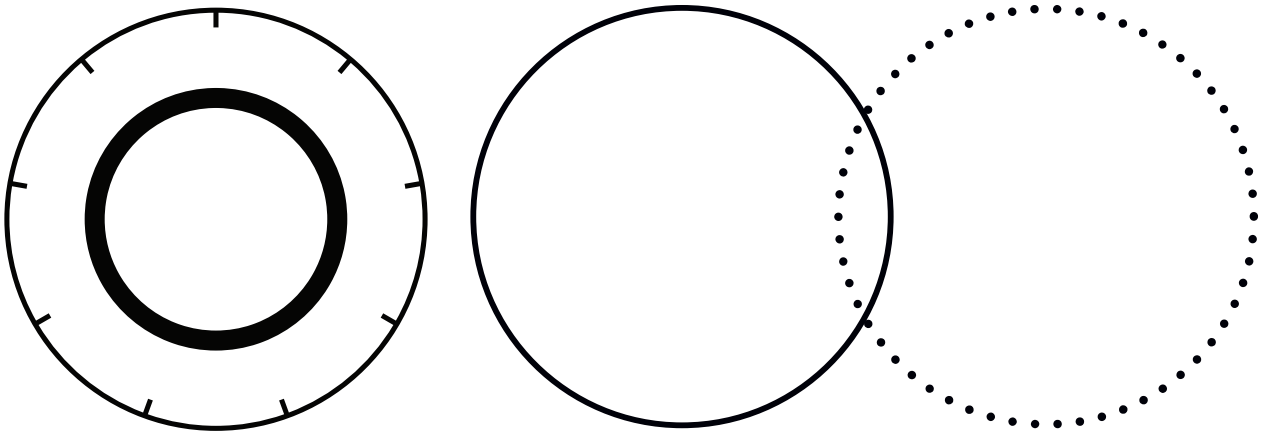
LaserCam-HR-II-UV

Operator's Manual



INNOVATIONS THAT RESONATE

COHERENT

LaserCam-HR II UV

Operator's Manual

COHERENT

Technical Support

In the U.S.:

Should you experience any difficulties with your product or need any technical information, please go to our web site www.Coherent.com. Should you need further assistance, please contact Coherent LSM Service by e-mail LSMservicet@coherent.com or telephone, (800) 343-4912. Please be prepared to supply the model and serial number of your meter, the description of the problem, and any attempted corrective steps to the Product Support Engineer responding to your request.

Telephone coverage is available Monday through Friday (except U.S. holidays and company shutdowns). Inquiries received outside of normal office hours will be captured by our automatic answering system and will be quickly returned the next business day.

Outside the U.S.:

If you are located outside the U.S., please visit www.Coherent.com for technical assistance, or contact your local Service Representative. Service Representative telephone numbers and addresses can be found on the Coherent web site.

Coherent provides telephone and web-based technical assistance as a service to its customers and assumes no liability for any injury or damage that can occur at the same time with such services. Under no conditions do these support services affect the terms of any warranty agreement between Coherent and the buyer. Operation of any Coherent laser with any of its interlocks defeated is always at the operator's own risk.

Coherent Corp	**Coherent Europe B.V. as EU Representative**
5100 Patrick Henry Dr.	Huis Ter Heideweg 14, Zeist,
Santa Clara, CA 95054	3705 LZ, Utrecht, The Netherlands

Product Made in the Wilsonville, Oregon U.S.A.

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1 Introduction

1.1 Preface

This documentation may contain sections in which particular hazards are defined or special attention is drawn to particular conditions. These sections are indicated with signal words in accordance with ANSI Z-535.6 and safety symbols (pictorial hazard alerts) in accordance with ANSI Z-535.3 and ISO 7010.

Anyone setting up or operating the LaserCam-HR II UV camera must first read and understand how safety information is presented prior to beginning any tasks.

NOTICE

This user information reported in this manual is in compliance with the following standards for Light-Emitting Products EN/IEC 60825-1 *"Safety of laser products – Part 1: Equipment classification and requirements"* 21 CFR Title 21 Chapter 1, Subchapter J, Part 1040 *"Performance standards for light-emitting products"*.

1.2 Safety Warnings

This section provides information about signal words and safety symbols that you need to know before you begin to use the LaserCam-HR II UV camera.

1.2.1 Signal Words

Four signal words are used in this documentation: **DANGER**, **WARNING**, **CAUTION** and **NOTICE**.

These signal words designate the degree or level of hazard when there is the risk of injury, as described in Table 1-1:

Messages relating to hazards that could result in both personal injury and property damage are considered safety messages and not property damage messages.

Table 1-1. Signal Words

Signal Word	Description
DANGER	Indicates a hazardous situation that, if not avoided, WILL result in ***death or serious injury***. This signal word is to be limited to the most extreme situations.
WARNING	Indicates a hazardous situation that, if not avoided, COULD result in ***death or serious injury***.
CAUTION	Indicates a hazardous situation that, if not avoided, could result in ***minor or moderate injury***.
NOTICE	Indicates information considered important, but not hazard-related. The signal word "NOTICE" is used when there is the ***risk of property damage***.

1.2.2 Symbols

The signal words **DANGER**, **WARNING**, and **CAUTION** are always emphasized with a safety symbol that indicates a special hazard, regardless of the hazard level. The icons are intended to alert the operator as described in Table 1-2:

Table 1-2. Safety Symbols

Icon	Alerts the operator to…
	Important notes or instructions for operation and maintenance.
	Danger of exposure to hazardous visible and invisible laser radiation.

Table 1-2. Safety Symbols

Icon	Alerts the operator to…
	Dangerous voltages when working with other equipment may be of sufficient magnitude to constitute a risk of electric shock.
	Danger of susceptibility to Electro-Static Discharge (ESD).

1 Safety and Compliance

This section describes requirements for safety and for compliance for persons setting up or operating the LaserCam-HR II UV camera.

1.1 General Safety Warnings and Cautions

Carefully review the following safety information to avoid personal injury and to prevent damage to this instrument or any sensor connected to it. This equipment contains no user-serviceable parts. For service information, refer to 'Service and Support' on page 23.

WARNING!
Do not operate the camera if its panels are removed or any of the interior circuitry is exposed.

WARNING!
Do not operate the camera in wet or damp conditions, or in an explosive atmosphere.

NOTICE
Operate the camera only within the specified voltage range.

CAUTION!
Do not operate the camera if there are suspected failures. Refer damaged equipment to qualified Coherent service personnel.

WARNING!
Use of controls or adjustments or performance of procedures other than those specified in this manual can result in exposure to hazardous radiation.

1.2 Laser and Optical Safety

DANGER!
The use and measuring of lasers is potentially dangerous. This instrument operates over wavelengths that include non-visible laser emissions.

Laser light, because of its optical qualities, poses safety hazards not associated with light from conventional light sources. The safe use of lasers requires all operators, and everyone near the laser system, to be aware of the dangers involved. Users must be familiar with the instrument and the properties of coherent, intense beams of light.

At all times, make sure that all personnel who operate, maintain or service the laser are protected from accidental or unnecessary exposure to laser radiation exceeding the accessible emission limits defined in the laser safety standards.

WARNING!
AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT!

The greatest concern when using a laser is eye safety. In addition to the main beam, there are often many smaller beams present at various angles near the laser system. Always wear appropriate laser safety eyewear for protection against the specific wavelengths and laser energy being generated.

CAUTION!
Laser safety eyewear protects the user from accidental exposure to laser radiation by blocking light at the laser wavelengths.

However, laser safety eyewear may also prevent the operator from seeing the beam or the beam spot. Exercise extreme caution even while wearing safety glasses.

For safety information specific to the use of lasers, read and obey all respective documentation provided by the manufacturer of the laser system being used.

1.3 Electrical Safety

The LaserCam-HR II UVcamera does not have dangerous voltages.

NOTICE
The LaserCam-HR II UV camera is designed to be operated as assembled; there are no user-serviceable components in the device. DO NOT disassemble the enclosure. *The Warranty is void if the enclosure is disassembled!*

1.3.1 Electrostatic Discharge (ESD)

The most common ESD damage occurs when handling a device during installation or use. Take the necessary measures to protect the system from ESD.

Dry air and carpet also create a higher potential for ESD. Remember to take precautions or shielding not only for operations, but for demonstrations or trade show exhibitions.

CAUTION!
Electrostatic charges as high as 4000 volts easily collect on the human body and equipment and can discharge without detection.

Although the electronics features have input protection, permanent damage can occur on devices subjected to high-energy electrostatic discharges. You must take correct ESD precautions to prevent damage or performance degradation.

1.3.2 Electrical Safety Precautions

Everyone must observe the electrical safety precautions when working with potentially hazardous electrical circuitry.

DANGER!
When working with electrical power systems, the rules for electrical safety must be strictly followed. Failure to do so could result in the exposure to lethal levels of electricity.

WARNING!
Normal operation of the camera should not require access to the power supply circuitry. Removing the power supply cover exposes the user to potential electrical hazards. Contact an authorized service representative before attempting to correct any problem with the power supply.

1.3.3 Safety Features and Compliance with Government Requirements

The following features are incorporated into the instrument to conform to government requirements:

European Union:
The European Community requirements for product safety are specified in the Low Voltage Directive (LVD) (published in 2014/35/EU). The Low Voltage Directive requires that lasers comply with the standard EN 61010-1/IEC 61010-1 "Safety Requirements For Electrical Equipment For Measurement, Control and Laboratory Use" and IEC 60825-1 "Safety of Laser Products". Compliance of this laser with the European Union requirements is certified by the CE mark.

1.3.4 International Standards and Sources of Additional Information

Following are sources for information about electrical safety standards, as well as safety equipment and training.

Safety Requirements For Electrical Equipment For Measurement, Control and Laboratory Use
IEC 61010-1 / EN 61010-1

International Electrotechnical Commission (IEC)
www.iec.ch

1.4 Compliance

This section describes compliance with various government requirements for safety, environmental regulations, and control law.

1.4.1 Environmental Compliance

1.4.1.1 Electromagnetic Compatibility

Compliance of this laser with the Electromagnetic Compatibility (EMC) requirements is certified by the CE mark and the UKCA mark.

Each application and installation is unique, and in some cases, the user may experience Electromagnetic Interference (EMI) noise being emitted from various electronic components. This laser may use high-frequency RF. While adequate countermeasures have been taken to suppress this emission to meet the requirements stated on the Declaration of Conformity, the user may wish to employ additional measures to suppress the EMI to reduce the emissions further. Standard methods of reducing the EMI are:

1. Use of shielded control cables grounded on both ends
2. Addition of appropriate ferrite beads to cables connected to the beam source.

1.4.1.2 RoHS Compliance

Coherent product(s) conform to all applicable requirements of the EU-RoHS Directive (2011/65/EU) and subsequent Amendment Directives including Directive (EU) 2015/863. Compliance Declarations are available upon request.

Coherent product(s) conform to all applicable requirements of the EU-REACH Regulation, (1907/2006). Compliance Declarations are available upon request.

1.4.1.3 China RoHS Compliance

Coherent product(s) conform to all applicable requirements of Restriction of Hazardous Substances Regulation SJ/T 11364-2014 commonly referred to as China RoHS.

Hazardous substances (if applicable) in the LaserCam-HR II UV are shown in the material declaration table included with the equipment, REACH Compliance.

The LaserCam-HR II UV camera is a green and environmentally friendly product with electronic and electrical components that can be recycled appropriately. This is identified by the Green logo shown in Figure 1-1. This label is attached on the underside of the camera.

Figure 1-1. China RoHS Green Label

Hazardous substances in the LaserCam-HR II are shown on the China RoHS Compliant Components table in Figure 2-1.

Figure 1-2. China-RoHS Compliant Components

部件名称 Part Name	有害物质 Hazardous Substances					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
电缆装配 Cable Assembly	X	O	O	O	O	O
本表格依据SJ/T 11364的规定编制						
O: 表示该有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下。 X: 表示该有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。						

1.4.1.4 Waste Electrical and Electronic Equipment (WEEE, 2002)

Coherent product(s) conform to all applicable requirements of the EU Waste Electrical and Electronic Equipment (WEEE)- Directive (2012/19/EU). WEEE management also covers EU Directive 2006/66/EC-EU Battery Directive and Directive 94/62/EC on Packaging and Packaging Waste. Do not dispose of these products or packaging as unsorted municipal waste.

Coherent joins approved compliance organizations to meet its collection and recycling obligations. For further information, please contact:

Email: info@rene-europe.com

Phone: +49 (0) 8266-869806

Website: www.rene-europe.com

CAUTION!
Do not dispose of these products as unsorted municipal waste. Contract a local distributor for procedures for recycling this equipment.

1.4.2 Product Labels

Product labels that show the compliance symbols discussed in this section, and their placement, are shown in the example in Figure 1-3

Figure 1-3. Product Labels and Placement

1.4.3 Export Control Laws

It is the policy of Coherent to comply strictly with export control laws of the United States of America (USA).

Export and re-export of lasers manufactured by Coherent are subject to U.S. Export Administration Regulations, which are administered by the Commerce Department. In addition, shipments of certain components are regulated by the State Department under the International Traffic in Arms Regulations (ITAR).

The applicable restrictions vary depending on the specific product involved and its destination. In some cases, U.S. law requires that U.S. Government approval be obtained prior to resale, export or re-export of certain articles. When there is uncertainty about the obligations imposed by laws in the USA, clarification must be obtained from Coherent or an appropriate agency of the U.S. Government.

For products manufactured in the European Union, Singapore, Malaysia, Thailand: These commodities, technology, or software are subject to local export regulations and local laws. Diversion contrary to local law is prohibited. The use, sale, re-export, or re-transfer directly or indirectly in any prohibited activities are strictly prohibited.

1.4.4 Declaration of Conformity

Declaration of Conformity certificates are available upon request.

2 Description and Specifications

This section describes the PowerMax-Pro kW sensor, and includes:

2.1 Product Introduction

The key elements of a typical camera-based beam profiling system, as shown in Figure 2-1, are the camera itself, Coherent BeamView analysis software running on an appropriate computer and, when necessary, beam attenuation optics.

Figure 2-1. Camera-Based Beam Profiling System

As a laser beam propagates, changes in the laser cavity cause the width and spatial intensity of the beam to change in space and time. Spatial intensity distribution is a fundamental parameter for indicating how a laser beam behaves in any application.

Changes in divergence, tolerance ranges in mirrors and lenses, and ambient conditions affect the laser cavity and beam delivery system as well.

Coherent beam diagnostic cameras are specifically designed or modified for laser analysis. They provide low noise, maximum linearity, and uniformity of response—all necessary for maximum measurement accuracy.

The LaserCam-HR II UV camera is shown in Figure 2-2.

Figure 2-2. LaserCam-HR II UV Camera

A LDFP (Low-Distortion Face Plate) filter is supplied with each camera—a laser-grade neutral density filter made of glass specified and polished specifically for laser diagnostic analysis. The LDFP filter is mounted in a standard C-Mount ring and provides attenuation of ambient room light so that the camera can be used with normal room lights.

2.2 Key Features

The LaserCam-HR II UV camera is a Beam Diagnostics Digital CCD camera that uses a laser grade $^{2}/_{3}$-inch progressive scan CCD sensor for detection and analysis. This covers laser beam profiles from 500 µm to 6.0 mm in diameter with 20.0 by 20.0 µm effective spatial resolution over the spectral range of 190 to 355 nm.

The characteristics of the LaserCam-HR II UV camera include excellent signal-to-noise ratio and linear response for accurate beam dimension and uniformity measurements. In addition, the camera offers overexposure protection for distortion-less measurements of saturated beam profiles. Other features include:

- USB 2.0 with 12-bit digital output.
- Compact 68 x 68 x 34 mm package minimizes space required in the optical train.
- Uses a single interface cable for data and power.
- Large area arrays.

- High resolution: 1280 x 1024 active picture elements (pixels).
- Low Distortion Faceplate (LDFP) that minimizes room light, protects the CCD array, and provides laser grade quality attenuation with a nominal Optical Density (OD) of 3.0 at 248 nm.
- Both Continuous Wave (CW) and pulsed operation, including external triggering. Variable exposure and trigger delay.
- High sensitivity and dynamic range. No lag, geometric distortion, or image burn-in.
- High-speed image capture rates (15 to 25 frames per second)
- Long-term UV sensor stability.
- Mountable in any orientation for maximum flexibility. Camera markings provide for X and Y alignments. Metric and English mounts included.
  Accepts C-mount optics, including all Coherent optical sampling, attenuation, and UV conversion accessories.
- CE compliant when used with a CE-compliant computer and cables.

2.3 Dimensions

Figure 2-3 shows the dimensions for the front view of the LaserCam-HR II UV camera.

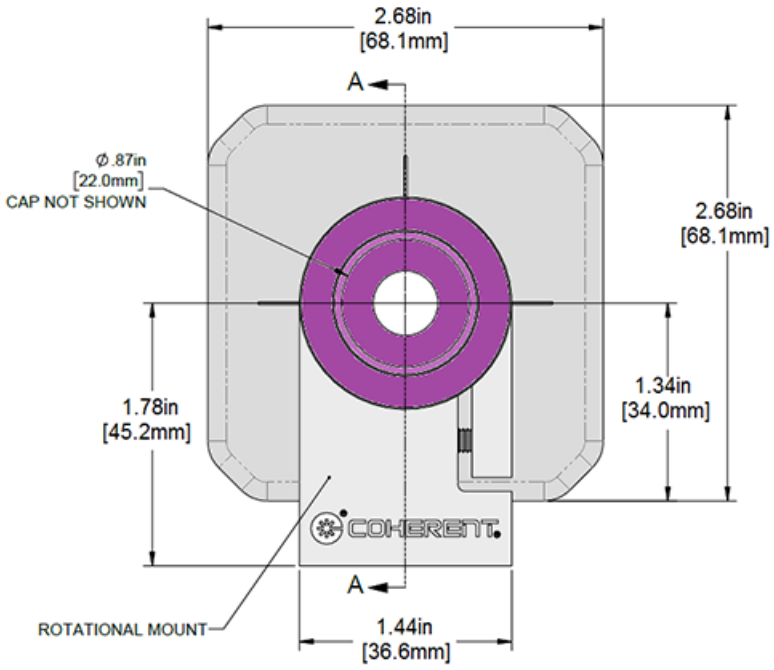


Figure 2-3. Dimensions — Front View

Figure 2-4 shows the dimensions for a side view of the LaserCam-HR II UV camera.

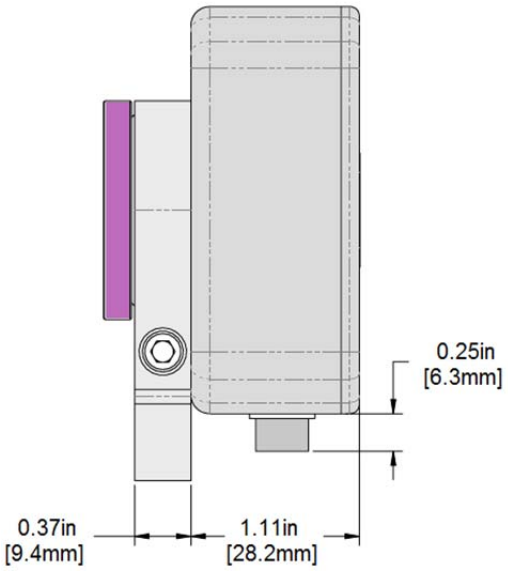


Figure 2-4. Dimensions — Side View

Figure 2-5 shows the dimensions for a side view of the LaserCam-HR II UV camera.

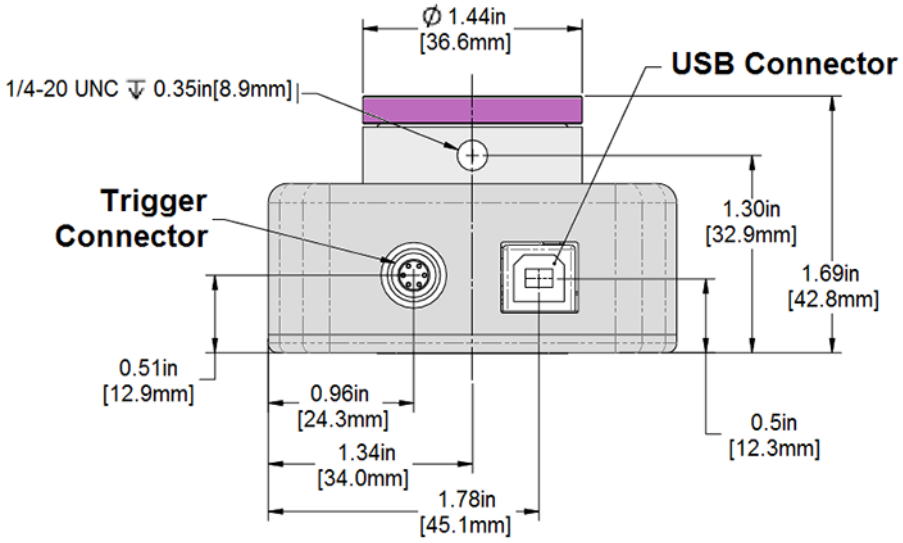


Figure 2-5. Dimensions — Top View

Go to 'Install and Set Up the Camera' on page 23 for information about how to set up the LaserCam-HR II UV camera system.

2.4 Specifications

This section provides various specifications for the LaserCam-HR II UV camera (P/N 1360550).

2.4.1 Electrical Specifications

Table 2-1 shows the electrical specifications for the LaserCam-HR II UV camera.

Table 2-1. Electrical Specifications

Description	Value
Signal-to-Noise Ratio	Signal-to-Noise Ratio
Power	Power
Video Output	Video Output
Black Level	Black Level
Exposure Time	Factory adjusted to 5 ms, user adjustable[a]
Synchronization	Internal free-running (crystal)
Gamma	1.0
Gain	No automatic gain control. Gain is factory set for optimum linear dynamic range.

a. Using a delay other than the 5 ms default causes the camera to go into an "un-calibrated" mode.

2.4.2 Environmental Specifications

Table 2-2 shows the environmental specifications for the LaserCam-HR II UV camera.

Table 2-2. Environmental Specifications

Parameter	Value
Operating Temperature	5°C to 60°C
Relative Humidity	Up to 95% non-condensing

2.4.3 Physical Specifications

Table 2-2 lists the physical characteristics of the LaserCam-HR II UV camera.

Table 2-3. Physical Characteristics

Parameter	Value
Weight	208 g (235 g with cable)
Camera Type	Progressive scanning CCD
Lens Mount	C-mount
Threaded Mounting Hole	$^1/_4$-20 rotational camera mount M6 rotational camera mount
Trigger Connector	Connector BNC receptacle (Trigger cable included)
I/O Connector	USB 2.0 Type B cable included
Low Distortion Face Plate (LDFP)	Laser-grade ND filter (removable)

2.4.4 Camera Specifications

Table 2-4 lists general specifications:

Table 2-4. Camera Specifications (2/3-inch)

Parameter	Specification
Spectral Range	190 nm to 355 nm
Sensor Active Area	8.3 mm (H) x 6.6 mm (V)
Sensor Elements (pixels)	1280 (H) x 1024 (V)

Table 2-4. Camera Specifications (2/3-inch) (continued)

Parameter	Specification
Effective Pixel Resolution	20 µm (H) x 20 µm (V)
Recommended Beam Diameter	0.5 mm to 6.0 mm
Variable Exposure Time	1 msec to 500 msec, default at 5 msec
Damage Threshold, without LDFP [a]	200 µJ/cm at 1064 nm
Camera Bit Depth	14-bit
Video Format	14-bit digital USB 2.0 High-Speed
Trigger Delay	20 µs
Maximum Pulse Trigger in Rate	200 Hz
Pulsed Mode Trigger Method	Trigger In (TTL)
Capture Modes	Continuous Wave (CW), Pulsed
CW Saturation	
With LDFP	90 mW/cm at 248 nm
Without LDFP	90 µW/cm at 248 nm
Pulsed Saturation	
With LDFP	5 mJ/cm at 248 nm
Without LDFP	5 µJ/cm at 248 nm

a. It is possible to measure beams <0.2 mm in diameter, but resolution is reduced.

2.5 Parts and Accessories List

Table 2-5 shows the parts that users can order for the LaserCam-HR II UV camera.

Table 2-5. Parts and Accessories

Part Number	Description
1360550	LaserCam-HR II UV Camera System
1156843	Low Distortion Face Plate (LDFP-UV)
1120313	Trigger Cable for LaserCam (RoHS)
1114614	USB 2.0 Cable, 3.0 meters (RoHS)
1136566	Optical Post and Stand Assembly
1086828	Camera Transit Clamp (Metric) (RoHS)
0216-094-00	Dust Cap
1363379	*LaserCam-HR II UV User Manual* (this document)

3 Install and Set Up the Camera

This section describes what is required to install the software and set up the LaserCam-HR II UV camera.

Set-up activities should be done in a clean environment under normal humidity and temperature conditions (see page 28 for environmental specifications).

WARNING!
LASER RADIATION - Always use precautions to avoid eye or skin exposure to both DIRECT and SCATTERED radiation.

Refer to 'Safety and Compliance' on page 5 to learn about required safety precautions when working with lasers.

3.1 Install the BeamView Software

It's important to follow the set-up procedure in the order in which it is presented. Failure to do so can result in errors.

NOTICE
The correct order for system set-up is:
— Install the software first, but *wait* to start the software.
— Unpack and inspect the camera and accessories.
— Set up and connect the camera to the workstation.
— Start the software on the workstation.

Do not connect the USB cable from the camera before the software is installed. If it is connected too soon, the Microsoft operating system detects the camera as a new device and attempts to install a standard and incorrect Windows device driver. The BeamView.NET software then cannot recognize the camera.

3.1.1 System Requirements

Use the most current and robust workstation possible. Support is provided on the following operating systems:

- Windows v10, v11 (32- and 64-bit)

In addition, the workstation must meet the following minimum requirements:

- CPU: 2.5 GHz or faster processor
- RAM: Minimum of 2 GB of RAM
- Available hard disk space: 10 GB
- USB 2.0 high-speed port
- Display: 1280 x 1024 screen resolution
- Microsoft .NET Framework 4.0 or higher. If no version (or an older version) is found on the workstation, then the installation program installs a version of Microsoft .NET Framework.

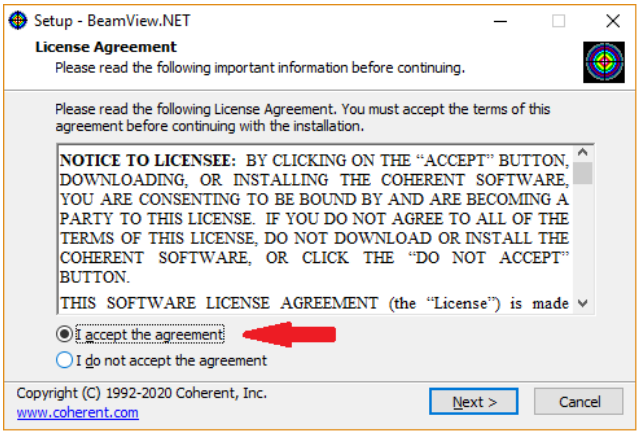
3.1.2 Installation Steps

Download and Install BeamView.NET software:

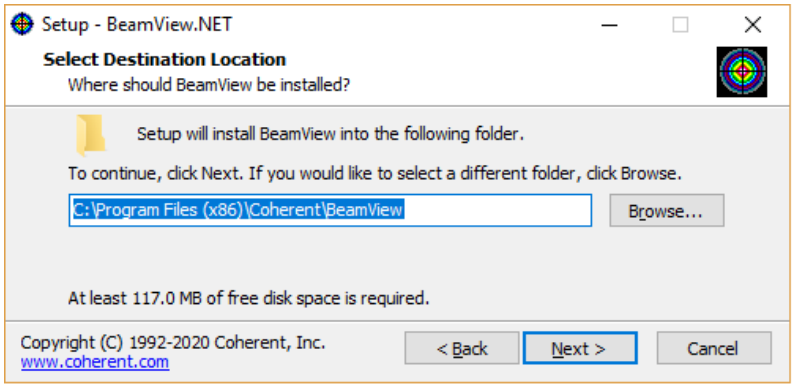
Refer to the *BeamView.NETUser Manual* (1416724) for complete software installation instructions.

1. Connect to www.Coherent.com/resources/.
2. Type **BeamView.NET** in the Site Search box.
3. Download the latest version of the BeamView.NET software, and the BeamView.NET User Manual

1. Start the Installation Wizard and follow instructions on-screen.
2. Review the License Agreement, and then accept the terms of the Agreement.



3. Select a directory on the workstation to install the files.



4. Follow the prompts to set up shortcuts and locations.
5. Review settings and begin installation.
6. Install device drivers as needed, when prompted.
7. Finish the software installation and close the Installation Wizard.

CAUTION!
Wait to start the software until after the camera is set up and connected.

3.2 Set Up the Camera

After you install the software, set up the LaserCam-HR II UV camera as follows:

- Connect the cables to the camera.
- Assemble the post holder and attach to an optical table or other flat surface.
- Mount the camera on the post.
- Connect the camera into the workstation. Wait a few seconds for the computer to recognize the hardware, and then launch the BeamView software.

These steps are described in the sections that follow.

Before set-up is started, gather the necessary tools and equipment. Then inspect the shipping box and unpack the contents. Ensure that the environment is clean and free of dust and debris.

CAUTION!
There are no user-serviceable components inside the LaserCam-HR II UV camera. DO NOT disassemble the enclosure itself. *The Warranty is void if the enclosure is disassembled!*

3.2.1 Tools and Equipment Required

Gather the following items:

- A set of M6 or 1/4-20 screws used to attach the base plate for the optical post holder assembly onto an optical table or other flat surface
- A source for compressed clean, dry air or compressed nitrogen to clean dust or particulates off of the sensor element

3.2.2 Unpack and Inspect Package

3.2.2.1 Receive and Inspect the Shipping Box

After the order is received, immediately examine the shipping boxes for any indication of damage.

3.2.2.2 Report Damage Immediately

If any damage is seen, write these discrepancies on the packing list. Also immediately contact both the shipping carrier and either an authorized Coherent representative or the Coherent Order Administration Department, as follows:

- Inside the USA: 1-(800)-367-7890
- Outside the USA: 1-(408)-764-4557

See 'Service and Support' on page 23 for more information.

3.2.2.3 Unpack Shipping Box

The LaserCam-HR II UV camera and accessories required for installation are packaged in a high-density plastic carrying case.

NOTICE

Keep the shipping box and all packaging materials for the camera and accessories. These materials are required for safe transport if you later ship the camera to another location or return a product to the Coherent factory.

To unpack the shipping box:

1. Open the shipping box, shown in Figure 3-1, and then remove the top foam layer.

Figure 3-1. Unpack the Shipping Box

2. Lift the high-density plastic carrying case with the camera and accessories out of the box and place on a flat, stable surface.
3. Remove the assembly and the Camera Care Sheet from the bottom of the box.
4. Open the high-density plastic carrying case.
5. Note the placement of contents in the shipping box. As shown in Figure 3-2, the camera is on the left and accessories are packed in the larger compartment on the right side of the case.
6. Remove accessories from the right side and put them on a clean surface.

Figure 3-2. Case for LaserCam-HR II UV Camera

WARNING!
Take necessary precautions or shielding to protect the system from Electrostatic Discharge (ESD). Otherwise, damage can occur to the electronics features of the LaserCam-HR II UV camera.

- Remove the USB cable.
- Remove the anti-static bag with the Trigger Cable, Metric Mounting Clamp, and Dust Cap, shown in Figure 3-3.

Figure 3-3. Accessories – Trigger Cable, Clamp, Dust Cap

- Remove the anti-static bags with the Post and Stand assembly, plus the hex driver and screw, shown in Figure 3-4.

7. Remove the Camera from the left compartment of the carrying case, as shown in Figure 3-5:

Figure 3-4. Accessories — Post and Stand Assembly, Hex Driver

Figure 3-5. Remove Camera from Case

The LaserCam-HR II UV is a digital CCD camera, designed for use with a USB 2.0 interface. The camera, trigger cable and rotational camera mount, and are shipped in a high-density plastic carrying case. This specially designed case protects all items during shipment, and that case is then packed in a shipping box with foam inserts for additional protection.

When inspecting a LaserCam-HR II camera, remove only the protective cover, not the LDFP (Low Distortion Faceplate), as shown in Figure 3-6.

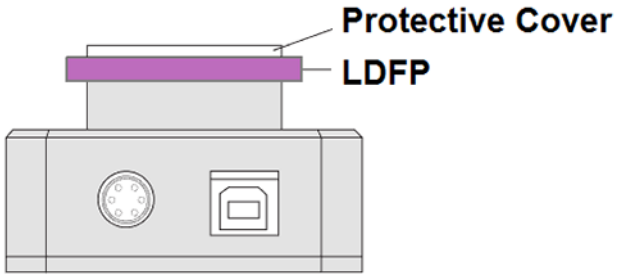


Figure 3-6. Protective Cover on LaserCam-HR II UV

3.2.3 Connect Cables to the Camera

After the software is installed and after all the components and accessories are unpacked, connect the cables to the camera as described in this section.

NOTICE

Do not connect the USB cable to the computer until instructed to do so.

3.2.3.1 USB Cable

The LaserCam-HR II UV camera interfaces through the USB 2.0 connector of any compatible PC using BeamView software.

- Connect the USB 2.0 cable to the port on the underside of the LaserCam-HR II UV camera, as shown in Figure 3-7.

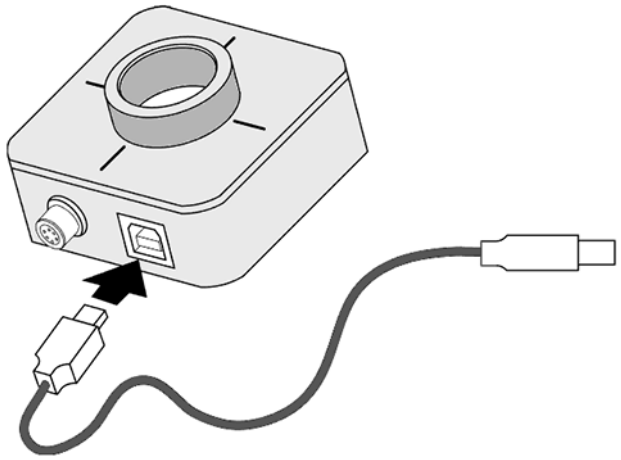


Figure 3-7. USB Cable

3.2.3.2 Trigger Cable

The Trigger Input and Pass/Fail Output cable (P/N 1120313) is used with the Triggering feature of the BeamView software. If you plan to use that feature, attach the BNC connector for the Trigger cable to the port on the underside of the camera, as shown in Figure 3-8.

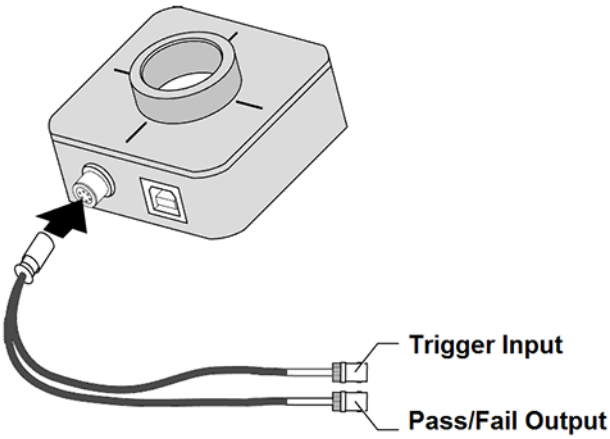


Figure 3-8. Trigger Input and Pass/Fail Output Cable

Set-up can vary, depending on your application. See 'Triggering Methods' on page 26 for more information about using that feature of the software.

3.2.4 Assemble the Post and Stand

Table 3-1 shows the parts for the Post and Stand Assembly (P/N 1136566) that are included with the LaserCam-HR II UV camera system:

Table 3-1. Parts for Post and Stand Assembly

Item	Description
Optical Post, Stainless Steel	Attaches to the Transit Clamp at the base of the LaserCam-HR II UV camera.
Optical Post Holder, 3.0" with set screw	A spring loaded plunger within the brass thumb-screw holds the steel post firmly within the post holder prior to final tightening. This allows one-handed positioning of post-mounted devices.
Optical Post Base, 2" x 3" x 3/8"	Ensures stable mounting. Bases are attached to the post holder using socket cap screws that fit within a bottom-located, counter-bored clearance hole.

Figure 3-9 shows an example of an assembled Post and Stand.

Figure 3-9. Post and Stand Assembly

To assemble the post assembly:

1. Attach the Post Holder to the Optical Post Base.
   a.) Put the Optical Post Holder in position over the center of the Post Base.
   b.) Hold the Optical Post Holder together with the Optical Post Base, and turn the Base over.
   c.) Insert a screw into the drilled hole.
   d.) Tighten with a hex wrench.
   e.) Turn the assembly back over into an upright position.
2. Attach the assembled Optical Post Base and Post Holder to a flat surface or an optical table using the screw mounts.

3.2.5 Mount the Camera

To mount the camera:

1. Insert the stainless steel Optical Post into the camera:
   a.) Turn the camera over and then insert the Optical Post into the pre-drilled hole in the base of the Transit Clamp on the camera.
   b.) Securely screw the Optical Post into place.
2. Firmly insert the Optical Post into the Optical Post Holder that is already attached to the Base and a flat surface or Optical Table.
3. Tighten the set screw on the Optical Post Holder to secure the inner stainless steel Optical Post. This stabilizes the camera.

3.2.6 Connect the Camera to the Workstation

The BeamView software does not automatically detect a device until it is plugged in.

Connect the other end of the USB cable from the camera to a USB port on the workstation.

CAUTION!

Wait to start the BeamView software until *after t*he USB cable from the camera is connected to the workstation.

If the USB cable is connected too soon from the camera to the workstation BEFORE the BeamView software is installed, the Microsoft operating system detects the camera as a new device and attempts to install a standard Windows device driver. This results in the camera having an incorrect device driver installed, and the camera is not recognized by the BeamView software.

NOTICE

The beam movement on the camera does not match the beam movement on the monitor for all positions between 0 and 90 degrees.

3.3 Next Steps

- Go to ’Description and Specifications’ on page 23 to review features specifications, and dimensions for the LaserCam-HR II UV camera.
- Go to ’Operation’ on page 23 to learn about the functions of the LaserCam-HR II UV camera.
- Go to ’Maintenance’ on page 23 for information about how to inspect and clean the LaserCam-HR II UV camera.

4 Operation

This section describes functions of the LaserCam-HR II UV camera, including:

- Warm-Up Time, Power On and Maximum Power Levels (page 23)
- Pixel Spacing and Saturation (page 24)
- Low Distortion Faceplate (LDFP) and Fringes (page 24)
- Triggering Methods (page 26)

Refer to ’Safety and Compliance’ on page 5 to learn about required safety precautions when working with lasers.

For general information and tips about using the LaserCam-HR II UV camera, see ’How to Get the Most from the Camera System’ on page 31.

4.1 Warm-Up Time

The LaserCam-HR II UV camera does not require warm-up. However, if the camera is used to make high-accuracy measurements, it must warm up for at least 15 minutes to insure best baseline (background) stability.

NOTICE

For best results, take the background map after the camera warm-up period.

4.1.1 Power On

The LaserCam-HR II UV camera has no ON/OFF switch. When power is applied to the camera with the USB 2.0 connection, the camera begins to operate.

4.1.2 Maximum Power Levels

The camera will saturate at approximately 90.0 µW/cm^2 at 248 nm wavelength at CW without the Low Distortion Face Plate (LDFP), or 5.0 µJ/cm^2 pulsed 248 nm wavelength without the LDFP.

CAUTION!
Damage can occur at power levels that are more than 10,000 times the saturation power density.

4.2 Pixel Spacing

The LaserCam-HR II UV camera incorporates a phosphor coating. The granularity of this thin coating results in an effective pixel size of 20.0 x 20.0 µm. In comparison, the CMOS array without the UV coating has a 6.5 x 6.5 µm pixel pitch.

Effective pixel spacing values for the LaserCam-HR II UV camera are as follows:

- Horizontal Spacing: 20.0 µm
- Vertical Spacing: 20.0 µm

4.3 Saturation

Saturation options for the LaserCam-HR II UV camera are shown in Table 4-1:

Table 4-1. Saturation Options

Wavelength	On Array	On LDFP
248 nm (CW)	90.0 µW/cm^2	90.0 mW/cm^2
248 nm (Pulse)	5.0 µJ/cm^2	5.0 mJ/cm^2

4.4 Low Distortion Faceplate (LDFP)

The Low Distortion Face Plate (LDFP) provides a protective window for the camera array. With an optical density of 3.0 at 248nm, the LDFP also acts as a background attenuator with 0.01% typical.

The LDFP is made of laser grade filter glass that minimizes interference fringes (see page 25) and does not distort the beam image.

The LDFP limits room light, instrumentation lights, and flash lamp light from reaching the camera sensor. These lights cause a background level that may not be effectively subtracted by the Background Subtraction Wizard.

4.5 Fringes

If the LDFP filter glass is installed in the camera, fringes can appear in the video, as shown in the example in Figure 4-1.

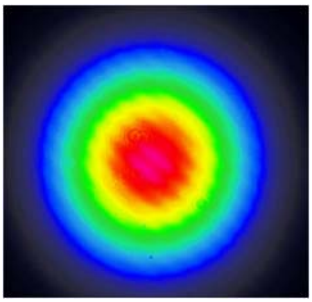


Figure 4-1. Fringes

The fringe pattern is caused by a second reflection off the sensor and LDFP superimposing back on the original beam image.

To correct this condition:

1. Loosen the C-mount setscrew.
2. Rotate the LDFP housing until the fringes are no longer present.

Slightly turning the camera with respect to the laser beam can also decrease this effect.

WARNING!
Direct eye contact with the output beam from the laser may cause serious eye injury and possible blindness. Always avoid eye or skin exposure to both DIRECT and SCATTERED radiation.

4.6 Triggering Methods

The LaserCam-HR II UV trigger lets the beam diagnostic system interface with pulsed lasers and transient optical events, including single-shot lasers.

This section describes the inherent delay of the LaserCam HR-II CCD array and how to compensate to capture images.

4.6.1 Set Up Connections for a Trigger

Users must first set up the camera with the correct cables and any other equipment required. A Trigger cable is included with the LaserCam-HR II UV camera. Figure 4-2 shows the cable inserted into the underside of the camera,

Figure 4-2. Trigger Cable Inserted

4.6.1.1 Trigger In

Trigger In uses the BNC connector labeled 'IN' on the Trigger and Pass/Fail cable for the LaserCam-HR II UV camera. This 5 VDC, TTL input—available on the rising or falling edge—causes the camera to immediately reset and begin integrating light.

The Trigger In delay is 20 µs. This is the time it takes for the camera to start integrating light after the trigger signal occurs. The LaserCam-HR II UV can sample laser pulse repetition rates to a maximum of 200 Hz without averaging adjacent pulses.

4.6.1.2 Trigger Out

Use an external pulse generator if the laser under test does not supply a ‘sync-out’ signal. Connect the pulse generator to the Trigger In connector. Apply a delayed trigger to the Enable or Trigger input connector of the laser.

Note that integration begins 20 µs after the rising edge of the camera trigger (Trigger In). Therefore, the laser enable pulse must be delayed by 20 µs, minus any delay in the laser-firing circuit.

4.6.1.3 Trigger Delay Tips

To avoid missed pulses due to jitter, add an additional trigger delay beyond the listed trigger delay values.

For low rep. rate lasers—such as 10 Hz lasers—delay the trigger enough to put the laser pulse in the middle of the integration window.

When a Trigger delay is entered, users must enter the value in µsec (based on increments of 1 ms resolution delay). If users enter something in between that, the system defaults back to the last valid saved integer. For example:

- If users enter 1000 and save it, the value displays as 1 ms.
- If users enter 1500 and save it, the value still displays at 1000 (or 1 ms).
- If users enter a value such as 100 and save it, the value displays as 0.

4.6.2 Pulsed Measurements with LaserCam-HR II UV

When taking pulsed measurements using the LaserCam-HR II, the camera and software offer a couple different triggering methods that can be used to capture images.

- **Auto-trigger mode,** where the BeamView software uses a set intensity threshold to determine if it will capture or discard a pulsed image.
- **External trigger mode**, where a voltage signal (typically a TTL pulse from the laser) can be sent to the camera to synchronize its capture period to the timing of the laser.

The next sections describe these triggering methods to capture pulsed images.

WARNING!
LASER RADIATION!
Always use precautions to avoid eye or skin exposure to both DIRECT and SCATTERED radiation.

4.6.2.1 Auto Trigger Mode

The auto-trigger mode for the LaserCam-HR II is a fairly simple setting for capturing pulses without the need to synchronize the camera to the laser. The auto-trigger feature allows the user to set an intensity threshold that BeamView USB software uses to determine whether it will capture an image or discard it.

If a laser pulse hits the camera and causes a certain number of pixels to exceed the set intensity level, that image is captured and saved into BeamView.

The intensity threshold level can be adjusted to any value between 0 and 100% to qualify whether an image is kept or not. It is recommended that you begin with an intensity value of approximately 50%.

One drawback to the auto-trigger method is that not all pulses reaching the camera are captured. Due to the timing of the capture period on the LaserCam-HR II, it is not possible for the camera to capture every pulse when working in auto-trigger mode.

- Usually this is not too much of an issue when collecting pulses from a laser running at rep rates higher than 10 Hz or so. At rep rates higher than 10 Hz, the camera collects images on a fairly regular interval and runs at a good rate.
- At rates below 10 Hz, BeamView appears to run fairly slowly because of the low rep rate and the camera's inability to capture every pulse.

Therefore, for lasers running at rep rates lower than 10 Hz (especially for single pulse applications), using the external trigger setting is usually a good option.

4.6.2.2 External Trigger Mode

The LaserCam-HR II 2/3 (P/N 1360550) camera has an external trigger circuit with a 20 µs delay built into it. This is something inherent to the CCD camera, so there is no way the delay can be shortened through camera set-up. That means, to ensure that the camera operates correctly with an external trigger, the trigger signal needs to occur at least 20 µs before the laser pulse hits the camera.

With a default 5 ms integration time, the LaserCam-HR II UV camera is 'open' to capturing pulses for 5 ms after the trigger delay.

Basically, as long as the trigger delay of 20 µs has passed, the pulse can hit the camera anytime within the next 5 ms and be captured correctly. Figure 4-3 shows a basic time line of how External Trigger Mode works.

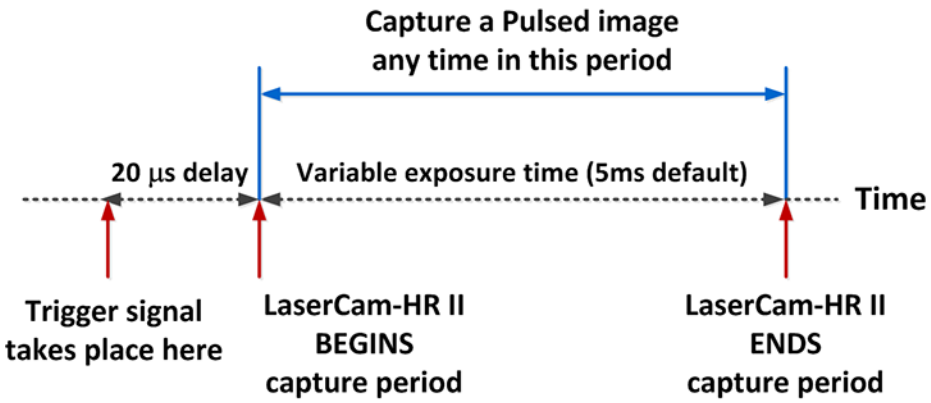


Figure 4-3. External Trigger Mode Time Line

On many lasers, the trigger signal and laser pulse may not match up with the 20 µs delay. For example, if a user has a laser that triggers only 10 µs before the pulse fires, then the LaserCam-HR II is triggering but does not capture any images. The laser is firing during the 20 µs delay, so nothing is captured by the camera during the inherent delay.

If this happens, the user should add a small amount of delay into the trigger signal or into the actual firing of the laser. For example, if something like a 10 µs delay is added to the time between the trigger signal and the laser firing, then capture should work correctly. This can be done through the use of external delay boxes or signal generators.

If the LaserCam-HR II is being used in pulsed mode and is capturing only blank images, trigger timing may possibly be the issue.

4.6.3 Trigger Delay in BeamView-USB Software

The BeamView USB software has a feature that helps in cases where the trigger delay is causing issues. This feature is called the "trigger delay" setting and can be accessed through the "capture / trigger" menu in BeamView USB. This feature basically uses the first trigger signal to capture the second laser pulse.

This software feature is useful in cases such as the one mentioned earlier, where the laser is firing only 10 µs after the trigger signal is sent to the camera. Due to the 20 µs delay, this would usually result in the camera

not capturing anything. However, if a longer than normal delay can be added between the trigger signal and the second pulse, the camera captures that second pulse while triggering on the first trigger signal.

4.6.3.1 Determine the Trigger Delay

For example, let's say a user has a pulsed 10 Hz laser with an external trigger that sends a trigger signal about 10 µs before the laser fires a pulse. If hooked directly up to the external trigger connection on the LaserCam-HR II, this would result in the camera triggering but not capturing any images during the 20 µs delay period. If this time between the trigger and the laser pulse cannot be adjusted on the laser, then the trigger delay on the camera can be lengthened to help capture the pulse correctly.

In such a case, set up a delay between the trigger signal and the second laser pulse. Because the camera has a 5 ms default integration time and the laser is firing one pulse every 100 ms (1/10 Hz), set a trigger delay of ~ 97 ms in the BeamView software.

With that setting, the laser would send a trigger signal, and 97 ms later the camera would start its integration. The second pulse would be captured. The camera would alternate trigger and capture, and then repeat.

The amount of delay can be determined by using something slightly shorter than the time between laser pulses. For example:

- For a 10 Hz laser (100 ms between pulses), something like a 97 ms delay could be used.
- For a 50 Hz laser (20 ms between pulses), a 17 ms delay could be used.

This sets enough delay for the camera to start its integration period before the next pulse is fired.

4.6.3.2 Capture Single-Pulse Lasers

The auto-trigger and trigger delay features do not work very well for capturing single pulse lasers.

In the case of a single pulse laser, the timing between the trigger signal and the laser firing needs to be adjusted to allow the camera to capture the first pulse while still accounting for the 20 µs delay in the camera. It is recommended that you use a pulse generator or signal delay box to set this up.

The 5 ms capture time on the LaserCam-HR II also sets the maximum rep rate at which the camera can be used for pulsed measurements.

For a 5 ms capture window, the inverse of that is 200 Hz. This means the camera can have up to 200 of these 5 ms capture periods per second.

- That means that the camera can capture single pulse images for rep rates up to 200 Hz.
- This does not mean that the software captures images at 200 Hz.

The update rate of the software is still limited to ~ 10 Hz, depending on the computer speed and the resolution used. This does mean that the camera can capture pulses at up to 200 Hz without getting multiple pulses into the same image.

Imagine running the laser at 400 Hz. The camera basically picks up two pulses in each capture period, which does not give an accurate image of each pulse. This 5 ms capture period limits the camera to rep rates of 200 Hz while capturing only single pulses in each image.

If working at rep rates above 200 Hz, the camera can be put into CW mode and should capture pulses correctly.

4.7 How to Get the Most from the Camera System

The LaserCam-HR II UV has been carefully designed to provide accurate measurements of the spatial and intensity characteristics of laser beams. Significant attention has been paid to every aspect of the instrument that impacts data accuracy.

4.7.1 Equipment Set-Up

The following tips help you get the best performance from the LaserCam-HR II UV camera.

- System tray—Turn off everything that is non-essential to the running of the computer. This action results in the fastest frame update rate possible.
- Resolution—Select 640 x 512 x 8 resolution to get the highest update rates.
- RAM—A minimum of 512 MB is required, and 1 GB is recommended. More RAM is typically better.
- Processor speed—A minimum of 3.3 GHz is recommended. Faster clock speeds provide higher frame update rates. The faster the processor speed, the better.

- Keep all optics clean—dirty LDFP, beam sampling, and attenuation optics will distort the beam under test. It is important that to regularly check optical surfaces for dust, fingerprints, and other contamination. Follow standard coated optical surfaces cleaning techniques. Refer to 'Maintenance' on page 23.

It's also important to understand that only need a few Milliwatt (mW) of laser power are needed to get an image on the camera. Using an attenuating optic such as a C-VARM allows control of the laser power input to the camera. This adjustment of laser power on the camera to 95% peak response is essential in using the full dynamic range of the camera.

4.7.1.1 Software Options

Tips when using the Inclusion command in the BeamView software:

Use the Inclusion command to reduce the size and amount of data that is processed.

The Inclusion command provides control of the sensor area where calculations are performed. Reducing this area can increase frame update rates and is especially effective with small spot sizes.

4.7.1.2 For More Information...

The LaserCam-HR II UV is a complex piece of optical test equipment. Many functions are included in the system that may not be obvious to a casual or first-time user. For example, calculations and functions are included in the instrument that you may think require post-processing or exporting of the data to another application, but in fact can be handled by the software and hardware.

For more information:

- It is strongly recommended to review this User Manual.
- Help files can also be accessed in the BeamView software (click the Help button) to learn about useful functions.

For more information or assistance, see 'Service and Support' on page 23.

5 Maintenance

5.1 Inspect and Clean the Sensor Surface

Dust in the atmosphere can be deposited onto the exposed surface of the camera. When irradiated by a high power laser beam, dust can burn and cause damage to the sensor surface.

CAUTION!
Best practice is to always keep the LDFP in place, and use the dust cap to protect the LDFP when not in use. Always avoid unnecessary exposure of the sensor to dust and dirt.

5.1.1 Inspect for Dust or Dirt

Regularly inspect the camera to ensure there is no dust on the sensor element. Any dust or contaminants can result in damage to the sensor. A good rule is to inspect first and clean only if necessary!

Inspect for dust or dirt:

1. Set any laser sources to OFF before the inspection is started.
2. Remove the Dust Cap and store it in a clean resealable bag to avoid contamination of the Dust Cap.
3. Observe the defects with a flashlight or a small light illuminating the camera.
4. Notice any movement when the illumination angle is changed:
   - If the defect moves, then the dust is on the LDFP.
   - If the defect does not move, it is dust on the sensor array.

CAUTION!
Touching the sensor can cause irreversible damage. Take all necessary precautions to insure that nothing comes in contact with the sensor surface.
Do not touch the sensor surface with your finger or any object. Cleaning the sensor surface voids the warranty.

Dust on the LDFP filter glass can cause distortion in the form of small circular diffraction rings or can cause low-intensity spots if present on the sensor array. The example on the right in Figure 5-1 shows an excessive amount of dust.

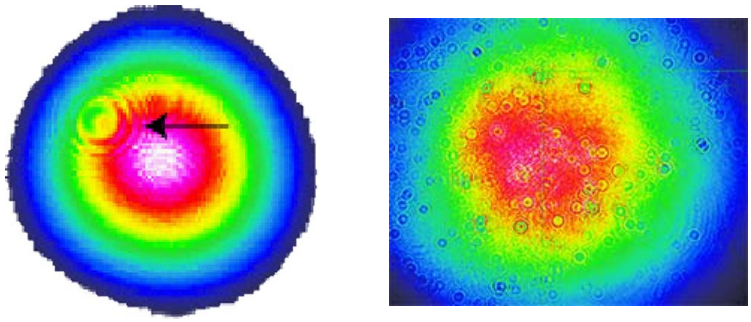


Figure 5-1. Dust on Filter Glass Causes Distortion

If low intensity spots or small circles are seen in the camera video, then dust may be present on the CCD sensor or on the Low Distortion Face Plate.

To verify the location, slightly rotate the LDFP lens on the camera. If the spot also moves on-screen in the BeamView software, the debris is on the LDFP lens. If not, the source of the spot could be anywhere else in the path.

5.1.2 Clean the Filter Glass

Clean the LDFP filter glass:

1. Use low-pressure nitrogen to gently blow particles off the surface.

WARNING!
Do *NOT* use canned air to clean the lens! The moisture and chemical propellant in the can could cause irreversible damage.

As an alternative to clean the filter glass, use Methanol and a lens tissue.

- ***Never*** use any other kind of cloth, tissue, or brush.
- ***Strictly avoid*** the use of any other kind of cleaning fluid.

2. Inspect the filter glass again.

Figure 5-2 shows an example of the surface after cleaning:

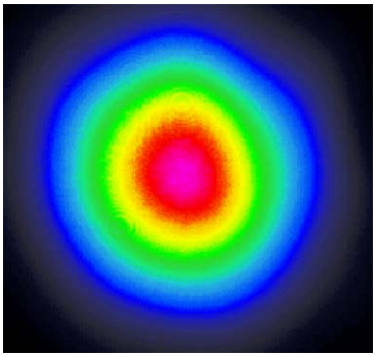


Figure 5-2. Filter Glass after Cleaning

If the sensor requires additional cleaning, contact Coherent Customer Service; see ’Service and Support’ on page 23 for more information.

I Warranty

LaserCam-HR II UV cameras ship with a standard one-year warranty, described in this section.

NOTICE

The warranty is maintained throughout the lifetime of the sensor if it is returned annually for service and recalibration.

I.1 Limited Warranty

Coherent, Inc. (the “Company”) warrants its laser power and energy meters and sensors products (“Products”) to the original purchaser (the “Customer”) that the product is free from defects in materials and workmanship and complies with all specifications, active at the time of purchase, for a period as specified in the sales agreement.

Coherent, Inc. will, at its option, repair or replace any product or component found to be defective during the warranty period. This warranty applies only to the original purchaser and is not transferable.

Refer to the sales agreement for full warranty details and for warranty limitations.

I.2 Warranty Limitations

The foregoing warranties shall not apply, and Coherent reserves the right to refuse warranty service, should malfunction or failure result from:

- Damage caused by improper installation, handling or use.
- Laser damage (including sensor elements damaged beyond repair).
- Failure to follow recommended maintenance procedures.
- Unauthorized product modification or repair.
- Operation outside the environmental specifications of the product.

Coherent assumes no liability for Customer-supplied material returned with Products for warranty service or recalibration.

II Service and Support

This section provides information about contacting Coherent for service and technical support. Depending on your location, contact Coherent as described in the next section.

To view general information about service and support, as well as a list of contact names, telephone numbers, and addresses worldwide, visit our website: www.Coherent.com

II.1 Contact Technical Product Support

Coherent provides telephone and web-based technical assistance as a service to its customers and assumes no liability for any injury or damage that may occur with such services.

Please be prepared to provide the following information to the Customer Support Engineer who responds to your request:

- Model or part number of the unit
- Serial number of the unit
- A description of the problem
- Any corrective steps that were attempted

Under no circumstances do these support services affect the terms of any warranty agreement between Coherent and the buyer. Operation of any Coherent laser with any of its interlocks (or safety features) defeated is always at the operator's own risk.

II.1.1 In the USA and North America

If you are located within the United States or North America, contact Coherent LMC Technical Support directly:

Table II-1. Coherent Service Centers

Location	Phone	E-mail
USA	1.800.343.4912	LSM.service@coherent.com

Table II-1. Coherent Service Centers

Location	Phone	E-mail
Europe	+49-6071-968-0	customer.support@coherent.com
International	503.454.5700	customer.support@coherent.com

II.2 Telephone coverage is available Monday through Friday (except during U.S. holidays). Inquiries received outside normal office hours are tracked by our automatic answering system and promptly returned the next business day.

II.3 Get Service

To obtain service under warranty, Customer must notify Coherent of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service.

Coherent shall, in its sole discretion, determine whether to perform warranty service the Customer's facility, at a Coherent facility, at or at an authorized repair station.

II.3.1 Prepare Product to Ship

If the Customer is directed by Coherent to ship the product to Coherent or to a repair station, Customer must:

1. Contact Coherent Customer Service (see 'Contact Technical Product Support' on page 23) to request a Return Material Authorization (RMA) number.
2. **Attach a tag to the product** that includes the following information:
   - The Returned Material Authorization number (RMA)
   - The name of the person to contact about any issues with the product, or other contact name. at the Customer site.
   - Both the billing address and shipping address for the Customer.
   - The name, model, and part number of the product.
   - The serial number of the product.

NOTICE
The tag can be in any format (such as a product photo), as long as all of the required information is included on the tag.

3. Also include a description of the problem and any corrective steps you may have attempted. Including this with the package ensures that the information is provided to the person working directly with the product.

II.3.2 Product Shipment Instructions

Package the product (to protect from damage during shipping) as follows:

Prepare a product to ship to Coherent:

1. Remember to attach the tag to the product with the information required above.
2. Wrap the product with polyethylene sheeting or equivalent material.

CAUTION!
Use appropriate materials to protect the product from Electrostatic Discharge (ESD) as you wrap and package the product.

3. Using the original shipping and packaging materials, pack the product. If the original carton and packing materials are not available:
   - Get a corrugated cardboard shipping carton with inside dimensions that are at least 6 in. (15 cm) taller, wider, and deeper than the product.
   - The shipping carton must be made of cardboard with a minimum of 375 lb. (170 kg) test strength.
   - Cushion the instrument in the shipping carton with packing material or urethane foam on all sides between the carton and the product. Allow at least 3 in. (7.5 cm) on all sides, as well as the top and bottom.
4. Make a seal on the shipping carton with packaging tape or an industrial stapler.

5. Put the RMA number received from Coherent Customer Service on the outside of all shipping labels and containers.

NOTICE

Items returned without an RMA number identified on the outside or inside of the box are subject to return to the sender.

6. Ship the product to the following address, with shipping prepaid:

   Coherent, Inc.
   Laser Measurement and Control
   Attention: RMA #

   27650 SW 95th Ave.
   Wilsonville, OR 97070
   USA

Coherent shall pay the cost of shipping the product back to the Customer in conjunction with:

- Recalibration and recertification of the product.
- Repair or replacement of equipment due to product failures that occur within the first twelve (12) months of time of sale or during an extended 12-month warranty period.

LaserCam-HR-II-UV Operator’s Manual

Part No. 1363379 Rev AB

COHERENT

INNOVATIONS THAT RESONATE

LaserCam-HR-II-UV Operator‘s Manual

Part No. 1363379 Rev AB