

6110 SERIES

Megapixel IEEE-1394a Camera

INSTALLATION AND OPERATION MANUAL

Preliminary 3a 4-14-05



Figure 1. Monochrome Progressive Scan Camera

Technical Manual 6X-1051

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COHU
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**6110 CAMERA
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1.0 GENERAL DESCRIPTION

This introduction briefly describes the overall characteristics of the Model 6112 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 CCD interline transfer progressive scan sensor. The glass faceplate is 0.75 mm thick with a reflective index of 1.5. There are 1360 horizontal and 1024 vertical active pixels. Pixels are square: 4.65 μm x 4.64 μm .

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.

The Camera obtains enhanced sensitive and low dark current through use of a Hole Accumulation Diode (HAD) sensor.

The sensor offers an electronic shutter with variable charge store time so that a full frame image can be obtained without a mechanical shutter.

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

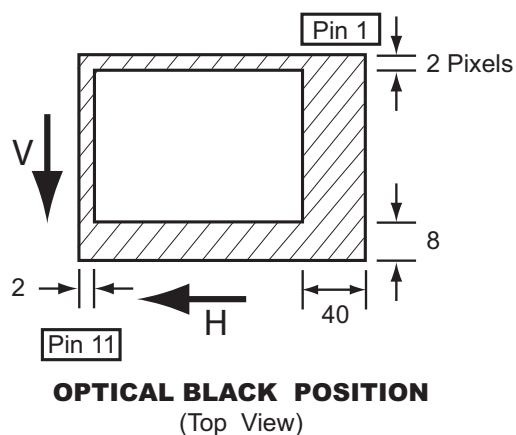


Figure 2. Sensor Optical Black Areas

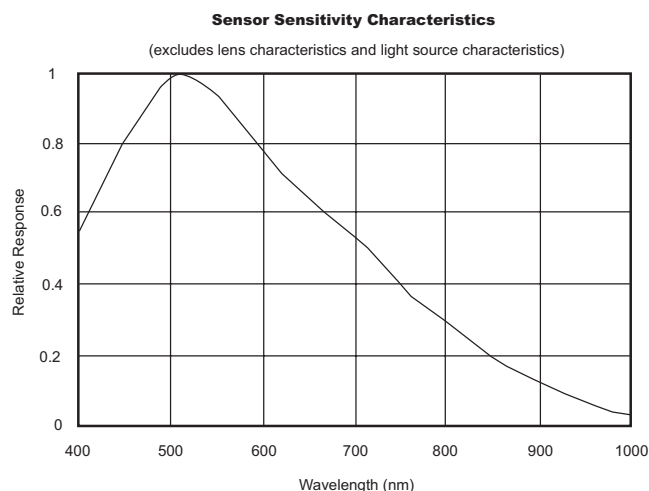


Figure 3. Sensor Sensitivity Characteristic

from outside the camera to maintain complete isolation from the other camera circuits.

1.2 Mechanical Characteristics

The 6110 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 these dimensions do not include the adjustable CS-mount. Also note that the base of the Camera is dimensioned both with and without the mounting block. It can be removed if desired.

The CS-mount lens adapter threads into the front of the housing. Adding the 5-mm extension

6110 CAMERA**INSTALLATION AND OPERATION****Table 1. Specifications**

ELECTRICAL	
Sensor	1/2-inch format 4.65 micron x 4.65 micron
Active Pixels	1360 (H) x 1024 (V)
Resolution	1024 x 1024 tv lines
Sensitivity	3 lux, faceplate for full video, min gain, 1/30 sec exposure
Frame Rate	4 f/s at full resolution; 15 f/s at 256 lines/frame
Scanning	1280 (H) x 960 (V); Fewer than 960 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 30 dB manually programmable
S/N	60 dB
Gamma	1.0 fixed
Image Processing	Mirror imaging and 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
MECHANICAL	
Dimensions	1.53 high x 2.13 wide x 3.74 long in inches (39 x 54 x 95 mm)
Weight	1.0 lb (454 grams)
Connectors (2)	IEEE 1394a (6 wire) video/control/power; RJ45 (10 wire) Optoisolated trigger input; 4 discrete optoisolated outputs
ENVIRONMENTAL	
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)

ring (provided) allows C-mount lenses to be used with the Camera.

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 four ways:

1. By the lens

2. To the top of the case

3. Directly to the bottom of the case, and

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

The top of the case has a single 1/4-20 hole for mounting purposes.

The bottom of the case has a pair of threaded 6-32 x 0.086-inch deep holes for direct mounting or these mounting points can be used

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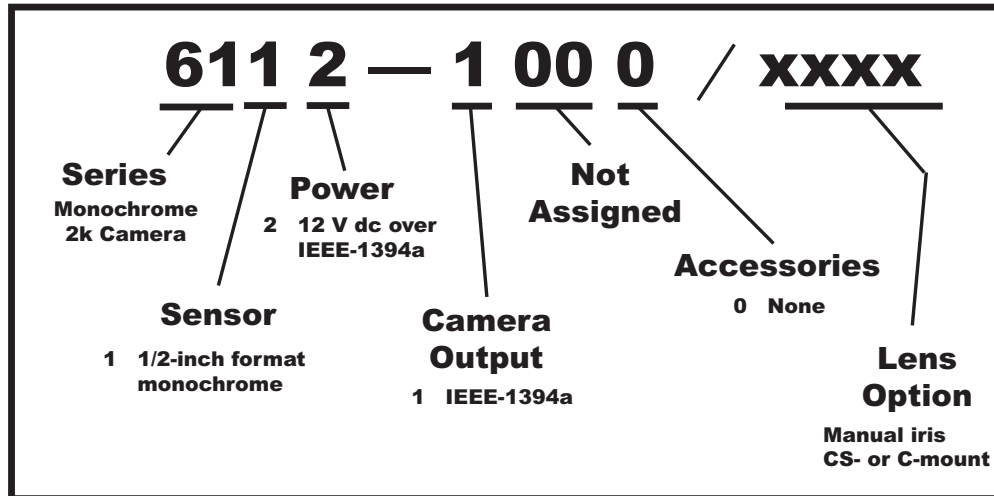


Figure 4. Model Number Interpretation Diagram

to attach the removable mounting block which then provides two 1/4-20 mounting holes.

1.2.1 CS-mount or C-mount Lens

Use a manual-iris lens compatible with the 1/2-inch sensor in the camera. Either a CS-mount lens or a C-mount lens can be used. Use of a C-mount lens will require that the 5-mm extender supplied with the Camera be threaded onto the C-mount lens before it is then threaded onto the CS-mount adapter.

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.

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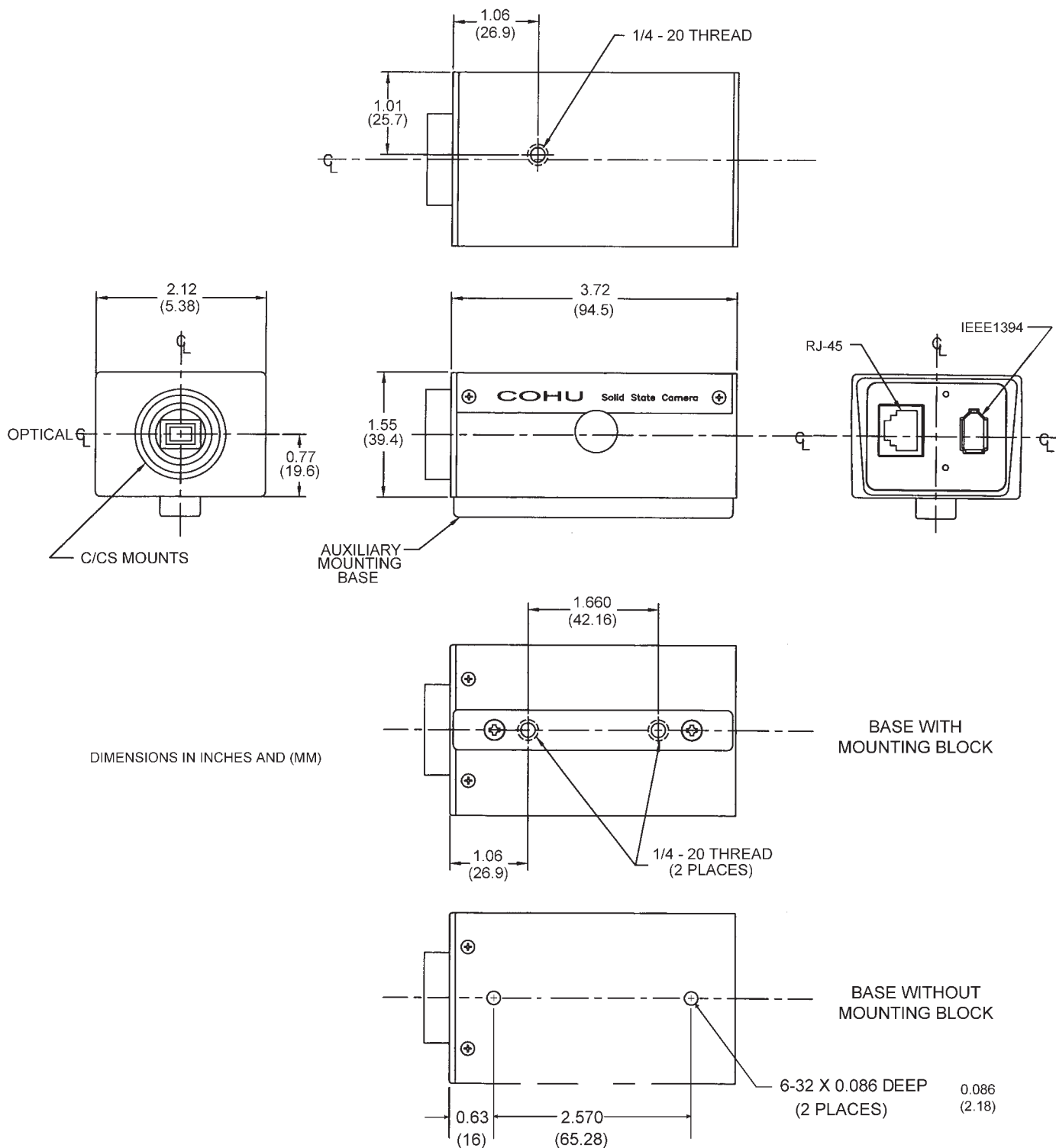


Figure 5. Dimensions, Model 6112

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

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. 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 6100 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

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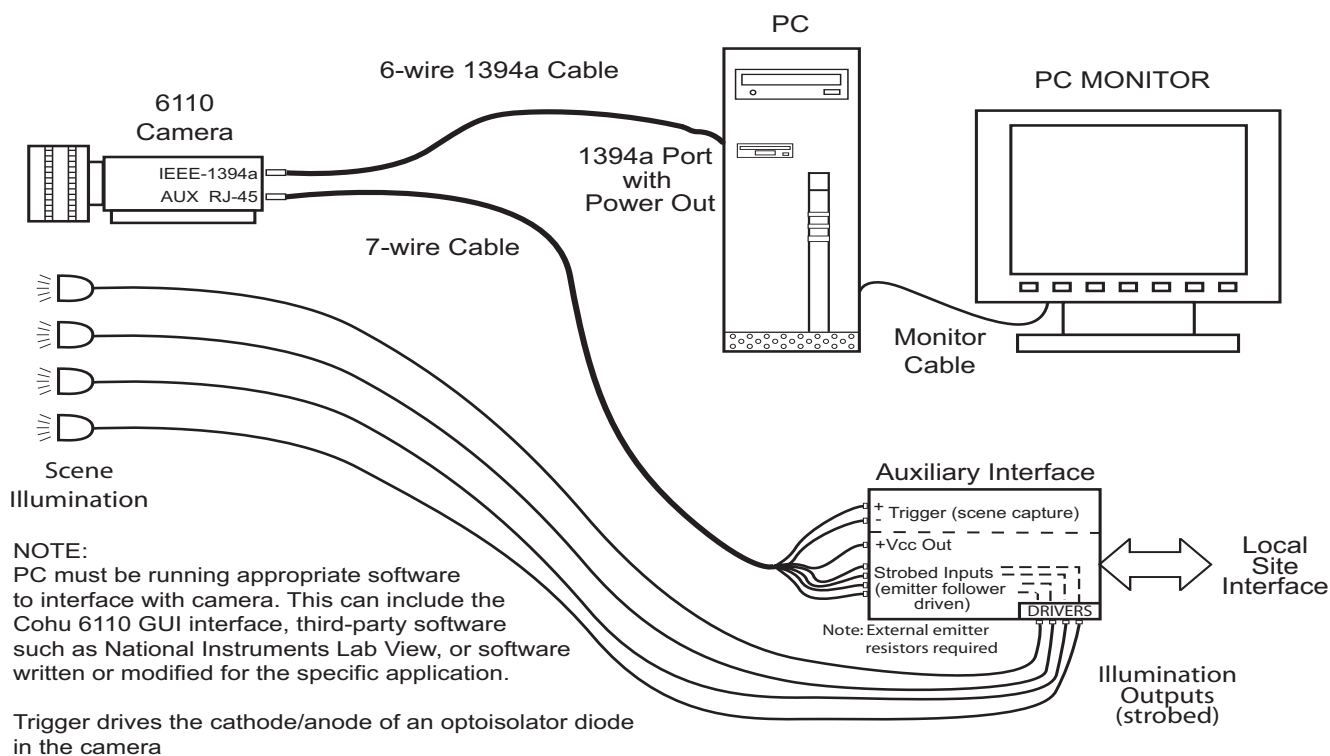


Figure 6. Typical Installation Interconnections

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.

2.5 Mounting Requirements

The dimensions shown in figure 5 related to mounting the Camera. The Camera can be mounted in four 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 the single 1/4-20 threaded hole on the top of the case

3. By the two 6-32-0.086 threaded holes on the bottom of the case

4. By two 1/4-20 threaded holes on a mounting adapter that can be installed on the bottom of the case. The Camera is typically shipped with this mounting block installed.

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

2.6 Installation Procedure

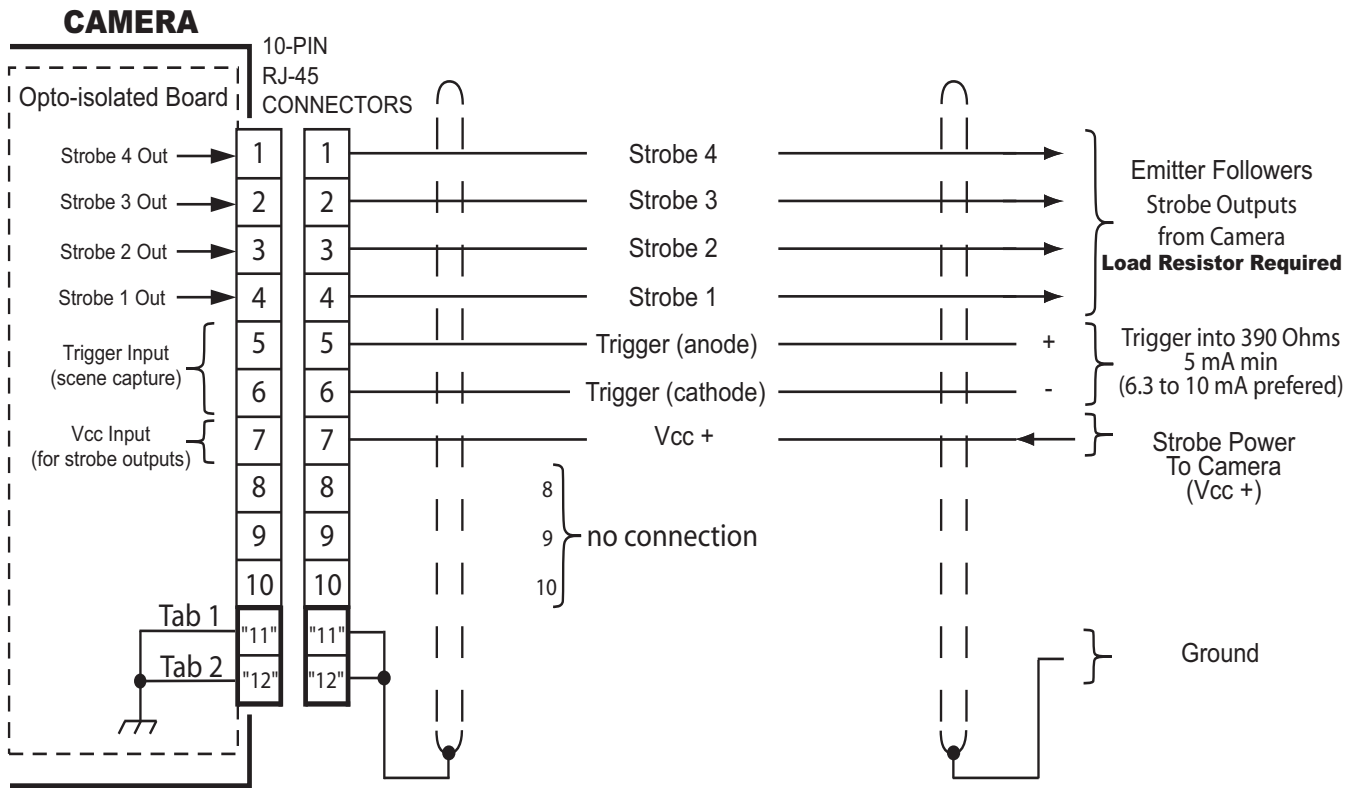
Prior to installing the camera it may be necessary to prepare an auxiliary interface if the triggering and strobe lines on the RJ-45 connector are to be used. See figures 6 and 7.

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.

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- 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
Kit 8366-7 Supplied Items		
1	CS-mount	8359208-001
2	Set Screw, stainless steel, hex head, nylon tipped, 4-40-5/32	2010258-005
3	Hex/Allen Wrench, L-style, 0.050-inch across flats	9710010-009
4	5-mm Extender (CS to C-mount adapter)	2010695-001
Also Included with Camera (not part of kit 8366-7)		
5	Mounting Block (mounts to bottom of Camera)	8369405-003
6	Screws (2), Flat Head, 6-32 x 3/8	0310010-027
7	Camera Control Software on CD	Cohu 6100 Viewer
<i>Note: Items 3 & 4 typically supplied loose. Items 5 & 6 typically part of camera body when shipped. Item 7, the CD, is supplied loose.</i>		

Table 4. Item Typically Required But Not Supplied

ITEMS TYPICALLY REQUIRED BUT NOT SUPPLIED		
ITEM	Description	Characteristics
1	Lens, CS-mount or 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). Noimnal 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

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.)
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 CS- or C-mount lens on the camera suitable for use with a 1/2-inch sensor. It may have to be mechanically back focused once the camera is operational. Back focus will have been factory set using the lens that the Camera was ordered with, but if the Camera was not ordered with a

lens then a typical lens would have been used. A field supplied lens may have a slightly different characteristic and thus require back-focusing of the lens mount adapter. This procedure is described in section 2.8.3.

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, the back focus adjustment for the lens, and other features.

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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.

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 RJ-45 type 8-pin Ethernet connector. Ethernet cables will not work.

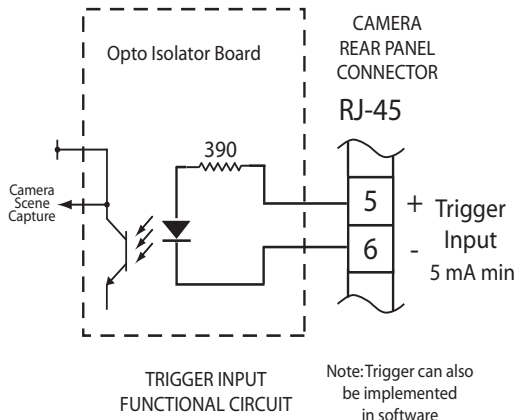
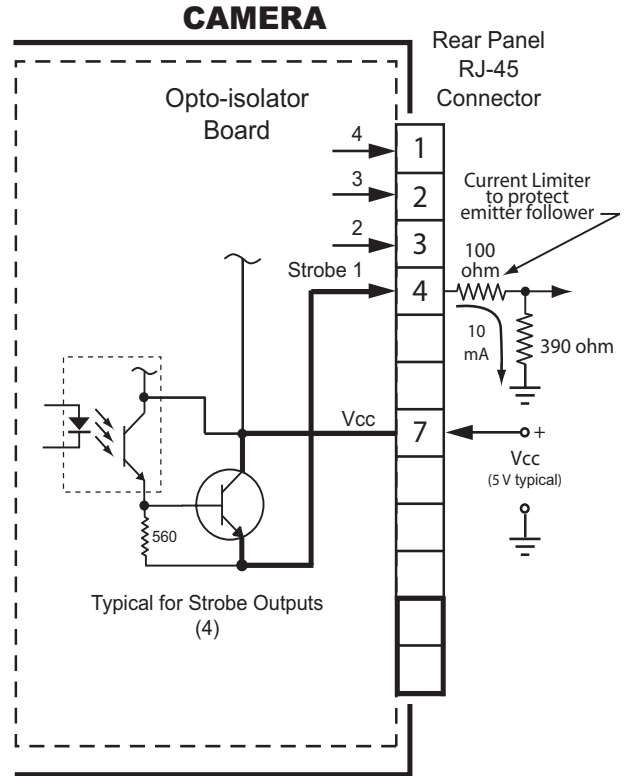


Figure 8. Trigger Input Functional Diagram



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

Figure 9. Strobe Output Functional Diagram

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 hardware 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, 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

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	_____		Set Serial Number	
_____	Partial Scan			
Camera Model	_____			
Maximum Speed	Draft Mode			

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

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. 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

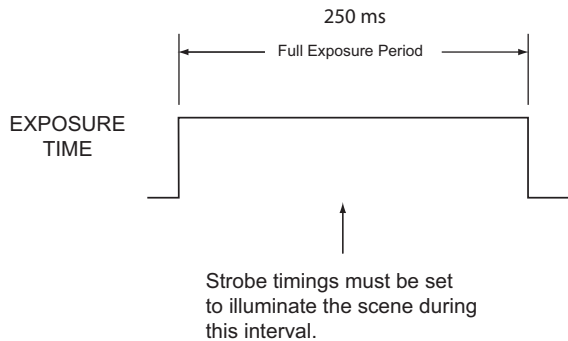
Once the camera is powered up and a picture has been obtained, the lens may have to be back focused before the Camera can be used. The lens must be fully threaded into the CS-mount (or for a C-mount lens into the 5-mm extender and then into the CS-mount). During any adjustments the lens and CS mount must be turned as unit at all times. The back focus adjustment is performed by rotating the whole assembly as a unit in and out of the housing of the camera. Back focus should only be changed after it has been determined that it is required. Proceed as follows for a step-by-step procedure to back focus the lens:

1. Verify that the setscrew is backed out sufficiently for the CS-mount to be threaded in and out of the Camera housing.
- 4.. Set the mechanical focus ring on the lens to infinity focusing
5. Turn on the camera
6. Obtain a picture on the monitor on a test

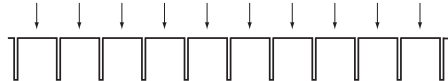
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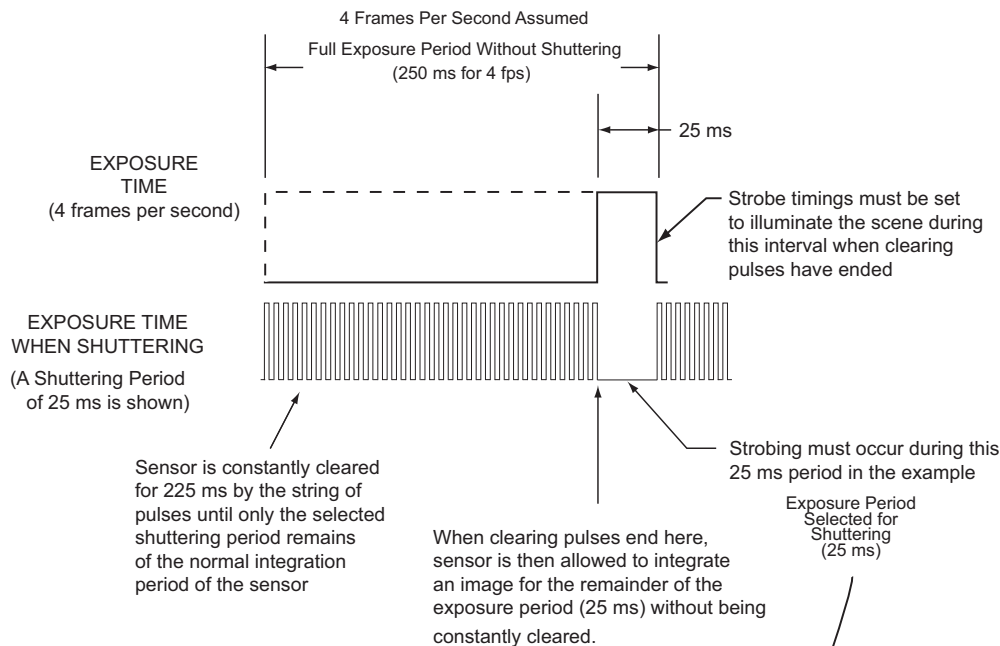
A. NO SHUTTERING



250 MS STROBE TIMES SHOWN DURING 10 INTERVALS WITHOUT SHUTTERING



B. WITH SHUTTERING



25 MS STROBE TIMES SHOWN AT END OF 10 INTERVALS

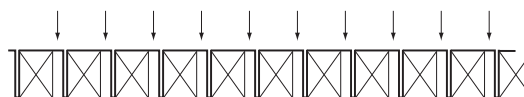


Figure10. Strobe Timing Reference

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pattern or scene with fine details sufficiently far away that it is into the infinity focusing distance of the lens

7. Rotate the CS-mount adapter and lens as a unit in and out of the Camera to obtain the best possible focus
8. Snug down the setscrew. Do not overtighten. It is nylon tipped.
9. Continue with any other required performance tests

2.6.4 Strobe Timing Reference

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

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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 6100 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 written or modified for the specific application to which the camera is to be used.

3.3 Frame Rates

The basic full-resolution (1280 [H] x 960 [V]) frame rate of the camera is about four frames per second (fps). This is a period of about 250 ms.

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

3.4 Menu Items

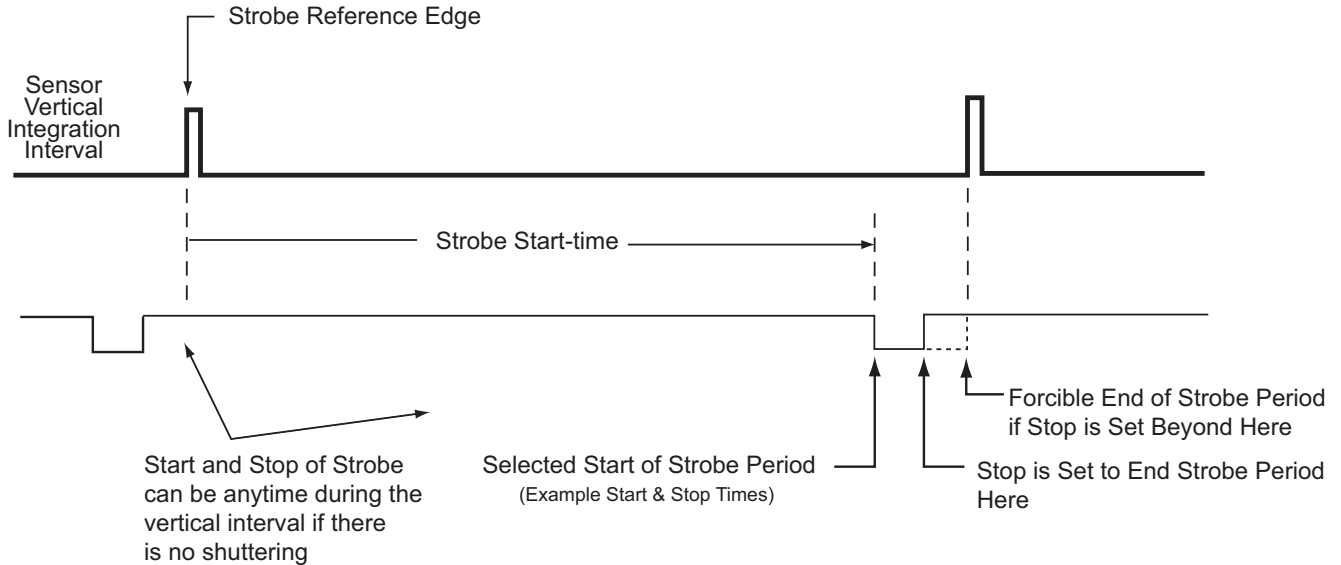
Section 3.5 lists each item that appears in the five drop down menus and briefly describes their functions. The descriptions covered in this section are shown in table 6.

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.

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

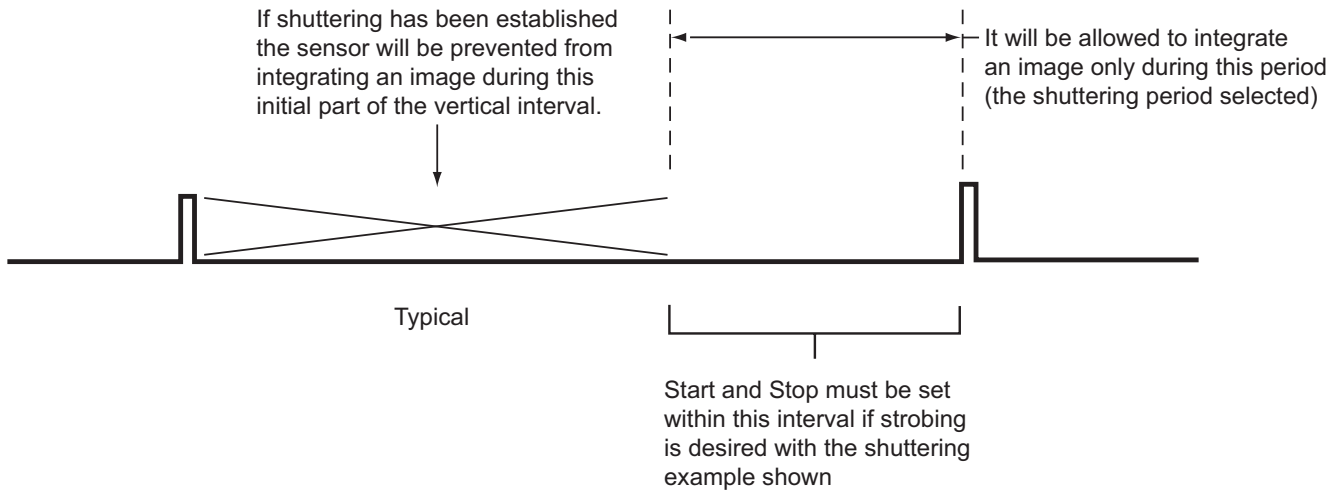


Figure 11. Strobe Output Field Reference

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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.

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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).

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.

INSTALLATION AND OPERATION**6110 CAMERA****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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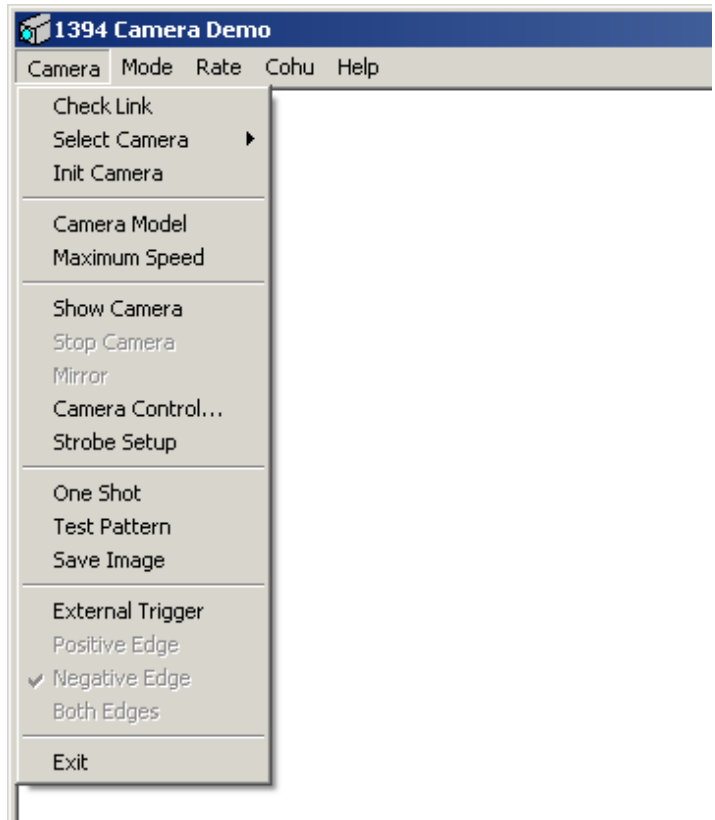
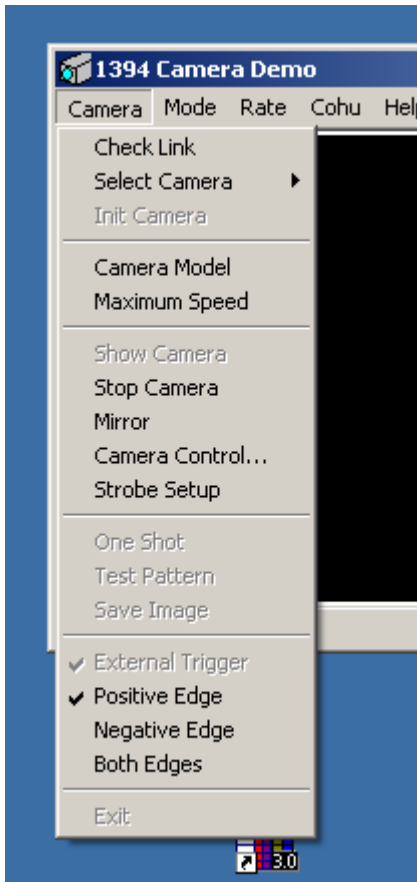


Figure 12. “Camera” Window (with typical selections)

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.

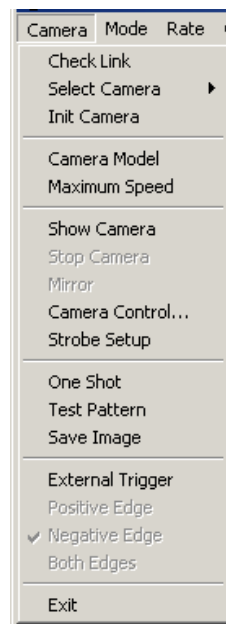


Figure 13. “Camera” Drop-down Menu (Camera Stopped)

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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 1280 x 960 Mono (16 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 four 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 four frames per second when all 960 scan lines are being used. Selecting fewer than 960 lines increases the frame rate — though not in proportion. Partial scan can be as few as two 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 960 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.

Only complete lines can be scanned. It is not possible to “narrow down” the scan from 1280.

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 980 to 240 — resulting in 12 frames per second.

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 capabilities. Thus many of the grayed out selections do not apply to the 6100 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.

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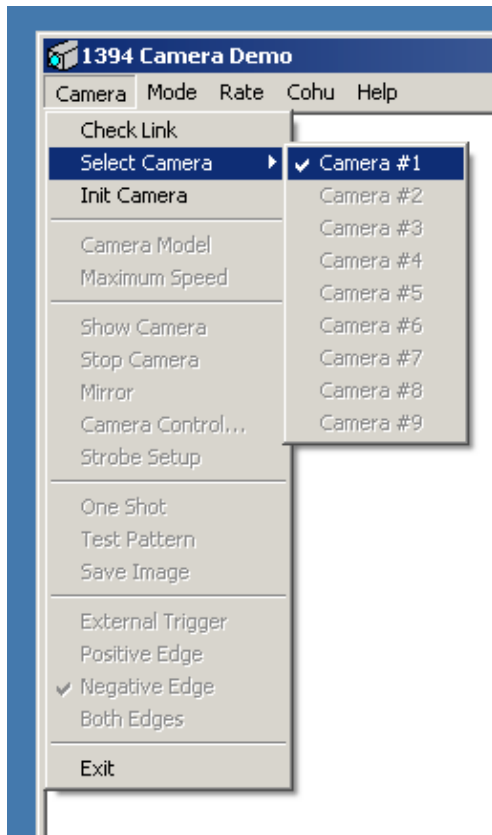


Figure 14. Camera Window with Select Camera Selected

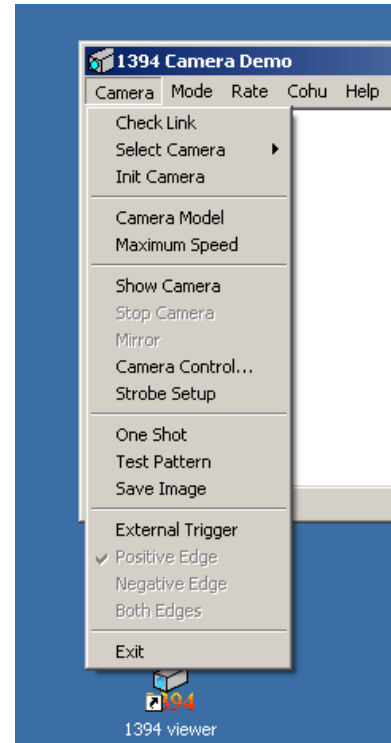


Figure 15. Camera Window After Init Camera Selected

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.

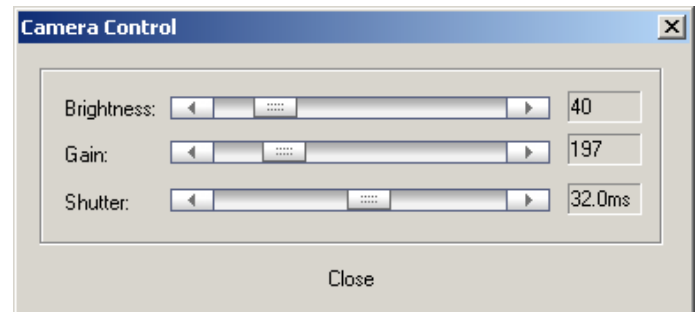


Figure 16. Camera Control Window

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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.

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.

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.

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Figure 17. Check Link Verify Window

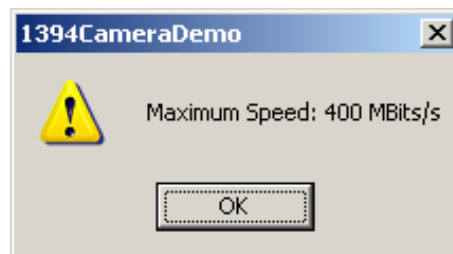


Figure 18. Maximum Speed Window (IEEE-I394 Maximum Bit Rate)



Figure 19. Problem Acquiring Image Window

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 dam-

aged 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.

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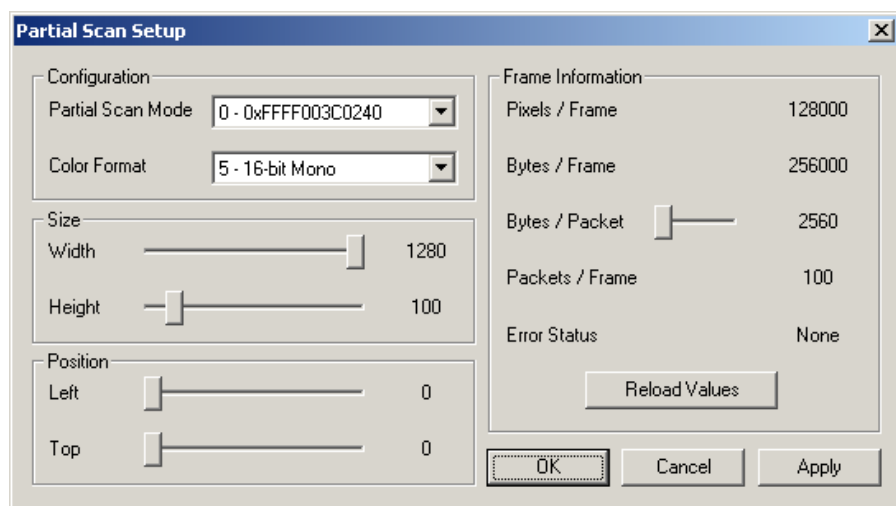


Figure 20. Partial Scan Setup Window



Figure 21. Camera Identification Window

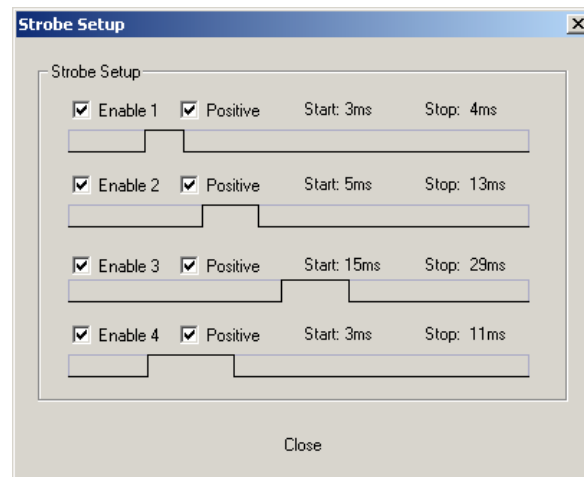
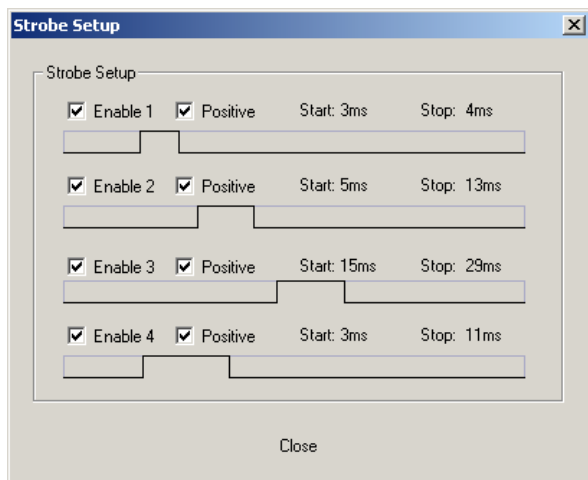
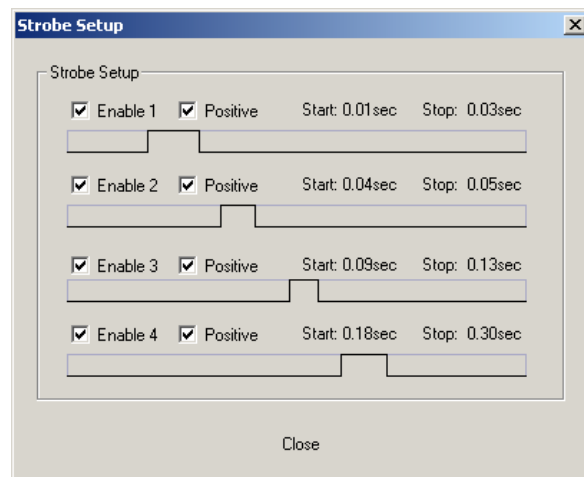
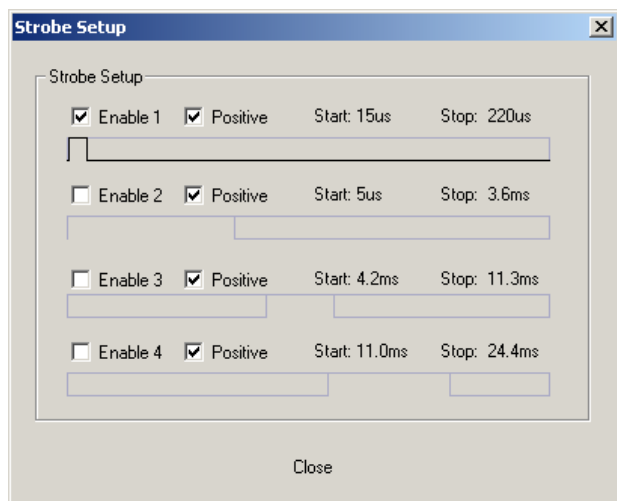
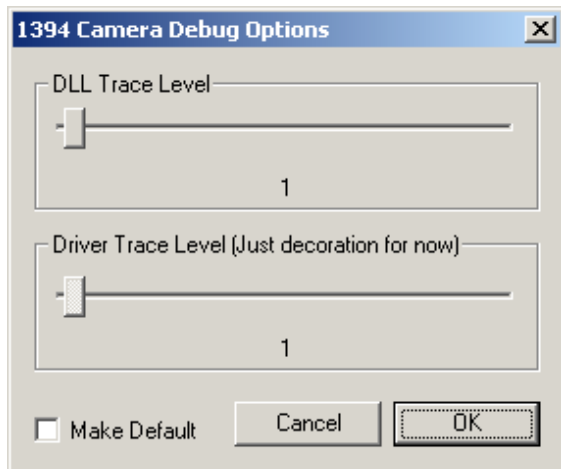
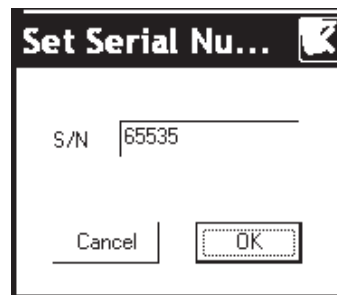


Figure 22. Strobe Windows (Various Typical Settings)

6110 CAMERA**Figure 23. Debug 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.

INSTALLATION AND OPERATION**Figure 24. Set Serial Number Window**

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-

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