3610 SERIES
DSP COLOR CAMERA
TECHNICAL REFERENCE MANUAL

RS-232C SERIAL CONTROL

PRELIMINARY “A”

CE
FCC

Figure 1. Machine Vision Color Camera

Technical Manual 6X-1042(A)

Phone: 858-277-6700
Fax: 858-277-0221
info@cohu.com
www.cohu-cameras.com

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Cohu Electronics • 3912 Calle Fortunada • San Diego, CA 92123-1827

COHU
Cohu Inc., Electronics Division

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Table 1. Specifications

ELECTRICAL	
Format	Interline transfer color CCD operating in field mode 1/2 inch (6.45 × 4.84 mm) standard 1/3 inch (4.88 × 3.66 m) future option
Pixels	768 × 494 NTSC 752 × 582 PAL
Pixel Cell Size	1/2 inch: 8.40 (H) × 9.80 (V) µm NTSC ; 8.60 (H) × 8.30 (V) µm PAL 1/3 inch: 6.35 (H) × 7.40 (V) µm NTSC ; 6.50 (H) × 6.25 (V) µm PAL
Resolution	NTSC: 460 H × 350 TV lines; PAL: 450 X 415
Internal Clock	28.63636 MHz (NTSC) 28.375 MHz (PAL)
Sync	Internal crystal
Frame Rate	30 fps (NTSC); 25 fps (PAL)
Sensitivity, Faceplate	1/2 inch: 3 lux with full video, minimum gain
White Balance	Auto or manual white balance, 2500 to 9500 K
Gamma	Choices of 10 gamma curves (8 power function, 2 linear)
Gain	0 to 32 dB gain control — either agc or menu selected manual adjustment
Shutter	1/60 (1/50 PAL) to 1/50,000 s, in nine steps (menu selected)
S/N	48 dB max; 22 dB S/N with 32 dB gain
Spectral Response	See figure 2
Integration	2 to 510 fields available using menu selection
Video Output	Simultaneous composite and S-video (NTSC or PAL)
Lens Control	5 volt camera: manual iris only 12 volt camera: manual iris, auto iris, or dc iris
Serial Communications	RS-232C, 19,200 baud (fixed)
Power Input	5 V dc ±10 % or 12 V dc ±10 % (depending on model)
Power Consumption	5 V: 2.5 W (500 mA) or 12 V: 4.2 W (350 mA)
Regulatory	CE CISPRII class A plus EN61000-4 -3, EN61000-4 -6, EN61000-4 -8 interference immunity test
MECHANICAL	
Dimensions	1 x 1 x 3 inch, less lens (see figure 5)
Weight	2.9 oz (82 g), less lens
Camera Mount	Two 1/4-20 screws (accepts 0.200 deep screw) top or bottom mounting block, or direct to top or bottom of camera body with two 2-56 inch screws, or via CS mount direct to microscope or similar device
Lens Mount	CS-mount, adjustable, or C-mount using 5 mm extension adapter Lens can be moved up to 3-inch from main electronics
Connectors	Single 12-pin Hirose HR10A-10R-12PC
Temperature	-20 to 70 °C operating -30 to 85 °C non operating
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's, 11 ms duration, no crash hazard to 75 g's, 11 ms duration
end	

1.0 GENERAL DESCRIPTION

This introduction briefly describes overall characteristics of the Camera (figure 1) related to its installation and operation.

1.1 Electrical Characteristics

The 3610 Series provides a small, lightweight, highly sensitive machine vision CCD Camera with all electrical connections via a single rear panel connector.

Setup and control settings are implemented by a graphical user interface (GUI) communicating through an RS-232C serial interface with the Camera.

The Camera operates in either NTSC or PAL format depending on the model. This Camera operates at an internal clock rate of 28.63636 MHz (NTSC) or 28.375 MHz (PAL). Table 1 lists specifications for this 3610 Camera.

Table 2 is a list of major features of the Camera — primarily those associated with the GUI.

The Camera is available in two different operating power configurations: 5 V dc and 12 V dc. Only manual iris lenses can be used with the 5 V dc Camera. The 12 V dc Cameras are available in three configurations: (1) an auto iris version (2) a dc iris version or (3) a freeze frame version — which requires the use of a manual iris lens.

1.1.1 Sensor Characteristics

Figure 2 shows the relative response characteristic of the sensor. These characteristic curves apply to both NTSC and PAL sensors. The curves show Cyan, Green, Yellow and Magenta responses.

The chart excludes both lens characteristics and light source characteristics.

Note however that the IR cut filter shown in figure 3 will modify the overall response of the Camera to light. This low pass filter starts blocking light above about 500 nanometers and at 600 nm passes only about 50 percent. Rolling off the response at these longer wavelengths minimizes the effect of infrared on the color response of the Camera.

1.2 Mechanical Characteristics

A model number interpretation diagram appears in figure 4. This diagram shows the various basic configurations of the Camera.

Dimensions for the Camera are shown in figure 5. Figure 6 is a detailed dimensional illustration for the optional mounting block that provides threaded 1/4-20 mounting holes. The Camera consists of a main body casting and front casting assembly.

Interconnections are via a 12-pin connector located on the rear panel.

FCC STATEMENTS

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This eqiupment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CAUTION: Changes or modifications to this device not expressly approved by Cohu Electronics could void the user's authority to operate the device.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

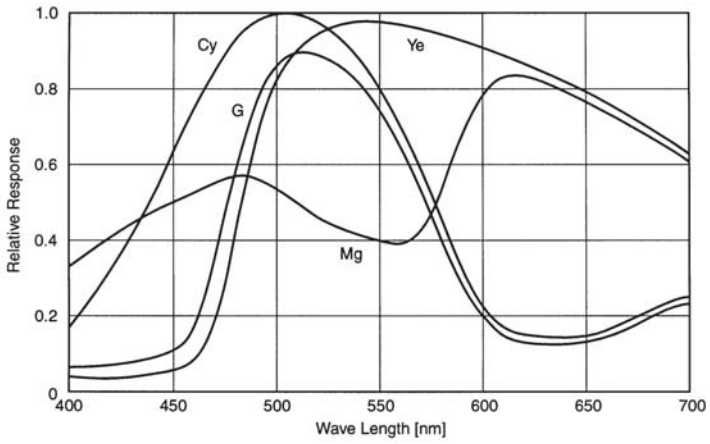

Figure 2. Sensor Response Characteristics

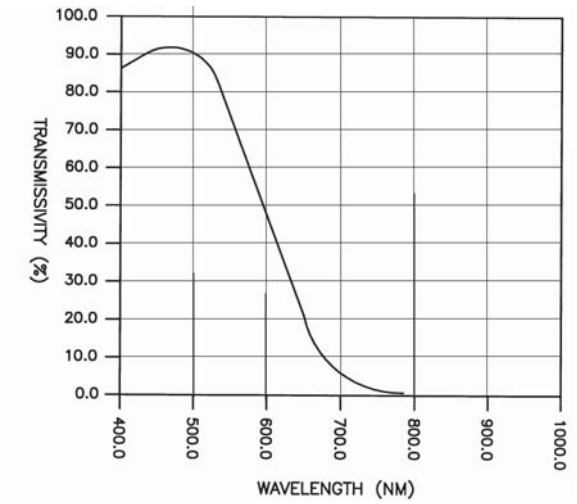

Figure 3. IR Cut Filter Response Characteristics

An adjustable CS-mount adapter threads onto the front of the casting. It is secured from turning by a nylon tipped hex-socket head set-screw.

The Camera can be mounted at any of three places on its body:

1. By the CS mount directly to a microscope or other similar device

2. By the top of the case — either with or without the optional mounting block

3. By the bottom of the case — either with or without the optional mounting block

Directly mounting to the top or bottom of the housing requires removal of the two black button head screws holding the outer housing cover in place at that location (top or bottom). The optional Accessory Kit contains the mounting block and a pair of 2-56 × 3/8 stainless steel screws to attach it to the Camera.

If the Camera is to be mounted directly without use of the optional mounting block, a pair of 2-56 stainless steel screws of the required length would have to be acquired. These are not supplied.

2.0 INSTALLATION

In addition to the actual installation requirements, this section covers a number of other items including proper shipping and handling of the Camera.

2.1 Unpacking and Receiving Inspection

This item was thoroughly tested and carefully packed in the factory. Upon acceptance by the carrier, they assume responsibility for its safe arrival. Should you receive this item in a damaged condition, apparent or concealed, a claim for damage must be made to the carrier.

To return the product to the factory for service, please contact the Customer Service Department for a Return Authorization Number. If a visual inspection shows damage upon receipt of this shipment, it must be noted on the freight bill or express receipt and the notation signed by the carrier's agent. Failure to do this can result in the carrier refusing to honor the claim.

When the damage is not apparent until the unit is unpacked, a claim for concealed damage must be made. Make a mail or phone request to the carrier for inspection immediately upon discovery of the concealed damage. Keep all cartons and packing materials.

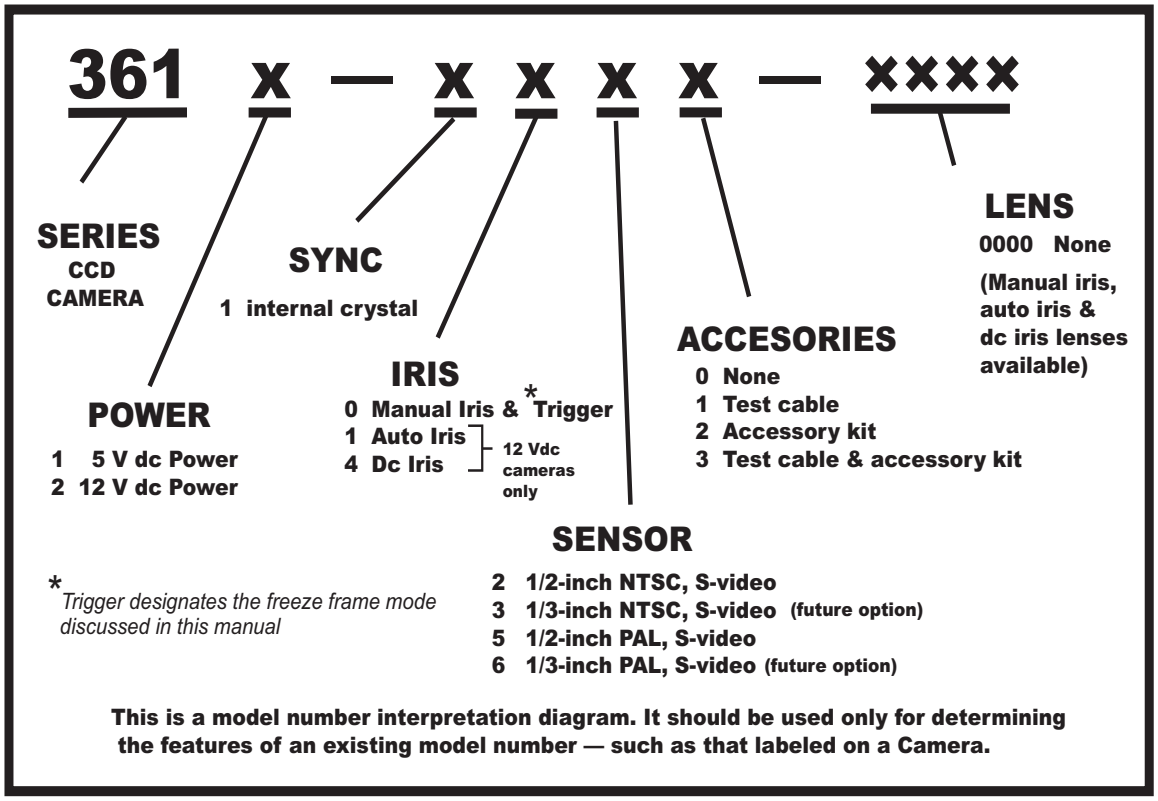

Figure 4. Model Number Interpretation Diagram

Since shipping damage is the carrier's responsibility, the carrier will furnish you with an inspection report and the necessary forms for filing the concealed-damage claim

2.2 Static Discharge Protection

Procedures in this manual do not require entry into the housing of the Camera. However in the event that an open unit were available, the following precautions should be followed:

CAUTION

This Camera contains sensitive devices that can be damaged by static discharge. Use appropriate static control methods when working inside the Camera.

Components used in modern electronic equipment, especially solid state devices, are susceptible to damage from static discharge. The relative susceptibility to damage for semiconductors varies from low with TTL to high with CMOS. Most other semiconductors fall between TTL and CMOS in susceptibility to static discharge. As a minimum, therefore, observe the following practices when working inside this or any other electronic equipment:

1. Use conductive sheet stock on the work bench surface.

2. Connect the sheet stock to ground through an 1 megohm or greater value resistor.

3. Use a wrist strap connected to ground through an 1 megohm or greater value resistor when working at the bench.

4. Maintain relative humidity of the room above 30 percent. This may require a room humidifier. Working on circuits with relative humidity below 30 percent requires extraordinary procedures not listed here.

5. Use antistatic bags to store and transport an

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

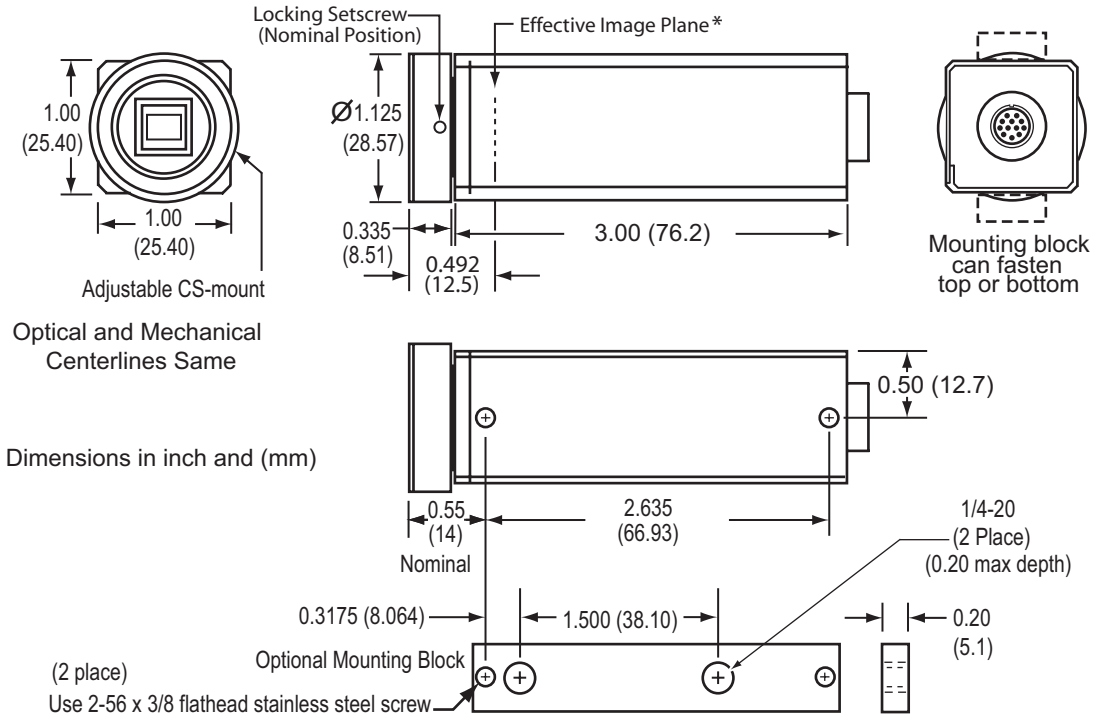

Figure 5. Dimensions, Model 3610 Camera

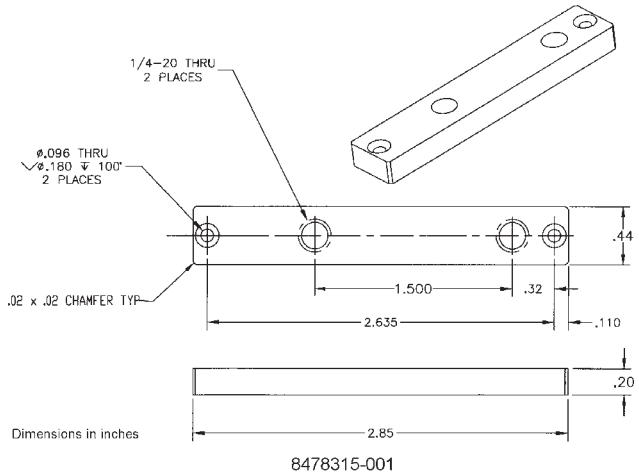

Figure 6. Dimensions, Optional Mounting Block

Table 2. Capabilities

AUTOMATIC OPERATION	
Standard Feature	Camera can be set up for unattended operation with no operator input
SERIAL REMOTE CONTROL FUNCTIONS	
Programmable Aperture Correction	Modifies high frequency response in camera circuits to enhance black-white transitions in the scenes. Has the effect of making scenes look "sharper." Can be implemented for horizontal alone, vertical alone, or for both horizontal and vertical simultaneously
Complex Gamma Curve Constructions	Makes it possible to taylor a gamma curve for the types of scenes typically viewed
2-D Mirroring	Allows for horizontal and vertical to be independently reversed left-right and top-bottom
Programmable backlight Compensation involving window masking and histrograms	Makes it possible to minimize the effect of bright areas of the scene outside the areas of interest either by masking out those areas or by applying an integration effect to a histrogram of the scene brightness levels
Windowed Auto Exposure	Makes it possible to window (select) an area of the scene upon which the auto exposure circuits will operate. Likewise, an area of the scene can be windowed (selected) upon which the auto white balance circuits will operate.
Electronic Pan & Tilt	When zoomed in from a full frame view, makes it possible to electronically move right/left (panning), up/down (tilt), or rotated (angle viewed changes)
Negative Y and/or C, monochrome, freeze	Luminance (Y) can be reversed to make an negative image and/or color (C) can be reversed or removed. Image can be frozen
Programmable Blemish Correction	Any pixel areas of the scene can be modified to the desired response and stored as a permanent characteristic for that area
Presets	Selections in the various GUI menus can be saved to a preset for easy recall
Auto/manual gain	Gain control can be set for either of two modes: 1. Automatic control by the camera to maintain video output or 2. Manual gain control mode through menu selections with the GUI
Shutter	The sensor can be made to collect light for less than the normal time (1/60 for NTSC or 1/50 for PAL). Nine selections are available up to 1/50,000 sec. Frames continues at the normal rate while shuttering.
Integration	The sensor can be made to collect light for enhanced sensitivity by menu selection of integration times from 2 fields to 510 fields. The Camera continues to output at its normal frame rate during this integration time but with the last integrated field until the next integrated field is available.
White Balance	Three white balance modes are available. One is automatic white balance with the camera circuits maintaining proper white balance. The second choice is for by moving sliders on a GUI screen to change the white balance curves manually. The other choice is the User mode in which it is possible to independently move sliders on the red and blue response curves.
OTHER CAPABILITIES	
Auto iris, dc iris, manual iris lens selections	All versions of the Camera can be used with a manual iris lens. Automatic iris lenses can be used with the 12 V dc version of the Camera — unless it has been optioned for the freeze frame mode of operation. These automatic iris lenses can be either a video driven auto iris lens or a dc iris lens (depending on which of these two lens options had been chosen for the Camera configuration).

exposes chassis, circuit boards, and components. Use new antistatic bags. Old, used bags lose their static protection properties.

This list serves as a reminder of the minimum acceptable practices. Be sure that all static discharge devices at the work bench are properly installed and maintained. Standard grounding mats and wrist straps purchased for use at work benches are supplied with leads having current limiting resistors for safety. Never substitute with a grounding lead not having the resistor.

Table 3. Items Supplied

ITEMS SUPPLIED		
ITEM	**DESCRIPTION**	**PART NUMBER**
1	CS-mount, 0.335 wide	8359208-001
2	Set Screw, nylon tipped, stainless, 4-40 x 5/32	2010258-005
Note: These items are typically mounted on the Camera when it is shipped. An optional Accessory Kit is available to supply additional items that may be useful in some installation.		

Table 4. Optional Accessory Kit

KIT 8478-3 (12 Volt Camera)		
ITEM	**DESCRIPTION**	**PART NUMBER**
1	Wrench, hex key, 1/16 inch	9710010-009
2	5 mm extender (C-mount adapter)	2010695-001
3	Mounting Block (mounts top or bottom)	8478315-001
4	Screw, flathead, 2-56 × 3/8 stainless (2 each)	0310118-006
5	Connector, plug, 12 pin (mates with rear panel connector)	1310398-212 (Hirose HR10A-10P-12S)

2.3 Equipment Supplied

The equipment supplied depends on what has been ordered. In its most basic form only the following would be supplied (table 3):

1. The Camera itself (either NTSC or PAL version)

2. A CS-mount adapter, 0.335 width

3. Locking setscrew for adapter (4-40 x 5/32)

4. Graphical User Interface (GUI) available either with the Camera on disk or downloaded from:

www.cohu-cameras.com/tech/tech.htm

The following items are provided if the optional accessory kit has been ordered (table 4):

1. Wrench, hex key (Allen) "L" type wrench, 1/16-inch

2. 5 mm extender ring for use with C-mount lenses

3. Mounting block (provides two 1/4-20 threaded holes)

4. Screw, flathead, 2-56 × 3/8 stainless (2 each)

5. Connector, plug, cable, 12-pin (mates with rear panel connector)

The following items will also be supplied if they were ordered:

1. Lens, for sensor imaging (for either 1/3-, 1/4-, or 1/2-inch sensor), depending on version of Camera

2. Power supply — depending on the version of Camera:

   a. 5 V dc, 500 mA power supply (Cohu type 8470-5) or

   b. 12 V dc, 350 mA power supply (Cohu type 8368-4)

Note that special-order Cameras and Cameras modified for special purposes may be shipped with other items. The above listing are the basic items for typical applications.

Table 3 lists the basic items supplied with a Camera. Table 4 lists items supplied in an optional accessory kit.

2.4 Equipment Required but Not Supplied

If the following items were not ordered with the Camera these will be required to make it operational:

1. CS- or C-mount lens suitable for the sensor format/size in Camera

2. Power supply, 5 V dc, 500 mA output or 12 V dc, 350 mA

3. Cable. Refer to one of these test cables as an example for the construction of an interconnection cable to be used with the Camera:

   a. See figure 8 for use with a 5 V dc (manual iris) versions of Camera

Table 5 Pin Functions, Rear Panel Connector

MANUAL IRIS CAMERAS

MANUAL IRIS REAR PANEL CONNECTOR		
PIN	**NAME**	**DESCRIPTION**
1	5/12 Return	*(See note below)*
2	+5 V dc	Power Input (500 mA)
	+12 V dc	Power Input (350 mA)
3	Shield	75 Ohm Composite Video Output
4	Video	
8	TXD	RS-232C Serial Communications
9	RXD	
10	Y	S-video Output
11	C	
5	Trigger	Freeze Frame Control
6	Not used	
7		
12		

NOTE: *Input power to pins 1 & 2 depends on the model of Camera*

AUTOMATIC IRIS CAMERAS

AUTO IRIS REAR PANEL CONNECTOR		
PIN	**NAME**	**DESCRIPTION**
1	Return	Power Input (350 mA)
2	+12 V dc	
3	Shield	75 Ohm Composite Video Output
4	Video	
8	TXD	RS-232C Serial Communications
9	RXD	
10	Y	S-video Output
11	C	
5	nc	(no connection)
6	Pwr 8.5Vdc	Auto Iris Control
7	Video	
12	Gnd C	

DC IRIS REAR PANEL CONNECTOR		
PIN	**NAME**	**DESCRIPTION**
1	Return	Power Input (350 mA)
2	+12 V dc	
3	Shield	75 Ohm Composite Video Output
4	Video	
8	TXD	RS-232C Serial Communications
9	RXD	
10	Y	S-video Output
11	C	
5	Ground	Dc Iris Control
6	Cont -	
7	Cont +	
12	Drive	

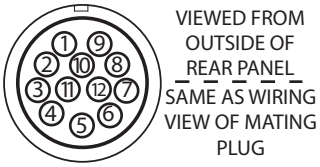

Figure 7. Rear Panel Connector Pin Locations

b. See figure 9 for use with auto iris or dc iris version of Camera (12 V dc operating power)

c. See figure 10 for use with a 12 V dc Camera optioned for freeze frame operation. (Requires use of a manual iris lens.)

4. 1/4-20 mounting bolt(s) of the proper length if the mounting block is to be used.

2.5 Cabling Requirements

A single 12-pin connector (figure 7) on the rear panel provides all electrical connections to the Camera. Table 6 lists the mating connector for a cable that attaches to this connector. Several test cables are shown in this manual. They can be used as an example for wiring the operating cable for a Camera.

Table 6. Mating Rear Panel Connector Plug

REAR PANEL CONNECTOR	MATING CABLE PLUG
Cohu 1310397-312 Hirose HR10A-10R-12PC	Cohu 1310398-212 Hirose HR10A-10P-12S

Figure 8 shows the wiring arrangement for a 5 V dc (manual iris only) version of the Camera. This cable provides for all operating capabilities of a 5 V dc Camera.

A 12 V dc version of the Camera may require a cable wired to either of two configurations. One is for use when the Camera is internally configured for use with either an auto iris lens or a dc iris lens. The other is for use when a 12 V dc Camera is internally configured for freeze frame operation.

1. Figure 9 shows the cable for use when a 12 V dc version of the Camera is configured for either an auto iris lens or a dc iris lens.

2. Figure 10 shows cable wiring for use when a 12 V dc Camera is internally configured for freeze frame operation. A manual iris lens must be used when the Camera is configured for freeze frame operation.

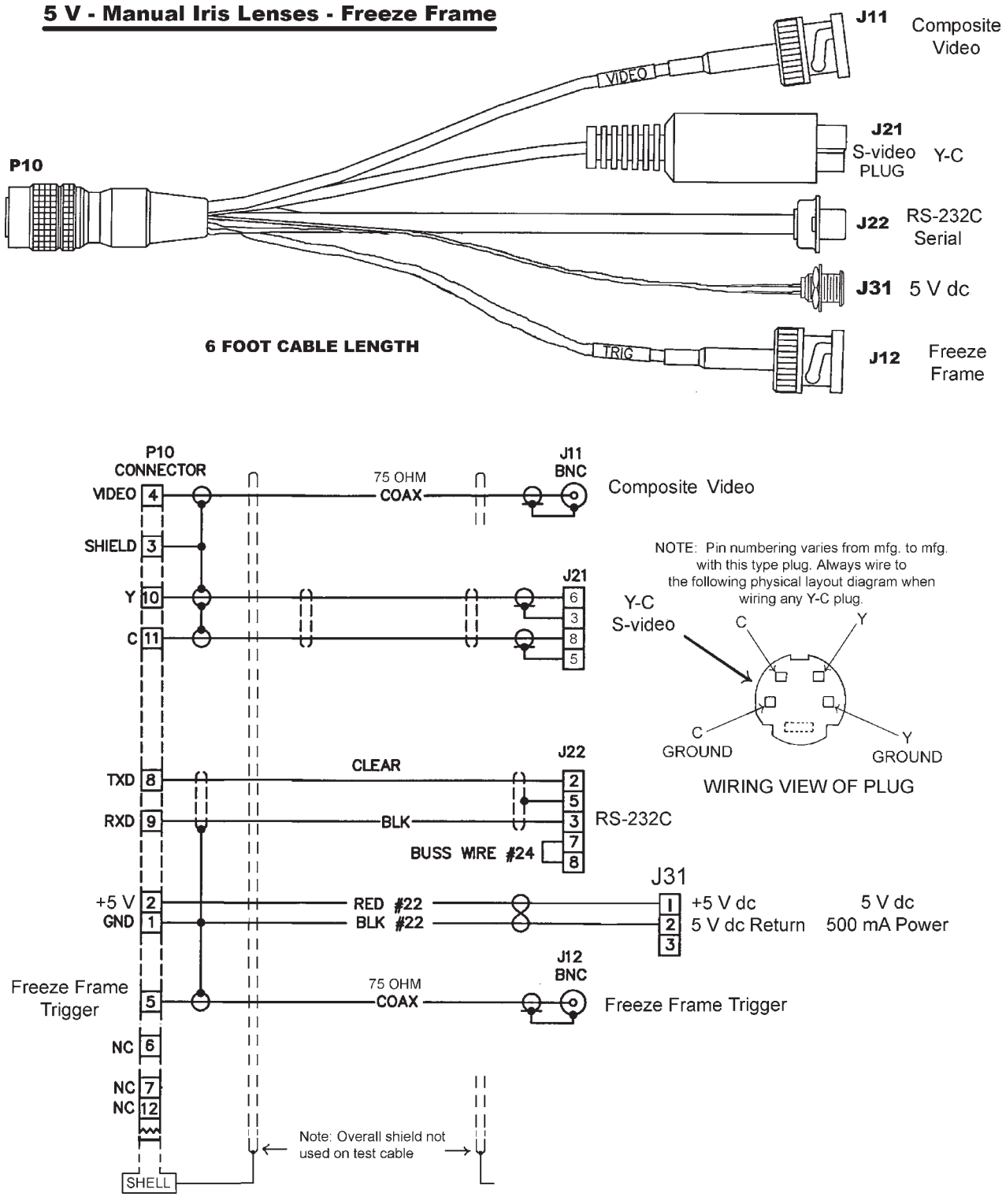

Figure 8. Test Cable, CTC-36 (5 V dc Camera)

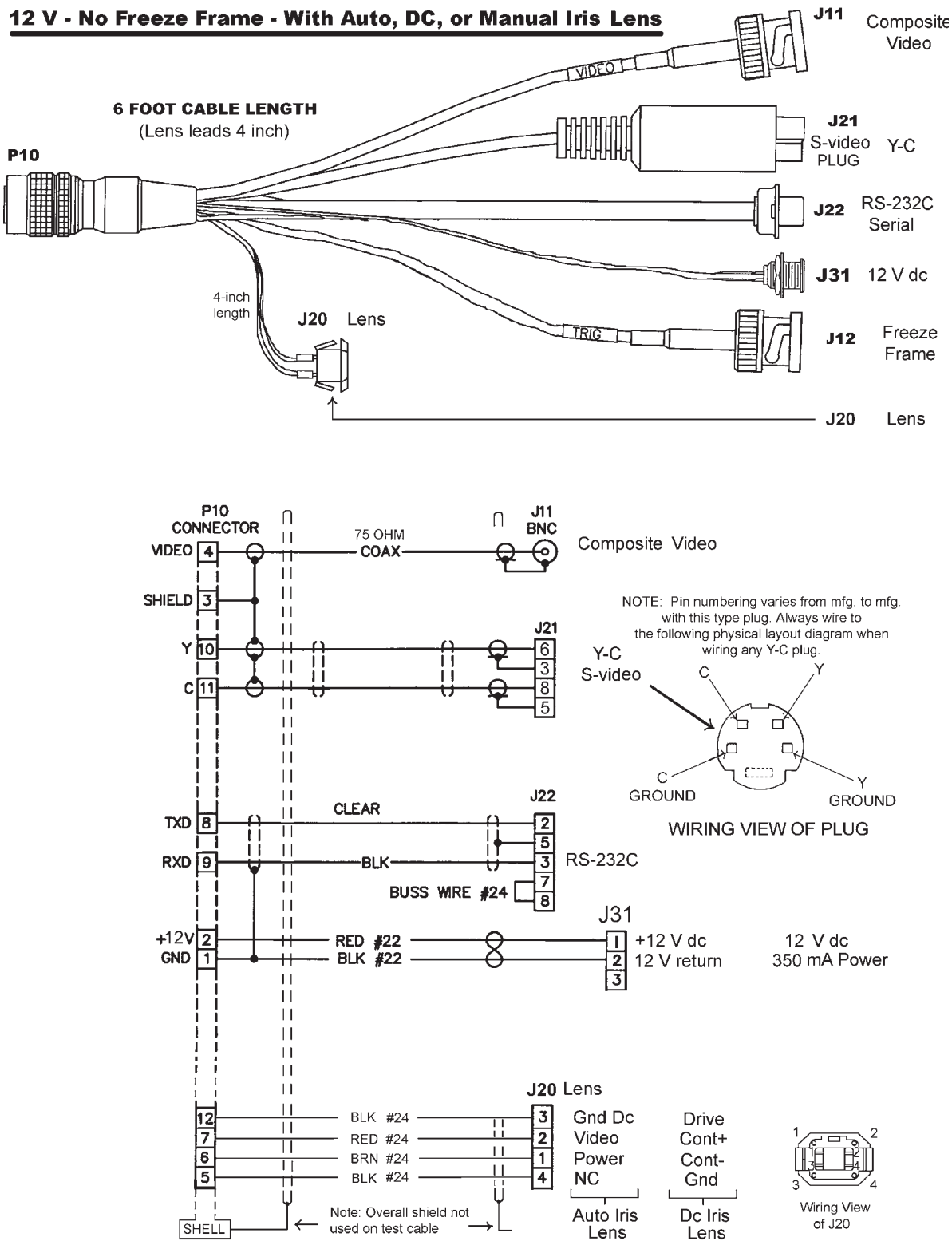

Figure 9. Test Cable, CTC-34 (12 V dc - (No Freeze Frame - Auto/Dc Iris Configuration)

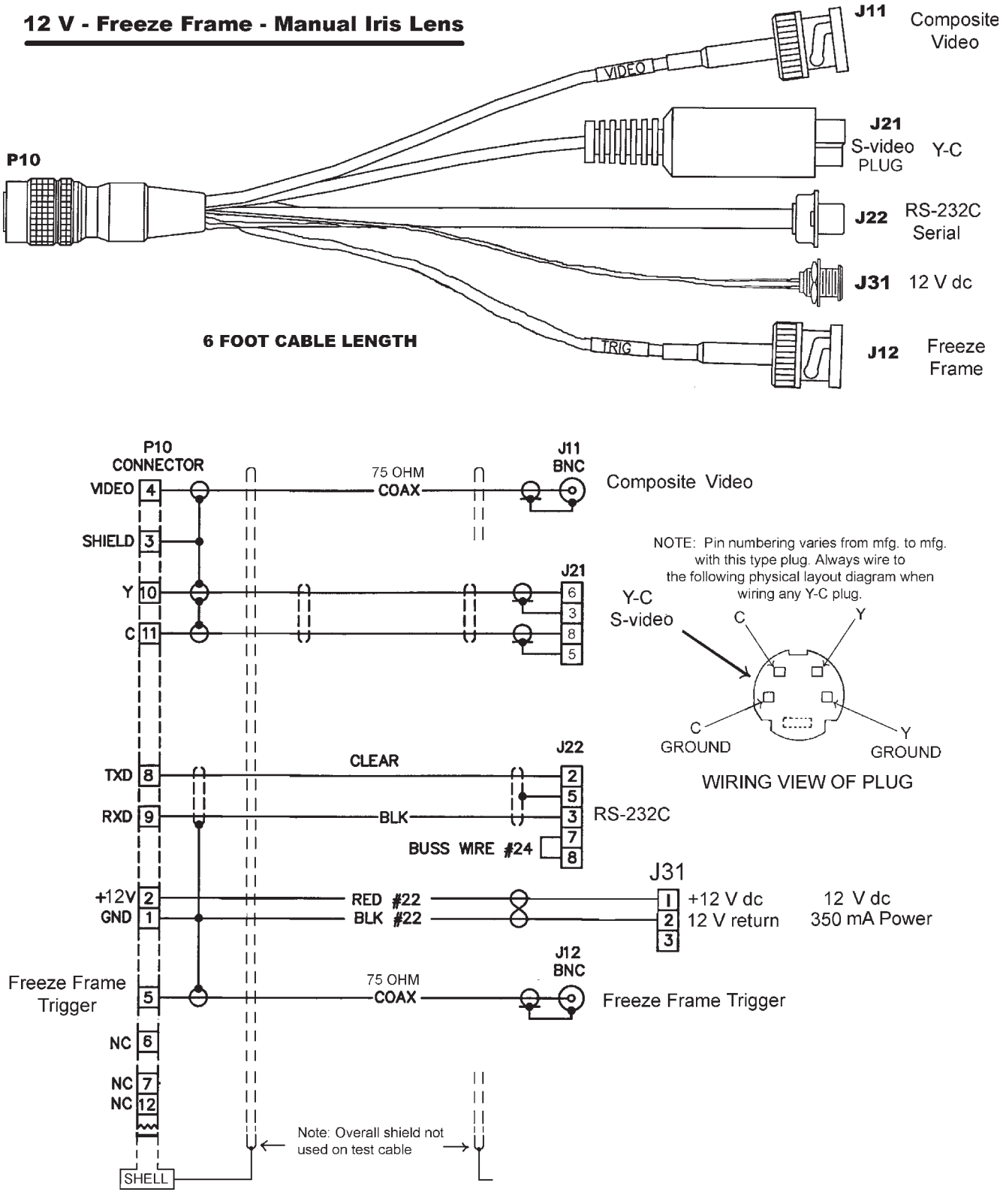

Figure 10. Test Cable, CTC-32 (12 V dc Freeze Frame Configuration)

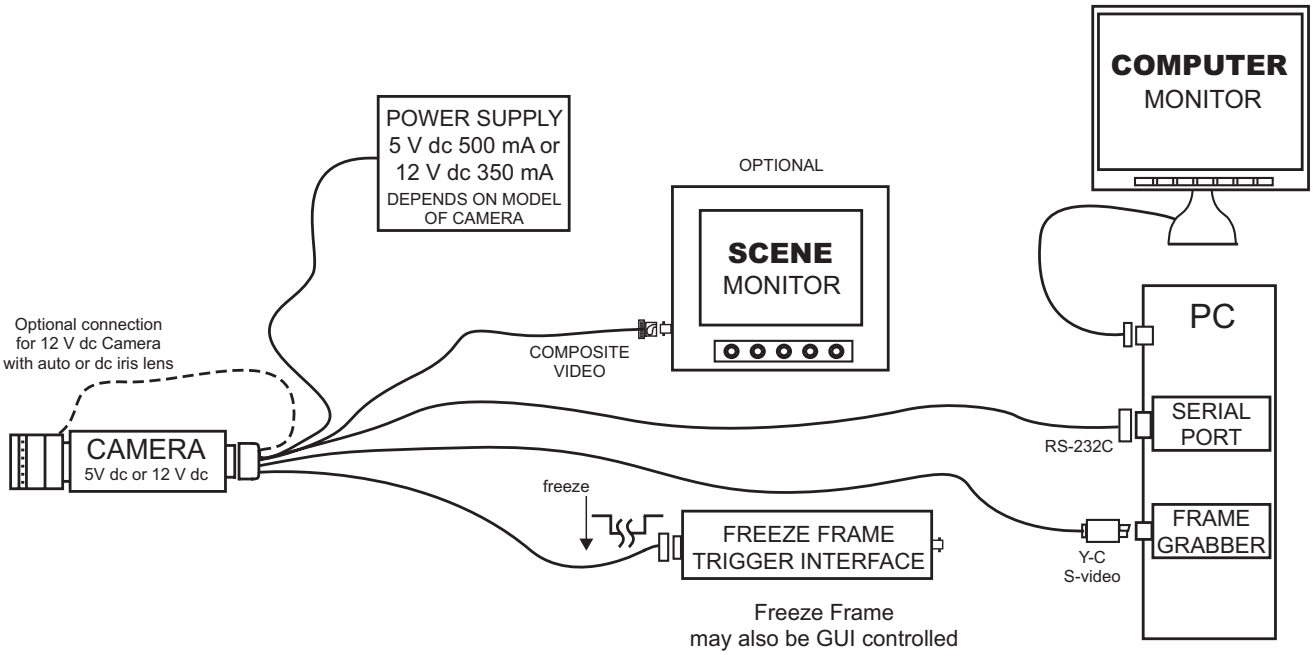

Figure 11. Typical Interconnection Diagram

Note that the pins 5, 6, 7, & 12 for a 12 V dc Camera can be interenally wired for any one of three functions.

1. Auto iris lens
2. Dc iris lens
3. Freeze frame operation

The model number designates these differences for 12 V dc Cameras. See the **IRIS** section of figure 4.

2.6 Power Requirements

The Camera is available in two different power configurations:

1. 5 V dc ±10% 500 mA (2.5 watt) power
2. 12 V dc ±10%, 350 mA (4.2 watt). Auto iris and dc iris versions of the Camera are available only in the 12 V dc version

2.7 Mounting Requirements

The dimensions shown in figures 5 and 6 illustrate all relevant characteristics related to mounting the Camera. Note that the CS-mount adapter is adjustable. The dimension to the front shoulder of the adapter is a nominal dimension. Also note that the 1/4-20 threaded holes in the bottom of the optional mounting adapter block are meant to accept not more than 0.200-inch depth from the mounting screws. A screw will bottom out if an attempt is made to thread it deeper than 0.200 inch.

2.8 CS- and C-mount Adapters

Lenses must be suitable for use with size of the sensor installed in the Camera (1/4-, 1/3-, or 1/2-inch). The front of the Camera body is fitted with an adjustable CS-mount adapter. It can be rotated on its threads for back focus distance by loosening a hex-socket head setscrew. (Figures 5 and 6 illustrate this setscrew at one location, but since the CS mount rotates, it can appear in any position.)

If a C-mount lens is to be used with the Camera a 5 mm extender ring (in the optional Accessory Kit) must be threaded onto the front of the CS mount. This ring provide the proper back focus distance for a C-mount lenses.

2.9 Serial Control Input (RS-232C)

Pins 8 and 9 on the rear panel connector provide RS-232C serial communications (19,200 baud) for control of internal Camera functions. Table 5 lists all 12 pin functions for the connector.

2.10 Installation Procedure

Installing the Camera is straightforward. It is only necessary to mount the Camera to a suitable base, attach the lens, attach the rear panel connector and apply power. This assumes the other end of the cable is properly connected to a source of power, a tv monitor, and any other required equipment.

Figures 8 is an example cable diagram of a test cable for use with the 5 V dc version of the Camera. Only manual iris lenses can be used with this Camera.

Figures 9 and 10 are example wiring diagrams illustrating test cables available for use with the 12 V dc version of the Camera.

Figure 9 is for use with either an auto iris lens or a dc iris lens — depending on how the Camera is internally configured.

Figure 10 is for use when the Camera is internally configured for freeze frame operation — in which case only a manual iris lens can be used.

These diagrams show composite video connected to a viewing monitor and the S-video connected to a frame grabber in the PC. Either video output can be used for the scene monitor and frame grabber if they are capable of accepting those inputs.

Freeze frame can also be implemented through the serial link by using the GUI interface on the PC. When the Camera is put into the freeze mode, it stores the current scene and continues to output that scene until the Camera is taken out of the freeze frame mode.

As a minimum, the following must be connected:

1. Operating power: either 5 V dc, 500 mA, or 12 V dc, 350 mA, depending on the version of the Camera

2. RS-232C data communications with a PC running the test/setup GUI software

3. Either of these two video monitoring methods:

   a. NTSC or PAL output on pin 4 of the rear panel connector

   b. The S-video outputs (Y on pin 10 and C on pin 11)

Additionally, the following connections can be made — depending on the requirements:

4. The freeze frame input (pin 5). This is only for the manual iris versions of the Camera

5. The unused video output may also be used. These outputs appear simultaneously.

6. An auto iris lens or a dc iris lens, depending on which type lens a 12 V dc version Camera is internally configured for — unless, of course, it is configured for freeze frame operation.

2.11 Preparation for Shipment and Storage

For storage periods exceeding about one month, seal the unit in a vapor-proof bag containing a fresh desiccant pack.

Maintain the Camera storage environment within a range of -30 to 85 °C (-22 to 185 °F).

For shipment, package with enough foam padding or other packing material to prevent damage that can occur during shipping. The original shipping carton is a good container if it has not been damaged or subjected to excessive moisture. For shipping to the factory by Common Carrier, use the following address:

Cohu Electronics
3912 Calle Fortunada
San Diego, CA 92123-1827

Please contact the Customer Service Department for a Return Authorization (RA) number before sending any shipments to the factory:

cst@cohu.com
or
858-277-6700 extension 261

Prominently display the RA number on the outside of the shipping container(s) and on paperwork contained inside. Give a brief description of why the equipment is being returned and list the symptoms of any problems being experienced with the equipment.

3.0 OPERATION

After the Camera is installed, the actual operation of the Camera is controlled by the related frame grabber and image processing software.

A manual lens may require some opening and closing of its iris in response to light conditions,. The lens may also require refocusing from time to time, but otherwise there is no other attention required for the Camera.

Camera functions are primarily controlled by the GUI interface running on a PC. Figure 12 is the “about” window of this software.

Figure 13 shows the opening window of the 3610 Graphical User Interface (GUI). Most control functions are performed from this window, but two other windows accessible from the Misc area also perform important functions:

1. Lens/Aperture opens the Lens Dialog window (fig. 14)

2. Set AE Window opens the Set Weight window (fig. 15)

3.1. DSP3600 GUI Home Screen (figure 13)

Figure 13 (DSP3600) is the primary control window where all the various functions are accessible. Clicking various buttons in this window causes drop down menus to appear (figure 16). Table 7 lists the various functions and gives a brief description.

Table 10 lists the default settings of the GUI. When any selection is changed, that message is immediately sent to the Camera for implementation.

Figure 12. About Screen

Any selection of settings in the GUI can be stored to one of the presets. Just select the desired preset number (Preset 1 to Preset 10), then click Download. If it is desired to make those (or some other group of selections) the internal default of the Camera, just click on the EEPROM button. Those settings are then stored in Camera memory and remain as the Camera default settings until other selections are stored by clicking on the EEPROM button again. The GUI will remember the factory default it is necessary to return to reset conditions.

If a frame grabber is used to capture the video output from a Camera, it too will have a GUI interface for manipulation of all its features.

3.1.1 Gamma Control

The gamma selections of the GUI make changes to the luminance (black-white) characteristic (Y-gamma). It can be set to any of 10 response curves.

Selections 0 through 7 are an increasingly nonlinear video response as shown in figure 17. These curves enhance video response in the darker areas of a scene.

Selection 8 (bottom curve in figure 18) is a standard linear video response. This may be the most desirable choice when making measurements where video level is a key factor.

Selection 9 (top curve in figure 18) is also a linear response but with an approximate 15 percent increase in gain. This results in a slight increase of noise in the video.

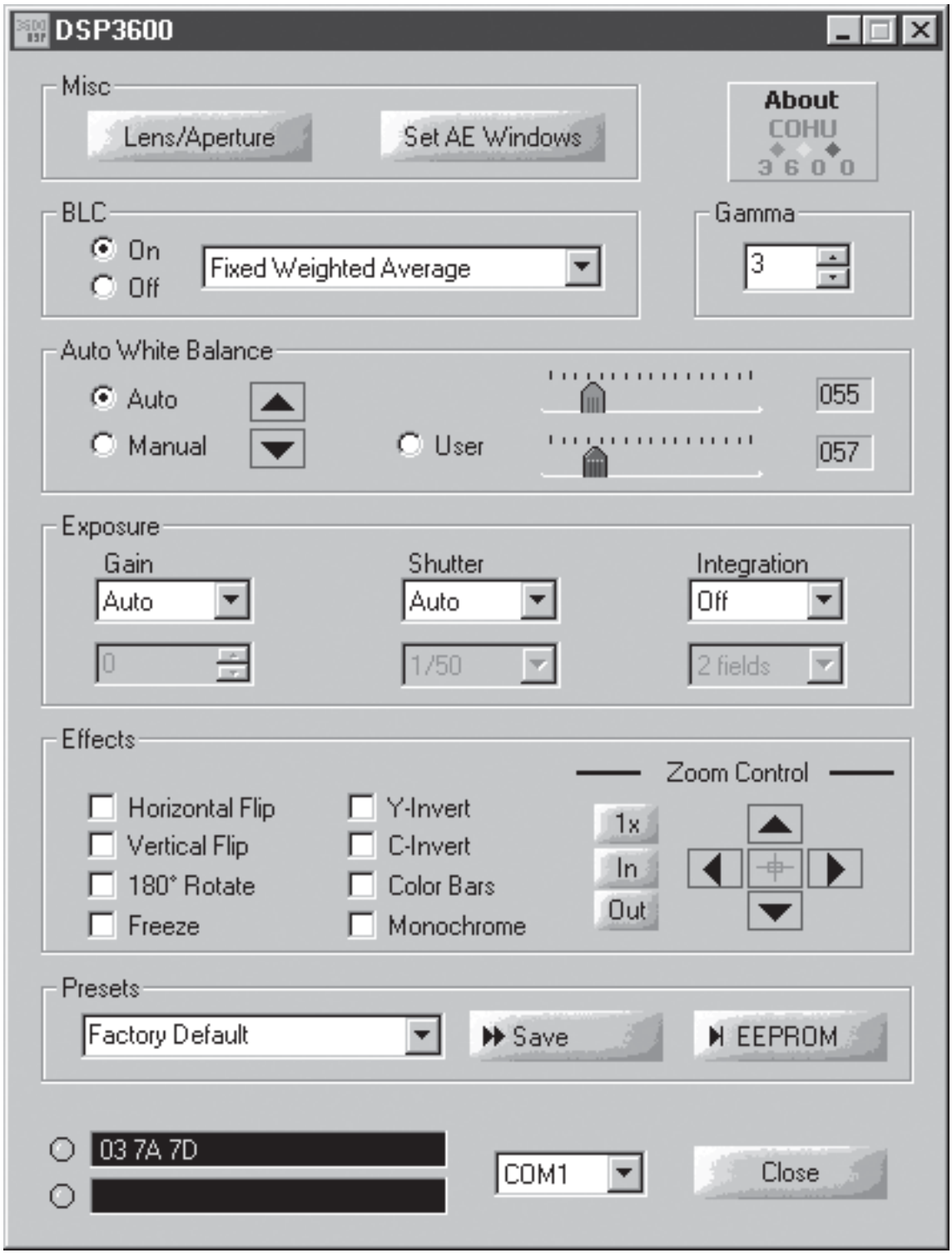

Figure 13. DSP3600 "Home" Screen

Table 7. DPS3600 “Home” Screen

FUNCTION AREA		
NAME	**EFFECT**	
Misc		
Lens/Aperture	Opens new screen for either lens iris setup or aperture conditions	
Set AE Windows	Opens new screen for setting gain control windows size and locations	
About		
About Cohu 3600	Opens new window identifying program and version level	
BLC (Back Light Compensation)		
On	Fixed Weighted Average	Windowed fixed weighting (5 areas)
	Auto Weighted Average	Windowed automatic weighting
	Brightens dark areas	Histogram Integration 1
	Darkens bright areas	Histogram Integration 2
Off	Back light compensation off	
Gamma (figures 17 and 18)		
Preset	0, 1, 2, 3, 4, 5, 6, 7, 8, or 9 can be selected (0 is least curve amount of curve, 7 is maximum curve). Gamma 8 is standard linear response. Gamma 9 is a linear response but with about 15% increased output — at the expense of additional noise	
AWB (Auto White Balance)		
Auto	Camera automatically adjusts white balance response curve	
Manual	Up / Down buttons adjust white balance response curve manually	
User	Activates red (top) and blue (bottom) sliders to right	Red slider changes red response curve
		Blue slider changes blue response curve
Exposure		
Gain	Auto / manual selectable	In manual: 0 through 7 selectable
Shutter	Auto / manual selectable	In manual: 1/50, 1/100, 1/250, 1/500, 1/1,000 1/2,000 1/4,000, 1/10,000, 1/20,000, 1/50,000 sec
Integration	Off / on selectable. When On, Gain & Shutter are set to Auto	2, 3, 4, 5, 10, 20, 40, 80, 160, 320, 510 fields available when On selected
Effects		
Horizontal Flip	Swaps the left and right of scene (not top and bottom)	
Vertical Flip	Swaps the top and bottom of scene (not left and right)	
180° Rotate	Rotates scene so top right becomes bottom left	
Freeze	Captures the current scene and continues to output it	
Y-Invert	Inverts the luminance signal	
C-Invert	Inverts the chroma signal	
Color Bars	Provides color bars at the output	
Monochrome	Removes chroma from the output	
Zoom Control	1x	Removes any digital zoom in effect
	In	Digitally zooms in
	Out	Digitally zooms out
	Tilt up button	Moves up in the scene
	Tilt down button	Moves down in the scene
	Pan right button	Moves right in the scene
	Pan left button	Moves left in the scene
	Center button	Returns to the center of the scene

Continued on next page

Table 7 (continued)	
FUNCTION AREA	
NAME	**EFFECT**
Presets	
Preset drop down menu	Choose from factory default or presets 1 through 7
Save	Saves preset 1 through 7 settings
EEPROM	Saves current entries to the eeprom
Message and COM Area	
Transmit Indicator and transmited data line	Indicator lights when data is being transmitted and hex code of data sent is shown
Receive Indicator and data received line	Indicator lights when data is being received and hex code of data received is shown
COM	Select from COM1 though COM3
Close	Closes the DSP3600 screen
end	

3.1.2 Freeze Frame

The current scene from a Camera can be stored into internal memory and presented as the output by either of two methods. (1) By checking the Freeze Image box on the GUI screen, or (2) by pulling pin 5 on the rear panel connector of the Camera low (5 V dc versions of the Camera only).

With either method, the scene is placed into memory at the end of the current vertical interval. That scene will continue to be presented until the freeze mode is ended. When the GUI Freeze Image box is unchecked or pin 5 is released to go high again, the new scene begins with the next vertical interval.

3.1.3 Back Light Compensation (BLC)

When the scene being viewed has a darker image in front of a bright background (such as a subject standing in front of a window at midday) a backlight condition results. The Camera has four BLC modes to select from when confronted with this situation. Two of these modes are based on a luminance comparison of different parts of the scene using windowing (3.4.1 and 3.4.2 below). Two others are based on a histogram analysis of the scene luminance (3.4.3 and 3.4.4 below). If both the foreground and background must show detail, a gamma curve can be used to make the foreground part of the scene brighter. This works best with the Darken Bright Areas mode (histogram 2).

3.1.3.1 Fixed Weighted Average (Window 1)

Select this compensation when the subject of interest is a backlighted dark image that does not move. The foreground subject will gain detail as a result of being made brighter, but the backlight area behind the subject will have a loss of detail due to this overall increased brightness level. In this mode, each of the window areas of the scene have fixed values assigned to them for determining how to render the overall scene.

3.1.3.2 Automatic Weighted Average (Window 2)

Select this compensation when the subject of interest is a backlighted image moving against the bright background. The foreground subject will gain detail as a result of being made brighter, but the backlight area behind the subject will have a loss of detail due to this overall increased brightness level. In this mode, the weighting values are automatically controlled in response to the light intensity detection window.

3.1.3.3 Brighten Dark Areas (Histogram 1)

This selection enhances details of a darker foreground subject that is backlighted. The bright backlighted area will be made even brighter with a resulting loss of detail.

Table 8. Lens Dialog Screen

FUNCTION AREA		
NAME	**EFFECT**	
Lens		
Level	Setting range	Adjustment range from 109 to 149
DC Servo	For dc iris lens	Sets the dc iris drive stage for the lens being used
Video Servo	For auto / video iris lens	Sets the auto iris video drive stage for lens used
Manual	For manual iris lens	Level setting grayed out when in manual
Aperture Correction		
HAPGL	Horizontal Aperture Gain Low	0, 1, 2, & 3 available for selection
HAPGH	Horizontal Aperture Gain High	0, 1, 2, & 3 available for selection
VAPG	Vertical Aperture Gain	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 available for selection
VHAPG	Vertical / Horizontal Aperture Gain	0, 16, 32, 48, 64, 80, 96, 112, 128, 144, 160, 176, 192, 208, 224, 240, & 255 available
Close		
Close	Click button	Closes the Lens Dialog window
end		

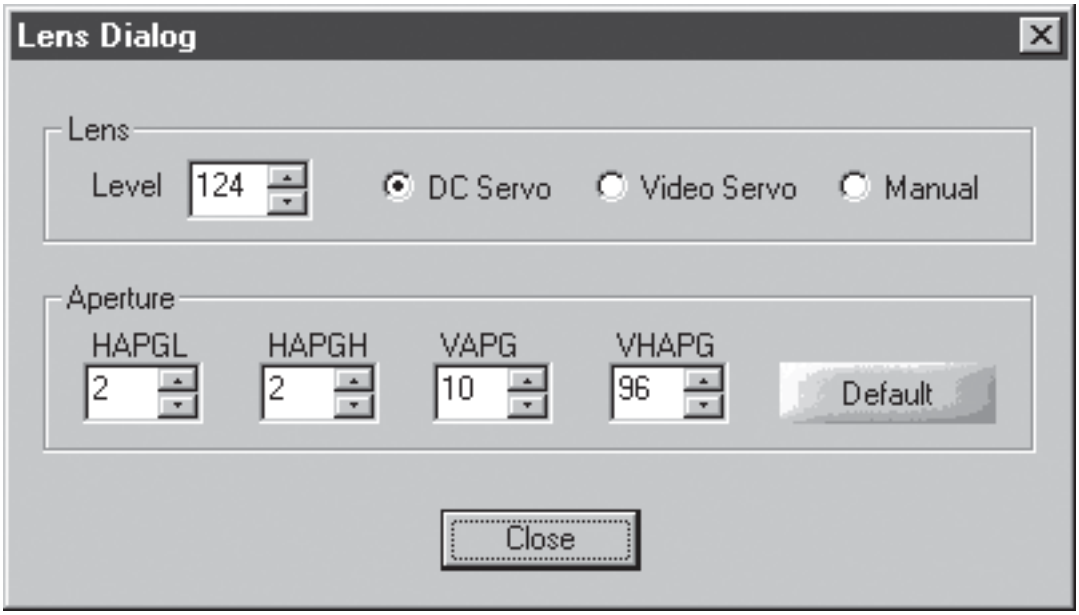

Figure 14. Lens Dialog Screen

Table 9. Set Weight Screen

FUNCTION AREA		
NAME	**EFFECT**	
Show Windows		
0	Physical locations of click buttons corresponds to corresponding window areas shown above	Click 0 to place this window into scene video
2		Click 2 to place this window into scene video
4		Click 4 to place this window into scene video
3		Click 3 to place this window into scene video
1		Click 1 to place this window into scene video
All	Show all windows in video	Click to place all windows into scene video
None	Show no window in video	Click to remove all windows from scene video
Reset to Default	Resets size and location of windows to the factory default	
Close		
Close	Click button	Click to close the window
end		

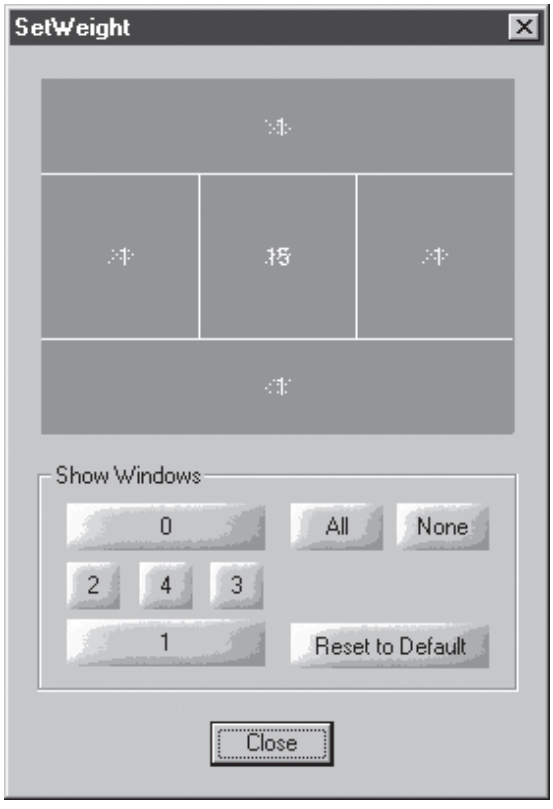

Figure 15. Set Weight Screen

Table 10. GUI Defaults

FUNCTION	DEFAULT SELECTION			
Port	COM1 (baud rate must be19,200)			
BLC	On	Fixed Weighted Average		
White Balance	Manual			
User	(not checked)	Red slider (top)	055	
		Blue slider (bottom)	057	
Exposure	AE Mode			
Aperture Correction	HAPGL 2	HAPGH 2	VAPG 10	VHAPG 96
Preset	Factory Default			

3.1.3.4 Darken Bright Areas (Histogram 2)

Use this selection to enhance detail in the backlighted area of the scene. The foreground image is made even darker, but use of a gamma curve can maintain detail of the foreground part of the image if this is necessary.

3.1.4 Download Button

Clicking the Download button sends the current GUI selections to the Camera. It will also store them into any GUI Preset (1 to 10) that may currently be selected — other than in the Factory Default selection. If Factory is the active preset, then the current selections are not stored by the GUI. (Also, clicking the download button is not required to send menu selections to the Camera. This occurs immediately when a menu selection is changed.)

3.1.5 EEPROM Button

Clicking the EEPROM button stores the current GUI settings in the Camera memory. This then becomes the Camera default settings until new settings are entered by pressing the EEPROM button again with different selections.

3.2 Lens/Aperture (Lens Dialog) Window (figure 14)

The Lens area of this screen provides settings for a dc iris lens, an auto iris (video

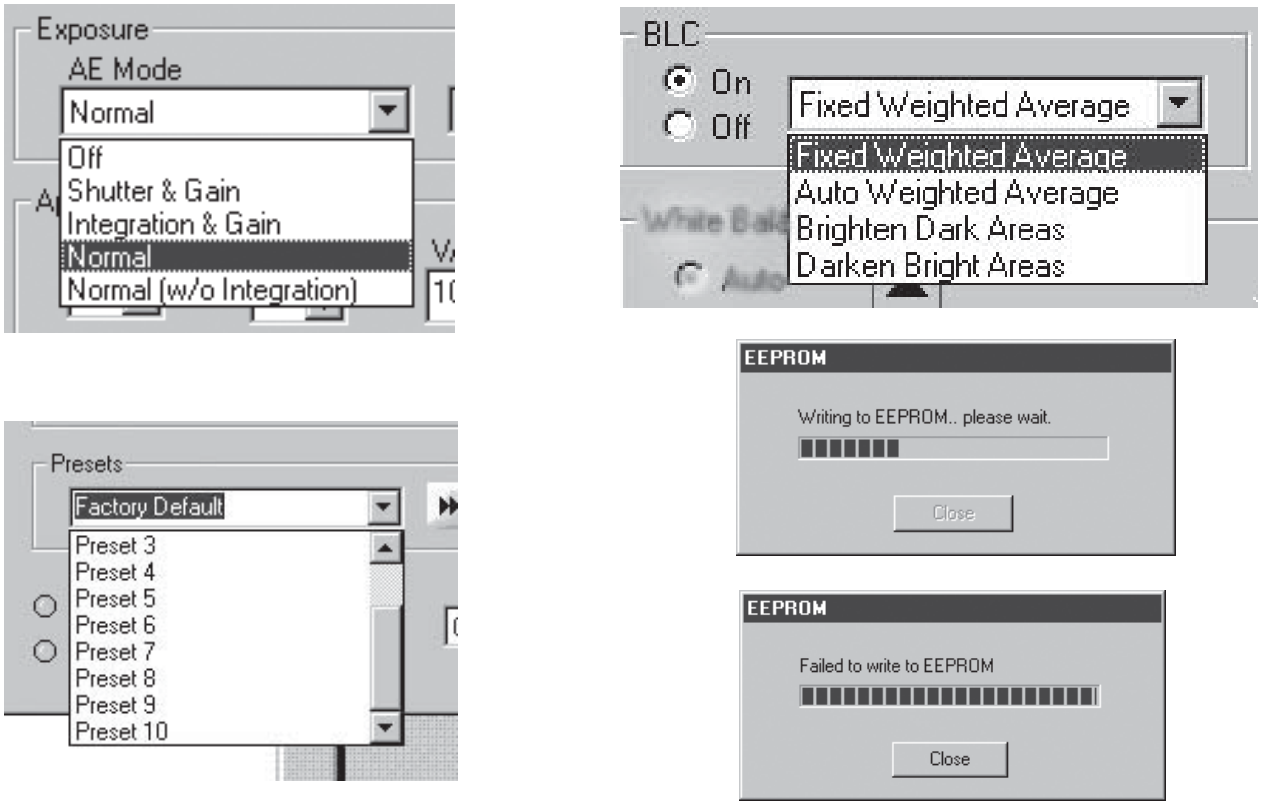

Figure 16. Typical Pop-up Windows

driven) lens, or for a manual lens for which no settings are required.

3.2.1 Lens Area

Level offers selections from 109 to 149 for setup of either a dc or auto iris lens. Dc Servo should be selected for use with dc iris lens. Select Ac Servo for auto iris lenses.

3.2.2 Aperture Area

The Aperture area of this screen provides settings for horizontal and vertical aperture. Table 8 lists these four settings together with the available values.

3.3 Set AE Windows (Set Weight) Window (figure 15)

Automatic gain control for a typical Camera is typically performed by monitoring the overall scene video level and then making adjustments to compensate when it becomes too high or too low.

The 3600 Camera, however, divides the scene into five areas that can be re-sized and shaped as desired. Each area is assigned a relative weight (from 1 to 15) for its contribution to the automatic gain control function of the Camera. For example, a high intensity light in one corner of the scene could be assigned a minimum influence upon gain by forming a small window over it and then assigning that window a low value (perhaps “1”).

Figure 15 shows the default size and location for these windows. These lines can be pulled to other locations by clicking and pulling on them with a mouse. There is an underlying grid to which they snap.

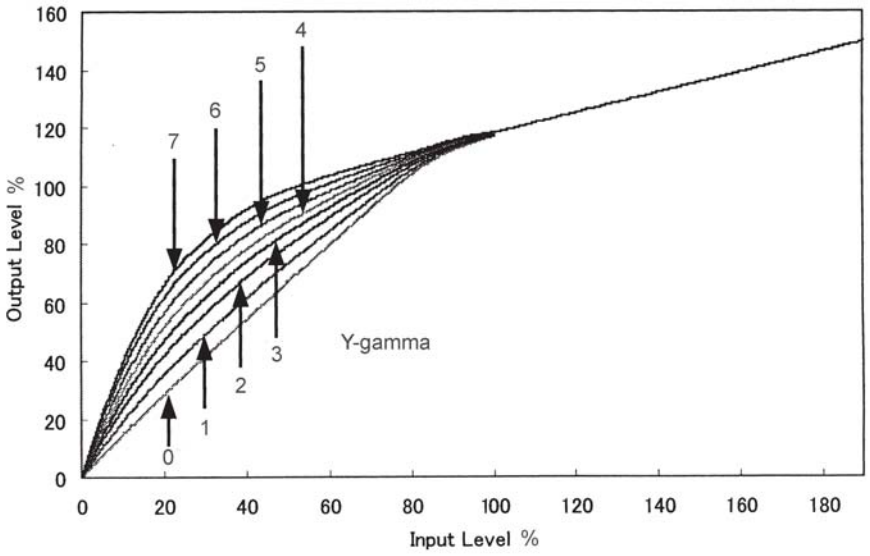

Figure 17. Non-linear Y-gamma Characteristics

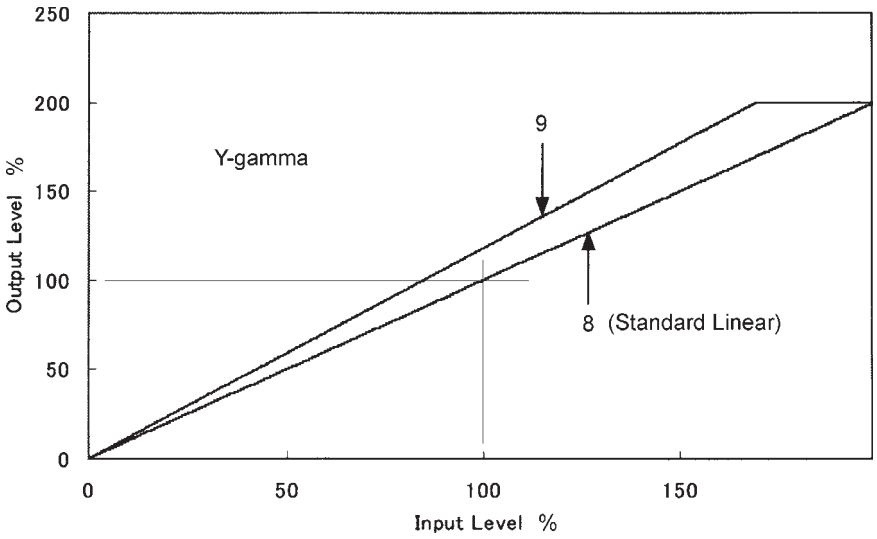

Figure 18. Linear Y-gamma Characteristics

The Show Windows area of the screen makes if possible to overlay the windowing lines to the video of the scene. The location of these buttons corresponds to the window areas shown above. Clicking on a button turns on a transparent overlay for that window area. The All and None buttons turns on and off an overlay of all the areas.

Reset to Default re-sizes the window grids to the factory set default size/locations.

Clicking the close button closes the window.

end text

COHU ELECTRONICS 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.

Pressurized Housings: Pressurized camera products include a lifetime pressurization warranty. Cohu will re-pressurize at no charge returned environmental cameras not exhibiting evidence of physical damage due to misuse. All warranty repairs will be performed at the factory or as otherwise authorized by Cohu in writing. Purchaser shall prepay transportation charges to Cohu.

Extended IR Cameras: Cameras utilizing extended infrared (extended IR) sensors found to exceed acceptable white blemish specifications within one month of delivery shall be repaired without charge.

This warranty does not extend to Cohu equipment subjected to misuse, accident, neglect, improper application, or repaired or altered by other than Cohu or those authorized by Cohu in writing. Cameras utilizing extended IR sensors are not warranted for use in areas of elevated levels of cosmic radiation. 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, implied, or statutory, including warranties of fitness for a particular purpose and merchantability, and set forth buyers sole remedy in connection with such warranties. Cohu, in no event, whether as a result of breach of contract or warranty, tort (including negligence) or otherwise, shall be liable for any penalties regardless of reason; collateral, consequential, incidental, or exemplary damages, including without limitation, any loss of profit or revenues, loss of use of any equipment or goods, or removal or re-installation of equipment without prior written approval.

A Return Authorization (RA) Number must be obtained from Cohu prior to returning any item for warranty repair or replacement.

4/03