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LITTON L-4261 18mm MICROCHANNEL WAFER TUBE IMAGE INTENSIFIERS

18mm image intensifier tubes; bare tube, tube with power supply, tube/power supply in metal housing.

FEATURES

- **High Luminous Gain**
- **Small Size**
- **High Resolution**
- **Low Noise**
- **No Distortion**
- **Lightweight**
- **Metal Ceramic Tube Body**

APPLICATIONS

- **Night Vision Goggles**
- **Pocket Scopes**
- **Low Light Level Input Stage**
- **High Speed Photography/Optical Shutter**

Second Generation Microchannel Plate Image Intensifiers are electron-optical devices in which the image of a scene, after being focused on to a photocathode, is intensified electronically. The intensified image is displayed on a luminescent screen. An intensifier consists of a photocathode, an electron-optical lens (Microchannel Plate) and a luminescent screen.

Litton's 18mm Microchannel Wafer Image Intensifier Tube is a high gain, minimum volume, second generation proximity focused device designed for use in any application where ambient illumination levels are low and auxiliary lighting is inadvisable or not available.

The tube consists of a high efficiency S-20R photocathode deposited on a fiber optic input window, a microchannel plate (MCP) current amplifier and a phosphor screen deposited on the twisted fiber optic output window. Low light level or infrared images focused on the fiber optic input window of the tube are converted into electron images by the photocathode. The tube's MCP, consisting of over a million microscopic channels, amplifies the electron image with virtually no distortion. The twisted fiber optics of the output eliminates the need for a corrective lens to invert the viewed image.

Litton's 18mm microchannel wafer image intensifiers can be completely self-contained with an integral high voltage power supply. The power supply incorporates Automatic Brightness Control (ABC) for uniform image output and bright source protection during exposure to high light levels. All high voltage is contained internally and the unit may be powered by a low current 2.7 volt battery or suitable laboratory power supply.

Major advantages of Litton microchannel plate image intensifiers are size, high resolution, low noise, no image distortion, and long life. The small size makes these devices particularly applicable where size is a primary factor, as in head mounted night vision goggles. These intensifiers offer very effective operation under high point light conditions such as flares, spotlights and tracers.

Due to the special saturation characteristics of the individual glass channels in the MCP, the operational recovery of these devices after exposure to high light levels is instantaneous.

Image intensifiers are currently in widespread use by the military as an aid in operations, surveillance and target acquisition at low light levels. They have also found many applications in non-military areas. Examples include: medicine, astronomy, industrial/scientific instrumentation, high speed or low light level photography, law enforcement, night flying, nocturnal entomology, ophthalmological surgery and as an aid to persons afflicted with retinitis pigmentosa.

L-4261 PERFORMANCE AND MECHANICAL SPECIFICATIONS

OPTICAL

Useful Screen & Photocathode
Diameter (mm) . . . . . 17.5 min./18 max.
Photocathode sensitivity (S-20R) (Note 1)
Luminous (μA/lm) 240
Radiant at 830 nm (mA/W) 15
Phosphor Screen Peak Wavelength (Angstroms) . . 5500
Luminous Gain (Variable) . . . . . 5,000 to 20,000
Typical 12,000
Resolution
Limiting (lp/mm) . . . . . 25 min.
At 30% contrast (lp/mm) 16
Variation across Screen (%) 15
Distortion (%) 0
Magnification
Ratio . . . . . 1 : 1
Variation across Screen (%) 0
Equivalent Background Input (lm/cm²)
@ 21 °C . . . . . 2.5×10^{-11}
Photocathode Illumination (max) (ft-c) 1

ELECTRICAL

Typical Voltages (volts) (Note 2)
MCP Output to Screen 6000
MCP Input to MCP Output . . . . . 700 - 900
Photocathode to MCP Input 200

CONFIGURATIONS

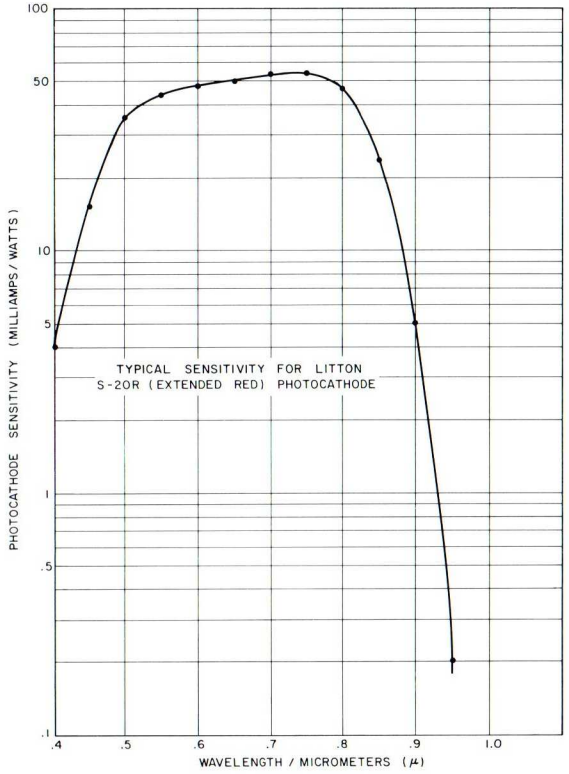
1. Tubes are normally furnished encapsulated in RTV with flying leads.
2. Tubes with power supply are also encapsulated in RTV with two flying leads for DC voltage applications. Electrical contact tabs can be obtained on special orders.
3. Tubes can be furnished with metal housing for ease in system mounting configurations.

PHYSICAL DIMENSIONS (See Drawings)

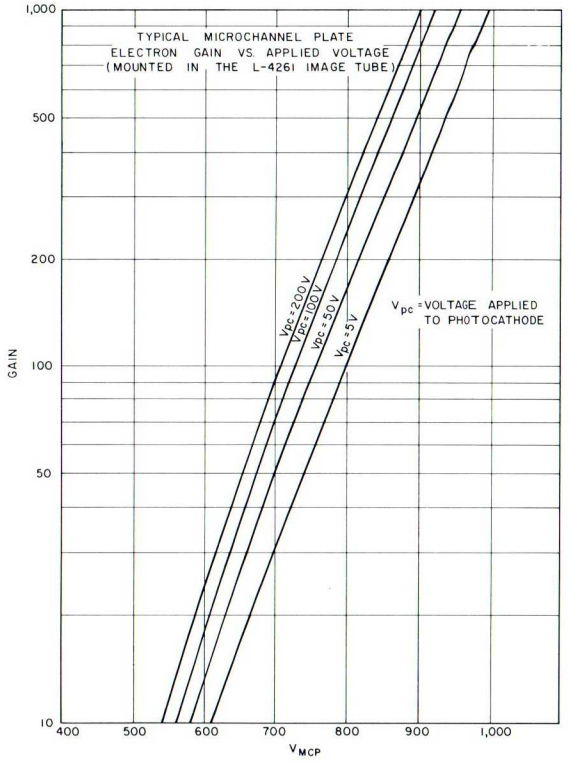
Approximate Weight . . . . . 56.5 grams/1.81 oz.
With Power Supply . . . . . 94.3 grams/3.03 oz.
Input Window . . . . . Fiber Optic, Plano Surface
Output Window . . . . . Fiber Optic (Note 3)
Power Supply—Wraparound Type, Hermetically Sealed dc/dc Converter, Regulated
Primary Input Voltage + 2.3 to 2.8 VDC Unregulated
Input Current . . . . . Typ. 10/15 mA

NOTES:

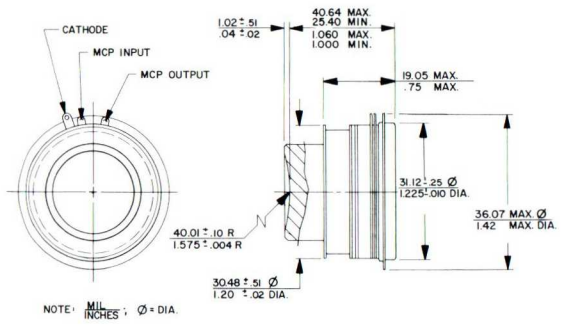
1. Measured at .01 lm photocathode illumination
2. All Positive
3. Fiber optic inverter output window with 1.575" radius of curvature (concave).



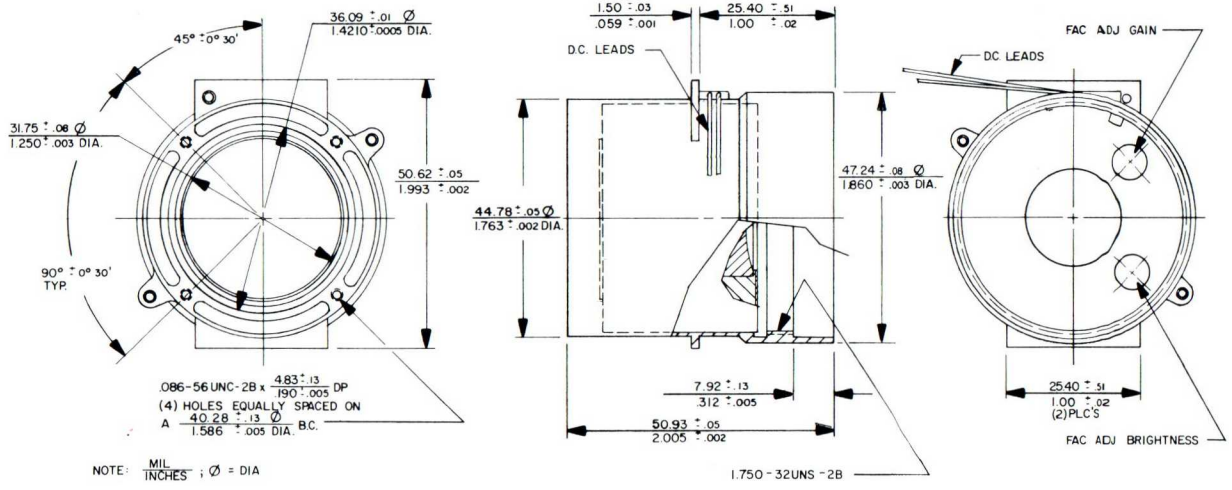
Typical sensitivity for Litton S 20R (extended red) photocathode.



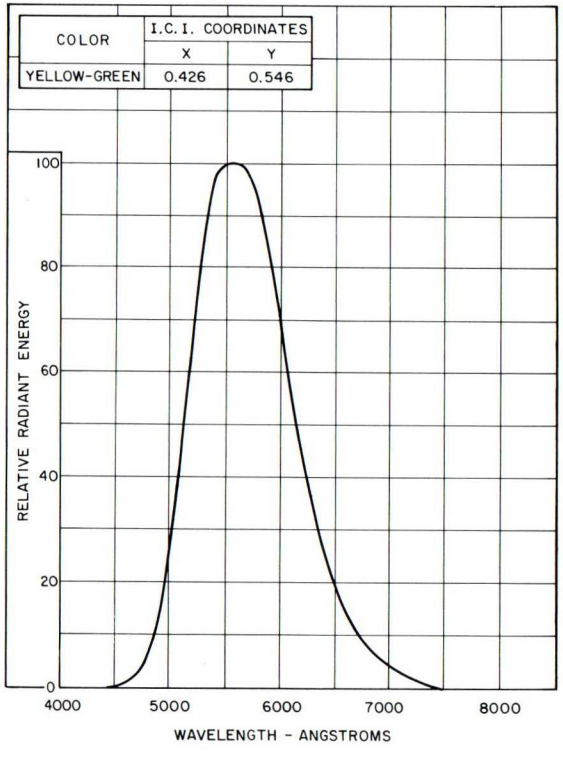
Typical microchannel plate electron gain vs. applied voltage (mounted in the L-4261 image tube).



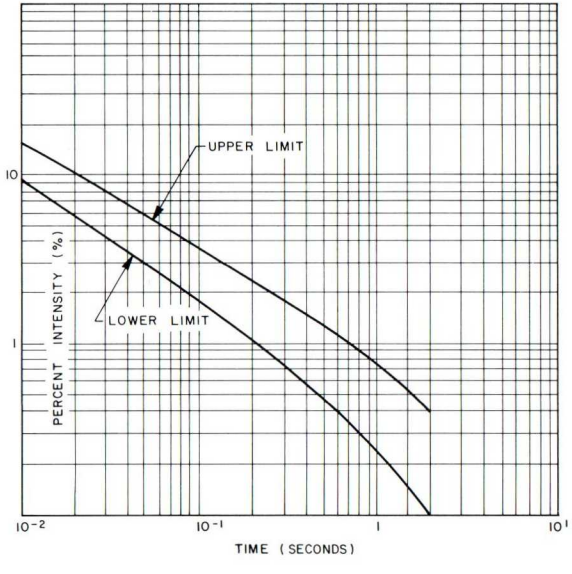
L-4261-07 18mm microchannel image intensifier tube (without power supply).



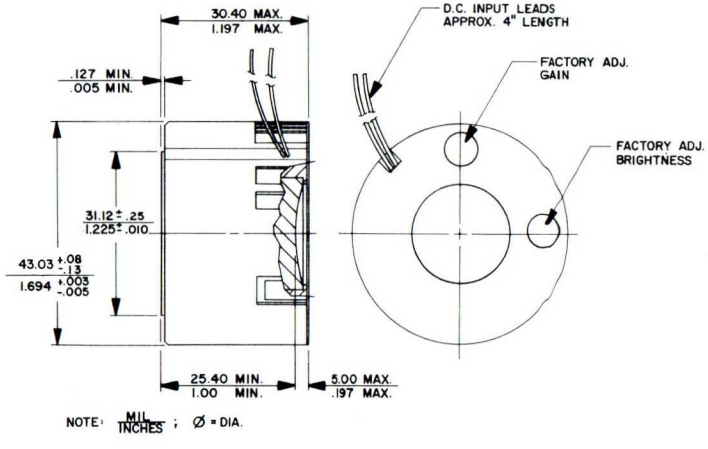
L-4261-07 18mm microchannel image intensifier tube (with power supply in standard goggle housing).



Spectral energy emmission characteristics of a typical L-4261 image intensifier phosphor.



Phosphor decay characteristics, F2126 type 10-52 phosphor.



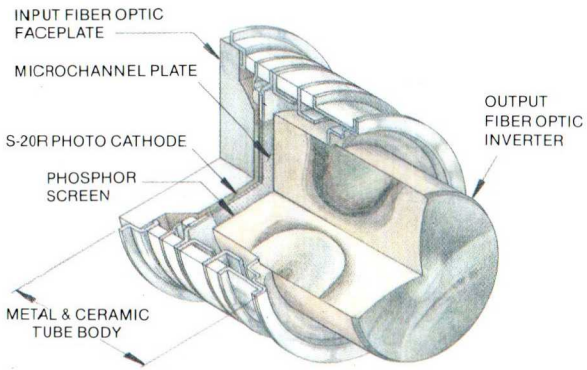
L-4261-07 18mm microchannel image intensifier tube (with integral power supply).

GENERAL TECHNICAL INFORMATION

The TUBE BODY of the L-4261 is a vacuum tight metal ceramic component that supports the active elements; photocathode, MCP and output screen in their critical spacing requirements. Litton has over 25 years of experience in this type of specialized high vacuum tube technology, which is fundamental in producing a quality long lasting product.

The PHOTOCATHODE is a photosensitive surface that emits electrons when exposed to light or other suitable radiation. The most common 2nd generation photocathode is produced from the evaporation of Potassium, Sodium, Antimony, and Cesium on a suitable transparent substrate in a vacuum. It is this process of the evaporation and deposition of these alkali metals that yields the S20R (extended red) photocathode.

The properties of the photocathode are described by spectral response and sensitivity.

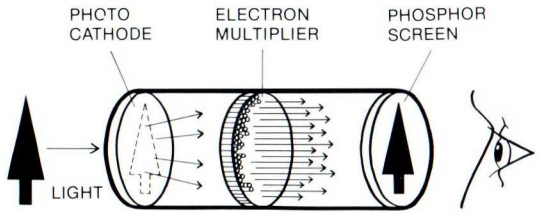


Illustrated cross section of an 18mm image intensifier tube.

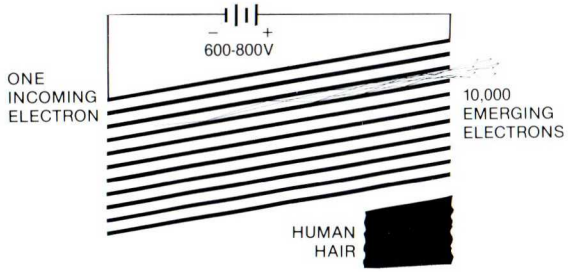
Spectral response is expressed in terms of the wavelength (nanometers) for which the photocathode has been optimized. Sensitivity is expressed in two ways: luminous sensitivity (μA/lm) and radiant sensitivity (mA/W), dependent upon the spectral response involved.

Passive night vision applications require photocathodes with high luminous and radiant sensitivities. The S20R photocathode in the L-4261 assures optimum performance in passive night viewing systems. In our image intensifiers the S20R multi-alkali photocathode is deposited on the inner surface of the input window.

The MICROCHANNEL PLATE (MCP) is a disc-shaped, continuous dynode electron multiplier. Single electrons impinging on the input of the MCP are multiplied thousands of times through the process of cascaded secondary emission.



Functional illustration of 18mm image intensifier performance.



Graphical illustration of the microchannel plate performance.

The MCP consists of millions of microscopic hollow-glass conducting channels fused into a disc-shaped array. Since each microscopic channel represents a separate high gain electron multiplier, and perfect position registration exists between the input and output faces of the MCP for each channel, the MCP is ideally suited as an imaging electron multiplier.

A disc, equivalent to the diameter of a quarter, contains approximately 1,760,000 channels of the size used in the type M-900 Series multipliers, and 60% of this disc would be open channels. Since the channels are normally 45 times as long as their diameter, this disc (the diameter of a quarter) would be one-third the thickness of a quarter. The glass channels in the MCP are connected in parallel electrically by metal electrodes on opposite faces of the disc. The MCP, which must operate in a vacuum, is specially processed to produce secondary electrons from the channel surfaces. When radiation impinges on the input of the array, secondary electrons are generated. These secondary electrons are accelerated when voltage is applied between the disc faces. Secondary electrons passing along the channels, collide with the channel surfaces to dislodge additional secondary electrons, thereby producing electron multiplication, or amplification. By varying the voltage across the disc, the gain of the multiplier can be controlled.

The PHOSPHOR SCREEN is deposited on the fiber optic output element and metalized with a thin layer of aluminum which prevents light backscatter and enhances the luminous output of the intensifier. Litton uses a yellow-green phosphor type 10-52, designated F2126. This phosphor has a relatively long persistence, approximately 10 ms for 10% relative intensity. The spectral emission of F2126 is centered around 5500A° with normal Gaussian distribution.

The Electro-Optics Department of Litton Industries Electron Tube Division has the technological depth and breadth to provide our customers with outstanding services and products in the rapidly growing and changing field of electro-optics and image intensification.

The Tempe, Arizona facility has been designed to permit growth and responsiveness to technological change. This begins with our management personnel and philosophy and extends throughout our scientific and engineering staff.

The Electro-Optics Department is large enough to meet your demanding high volume production requirements, while being small and personal enough to address your specialized one of a kind electro-optical requirements.

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LIT-223-5M-879
Printed in U.S.A.