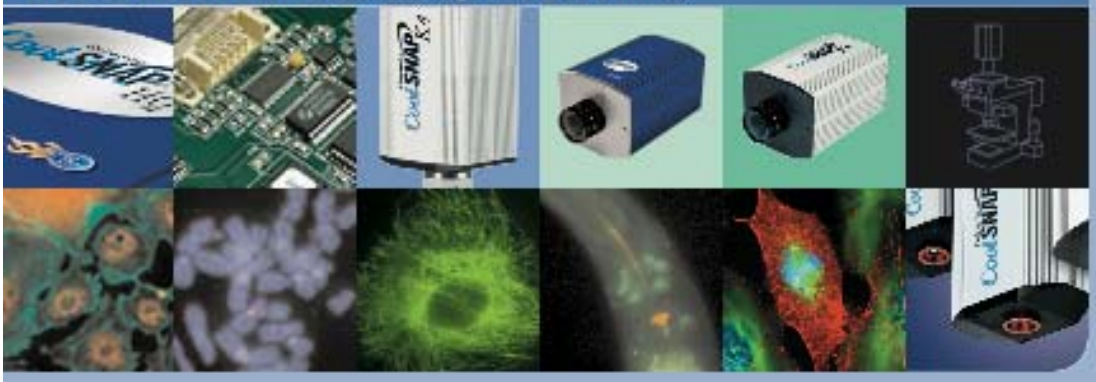
Photometrics®

CoolSNAP™

USER MANUAL CoolSNAP$_{HQ^2}$ and CoolSNAP$_{K4}$



PHOTOMETRICS®

a division of Roper Scientific, Inc.

User Manual for CoolSNAP$_{HQ^2}$ and CoolSNAP$_{K4}$ Systems

PHOTOMETRICS®
a division of Roper Scientific, Inc.

57-063-001 Rev D0

Photometrics
3440 East Britannia Drive
Tucson, Arizona 85706
Tel: 520.889.9933
Fax: 520.295.0299

57-063-001 Rev D0

LIMITED WARRANTY

Photometrics, a division of Roper Scientific, Inc., ("Photometrics," us," "we," "our") makes the following limited warranties. These limited warranties extend to the original purchaser ("You", "you") only and no other purchaser or transferee. We have complete control over all warranties and may alter or terminate any or all warranties at any time we deem necessary.

Basic Limited One (1) Year Warranty
Photometrics warrants this product against substantial defects in materials and / or workmanship for a period of up to one (1) year after shipment. During this period, Photometrics will repair the product or, at its sole option, repair or replace any defective part without charge to you. You must deliver the entire product to the Photometrics factory or, at our option, to a factory-authorized service center. You are responsible for the shipping costs to return the product. International customers should contact their local Photometrics authorized representative/distributor for repair information and assistance, or visit our technical support page at www.photomet.com.

Limited One (1) Year Warranty on Refurbished or Discontinued Products
Photometrics warrants, with the exception of the CCD imaging device (which carries NO WARRANTIES EXPRESS OR IMPLIED), this product against defects in materials or workmanship for a period of up to one (1) year after shipment. During this period, Photometrics will repair or replace, at its sole option, any defective parts, without charge to you. You must deliver the entire product to the Photometrics factory or, at our option, a factory-authorized service center. You are responsible for the shipping costs to return the product to Photometrics. International customers should contact their local Photometrics representative/distributor for repair information and assistance or visit our technical support page at www.photomet.com.

Normal Wear Item Disclaimer
Photometrics does not warrant certain items against defect due to normal wear and tear. These items include internal and external shutters, cables, and connectors. *These items carry no warranty, expressed or implied.*

Sealed Chamber Integrity Limited 24 Month Warranty
Photometrics warrants the sealed chamber integrity of all our products for a period of twenty-four (24) months after shipment. If, at anytime within twenty-four (24) months from the date of delivery, the detector should experience a sealed chamber failure, all parts and labor needed to restore the chamber seal will be covered by us. *Open chamber products carry NO WARRANTY TO THE CCD IMAGING DEVICE, EXPRESSED OR IMPLIED.* Responsibility for shipping charges is as described above under our Basic Limited One (1) Year Warranty.

Vacuum Integrity Limited 24 Month Warranty
Photometrics warrants the vacuum integrity of all our products for a period of up to twenty-four (24) months from the date of shipment. We warrant that the detector head will maintain the factory-set operating temperature without the requirement for customer pumping. Should the detector experience a Vacuum Integrity failure at anytime within twenty-four (24) months from the date of delivery all parts and labor needed to restore the vacuum integrity will be covered by us. Responsibility for shipping charges is as described above under our Basic Limited One (1) Year Warranty.

Software Limited Warranty
Photometrics warrants all of our manufactured software discs to be free from substantial defects in materials and / or workmanship under normal use for a period of one (1) year from shipment. Photometrics does not warrant that the function of the software will meet your requirements or that operation will be uninterrupted or error free. You assume responsibility for selecting the software to achieve your intended results and for the use and results obtained from the software. In addition, during the one (1) year limited warranty. The original purchaser is entitled to receive free version upgrades. Version upgrades supplied free of charge will be in the form of a download from the Internet. Those customers who do not have access to the Internet may obtain the version upgrades on a CD-ROM from our factory for an incidental shipping and handling charge. *See Item 12 in the following section of this warranty ("Your Responsibility") for more information.*

Owner's Manual and Troubleshooting
You should read the owner's manual thoroughly before operating this product. In the unlikely event that you should encounter difficulty operating this product, the owner's manual should be consulted before contacting the Photometrics technical support staff or authorized service representative for assistance. If you have consulted the owner's manual and the problem still persists, please contact the Photometrics technical support staff or our authorized service representative. *See Item 12 in the following section of this warranty ("Your Responsibility") for more information.*

Your Responsibility
The above Limited Warranties are subject to the following terms and conditions:

1. You must retain your bill of sale (invoice) and present it upon request for service and repairs or provide other proof of purchase satisfactory to Photometrics.
2. You must notify the Photometrics factory service center within (30) days after you have taken delivery of a product or part that you believe to be defective. With the exception of customers who claim a "technical issue" with the operation of the product or part, all invoices must be paid in full in accordance with the terms of sale. Failure to pay invoices when due may result in the interruption and/or cancellation of your one (1) year limited warranty and/or any other warranty, expressed or implied.
3. All warranty service must be made by the Photometrics factory or, at our option, an authorized service center.
4. Before products or parts can be returned for service you must contact the Photometrics factory and receive a return authorization number (RMA). Products or parts returned for service without a return authorization evidenced by an RMA will be sent back freight collect.
5. These warranties are effective only if purchased from the Photometrics factory or one of our authorized manufacturer's representatives or distributors.
6. Unless specified in the original purchase agreement, Photometrics is not responsible for installation, setup, or disassembly at the customer's location.
7. Warranties extend only to defects in materials or workmanship as limited above and do not extend to any product or part which has:
    - been lost or discarded by you;
    - been damaged as a result of misuse, improper installation, faulty or inadequate maintenance or failure to follow instructions furnished by us;
    - had serial numbers removed, altered, defaced, or rendered illegible;
    - been subjected to improper or unauthorized repair; or
    - been damaged due to fire, flood, radiation, or other "acts of God" or other contingencies beyond the control of Photometrics.
8. After the warranty period has expired, you may contact the Photometrics factory or a Photometrics-authorized representative for repair information and/or extended warranty plans.
9. Physically damaged units or units that have been modified are not acceptable for repair in or out of warranty and will be returned as received.
10. All warranties implied by state law or non-U.S. laws, including the implied warranties of merchantability and fitness for a particular purpose, are expressly limited to the duration of the limited warranties set forth above. With the exception of any warranties implied by state law or non-U.S. laws, as hereby limited, the forgoing warranty is exclusive and in lieu of all other warranties, guarantees, agreements, and similar obligations of manufacturer or seller with respect to the repair or replacement of any parts. In no event shall Photometrics' liability exceed the cost of the repair or replacement of the defective product or part.
11. This limited warranty gives you specific legal rights and you may also have other rights that may vary from state to state and from country to country. Some states and countries do not allow limitations on how long an implied warranty lasts, when an action may be brought, or the exclusion or limitation of incidental or consequential damages, so the above provisions may not apply to you.
12. When contacting us for technical support or service assistance, please refer to the Photometrics factory of purchase, contact your authorized Photometrics representative or reseller, or visit our technical support page at www.photomet.com.

U. S. Government Restricted Rights

The software and documentation are provided with Restricted Rights. Use, duplication, or disclosure by the Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013 or subparagraphs (c)(1) and (2) of the Commercial Computer Software-Restricted Rights at 48 CFR 52.227-19, as applicable. Contractor/manufacturer is Photometrics, 3440 East Britannia Drive, Tucson, AZ 85706.

This license is effective until terminated. It will terminate upon the conditions set forth above or if you fail to comply with any term hereof. Upon termination, you agree that the software and accompanying materials, and all copies thereof, will be destroyed. This agreement is governed by the laws of the State of Arizona. You acknowledge that you have read this agreement, you understand it, you agree to be bound by its terms, and that this is the complete and exclusive statement of the agreement between you and Photometrics regarding the software.

European Union - Declaration of Conformity

CoolSNAP K4 Digital Camera System CE

with AC – DC Power Supply

Council Directives 73/23/EEC and 89/336/EEC

with Amendments 92/31/EEC, 93/97/EEC and 93/68/EEC.

The Product cited herein complies with the following Safety Standards when installed and operated in accordance with the Installation and Users Manual Provided. The product is declared to comply by Design, 3rd Party Evaluation and Testing. EMC Testing and Evaluations were performed by Garwood Laboratories, Inc. an Independent EMC Laboratory located in San Clemente, CA 92673, USA. The Certification Program Management and Product Safety Testing and Evaluations was provided by Garwood Laboratories Inc.

SAFETY STANDARDS – Low Voltage Directive

EN 601010 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.

EN 60950 Safety of Information Technology Equipment (This Standard is used to qualify the AC-DC Power Supply)

EMC STANDARDS – EMC Directive

EN 61326-1 Emissions and Immunity for Electrical Equipment for Measurement, Control and Laboratory Use.

EN 55011 Emissions Tests for Industrial, Scientific, and Medical (ISM) Equipment

Importers Name: _____

Importers Address: _____

_____

_____

Manufacturers Name: Photometrics, a Division of Roper Scientific

Manufacturers Address: Tucson, AZ 85706, USA

Description of Equipment: CoolSNAP K4 Digital Camera, Power Supply, PCI Card , Interface Cable and Programming

Model Number: CoolSNAP K4 Digital Camera System

Serial Number(s)

We the undersigned hereby declare that the equipment specified above conforms to the noted Machinery Directive and the appropriate Standards. Refer to the Technical Construction File, RSI 040330-1

IMPORTER	MANUFACTURER
Signature _____	Signature _____
Typed Name _____	Typed Name _____
Title _____	Title _____
Date _____	Date _____

Equipment verified to be Compliant by: Chuck Helton, Product Safety Group, Garwood Test Laboratories , San Clemente, CA, USA. This is based on the evaluation of a single sample as documented in the TCF.

Manufacturer's Declaration Of Conformity

Product Identification

Product	Camera
Brand	Photometrics
Model/Type	Cool Snap HQ2
Version	N/A
Additional Information	(none)

Manufacturer

Name & Address	Photometrics a division of Roper Scientific, Inc. 3440 E. Britannia Drive, Suite 100 Tucson, AZ 85706
Country:	USA

EU Representative

Name & Address	
Country:	
Function:	

A Sample has been tested by

Name & Address	M. Flom Associates, Inc. 3356 N. San Marcos Place, Suite 107 Chandler, AZ 85225
Country	USA

Standards Used

X EN 50082-1, EN 60000-3-2: Current Harmonics
X EN 50082-1, EN 60000-3-3: Voltage Fluctuations and Flicker
X EN 50082-1, EN 61000-4-2: Electrostatic Discharge (ESD)
X EN 50082-1, EN 61000-4-3: Radiated Electromagnetic Field (EMF)
X EN 50082-1, EN 61000-4-4: Electrical Fast Transient/Burst (EFT)
X EN 50082-1, EN 61000-4-5: Surge Immunity (Mains)
EN 50082-1, EN 61000-4-6: RF Injected Current
X EN 50082-1, EN 61000-4-11: Voltage Dips and Interruptions
X EN 55022-1998 with Amendment A1: 2000 (CISPR-22)
EN 55011-1998 with Amendment A2: 2002 (CISPR-11)
EN 50082-1-1997
EN 60601-1-1, DB9801, HE195: Leakage Current

The product is in conformity with Directive 89/336/EEC based on test results using harmonized standards in accordance with Article 10(a) of the Directive.

Signature of EU Representative

Signature	
Place	
Date	
Number	

M. Flom Associates, Inc.
3356 N. San Marcos Place, Suite 107
Chandler, Arizona 85225-7176
(480) 926-3100 phone, fax (480) 926-3598

MFA p0570015, d0580004

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Chapter 1. Introduction

Description

The Photometrics® CoolSNAP$_{HQ^2}$ and CoolSNAP$_{K4}$, from Roper Scientific®, are industry-leading cameras for low-light fluorescence microscopy. These cameras incorporate progressive-scan CCDs (charge-coupled devices), a 12- or 14-bit digitizer, and low-noise electronics to produce monochrome images at greater than 1k x 1k resolution.

System Components

In addition to the components shown below, the CoolSNAP™ package also includes RS Image™ software.

Camera (with Test Lens) and DATA Cable

CoolSNAP IEEE-1394 Cable

CoolSNAP LVDS Cable

CoolSNAP IEEE-1394 Interface Card

CoolSNAP LVDS Interface Card

Power Supply with Power Cable and Power Cord

About This Manual

The *CoolSNAP User Manual* is divided into five chapters. It is suggested that you read the entire manual before operating the camera in order to ensure proper use. The chapters that follow this introduction are

- **System Installation** — Instructions for connecting your CoolSNAP camera to your computer via the CoolSNAP PCI card.
- **Operating Features** — Discusses CoolSNAP features such as antiblooming, trigger modes, and (for the CoolSNAP$_{HQ^2}$) the dual-speed ADC.
- **Troubleshooting** — Provides answers to camera system problems.
- **Basic Specifications** — Provides specifications for CoolSNAP system components.

Note: Unless otherwise noted, the CoolSNAP$_{HQ^2}$ and the CoolSNAP$_{K4}$ cameras are referred to by the name "CoolSNAP".

Precautions

The CCD and other system electronics are extremely sensitive to electrostatic discharge (ESD). To avoid permanently damaging the system, please observe the following precautions:

- If you are using high-voltage equipment (such as an arc lamp) with your camera system, be sure to turn the camera power *on last* and power the camera *off first.*
- Never connect or disconnect any cable while the camera system is powered on.
- Although you should switch off the *camera's* power supply before disconnecting any camera system cable, you do *not* need to power off your computer to detach the cables.
- Use caution when triggering high-current switching devices (such as an arc lamp) near your system. The CCD can be permanently damaged by transient voltage spikes. If electrically noisy devices are present, an isolated, conditioned power line or dedicated isolation transformer is highly recommended.
- Always leave one inch of space around the camera's external cooling fins for air flow.
- Never open the camera. There are no user-serviceable parts inside the CoolSNAP camera. Opening the camera voids the warranty.
- Use only the PCI card, cables, and power supply designated for this camera system. Using non-CoolSNAP$_{HQ^2}$ /CoolSNAP$_{K4}$ cables, PCI cards, or power supplies may result in permanent damage to your system.
- Do not use a C-mount lens that has optics that extend behind the flange of the lens.
- Severe power line disruptions may cause the camera to lock-up. Cycling power will correct this.

Environmental Requirements

The CoolSNAP camera system should be operated in a clean, dry environment.

The camera system's ambient operating temperature is 0°C to 30°C with less than 80% relative humidity, noncondensing.

Storage Requirements

Store the CoolSNAP camera system in its original containers. To protect the system from excessive heat, cold, and moisture, store at an ambient temperature between -20°C and 60°C with a relative humidity of 0%-90%, noncondensing.

Microscopes, Lenses, and Tripods

The camera has a standard threaded video mount and can be mounted to any microscope that accepts a standard C-mount adapter. The camera also allows you to install any lens that is compatible with a standard threaded video mount as long as its optics do not extend behind the flange of the lens. The CoolSNAP camera can be mounted to a tripod using the tripod mounting attachment located on the bottom of the camera. See *Additional Measurements* on page 17 for more information.

Note: In microscopy applications, a 1.0x C-mount camera coupler is recommended for proper field of view.

Repairs

The CoolSNAP camera system contains no user-serviceable parts. Repairs must be done by Photometrics. Should your camera system need repair, contact Photometrics Customer Service. Please save the original packing materials so you can safely ship the camera system to another location or return it for repairs if necessary.

Note: Do not open the camera. Opening the CoolSNAP camera voids the warranty.

Cleaning

Clean exterior surfaces of the camera with a dry, lint-free cloth. To remove stains, contact Photometrics Customer Service. To clean the camera's imaging window, use only a filtered compressed-air source. Hand-held cans are not recommended, as they may spray propellant onto the window. Do not touch the window.

Photometrics Customer Service

If you have any questions about your camera system, contact Photometrics Customer Service. When you call, please have your Photometrics sales order number or equipment serial numbers available.

- Tel: 800. 874.9789/520.889.9933 between 8:00 am and 5:00 pm MST
- Fax: 520.295.0299
- Email: cservice@photomet.com
- Mail: Photometrics
  3440 East Britannia Drive
  Tucson, Arizona 85706

In Europe, you can reach Customer Service at:

BENELUX

- Tel: 31.347.324989
- Fax: 31.347.324979
- Email: mailto@roperscientific.com
- Mail: Roper Scientific, BV
  Ir. D.S. Tuijnmanweg 10
  4131 PN VIANEN, Netherlands

FRANCE

- Tel: 33.160.86.03.65
- Fax: 33.160.86.07.09
- Email: princeton.instruments@wanadoo.fr
- Mail: Roper Scientific, SARL
  Z.I. Petite Montagne Sud
  4, rue de l'Oisans - C.E. 1702
  91017 Evry Cedex, France

GERMANY

- Tel: 49.89.660.779.3
- Fax: 49.89.660.779.50
- Email: mail@roperscientific.de
- Mail: Roper Scientific, GmbH
  Rosenheimer Landstr. 87
  D-85521 Ottobrunn, Germany

In Japan, you can reach Customer Service at:

- Tel: 81.3.5639.2731
- Fax: 81.3.5639.2775
- Email: sales@roper.co.jp
- Mail: Nippon Roper, K.K.
  Sakurai Building
  2-8-19 Fukagawa
  Koto-ku, Tokyo
  Japan 135-0033

General product information and answers to some customer service questions can be found on our website: http://www.photomet.com

Chapter 2. System Installation

Carefully review the *Precautions* section on page 2 before performing any of the procedures outlined here. Again, use only a CoolSNAP cable and a CoolSNAP interface card with your CoolSNAP camera. Using a different cable or interface card may result in permanent damage to your system.

Introduction

Your CoolSNAP$_{HQ^2}$ or CoolSNAP$_{K4}$ camera system has the following hardware components:

- **LVDS cameras:**
  - LVDS data cable
- **IEEE-1394 cameras:**
  - 6-pin to 6-pin IEEE-1394 data cable
  - 6-pin to 4-pin IEEE-1394 data cable
- Camera head
- Power supply
- Interface card
- Power cord

CoolSNAP system components are linked by the data cable and controlled by your host computer system. All of these hardware components should be included with your shipment. Refer to the information and figures in *System Components* on page 1.

Keep all the original packing materials so you can safely ship the CoolSNAP system to another location or return it for service if necessary.

If you have any difficulty with any step of the instructions, contact Photometrics Customer Service.

Software Compatibility Requirements

The CoolSNAP package includes the RS Image capture software program designed for use with your CoolSNAP camera.

All other imaging software must also be PVCAM®-compatible. For full access to imaging software functions, the most current version of PVCAM must be used.

Host Computer Requirements

The host computer for your CoolSNAP camera must have the following:

- Windows® 2000 SP4 or XP SP2 operating system
- 1 GHz Pentium® 4 (or greater)
- 256 MB RAM (or greater)
- CD-ROM drive
- At least one unused PCI or PCI-X card slot
- 16-bit color display (or greater)

If you are a Mac user, the host computer for your CoolSNAP camera must have the following:

- Macintosh OS X.3 (Panther)
- 512 MB RAM (or greater)
- CD-ROM drive
- At least one unused PCI or PCI-X card slot (LVDS cameras only)
- At least one unused IEEE-1394 port (IEEE-1394 cameras only)
- Video adapter that supports 24-bit color (millions of colors)

Multiple Cameras

Windows versions of PVCAM support multiple open cameras. In order to use this function, it must also be supported by your imaging software. Many imaging packages support multiple open cameras.

If your imaging software supports multiple open cameras, there must be a separate interface card for each camera.

PVCAM for Macintosh and PVCAM for Linux® do not support the multiple open camera feature.

Software Installation

An Installation Guide appropriate to your system is included with your camera. This guide provides step-by-step instructions for installing the camera interface software and the application software for Windows-based and Macintosh-based computers. Additional instructions are included for installing an interface card in your computer and capturing images.

The CD-ROM contains the following files:

- **Linux directory —** this directory contains the files for installation on a Linux PC.
- **Mac OS directory —** this directory contains the files for installation on a Macintosh computer.
- **Manuals directory —** this directory contains the system manuals in PDF format.
- **Win OS directory —** this directory contains the files for installation on a Windows PC.

Installing the Interface Card

You will be using a CoolSNAP interface card to allow the camera to communicate with your computer.

Refer to the Readme text files on the CD-ROM and to the Quick Installation Guide before installing the interface card.

After installing the interface card, go to *Connecting Your CoolSNAP Camera*.

Connecting Your CoolSNAP Camera

The CoolSNAP cable connects your CoolSNAP camera to the CoolSNAP interface card. It is designed to serve as a conduit for data.

CoolSNAP IEEE-1394 Cable

CoolSNAP LVDS Cable

To connect your CoolSNAP LVDS camera:

1. Connect either end of the CoolSNAP LVDS cable to the CoolSNAP interface card that you have installed in the host computer.
2. Connect the other end of the CoolSNAP LVDS cable to the DATA connector located on the back of the camera (shown below).

CoolSNAP$_{HQ^2}$ (LVDS version)
CoolSNAP$_{K4}$ Rear Panel

The following connectors are located on the back of the CoolSNAP LVDS camera:

- ***DATA connector:*** 20-pin, high-density connector for data transfer.
- ***POWER connector:*** 5-pin, LEMO connector for camera power (see *POWER Connector Pinout* on page 19 for details).
- ***I/O connector:*** DB26, high-density connector for input/output control signals (see *I/O Connector Pinout* on page 20 for details).

Note: The rear panel also has a power switch (|=ON, O=OFF).

To connect your CoolSNAP IEEE-1394 camera:

1. Select the appropriate CoolSNAP IEEE-1394 data cable:
   - If you installed the CoolSNAP IEEE-1394 interface card, or have another IEEE-1394 interface card already installed, use the 6-pin to 6-pin data cable.
   - If you have a 4-pin IEEE-1394 connector on your computer (such as a laptop), use the 6-pin to 4-pin data cable.
2. Connect the data cable to the computer. Be sure to connect the cable in the proper orientation.
3. Connect the other end of the data cable to the DATA connector on the camera. Be sure to connect the cable in the proper orientation.

CoolSNAP$_{HQ^2}$ (IEEE-1394 version) Rear Panel

The following connectors are located on the back of the CoolSNAP IEEE-1394 camera:

- ***DATA connector:*** 6-pin, Type 1 IEEE-1394 connector for data transfer.
- ***POWER connector:*** 5-pin, LEMO connector for camera power (see *POWER Connector Pinout* on page 19 for details).
- ***I/O connector:*** DB26, high-density connector for input/output control signals (see *I/O Connector Pinout* on page 20 for details).

Note: The rear panel also has a power switch (|=ON, O=OFF).

Chapter 3 Operating Features

Dual-Mode Operation (CoolSNAP$_{HQ^2}$ Only)

A unique feature of the CoolSNAP$_{HQ^2}$ is that it allows two different CCD clocking modes that allow you choose between speed and NIR sensitivity. In the PVCAM implementation, the clocking modes are referred to as "normal" and "alternate normal".

Normal mode

In "Normal" mode, the CCD is optimized for maximum anti-blooming protection and frame rate. In this mode, the CCD can be clocked so that exposure and readout happen simultaneously as shown in the example below.

Example: Consider a situation where the full frame readout time is 96 msec (at 20 MHz) and the exposure time is 200 msec. The readout of a frame will occur during the exposure of the next frame. This is possible because the CCD has alternate columns of sensitive and masked areas. While charge is integrating in the sensor area, the previous frame, which is in the masked area, can be read out (Figure 1). In this example, the time required to acquire the three-image sequence is 696 ms (3 x 200 + 96) and the frame rate is approximately 4.3 fps.

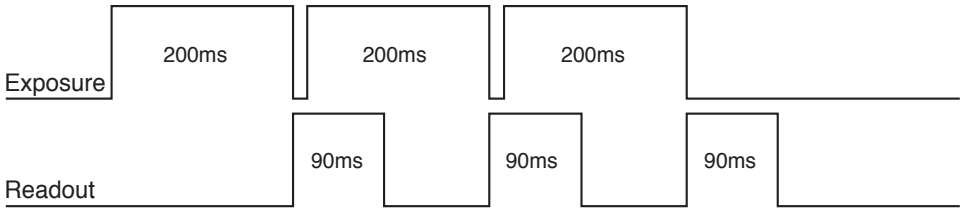


Figure 1. Normal Mode, Overlapped

If the exposure time is less than the readout time (for example, 50 msec), the camera operates in "nonoverlapped" mode (see Figure 2). The effective frame rate for this is 9.4 fps (1/[(0.05+(5x0.096))/5]). While in Normal mode, the camera firmware automatically calculates the readout times, taking into account binning and/or subregion, and carries out the exposure-readout sequence to maximize the frame rate.

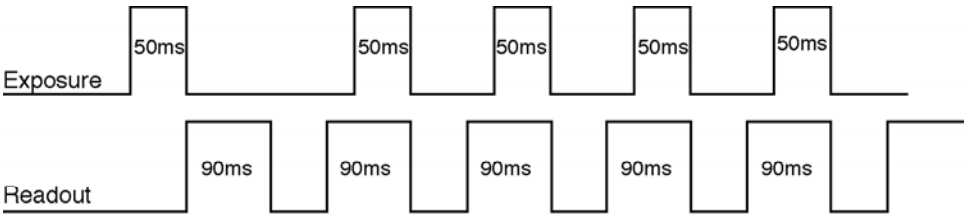


Figure 2. Normal Mode, Nonoverlapped

Alternate Normal mode

In "Alt-Normal", it is possible to achieve higher QE in the NIR (peak QE of approximately 65%) by manipulating the CCD clock voltages. Also, in this high-sensitivity mode, the preamplifier is switched off during the exposure to eliminate the background generated by preamplifier glow. In this clocking mode, irrespective of what the exposure time is, the camera operates in "nonoverlapped" or "sequential" mode.

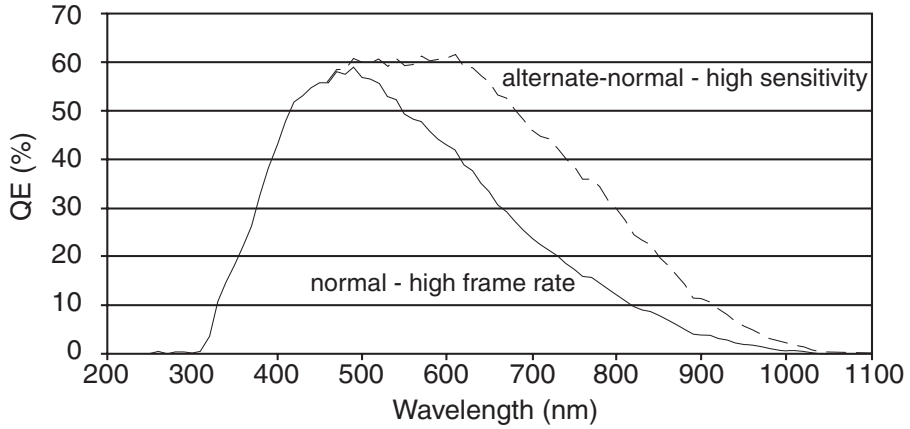


Figure 3. QE for Normal and Alternate Normal Modes

Antiblooming

Typically, interline CCD devices are designed with antiblooming capabilities. To prevent excess electronic charge from migrating to adjacent pixels, "drains" are built into the CCD. These drains remove any excessive charge generated from an overexposed pixel. Sony interline CCDs will prevent blooming for optical signals greater than 1000 times the full-well capacity of a single pixel. However, the extended QE capabilities of the Sony ICX285 in the CoolSNAP$_{HQ^2}$ reduce the antiblooming suppression for certain modes. In normal mode, the CCD operates with typical antiblooming suppression. But in alternate normal mode, the enhanced sensitivity causes a reduction in antiblooming to greater than 100 times single-pixel full-well capacity.

Triggered Operation

The CoolSNAP$_{HQ^2}$ and CoolSNAP$_{K4}$ offer several methods of integration with external trigger sources, such as delay generators or laser pre-triggers. Each camera has a 26-pin, high-density I/O connector (pinout functions are described on page 20) on the back for trigger-in/out and various TTL input and output operations. A special cable is available to access primary signals such as "Trigger-in," "Trigger-invert," "Expose out," "End of frame," and "Interline shift." In the default mode, the camera triggers on the rising edge of a TTL signal. To invert the triggering polarity, the "Trigger-invert" must be grounded, which can be done with a 50-ohm terminator. The CoolSNAP cameras support the trigger modes described on the following page (Note that all of these modes are operated in "nonoverlapped" mode).

Trigger-first mode In this mode, the camera requires only one trigger to acquire a sequence of frames. Each frame is exposed for a length of time entered into the software and read out. Once the trigger is received, the camera is inhibited from taking any further triggers until the entire sequence is completed (see Figure 4).

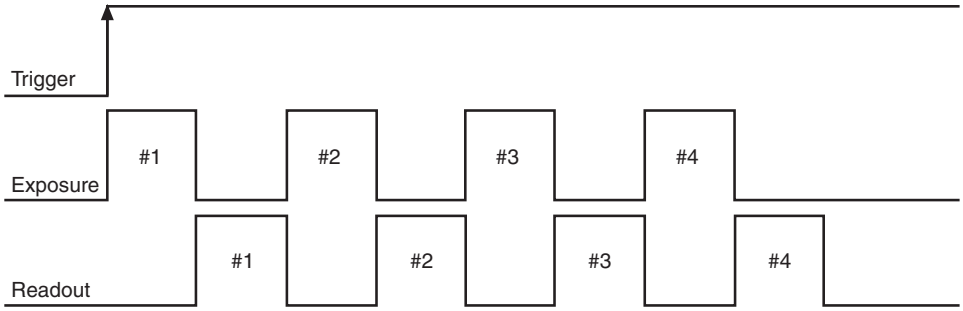


Figure 4. Trigger-First Mode Timing Diagram

Strobe mode In this mode, each frame in a sequence requires a trigger. Each frame is exposed for a length of time entered into the software and is then read out. If the trigger arrives during the exposure-readout of the previous frame, it is ignored (see Figure 5). For a sequence of one frame, strobe mode and trigger-first mode are the same.

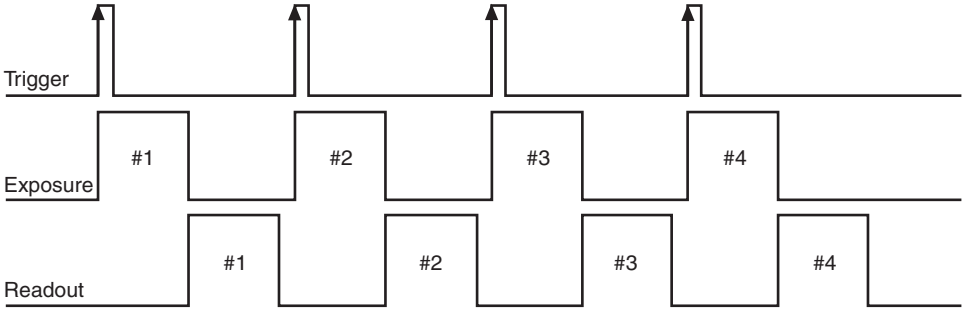


Figure 5. Strobe Mode Timing Diagram

Bulb mode In this mode, exposure time for each frame is determined by the trigger pulse width. Exposure time entered into the software is not used in this mode (see Figure 6).

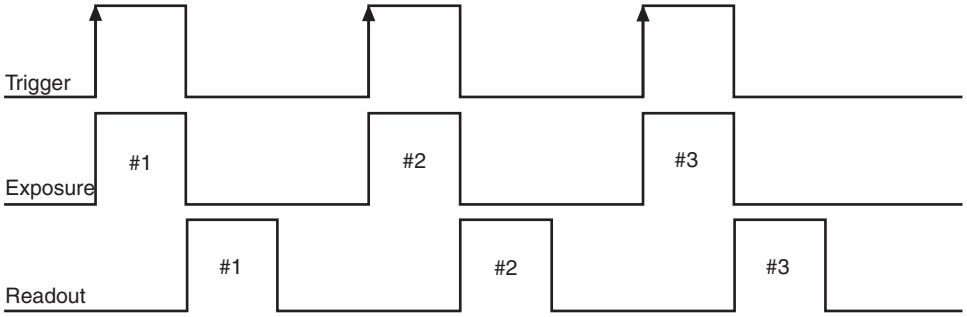


Figure 6. Bulb Mode Timing Diagram

CoolSNAP$_{HQ^2}$ Application Examples

Example 1

"I have a CoolSNAP$_{HQ^2}$ and want to operate the camera in the most sensitive setting for taking high-resolution, single images."

For this application, the camera should be operated in "alternate normal" mode to provide the best quantum efficiency. Furthermore, the readout speed of the camera should be set to 10 MHz to reduce the read noise. Finally, the camera gain should be set to 2. These settings will operate the camera in its most sensitive mode.

Example 2

"I would like to acquire sequences of images with a CoolSNAP$_{HQ^2}$ to study time-correlated phenomena. My light level is fairly high and I want to optimize the acquisition rate of the camera."

First, the camera speed should be set to 20 MHz. In addition, the camera should be put into "normal" mode to take advantage of the overlapping of the readout with the integration time. Finally, the "clearing" mode of the camera should be set to "clear pre-sequence" to remove the clearing overhead between frames. Of course, reducing the region of interest and increasing binning will always increase the frame rate further.

Example 3

"I would like to use a CoolSNAP$_{HQ^2}$ to study the immediate response of a specimen to an electrical stimulus."

The camera should be set up as in Example 2 for optimum time resolution. Furthermore, the camera should be set to "Trigger-first" mode. The same TTL signal that is providing the electrical stimulus should be sent to pin number 1 on the I/O port on the back of the camera.

Chapter 4. Troubleshooting

If you have any difficulty while troubleshooting, or do not see your camera system's symptoms listed here, contact Photometrics Customer Service.

System Does Not Boot Normally

If your operating system does not boot normally after you have installed an interface card, try installing the new card in another open PCI slot. If this does not work:

1. *Turn off your computer* and remove the newly installed card.
2. Turn your computer back on. If your system boots normally, there is probably an interrupt conflict between a previously installed expansion card and the interface card that you are installing.
3. If you need assistance resolving the interrupt conflict, contact Photometrics Customer Service.

New Hardware Found Dialog Box Does Not Appear (Windows 2000/XP)

If the New Hardware Found dialog box does not appear after installing a new interface card to your computer and booting Windows 2000/XP:

- Check to make sure that the new interface card is inserted in a PCI slot according to your computer manufacturer's instructions and that the Photometrics disc is in the host computer's CD drive.
- It is possible that there is a conflict between the new interface card and a previously installed expansion card. *With the computer's power turned off,* remove any previously installed expansion cards that your system does not need to function. (If you are unsure which cards can be safely removed, call Photometrics Customer Service.) Then turn your computer back on and boot Windows 2000/XP again.
- If the New Hardware Found dialog box still does not appear, contact Photometrics Customer Service.

Images Not Displayed

If no images appear:

- Confirm that the switch on the power supply is set to "|".
- Confirm that the correct CoolSNAP camera is selected in your imaging software application.
- Power off the camera and the host computer and check all system connections (particularly the DATA and power cables). Restart.
- Confirm that operating system is set for at least 64k colors (16 bits).
- Confirm that the camera is operational by taking an image with a standard C-mount lens attached to your CoolSNAP. Using normal room lighting, place the camera on a table about 3 meters away from an object and acquire an image.

If the problem persists, contact Photometrics Customer Service.

Bright Spots in Image / Increased Background Noise

If you notice bright spots (hot pixels) in the image or an increase in background noise, take another calibration image and then re-acquire the original image.

Camera Running Too Warm

It is normal for the camera to be slightly warm to the touch while in operation. However, if the camera is more than slightly warm to the touch (and at least 1/2 inch of space has been left around the camera for air flow), switch off the camera immediately and contact Photometrics Customer Service.

PVCAM Error Message Appears

If a PVCAM error message appears, note the message's number code and contact Photometrics Customer Service.

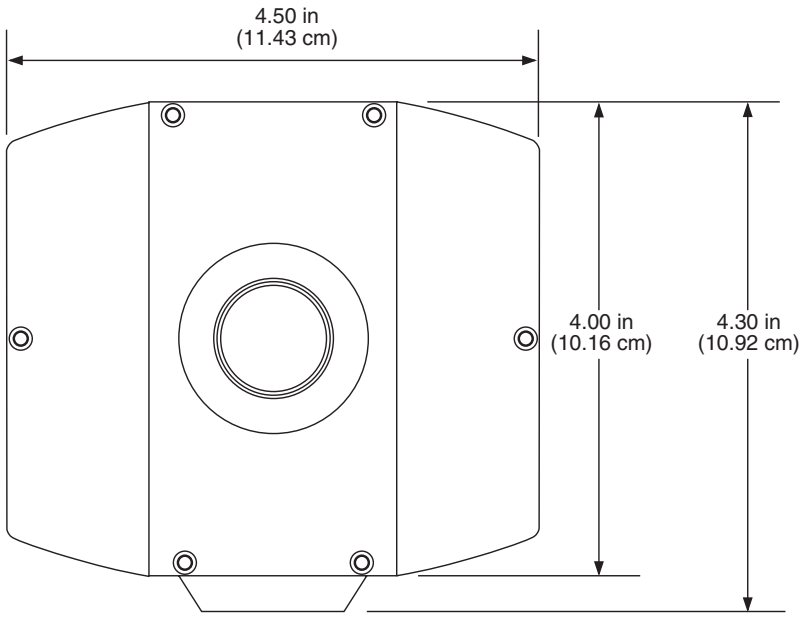
Lengthy Pauses During Imaging

If you notice lengthy pauses marked by a lot of disk activity while imaging:

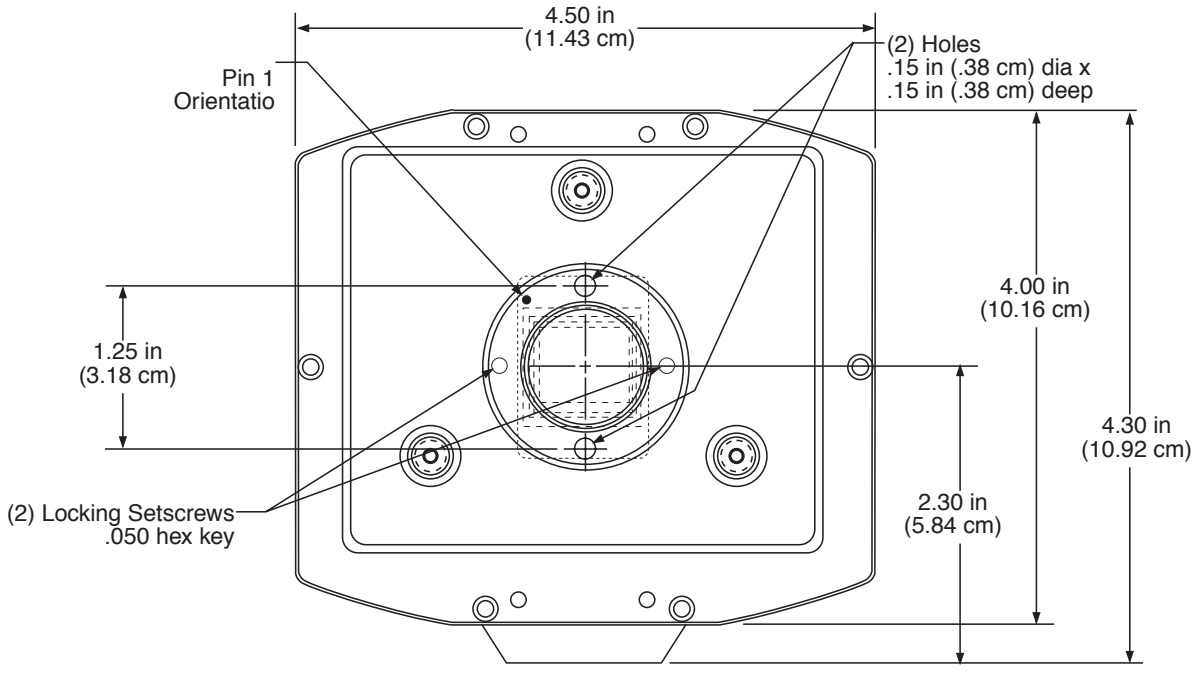
- Close any other programs that may be running.
- Install more physical memory to your computer system.

Chapter 5. Basic Specifications

Camera Dimensions (Front)

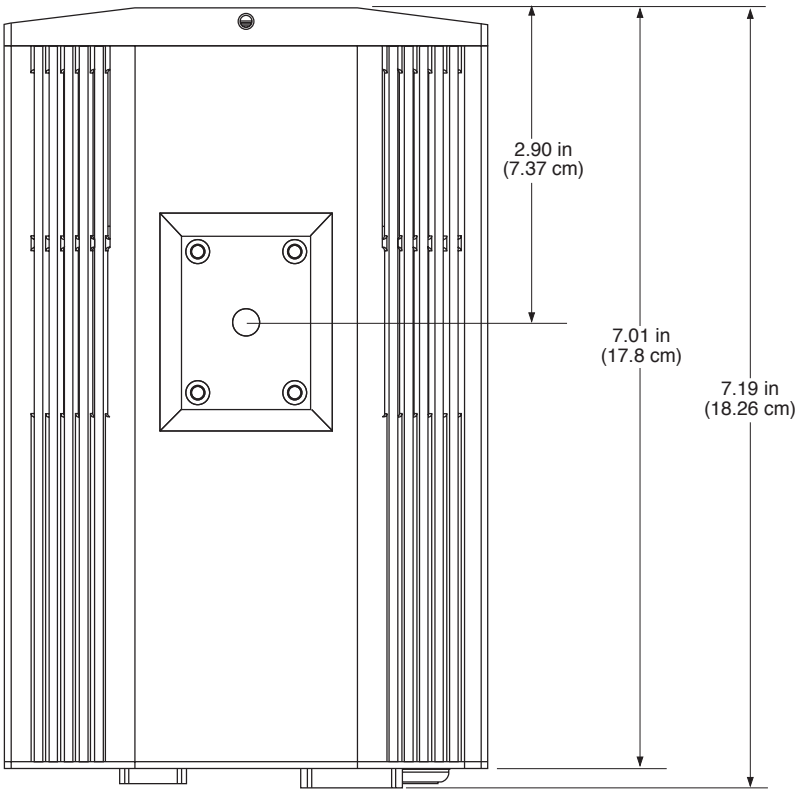


CoolSNAP$_{HQ^2}$ Camera: Front View

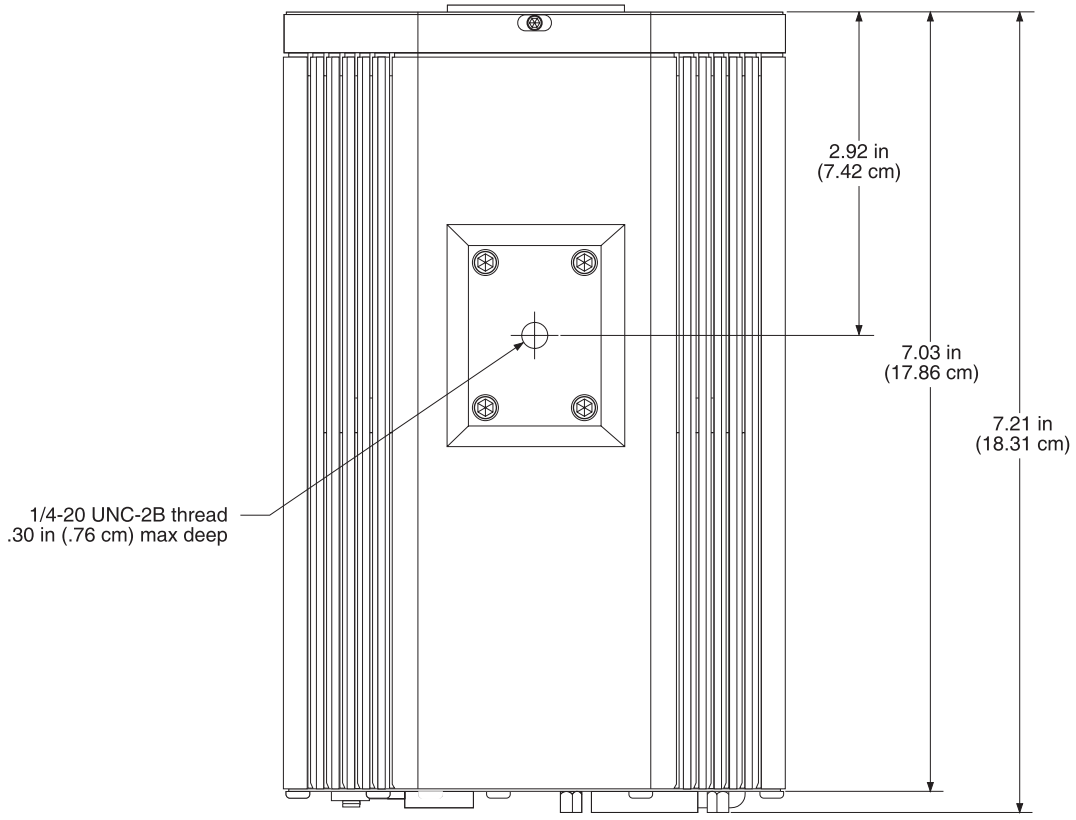


CoolSNAP$_{K4}$ Camera: Front View

Camera Dimensions (Bottom)

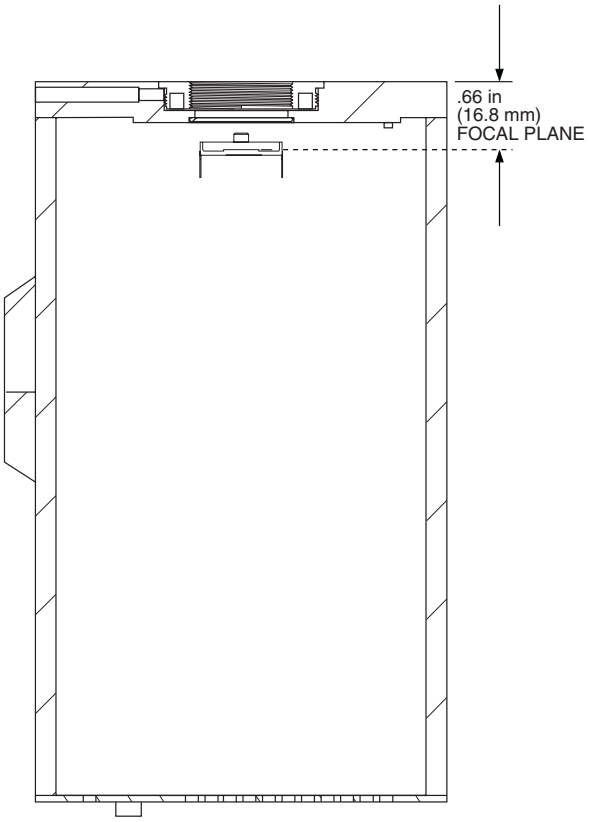


CoolSNAP$_{HQ^2}$ Camera: Bottom View

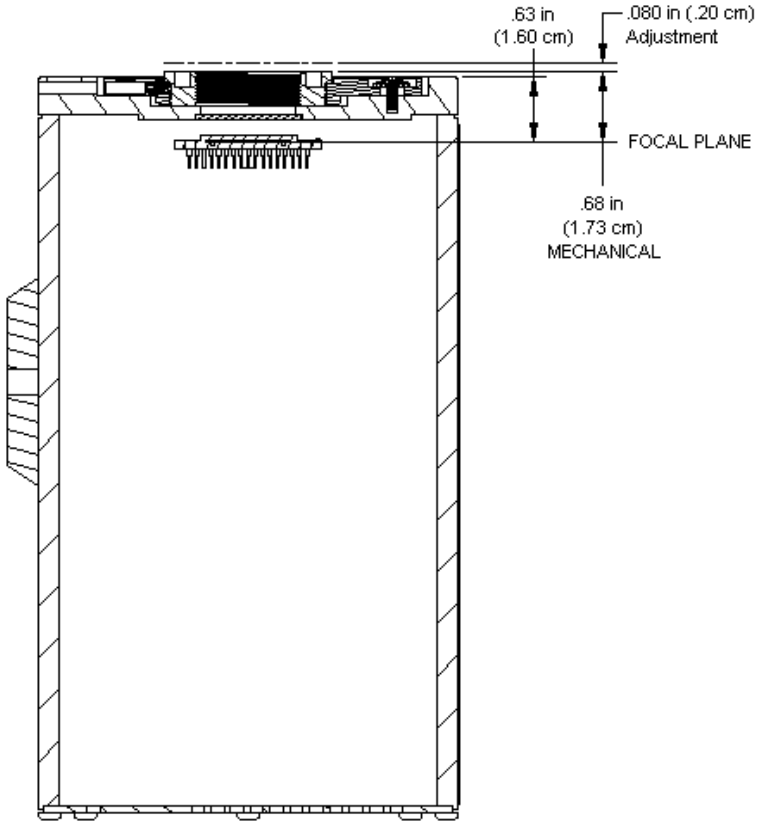


CoolSNAP$_{K4}$ Camera: Bottom View

Focal Plane Measurement



CoolSNAP$_{HQ^2}$ Camera: Focal Plane



CoolSNAP$_{K4}$ Camera: Focal Plane

Additional Measurements

Camera weight: 6.5 lb. (2.9 kg)

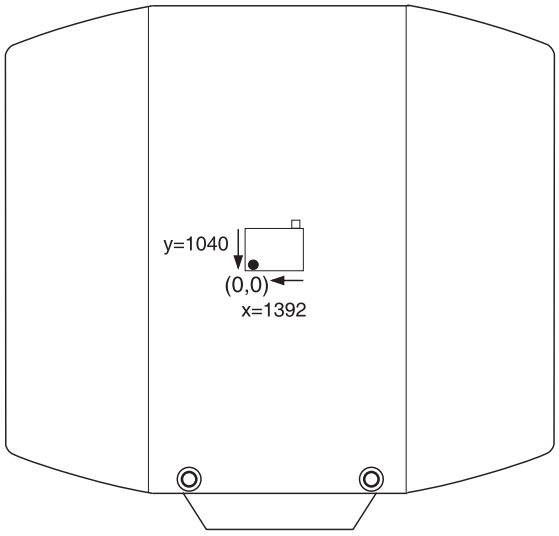
Tripod mounting hole (bottom of camera): .25 in.-20 UNC-2B

Safe tripod mounting screw length: .25 in. (.63 cm)

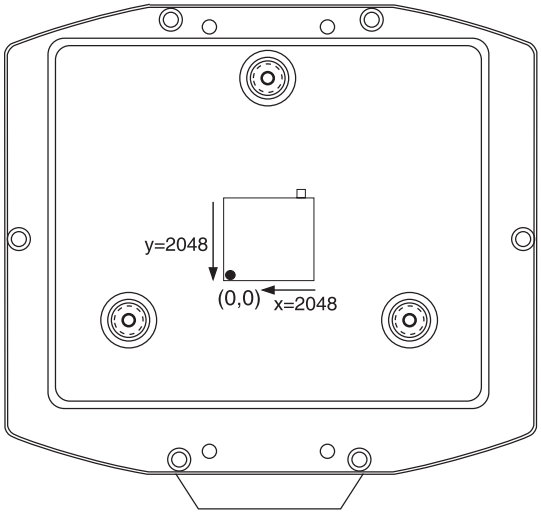
Flange focal distance: .66 in (16.8 mm)

CCD Specifications and Orientation

	CoolSNAP$_{HQ^2}$	*CoolSNAP$_{K4}$*
Image Type	Mono	Mono
Resolution	1392 x 1040	2048 x 2048
Pixel Size	6.45 μm x 6.45 μm	7.4 μm x 7.4 μm
Digitization Rate	10 MHz and 20 MHz	10 MHz and 20 MHz



CoolSNAP$_{HQ^2}$ CCD Orientation



CoolSNAP$_{K4}$ CCD Orientation

Connectors

CoolSNAP$_{HQ^2}$ (IEEE-1394 version) Rear Panel

CoolSNAP$_{HQ^2}$ (LVDS version) CoolSNAP$_{K4}$ Rear Panel

The following connectors are located on the back of the camera:

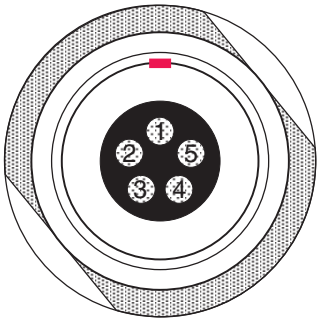
DATA connector: for data transfer.

- LVDS cameras: 20-pin, high-density connector.
- IEEE-1394 cameras: 6-pin, Type 1 IEEE-1394 connector.

POWER connector: 5-pin, LEMO connector for camera power.

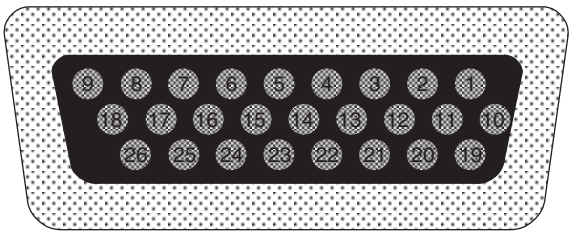
I/O connector: DB26, high-density connector for input/output control signals.

POWER Connector Pinout



1. +12V
2. +12V
3. GND
4. GND
5. GND

I/O Connector Pinout



The I/O (Input/Output Status) connector provides information about trigger function, DAC, and TTL signals. Inputs must be at least 3.15 V for a high and less than 0.9 V for a low.

The numbers on the I/O connector diagram correspond to the numbers given to the definition of each of the pins. The I/O connector is a female, DB26, high-density connector. An I/O cable (Part #: 37-107-002) to access Trigger Input (Pin 1), Trigger Invert Input (Pin 2), Frame Readout (Pin 7), Camera exposing output (Pin 8), and Shutter Output (Pin 23) is available from Photometrics.

1 ***Trigger Input:*** This input is internally tied high through a 4.7kΩ resistor. With Trigger Invert Input open or tied high, a rising edge of the Trigger Input signal initiates the trigger. The trigger source would normally hold this input low, then drive it high to initiate the trigger. To change the state of this input see Trigger Invert Input.

2 ***Trigger Invert Input:*** This input is internally tied high through a 4.7kΩ resistor. With this input open or tied high, a rising edge on Trigger Input will initiate the trigger. With this input pulled low, a falling edge on Trigger Input will initiate the trigger. It can be pulled low by grounding it via a 50Ω terminator.

3 ***GND:*** System digital ground. Any external circuitry intended to interface with the trigger control signals must reference this ground connection.

Port 4 ***4*** ***DAC 1:*** 8-bit programmable output (0-5 V)

Port 5 ***5*** ***DAC 2:*** 8-bit programmable output (0-5 V)

6 ***GND:*** System digital ground. Any external circuitry intended to interface with the trigger control signals must reference this ground connection.

7 ***Frame Readout:*** Active high. A high level on this output indicates that data is being transferred.

8 ***Camera Exposing Output:*** Active high. A high level on this output indicates that the camera is exposing (integrating).

9 ***Interline Shift:*** Active high. A high level on this output indicates that shifting under the interline mask is in progress.

Port 0 ***10*** ***TTL I/O data bit 0:*** TTL level programmable input or output

11 ***TTL I/O data bit 1:*** TTL level programmable input or output

Port 1

12 ***TTL I/O data bit 0:*** TTL level programmable input or output

13 ***TTL I/O data bit 1:*** TTL level programmable input or output

Port 2

14 ***TTL I/O data bit 0:*** TTL level programmable input or output

15 ***TTL I/O data bit 1:*** TTL level programmable input or output

Port 3

16 ***TTL I/O data bit 0:*** TTL level programmable input or output

17 ***TTL I/O data bit 1:*** TTL level programmable input or output

18 ***GND:*** System digital ground. Any external circuitry intended to interface with the trigger control signals must reference this ground connection.

19 ***Power Status:*** A high level on this output indicates that the camera power is switched on (+5 V = on, 0 V = off).

20 ***GND:*** System digital ground. Any external circuitry intended to interface with the trigger control signals must reference this ground connection.

21 (not used)

22 (not used)

23 ***Shutter Output:*** TTL output for timing of external shutter driver. Signal is high during Shutter Open Delay and exposure time. The pin does not provide power to drive the shutter directly, so an external shutter drive controller is required.

24 Do not connect.

25 ***GND:*** System digital ground. Any external circuitry intended to interface with the trigger control signals must reference this ground connection.

26 ***GND:*** System digital ground. Any external circuitry intended to interface with the trigger control signals must reference this ground connection.

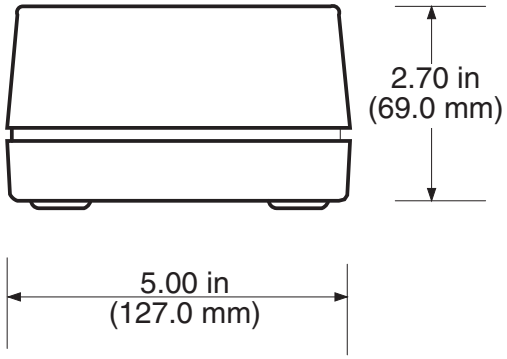
Power Supply Specifications and Dimensions

Voltage Output: +12 Vdc

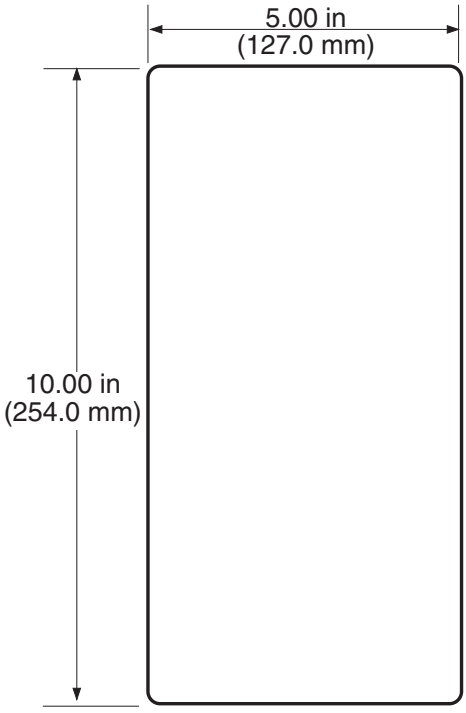
Voltage Input: 100-240 V~ @ 47-63 Hz

Maximum Power Output: 110 W

Power Supply Weight: 4.5 lb (2.0 kg)



Power Supply: Front View



Power Supply: Top View

BENELUX
Roper Scientific, BV
Ir. D.S. Tuijnmanweg 10
4131 PN VIANEN, Netherlands
tel: 31.347.324989
fax: 31.347.324979
email: mailto@roperscientific.com

FRANCE
Roper Scientific, SARL
Z.I. Petite Montagne Sud
4, rue de l'Oisans - C.E. 1702
91017 Evry Cedex, France
tel: 33.160.86.03.65
fax: 33.160.86.07.09
email: princeton.instruments@wanadoo.fr

GERMANY
Roper Scientific, GmbH
Rosenheimer Landstr. 87
D-85521 Ottobrunn, Germany
tel: 49.89.660.779.3
fax: 49.89.660.779.50
email: mail@roperscientific.de

USA
Photometrics
3440 East Britannia Drive
Tucson, Arizona 85706
tel: 800.874.9789 or 520.889.9933
fax: 520.295.0299
email: cservice@photomet.com

JAPAN
Nipon Roper, K.K.
Sakurai Building
2-8-19 Fukagawa,
Koto-Ku_Tokyo
135-0033
tel: +81.3.5639.2731
fax: +81.3.56.39.2775
email: sales@roper.co.jp