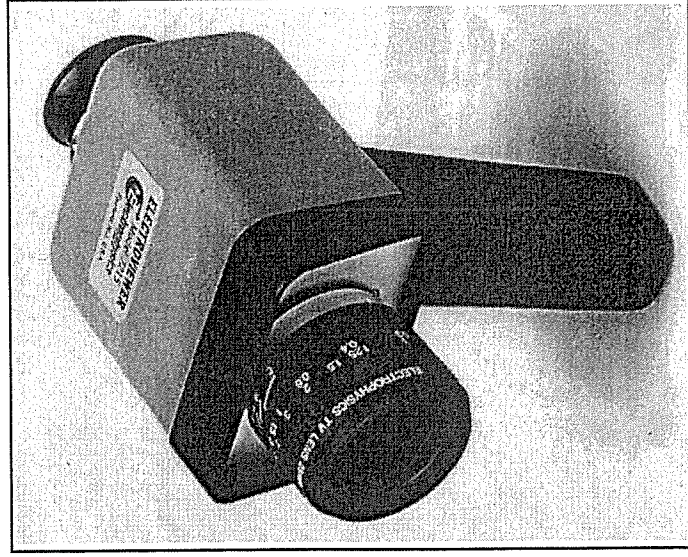




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OPERATING MANUAL ELECTROVIEWER Series 7215C



Please review these important instructions before operating the IR Electro-Viewers. If further assistance is necessary, please contact our Technical Support Group.

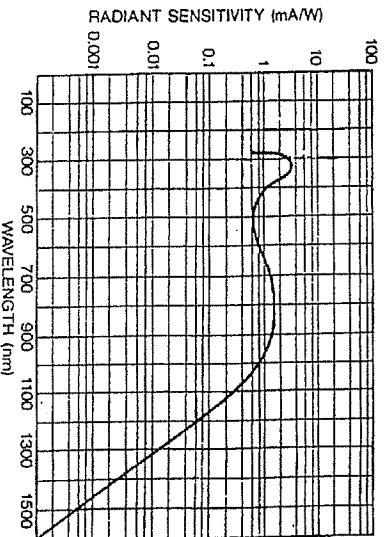
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I. INTRODUCTION

The Infrared **ElectroViewers** 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-1 photocathode response (see figure above) and a fiber-optic faceplate, close focusing capability to 3" (8 cm) without a close-up lens accessory, a magnifying eyepiece lens, lightweight and sturdy construction, and commercially available batteries. The Model 7215C is the standard unit, while the 7215CP offers a slightly enhanced optical performance.

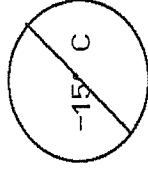
Spectral Response Characteristic



II. HANDLING PRECAUTIONS

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

- 1) *Do not store the Viewer in temperatures lower than -15°C as this may cause the infrared tube to crack.*

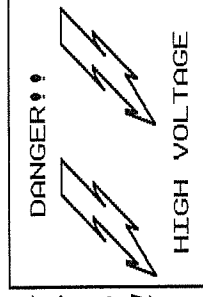


- 2) *Do not point the Viewer directly at any high intensity light beams as this may damage the infrared detector. Limit the power density to less than 100 mW/cm^2 . When viewing very bright objects, always rotate the iris on the*



Objective Lens so that the iris opening is either closed or very small. The iris may not attenuate collimated sources. Consequently, neutral density filters should be used to attenuate laser sources.

- 3) Although the **ElectroViewer** is a solid-state, modular unit, 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.



- 4) **Do not touch** internal parts (such as the input faceplate or output screen) while the unit is powered as high voltage may be present. Note that the unit may stay charged for a short time after powering. Consequently, let the unit stand for at least five minutes before cleaning the faceplate or screen.

- 5) It is very important to note that an Infrared **Viewer** does not protect the eye from harmful high-intensity infrared laser radiation. To prevent any invisible radiation from reaching the eye. **Always**

wear eye-safe goggles when working with lasers (heat absorbing safety glasses are recommended around thermal sources). If your eyes feel itchy, stop and check out the equipment. Use the **ElectroViewer** to check for the presence of any unwanted stray radiation.

III. METHOD OF OPERATION

Power:

To power the **ElectroViewer**, press and hold the red push-button switch located on the handle (see Fig. 3.1). Note that because of the high capacitance internal power supply, the Viewer may remain powered for a short time after releasing the button.

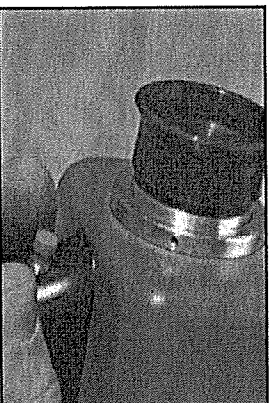


Fig. 3.1: 7215 power button

Lenses:

Once power is initiated, the **ElectroViewer** requires that both the Objective Lens and the Eyepiece Lens be focused. The standard objective lens has a focal length of 25 mm and is attached to the front of the Viewer. The eyepiece lens has a rubber eyecup and is located on the back of the Viewer.

Objective Lens Focus: The focus is altered by rotating the lens focus ring on the Objective Lens (see Fig. 3.2). Adjustment of this ring

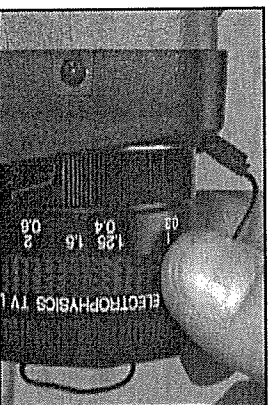


Fig. 3.2: Focus ring

allows the user to optimize the image clarity obtained depending on the object's distance from the Viewer. Note that rotation of the ring counterclockwise (as seen while facing the back of the viewer) focuses the lens at points further away (toward infinity); clockwise rotation of the focus ring focuses the lens at closer objects (as close as about 8 cm). Note that although the lens focus is graduated, actual focus distances will vary somewhat depending upon the wavelength of the object.

Objective Lens Aperture: The aperture positioning is altered by rotating the lens diaphragm ring on the objective lens (see Fig. 3.3). 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

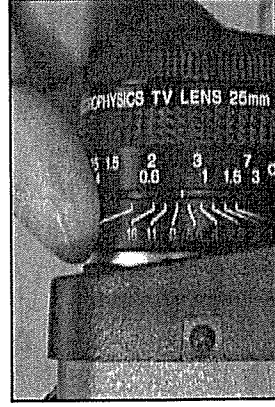


Fig. 3.3: Aperture ring

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 **ElectroViewer's** very sensitive detector. For diffuse reflections, often the best image is obtained at the lowest aperture values. Note that the depth of field is also affected by the aperture position. Small values of F-stop ($F1.4$) result in small depths-of-focus for which very accurate focusing is required; large values of F-stop ($F16$) result in large depths of field for which little focusing is required.

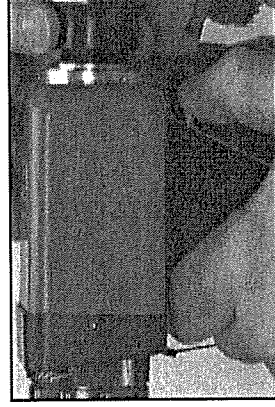


Fig. 3.4: Adjust eyepiece

Eyeiece Lens: The eyeiece lens is prefocussed at the factory. However, different users may find other adjustments preferable for their own vision. To refocus the lens, the following procedure is suggested. First, set the objective lens iris to the wide-open position (such as F1.4) and select a target for focusing (such as a flat surface with some writing). Press and hold the red push-button switch and observe the image as viewed through the eyeiece. Adjust the objective lens to obtain the optimum focus and then rotate the eyeiece lens (see Fig. 3.4) until a clear image is obtained. The optimum position of the eyeiece lens may vary with the eyesight of the observer.

IV. NOTES ON OPERATION

Changing Batteries:

Batteries are easily replaced by removing the two Phillips-head screws on the handle and removing the battery from the battery clip (see Figs. 4.1 and 4.2). A 9-V alkaline (NEDA 1604) battery is required for replacement.

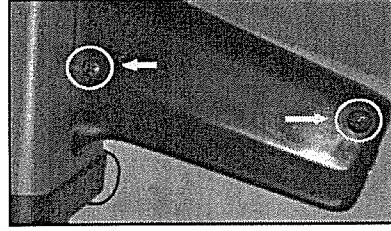


Fig. 4.1: Battery release screws

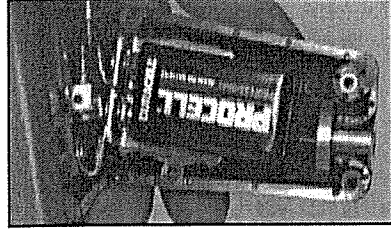


Fig. 4.2: Battery cover removed

Changing Lenses: A variety

of different C-mount type objective lenses are available for the **ElectroViewer**, from wide-angle to telephoto (SLR lenses may also be used with the proper adapter). To exchange the Objective Lens, simply rotate the lens housing counterclockwise (as seen by facing the front of the Viewer, see Fig. 4.3). Similarly, to replace the objective lens, simply match the lens thread with the thread on the lens mount and rotate the lens clockwise (see Fig. 4.4).

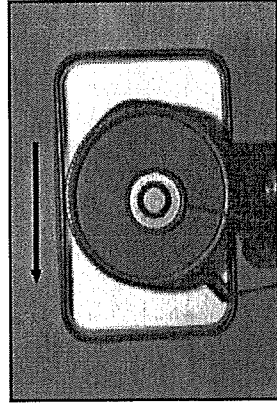


Fig. 4.3: Remove lens

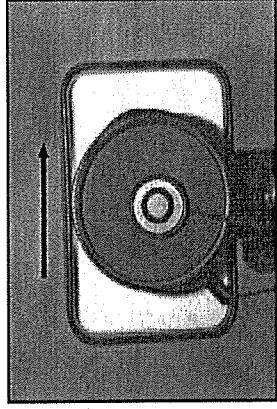


Fig. 4.4: Replace lens

Cleaning Optical Surfaces:

Periodically clean all optical surfaces using soft lens paper (or a cotton swab) and lens cleaner or alcohol. (Do not touch inside of the Viewer while it is powered, for this may cause shock.) Clean the eyepiece and objective lens outer surfaces, along with the Viewer's inside faceplate (after removing the objective lens, see Fig. 4.5) and the output screen (after removing the eyepiece, see Fig. 4.6).

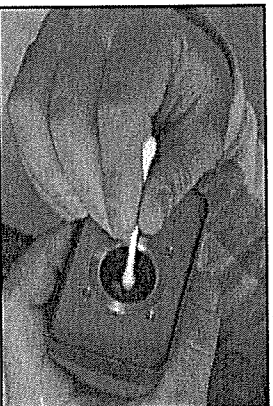


Fig. 4.5: Clean inside faceplate

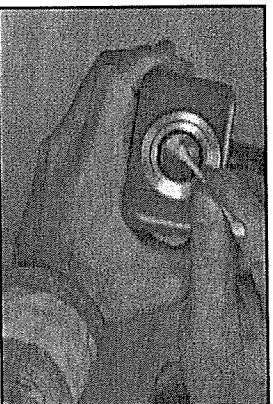
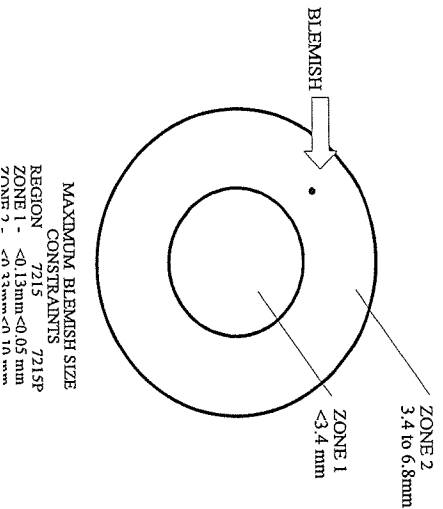


Fig. 4.6: Clean outside screen

Image Blemishes:

Small black spots can be found for several reasons. Because the image converter tube utilizes high voltage signals, the front and back faceplates very often attract dust.



These can easily be removed with a cotton swab or lens cleaning cloth. In addition, because of the manufacturing processes involved in producing all similar electro-optical devices, sometimes very small cosmetic blemishes can actually occur inside the image converter tube. These black spots do not affect the performance or reliability of the near-infrared viewer. We select only those image converters that have blemishes smaller than the maximum size constraints shown in the adjacent figure. For example, a blemish in the central part of the image can only be as large as 0.13mm ($<2\%$ of the screen size).

V. MODELS

Several models of the **Electro Viewer 7215C** are available to better meet certain application requirements. They are:

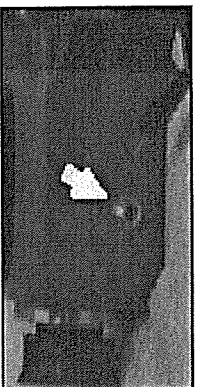
Model 7215C:

This is the standard version. It includes a 25 mm F1.4 Objective Lens with iris diaphragm and 9 V alkaline battery.

Models 7215C-AC, 7215C-ACE:

AC/battery versions (see picture).

These are the same as the **Model 7215C** except they have an additional jack on the chassis side panel for connection of an AC/DC adapter.



Model 7215C-AC(E)

Simply insert the plug from the AC/DC adapter into the jack. Note that by inserting the plug, the internal 9 V battery is disconnected so that it is not inadvertently charged. Removing the adapter plug returns connection of the battery (if any). **Model 7215C-AC** is for 110-120 Vac; **Model 7215C-ACE** is for 220-240 Vac.

Models 7215C-S, 7215C-S-AC, 7215C-S-ACE:

Toggle switch versions. On these units, the standard red push button power switch (located on the pistol grip) is replaced with a toggle switch. When the switch is up (pointing toward the eyepiece), the **Viewer** is on; when the switch is pointing down, it is off. It is important to note that unnecessary use of the **Viewer's** image converter tube will significantly reduce its operating life. Do not leave the **Viewer** on when not in use!

**Models 7215CP, 7215CP-AC, 7215CP-ACE, 7215CP-S,
7215CP-S-AC, 7215CP-S-ACE:**

Premium versions are denoted by the letter 'P'. These are the same as the regular models except that these models include a premium detector having reduced spurious signal specifications and improved response at longer wavelengths. Units are selected to detect power densities lower than 20 mW/cm² at 1.3 μ m.

VI. ACCESSORIES

The following accessories are available:

Model B9V 9-V Alkaline battery for IR Viewers

Model C7215 Foam-lined carrying/storage case:
Made for safe storage and easy carrying.

Model CLS Close-up lens set (37.5 mm thread):
Screws into filter thread of a standard 25 mm objective lens only.
Allows focusing to about 4-6".

Model F25 Filter Holder for 1" filters on 25 mm objective lens:
Filter holder captures 1" filters to front of a 25 mm objective lens on
Viewer.

Model IRFV Visible Light Cut Filter:
An infrared long-pass filter that blocks wavelengths shorter than
about 800 nm and passes near infrared light only. Includes F25 filter
holder for mounting to a 25 mm objective lens.

Model IRL600AC IR Microbeam Room Light:
High intensity IR light source. Includes IRL600 IR Microbeam and
PS-600 power supply. 12 Watts, AC operated.

Model WS-10 Wrist strap for hand-held Infrared Viewer:
Made to screw into the bottom of the handle (see Fig. 6.6).

Model XT Extension tube set:

For use between objective lens and Viewer. Allows focusing to 1-2" .

Model LPF-(****) Long-pass filter:

Sharp infrared cut-on filter, minimum average transmittance better than 75%, 0.1% blocking from UV. (****) is the cut-on value defined at 50% transmittance (e.g. LPF-700 has a cut-on value of 700 nm), 25.4 mm diameter.

Model SPF-(****) Short-pass filter:

Sharp infrared cut-off filter, minimum average transmittance better than 65%, 0.1% blocking through far-IR. (****) is the cut-off value defined at 50% transmittance (e.g. SPF-700 is a short-pass filter having a cut-off value of 700 nm), 25.4 mm diameter.

Model IF-(****) Band-pass interference filter:

Filter with better than 0.01-0.1% out-of-band transmittance, three cavity construction, bandwidth < 15 nm (full-width, half magnitude), 45% minimum peak transmittance, 25.4 mm diameter.

Model NDF-(****) Neutral density filter:

Coated filter, attenuates incident light by absorption and reflection, 25.4 mm diameter. Typical spectral transmittance curves are very flat from 400 nm to 2.5 μm . (****)=nominal density.

VII. APPLICATIONS

Viewing Collimated Laser Sources:

The **ElectroViewer** is ideal for locating and focusing infrared laser beams and finding stray laser reflections that could be harmful. Commonly, to image a laser spot, position a diffuser (such as a white card) in the beam path and focus the **Viewer's** objective lens on the diffuse reflection of the beam on the card. In order to see an infrared laser beam in "midair", aerosols or smoke can be used in the beam path to scatter the beam. (Note that use of these materials can fog optical components.)

"See in the Dark" Applications:

The **ElectroViewer** can be used in conjunction with an infrared illuminator to see in the dark (for color film processing, retinal tissue examination, nighttime surveillance of animals, etc.). 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.

Observation of the Thermal Emission of Objects:

The **ElectroViewer** can be used to image the radiation of objects hotter than 600°C. Assuming that objects generally radiate in accordance with black-body radiation characteristics, the objects in this temperature range (and hotter) emit enough infrared radiation in the 0.7-1.3 μm wavelength range to be detected by the sensitive **ElectroViewer**.

Analysis of Materials Transparent to Near-Infrared Light:

A variety of materials that are opaque to visible light are transparent to longer wavelengths 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, or dislocations that could cause the device to malfunction.

VIII. SPECIFICATIONS

Spectral responsivity: 400-1500 nm

Wavelength of peak response: 800-850 nm

Resolution: >80 line-pairs/mm center

Field-of-View: 40° (with 25 mm objective lens)

Focus: 8 cm to infinity (with 25 mm objective lens)

Photocathode: S-1, 17 mm diameter

Fluorescent Screen: P-20, 6.8 mm diameter

Faceplate Distance: 16.5 mm nominal (measured from the **Viewer** outside flange to the center of the detector faceplate)

Damage Threshold: 100 mW/cm² CW

Battery life: 100 hours typical

Weight: 1 lb. (454 g)

Power: Standard 9 V battery located in handle

Ambient Temperature limits: -20°C to +50°C

WARRANTY

The Electrophysics Corporation warrants the **Electro Viewer** to be free from defects in workmanship and materials for a period of two years from date of shipment. This warranty does not apply to devices that have been damaged due to unfavorable operating conditions. This warranty is in lieu of all other warranties, expressed or implied, and does not cover incidental or consequential loss.

Liability under this warranty is limited to repairing any equipment that proves to be defective during the warranty period, provided that prior authorization for such return and repair has been given by an authorized representative of Electrophysics Corporation. Equipment to be repaired must be returned insured freight paid and will be returned by surface freight. In-warranty repaired equipment is warranted only for the remaining unexpired portion of the original warranty period applicable to the repaired equipment.

This warranty does not apply to any instrument or component not manufactured by Electrophysics Corporation. When products manufactured by others are included in Electrophysics' equipment, the original manufacturer's warranty is extended to Electrophysics' customers.

This warranty does not apply to equipment or components which, in the opinion of Electrophysics Corporation, have become defective or unworkable due to abuse, mishandling, misuse, accidental alteration, negligence, improper installation, attempted repair, or other causes beyond Electrophysics' control.

This above warranty is only valid for units purchased and used in the United States. Products with foreign-end destinations are subject to a warranty surcharge. A State Department Export License is required for export.

The **Electro Viewer** is manufactured in New Jersey by Electrophysics Corporation. For further information about other Electrophysics products, please call us at (973) 882-0211.

