PHOTOMETRICS®

CoolSNAP™
DYNO

PHOTOMETRICS
CMOS, EMCCD and CCD Cameras for Life Sciences

LIMITED WARRANTY

Photometrics ("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 Two (2) Year Warranty

Photometrics warrants this product against substantial defects in materials and/or workmanship for a period of up to two (2) years 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.photometrics.com**.

Limited One (1) Year Warranty on Refurbished or Discontinued Products

Photometrics warrants, with the exception of the CMOS or CCD image sensor 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.photometrics.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.*

Software Limited Warranty

Photometrics warrants all of our manufactured software discs or memory devices 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 or USB memory device from our factory for an incidental shipping and handling charge.

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, refer to the owner's manual. If the problem persists, please contact the Photometrics technical support staff or an authorized service representative.

Your Responsibility

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

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.

You must notify the Photometrics factory service center within thirty (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 two (2) year limited warranty and/or any other warranty, expressed or implied.

All warranty service must be made by the Photometrics factory or, at our option, an authorized service center.

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.

These warranties are effective only if purchased from the Photometrics factory or one of our authorized manufacturer's representatives or distributors.

Unless specified in the original purchase agreement, Photometrics is not responsible for installation, setup, or disassembly at the customer's location.

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.

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.

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.

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.

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.

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.photometrics.com.**

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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.

Table of Contents

Chapter 1.

INTRODUCTION

The CoolSNAP DYNO is the ideal camera for highly sensitive microscopic imaging and documentation. With peak quantum efficiency of 75%, combined with extraordinarily low electronic and thermal noise, the CoolSNAP DYNO provides higher resolution and sensitivity in a form factor that saves space in laboratory settings. The CoolSNAP DYNO camera uses a USB 3.0 data connection for a fast and easy installation, while maintaining backwards compatibility for USB 2.0 at reduced data rates for use with a variety of host computers.
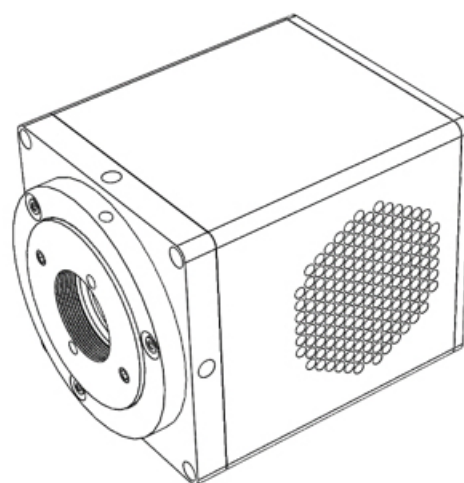
This manual describes the installation and configuration procedures for your new CoolSNAP DYNO. Descriptions of CoolSNAP DYNO camera settings are also included.

System Components

Your new camera system includes:

- CoolSNAP DYNO Camera
- 7.5V DC, 2.5A power supply (actual model may vary)
- USB 3.0 cable
- Ocular® imaging software
- USB flash drive: PVCAM driver, manual, datasheet, training materials

Precautions

The CoolSNAP DYNO 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 turn 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 image sensor 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 at least one inch of space around the camera housing.

- Never open the camera. There are no user-serviceable parts inside the CoolSNAP DYNO camera. Opening the camera voids the warranty.

- Use only the USB 3.0 interface, cables, and power supply designated for this camera system. Using non-CoolSNAP DYNO cables 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.

Environmental Conditions for Operation and Storage

Your CoolSNAP DYNO camera system should be operated in a clean, dry environment. The camera system's ambient operating temperature is 0°C to 30°C with 80% relative humidity, noncondensing. Contact Photometrics customer service for information if operating outside of this range.

To protect your CoolSNAP DYNO during storage, use 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% to 90%, noncondensing.

Optics and Mounting

The CoolSNAP DYNO camera lens mount accepts a standard 1″ diameter, C-mount lens or adapter. The camera is also compatible with a standard C-mount lenses as long as its optics do not extend behind the flange of the lens.

If desired, the CoolSNAP DYNO may be mounted to a tripod or other device using the mounting attachment located on each side of the camera's front plate. See the Specifications chapter for more information.

Cleaning

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

Repair

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

**IMPORTANT: DO NOT OPEN the camera.
Opening the CoolSNAP DYNO camera voids the warranty.**

INSTALLATION

This chapter will detail the proper installation of your CoolSNAP DYNO camera. In order to install and use the camera, the following items are required:

- CoolSNAP DYNO camera (supplied)
- USB 3.0 data cable (supplied)
- 7.5V DC, 2.5A   power supply (supplied)
- USB PVCAM Driver "installer" (supplied and also available on the Photometrics website)
- 110V/220V power connection
- A PVCAM compatible imaging application, such as Ocular (supplied)
- A PC that meets host computer requirements

Optional items that are included with your CoolSNAP DYNO camera:

- Trigger cable

Host Computer Requirements

The host computer for your CoolSNAP DYNO camera must include:

- Windows 7, Windows 8, or Windows 10 (64-bit)
  Refer to the Photometrics website for the latest list of minimum computer recommendations
- 2.0 GHz or faster Intel processor: either Xeon or Core i5
- 4+ GB RAM
- 250+ GB serial ATA (SATA) HDD and/or >64 GB solid state drive (SDD) for high-speed imaging and storage
- 256+ MB slot-based ATI/NVIDIA video graphics card (i.e., not an "onboard/integrated graphics" adapter)
- USB port or Internet access to install the driver
- At least one USB 3.0 interface port (USB2.0 is supported, but at reduced frame rate)

NOTE: Minimum requirements as of December 2015. Supported computer systems will change as new cameras, computer hardware, and operating systems are introduced and older models then become obsolete. For current information on recommended computer specifications, please visit: **http://www.photometrics.com/support/computer-specs**

NOTE: The CoolSNAP DYNO camera will also operate from a USB2 port by reducing the maximum readout speed from 50MHz to 17.5 MHz, impacting achievable frame rates.

Camera Power Requirements

- 7.5V DC, 2.5A

A power supply for use with your CoolSNAP DYNO camera has been provided by Photometrics.

**IMPORTANT: Follow the below steps in order.
DO NOT CONNECT the camera until the driver is installed.**

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1. Install the Camera Driver

In order for the CoolSNAP DYNO camera to communicate with the host PC, the camera's device driver must first be installed. The latest version of the PVCAM driver installer is available on the Photometrics website as well as the provided USB drive. The recommended driver for the CoolSNAP DYNO is PVCAM 3.6.7.2 or newer. However, the camera will work with revisions as old as PVCAM 3.0.9.2. Be sure to select the appropriate installer based on your PC's operating system.

The CoolSNAP DYNO camera is designed and tested for use with Microsoft Windows 64-bit operating systems. Contact Photometrics customer service for more information.

After completing the PVCAM installation, restart your PC when prompted by the wizard. For advanced users wishing to use the camera in a custom programming environment, the PVCAM Software Development Kit is available on the Photometrics website.

NOTE: Supplemental PVCAM installation information can be found on the Photometrics website: **http://www.photometrics.com/support/downloads/**

Note: Users can find the PVCAM SDK is on the Photometrics website at: **http://www.photometrics.com/support/downloads/pvcam-sdk/**

2. Connect the Camera

Note: the camera does not have a power switch.

There are three connectors on the back of the CoolSNAP DYNO camera: a USB 3.0 connector, a power supply connector, and an I/O connector. Connect the camera following these steps:

1. Connect the supplied USB 3.0 cable to the USB 3.0 interface port on your computer and connect the other end of the cable to the USB 3.0 connector located on the back of the camera. (The USB 3.0 interface transfers camera

settings and image data to the host PC.) The CoolSNAP DYNO camera should be connected to a USB 3.0 port. It should also be the only device on its USB root hub controller (see Figure 2 below). Please see the following section on how to select the appropriate USB port for optimum camera performance. This ensures the maximum bus bandwidth is available to the camera for data transfers. USB 3.0 ports are often (but not always) identifiable by a blue internal socket or the "SuperSpeed" (or just "SS") USB logo.

2. After the USB 3.0 cable has been connected to the computer and camera, connect the CoolSNAP DYNO camera power supply's cable to the power connector located on the back of the camera. (Your CoolSNAP DYNO camera is powered by the 12V 5A or greater power supply provided by Photometrics.) Lastly, plug the power supply's cord into an appropriate power source.

3. Optional: An optional I/O connector is available on your camera for optional hardware triggering. The I/O connector provides multiple I/O signals that allow highly precise synchronization with external hardware components such as light sources via TTL signals. Information on how to set up and configure the CoolSNAP DYNO camera for hardware triggering can be found in the next chapter of this manual.

Note on Selecting the Optimal USB 3.0 Port:

Most modern computers come with both USB 3.0 and USB 2.0 ports. This camera should be connected to a USB 3.0 port. However, if no USB 3.0 port is available, you can operate the camera with USB 2.0 as well. The camera is designed to work with USB2.0 at a reduced data rate of 17.5MHz pixels/sec.
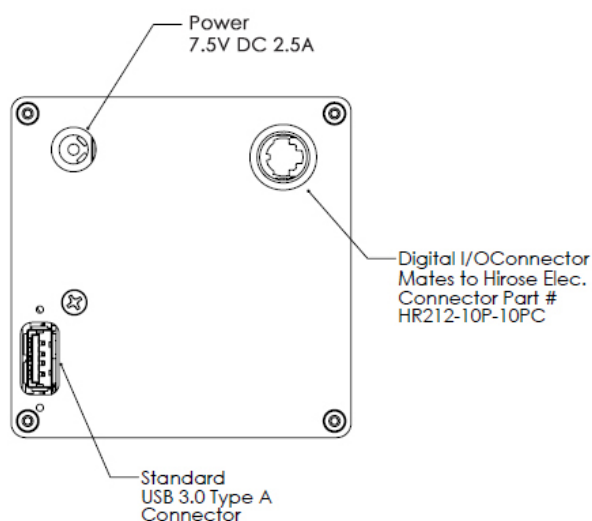
There are several ways to distinguish USB 2.0 from USB 3.0. First, the "Super Speed" or SS logo may be present, indicating a port is USB3.0. Usually, USB 2.0 ports are gray or black, while USB 3.0 ports are blue; however, this is not a steadfast rule. Additionally, USB 3.0 ports have 9 wires while USB 2.0 ports only contain 4 wires. If you cannot tell a port's USB version by the color of the port, take a closer look at the number of wires inside the USB port. On a USB 3.0 port, you will see an additional 5 recessed signal wires inside the port, opposite the standard 4 wires.

Additionally, in Device Manager, a USB 3.0 port might have "USB3" in its name (e.g. Intel USB 3.0 eXtensible Host Controller). You should ensure that the camera is connected to a USB 3.0 Root Hub. Determining which USB root hub your camera is connected to is discussed below.

Each USB host controller has a Root Hub to which multiple physical ports are connected. Each port can have a device plugged in or another hub to allow connection of more devices. However, the CoolSNAP DYNO camera should be the only device connected to a single USB Root Hub. If other devices are connected to the same Root Hub, then camera communication may fail, which can result in camera hanging or image tearing depending on the bandwidth consumed by the other devices.

Since it is not always straightforward to tell which port on a PC is connected to which Root Hub, follow the procedure below to make sure that the camera is the only device connected to its particular Root Hub.

1. Open Device Manager (click the Start Button and type "Device Manager")

2. In the menu, click View -> Devices by Connection (Figure 1)

3. According to Figure 2, find the USB host controllers, expand them, and check whether your camera is the only device connected to the Root Hub.
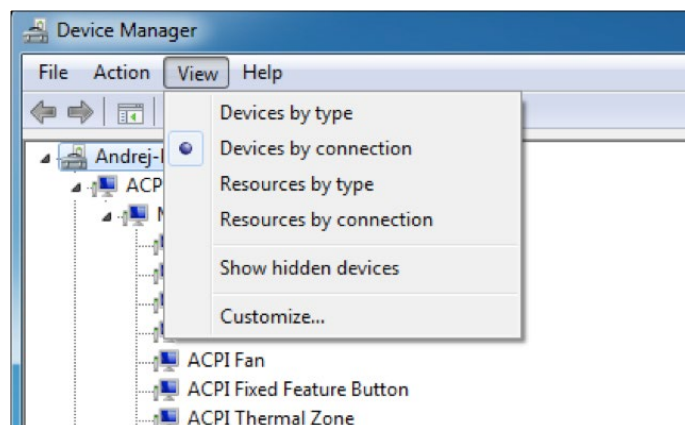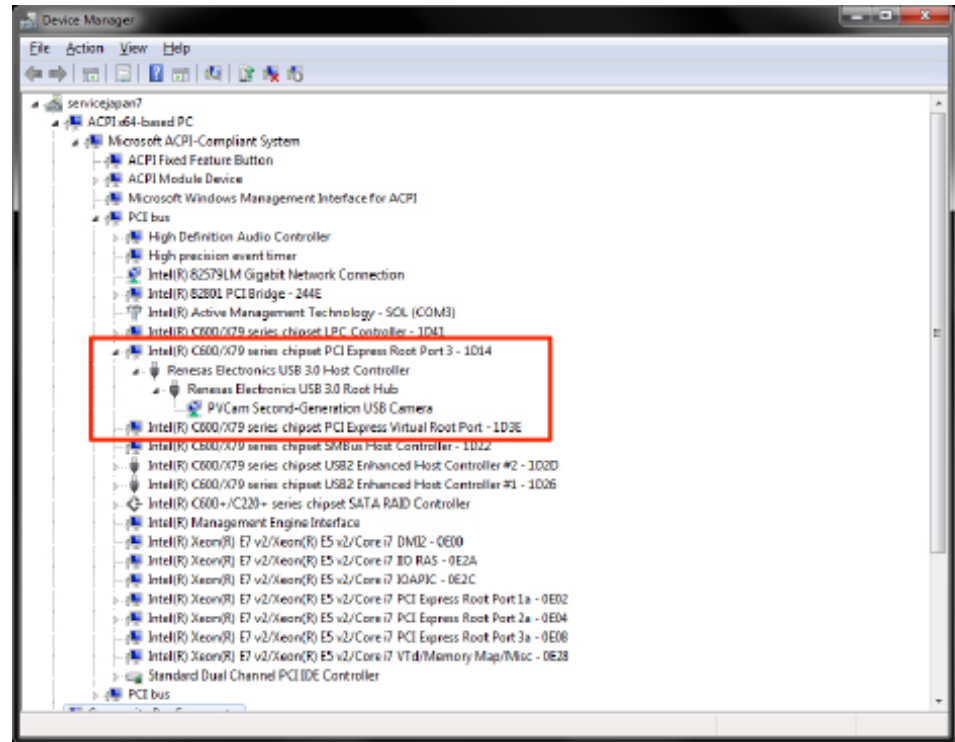

Figure 1. Devices by connection

Figure 2. Photometrics USB3 camera is the only device on its USB Root Hub.

If more devices are connected to the same USB Root Hub, please reconnect them to a different port for optimal camera performance.

Note on Optimum Mounting of CoolSNAP DYNO Camera

It is important to maintain a minimum of 1″ clearance on the vented sides of the CoolSNAP DYNO camera to allow proper air flow, removing heat generated by Thermoelectric Cooling of the sensor. Blocking this air flow will impede the camera's ability to cool, and may cause the camera to overheat. While the camera has thermal shutdown protection, overheating the camera may cause permanent and irreparable damage, voiding your warranty.

Chapter 3.

Using Your CoolSNAP DYNO Camera

Imaging Software

The CoolSNAP DYNO cameras comes with a full featured camera control application, Ocular imaging software. For an up-to date list of other compatible third-party imaging software applications, please visit our website at **http://www.photometrics.com.**

The CoolSNAP DYNO camera's image capture capabilities are controlled entirely through your imaging software. Basic functionalities include control over exposure time, gain state, clearing mode, region of interest (ROI), and pixel binning. Additional information on camera use and CCD operating is available on the web, please visit: **http://www.photometrics.com.**

Basic Camera Parameters

Exposure Time

The CoolSNAP DYNO camera's exposure controls allow you to adjust the integration time for each acquisition. By increasing the exposure time, more light is captured by the sensor and a better signal-to-noise ratio (SNR) is achieved. The exposure time should be adjusted to a level that achieves the shortest integration time possible while still maintaining sufficient SNR.

Gain State

Gain (with regards to cameras) is defined as the conversion factor of captured electrons to a digital signal, often referred to as a grey value or ADU (Analogue to Digital Unit) and has units of electrons per ADU (e/ADU). Knowing the gain of a camera allows users to directly compare an ADU value as measured from their software to the physical number of electrons actually captured by the camera's sensor. Gain plays a critical role in many of the camera's parameters including dynamic range and read noise.

The CoolSNAP DYNO camera provides three user-selectable gain states enable optimal camera performance for different imaging environments:

- Gain State 1 ≈ 1.65e-/ADU
  (Optimized for maximum dynamic range when binning)

- Gain State 2 ≈ 1.3e-/ADU
  (Mapped to the linear, single pixel full well of the sensor)

- Gain State 3 ≈ 0.61e-/ADU
  (Optimized for sensitivity, 1/2 single pixel full well)

Gain State 1 leverages the larger charge capacity of the serial register, in order to extend dynamic range. This advantage can only take place when binning. Gain State 2 uses the full dynamic range of the pixel and is recommended for applications requiring moderate sensitivity. Gain State 3, although only using a half of the single pixel full well, is ideal for resolving low luminescence signals due to the very lowest read noise attainable.

Sensor Cooling

To further reduce thermally generated noise, the CoolSNAP DYNO camera system provides regulated sensor cooling of -12°C in a 22°C ambient, which effectively eliminates dark current noise from typical imaging scenarios.

Clearing Mode

When the camera does not expose and read out images simultaneously, it is in Non-Overlap Mode. Non-Overlap Mode is set by choosing "Pre-Exposure Clearing" for the clearing mode of the camera. This allows the sensor to clear accumulated charge before the start of each exposure.

The following waveforms show how Non-Overlap Mode functions. The main benefit of Non-Overlap Mode is that there are no limitations imposed upon the exposure time, and the set exposure time is the actual exposure time. The tradeoff for this accuracy is the frame rate, as each frame must be completely digitized before beginning the next exposure cycle.

When the camera is able to expose and read out images simultaneously, it is in Overlap Mode. Overlap Mode is set by choosing "Pre-Sequence Clearing" for the clearing mode of the camera. This allows one clear before the imaging sequence starts. The following waveforms show how Overlap Mode functions. When using Overlap Mode, the frame rate is higher as compared to Non-Overlap Mode and provides the ability to continuously image. However, since exposure and readout occur simultaneously, the minimum exposure time is dependent on the time taken to complete readout. In timed mode + Overlap Mode, exposure times may be set that are shorter than the readout time, as shown in timing diagram below.
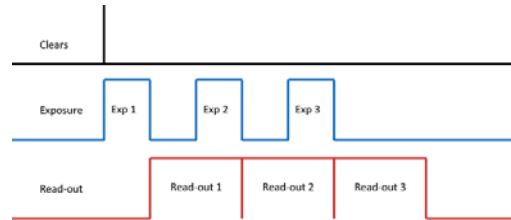
ROI / Binning

The CoolSNAP DYNO camera supports both user-defined, arbitrary regions of interest (ROI) as well as hardware pixel binning modes of 1x1, 2x2, 4x4, 6x6, 8x8, 12x12, 16x16, and 24x24. Both ROIs and pixel binning will enable faster frame rates, making focusing and scanning much easier. Pixel binning also has the advantage of significantly increasing the signal-to-noise ratio (SNR) of the image, as the effective pixel size is increased, collecting more light, and the impact of read-noise is diminished relative to adding signals together off chip.

Device Synchronization

Your CoolSNAP DYNO camera offers several methods of hardware synchronization via transistor-transistor logic (TTL) signals with external devices, including function generators, light sources, shutters and filters. Each camera has an I/O connector (pin out functions are described in the specifications chapter) on the back for trigger-in/out and various TTL input and output operations.

An optional cable is available to access primary signals such as "Trigger-in," "Expose out," "End of Frame" and "Shutter Out". The camera triggers on the rising edge of a TTL signal. The CoolSNAP DYNO camera supports three trigger modes:

Trigger-First Mode

In this mode, the camera requires one trigger to begin the acquisition of a stream of images. Once a single trigger is received, the camera will use its internal clock to acquire the entire image stream, independent of any future triggers. It is possible to run this triggering mode in either Non-Overlap Mode or Overlap Mode (right).
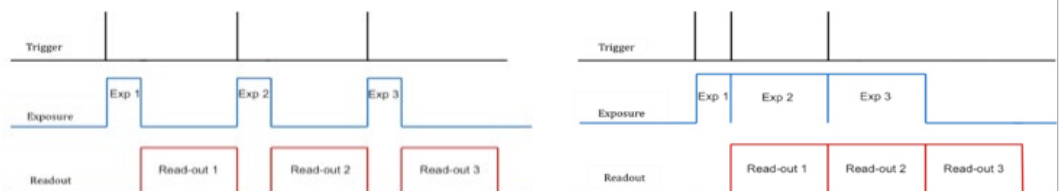
Strobe Mode

In this Mode, each frame in the sequence requires a trigger. When a trigger is received, the camera exposes for the time set in the software. If Strobe Mode is set to run in Overlap Mode, then all exposures except the initial one will be equal to, or larger than, the readout time. Triggers received while Trigger Ready is low are ignored. For a sequence of one frame, Strobe Mode and Trigger-first Mode are the same. Non-Overlap Mode is shown on the left; Overlap Mode is shown on the right.
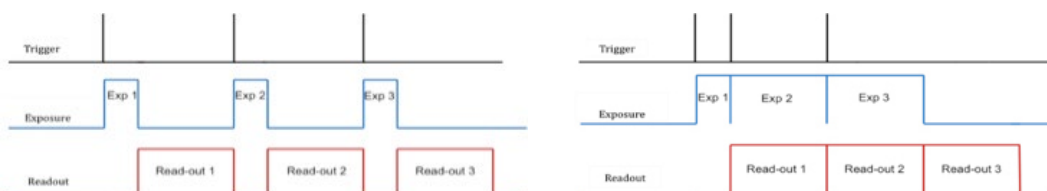
Bulb Mode

In this mode, each frame in the sequence requires a trigger. The camera exposes for the duration the trigger signal is high. Exposure time entered into the software is not used in this mode. Triggers received when Trigger Ready is low are ignored. Non-Overlap Mode is shown below.
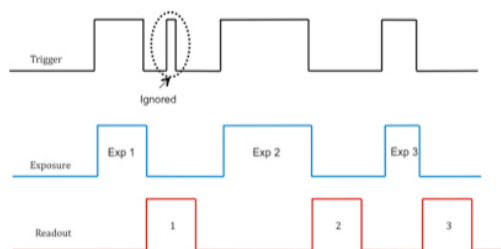
TRIGGERING NOTE: though present on some trigger cables, the CoolSNAP DYNO camera does not provide a "Trigger Ready" signal.

Recommended Initial Settings

Initial settings for microscopic imaging (available options depend on application software):

- 14 bits
- Gain State 2
- 30 msec exposure time
- Clear Pre-Exposure
- Clear count 2
- Display gamma of 1
- Full frame (no ROI)
- Binned 2x2 for live preview to increase frame rate
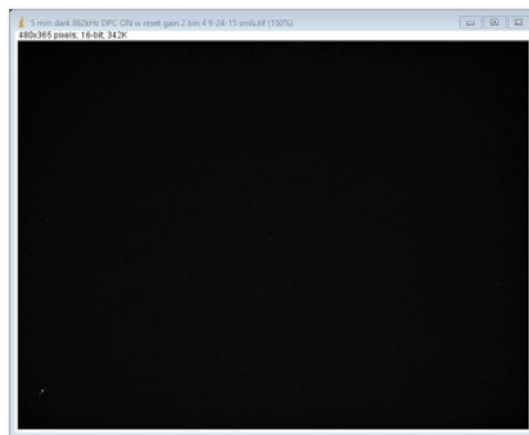- Binned 1x1 for capture
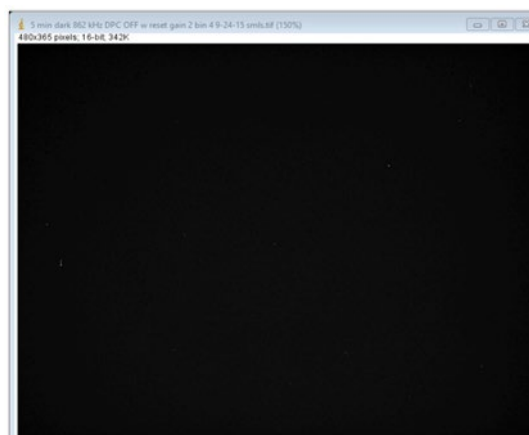
Chapter 4.

Intelligent Quantification

Embedded Image Processing Algorithms

The CoolSNAP DYNO camera includes user controllable features designed to enhance camera performance and image quality.

Defective Pixel Correction

Defective Pixel Correction: ON

Defective Pixel Correction: OFF

Photometrics only uses sensor manufacturers highest grade CCD sensors in your CoolSNAP DYNO camera. However, manufacturer's specifications do not always meet customer needs for defect free imaging. This is particularly true for "hot" pixels – pixels that generate dark current at a far higher rate than average. The converse is also true, e.g. certain pixels response to light is far lower than average, known as "dark pixels". In both cases, suitable threshold can be determined for defective pixels, and their locations stored in the camera during manufacture. When Defective Pixel Correction is enabled, the signal in each defect location is replaced by the average of the pixel immediately preceding and following the defect. The CoolSNAP DYNO camera can store up to 2048 defects locations.

The factory default method for determining defective "hot" pixels is to take a pair of 10 minute dark images. After removing the bias offset, the 1800 "hottest" pixels are selected as potential defects. A suitable floor is chosen so that the algorithm does not accidentally catch the tail of the normal dark current noise distribution. If the same location is defective in both dark images, its location is programmed into the camera as a defect.

To determine defective dark pixels, the camera is exposed to uniform light, filling the pixels to 50% saturation. A median filter is applied, and the original image is subtracted from the filtered image. Any pixels that have a signal level of 40% or more of saturation, are deemed defective. Up to 200 dark pixels are stored for correction using this method.

Chapter 5.

TROUBLESHOOTING

Resolving Problems with the Camera

Computer Does Not Recognize Newly Installed Camera

Confirm that the latest PVCAM camera driver is installed on the computer while also checking to make sure the computer meets the minimum system configuration requirements to run the CoolSNAP DYNO camera. Confirm that the camera's power is on and the DC power supply is plugged in. The fan used to remove heat from the sensors Peltier cooler will generate a slow airflow that can be felt if the camera power is on.

If necessary, restart the computer and repeat the power on cycle. If a New Hardware Found dialog box still does not appear, contact Photometrics Support.

Images Not Displayed

If no images appear:

- Confirm that the camera's power is on.
- Confirm that the correct CoolSNAP DYNO camera is selected in your imaging software application.
- Power off the camera and the host computer and check all system connections. Restart.
- Confirm that the camera is operational by taking an image with a standard C-mount lens attached to your CoolSNAP DYNO camera. Using normal room lighting, place the camera on a table about 3 meters away from an object and acquire an image.

If the camera is powered on and recognized by the computer and still is not able to capture an images, please contact Photometrics Support.

PVCAM Error Message Appears

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

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.

Camera Fan Not Running

The CoolSNAP DYNO camera has a fan that operates continuously. If the camera is imaging, but the fan is not operating, please contact Photometrics Support. The fan can be viewed through the vent holes on one side of the camera.

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 one inch of space has been left around the camera housing), switch off the camera immediately and contact Photometrics Support. If the camera has become hot due to having cooling blocked, move the camera to allow free air flow. Contact Photometrics Support if the camera fails to recover regulated cooling. Note that heat is only emitted from one side of the camera: air goes in the camera → across cooling fins → out of camera.

Unresolved Problems - Contacting Photometrics Support

If you are still unable to resolve your problem, contact Photometrics Support for assistance in one of four ways:

1. Visit **https://www.photometrics.com/support/technotes** for a list of all frequently asked questions. Your issue may be resolved in one of these faqs.
2. Visit **http://www.photometrics.com/contact/** and fill out a support form online.
3. Call one of Photometrics's regional support offices at the appropriate number below.

   To assist you better and to quickly resolve the issue, it is recommended that you are at your computer during the call.

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Shanghai Roper Industries Trading Co., Ltd.
Tel: +86.21.3377.3519

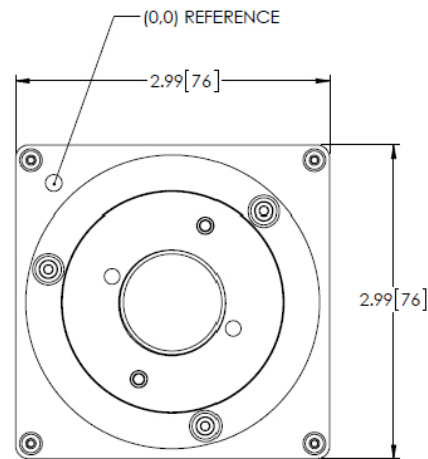**Japan**
Nippon Roper K.K.
Tel: 81.3.5639.2731

Europe
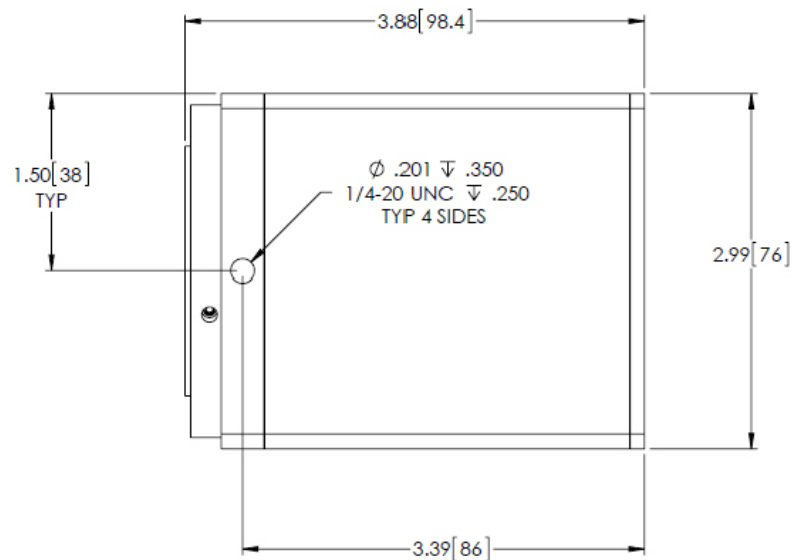Roper Engineering s.r.o.
Tel: 420.597.305.857

Chapter 6.

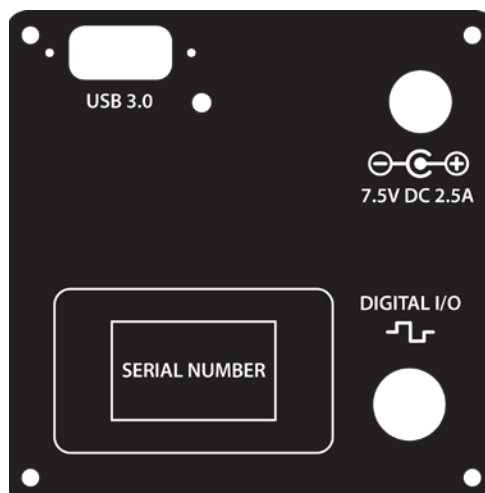# SPECIFICATIONS

Camera Dimensions (Front)

(0,0) REFERENCE

2.99[76]

2.99[76]

Camera Dimensions (Bottom)

3.88[98.4]

1.50[38]
TYP

Ø .201 ▼ .350
1/4-20 UNC ▼ .250
TYP 4 SIDES

2.99[76]

3.39[86]

Additional Camera Measurements

Dimensions:	98.4mm x 76 mm x 76 mm (length x width x height)
Camera weight:	1.55 lbs, 0.72 kg
Optical interface:	1", C-mount optical format
Mounting hole thread size:	1/4"-20 thread, located near front of camera

Connectors on Back of Camera

Power Supply Specifications

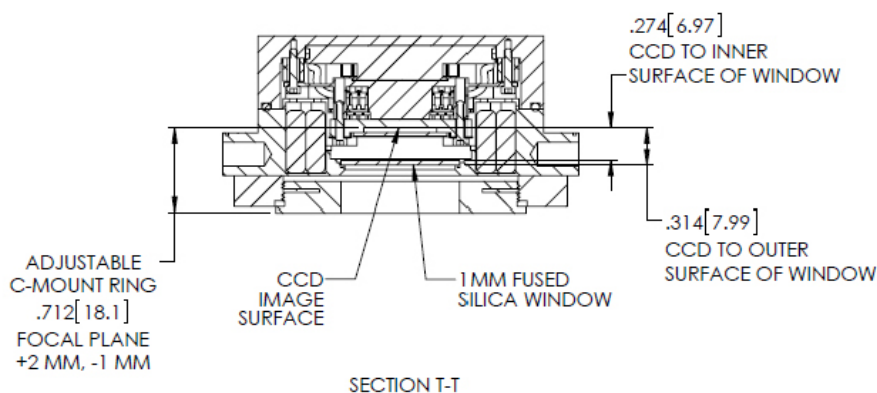**IMPORTANT: Only operate the CoolSNAP DYNO camera with the power supply provided by Photometrics.**

For applications requiring use of instrumentation supplied power, please contact your Photometrics Customer Support for advice.

Voltage output: +7.5V DC, 2.5A

Voltage input: 100 – 240 V @ 50 – 60 Hz

Focal Plane Measurement

Sensor Specifications

Image type: Monochrome Scientific CCD. Sensor specifications are provided in the data sheet.

Sensor Orientation

The CoolSNAP DYNO camera uses "multiport" sensors. Multiport sensors can be read entirely from one common output for all pixels, as is the case of typical CCD sensors, or from 2 or more outputs in parallel to achieve greater frame rates. When operating in USB3.0 mode, 50 MHz digitization is accomplished on the CoolSNAP DYNO camera by reading the sensor out of two ports in parallel, each running at 25 MHz pixel rates for a net 50 MHz.

When operating out of a single port, as in the 17.5 MHz USB2 compatibility mode, the corner of the sensors (0,0) pixel, the pixel closest to the sensor output, is indicated by a dimple on the front of the camera as shown below:
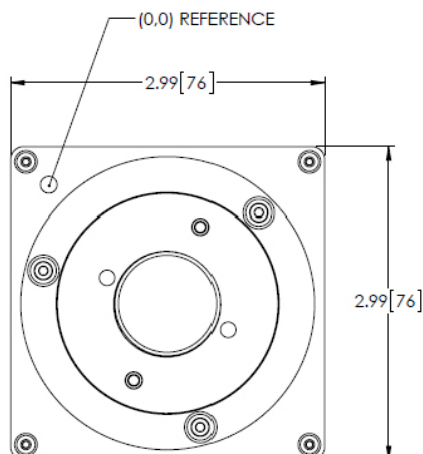
I/O Connector Pinout

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

The I/O trigger cable connects to Hirose connector HR212-10P-10PC on the back of the camera. Below is a description of each of the trigger pins. The numbers on the I/O connector diagram correspond to the numbers given to the definition of each of the pins.

Pin #	Signal	Pin #	Signal
1	Ground	5	Expose Out
2	Ground	6	Trigger In
3	Shutter Output	7	No Connection
4	Frame Readout	8	No Connection
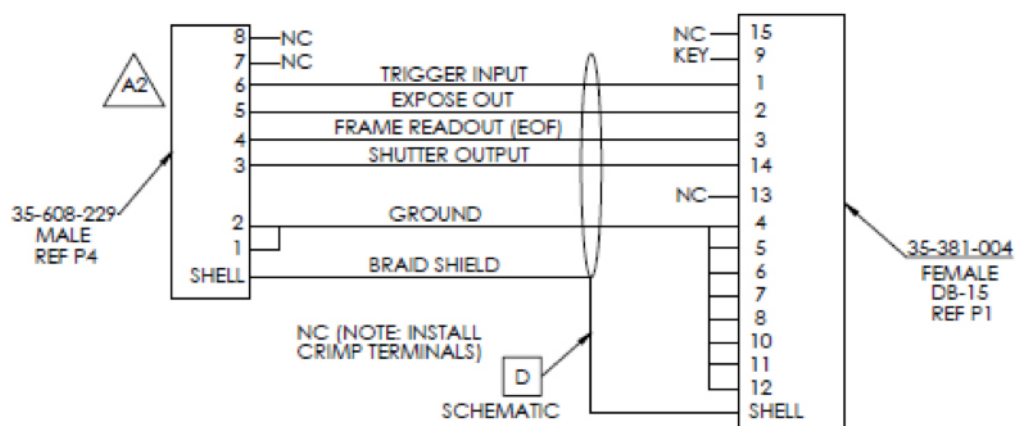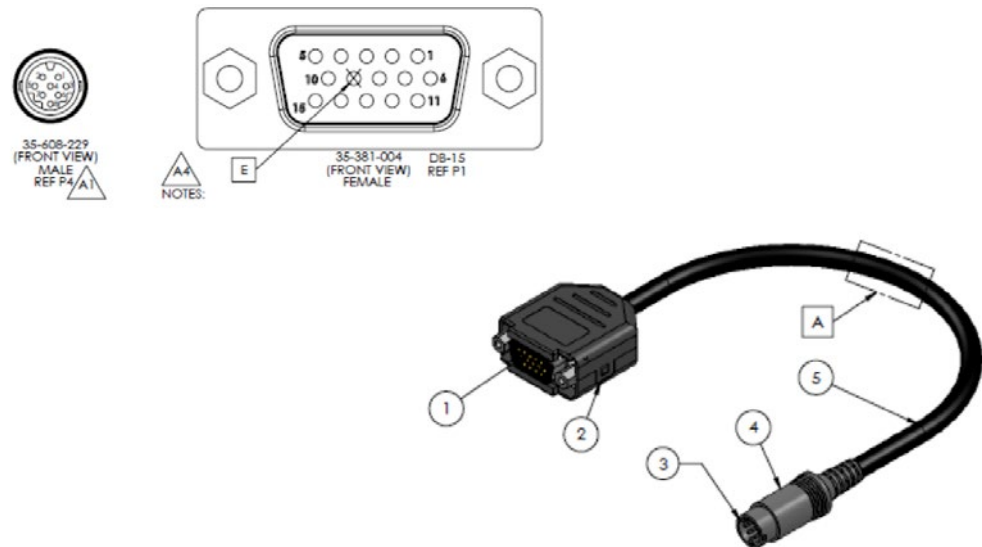
Triggering signal behavior:

- **Trigger In** – the input trigger to the camera
- **Camera Expose** – represents when the camera is exposing/acquiring an image
- **Read Out** – represents completion of readout of the image
- **Shutter Output** – TTL output to control timing of an external shutter driver
- **Ground** – system digital ground

Types of triggering supported by the CoolSNAP DYNO Camera:

- **Trigger-first Mode** (Overlap/Non-Overlap)
- **Strobe Mode** (Overlap/Non-Overlap)
- **Bulb Mode** (Non-Overlap)

Five shutter behavior modes are available:

- **Open Never** – Shutter is always closed.
- **Open Pre-Exposure** – Open before every exposure, closed when not exposing.
- **Open Pre-Sequence** – Open before start of sequence, closed at end of sequence.
- **Open Pre-Trigger** – Causes shutter to open before external trigger is received. In non-triggered mode, operates as "Open Pre-Exposure".
- **Open No Change** – Sends no signals to open or close the shutter.

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