VWR1B & VWR2B Infrared Viewers

User Guide

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Chapter 1 Safety

Shock Warning
Electrical safety requirements must be followed while operating this device.

Warning
The customer is responsible for light source safety while using viewer as a standalone device or integrated into a system.

Warning
The customer must consider protective measures if necessary.

Warning
This device will not protect you from direct or high light radiation. Use viewer with caution and appropriate attenuation.

Chapter 2 Description

2.1 About

Infrared (IR) viewers (Item #'s VWR1B and VWR2B) are high-grade image converters designed to observe indirect radiation of infrared lasers, light emitting diodes (LED), and other IR sources in the 350 – 1700 nm region. The lightweight, compact device is designed to be used hand-held.

The IR viewers have excellent resolution of 60 LP/mm and IR sensitivity. These devices can view continuous and pulsed laser radiation, with the ability to visualize pulse duration from ps to µs without synchronization.

2.2 Applications

- Laser Alignment and Safety
    - IR viewers are ideal for alignment of UV to IR laser beams and optical components in UV to IR systems.
    - Viewer can safely visualize beam that are not visible through required laser safety glasses.
- Viewing Dirty and/or Damaged Optics in Situ
- Directly Visualizing Beam Size and Shape
- Identifying Break or Light Leakage in a Fiber System
- Aligning Laser Cavities
- Viewing Overlapping Spots in a Crystal

2.3 How Does it Work?

The IR viewers are based on a first-generation high-grade image converter that has an electro-static focusing system, photocathode S-1+ with increased concentration of oxygen and screen of type P-20 with the maximum of luminescence at 550 nm.

IR viewers focus emitted or reflected light from a chosen subject into an evacuated tube with a photocathode where a photoelectron image is generated by the incident radiation. The generated photoelectrons are accelerated by a 16 - 18 kV voltage when powered. These accelerated photoelectrons are directed toward the output phosphor screen. When they hit the phosphor, the incident photoelectrons cause it to glow. The

photoelectrons generated by the photocathode and their subsequent acceleration by a strong electric field is known as an electrostatic lens. Photoelectrons generated in different locations by the incident radiation arrive at the phosphor screen in different locations as well, creating a visible image of the incident radiation. The fluorescent green light output (550 nm) from the excitation of the phosphor can be observed via an adjustable eyepiece lens and is independent of the wavelength of the incident radiation.

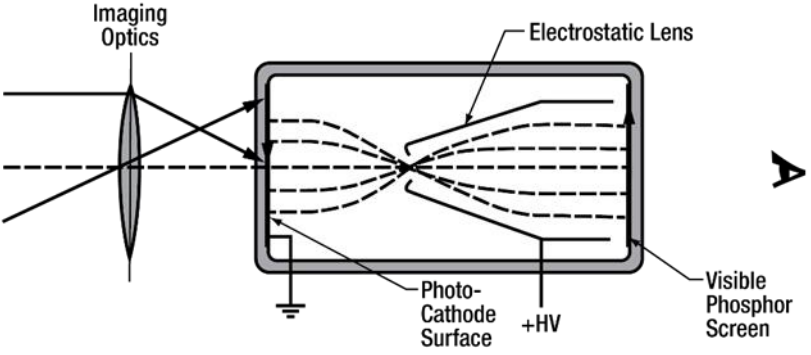


Figure 1 Diagram of the IR Viewer Phosphor Screen

2.4 Parts List

Each of the VWR1B and VWR2B IR Viewers will come with the following parts:

1. The VWR1B or VWR2B IR Viewer
2. One Cap for Removable Filter
3. One USB to Micro-USB Cord
4. The Carrying Case

The IR viewers do not ship with a battery charger or adapter; for a compatible charger, we recommend the Item # DS5 Regulated Power Supply.

Chapter 3 Operation

Caution
Do not use the device for direct beam viewing. Long-term over-exposure may cause saturation of screen and decrease of resolution or irreversible reduction of photocathode response.

Warning
While operating the viewer, do not stare at the direct laser (or other source) light even with safety goggles.

3.1 Operation Instructions

1. To charge the device, use the micro-USB outlet on the side of the handle. The unit will come charged.
2. Take off the lens cover. To switch the unit on, press button (6). NOTE: After switching off, the device continues to work for some minutes due to the accumulated power.
3. The switch remains in the on position once (6) is pressed. The unit will power down on its own after several minutes.
4. Rotate the ring (1) to focus the lens 1X (F1.4/25 mm lens). To adjust the iris (3), release the screw, adjust the diaphragm (3) and tighten the screw. Turn the ring (4) for eyepiece focus adjustment.
5. IR viewers come with a removable IR filter (9). While viewing reflected radiation, paper cards or metallic surfaces will work. TIP: For some wavelength regions, viewing through an IR viewer using an IR detector card as the surface under illumination can

provide additional sensitivity (this works especially well near 1550 nm).

Chapter 4 Viewer Diagram

1. Focus Adjustment Ring
2. Focus Adjustment Lock
3. Iris Adjustment Ring and Lock
4. Adjustable Focus Eyepiece
5. Eyepiece Locking Screw
6. Button ON/OFF
7. Power Status LED
8. Micro-USB Charging Port
9. IR Filter

Chapter 5 Additional Information

5.1 IR Viewer in Comparison with a CCD Camera

Certain models of CCD cameras can be used to observe near-infrared radiation at wavelengths up to 1100 nm. However, because these cameras are designed for optimum performance in the visible wavelength range, they exhibit mediocre performance in the near-infrared range; image bleeding, blooming, low sensitivity and low contrast are some of the observed characteristics. Image conversion viewers are designed to observe a much wider spectrum.

5.2 Visualization of Infrared Laser Beam in “Mid-Air”

It is difficult to view infrared laser beams in “mid-air” (1100 - 2000 nm). However, if dust particles are in the beam path, the beam will become partly visible. Basically, IR viewers can be used to see the projection of the infrared beam spot on a flat diffusing surface such as a white card or metallic surface.

5.3 Black Spots on Screen

Black spots on the screen are cosmetic blemishes in the image converter that do not affect the performance or reliability of an infrared viewer. Some spots are inherent in the manufacturing processes. An example of a VWRxB IR Viewer with several black spots that are allowable is shown in Figure 2.

Zone	Form and Size of Zones on Photocathode	Greatest Ø of Points (mm)			Total Area of Allowable Defects on Screen (mm^2)
		Non-accounted	Accounted		
			Typical	Max	
1	Circle Ø12 mm	0.25	0.8	3	1.5
2	Ring Ø12 - 19 mm	0.5	1	5	2
3	Ring Ø19 - 24 mm	Not Specified			

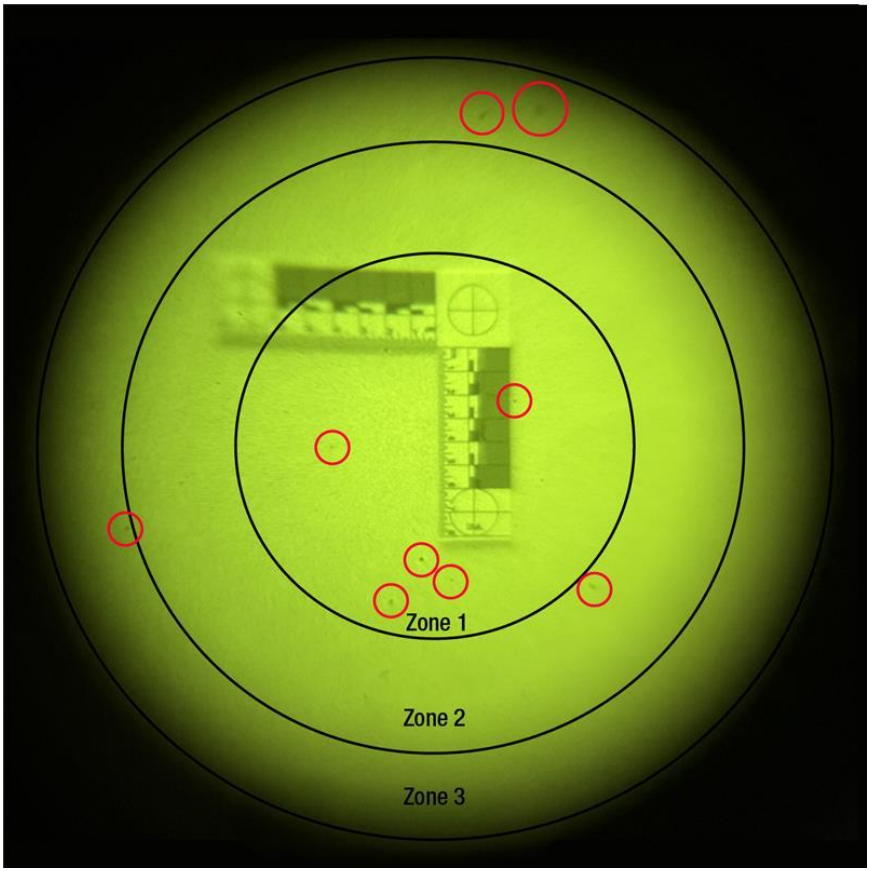


Figure 2 The image above shows some acceptable black spots (circled in red) as defined by the table above. The Zones referenced in the table are labeled on the image.

Chapter 6 Spectral Sensitivity

This plot shows the typical spectral sensitivity of each IR viewer. This data is for reference only and actual performance may vary.

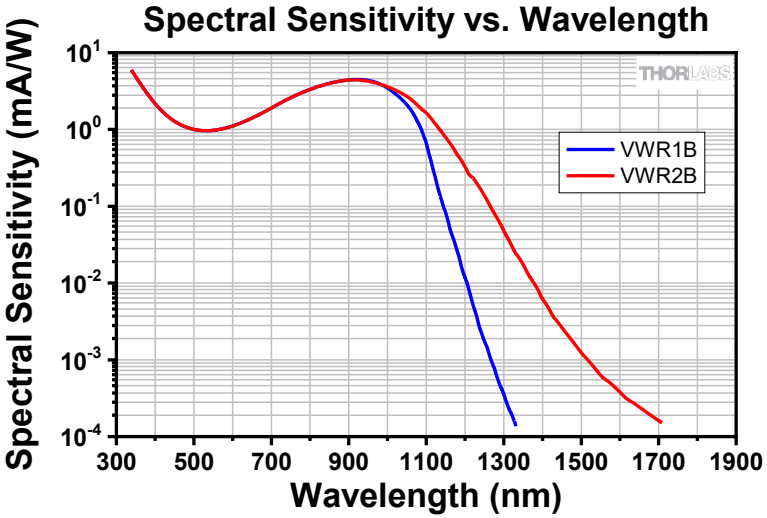


Figure 3 Typical Spectral Sensitivity for VWR1B and VWR2B

Chapter 7 Power Density

This plot shows the typical power density required to see IR laser light with the IR Viewers. This data is for reference only and actual performance may vary.

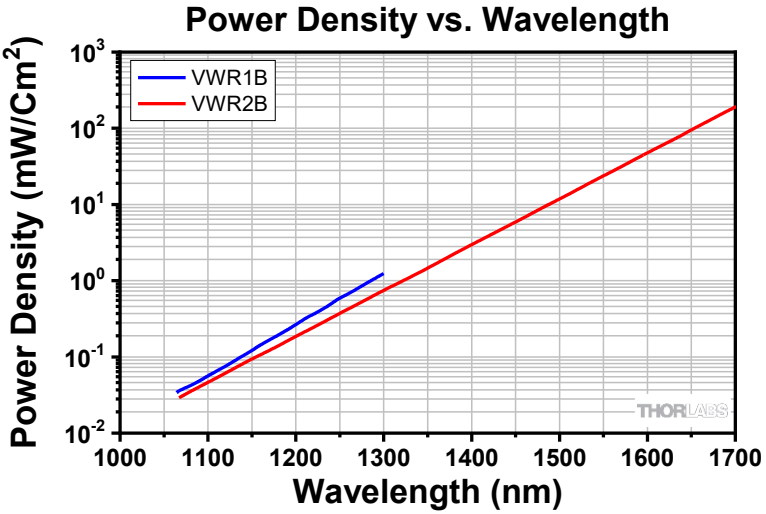


Figure 4 Typical Power Density Required to View Laser Light in the IR

Chapter 8 Photosensitivity

The minimum detectable signal for a near-infrared viewer depends on:

- Power Density
- Wavelength of Incident Radiation
- Effective Aperture of the Objective Lens
- Distance between Observed Target and the Viewer
- Time Duration of the Signal (Pulsed or Continuous)
- Reflectivity of the Diffusing Surface
- Sensitivity of Human Eye or Device Used in Viewing the Output of the IR Viewer

The following values are the approximate minimum power densities required for observing an infrared laser source from a distance of one meter:

- 20 $\mu W/cm^2$ for 1060 nm source
- 500 $\mu W/cm^2$ for 1300 nm source

Chapter 9 Specifications

Item #	VWR1B	VWR2B
Spectral Sensitivity	350 - 1300 nm	350 - 1700 nm
Resolution	60 LP/mm	
Field of View	40°	
Magnification	1X	
Objective Lens	F1.4/25 mm	
Adjustable Iris	Included	
Focus	<0.1 m to Infinity	
Charging Port	5 V Micro-USB	
Non-Uniformity of Screen	<20%	
Non-Uniformity of Response	<15%	
Distortion of Image	<18%	
Battery Life (Continuous)	50 hours	
Weight	0.4 kg	
Dimensions	153.0 mm - 157.1 mm x 172.9 mm x 51.0 mm (6.02" - 6.18" x 6.81" x 2.01")	
Temperature Range	-10 °C to 40 °C	
Mounting Thread	1/4"-20 Internal Thread	

Chapter 10 CE Certification

in accordance with EN ISO 17050-1:2010

We: Thorlabs Inc.

Of: 43 Sparta Avenue, Newton, New Jersey, 07860, USA

in accordance with the following Directive(s):

2014/35/EU	Low Voltage Directive (LVD)
2014/30/EU	Electromagnetic Compatibility (EMC) Directive*
2011/65/EU + 2015/86	Restriction of Use of Certain Hazardous Substances (RoHS)

hereby declare that:

Model: ***VWR1B and VWR2B***

Equipment: ***IR Viewers***

is/are in conformity with the applicable requirements of the following documents:

EN 61010-1	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.	2010 + A1:2019 + AC:2019.
EN 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances	2018
EN 55032	Electromagnetic compatibility of multimedia equipment. Emission requirements	2015/AC:2016

and which, issued under the sole responsibility of Thorlabs, is/are in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8th June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, for the reason stated below:

contains no substances in excess of the maximum concentration values tolerated by weight in homogenous materials as listed in Annex II of the Directive

I hereby declare that the equipment named has been designed to comply with the relevant sections of the above referenced specifications, and complies with all applicable Essential Requirements of the Directives.

Signed: 

On: 09 June 2023

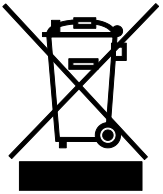
Name: Danielle Strong

Position: Director of Quality and Compliance

EDC - VWR1B and VWR2B -2023-06

CE

Chapter 11 Warranty and RMA Information



Annex I

Thorlabs verifies our compliance with the WEEE (Waste Electrical and Electronic Equipment) directive of the European Community and the corresponding national laws. Accordingly, all end users in the EC may return "end of life" Annex I category electrical and electronic equipment sold after August 13, 2005 to Thorlabs, without incurring disposal charges. Eligible units are marked with the crossed out "wheelie bin" logo (see right), were sold to and are currently owned by a company or institute within the EC and are not dissembled or contaminated. Contact Thorlabs for more information. Waste treatment is your own responsibility. "End of life" units must be returned to Thorlabs or handed to a company specializing in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site. It is the user's responsibility to delete all private data stored on the device prior to disposal.

11.1 Return of Devices

This precision device is only serviceable if returned and properly packed into the complete original packaging including the complete shipment plus the cardboard insert that holds the enclosed devices. If necessary, ask for replacement packaging. Refer servicing to qualified personnel.

Chapter 12 Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.

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