

2740 SERIES ENVIRONMENTAL CAMERA INSTALLATION AND OPERATION MANUAL



Shown with optional sun shield

Figure 1. Low Light Level Environmental Camera

Technical Manual 6X-1048a

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1.0 GENERAL DESCRIPTION

This introduction briefly describes overall characteristics of the Model 2740 monochrome Camera (figure 1) related to its installation and operation.

1.1 Electrical Characteristics

The 2740 camera provides a highly sensitive interline transfer CCD Camera in a pressurized environmental housing. All electrical connections are via a single 39 pin rear panel connector. Table 1 lists electrical, mechanical, and environmental specifications for the 2740 Camera.

Video output may be provided by an optional fiber optic connector added on the rear panel. When this option is selected, the 75 ohm output on the 39 pin connector should not be terminated. Any temporary connections to this 75 ohm output for maintenance purposes should be done with a short 75 ohm coax cable to avoid any “stub” effect that may cause ghosting in the video.

The Camera operates with either NTSC or PAL format, depending on the model. Both of these formats are available in a high-sensitivity version.

This Camera operates at an internal clock rate of 28.6363 MHz (NTSC) or 28.375 MHz (PAL).

If the phase adjust line lock option is installed, the vertical interval of the camera is referenced to the 60 Hz power input for NTSC (or the 50 Hz power input for PAL). A six position switch on the rear panel then makes it possible to shift this reference in 60 degree increments so that the camera can be phased with other cameras in the system that may not have the same power line phase reference. This phase difference can occur either because the other cameras are on a different phase of the power source or perhaps because they are connected to a power source operating from a different transformer.

The Camera is available with either 115 V ac or 24 V ac input power — depending on the model. An internal 20 watt heater cycles on an

off at low environmental temperatures to maintain temperature inside the housing at operating levels.

When an optional zoom lens is installed, dedicated pins on the connector provide for control of zoom, focus, and iris. Pins are also assigned for location of the lens zoom position.

When an optional ID generator is mounted inside the camera housing, it can be programmed to provide messages in the video. It also provides barrel pressure and temperature when these displays are turned on.

Programming and control of the ID generator is via RS-422 on the rear panel multipin connector. Cohu’s Win MPC graphical user interface (GUI) software can be used to program these messages. (WinMPC is available at no cost from the cohu-cameras web site or by mail on CD.) — or the system control software can be used if it has been implemented with the proper protocol messages.

If either shuttering or a manual gain setting is desired, these setting must be performed before the camera housing is sealed and pressurized. Changing either of these optional settings requires complete disassembly of the camera housing. It must then be re-sealed, purged with dry nitrogen, and pressurized with the dry nitrogen before returning to service. For more information about the internal camera module refer to Cohu Techni-

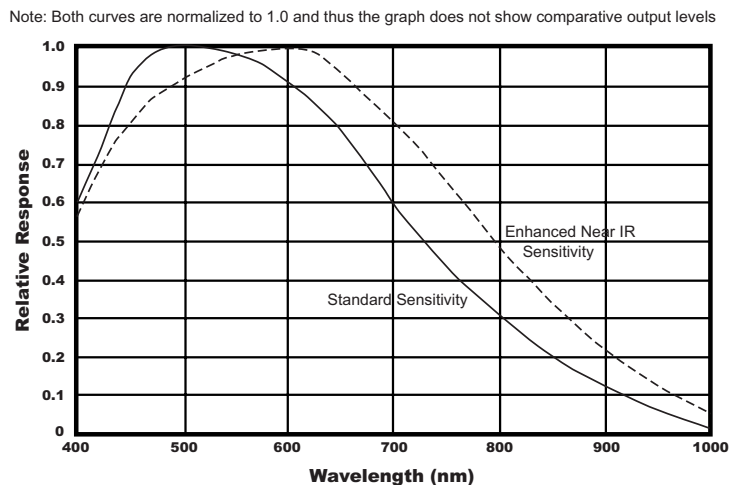


Figure 2. Sensor Wavelength Response Characteristics

Table 1. Specifications

| ELECTRICAL | |
|------------------------|--|
| Format | RS-170: 1/2-inch interline transfer monochrome CCD operating in field mode or CCIR: 1/2-inch interline transfer monochrome CCD operating in field mode (both available with extended near IR sensitivity) |
| Pixels | 768 × 494 RS-170; 752 × 582 CCIR |
| Pixel Cell Size | 8.4 (H) × 9.8 (V) μm RS-170 8.6 (H) × 8.3 (V) μm CCIR |
| Resolution | 580 HTVL (RS-170) 560 HTVL (CCIR) |
| Internal Clock | 28.6363 MHz (RS-170) 28.375 MHz (CCIR) |
| Sync | Internal crystal, or rear panel switch adjustable line lock, depending on model |
| Frame Rate | 30 fps (RS-170); 25 fps (CCIR) |
| Sensitivity, Faceplate | Full video, max gain, agc off: Standard: 0.0012 lux Extended: 0.0009 lux 80% video, max gain, agc off Standard: 0.0010 lux Extended: 0.0007 lux Agc On, extended sensitivity sensor: 0.28 lux, nominal min gain; 80% video, max gain, 0.0007 lux |
| Gamma | 0.6 normal fixed (optional fixed 0.45 or 1.0) |
| Sharpness Circuit | None used |
| Gain | 0 to 46 dB gain control — either agc or internal manual adjustment |
| Shutter | 1/60 (1/50 CCIR) to 1/100,000 sec; 8 steps (Internal switch access) |
| S/N | 58 dB max; 10 dB S/N with 46 dB gain (0.6 gamma) |
| Spectral Response | See figure 2 |
| Power Input | 24 V ac ±10 % or, depending on model, 115 V ac ±10 % |
| Power Consumption | 30 W ; heater draws an additional 20 W each time it cycles on in cold weather |
| Video Output | RS-170 or CCIR, depending on model Fiber optic ST connector output optional |
| Lens Control | Auto iris (video style) and dc iris; zoom lens optional |
| MECHANICAL | |
| Dimensions | 21 inch long × 5.2 inch high (533 × 132 mm), without sun shield. See figure 4 |
| Weight | 10 lb (3.9 kg), less lens |
| Camera Mount | 5 each 1/4-20 threaded holes on mounting base attached to barrel housing |
| Connectors | 39-pin Bendix PT07C-20-39P, Schrader valve for pressure charging with dry nitrogen, pressure relief valve, optional fiber optic connector |
| ENVIRONMENTAL | |
| Temperature | -20 to 60 °C (-4 to 140 °F) operating -40 to 60 °C (-40 to 140 °F) operating with heaters -30 to 85 °C (-22 to 185 °F) non operating |
| Humidity | Up to 100 % relative humidity |
| Vibration (less lens) | Sine vibration from 5 to 60 Hz, with 0.082 inch total excursion (15 g's at 60 Hz) Random vibration from 60 to 1,000 Hz, 5 g's rms (0.027 g ² /Hz without damage) |
| Shock (less lens) | Up to 15 g's, 11 ms, in any axis under non-operating conditions, MIL-E-5400T, paragraph 3.2.24.6 |
| Altitude | Sea level to equivalent of 3,000 meters (10,000 feet) 508 mm / 20 inches of mercury) |
| Air Contaminants | Withstands exposure to sand, dust, fungus, and salt atmosphere, per MIL-E-5400T, paragraph 3.2.24.7, 3.2.24.8, and 3.2.24.9. |
| Explosion | MIL-E-5400T, paragraph 3.2.24.10 |
| Acoustical Noise | Greater than 150 dB continuously for 30 minutes |
| Immunity | EN61000-4-3, -4-6, -4-8 interference immunity tests |

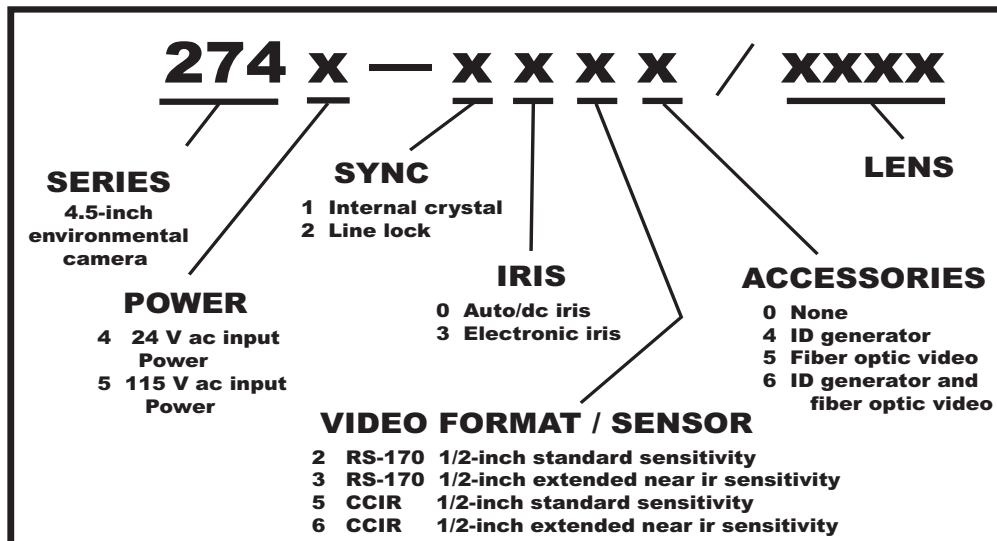


Figure 3. Model Number Interpretation Diagram

cal Manual 6X-1040 (2700 camera) — available on the cohu-cameras web site.

A model number interpretation diagram appears in figure 3. That diagram shows the various basic configurations of the Camera. An optional sun shield is also available but it is not modeled into this number sequence.

The following options are available for the camera:

1. Fiber optic video output
2. ID generator
3. Variable phase line lock
4. Either manual iris lens, auto iris lens, dc iris lens, or zoom lens
5. Sunshield

1.1.1 Sensor Characteristics

Figure 2 shows the typical response characteristic across relevant wavelengths of the sensor. This chart shows both the standard sensitivity curve and the enhanced sensitivity curve.

The camera lens and the window in the barrel housing will have a slight impact on these curves.

These characteristic curves apply to both NTSC and PAL sensors.

1.2 Mechanical Characteristics

Dimensions are shown in figure 4. The Camera consists of a sealed and pressurized 21 inch long barrel housing attached to a mounting base with two stainless steel straps.

An optional sun shield can be mounted over the housing to prevent heat build up from direct sun light on the barrel. This sun shield extends beyond the ends of the barrel about three inches at each end. It can provide some protection from direct sun exposure on the camera lens in certain situations.

All electrical connections are made via a 39-pin connector located on the rear panel. A fiber optic option makes video available from a fiber optic connector located on the rear panel. Video from the 39 pin connector, then, should not be used.

A Schrader valve (car tire type valve) on the rear panel provides for pressurizing the housing with dry nitrogen. This valve can be used to occasionally add dry nitrogen as necessary to maintain pressure in the barrel at about 5 psi (35 kPa).

A pressure relief valve on the rear panel releases pressure at 20 psi (138 kPa) to prevent extreme over-pressurization of the housing.

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The mounting base for this camera has five 1/4-20 holes down the center line. This mounting base plate aluminum is 1/4-inch thick.

At least two of these threaded holes must be used to secure the camera to its mounting platform. Use high quality grade 316 stainless steel bolts and lock washers.

The threads on these bolts should extend beyond the camera baseplate by at least 1/16 inch to ensure that at least one full thread is exposed. But the bolts must not extend beyond the camera base plate more than 3/8 inch or they could bottom out on the barrel housing.

2.0 INSTALLATION

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

2.1 Unpacking and Receiving Inspection

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

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.

INSTALLATION AND OPERATION

Table 2. Items Supplied

| ITEMS SUPPLIED | |
|--|--|
| ITEM | DESCRIPTION |
| 1 | Camera Barrel |
| 2 | Base |
| 3 | Stainless steel base-to-barrel attachment straps (2) |
| Note: These items are supplied as one assembly | |

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

2.2 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.

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.

2.3 Equipment Supplied

The camera consists of a single environmental housing with attached mounting base. Cameras intended for use outdoors typically are fitted with an optional sun shield assembly that wraps around the top half of the camera and extends about three inches beyond the housing at each end.

This sunshield minimizes heat buildup inside the camera by shielding it from the direct rays of the sun. It can also provide some protection from lens flare in certain situations.

2.4 Equipment Required but Not Supplied

As a minimum the camera requires a source of operating power, a monitor on which to view the scene, an interconnection cable, and a computer running the Cohu WinMPC software for setup of the ID generator if this option is installed.

This software is available at no cost as a download from Cohu Electronics (www.cohu-cameras.com) or by mail on a CD.

Table 3. Rear Panel Connector and Mating Cable Plug

| REAR PANEL CONNECTOR | MATING CABLE PLUG |
|--|--|
| Cohu 1310225-004 Bendix PT07C-20-39P | Cohu 1310230-005 Bendix PT06A-20-39S(SR) |
| | Straight potting sleeve Cohu 1310216-002 |
| | 90° strain relief 1310441-001 and straight potting sleeve 1310216-004 |
| <small>Note: Mating Cable Plug requires either the -002 straight potting sleeve or the 90 degree strain relief with the -004 potting sleeve.</small> | |

Communications with the optional ID generator must be via RS-422. Since the serial port on most PC computers is likely to be RS-232, a 232/422 converter will likely be required; however, computers without either a 232 or 422 serial port will likely have a USB port. In this case a USB-to-422 converter will be required.

Installing the camera will also require grade 316 stainless steel mounting hardware and a platform of some type on which to mount it.

2.5 Cabling Requirements

A single 39-pin connector on the rear panel provides all electrical connections for the Camera. See figure 5 for a typical system interconnection cable.

If the optional fiber optic ST connector is mounted at the rear panel to provide video output, a mating ST connector with fiber optic cable must be used to interconnected with it.

2.6 Power Requirements

The Camera is available as either a 24 V ac or a 115 V ac version. Even though a Camera will be configured for only one of these input voltages, they are applied to different pins on the rear panel connector.

A line-lock version of the Camera has a six position phase switch on the rear panel. See section 2.8.

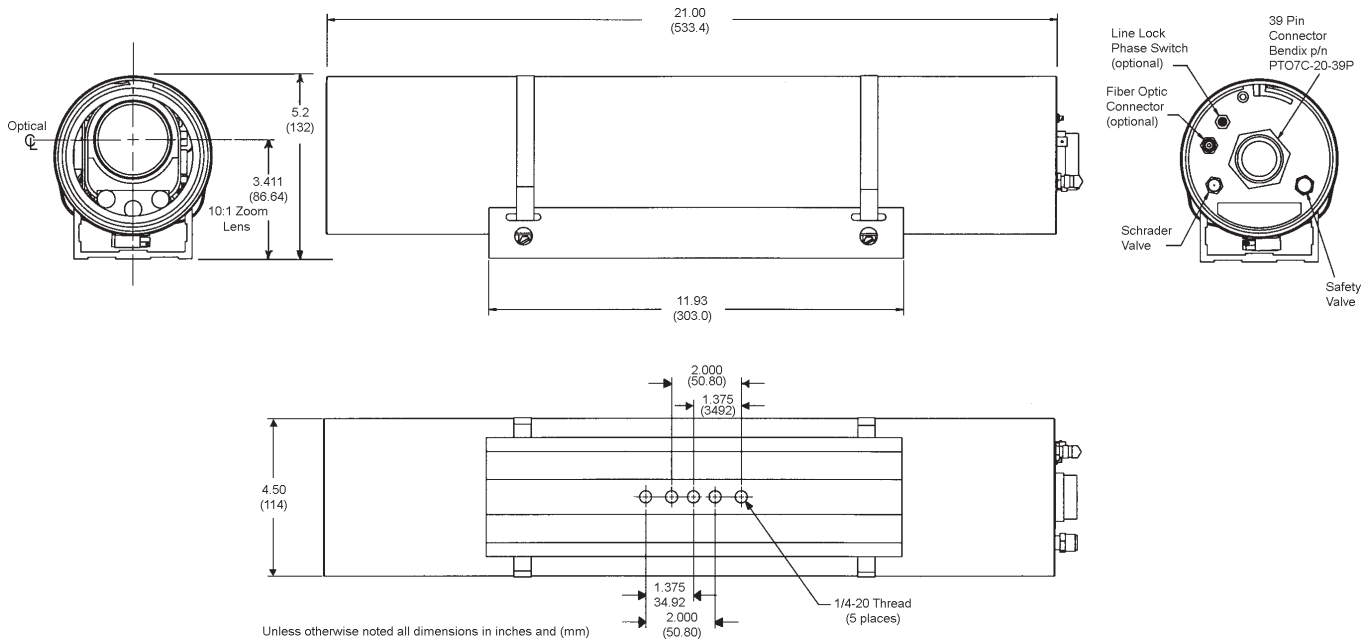


Figure 4. Dimensions, Model 2740 Camera

2.7 Mounting Requirements

The dimensions shown in figure 4 illustrate characteristics of the camera related to securing it to a pan-and-tilt unit, pedestal base, arm, or similar mounting platform.

The five 1/4-20 holes on the bottom of the camera mounting base are threaded through 1/4-inch thick aluminum plate.

The bolts used to hold the camera to a mounting platform should extend at least 1/16 inch beyond the 1/4-inch camera base plate so that a full thread is exposed. Bolts extending more than 3/8 inch beyond the camera base plate could jam against the barrel housing of the camera. This should not be allowed to happen.

2.8 Line Lock Operation

The line lock version of this Camera relies on a sync reference derived from the ac power line in place of an internal crystal oscillator as the reference source.

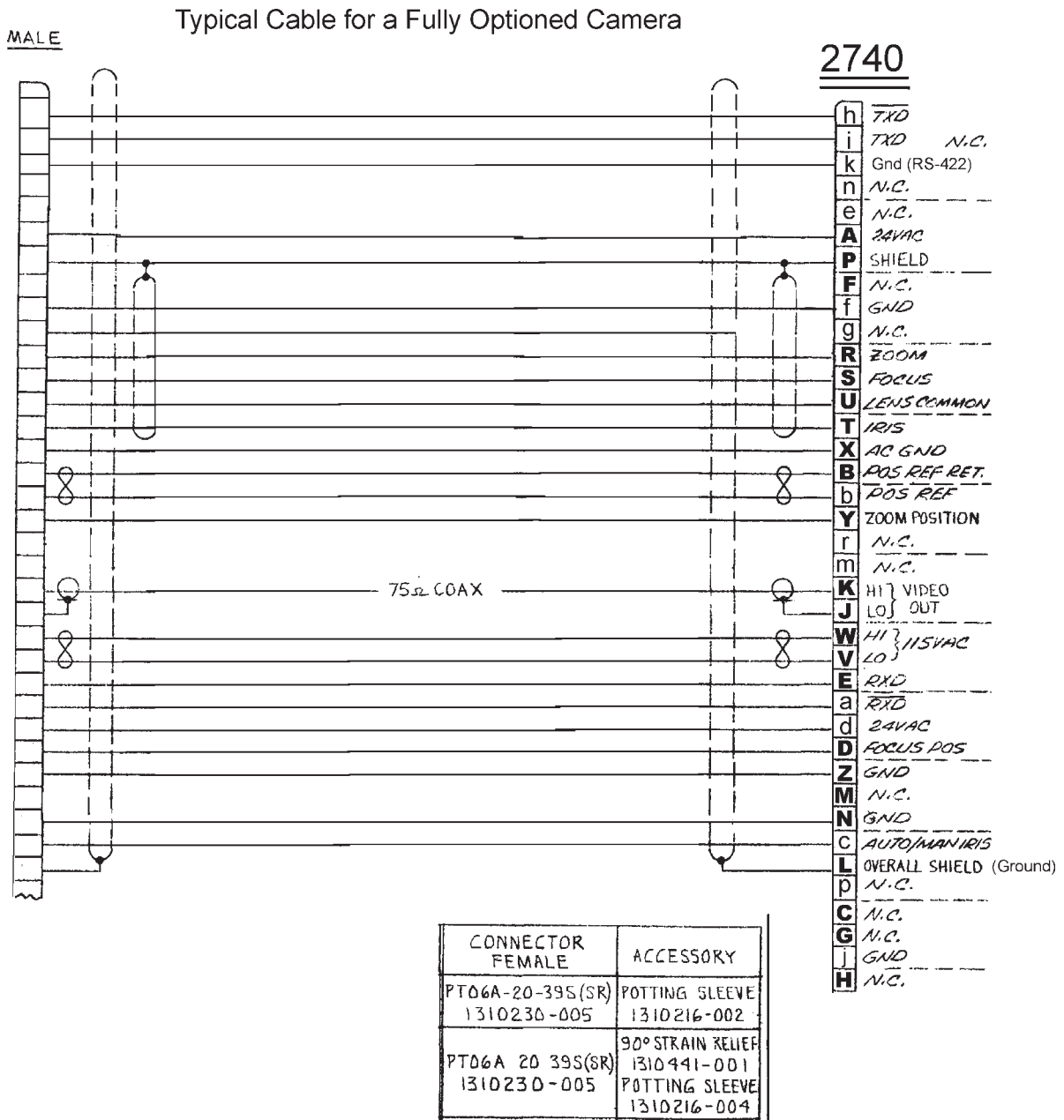
With equipment operating from different phases of the power line, or perhaps off a different

transformer or other source, a typical step-phase change in 60 degree increments makes it possible to match with the vertical interval of other cameras or equipment in the system.

2.9 Installation Procedure

Installing the Camera is straightforward. If it is known that the internal camera module control functions are properly set, it is only necessary to mount the Camera to a suitable base, mate the rear panel connector, and apply power. This assumes the other end of the cable is properly connected to a source of power, a tv monitor, and any other required equipment.

See figure 5 for the wiring diagram of a typical cable to use with the Camera. Not all of the connections shown may be required. As a minimum, this cable must provide power to the camera and video to a tv monitor (unless the optional fiber optic video output option has been installed). Additional connections are required when either a zoom lens or the ID generator option is installed.



NOTE: When camera is optioned for the fiber optic video output the 75 ohm coax is not required for this cable

The TXD, TXD, RXD, and RXD wires are required only when the camera has the ID Generator option

Wiring for pins B, D, P, R, S, T, U, Y, b and c are required only when the camera has a zoom lens installed

Figure 5 . Typical Interconnection Cable

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2.9.1 ID Generator Messages (Option)

Entering messages into the optional ID generator requires use of either Cohu's WinMPC maintenance software or the system control software if that software has been implemented with the proper Cohu protocol messages (and RS-422 system communications is available). WinMPC can be obtained at no cost from the cohu-cameras.com website or by mail on CD.

The ID generator messages are programmed in via RS-422 on the 39-pin rear panel connector. Since the serial port on a computer is typically an RS-232 port, a 232 to 422 converter will probably have to be used for this connection. It is recommended that a B&B model 422PP9TB converter be use (Available from Cohu as part number 3010100-001). There are subtle differences among these types of converters and not all will work in this application.

If the computer does not have an RS-232 port it likely will have a USB port. In this case, a USB-to-422 converter will be required.

WinMPC (or properly configured system control software) can also be used to turn on and off a display of internal housing pressure and temperature when the ID generator option is installed.

Messages to be displayed by the ID generator, an indication of the nitrogen pressure, and interior barrel temperature readings can also be controlled by the system software if the correct protocol messages have been implemented and RS-422 communications is established with the camera.

2.9.2 Rear Panel Features

All interconnections with the camera are via a 39-pin Bendix type connector (figures 6 and 7) — unless the fiber optic video option is installed in which case video leaves the camera on an ST type fiber optic connector (figure 8).

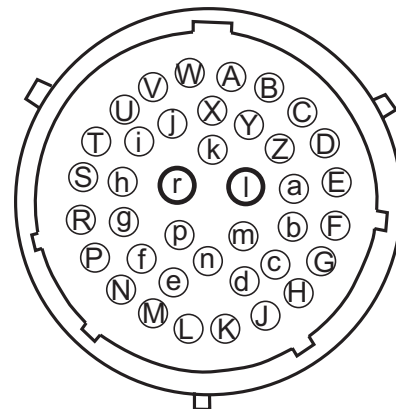
2.9.2.1 39-pin Connector

Table 4 lists all pin functions of this connector. Note that certain pins are not used and others may not be used depending on what options are installed in the camera.

INSTALLATION AND OPERATION



Figure 6 . Rear Panel Features (basic camera)



Looking at rear panel of camera. Same pin orientation as the rear wiring view of mating connector

Figure 7. Connector Pin Orientation

Position return pins are used only when the camera has been mated with a zoom lens.

The TXD, TXD (not) and RXD, RXD (not) RS-422 pins are used only when the related ID generator circuit board option is installed.

Note that separate pins are dedicated to 115 V ac and to 24 V ac input power. The camera will be internally configured to accept only one of these input voltages.

Table 4. Pin Functions, Rear Panel Connector

| PIN | FUNCTION |
|-----|-----------------------------|
| A | 24 V ac |
| B | position reference return |
| C | not used |
| D | focus position |
| E | RXD |
| F | not used |
| G | not used |
| H | not used |
| J | ground, video out |
| K | video out |
| L | ground |
| M | not used |
| N | ground |
| P | shield (zoom lens controls) |
| R | zoom |
| S | focus |
| T | iris |
| U | lens common (ground) |
| V | 115 V ac low (neutral) |
| W | 115 V ac high (line) |
| X | ground, ac power (115) |
| Y | zoom position |
| Z | ground |
| a | RXD (not) |
| b | position reference |
| c | auto/manual iris select |
| d | 24 V ac input |
| e | not used |
| f | ground |
| g | not used |
| h | TXD (not) |
| i | TXD |
| j | not used |
| k | ground (RS-422) |
| l | not used |
| m | not used |
| n | not used |
| p | not used |
| r | not used |

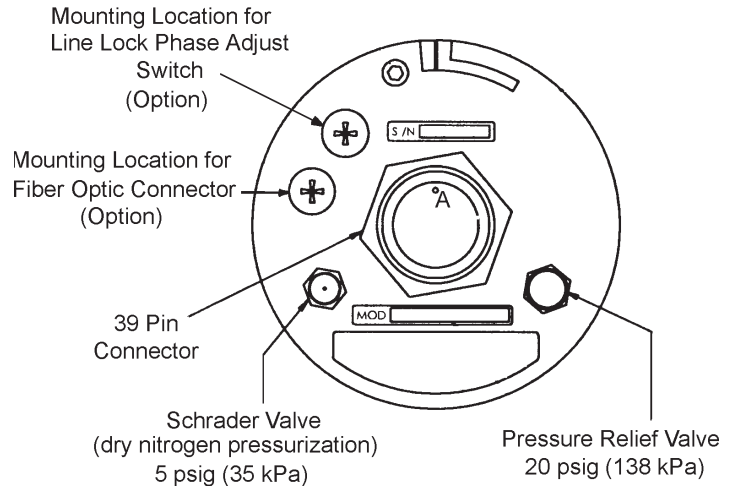


Figure 8. Rear Panel Features (optioned camera)

2.9.2.2 Connector Tx (Transmit) and Rx (Receive) Conventions

Table 4 and figure 5 show pin functions for RS-422 connections. The Tx+ Tx- and Rx+ Rx- notations for these RS-422 connectors and all other RS-422 connectors in a system using this notation cause much confusion for field installers. There is a tendency to want to connect Tx to Tx and Rx to Rx. This almost always is wrong.

The Tx+ output of one piece of hardware should go to the Rx+ input of another. And Tx- goes to Rx-. Note that “not” can be used for the “-” (minus) designation, e.g., Tx (not) and Rx (not).

To add to the confusion Tx and Rx are not universally used notations for the same functions. Some times “Command Out” is used for Tx and “Command In” for Rx. Other naming conventions are also used among different equipment and cables.

Because RS-422 provides bidirectional communications over the same cable (although on different wire pairs) a connector can be an input at one moment and then an output milliseconds later (RS-422 half-duplex). Thus, markings that would attempt to label connectors as either input or output would be somewhat arbitrary.

With RS-422, the wire pairs themselves, though, pass data in only one direction. For

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example, output pins on connector A must be routed to the input pins of connector B. And to get data back the other direction, the output pins on B must then be connected to the input pins on A. The concept is simple but in practice the labeling found in the field can sometimes be confusing.

If any confusion exists it is best to contact the Customer Support department at Cohu or your local Cohu representative.

2.9.2.2 Fiber Optic Connector (option)

An ST type connector is mounted on the rear panel when the fiber optic video output option is installed in the camera. This connector supports an 850 nm multimode connection with 62.5 μm fiber. Optical budget is 13 dB. This module is a GE Interlogix Fiber Options model S700VT-TST.

The companion units are their model S700VR and S702VR receivers. Receiver modules from other manufacturers should be tested before committing to their use with this camera. Consult with a Cohu Electronics Applications Engineer or a Cohu Field Representative for further information.

Using 75 Ohm Video Output when Fiber Optic Option Installed

When the fiber optic video output option is installed in the camera, video from pins K and L on the 39 pin connector cannot be used for system video connections because this is not an isolated output. The input to the fiber optic module inside the camera is internally terminated with 75 ohms and pins K and L merely tap off at this module input. Using the K and L output pins would require double termination.

But for temporary maintenance functions, pins K and L (video) could be used in addition to this fiber optic output, if desired, so long as only a short cable is connected to these pins and no termination is used. Monitors used for servicing video equipment usually have a switch to insert or remove the 75 ohm termination on their input.

A long cable could act as a “stub” to cause interference such as ghosting in the video signal.

Terminating pins K and J when the fiber optic option is installed would cause the video level to drop to one-half of normal.

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Figure 9. Humidity Indicators (Blue is Normal)

2.9.2.3 Phase Adjust Line Lock Switch (Option)

If the vertical interval of a camera must occur at the same time as the vertical interval of other equipment in the system, a six position switch on the rear panel provides for six 60-degree increments of shift when the line lock option is installed. Equipment operating on other phases of the power line or perhaps from a different transformer will typically have phase differences in 60 degree increments.

2.9.2.4 Schrader Valve

The Schrader valve installed on this camera is functionally identical to those used for car tires — but this valve should be used to introduce only dry nitrogen into a camera housing.

During assembly cameras are purged of normal room air (which typically has a high relative humidity) by flowing dry nitrogen into the Schrader valve and out the pressure relief valve. This relief valve is held open to aid in the flow of nitrogen out of the camera. The **PRESS. RELIEF** bolt (figure 6) can also be removed when it is desired to flow dry nitrogen through the housing.

This purging process removes moist room air from inside the camera to provides an internal relative humidity of about five percent.

A camera is typically pressurized to 5 psi (34 kPa). Pressure can be allowed to go below this — even down to one or two pounds so long as the pressure does not ever become zero.

An occasional recharge of dry nitrogen can be used to maintain pressure near 5 psi (34 kPa). If pressure continually drops it is an indication of a slow leak and the camera requires maintenance.

These pressure references are gauge pressures (psig). They are relative to the altitude above sea level at which they are being measured.

2.9.2.5 Pressure Relief Valve

The pressure relief valve opens at about 20 psi (138 kPa). This valve should be manually lifted off its seat when it is desired to flow dry nitrogen through the camera to purge any moisture laden atmospheric air from the camera.

This valve has short section of clear tubing around it to prevent the pop-up stem from accidentally being moved and thus releasing pressure. This plastic will have to be taken off to gain access to the pop up valve for manual release of pressure. Be sure to install the tubing again after purging and pressurization is completed.

2.10 Front Window Features

The camera lens is mounted behind the window at the front of the camera housing. Near the bottom of this window are three circular disks inside the camera housing. The disk on the left is labeled 10, the middle one 20, and the one on the right 30. See figure 9.

When relative humidity inside the camera is below 10 percent, all these disks will be blue in color. If humidity inside the camera should for some reason rise above 10 percent, the 10 disk will change color to pink. Likewise, if relative humidity rises above 20 or 30 percent the related disk will also turn pink. These disks can be used as an indication of the approximate relative humidity inside the camera. It should be below 10 percent and all disks blue in color.

If these disks turn pink it is an indication that pressurization with dry nitrogen has dissipated and moisture laden air has entered. Or it could mean that the camera was not properly reas-

sembled and purged with dry nitrogen during maintenance procedures.

It may be possible to flow dry nitrogen through the camera for several minutes in an attempt to purge moist air from the camera and thus turn a humidity indicators blue again — but this could expend a large amount of dry nitrogen. And if a desiccant pack inside the housing has absorbed moisture (which is likely) the camera would then require disassembly to replace this pack.

Once an internal desiccant pack absorbs excess moisture it has to be removed and either oven dried for at least 16 hours or replaced by a fresh, dry pack that has been kept in a tightly sealed container.

When a camera is being assembled warm air is blown across these humidity indicators with a heat gun to remove moisture and turn them blue. Stripping them of moisture by flowing dry nitrogen across them can require far more dry nitrogen than is required to purge moisture laden air from the housing components.

2.11 Preparation for Shipment and Storage

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

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

For shipment, package with enough foam padding or other packing material to prevent shipping damage that can occur. 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 of Cohu Electronics 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 paper-work contained inside. Give a brief description of why the equipment is being returned and list the symptoms of any problems being experienced with the equipment.

3.0 OPERATION

After the Camera is installed, operation of the Camera requires minimum attention. If a zoom lens is being used, the zoom in/out and focus may have to be changed occasionally.

Optional ID generator messages and readout of internal housing pressure and temperature may be visible — or they can be turned on and off if the proper protocol messages have been implemented and RS-422 communications exists with the camera.

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