

COHU, INC Electronics Division

Installation and Operation Instructions

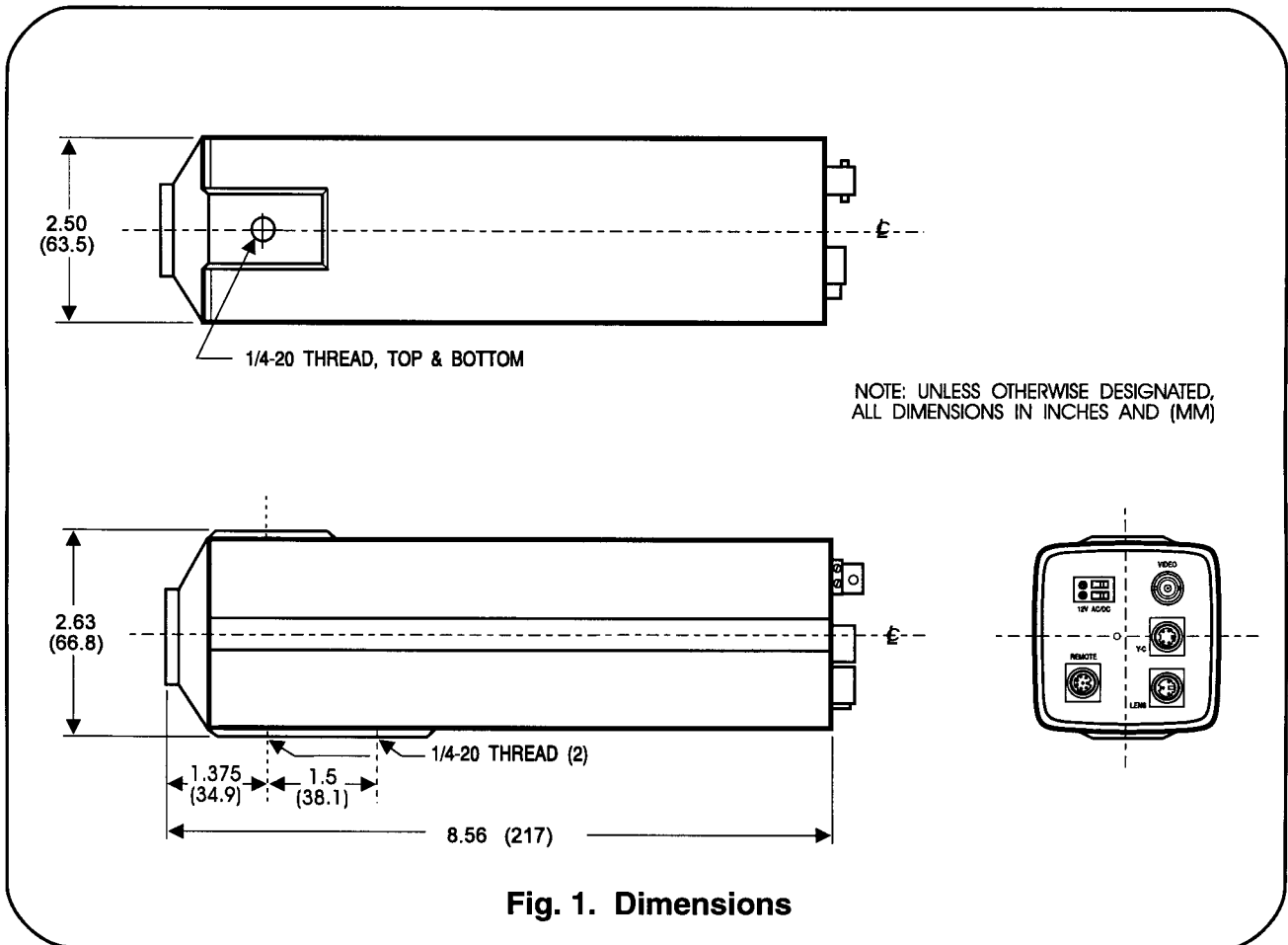


Fig. 1. Dimensions

COMPLIES WITH FEDERAL COMMUNICATIONS COMMISSION
 RULES AND REGULATIONS
 PART 15 FOR CLASS B DIGITAL DEVICES

8210 SERIES NTSC / Y-C COLOR CCD CAMERAS

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COHU
 Cohu, Inc./Electronics Division

Table 1. Specifications

ELECTRICAL	
Imager	Single interline transfer CCD with matrix filter (cyan, yellow, magenta, green)
Image Area	6.4 mm (H) x 4.8 mm (V) 1/2-inch format
Active Picture Elements	768 (H) x 494(V)
Resolution	Horizontal 460 tv lines Vertical >350 tv lines
Sensitivity (3200 K faceplate illumination)	6.5 lux full video (Agc off) 0.5 lux 80 percent video (Agc on)
Electronic Shutter	Switch selectable, 8 steps, 1/60 (off) to 1/10,000 second
Integration	Switch selectable, 8 steps, 2 to 16 fields (Grab pulse available)
Gamma	0.5
Agc	0—20 dB, peak-average adjustable
Signal to Noise Ratio (Agc off)	48 dB (NTSC with 4.5 MHz filter) 48 dB (Y-output) (6 MHz filter)
Video Outputs All 75 ohm unbalanced	Encoded: NTSC 1 Vp-p, Composite S Video: Y — 1 Vp-p; C — 0.285 Vp-p
Auto Lens Output	Peak-average characteristic tracks agc adjustment to eliminate agc/auto-lens interaction
Color Lock	Horizontal phase adjustment Burst phase adjustment
Color Balance	Through-lens type Less than 10 IRE units unbalanced from 2850 to 5800 K
Synchronization	EIA RS-170(A) crystal, color lock standard
Power Requirements	12 V dc/ac 60 Hz standard 24 V ac 60 Hz, 24-28 V dc optional 115 V ac 60 Hz optional, with wall transformer to provide 12 V ac
Power Consumption	4.5 Watts
ENVIRONMENTAL	
Ambient Temperature Limits	Operating: -20 to 50 °C (-4 to 122 °F) Storage: -30 to 70 °C (-22 to 158 °F)
Humidity	Up to 95% relative humidity, noncondensing
Vibration (less lens)	5 to 60 Hz with 0.082 inch total excursion (15 g's at 60 Hz). From 60 to 1000 Hz, 5 g's rms random vibration without damage
Shock (less lens)	Up to 15 g's in any axis under nonoperating conditions, MIL-E-5400T, paragraph 3.2.24.6
Altitude	Sea level to equivalent of 3000 meters (10,000 feet) 508mm/20 inches of mercury

MECHANICAL	
Dimensions	See figure 1
Weight (less lens)	652 grams (23 ounces) for 12 volt model
Lens Mount	CS mount standard, CS to C-mount adapter furnished
<i>See table 2 for model number interpretation</i>	
<i>Cohu reserves the right to change specifications without notice</i>	

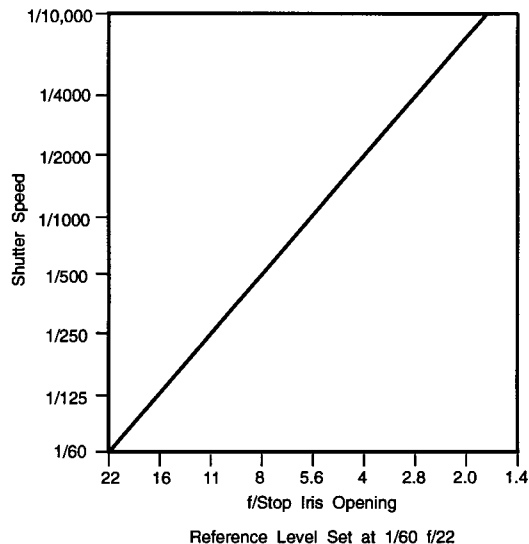
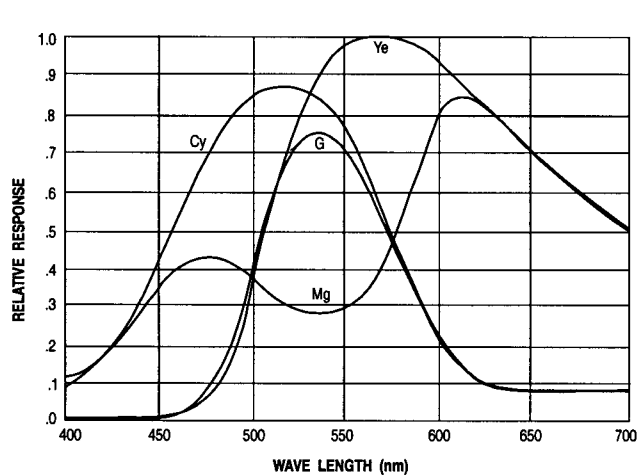


Figure 2. Matrix Filter Color Responses

Figure 3. Typical f/Stop vs. Shutter

**COMPLIES WITH FEDERAL COMMUNICATIONS COMMISSION
RULES AND REGULATIONS
PART 15 FOR CLASS B DIGITAL DEVICE**

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on. The user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and the receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Table 2. Model Number Interpretation

821X—		X	XXX /	XXXX	
Power Options		Configuration		Module Options	Lens Options
2	12 Vdc/ac, 60 Hz	1	NTSC/Y-C	000 None	0000 None
4	24 Vac, 24-28 Vdc	2	RGB *	300 Electronic Iris	
5	115 Vac, 60 Hz with wall transformer				
Manual Iris Lens, CS Mount AO03 3.7mm, f/1.6 (1/2 in.) AO06 6mm, f/1.4 (1/2 in.) AO13 12mm, f/1.4 (1/2 in.)		Auto Iris Lens, CS Mount EH04 3.7mm, f/1.6 (1/2 in.) EH06 6mm, f/1.4 (1/2 in.) EH13 12mm, f/1.4 (1/2 in.)		Manual Iris Lens, C Mount AL04 4.5mm, f/2 (2/3 in.) AL06 6.5mm, f/1.8 (2/3 in.) AL08 8mm, f/1.4 (2/3 in.) AL12 12mm, f/1.4 (1 in.) AL16 16mm, f/1.4 (2/3 in.) AL26 25mm, f/1.6 (2/3 in.) AL51 50mm, f/1.8 (2/3 in.) AL75 75mm, f/1.8 (1 in.)	Auto Iris Lens, C Mount ES05 4.8mm, f/1.8 (2/3 in.) ES06 6mm, f/1.2 (1/2 in.) ES08 8mm, f/1.4 (2/3 in.) ES13 12mm, f/1.2 (1/2 in.) ES16 16mm, f/1.4 (2/3 in.) ES25 25mm, f/1.4 (1 in.) EH35 35mm, f/1.4 (2/3 in.) ES50 50mm, f/1.8 (1 in.)
* Not covered in this manual					

1.0 ELECTRICAL CHARACTERISTICS

A 1/2 inch interline transfer sensor is used to produce one channel of video to obtain color. This sensor has a matrix filter of cyan, yellow, magenta, and green (fig. 2).

Up to 20 dB gain is available, either with automatic gain control (agc) or with an internal manual gain potentiometer. A peak-average control determines whether the agc circuit responds more to peaks of light in the scene or to the overall scene lighting.

Auto iris lens video is derived after the peak-average stage in the Camera to minimize undesirable interaction between internal Camera agc and auto iris lens settings.

Three modes of white (color) balance can be selected at the side panel: automatic, side-panel-set manual, and externally controllable manual.

Also at the side panel is switch selection for electronic iris, shutter, or integration modes. Shutter 1/60 mode provides conventional Camera operation. Shutter and integration are described below. Note: This Camera operates at a field rate of 59.94 Hz, the NTSC color standard field rate. But for convenience, field rate will usually be referred to as 60 Hz throughout the manual.

1.1 Shutter Mode

Shutter mode makes it possible to produce stop action by reducing the effective field period of the Cam-

era. While the sensor continues to operate at the 60 Hz rate, it is allowed to collect the image only for the duration of the selected shutter time. For example, if a shutter of 1/1000 second is selected, the sensor is allowed to collect light from the scene for only 1/1000 second before it is transferred into storage to be read out. Read out of the image from the sensor still occurs at the 60 Hz field rate. Shutter speeds from 1/60 to 1/10,000 second are available. The 1/60 shutter rate is identical to standard operation at 60 fields per second.

In direct proportion to shutter speed, the effective light sensitivity of the Camera is reduced. For example, selecting a shutter speed of 1/250 second corresponds to 2 f/stops loss in light. A 1/4000 shutter rate corresponds to 6 f/stops loss in light. This must be planned for when using the shutter mode of the Camera. The lens may have to be opened up and scene lighting may have to be increased.

Figure 3 illustrates a typical relationship of shutter speed vs. f/stops. This figure assumes that scene lighting is such that the lens can be set to f/22 while operation at the normal 1/60 second field rate.

1.2 Integration Mode

Integration mode allows the sensor to integrate light beyond the normal time period of one field (at a 60 Hz rate). The sensor continues to collect light for 2 to 16 field periods, depending on the side panel switch setting.

At the end of the integration period, an output Grab Pulse is produced at pin 8 of rear panel connector J58 and simultaneously a field of video is initiated at the rear panel video outputs. Use of integrated video requires a frame grabber circuit board and related software.

1.3 Electronic Iris Mode (optional)

The electronic iris board uses the video signal level to control the shutter (sensor integration time) through a continuously variable range (seven f-stops). The board outputs a pulse train of sensor clearing pulses that stop at the appropriate point before the end of the field and allow the sensor to integrate. The optional electronic iris board must be installed to use this mode.

2.0 MECHANICAL CHARACTERISTICS

Most circuits for the Camera mount on four vertically oriented boards interfacing through hinged connectors to an interconnection board at the bottom. These boards mount to the front casting. They are secured at the rear by the rear panel when the case is installed. Grooves inside the top of the case extrusion hold the circuit boards in place when installed.

The sensor board mounts to four pads inside the back of the front casting. In front of the sensor board is a combination IR blocking and antialiasing filter.

At the front of this casting is a circular opening threaded to accept a 1.250-32 UNS-2A CS-mount adaptor. A 5 mm extension ring is supplied to adapt this CS mount for use with a C-mount lens. (C-mount lenses must be spaced 5 mm farther away from the sensor than CS-mount lenses.)

Opposite each other at the top and bottom of the front casting are threaded holes to accept 1/4-20 UNC mounting bolts. On the bottom of the housing is a second 1/4-20 threaded hole, 1.5 inch (38.1 mm) to the rear of the mounting hole in the casting.

The left side of the case has holes down its length for access to certain switches and adjustments on the sync board. A decorative, protective trim strip, held in place by a 2-56 x 1/8 flathead screw, covers these holes when access is not required.

All interconnections with the Camera are made on the rear panel (fig. 4). Table 3 gives a factory part numbers and also the part numbers of a manufacturer for these connectors and their mating plugs.

3.0 POWER REQUIREMENTS

Input power applied to the Camera rear panel connector routes through filtering to a bridge rectifier.

Optoisolators and a flyback transformer in the Camera isolate power input circuits from other circuits in the Camera. This has the same effect as an isolation transformer on the input. The advantage to this isolation is that it allows multiple Cameras to be operated from a single 12 V ac source.

Standard power input to the Camera is 12 V ac, 60 Hz, or +12 V dc. The dc power positive lead can be applied to either input, with the common lead then being connected to the remaining input.

If the Camera is to be operated from ac line power, an optional plug-in wall transformer is required to step down the line voltage to 12 V ac. This wall transformer operates from 115 V ac, 60 Hz power. If the Camera is to operate from a 12 V dc power supply, the positive power lead must have a 1/2 amp time-lag fuse in series.

4.0 EQUIPMENT SUPPLIED

The following list does not include any optional or special-request items. A lens ordered with the Camera will either be installed on or packed with the Camera.

1. CS-mount adaptor (provides 12.5 mm back spacing for CS-mount lenses)
2. C to CS-mount 5mm Extension Ring (screws into CS-mount adaptor to provide 17.5 mm back spacing for C-mount lenses)
3. Plug for remote connector J58
4. Lens connector (installed if an auto-iris lens is supplied)

5.0 EQUIPMENT REQUIRED BUT NOT SUPPLIED

The following items are the minimum required to make use of the Camera. Note that some items listed here can be selected as an option with the Camera.

1. CS or C-mount lens
2. Power source: 12 or 24-28 V dc or 12/24 V ac 60 Hz. The optional 115 V ac wall transformer provides 12 V ac to the Camera.
3. Color monitor, Composite input or Y-C inputs
4. Frame grabber board and software (if integration feature is to be used)

6.0 UNPACKING AND RECEIVING INSPECTION

This item was thoroughly tested and carefully packed in the factory. Upon acceptance by the carrier, they assume responsibility for its safe arrival. Should you receive this item in a damaged condition, apparent or concealed, a claim for damage must be made to the carrier. To return the product to the factory for service, please contact the Customer Service Department for a Return Authorization (RA) number.

If a visual inspection shows damage upon receipt of this shipment, it must be noted on the freight bill or express receipt and the notation signed by the carrier's agent. Failure to do this can result in the carrier refusing to honor the claim.

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

7.0 STATIC DISCHARGE PROTECTION

Components used in modern electronic equipment, especially solid state devices, are susceptible to damage from static discharge. The relative susceptibility to damage for semiconductors varies from low with TTL to high with CMOS. Most other semiconductors fall between TTL and CMOS in susceptibility to static discharge.

As a minimum, therefore, observe the following practices when working inside this or any other electronic equipment:

1. Use conductive sheet stock on the work bench surface.
2. Connect the sheet stock to ground through an approximate 1 megohm resistor.
3. Use a wrist strap connected to ground through an approximate 1 megohm 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 when relative humidity is below 30 percent requires extraordinary procedures not listed here.
5. Use static bags to store and transport exposed chassis, circuit boards, and components. Use new static 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.

WARNING

The leads for the sheet stock on the work bench and the wrist strap must have a resistor in the megohm range inserted in series. This prevents the person at the bench from being directly grounded. The resistors limit current to a safe value in the event that dangerous voltage is contacted.

Standard grounding sheets and wrist straps purchased for use at work benches are supplied with leads having the required current limiting resistors for safety. Never substitute a lead that does not have a resistor.

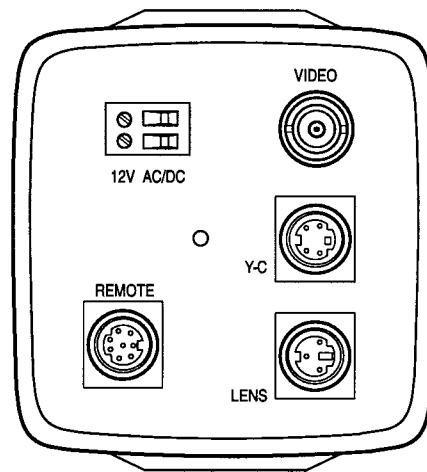
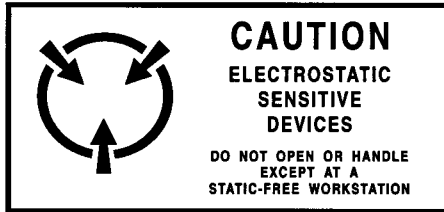


Fig. 4. Rear Panel

Table 3. Interfacing connectors

NAME	MATING CONNECTOR FOR CABLE	
VIDEO (P4)	BNC Plug	—
Y-C OUT (P5)	1310373-104 4 Pin Mini DIN Plug	TRW-Cinch MD-4P
LENS (P9)	1310373-103 3 Pin Mini DIN Plug	TRW-Cinch MD-3P
POWER (P30)	N/A Requires Stripped Wire Ends	—
REMOTE (P58)	1310373-108 8 Pin Mini DIN Plug	TRW-Cinch MD-8P

8.0 INSTALLATION PROCEDURE



The following installation procedure assumes that the Camera is first checked out and adjusted before mounting at its working location:

1. Connect power, video, and if required, the remote cables.
2. Install the lens and check back focus.
3. Set up side panel adjustments for the intended application (if required).
4. Make internal settings (Required only for special applications).
5. Route all required cables, including power, to the intended mounting location.
6. Mount the Camera, adjust it to observe the desired scene, and verify proper operation.

8.1 Power Connections

CAUTION

Do not apply power outside the recommended operating range of the Camera (12/24 V ac, 12 or 24-28 V dc \pm 10% at the Camera rear panel input or 115 V ac \pm 10% 60 Hz at the external wall transformer.)

See figure 5. Power is applied to a rear panel terminal block that accepts stripped leads for the input. Leads are inserted into the blocks, then screws are tightened to secure them in place.

Do not allow the stripped leads to come into contact with each other when power is applied. This can blow a fuse or damage a wall transformer type supply.

The Camera has filtering and a bridge rectifier at its power input. Optoisolators are used in the Camera to isolate input power from other circuits. This provides several advantages. It makes it possible to connect dc power to the inputs without regard to polarity. It also make it possible to operate multiple Cameras from a single source of ac. Normally with bridge rectifier power

input, connecting two or more cameras to the same source of ac power would damage the rectifiers.

8.2 Video Connections

Two types of video output are provided on the Camera. One is at a BNC connector (J4) which provides standard NTSC composite video output (fig. 6). This NTSC format combines video, subcarrier, blanking, sync, and burst into one signal at a 75 ohm, 1 Vp-p output.

An S video Y-C output is also available (fig. 7). It provides the color signals on two pins of a four-pin connector, J5. This is the industry standard connector for Y-C video. A standard cable can be used.

Pin 3 (Y output) provides a 75 ohm 1 Vp-p luminance output, which includes video, blanking, and sync.

Pin 4 supplies the C (chroma) output, providing a 0.285 Vp-p signal containing subcarrier and burst, which is the color information.

8.3 Remote Input/Output Connector (J58)

Connector J58 has eight pins to provide multiple input and output functions. Figure 8 illustrates these pin functions. Table 4 provides additional details. Note that pin 2 is shown as receiving voltage from a potentiometer connected to 5 V dc at pin 5 of J58. Using an external source of power for a potentiometer connected to pin 2 could lead to damage: (1) The voltage should never exceed 5 volts, and (2) It should be removed either before or simultaneous with power being turned off at J30, the Camera power input. The Camera-supplied 5 volt source meets both these conditions.

8.4 Sync Input (J58-3)

If it is desired to sync the Camera to a master sync source or to genlock it to another Camera, deemed the master Camera, the input should be applied to pin 3 of J58. Pin 3 of figure 8 shows typical input waveforms and gives minimum and maximum peak-to-peak levels.

8.4.1 Genlocking

A composite video signal applied to the sync input for genlocking typically will have video, blanking, sync, and if it is color video, also subcarrier and burst. An internal Camera circuit strips away everything from a composite signal not needed for genlocking. Since only the sync pulses are required for genlocking, everything else is stripped away or not used.

A sync signal applied to pin 3 need have only the composite sync pulses to genlock the Camera. Their rate should be for NTSC color, 63.556 μ s horizontal (59.94 Hz field rate /15,734 Hz field frequency).

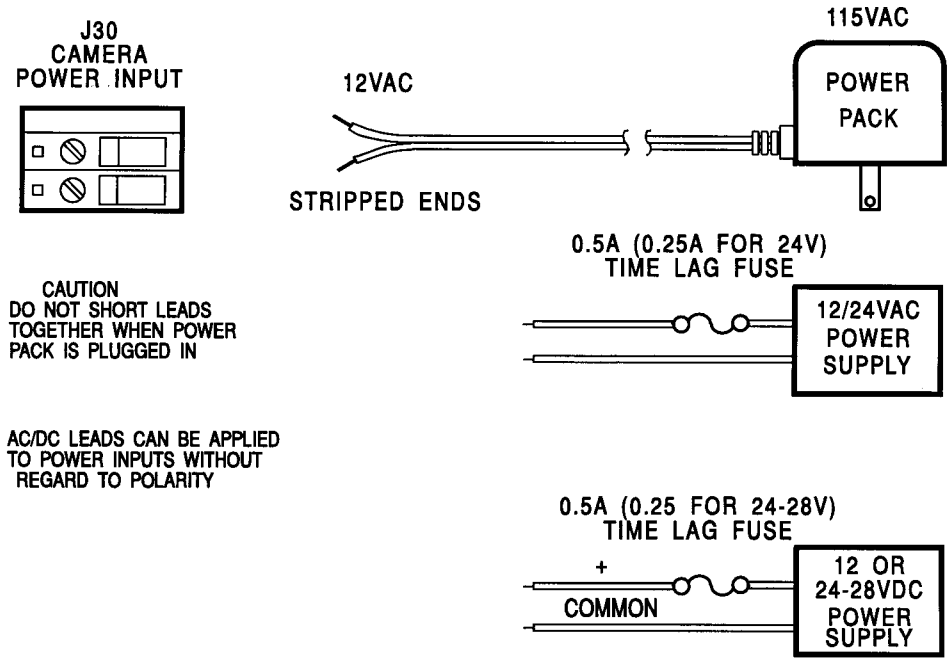


Figure 5. Power Connections

While this color Camera will genlock to the 60 Hz field rate used with many monochrome cameras, a color monitor connected to the output video may not be able to provide color when locked to the 60 Hz rate. (Many monochrome cameras built in recent years operate at the NTSC field rate of 59.94 Hz. If such a camera is used as the genlocking reference source, a typical color monitor should have no problem providing color when locked onto the color video.)

8.4.2 Color Locking

For color locking, the input signal applied to pin 3 must have horizontal-rate sync pulses and burst. This combination, without any video or subcarrier, is typically called black burst. (Color locking requires the 59.94 Hz NTSC field rate.) It may also have video with subcarrier and blanking, but those parts of a signal are not required for color locking. The internal circuit strips them away.

While the Camera will color lock to sync pulses and burst, several internal adjustments are required if it is desired to have internal Camera burst in-phase with the reference input burst. Section 10.1 and table 6 describe these adjustments.

8.5 Integration

In its standard operating mode the Camera sensor collects (integrates) an image from the lens for about 1/60 sec-

ond (one field) before transferring it into storage for readout.

Integration mode allows the Camera sensor to accumulate an image for more than the normal one-field (1/60 second) interval. Setting the side panel SHUTTER/E-IRIS/INTEGRATE switch to INTEGRATE activates the related eight-position selection switch, which in integrate mode provides for selection of 2, 4, 6, 8, 10, 12, 14, and 16 field integration periods.

One benefit of this extended integration period is that the Camera effectively becomes more sensitive to scene lighting. (That is, much less light is required on the scene.) A major disadvantage, though, is that dark current increases in proportion to the integration period, reducing dynamic range of the Camera. (More noise is generated in the picture.) This can be minimized to some extent by operating the Camera in as cool an environment as possible.

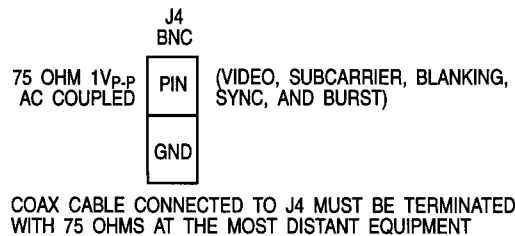


Figure 6. NTSC Composite Video Output (J4)

Another potential disadvantage is that relative motion between the Camera and scene can lead to smearing of the integrated image. Beyond the briefest of integration periods, virtually no relative movement can be tolerated.

Making use of the integrated video output requires a frame grabber circuit board and related software.

The grab pulse for this board is provided as an output at pin 8 of J58. This pulse provides a leading (rising 0 to 5 volt) edge coincident with the beginning of video for the integrated output field (fig. 8). This pulse is provided for each integrated output field.

8.6 Lens Installation

1. Remove the protective plastic plug from the lens CS-mount adaptor opening.
2. Clean the lens and the filter glass in front of the sensor. Use methyl alcohol or an optical-quality solution and a cotton swab. Never rub an optical surface with a dry swab.

NOTE

The filter glass in front of the sensor faceplate is out of the focal plane of the Camera. Minor contaminants on this surface will not likely show up in the picture for typical applications. However, when using collimated light, such as in microscopy and other scientific applications, minor dust on the filter may be displayed in the picture. Gentle pressurized air can be helpful in removing these contaminants in such cases.

3. Check the setscrew and make sure it is snugged down. Be careful not to overtighten.
4. Screw the lens into the adapter. Snug down so the two will turn as one unit when the setscrew is loosened for focus adjustments. (Refer to the next section, Back Focus Adjustments, regarding installation of CS-mount and C-mount lenses.)
5. If an auto lens is used, plug the lens cable (P9) into the lens connector (J9) on the rear panel. See figure 9 for an illustration of wiring and pin functions.

8.7 Back Focus Adjustment

This adjustment generally is not required unless the CS mount adaptor has been moved. If a C-mount lens is to be used, a 5 mm extension ring is screwed into the CS-mount adaptor to properly position the C-mount lens.

See figure 10. Back focus sets the distance between the lens and the focal plane of the sensor. For a CS type lens, the distance from the shoulder of the lens to the focal plane of the sensor is 12.5 mm. For a C-mount lens, this distance is 17.5 mm. The Camera is supplied with a CS mount adaptor that when properly adjusted provides the 12.5 mm spacing for a CS-type lens. To use a C-mount lens with this CS adaptor requires that the 5 mm extension ring be installed. This ring positions the C-mount lens the additional 5 mm away so that it focuses on the sensor.

The CS adaptor is adjusted for perfect focus with a typical lens at the factory. The 5 mm extension ring can most likely be installed or removed for use with another type lens without further adjustment to the CS adaptor. Always be sure that a CS lens (or C lens with 5 mm extender) is fully threaded into the adaptor.

Adjusting the CS-mount adaptor, should it be required, is a simple procedure. The setscrew is loosened. Then adjustment is made by rotating the lens and adaptor, as a unit, slightly in and out of the Camera lens well to obtain perfect focus. The adaptor ring is then locked down at that position with the setscrew. To make this setting, have the Camera operating, then proceed as follows:

1. Fully thread the lens (and 5 mm extension ring, if used) into the adaptor ring.

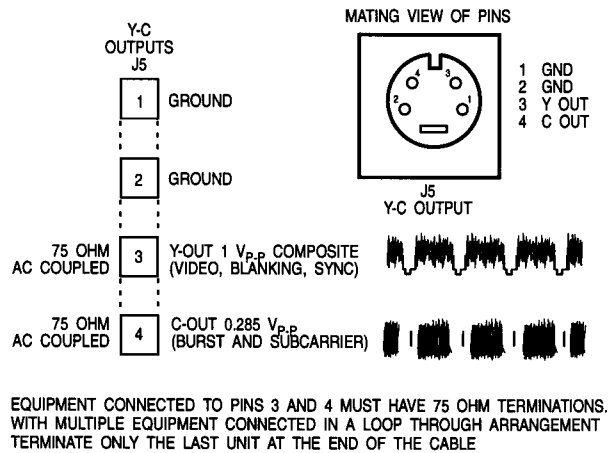


Figure 7. Y-C Video Output (J5)

EQUIPMENT CONNECTED TO PINS 3 AND 4 MUST HAVE 75 OHM TERMINATIONS. WITH MULTIPLE EQUIPMENT CONNECTED IN A LOOP THROUGH ARRANGEMENT TERMINATE ONLY THE LAST UNIT AT THE END OF THE CABLE

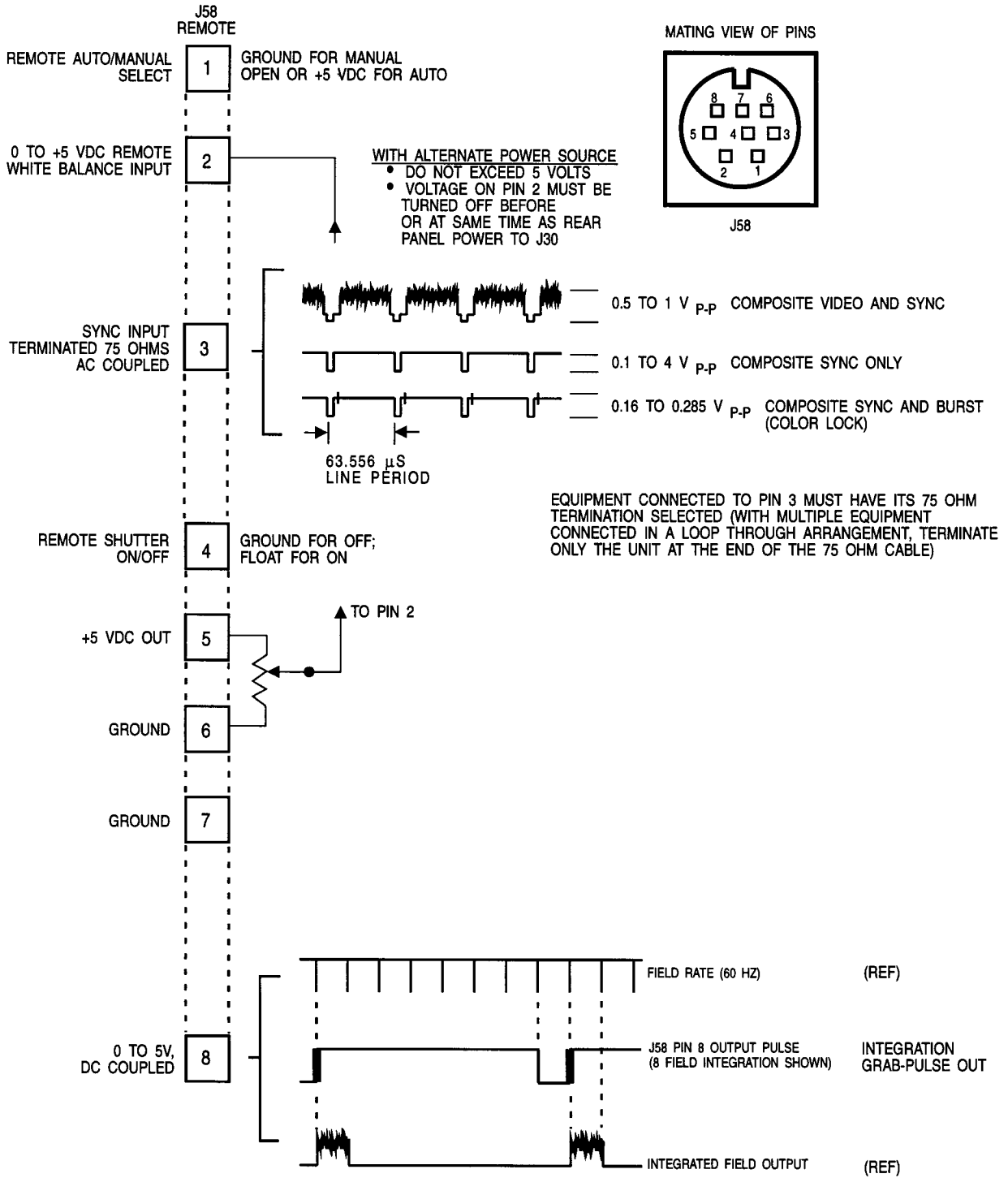


Figure 8. Remote Input/Output (J58)

Table 4. Remote Input/Output Connector (J58) Functions

PIN NUMBER	PIN NAME	PIN FUNCTION
1	Remote Auto/Manual White Balance Select	Side panel switch must be set to Remote to activate this input. Ground for manual; Open or +5 V dc for Auto
2	Remote White Balance Control Input	Adjustable 0 to +5 V dc input provides control of color balance. The +5 V dc source for this input should be taken from pin 5 of J58. If applied from some other source, do not allow it to exceed 5 volts and be sure it is removed from pin 2 before or at the same time as the Camera is turned off.
3	External Sync Input	0.5 to 1 Vp-p Composite Video (video and sync) 0.1 to 4 Vp-p Sync only Color Lock (sync and burst), 0.16 to 0.285 Vp-p. When color locking for special applications, such as with split screen operation, internal Camera burst may have to be adjusted to be in phase with the reference burst. This requires test instruments. See table 6.
4	Remote Shutter On/Off	Ground for Off; Float or +5 V dc for On. Active only when side panel switch is set to Shutter.
5	+5 V dc Output	Output voltage for use with a remote color balance control potentiometer. Connect the potentiometer between this pin and ground on pins 6 or 7.
6	Ground	Ground for remote inputs
7	Ground	Ground for remote inputs
8	WEN (Write Enable) Output Integrate Pulse Output)	A positive going pulse edge (0 to 5 V) coincident with the beginning of the integrated field output. (Goes low again one field before the next leading edge)

2. Set the lens focusing ring to infinity.
3. Point the Camera at a distant scene well into the infinity focusing distance of the lens.
4. Add neutral density (ND) filters in front of the lens while opening the iris all the way so that a normal picture is maintained on the picture monitor.
5. Note whether the scene is in sharp focus. If it is, no adjustment is required.
6. If the scene is out of focus, loosen the setscrew (6-32 x 5/32) with a 0.060 inch hex wrench and rotate the lens and adaptor as a unit in and out of the Camera until the scene is in focus.
7. Snug down the setscrew. It is nylon tipped, so do not overtighten.
8. Verify that sharp focus has been maintained after locking down the setscrew, then stop down the lens iris and remove the neutral density filters.

8.8 Auto Iris Lens Gain

If an auto iris lens is used and the video viewed on a monitor pulsates (hunts) under bright lighting conditions, or lacks contrast or is washed out, gain on the auto iris lens may require adjustment. To readjust gain on the lens, proceed as follows:

1. Set the side panel AGC/OFF switch to OFF.
2. Adjust the gain potentiometer on the auto iris lens to obtain a normal, stable picture on the monitor.
3. Set the switch to AGC (on) and determine that a normal, stable picture remains. If not, proceed to step 1 and repeat the procedure until all conditions are met with no further adjustment being required.
4. Verify that the picture remains stable with changes in scene lighting.

9.0 SIDE PANEL ADJUSTMENTS

Side panel adjustments are accessible when a trim plate is removed on the left side of the Camera. Remove the flat head screw (2-56 x 1/8) at the rear of the plate, and lift the plate up and to the rear for access.

Table 5 describes adjustments and switch settings accessible on the side panel of the Camera. For standard operation, the following settings are suggested:

- AGC/OFF to AGC
- AVG/PEAK to midrange or at factory setting
- SHUTTER/E-IRIS/INTEGRATE to SHUTTER
- MANUAL/AUTO/REMOTE to AUTO

Use of the integrate mode requires a frame grabber circuit board and related software. These boards and their software are available from a variety of manufacturers.

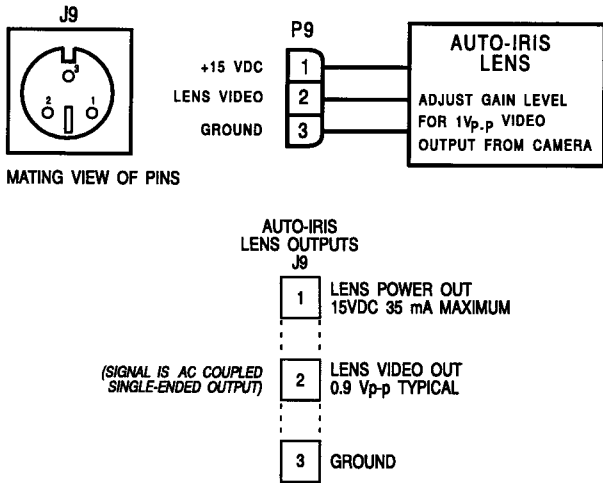


Figure 9. Auto Iris Output (J9)

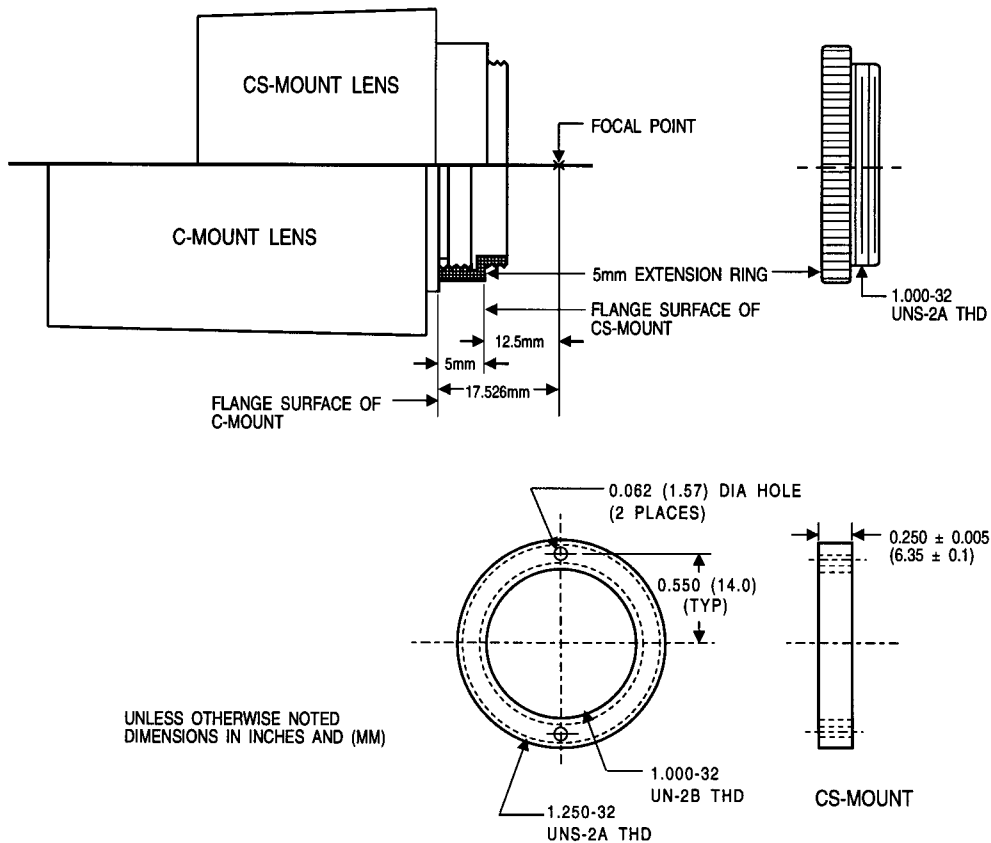


Figure 10. CS and C-Mount Adaptors

Table 5. Side Panel Adjustments



CONTROL NAME	NORMAL SETTING	FUNCTION
AGC (on)/OFF Switch (S2)	AGC (on)	On provides automatic gain control (agc). OFF provides fixed gain and activates the internal manual gain control (MAN R11). With agc on, camera gain will increase to hold 90 percent output video when the light level on the image sensor falls too low to maintain full video output. It will hold video at 90 percent through a 20 dB range. Noise level in the video increases in proportion to the amount of agc being used.
PEAK/AVG (Agc Peak/Average) Adjustment (R4)	Midrange	This control determines whether the agc responds more to peaks of video from the scene or to the overall light in the scene. The setting of this control is often done under actual scene lighting conditions to obtain the best possible picture from the Camera. Generally, a setting to midrange or slightly toward Average is best. However, if light colors tend to wash out, set the control slightly more toward peak.
SHUTTER/E-IRIS/ INTEGRATE Switch (S41)	SHUTTER	When set to SHUTTER or to INTEGRATE, the effective field rate can be set to any of eight rates using switch S42 (see below). E-IRIS position used only if the optional electronic iris board is installed.
8-position Switch (Shutter/Integrate) (S42)	1/60	Selectable shutter rates are: 1/60, 1/125, 1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/10,000 Selectable integration periods are: 2 fields, 4, 6, 8, 10, 12, 14, and 16 fields (The 1/60 shutter setting in the SHUTTER mode corresponds to normal operation. When SHUTTER is selected on the side panel, shutter operation can be turned on and off remotely at pin 4 of J58 on the Camera rear panel.
AUTO/MANUAL/ REMOTE White Balance Switch (S1)	AUTO	In AUTO, the camera maintains proper color rendition automatically by referencing to white areas of the scene; the AUTO mode automatically compensates for changes in scene lighting. In MANUAL, the side panel WHITE BALANCE (color balance) control (described below) sets color output. In REMOTE, an external potentiometer can be connected to pin 2 of J58 on the camera rear panel to provide for remote manual control of white (color) balance; pin 1 of J58 is also activated to allow switching between this external potentiometer and the internal AUTO mode.
WHITE BALANCE Adjustment (R20)	As desired	This side panel adjustment controls color output balance only when the AUTO/MANUAL/REMOTE switch is set to MANUAL. This mode is useful when using the Camera with a fixed lighting source having no color temperature variations. Make this adjustment to obtain the desired scene rendition.

Table 5. Side Panel Adjustments (continued)

CONTROL NAME	NORMAL SETTING	FUNCTION
<p><i>NOTE: The Camera will automatically synchronize with a color lock reference input signal applied at J58-3 on the rear panel. But for special applications, internal burst may have to be placed in-phase with the reference burst at some distant location due to differences in cable lengths (and thus in propagation delays). This requires adjusting R167 with a dual trace oscilloscope, then adjusting S81, S82, and R98 using a vector scope.</i></p>		
Horizontal Phase Color Lock (R167)	As required	Positions horizontal sync to be coincident with sync in the color lock input. Must be set before burst phase of the Camera can be adjusted to exactly match burst phase of the color lock signal. (S81 and R98 adjust burst).
0° and 180° (S81)	As required	Provides 0° and 180° burst phase shift. Used in conjunction with R98 to provide burst phase shifts of 0°-360°.
S.C. PHASE A (R98)	As required	Provides fine phase adjustment of burst phase established by S81.

9.1 Color Lock Adjustments

The Camera will automatically color lock when an appropriate signal is applied to pin 3 of the remote connector (J58). For special applications, such as with split screen work, placing the internal burst in phase with the applied reference burst requires four internal adjustments on the sync board. These adjustments require the use of a vector scope. See table 5.

First R167 (H PHASE C. LOCK) must be adjusted to position the horizontal sync pulses coincident with the applied horizontal sync reference pulses. Only then can burst be placed in phase with the reference burst signal.

The approximate phase is set by positioning switches S81 (S.C PHASE B) to obtain a phase shift of 0° or 180° as required. Then a fine phase adjustment is made with R98 (S.C. PHASE A). This last step places internal burst exactly in phase with the reference burst.

11.0 PREPARATION FOR SHIPMENT AND STORAGE

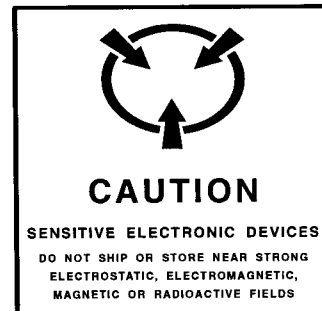
For storage periods exceeding about one month, seal the unit in a vapor-proof bag containing a fresh desiccant pack. Maintain the Camera storage environment within a range of -30 to 70 °C (-22 to 158 °F).

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 5755 Kearny Villa Road, San Diego, CA 92123 as the address. Please contact the Customer Service Department for a Return Authorization (RA) number before sending any shipments to the factory.

CAUTION

Cameras not in service or cameras being stored should always have their lens iris closed (or the lens opening to the sensor capped) to prevent strong light from bleaching the color dyes in the sensor.



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WARRANTY

Cohu, Inc., Electronics Division, warrants equipment manufactured to be free from defects of material and workmanship. Any part or parts will be repaired or replaced when proven by Cohu examination to have been defective within two years from date of shipment to the original purchaser for standard CCD cameras and one year from date of shipment to the original purchaser for intensified CCD cameras and all other Cohu manufactured products.

All warranty repairs will be performed at the factory or as otherwise authorized by Cohu in writing. Transportation charges to Cohu shall be prepaid by purchaser.

This warranty does not extend to Cohu equipment subjected to misuse, accident, neglect, or improper application, nor repaired or altered by other than Cohu or those authorized by Cohu in writing. **Television image pickup tubes, image intensifiers, lenses, and products manufactured by companies other than Cohu are warranted by the original manufacturer.** This warranty is in lieu of all other warranties expressed or implied. Cohu shall not be liable for collateral or consequential damages.

A Return Authorization (R. A.) number must be obtained from Cohu prior to returning any item for warranty repairs or replacement.



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