

# **7210 SERIES IEEE-1394a Camera INSTALLATION AND OPERATION MANUAL**

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**Preliminary 1      4-20-05**



**Figure 1. Monochrome Progressive Scan Camera**

**Technical Manual 6X-1052**

**April 20, 2005**

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**COHU**  
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**7210 CAMERA  
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**INSTALLATION AND OPERATION  
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## INSTALLATION AND OPERATION

## 7210 CAMERA

### 1.0 GENERAL DESCRIPTION

This introduction briefly describes the overall characteristics of the Model 7212 Camera (figure 1) related to its installation and operation.

#### 1.1 Electrical Characteristics

A model number interpretation diagram appears in figure 4. That diagram shows the various basic configurations of the Camera. Table 1 lists the specifications.

##### 1.1.1 Sensor Characteristics

The sensor is a 1/2-inch (8 mm) 4:3 aspect ratio package. It is a monochrome CMOS sensor operating in the progressive scan mode.

A freeze-frame feature allows all pixels to integrate in parallel. They all start charge integration simultaneously and stop charge integration simultaneously.

The glass faceplate is a nominal 0.525 mm thick with a reflective index of 1.52 at 546 nm. There are 659 horizontal and 494 vertical active pixels. Pixels are square: 9.9  $\mu\text{m}$  x 9.9  $\mu\text{m}$ .

Figure 2 shows the optical black pixels surrounding the active area. Figure 3 graphs the spectral sensitivity of the sensor. Note that this is the sensitivity curve of the sensor itself — not including any lens or light source.

##### 1.1.2 IEEE-1394a Connector (6-pin)

This connector is the six pin version of a 1394a connector. Two pins are used to carry power to the camera. The camera derives operating power for video and processing control from this connector. (Strobe circuits obtain dedicated power from the RJ-45 connector.)

##### 1.1.3 RJ-45 10 Wire Connector

Only seven of the 10 pins on this connector are used: two for the trigger input to capture scenes, four to strobe external scene lighting circuits, and one to provide Vcc input for these strobe circuits. These are opto-isolate circuit functions. Power for these circuits is provided from outside the camera to maintain complete isolation from the other camera circuits.

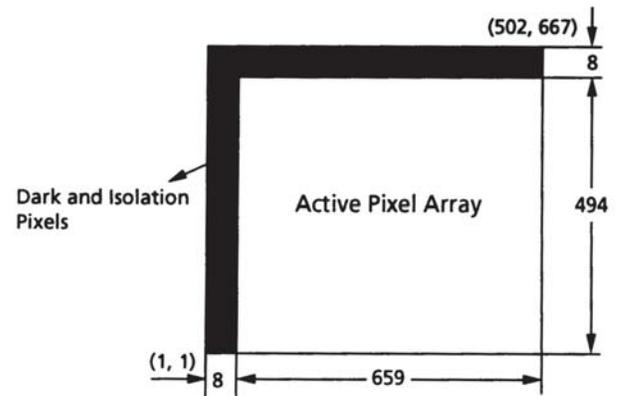


Figure 2. Sensor Optical Black Areas

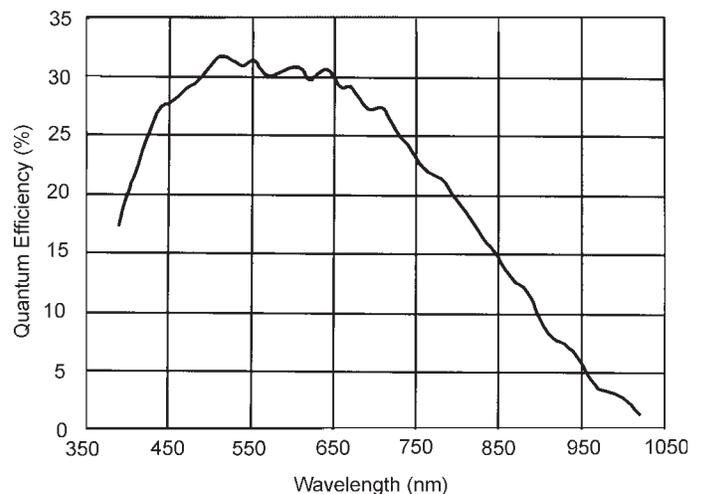


Figure 3. Sensor Sensitivity Characteristic

### 1.2 Mechanical Characteristics

The 7210 has optical and mechanical interfaces identical to the Cohu model 2600 camera. It can be mechanically substituted in place of a 2600 camera.

Dimensions are shown in figure 5. Note that the base of the Camera is dimensioned with mounting block on the bottom of the Camera. It can be moved to the top if desired or left off entirely if the camera is to be mounted in some other manner such as by the lens.

The sensor image plane dimension is to the mounting shoulder against which the C-mount lens tightens when threaded in.

CS-mount lenses cannot be used.

**7210 CAMERA****INSTALLATION AND OPERATION****Table 1. Specifications**

<b>ELECTRICAL</b>	
Sensor	1/2-inch format 9.9 micron x 9.9 micron
Active Pixels	659 (H) x 494 (V)
Sensitivity	15 lux, faceplate for full video, min gain, 1/30 sec exposure
Frame Rate	70 f/s at full resolution (30 nominal)
Scanning	659 (H) x 494 (V); Fewer than 494 lines can be selected
Trigger Input	Optoisolated input for scene capture on RJ-45 auxiliary connector
Shutter	Programmable 1/15 to 1/20,000 sec; up to 5 sec integration
Gain	0 to 25 dB manually programmable
S/N	45 dB (48 dB dynamic range)
Gamma	1.0 fixed
Image Processing	Mirror imaging and Region of Interest (ROI)
Video Output	IEEE-1394A IIDC [D-cams] compliant [16 bit format]
Sync	Internal; optional opto-isolated hardware trigger or software trigger
Control Outputs	4 optoisolated strobing outputs
Controls	Gain, shutter, offset, frame rate, ROI window via D-cam registers
Power, video and control	12 V dc (8 to 30 V dc IEEE-1394a compatible less than 3 watts)
Power, auxiliary input	Vcc required for opto-isolated strobe outputs
<b>MECHANICAL</b>	
Dimensions	1.35 high x 1.73 wide x 2.84 long in inches (34.3 x 43.9 x 72.1 mm)
Weight	3.7 oz (106 grams)
Connectors (2)	IEEE 1394a (6 wire) video/control/power; RJ45 (10 wire) Optoisolated trigger input; 4 discrete optoisolated outputs
Lens	C-mount type only
<b>ENVIRONMENTAL</b>	
Temperature	-5 to 60 °C (23 to 140 °F) operating; -20 to 70 °C (-4 to 158 °F) storage
Humidity	<95 %, non-condensing
Shock	80 g (IEC 68)
Vibration (less lens)	8 g (IEC 68)
<b>PRELIMINARY</b>	

Two connectors are located at the rear panel. One is an IEEE-1394a six-pin connector that carries video/control input power and the other is an RJ-45 10-pin connector to support the auxiliary functions of triggering and strobing. The RJ-45 has power input on pin 7 to drive the strobe stages. Triggering is directly driven by the externally applied trigger signal.

The camera can be mounted in three ways:

1. By the lens
2. To a removable mounting block on the top of the case

3. To a removable mounting block on the bottom of the case.

The mounting block provides a pair of 1/4-20 mounting holes.

### 1.2.1 C-mount Lens

Use a manual-iris lens compatible with the 1/2-inch sensor in the camera. A C-mount lens must be used. Thread the lens fully into the Camera. No back focus tracking is required.

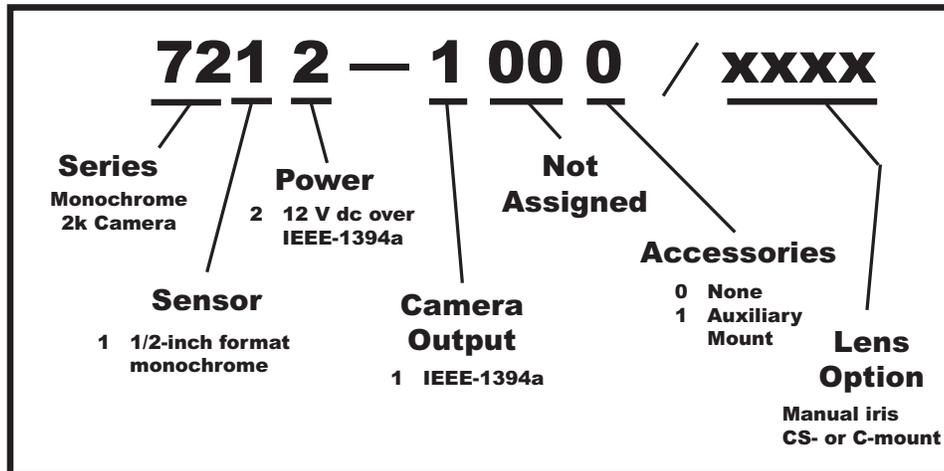


Figure 4. Model Number Interpretation Diagram

## 2.0 INSTALLATION

This section covers the general requirements of installing the camera including cabling and power requirements. In addition to the actual installation requirements, this section covers a number of other items including static discharge protection and proper shipping and handling of the Camera. Refer to table 2 for a summary of key points to remember about installing and using the Camera.

Section 4 of this manual covers Receiving Inspection, Static Precautions, and Return Shipment to the Factory.

### 2.1 Equipment Supplied

Table 3 lists the equipment supplied with the basic camera model number. Other items may be supplied if they were ordered with the camera.

### 2.2 Equipment Required but Not Supplied

Table 4 is a list of equipment required to make the camera operational in a minimum configuration. Other items may be required depending on the application.

### 2.3 Cabling Requirements

The rear panel provides two connectors for interconnections with other equipment.

As a minimum, the IEEE-1394a connector

must be used. It provides several functions including operating power to the camera, picture data out to the viewing PC, and control functions for the camera.

The RJ-45 connector offers two auxiliary functions that may not be required. This is an opto-isolated port and thus requires its own supply power on pin 7. It has a trigger input to capture a scene image and four programmable strobe outputs to “fire” strobe lights during the integration period of the sensor.

#### 2.3.1 IEEE-1394a Cable

Installation cables for IEEE-1394a are best obtained from a reliable cable manufacturer and not built on-site. Use only a cable of the highest quality. All six wires are required since the camera draws its operating power from this cable.

For test bench cables, though, it is possible to buy RJ-45 10-pin cable connectors and use a punch-down tool to install the required wires onto the connector.

#### 2.3.2 RJ-45 Auxiliary Cable

Only seven of the 10 pins of this connector are used. One pin is input power for the strobe outputs, four are strobe output lines, and two provide trigger input for scene capture. Depending on the length of this cable run and the noise environment of the installation it may not require overall shielding or shielding of the trigger lines.

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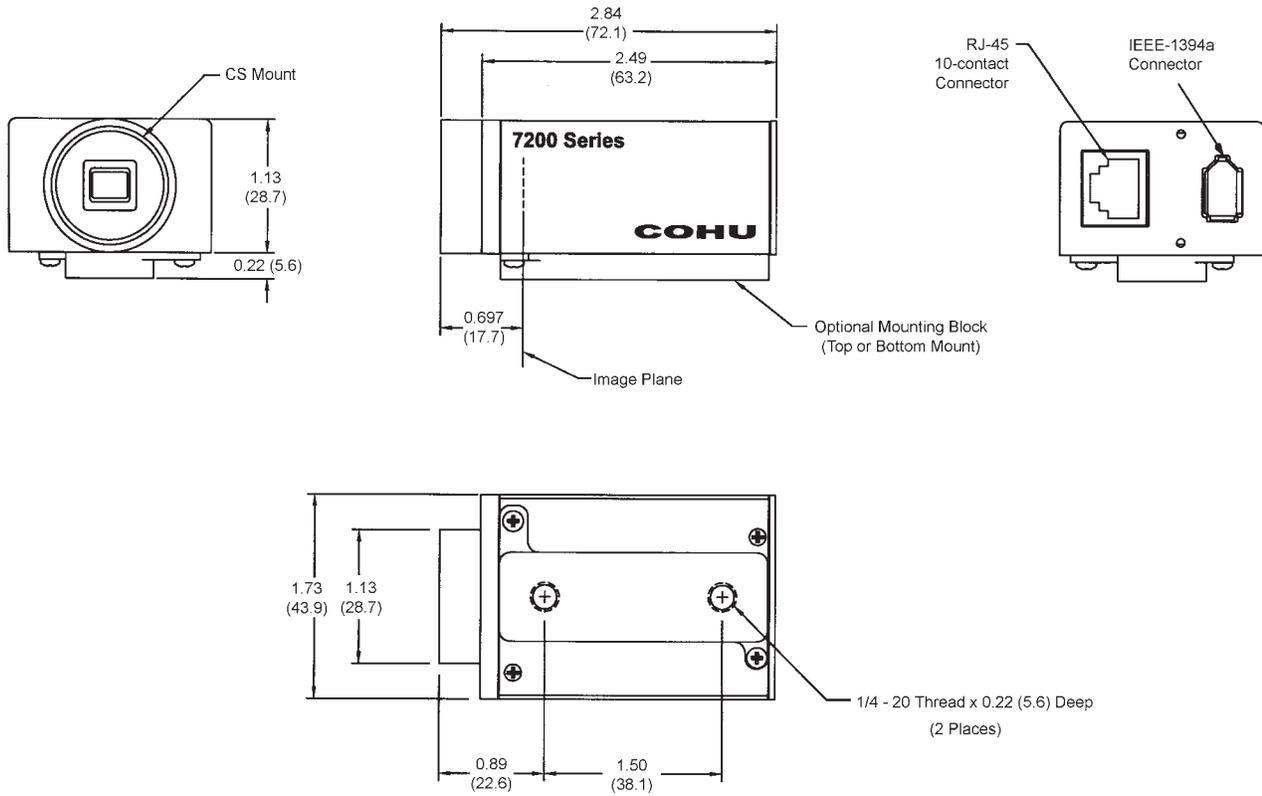


Figure 5. Dimensions, Model 7210

Table 2. Key Points to Remember

ITEM	KEY POINTS
STROBE OUTPUTS	
1	Using the strobe outputs requires a cable with an RJ-45 connector
2	Using the strobe outputs requires that power be supplied to the RJ-45 connector
3	Strobe outputs must be current limited to protect the internal emitter follower drive transistor
4	Strobe outputs are optoisolated from other camera circuits
5	Start & stop times on the strobe setup window must be within the frame time being used
6	Shuttering impacts the strobe times that can be set. When the sensor is being shuttered, the integration interval during which time the scene is obtained occurs during the last part of the vertical interval
TRIGGER INPUT	
7	External triggering for scene capture can be implemented either through the software interface or by a hardwire connection on the RJ-45 connector
8	Hardwire triggering does not use the Vcc power input on the RJ-45 rear panel connector
POWER INPUTS	
9	Power for camera video and control circuits is supplied via the 1394a cable (a 6-wire cable)
10	When strobe outputs are to be used, power must also be supplied to the RJ-45 auxiliary connector
OPERATING CONSIDERATIONS	
11	Selecting some of the control functions requires stopping the camera (stop is equivalent to pause)
12	At full resolution, maximum frame rate is 4 frames per second
13	For setup and adjustment purposes, select the Draft mode for 12 frames per second operation
14	A tif or bmp image of the scene can be saved to an external hard drive or other device

Figure 7 is the wiring diagram for a cable showing overall shielding for longer runs.

## 2.4 Power Requirements

Operating power for the camera must be supplied via the 1394a cable. Power for the strobe outputs must be supplied to the RJ-45 connector if they are to be used.

### 2.4.1 Power Over 1394a

The IEEE-1394a specification provides for devices to obtain operating power over a 1394a cable (6-wire type). The 7200 makes use of this feature so the device it is connected to must provide this power. Powered 1394a sources must be capable of supplying any voltage from 8 to 30 V dc.

The Camera requires 12 V dc from the 1394a cable at less than 3 watts

If the Camera is to be operated with Viewer software running on a laptop computer it is likely

that this computer will have a 4-pin (non-powered) 1394a connector. In this case an external power supply adaptor will be required to interconnect between the 4-pin 1394a connector on the laptop and a 6-pin 1394a cable (powered type) — which then provides this adapter voltage to the Camera. These adapters are specifically made for 1394a applications.

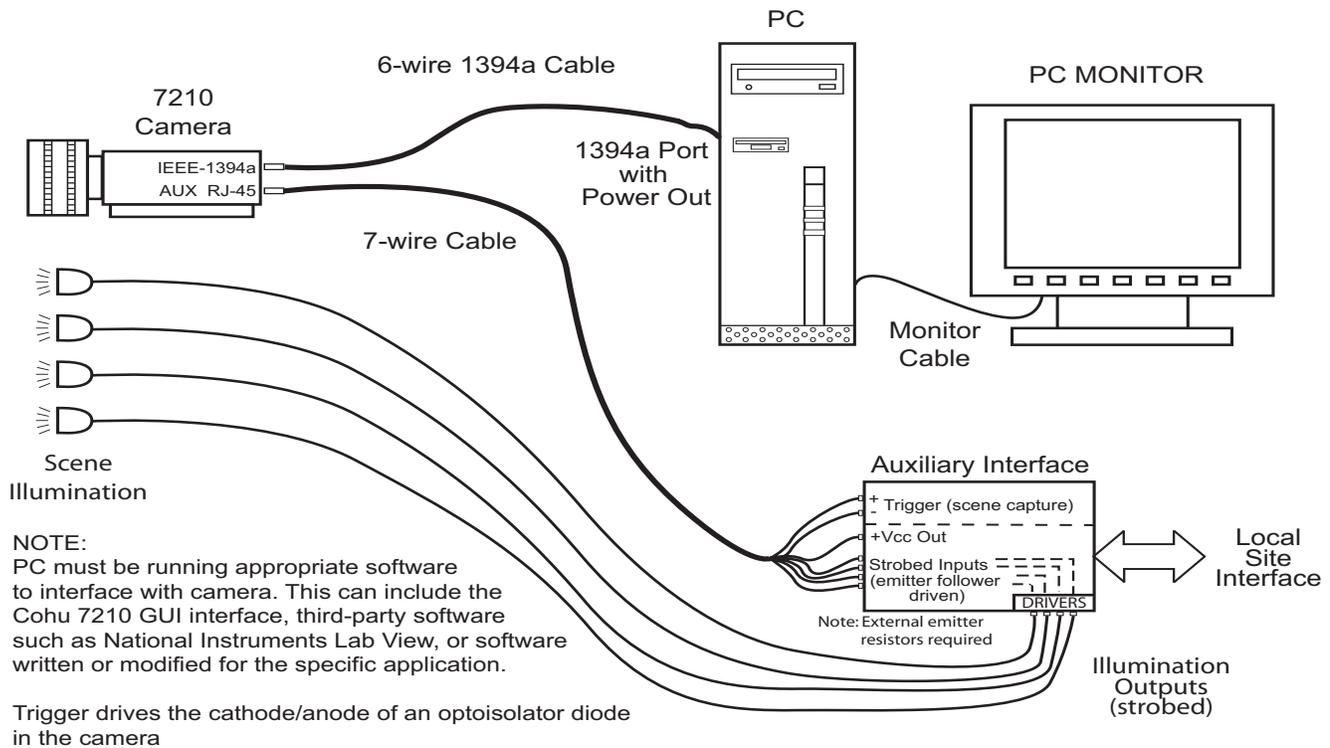
### 2.4.2 Strobe Power via RJ-45

If power is required to the RJ-45 auxiliary connector, it is applied to pin 7. This power is labeled +Vcc on the illustrations because the actual voltage applied depends on the circuit externally connected to the strobe outputs. A typical input range would be from 3.3 V dc to 15 V dc.

The strobed outputs are common collector (emitter follower) circuits. Each output is specified to provide a maximum of 35 mA in continuous operation. An external 100 ohm series resistor is shown in figure 9 to protect the internal drive transistor from an accidental short to ground. This assumes a 5 V dc input for Vcc on pin 7.

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**Figure 6. Typical Installation Interconnections**

### 2.5 Mounting Requirements

The dimensions shown in figure 5 related to mounting the Camera. The Camera can be mounted in three different mounting configurations:

1. By the lens (being careful to ensure that the attached cables do not provide excessive pressure on the camera)
2. By two 1/4-20 threaded holes on a mounting adapter that can be installed on the bottom of the case.
3. By two 1/4-20 threaded holes on a mounting adapter that can be installed on the top of the case.

The following paragraphs describe some of the features of the Camera related to the installation process.

### 2.6 Installation Procedure

Prior to installing the camera it may be necessary to prepare an auxiliary interface if the trigger-

ing and strobe lines on the RJ-45 connector are to be used. See figures 6 and 7.

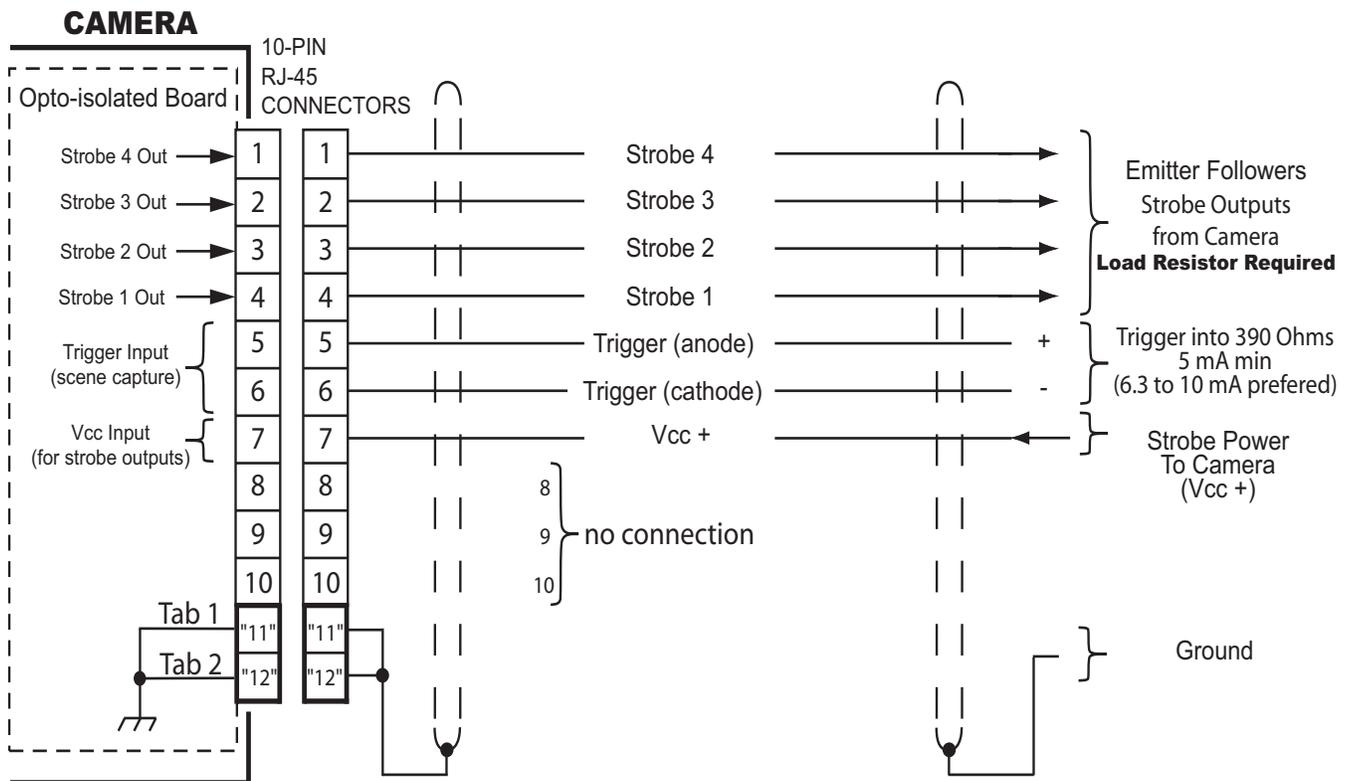
The camera can only be operated by Viewer software running on a PC interfaced via a IEEE-1394a cable.

Installing the Camera is straightforward. It is only necessary to mount the Camera to a suitable base, install the lens, attach the cable(s), apply power, and operate it using the Viewer software.

Table 5 lists the two cables that interconnect with the Camera rear panel. The RJ-45 cable is required only if external triggering or strobe outputs are to be used.

The following is a general description of the typical installation procedure for a camera.

1. Prepare the auxiliary interface and cable for the RJ-45 connector if this is required. Use of the strobe functions requires that power be supplied to the opto-isolator stages in the camera dedicated to the strobe circuits. (The trigger input directly drives the cathode and anode of a photodiode in the Camera and does not use the Vcc input of the strobe circuits.)



- Notes:
- Strobe outputs are emitter followers that must have an external resistor to limit current and develop signal
  - Triggering causes the camera to capture an image and provide it as output on the IEEE-1394a cable
  - Strobe and triggering are optoisolated from other Camera circuits
  - Strobe circuits receive Vcc power from the external strobe-power source
  - RJ-45 Tabs ("11" & "12") are common/ground connections making a mechanical connection with the cable shield on sides of plug and circuit board mounted receptacle
  - Be aware that Ethernet cables cannot be used. Ethernet uses 8 pin connectors of the RJ-45 series.

**Figure 7. Auxiliary Input (10-pin RJ-45) Cable Diagram**

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**Table 3. Items Supplied**

ITEMS SUPPLIED		
Item	Description	Cohu Part Number
Items 1 and 2 supplied only when the Auxiliary Mount option is selected with camera order		
1	Mounting Block (mounts to top or bottom of Camera)	8476505-001
2	Screws (2), Pan Head, 2-56 x 3/16	0310039-002
3	Viewer/Control Software on CD	Cohu 7200 Viewer
<small>Note: Items 1 and 2 can be ordered separately as kit 8476-5. Item 3 is shipped with camera or can be downloaded from the cohu-cameras.com web site.</small>		

**Table 4. Item Typically Required But Not Supplied**

ITEMS TYPICALLY REQUIRED BUT NOT SUPPLIED		
ITEM	Description	Characteristics
1	Lens, C-mount (manual iris only)	For 1/2-inch sensor
2	Cable, IEEE-1394 (must supply power)	6-wire version to supply power
3	Cable, Auxiliary (optional)	Auxiliary cable for using the triggering and strobe functions if desired. Mates with RJ-45 connector on rear panel
4	Power source for strobe functions (Vcc). Noiminal 5 V dc at apporoximately 25 mA.	Via pin 7 of RJ-45 connector. Return line(s) are the strobe outputs. (Open collector)
5	Video monitor	Compatible with PC video output
6	PC, laptop or other	6-wire (powered) IEEE-1394a
7	Alternate Camera Control Software	National Instruments Lab View, or custom software written / modified for the 6100

2. Prepare the PC by verifying that it has an IEEE-1394a port with power output and also the appropriate software to communicate with the camera

3. Install a C-mount lens on the camera suitable for use with a 1/2-inch sensor.

4. Mount the camera

5. Connect the 1394a and if required the auxiliary cable

6. Obtain a picture from the camera. This requires use of the Viewer GUI software operating on a PC. See section 3.0 for Operating instructions.

7. Adjust mechanical back focus by rotating the lens and C-mount if required. See section 2.8.3.

8. Make any other adjustments to focusing and mechanical alignment if required.

9. Perform an operational test of the camera functions. Sections 2.8.1 through 2.8.4 provide additional installation instructions about the rear panel connectors, and other features.

**2.6.1 IEEE-1394a 6-pin Connector**

Plug the 1394a cable into the rear panel 1394a connector. Be sure the plug is properly oriented. Attempting to force it in improperly oriented could possibly apply voltage to the data and trigger lines and damage them.

**2.6.2 RJ-45 10-pin Connector**

If either the scene capture triggering input or the strobe functions are to be used for illuminating the scene, plug in the auxiliary cable connector to the 10-pin RJ-45 type connector

This connector has grounding tabs on each side. Thus, the mating cable plug also must have grounding contacts on the sides to which the cable shield is connected.

Note: This is not an 8-pin version the RJ-45 series of connectors used with Ethernet connections. Ethernet cables will not work.

**2.6.2.1 Trigger Input**

The trigger input (figure 8) is used to capture a scene at a chosen moment in time using an external hardwire connection. (The trigger function can also be implemented with the Viewer software.) This input is independent of the strobe outputs and their Vcc power input.

Triggering is optoisolated from other camera circuits. Pin 5 of the RJ-45 auxiliary connector connects through a 390 ohm resistor to the anode of a photodiode inside the camera. Pin 6 connects to the cathode of that diode. A minimum of 5 mA is recommended to drive this photodiode,

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**Table 5. Cables Required**

DESCRIPTION	CAMERA CONNECTOR	MATING CABLE PLUG
IEEE-1394a	6-pin IEEE-1394A	6-pin IEEE-1394a
Auxiliary	10-pin RJ-45 with side ground tabs	10-pin RJ-45 plug with side ground tabs connected to cable shield

*Note: This table lists only cables connecting directly to the Camera. Other cables will be required for interconnections with other equipment. See figure 6 for a typical installation.*

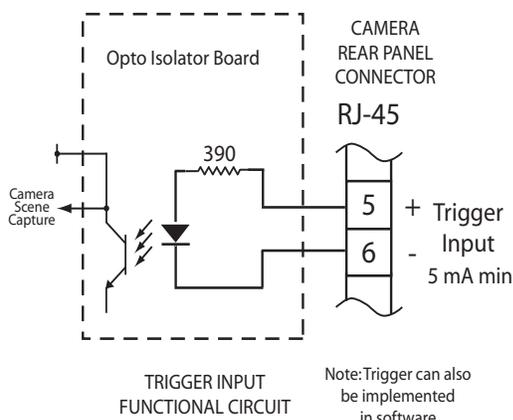
but for long term reliability it is better to use a minimum of 6.3 to 10 mA. Applying a TTL level 5 volts to the input would produce about 13 mA drive current.

### 2.6.2.2 Strobe Outputs and Vcc Input

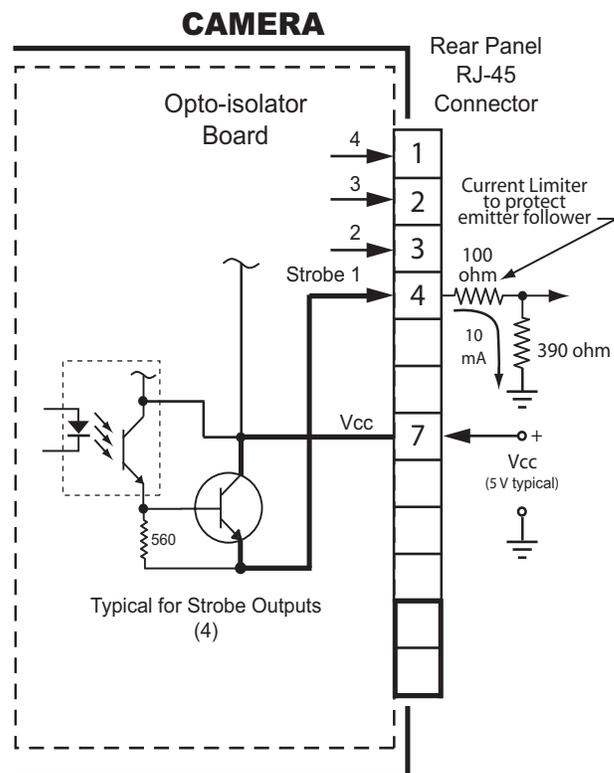
Using the strobe outputs requires that they be provided with their own input power (Vcc) on pin 7 of the RJ-45 auxiliary connector. These four outputs are isolated from other Camera circuits by a four stage optoisolated IC inside the Camera, and thus the strobe outputs require their own power from an external source to maintain this isolation.

Each of these four outputs is directly driven by an emitter follower transistor inside the camera (figure 9) without any current limiting resistor. An external current limiting emitter resistor must be provided outside the camera for each of these outputs or the internal transistors will be damaged.

Figure 9 shows a typical circuit using a 100 ohm current limiter into a 390 ohm load resistor.



**Figure 8. Trigger Input Functional Diagram**



**CAUTION: Shorting a strobe output to ground with Vcc applied will destroy the internal emitter follower transistor**

**Figure 9. Strobe Output Functional Diagram**

With 5 V dc applied for Vcc the approximate current through the internal emitter follower and external resistors would be 10 mA (1/4 W).

Continuous current drain from a strobe output should be limited to a maximum of 35 mA in an installed operation when the Camera is in service.

So long as the load driven by a strobe output does not short to ground, otherwise exceed the maximum current limitation, or backfeed any damaging voltage spikes the suggested load circuit shown in figure 9 can be modified as desired.

### 2.6.3 Lens Back Focus

After the C-mount lens is fully threaded into the camera body no back focus tracing is required.

### 2.6.4 Strobe Timing Reference

The strobe outputs must have their timings set (figure 22) to produce scene illumination

**Table 6. Drop-down Menu Selections**

Camera	Mode	Rate	Cohu	Help
Check Link	1280x960 Mono (16-bit)	7.5 pfs	Camera Reset	About 1394Cohu Demo...
Select Camera	_____		_____	Debug Setting
Init Camera	Partial Scan		Set Serial Number	
_____	_____			
Camera Model	Draft Mode			
Maximum Speed				
_____				
Show Camera				
Stop Camera				
Mirror				
Camera Control				
Strobe Setup				
_____				
One Shot				
Test Pattern				
Save Image				
_____				
External Image				
Positive Edge				
Negative Edge				
Both Edges				
_____				
Exit				

NOTES

The **Mode** and **Rate** columns above show only the items applicable to the model 6100 Camera. Grayed-out items that appear in the actual drop down menus are not listed here.

In the **Camera** column, certain items in the actual drop down menu will be grayed out depending on the selections currently in effect

during the time when the sensor is integrating an image. Timing illustration A in figure 10 shows that the full sensor integration period is available when the Camera (sensor) does not have a shutter period selected.

Illustration B in figure 10, however, shows that when the Camera is set for a typical shutter period of about one-half the normal period, the initial period of sensor integration is constantly being cleared by a string of pulses. The sensor is only allowed to integrate an image of the scene after these clearing pulses end. The remaining time would be the shutter period selected. It is during this period that the strobe outputs can be set to “fire” strobe lights on the scene.

The important thing to note is that the shuttering time selected occurs at the end of the normal integration period of the sensor — not during the initial period when the sensor is constantly being cleared. The clearing stops at the time in the when the shuttering time selected remains in the vertical interval.

If the Camera (sensor) has been set for a very short shuttering period, only a very slight integration time at the end of normal integration is available.

**3.0 OPERATION**

Operating the camera consists primarily of making menu selections and settings. The following paragraphs briefly describe the function of each selection. Figure 19 shows a window that opens if the Camera has problems acquiring an image.

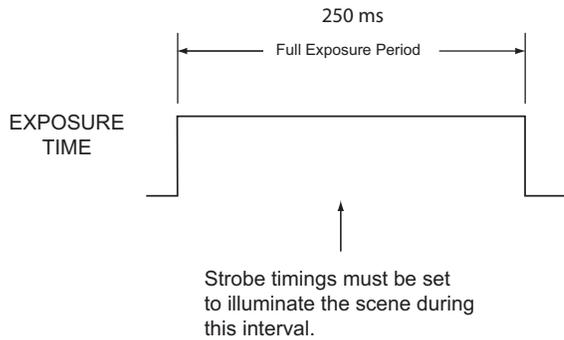
**3.1 Control Inputs and Outputs**

All operating functions of the Camera occur through two electrical connectors are located on the rear panel. One is a six-pin IEEE-1394a interface and the other is an RJ-45 connector used for two functions that may not be used: triggering the Camera to capture a scene and strobing lightin to illuminate the scene.

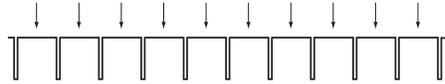
**3.2 Software Control**

Viewer software must be used to control most camera functions. The Cohu 7200 GUI Viewer can be used for basic control functions or a third-parts software such as National Instruments Lab View can be used. For some applications it may be preferable to have software

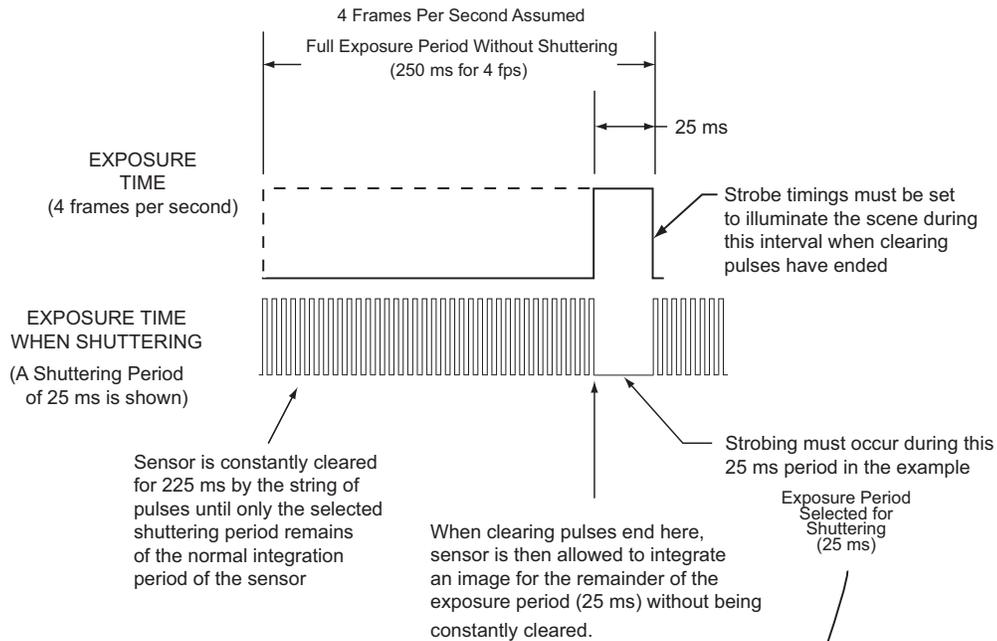
**A. NO SHUTTERING**



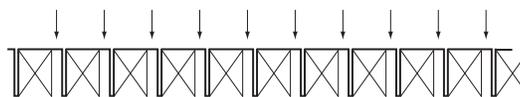
250 MS STROBE TIMES SHOWN DURING 10 INTERVALS WITHOUT SHUTTERING



**B. WITH SHUTTERING**



25 MS STROBE TIMES SHOWN AT END OF 10 INTERVALS



**Figure10. Strobe Timing Reference**

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written or modified for the specific application to which the camera is to be used.

### 3.3 Frame Rates

The basic full-resolution (659 [H] x 494 [V]) frame rate of the camera is about 70 frames per second (fps); 30 fps nominal.

Increased frame rates are available by selecting the Partial Scan mode to scan fewer lines. As few as 50 lines can be scanned.

### 3.4 Menu Items

Section 3.5 lists each item that appears in the five drop down menus and briefly describes their functions. The descriptions covered in this section are shown in table 6.

Some of the menu selections require that Camera operation be halted by the **Stop Camera** function in the **Camera** menu.

### 3.5 “Camera” Drop-down Menu Items

This section briefly describe the various drop-down menu selections available under **Camera**. See the Camera column in table 6 for a summary of these selections. Table 7 expands on functions of the Camera drop down menu selections. They are also described in sections 3.5.1 through 3.5.10.

#### 3.5.1 Check Link

This selection (figure 17) causes the Viewer software display all available cameras on the 1394a cable.

#### 3.5.2 Select Camera

Placing the menu cursor over this item causes a flyout window (figure 14) to appear showing all the available cameras on the 1394 cable. Click on the desired camera.

#### 3.5.3 Init Camera

Clicking on this item causes the viewer to connect with the camera to determine its various operating characteristics (figure 15).

#### 3.5.4 Camera Model

Clicking on this item causes a window to appear (figure 21) showing the vendor associated with the selected camera, the model number of this camera, and the unique identification number of this camera.

#### 3.5.5 Maximum Speed

Clicking on this item opens a new window (figure 18) that shows the IEEE-1394 data rate.

#### 3.5.6 Show Camera

Clicking on this item starts camera operation. If the image generated on the picture monitor is totally black or totally white, it may be necessary to change settings in the Camera Control . . . menu item. (Shuttering, Gain, and Brightness may not be properly set for the light level on a scene).

#### 3.5.7 Stop Camera

Stop camera puts it into a “pause” mode and ends output of an image. The Camera must be stopped to activate certain other menu selections. Figure 13 shows the menu after Stop has been selected. Note that Stop is grayed out and Show Camera is active.

#### 3.5.8 Mirror

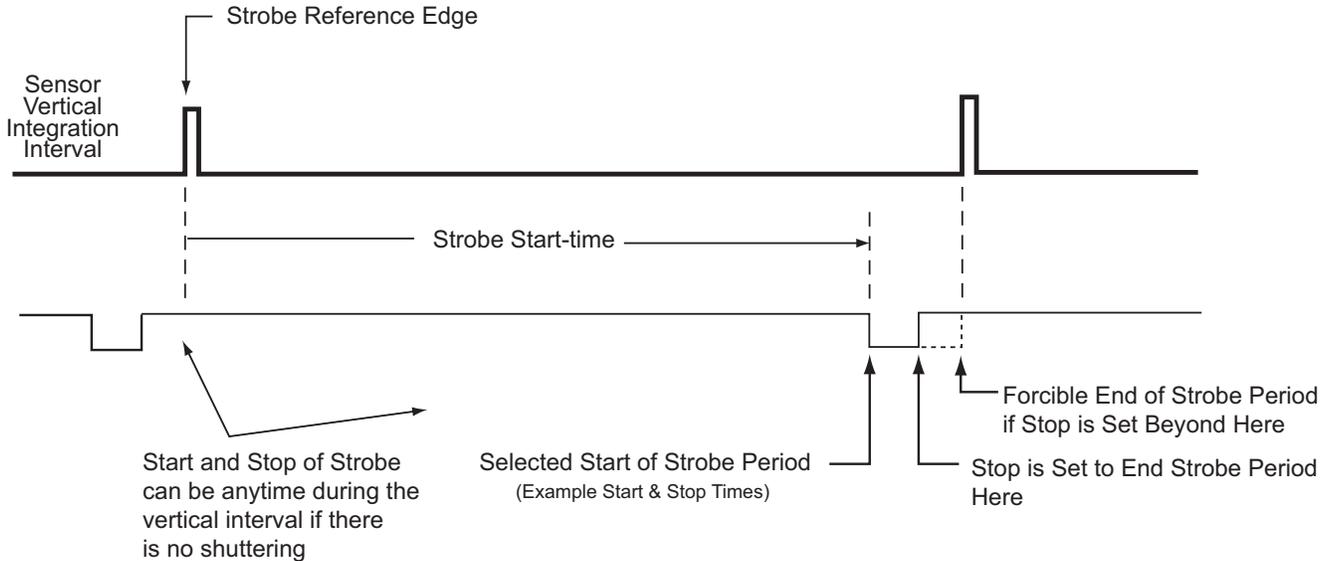
Mirror causes the image being generated to switch left and right sides. Top-bottom stays the same.

#### 3.5.9 Camera Control . . .

Opens up a new window (figure 16) with slider bars to control Shuttering, Gain, and Brightness. These values can also be changed by using the right and left arrow keys and the keyboard. A shuttering rate cannot be set that is longer than the frame rate currently established.

Nominal values: Gain to 215; Brightness to 150; shuttering to 1/30 sec (33 ms shutter period).

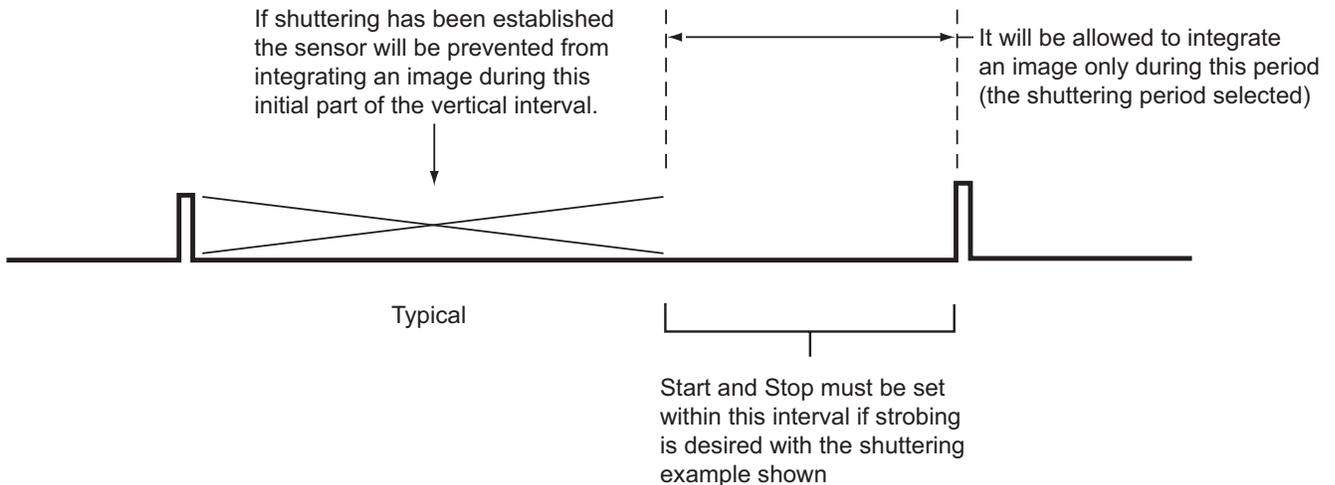
**A. Available Strobing Interval Without Shuttering**



Note: Start and Stop are set in the viewer software strobe Setup Window  
This window is accessible from the Camera Drop-down menu.

(See Figure 22)

**B. Available Strobing Interval when the Camera is Being Shuttered**



**Figure 11. Strobe Output Field Reference`**

**7210 CAMERA****INSTALLATION AND OPERATION****3.5.10 Strobe Setup**

Four outputs on the rear panel RJ-45 connector can be used to strobe drive external circuits that operate strobe lights. These outputs could be used to strobe other functions in machine vision applications, too. Clicking on this menu item opens a new window (figure 22) containing four sliding bars to set the start and stop point for each output. The related box must be checked to activate the output. The strobe should not be set for a timing that is not consistent with the existing frame rate or for when a shuttering selection has reduced the initial part of the integration period of the sensor. See section 2.8.4 for shuttering details.

**3.5.11 One Shot**

When the camera is stopped, this menu item can be clicked to cause the camera to capture a single image and provide it as output.

**3.5.12 Test Pattern**

When the camera is stopped, this menu item can be selected to turn-on a gray scale test pattern output.

**3.5.13 Save Image**

Selecting this item prompts for a storage location and image file type (bmp or tif).

**3.5.14 External Trigger**

The camera can be externally triggered either by a rear-panel hard wire input on the RJ-45 connector or by a software input from the Viewer. This causes the camera to obtain an image at a desired moment in time and provide that image as an output.

When this menu item is selected, three other choices become available: Positive Edge, negative edge, and Both. (Both is a special function.)

**3.5.15 Positive Edge**

Select Positive Edge if the camera is to be triggered on a positive-going edge of a pulse or waveform.

**3.5.16 Negative Edge**

Select negative edge if the camera is to be triggered on the negative-going edge of a pulse or waveform.

**3.5.17 Both Edges**

When the both edge menu item is selected the triggering input to the camera must have equal positive and negative times.

**3.5.18 Exit**

Selecting Exit shuts down the camera and exits the Viewer.

**3.6 Mode Menu Items**

The following paragraphs briefly describe the function of each selection available under the drop down Mode menu selection.

**3.6.1 659 x 494 Mono (8 Bit)**

This is the maximum full-frame mode for the camera. The grayed-out selections apply to other cameras. The frame rate at full scan is 70/30 frames per second. An increased frame rate can be obtained by using the Partial Scan mode.

**3.6.2 Partial Scan**

Selecting Partial Scan makes it possible to increase the frame rate of the camera. The Camera operates at 70/30 frames per second when all 659 scan lines are being used. Selecting fewer than 659 lines increases the frame rate — though not in proportion. Partial scan can be as few as 50 lines.

The Camera must be stopped before the Partial Scan Mode can be selected. Clicking on Menu produces a drop-down list of selections from which the Partial Scan mode can be selected. This opens a new window: Partial Scan Setup (figure 20) which has a slider bar to change the number of lines from 659 to some other value. Using the right and left computer keypad arrows will step the number of lines one at a time. Use the slider to get close, then step with the right/left keys.

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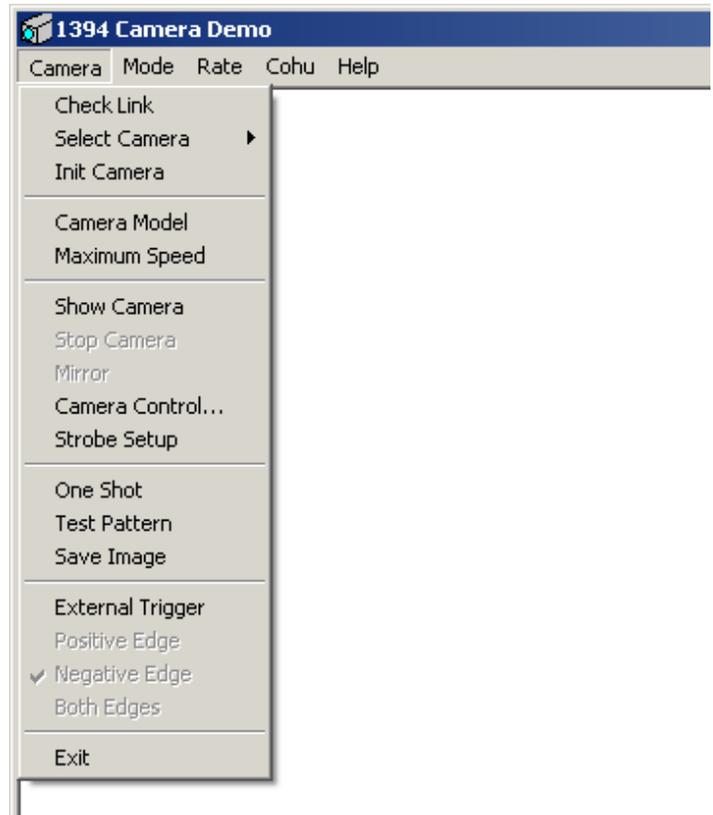
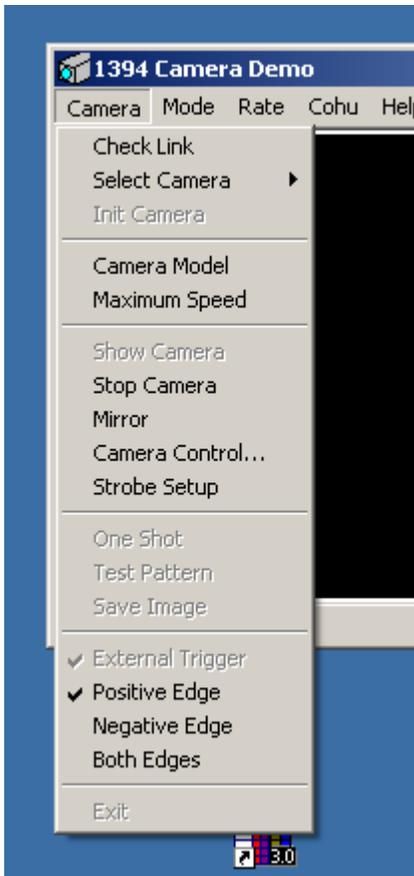
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Table 7. "Camera" Drop-down Menu Items

ITEM	NAME	FUNCTION
1	Check Link	Polls IEEE-1394a for all available cameras
2	Select Camera	Opens a window to select the desired camera from a list
3	Init Camera	Initializes the camera selected in item 2
4	Camera Model	Shows model of camera as entered in camera ROM
5	Maximum Speed	Shows IEEE-1394a speed (400 Mbits/sec)
6	Show Camera	Activates image capture at the current frame rate
7	Stop Camera	Deactivates image capture. Activates the One Shot, Test Pattern, Save Image, & External Trigger
8	Mirror	Switches the camera image output left-right
9	Camera Control	Opens a new window for control of Brightness, Gain, & Shutter
10	Strobe Setup	Opens a new window for control of the 4 strobe outputs (See figure 22)
11	One Shot	Stores the current image. Camera must be stopped before use of One Shot
12	Test Pattern	Generates a gray scale test pattern output. First select Stop Camera, then Test Pattern, then Start Camera. A gray scale test pattern should then be visible. Stop Camera must be selected to use this feature
13	Save Image	Opens a window prompting for a storage location. Tiff or bmp file format can be selected. Stop Camera must be selected to use this feature
14	External Trigger	Activates the external trigger input. Stop Camera must be selected to use this feature. A software trigger = 0 input then requires another input to select whether a positive or negative edge initiates integration of an image. The integration period is then determined by the currently selected frame rate. A trigger = 1 software input initiates integration of an image beginning with a negative edge. The integration then ends with a subsequent positive edge. (The width of this negative-going pulse is the integration period.) See text for additional requirements.
15	Positive Edge	Begins obtaining an image upon receipt of a positive-going trigger edge. Ends with the currently established frame rate.
16	Negative Edge	Begins obtaining an image upon receipt of a negative-going trigger edge. Ends with the currently established frame rate.
17	Both Edges	Begins obtaining an image on the negative-going edge and continues until the positive edge. Outputs the image after the positive edge. Not a D-Cams mode.
18	Exit	Shuts down the Viewer GUI software

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**Figure 12. “Camera” Window (with typical selections)**

Only complete lines can be scanned. It is not possible to “narrow down” the scan from 494.

### 3.6.3 Draft Mode

Draft mode is a quick way to increase frame rate temporarily for setup and adjustment purposes. The number of lines is reduced from 659 to 240 — resulting in a higher frame rate.

### 3.7 Rate Drop Down Menu Items

This is a general purpose viewer. The frame rates shown in this drop down menu are typical frame rates for typical machine vision cameras that may be used with the viewer. No selection can be made in this menu.

#### 3.7.1 7.5 fps (Frames Per Second)

A default listing that cannot be changed. This Viewer is based in a generic software meant to be tailored to cameras of many different capa-



**Figure 13. “Camera” Drop-down Menu (Camera Stopped)**

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## 7210 CAMERA

bilities. Thus many of the grayed out selections do not apply to the 7200 Camera.

### 3.8 Cohu Drop Down Menu Items

Two selections are available under the Cohu drop down menu.

#### 3.8.1 Camera Reset (Reset EEPROM)

Caution: Do not click this selection without understanding the complete procedure required..

Reset should be used only when it is desired to clear the EEPROM of its current settings and return them to the factory defaults.

After Reset is clicked the Camera power must be turned off and then back on. It takes at least 40 seconds for the EEPROM to be reinitialized after power up. **DO NOT TURN THE CAMERA OFF AGAIN DURING THIS TIME.** It could result in an inoperative Camera.

#### 3.8.2 Set Serial Number

See section 3.10.3 for the ramifications of changing this number.

This selection is for setting or changing an identification number for the Camera. It is used by the operating system device manager and the Viewer software to identify the Camera.

This is an internal serial number. It is not the same as the factory manufacturing serial number assigned to the Camera.

### 3.9 Help Drop Down Menu Items

The Help drop down menu offers two selections to click on.

#### 3.9.1 About 1394 Cohu Demo

Provides information about the version level of the Viewer software.

#### 3.9.2 Debug Settings

Opens a new window (figure 23) with two slider bars. The top bar for DLL Trace Level is currently implemented. The bottom bar (for Driver Trace Level) is not functional.

### 3.10 Pop-up Viewer Windows

A variety of new windows open up in response to selections made on the drop down menus. Each of these windows is describes in this section.

#### 3.10.1 Camera Control

This window (figure 16) is opened from within the camera drop down menu. It has three slider bars:

- brightness
- gain
- shutter.

The Brightness bar controls the black level reference setting. Settings toward the left favor dark areas of the scene at the expense of white areas. Settings toward the right side of the slider bar compress the dark areas of the scene into less of the dynamic range.

To favor darker areas of the scene (make their details more visible), position the slider bar more to the left. If the darker areas of the scene do not contain any details of interest, then position the slider bar more to the right.

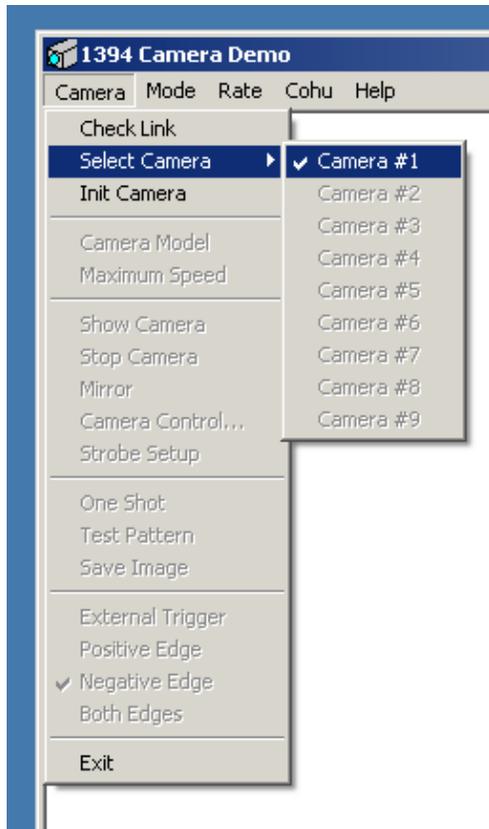
The Gain bar sets internal gain of the Camera through a certain range of adjustment. Moving the bar to the far right makes the camera more sensitive to the scene lighting but with some additional noise in the scene image. With the bar fully left, this adjustable gain range is set to minimum and noise in the scene will be minimized.

The Shuttering bar reduces the amount of time the sensor is allowed to integrate an image. When any frame rate is established for the camera there is a corresponding amount of time established for the sensor to capture (integrate) an image. This basic integration period can be reduced by sliding the shuttering bar to the right.

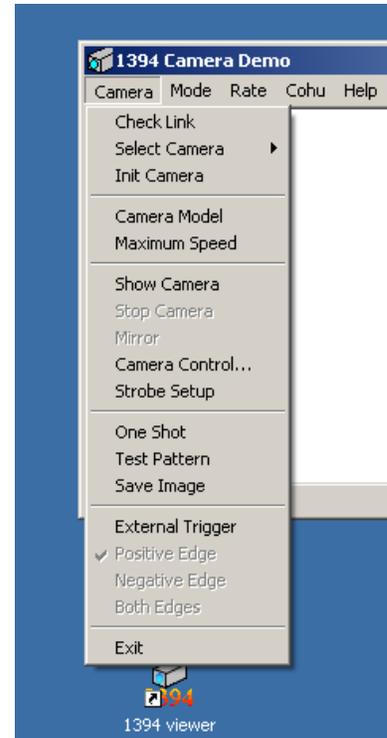
Clearing pulses are applied to the sensor which prevent it from integrating an image until they end. The shuttering period is the amount of time remaining for the sensor to integrate an image before it would normally end its integration period anyway based on the established frame rate. See section 2.8.4.

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**Figure 14. Camera Window with Select Camera Selected**



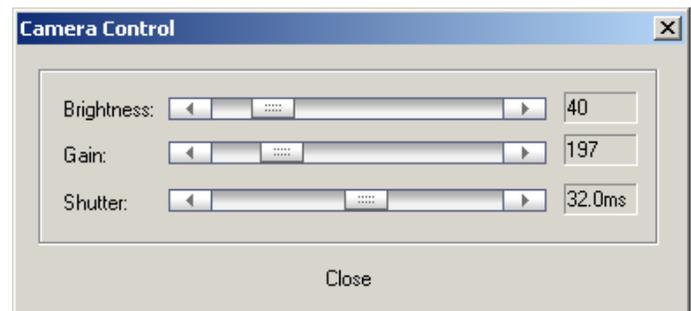
**Figure 15. Camera Window After Init Camera Selected**

When shuttering is established the Camera becomes less sensitive to scene lighting but as a benefit any movement between the Camera and the scene is minimized. Shuttering can remove any “smear” noticed in the scene due to movement.

The related strobe outputs, if used, must be set to be within the image capture time of the sensor, so if shuttering is being used the strobes must occur during the time the sensor is integrating the image — which will be after the clearing pulses end and the sensor is allowed to integrate the scene image. Section 2.8.4 and figure 11 further explain this.

### 3.10.2 Strobe Setup

This window (figure 22) is opened from the Camera drop down menu. It has four slider bars to control the start and stop point for the four strobe outputs. A check box is included with each bar to turn the related strobe output on and off. The output can also be made positive or negative with the Positive check box.



**Figure 16. Camera Control Window**

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The leading and trailing edges can be dragged to the desired start and stop timing referenced to the beginning of the vertical interval. These start and stop timings must be within the time the sensor is integrating the scene image. The frame interval is determined by the frame rate currently being used. If shuttering is being used, though, the sensor captures the scene image later in its normal integration period. See section 2.8.4.

### 3.10.3 Cohu Set Serial Number

**Note: Do not click this selection before reading the following:**

This window (figure 24) is opened from the Cohu drop down menu.

A camera serial or identifying number can be entered here in place of the existing number. Be aware, however, that changing this number requires going out to the operating system device manager and having it “find” this camera with a new identifier.

And then the Viewer software will also have to determine the characteristics of this “new” cameras and load a suitable driver to match these characteristics.

When a new number has been entered the camera will not be operational again until all this has occurred.

It is not possible to revert to the old number, if desired, until the camera is first operational with the new number.

### 3.10.4 About 1394 Cohu Viewer

This window (figure 21) is opened from the Help drop down menu. The window provides version information about the Viewer.

### 3.10.5 Debug Settings

This window (figure 23) is opened from the Help drop down menu when clicking Debug Settings. It offers two slider bars to help with debugging.

## 4.0 HANDLING INSTRUCTIONS

Refer to this section for instructions about handling the Camera during receiving from the

Common Carrier Agent and for returning the Camera to the factory in the event that is necessary.

Section 4.2 covers handling the camera with regards to static discharge. This is primarily a consideration when the Camera is opened for maintenance operations — which this manual does not cover.

### 4.1 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.

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.

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.

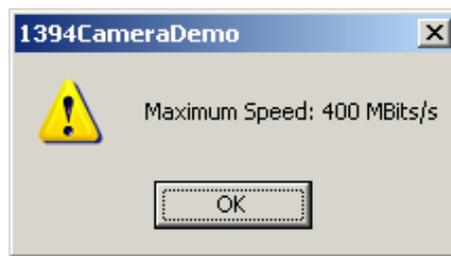
To return the product to the factory for service, please contact the Customer Service Department for a Return Authorization (RA) Number.

### 4.2 Static Discharge Protection

Procedures in this manual do not require entry into the housing of the Camera. But in the event that a disassembled Camera is being handled, 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.

**7210 CAMERA****Figure 17. Check Link Verify Window****INSTALLATION AND OPERATION****Figure 18. Maximum Speed Window (IEEE-I394 Maximum Bit Rate)****Figure 19. Problem Acquiring Image Window**

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 a 1 megohm or greater value resistor.
3. Use a wrist strap connected to ground through a 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 exposed 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.

**4.3 Preparation for Shipment and Storage**

Maintain the Camera storage environment within a range of -20 to 70 °C (-4 to 158 °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:

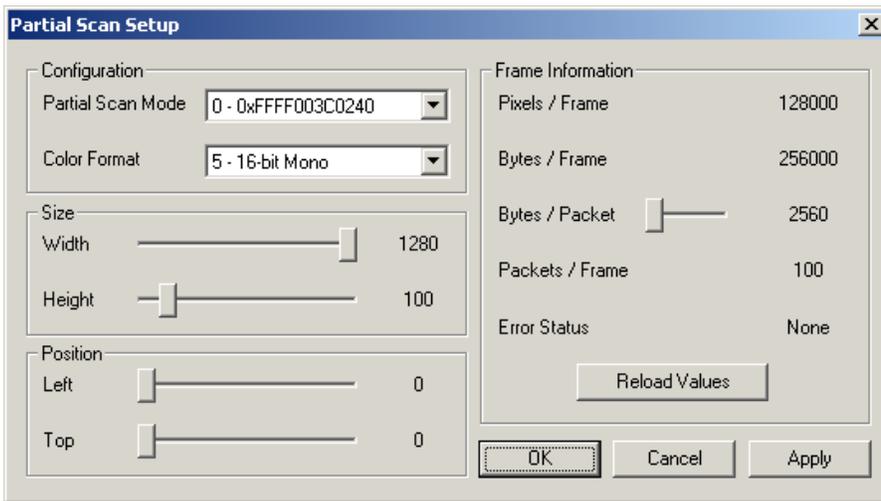
**cst@cohu.com  
or  
858-277-6700 extension 261**

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.

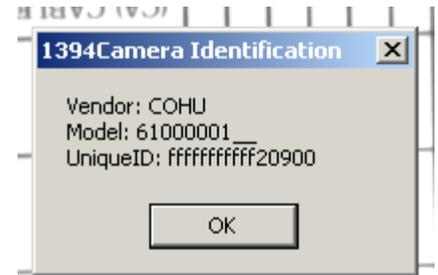
**-end text-**

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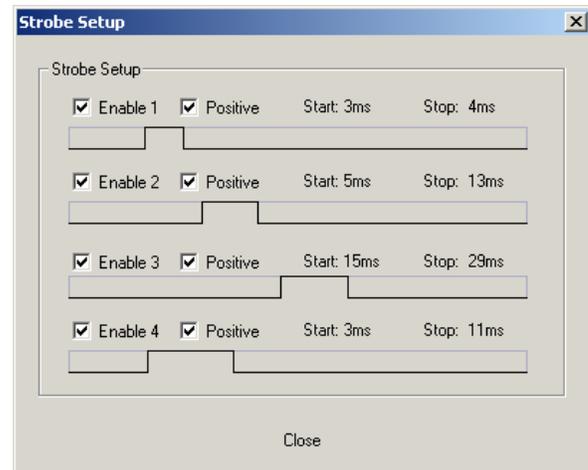
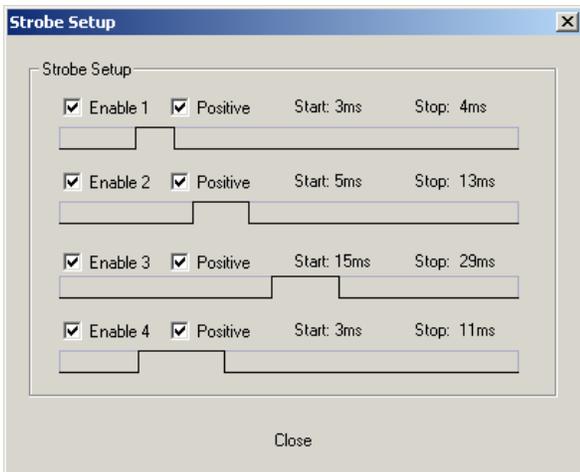
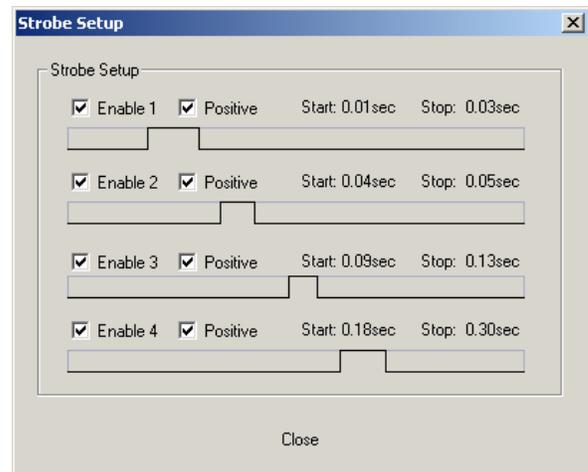
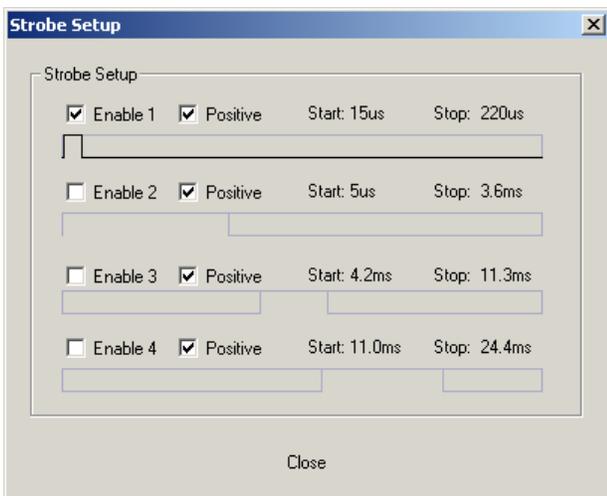
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**Figure 20. Partial Scan Setup Window**



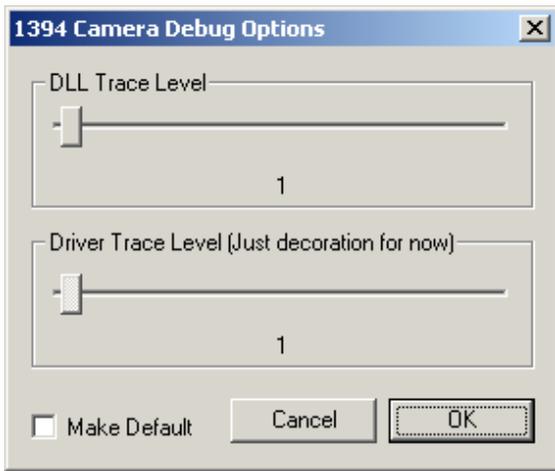
**Figure 21. Camera Identification Window**



**Figure 22. Strobe Windows (Various Typical Settings)**

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**Figure 23. Debug Window**



**Figure 24. Set Serial Number Window**

**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