

I. R. VIEWER  
MODEL #1017

## I. R. VIEWER

### 1.0 INTRODUCTION:

The Infrared (I.R.) Viewers are high resolution devices for observing radiation in the near infrared part of the electromagnetic spectrum. Notable design features include: a C-mount high-speed objective lens with variable aperture and adjustable focus; a high resolution, shock-mounted image converter tube having an S-I photocathode response; close focusing capability to 10" (25 cm) without a close-up lens accessory; a magnifying eyepiece lens; lightweight and sturdy construction; commercially available batteries.

### 2.0 HANDLING PRECAUTIONS:

Please note that the I.R. Viewer is a finely adjusted precision instrument. To be assured of trouble-free operation, full performance capabilities and long service life, we strongly recommend that you check these instructions completely before attempting to operate the viewer.

### 2.1 DO NOT STORE THE VIEWER IN TEMPERATURES LOWER THAN -15 DEGREES CENTIGRADE as this may cause the infrared tube to crack.

### 2.2 DO NOT POINT THE VIEWING DIRECTLY AT ANY HIGH INTENSITY LIGHT BEAMS as this may damage the infrared detector. Limit the power density to less than 100 nW/sq.cm. When viewing very bright objects, always rotate the iris on the Objective Lens so that the iris opening is either closed or very small. The iris may not attenuate collimated sources. Consequently, neutral density filters may be necessary to attenuate some laser sources.

### 2.3 Although the IR Viewer is a solid-state, modular unit using mainly low-voltage circuitry at non-hazardous energy levels, high power supply voltages are present on certain parts of the interior. **It is strongly recommended that the Viewer not be disassembled.** Consult the factory for recommendations.

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### 3.0 METHOD OF OPERATION:

#### 3.1 POWER:

To power the I.R. Viewer, depress and maintain the red push-button switch located on the handle. Note that the viewer may remain powered for a short time without having the button depressed.

#### 3.2 FOCUS:

Once the viewer power is initiated, the I.R. Viewer requires that both the Objective Lens and the Eyepiece Lens be focused.

#### 3.3 OBJECTIVE LENS:

The focus is altered by rotating the lens focus ring on the Objective Lens. Adjustments of this ring allows the user to optimize the image clarity obtained depending on the object's distance from the viewer. Note that rotation of the ring counter-clockwise (as seen while facing the back of the viewer) focuses the lens at points further away; clockwise rotation of the focus ring focuses the lens at closer objects.

The aperture is altered by rotating the lens diaphragm ring furthest on the viewer. On some lenses, the lens ring is graduated into F-stop values, i.e. F:1.4, F:2.0, F:2.8,...C (closed). Adjustment of the lens aperture ring allows the user to optimize the image obtained due to the brightness of objects at different radiated power levels. For brighter sources, the aperture should be kept at higher values (near closed) to limit the amount of radiation that is incident on the I.R. Viewer's very sensitive detector. For diffuse reflections, often the best image is obtained at the lowest values of aperture. Note that the depth of focus is also affected by the aperture position. Small values of F-stop (F:1.4) result in small depth-of-focus for which very accurate focusing is required; large values of F-stop (F:16) result in large depths-of-focus for which little focusing is required.

#### 3.4 EYEPiece LENS:

The eyepiece lens is pre-focussed at the factory. However, different users may find other adjustments preferable for their own vision. To refocus, the following procedure is suggested. First, set the objective lens iris to the wide-open position (such as F:1.4) and select a target for focusing (such as a flat surface with some writing). Depress and maintain the red push-button switch and observe the image as viewed through the

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eyepiece. Adjust the objective lens for optimum focus. Then, adjust the eyepiece lens until a clear image is obtained. The optimum position of the eyepiece lens may vary with the eyesight of the observer.

### 4.0 NOTES ON OPERATION:

#### 4.1 SPHERICAL ABERRATION:

For wide aperture settings (i.e. F:1.4), although the output image can be extremely sharp in the center of the field, often the perimeter area of the image is somewhat defocused. This spherical aberration is a result of the non-planar nature of the detector surface. Adjustment of the iris diaphragm to higher values of F-stop will reduce the peripheral effect.

#### 4.2 CHANGING LENSES:

A variety of different objective lenses are available for the I.R. Viewer, from wide-angle to telephoto. To exchange the Objective lens, simply rotate the objective lens housing counterclockwise (as seen by facing the viewer). Similarly, to replace the objective lens, simply match the lens thread with the thread on the lens mount and rotate the lens clockwise (as seen by facing the viewer).

#### 4.3 VIEWER MAINTENANCE:

Periodically clean all optical surfaces using soft lens paper and lens cleaner or alcohol. Batteries are easily replaced by removing the two phillips screws on the handle and removing the battery from the battery clip. A 9V alkaline (NEDA 1604) battery is recommended as replacement.

### 5.0 APPLICATIONS:

#### 5.1 VIEWING LASER SOURCES:

**CAUTION:** Direct or indirect laser energy should not be allowed to impinge on the Infrared Viewer Image Tube. Power levels in excess of  $100\text{mw}/\text{cm}^2$  will cause permanent damage to the viewer.

Allow the laser beam to impinge on a suitable beam stop, such as a power detector head or beam diffuser. With the I.R. Viewer several feet from the target, adjust the iris diaphragm for the proper intensity level, then adjust focus for a clear, sharp image.

#### 5.2 "SEE IN THE DARK" APPLICATIONS:

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The I.R. Viewer can be used in conjunction with an infrared illuminator to see in the dark (for color film processing, retinal tissue examination, night-time surveillance of animals). The infrared illuminator can be as simple as a flashlight or lamp with a long-pass infrared filter attached (the filter transmits the lamp's near infrared light and blocks all visible light). LED-based light sources can provide the same infrared illumination without the heat generation of filtered light sources (and the possibility of the filters cracking). Long distance surveillance requires a high intensity light source. (See Section 6.0 on Eye-Safety).

### 5.3 OBSERVATION OF THE THERMAL EMISSION OF OBJECTS:

The I.R. Viewer can be used to image the radiation of objects hotter than 600 degrees Centigrade temperature range. Assuming that objects generally radiate in accordance with the black-body radiation characteristic, then objects in this temperature range (and hotter) emit enough infrared radiation in the 0.7-1.3 micron wavelength range to be detected by the sensitive I.R. Viewer.

### 5.4 ANALYSIS OF MATERIALS TRANSPARENT TO NEAR-INFRARED LIGHT:

A variety of materials which are opaque to visible light are transparent to longer wavelength near infrared radiation. Consequently, sub-surface analysis in these spectral bands can be used for locating non-uniformities in the material or for post-processing failure analysis. For example, the examination of silicon and gallium arsenide wafers (used as integrated circuit substrates) can show sub-surface non-uniformities such as doping patterns, striations, and dislocations that could cause device malfunction.

### 6.0 EYE SAFETY WHEN USING NEAR-INFRARED LIGHT SOURCES:

Because the human eye is not sensitive to infrared light, it is very important to realize that invisible infrared light can be dangerous.

As a result of the fact that near infrared light is not detected by the retina, the eye's iris diaphragm does not close when high light-levels are present. Because near-infrared light passes easily through the clear eye structures and images on the retina, it is particularly hazardous. Lasers and other collimated sources present the greatest danger, but thermal sources which appear dull red can easily supply enough radiation to be harmful.

It is very important to note that an I.R. Viewer does not protect the eye from harmful high-intensity infrared laser radiation. Although the I.R. viewer will convert the infrared light to visible light, it is not guaranteed that all the energy associated with the incident radiation is converted. Thus, the normal eye safety procedures should be used.

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It is always best to prevent any invisible radiation from reaching the eye.

### WARNING!!!

ALWAYS WEAR PROPER LASER SAFETY GOGGLES WHEN WORKING WITH LASERS. HEAT ABSORBING SAFETY GLASSES ARE RECOMMENDED AROUND THERMAL SOURCES.

If your eyes feel scratchy, stop and check out the equipment. Use the I.R. Viewer to check for the presence of any unwanted stray radiation.

#### 7.0 ACCESSORIES:

A variety of accessories are available such as: close-up lens sets (CLS), extension tubes (XT), microscope and telescope adapters (M25, T25) infrared filters (long-pass, short-pass, band-pass and neutral density) and infrared illuminators.

#### 8.0 SPECIFICATIONS:

Spectral Responsivity:	Visible to 1300nm
Wavelength of Peak Response:	800-850nm
Resolution:	50 line-pairs/mm minimum
Field-of-View:	40° (with 25mm objective lens)
Focus:	25 cm to infinity (with 25mm obj. lens)
Photocathode:	S-1, 18mm diameter
Fluorescent Screen:	P-20, 14mm diameter
Battery Life:	100 hours typical
Weight:	1 lb. (450 g)
Power:	Standard 9V Battery (NEDA 1064) located in handle
Ambient Temperature Limits:	(-20)-(+50) Degrees C