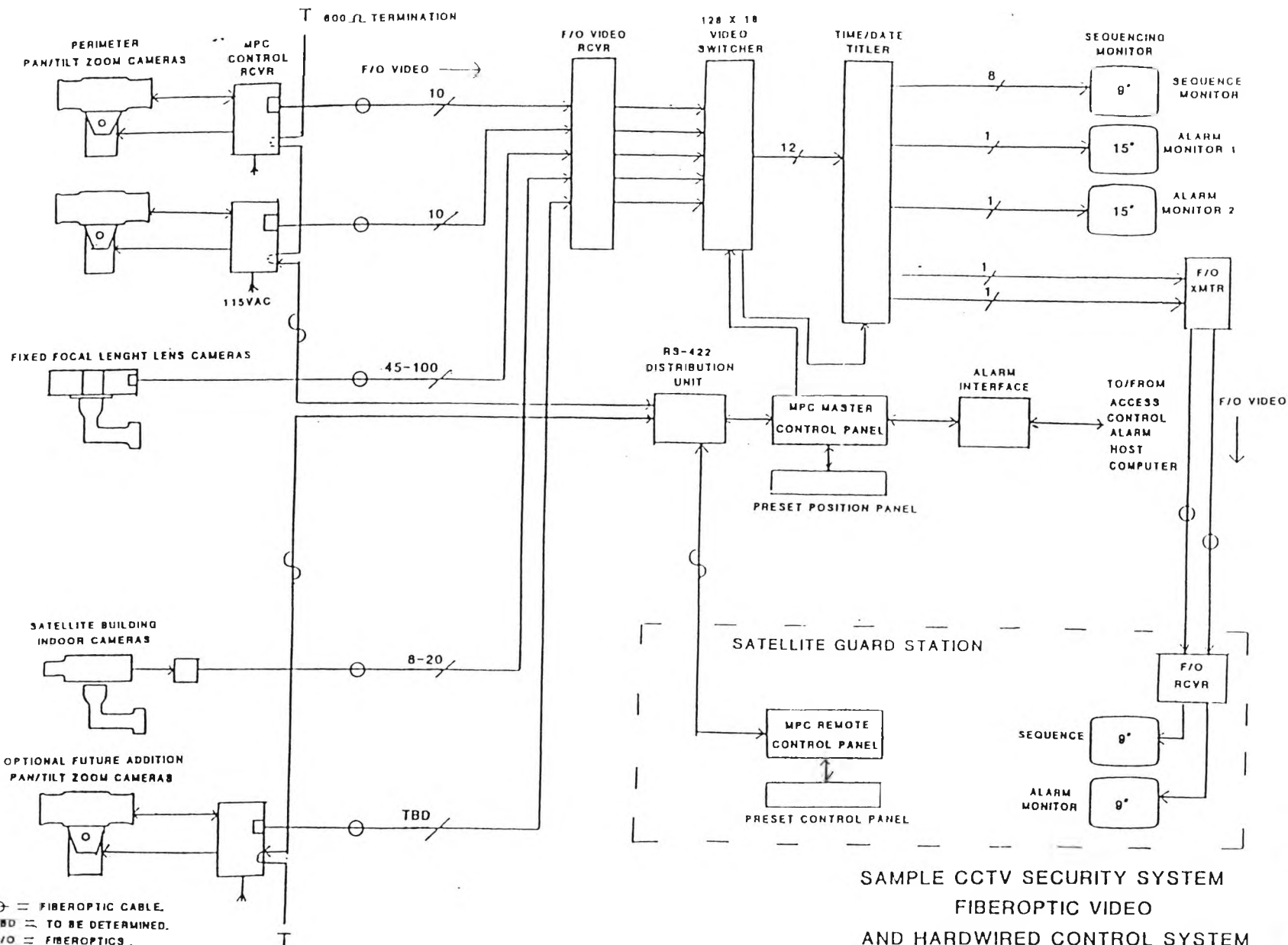
When no alarm is present, the operator at the CGS may have any camera displayed on any of the sequence monitors or may have any combination of cameras sequencing on any of these monitors. The alarm monitors will be blank during non alarm modes. The operator at the SGS may have any of its dedicated cameras sequencing or viewed on its sequencing monitor. The alarm monitor will be blank in the nonalarm periods.

B. Alarm Operation

When an alarm is generated and is received by the master control panel via TTL logic high signal from host alarm computer through alarm interface unit it will automatically switch that video output to one of the matrix switcher alarm monitors and the appropriate SGS alarm monitor.

During an alarm, the monitor in the CGS will display the first alarm scene. Monitor 2 will display the second alarm screen. The alarm monitor located by the SGS's will sequence between consecutive alarms that occur in their coverage zones.

If the alarm is from a PTZ location, the camera will automatically pan, tilt, and zoom to a preassigned preset scene. If more alarms occur, the zone numbers are added to the alarm queue and the associated camera(s) for the zones in the alarm queue are sequenced on the secondary alarm monitors and the appropriate SGS monitors. If desired the operator may shift the queue to sequence through the alarms by depressing the next alarm button on the master or remote control panel. The next alarm camera is then displayed on the primary alarm monitor and the camera previously displayed on the alarm monitor 1 is displayed as part of sequence on alarm monitor 2 in the CGS. When the operator in the SGS depresses the next alarm button the alarm scene will be displayed on the sequencing monitor. The previously displayed alarm scene will be displayed on the SGS's alarm monitor and join the predetermined alarm sequence. All alarms shall remain active until cleared by the operator at the CGS and the SGS.



CENTRAL
GUARD
STATION

SAMPLE CCTV SECURITY SYSTEM
FIBEROPTIC VIDEO
AND HARDWIRED CONTROL SYSTEM
BLOCK DIAGRAM

5. \oplus = FIBEROPTIC CABLE.
4. TBD = TO BE DETERMINED.
3. F/O = FIBEROPTICS.
2. \square = SHIELDED TWISTED PAIR.
1. NO SCALE.

COHU ELECTRONICS DIVISION	
CODE IDENT NO. 05157	
PROPOSAL NO. F/O SYSTEMS	
DATE	8/18/80
DFTSMH	S.F.
ENGR	S. FEARN
DWG NO	3

SAMPLE

FIBER OPTIC VIDEO AND CONTROL CCTV SYSTEM DESCRIPTION

Reference: F/O Systems Block Diagram #4

I. GENERAL

The proposed CCTV System will provide security monitoring for a fence perimeter. As shown in the CCTV System Block Diagram, the system consists of eighteen fixed cameras, four pan/tilt/zoom cameras, and one indoor mounted camera, each located so as to provide complete coverage of the Protection Zone. The video signals are monitored by operators at the Central Guard Station (CGS) and the Secondary Alarm Station (SGS).

Four of the 9" monitors at both the CGS and the SGS consoles are dedicated to sequencing of selected camera scenes. The remaining eight 9" monitors and the four 15" monitors provide for manual viewing of the desired scenes. In the event of an alarm condition, the associated camera will be displayed on one of the 15" monitors until manually cleared.

II. SYSTEM DESCRIPTION

Video signals from the twenty-three cameras are transmitted via fiber optic cable to the CGS equipment cabinet which contain the fiber optic receivers for each camera. The output of the fiber optic receivers is composite video which passes to the video loss detectors. In the event of loss of video signal from one or more cameras, the video loss detector will provide contact closure to the alarm interface panel for detection by the alarm computer. The loss of signal will also be annunciated locally to provide an indication to the operator.

The outputs of the video loss detector are fed to the ID generators which superimpose a two-digit camera ID onto the composite video signal from each camera. Thus, the camera ID is visible to the operator when viewing the particular camera scene on a monitor. The ID generator also provides adjustments for the x-y position on the monitor and character intensity.

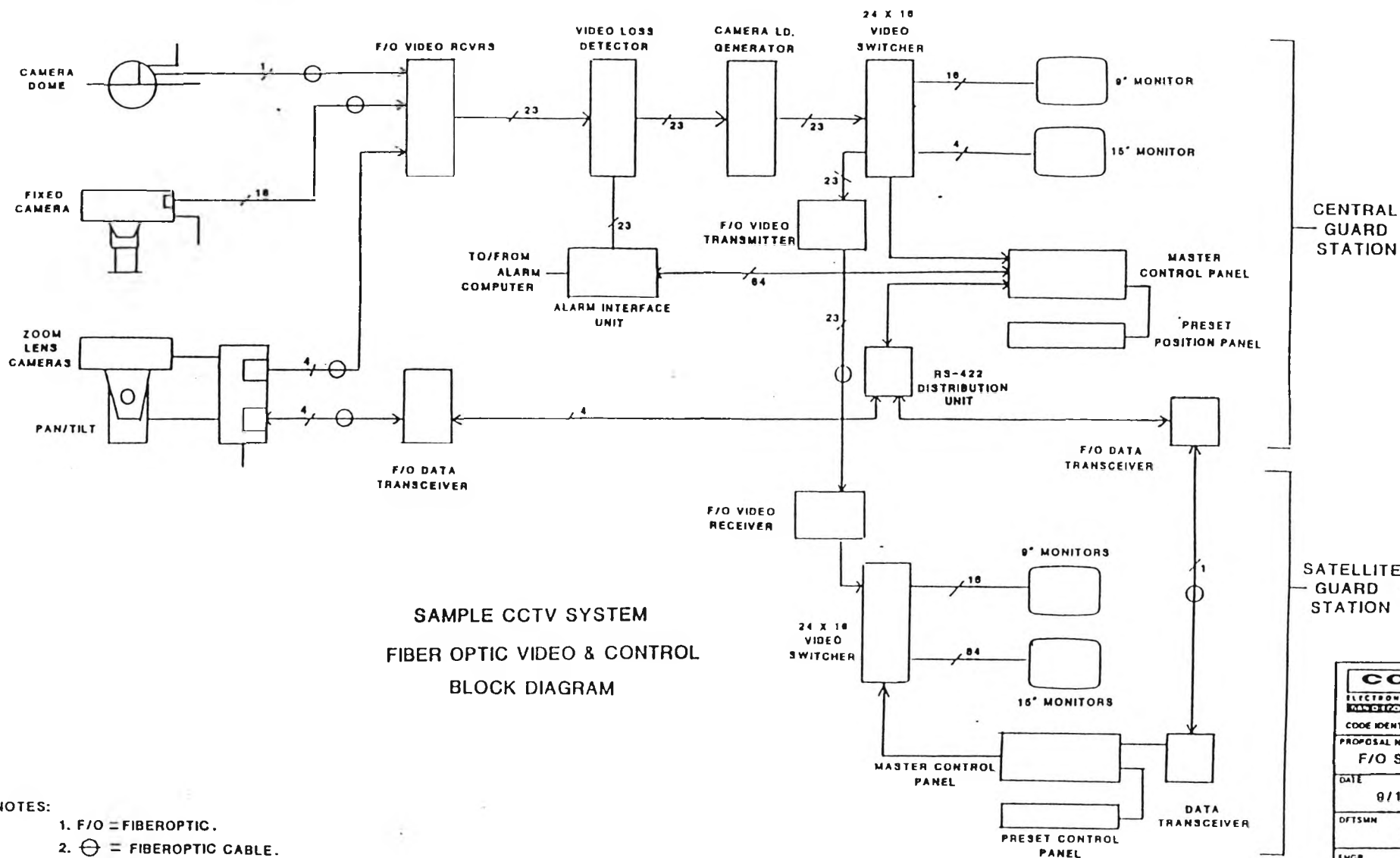
The outputs of the ID Generators are fed to a 24x16 Video Switcher. The Video Switcher provides the capability to select the desired camera scenes for viewing either on the four sequencing monitors or the eight manually selected monitors. Selection of the desired camera output is normally handled by the operators using the MPC Remote panels at the CGS and SGS consoles. For maintenance purposes, the MPC Master in the CGS cabinet may also be used for camera selection.

F/O Video and Control Data
page 2 of 2

Twenty-three loop through outputs from the Video Switcher are fed to Fiber optic Transmitters for transmission to the SGS Console. At the SGS, the fiber optic signals are converted back to video and distributed to the sixteen monitors in a similar fashion to the CGS Console. An MPC Remote Panel at the SGS allows the operator to control the desired scenes to be monitored, independent of the CGS operation.

In addition to the required video and control equipment, an Alarm Interface Panel is provided to allow for connections between the MPC Master and the Alarm Computer. In the event of an alarm, the Alarm Computer will generate a contact closure at the Alarm Interface Panel for detection by the MPC Master. The MPC Master will then switch the associated camera scene to one of the 15" monitors at the CGS and SGS consoles. The alarm scene will remain until manually cleared by the Operator.

The Master Control Panel located in the CGS has the capability of locking-out the controls in the SGS via the bi-directional RS422 fiber optic data link.



NOTES:

1. F/O = FIBEROPTIC.
2. ⊕ = FIBEROPTIC CABLE.

COHU ELECTRONICS DIVISION MANUFACTURING	
CODE IDENT NO. 05157	
PROPOSAL NO.	
F/O SYSTEMS	
DATE	9/18/80
DTSMN	S.F.
ENGR	S. FEARN
DWG NO	4

APPLICATION NOTE

Performance of the 1/4-inch Sensor

Content

This Application Note compares performance of a 1/4-inch format camera to that of a 1/2-inch format camera when using zoom lenses.

1/4-inch Sensor Performance

Cohu 1300 Series Cameras can be provided with a 1/4-inch image sensor by requesting ER-3048. Using a 1/4-inch sensor provides an overall cost savings of 30 percent or more for each zoom lens camera site, depending on the requirements of the installation.

This savings results from three areas: the lens, the barrel housing, and the pan and tilt unit (P & T). The zoom lens is much smaller, less expensive, and can fit in a 4.5-inch diameter housing instead of the more expensive, heavier 6-inch housing. Since the housing is much smaller and lighter, a medium duty P & T can be used instead of a more expensive heavy duty model (fig.1).

An additional benefit of the smaller housing and P & T is that they provide less loading effect when mounted. This is especially important on poles, where wind loading can be an important consideration.

The Zoom Lens

As an example of the lens savings, consider a site

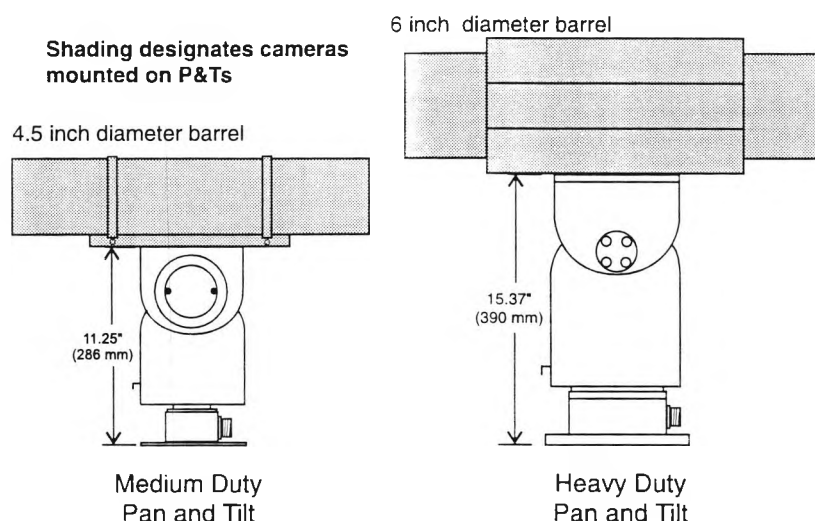


Figure 1. The 4.5-inch diameter camera mounted on the medium duty pan & tilt provides the same field of view coverage as the much larger 6-inch diameter camera mounted on the heavy duty pan & tilt.

planned for a 1/2-inch sensor requiring a 16- to 160-mm lens to provide the desired coverage. This lens is larger and more expensive (at bottom in figure 2). By using a camera with a 1/4-inch sensor, a much less expensive 8- to 80-mm zoom lens (top of figure 2) can

be used to provide virtually the same coverage. Table 1 lists the horizontal and vertical angles of coverage for each of these lenses. Both telephoto and wide angle figures are given. Note that the 8 to 80 lens has a slightly wider angle of view.

Table 1. Zoom Lens Comparison

ZOOM LENS	LENS/CAMERA FORMATS	FOCAL LENGTH SET	HORIZONTAL VIEWING	VERTICAL VIEWING
16 to 160mm Zoom Lens 1 in. format	1-inch lens used with 1/2 inch camera	16 mm	22.62°	17.05°
		160 mm	2.28°	1.72°
8 to 80 mm Zoom Lens 1/2 in. format	1/2-inch lens used with 1/4 inch camera	8 mm	25.36°	19.16°
		80 mm	2.58°	1.93°

The 16-160 lens is used with a 1/2-inch format camera, and the 8-80 is used with a 1/4-inch format camera. This allows the 8-80 lens to have H and V coverage similar to the 16-160 lens. (The H and V viewing angles of the 8-80 lens are calculated values.)

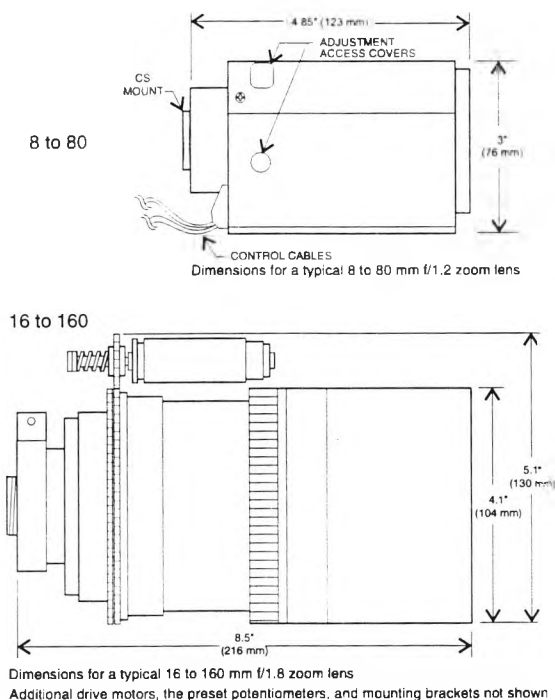


Figure 2. The 8 to 80 mm zoom lens (top) used with a 1/4-inch sensor provides about the same field of view as the 16 to 160 mm zoom lens (bottom) used with a 1/2-inch sensor. The f/1.2 maximum aperture of the 8 to 80 lens allows more light to pass than does the f/1.8 maximum aperture of the 16 to 160 lens.

Pan and Tilt Units

A typical medium duty P & T may be rated for mounting a 40 pound camera. A typical heavy duty P & T might be rated for a 100 pound camera. As can be seen in figure 1, the size difference is significant. The engineering calculations could well determine that a less expensive pole is possible with the smaller, lighter barrel and P & T. It is even possible that this combination could be mounted on an existing pole whereas the large heavy barrel and P & T would require a pole of their own.

Overall Lens-Camera Sensitivity

Overall sensitivity is determined by the maximum f/stop of the lens combined with the sensitivity of the camera itself. With our example the f/1.2 lens aperture allows more than twice as much light to pass as does an f/1.8 aperture. Thus a 10 lux 1/4-inch format camera with an f/1.2 lens is equivalent to a 4.5 lux 1/2-inch format camera with an f/1.8 lens. Table 2 shows this us-

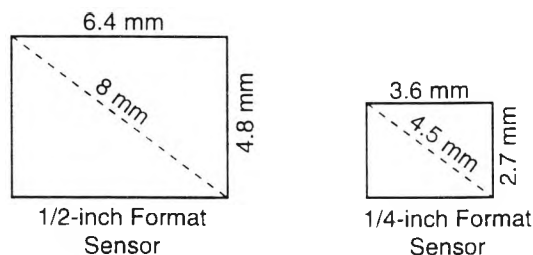


Figure 3. Comparison of relative size for 1/2- and 1/4-inch format sensors. Note that in surface area the 1/4-inch format sensor is about one-third the size of the other sensor.

ing scene illumination sensitivities. This table also lists the resolution for each of these cameras. They are virtually identical, with the 1/4-inch sensor slightly better for horizontal.

Figure 3 shows both the 1/2- and 1/4-inch sensors together with their dimensions. While the 1/4-inch sensor has about one-third the surface area of the 1/2-inch sensor, the camera is able to maintain the same vertical resolution and slightly better horizontal resolution. □

Table 2. Comparison of Sensitivity

CAMERA	*SCENE ILLUMINATION	RESOLUTION TV LINES
1300, 1/2 inch	† ≈140 lux	460 (H) x 350 (V)
1300, 1/4 inch ER-3048	‡ ≈95 lux	470 (H) x 350 (V)
*Full video, agc off		
†1/2-inch format camera with f/1.8 lens at max aperture		
‡1/4-inch format camera with f/1.2 lens at max aperture		

APPLICATION NOTE

Gamma Correction

6X-5054

July 27, 1995
Rev. 1 9-17-96

SUMMARY

This application note discusses gamma correction as it applies to closed circuit television cameras and TV monitors.

What is Gamma Correction?

TV monitors using a picture tube have a nonlinear relationship between input signal voltage and brightness provided on the screen. The monitor compresses black areas of the scene. To compensate for this effect, a correction factor called gamma is applied at the camera. This correction emphasizes black areas of the scene in the camera so that when the scene is presented on the monitor it has an overall linear relationship to the actual scene.

No gamma correction is required if the camera video is being used by a linear device. This could include a solid-state flat panel display or various measurement equipment.

The Problem in the TV Monitor

The TV monitor controls brightness of the scene on its picture tube by varying voltage on the control grid of the tube. Across much of its range the grid voltage provides a near linear change in brightness on the screen. But for scene areas approaching black the tube does not make the scene proportionally black

to provide an accurate representation. As the grid voltage approaches cutoff of the electron beam (black), it loses its linearity. Blacks in the scene do not become dark enough.

This could be compensated for within the monitor but in the early days of television it was decided to make gamma correction at the camera. There were relatively few cameras but many TV sets.

The Solution in the Camera

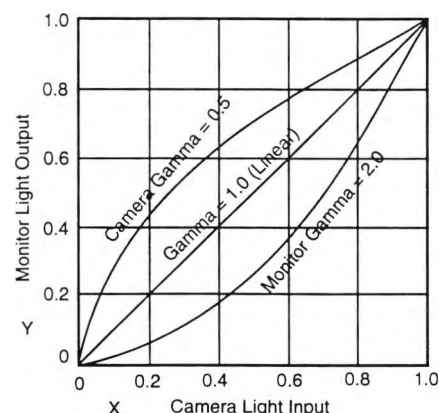
Since the TV monitor compresses blacks, the camera must in some way compensate for this. A CCD camera, being inherently linear, has a gamma of 1.0. (Tube type cameras are not inherently linear. A vidicon, for example, has a gamma of 0.65. These tube type cameras are not considered in this application note.)

Gamma correction in a camera consists of stretching the blacks an amount equal to the compression in the monitor.

The camera stretches the blacks in a scene, the monitor then compresses them a like amount. The result is a linear representation of the white, gray, and black areas of the scene as shown in the illustration.

Why is it Called Gamma Correction?

Prior to the development of television, the photographic industry used the lower case Greek letter gamma (γ) to designate the maximum slope of a



Gamma Curves. A typical monochrome monitor may have a gamma of 2.0. To compensate for this a gamma correction of 0.5 is applied in the camera. The resultant is an overall linear response with an effective gamma of 1.0 for the camera and monitor together.

curve showing exposure vs. density for film. The television industry adapted this term gamma to designate a similar effect in their industry. In television, gamma is the exponent of a number defining the slope of a transfer characteristic:

$$y = x^\gamma$$

A picture tube gamma is typically 2.0 (or 2.2 for color tubes). Thus the value of γ for a monochrome tube would establish a transfer curve of x^2 . To obtain an overall linear response the camera gamma must then be 0.5. Note that $0.5 \times 2.0 = 1.0$. The product of the two gammas gives overall gamma.

APPLICATION NOTE

Auto Iris and DC Iris Lens Control Circuits

APPLICABILITY

This Application Note applies to use of the Cohu cameras listed in table 1 with fixed-focus auto-iris or dc-iris lenses. It does not apply to the use of Cohu cameras with a zoom lens.

Auto Iris Lens Basics

Auto iris lenses use a video signal to control the iris. They convert this video to a dc signal which is then used to control a drive stage that opens and closes the lens iris. Since they have on-board electronics they also require power from the camera, typically +5, +9 or +12 Vdc.

Dc Iris Lens Basics

The dc iris lens operates from a dc signal applied from the camera. This dc signal directly controls the iris mechanism. The lens does not require any power supply voltage from the camera. The dc lens, however, must supply feedback to the control circuits in the camera.

The iris mechanism for either of these lenses typically uses either a galvanometer or some form of linked servo.

Use of Auto Iris vs. Dc Iris

Since the auto iris lens has part of the required electronics on its own internal circuit board this type of lens tends to be somewhat larger and more expensive. With the dc iris lens these circuits are moved inside the camera. The dc iris lens can be slightly smaller and less expensive. But since they are a newer type lens, there are fewer of them available in the various focal lengths.

A Typical Auto Iris Lens

Figure 1 shows a typical auto iris lens, which consists of two basic parts (not counting optics)—the iris mechanism itself and the electronic drive circuit.

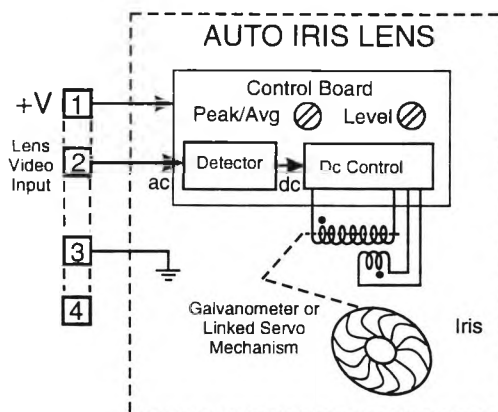


Fig. 1. Typical Auto Iris Lens

The iris is opened and closed either by a galvanometer action or a linked servo.

The Control Board generates drive to the iris mechanism to maintain the video input at a constant level. The board has both a level potentiometer and a peak/average potentiometer, which are adjustable from outside the lens through access holes. The level potentiometer sets the level of the lens video to be maintained from the cam-

TABLE 1. CAMERA MODELS VS. LENS OUTPUTS

Derived Video - No sync	Isolated Video - No sync	Isolated Video - Composite Sync
4700/4800	1100*	(Pending) 1100*
4900	1300*	(Pending) 1300*
8200	2100*	(Pending) 2100*
	2200*	(Pending) 2200*
		(Pending) 3500
		(Pending) 6600**

*Also available with an option board for dc iris output; **Switch selectable dc iris output

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APPLICATION NOTE

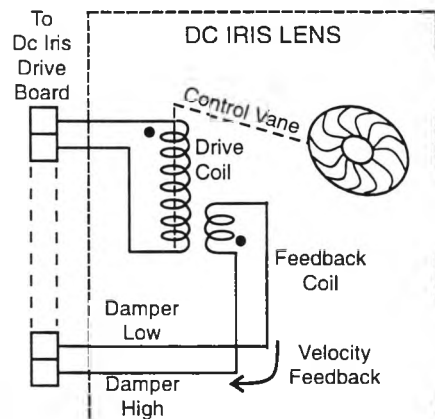


Fig. 2. Typical Dc Iris Lens

era. The peak/average potentiometer is intended to control how the lens responds to different kinds of scene lighting (such as scenes with significant highlights or scenes with relatively flat, even lighting). When used with Cohu cameras having the derived video output signal (table 1) this lens control has minimal effect. This results because these Cohu cameras do not provide an actual video signal to the lens but instead an ac signal whose level is derived from the level of the video.

Any required adjustment should begin by setting the lens peak-average control to midrange. Turn agc off and then set the gain control for 1 Vp-p video out of the camera.

A Typical Dc Iris Lens

The typical dc-iris lens consists of a single mechanism for control of the iris (fig. 2). This typically consists of a galvanometer that moves a control vane linked to the iris. A pickup coil provides velocity feedback to the camera drive circuit. There are no active devices in a dc iris lens—only the drive coil and a feedback coil.

Lens-Camera Interaction

techniques.

The majority of control for this extreme range comes from the iris (fig. 3). An auto-iris or dc-iris lens has the ability to open and close the iris to provide the greatest available range of light control. During noonday sun the lens might be nearly (or completely) stopped down. As the sun sets and before any artificial lighting comes on the iris might be fully open, allowing the maximum possible amount of scene lighting to pass through the lens into the camera. With the iris fully open, a further reduction of scene lighting causes automatic gain control (agc) circuits within the camera to increase gain to maintain near full video output. With the iris fully open and agc at maximum gain, a further darkening of

The scene lighting into a camera often varies over a considerable range. For example, an outdoor camera may view a scene under early morning light at dawn, then bright noonday sun, and later the near dark of twilight. During midday sun elements of the scene may reflect blinding highlights. Handling such a wide range of light requires several different

LENS CONTROL CIRCUITS

the scene will result in the video level dropping in proportion. Useable video is available down to about 30 percent video. Below that the scene quickly becomes unusable.

As can be seen from this description, under conditions of bright scene lighting the lens iris maintains control of video level. Below a certain level of scene lighting the lens iris will be fully open. A further reduction in scene lighting then causes agc in the camera to increase camera video gain to maintain video output near 1 Vp-p. As agc increases gain in the video stages the noise level increases too. This may be noticeable as slight "snow" in the picture at higher gain levels.

Auto-iris Lens Control

The auto iris lens has a Level potentiometer (sometimes labeled Gain or a similar

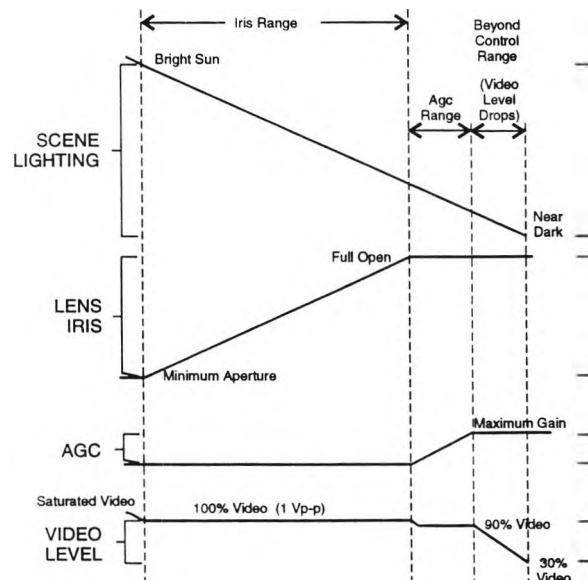


Fig. 3. Lens-Camera Interaction

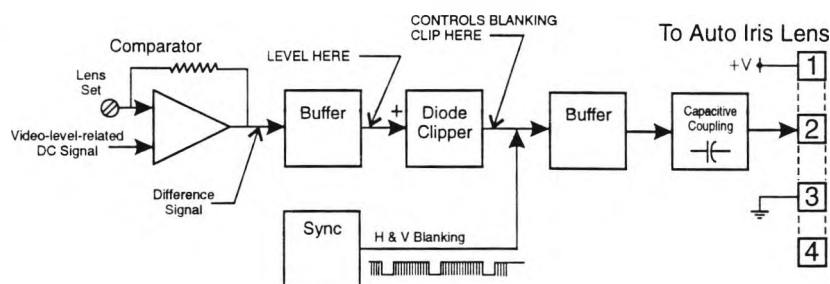


Fig. 4. Derived Video Drive for Auto-iris Lens

name) and a peak/average potentiometer. Within the camera there can be gain, agc level, agc threshold, and peak/average potentiometers. If these controls are not properly set the camera agc and the lens control circuits may interact with each other in an undesired manner. The lens may be forced fully open or closed when not desired or it may "hunt." "Hunt" is a condition in which the lens constantly opens and closes somewhat even though scene lighting is constant. This is noticeable on the monitor as a constant increase and decrease of overall scene lighting over several seconds or longer.

signs (fig. 4) generate a derived video obtained by modulating the composite blanking signal with a dc signal related to video level. (2) More-recent designs use true video tapped off (prior to agc) and isolated from the

normal video circuits of the camera (fig. 5).

Derived Video Circuits

Figure 4 shows generation of the derived video from composite blanking. A dc signal related to the video level is applied to a comparator stage. One input of this stage is biased by a Lens Set potentiometer. The other input receives a dc signal whose level relates to the level of the video output of the camera. The output of this comparator is a difference (error) signal that is buffered for application to the plus (+) side of a diode clipper. The voltage level at this side of the diode clipper determines the clipping level of the composite blanking (an ac

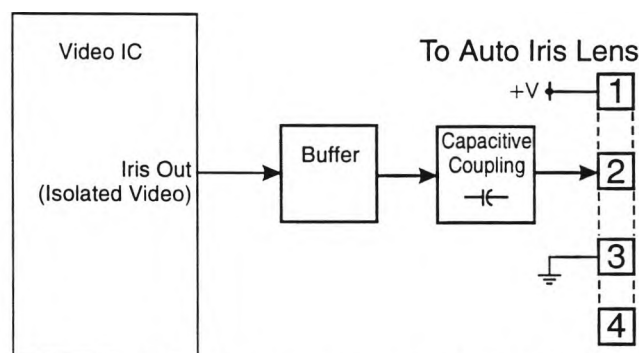


Fig. 5. Isolated Video Drive for Auto-iris lens

DC Iris Lens Controls

Since the dc iris lens has no internal adjustable controls (fig. 2) setting up its operation with the camera is somewhat simpler. The only control directly relate to lens operation is the lens Video Level potentiometer, a part of the camera lens drive circuit (fig. 6). With agc off, this control is set so the iris provide 1 Vp-p video out of the camera.

Camera Drive Circuits for an Auto-iris Lens

Cohu cameras have two types of drive circuits for an auto-iris lens: (1) Earlier de-

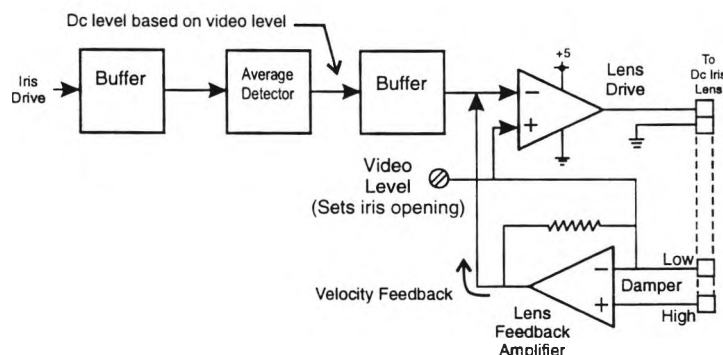


Fig. 6. Dc-iris Lens Drive Circuit

APPLICATION NOTE

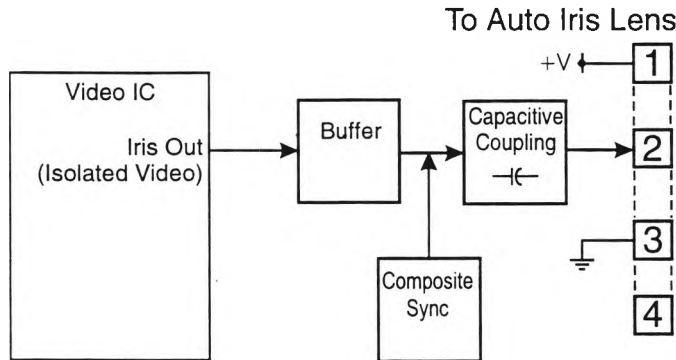


Fig. 7. Isolated Video Drive with Composite Sync

signal) on the other side of the clipper. Since the voltage on the plus side varies in relation to the video level, the clip level on the blanking side varies in proportion. The ac blanking signal is being modulated in response to the video level.

This modulated ac signal is buffered, capacitively coupled, and applied to the lens video output of the camera as an ac signal which simulates the lens video signal.

Because this video output is derived from a signal with fixed repetition rate (blanking) it tends to mask out any variations that would affect the peak-average circuit in the auto-iris lens.

This lens control is usually set mid range.

True Video Drive Circuits

Figure 5 illustrates a typical isolated output from a camera providing true lens video for use by an auto-iris lens. This is an isolated video that is passed through capacitive coupling to the lens interface connector.

It is a fixed gain source with level proportional to the signal emerging from the sensor. It is tapped off prior to agc stages.

Camera Drive Circuits for a Dc-iris Lens

Figure 6 shows a functional diagram for the dc iris drive circuits.

LENS CONTROL CIRCUITS

An average detector smooths variations of the dc iris drive signal. This averaged signal is applied to the negative input of the Lens Drive operational amplifier. Note that this input does not have the gain-set feedback resistor. Instead, gain is dynamically controlled by the feedback signal from the dc-iris lens. The Iris Level potentiometer is adjusted by setting output to 1 Vp-p when agc is off.

Type of Lens Drive Circuits vs. Cohu Cameras

Table 1 lists Camera model numbers with the type of lens drive circuit used for each model. Note that the dc iris capability usually requires an optional circuit board.

Isolated Video with Composite Sync

Video combined with sync provides somewhat better iris action with certain lenses.

Current cameras do not provide sync with their isolated video, but the 1100 and other cameras will offer this feature in the near future (fig 7).

APPLICATION NOTE

Genlock

Content

This Application Note applies primarily to typical monochrome cameras used in genlock configurations. The unique aspects of genlocking color cameras is discussed on page 7. Refer to the individual technical manuals of specific cameras to determine connection and setup requirements.

What is Genlock?

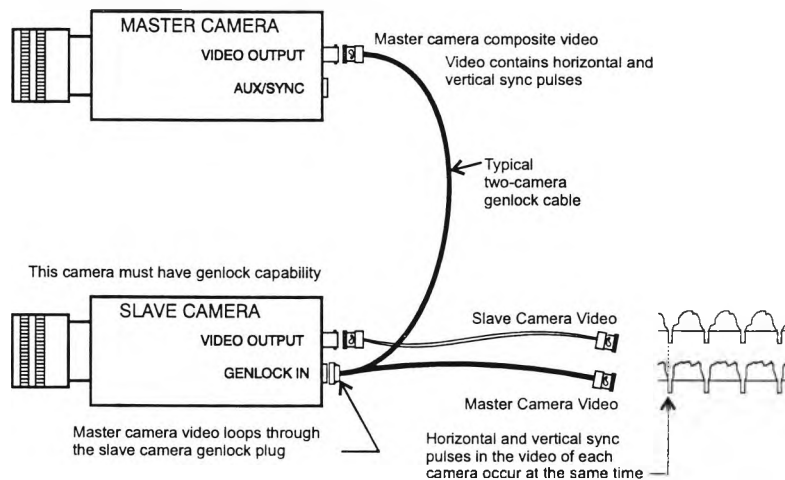
Genlock is the technique of having one or more cameras in a system tied to a single sync reference so that all vertical and horizontal intervals occur at the same time.

Why Do We Need Genlock?

Since genlock makes all the horizontal and vertical sync pulses in a system occur at the same time, equipment requiring critical timings can lock up to the sync very rapidly when switched into or across video lines. This is typically done with screen splitters, faders, and other specialized equipment.

Genlocked cameras can be routed through a video switcher without causing vertical roll on TV monitors at the switching transition, but it may be more cost effective to use line lock in this application. (Line lock is a method of adjusting each

The only requirement for this camera is that it have standard composite video output on a BNC connector



Genlock circuit extracts sync pulse timings from the master camera video. These pulses are used to lock up the horizontal and vertical intervals of the slave camera to those of the master camera

Figure 1. A Basic genlock arrangement showing two cameras. Genlock in the Slave Camera locks its horizontal and vertical sync to H and V sync contained in the Master Camera video.

camera to the phase of the power line so that vertical intervals occur at the same time.) All the line lock cameras must operate from an ac input voltage to their rear panel power input (typically 12, 24, or 28 V ac, etc). This voltage must be stepped down from the building ac power line by a transformer.

Composite Video

Composite video refers to a video signal that includes not only the video necessary to make up the picture but also sync pulses required by the monitor to reconstruct the picture. This is the normal type of video

signal. It also has blanking pulses but they are not of interest for a genlock discussion.

This sync is made up of vertical pulses occurring at a 60 Hz rate (50 Hz for CCIR) and horizontal pulses occurring at an 15,750 Hz rate (15,625 for CCIR).

A Basic Two-camera Genlock Arrangement

The most basic genlock arrangement is shown in figure 1. One camera, the Master, acts as the sync source for the second camera, the Slave. The video signal of the Slave is locked to that of the Master. The horizontal

and vertical intervals of both cameras then occur at the same time. The Master Camera can be any camera having a composite video output. The Slave Camera, however, must have the genlock feature to accept the external genlock signal.

Figure 2 illustrates wiring of a typical cable useful for genlocking two cameras together. This cable is intended for use with a single Slave Camera with the genlock option.

Adding Additional Cameras in a Genlock Configuration

Having multiple Slave Cameras in a system is in principle no different than having the single Slave Camera shown in figure 1. In effect it is only necessary to add more Slave Cameras to the cable. See figure 3. In this figure six Slave Cameras have been connected to the video output cable of the Master Camera. All six Slave Cameras have horizontal and vertical intervals locked to the Master Camera (assuming all the Slave Cameras have genlock capability).

The cable shown in figure 2 would have to be modified to provide the additional genlock connectors to mate with rear panels of the Slave Cameras.

The major limitation is the loading effect placed on the video output of the Mas-

The Master camera does not require the genlock option. Any camera with a composite video BNC output can be used

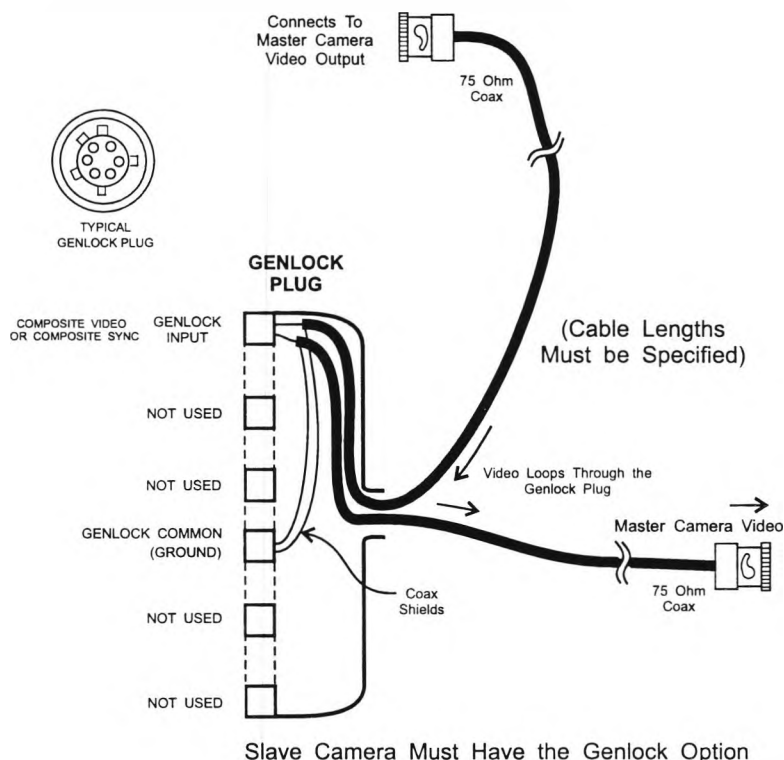


Figure. 2. A typical two-camera genlock cable.

ter Camera. Even though genlock inputs of the Slave Cameras must be a high impedance they still load the line somewhat.

MULTIPLE CAMERA GENLOCK SYSTEMS

The Sync Generator as a Master Source

Figure 4 shows a method of increasing the number of Slave Cameras in a genlock configuration. By replacing the Master Camera with a dedicated sync generator the number of Slave Cameras that can be put on

the line is increased. A typical sync generator has a greater capability to drive multiple cameras than does a video camera.

Note that in this configuration the last camera, at the end of the cable, must be terminated with 75 ohms. This is required to maintain the characteristic impedance of the coaxial cable to prevent signal reflections on the cable.

Using Distribution Amplifiers

If it is necessary to add even more Slave Cameras in a genlock system, one or more distribution amplifiers

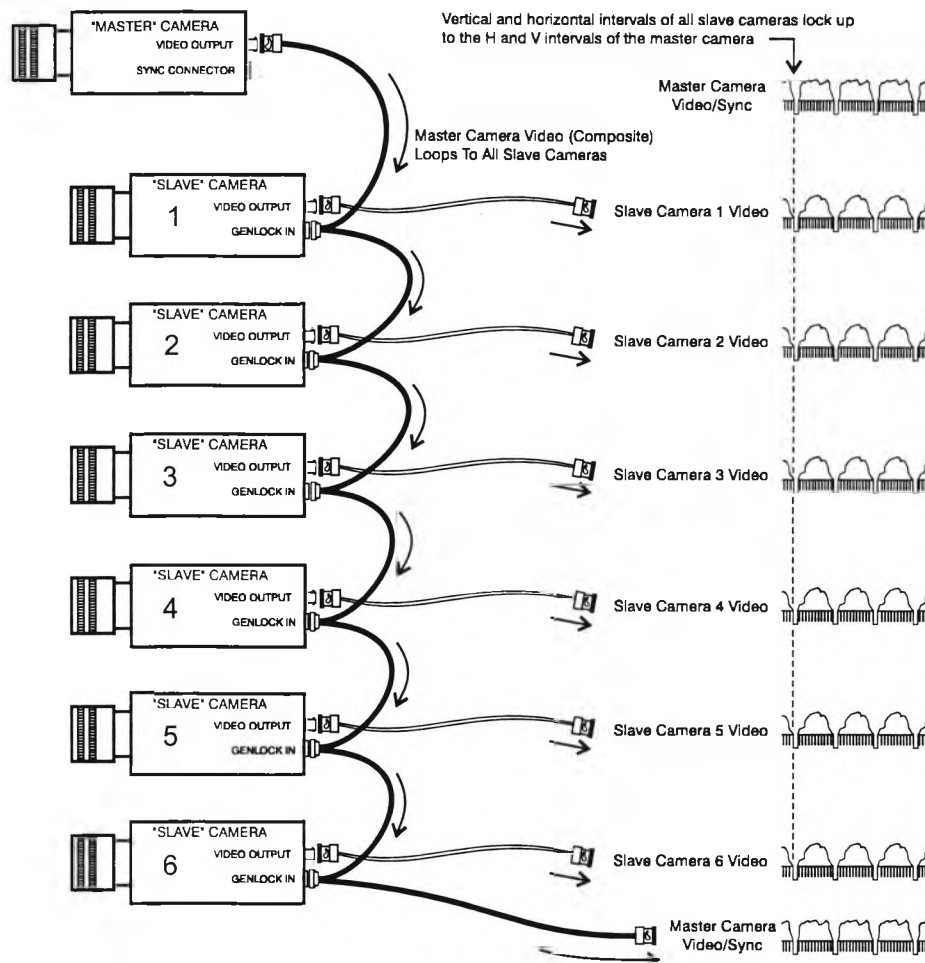


Figure 3. A typical genlock arrangement with six Slave Cameras having their horizontal and vertical sync pulses locked to the H and V pulses of the Master Camera. The Master Camera can be any camera that supplies composite video. Each Slave Camera, though, must have genlock capability so it can lock up to the sync pulses supplied with the Master Camera Video. Although each Slave Camera presents high impedance to the genlock cable, when combined on the cable they reduce the level somewhat. This limits the number of Slave Cameras that can be connected in a loop-thought arrangement. Loss inherent to the coax cable can also become a factor in long cable runs.

can be added into the system. See figures 5 and 6.

In figure 5 a single distribution amplifier has been added into the system. The amplifier shown here has a single input and four outputs, which are isolated from each other. Each output may drive 12 or more Slave Cameras.

If additional Slave Cameras must be added into the system, the arrangement in figure 6 can be used. Here one of the outputs of a distribution amplifier drives a second distribution amplifier. This second amplifier then may have 48 or more Slave Cameras connected onto its four outputs.

It should be understood that these systems are illustrative only. The capability of various sync generators and distribution amplifiers to drive Slave Cameras depends on their specifications and may be greater or less than shown in the illustrations in this application note.

Some distribution amplifiers are for video and may

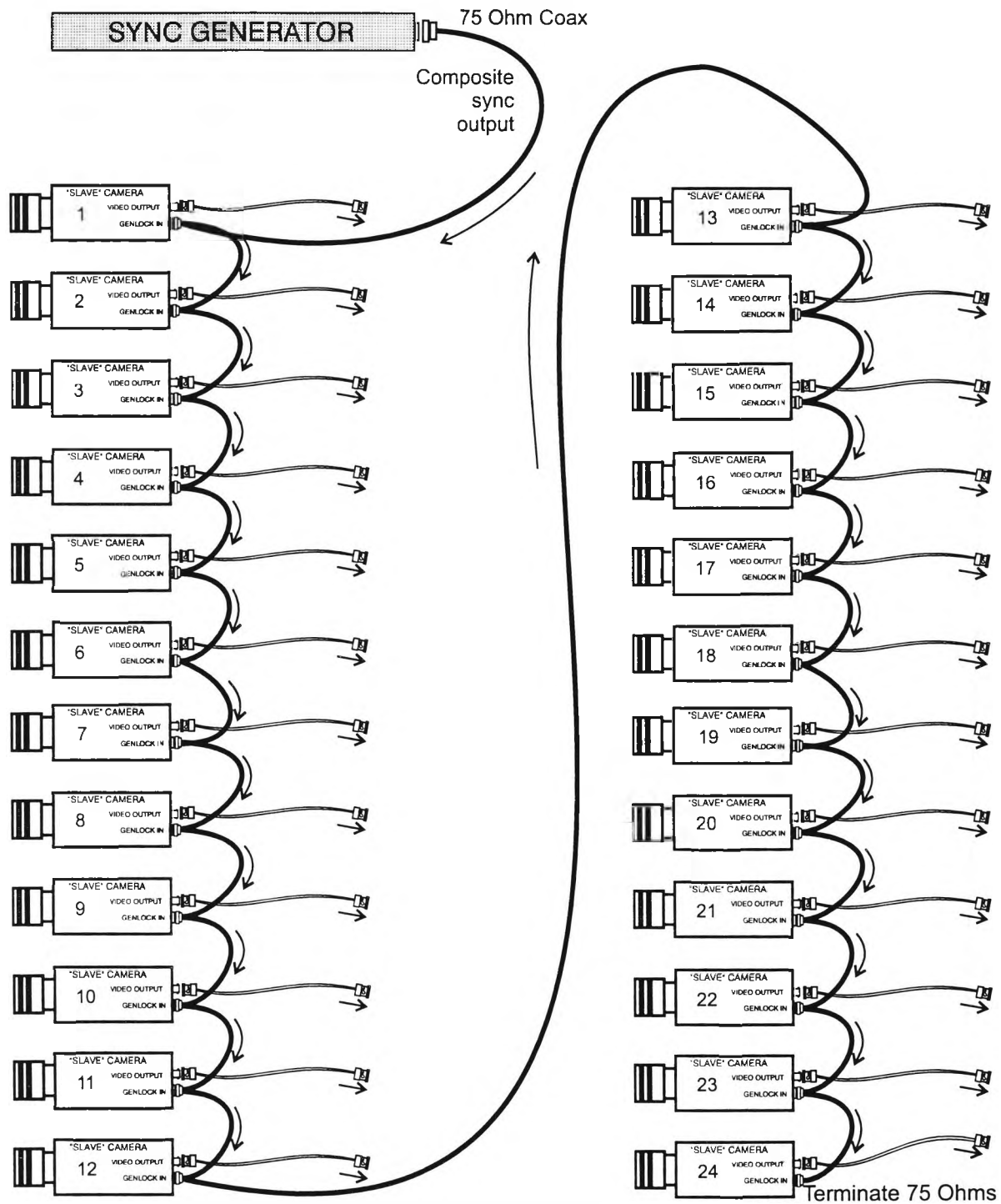


Figure 4. Instead of a Master Camera driving the Slave Cameras a sync generator can be used. The typical sync generator will have the ability to drive more Slave Cameras than a camera is capable of driving. The sync generator provides horizontal and vertical sync pulses, but no video. In this arrangement the last Slave Camera at the end of the cable must be terminated with 75 ohms. All other Slave Cameras must provide a high impedance to the genlock cable.

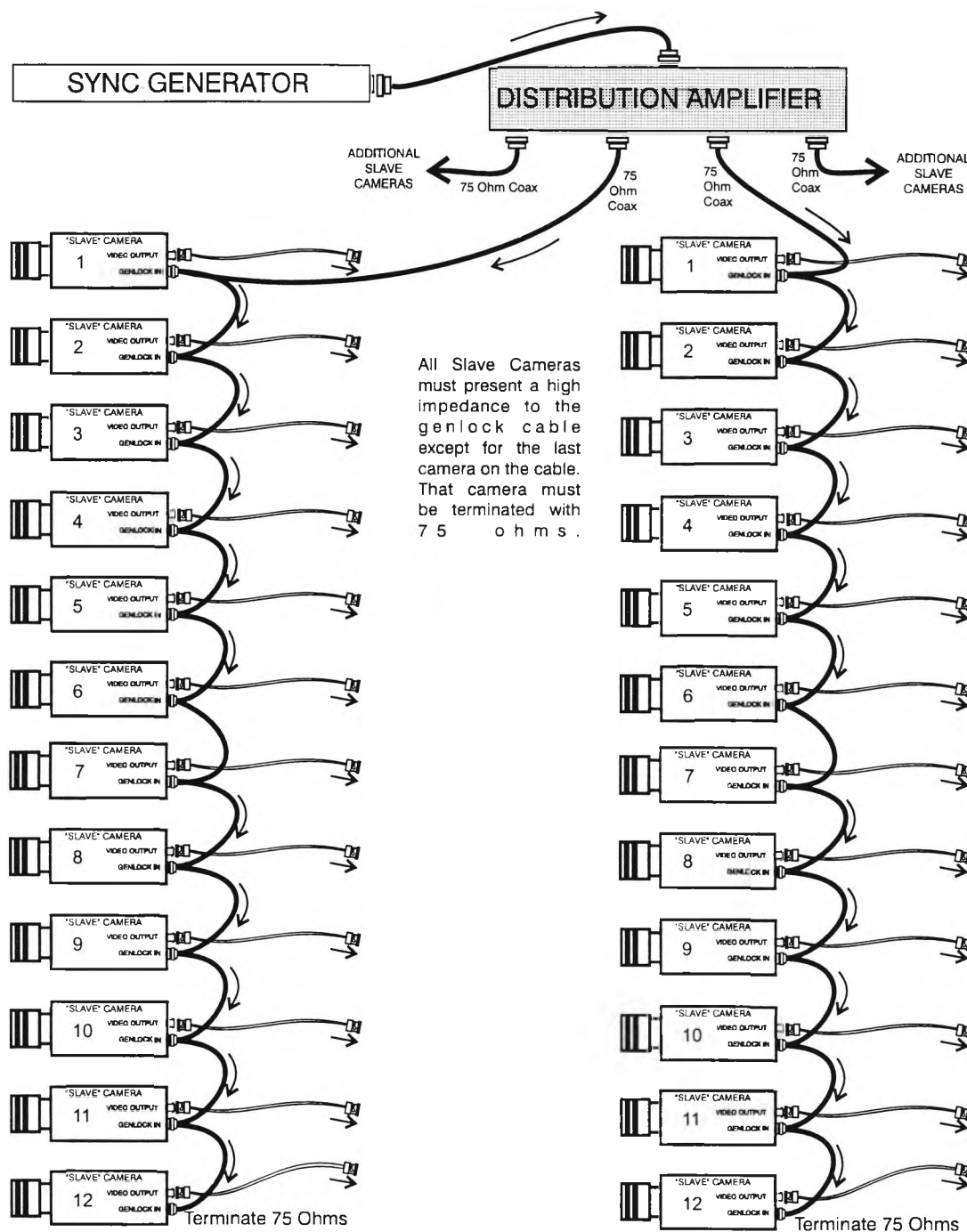


Figure 5. When it is necessary to genlock many Slave Cameras in a system, it may become necessary to use a distribution amplifier. It provides multiple outputs, each one capable of driving many Slave Cameras. The distribution amplifier shown here has four isolated outputs each capable of driving 12 or more Slave Cameras. Various models of distribution amplifiers have different capabilities.

provide dc level restoration to the video. Others are solely for sync signals.

Coaxial Cable Characteristics

Video signals and genlock signals most often are routed from camera to camera via 75 ohm coaxial cable. Unlike wiring used to route standard ac and dc voltages and signals from place to place, coaxial cable is in effect a tuned circuit and requires very specific connection methods for proper operation.

A 75 ohm coaxial cable run must have a 75 ohm termination at each end and no significant load in between. If connections must be made along a cable run, either with connectors or hard-wire connections, the device(s) attached to mid cable must be a high impedance. On a 75 ohm cable a single attached device should have an impedance of at least 1000 ohms and with multiple devices attached along a cable run, each device should preferably offer no more than a 10 to 20 kilohm load. These mid-cable loads not only reduce signal level but also can set up impedance imbalances to cause signal reflections.

On long cable runs the signal loss of the cable itself must be considered. With RG-59/U coaxial cable the loss for signals in the video range (below 10 MHz) is about 0.9 dB per 100 foot.

(See the top chart in figure 9.) A 500 foot run would have a cable loss of 4.5 dB, reducing a 1 Vp-p video signal to 0.6 Vp-p. This is about the maximum allowable loss in a video cable run. Only copper conductor coaxial cable should be used. (See the RG-59/U Coaxial Cable Propagation Delay section below for further information.)

To reduce cable loss, RG-11/U coax can be used. This cable has less loss, typically about 0.35 dB per 100 foot. Loss for a 500 foot run is about 1.75 dB, reducing a 1 Vp-p video signal to 0.82 Vp-p.

If a coaxial cable carries only sync data for genlocking the loss will be less than with a cable also carrying the wider bandwidth video signal. Sync operates in the area from dc up to about 2 MHz on the cable, so the loss would be somewhat less than the loss at 10 MHz described above.

Using the greater loss factor at 10 MHz provides a reserve, but care would have to be taken that this did not result in too high a signal level at some point on the cable when adding equalization amplifiers.

Coaxial Cable Equalization

The attenuation characteristic of coaxial cable is not linear. See the top chart in figure 9. As frequency increases the loss associated with the cable run increases.

The loss factor described in the preceding discussion of coaxial cable was at 10 MHz. Immediately above or below this frequency the loss through the cable is higher or lower, respectively.

Thus the higher frequency components of a signal passing down a coaxial cable sustain more loss than its lower frequency components. To compensate for this effect on long cable runs, equalization amplifiers are placed in the line. They are adjusted to have more gain at higher frequencies. When combined with the increased high frequency loss of the cable, the overall effect is a flat response.

An equalization amplifier (or amplifiers) can provide a significant gain boost for signals passing through a cable, greatly extend the allowable cable run. Figure 9 illustrates a typical example of using an equalization amplifier.

Coaxial Cable Propagation Delay

Another characteristic to consider with coaxial cable is propagation delay. It takes time for the signal to pass down the cable. A typical figure is about 1.5 nanoseconds (ns) per foot of cable, or 1.5 microseconds (μ s) per 1000 foot of cable.

The horizontal line period of a monochrome RS-170 camera is 63.5 μ s. The horizontal sync pulse is 4.2 to 5.7 μ s wide. A 1 μ s delay in

the cable may be a significant factor.

In critical work involving fading, split screen, and other specialized applications this delay may cause problems. Cameras with genlock capability typically have an internal adjustment to allow the horizontal sync pulses to be shifted in time to compensate for this cable delay and any other timing shifts in the system.

RG-59/U Coaxial Cable Propagation Delays

Some types of coaxial cable (especially those carrying the designation RG-59/U) are available with several different types of wire for the conductors. Any wire or wire combination other than copper is not suitable for CCTV use.

Do not use copper clad steel conductor, copper clad aluminum conductor, or any other wire or wire combination other than copper conductor.

The video and sync signals extend from near dc up to about 6 MHz. The low frequency components of these signals tend to travel throughout the entire con-

ductor. The higher frequency components tend to travel on the outer "skin" of the conductor. If the conductor has different metals for the inner core and outer skin, high and low frequency components of the signal have different transmission properties. This causes signal distortion in the video.

Further problems can be experienced with control systems that place their signals in the vertical blanking. They can be adversely affected by coaxial cable with mixed conductor metals. Erratic switching and control problems can be experienced.

Genlock for Color Cameras (Color Lock)

When dealing with color cameras the genlock function is also referred to as color lock.

While this Application Note deals primarily with genlocking monochrome (black and white) cameras, color cameras can also be synchronized.

The basic cabling and distribution methods for locking up color cameras to

a common sync reference are the same as those previously described, but certain factors make it more complicated than locking up monochrome cameras. Cable routing in areas with interference signals or noise may be more critical and signal levels on the cables may have to be maintained at higher levels.

Sync in a color system has a 3.58 MHz burst signal riding on the back porch of horizontal sync blanking pulses. This burst signal provides critical timing for color information. Locking up a color slave camera to color sync requires that chroma burst as well as horizontal and vertical be synchronized to the reference sync source. The cable propagation delays become even more critical; therefore, the camera will normally have a method for adjusting the burst phase relative to the input reference.

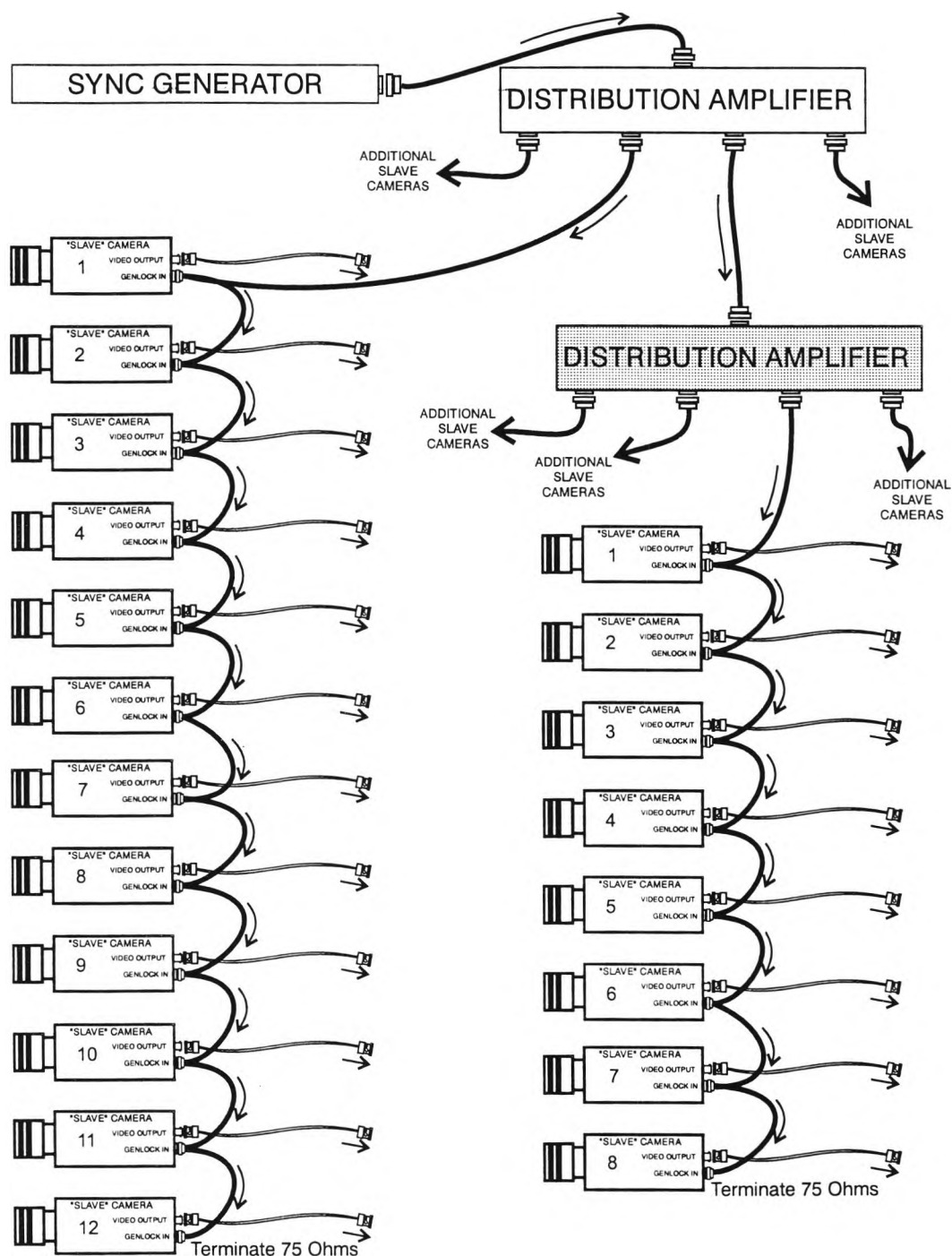


Figure 6. When the requirements of a system exceed the capability of a single distribution amplifier, additional units can be added as shown above. One output of a distribution amplifier is used to drive an additional distribution amplifier. This arrangement can also be used when the physical layout or an installation makes it convenient to have multiple distribution points for the various Slave Cameras.

APPLICATION NOTE

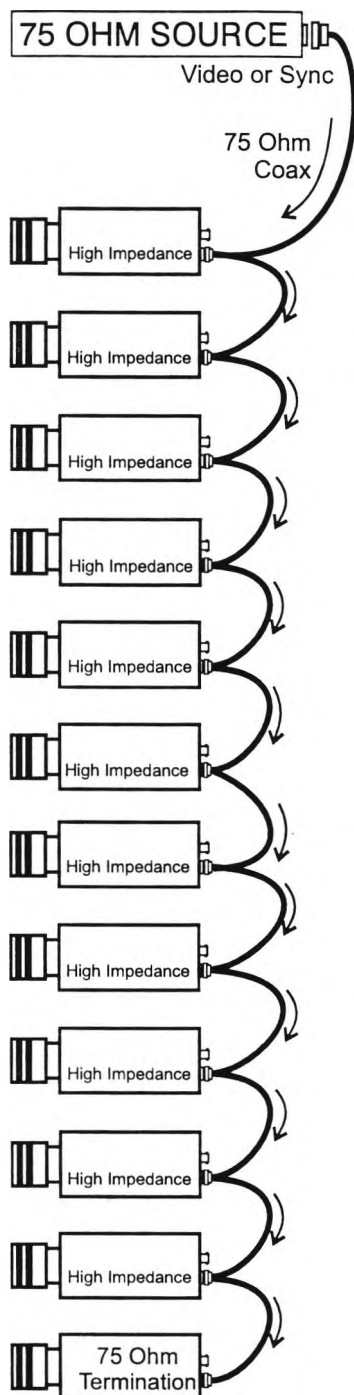


Figure 7. When coaxial cable is used, only the beginning (source) and end of the cable can be terminated with the characteristic impedance of the cable. (With video systems 75 ohm coaxial cable is used.) Any equipment connected between the source and end termination must present a high impedance to the cable.

GENLOCK

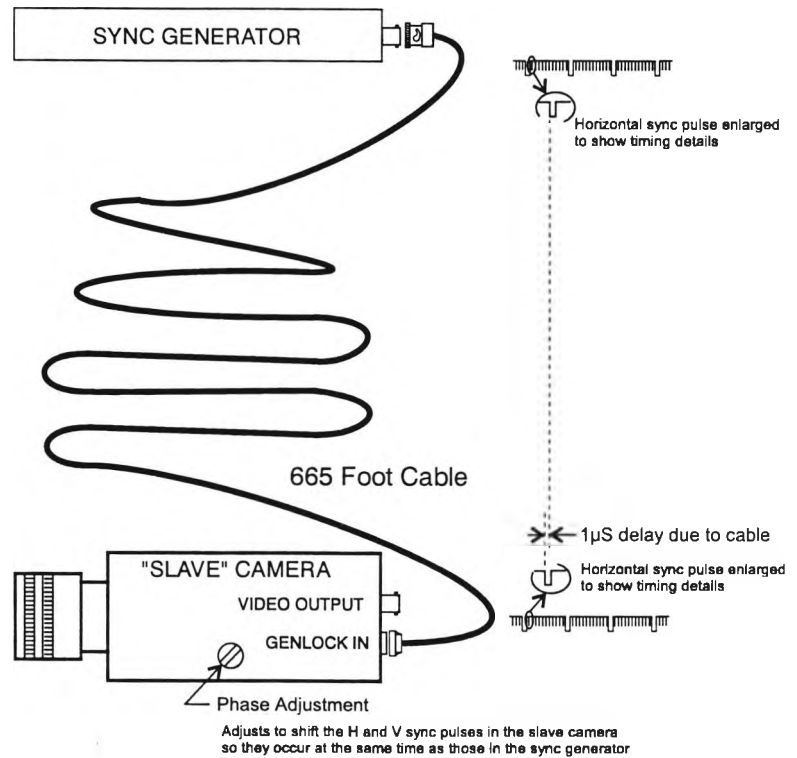
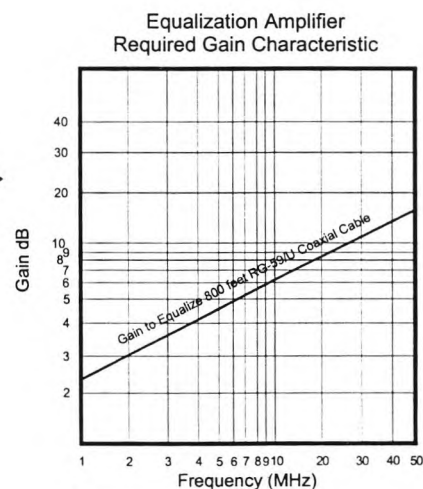
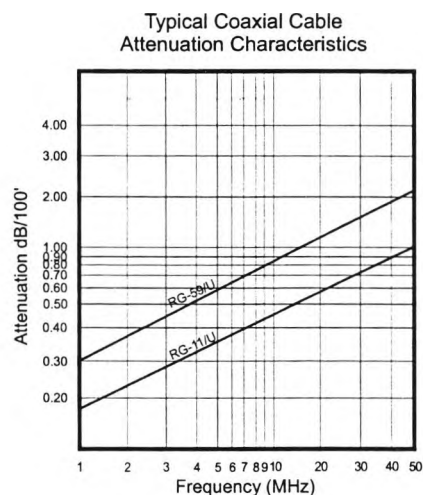
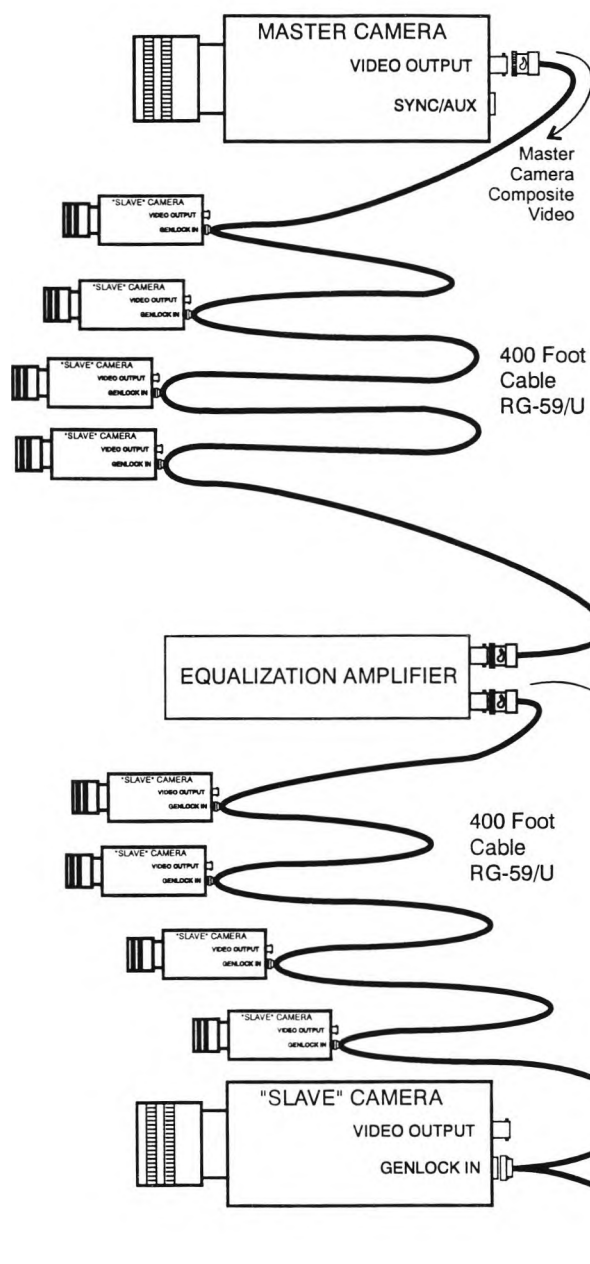


Figure 8. Coaxial cable typically has a propagation delay for the signal of $1.5 \mu\text{s}$ per 1000 foot of cable. The 665 foot of cable shown above would result in a $1 \mu\text{s}$ delay for all horizontal and vertical sync pulses in the slave camera. The detail drawings expand a horizontal pulse in each waveform to illustrate this $1 \mu\text{s}$ delay. Genlock cameras typically have adjustments to compensate for cable delay.



While the equalization amplifier is shown with gain out to 50 MHz, the master camera video and sync signals are contained within about the first 6 MHz.

Figure 9. Equalizing an 800 foot run of a typical RG-59/U Coaxial Cable. Because coax has a nonlinear attenuation characteristic in relationship to frequency, an amplifier placed in the line to overcome cable loss must also be nonlinear. The top graph shows loss per 100 foot of cable for typical RG-59/U and RG-11/U coax. To equalize the 800-foot run of RG-59/U coax illustrated here, the amplifier must have the gain characteristic shown in the lower graph. Note that both these graphs are shown in log-log form; the straight lines depict non linear characteristics. The equalizing amplifier need not be exactly mid cable as shown. It should be placed in the cable at a point where sync level is still of sufficient level to drive the genlock input of a camera. When planning cable runs careful attention must be given to losses in the system and the required equalization/amplification required to compensate for them. Too little or too much signal level can cause problems. All inputs have a range of signal levels within which they operate.

COHU
Cohu, Inc. Electronics Division

Commuter Rail Line Uses Cohu CCTV To Monitor Stations

In an effort to unclog the ever congested transportation corridors of Southern California, San Diego's North County Transit District (NCTD) has inaugurated a rail service that puts passenger safety and security at the top of the list. Incorporated into the new "Coaster" rail service is a CCTV system that, officials believe, has led to enthusiastic acceptance of the service and has documented a sense of safety among passengers waiting at the stations.

Sleek blue and green Coaster trains cruise along the scenic California coastline from downtown San Diego north to Ocean-side, at speeds nearly twice that of the adjacent freeway. But Californians are not



A color camera, mounted on a pan/tilt unit, gets a clear view of the platform and ticket vending machines. Parking lot cameras are monochrome.

known for easily giving up their cars. NCTD realized that the best way to get car-loving people onto the trains is to make rail-riding affordable, comfortable, and fast. On top of that, make the passenger waiting areas safe and secure. With that in mind, NCTD security officials developed a closed circuit television system designed to monitor six Coaster railroad stations in the North County Transit District's jurisdiction, two of which it shares with Amtrak.

San Diego-based Cohu, Inc. Electronics Division was selected to design a state-of-the-art CCTV system, and manufacture the television cameras and system controls. Following installation, Cohu engineers completed a systems test and conducted operational training to assure that the many integrated functions performed perfectly.

SYSTEM DESIGNED FROM THE BOTTOM UP

"Passenger safety and security, as well as protecting the assets of the public agency, were our primary design objectives," according to North County Transit District Security Manager, John Hanlon. "Because every transit system is unique, we had no

real model after which to pattern ourselves. Instead, we identified known problem areas and anticipated where others might exist," he said. In addition to Hanlon's own studies, he consulted local specialists and manufacturers who might be able to provide

Continued on page 2

SYSTEM DESIGNED FROM BOTTOM UP

continued from page 1

equipment for the Coaster security system. "The project development took nearly two years and was truly a team effort," he said.

Like all transit systems, every station is as different as the neighborhood it serves. The concerns were different, and the needs were different. An important aspect was to fully integrate the system. "We spent a lot of time identifying the cameras, monitors, multiplexing equipment, and fiber optics," Hanlon explained. "We studied nearly every conceivable angle of the system to determine what needs existed, and what might be required in the future, then came up with a system that could do as much as possible. The goal was to make sure that it all came together as a whole." Very few organizations were willing to commit to that level of time and effort. NCTD's proposal evaluation team selected Metro Video Systems as the system integrator. The El Segundo, California company "was willing and able to combine all the diverse elements of both the physical system and unique requirements of each station into one system," Hanlon said. Metro Video, in turn, relied upon Cohu for its experience in large systems and reputation for quality and reliability.

In designing the CCTV system, Hanlon had the luxury of working from the ground up. "We knew that there were specific zones we wanted to survey, such as platforms, rail crossings, and parking lots. Once those zones were established, we positioned CCTV cameras in such a manner that some areas could actually have dual coverage from more than one camera," he said.

CCTV SYSTEM USES HIGH PERFORMANCE COLOR AND MONOCHROME CAMERAS

"The closed circuit television system gives us the best of both worlds," Hanlon



The Cohu cameras are enclosed in a pressurized housing to completely protect the cameras' internal electronic circuitry and lenses from adverse environmental conditions, especially the corrosive salt air from the nearby Pacific Ocean.

said. The CCTV system, which utilizes both the Cohu color model 8240 and Cohu model 4940 black and white cameras, provides security officers with views of passenger platforms and parking lots 24 hours a day, seven days a week. The cameras are designed to work in both full daylight and in low light levels for night viewing. Selectively using color and monochrome cameras and pan/tilt mechanisms was a matter of cost and function. While the monochrome cameras cost slightly less than color models, they are more sensitive to low lighting conditions, making them perfect for parking lot surveillance. If an incident is observed from the monochrome camera, the color camera on a pan/tilt can be rotated to the scene for a look from another angle.

Video tape recorders store the images for later analysis, if required. Security personnel monitoring the system can contact officers at the various stations or aboard the trains to notify them of any incident or violation.

CONTROL ROOM DESIGNED FOR EFFICIENCY

The control room design allows a single operator to see the activities at all six stations simultaneously. For each station, nine inch monochrome Cohu monitors display the signal from each monochrome camera, while a 19-inch color monitor displays the signal from the color camera or, if desired, a large screen display of a monochrome camera. All stations have their own dedicated VCR, each multiplexed so that all cameras are recorded continuously. Quads connected to some stations allow for multiple images on a single monitor.

An operator seated at the console uses a Cohu MPC Series system controller to provide camera and pan/tilt control at each station. Signals between the stations and control room are bi-directional RS-422 communications. The MPC controller also

COHU ELECTRONICS

initiates video switching and allows for RS-232 PC interface with a future LAN network.

The central equipment room is located adjacent to the control room. The location affords easy access to the equipment for maintenance and an extra level of protection from vandalism.

CAMERAS SELECTED FOR PERFORMANCE AND POSITION

Cohu color cameras are used on the train platform, with some mounted on pan/tilt mechanisms, depending upon the installation. High sensitivity monochrome cameras are used to survey the parking areas. Each high performance camera is enclosed in a pressurized housing. This housing creates a controlled environment for the camera and optics in order to increase camera life and significantly reduce maintenance costs. This feature is especially important to NCTD, as several of its stations are located as close as 200 yards from the Pacific Ocean. The housing further shields the cameras from airborne contaminants such as chemical pollutants, condensation, combustion by-products, and fungus.

Camera position and lens settings can be preset in computer memory, allowing operators to rapidly "zoom in" on a predetermined field of view, if necessary. Signals from the cameras and to the pan/tilt mechanisms are converted to digital signals within a secure hub at each station. The signals are multiplexed into a

fiber optic cable and sent to and from the security control room in Oceanside.

The images from the stations are startlingly brilliant. "That's the beauty of good cameras and fiber optics: There is no noise," Hanlon points out. "The ones and zeros that are sent from Solana Beach are the same ones and zeros we receive in the control room. If any [component] is failing, it is immediately detected, and a serviceperson dispatched."

Ticket vending machines are positioned in full view of the cameras. A unique feature of the system, as designed by Hanlon, also puts the ticket machine's audit and security system on the same fiber as the cameras, with annunciation in the control room, thus alerting officers to tampering or fraud.

PUBLIC SATISFACTION

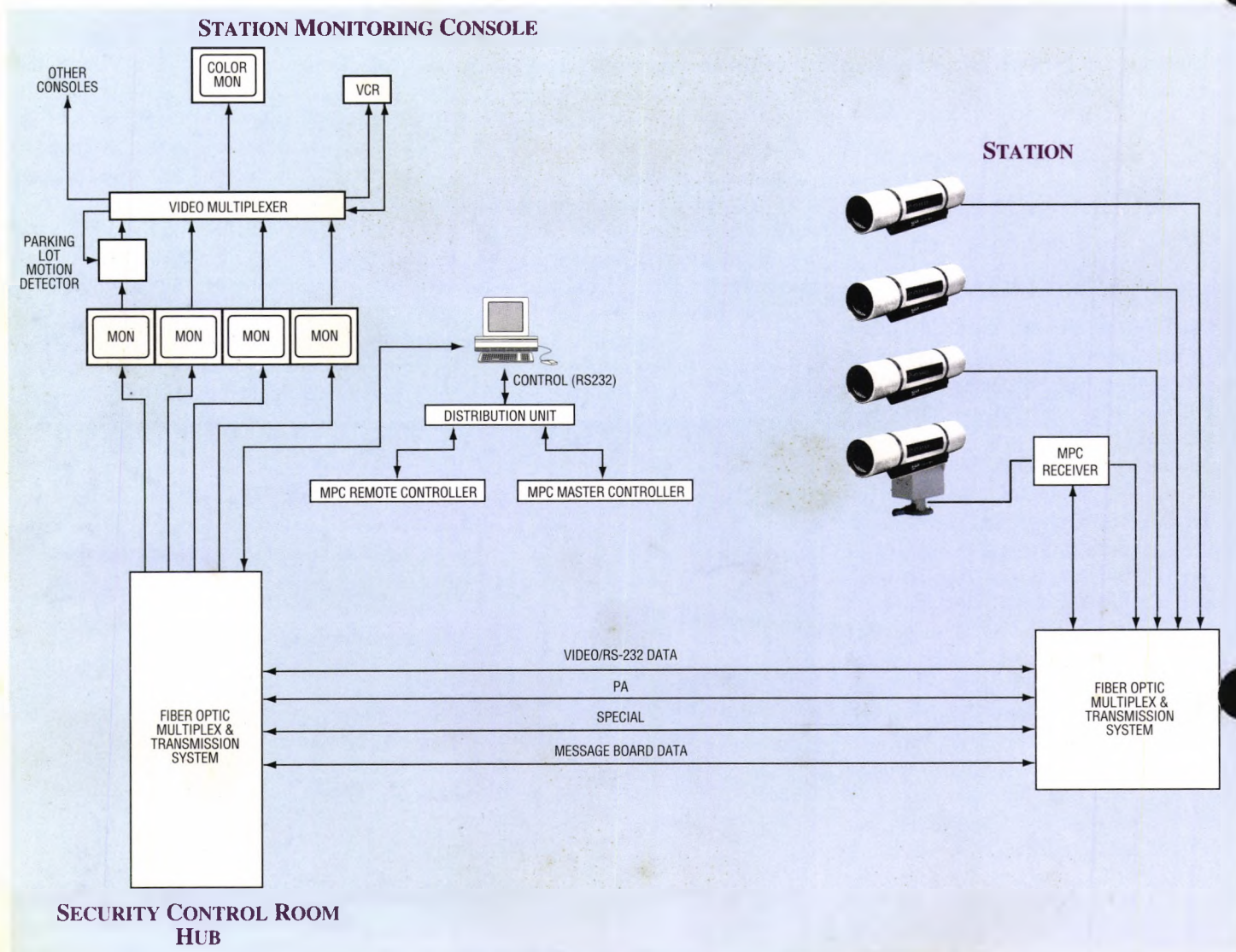
Public acceptance of the surveillance and security system has been entirely positive. Hanlon, quoting from an independent survey conducted by the San Diego Association of Governments, reports that passengers feel 100% safe aboard the trains, 99% safe while waiting on the platforms, and 98% safe in the parking lots because of the security measures that have been implemented.

"The riders are learning," he said, "that they are personally secure on our platforms and aboard the trains, and that their cars have an extra level of security in our lots. That has led to a continuing increase in ridership, and that's what public transportation should be about."



Security director, John Hanlon, shows off the central control room. For each station, small monochrome Cohu monitors display the signal from each camera, while a 19-inch color monitor can be selected for the color detail or simply a larger image.

TYPICAL STATION TO CONTROL CENTER DIAGRAM



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balances of all reported financial activity. The VECTOR system is balanced to the CIP toll plaza general ledger to the SCDOT bank account balances. IMS recommends that at least two bank accounts be opened: one for the initial deposit of funds, the second to be funded from the first for CSC refunds management. Exact reporting interface designs will be provided upon determination of a financial institution by SCDOT as well as a review of SCDOT's daily deposit requirements.

4.f Maintenance

IMS employs an aggressive maintenance program to ensure our equipment and software design satisfies contractual requirements and that preventive and corrective maintenance is timely and effective.

IMS' maintenance approach has been validated on our other full-scale ETC projects, e.g., the Georgia State Tollway Authority's GA400 Toll Road and California's Transportation Corridor Agencies, and several ongoing TCS software maintenance contracts. IMS' maintenance program begins during equipment/software design and integration and includes full service maintenance, inventory management, and performance reports that fully support operational, maintainability and reliability requirements. On the SCDOT contract, IMS also will maintain the facilities and grounds for the 10-year term of the contract. Subject to SCDOT approval, IMS will subcontract with the locally-operated South Carolina firms addressed in Section 7 for the following services: landscaping and grounds maintenance, janitorial services in the lanes and toll plaza, and plant facilities maintenance.

During the basic contract period and all options exercised by the SCDOT, trained and experienced service technicians will be available 24 hours a day, 7 days a week to provide timely service and ensure system availability. The following is a synopsis of the main components of IMS' maintenance program that will be executed on the CIP project.

Design Integration. The proposed ETC system is a modular component design with proven maintainability and demonstrated reliability, thereby ensuring ease of on-site replacement and accomplishment of day-to-day maintenance. Our design integrates highly reliable equipment, resulting in low spare parts inventory requirements.

Response Time/Repair Time. As indicated in Section 3, IMS is committed to meeting certain maintenance standards. Initial response by telephone begins within 15 minutes of notification, full response begins within two hours, and repair is completed within a total of four hours. The repair time is measured from the time the problem is first reported to IMS until the particular component is functioning properly. Our swap-out maintenance concept and fully automated MMS ensure that IMS can meet this rapid MTTR.

Toll System Maintenance Personnel. The maintenance workforce for the CIP project will meet IMS' prescribed workforce standards as specified in our corporate position descriptions. This documentation, which is identical to that used on other programs we manage, uses the following standard service technicians classifications applicable to the SCDOT ETC requirement: lead technician and field technician. The lead technician, who is responsible for highly complex tasks including preventive maintenance and repair/installation of computer and communications systems, will have graduated from high school and an electronic or technical school and/or training and have three or more years of complex system maintenance experience. The field technician, who reports to the lead technician, will be responsible for diagnosis and repair of toll collection and communications systems and subsystems with minimal assistance. The position requires a high school education and graduation from a recognized electronic technical schools and three or more years of related experience.

Preventive Maintenance (PM). We consider PM to be the most important part of our maintenance program. Our automated MMS accommodates the entry of PM schedules, flags the required actions as required, and creates work orders. PM is most effective when it is scheduled through the MMS and completed work is documented on forms entered into the MMS database. The information can be used to track and monitor all maintenance activity/trends and provide the data necessary to produce informative reports. IMS' reliability calculations indicate that an effective PM program reduces corrective maintenance to a factor of 10% of the total maintenance workload. IMS PM activity is performed in accordance with daily, weekly, monthly, and annual PM schedules and includes: visual inspections; cleaning; adjustments to manufacturer specifications; lubrication;