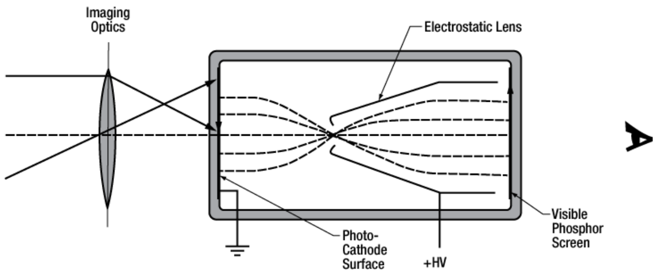
Infrared Viewers

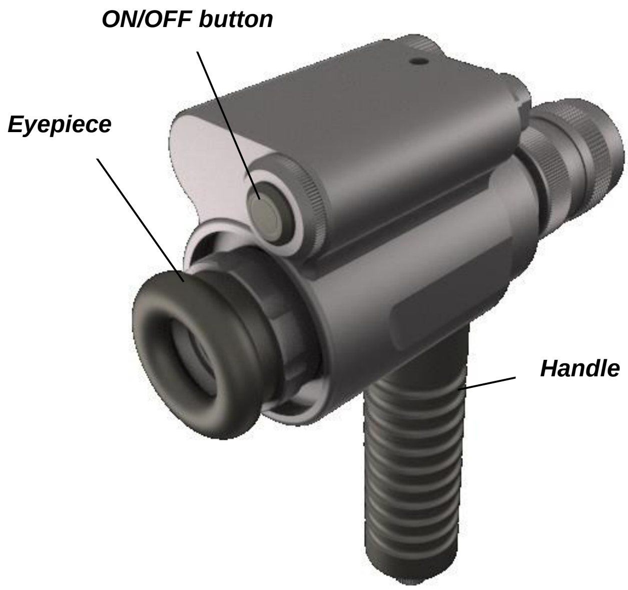
ABRIS-M series
Converts 350-2000nm radiation to visible

In science, medicine, industry, connected with optics, one is often dealing with infrared light, e.g. in the form of infrared beams emitted by lasers. It can then be difficult e.g. to follow a beam path or to check a beam position without any visual aid. Therefore, one often uses infrared viewers (IR viewers), i.e., devices which effectively make infrared light visible. One can look into the ocular (eyepiece) of such a viewer and see an image, which is created from infrared light entering the device through the objective on the opposite side.

How ABRIS-M works

The basic operation principle of an infrared viewer is as follows:
- Infrared light from some source, entering the objective, is imaged onto image converter. That device has a photocathode (a photosensitive area) inside an evacuated tube where photoelectrons can be generated by incident infrared radiation.
- The generated photoelectrons are accelerated by a strong electric field (created by applying a high voltage of e.g. several kilovolts) and then hit a phosphor on the opposite side of the tube. There, the electrons cause the phosphor to glow; depending on the type of phosphor, the color of the emitted light may e.g. be green. (The emitted light color is independent of the wavelength of the radiation hitting the photocathode.) As electrons generated on different locations on the photocathode are sent to different locations on the phosphor, a visible image is created there.
- The visible light can then get through the ocular into an eye of the user, so that a visible image can be generated on the retina. The precise technology used in the image converter is usually not revealed in product descriptions.





Features

- *Observe Indirect Radiation of Infrared Lasers, Light Emitting Diodes (LEDs), Dye Lasers, and Other IR Sources*
- *Pulsed and CW light detection without synchronization*
- *View nano- and picosecond pulses*
- *Versions 350 - 1300 nm, 350 - 1700 nm and 350-2000 nm*
- *Power from 16340 or CR123 battery + DC 5V USB-C*
- *Excellent Resolution of 60 LP/mm*

Applications

- *Laser Alignment and Safety*
- *Examine Dirty and/or Damaged Optics in Situ*
- *Visualize Beam Size and Shape*
- *Identify Breaks or Light Leakage in a Fiber System*
- *Align Laser Cavities*
- *View Overlapping Spots in a Crystal*
- *Other IR Light Applications in Photonics, Biology, Agriculture, and Electronics*

Photosensitivity

Near-infrared viewer with the S1 photocathode material (Ag-O-Cs: based on silver oxide, doped with cesium) can be used for about 0.4 µm to 1.5 µm or even 2.0 µm; it is reasonably sensitive to 1064-nm light from a YAG laser, while far higher intensities are required to see anything at 1.5 µm or even 2.0 µm. Observable intensity levels may vary by more than a factor of 100 within that wavelength range.

The minimum detectable signal for the IR viewers depends on:

- *Power Density*
- *Wavelength of Incident Light*
- *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 the Human Eye to the IR Viewer Output*

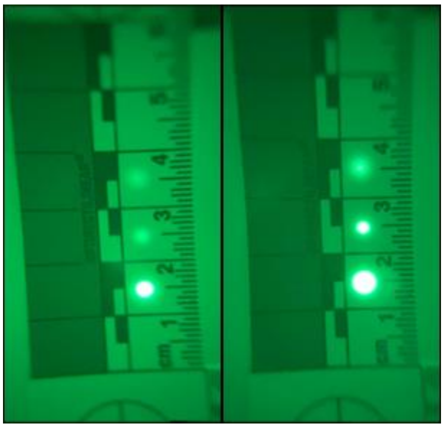
Minimal power density of radiation the reflected from metallic surface at signal/noise = 20 dB that is viewed through IR viewer is measured by at distance one meter as standard.
Approximately minimum power densities required for viewing an infrared laser beam from a distance one meter:

- *20 µW/cm*cm for a 1,06 µm*
- *500 µW/cm*cm for a 1,3 µm*

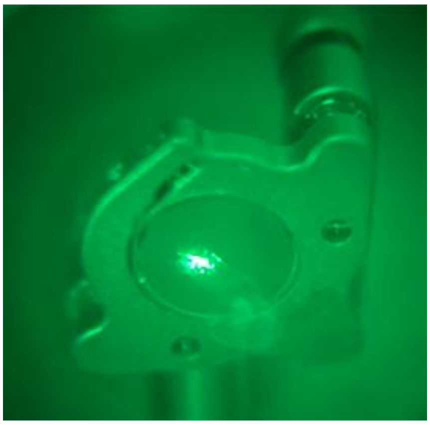
*The IR viewer with sensitivity 350…2000 nm has the photocathode S-1+ type that contains the increased concentration of oxygen that increases sensitivity of the photocathode and shifts it in infrared area. The IR viewer can be used to view 2.0 µm laser beam at minimum power density 2 W/cm*cm. When operated in the 1500…2000 nm range, the IR viewer has a low spectral response; therefore observations can be performed when the following requirements are met:*

1.Use an IR cut-off filter or interference filter and darken the room to reduce the external background.
2.Use a metallic surface for viewing the laser infrared reflective radiation, as any paper for these purposes will absorb infrared radiation.

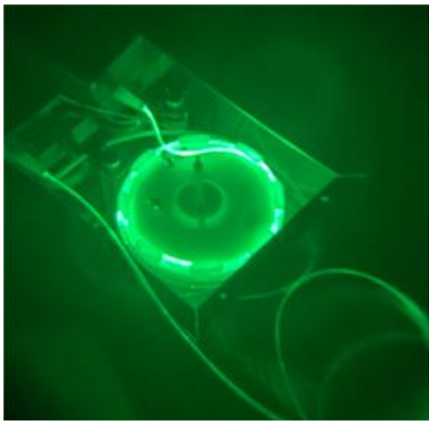
The image gallery



Spots from three different laser beams viewed through the scope of the VRW1B viewer (left), which is optimized for use with sources from 350 - 1300 nm and the VWR2B viewer (right), which is optimized for use with sources from 350 - 1700 nm. Top - 1650 nm at 80 mW, Middle - 1550 nm at 40 mW, Bottom - 1310 nm, 5 mW.



View through the scope of the VWR1B viewer (350 - 1300 nm) of light from a 1050 nm, 50 mW laser source hitting a dirty/scratched optic.



View through the scope of the VWR1B viewer (350 - 1300 nm) of a high power (50 W) 980 nm pump diode spool.

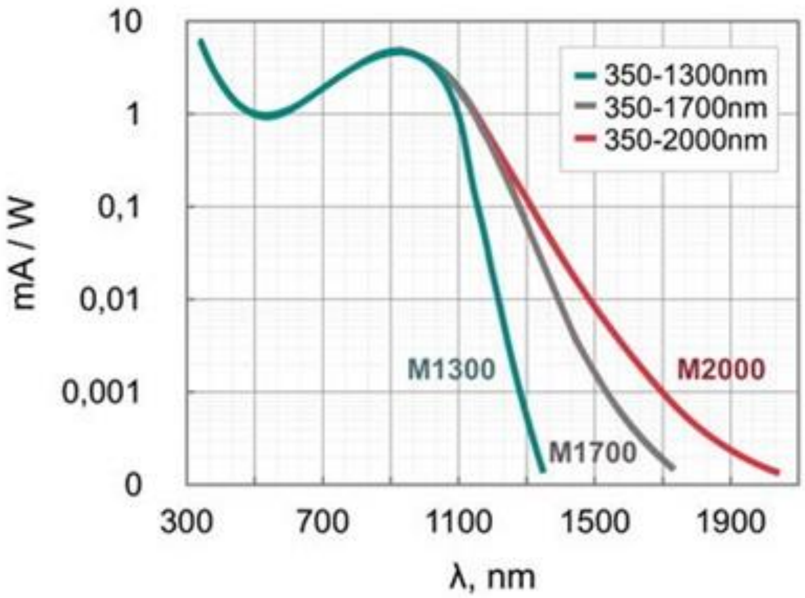
Specifications

Version	***ABRIS-M 1X***	***ABRIS-M 2X***	***Abris-M 3X***
Spectral sensitivity	***ABRIS-M 1300 nm*** ***ABRIS-M 1700 nm*** ***ABRIS-M 2000 nm***		***ABRIS-M 1300 nm*** ***ABRIS-M 1700 nm***
Resolution (center)	*60 Lp/mm*		
Field of view	*40°*	*20°*	*14°*
Magnification	*1X*	*2X*	*3X*
Objective lens	*F1.4/26 mm*	*F1.4/50 mm*	*F2.8/75 mm*
Focus	*0.2… ∞ cm*	*0.4… ∞ cm*	*0.85… ∞ cm*
Lens mount thread	*CS - mount*		
Battery	*1xCR123, 3V or 1x16340, 3.7V*		
Non-uniformity of screen	*<20%*		
Non-uniformity of response	*<15%*		
Distortion of image	*<18%*		
Battery life (continuous)	*35 hours*		
External power supply	*DC 5B, 30 mA*		
Interface	*USB type-C*		
Weight	*0.38kg*	*0.42kg*	*0.5kg*
Dimensions	*145x78x52 mm*		*150x78x52 mm*
Temperature range	*-10ºC…40ºC*		
Handle connection	*R"1/4"*		

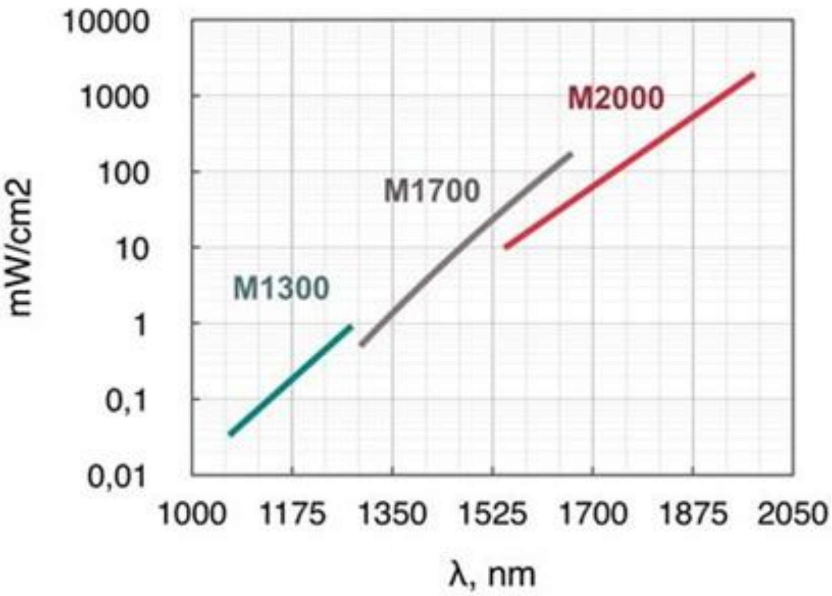
Typical spectral sensitivity

Approximately minimum power densities required to view an infrared laser beam from a distance one meter

ABRIS-M 1300	ABRIS-M 1700	ABRIS-M 2000
40 μW/cm² at 1,06 μm	500 μW/cm² at 1,3 μm	10 mW/cm² at 1,5 μm
700 μW/cm² at 1,3 μm	50 mW/cm² at 1,5 μm	50 mW/cm² at 1,7 μm
	150 mW/cm² at 1,7 μm	180 mW/cm² at 1,8 μm
		2 W/cm² at 2,0 μm



Spectral sensitivity for Abris M series IR viewers



Approximately minimum power densities required to view
an infrared laser beam with Abris M series from a 1 meter distance

How to determine the minimum power density required for detection of signal?

To determine the minimum power density in mW/cm2 required to yield a detectable signal, use the following procedure. Divide the laser power in milliWatts by the area of the beam at the distance to be measured. For an elliptical beam, the area is equal to 2/3 x w x h. For example, if h = 10mm and w = 40mm, then the area of the beam = 2/3 x 10mm x 40mm = 2/3 x 400mm= 266.7mm
To convert to cm, divide by 100. Therefore, the area = approximately 2.7cm. To determine the required power density, divide the laser power by the 2.7 cm figure. For example, if the laser output is 5mW, the required power density will be 5mW/2.7 cm, or 1.85mW/ cm.
For a circular beam, area is equal to . x r, where r = the radius of the beam. For example, if both the height and width of a beam at the distance to be measured are 5mm, then the area of a beam at this distance = 3.14 x 2.5mm (half the diameter, squared) = 3.14 x 6.25mm = 19.6mm. Divide by 100 to convert to cm, so the area = approximately 0.19cm. Now divide laser power by 0.19cm to determine the required power density. For example, if the laser output is 5mW, the required power density will be 5mW/0.19cm, or 26.31mW/cm.