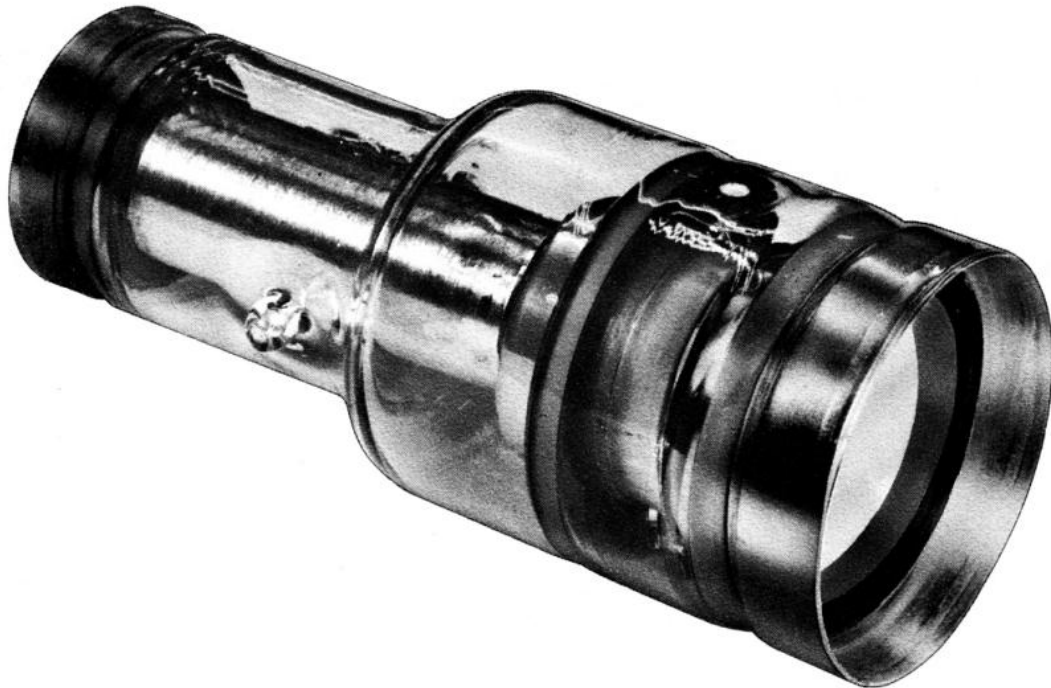


INFRARED IMAGE CONVERTER TUBE

TYPE 6411

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



The 6411 Image Converter Tube changes infrared radiation to a visible image.

The 6411 Image Converter Tube has a cathode sensitivity in the near-infrared portion of the spectrum. It can be used in any application where it is necessary or desirable to "see in the dark". Its many uses include the inspection of photographic film, the determination of temperature distribution in heated objects, medical and biological research, criminal investigations, high speed photography, and in

various military operations. The Image Converter Tube is used with an objective lens and magnifying eyepiece. An inverted image on the cathode is reinverted by the electron optics of the tube so that the image as it appears on a screen or seen through an eyepiece is correct. For the majority of viewing applications a filtered tungsten lamp is used for irradiating the subject.

For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3702 E. Pontiac St., Fort Wayne, Indiana.

IMAGE CONVERTER TUBE

TYPE 6839

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



The Image Converter Tube acts as an electronic shutter in photographing extremely short duration events such as explosion phenomena

The 6839 Image Converter Tube operates as an electronic shutter when pulsed. The tube contains an electron lens, a photocathode (the source of electrons), and a phosphor screen transducer which converts the electrical energy into light. The tube acts as a diode, having two consecutive cylinders forming the lens system, with the electrons from the cathode being electrostatically focused on the phosphor

screen by the tube geometry. An external lens focuses the subject object on the cathode of the tube and when a short duration voltage pulse is applied to the tube at some predetermined time, the incident image is reproduced on the phosphor screen. Any short duration event is then instantaneously recorded on photographic film facing the phosphor screen.

For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3702 E. Pontiac St., Fort Wayne, Indiana.

IMAGE TUBE

TYPE 7177

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



The 7177 Image Tube is a fixed-focus-type tube with an S-1 spectral response and a P-20 phosphor screen.

The 7177 Image Tube has a cathode sensitivity covering the visible and near-infrared portion of the spectrum. It can be used in any application where it is necessary or desirable to "see in the dark". Because of its small size and voltage requirements it can be incorporated into a portable unit. Its many uses include the inspection of photographic film which is not sensitive to infrared light, criminal investigation, and various military operations. It may also be used as a light shutter

for high speed photography. The image tube is used with an objective lens and a magnifying eyepiece. An inverted image on the cathode is reinverted by the electron optics of the tube so that the image, as it appears on a screen or seen through an eyepiece, is correct. For the majority of viewing applications a filtered tungsten lamp is used for irradiating the subject. This tube is of the unipotential or fixed-focus type, consequently no focusing voltage is required.

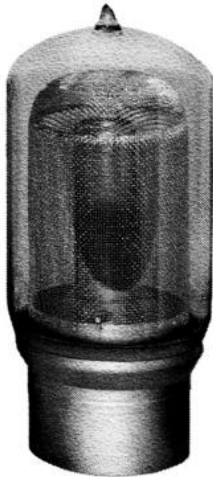
For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3700 E. Pontiac St., Fort Wayne, Indiana.

COAXIAL PHOTOTUBE

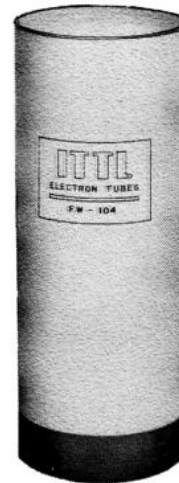
TYPES FW-100 and FW-104

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



FW-100



FW-104

The ITTL Coaxial Phototubes are used for detection and measurement of nuclear radiation.

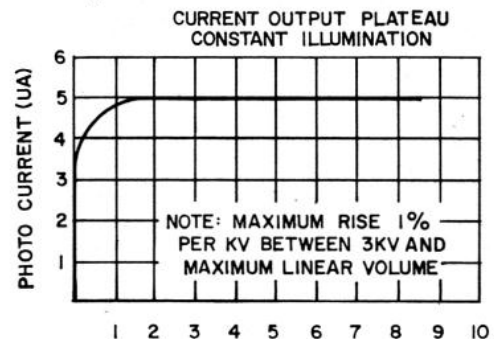
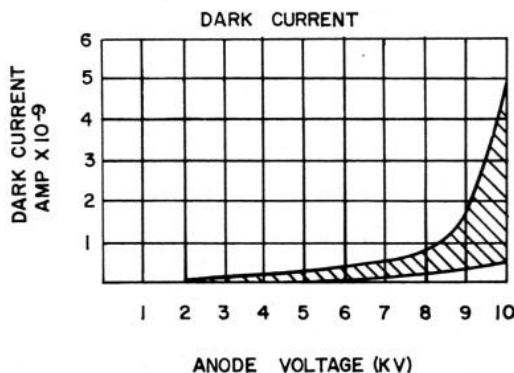
The Coaxial Phototube is a diode of coaxial geometry designed for high current and linear output in conjunction with scintillating material. An S-4 cathode is used having approximately the same peak spectral response

location as the emission peak of the fluor. The impedance matches a 50-ohm coaxial line. Recording equipment normally consists of a traveling-wave oscilloscope such as the EG&G 2236.

ELECTRICAL AND OPTICAL DATA:

Type Cathode
Cathode Luminous Sensitivity
Cathode Radiant Sensitivity
Maximum Dark Current at 6 Kilovolts

S-4
30 microamperes per lumen, average
0.029 microampere per microwatt at 4000Å
10 x 10⁻⁹ ampere



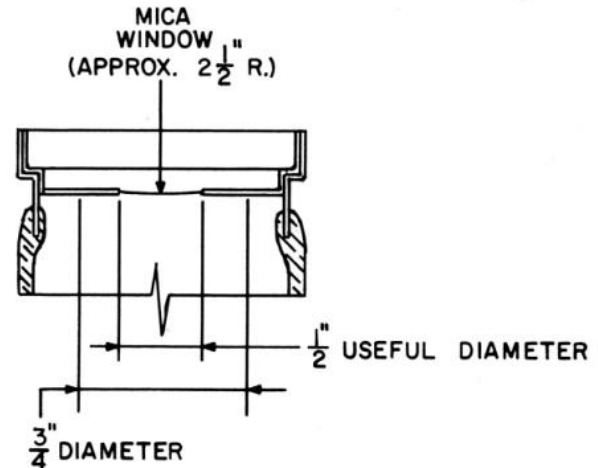
For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3700 E. Pontiac St., Fort Wayne, Indiana.

IMAGE TUBE

TYPE FW-109

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • San Fernando and Palo Alto, Calif.



The FW-109 image tube is of the same general geometry as the 6411/IC16 with the exception of the exit face plate which carries the phosphor screen. It has an exit window of very thin film mica (0.0004 inch). Useful diameter is $\frac{1}{2}$ inch. The thin film mica window is hermetically sealed to the anode terminal and tube body and supports atmospheric pressure with a good margin of safety. A photographic film may be brought into intimate contact with the window and the image on the phosphor screen may be photo-

graphed directly without the loss of light inherent with even a fast lens system. Because of the small separation of the photographic film and phosphor screen the loss in resolution is minimized.

The FW-109 has found favor as an intensifier for photography of stellar spectra. Gains of 50 to 100 over direct photography have been reported.

The electrical characteristics (operating and focus voltages) are identical to those of the 6411/IC16.

DATA

Cathode	Antimony-cesium
Cathode response	S-11
Cathode sensitivity	
Luminous	30 $\mu\text{a/lumen}$
Radiant at 4400 Angstroms	0.037 $\mu\text{a}/\mu\text{w}$
Cathode (useful diameter)	0.970 inch
Phosphor	P-11
Phosphor screen (useful diameter)	0.500 inch
Image magnification (paraxial)	0.68 inch
Resolution at 16 kv operating voltage (paraxial)	45 line pairs/mm

IMAGE INTENSIFIER TUBE

TYPE FW-113

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • San Fernando and Palo Alto, Calif.

The FW-113 two-stage cascaded image converter tube is a magnetically focused image intensifier with an S-11 photocathode, sensitive in the visible portion of the spectrum. The tube consists of two magnetically focused image converter tubes, cascaded in a single glass envelope, the output of the first communicating with the input of the second through a thin transparent window. The two sections of the tube are diodes, with one electrode common, and only three electrical connections are necessary for operation. A minimum of light and image detail is lost in the thin-film coupling, and the output is a greatly intensified replica of the input image. Magnetic focusing assures uniform, high resolution over the entire

viewing screen area. The magnet establishes an essentially uniform focusing field axially of the tube. An electromagnet may also be used for focusing, and would afford the advantage for experimentation that focusing could be achieved at different tube operating voltages. Either a P-20 screen for visual observation of the output image, or a P-11 to match the input response of photosensitive devices and photographic plates can be supplied.

Because of immediate widespread interest in the tube for experimental purposes, an objective specification indicative of the state of the art is available, based upon limited test data from a few developmental tubes.

FW-113 Characteristics (objective)

Electrical Characteristics (1):

First stage	-10 ± 2 kv
Second stage	+10 ± 2 kv
Focusing magnetic flux density	475 gauss

General Characteristics:

Input cathode surface	S11	
Output phosphor screen (2)	P20	
Useful cathode diameter	1.5	inches
Useful phosphor screen diameter	1.5	inches
Image magnification (3)	0.9 - 1.0	
Resolution, paraxial	15	line pairs/mm
Resolution at 0.675 inch R	15	line pairs/mm
Background screen brightness (4)	2	μ lambert
Overall luminous sensitivity (5)	1000	μa/lumen
Brightness gain (6)	400	
Maximum input illumination	1	foot-candle



Image Intensifier

- (1) Independent voltage controls are required to focus each stage. Voltages given are design values for the specified magnetic focusing field strength, but other values of E and H may be determined from the approximate relationship $H \propto \sqrt{E}$. Lower values of E with a consequent reduction of brightness gain can be used to reduce the mean background screen brightness. The upper value of E, 12 kv/stage, is specified on the basis of a suitable margin of safety regarding destructive internal glow or flashover.
- (2) P-11 phosphor also available.
- (3) Image magnification and distortion are de-

pendent upon the uniformity of the magnetic focusing field.

- (4) Cathode not illuminated; temperature 25 degrees C.
- (5) Ratio of phosphor screen current to cathode illumination from a standard tungsten light source, 2870 degrees K color temperature.
- (6) The quotient of luminous output flux, in terms of visual excitation, divided by cathode illumination flux from a standard tungsten light source. With a P-11 phosphor, fluorescent in the blue, the brightness gain would be 100. Specified in terms of S-11 cathode response, brightness gain with a P-11 phosphor would be 1200.

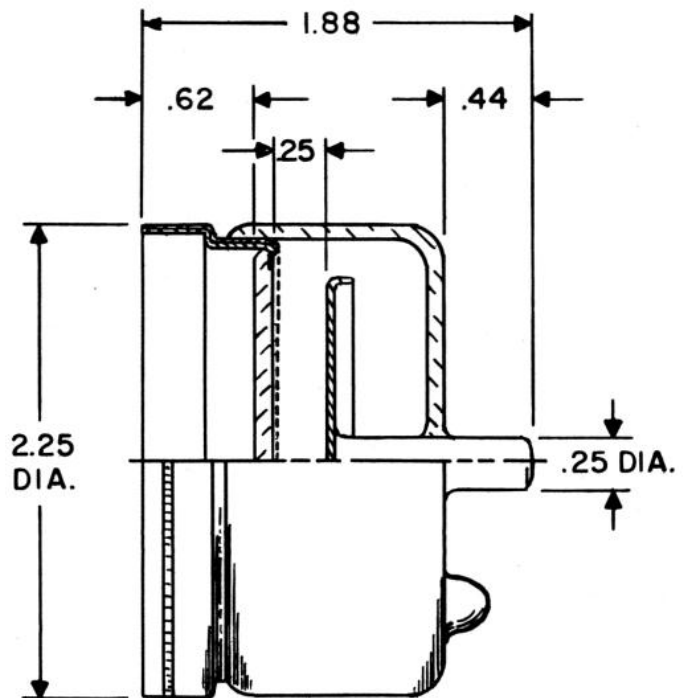
For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3700 E. Pontiac St., Fort Wayne, Indiana.

HIGH-CURRENT PHOTOTUBE

FW-114

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



The FW-114 High-Current Phototube has a current output linear from 10^{-9} ampere to 25 amperes

The FW-114 is a biplanar type photodiode designed for close optical coupling to a flat disc scintillator accommodated in the face-plate cavity of the tube. It is one of a family of high current capacity phototubes developed by ITTL which have become standard items for measurement of high-density gamma radiation of short time duration. Using a scintillation phosphor, the FW-114 phototube can be used to monitor cosmic rays, X rays, and nuclear particles. Since the dark current at 2500 volts is 10^{-9} ampere (average) and the output of the tube is linear up to 25 amperes, the maximum

dynamic range of the FW-114 is 2.5×10^{10} . The useful dynamic range is therefore limited only by the characteristics of the associated circuitry. Two other sizes available are the FW-127, which is 5 inches in diameter, and the FW-128, which is 1- $\frac{1}{4}$ inches in diameter.

Other tubes of this type available from ITTL are the FW-100, where the scintillator takes the form of a cylinder surrounding the tube, and the FW-104, where radiation from the scintillator enters the phototube through a circular window.

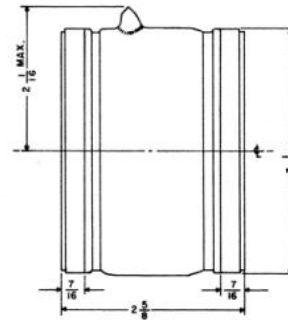
For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3700 E. Pontiac St., Fort Wayne, Indiana.

IMAGE TUBE

TYPE FW-116

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • San Fernando and Palo Alto, Calif.

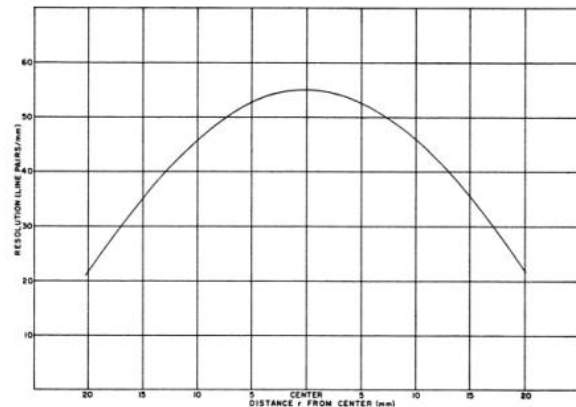


The FW-116 is a unipotential magnetically focused image tube capable of high resolution and low distortion. The tube may be operated under static or pulsed conditions and is intended

(by reason of its P-11 type phosphor screen) for photographic applications rather than direct viewing.

PRELIMINARY DATA

Cathode	Cesium-antimony
Cathode response	S-11
Cathode sensitivity	
Luminous	30 $\mu\text{a/lumen}$
Radiant	0.03 $\mu\text{a}/\mu\text{w}$
Cathode useful area	1½ inch diameter
Phosphor	
Type	P-11
Useful area	1½ inch diameter
Image	
Magnification (paraxial)	1 (approximately)
Resolution (paraxial)	50 line pairs/mm *
Distortion	**
Anode voltage (static)	10 kv ***
Magnetic field strength	450 Gauss



Characteristic resolution curve with tube immersed symmetrically in cylindrical solenoid (uniform winding) and focused for maximum resolution in center of field. Dimensions of solenoid: 7½ inches long, 9½ inches OD, 4¾ inches ID.

* Depending on uniformity of magnetic field.

** Since distortion is a function of magnetic field uniformity, no figure can be specified. Nonuniformity results in both image rotation and S distortion; however, even with relatively nonuniform fields the image quality is inherent superior to that obtained with a purely electrostatic lens system. The tube is normally operated immersed in the most uniform region of a solenoid; however, very acceptable image reproduction may be had using a squirrel-cage array of uniformly distributed ⅜ inch diameter by 6 inch length Alnico rod magnets, 48 in number.

*** Normally, an image tube may be operated for short time intervals at approximately four times rated anode voltage without increase in background.

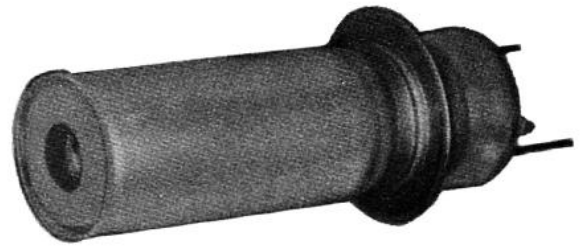
For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3700 E. Pontiac St., Fort Wayne, Indiana.

INDIUM ANTIMONIDE PHOTOCONDUCTIVE INFRARED DETECTOR

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • San Fernando and Palo Alto, Calif.

ITT Laboratories has developed an indium antimonide infrared detector of the photoconductive type which is sensitive in the intermediate infrared range. Having high sensitivity and fast response, the detector can be used with a mechanical scanner for infrared mapping of terrain or for search of aircraft, missiles, tanks, etc. For cooling to its nominal temperature of 77 degrees Kelvin, the sensitive element is mounted on the end of a cooling well which is kept filled with liquid nitrogen or is fitted with a cryostat for operation with pressurized nitrogen gas. A wide range of cell resistances permits efficient coupling to either transistor or vacuum tube preamplifiers. An appropriate preamplifier and cryostat cooler can be supplied with each detector. Special envelopes and detector configurations as well as array-type cells are also custom-made for specific requirements.

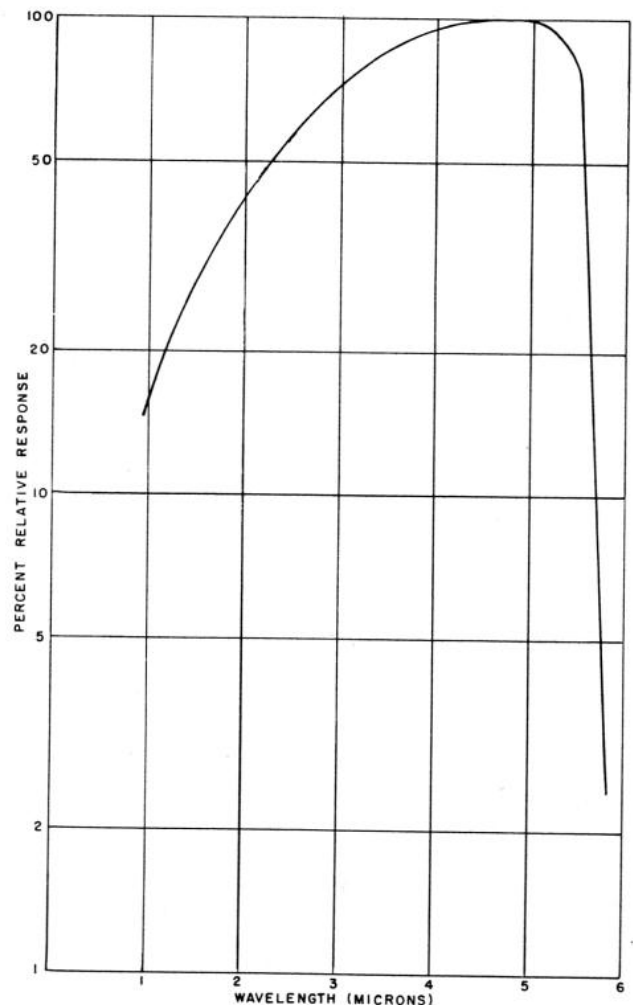


TECHNICAL SPECIFICATIONS

Spectral response	See figure
Time constant	less than 1.0 microsecond
Cell resistance	1 K to 50 K ohms
D* (detectivity)	4×10^9 cm/watt (1)
Nominal operating temperature	77 degrees Kelvin
Standard area	0.5 mm by 0.5 mm (2)
Cooling well inside diameter	1/4 inch or 3/8 inch

Notes:

- (1) Measured at 77 degrees Kelvin operating temperature with 500-degree Kelvin black-body radiation source, 900-cps chopping frequency, and a 1-cps bandwidth.
- (2) Other areas available as required.



For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3700 E. Pontiac St., Fort Wayne, Indiana.

LEAD TELLURIDE INFRARED DETECTORS

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.

ITTL Lead Telluride Infrared Detectors are coolable photoconductive type cells, sensitive out to 6 microns. These detectors require cooling of the active flake down to liquid-nitrogen temperature in order to obtain high sensitivity and response. Having a relatively fast response time of 10 microseconds, they can be used with mechanical scanners for infrared mapping of terrain, or search for aircraft, missiles, tanks, etc. The sensitive element is mounted on the end of a cooling well which is normally kept filled with liquid nitrogen.



Lead Telluride Cell

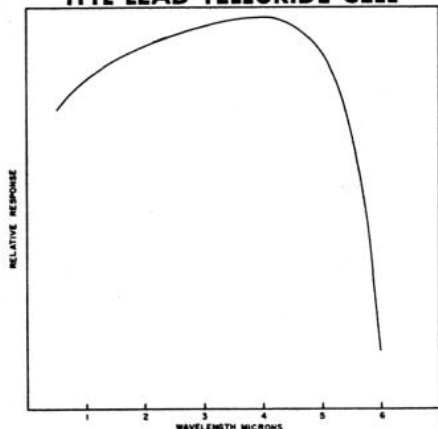
These cells can be supplied with an ITTL cooling head which operates from pressurized nitrogen gas. Cells also can be supplied in mountings with appropriate preamplifiers and cryostat coolers.

TECHNICAL SPECIFICATIONS

Standard size in mm	Class I		Class II	
	D* cm/watt	NEP watt	D* cm/watt	NEP watt
2.0 x 2.0	8.0×10^8	2.5×10^{-10}	5.0×10^8	4.0×10^{-10}
1.0 x 1.0	8.0×10^8	1.25×10^{-10}	5.0×10^8	2.0×10^{-10}
0.5 x 0.5	8.0×10^8	6.25×10^{-11}	5.0×10^8	1.0×10^{-10}

Measured at 500 degrees K black body radiation, 400 cps chopping frequency, bandwidth referred to 1 cps. $D^* = \sqrt{\text{area}}/\text{NEP}$.

TYPICAL RESPONSE OF ITTL LEAD TELLURIDE CELL



ITTL Lead Telluride Infrared Detectors are available with either 1/4-inch or 3/8-inch wells. Cells of nonstandard size can be custom-made as small as 0.25 mm² to as large as 4.0 mm². Minimum over-all diameter is 0.3 mm and the maximum diameter is 10.0 mm. Special envelopes and detector configurations as well as interdigital cells are also custom-made for specific requirements.

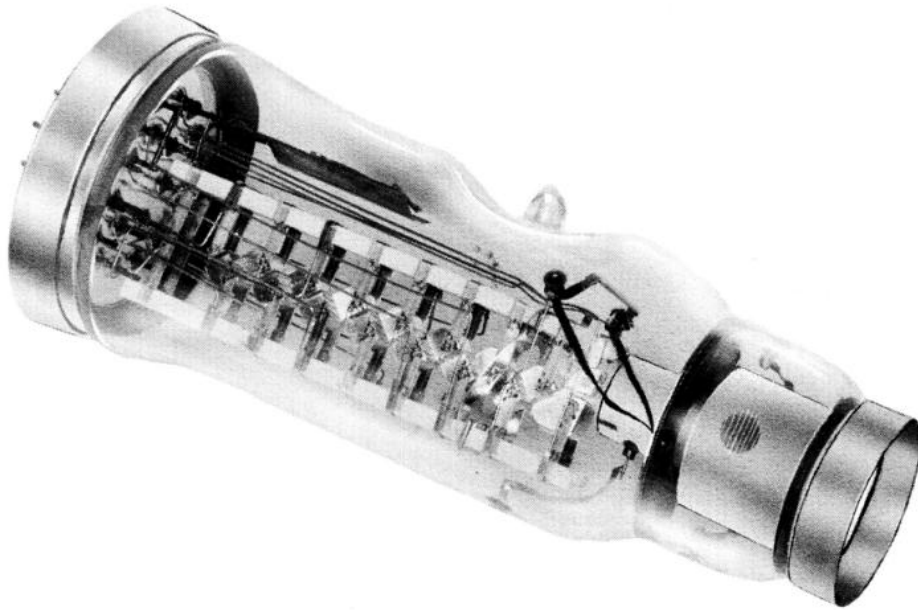
For further information write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3700 E. Pontiac St., Fort Wayne, Indiana.

MULTIPLIER PHOTOTUBE

TYPE 6836

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



The Multiplier Phototube type 6836 is a 16-stage multiplier of the end-window type having an S-1 spectral sensitivity characteristic. To minimize cathode noise the active cathode in this tube is reduced to a central area of approximately $\frac{1}{8}$ -inch diameter. The tube is capable of detecting and measuring extremely weak sources of infrared radiation and will

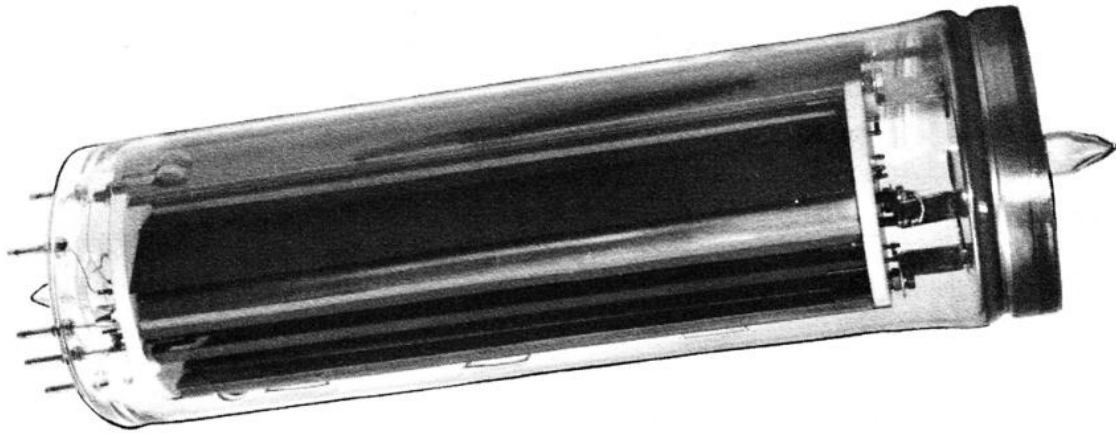
find its greatest application as a means of making photometric measurements in the region from 7000 to 12,000 angstroms wavelength. Because of its high signal-to-noise ratio this tube has found particular favor with the observatories in their work with faint and far distant celestial objects.

For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3700 E. Pontiac St., Fort Wayne, Indiana.

HIGH CURRENT MULTIPLIER PHOTOTUBE

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



The High Current Multiplier Phototube is primarily used for determining the shape and the peak amplitude of very brief, extremely intense light flashes.

The basic elements of the High Current Multiplier Phototube are a translucent photoemissive cathode prepared on conducting glass and a secondary-emission multiplier. Ultraviolet and visible radiation striking the elongated cathode strip causes electrons to be emitted from the side nearest the secondary emitting dynodes. The electrons are caused to move to the first dynode and the resulting secondary electrons to the next and so on by means of the potentials established at the dynodes by

the external power supply. The collector electrodes of the multiplier have been designed so that a coaxial transmission line having a characteristic impedance of 50 ohms will be well matched at the tube output when connected between the 6th dynode and the collector. High-frequency components of the signal will therefore be preserved at the output so that the tube can be used for very accurate measurements of the rise time of light flashes.

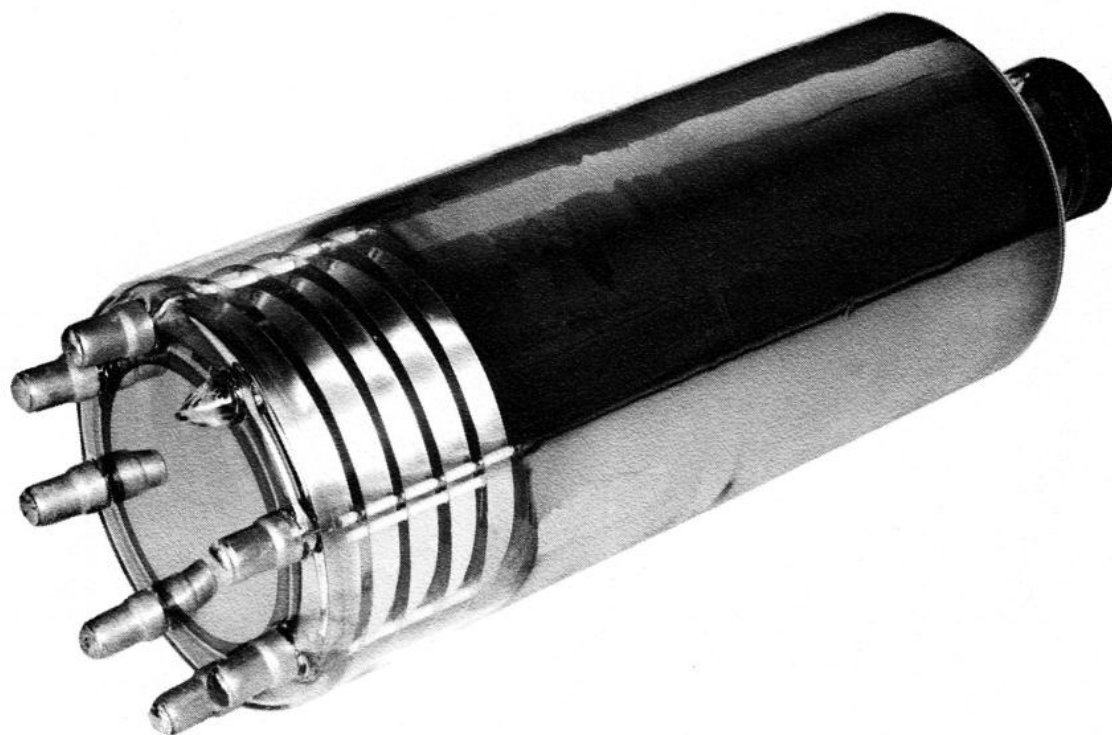
For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3702 E. Pontiac St., Fort Wayne, Indiana.

IMAGE DISSECTOR HIGH-RESOLUTION TV CAMERA TUBE

TYPE 6656

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



Operating on the photoemission principle the 6656 Image Dissector Tube has extremely high resolution and long life.

The 6656 Image Dissector is a television camera tube that is adaptable to any application where extremely high resolution and good tonal rendition are important. The output signal varies linearly with the light intensity over a considerable range. The Image Dissector is readily adaptable to the needs of each particular user by simply providing the multiplier section with an aperture which

is ideal for the intended application. The Image Dissector employs a translucent photocathode of cesium-oxygen-silver which has an S-1 spectral response, making it most sensitive to red and infrared radiation. A similar tube the 6657 is also available which uses a translucent photocathode of cesium-antimony and has an S-9 spectral response.

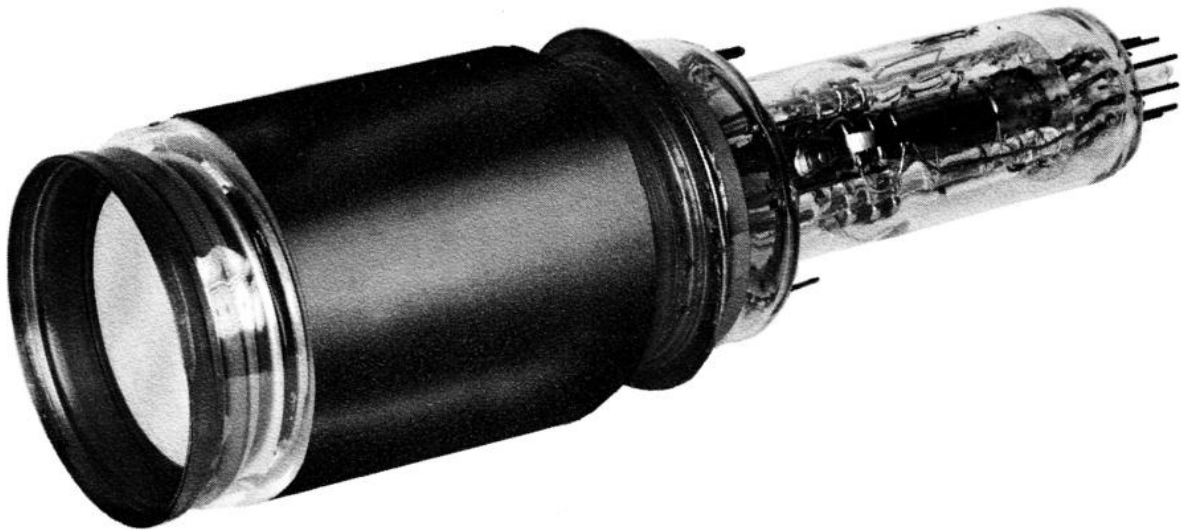
For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3700 E. Pontiac St., Fort Wayne, Indiana.

IATRON®

TYPE 7172

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



2½-INCH STORAGE CATHODE-RAY TUBE
Electrostatic Focus; Electrostatic Deflection

The 7172 Iatron is a storage cathode-ray tube that produces a bright, visual display for direct viewing of electrically stored information. It incorporates a cathode-ray gun for electrical signal input, an insulator mesh for beam charge storage, a flooding gun for viewing and erasing, and an aluminized phosphor viewing screen for visual output. The large undeflected flooding beam continuously excites the 1⅞-inch viewing screen through the insulator mesh and is modulated in cross-section by the stored signal charge pattern. Special features of this tube are bright daylight viewing of electrical signals by image amplification and the ability to write, store, and erase such information at will. Used as a panel-mounted indicator in aircraft, its fast writing and high deflection speed permits accurate

and instantaneous presentation of electrical information. Since coaxial electron guns are used, there is no trapezoidal distortion of the scanning pattern. The symmetrical envelope occupies minimum space. Deflection circuits with adequate power can be included in the space between the tube neck and the indicator case. Connections to the deflecting electrodes are conveniently located in the shoulder stem. With an over-all operating voltage of only 4500 volts, signals are displayed at a brightness of 1500 foot lamberts. A display of random dots not perceptible with a conventional cathode-ray tube, or occurring while the operator's attention is diverted, can be stored and viewed for periods up to 30 seconds.

For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3702 E. Pontiac St., Fort Wayne, Indiana.

IATRON[®]

TYPE 7173

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



4-INCH STORAGE CATHODE-RAY DISPLAY TUBE
DIRECT VIEW TYPE

Electromagnetic Focus; Electromagnetic Deflection

The 7173 Iatron is a storage cathode-ray tube that produces a bright, visual display for direct viewing of electrically stored information. It incorporates a writing gun for electrical signal input, an insulator mesh for beam charge storage, a flooding gun for viewing and erasing, and an aluminized phosphor viewing screen for visual output. The large undeflected flooding beam continuously excites the 3-inch useful area of the viewing screen through the insulator mesh, and is

modulated in cross-section by the stored signal charge pattern. Special features of this tube are bright daylight viewing of electrical signals by image amplification, and the ability to write, store, and erase such information at will. It is intended for use in airborne radar and other electronic displays where these special features as well as small size, low-voltage operation, magnetic focusing, and magnetic deflection are desired.

For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3700 E. Pontiac St., Fort Wayne, Indiana.

IATRON[®]

TYPE 7174

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



**4-INCH STORAGE CATHODE-RAY DISPLAY TUBE
PROJECTION TYPE**

Electromagnetic Focus; Electromagnetic Deflection

The 7174 Iatron is a storage cathode-ray tube that produces a bright, visual display of electrically stored information for optical projection onto a large screen. It incorporates a writing gun for electrical signal input, an insulator mesh for beam charge storage, a flooding gun for viewing, and an aluminized phosphor viewing screen for visual output. The large undeflected flooding beam continuously excites the 3-inch viewing screen through the insulator mesh, and is modulated in cross-section by the stored signal charge pattern. Special features of this tube are bright daylight viewing of electrical signals by image amplification and the ability to write, store,

and erase such information at will. It is intended primarily for use in radar projection indicators where a display larger than available with direct-view tubes is required. One such application is in air-traffic control, giving a large flat horizontal radar display for plotting the location and course of aircraft. The rate of erasing is adjustable by the operator to control the visual duration of written information, or the display can be erased instantaneously when, for example, it is desired to clear the screen of noise clutter or of smeared images as a result of transverse motion or turning of the aircraft.

For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3700 E. Pontiac St., Fort Wayne, Indiana.

IATRON[®]

TYPE 7175

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



5-INCH STORAGE CATHODE-RAY DISPLAY TUBE

Electrostatic Focus; Electromagnetic Deflection

The 7175 Iatron is a storage cathode-ray tube that produces a bright, visual display for direct viewing of electrically stored information. It incorporates a writing gun for electrical signal input, an insulator mesh for beam charge storage, a flooding gun for viewing, and an aluminized phosphor viewing screen for visual output. The large undeflected flooding beam continuously excites the 4-inch viewing screen through the insulator mesh, and is modulated in cross-section by the stored signal charge pattern. Special features of this tube are bright daylight viewing of electrical signals by image amplification and the ability to write, store, and erase such information at will. It is

intended primarily for use in radar indicators with magnetic deflection and was developed especially for airborne weather-penetration radar. Either a mechanically rotated deflection coil or a resolver and stationary coil can be used for scanning to produce a continuous display with halftones and good resolution. The rate of erasing is adjustable by the operator to control the visual duration of written information or, the display can be erased instantaneously when, for example, it is desired to clear the screen of noise clutter or smeared images resulting from transverse motion or turning of the aircraft.

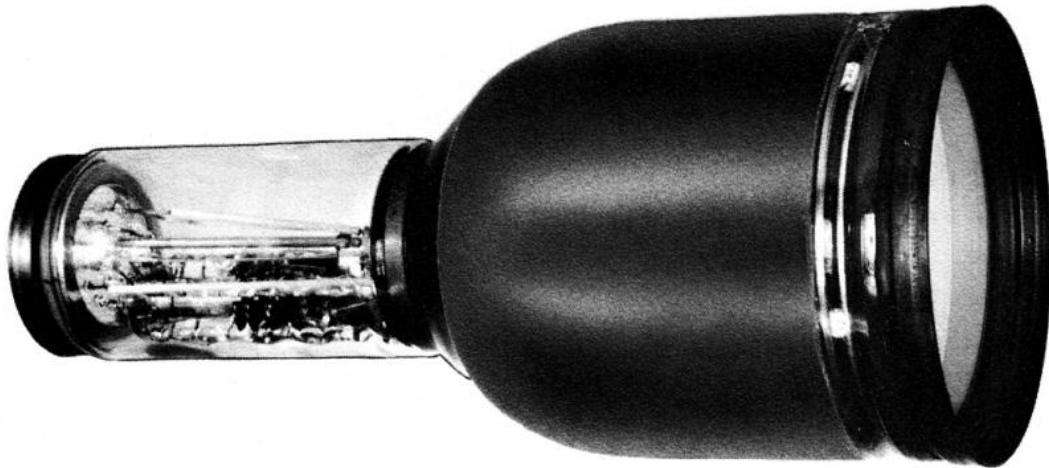
For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3702 E. Pontiac St., Fort Wayne, Indiana.

IATRON[®]

TYPE 7176

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



5-INCH STORAGE CATHODE-RAY DISPLAY TUBE
Electrostatic Focus; Electrostatic Deflection

The 7176 Iatron is a storage cathode-ray display tube that produces a bright, visual display for direct viewing of electrically stored information. It incorporates a standard cathode-ray gun for signal input, an insulator mesh for beam charge storage, a flooding gun for viewing, and an aluminized phosphor viewing screen for visual output. The large undeflected flooding beam continuously excites the 4-inch viewing screen through the insulator mesh and is modulated in cross-section by the stored sig-

nal charge pattern. Gray shades are produced in accordance with the amplitude variations of the input signals. Special features of this tube are bright daylight viewing of electrical signals by image amplification and the ability to write, store, and erase such information at will. It is intended primarily for use in radar and other electronic displays where these special features are desirable and electrostatic focus and electrostatic deflection are required.

For further information and detailed technical specifications write to the Director, Components and Instrumentation Laboratory, ITT Laboratories, 3702 E. Pontiac St., Fort Wayne, Indiana.

IATRON[®]

TYPE FW-105

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



5-INCH STORAGE CATHODE-RAY DISPLAY TUBE

Electrostatic Focus; Electrostatic Deflection

The FW-105 Iatron is a storage cathode-ray display tube that produces a bright, visual display for direct viewing of electrically stored information. It incorporates a standard cathode-ray gun for signal input, an insulator mesh for beam charge storage, a flooding gun for viewing, and an aluminized phosphor viewing screen for visual output. The large undeflected flooding beam continuously excites the 4-inch viewing screen through the insulator mesh and is modulated in cross-section

by the stored signal pattern. Gray shades are produced in accordance with the amplitude variations of the input signals. Special features of this tube are bright daylight viewing of electrical signals by image amplification and the ability to write, store, and erase such information at will. It is intended primarily for use in radar and other electronic displays where these special features are desirable and electrostatic focus and electrostatic deflection are required.

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BARRIER-GRID STORAGE CATHODE-RAY TUBE

FW-202

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



The ITTL barrier-grid storage tube is an electrical input—electrical output device. This tube utilizes a single, electrostatically focused and deflected gun for "writing" in and "reading" out information on a solid spherically curved target. The target consists of a metal bowl with a thin dielectric layer fused to its concave side and a curved, fine-mesh screen in turn fused to the dielectric layer. The center of deflection of the gun approximately coincides with the center of curvature of the target assembly. A collector ring and an associated electron optical system for focusing the signal electrons from the target onto the collector electrode are positioned between the gun and the target.

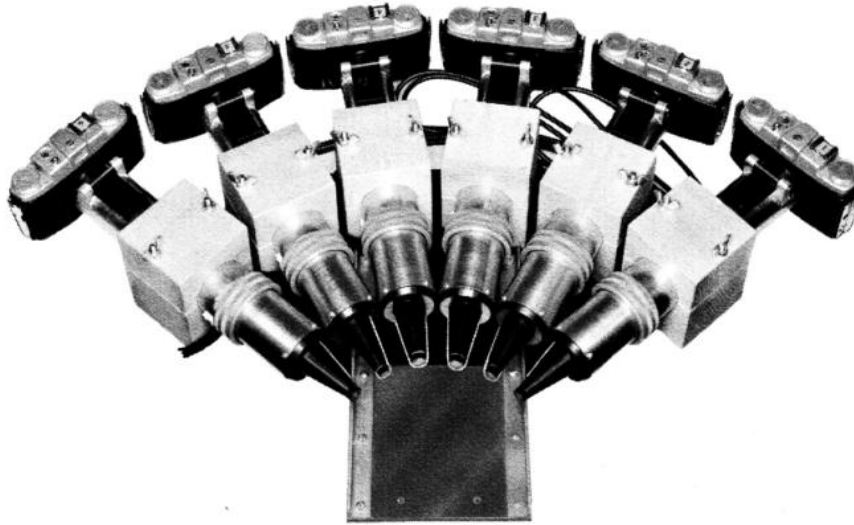
The ITTL barrier-grid storage tube possesses two important properties: if a pattern of repetitive signals is applied to the metallic target substrate in synchronism with the scanning electron beam, no signal will appear at the output

of the tube after a few cycles and secondly excellent registration is obtained between the writing and reading patterns. If a moving signal is present in this pattern of repetitive signals, (i.e., the background pattern) only the moving signal will appear in the output. The tube can be used in radar MTI or infrared applications where it is desirable to cancel out background radiation and observe only the moving targets. The second property is most useful for binary information storage using random access operations. The ITTL Barrier-Grid-Storage Tube can also be used for signal-to-noise improvement because of the integrating property of the storage surface and because the signal builds up at a faster rate than the random noise background. The ITTL barrier-grid storage tube is capable of resolving 1400 TV lines/diameter, 50 percent contrast and has less signal shading and signal disturbance than other commercially available tubes.

MICROSHUTTER CAMERA

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



The ITTL Microshutter Camera uses a pulse diode type image tube (ITTL 7177 or ITTL 6839) as an ultra-high speed photographic shutter. The Microshutter Camera records photographically high-speed events such as exploding wire, electric arcs, high-speed projectiles, and rotating high-speed objects. Such phenomenon may be "stopped" and captured on conventional film at speeds equal to the time required for light to travel 10 feet. The Microshutter Camera can be used single or in multiples up to 12 units with individual or time-sequenced electronic exposure systems. The exact exposure time, as short as 0.01 microsecond, may be set by the use of selected delay lines in the hydrogen-thyratron pulsing

circuit. Thus it is possible to photograph extremely short duration light flash phenomenon. The ITTL 7177 or 6839 diode-type image converter tube used in the Microshutter Camera consists of a photocathode and a phosphor screen in opposite ends of a glass envelope with an intervening electrostatic lens. When a d-c voltage is applied between the cathode and the anode an image focused on the photocathode will appear on the phosphor screen. If the voltage applied is a pulse of short duration, only this "state" of the image at the instant of the pulse will transfer to the phosphor screen. The persistence of the phosphor will permit the "state" of the image to be photographed.

MICROSHUTTER CAMERA SPECIFICATIONS

Exposure time	10 ⁻⁸ second, minimum
Image tube	7177 or 6839
Photocathode	S11
Phosphor	P11

RESOLUTION

7177 Image tube	16 line pairs per mm on photocathode for center 1/4-inch diameter area on phosphor screen.
6839 Image tube	40 line pairs per mm on photocathode for center 5/8-inch diameter area on phosphor screen. Tapers to 10 line pairs per mm at periphery.

ELECTRONIC SCANNING DETECTOR FOR SPECTROMETERS

A PRODUCT OF ITT LABORATORIES

Nutley, N. J. • Fort Wayne, Ind. • Chicago, Ill. • San Fernando and Palo Alto, Calif.



The Electronic Scanning Detector, designed for use with spectrometers, can measure the radiation from static events or from events in which the energy distribution spectrum varies rapidly or is displayed for only a short period of time. The detector analyzes a spectrum dispersed and projected onto the photocathode of a miniature image dissector camera tube. Fixed rates of 100 or 1000 scans per second are selected for optimum repetitive scanning of the spectrum (other scan rates are available). Analog information of voltage versus

time at the output can be recorded and reduced to yield an irradiance versus wavelength plot for any exposure period or an irradiance versus time plot of any wavelength increment of the spectrum. The present equipment measures visible radiation; other versions can be made to be sensitive to the ultraviolet or near-infrared regions of the spectrum.

Features of this device are: rapid response, high resolution, high sensitivity, ruggedness, and compact size.

SPECIFICATIONS

Image dissector tube	FW-110 (miniature)
Spectral response	S-11 (3300 to 6000 angstroms)
Minimum radiant sensitivity, at 4400 angstroms	1×10^{-8} watt/cm ² angstrom
Maximum radiant intensity, at 4400 angstroms	2×10^{-5} watt/cm ² angstrom
Resolution	10 angstroms
Quality area of cathode	3/4 inch wide by 1/4 inch high
Scan rates	100/1000 scans per second
Physical size:	
Image dissector unit	11 inches long by 3 inches diameter
Electronics package	15 inches long by 5 inches wide by 7 inches high
Total weight	22 pounds
Power source	115 vac, 400 cps, single phase

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