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GEC CATALOGUE No. 1247

Mr. F. Langford-Smith
Name Title

English Electric Valve Company, Limited
Company

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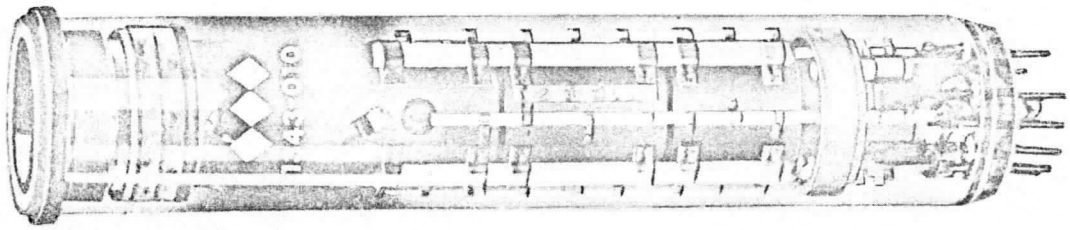
GENERAL ELECTRODYNAMICS CORPORATION
4430 FOREST LANE • P. O. BOX 798 • GARLAND, TEXAS

GENERAL ELECTRODYNAMICS CORPORATION

TD 1343-010 SUPER-RUGGEDIZED SLOW SCAN VIDICON

ELECTROSTATIC FOCUS AND DEFLECTION



The TD 1343-010 vidicon was designed specifically for the Mariner III and IV Spacecraft. It is a fully electrostatic vidicon which is particularly suitable where power, weight and volume are all of prime consideration. A super-ruggedized tube design was chosen to withstand the shock of the powered phases of the flight and to minimize microphonics induced by other spacecraft equipment, such as shutters, tape recorders and squibs. The patented internal construction permits the tube to be operated in any position.

In typical operation, for instance in the Mariner camera, the light input from a 200-millisecond exposure is stored in a slow scan photoconductor of proprietary manufacture. Subsequent readout and simultaneous tape storage is accomplished during a 24-second frame. The system consists of a 200 x 200 resolution element format in which 200 scanning lines are used.

One of the particular requirements for which the 1343-010 was designed was the pulsed beam operation encountered in the Mariner application. This operation requires the cathode to be pulsed at 100 Kcps to provide an improved signal and allow for simplified circuit design. The tube may also be operated using true digital scan or conventional continuous scan. Which scanning mode to select will depend on the intended application.

Unity gamma is highly desirable from a circuitry standpoint, and from an optical point of view a wide dynamic range is required. The photoconductor is optimized to provide these mutually conflicting requirements. The Mariner mission, for instance, calls for a spectral response that is almost flat over the visible region; the photoconductor of the 1343-010 substantially meets this requirement. In slow scan applications, the photoconductor dark current should be as low as possible; the 1343-010 has a very low dark current of the order of 0.2 na, even at the 24-second frame time of the Mariner camera. The low dark current permits a stable camera set-up by use of the black level reference deposited inside the tube.

One of the features of the fully electrostatic vidicon is the Deflectron deflection system which provides a common center of deflection, thereby minimizing vidicon electron-optical aberrations. Since distortions can occur elsewhere in the television system, it was considered desirable to use fiducial marks in the plane of the photoconductor for determination of the precise relationship of objects being viewed.

GENERAL:

Operating Position	Any
Focusing Method	Electrostatic
Deflection Method	Electrostatic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.

ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ± 10%
Current (at 6.3 V)	150 ma ± 10%
Spectral Response	Visible; 4000 to 7000 Angstroms
Direct Interelectrode Capacities	
Signal Electrode to all others	4 pf
D 1 to D 2 (Horizontal Plates)	6 pf
D 3 to D 4 (Vertical Plates)	6 pf

ABSOLUTE MAXIMUM RATINGS:

Grid No. 1 Voltage		
Negative Bias		300 V
Positive Bias		0 V
Heater to Cathode Peak Voltage		
Heater Negative with Respect to Cathode		125 V
Heater Positive with Respect to Cathode		10 V
Grid No. 2 Voltage		750 V
Grid No. 3 Voltage		1000 V
Grid No. 4 Voltage		1000 V
Grid No. 5 Voltage		1000 V
Faceplate		
Illumination		1000 ft-c
Operating and Storage Temperature		-54 to + 71°C
Signal Electrode Current		.60 uA
Shock		50g for 5 milliseconds; 30g for 11 milliseconds
Vibration:	Sinusoidal	0.7 inches da from 5 to 28 cps 20 g from 28 to 500 cps
	Gaussian Noise	5 g from 20 to 2000 cps for 5 mins.
Microphonics		Shock Impulse of 5 g for 5 ms. Observed microphonics less than noise
Acceleration		30 g @ 800 g/sec.
Ambient Accoustical Noise		150 db overall sound pressure level

TYPICAL OPERATION:

	Low Voltage	High Voltage
Minimum Peak-to-Peak Blanking Voltage		
When applied to Grid No. 1	30 V	
When applied to Cathode	10 V	
Deflection Voltages (Peak-to-Peak)		
Horizontal (D1 to D2)	60 V	90 V
Vertical (D3 to D4)	50 V	75 V
All Plates DC Voltage	160 to 240 V	250 to 350 V
Grid No. 1 Voltage (For picture cutoff with no blanking voltage on Grid No. 1	-30 to -70 V	-45 to -100 V
Grids No. 2 and 4 Voltage	200 V	300 V
Grid No. 3 Focus Electrode Voltage	0 to 50 V	30 to 70 V
Grid No. 5 Voltage	300 V	500 V
Signal Electrode Voltage	10 to 25 V	
Average Gamma of Transfer Characteristic	Unity	
Faceplate Temperature	30° to 35°C	

PRINCIPLES OF OPERATION OF TD 1343-010

INTRODUCTION

It is assumed that the principles of operation of standard fully magnetic vidicons are well understood. Fully electrostatic vidicons employ an electrostatic focusing field and a Deflectron deflection system. Slow scan vidicons employ a special photoconductor. In the following paragraphs, these and other differences between the standard magnetic tube and the 1343-010 will be discussed.

ELECTRON-OPTICAL

FOCUS. Electrostatic focus is accomplished in a saddle field lens arrangement composed of grids 2, 3 and 4, with grid 3 as the variable focusing electrode.

DEFLECTION. Electrostatic deflection in the 1343-010 is accomplished through the use of a specially designed deflection electrode configuration called the Deflectron. A photograph of the Deflectron is shown in Figure 1. The conventional crossed pair of deflection plates causes the electron beam to be deflected sequentially; that is, in passing between the first set of plates it is deflected in one plane and then when reaching the second set of plates it is deflected in the other plane. The Deflectron causes the beam to be deflected both horizontally and vertically simultaneously as in magnetic deflection. This common center of deflection reduces defocusing caused by dissimilar horizontal and vertical scanning angles, the undesirable effects of fringe fields such as astigmatism, coma and keystoning and other abberations found in conventional deflection plate scanning. In a GEC Deflectron, quadrature is as good as that obtained in the best magnetic deflection yokes. The Deflectron gives considerable freedom in selection of scanning formats, for instance, horizontal and vertical deflection may be interchanged or rotated as desired.

Physically the Deflectron is a cone of insulating material, the inside of which contains the printed deflection electrode pattern. The pattern of the Deflectron is illustrated laid out on a flat plane in Figure 2. If the pattern is rolled to connect Side A to Side B, four individual electrical paths can be traced.

FIELD CORRECTION. A special mesh electrode, grid 5, is incorporated in the 1343-010 to assure flat field output and to compensate for beam landing error and optical lens distortion. The potential of this mesh can be varied independently of the other electrodes.

SLOW SCAN PHOTOCONDUCTOR

CHARGE STORAGE. The light input signal is stored in a photoconductive layer whose dark resistance is very high. This high dark resistance results in a low front-to-back leakage current which permits storage of information for long frame or delay times. The high dark resistance also results in a low lateral leakage which permits the storage of high resolution information. It is to be noted that the ability of this layer to store information does not depend on photoconductive lag. In fact, the information is erased quickly when scanned.

The information to be stored in the photoconductive layer may be received either at a low light level with a long exposure time, or at a high light level with a short exposure time. The tube will saturate at a given foot-candle-second exposure level. For Mariner III and IV missions, the exposure time normally is 200 milliseconds, but an alternate exposure time of 18 milliseconds is available.

SLOW SCAN. "Slow Scan" is generally defined as any rate slower than standard TV rate, that is, slower than 30 frames per second. At these longer frame times, the charge leakage of standard photoconductors is excessive and slow scan photoconductors are required. Either continuous scanning or single frame scanning may be employed, depending on the application.

SCANNING SYSTEM. The Mariner scanning system, for instance, produces one picture every 48 seconds. Twenty-four seconds are used for active frame scan during which time the signal is read out and stored on tape. The remaining 24 seconds are used to prepare the photoconductor for a new picture and to expose the new picture. The exposure time is either 200 msec. or 18 msec. depending on the available light level.

There are 200 horizontal scan lines, one line occurring each 120 msec. The active line time is 14.4 msec. during which time the cathode is modulated by a 100 Kcps square wave. The remainder of the 120 msec. is used to erase residual information.

SIGNAL OUTPUT CURRENT. The signal derived from the photoconductor used in the 1343-010 is a function of photoconductor illumination, target voltage, area scanned and rate of scan. In the unattended Mariner application only the illumination is a variable, and with the unity gamma provided, the output current is directly proportional to the level of illumination.

DARK CURRENT. This type of slow scan photoconductor has a typical dark current of 0.2 na at standard TV rates, with the normal 1/2 x 3/8 in. raster. Dark current varies with frame time, and beam travel rate so that for the Mariner application, the dark current is of the order of 0.2 na.

RESIDUAL SIGNAL AND ERASURE. Although the signal can be stored in some GEC photoconductors for as long as fifteen minutes with little degradation, the 1343-010 was optimized for a 24-second frame rate. The residual signal after the first scan is small and the signal is erased quite readily when the surface is subsequently scanned by the electron beam. In the Mariner application, complete erasure was effected by rescanning each line several times immediately after each line readout.

SPECTRAL RESPONSE. Slow scan photoconductors have generally the same spectral response as S-18. The Mariner mission calls for a spectral response that is almost flat over the visible region. The 1343-010 has a relative response above 75% over the entire range from 4000 to 6000 angstroms, decreasing to 0% at approximately 7000 angstroms.

LIGHT TRANSFER CHARACTERISTIC. The light transfer characteristic is best expressed by the gamma, or linear slope of the log-log plot of output signal as a function of faceplate illumination. The average gamma is near unity within the dynamic range of the tube. (The dynamic range is the range of values of illumination between zero signal and photoconductor saturation.) For Mariner, a gamma of unity was highly desirable from photogrammetrical and circuitry standpoints. Since a wide range of illumination levels was anticipated on Mars, a photoconductor with a wide dynamic range was required. The 1343-010 is optmized to provide these mutually conflicting requirements.

BLACK LEVEL REFERENCE

In slow scan applications, it is very important to have a stable camera set-up. A very dependable method for obtaining stable operation is to provide a reference black area within the vidicon, which accurately tracks the vidicon dark current, to which the video level is clamped. The black level reference used in the 1343-010 is shown in Figure 3.

FIDUCIAL MARKS

Electronic distortions resulting in inaccurate spatial measurements can occur at many points in the television system. For the Mariner mission, fiducial marks (these marks are often referred to as a reticle or reseau pattern) are deposited in the plane of the phtoconductor for determination of the precise relationship of objects being viewed. The fiducial marks used in the 1343-010 are shown in Figure 3.

RESOLUTION

A fully electrostatic vidicon is capable of a limiting resolution in excess of 600 TV lines in the center. Slow scan photoconductors are inherently capable of much higher resolution. The 1343-010 thus easily exceeds the resolution requirements of the Mariner application which is limited by the scanning format and bandpass of the system.

SCANNING MODES

This type of vidicon is readily adaptable to various unconventional scanning modes such as spiral scan or radial scan. Digital scanning can also be employed. The aspect ratio of rectangular scanned areas may be varied as desired. In the standard orientation for linear scanning, horizontal scan lines are essentially parallel to a plane passing through base pins Nos. 2 and 9, but other orientations may be used if desired.

In the Mariner application, the design parameters of the optical system prescribed the use of a relatively small scanning area of .22 x .26, and an active area of .22 x .22 inches.

ENVIRONMENTAL

The absolute maximum ratings shown on page 2 list the normal environmental levels which the super-ruggedized tube design used for the Mariner application will withstand. The camera containing the 1343-010 was subjected to three orthogonal vibration tests of 10-minute duration each, with Gaussian noise to 14g rms added with sinusoidal vibration to 9g rms. An additional low frequency sinusoidal three-axis shake of several seconds duration with levels up to 30g rms was performed.

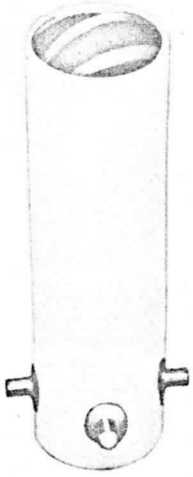


FIG. 1

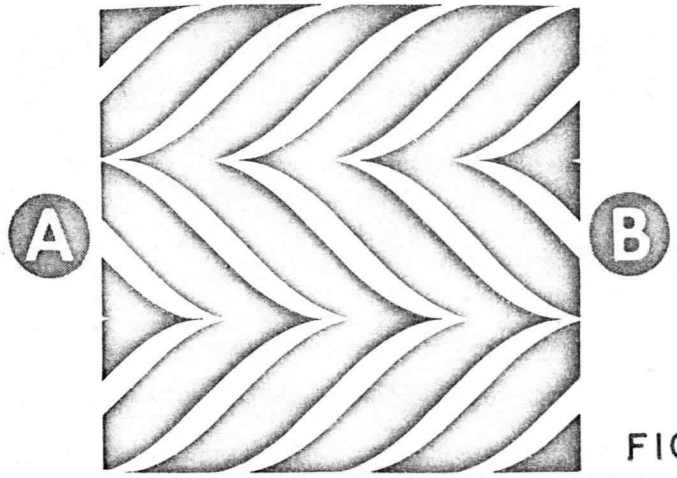


FIG. 2

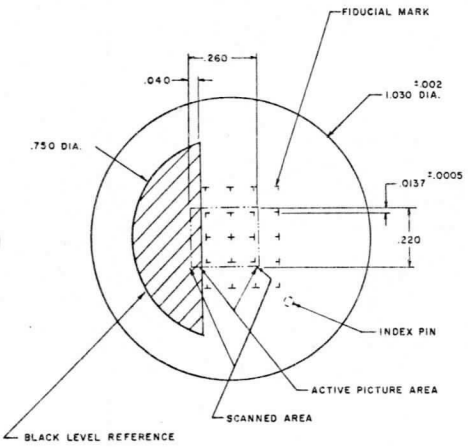


FIG. 3 VIEW OF FACEPLATE SHOWING BLACK LEVEL REFERENCE AND FIDUCIAL MARKS

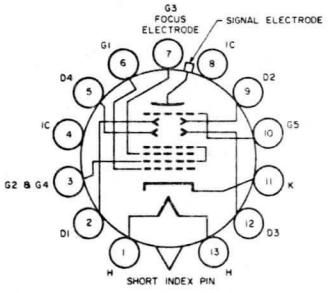


FIG. 5 BOTTOM VIEW

PIN 1:	HEATER
PIN 2:	D1 HORIZONTAL DEFLECTION PLATE
PIN 3:	GRID NO. 2 & 4
PIN 4:	INTERNAL CONNECTION--DO NOT USE
PIN 5:	D4 VERTICAL DEFLECTION PLATE
PIN 6:	GRID NO. 1
PIN 7:	G3 FOCUS ELECTRODE
PIN 8:	INTERNAL CONNECTION--DO NOT USE
PIN 9:	D2 HORIZONTAL DEFLECTION PLATE
PIN 10:	GRID NO. 5
PIN 11:	CATHODE
PIN 12:	D3 VERTICAL DEFLECTION PLATE
PIN 13:	HEATER
SHORT INDEX PIN:	INTERNAL CONNECTION--DO NOT USE
FLANGE:	SIGNAL ELECTRODE

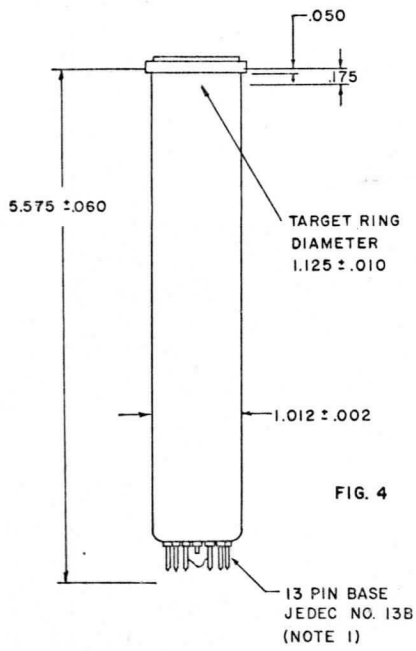


FIG. 4

NOTES

1. Base-pin positions fit 0.25 inch thick, 15-hole flat plate gage with holes located as follows: 14 holes, 0.0470 (±0.0005) inch diameter, equally spaced, 0.2510 (±0.0005) inch apart on a circle, 0.6560 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) inch diameter, concentric with 14-hole circle.
2. All dimensions are shown in inches.
3. Faceplate thickness 0.094 + 0.004 - 0.008.
4. The socket for this tube can be obtained from GEC.

GENERAL ELECTRODYNAMICS

GENERAL ELECTRODYNAMICS CORP.
4430 Forest Lane Garland, Texas 75040
214-276-1161
TWX #901-860-5193 — TELEX #73-2395

TD 1342-010 SUPER-RUGGEDIZED SLOW SCAN VIDICON

MAGNETIC FOCUS AND DEFLECTION
SEPARATE MESH, 150 MILLIAMP HEATER

The TD 1342-010 vidicon was specifically designed for the television cameras onboard the Mariner '69 Mars Probe. A fully magnetic tube with separate mesh and an unusual electron optical design, it is capable of at least 1500 TV lines limiting resolution. Its special electron optics allows control of shading and provides the ability to withstand severe over-beaming with negligible loss of resolution.

The super-ruggedized design enables the vidicon to withstand the rigors of power flight aboard Mariner's Atlas-Centaur launch vehicle and prevents it from being damaged by the pyrotechnic events which occur during a Mariner cruise. The design also minimizes microphonics induced by other satellite equipment such as the high speed shutters. The patented internal construction permits the tube to be operated in any position.

In typical operation in a Mariner '69 camera one picture is taken every 84 seconds. After exposure, 42 seconds are required to scan the 704 line raster. Erase and prime are accomplished by one 25-second scan of the photosurface. A typical exposure might contain highlight levels equivalent to a .2 footcandle-second exposure at the vidicon faceplate. Exposure times are in the 100 millisecond range.

In the Mariner application, the 1342-010 is operated with an 18.9 Khz cathode chopping frequency, the duty cycle being 50 percent. This scanning method generates a large signal current than is obtained with conventional continuous scanning and is recommended for slow scan television cameras with frame times longer than 20 seconds.

DATA

GENERAL:

Operation Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image	0.625 in.
Orientation of Image	Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.

ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ± 10%
Current (at 6.3 V)	.15 A ± 10%
Direct Interelectrode Capacity	
(Signal Electrode to all other Electrodes	3.1 pf

ABSOLUTE MAXIMUM RATINGS:

Heater — Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V
Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V
Grid No. 2 Voltage	1000 V
Grid No. 3 Voltage	1000 V
Signal Electrode Current	.60 ua

TYPICAL OPERATION: (For 42-Second Frame Time)

Minimum Peak-to-Peak Picture Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Grid No. 1 Voltage (For signal cut off with no blanking applied)	—50 to —100 V
Grid No. 2 Voltage (See Note A)	600 V
Grid No. 3 Voltage (See Note B)	710 V
Focus Field Strength	(Adjust) 60 gauss
Scanned Area	.506 x .378 inches
Faceplate Temperature	30° to 35° C
Average Gamma of Transfer Characteristic	Unity
Signal Electrode Voltage	(Adjust) 5 to 30 V
Center Resolution, Minimum (See Note C)	600 TV Lines at 60%

Note A: The Grid 2 power supply must be capable of delivering up to 2 milliamperes at 600 Volt to Grid 2.

Note B: For best shading and resolution performance the ratio of Grid 3 to Grid 2 voltages should be close to 1.2:1.

Note C: In order to meet the resolution specifications, the following magnetic components will be used:

DEFLECTION YOKE — GEC ED 6080A

FOCUS AND ALIGNMENT COIL ASSEMBLY — GEC ED 6080B

ENVIRONMENTAL RATINGS

GENERAL

Faceplate Illumination	1000 ft-c
Temperature (Faceplate)	
Operating:	— 30 to + 60° C
Storage:	— 30 to + 65° C

NON-OPERATIONAL TESTS

Sine Wave Vibration:

Vibration on all 3 axes at one octave per minute at the following levels:

a. 5 to 30 Hz at 0.75 g rms
b. 30 to 200 Hz at 15.0 g rms
c. 200 to 1000 Hz at 9.0 g rms
d. 1000 to 2000 Hz at 6.0 g rms

Random Vibration:

Vibration on all 3 axes for 60 seconds per axis at 18.1 g rms. The spectrum is shaped as follows:

a. 25 — 50 hz 24 db/octave roll-off
b. 50 — 150 hz 2.25 g^2/cps
c. 150 — 225 hz linear decrease to .065 g^2
d. 225 — 750 .065 g^2/cps
e. 750 — 2000 12 db/octave roll-off

Shock: Two 250 g, 0.5 ± 0.1 ms terminal peak sawtooth shocks, along 3 axes in each direction (12 tests).

Static Acceleration: ± 9 g along 3 axes for 5 minutes (6 tests).

PRINCIPLES OF OPERATION OF TD 1342-010

INTRODUCTION

It is assumed that the principles of operation of standard fully magnetic vidicons are well understood. Slow scan vidicons employ a special photoconductor. In the following paragraphs this and other differences between the standard magnetic tube and the 1342-010 will be discussed.

SLOW SCAN PHOTOCONDUCTOR

CHARGE STORAGE. The light input signal is stored in a photoconductive layer whose dark resistance is very high. This high dark resistance results in a low front-to-back leakage current which permits storage of information for long frame or delay times. The high dark resistance also results in a low lateral leakage which permits the storage of high resolution information. It is to be noted that the ability of this layer to store information does not depend on photoconductive lag. In fact, the information is erased quickly when scanned.

The information to be stored in the photoconductive layer may be received either at a low light level with a long exposure time, or a high light level with a short exposure time. The tube will saturate at a given foot-candle-second exposure level.

SLOW SCAN: "Slow Scan" is generally defined as any rate slower than standard TV rate; that is, slower than 30 frames per second. At these longer frame times the charge leakage of standard photoconductors is excessive and slow scan photoconductors are required. Either continuous scanning or single frame scanning may be employed, depending on the application.

SCANNING SYSTEM: The Mariner scanning system, for instance, scans 704 lines in a 42-second period. The photoconductor used in the 1342-010 can be used for either longer or shorter frame times.

SIGNAL OUTPUT CURRENT. The signal derived from the photoconductor used in the 1342-010 is a function of photoconductor illumination, target voltage, area scanned and rate of scan.

DARK CURRENT. This type of slow scan photoconductor has a typical dark current of 0.5 nA at standard TV rates with the normal ½ x ⅜ inch raster. Dark current varies with frame time and beam travel rate so that for the Mariner application the dark current is of the order of .1 nanoamp.

RESIDUAL SIGNAL AND ERASURE. Although the signal can be stored in some GEC photoconductors for as long as fifteen minutes with little degradation, the 1342-010 was optimized for a 42-second frame time. The residual signal after the first scan is small and the signal is erased quite readily when the surface is subsequently scanned by the electron beam. In the Mariner mode, typically 95% erasure is effected by the single erase frame.

LIGHT TRANSFER CHARACTERISTIC. The light transfer characteristic is best expressed by the gamma or linear slope of the log-log plot of output signal as a function of faceplate illumination. The average gamma is near unity within the dynamic range of the tube. (The dynamic range is the range of values of illumination between zero signal and photoconductor saturation.) Since Mariner is expected to photograph a wide range of illumination levels, a photoconductor with a wide dynamic range is required. The 1342-010 is optimized to meet these mutually conflicting requirements.

BLACK LEVEL REFERENCE

In slow scan applications, it is very important to have a stable camera set-up. A very dependable method for obtaining stable operation is to provide a reference black area within the vidicon. This reference, to which the video level is clamped, accurately tracks the dark current.

FIDUCIAL MARKS

Electronic distortions resulting in inaccurate spatial measurements can occur at many points in the television system. Fiducial marks (these marks are often referred to as a reticle or reseau pattern) are deposited in the plane of the photoconductor for determination of the precise relationship of objects being viewed.

RESOLUTION

The 1342-010 vidicon is capable of a limiting resolution in excess of 1500 lines at the center at TV rates. Slow scan vidicons are inherently capable of much higher resolution than standard TV rate vidicons. Mariner system bandwidth does not permit measurement of the limiting resolution of 1342-010 but modulation values of 50% at 800 TV lines are typical.

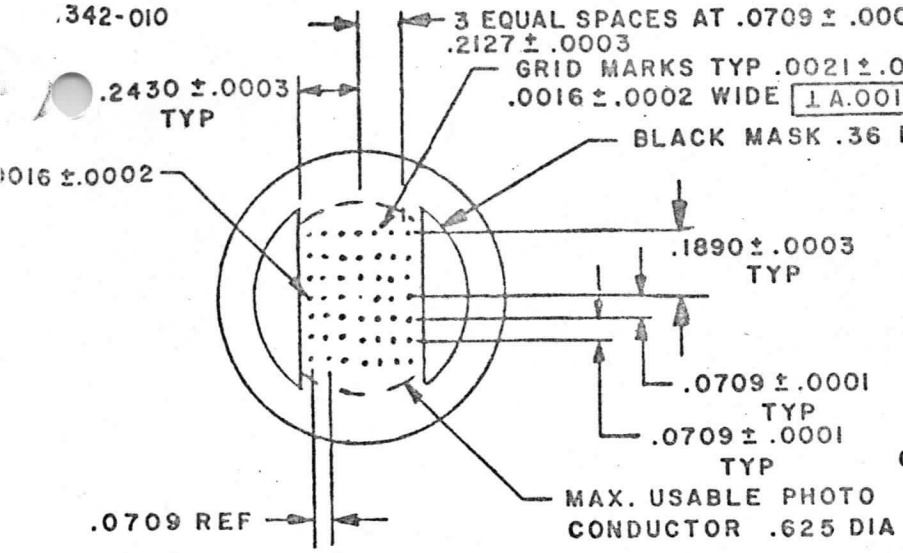


FIG. 1 VIEW OF FACEPLATE SHOWING BLACK LEVEL REFERENCES AND FIDUCIAL MARKS

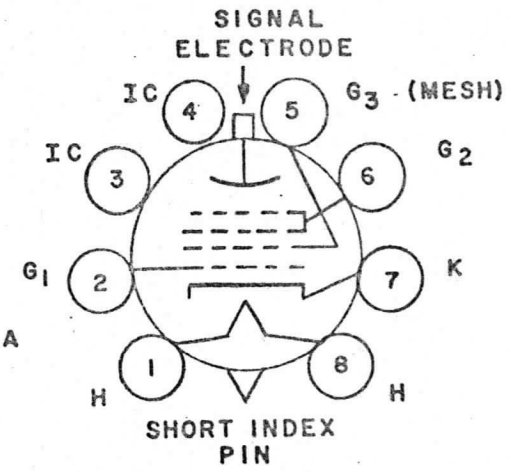


FIG. 3 BOTTOM VIEW

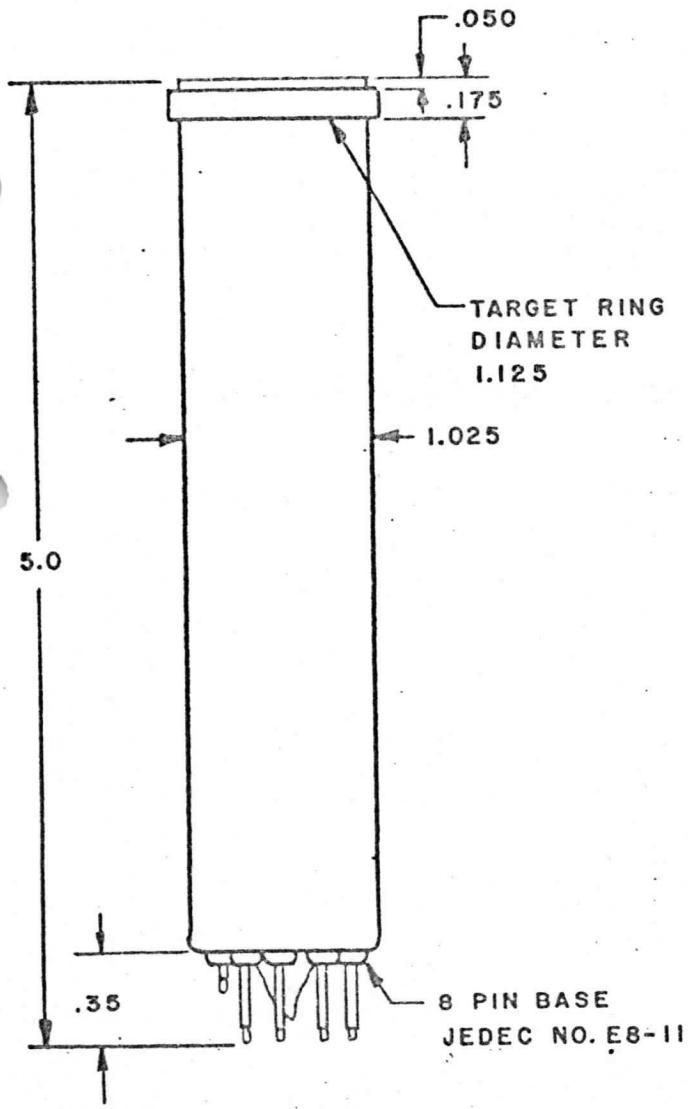


FIG. 2

PIN 1: HEATER
PIN 2: GRID NO.1
PIN 3: INTERNAL CONNECTION - DO NOT USE
PIN 4: INTERNAL CONNECTION - DO NOT US
PIN 5: GRID NO. 3 (MESH)
PIN 6: GRID NO. 2
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL
SHORT INDEX PIN: INTERNAL CONNECTION - DO NOT USE

NOTE

1. ALL DIMENSIONS ARE SHOWN IN INCHES.

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS
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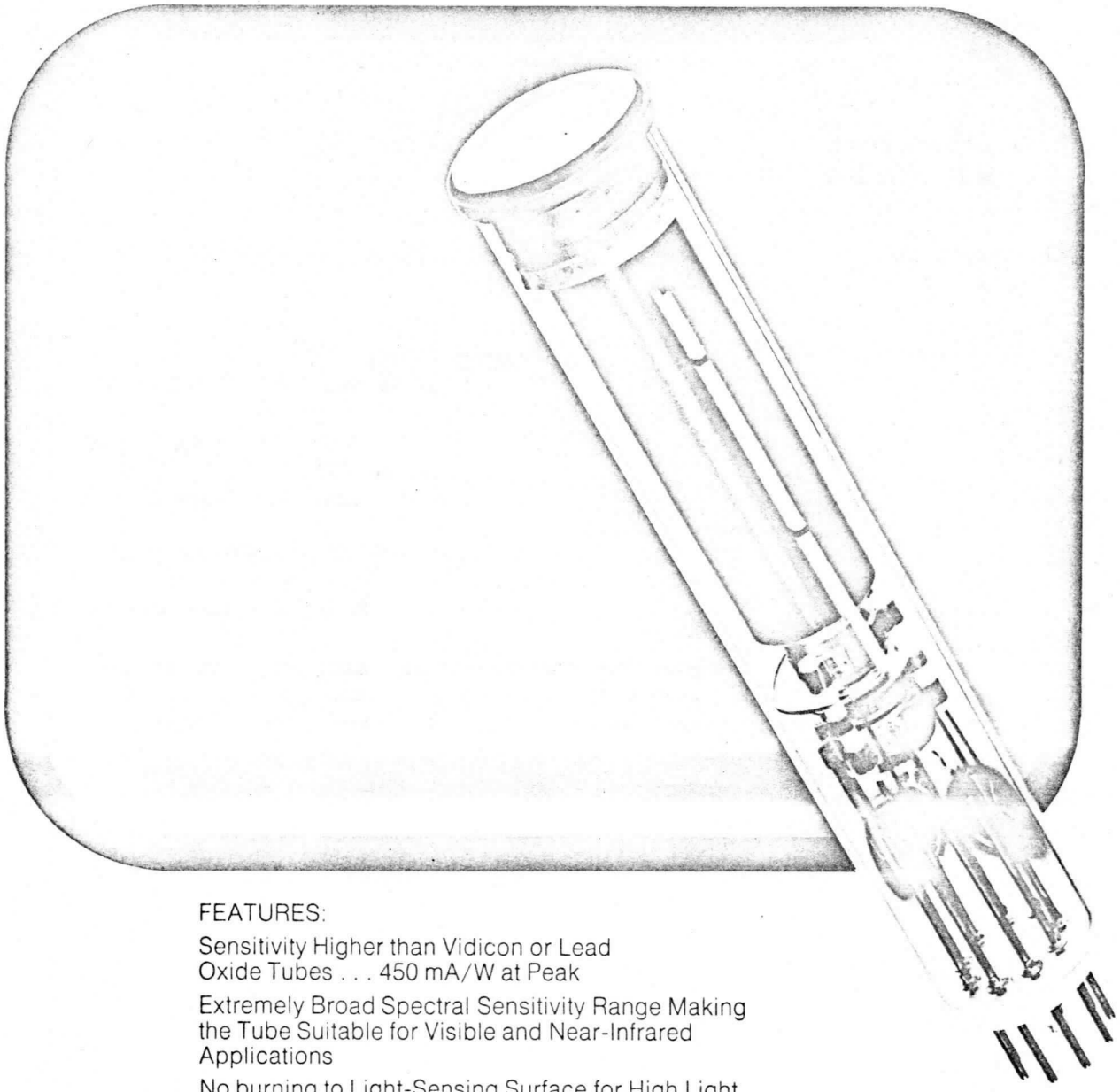
BROADWAY 6-1161

LITHO IN U.S.A.

GENERAL ELECTRODYNAMICS
TYPES TD 1306-046, TD 1306-047



FEATURES:

Sensitivity Higher than Vidicon or Lead Oxide Tubes . . . 450 mA/W at Peak

Extremely Broad Spectral Sensitivity Range Making the Tube Suitable for Visible and Near-Infrared Applications

No burning to Light-Sensing Surface for High Light Levels (6×10^7 lm/ft^2)

APPLICATIONS:

Closed-Circuit Television

Videophone

Educational Television

Hospital Surveillance

Industrial and Military Applications

GENERAL ELECTRODYNAMICS

4430 FOREST LANE, GARLAND, TEXAS 75042

PHONE: (214) 276-1161 / TWX (910) 860-5193 / TELEX 73-2395

TYPES TD 1306-046, TD 1306-047
SILICON-DIODE-ARRAY IMAGE TUBES

Description:

The TD 1306-046 and TD 1306-047 Image Tubes are one-inch (25.4-millimeter) silicon-diode-array image tubes utilizing scanning electron optics of the all-magnetic 8507 type. The light-sensing surface is a single slice of a silicon crystal containing at least 620,000 diodes per square centimeter, with 750,000 diodes within a standard 3/8 inch X 1/2-inch (9.5 mm X 12.7-mm) beam-scanned raster. The use of silicon material as the light-sensing surface provides a spectral response from 0.35 to 1.1 micrometers with low dark current and low image-retention properties.

The TD 1306-046 and TD 1306-047 are standard silicon diode array devices for industrial and commercial applications. Versions of both can be provided which have the same performance with additional environmental qualifications for military applications.

Electrical Data:

Heater Voltage, AC or DC	6.3V ± 10%
Heater Current at 6.3V (See Note 1)	0.1A ± 10%
Nominal Direct Interelectrode Capacitance, Target to Other Electrodes (See Note 2)	4.6 pF
Focusing Method (See Note 3)	Magnetic
Deflection Method (See Note 3)	Magnetic

Optical Data:

Spectral Response (See Figure 2)	0.35 to 1.1 μm
Target-to-Front-Plate Distance (See Figure 8)	0.073 ± 0.010 in. 1.85 ± 0.25 mm
Target-to-Face-Plate Distance (See Figure 8)	0.023 ± 0.007 in. 0.58 ± 0.18 mm
Faceplate Thickness (See Figure 8)	0.050 ± 0.003 in. 1.27 ± 0.08 mm
Faceplate Index of Refraction at 0.5893 μm	1.487

NOTES:

1. Cathodes with other heater currents are available on special request.
2. This capacitance will increase as the tube is inserted into the focus and deflection coil assemblies.
3. Deflection and focusing alignment coils: VYLFA 857 from Cleveland Electronics Inc., 200 Highland Road, Twinsburg, Ohio 44087 (or equivalent).

target

Scanned Area	3/8 in X 1/2 in 9.5 mm X 12.7 mm
Maximum Useful Diagonal	0.62 in 15.75 mm

Orientation of Raster:

Proper orientation of the tube occurs when the horizontal scan axis, defined as the axis given by the short pin and the center axis of the tube, is parallel to the horizontal deflection plane with the short pin at 9 o'clock when viewed from the rear of the tube.

general mechanical data

Overall Length	6.250 ± 0.125 in 158.75 ± 3.18 mm
Greatest Diameter	1.125 ± 0.010 in 28.58 ± 0.25 mm
Base	Small Button Ditetrar (JEDEC E8-11)
Bulb	T8
Socket	Cinch No. 8VT (See Note 4) or equivalent
Deflection and Focusing Alignment Coils	See Note 5
Weight (approximate)	2.3 oz 65.2 g
Detailed Outline Dimensions	See Figure 8
Operating Position	Any

absolute maximum ratings at 25°C faceplate temperature (unless otherwise noted), see notes 6 and 7

Target Voltage	10V
Grid-4 Voltage	350V
Grid-3 Voltage (See Note 8)	Grid 4 Voltage
Grid-2 Voltage	350V
Grid-1 Voltage	-150V
Heater-Cathode Peak Voltage Range	-125V to 10V
Faceplate Illumination (See Note 9)	6×10^7 lm/ft^2 6×10^8 lux 3×10^7 W/m^2
Operating Temperature Range (See Note 10)	-10°C to 100°C
Storage Temperature Range	-54°C to 200°C

NOTES:

4. Manufactured by Cinch Manufacturing Company, 1501 Morse Avenue, Elk Grove Village, Illinois 60007
5. For dimensions and approximate position of these coils, see Figure 9.
6. The maximum ratings in the tabulated data are established in accordance with the following definition for rating electron devices: absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.
7. All voltages with the exception of heater voltage are with respect to the cathode when the cathode is unblanked.
8. Grid-3 voltage must be less than grid-4 voltage. The recommended ratio is between 0.8 and 0.9 to 1.
9. Silicon diode image tubes can stand the image of the sun on the light-sensing layer without damage.
10. The dark current of silicon-diode-arrays doubles with each 10°C increase in array temperature. Consequently, although no damage will occur from operating the tube at 100°C, the obtaining of a usable picture cannot be guaranteed at that temperature.

recommended operating conditions at 25°C faceplate temperature, see note 7

Grid-4 Voltage	350V
Grid-3 Voltage (See Note 8)	290V
Grid-2 Voltage	300V
Grid-1 Voltage for Picture Cutoff	-40 to -75V
Target Voltage	10V
Peak-to-Peak Blanking Voltage:	
Applied to Grid 1	-75V
Applied to Cathode	20V
Field Strength at Center of Focus Coil	40 ± 5 Gauss
Field Strength of Adjustable Alignment Coil	0 to 4 Gauss
Focusing Coil Current	54 mA
Peak-to-Peak Deflecting Coil Alignment Current:	
Horizontal	370 mA
Vertical	36 mA
Tube and Coil Positioning	See Figure 9

operating characteristics at 25°C faceplate temperature and recommended operating conditions

PARAMETER		TEST CONDITIONS	1306-046			1306-047			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Sensitivity *Signal Current*	Monochromatic Light	λ = 0.7 μm	450			450			mA/W
	Unfiltered Light from Tungsten Source	Color temperature = 2854 K, Faceplate illumination = 0.1 lm/ft²		6300 *395*			6300 *395*		μA/lm *nA*
	Visible Light	Color temperature = 2854 K, See Note 11		1180 *74*			1180 *74*		μA/lm *nA*
	Infrared Light	See Note 12		*37*			*37*		*nA*
Dark Current				10			15		nA
Lag	After 33 ms or third field	Signal current = 100 nA		15%			25%		
	After 50 ms or fourth field			10%			20%		
Limiting Resolution		See Note 13	350			325			TV lines
Number of Linear Gray Scale Steps Reproduced on Resolution Chart				10			10		steps
Nonuniformity (See Note 14)				20%			20%		
Transfer Characteristic, γ		Signal current = 4 nA to 500 nA		1.0			1.0		

NOTES:

7. All voltages with the exception of heater voltage are with respect to the cathode when the cathode is unblanked.
8. Grid-3 voltage must be less than grid-4 voltage. The recommended ratio is between 0.8 and 0.9 to 1.
11. With a tungsten light source of the specified color temperature, an infrared-absorbing filter (Schoot KG-3, 5mm thick, available from Fish Shurman Corp., New Rochelle, N.Y., or equivalent) is interposed between the light source and the tube faceplate. Illumination on the IR filter is 0.1 lm/ft².
12. With a tungsten light source at a color temperature of 2854 K, an infrared-transmitting filter (Corning CS-7-56, available from Corning Glass Works, Corning, N.Y., or equivalent) is interposed between the light source and the tube faceplate. Illumination on the IR filter is 0.1 lm/ft².
13. Resolution is measured with an uncompensated video amplifier with response that is flat within ± 1 db to 10 MHz. Limiting resolution is defined as the TV-line number at which the amplitude response is 5% of the response at some very low TV-line number. TV-line numbers are determined by the number of equal width black and white lines which will fit into the physical height of the image focused on the camera-tube faceplate. Resolution measurements are made on a 4-by-3 aspect ratio with a 0.62-inch (15.75-mm) diagonal dimension.
14. Nonuniformity is the deviation within the scanned area expressed as a percentage of the peak video signal.

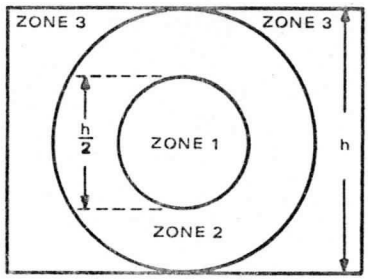
defect definitions

The quality of a silicon-diode-array tube is a function not only of the size and the number of white and black defects which appear on the scanned area, but also of the location of these defects. Three nonoverlapping zones are defined for defect location as shown in Figure 1.

A blemish is defined as a point-type black or white defect within the image that produces a spurious signal that exceeds or equals 10% of an otherwise uniform signal. An area defect within the image produces a spurious signal that exceeds or equals 3% of an otherwise uniform signal.

Blemish and area-type-defect widths are measured in equivalent TV scan lines in a 525-scan-line system, with a raster geometry of 0.260 inch by 0.346 inch (6.6 mm X 8.8 mm) using a uniform signal of 150 nA at a faceplate temperature of 25°C.

The table below shows the maximum number of defects allowed according to size and location for each of the tube types.



DEFECT ZONES
Zone 1 is 15% of area.
Zone 2 is 45% of area.
Zone 3 is 40% of area.
FIGURE 1

TUBE TYPE	DEFECT SIZE	MAXIMUM NUMBER OF DEFECTS		
		ZONE 1	ZONE 2	ZONE 3
TD 1306 -046	1 TV line or less†			
	Over 1 TV line	1	2	2
	Over 4 TV lines	0	1	2
	Over 6 TV lines	0	0	1
	Over 9 TV lines	0	0	0
TD 1306 -047	1 TV line or less†			
	Over 1 TV line	1	3	4
	Over 4 TV lines	0	1	2
	Over 6 TV lines	0	0	1
	Over 9 TV lines	0	0	1
	Over 16 TV lines	0	0	0

†Defects of this size are not counted unless clustered to produce an area-type defect.

TYPICAL CHARACTERISTICS

SPECTRAL RESPONSE CHARACTERISTICS

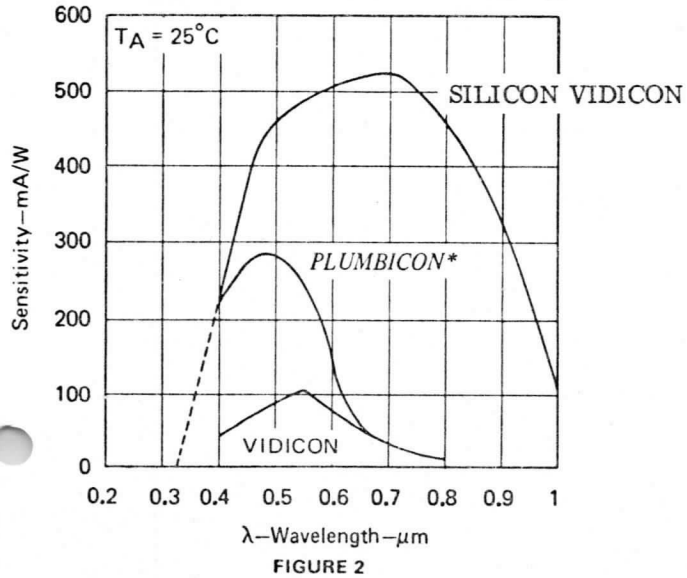


FIGURE 2

*Registered trademark of North American Philips Corporation

SOURCES:

Vidicon curve is from RCA type 4503A data sheet dated 8-68.

Plumbicon curve is from an article entitled "New Plumbicon TV Camera Pickup Tubes" by R.S. Levitt, Ampex Electro-Optics Corp., published in "Society of Motion Picture and Television Engineers," Vol. 79, No. 2, February 1970.

TYPICAL CHARACTERISTICS

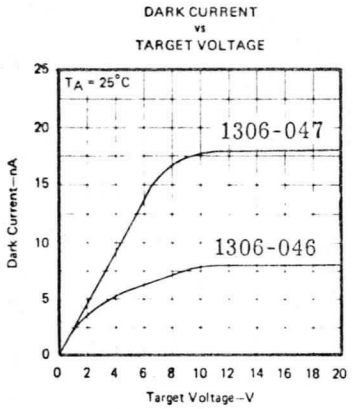


FIGURE 3

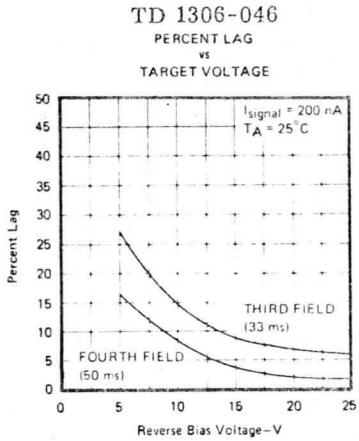


FIGURE 4

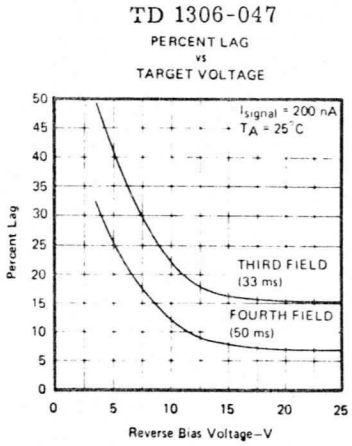


FIGURE 5

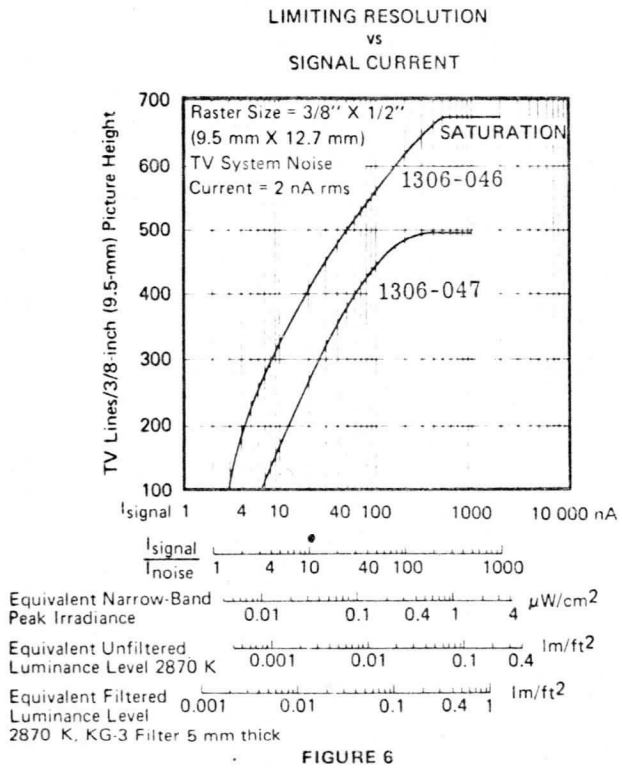


FIGURE 6

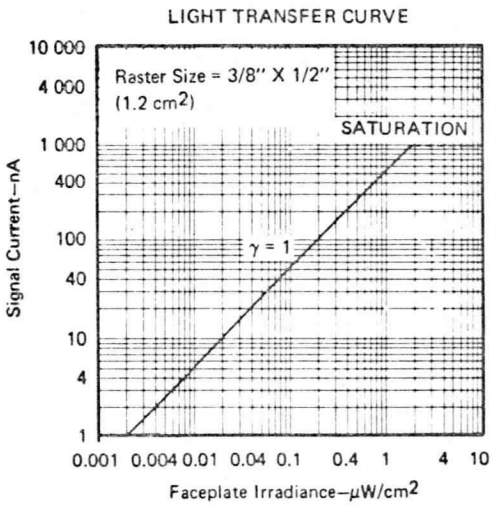
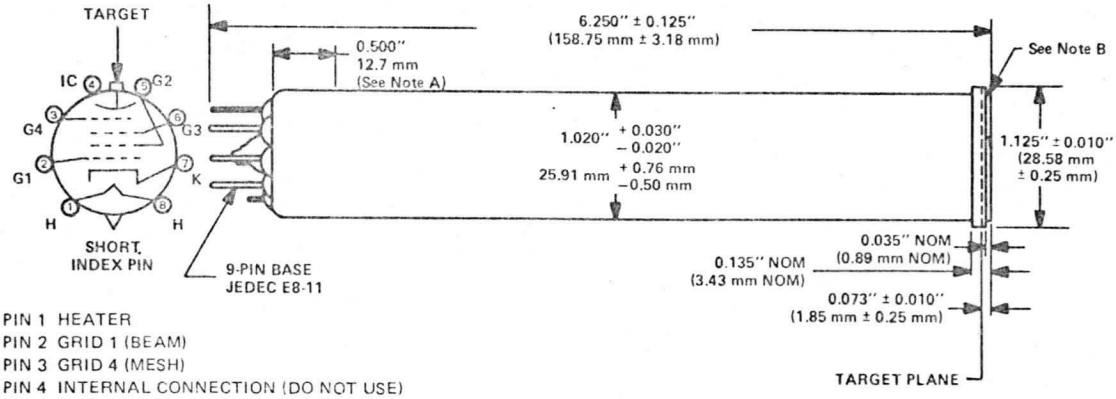


FIGURE 7

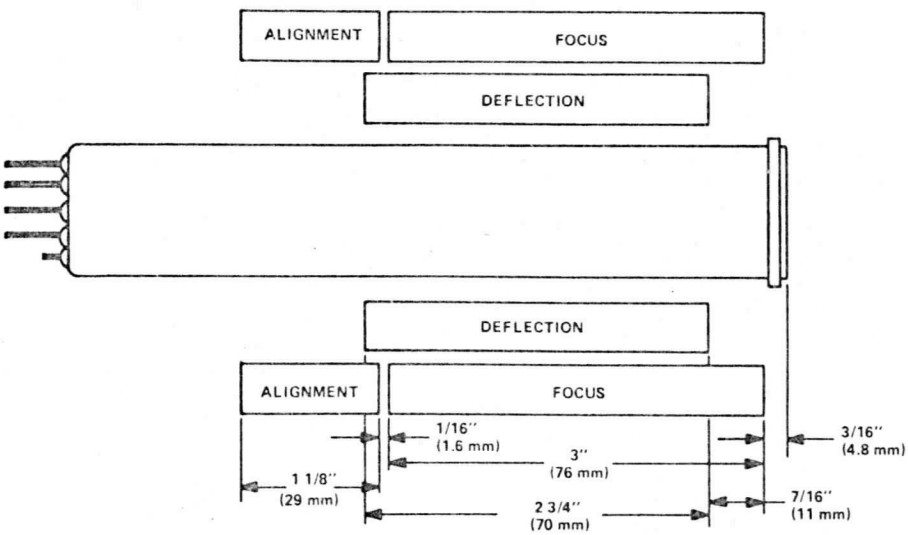
MECHANICAL DATA



PIN 1 HEATER
PIN 2 GRID 1 (BEAM)
PIN 3 GRID 4 (MESH)
PIN 4 INTERNAL CONNECTION (DO NOT USE)
PIN 5 GRID 2 (ACCELERATOR)
PIN 6 GRID 3 (FOCUS)
PIN 7 CATHODE
PIN 8 HEATER
SHORT INDEX PIN: INTERNAL CONNECTION (DO NOT USE)
FLANGE: SIGNAL ELECTRODE (TARGET)

NOTES: A. Diameter of tube near ends may shrink as required for sealing.
B. Faceplate is Corning type 7056 glass with a thickness of 0.050" ± 0.003" (1.27 mm ± 0.09 mm).

PHYSICAL DIMENSIONS
FIGURE 8



APPROXIMATE COIL LOCATIONS
FIGURE 9

GENERAL ELECTRODYNAMICS CORPORATION
4430 FOREST LANE, GARLAND, TEXAS 75040
Phone: 214-276-1161
TWX: #901-860-5193 - TELEX #73-2395

TD 1302 SUPER-RUGGEDIZED VIDICON
MAGNETIC FOCUS AND MAGNETIC DEFLECTION
HALF-INCH DIAMETER

The TD 1302 Vidicon is designed for use where rugged environment, power, weight and volume are all of prime consideration. This half inch tube is capable of withstanding severe shock and vibration, high ambient noise, and the low pressure encountered in space.

At the typical operating voltages given below, the limiting center resolution is 600 lines. This tube is suitable for televising live scenes giving pictures of satisfactory quality with as little as 0.2 foot-candles average illumination on the faceplate.

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.35 in.
Orientation of Image...Horizontal Scan should be essentially parallel to a plane passing through tube axis & the short index pin.	

ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V $\pm$ 5%
Current (at 6.3 V)	.17 A $\pm$ 10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	2 pf
Spectral Response	S-18

ABSOLUTE MAXIMUM RATINGS:

Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	50 V
Heater Positive with Respect to Cathode	10 V
Short term overload	+125 V, 1 min.max.
Grid No. 1 Voltage	
Negative Bias Values	200 V
Positive Bias Values	0 V

TD 1302 (continued):

ABSOLUTE MAXIMUM RATINGS (continued):

Grid No. 2 Voltage		750 V
Grid No. 3 Voltage		1000 V
Signal Electrode Current		.35 μA
Signal Electrode Voltage		50 V
Faceplate		
Illumination		1000 ft-cdl.
Operating Temperature		-10 to +71° C
Storage Temperature		125° C
Shock		100 g for 11 millisecs. 200 g for 5 millisecs.
Vibration:	Gaussian Noise	20 g RMS, from 10-2000 CPS for 20 mins., 60 g RMS, from 10-2000 CPS for 5 seconds in vertical plane.
Ambient Acoustical Noise		175 db sound pressure level
Humidity		100%

TYPICAL OPERATION:

Minimum Peak-to-Peak Blanking Voltage	
When applied to Grid No. 1	70 V
When applied to Cathode	30 V
Grid No. 1 Voltage (For picture cut-off with no blanking voltage on Grid No. 1)	-45 to -100 V
Grid No. 2 Voltage	400 V
Grid No. 3 Voltage	600 V
Signal Electrode Voltage	10 to 50 V
Scanned Area	0.28 x 0.21 in.
Faceplate Temperature	30° to 35° C
Average Gamma of Transfer Characteristic over Signal Output Current Range of .05 to .2 μA	.65
Typical Signal Output Current at .05 μA dark current and 1 ft.-candle average faceplate illumination	.15 μA
Limiting Resolution, TV Lines, At Center	600
At Corner	500

HIGH VOLTAGE OPERATION:

Grid No. 1 Voltage (for picture cut-off)	-80 V to -175 V
Grid No. 2 Voltage	700 V
Grid No. 3 Voltage	1000 V
Limiting Resolution, Minimum, At Center, TV lines	800
Minimum, At Corner, TV lines	700

TD 1302 (continued):

Connections:		
	Pin 1:	Heater
	Pin 2:	Cathode
	Pin 3:	Grid No. 1
	Pin 4:	Grid No. 2
	Pin 5:	
	Pin 6:	Grid No. 3
	Pin 7:	Heater
	Short Index Pin:	Internal Connection - Do Not Use.
	Flange - Signal Electrode.	

NOTES:

1. Base-pin positions fit 0.25 inch thick, 9-hole flat plate gage with holes located as follows: 8 holes, 0.0470 (± 0.0005) inch diameter, equally spaced 0.1200 (± 0.0005) inch apart on a circle, 0.3125 (± 0.0005) inch diameter, plus a center hole, 0.187 (± 0.001) inch diameter, concentric with 8-hole circle.

2. All dimensions are shown in inches.

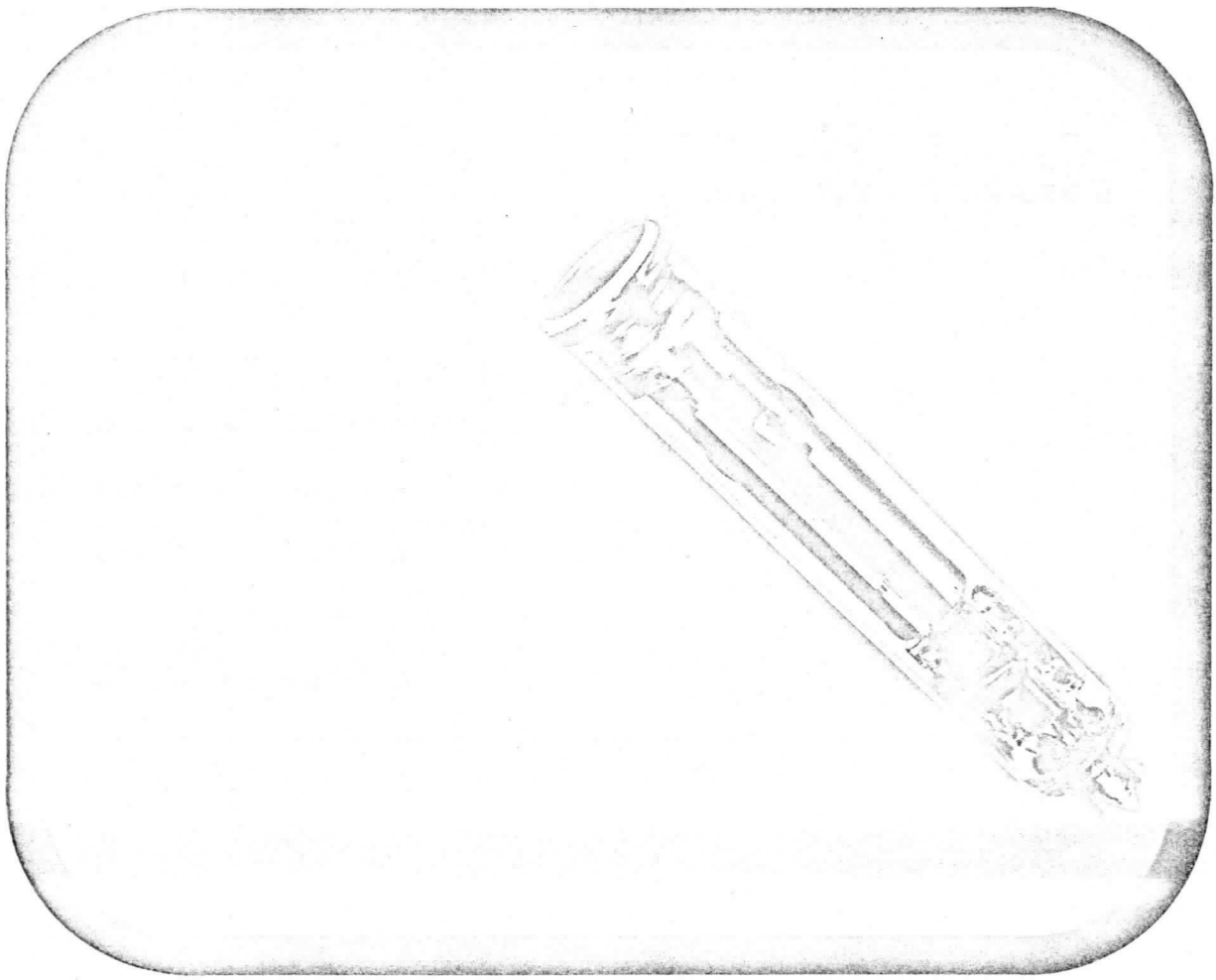
3. Faceplate thickness 0.055 ± 0.001.

4. The socket for this tube can be obtained from GEC.

5. The following coils can be used with this tube supplied by Cleveland Electronics:

Alignment Coil	5 VA362
Deflection Yoke	5HVY361
Focus Coil	5VF225.

GENERAL ELECTRODYNAMICS
TYPES TD 1304-004, TD 1304-005



FEATURES:

Sensitivity Higher than Vidicon or Lead Oxide Tubes . . . 45 mA/W at peak

Extremely Broad Spectral Sensitivity Range Making the Tube Suitable for Visible and Near-Infrared Applications

No Burning of Light-Sensing Surface for High Light Levels (6 x 10⁷ lm/ft²)

APPLICATIONS:

Color capability for Closed-Circuit and Educational Television

Monochrome Closed-Circuit Television

Videophone

Portable Industrial Television Equipment

Hospital Surveillance

Industrial and Military Applications

GENERAL ELECTRODYNAMICS

4430 FOREST LANE, GARLAND, TEXAS 75042

PHONE: (214) 276-1161 / TWX (910) 860-5193 / TELEX 73-2395

TYPES TD 1304-004, TD 1304-005
SILICON-DIODE-ARRAY IMAGE TUBES

Description:

The 1304-004 and 1304-005 Silicon Vidicon tubes are two-thirds-inch (18-millimeter) silicon-diode-array image tubes utilizing scanning electron optics of the all-magnetic separate-mesh type. The light-sensing surface is a single slice of a silicon crystal containing at least 620,000 diodes per square centimeter, with 360,000 diodes within a standard 0.260-inch X 0.346-inch (6.6 mm X 8.8 mm) beam-scanned raster. The use of silicon material as the light-sensing surface provides a spectral response from 0.35 to 1.1 micrometers with low dark current and low image-retention properties.

The 1304-004 and 1304-005 are standard Silicon Diode Array devices for industrial and commercial applications. Versions of both can be provided which have the same performance with additional environmental qualifications for military applications.

electrical data

Heater Voltage, AC or DC	6.3V ± 10%
Heater Current at 6.3V (Nominal)	95 mA
Nominal Direct Interelectrode Capacitance, Target to Other Electrodes (See Note 1)	3 pF
Focusing Method (See Note 2)	magnetic
Deflection Method (See Note 2)	magnetic

optical data

Spectral Response (See Figure 2)	0.35 to 1.1 μm
Target-to-Front-Plate Distance (See Figure 9)	0.070 ± 0.010 in 1.78 ± 0.25 mm
Target-to-Face-Plate Distance (See Figure 9)	0.020 ± 0.007 in 0.51 ± 0.18 mm
Faceplate Thickness (See Figure 9)	0.050 ± 0.003 in 1.27 ± 0.08 mm
Faceplate Index of Refraction at 0.5893 m	1.487

NOTES:

1. This capacitance will increase as the tube is inserted into the focus and deflection coil assemblies.
2. Deflection and focusing alignment coils: Sanyo R-W-1861 or Mullard KV-12 or equivalent.

target

Scanned Area	0.260 in X 0.346 in 6.6 mm X 8.8 mm
Maximum Useful Diagonal	0.435 in 11.05 mm

Orientation of Raster:

Proper orientation of the tube occurs when the horizontal scan axis, defined as the axis through the index (gap in pin circle) and the center axis of the tube, is parallel to the horizontal deflection plane with the index at 9 o'clock when viewed from the rear of the tube.

general mechanical data

Overall Length	3.935 ± 0.035 in 99.95 ± 0.89 mm
Greatest Diameter	0.778 ± 0.005 in 19.76 ± 0.13 mm
Base	7-Pin Miniature Small Button Ditetrar
Bulb	E7-1
Socket	Amphenol 78-7P (See Notes 3 and 4)
Deflection and Focusing Alignment Coils	See Note 5
Weight (approximate)	0.77 oz 21.8 g
Detailed Outline Dimensions	See Figure 9
Operating Position	Any

absolute maximum ratings at 25°C faceplate temperature (unless otherwise noted), see notes 6 and 7

Target Voltage	10V
Grid-4 Voltage	350V
Grid-3 Voltage (See Note 8)	Grid 4 Voltage
Grid-2 Voltage	350V
Grid-1 Voltage	-150V
Heater-Cathode Peak Voltage Range	-125V to 10V
Faceplate Illumination (See Note 9)	6×10^7 Im/ft^2 6×10^8 lux 3×10^7 W/m^2
Operating Temperature Range (See Note 10)	-10°C to 100°C
Storage Temperature Range	-54°C to 200°C

NOTES:

3. Manufactured by Amphenol, 2801 South 25th Ave., Broadview, Illinois 60153.
4. Center hole requires enlargement.
5. For dimensions and approximate position of these coils, see Figure 10.
6. The maximum ratings in the tabulated data are established in accordance with the following definition for rating electron devices: absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.
7. All voltages with the exception of heater voltage are with respect to the cathode when the cathode is unblanked.
8. Grid-3 voltage must be less than grid-4 voltage. The recommended ratio is between 0.8 and 0.9 to 1.
9. Silicon Diode Array image tubes can stand the image of the sun on the light sensing layer without damage.
10. The dark current of silicon-diode arrays doubles with each 10°C increase in array temperature. Consequently, although no damage will occur from operating the tube at 100°C, the obtaining of a usable picture cannot be guaranteed at that temperature.

recommended operating conditions at 25°C faceplate temperature, see note 7

Grid-4 Voltage	350V
Grid-3 Voltage (See Note 8)	300V
Grid-2 Voltage	300V
Grid-1 Voltage for Picture Cutoff	-40 to -75V
Target Voltage	10V
Peak-to-Peak Blanking Voltage:	
Applied to Grid 1	-75V
Applied to Cathode	20V
Field Strength at Center of Focus Coil	55 ± 5 Gauss
Field Strength of Adjustable Alignment Coil	0 to 4 Gauss
Focusing Coil Current	136 mA
Peak-to-Peak Deflecting Coil Alignment Current:	
Horizontal	135 mA
Vertical	20 mA
Tube and Coil Positioning	See Figure 10

operating characteristics at 25°C faceplate temperature and recommended operating conditions

PARAMETER		TEST CONDITIONS	1304-004 MIN	1304-004 TYP	1304-004 MAX	1304-005 MIN	1304-005 TYP	1304-005 MAX	UNIT
Sensitivity *Signal Current*	Monochromatic Light	λ = 0.7 μm	450			450			mA/W
	Unfiltered Light from Tungsten Source	Color temperature = 2854 K, Faceplate illumination = 0.1 lm/ft²		6300 *395*			6300 *395*		μA/lm *nA*
	Visible Light	Color temperature = 2854 K, See Note 11		1180 *74*			1180 *74*		μA/lm *nA*
	Infrared Light	See Note 12		*37*			*37*		*nA*
Dark Current				10			15		nA
Lag	After 33 ms or third field	Signal current = 100 nA		15%			25%		
	After 50 ms or fourth field			10%			20%		
Limiting Resolution		See Note 13	350			325			TV lines
Number of Linear Gray Scale Steps Reproduced on Resolution Chart				10			10		steps
Nonuniformity (See Note 14)				20%			20%		
Transfer Characteristic, γ		Signal current = 4 nA to 500 nA		1.0			1.0		

NOTES:

7. All voltages with the exception of heater voltage are with respect to the cathode when the cathode is unblanked.
8. Grid-3 voltage must be less than grid-4 voltage. The recommended ratio is between 0.8 and 0.9 to 1.
11. With a tungsten light source of the specified color temperature, an infrared-absorbing filter (Schoot KG-3, 5 mm thick, available from Fish Shurman Corp., New Rochelle, N.Y., or equivalent) is interposed between the light source and the tube faceplate. Illumination on the IR filter is 0.1 lm/ft².
12. With a tungsten light source at a color temperature of 2854 K, an infrared-transmitting filter (Corning CS-7-56, available from Corning Glass Works, Corning, N.Y., or equivalent) is interposed between the light source and the tube faceplate. Illumination on the IR filter is 0.1 lm/ft².
13. Resolution is measured with an uncompensated video amplifier with response that is flat within ± 1 dB to 10 MHz. Limiting resolution is defined as the TV-line number at which the amplitude response is 5% of the response at some very low TV-line number. TV-line numbers are determined by the number of equal width black and white lines which will fit into the physical height of the image focused on the camera-tube faceplate. Resolution measurements are made on a 4-by-3 aspect ratio with a 0.435-inch (11.05-mm) diagonal dimension.
14. Nonuniformity is the deviation within the scanned area expressed as a percentage of the peak video signal.

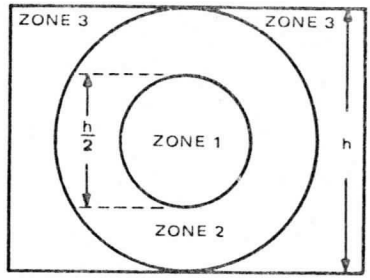
defect definitions

The quality of a silicon-diode-array tube is a function not only of the size and the number of white and black defects which appear on the scanned area, but also of the location of these defects. Three nonoverlapping zones are defined for defect location as shown in Figure 1.

A blemish is defined as a point-type black or white defect within the image that produces a spurious signal that exceeds or equals 10% of an otherwise uniform signal. An area defect within the image produces a spurious signal that exceeds or equals 3% of an otherwise uniform signal.

Blemish and area-type-defect widths are measured in equivalent TV scan lines in a 525-scan-line system, with a raster geometry of 0.260 inch by 0.346 inch (6.6 mm X 8.8 mm) using a uniform signal of 150 nA at a faceplate temperature of 25°C.

The table below shows the maximum number of defects allowed according to size and location for each of the tube types.



DEFECT ZONES
Zone 1 is 15% of area.
Zone 2 is 45% of area.
Zone 3 is 40% of area.
FIGURE 1

TUBE TYPE	DEFECT SIZE	MAXIMUM NUMBER OF DEFECTS		
		ZONE 1	ZONE 2	ZONE 3
TD 1304 -004	1 TV line or less†			
	Over 1 TV line	1	2	2
	Over 4 TV lines	0	1	2
	Over 6 TV lines	0	0	1
	Over 9 TV lines	0	0	0
TD 1304 -005	1 TV line or less†			
	Over 1 TV line	1	3	4
	Over 4 TV lines	0	1	2
	Over 6 TV lines	0	0	1
	Over 9 TV lines	0	0	1
	Over 16 TV lines	0	0	0

†Defects of this size are not counted unless clustered to produce an area-type defect.

TYPICAL CHARACTERISTICS

SPECTRAL RESPONSE CHARACTERISTICS

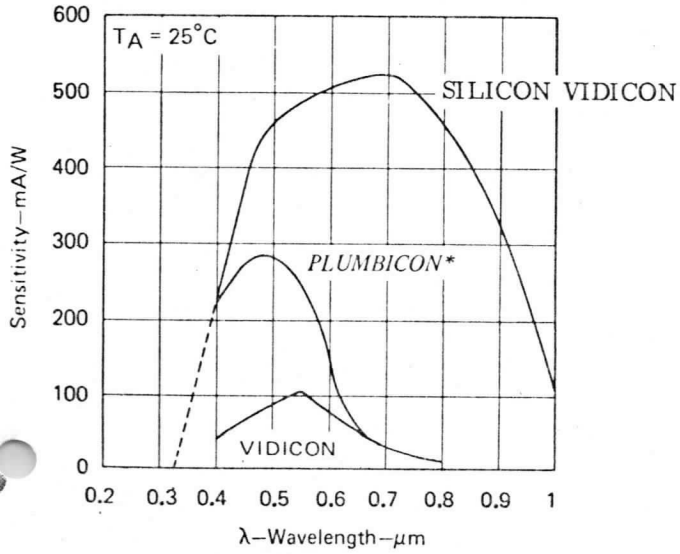


FIGURE 2

*Registered trademark of North American Philips Corporation

SOURCES:

Vidicon curve is from RCA type 4503A data sheet dated 8-68.

Plumbicon curve is from an article entitled "New Plumbicon TV Camera Pickup Tubes" by R.S. Levitt, Ampex Electro-Optics Corp., published in "Society of Motion Picture and Television Engineers," Vol. 79, No. 2, February 1970.

TYPICAL CHARACTERISTICS

1304-004
PERCENT LAG
vs
TARGET VOLTAGE

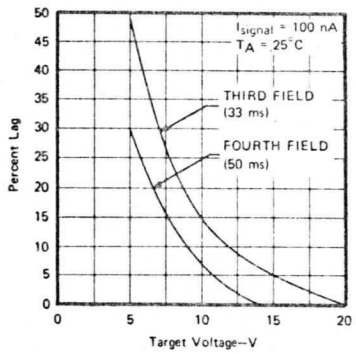


FIGURE 3

1304-005
PERCENT LAG
vs
TARGET VOLTAGE

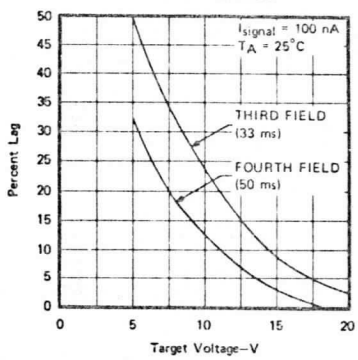


FIGURE 4

PERCENT LAG
vs
TIME

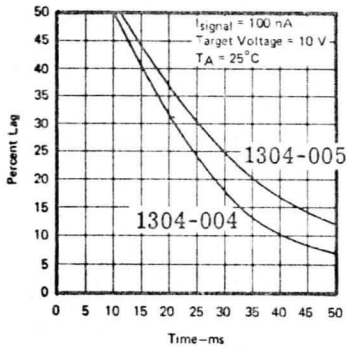


FIGURE 5

DARK CURRENT
vs
TARGET VOLTAGE

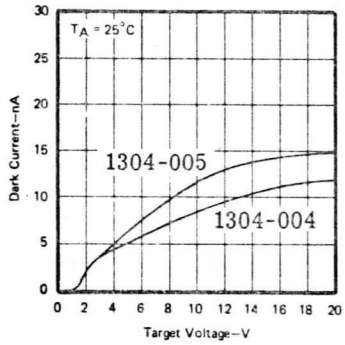


FIGURE 6

SQUARE-WAVE MODULATION
TRANSFER CURVE

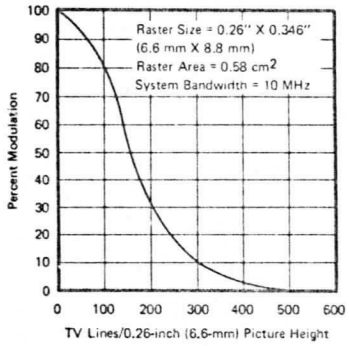


FIGURE 7

LIGHT TRANSFER CURVE

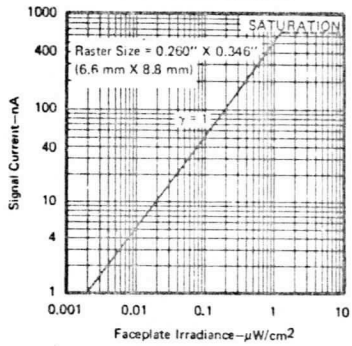
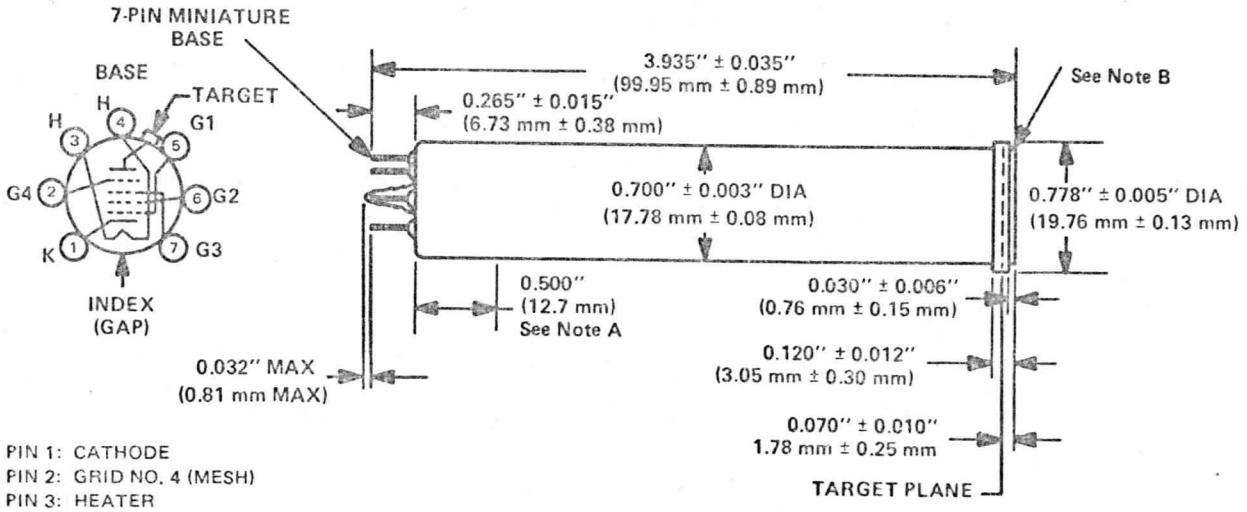


FIGURE 8

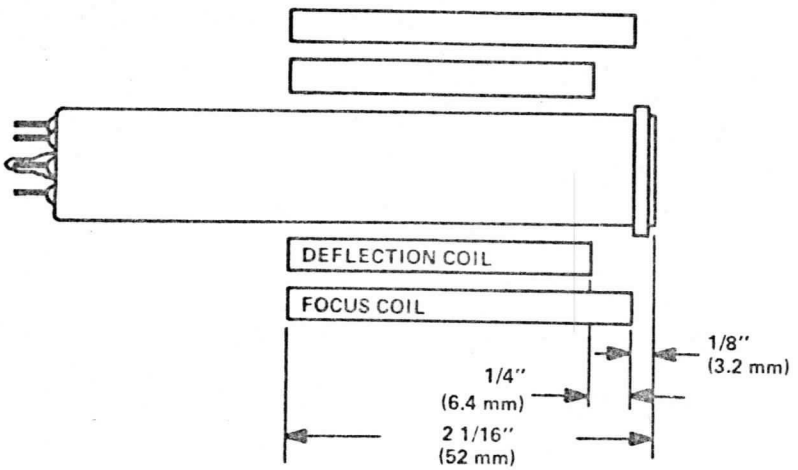
MECHANICAL DATA



PIN 1: CATHODE
PIN 2: GRID NO. 4 (MESH)
PIN 3: HEATER
PIN 4: HEATER
PIN 5: GRID NO. 1 (BEAM)
PIN 6: GRID NO. 2 (ACCELERATOR)
PIN 7: GRID NO. 3 (FOCUS)
FLANGE: SIGNAL ELECTRODE (TARGET)

NOTES: A. Diameter of tube near ends may shrink as required for sealing.
B. Faceplate is Corning type 7056 glass with a thickness of 0.050" ± 0.003" (1.27 mm ± 0.08 mm).

PHYSICAL DIMENSIONS
FIGURE 9



APPROXIMATE COIL LOCATIONS
SANYO R-W-1861 YOKE
FIGURE 10

GENERAL ELECTRODYNAMICS

TD 1305-001 SUPER-RUGGEDIZED VIDICON

ELECTROSTATIC FOCUS AND MAGNETIC DEFLECTION
HALF-INCH DIAMETER

The TD 1305-001 Vidicon is designed for use where rugged environment, power, weight and volume are all of prime consideration. This half-inch tube is capable of withstanding severe shock and vibration, high ambient noise, and the low pressure encountered in space. The 1305-001 employs electrostatic focus, and as a result, the power required is less, and the deflection coils can be smaller and lighter than for fully magnetic half-inch vidicons. At the typical operating voltages given below, the limiting center resolution is 500 lines. This tube is suitable for televising live scenes giving pictures of satisfactory quality with as little as 0.2 foot-candles average illumination on the faceplate.

GENERAL:

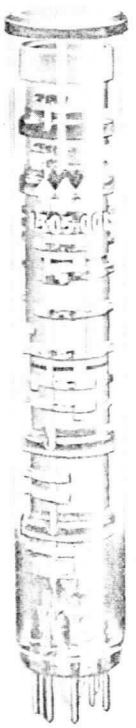
Operating Position	Any
Focusing Method	Electrostatic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.35 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	

ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ± 5%
Current (at 6.3 V)	.17 A ± 10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	2 pf
Spectral Response	S-18

ABSOLUTE MAXIMUM RATINGS:

Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	50 V
Heater Positive with Respect to Cathode	10 V
Short term overload	± 125 V, 1 min. max.
Grid No. 1 Voltage	
Negative Bias Values	200 V
Positive Bias Values	0 V



ABSOLUTE MAXIMUM RATINGS (Continued):

Grids No. 2 and 4 Voltage		750 V
Grid No. 3 Voltage		750 V
Grid No. 5 Voltage		750 V
Signal Electrode Current		.35 ua
Signal Electrode Voltage		50 V
Faceplate		
Illumination		1000 ft-c
Operating Temperature		-10 to + 71° C
Storage Temperature		125° C
Shock		100 g for 11 milliseconds 200 g for 5 milliseconds
Vibration:	Gaussian Noise	20 g RMS, from 10 - 2000 CPS for 20 mins. 60 g RMS, from 10 - 2000 CPS for 5 seconds in vertical plane.
Ambient Acoustical Noise		175 db sound pressure level
Humidity		100%

TYPICAL OPERATION:

Minimum Peak-to-Peak Blanking Voltage	
When applied to Grid No. 1	70 V
When applied to Cathode	30 V
Grid No. 1 Voltage (For picture cut off with no blanking voltage on Grid No. 1)	-45 to -100 V
Grids No. 2 and 4 Voltage	400 V
Grid No. 3 Voltage	60 to 100 V
Grid No. 5 Voltage	600 V
Signal Electrode Voltage	10 to 50 V
Scanned Area	0.28 x 0.21 in.
Faceplate Temperature	30° to 35° C.
Average Gamma of Transfer Characteristic over Signal Output Current Range of .05 to .2 uA	.65
Typical Signal Output Current at .05 ua dark current and 1 foot-candle average faceplate illumination	.15 ua

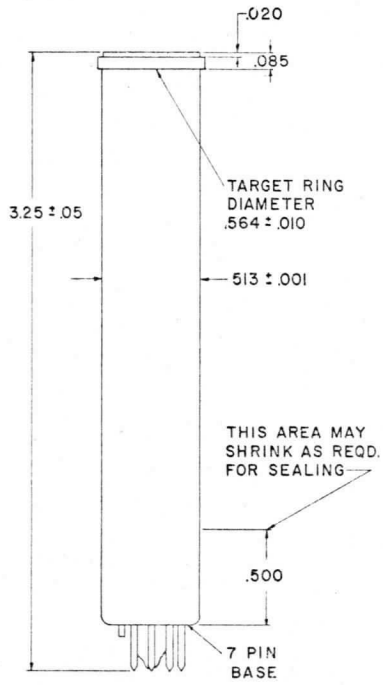
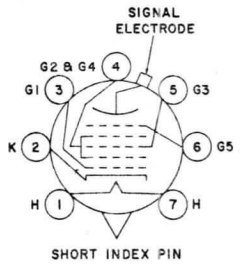


FIG. 1



PIN 1: HEATER
PIN 2: CATHODE
PIN 3: GRID NO. 1
PIN 4: GRIDS NO. 2 & 4
PIN 5: GRID NO. 3
PIN 6: GRID NO. 5
PIN 7: HEATER
SHORT INDEX PIN: INTERNAL CONNECTION --DO NOT USE

FIG. 2 BOTTOM VIEW

NOTES

1. Base-pin positions fit 0.25 inch thick, 9-hole flat plate gage with holes located as follows: 8 holes, 0.0470 (±0.0005) inch diameter, equally spaced 0.1200 (±0.0005) inch apart on a circle, 0.3125 (±0.0005) inch diameter, plus a center hole, 0.187 (±0.001) inch diameter, concentric with 8-hole circle.
2. All dimensions are shown in inches.
3. Faceplate thickness 0.055 ± 0.001.
4. The socket for this tube can be obtained from GEC.
5. The following coils can be used with this tube:
   Alignment Coil 5VA362
   Deflection Yoke 5HVY361

GENERAL ELECTRODYNAMICS

GENERAL ELECTRODYNAMICS CORP.
8430 Forest Lane Garland, Texas 75040
214-276-1161
TWX #901-860-5193 — TELEX #73-2395

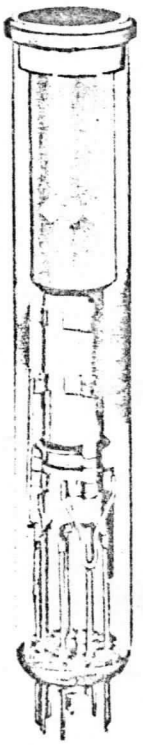
8541
1306-001 VIDICON

MAGNETIC FOCUS AND DEFLECTION SEPARATE MESH

The TD 1306 is a high resolution 1 inch vidicon. It has a separate mesh electrode, permitting higher resolution and improved uniformity of focus. The TD 1306 has been specially designed for televising live scenes giving pictures of satisfactory quality with as little as 0.2 foot-candles of illumination on the faceplate. The improved photoconductive coating features high sensitivity, resistance to burn-in, and excellent uniformity, so that optimum pictures may be obtained by adjustment of the signal electrode voltage without limiting restrictions on the dark current. The 1000-line/inch mesh provides improved uniformity of focus over the scanned area and maintains high resolution and sensitivity at the corners as well as in the center of the faceplate. Patented internal construction allows the tube to be operated in any position and in high ambient noise environments.

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	



ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ±10%
Current	.10 A ±10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 pf
Spectral Response	S-18

ABSOLUTE MAXIMUM RATINGS:

Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V
Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V

ABSOLUTE MAXIMUM RATINGS (Continued):

Grid No. 2 Voltage	1000 V
Grid No. 3 Voltage	1000 V
Grid No. 4 (Mesh) Voltage	1000 V
Faceplate	
Illumination	1000 ft-c
Operating Temperature	71° C
Storage Temperature	125° C
Signal Electrode Current	.60 uA

TYPICAL OPERATION:	Low Voltage	High Voltage
Minimum Blanking Voltage (Peak to Peak)		
When applied to Grid No. 1	30 V	
When applied to Cathode	10 V	
Grid No. 1 Voltage (For signal cut off with no blanking applied)	-45 to -100 V	
Grid No. 2 Voltage	300 V	300 V
Grid No. 3 Voltage	265 V	450 V
Grid No. 4 (Mesh) Voltage	400 V	675 V
Focus Field Strength	40 gauss	50 gauss
Signal Electrode Voltage	15 V to 75 V	
Scanned Area	0.500 x 0.375 in.	
Faceplate Temperature	30° to 35° C	
Average Gamma of Transfer Characteristic over Signal Output Range from .05 to .20 uA	.65	
Typical Signal Output Current at .02 ua dark current and 1 foot-candle faceplate illumination	.2 ua	

For optimum results it is recommended that the mesh voltage (Ec4) be 1.1 to 1.5 times the anode voltage (Ec3). Under no conditions should Ec4 be lower than Ec3

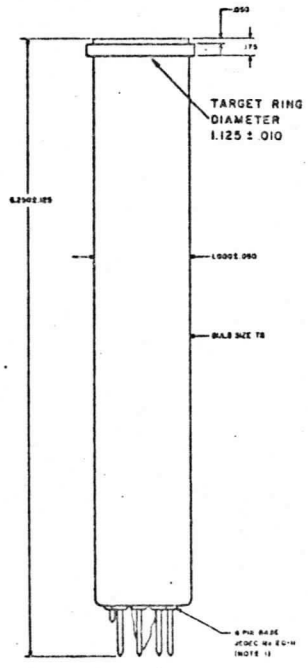


FIG. 1

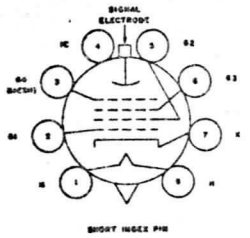


FIG. 2 BOTTOM VIEW

PIN 1: HEATER
PIN 2: GRID No. 1
PIN 3: GRID NO. 4 (MESH)
PIN 4: INTERNAL CONNECTION--DO NOT USE
PIN 5: GRID NO 2
PIN 6: GRID NO 3
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) in. diameter, concentric with 9-hole circle.

2. All dimensions are shown in inches.

GENERAL ELECTRODYNAMICS CORPORATION

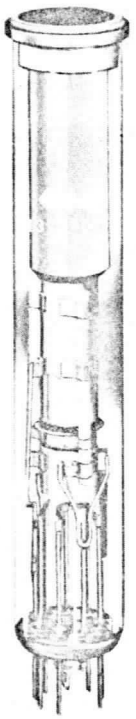
TD 1325-001 VIDICON

MAGNETIC FOCUS AND DEFLECTION

The TD 1325-001 Vidicon has been designed for industrial televising of live scenes, where the low burn-in characteristic of the tube makes it especially useful for observing scenes which may be stationary for extended periods of time. Its photoconductor is ideally suited for pick-up of high contrast information where maximum sensitivity is not required. Excellent lag characteristics make the tube suitable for televising live scenes, giving pictures of satisfactory quality with as little as 0.5 foot-candle average illumination on the faceplate. The 1000-lines/inch mesh provides exceptional uniformity of focus over the entire scanned area, thereby maintaining high resolution and sensitivity at the corners as well as in the center of the faceplate. Patented internal construction allows the tube to be operated in any position and in high ambient noise environments.

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Maximum Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	



ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ±10%
Current (at 6.3 V)	0.60 A ±10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 pf
Spectral Response	S-18

ABSOLUTE MAXIMUM RATINGS:

Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V
Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V

ABSOLUTE MAXIMUM RATINGS (Continued):	
Grid No. 2 Voltage	1000 V
Grid No. 3 Voltage	1000 V
Faceplate	
Illumination	1000 ft-c
Operating Temperature	71° C
Storage Temperature	125° C
Signal Electrode Current	.60 uA

TYPICAL OPERATION:	
Minimum Peak-to-Peak Picture Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Grid No. 1 Voltage (For picture cut off with no blanking voltage on Grid No. 1)	-45 to -100 V
Grid No. 2 Voltage	300 V
Grid No. 3 Voltage	200 to 300 V
Average Gamma of Transfer Characteristic over Signal Output Current operating range of .05 to .2 uA	.65
Scanned Area	0.500 x 0.375 in.
Faceplate Temperature	30° to 35° C.
Typical Signal Output Current at .02 ua dark current and 1 foot-candle average faceplate illumination	.06 ua
Signal Electrode Voltage (for typical signal output current)	15 V to 75 V

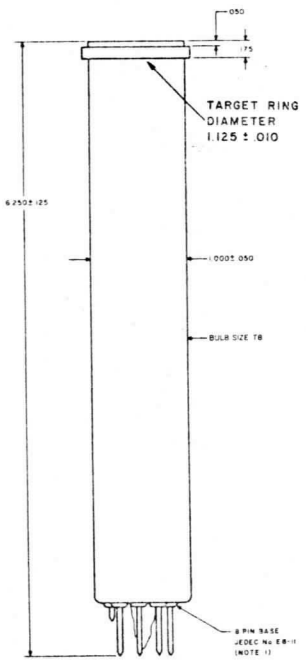


FIG. 1

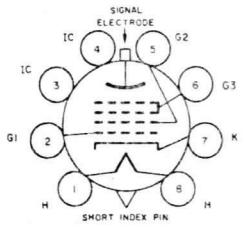


FIG. 2 BOTTOM VIEW

PIN 1: HEATER
PIN 2: GRID No. 1
PIN 3: INTERNAL CONNECTION--DO NOT USE
PIN 4: INTERNAL CONNECTION--DO NOT USE
PIN 5: GRID No. 2
PIN 6: GRID NO. 3
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) in. diameter, concentric with 9-hole circle.

2. All dimensions are shown in inches.

GENERAL ELECTRODYNAMICS CORPORATION

TD 1326 STORAGE VIDICON

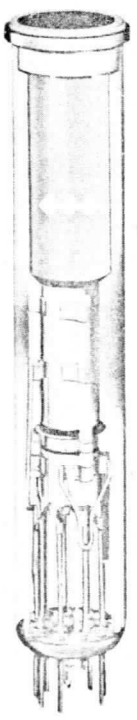
FOR BRIGHT TV DISPLAY FROM SLOWER THAN TV SCANS

The TD 1326 broadcast quality vidicon is designed to provide controllable short term storage and is suitable for such applications as pickup from a radar display tube or slow scan television. Magnetic focus and deflection are used thereby enabling a standard industrial camera to provide a bright screen display on a television monitor. Erasure with special circuits or flood lighting is not required, making an easy adaptation of the camera to the system. The photoconductor used in this vidicon is also available with other vidicon features should they be found necessary in special applications. Some of these are: separate mesh, short envelope, 150 ma filament, hybrid or fully electrostatic focus and deflection. With the patented GEC internal particle shield, the tube may be handled or operated in any position.

DATA

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Maximum Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	



ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ±10%
Current (at 6.3 V)	.60 A ±10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 pf
Spectral Response	S-18

ABSOLUTE MAXIMUM RATINGS:

Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V
Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V
Grid No. 2 Voltage	1000 V

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS
P. O. BOX 798 BROADWAY 6-1161

BULLETIN NO. TD 140 — 11-65

ABSOLUTE MAXIMUM RATINGS (Continued):

Grid No. 3 Voltage	1000 V
Faceplate	
Illumination	200 ft-c
Operating Temperature	71° C
Storage Temperature	125° C
Signal Electrode Current	.60 uA

TYPICAL OPERATION:

Minimum Peak-to-Peak Picture Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Grid No. 1 Voltage (For picture cut off with no blanking voltage on Grid No. 1)	-45 to -100 V
Grid No. 2 Voltage	300 V
Grid No. 3 Voltage	200 to 300 V
*Optimum Signal Output Current	.2 μa
Signal Electrode Voltage	(See Figure 2)
Signal Electrode Voltage (for optimum signal output current (See Figure 2)	12 to 25 V
Decay Characteristic (storage time)	(See Figure 1)
Average Gamma of Transfer Characteristic over Signal Output Current operating range of .05 to .2 uA	.65
Scanned Area	0.500 x 0.375"
Faceplate Temperature	30° to 35° C.
Magnetic Field Intensity at Center of Focusing Device	40 gauss
Magnetic Field Intensity of Adjustable Alignment Coil	0 to 4 gauss

*Signal output current equals signal electrode current minus dark current

OPERATING CONSIDERATIONS:

The retentivity characteristic of the TD 1326 is a function of signal electrode voltage, light level, and exposure time. Figure 1 illustrates the storage characteristic at several different light intensities. In each case, the target voltage was readjusted to bring the signal to the same initial level. The storage characteristic of the 8484 vidicon is shown for comparison.

Generally, it can be said that if the faceplate illumination is decreased and the signal electrode voltage increased to return the signal current to .2 microampere, the storage time will be increased. The tube signal current can be made to decay to the dark current value in from 1/2 to 12 seconds, depending on the light intensity, exposure, and target voltages. With this decay characteristic, the TD 1326 is ideally suited to weather radar pickup. Other decay characteristics are available for special applications requiring them.

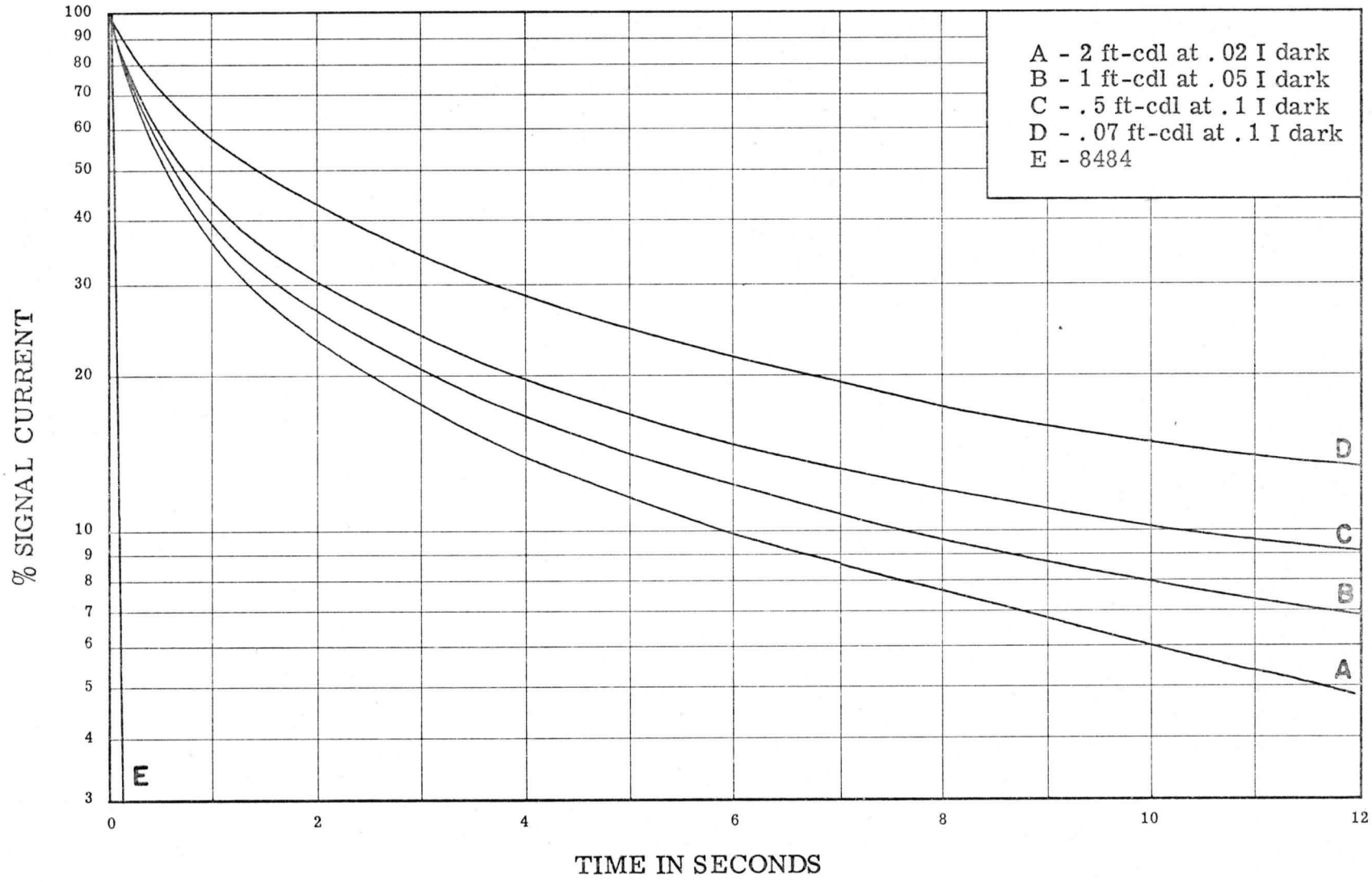


Figure 1. Decay characteristic for four combinations of illumination and target voltage. Except for case D, the initial signal current was approximately 0.2 ua. The 8484 is shown for comparison.

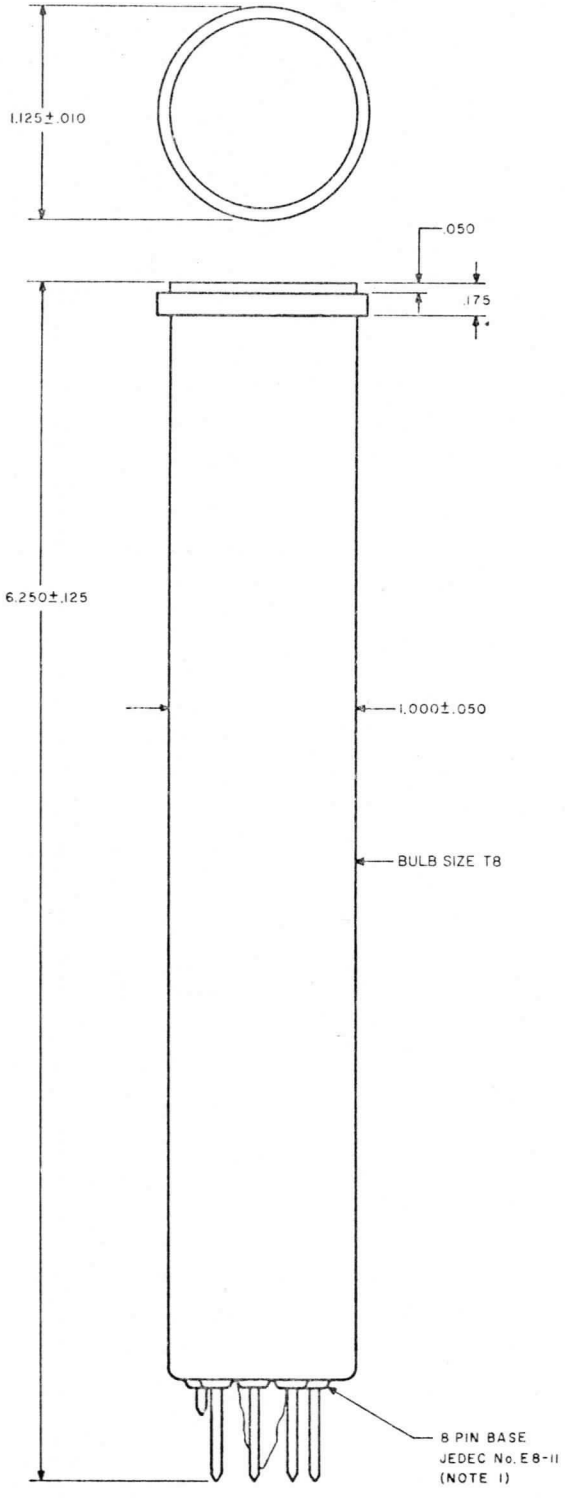


FIG. 2

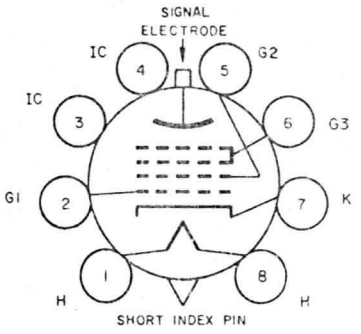


FIG. 3

BOTTOM VIEW

PIN 1: HEATER
PIN 2: GRID No. 1
PIN 3: INTERNAL CONNECTION--DO NOT USE
PIN 4: INTERNAL CONNECTION--DO NOT USE
PIN 5: GRID No. 2
PIN 6: GRID NO. 3
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) in. diameter, concentric with 9-hole circle.

2. All dimensions are shown in inches.

3. Faceplate:

Mechanical Thickness (t)	0.094 + 0.004 - 0.008
Refractive Index (u)	1.484 at 5893 angstroms
Optical Thickness (t/u)	0.063 nominal

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS
P. O. BOX 798 BROADWAY 6-1161

LITHO IN U.S.A.

GENERAL ELECTRODYNAMICS CORPORATION

TD 1339-001 SUPER-RUGGEDIZED VIDICON

ELECTROSTATIC FOCUS, MAGNETIC DEFLECTION

The 1339-001 Super-ruggedized vidicon is designed for use where environment, resolution, power, weight and volume are all major criteria. This tube employs electrostatic focus, and as a result, the deflection power required is less, and the deflection coils can be smaller and lighter than for conventional vidicons. At normal voltages, the limiting center resolution is better than 600 lines, and at higher voltages, the resolution is correspondingly higher. The 1339-001 is suitable for televising live scenes giving pictures of satisfactory quality with as little as 0.2 foot-candles average illumination on the faceplate. The photoconductive coating has excellent uniformity over a wide range of dark currents. Patented internal construction allows the tube to be operated in any position.

Modified versions of this tube are available with slow scan photoconductor, reticle, and black reference mask; consideration can be given to more severe environment and other special requirements.

GENERAL:

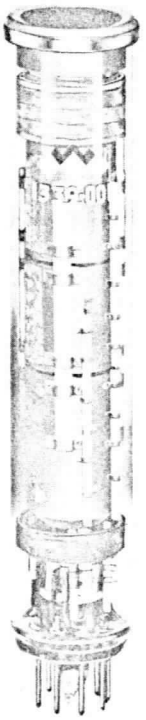
Operating Position	Any
Focusing Method	Electrostatic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	

ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ±10%
Current (at 6.3 V)	.15 A ±10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	4 pf
Spectral Response	S-18

ABSOLUTE MAXIMUM RATINGS:

Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V
Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V



ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS

BULLETIN NO. TD 125 — 9-64

ABSOLUTE MAXIMUM RATINGS (Continued):

Grid No. 2 Voltage		750 V
Grid No. 3 Voltage		1000 V
Grid No. 4 Voltage		1000 V
Grid No. 5 Voltage		1000 V
Faceplate		
Illumination		1000 ft-c
Operating Temperature		71° C
Storage Temperature		125° C
Signal Electrode Current		.60 uA
Signal Electrode Voltage		100 V
Acceleration		30 g
Shock		100 g for 11 milliseconds duration pulse
Vibration	Gaussian Noise:	20 g RMS, from 10-2000 CPS for 5 mins. in each of 3 planes 60 g RMS, from 10-2000 CPS for 5 seconds in lateral planes
Ambient Accoustical Noise		175 db Sound Pressure Level
Altitude		Space

TYPICAL OPERATION:

Minimum Peak-to-Peak Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Grid No. 1 Voltage (For picture cut off with no blanking voltage on Grid No. 1	-45 to -100 V
Grid No. 2 Voltage	300 V
Grid No. 3 Voltage	30 to 60 V
Grid No. 4 Voltage	300 V
Grid No. 5 Voltage	500 V
Signal Electrode Voltage	15 V to 75 V
Scanned Area	0.500 x 0.375 in.
Faceplate Temperature	30° to 35° C.
Average Gamma of Transfer Characteristic over Signal Output Current Range of .05 to .2 uA	.65
Typical Signal Output Current at .02 ua dark current and 1 foot-candle faceplate illumination	.18 ua

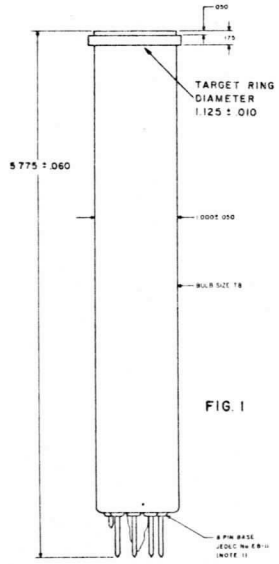


FIG. 1

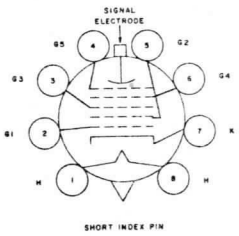


FIG. 2 BOTTOM VIEW

PIN 1: HEATER
PIN 2: GRID No. 1
PIN 3: GRID NO. 3
PIN 4: GRID NO. 5
PIN 5: GRID NO. 2
PIN 6: GRID NO. 4
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

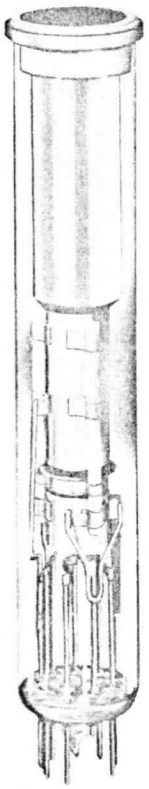
NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001)in. diameter, concentric with 9-hole circle.
2. All dimensions are shown in inches.
3. Faceplate thickness 0.094 + 0.004 - 0.008.
4. Precision-ground glass available on request.

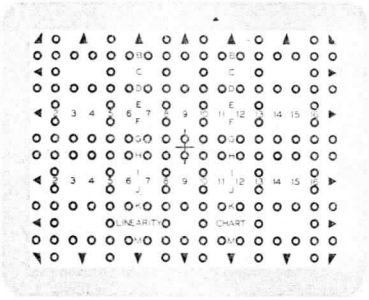
GENERAL ELECTRODYNAMICS

RETICON™

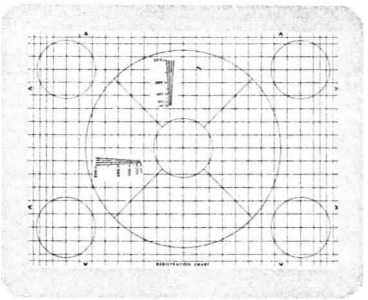
NEW SIMPLIFIED AID FOR TV SYSTEM TESTING



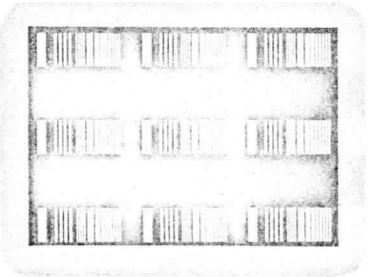
TD 1350



LINEARITY
Pattern-001

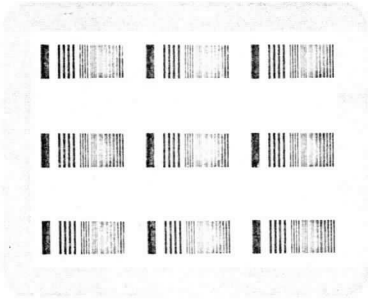


REGISTRATION
Pattern-002

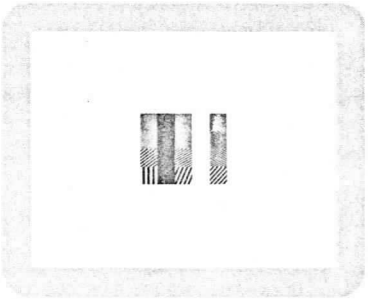


RESOLUTION BURST
Pattern-003

RESOLUTION BURST
Pattern-004



SLANT LINE BURST
Pattern-005



The RETICON is a vidicon with a special reticle for use in making geometric accuracy tests on TV cameras. It generates a test pattern image without requiring optics. The photoconductive coating permits the superimposition of an external test pattern on the internally generated reticle pattern.

The RETICON uses the same photoconductor and electron optics as the GEC type 8484 vidicon which provides satisfactory picture quality with as little as 0.2 foot-candles of faceplate illumination. The photoconductor features high sensitivity, resistance to burn-in and excellent uniformity, so that optimum test conditions can be established.

The RETICON is designated as GEC type TD 1350 and is available with your selection of one of the reticles shown. Other reticles or electron gun structures are available on a custom basis.

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS, GARLAND, TEXAS
P. O. BOX 798 (214) BROADWAY 6-1161

BULLETIN NO. 157—5-67

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	

ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ±10%
Current	.60 A ±10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 pf
Spectral Response	S-18

ABSOLUTE MAXIMUM RATINGS:

Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V
Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V
Grid No. 2 Voltage	1000 V
Grid No. 3 Voltage	1000 V
Faceplate	
Illumination	1000 ft-c
Operating Temperature	71° C
Storage Temperature	125° C
Signal Electrode Current	.60 uA

TYPICAL OPERATION:

Minimum Peak-to-Peak Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Grid No. 1 Voltage (For picture cut off with no blanking voltage on Grid No. 1)	-45 to -100 V
Grid No. 2 Voltage	300 V
Grid No. 3 Voltage	200 to 300 V
Signal Electrode Voltage	
For 5 ft-c faceplate illumination and signal output current of .2 uA	20 to 50 V
For .2 ft-c faceplate illumination and signal output current of .14 uA	40 to 100 V
*Optimum Signal Output Current	
For uniform 2870° K Tungsten Illumination on faceplate down to .5 ft-c	.2 uA
For uniform 2870° K Tungsten Illumination on faceplate from .2 ft-c to .5 ft-c	.14 to .2 uA
Average Gamma of Transfer Characteristic over Signal Output Current operating range of .05 to .2 uA	.65
**Scanned Area	0.500 x 0.375"
Faceplate Temperature	30° to 35° C.
Magnetic Field Intensity at Center of Focusing Device	40 gauss
Magnetic Field Intensity of Adjustable Alignment Coil	0 to 4 gauss

*Signal output current equals signal electrode current minus dark current.

**A scanned area of 0.500 x 0.375" was used to obtain all data and characteristic curves.

GENERAL ELECTRODYNAMICS CORPORATION

GENERAL ELECTRODYNAMICS CORP.
4430 Forest Lane Garland, Texas 75040
214-276-1161
TWX #901-860-5193 — TELEX #73-2395

TD 1355-010 RUGGEDIZED VIDICON

MAGNETIC FOCUS AND DEFLECTION
SEPARATE MESH, 150 MILLIAMP HEATER, SHORT TUBE

The TD 1355-010 is a ruggedized, non-microphonic, short (5-1/8 in.) vidicon with separate mesh. The 1355-010 is capable of withstanding shock impulses of 100 g for 11 milliseconds, and the tube is able to provide usable pictures under conditions of 140 db ambient noise or 10 g sinusoidal vibration. This tube has a 150 mA heater and it is intended primarily for ruggedized applications in transistorized camera equipment where space is restricted and heat dissipation must be kept to a minimum. The 1355-010 has a separate mesh electrode, providing higher resolution, improved uniformity of focus, and flatness of field. It has been specially designed for televising live scenes giving pictures of satisfactory quality with as little as 0.2 foot-candles of illumination on the faceplate. The improved photoconductive coating features high sensitivity, resistance to image burn-in, and excellent uniformity, so that optimum pictures may be obtained by adjustment of the signal electrode voltage without limiting restrictions on the dark current. The patented internal construction permits the tube to be operated in any position and in high ambient noise environments.

GENERAL:

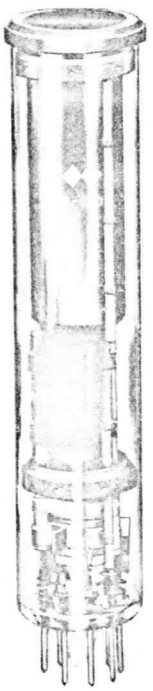
Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	

ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ± 10%
Current (at 6.3 V)	.15 A ± 10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 pf
Spectral Response	S-18

ABSOLUTE MAXIMUM RATINGS:

Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V
Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V



ABSOLUTE MAXIMUM RATINGS (Continued):

Grid No. 2 Voltage	1000 V
Grid No. 3 Voltage	1000 V
Grid No. 4 (Mesh) Voltage	1000 V
Signal Electrode Current	.60 ua

TYPICAL OPERATION:

Minimum Peak-to-Peak Picture Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Grid No. 1 Voltage (For signal cut off with no blanking applied)	-45 to -100 V
Grid No. 2 Voltage (See Note A)	300 V
Grid No. 3 Voltage (See Note E)	400 to 500 V
Grid No. 4 (Mesh) Voltage (See Note F)	675 V
Focus Field Strength	50 gauss
Scanned Area	1/2 x 3/8 inch
Faceplate Temperature	30° to 35° C
Average Gamma of Transfer Characteristic over Signal Output Current Range from .05 to .20 ua	.65
Typical Signal Output Current at .02 ua Dark Current and 1 ft-c average faceplate illumination	.2 ua
Signal Electrode Voltage (For Typical Signal Output Current)	15 to 75 V
Resolution, Limiting, Minimum (See Note B)	
Center	750 TV lines
Corner	600 TV lines
Shading (See Note B)	
Signal (See Note C)	30%
Dark Current (See Note D)	20%

NOTE A: The Grid No. 2 power supply must be capable of delivering up to 2 milliamperes at 300 volts to Grid No. 2.

NOTE B: In order to meet the resolution and shading specifications, the following magnetic components will be used:

Focus Coil	VF-115-4AL*, or equivalent
Deflection Yoke	VYL-160*, or equivalent
Alignment Coil	VA-132*, or equivalent.

*These components are manufactured by Cleveland Electronics, Inc., 1974 East 61st Street, Cleveland, Ohio.

NOTE C: The faceplate is illuminated by uniform white light. Signal shading is measured by adjusting the target voltage and illumination to obtain 0.02 ua dark current and 0.20 ua signal current. The waveform oscilloscope gain is adjusted so that the video output from black to white represents 100 percent. No white area shall have a signal output which departs from the 100 percent level by more than the acceptance limit.

NOTE D: Dark current uniformity is measured at 0.1 uA dark current with no illumination on the faceplate. The scope is adjusted in a manner similar to Note C, above.

NOTE E: Adjust Grid No. 3 voltage for best overall resolution.

NOTE F: Mesh voltage should be between 1.1 and 1.5 times Grid No. 3 voltage. The exact voltage depends on desired picture characteristics.

ENVIRONMENTAL RATINGS:

This tube is capable of withstanding the following conditions:

GENERAL

Faceplate Illumination	1000 ft-c
Temperature (Faceplate)	MIL-E-5272C, Par. 4.14.2, Proc. II
Operating	-40 to + 71° C
Storage	-70 to + 125° C

OPERATIONAL TESTS:

The tube will be operated as under TYPICAL OPERATION, as shown on page 2. Throughout the operational tests, the amplitude of any spurious signals generated by the vidicon must not exceed 80 percent of the maximum white-signal value, and the tube must provide a center resolution of at least 300 TV lines.

Vibration: Sinusoidal: The following vibration cycle shall be applied to the tube in each of the three orthogonal axes, consecutively:

Frequency	Acceleration	Double Amplitude
5 to 28 cps	0.35 to 10 g	0.250 in.
28 to 500 cps	10 g	0.25 to 0.0007 in.

The rate of frequency change shall be logarithmic (with no dwell at resonant frequencies) and shall be such that a complete cycle (5-500-5) will consume approximately 5 minutes.

Vibration: Random: The tube shall be tested for white (Gaussian) noise by subjecting the tube to a vibration with an amplitude of 10g rms for 5 minutes, in each of three orthogonal planes. The noise shall be band-limited between 15 and 1500 cps.

Ambient Noise: 140 db overall sound pressure level, 20 to 2000 cps, for 5 minutes.

Altitude: Space Environment: At some intermediate altitudes, potting of the tube base may be required to prevent corona effects.

NON-OPERATIONAL TESTS:

Shock: These tests are conducted in accordance with MIL-E-5272C, Par. 4.15.4, Proc. IV except that the shocks are increased to an 11 milliseconds time duration and a 100g peak acceleration.

Vibration: Sinusoidal: MIL-E-5272C, Par. 4.7.12, Proc. XII.
A resonance survey is conducted with vibration applied along each axis of any set of three mutually perpendicular axes. Vibration is performed at 10g for a period of 30 minutes at each resonance in each axis, and then cycled between 5 and 500 cps until a total of 3 hours vibration per axis is attained. The cycled vibration is swept logarithmically from 5 to 500 and back to 5 cps during a 15-minute period.

Vibration: Random: White (Gaussian) noise 10g rms band-limited between 5 and 2500 cps for a period of 10 minutes in each of the three orthogonal axes.

Acceleration: MIL-E-5272C, Par. 4.16.1, Proc. I.
An acceleration of 30 g applied for 1 minute in each direction along each of three mutually perpendicular planes.

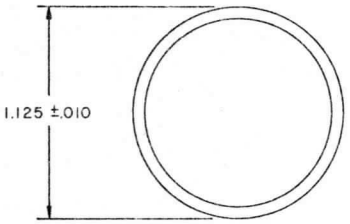


FIG. 1

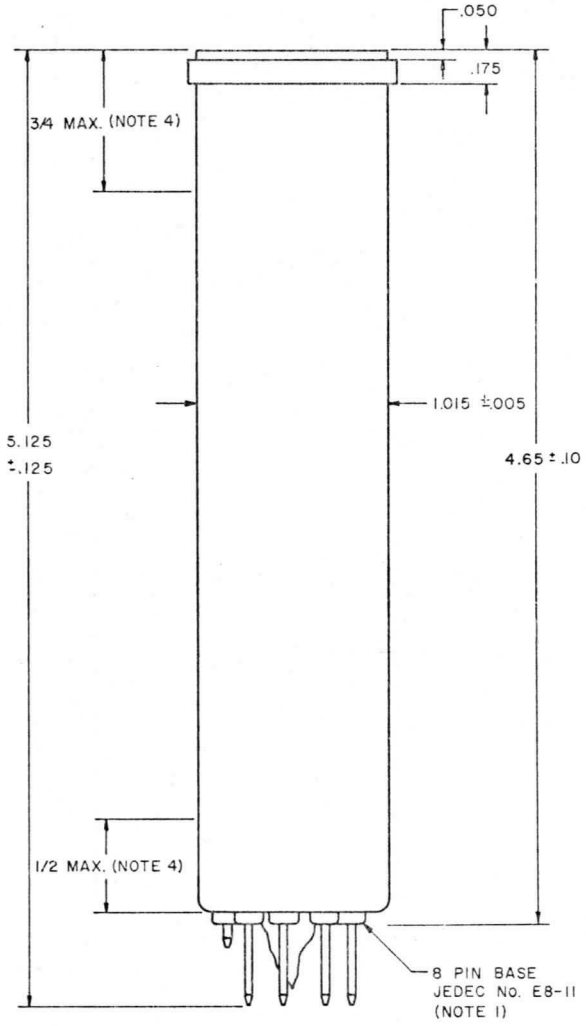
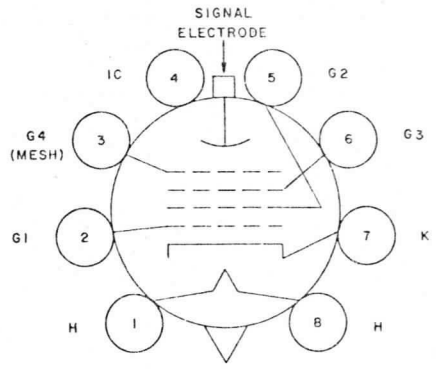


FIG. 2



SHORT INDEX PIN

FIG. 3 BOTTOM VIEW

PIN 1: HEATER
PIN 2: GRID No. 1
PIN 3: GRID NO. 4 (MESH)
PIN 4: INTERNAL CONNECTION--DO NOT USE
PIN 5: GRID NO. 2
PIN 6: GRID NO. 3
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) in. diameter, concentric with 9-hole circle.

2. All dimensions are shown in inches.

3. Faceplate:

Mechanical Thickness (t)	0.094 + 0.004 - 0.008
Refractive Index (u)	1.484 at 5893 angstroms
Optical Thickness (t/u)	0.063 nominal

4. Diameter of tube near ends may shrink as required for sealing.

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS
P. O. BOX 798 BROADWAY 6-1161

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GENERAL ELECTRODYNAMICS CORPORATION

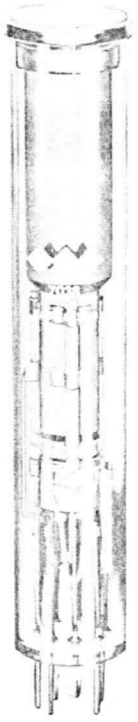
7038 VIDICON

MAGNETIC FOCUS AND DEFLECTION

The 7038 Vidicon is primarily designed for applications, such as film pickup, where rapid motion is to be viewed with a minimum of streaking and blurring. This tube is suitable for televising live scenes, giving pictures of satisfactory quality with as little as 0.5 foot-candles average illumination on the faceplate. The photoconductive coating has excellent uniformity over a wide range of dark currents. The 1000-line/inch mesh provides improved uniformity of focus over the scanned area and maintains high resolution and sensitivity at the corners as well as in the center of the faceplate. Patented internal construction allows the tube to be operated in any position and in high ambient noise environments.

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	



ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ± 10%
Current (at 6.3 V)	.60 A ± 10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 pf
Spectral Response	S-18

ABSOLUTE MAXIMUM RATINGS:

Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V
Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V

ABSOLUTE MAXIMUM RATINGS (Continued):

Grid No. 2 Voltage	1000 V
Grid No. 3 Voltage	1000 V
Faceplate	
Illumination	1000 ft-c
Operating Temperature	71° C
Storage Temperature	125° C
Signal Electrode Current	.60 uA

TYPICAL OPERATION:

Minimum Peak-to-Peak Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Grid No. 1 Voltage (For picture cut off with no blanking voltage on Grid No. 1)	-45 to -100 V
Grid No. 2 Voltage	300 V
Grid No. 3 Voltage	200 to 300 V
Average Gamma of Transfer Characteristic over Signal Output Current operating range of .05 to .2 uA	.65
Scanned Area	0.500 x 0.375 in.
Faceplate Temperature	30° to 35° C.
Typical Signal Output Current at .02 ua dark current and 1 foot-candle faceplate illumination	.08ua
Signal Electrode Voltage	15 V to 75 V

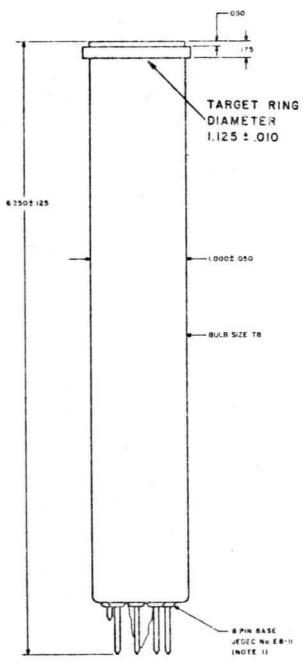


FIG. 1

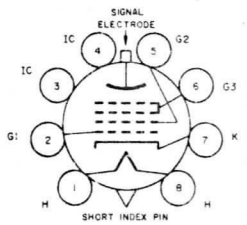


FIG. 2 BOTTOM VIEW

PIN 1: HEATER
PIN 2: GRID No. 1
PIN 3: INTERNAL CONNECTION--DO NOT USE
PIN 4: INTERNAL CONNECTION--DO NOT USE
PIN 5: GRID No. 2
PIN 6: GRID NO. 3
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) in. diameter, concentric with 9-hole circle.
2. All dimensions are shown in inches.
3. Faceplate thickness 0.094 + 0.004 - 0.008.

GENERAL ELECTRODYNAMICS CORPORATION

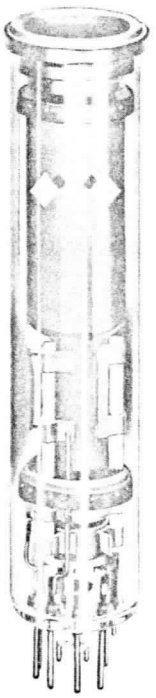
7226A RUGGEDIZED VIDICON

MAGNETIC FOCUS AND DEFLECTION
150 MILLIAMP HEATER, SHORT TUBE

The 7226A is a ruggedized, non-microphonic, short (5-1/8 in.) vidicon. The 7226A is capable of withstanding shock impulses of 100 g for 11 milliseconds, and the tube is able to provide usable pictures under conditions of 140 db ambient noise or 10 g sinusoidal vibration. This tube has a 150 mA heater and it is intended primarily for ruggedized applications in transistorized camera equipment where space is restricted and heat dissipation must be kept to a minimum. It has been specially designed for televising live scenes giving pictures of satisfactory quality with as little as 0.2 foot-candles of illumination on the faceplate. The improved photoconductive coating features high sensitivity, resistance to image burn-in, and excellent uniformity, so that optimum pictures may be obtained by adjustment of the signal electrode voltage without limiting restrictions on the dark current. The patented internal construction permits the tube to be operated in any position and in high ambient noise environments.

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	



ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ± 10%
Current (at 6.3 V)	.15 A ± 10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 pf
Spectral Response	S-18

ABSOLUTE MAXIMUM RATINGS:

Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V
Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS
P. O. BOX 798 BROADWAY 6-1161

BULLETIN NO. TD 145 — 9-65

ABSOLUTE MAXIMUM RATINGS (Continued):

Grid No. 2 Voltage	1000 V
Grid No. 3 Voltage	1000 V
Signal Electrode Current	.60 ua

TYPICAL OPERATION:

Minimum Peak-to-Peak Picture Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Grid No. 1 Voltage (For signal cut off with no blanking applied)	-45 to -100 V
Grid No. 2 Voltage (See Note A)	300 V
Grid No. 3 Voltage	250 to 300 V
Focus Field Strength	40 gauss
Scanned Area	1/2 x 3/8 inch
Faceplate Temperature	30° to 35° C
Average Gamma of Transfer Characteristic over Signal Output Current Range from .05 to .20 ua	.65
Typical Signal Output Current at .02 ua Dark Current and 1 ft-c average faceplate illumination	.2 ua
Signal Electrode Voltage (For Typical Signal Output Current)	15 to 75 V
Resolution, Limiting, Minimum (See Note B)	
Center	650 TV lines
Corner	450 TV lines
Shading (See Note B)	
Signal (See Note C)	35%
Dark Current (See Note D)	25%

NOTE A: The Grid No. 2 power supply must be capable of delivering up to 2 milliamperes at 300 volts to Grid No. 2.

NOTE B: In order to meet the resolution and shading specifications, the following magnetic components will be used:

Focus Coil	VF-115-4AL*, or equivalent
Deflection Yoke	VYL-160*, or equivalent
Alignment Coil	VA-132*, or equivalent.

*These components are manufactured by Cleveland Electronics, Inc., 1974 East 61st Street, Cleveland, Ohio.

NOTE C: The faceplate is illuminated by uniform white light. Signal shading is measured by adjusting the target voltage and illumination to obtain 0.02 ua dark current and 0.20 ua signal current. The waveform oscilloscope gain is adjusted so that the video output from black to white represents 100 percent. No white area shall have a signal output which departs from the 100 percent level by more than the acceptance limit.

NOTE D: Dark current uniformity is measured at 0.1 uA dark current with no illumination on the faceplate. The scope is adjusted in a manner similar to Note C, above.

ENVIRONMENTAL RATINGS:

This tube is capable of withstanding the following conditions:

GENERAL

Faceplate Illumination	1000 ft-c
Temperature (Faceplate)	MIL-E-5272C, Par. 4.14.2, Proc. II
Operating	-40 to + 71° C
Storage	-70 to + 125° C

OPERATIONAL TESTS:

The tube will be operated as under TYPICAL OPERATION, as shown on page 2. Throughout the operational tests, the amplitude of any spurious signals generated by the vidicon must not exceed 80 percent of the maximum white-signal value, and the tube must provide a center resolution of at least 300 TV lines.

Vibration: Sinusoidal:	The following vibration cycle shall be applied to the tube in each of the three orthogonal axes, consecutively:

Frequency	Acceleration	Double Amplitude
5 to 28 cps	0.35 to 10 g	0.250 in.
28 to 500 cps	10 g	0.25 to 0.0007 in.

The rate of frequency change shall be logarithmic (with no dwell at resonant frequencies) and shall be such that a complete cycle (5-500-5) will consume approximately 5 minutes.

Vibration: Random:	The tube shall be tested for white (Gaussian) noise by subjecting the tube to a vibration with an amplitude of 10g rms for 5 minutes, in each of three orthogonal planes. The noise shall be band-limited between 15 and 1500 cps.
Ambient Noise:	140 db overall sound pressure level, 20 to 2000 cps, for 5 minutes.
Altitude:	Space Environment: At some intermediate altitudes, potting of the tube base may be required to prevent corona effects.

NON-OPERATIONAL TESTS:

Shock:	These tests are conducted in accordance with MIL-E-5272C, Par. 4.15.4, Proc. IV except that the shocks are increased to an 11 milliseconds time duration and a 100g peak acceleration.
Vibration: Sinusoidal:	MIL-E-5272C, Par. 4.7.12, Proc. XII. A resonance survey is conducted with vibration applied along each axis of any set of three mutually perpendicular axes. Vibration is performed at 10g for a period of 30 minutes at each resonance in each axis, and then cycled between 5 and 500 cps until a total of 3 hours vibration per axis is attained. The cycled vibration is swept logarithmically from 5 to 500 and back to 5 cps during a 15-minute period.
Vibration: Random:	White (Gaussian) noise 10g rms band-limited between 5 and 2500 cps for a period of 10 minutes in each of the three orthogonal axes.
Acceleration:	MIL-E-5272C, Par. 4.16.1, Proc. I. An acceleration of 30 g applied for 1 minute in each direction along each of three mutually perpendicular planes.

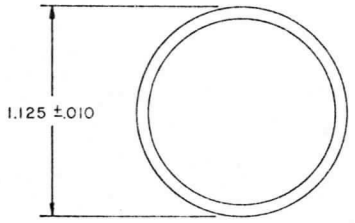


FIG. 1

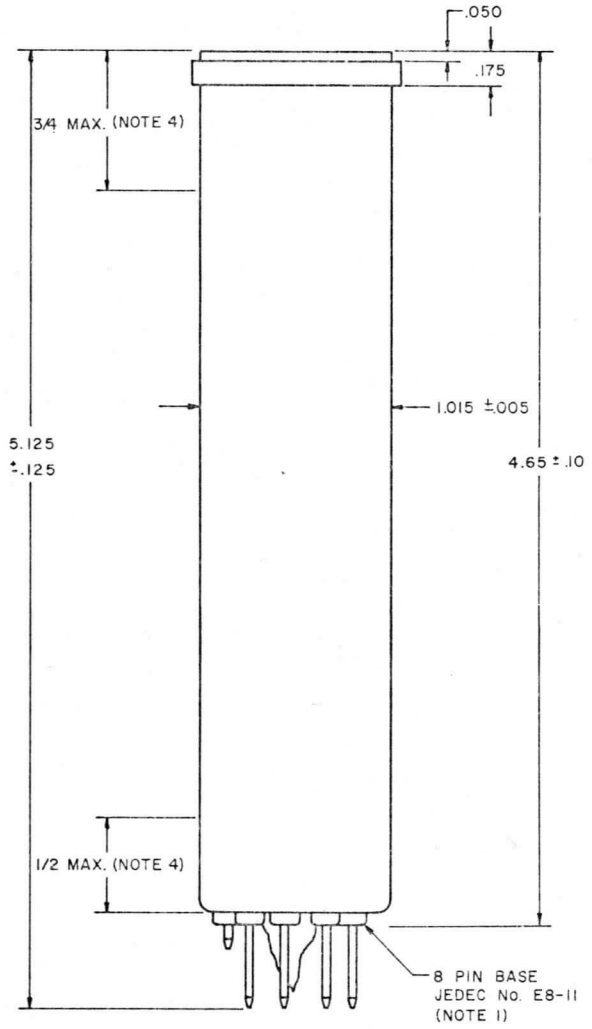


FIG. 2

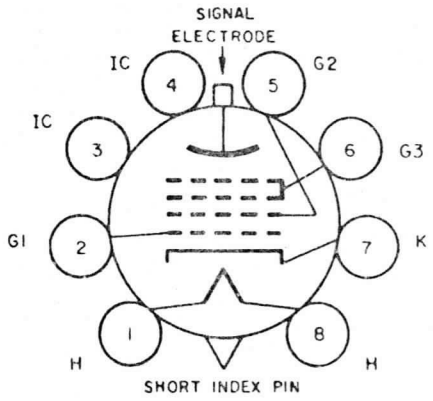


FIG. 3 BOTTOM VIEW

PIN 1: HEATER

PIN 2: GRID No. 1

PIN 3: INTERNAL CONNECTION--DO NOT USE

PIN 4: INTERNAL CONNECTION--DO NOT USE

PIN 5: GRID No. 2

PIN 6: GRID NO. 3

PIN 7: CATHODE

PIN 8: HEATER

FLANGE: SIGNAL ELECTRODE

SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) in. diameter, concentric with 9-hole circle.

2. All dimensions are shown in inches.

3. Faceplate:

Mechanical Thickness (t)	0.094 + 0.004 - 0.008
Refractive Index (u)	1.484 at 5893 angstroms
Optical Thickness (t/u)	0.063 nominal

4. Diameter of tube near ends may shrink as required for sealing.

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS
P. O. BOX 798 BROADWAY 6-1161

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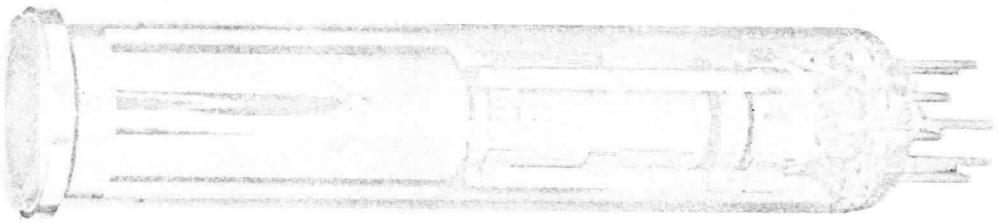
GENERAL ELECTRODYNAMICS
4430 FOREST LANE, GARLAND, TEXAS 75042
PHONE: (214) 276-1161 / TWX (910) 860-5193

7262A VIDICON, SHORT BULB
MAGNETIC FOCUS AND DEFLECTION



The 7262A Vidicon has been specially designed for televising live scenes giving pictures of satisfactory quality with as little as 0.2 foot-candles of illumination on the faceplate. The improved photoconductive coating features high sensitivity, resistance to burn-in, and excellent uniformity, so that optimum pictures may be obtained by adjustment of the signal electrode voltage without limiting restrictions on the dark current. The 7262A features uniformity of focus over the scanned area and high resolution and sensitivity at the corners as well as in the center of the faceplate. Patented internal construction allows the tube to be operated in any position and in high ambient noise environments. The short gun gives the tube some degree of ruggedization.

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Maximum Useful Diagonal of Rectangular Image (4 X 3 Aspect Ratio)	0.625 in.
Orientation of Image .... Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	

ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ± 10%
Current (at 6.3 V)	0.095 ± 10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	4.6 pf
Spectral Response	S-18

ABSOLUTE MAXIMUM RATINGS:

Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V

ABSOLUTE MAXIMUM RATINGS: (Continued)

Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V
Grid No. 2 Voltage	1000 V
Grid No. 3 and Grid No. 4 Voltage	1000 V
Faceplate	
Illumination	1000 Max ft-c
Operating Temperature	71° C
Storage Temperature	125° C
Signal Electrode Current	.60 uA

TYPICAL OPERATION:

Minimum Peak-to-Peak Blanking Voltage	
When applied to Grid No. 1	75 V
When applied to Cathode	20 V
Grid No. 1 Voltage (For picture cut off with no blanking voltage on Grid No. 1)	-45 to -100 V
Grid No. 2 Voltage	300 V
Grid No. 3 Voltage	250 to 300 V
Average Gamma of Transfer Characteristic over Signal Output Current operating range of .05 to .2 uA	.65
Scanned Area	0.500 X 0.375 in.
Faceplate Temperature	30° to 35° C
Typical Signal Output Current at .02 uA dark current and 1 foot-candle faceplate illumination	.2 uA
Signal Electrode Voltage (for typical signal output current)	15 V to 75 V

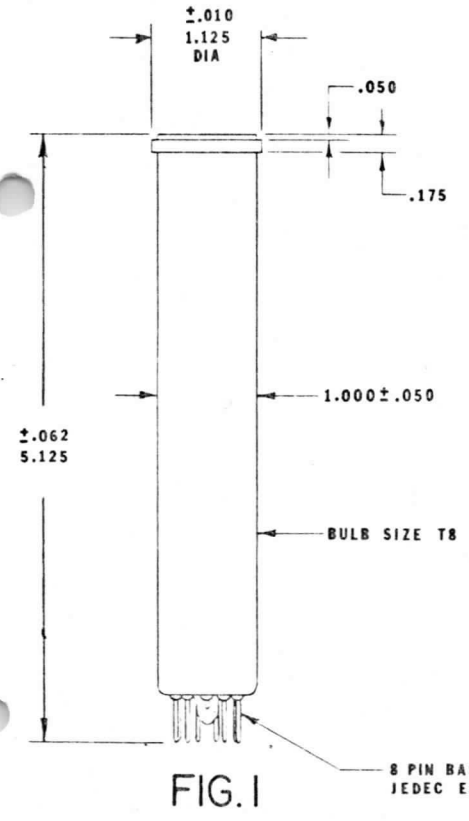
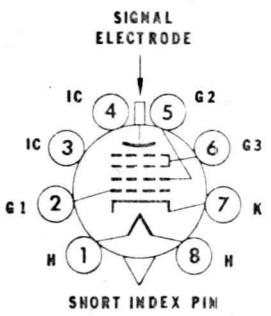


FIG. 1



PIN 1: HEATER
PIN 2: GRID NO. 1
PIN 3: INTERNAL CONNECTION - - DO NOT USE
PIN 4: INTERNAL CONNECTION - - DO NOT USE
PIN 5: GRID NO. 2
PIN 6: GRID NO. 3
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION - - DO NOT USE

FIG. 2 BOTTOM VIEW

NOTES

1. All dimensions are shown in inches.
2. Faceplate:

Mechanical Thickness (t)	0.094 + 0.004 - 0.008
Refractive Index (u)	1.484 at 5893 angstroms
Optical Thickness (t/u)	0.063 nominal

GENERAL ELECTRODYNAMICS CORPORATION

7522 VIDICON

ELECTROSTATIC FOCUS AND DEFLECTION

The 7522 electrostatic focus and deflection vidicon was designed for equipment with a primary requirement for small size and weight and for low power input which can be achieved by the elimination of the magnetic focusing and deflection components. Electrostatic deflection is accomplished with a deflectron, thereby reducing the geometric distortion attributable to the vidicon. Resolution in excess of 600 lines is obtained in the center with high voltage operation. Power requirements and operating voltages are easily supplied with completely transistorized circuits.

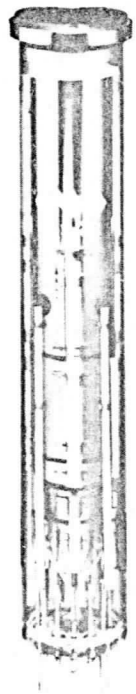
DATA

GENERAL:

Operating Position	Any
Focusing Method	Electrostatic
Deflection Method	Electrostatic
Maximum useful diagonal of rectangular image (4 x 3 aspect ratio)	0.625 in.
Orientation of Image - Horizontal Scan is essentially parallel to a plane passing through pins No. 2 and 9	

ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ± 10%
Current (at 6.3 V)	300 ma ± 10%
Spectral Response	Modified S-18 (FIG. 3)
Direct Interelectrode Capacities	
Signal Electrode to all others	4 pf
D 1 to D 2 (Horizontal Plates)	6 pf
D 3 to D 4 (Vertical Plates)	6 pf



ABSOLUTE MAXIMUM RATINGS:

Heater to Cathode Peak Voltage	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V
Grid No. 1 Voltage	
Negative Bias	300 V
Positive Bias	0 V
Grid No. 2 Voltage	750 V
Grid No. 3 Voltage	1000 V
Grid No. 4 Voltage	1000 V
Grid No. 5 Voltage	1000 V

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS
P. O. BOX 798 BROADWAY 6-1161

BULLETIN NO. TD 113 — 2-66

ABSOLUTE MAXIMUM RATINGS (Continued):	
Faceplate	
Illumination	1000 ft-c
Operating Temperature	71° C
Storage Temperature	125° C
Signal Electrode Current	.60 uA

TYPICAL OPERATION:	Low Voltage	High Voltage
Minimum Peak-to-Peak Blanking Voltage		
When applied to Grid No. 1	30 V	
When applied to Cathode	10 V	
Deflection Voltages (Peak-to-Peak)		
Horizontal (D1 to D2)	60 V	90 V
Vertical (D3 to D4)	50 V	75 V
All Plates DC Voltage	160 to 240 V	250 to 350 V
Grid No. 1 Voltage (For picture cutoff with no blanking voltage on Grid No. 1)	-30 to -70 V	-45 to -100 V
Grids No. 2 and 4 Voltage	200 V	300 V
Grid No. 3 Focus Electrode Voltage	0 to 50 V	30 to 70 V
Grid No. 5 Voltage	300 V	500 V
Signal Electrode Voltage (for typical signal output current)	20 to 100 V	
Typical Signal Output Current at .02 ua dark current and 1 ft-candle average faceplate illumination	.18 ua	
Average Gamma of Transfer Characteristic over Signal Output Current Range of .05 to 0.2 uA	.65	
Scanned Area	0.500 x 0.375 in.	
Faceplate Temperature	30° to 35° C	

PRINCIPLES OF OPERATION

Electrostatic deflection in the 7522 is acccomplished through the use of a specially designed deflection electrode configuration called the Deflectron. A photograph of the Deflectron is shown in Figure 1. The conventional crossed pair of deflection plates causes the electron beam to be deflected sequentially; that is, in passing between the first set of plates it is deflected in one plane and when reaching the second set of plates it is deflected in the other plane. The Deflectron causes the beam to be deflected both horizontally and vertically simultaneously as in magnetic deflection. This common center of deflection reduces defocusing caused by dissimilar horizontal and vertical scanning angles.

Astigmatism, coma, key-stoning, and other abberations found in conventional deflection plate scanning are also reduced. In a GEC Deflectron, quadrature is as good as that obtained in the best magnetic deflection yokes. The Deflectron gives considerable freedom in selection of scanning formats. Horizontal and vertical deflection may be interchanged as identical circuits can be used to drive either one.

Physically the Deflectron is a cone of insulating material, the inside of which contains the deflection electrode pattern. The pattern of the Deflectron is illustrated laid out on a flat plane in Figure 2. If the pattern is rolled to connect Side A to Side B, four individual deflection plates can be traced.

This type of vidicon is readily adaptable to various unconventional scanning modes such as spiral scan or radial scan. Digital scanning can also be employed. The aspect ratio of rectangular scanned areas may be varied as desired. In the standard orientation for linear scanning, horizontal scan lines are essentially parallel to a plane passing through base pins Nos. 2 and 9, but other orientations may be used if desired.

FIG. 1

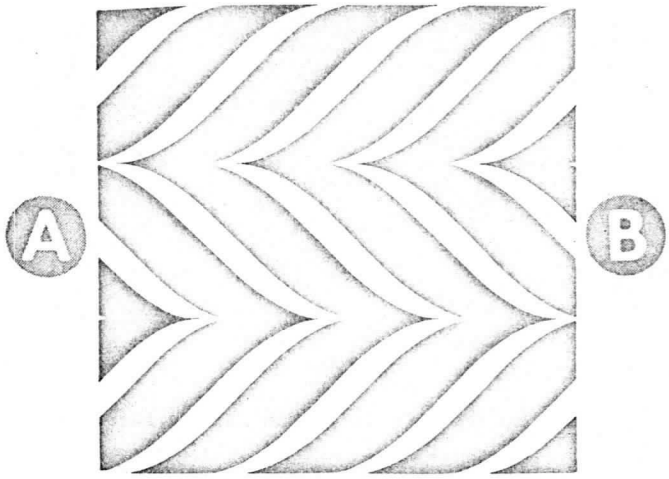


FIG. 2

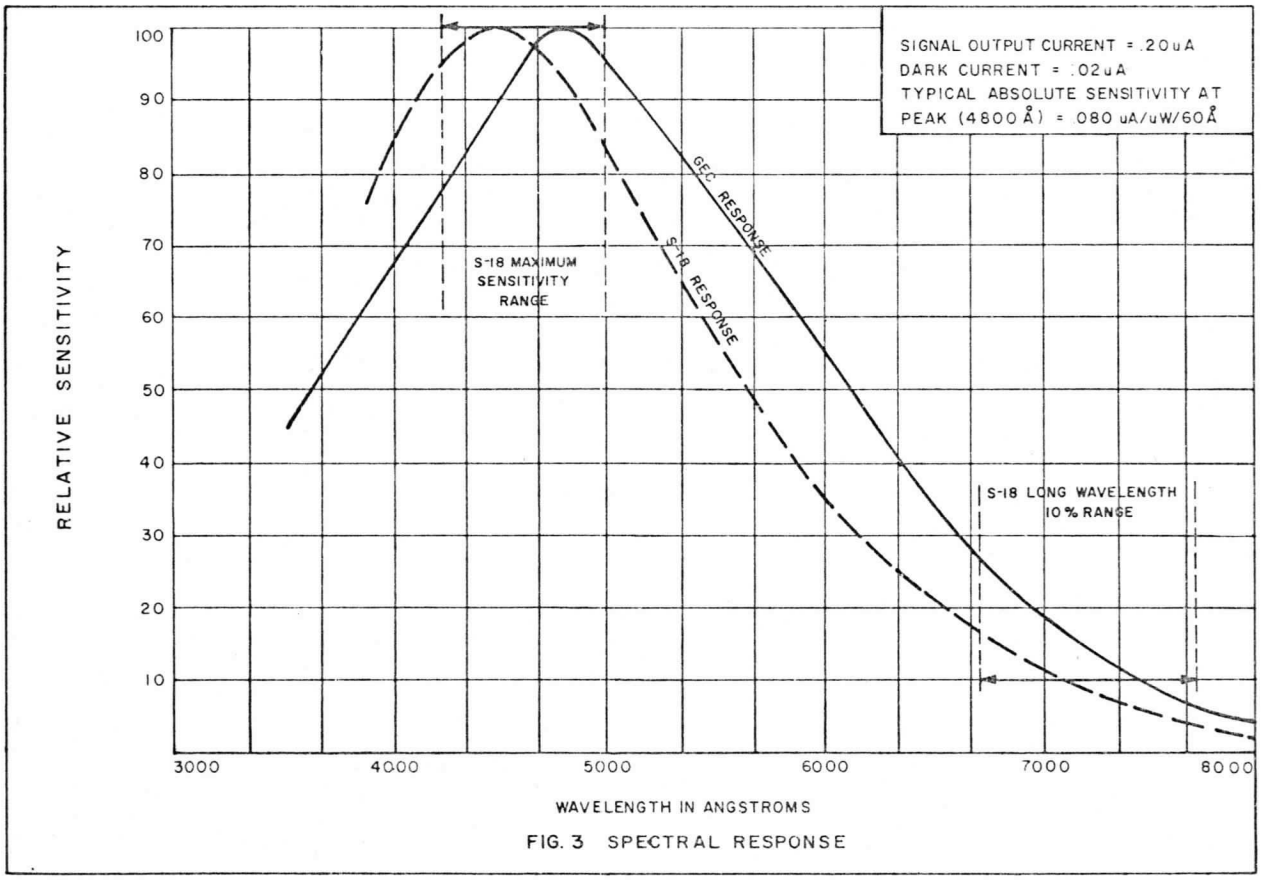
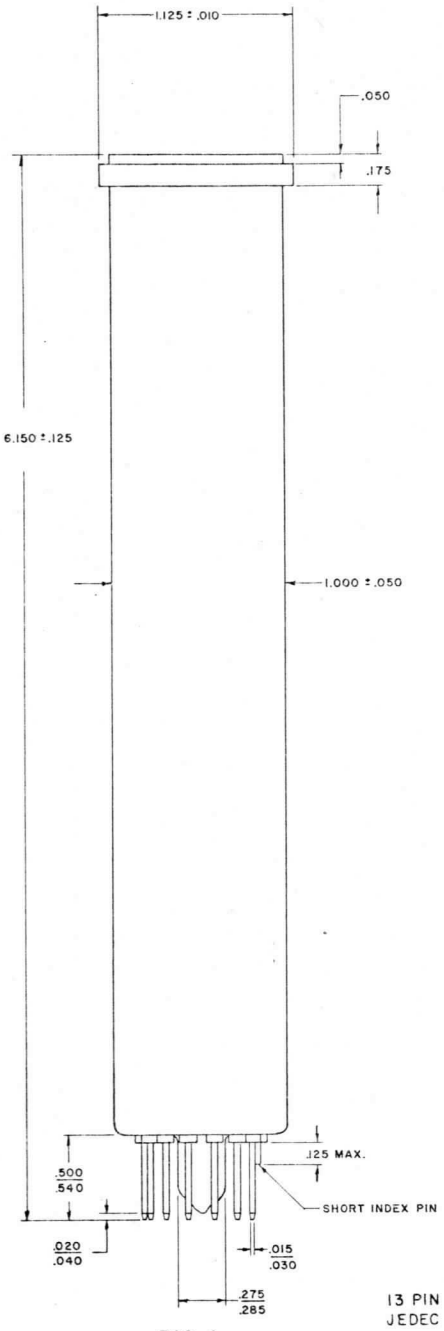


FIG. 3 SPECTRAL RESPONSE



13 PIN BASE
JEDEC NO. 13B
(NOTE 1)

FIG. 4

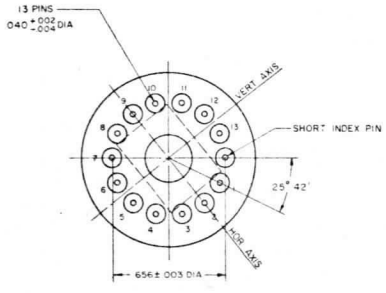
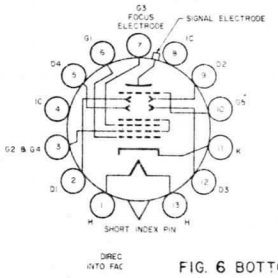


FIG. 5



PIN 1	HEATER
PIN 2	D1 HORIZONTAL DEFLECTION PLATE
PIN 3	GRID NO 2 & 4
PIN 4	INTERNAL CONNECTION--DO NOT USE
PIN 5	D4 VERTICAL DEFLECTION PLATE
PIN 6	GRID NO 1
PIN 7	G3 FOCUS ELECTRODE
PIN 8	INTERNAL CONNECTION--DO NOT USE
PIN 9	D2 HORIZONTAL DEFLECTION PLATE
PIN 10	GRID NO 5
PIN 11	CATHODE
PIN 12	D3 VERTICAL DEFLECTION PLATE
PIN 13	HEATER
SHORT INDEX PIN	INTERNAL CONNECTION--DO NOT USE
FLANGE	SIGNAL ELECTRODE

FIG. 6 BOTTOM VIEW

NOTES

1. Base-pin positions fit 0.25 inch thick, 15-hole flat plate gage with holes located as follows: 14 holes, 0.0470 (±0.0005) inch diameter, equally spaced, 0.2510 (±0.0005) inch apart on a circle, 0.6560 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) inch diameter, concentric with 14-hole circle.

2. All dimensions are shown in inches.

3. Faceplate:

Mechanical Thickness (t)	0.094 + 0.004 - 0.008
Refractive Index (u)	1.484 at 5893 angstroms
Optical Thickness (t/u)	0.063 nominal

4. The socket for this tube can be obtained from GEC. Specify part number SB-5201-001.

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS
P. O. BOX 798 BROADWAY 5-1161

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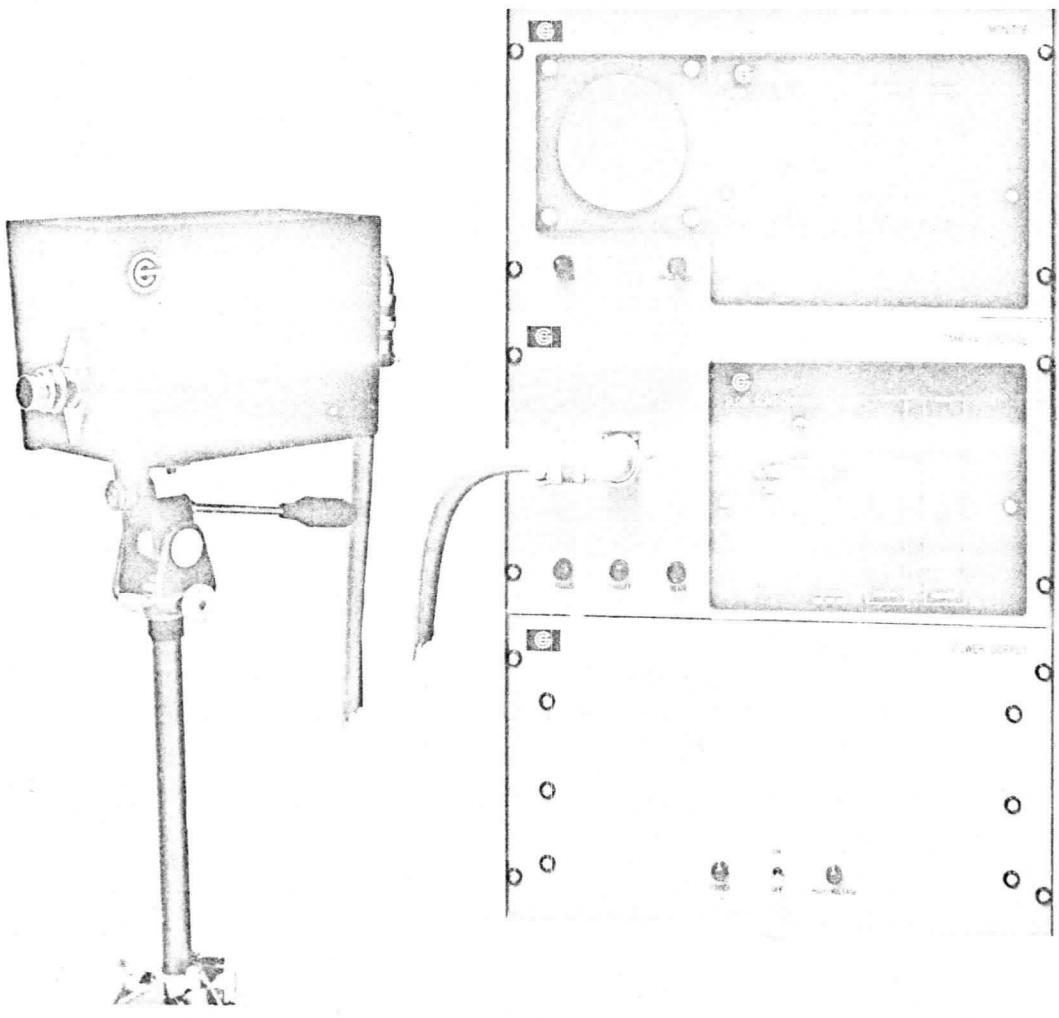
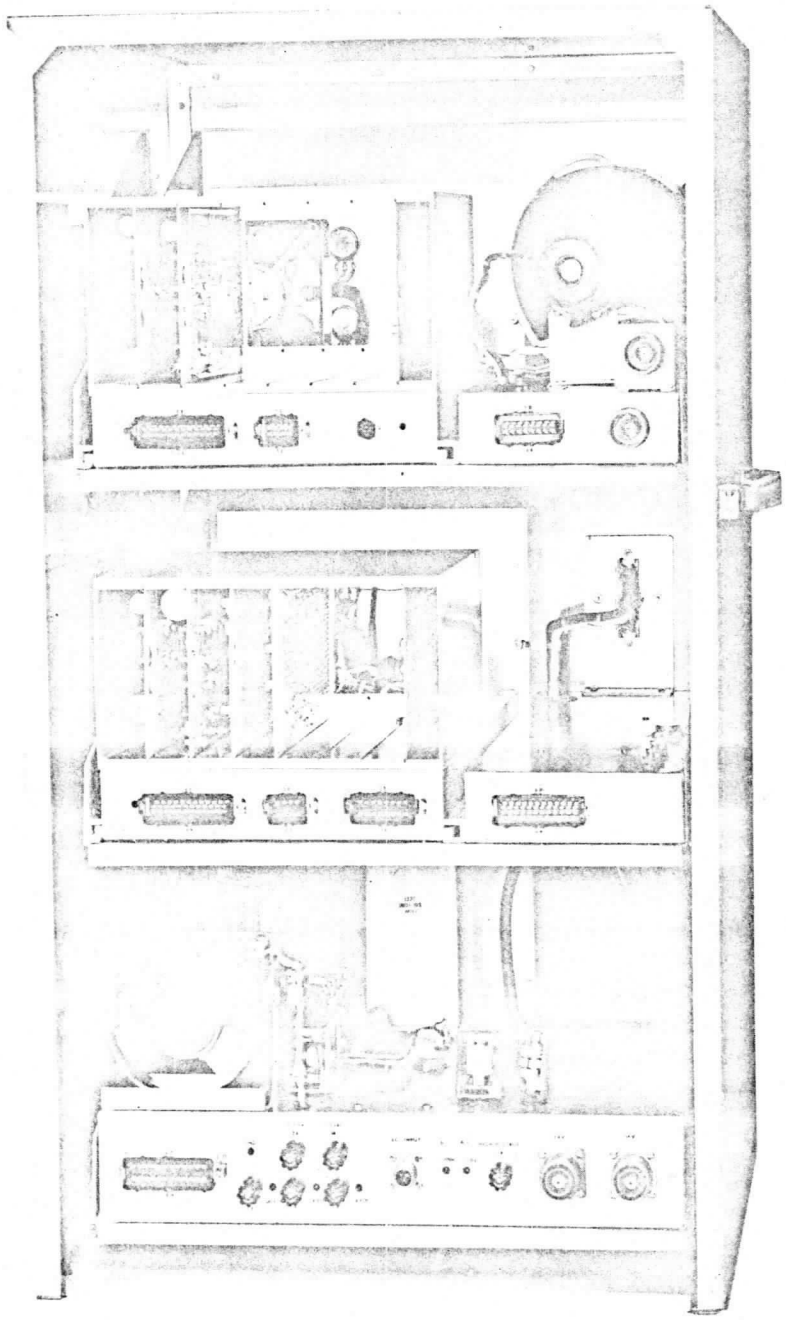
GENERAL ELECTRODYNAMICS

ED 6030B TRANSISTORIZED TELEVISION SYSTEM

VARIABLE SLOW SCAN



BULLETIN NO. ED 604

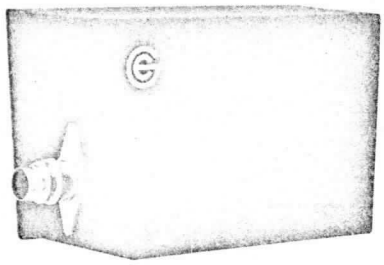


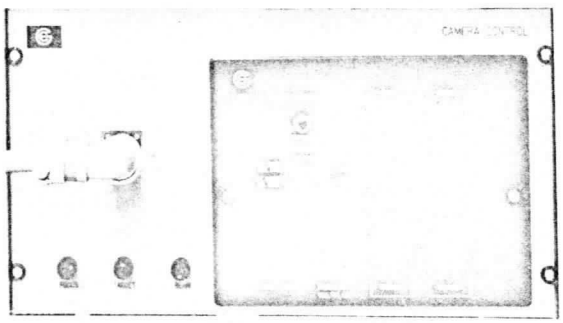
The ED 6030-B features solid construction with plug-in printed circuit boards to assure easy access. Rigid unitized mechanical assembly with standard components provides maximum reliability. System weight—less than 100 lbs.

The ED 6030-B is a complete variable scan television system consisting of camera head, camera control, monitor and power supply. The system is transistorized, providing small size and weight with minimum power consumption and maximum reliability. It is contained in a cabinet approximately 20 x 19 x 35 inches in height with easily accessible internal layout. Weight of the entire system is less than 100 pounds. Operating on single phase 105 - 125 V 58 - 62 cycle AC, the system consumes only 150 watts.

CAMERA HEAD

The lens, vidicon, deflection components and preamplifier are contained in the camera head. The head may be operated at distances up to 25 feet from the cabinet. The camera uses a rugged GEC vidicon tube which may be shipped, stored or operated in any position without special precautions. A 25mm f/1.9 lens is supplied with the camera. A keyed clamp circuit is used to obtain excellent frequency response.

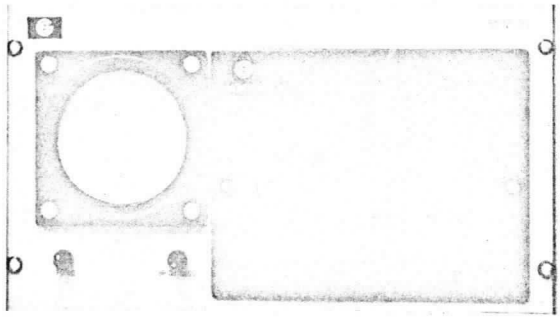




CONTROL CHASSIS

The control chassis contains a plug-in slow scan module which houses control circuits in printed circuit board form. The control chassis contains all the circuits necessary for operation of the vidicon. This unit provides continuously variable control of the scanning frequency from .02 frames per second up to 2 frames per second. Line frequency is continuously variable from 10 cycles per second up to 1000 cycles per second. A "one shot" feature is included which allows only one frame to be scanned when the panel mounted push button is actuated or an external pulse applied. Transistorized sweep generators provide continuously variable frequency sawtooth waveforms for driving the line and frame sweep amplifier as well as for external use. They may be synchronized internally or externally. Sweep amplifiers, also transistorized, supply the power gain necessary to drive the magnetic deflection yoke of the vidicon. Excellent linearity is assured by negative current feedback around the amplifier, and amplifiers are DC coupled to maintain linearity at slow sweep speeds. Temperature stabilization is incorporated. Video performance includes a resolution of 600 lines and 9 scales of gray. Video signals are supplied at 1 volt from a 75 ohm impedance. The system operates with a standard 4 volt sync pulse.

MONITOR



The monitor, provided as part of the system, is designed around the 5 CK high resolution cathode ray tube with a P12 long decay time phosphor. Other phosphors are available on special request. The monitor chassis consists of a cathode ray tube assembly and plug-in monitor control module. The monitor control module contains the circuits necessary for driving the monitor tube. The amplifiers which drive the monitor tube are DC coupled and similar in design to those which drive the vidicon. A high level DC coupled video amplifier provides sufficient gain to fully modulate the CRT. The high resolution flat face cathode ray tube is protected from stray fields by a magnetic shield. Provisions are made to mount a polaroid camera. A shutter control circuit is included to provide a contact closure during the frame sweep period for external camera synchronization.

POWER SUPPLY

The power supply provides all regulated voltages for the complete system in addition to the high voltage for the CRT.

FEATURES

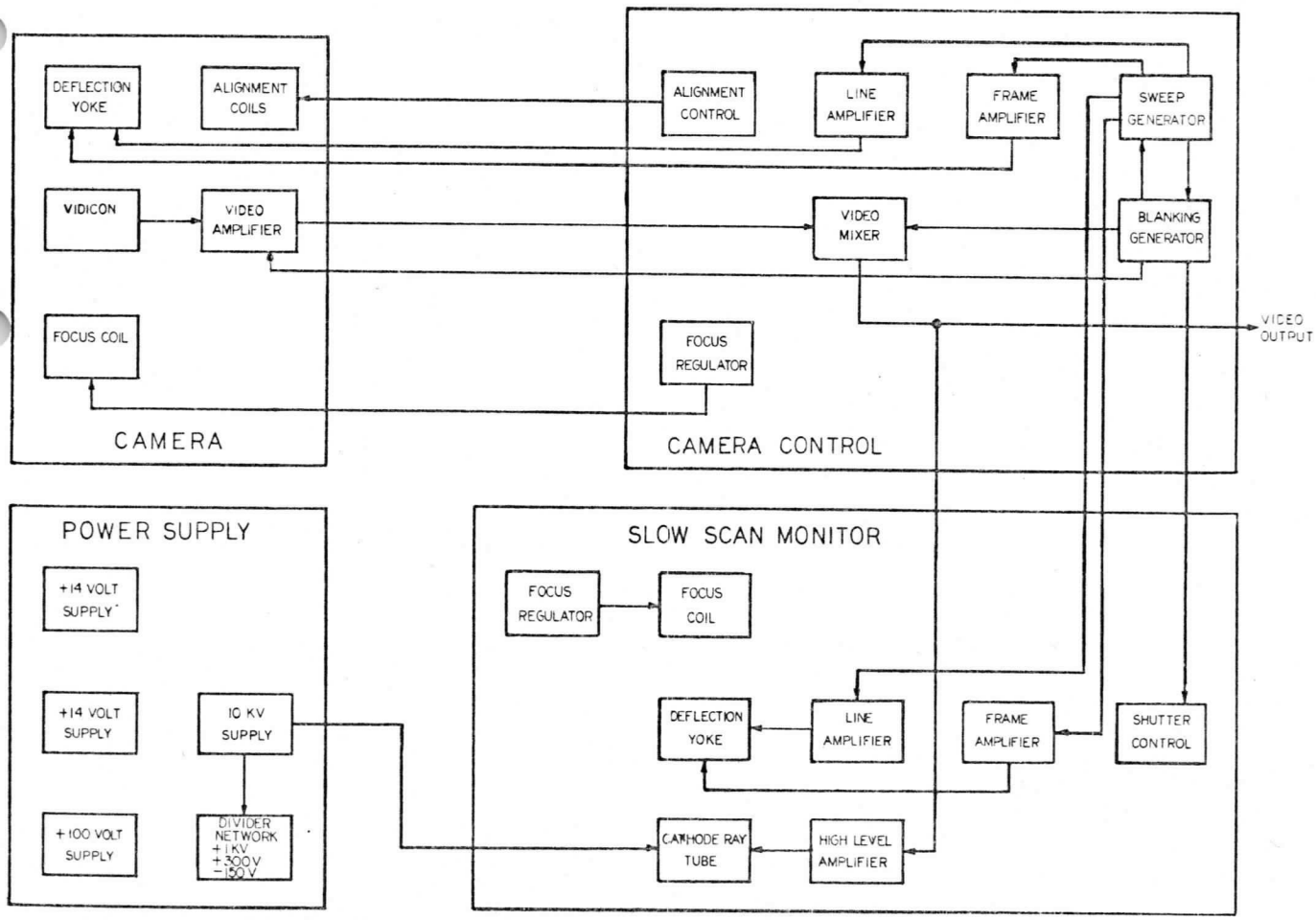
Fully magnetic Vidicon Tube
Sampling of yoke current assures vidicon protection from sweep failure.
Plug-in printed circuits
Solid state system

OPTIONAL ACCESSORIES

Electronically actuated shutter
Remote monitor
Recording film camera
Scan converter
Disc recorder storage

SPECIFICATIONS

Input Voltage	105-125 VAC/58 to 62 cps
Power Consumption	150 watts
Deflection Generators	
Line	
Frequency (Two Ranges)	10 to 1000 cps
Input Sweep Sensitivity	2 volts P-P
Sweep Voltage Output	2 volts P-P
Input Sync	4 volts negative
Output Sync	4 volts negative
Frame	
Frequency (Two Ranges)	.02 to 2 cps
Input Sweep Sensitivity	2 volts P-P
Sweep Voltage Output	2 volts P-P
Input Sync	4 volts negative
Output Sync	4 volts negative
Blanking Generator	
Output	± 10 volts (blanking negative)
Video	
Frequency Response	Essentially DC to 1 MC
Output Amplitude	1.0 volt nominal (white positive)
Resolution	600 lines
Number of Gray Scales	Nine
Cathode Ray Tube	5CKP12
Lens	Wollensak f/1.9 25mm F.L.



GENERAL ELECTRODYNAMICS

ED 6038 A

TV INSTRUMENTATION CAMERA

MINIATURE

RUGGED

VERSATILE

BULLETIN NO. 6038A

MINIATURE

Three actual size photographs on succeeding pages tell how small the camera really is. What they cannot tell is that the ED 6038 A camera head weighs only 14 ounces and the ED 6038 A-1 camera head weight is 48 ounces. The control unit has a depth of 6½ inches and weighs 8¼ pounds.

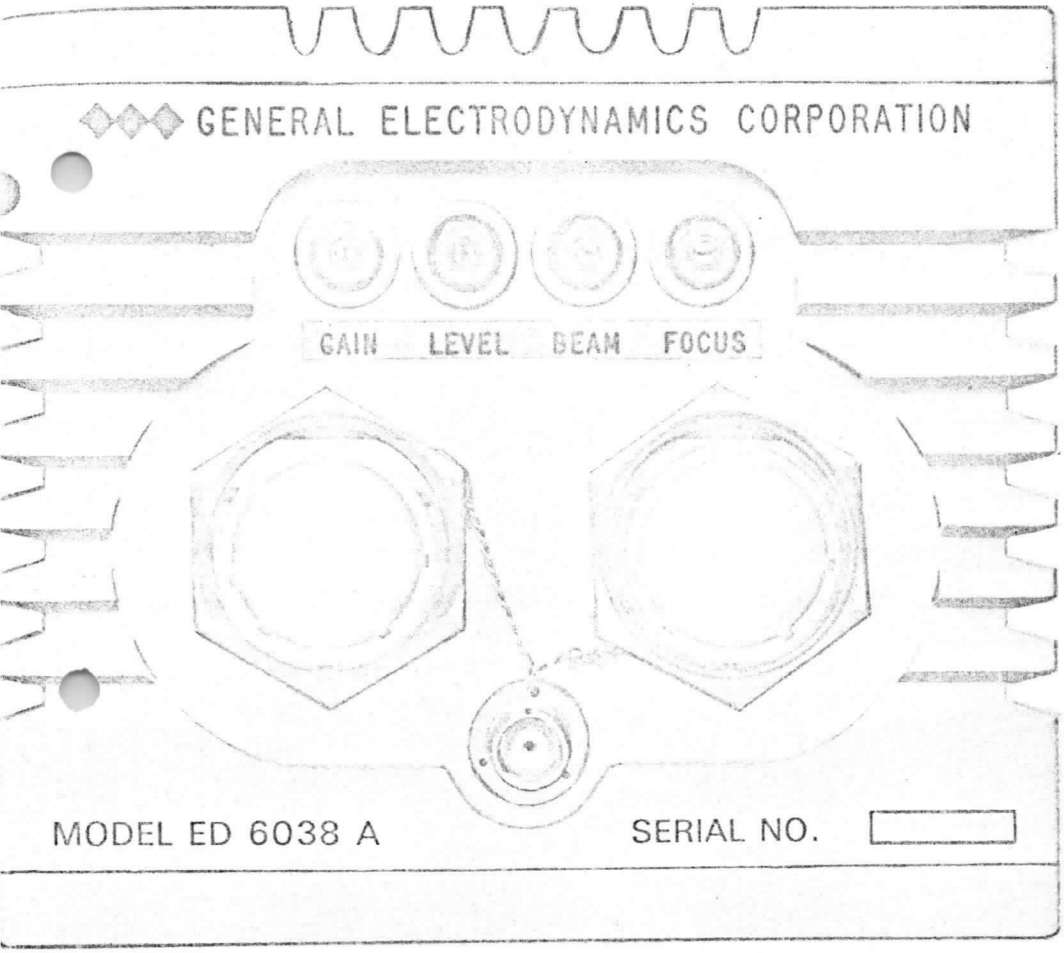
RUGGED

Look at the environment in which this camera will operate:

Vibration	20 cps — 2 kc random distribution 20 G's RMS in each of three axes 60 G's RMS for three seconds, in each of three axes
Shock	100 G's for 11 ms
Temperature	–10°C to +71°C, Operating
Relative Humidity	100%
Explosive atmosphere	
Ambient acoustical noise	More than 175 db overall sound pressure level
Altitude	Space Environment

VERSATILE

General Electrodynamics Corporation's total electro-optical capability enables it to quickly engineer most application requirements where instrumentation television is indicated. Our Electronic Tube Division supplies the "eye" for this camera. All you have to tell us is what the "eye" must see.



(ACTUAL SIZE)

UP TO
WITH R
AND NO L

UP
TO
150
feet

COMPLETELY
INTERCHANGEABLE
ONLY NECESSITATES SWEEP
ADJUSTMENT IN CONTROL BOX

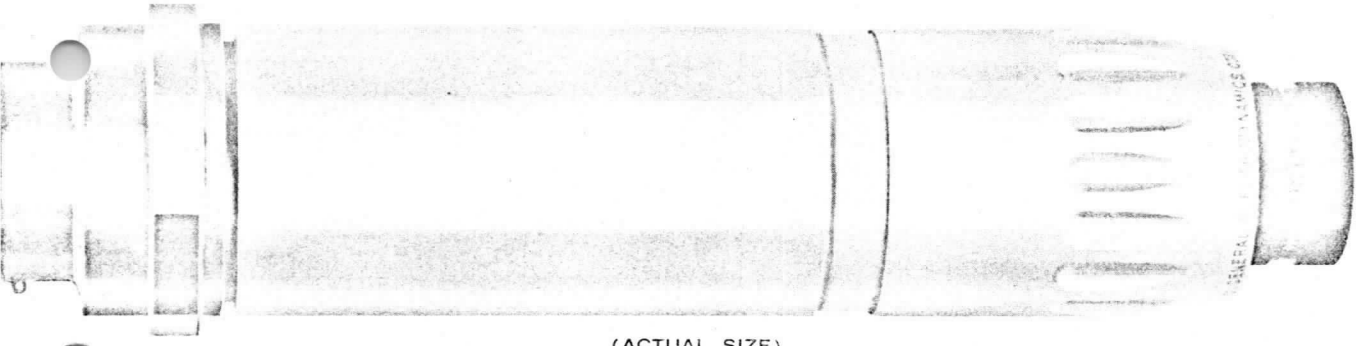
ED 6038 A-1 USE

24 to 36 V.D.C.
15 watts

COMPOSITE VIDEO SIGNAL
CONFORMS TO EIA
STANDARD RS-170

TO 1[illegible]0 feet
H RG-59
O LINE AMPLIFIERS

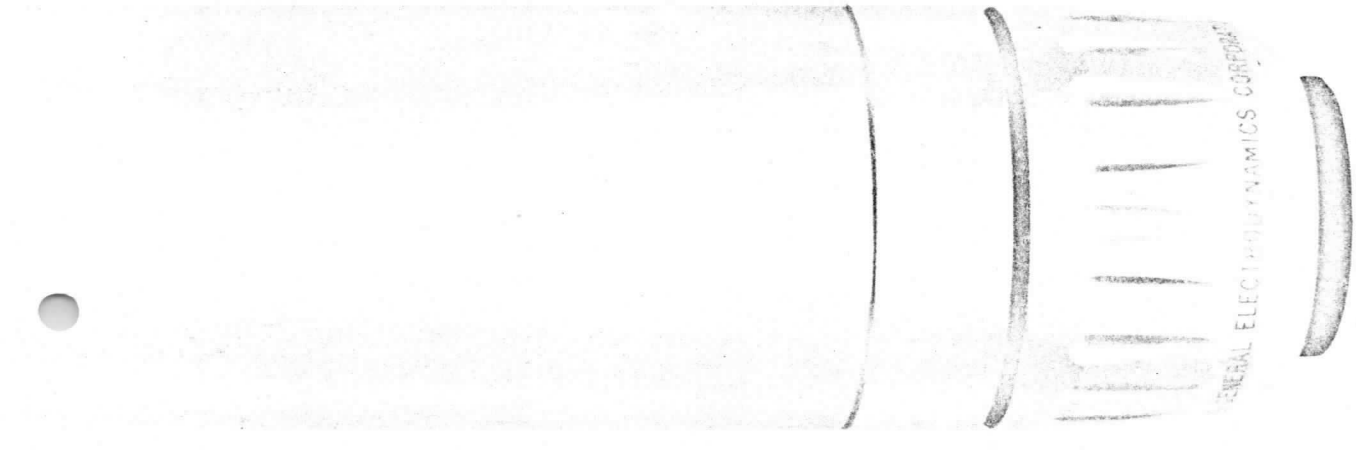
ED 6038 A USES ½-INCH TD 1305 VIDICON 500 TV LINES RESOLUTION



"D"
MOUNT
LENS

(ACTUAL SIZE)

USES 1-INCH TD1339 VIDICON 700 TV LINES RESOLUTION



"C"
MOUNT
LENS

(ACTUAL SIZE)

FEATURES

Electrostatic Focus Vidicon Tube
Sampling of yoke currents
assures vidicon protection
from sweep failure.
Plug-in printed circuits
Solid state system
Reliable, detailed pictures under
adverse environmental conditions.

ACCESSORIES

LENSES

5.5 mm	f/1.8	(GEC 1499)
10 mm	f/1.8	(GEC 2035)
25 mm	f/1.4	(GEC 2036)
38 mm	f/2.8	(GEC 2037)
75 mm	f/4.2	(GEC 2038)

HEAD MOUNT MODEL MD 380

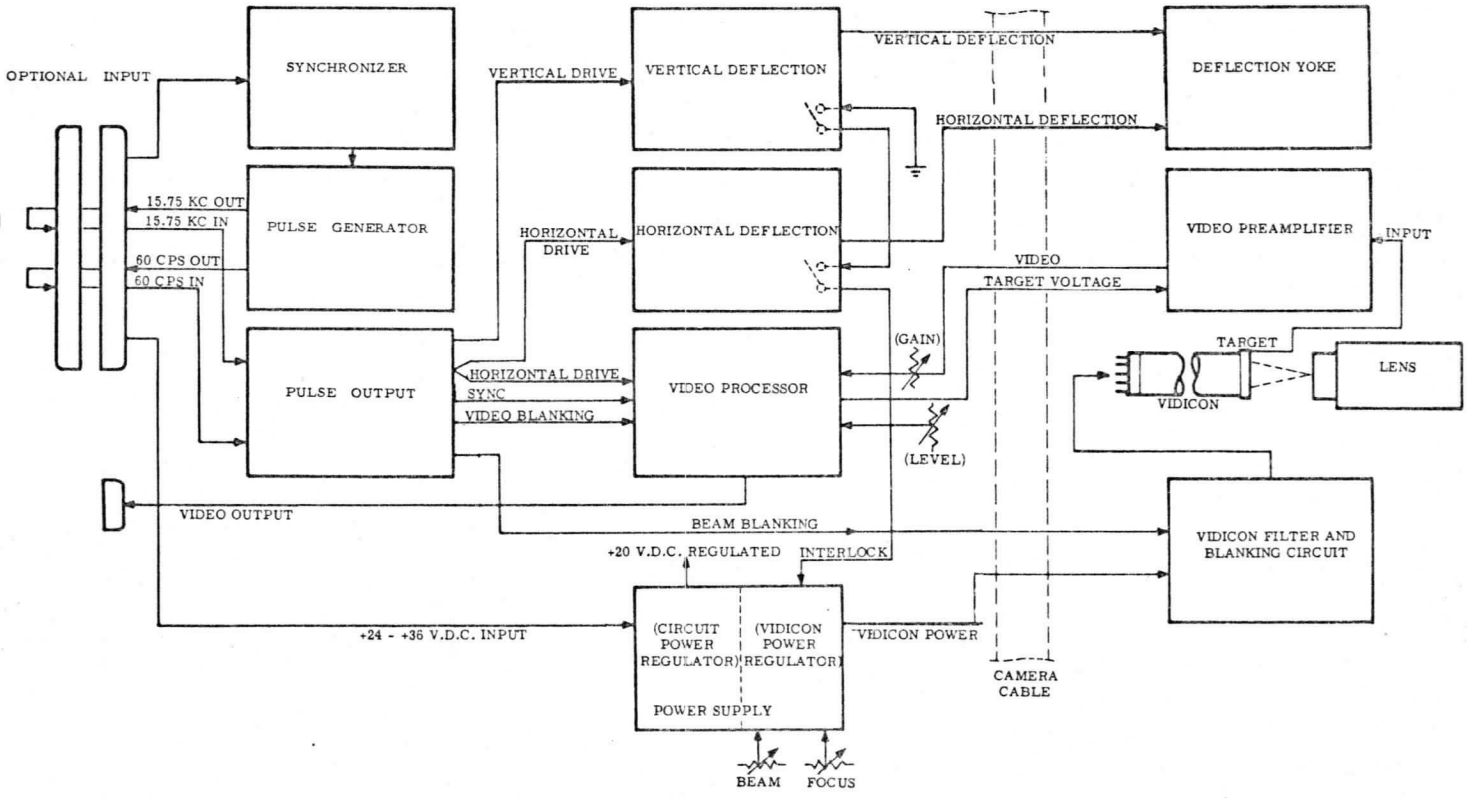
SPECIFICATIONS

Horizontal Scanning Frequency.....15,750 cps
Vertical Scanning Frequency.....60 cps
Interlace..... 2:1 30 fr/sec
Aspect Ratio, Height to Width.....3:4
Sweep Linearity.....Better than ± 1%
Sync and Blanking.....Standard Broadcast EIA

Video Output.....1.4 V PP composite into 75-ohm load
Automatic Constant Video Output ..10—10,000 ft. candle
Usable Pictures.....obtained with 1 ft. candle
Color Response.....Approximates human eye
Grey Scale Reproduction.....10 steps
Keyed Clamp.....Provides constant black level

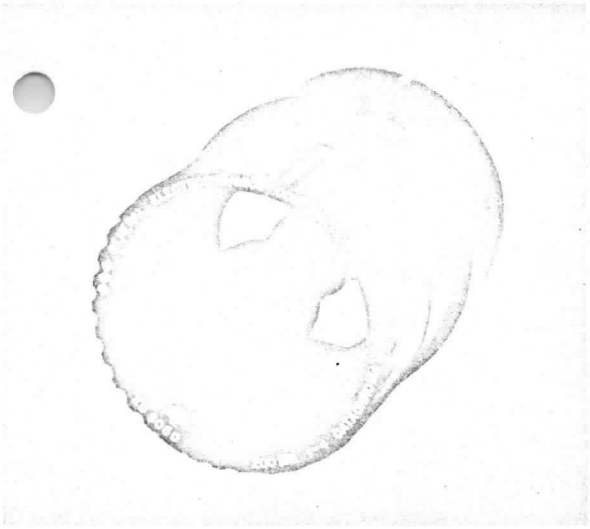
Voltage Regulation holds picture stable over 24 to 36 VDC
Input Power.....24 to 36 VDC, 15 watts

BLOCK DIAGRAM

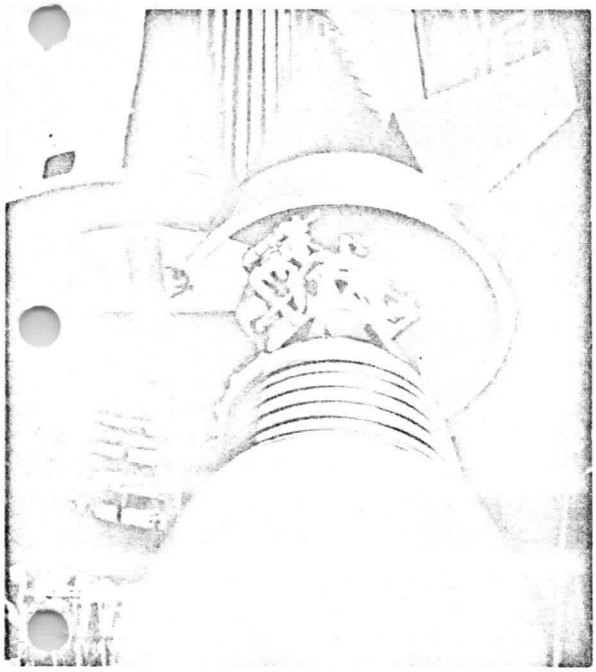


ELECTRONICS DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS 75040
P. O. BOX 798 A/C 214 276-1161

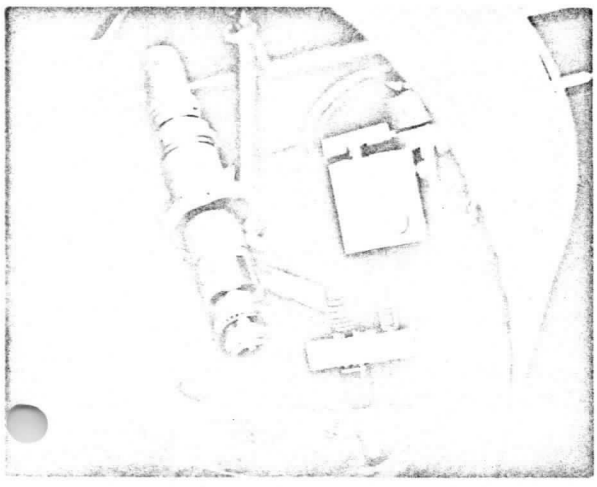
APPLICATIONS



The camera head's small size gives it easy access through small openings or inspection ports. Internal inspection of finished tanks or other large enclosures of critical systems is easily accomplished. Pipe lines, narrow raceways, sewers, or other distribution systems can be internally inspected with ease. Small size enabled the camera head to be mounted in the center of the catadioptric lens pictured at the left. The complete 200mm focal length lens and camera head has a total package size of 4¼ inches diameter by 6 inches long.



Whether observing an operating rocket engine at close range or used at the end of a crane for manipulation control, the ED 6038 A can take it. Other tough applications for which the ED 6038 A is easily suitable are terrain surveillance from slow flying aircraft, blast furnace monitoring, or in any areas of extreme noise and/or vibration.



Here is a good example of a stringent requirement placed on the "eye" of the ED 6038 A. Look at a TIG arc weld in process and give a detailed presentation of the torch tip, molten metal puddle, incoming seam, and finished weld. Sound impossible? The ED 6038 A does it.

LET'S TALK ABOUT YOUR APPLICATION

ELECTRONICS DIVISION

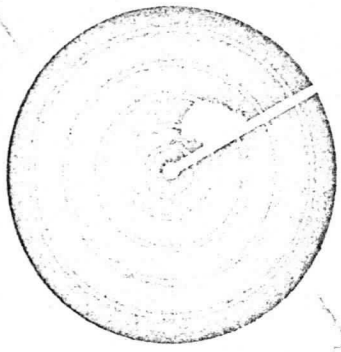
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS 75040

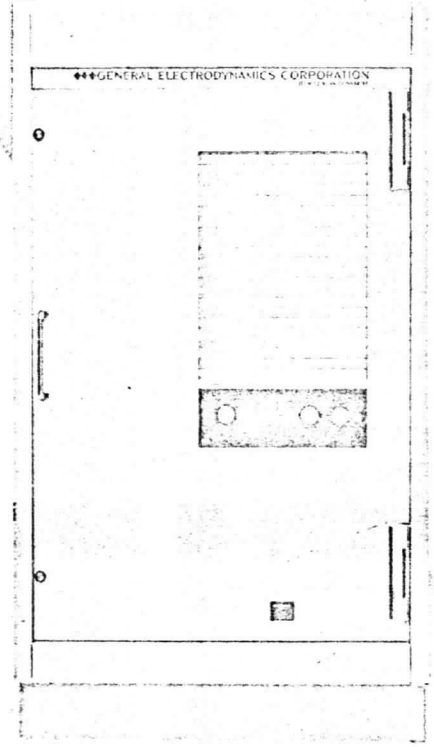
P. O. BOX 798 A/C 214 276-1161

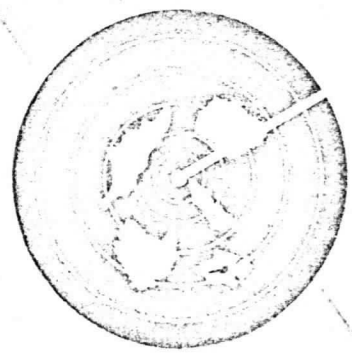
GENERAL ELECTRODYNAMICS CORPORATION

ED 6052 SCAN CONVERTER

GENERAL ELECTRODYNAMICS CORP.
4430 Forest Lane Garland, Texas 75040
214-276-1161
TWX #901-860-5193 — TELEX #73-2395



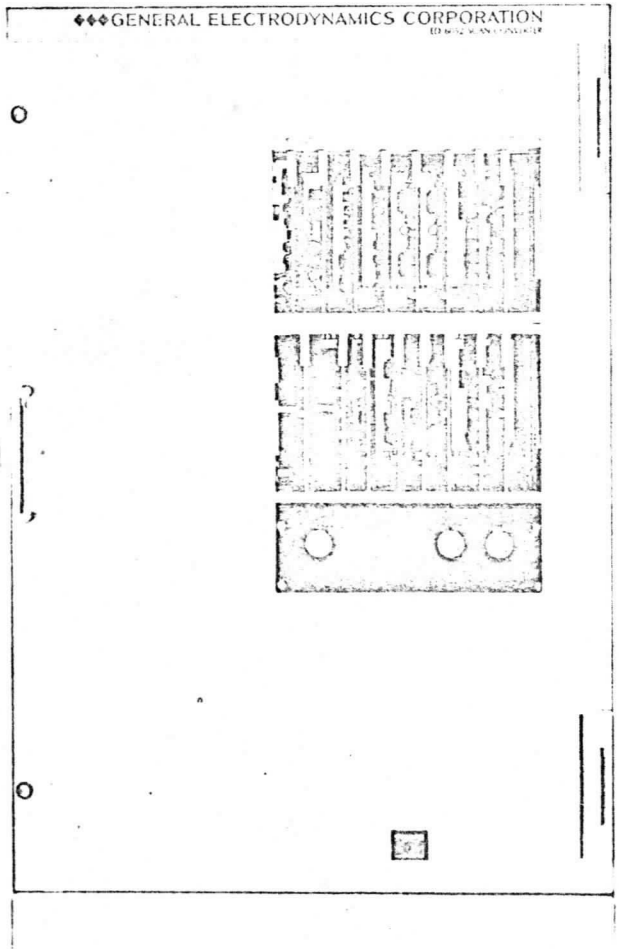




◇◇◇ BRIGHT DISPLAY ..... Bright television display can be easily viewed, even in normally illuminated rooms. Any number of monitors can be connected to the ED 6052, thereby providing multiple viewing screens at strategic locations.

◇◇◇ CONTROLLABLE STORAGE ..... By adjusting the storage period the television presentation can be optimized for any antenna rotation. After an image is read in, storage can be adjusted to provide a long period for concentrated study of the phenomena.

◇◇◇ DIRECTLY RECORDABLE ..... The composite video signal may be used with any recording equipment presently available for television. Additionally, the bright monitor display can be readily photographed.



GENERAL ELECTRODYNAMICS CORPORATION ED 6052 SCAN CONVERTER CONVERTS RADAR INFORMATION TO STANDARD TV DISPLAY

ADJUSTABLE STORAGE for display optimization DYNAMIC FOCUSING for uniform resolution RHO-THETA SWEEPS generated and rotated electronically RANGE RINGS electronically generated

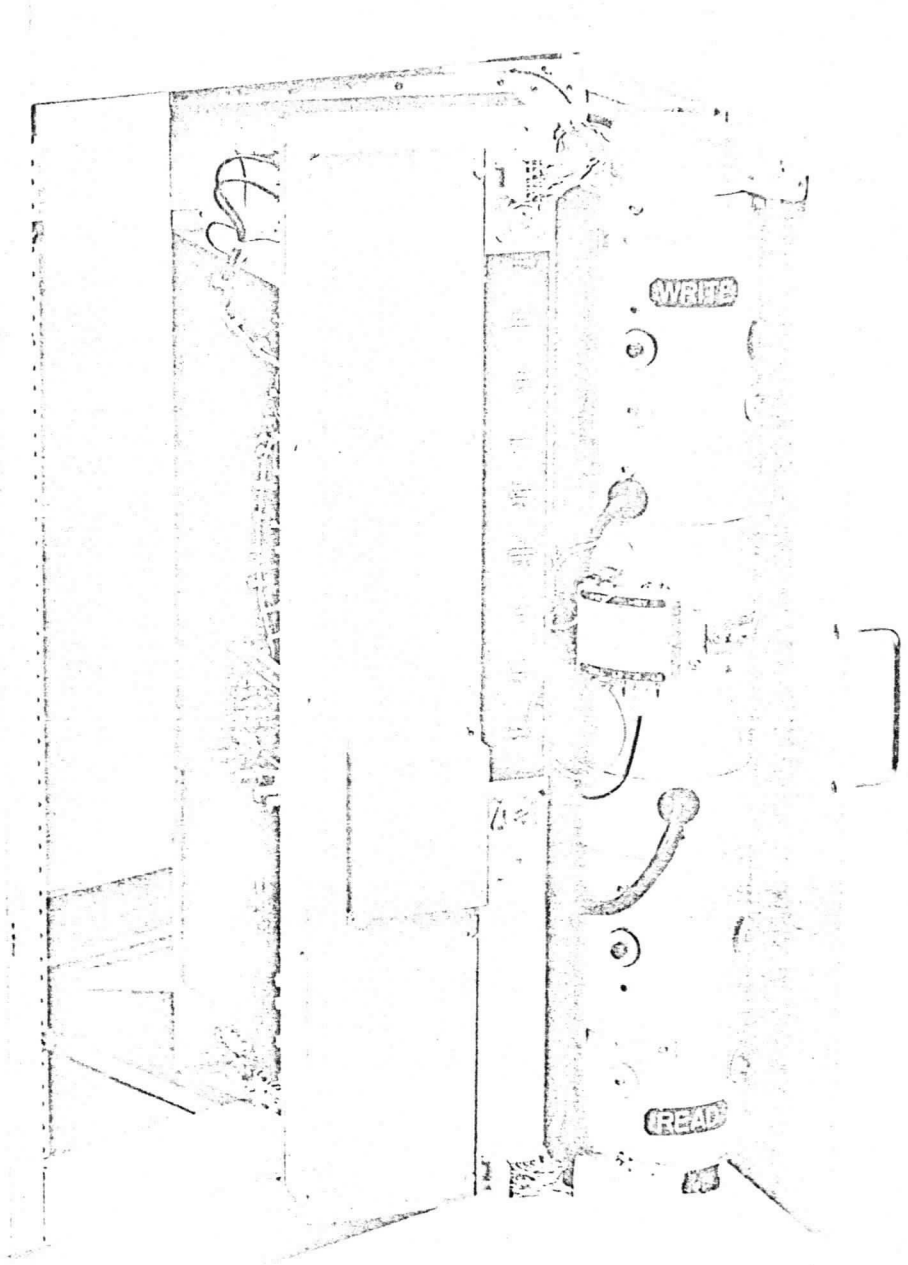
REMOTE CONTROL of both range change and erase function

MAP OVERLAY GENERATOR available for superimposing area map to aid viewer in orienting himself with the radar presentation

FRONT PANEL is hinged for complete front access

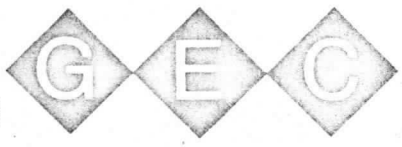
COMPLETELY TRANSISTORIZED with plug-in circuitry

STANDARD 19" RACK MOUNTING



INPUTS:
110 VAC 60 cps, 1.5a
Antenna synchro or resolver signal
Sweep trigger
Radar video
Television sync and blanking

OUTPUTS:
Television rate composite video signal which can be used to drive any number of closed circuit television monitors



GENERAL ELECTRODYNAMICS
ED 6073B

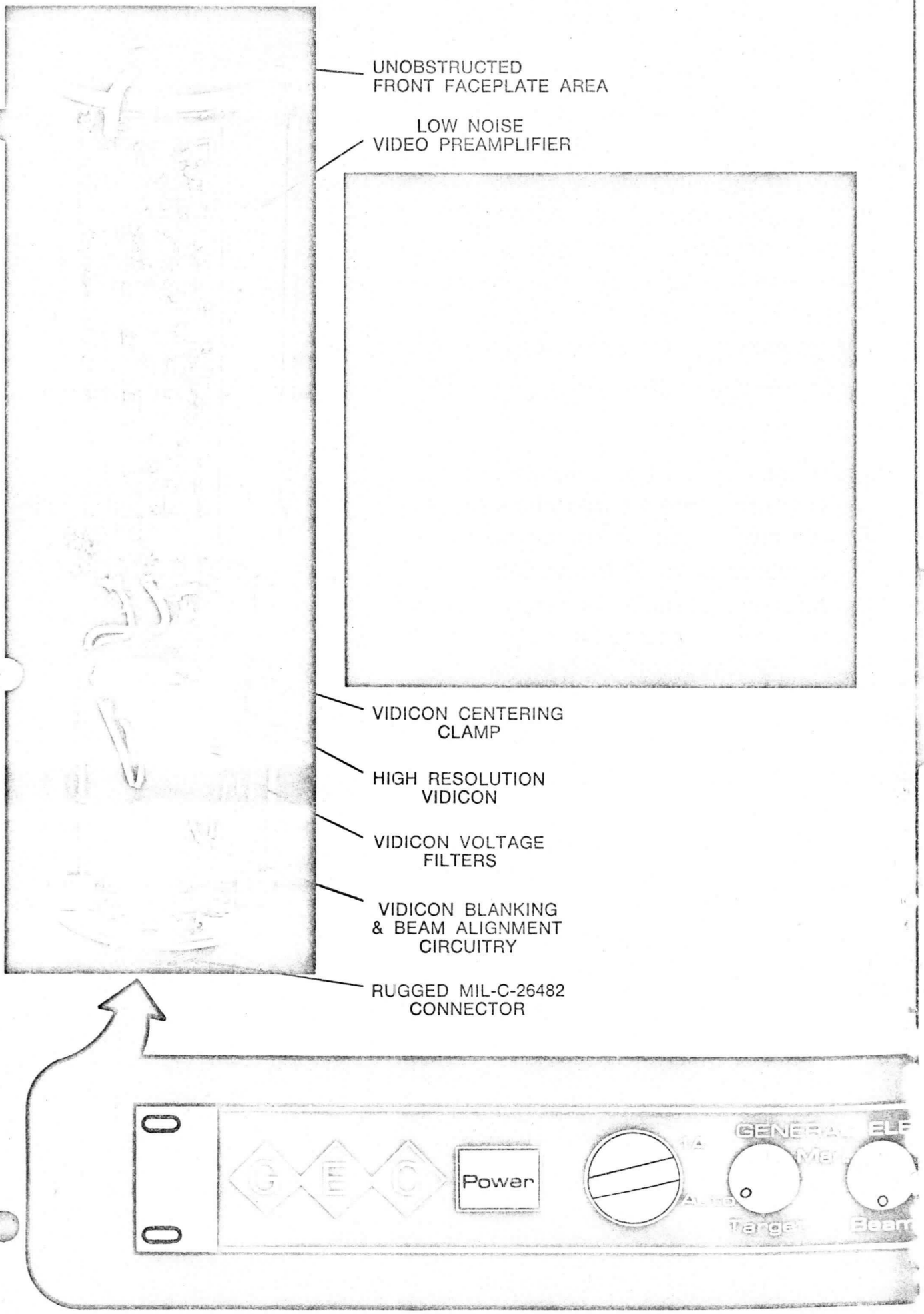
"A quality high resolution camera with unsurpassed performance and versatility."

- SMALL COMPACT SIZE.
- SIGNAL CHARACTERISTICS ARE AUTOMATICALLY CORRECTED.
- FAST-ACTING AUTOMATIC BEAM CONTROL.
- 30 MHz BANDWIDTH.
- PROGRAMMABLE SYNC. GENERATOR.
- EXTENDED VIDICON LIFE.
- ASSURED STABILITY AND PERFORMANCE OVER LONG PERIODS WITHOUT ADJUSTMENT.
- PRECISION ASPECT RATIO.
- VIDICON SENSITIVITIES WHICH COVER A BROAD SPECTRUM (X-RAY TO INFRA-RED).
- SOLID-STATE CIRCUITRY.

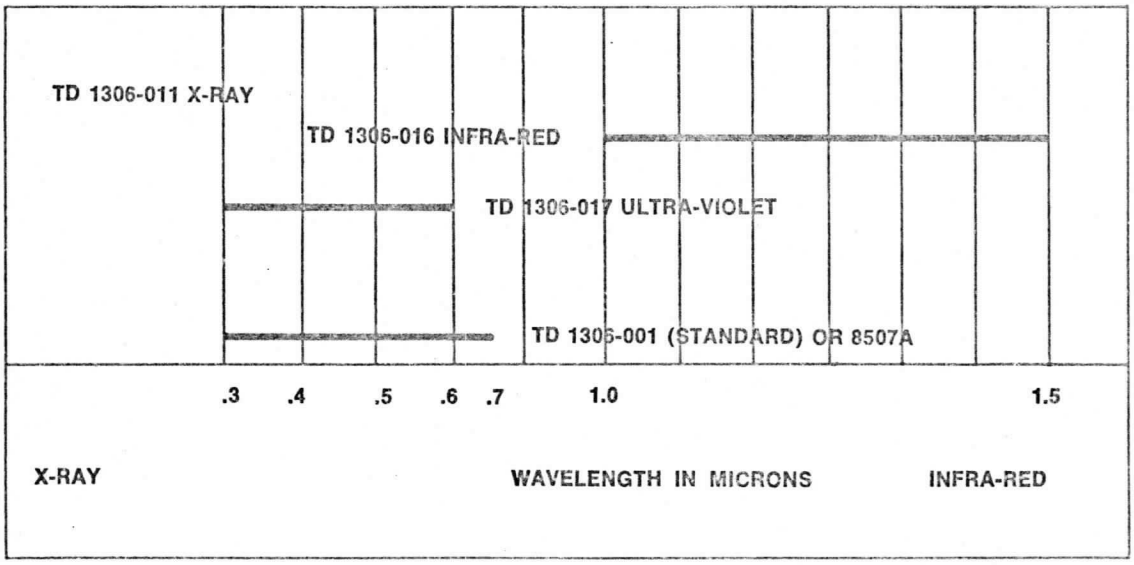
GENERAL ELECTRONICS

4430 FOREST LANE, GARLAND, TEXAS 75042

PHONE: (214) 276-1161 / TWX (901) 860-5196 / TELEX 73-2095


UNOBSTRUCTED
FRONT FACEPLATE AREA
LOW NOISE
VIDEO PREAMPLIFIER
VIDICON CENTERING
CLAMP
HIGH RESOLUTION
VIDICON
VIDICON VOLTAGE
FILTERS
VIDICON BLANKING
& BEAM ALIGNMENT
CIRCUITRY
RUGGED MIL-C-26482
CONNECTOR
Power

RELATIVE SPECTRAL RESPONSE
VIDICONS AVAILABLE



POWER REQUIREMENTS: 115 V AC +10%; 47 to 420 Hz, 50 watts nominal at 115V.

VERTICAL SWEEP RATES: 60 fields per second; 30 frames per second interlaced 2:1 or 15 frames per second interlaced 4:1.

HORIZONTAL SWEEP RATES: Master oscillator delivers 15,750 Hz to 35,750 Hz and is power line-locked. Master oscillator can be crystal controlled for stability better than 0.01%. Other scan rates are available as options.

SCANNING: Sequential scan up to 600 scanning lines, 2:1 interlace up to 1225 scanning lines, or 4:1 interlace up to 2049 scanning lines. Selectable by built-in, pre-wired connector.

SYNC AND BLANKING WAVEFORM: Conforms to EIA Standards RS-170, RS-330 or RS-343 depending on scanning rate used. All pulse amplitudes accurate and are temperature compensated to within 1%.

CAMERA TUBE TYPE: 1 inch vidicon magnetic focus and deflection high resolution TD1836-001. Silicon vidicon available as option.

SENSITIVITY: 1 volt peak-to-peak black one-half video output using a TD1836-001 vidicon and 11 f/2 lens at a standard EIA resolution test chart with 30 foot-candles average illumination. Peak-to-peak signal to rms noise ratio is 40 db. Typical lag characteristic is 20% residual signal at end of third field, 1/60 second time lag. Less than 3% residual signal at end of third field.

AUTOMATIC LIGHT RANGE: Light variation of 10,000:1 produces less than 6 db change in video signal. Lower limit of 0.3 footcandle scene illumination for useable picture.

RESOLUTION STABILITY VS. TEMPERATURE: Less than 10% degradation over a temperature range of -10° C (14° F) to 70° C (158° F).

RESOLUTION STABILITY VS. INPUT VOLTAGE VARIATION: No perceptible change with an input voltage variation from 95 V AC to 125 V AC.

GRAY SCALE RENDITION: 10 shades of gray using EIA Gray Scale Overlay Strips in conjunction with the EIA TV Resolution Chart, 1956.

SIGNAL TRANSMISSION DISTANCE: Camera head may be separated by up to 2000 feet. A compensating unit compensates for difference in cable lengths.

(MECHANICAL)

DIMENSIONS (LESS LENS): Camera head has cylindrical shape 2½ inches diameter by 9½ inches long. Control unit mounts in 19 inch rack, occupies 14¼ inches rack space and is 15 inches deep.

WEIGHT (LESS LENS): Camera head weighs 4 pounds. Control unit weighs 11 pounds.

(ENVIRONMENTAL)

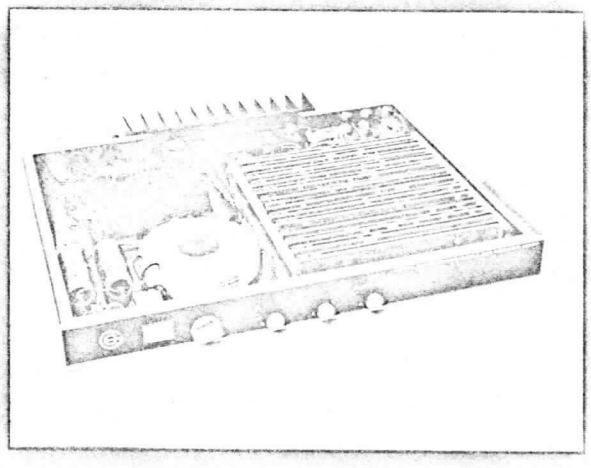
AMBIENT TEMP. LIMITS
-10° C (14° F) to 70° C (158° F) — Operating
-50° C (-67° F) to 85° C (185° F)—Non-operating

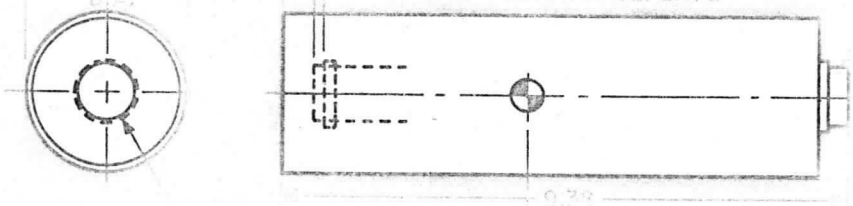
AIR PRESSURE LIMITS
10,000 Ft.

VIBRATION LIMITS
2 gs 10-500 Hz

SHOCK LIMITS
15 gs — any direction

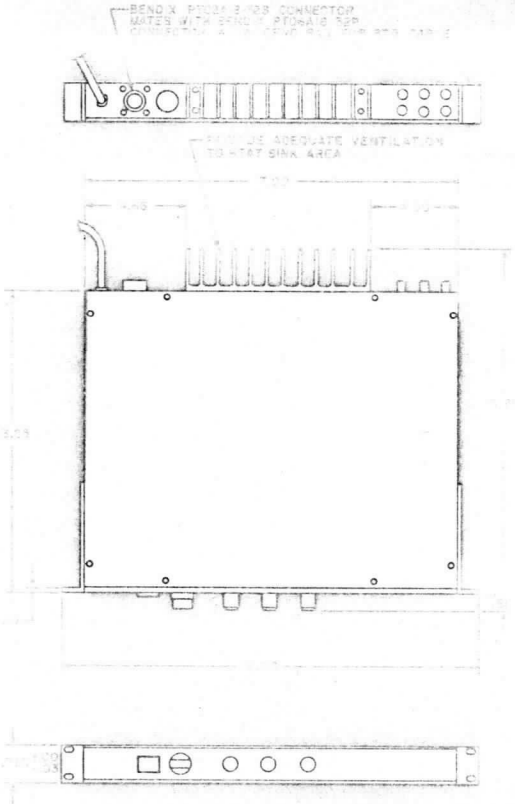
HUMIDITY LIMITS
90%

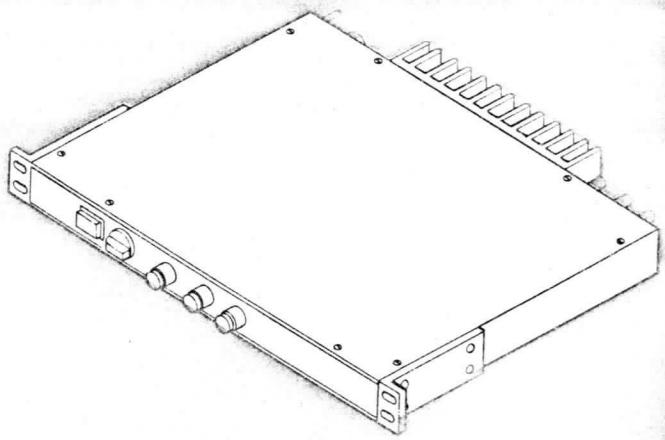


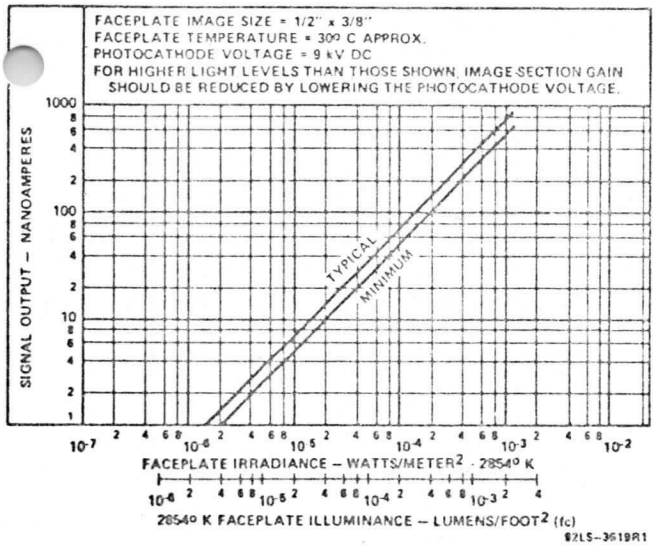


OPTIONS — 6073B

Video Polarity Switch	6073-00740
DC Coupled Video Output	6073B-00741
CCU Shock Mounts	03411
Gamma Correction	6073B-00742
Fast-Retrace Vertical Deflection	6073B-00743
35mm Bayonet Mount Lens Adapter	6073B-10012-5
Remote Beam, Target & Focus Controls — Short Distance	6073B-00744
Remote Beam, Target & Focus Controls — Long Distance	6073B-00745
Remote Gamma Control	6073B-00746
Remote Video Gain & Pedestal	6073B-00747
Remote Video Polarity Control	6073B-00748
Remote Horizontal Sweep Reversal	6073B-00749
Remote Vertical Sweep Reversal	6073B-00750
Pulse Driver (Sync, Blanking and Drives)	6073-00732





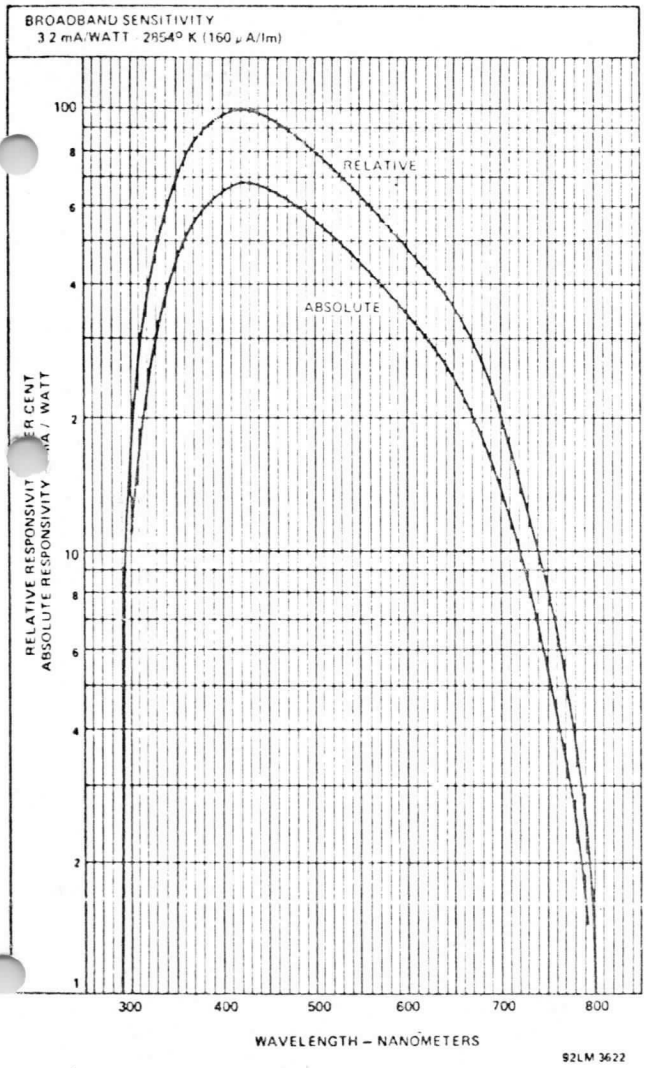


Transfer Characteristics

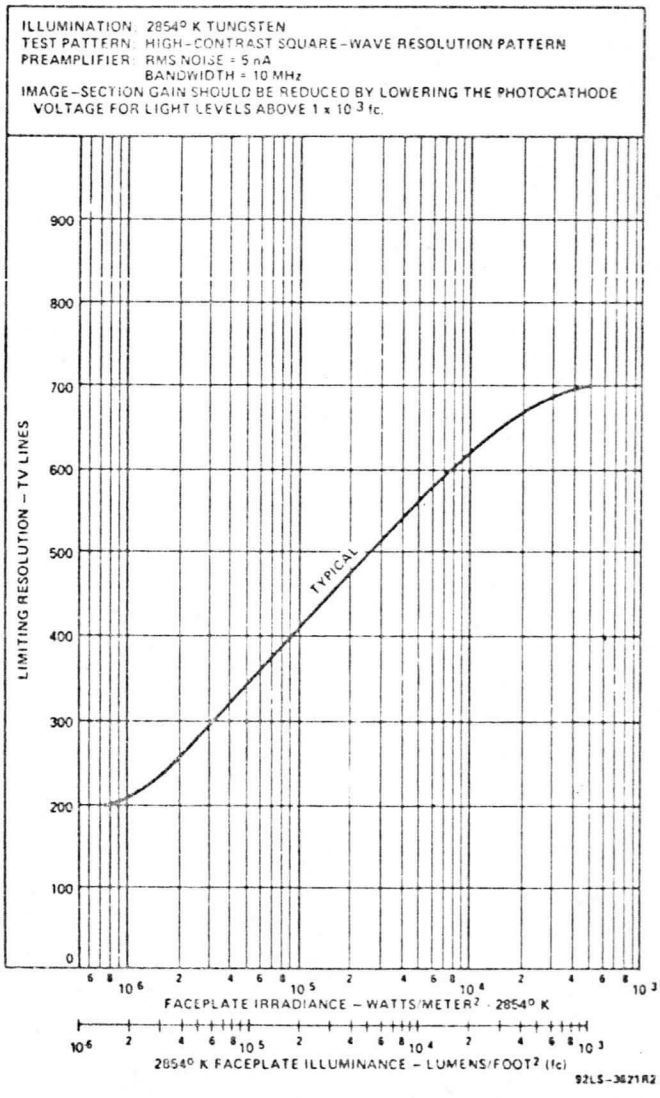
GENERAL ELECTRODYNAMICS

4430 FOREST LANE

GARLAND, TEXAS 75042



Typical Photocathode Responsivity



Resolution Characteristics

"A QUALITY TELEVISION CAMERA WHICH PERFORMS HIGH RESOLUTION IN NEAR DARK-FIELD ENVIRONMENTS"

ED 7070

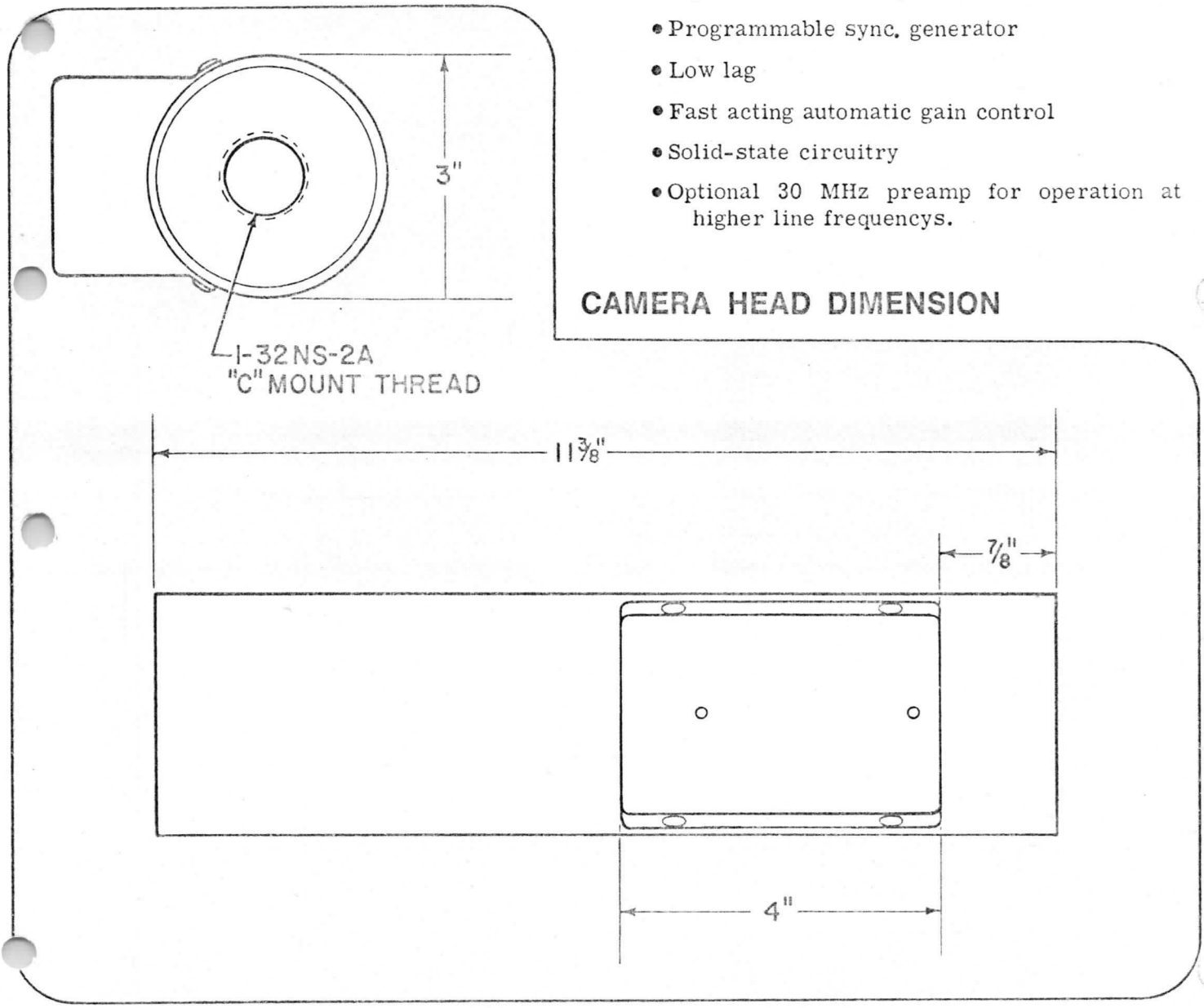
WHAT IS THE ED 7070?

The ED 7070 Television Camera combines a 16 mm silicon-intensifier target (SIT) camera tube with a sturdy, compact, high resolution camera head and control unit capable of continuous operation near the photo-electron noise limit. In other words, a television camera which can resolve detail (that your eyes cannot) in a near dark-field environment.

ADVANTAGES OF THE ED 7070.

- Very high sensivitivity
- High resolution/very low light level (700 lines/ 5 x 10 - 4 ft candles)
- Small compact size
- Signal changes w/scene illumination automatically corrected
- Low noise preamplifier
- Assured stability and performance over long periods without adjustments
- Programmable sync. generator
- Low lag
- Fast acting automatic gain control
- Solid-state circuitry
- Optional 30 MHz preamp for operation at higher line frequencys.

CAMERA HEAD DIMENSION



GENERAL ELECTRODYNAMICS

4430 FOREST LANE, GARLAND, TEXAS 75042

PHONE: (214) 276-1161 / TWX (910) 860-5193 / TELEX 73-2395

REVISIONS			
DATE	SOURCE	SHEETS AFFECTED	APPROVALS

MONOCHROME TELEVISION CAMERA
SELF-CONTAINED
VERY LOW LIGHT LEVEL (SIT)

CUSTOMER	
CONTRACT	
PROJ. NO.	
APPROVALS	DATE
Bill Bantle	4-9-74

GENERAL ELECTRODYNAMICS
4430 FOREST LANE
GARLAND, TEXAS 75040

TITLE

TELEVISION CAMERA, SELF-CONTAINED
VERY LOW LIGHT LEVEL (SIT)

CODE IDENT. NO.	MODEL
06433	ED 7090

DIVISION

SHEET 1 OF 7

ED 7090 SELF-CONTAINED VERY LOW LIGHT LEVEL TELEVISION CAMERA

The ED 7090 is a self-contained, very low light level, monochrome television camera capable of operating at light levels equivalent to a full moon on a clear night. A wide dynamic range is achieved by using a lens with wide range attenuation, which is usually achieved with an iris spot or by introducing neutral density filters. Such a combination gives excellent results with scene brightness from 3×10^{-3} to 10^{4} foot-lamberts.

The ED 7090 can operate from the built-in internal sync generator or can be driven from an external sync generator. Simply connecting or disconnecting the sync generator board by means of plug-in connectors changes from one mode of operation to the other.

POWER REQUIREMENTS: Operates from either 105 to 130 VAC, 47 to 420 Hz, 19 watts max. or from 12 to 36 VDC at 1 a. maximum. No damage to camera with 1 msec. over voltage of 170 volts on A.C. operation, and momentary or continuous under voltage to zero volts on AC or DC operation.

VERTICAL SWEEP RATES: 30 frames per second, 60 fields per second, interlaced 2:1.

HORIZONTAL SWEEP RATES: 15,750 Hz derived from cvystal controlled master oscillator operating at 31, 500 Hz with a stability better than O.O1%.

SCANNING: 2:1 interlace with 525 scanning lines per frame.

SCAN FORMAT: Adjustable-can be 4:3, 1:1, or 3:4. Sweep sizes are variable by $\pm$ 30% of the nominal 4:3 scan size.

SYNC & BLANKING WAVEFORM: Conforms to EIA Standard RS-330. All pulse widths are adjustable and are temperature compensated to stay within 1%. May be adapted to synchronization from an external sync generator by simply un-plugging the sync generator board.

CAMERA TUBE TYPE: 1-inch silicon-intensifier target (SIT) tube with magnetic focus and deflection. Normally supplied with a type 4804 (SCI). Other grades are available.

SENSITIVITY: One volt peak-to-peak black negative video output using a type 4804 SIT tube and f/1.8 lens with neutral density filter viewing a scene with a brightness of 1×10^{-2} foot-lamberts. The peak-to-peak signal to rms noise ratio with this illumination is 40 db.

AUTOMATIC LIGHT RANGE: Obtained with a combination of automatic sensitivity control of the intensifier section and automatic control of the light through the lens. There is less than 6 db change in video signal with light variation of 3,000,000 to 1 using a lens with wide range attenuation. Automatic bandwidth reduction is provided to improve signal to noise ratio at low light level extremes.

GEOMETRIC DISTORTION: Less than 2% for both vertical and horizontal directions.

GRAY SCALE RENDITION: 10 shades of gray using EIA gray scale overlay strips in conjunction with the EIA TV Resolution Chart, 1956.

BLACK LEVEL CONTROL: Black level is controlled by circuitry that maintains a fixed black level in the output signal within plus or minus 5 percent. The circuit is of the driven clamp type.

VIDEO PEAK CLIPPING: An adjustable video peak clipper is provided. The peak clipping level is adjustable between plus or minus 3 db of the normal output level. The peak clipper operation does not deteriorate video quality in "below clipping" signal levels or cause synchronizing instability in the associated monitor.

RESOLUTION: Operating at 30 frames per second, 2:1 interlace with 525 scanning lines per frame, the following resolution is obtained.

With photoconductor illumination of 3×10^{-4} foot-candles the horizontal limiting resolution in the center is better than 600 TV lines and in each corner better than 500 TV lines. With photoconductor illuminator of 10^{-4} the horizontal limiting resolution in the center is approximately 500 TV lines.

APERTURE: The camera contains aperture correction circuitry which is adjustable from 0 to 6.0 db and peaked at 10 Mhz nominal. The circuit is of the low phase distortion type.

OUTPUT-VIDEO ADJUSTABLE: Composite signal usually set with 0.7 volt peak-to-peak black negative video and total composite signal of 1.0 volt peak-to-peak. Adjustable sync amplitude is usually set to occupy approximately 30% of the total amplitude. Video available on 75 ohm Type "UHF" connector for 75 ohm line driving, and video is optionally available on 124 ohm balanced line output for long video line driving. A video "Test" BNC type output is available on the camera rear plate.

SCAN FAILURE PROTECTION: Vertical and horizontal sweep voltages and currents are sampled. Instantaneous, transistorized circuitry fully protects the vidicon.

HORIZONTAL SCAN FREQUENCY: Controlled from either external drive or internal camera sync generator. Internal camera generator has a master oscillator which is a temperature stabilized crystal controlled master oscillator with less than 0.01% change from -10° C (14° F) to $+49^{\circ}$ C ($+120^{\circ}$ F).

VERTICAL SCAN FREQUENCY: Controlled from either external drive or internal camera sync generator. Derives the vertical frequency from the horizontal frequency with binary dividers.

DC COMPONENT TRANSMISSION: None. Video is AC coupled to the outputs.

RESOLUTION STABILITY VS. TEMPERATURE: Less than 10% degradation over a temperature range of -10° C (14° F) to $+49^{\circ}$ (120° F).

RESOLUTION STABILITY VS. INPUT VOLTAGE VARIATION: No perceptible change with an input AC voltage variation from 95 VAC to 135 VAC, or an input D.C. voltage variation of 12 to 36 VDC.

OPERATIONAL STABILITY: Stable operation is achieved within five minutes of turn-on for temperatures above zero degrees centigrade and within 15 minutes at lower temperatures.

CONTROLS:

External Controls
Power on/off
Beam
Focus

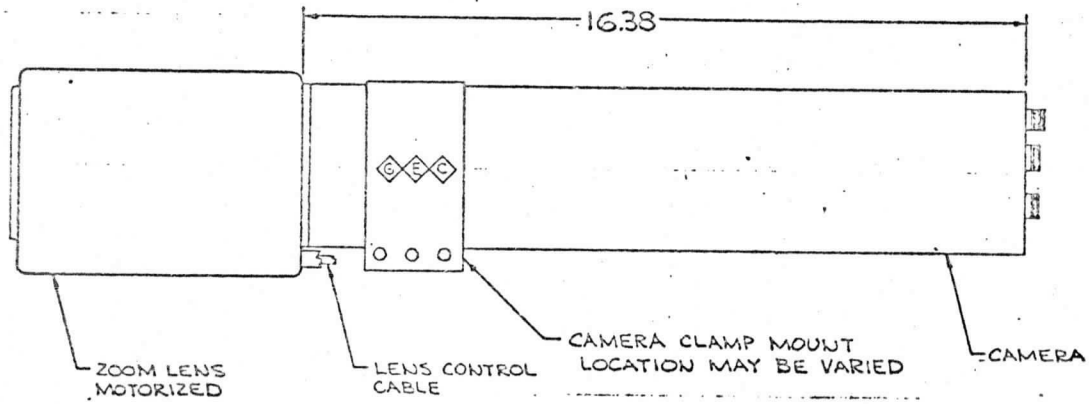
External controls may be provided locally with a small control unit connected to the remote-control connector on the camera or may be remoted up to a distance of 3,000 feet. Mechanical optical focus adjustable from front of camera.

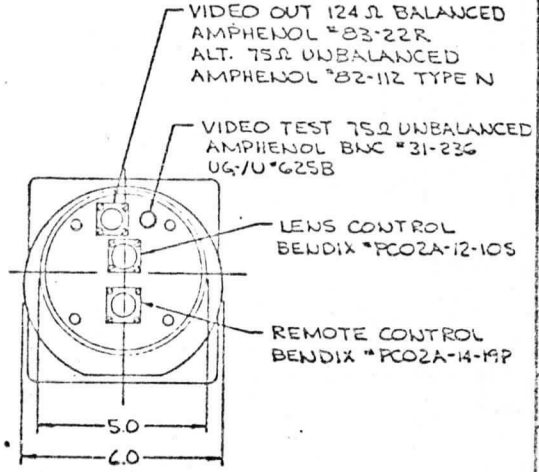
CONNECTORS:

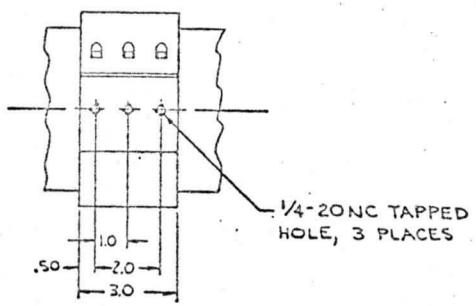
1 Type "UHF" for 75-ohm line output, or optionally
1 Amphenol Type 6225 for 124 ohm balanced video line output
1 Zoom Lens output
1 Remote functions input, containing inputs for:

a. Beam
b. focus
c. Power input, 105 to 130 VAC or
d. Power input, +12 to +36 VDC
e. Optional vertical drive input
f. Optional horizontal drive input
g. Zoom lens controls
h. Automatic/manual iris control

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED







NOTES:
1. CAMERA CONTROL CAN BE FROM REMOTE CONTROL UNIT OR LOCAL CONTROL UNIT ATTACHED TO REAR OF CAMERA.
2. LOCAL CONTROL UNIT IS USED FOR LOCAL OPERATION OR TEST AND MAINTENANCE. IT IS REMOVED FOR REMOTE CONTROL OPERATION.

ITEM NO	QTY REQ	PART NO.	DESCRIPTION	ZONE

PARTS LIST

NEXT ASSY	USED ON	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ON:
FRACTIONS
DECIMALS
ANGLES

MATERIAL

CONTRACT NO.

DWG NO.

APPROVED		DATE
ENGINEER		
CHECKED		
DRAWN	[illegible]	5/12/74
APPROVED		
APPROVED		

GENERAL ELECTRODYNAMICS CORPORATION
GARLAND, TEXAS

OUTLINE, MAX DIMENSIONS CAMERA VERY LOW LIGHT LEVEL

SIZE	CODE IDENT NO	G.E.C. DRAWING	REV
C	06433	7090-[illegible]0972	

10

REVISIONS			
DATE	SOURCE	SHEETS AFFECTED	APPROVALS
A 6/5/74	BMB		BMB

MONOCHROME TELEVISION CAMERA
SELF-CONTAINED
ULTRA-LOW LIGHT LEVEL

APPROVALS	DATE
Bill Banks	3-25-74

CUSTOMER

CONTRACT

PROJ. NO.

GENERAL ELECTRODYNAMICS
4430 FOREST LANE
GARLAND, TEXAS 75040

TITLE
TELEVISION CAMERA, SELF-CONTAINED
ULTRA LOW LIGHT LEVEL

CODE IDENT.NO.	MODEL
06433	ED 7085

DIVISION

SHEET 1 OF 7

ED 7085 SELF-CONTAINED ULTRA LOW LIGHT LEVEL TELEVISION CAMERA

The ED 7085 is a self-contained, ultra low light level, monochrome television camera capable of operating at light levels equivalent to starlight with no moon present. In most applications, overcast night skies provide enough reflection of scattered light for very satisfactory viewing. A wide dynamic range is achieved by using a lens with wide range attenuation, which is usually achieved with an iris spot or by introducing neutral density filters. Such a combination gives excellent results with scene brightness from 10^{-4} to 10^{4} foot-lamberts.

The ED 7085 can operate from the built-in EIA STD. RS-170 internal sync generator or can be driven from an external sync generator. Simply connecting or disconnecting the sync generator board by means of plug-in connectors changes from one mode of operation to the other.

POWER REQUIREMENTS: Operates from either 105 to 130 VAC, 47 to 420 Hz, 19 watts max. or from 12 to 36 VDC at 1 a. maximum. No damage to camera with 1 msec. over voltage of 170 volts on A.C. operation, and momentary or continuous under voltage to zero volts on AC or DC operation.

VERTICAL SWEEP RATES: 30 frames per second, 60 fields per second, interlaced 2:1.

HORIZONTAL SWEEP RATES: 15,750 Hz derived from crystal controlled master oscillator operating at 31,500 Hz with a stability better than 0.01%.

SCANNING: 2:1 interlace with 525 scanning lines per frame.

SCAN FORMAT: Adjustable - Can be 4:3, 1:1 or 3:4. Sweep sizes are variable by ±30% of the nominal 4:3 scan size.

SYNC & BLANKING WAVEFORM: Conforms to EIA Standard RS-170. All pulse widths are adjustable and are temperature compensated to stay within 1%. May be adapted to synchronization from an external sync generator by simply un-plugging the sync generator board.

CAMERA TUBE TYPE: 1-inch intensifier silicon-intensifier target (ISIT) tube with magnetic focus and deflection. Normally supplied with a type 4849.

SENSITIVITY: One volt peak-to-peak black negative video output using a type 4849 ISIT tube and f/2.5 lens with neutral density filters viewing a scene with a brightness of 10^{-4} foot-lamberts. The peak-to-peak signal to rms noise ratio with this illumination is 40 db. With a scene brightness of 5×10^{-5} the signal to noise ratio is 36 db.

AUTOMATIC LIGHT RANGE: Obtained with a combination of automatic sensitivity control of the intensifier sections and automatic control of the light through the lens. There is less than 3 db change in video signal with light variation of 50,000,000 to 1 using a lens with wide range attenuation. Automatic bandwidth reduction is provided to improve signal to noise ratio at low light level extremes.

GEOMETRIC DISTORTION: Less than 2% for both vertical and horizontal directions.

GRAY SCALE RENDITION: 10 shades of gray using EIA gray scale overlay strips in conjunction with the EIA TV Resolution Chart, 1956.

BLACK LEVEL CONTROL: Black level is controlled by circuitry that maintains a fixed black level in the output signal within plus or minus 5 percent. The circuit is of the driven clamp type.

VIDEO PEAK CLIPPING: An adjustable video peak clipper is provided. The peak clipping level is adjustable between plus or minus 3 db of the normal output level. The peak clipper operation does not deteriorate video quality in "below clipping" signal levels or cause synchronizing instability in the associated monitor.

RESOLUTION: Operating at 30 frames per second, 2:1 interlace with 525 scanning lines per frame, the following resolution is obtained.

With photoconductor illumination of 5×10^{-5} foot-candles the horizontal limiting resolution in the center is better than 600 TV lines and in each corner better than 500 TV lines. With photoconductor illuminator of 5×10^{-6} the horizontal limiting resolution in the center is approximately 500 TV lines.

APERTURE: The camera contains aperture correction circuitry which is adjustable from 0 to 6.0 db and peaked at 10 Mhz nominal. The circuit is of the low phase distortion type.

OUTPUT-VIDEO ADJUSTABLE: Composite signal usually set with 0.7 volt peak-to-peak black negative video and total composite signal of 1.0 volt peak-to-peak. Adjustable sync amplitude is usually set to occupy approximately 30% of the total amplitude. Video available on 75 ohm Type "UHF" connector for 75 ohm line driving, and video is optionally available on 124 ohm balanced line output for long video line driving. A video "Test" BNC type output is available on the camera rear plate. Built-in switch-selectable video coax pre-equalization to compensate for up to 3000 ft. of cable.

SCAN FAILURE PROTECTION: Vertical and horizontal sweep voltages and currents are sampled. Instantaneous, transistorized circuitry fully protects the vidicon.

HORIZONTAL SCAN FREQUENCY: Controlled from either external drive or internal camera sync generator. Internal camera generator has a master oscillator which is a temperature stabilized crystal controlled master oscillator.

VERTICAL SCAN FREQUENCY: Controlled from either external drive or internal camera sync generator which derives the vertical frequency from the horizontal frequency with binary dividers.

DC COMPONENT TRANSMISSION: None. Video is AC coupled to the outputs.

RESOLUTION STABILITY VS. INPUT VOLTAGE VARIATION: No preceptible change with an input AC voltage variation from 95 VAC to 135 VAC, or an input D.C. voltage variation of 12 to 36 VDC.

OPERATING TEMPERATURE RANGE: $-20^{\circ}C$ ($-4^{\circ}F$) to $+60^{\circ}C$ ($+140^{\circ}F$).

RESOLUTION STABILITY VS. TEMPERATURE: Less than 10% degradation over a temperature range of $-10^{\circ}C$ ($14^{\circ}F$) to $+49^{\circ}$ ($120^{\circ}F$).

OPERATIONAL STABILITY: Stable operation is achieved within five minutes of turn-on for temperatures above zero degrees centigrade and within 15 minutes at lower temperatures.

CONTROLS:

External Controls
Power on/off
Beam
Focus

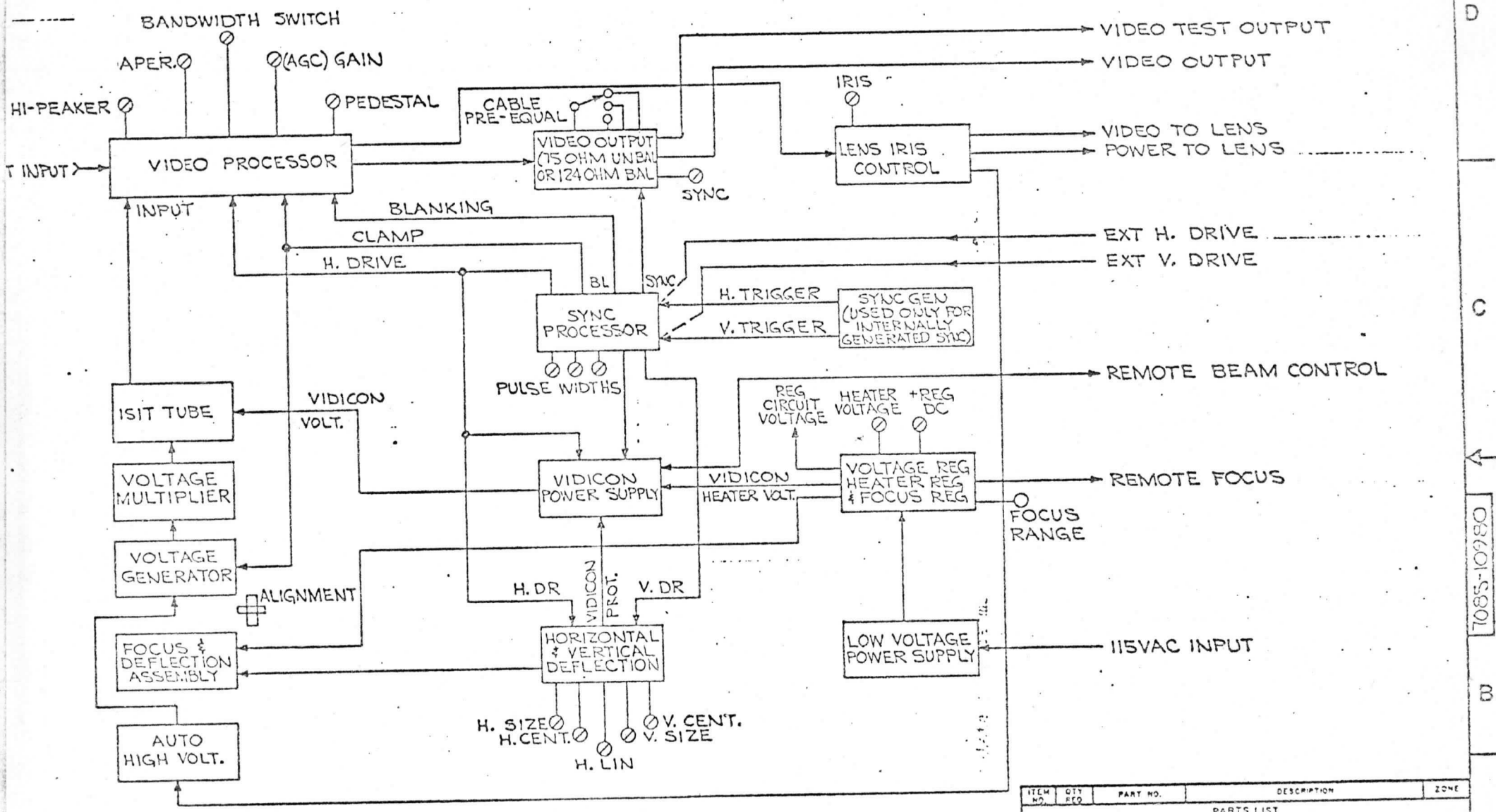
External controls may be provided locally with a small control unit connected to the remote-control connector on the camera or may be remoted up to a distance of 3,000 feet. Mechanical optical focus adjustable from front of camera.

CONNECTORS:

1 Type "UHF" for 75-ohm line output, or optionally
1 Amphenol Type 6225 for 124 ohm balanced video line output
1 Zoom Lens output
1 Remote functions input

a. Beam
b. focus
c. Power input, 105 to 130 VAC or
d. Power input, +12 to +36 VDC
e. Optional vertical drive input
f. Optional horizontal drive input
g. Zoom lens controls
h. Automatic/manual iris control

ZONE	LTR	DESCRIPTION	DATE	APPROVED



ITEM NO.	QTY REQ	PART NO.	DESCRIPTION	ZONE

PARTS LIST

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ON:
FRACTIONS
DECIMALS
ANGLES

MATERIAL

CONTRACT NO.

DWG NO.

		DATE
APPROVED		
ENGINEER		
CHECKED		
DRAWN		3/21/74
APPROVED		
APPROVED		

GENERAL ELECTRODYNAMICS CORPORATION
GARLAND, TEXAS

BLOCK DIAGRAM
ED7085 CAMERA

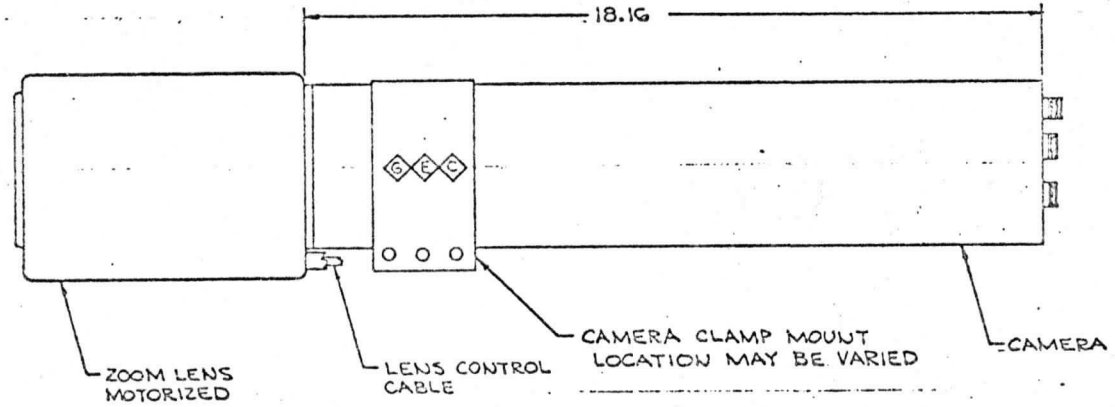
SIZE	CODE IDENT NO.	GEC DRAWING NO.	REV
C	06433	7085-10980	

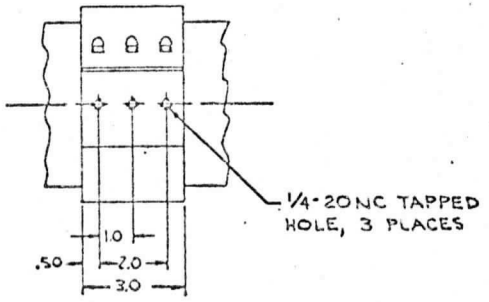
SCALE ~ WEIGHT SHEET

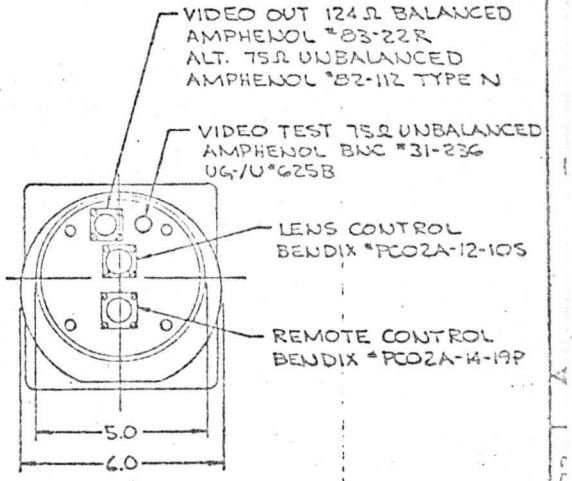
7085-10980

D C B A

ZONE	LTR	DESCRIPTION	DATE	APPROVED







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PARTS LIST

NEXT ASSY	USED ON

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON:
FRACTIONS
DECIMALS
ANGLES

MATERIAL

CONTRACT NO.

DWG NO.

		DATE
APPROVED		
ENGINEER		
CHECKED		
DRAWN	[illegible]	3/12/74
APPROVED		
APPROVED		

GENERAL ELECTRODYNAMICS CORPORATION
GARLAND, TEXAS

OUTLINE, MAX DIMENSIONS CAMERA ULTRA LOW LIGHT LEVEL

SIZE	COGL IDENT NO.	GEC DRAWING NO.	REV
C	06433	7085-00972	

SCALE [illegible] WEIGHT SHEET

GEC price list

ELECTRONIC TUBES

February 1, 1962

GEC Type	Description	User Price
	Vidicons	
1320	Special Industrial	$230.00
1326	Storage	$725.00
1343	Ruggedized Electrostatic	$2088.00
6326A	TV Film Pick Up (Dynamic Focus)	$515.00
7038	TV Film Pick Up	$230.00
7226	Short Length, Low Power Heater	$275.00
7226A	Ruggedized 7226	$665.00
7291	TV Film Pick Up	$375.00
7325	High Sensitivity	$230.00
7336	Broadcast Live Pick Up (Dyn. Focus)	$515.00
7522	Electrostatic Focus and Deflection	$1265.00
7697	Industrial Low Target Voltage	$230.00
7735A	Industrial	$230.00
	Scan Conversion Tubes	
7828	Simultaneous Read and Write, Controllable Storage	$2340.00
	Accessories	
52-01	7522 Socket	$6.05

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS

BULLETIN NO. GEC-106 – 2-62

G E C application letter

VIDICON APPLICATIONS

GEC 1320	Special Industrial Vidicon. Designed for high contrast scenes where ultimate sensitivity is not needed. Insensitive to image retention from stationary scenes such as plotting boards and water gages.
GEC 1326	Storage Vidicon. Retains image after scene is removed. Ideally suited for TV weather radarscope pick-up.
GEC 1343	Ruggedized Electrostatic Focus and Deflection Vidicon. Electrical characteristics similar to 7522.
GEC 6326A	TV Film Pickup. Characteristics controlled for optimum film pick-up operation. Provision for dynamic focus.
GEC 7038	TV Film Pickup. For cameras adjusted for this type.
GEC 7226	Short Length, Low Power Heater Vidicon. Designed for transistorized, compact cameras.
GEC 7226A	Ruggedized Vidicon. Includes advantages of 7226 with ruggedized construction. Operates under MIL-E-5272A environmental conditions. Primarily used for military applications such as missiles and aircraft or severe industrial environments.
GEC 7291	TV Film Pick-Up. Identical to 6326A but without dynamic focus.
GEC 7325	Latest Advance in Vidicon Camera Tubes. Highest sensitivity, lowest lag tube available. Excellent pictures obtained from low light level scenes. This improved tube gives performance superior to 7735A.
GEC 7336	Broadcast Quality Live Pick-Up. For televising live scenes in broadcast applications. Combines high sensitivity of 7325 with provision for dynamic focus.
GEC 7522	Electrostatic Focus and Deflection. Low power requirements for focus and deflection. Capable of any type scan.
GEC 7697	For Industrial Cameras with automatic sensitivity control. Target voltage held to low value and close limits as required in some automatic TV cameras. Other characteristics identical to the 7325.

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS
BULLETIN NO. GEC-108—5-61

GENERAL ELECTRODYNAMICS CORPORATION

EIA REGISTERED AND GEC STANDARD VIDICON TYPES

May, 1965

TYPE	Diameter – ins.	Length – ins.	Focus; Deflection	Heater – ma.	Separate Mesh	Ruggedization	FEATURES: APPLICATIONS
6326A	1	6-1/4	MM	600	–	–	TV film pickup; kovar seal; dyn. focus
7038	1	6-1/4	MM	600	–	–	Live scenes and TV film pickup
7226	1	5-1/8	MM	150	–	–	Short length; low power heater
7226A	1	5-1/8	MM	150	–	R	Ruggedized 7226
7290	1	6-1/4	MM	600	–	–	Slow scan
7291	1	6-1/4	MM	600	–	–	TV film pickup; kovar seal
7325	1	6-1/4	MM	600	–	–	Superseded by 8484
7336	1	6-1/4	MM	600	–	–	Broadcast live pu; Prov. for dyn. focus
7522	1	6-1/8	EE	300	Yes	–	Electrostatic with Deflectron
7697	1	6-1/4	MM	600	–	–	Low target voltage for ATC
7735A	1	6-1/4	MM	600	–	–	Superseded by 8484
8355	1	6-1/4	MM	300	–	–	8484 construction
8484	1	6-1/4	MM	600	–	–	Standard high sens. & high res.
8485	1	6-1/4	MM	300	Yes	–	Hi res.; separate mesh; new gun design
8507	1	6-1/4	MM	600	Yes	–	High resolution; separate mesh
8572	1	6-1/4	MM	600	Yes	–	TV film pickup; separate mesh
8633	1	5.81	EE	300	Yes	SR	Missile; surveillance
TD1305-001	1/2	3-1/4	EM	170	Yes	SR	Extreme environment; small size
TD1320	1	6-1/4	MM	600	–	–	Plotting boards; stationary scenes
TD1326	1	6-1/4	MM	600	–	–	Radar display; short term storage
TD1337	1	6-1/8	EM	300	Yes	–	Hybrid; compact camera
TD1341-001	1	6-1/4	MM	300	Yes	–	High resolution; stationary scenes
TD1348-001	1	6-1/4	MM	300	Yes	–	High resolution, high sensitivity
TD1354-001	1	6-1/4	MM	300	–	–	Plotting boards; stationary scenes
TD1355	1	6-1/4	MM	150	Yes	–	Separate mesh; low power heater

M – Magnetic E – Electrostatic R – Ruggedized SR – Super-ruggedized

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS
P. O. BOX 798 214-276-1161

BULLETIN NO. TD 126–5-65

GEC 1343 RUGGEDIZED ELECTROSTATIC VIDICON

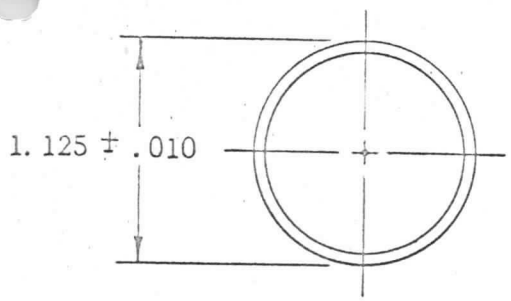
Tentative Data

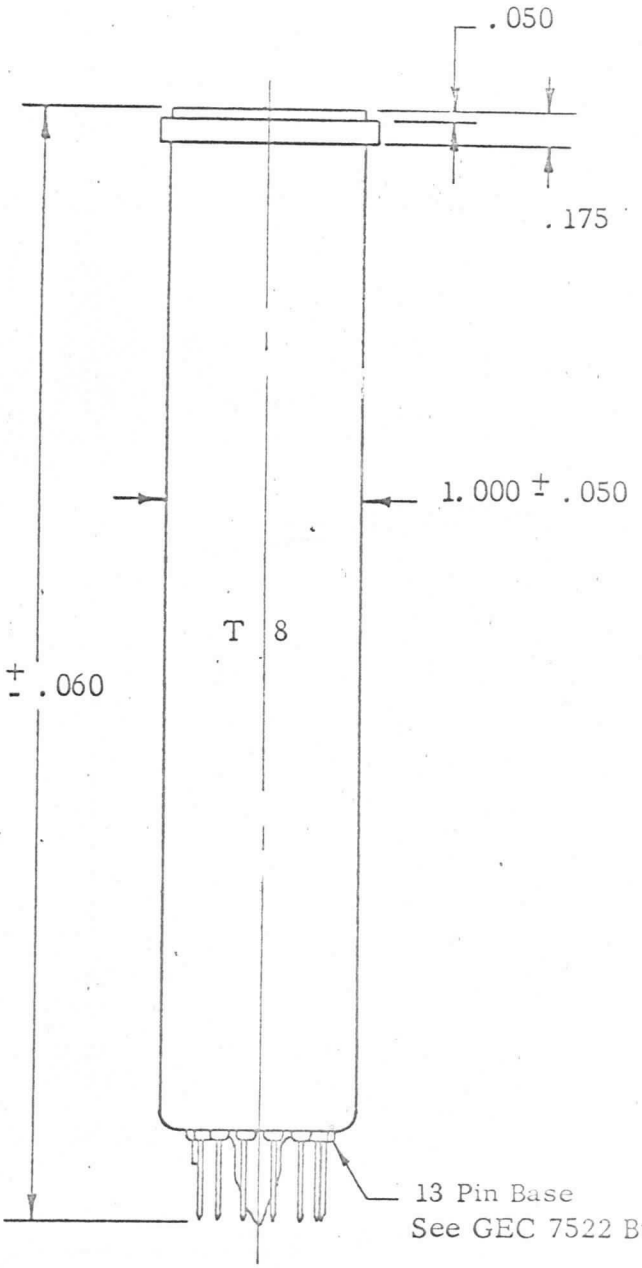
The GEC 1343 Ruggedized Electrostatic Focus and Deflection Vidicon operates in severe environmental conditions typically found in military and space applications. Camera volume, weight and power requirements are minimized because no external focus or deflection components are needed. A low power heater is used. Other electrical characteristics are similar to the GEC 7522.

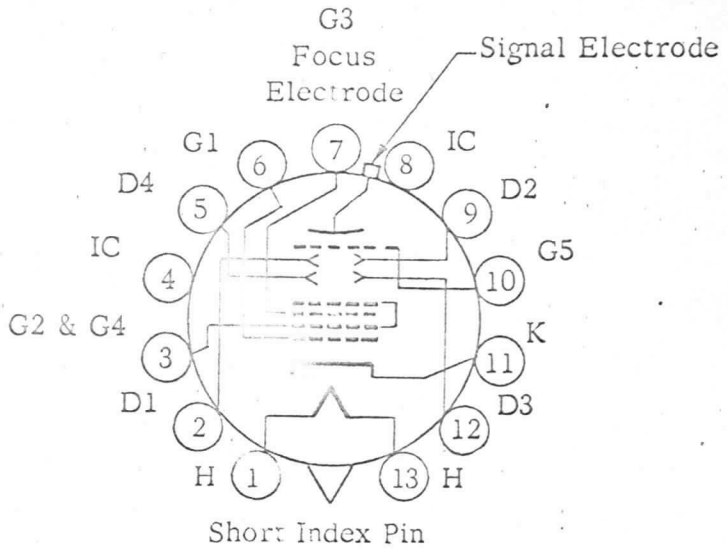
GENERAL:	
Operating Position	Any
Focusing Method	Electrostatic
Deflection Method	Electrostatic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
ELECTRICAL CHARACTERISTICS:	
Heater	
Voltage (AC or DC)	6.3 V ± 10%
Current	150 ma
Spectral Response	S-18
Direct Interelectrode Capacities	
Signal Electrode to all others	4 uuf
D 1 to D 2 (Horizontal Plates)	6 uuf
D 3 to D 4 (Vertical Plates)	6 uuf
ABSOLUTE MAXIMUM RATINGS:	
Grid No. 1 Voltage	
Negative Bias	300 V
Positive Bias	0 V
Heater to Cathode Peak Voltage	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V
Grid No. 2 Voltage	750 V
Faceplate	
Illumination	1000 ft-c
Temperature (Operating)	71° C.
Signal Electrode Current	0.6 uA
TYPICAL OPERATION:	
Scanned Area	0.500 x 0.375 in.
Faceplate Temperature	30° to 35° C.
Optimum Signal Output Current (Less Dark Current, with uniform 2870° K Tungsten illumination on faceplate.)	
5 ft-c and greater	0.2 uA
0.2 to 0.5 ft-c	.05 to .1 uA
Signal Electrode Voltage	20 to 100 V

TYPICAL OPERATION, Continued:

Average Gamma of Transfer Characteristic over Signal Output Current Range of .05 to 0.2 uA	.55
Grid No. 5 Voltage	300 V
Focus Electrode Voltage	0 to 50 V
Grid No. 2 and Grid No. 4 Voltage	200 V
Grid No. 1 (For signal cutoff with no blanking on G1)	-45 to -100 V
Minimum Blanking Voltage (Peak to Peak)	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Deflection Voltages (Peak to Peak)	
Horizontal (D 1 to D 2)	60 V
Vertical (D 3 to D 4)	50 V
Horizontal Plates DC Voltage	200 V to 250 V
Vertical Plates DC Voltage	200 V to 250 V







Direction of Light
Into Faceplate of Tube

Pin 1: Heater
Pin 2: D1 Horizontal Deflection Plate
Pin 3: Grid No. 2 & 4
Pin 4: Internal Connection--Do not use
Pin 5: D4 Vertical Deflection Plate
Pin 6: Grid No. 1
Pin 7: G3 Focus Electrode
Pin 8: Internal Connection--Do not use
Pin 9: D2 Horizontal Deflection Plate
Pin 10: Grid No. 5
Pin 11: Cathode
Pin 12: D3 Vertical Deflection Plate
Pin 13: Heater
Short Index Pin; Internal Connection--Do not use
Flange: Signal Electrode

Electronic Tube Division
GENERAL ELECTRODYNAMICS CORPORATION
Garland, Texas

GEC technical data

GEC 1326 STORAGE VIDICON

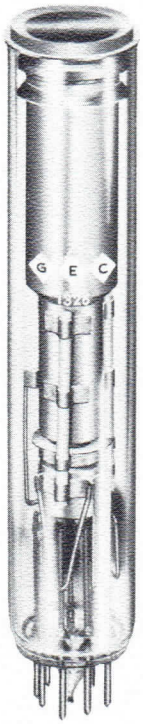
TENTATIVE DATA

The GEC 1326 broadcast quality vidicon is designed specifically to provide controlled short term storage and is suitable for such applications as radar display tube pickup and slow scan television. Its special photoconductive faceplate coating permits storage of the video signal over a controlled period of time, yet the image will decay without erasure by external light or by special erasing circuits. With the patented GEC internal particle shield construction, the tube may be handled or operated in any position.

DATA

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	



ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ±10%
Current	.60
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 uuf

ABSOLUTE MAXIMUM RATINGS:

Anode Voltage	350 V
Grid No. 2 Voltage	350 V
Grid No. 1 Voltage	
Negative Bias Values	125 V
Positive Bias Values	0 V
Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS

BULLETIN NO. GEC-112-10-60

ABSOLUTE MAXIMUM RATINGS, Continued:

Faceplate	
Illumination	200 ft-c
Temperature	71° C.
Signal Electrode Current	. 60 uA

TYPICAL OPERATION:

Scanned Area	0. 500 x 0. 375"
Faceplate Temperature	30° to 35° C.
Optimum Signal-Output Current (Signal Electrode Current Minus Dark Current) For uniform 2870° K Tungsten Illumination on faceplate	. 2 uA
Signal Electrode Voltage For 1 ft-c faceplate illumination and signal-output current of . 2 uA	12 to 25 V
Average Gamma of Transfer Characteristic over Signal-Output Current operating range of . 05 to . 2 uA	. 65
Anode Voltage	200 to 300 V
Grid No. 2 Voltage	300 V
Grid No. 1 Voltage (For picture cut-off with no blanking voltage on Grid No. 1)	-45 to -100 V
Minimum Peak-to-Peak Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Magnetic Field Intensity at Center of Focusing Device	40 gauss
Magnetic Field Intensity of Adjustable Alignment Coil	0 to 4 gauss
Storage Time (During Continuous Reading) Variable with signal electrode voltage, light level and exposure.	See Figure 2.

OPERATING CONSIDERATIONS:

The retentivity characteristic of the GEC 1326 is a function of signal electrode voltage, light level and exposure time. Figure 1 illustrates the tube storage characteristic in comparison to the 6326A vidicon. The graph represents the decay for only one condition of light level and signal electrode voltage. If the faceplate illumination is lowered, and the signal electrode voltage raised to return the signal current to . 2 microamperes, the storage will increase. Figure 2 illustrates the effect of a range of lens stop settings on the storage of the tube, with scene illumination constant. In any case, the tube signal current will decay to dark current value in from 5 to 30 seconds, depending on light and tube operating potentials without the necessity of erasure by external light or special circuits. For this reason, the tube is ideally adaptable to weather radar pickup and will provide proper decay characteristics for this purpose. The GEC 1326 may be used in any standard camera utilizing a 1 inch vidicon.

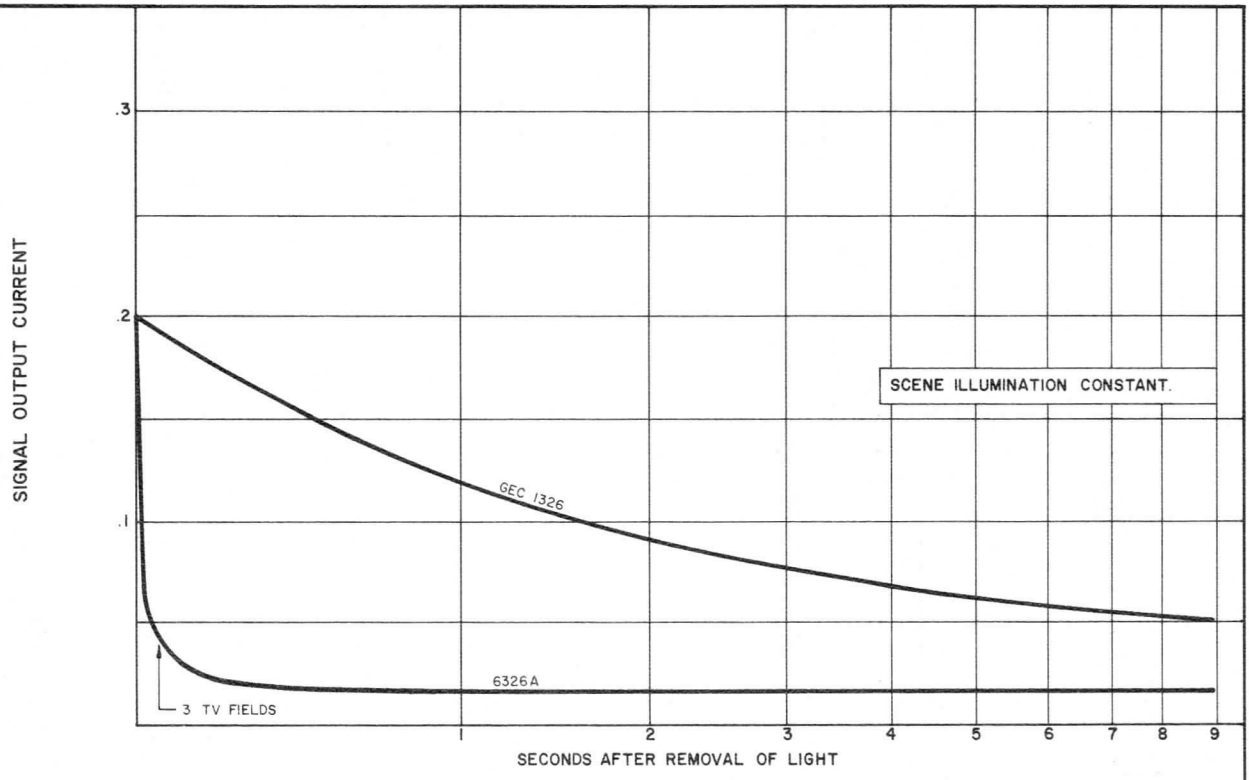


FIG. 1 DECAY CHARACTERISTICS OF 6326A AND GEC 1326 VIDICONS

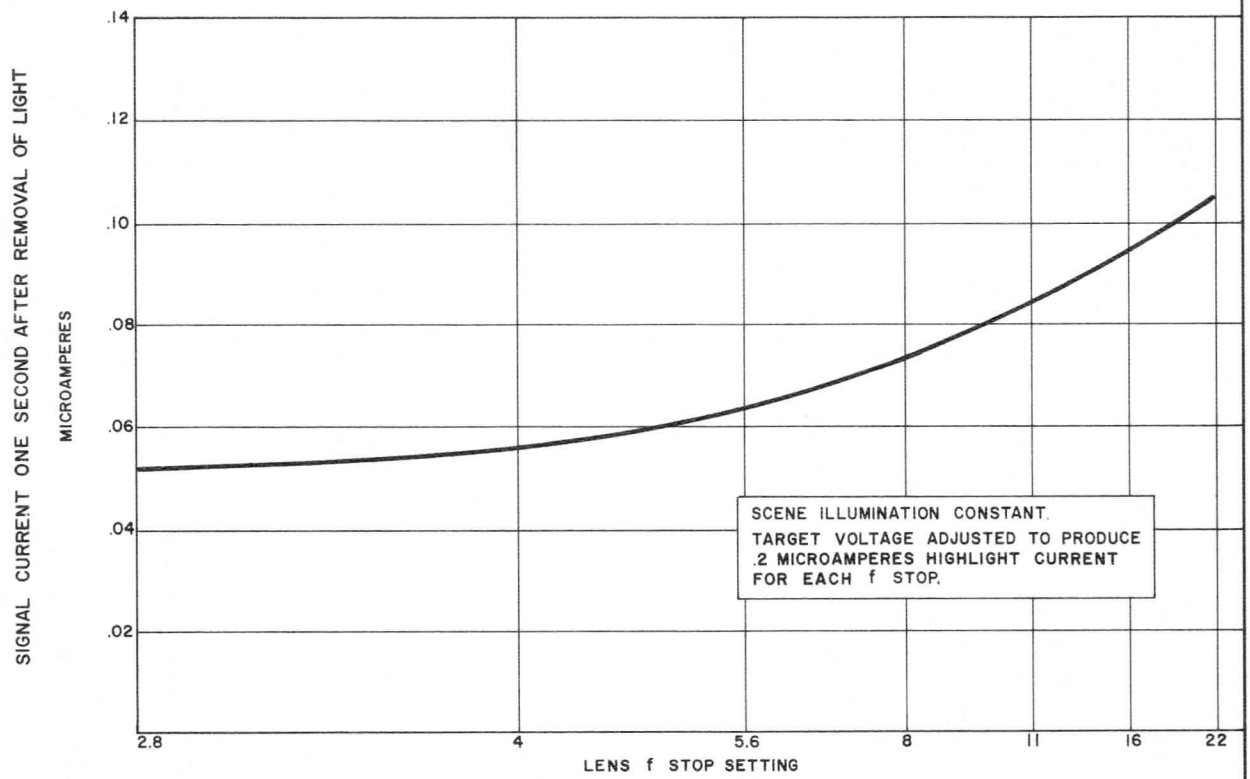


FIG. 2 STORAGE VS FACEPLATE ILLUMINATION GEC 1326 VIDICON

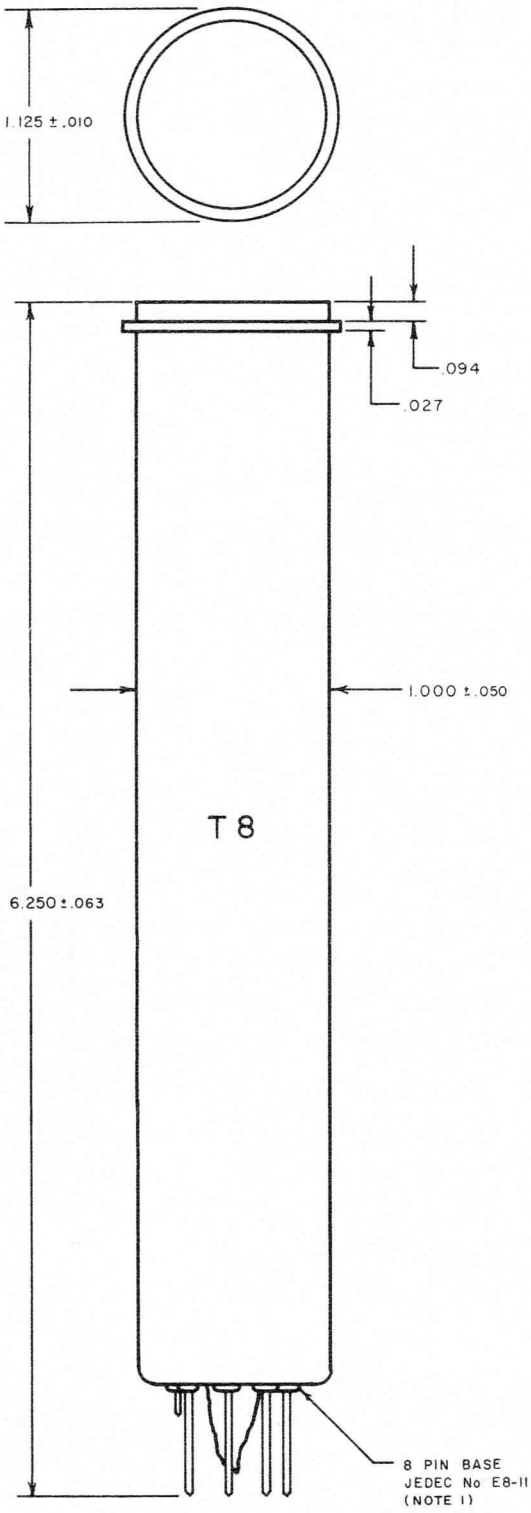


FIG. 3

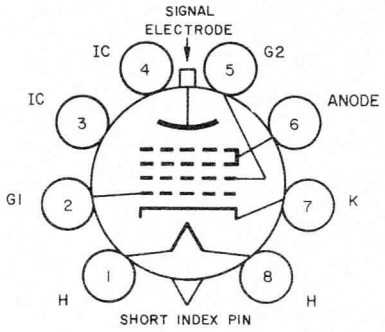


FIG. 4

8 HM

DIRECTION OF LIGHT:
INTO FACEPLATE OF TUBE

PIN 1: HEATER
PIN 2: GRID No. 1
PIN 3: INTERNAL CONNECTION--DO NOT USE
PIN 4: INTERNAL CONNECTION--DO NOT USE
PIN 5: GRID No. 2
PIN 6: ANODE
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) in. diameter, concentric with 9-hole circle.

2. All dimensions are shown in inches.

GEC technical data

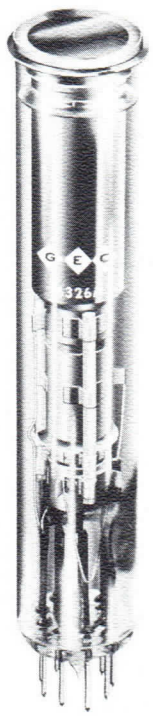
GEC 6326A VIDICON

The GEC 6326A Vidicon has characteristics controlled for optimum broadcast television film pick-up. Its high resolution and freedom from blemishes, together with its ability to be operated with dynamic focus, makes the tube well suited to broadcast and other high quality applications. The patented GEC improved internal construction allows the tube to be operated in any position.

DATA

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	



ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ±10%
Current	.60 A ±10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 uuf
Spectral Response	S-18

ABSOLUTE MAXIMUM RATINGS:

Anode Voltage	350 V
Grid No. 3 Voltage	350 V
Grid No. 2 Voltage	750 V
Grid No. 1 Voltage	
Negative Bias Values	125 V
Positive Bias Values	0 V
Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS

BULLETIN NO. GEC-109—4-60

ABSOLUTE MAXIMUM RATINGS, Continued:

Faceplate	
Illumination	1000 ft-c
Temperature	71° C.
Signal Electrode Voltage	125 Volts Max.

TYPICAL OPERATION WITH STATIC FOCUSING:

Scanned Area	0. 500 x 0. 375"
Faceplate Temperature	30° to 35° C.
Signal Electrode Voltage for Dark Current of 0. 02 uA	10 to 75 V
Signal Output Current (Signal Electrode Current Minus Dark Current)	0. 1 to 0. 2 uA
Average Gamma of Transfer Characteristic over Signal-Output Current operating range of . 05 to . 2 uA	. 55
Anode Voltage	200 to 300 V
Grid No. 3 Voltage	200 to 300 V
Grid No. 2 Voltage	300 V
Grid No. 1 Voltage (For picture cut-off with no blanking voltage on Grid No. 1)	-45 to -100 V
Minimum Peak-to-Peak Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Magnetic Field Intensity at Center of Focusing Device	40 gauss
Magnetic Field Intensity of Adjustable Alignment Coil	0 to 4 gauss

TYPICAL OPERATION WITH DYNAMIC FOCUSING:

Grid No. 3 used separately as dynamic focusing electrode	
Values for operation are the same as those shown under Typical Operation with Static Focusing with the exception of the following:	
Grid No. 3 Voltage - DC Value	200 to 300 V
Grid No. 3 Parabolic Voltage Peak-to-Peak Value	60 V (approx)

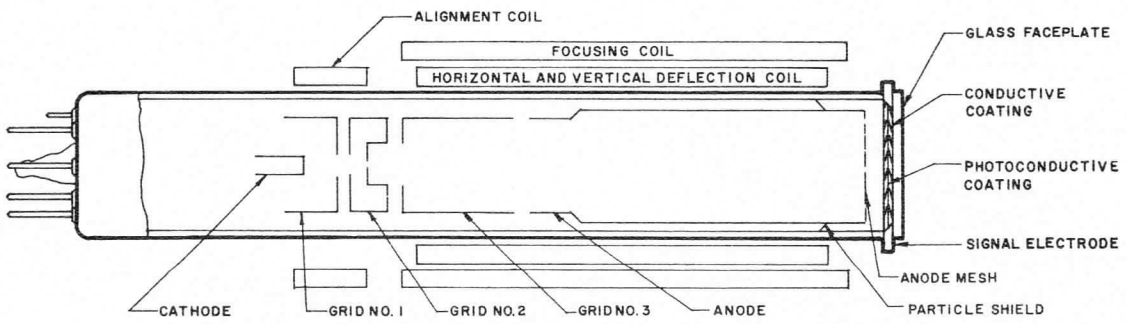


FIG. 1

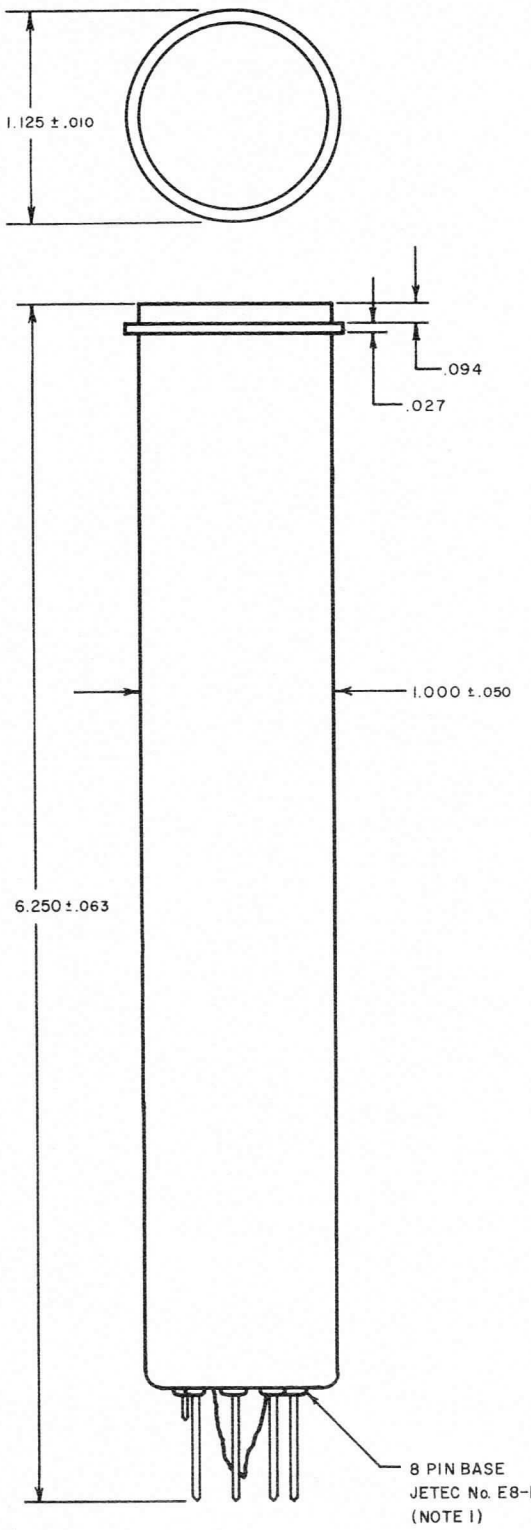


FIG. 2

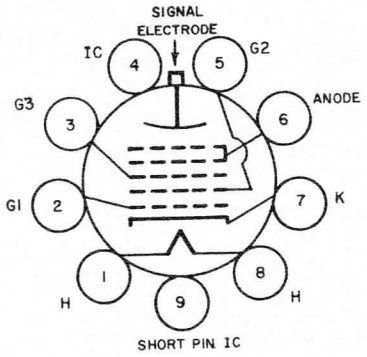


FIG. 3

PIN 1: HEATER
PIN 2: GRID No. 1
PIN 3: GRID No. 3
PIN 4: INTERNAL CONNECTION--DO NOT USE
PIN 5: GRID No. 2
PIN 6: ANODE
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) in. diameter, concentric with 9-hole circle.

2. All dimensions are shown in inches.

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS

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GEC technical data

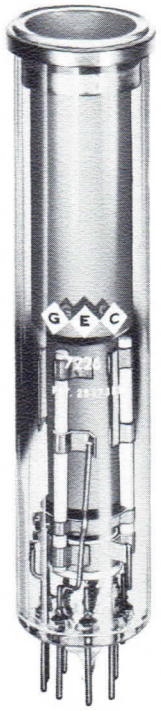
GEC 7226 VIDICON

Type GEC 7226 is a short-length vidicon with a 150MA heater intended for use in transistorized camera equipment where space is restricted and where heat dissipation must be kept at a minimum. The high sensitivity and low lag of this tube make it primarily suited for live pick-up. The GEC particle shield permits operation of the tube in any position.

DATA

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	



ELECTRICAL CHARACTERISTICS:

Heater (for Unipotential Cathode)	
Voltage (AC or DC)	6.3 V ±10%
Current	0.15 A ±10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 uuf

ABSOLUTE MAXIMUM RATINGS:

Anode Voltage	750 V
Grid No. 2 Voltage	750 V
Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V
Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS

BULLETIN NO. GEC-102 – 9-61

ABSOLUTE MAXIMUM RATINGS, Continued:

Faceplate	
Illumination	1000 ft-c
Temperature	71° C.
Signal Electrode Current	.60 uA

TYPICAL OPERATION:

Scanned Area	0.500 x 0.375"
Faceplate Temperature	30° to 35° C.
Optimum Signal-Output Current (Signal Electrode Current minus Dark Current)	
For uniform 2870° K Tungsten illumination on faceplate down to .5 ft-c	.2 uA
For uniform 2870° K Tungsten illumination on faceplate from .2 ft-c to .5 ft-c	.14 to .2 uA
Signal Electrode Voltage	
For 5 ft-c faceplate illumination and signal-output current of .2 uA	10 to 50 V
For .2 ft-c faceplate illumination and signal-output current of .14 uA	40 to 100 V
Average Gamma of Transfer Characteristic over Signal-Output Current operating range of .05 to .2 uA	.65
Anode Voltage	200 to 300 V
Grid No. 2 Voltage	300 V
Grid No. 1 Voltage (For picture cut-off with no blanking voltage on Grid No. 1)	-45 to -100 V
Minimum Peak-to-Peak Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Magnetic Field Intensity at Center of Focusing Device	40 gauss
Magnetic Field Intensity of Adjustable Alignment Coil	0 to 4 gauss

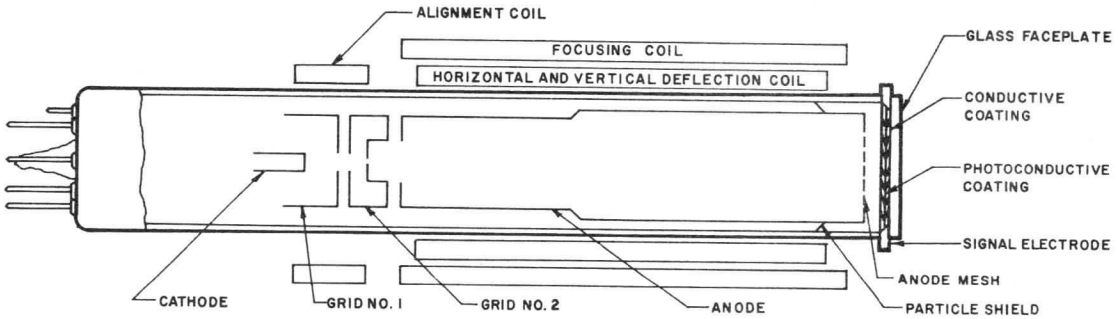


FIG. 1

PRINCIPLES OF OPERATION

The operation of the GEC 7226 Vidicon is based on the principle of photoconductivity. This effect produces a change in electrical conductivity with variations in incident light intensity.

The inside surface of the Vidicon faceplate is coated with a transparent conductive coating as shown in Figure 1. Over this is deposited a layer of photoconductive material. This material, when dark, is a reasonably good insulator. The electron beam is made to scan the back surface of this photoconductive surface.

In operation, the front surface of the photoconductor is held at a potential of some 30V, more or less, positive with respect to the cathode, by the application of this voltage to the transparent conductive coating. The scanning electron beam deposits a negative charge on the back surface of the photoconductor. Where the photoconductor is dark, and its resistance therefore high, the negative charge accumulates until this back surface is at the same potential as the cathode; any further electrons will be turned away. The dark portions of the photoconductor thus become charged in the manner of a capacitor. Dark current is slight electrical leakage through the dark areas.

But where light falls on the photoconductor, from the image of the scene, the conductivity of the material is substantially increased. The resulting leakage of the charge leaves a "hole" in the pattern of negative charge at any illuminated point. Upon its next trip across this point, then, the scanning beam will deposit electrons into this "hole"; this movement of charge calls for a corresponding flow of current into the transparent conductive coating, and the resulting voltage across the load resistor is the output video signal.

The Vidicon thus has the ability to "store" the image for an entire scanning cycle; the image is "photographed" in the pattern of negative charge on the back surface of the photoconductive material, and is accumulated there for the time of one complete frame. This process allows the improved GEC Vidicon to produce usable output from scenes which are dimly lighted.

The end of the anode nearest the faceplate is covered by a very fine mesh screen. The purpose of this screen is to establish a uniform decelerating field in the vicinity of the photoconductive surface, so that the electrons will arrive perpendicular to this surface and with low velocity. The fine-mesh screen simply provides a conducting plane through which electrons can readily pass.

Focusing of the electron beam is done by a magnetic field which is parallel to the axis of the tube. Two magnetic fields which are perpendicular to the axis of the tube and to each other are the means of alignment. Deflection is accomplished by means of magnetic fields perpendicular to the axis of the tube. External coils are necessary to produce these fields.

OPERATING CONSIDERATIONS

DARK CURRENT:

Dark current increases with signal electrode voltage. In normal operation, dark current does not present a problem unless it is non-uniform across the photoconductive surface. The GEC 7226 has extremely uniform dark current, which eliminates the problems of edge flare, shading, and graininess present in earlier type vidicons. This permits the 7226 to be operated at higher values of dark current.

OPTIMUM SIGNAL ELECTRODE CURRENT:

The GEC 7226 is not limited in its operation by dark current restrictions, as explained above. Therefore, best picture quality can be obtained by adjusting for optimum signal electrode current as shown in Figure 2. The resulting dark current is also shown in Figure 2 as an aid in circuit design. Signal output is the difference between signal electrode current and dark current and therefore can be obtained directly from Figure 2.

LIGHT TRANSFER CHARACTERISTICS:

Typical signal output current as a function of faceplate illumination is shown in Figure 3. The slope of the curve gives the average gamma of the tube.

SENSITIVITY:

Vidicon sensitivity is a function of the photoconductive coating characteristics as well as signal electrode voltage. The GEC 7226 has an improved photoconductive surface with higher inherent sensitivity than previous vidicons. At the same time, photoconductive surface uniformity permits operation at higher signal electrode voltages without dark current limitations. Therefore, higher effective sensitivity from higher signal electrode voltage is added to the improved inherent sensitivity.

Figure 3 also shows the variation of sensitivity with dark current. For example, at 1 foot candle and .02 uA dark current the signal output is .20 uA. Increasing the dark current to .2 uA increases the signal output to .50 uA. Since dark current increases with signal electrode voltage, this curve demonstrates the variation of sensitivity with signal electrode voltage.

PERSISTENCE:

The GEC 7226 vidicon has improved persistence characteristics as a result of its new photoconductive surface. Figure 6 shows these characteristics.

OPERATING TEMPERATURES:

No damage will result from operation of the tube at a temperature as high as 71° C. Figure 7 has been included as an aid to circuit design. This curve shows the variation in signal electrode voltage to maintain a constant signal electrode current as temperature is varied.

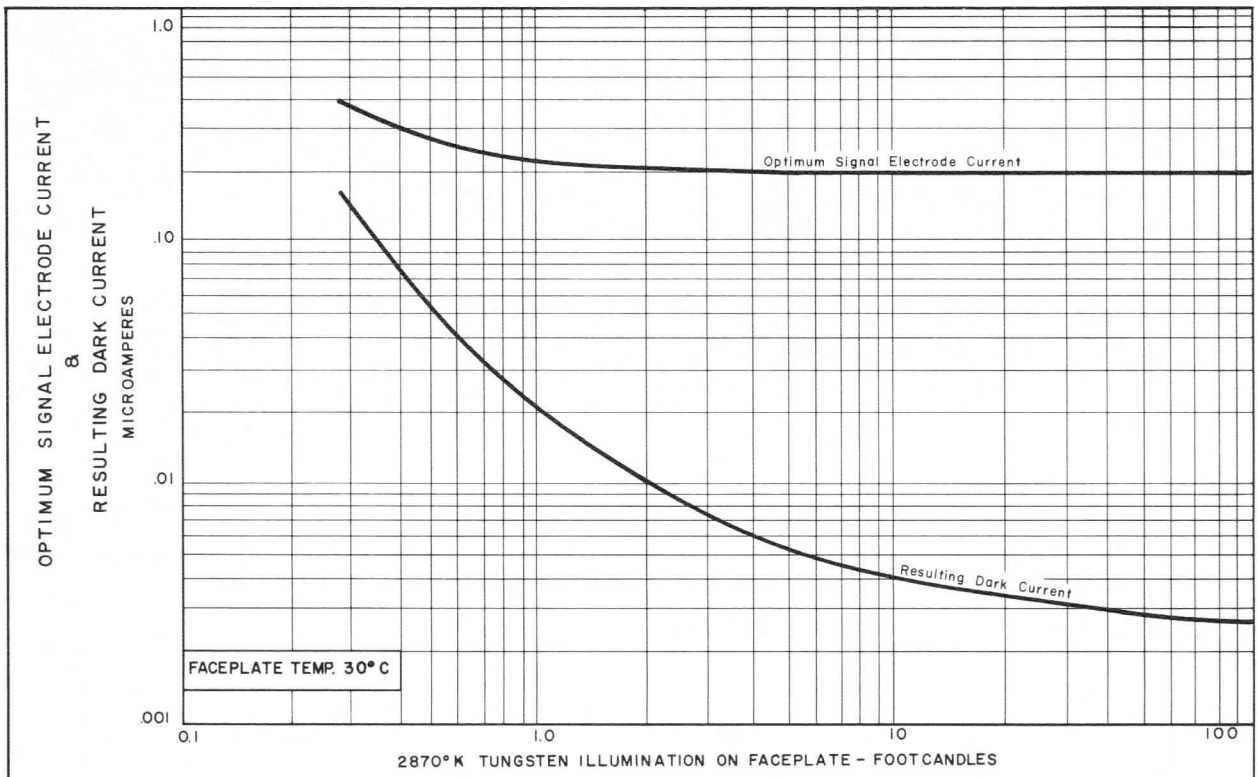


FIG. 2 OPTIMUM SIGNAL ELECTRODE CURRENT

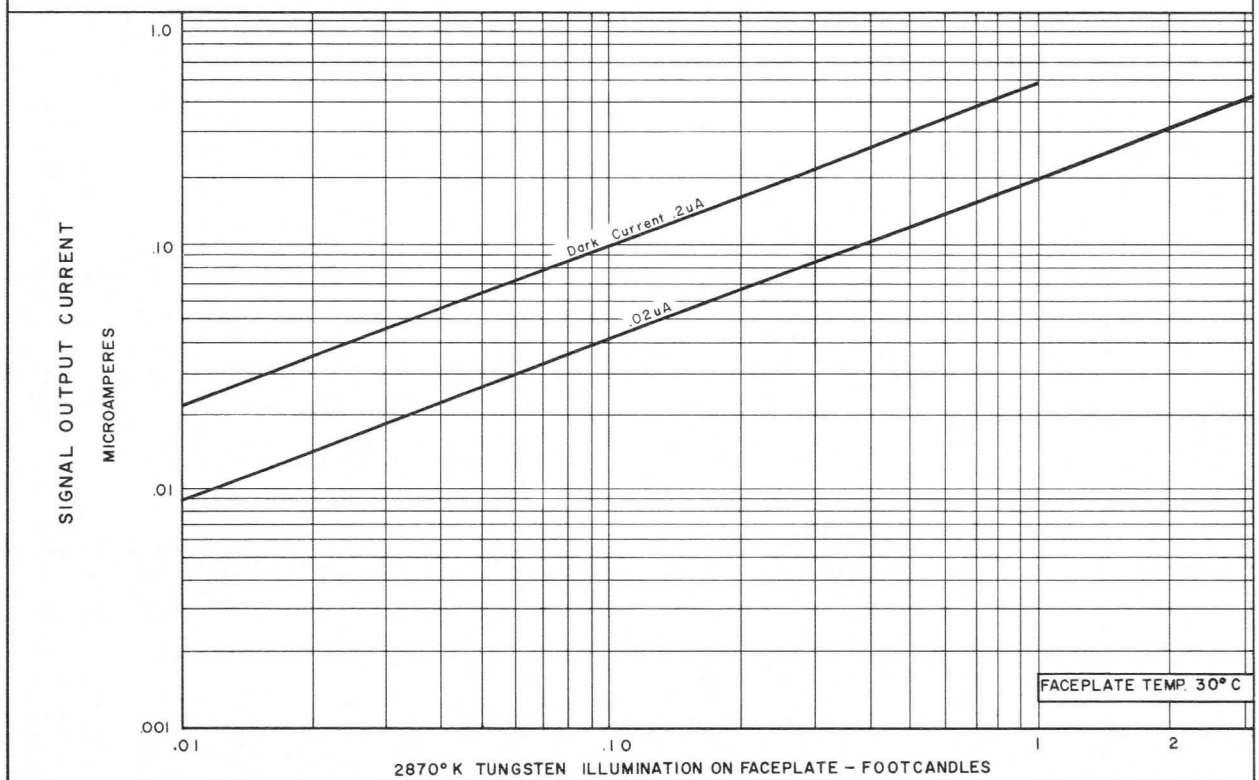


FIG. 3 TYPICAL LIGHT TRANSFER CHARACTERISTIC

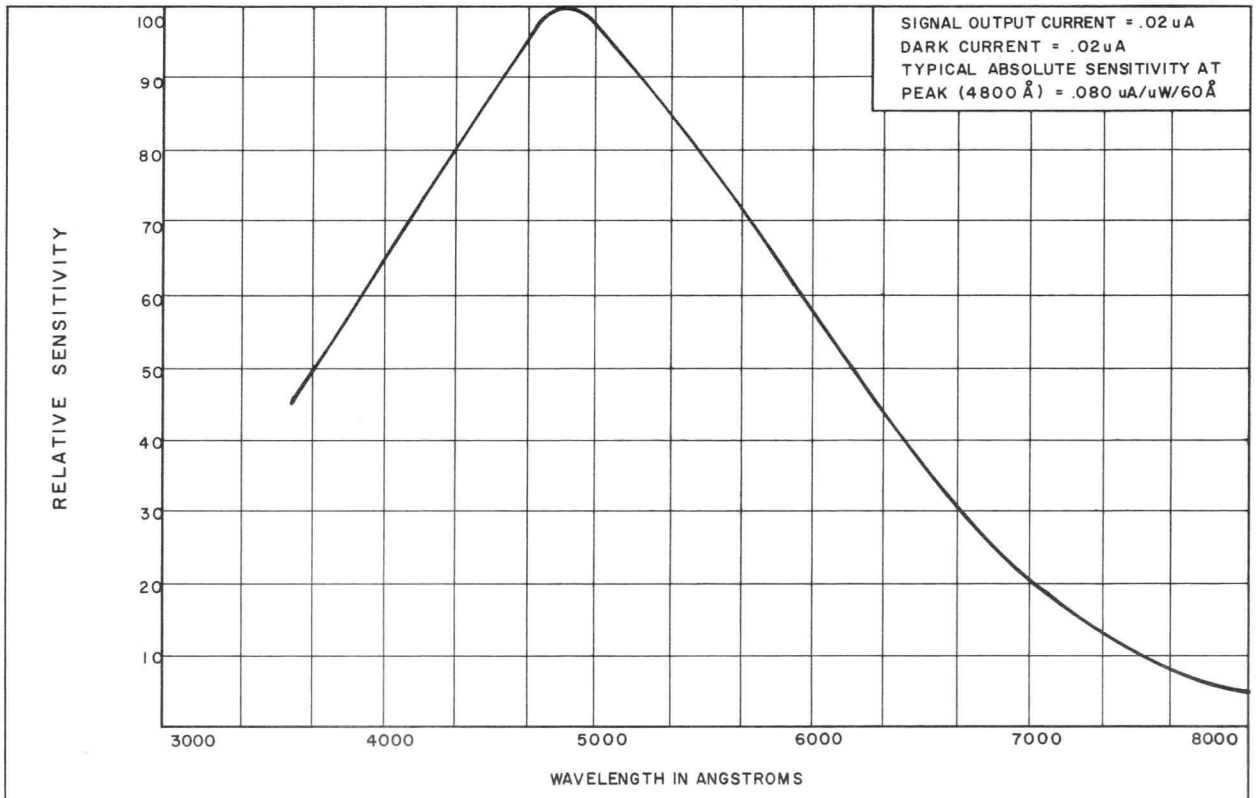


FIG. 4 SPECTRAL RESPONSE

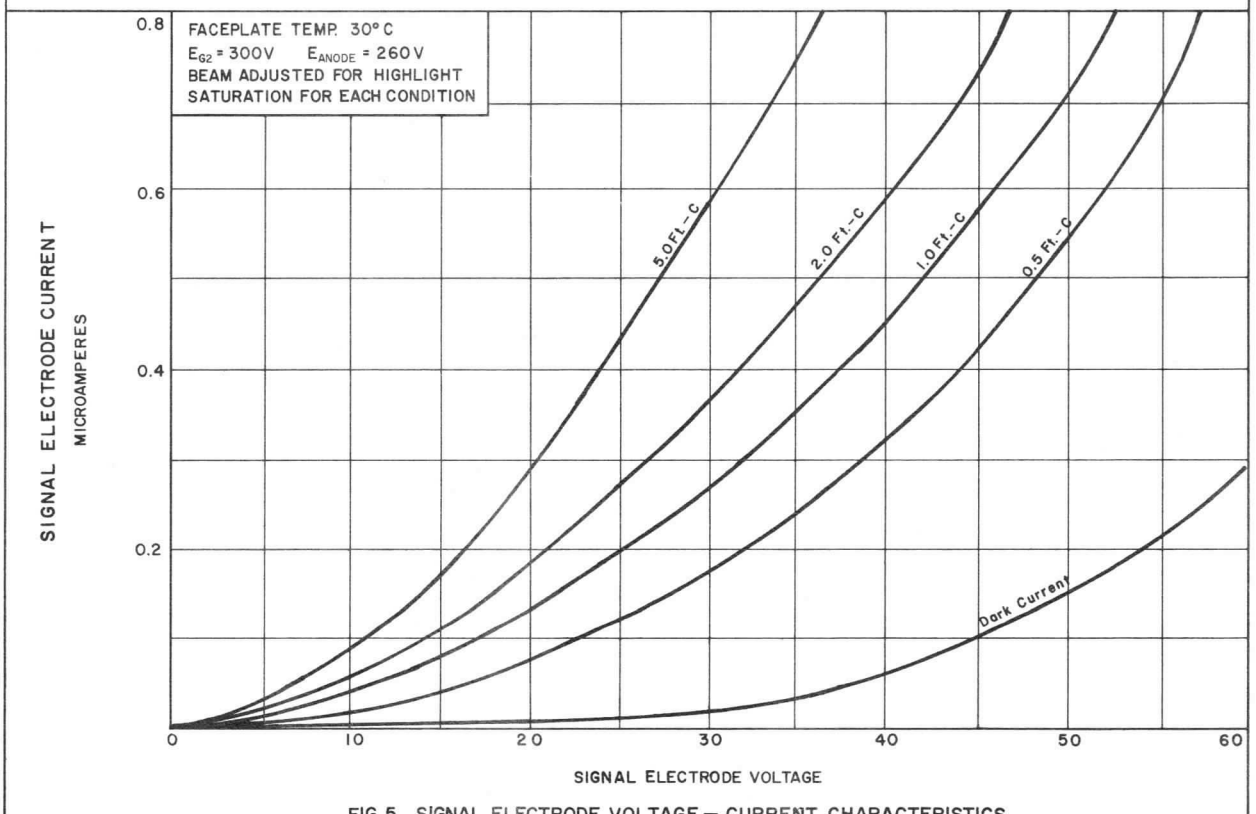


FIG. 5 SIGNAL ELECTRODE VOLTAGE — CURRENT CHARACTERISTICS

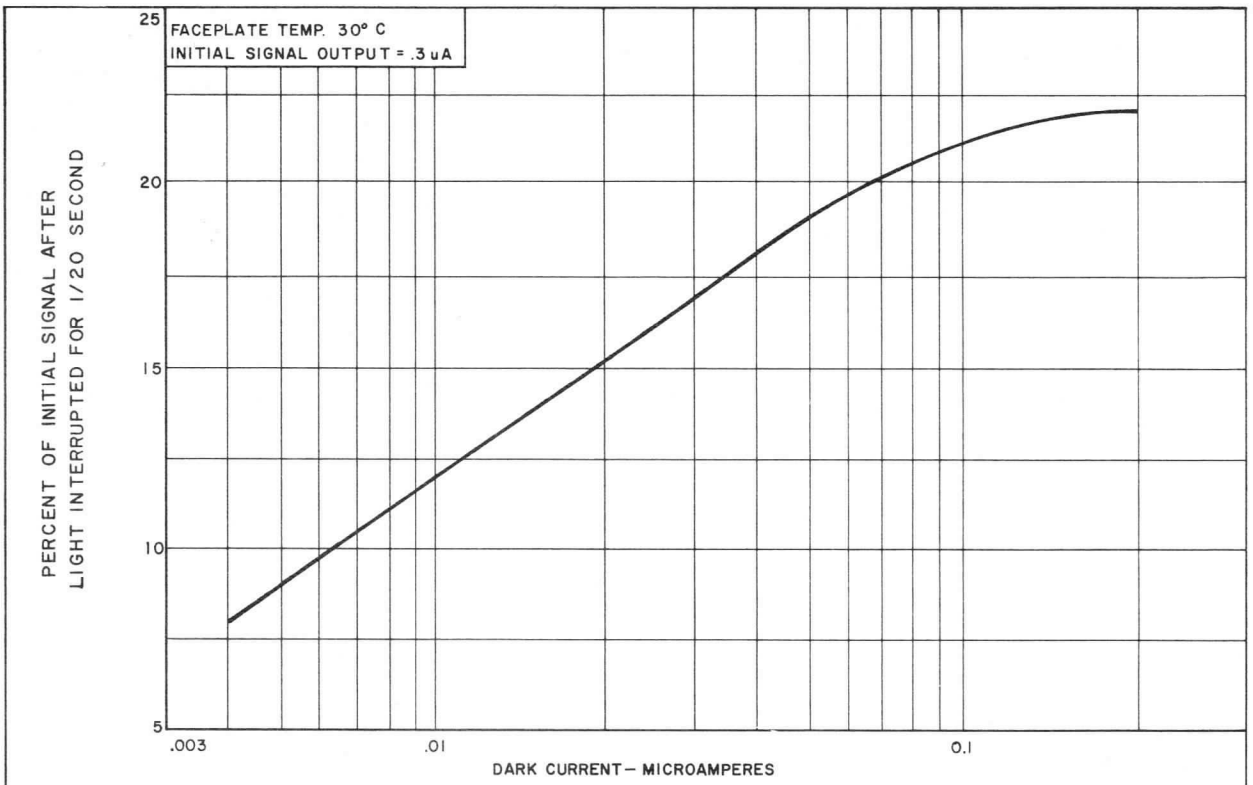


FIG. 6 TYPICAL PERSISTENCE CHARACTERISTICS

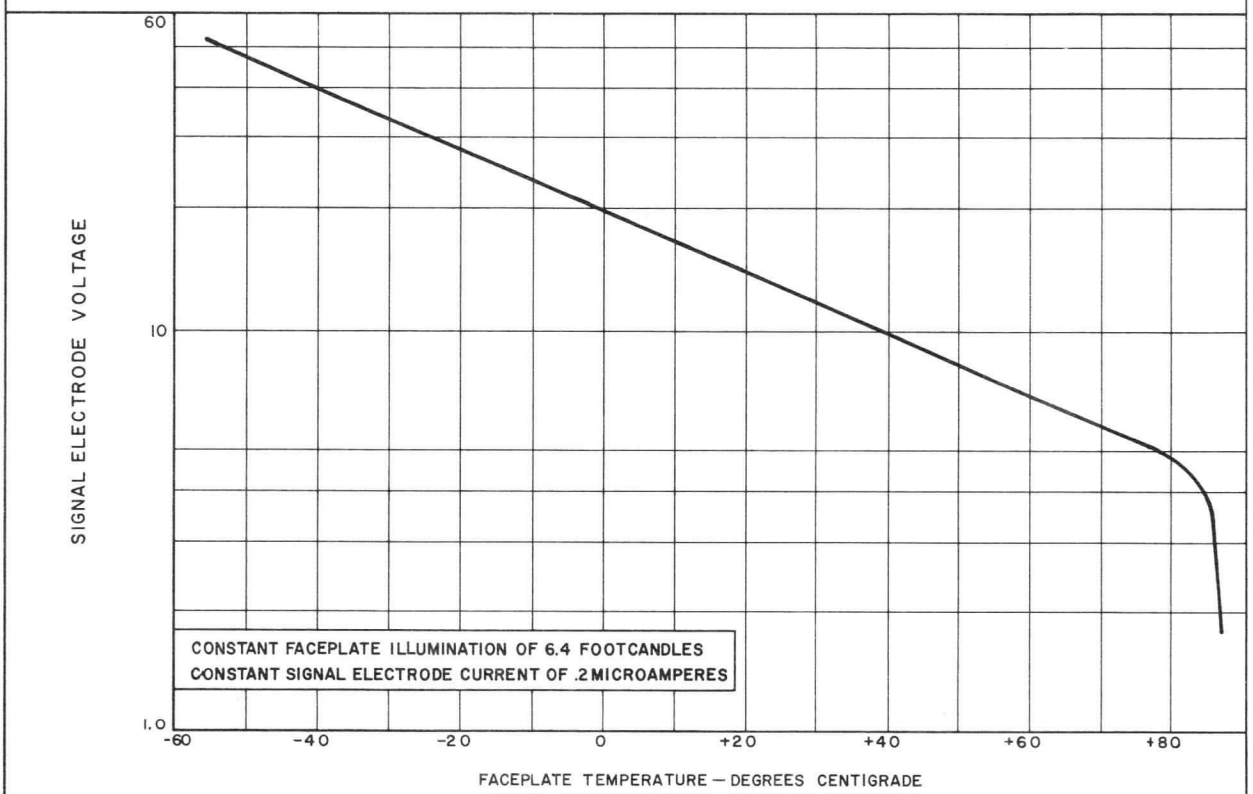
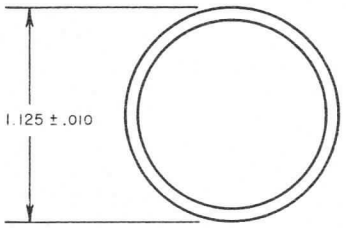


FIG. 7 TEMPERATURE CHARACTERISTICS



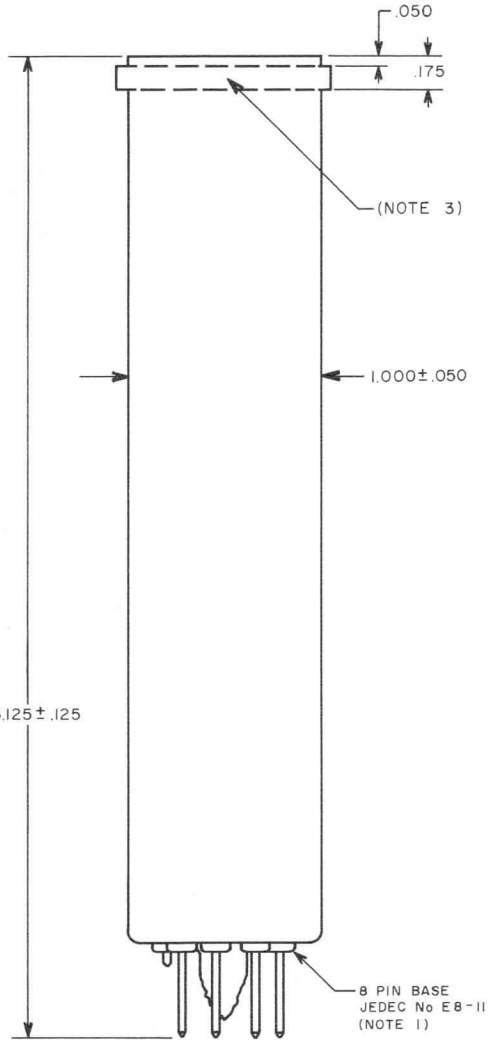
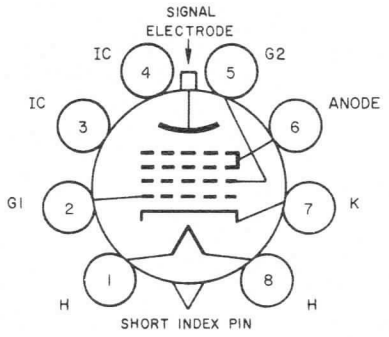


FIG. 8



8 HM

DIRECTION OF LIGHT:
INTO FACEPLATE OF TUBE

FIG. 9

PIN 1: HEATER
PIN 2: GRID No. 1
PIN 3: INTERNAL CONNECTION--DO NOT USE
PIN 4: INTERNAL CONNECTION--DO NOT USE
PIN 5: GRID No. 2
PIN 6: ANODE
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) in. diameter, concentric with 9-hole circle.

2. All dimensions are shown in inches.

3. Target Contact Flange in the form of a metal ring encircling the tube and having the indicated diameter may be located along the tube axis in any part of or all of the space between the dashed lines.

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GEC technical data

GEC 7226A RUGGEDIZED VIDICON

Type GEC 7226A is a ruggedized non-microphonic Vidicon intended primarily for live pick-up use in transistorized camera equipment where space is restricted and where heat dissipation must be kept at a minimum. The tube is constructed to withstand severe shock, vibration, and random white noise environments in any position without deterioration of the picture due to microphonics or dislocation of tube elements or loose particle damage to photo-conductive surface.

DATA

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	

ELECTRICAL CHARACTERISTICS:

Heater (for Unipotential Cathode)	
Voltage (AC or DC)	6.3 V ±10%
Current	0.15 A ±10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 uuf

ABSOLUTE MAXIMUM RATINGS:

Anode Voltage	750 V
Grid No. 2 Voltage	750 V
Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V
Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS

BULLETIN NO. GEC-103— 9-61

ABSOLUTE MAXIMUM RATINGS, Continued:

Faceplate	
Illumination	1000 ft-c
Temperature	71° C.
Signal Electrode Current	.60 uA

TYPICAL OPERATION:

Scanned Area	0.500 x 0.375"
Faceplate Temperature	30° to 35° C.
Optimum Signal-Output Current (Signal Electrode Current minus Dark Current)	
For uniform 2870° K Tungsten illumination on faceplate down to .5 ft-c	.2 uA
For uniform 2870° K Tungsten illumination on faceplate from .2 ft-c to .5 ft-c	.14 to .2 uA
Signal Electrode Voltage	
For 5 ft-c faceplate illumination and signal-output current of .2 uA	10 to 50 V
For .2 ft-c faceplate illumination and signal-output current of .14 uA	40 to 100 V
Average Gamma of Transfer Characteristic over Signal-Output Current operating range of .05 to .2 uA	.65
Anode Voltage	200 to 300 V
Grid No. 2 Voltage	300 V
Grid No. 1 Voltage (For picture cut-off with no blanking voltage on Grid No. 1)	-45 to -100 V
Minimum Peak-to-Peak Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Magnetic Field Intensity at Center of Focusing Device	40 gauss
Magnetic Field Intensity of Adjustable Alignment Coil	0 to 4 gauss

ENVIRONMENTAL CONDITIONS:

Faceplate Temperature	71° C. Max.
Shock	(MIL-E-5272A, Para. 4.15.1, Procedure I)
Vibration	(MIL-E-5272A, Para. 4.7, Procedure I)

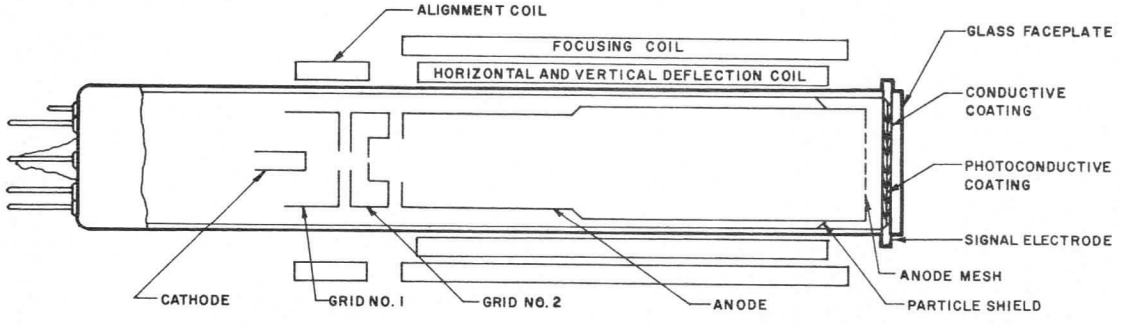


FIG. 1

OPERATING CONSIDERATIONS

DARK CURRENT:

Dark current increases with signal electrode voltage. In normal operation, dark current does not present a problem unless it is non-uniform across the photoconductive surface. The GEC 7226A has extremely uniform dark current, which eliminates the problems of edge flare, shading, and graininess present in earlier type vidicons. This permits the 7226A to be operated at higher values of dark current.

OPTIMUM SIGNAL ELECTRODE CURRENT:

The GEC 7226A is not limited in its operation by dark current restrictions, as explained above. Therefore, best picture quality can be obtained by adjusting for optimum signal electrode current as shown in Figure 2. The resulting dark current is also shown in Figure 2 as an aid in circuit design. Signal output is the difference between signal electrode current and dark current and therefore can be obtained directly from Figure 2.

LIGHT TRANSFER CHARACTERISTICS:

Typical signal output current as a function of faceplate illumination is shown in Figure 3. The slope of the curve gives the average gamma of the tube.

SENSITIVITY:

Vidicon sensitivity is a function of the photoconductive coating characteristics as well as signal electrode voltage. The GEC 7226A has an improved photoconductive surface with higher inherent sensitivity than previous vidicons. At the same time, photoconductive surface uniformity permits operation at higher signal electrode voltages without dark current limitations. Therefore, higher effective sensitivity from higher signal electrode voltage is added to the improved inherent sensitivity.

Figure 3 also shows the variation of sensitivity with dark current. For example, at 1 foot candle and .02 uA dark current the signal output is .20 uA. Increasing the dark current to .2 uA increases the signal output to .50 uA. Since dark current increases with signal electrode voltage, this curve demonstrates the variation of sensitivity with signal electrode voltage.

PERSISTENCE:

The GEC 7226A vidicon has improved persistence characteristics as a result of its new photoconductive surface. Figure 6 shows these characteristics.

OPERATING TEMPERATURES:

No damage will result from operation of the tube at a temperature as high as 71° C. Figure 7 has been included as an aid to circuit design. This curve shows the variation in signal electrode voltage to maintain a constant signal electrode current as temperature is varied.

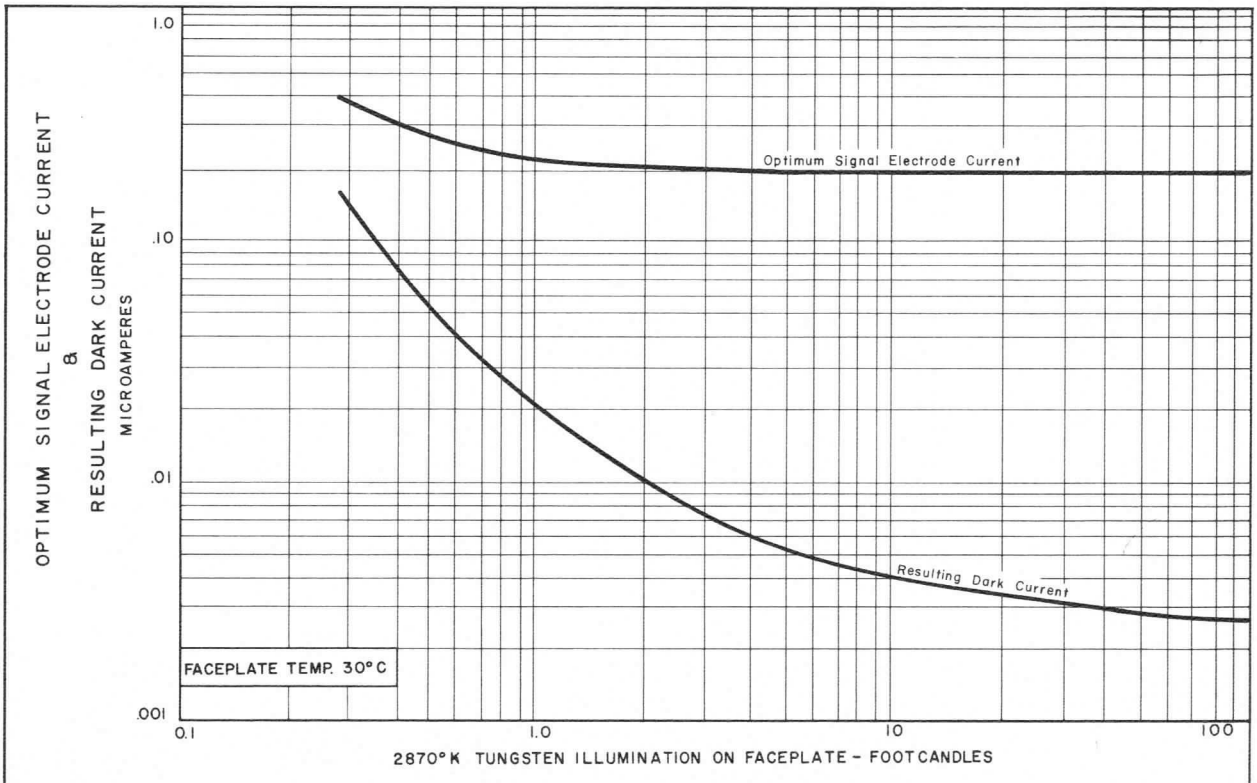


FIG. 2 OPTIMUM SIGNAL ELECTRODE CURRENT

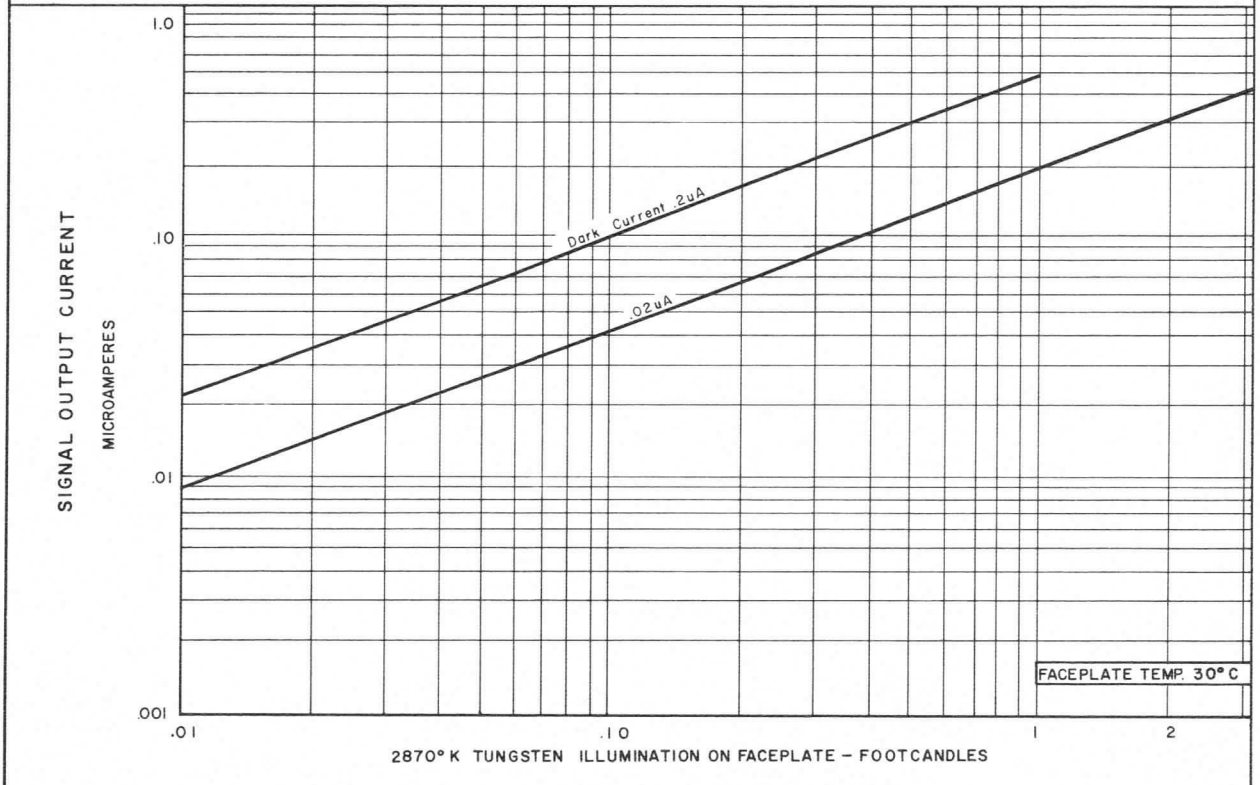


FIG. 3 TYPICAL LIGHT TRANSFER CHARACTERISTIC

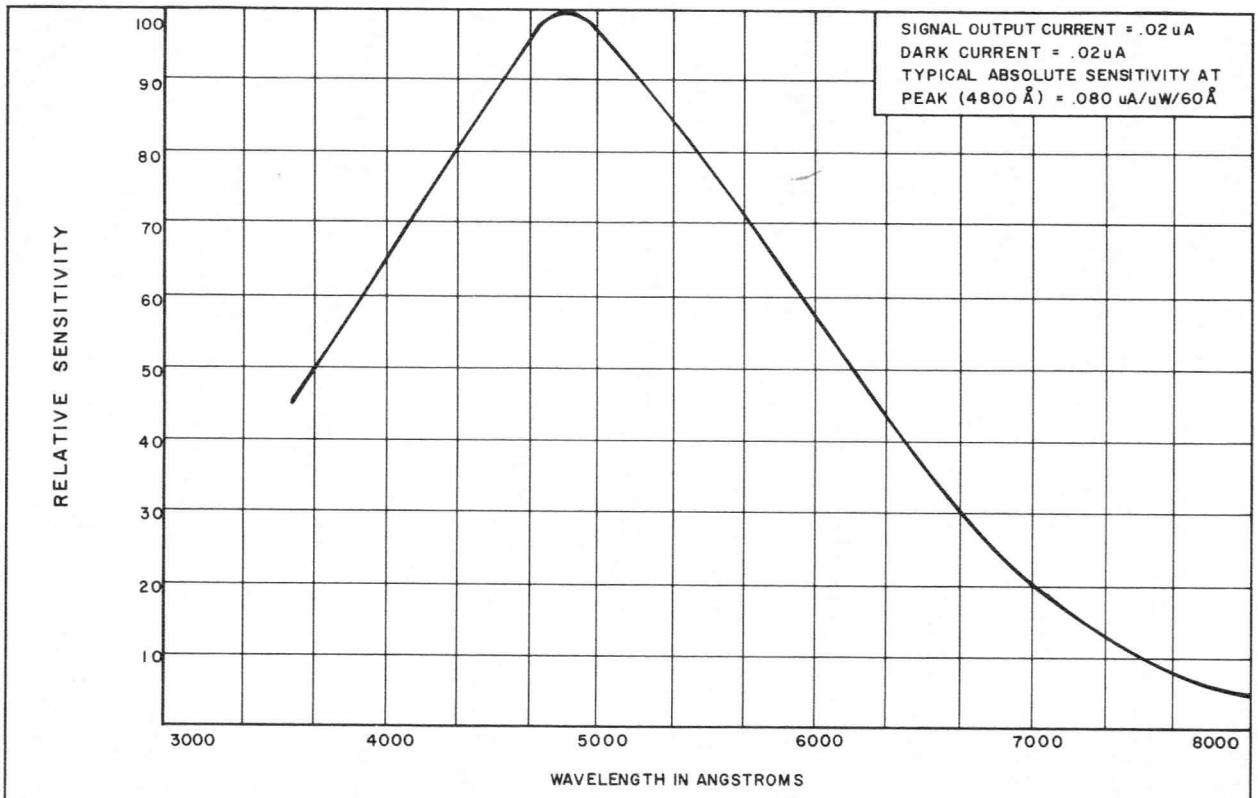


FIG. 4 SPECTRAL RESPONSE

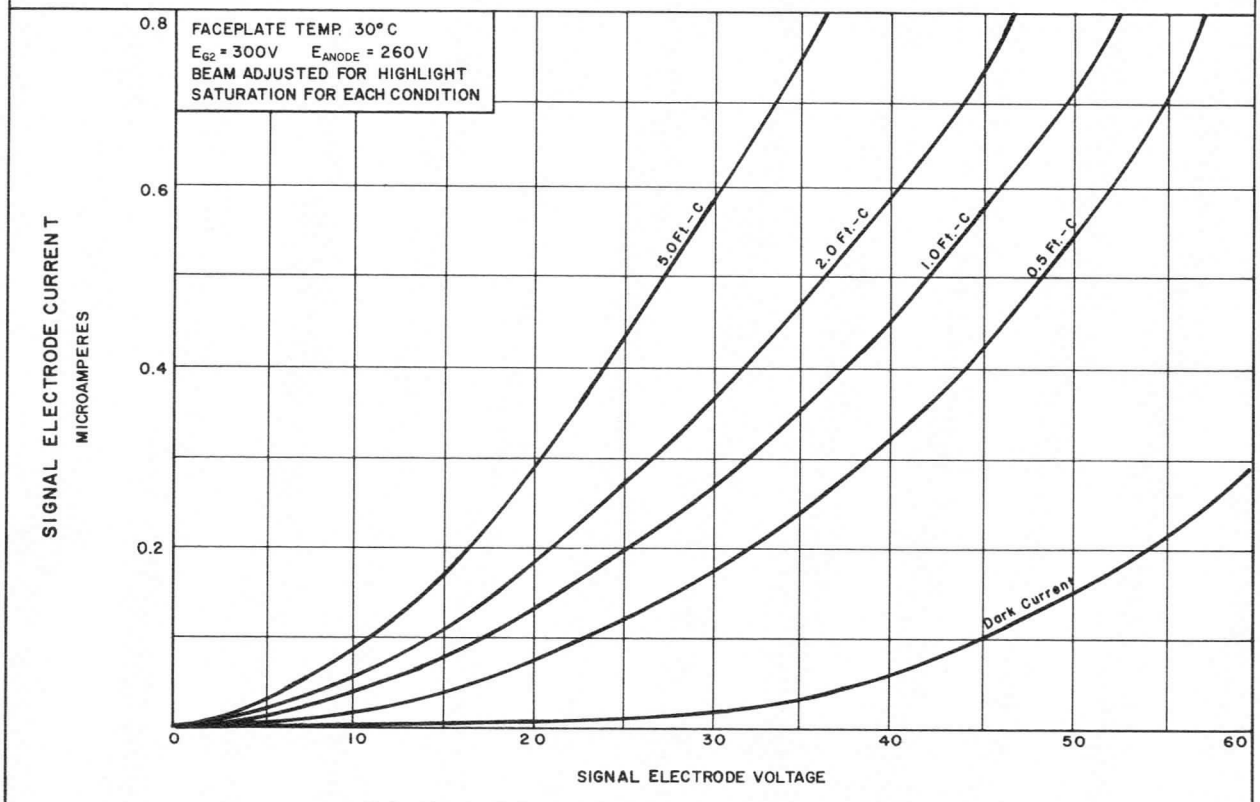


FIG. 5 SIGNAL ELECTRODE VOLTAGE — CURRENT CHARACTERISTICS

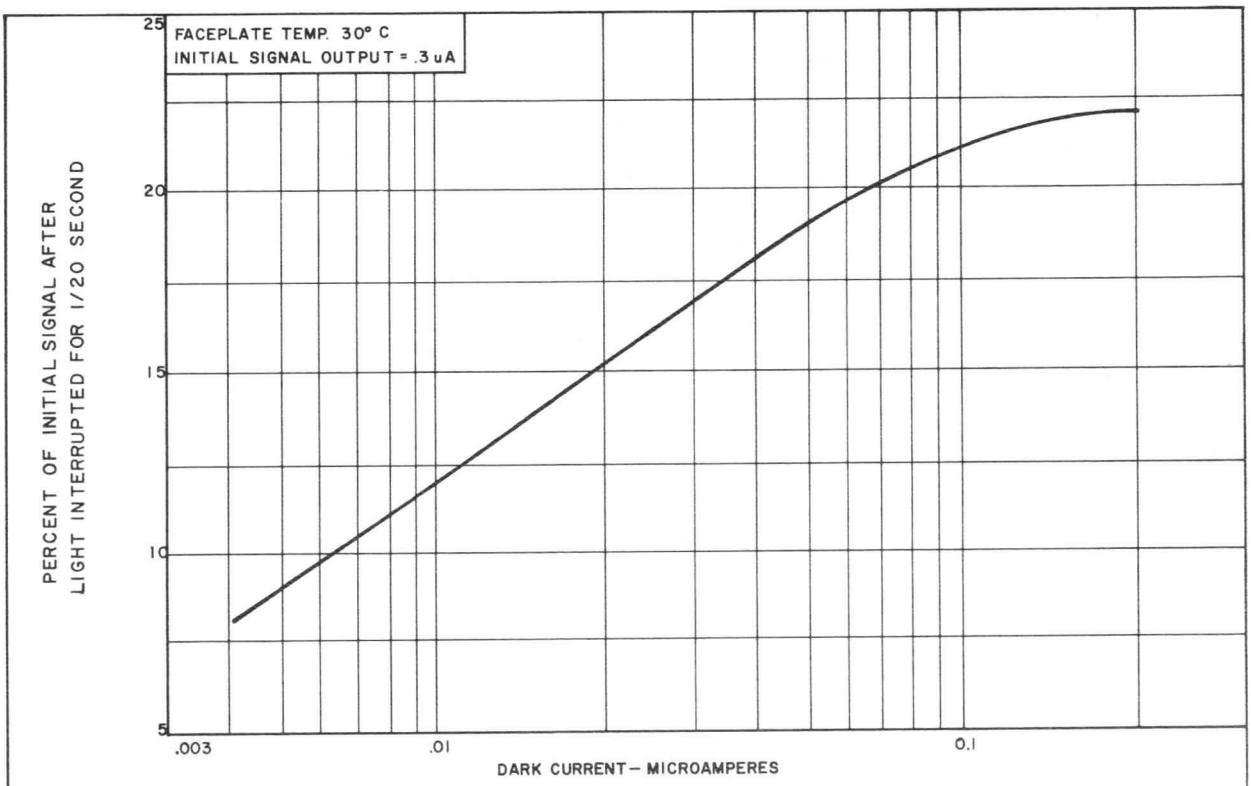


FIG. 6 TYPICAL PERSISTENCE CHARACTERISTICS

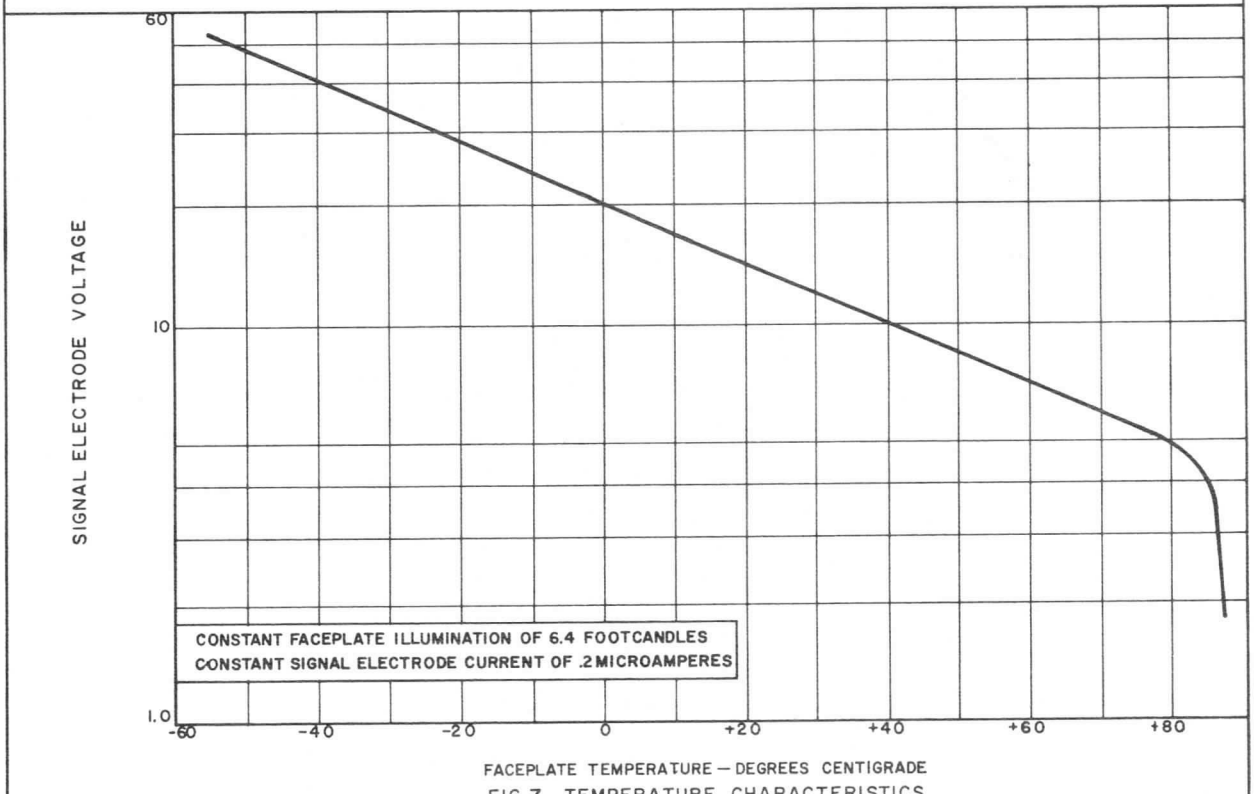


FIG. 7 TEMPERATURE CHARACTERISTICS

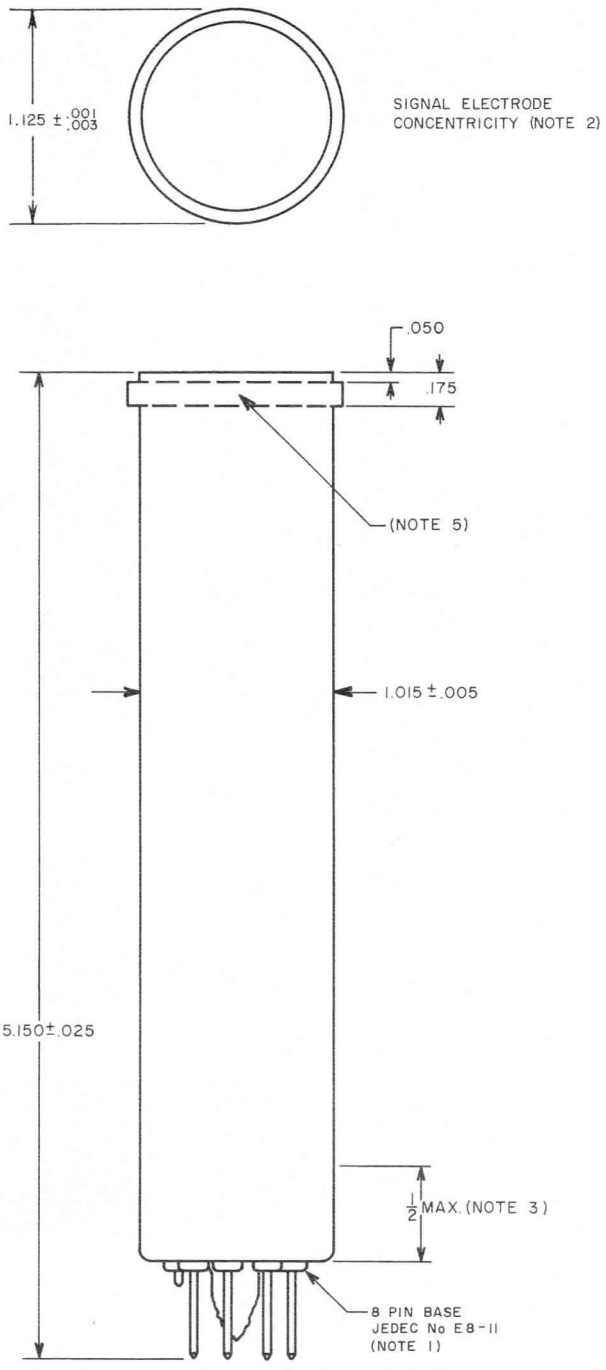


FIG. 8

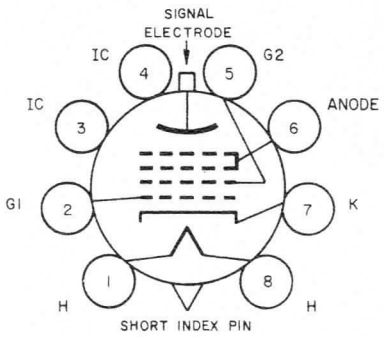


FIG.9

PIN 1: HEATER
PIN 2: GRID No. 1
PIN 3: INTERNAL CONNECTION--DO NOT USE
PIN 4: INTERNAL CONNECTION--DO NOT USE
PIN 5: GRID No. 2
PIN 6: ANODE
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

NOTES

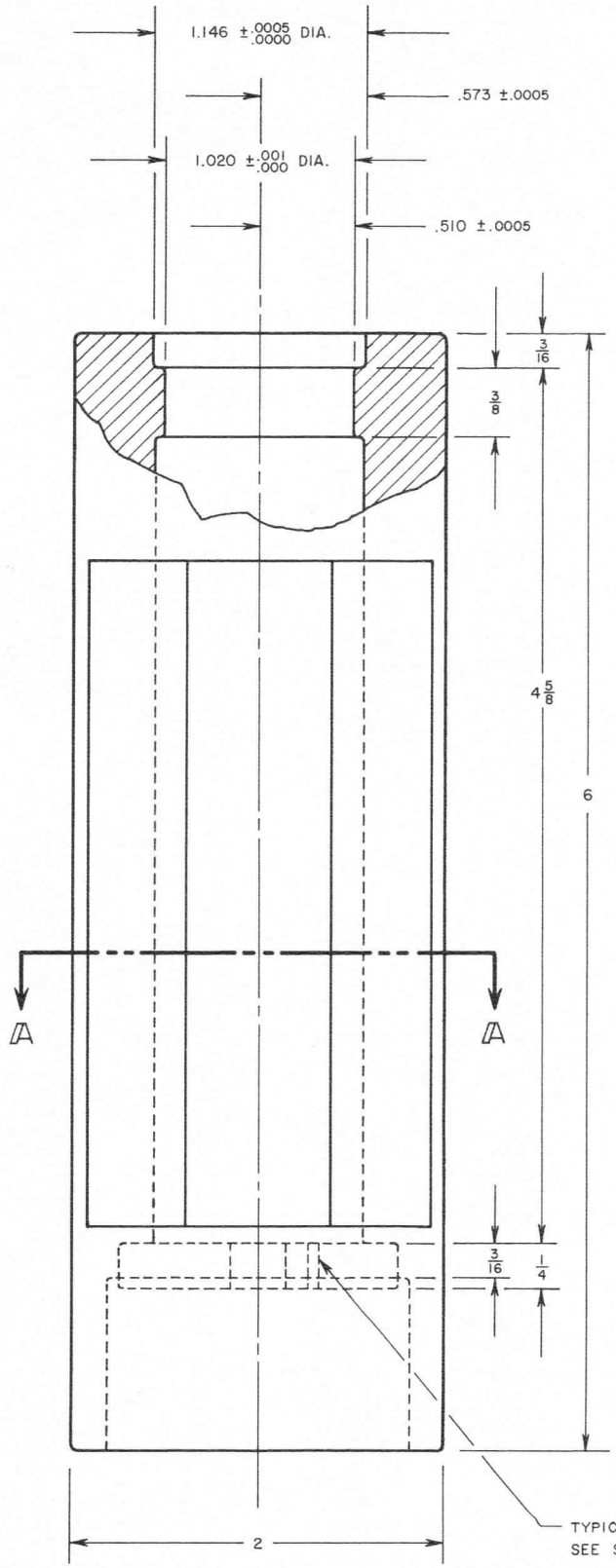
1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) in. diameter, concentric with 9-hole circle.

2. Signal electrode, bulb outside diameter, and base-pin circle concentricity tolerances are held to enable the tube to fit concentricity gage, Figure 10.

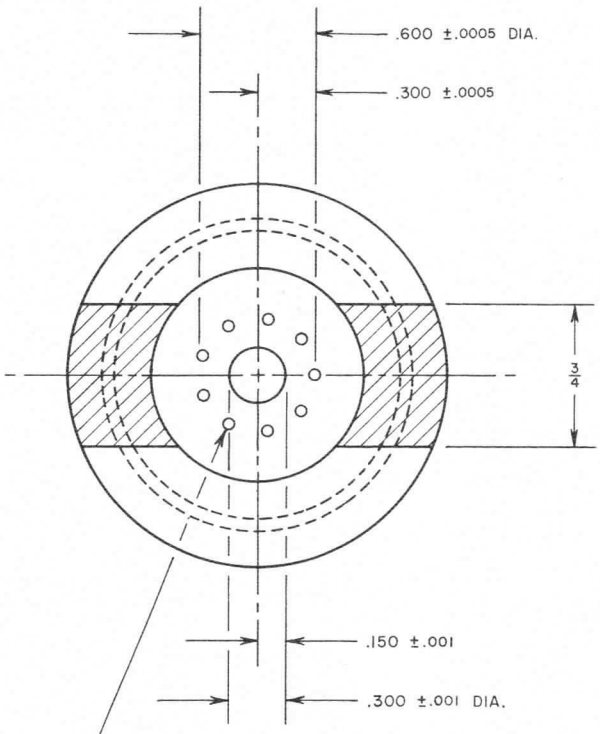
3. The 1/2" maximum length seal area will not exceed the bulb maximum diameter (1.020") but may be less than the bulb minimum diameter (1.010").

4. All dimensions are shown in inches.

5. Target Contact Flange in the form of a metal ring encircling the tube and having the indicated diameter may be located along the tube axis in any part of or all of the space between the dashed lines.



SECTION A-A



CONCENTRICITY GAGE

FIG. 10

GEC technical data

GEC 7291 VIDICON

TENTATIVE DATA

The GEC 7291 Vidicon provides superior broadcast television film pickup. Quality characteristics include high resolution and freedom from blemishes. The patented GEC improved internal construction allows the tube to be operated in any position.

DATA

GENERAL:	
Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	
ELECTRICAL CHARACTERISTICS:	
Heater	
Voltage (AC or DC)	6.3 V ±10%
Current	.60 A
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 uuf
Spectral Response	S-18
ABSOLUTE MAXIMUM RATINGS:	
Anode Voltage	350 V
Grid No. 2 Voltage	750 V
Grid No. 1 Voltage	
Negative Bias Values	125 V
Positive Bias Values	0 V
Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V
Faceplate	
Illumination	1000 ft-c
Temperature	71° C.
Signal Electrode Voltage	125 Volts Max.

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS

BULLETIN NO. GEC-111—8-60

TYPICAL OPERATION:

Scanned Area	0.500 x 0.375"
Faceplate Temperature	30° to 35° C.
Signal Electrode Voltage for Dark Current of 0.02 uA	10 to 75 V
Signal Output Current (Signal Electrode Current Minus Dark Current)	0.1 to 0.2 uA
Average Gamma of Transfer Characteristic over Signal-Output Current operating range of .05 to .2 uA	.55
Anode Voltage	200 to 300 V
Grid No. 2 Voltage	300 V
Grid No. 1 Voltage (For picture cut-off with no blanking voltage on Grid No. 1)	-45 to -100 V
Minimum Peak-to-Peak Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Magnetic Field Intensity at Center of Focusing Device	40 gauss
Magnetic Field Intensity of Adjustable Alignment Coil	0 to 4 gauss

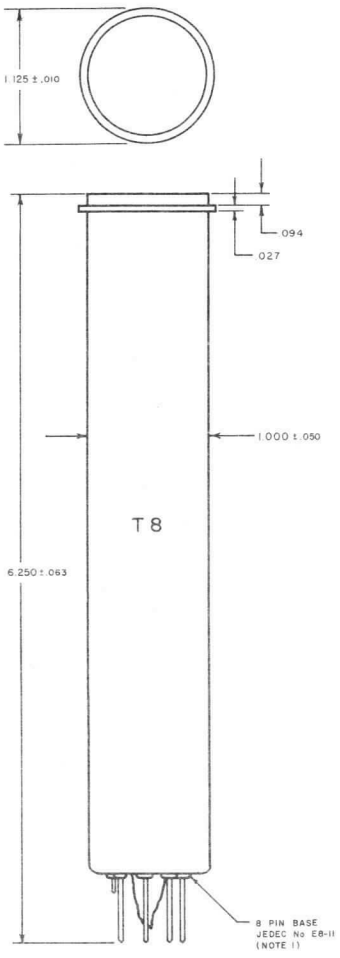


FIG. 1

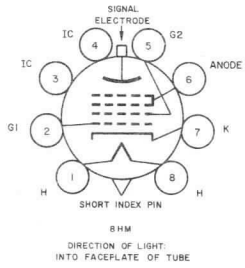


FIG. 2

PIN 1: HEATER
PIN 2: GRID No. 1
PIN 3: INTERNAL CONNECTION--DO NOT USE
PIN 4: INTERNAL CONNECTION--DO NOT USE
PIN 5: GRID No. 2
PIN 6: ANODE
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) in. diameter, concentric with 9-hole circle.

2. All dimensions are shown in inches.

GEC technical data

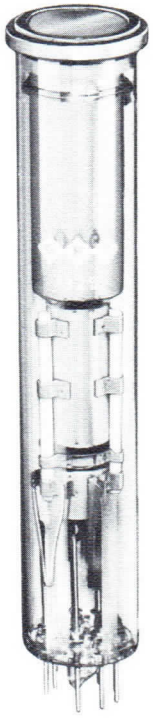
GEC 7325 VIDICON

The GEC 7325 Vidicon has been especially designed for televising live scenes giving pictures of satisfactory quality with as little as .2 foot candles of illumination on the faceplate. Its improved photoconductive surface has excellent lag characteristics at low light levels, as well as high sensitivity. Optimum pictures may be obtained by adjustment of signal electrode voltage without limiting restrictions on dark current. The GEC improved internal construction allows the tube to be operated in any position and in high ambient noise environments.

DATA

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	



ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ±10%
Current	.60 A ±10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 uuf
Spectral Response (See Fig. 4)	S-18

ABSOLUTE MAXIMUM RATINGS:

Anode Voltage	750 V
Grid No. 2 Voltage	750 V
Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V
Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS

BULLETIN NO. GEC-104 – 9-61

ABSOLUTE MAXIMUM RATINGS, Continued:

Faceplate	
Illumination	500 ft-c
Temperature	71° C.
Signal Electrode Current	.60 uA

TYPICAL OPERATION:

* Scanned Area	0.500 x 0.375"
Faceplate Temperature	30° to 35° C.
** Optimum Signal-Output Current (See Figure 2)	
For uniform 2870° K Tungsten Illumination on faceplate down to .5 ft-c	.2 uA
For uniform 2870° K Tungsten Illumination on faceplate from .2 ft-c to .5 ft-c	.14 to .2 uA
Signal Electrode Voltage	
For 5 ft-c faceplate illumination and signal-output current of .2 uA	30 to 50 V
For .2 ft-c faceplate illumination and signal-output current of .14 uA	40 to 100 V
Average Gamma of Transfer Characteristic over Signal-Output Current operating range of .05 to .2 uA	.65
Anode Voltage	200 to 300 V
Grid No. 2 Voltage	300 V
Grid No. 1 Voltage (For picture cut-off with no blanking voltage on Grid No. 1)	-45 to -100 V
Minimum Peak-to-Peak Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Magnetic Field Intensity at Center of Focusing Device	40 gauss
Magnetic Field Intensity of Adjustable Alignment Coil	0 to 4 gauss

* A scanned area of 0.500 x 0.375" was used to obtain all data and characteristic curves.

** Signal-Output Current equals signal electrode current minus dark current.

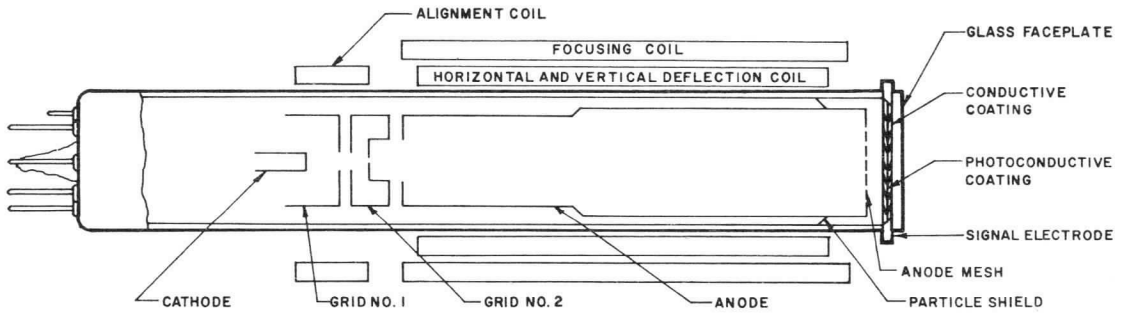


FIG. 1

PRINCIPLES OF OPERATION

The operation of the GEC 7325 Vidicon is based on the principle of photoconductivity. This effect produces a change in electrical conductivity with variations in incident light intensity.

The inside surface of the Vidicon faceplate is coated with a transparent conductive coating as shown in Figure 1. Over this is deposited a layer of photoconductive material. This material, when dark, is a reasonably good insulator. The electron beam is made to scan the back surface of this photoconductive surface.

In operation, the front surface of the photoconductor is held at a potential of some 30V, more or less, positive with respect to the cathode, by the application of this voltage to the transparent conductive coating. The scanning electron beam deposits a negative charge on the back surface of the photoconductor. Where the photoconductor is dark, and its resistance therefore high, the negative charge accumulates until this back surface is at the same potential as the cathode; any further electrons will be turned away. The dark portions of the photoconductor thus become charged in the manner of a capacitor. Dark current is slight electrical leakage through the dark areas.

But where light falls on the photoconductor, from the image of the scene, the conductivity of the material is substantially increased. The resulting leakage of the charge leaves a "hole" in the pattern of negative charge at any illuminated point. Upon its next trip across this point, then, the scanning beam will deposit electrons into this "hole"; this movement of charge calls for a corresponding flow of current into the transparent conductive coating, and the resulting voltage across the load resistor is the output video signal.

The Vidicon thus has the ability to "store" the image for an entire scanning cycle; the image is "photographed" in the pattern of negative charge on the back surface of the photoconductive material, and is accumulated there for the time of one complete frame. This process allows the improved GEC Vidicon to produce usable output from scenes which are dimly lighted.

The end of the anode nearest the faceplate is covered by a very fine mesh screen. The purpose of this screen is to establish a uniform decelerating field in the vicinity of the photoconductive surface, so that the electrons will arrive perpendicular to this surface and with low velocity. The fine-mesh screen simply provides a conducting plane through which electrons can readily pass.

Focusing of the electron beam is done by a magnetic field which is parallel to the axis of the tube. Two magnetic fields which are perpendicular to the axis of the tube and to each other are the means of alignment. Deflection is accomplished by means of magnetic fields perpendicular to the axis of the tube. External coils are necessary to produce these fields.

OPERATING CONSIDERATIONS

DARK CURRENT:

Dark current increases with signal electrode voltage. In normal operation, dark current does not present a problem unless it is non-uniform across the photoconductive surface. The GEC 7325 has extremely uniform dark current, which eliminates the problems of edge flare, shading, and graininess present in earlier type vidicons. This permits the 7325 to be operated at higher values of dark current.

OPTIMUM SIGNAL ELECTRODE CURRENT:

The GEC 7325 is not limited in its operation by dark current restrictions, as explained above. Therefore, best picture quality can be obtained by adjusting for optimum signal electrode current as shown in Figure 2. The resulting dark current is also shown in Figure 2 as an aid in circuit design. Signal output is the difference between signal electrode current and dark current and therefore can be obtained directly from Figure 2.

LIGHT TRANSFER CHARACTERISTICS:

Typical signal output current as a function of faceplate illumination is shown in Figure 3. The slope of the curve gives the average gamma of the tube.

SENSITIVITY:

Vidicon sensitivity is a function of the photoconductive coating characteristics as well as signal electrode voltage. The GEC 7325 has an improved photoconductive surface with higher inherent sensitivity than previous vidicons. At the same time, photoconductive surface uniformity permits operation at higher signal electrode voltages without dark current limitations. Therefore, higher effective sensitivity from higher signal electrode voltage is added to the improved inherent sensitivity.

Figure 3 also shows the variation of sensitivity with dark current. For example, at 1 foot candle and .02 uA dark current the signal output is .20 uA. Increasing the dark current to .2 uA increases the signal output to .50 uA. Since dark current increases with signal electrode voltage, this curve demonstrates the variation of sensitivity with signal electrode voltage.

PERSISTENCE:

The GEC 7325 vidicon has improved persistence characteristics as a result of its new photoconductive surface. Figure 6 shows these characteristics.

OPERATING TEMPERATURES:

No damage will result from operation of the tube at a temperature as high as 71° C Figure 7 has been included as an aid to circuit design. This curve shows the variation in signal electrode voltage to maintain a constant signal electrode current as temperature is varied.

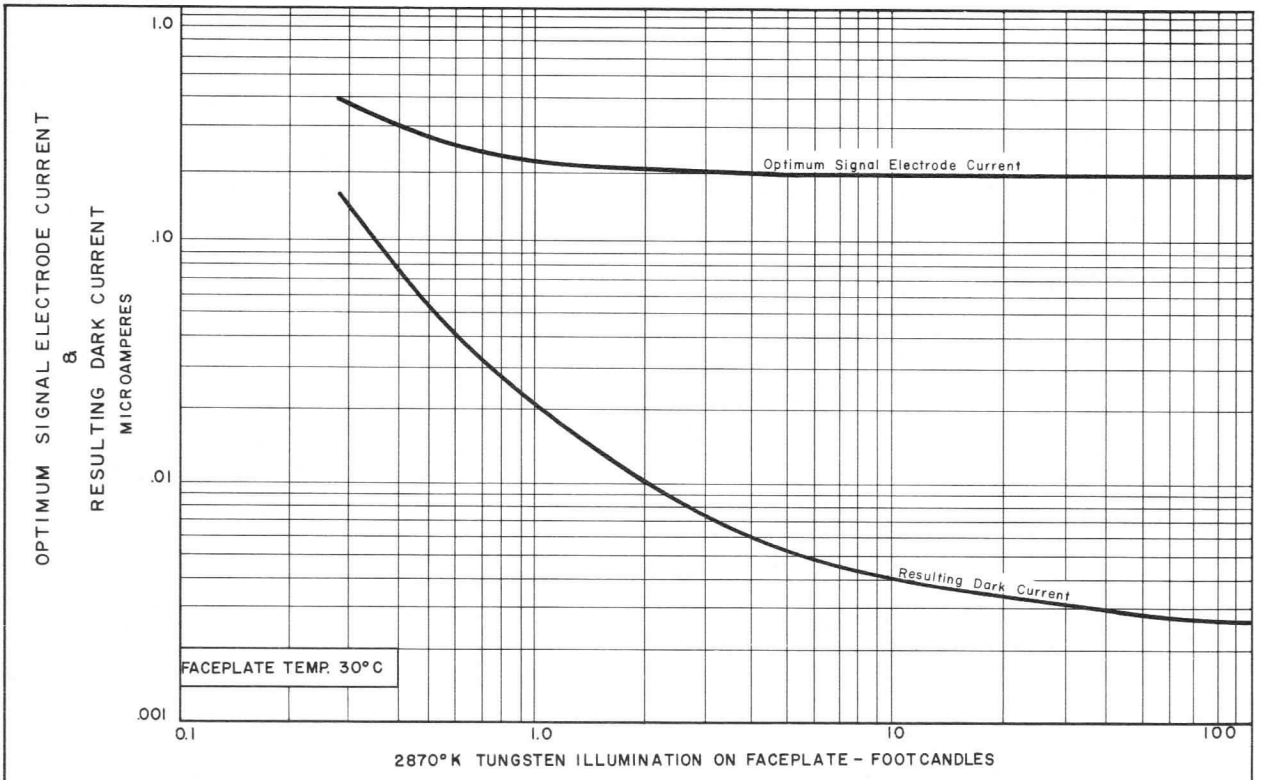


FIG. 2 OPTIMUM SIGNAL ELECTRODE CURRENT

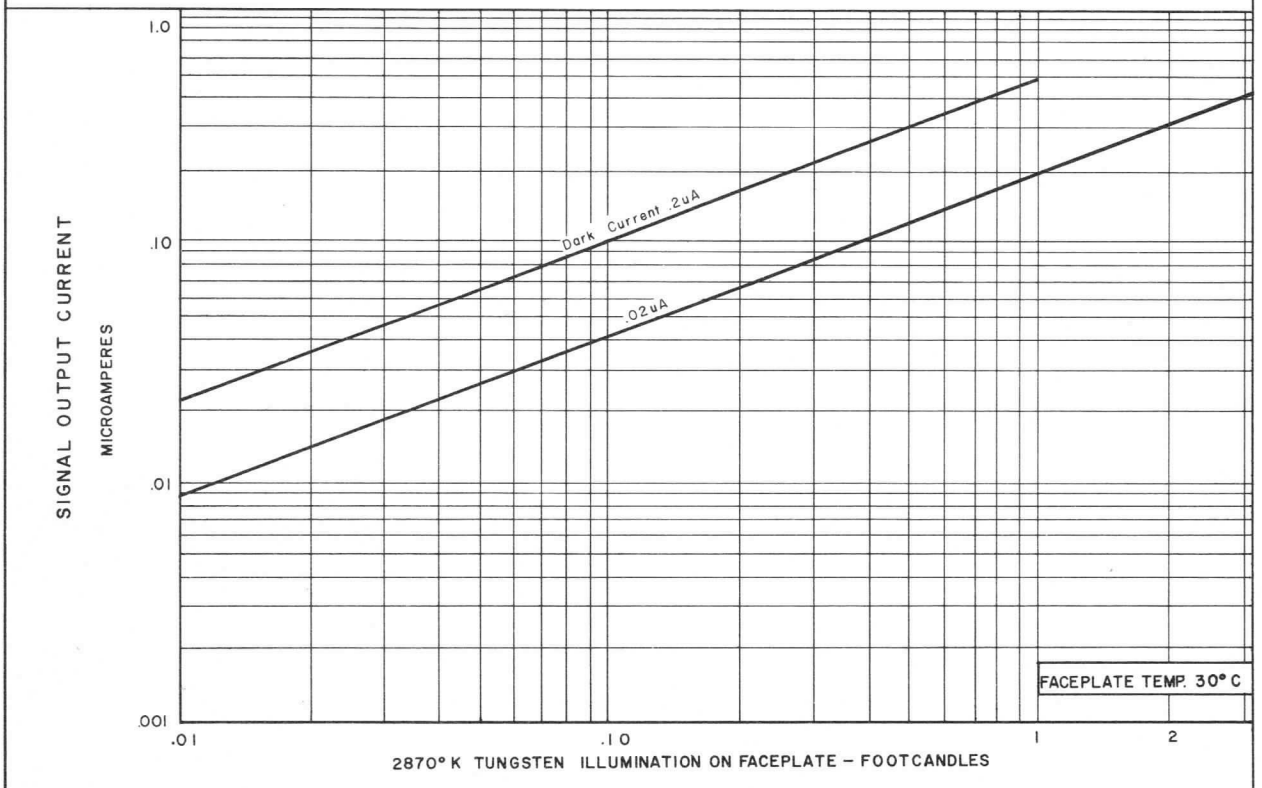


FIG. 3 TYPICAL LIGHT TRANSFER CHARACTERISTIC

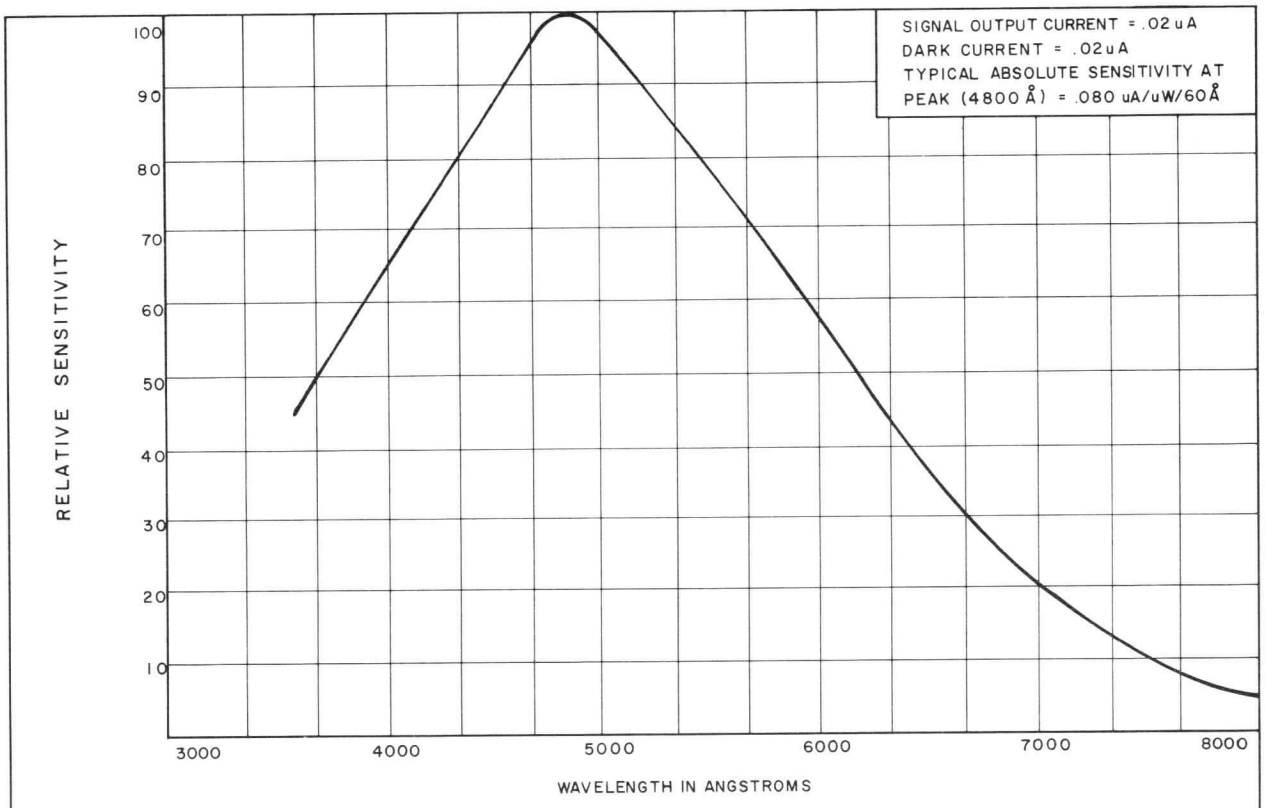


FIG. 4 SPECTRAL RESPONSE

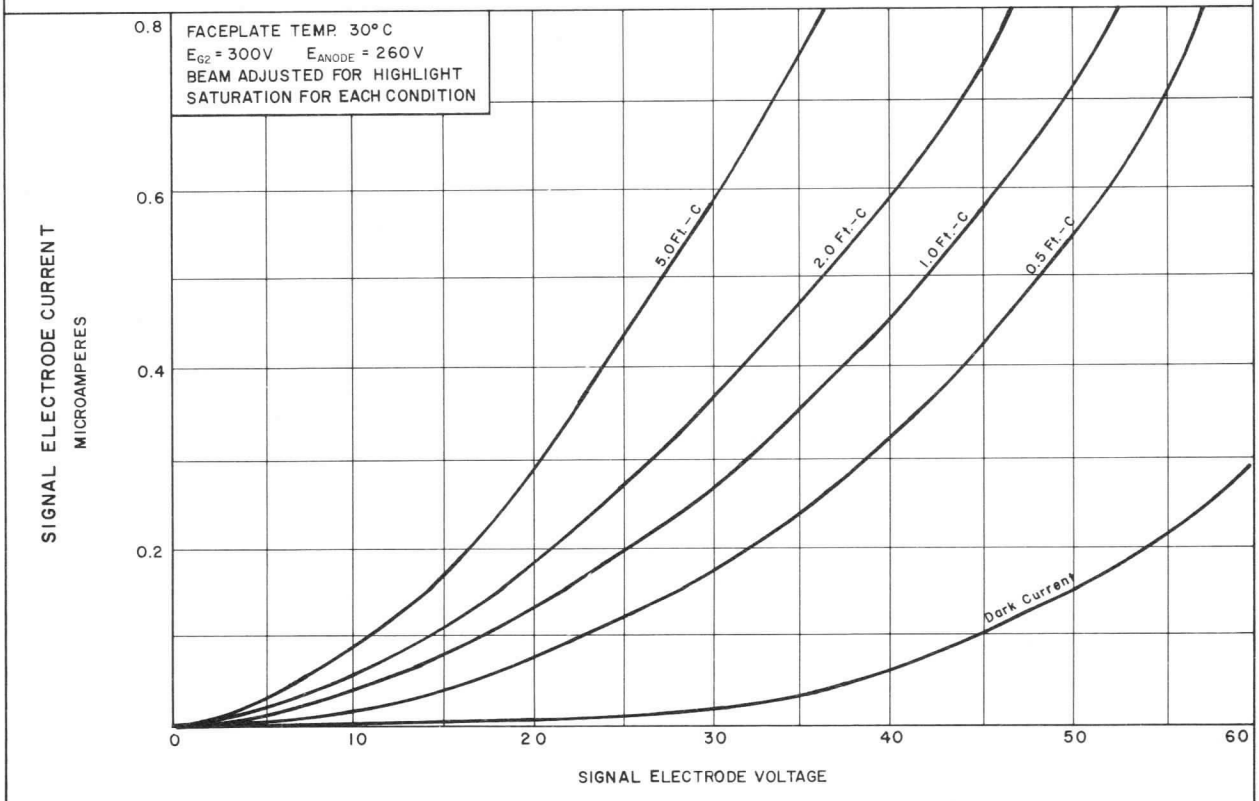


FIG. 5 SIGNAL ELECTRODE VOLTAGE — CURRENT CHARACTERISTICS

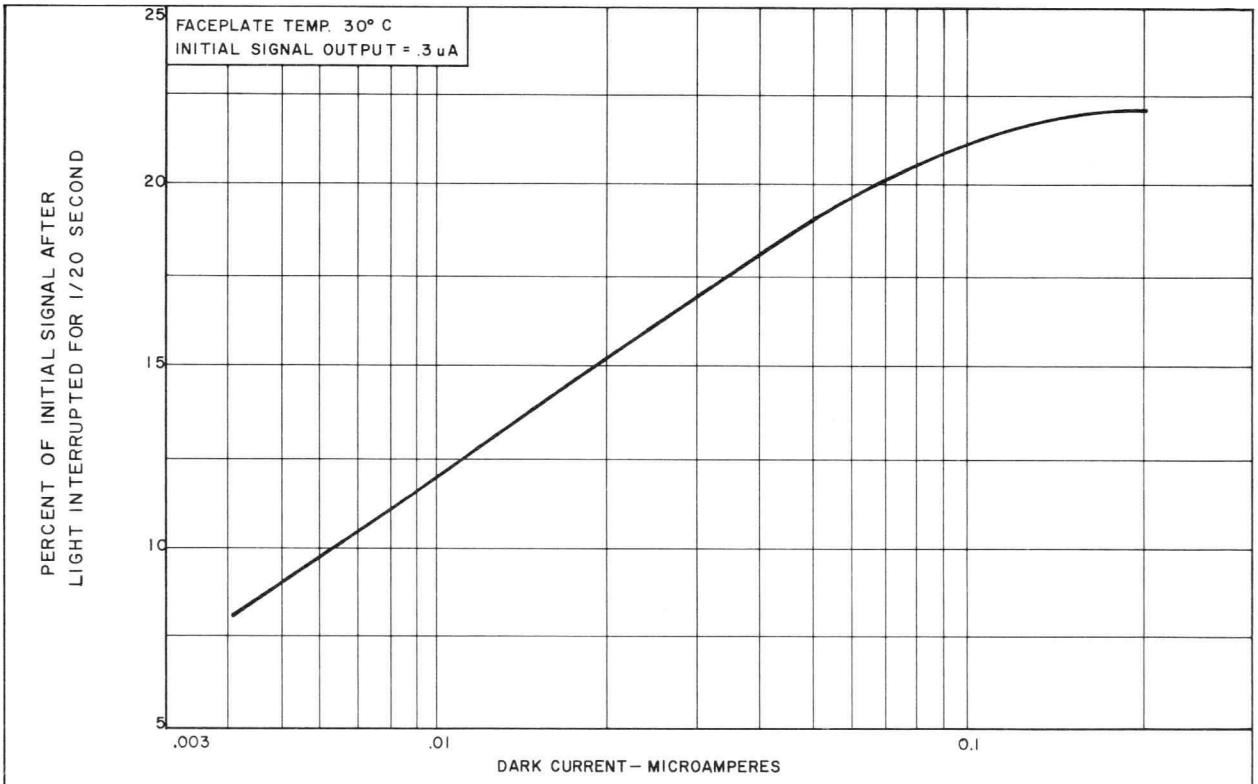


FIG. 6 TYPICAL PERSISTENCE CHARACTERISTICS

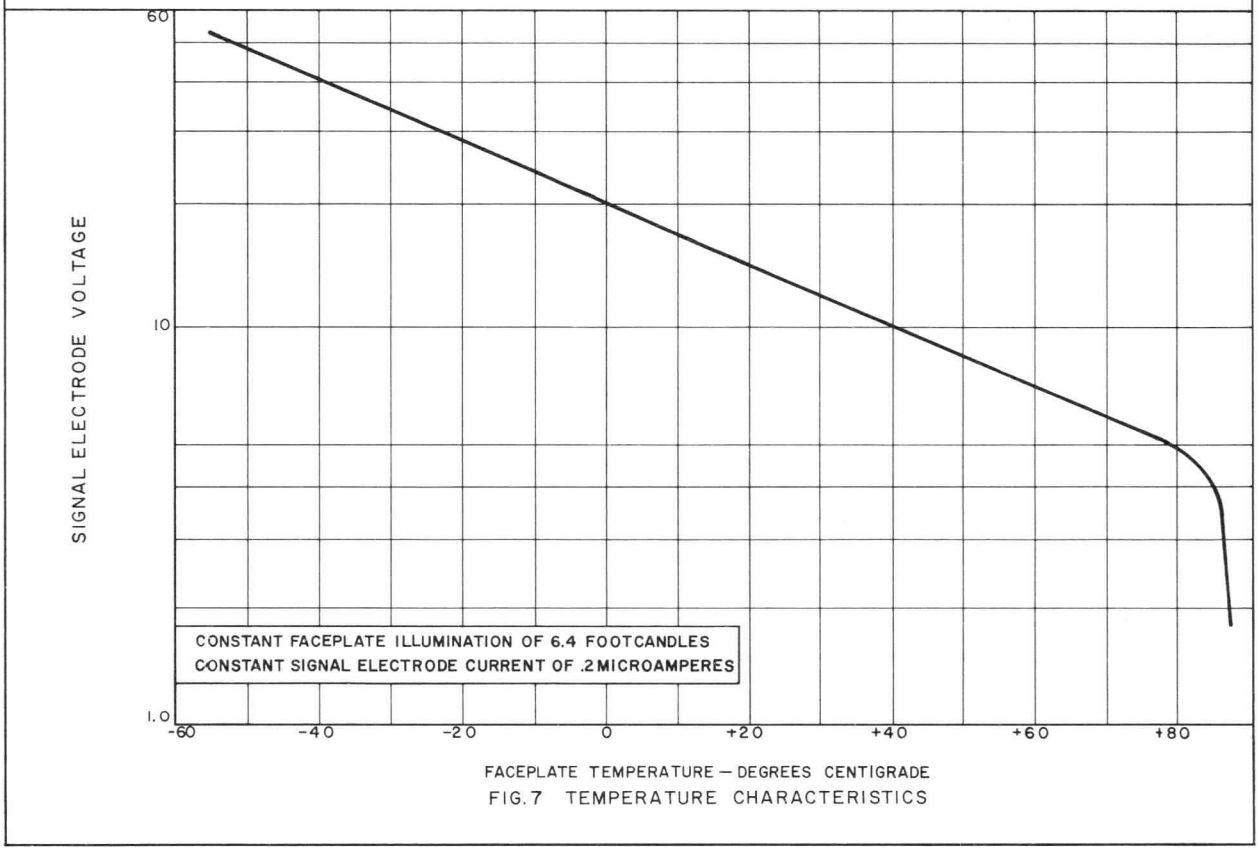


FIG. 7 TEMPERATURE CHARACTERISTICS

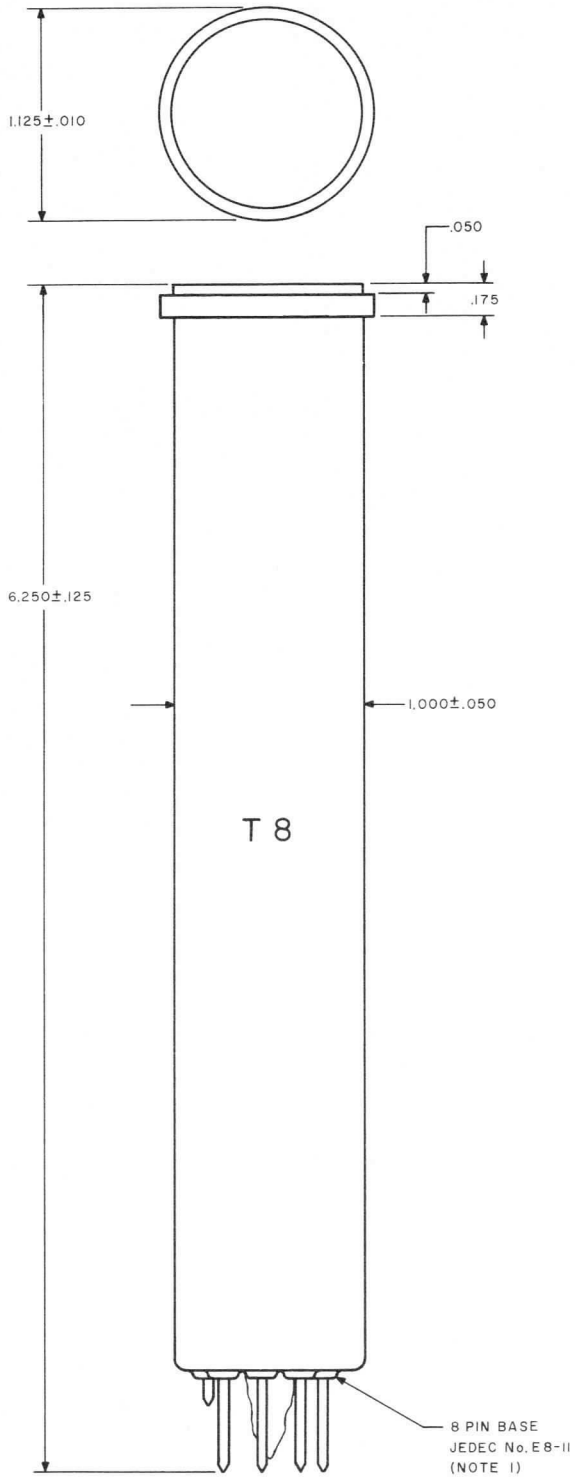


FIG.8

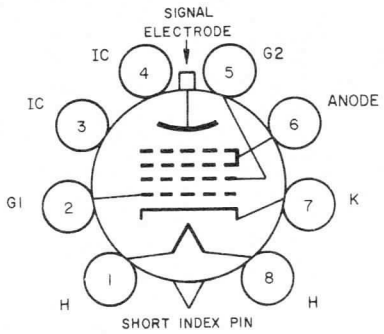


FIG.9

8 HM

DIRECTION OF LIGHT:
INTO FACEPLATE OF TUBE

PIN 1: HEATER
PIN 2: GRID No. 1
PIN 3: INTERNAL CONNECTION--DO NOT USE
PIN 4: INTERNAL CONNECTION--DO NOT USE
PIN 5: GRID No. 2
PIN 6: ANODE
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) in. diameter, concentric with 9-hole circle.

2. All dimensions are shown in inches.

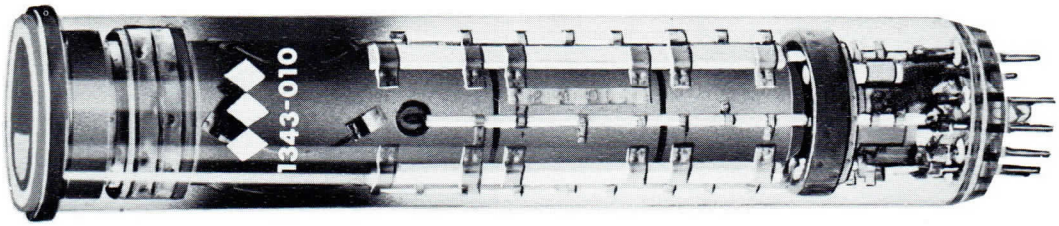
ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS

LITHO IN U.S.A.

GENERAL ELECTRODYNAMICS CORPORATION

TD 1343-010 SUPER-RUGGEDIZED SLOW SCAN VIDICON

ELECTROSTATIC FOCUS AND DEFLECTION



The TD 1343-010 vidicon was designed specifically for the Mariner III and IV Spacecraft. It is a fully electrostatic vidicon which is particularly suitable where power, weight and volume are all of prime consideration. A super-ruggedized tube design was chosen to withstand the shock of the powered phases of the flight and to minimize microphonics induced by other spacecraft equipment, such as shutters, tape recorders and squibs. The patented internal construction permits the tube to be operated in any position.

In typical operation, for instance in the Mariner camera, the light input from a 200-millisecond exposure is stored in a slow scan photoconductor of proprietary manufacture. Subsequent readout and simultaneous tape storage is accomplished during a 24-second frame. The system consists of a 200 x 200 resolution element format in which 200 scanning lines are used.

One of the particular requirements for which the 1343-010 was designed was the pulsed beam operation encountered in the Mariner application. This operation requires the cathode to be pulsed at 100 Kcps to provide an improved signal and allow for simplified circuit design. The tube may also be operated using true digital scan or conventional continuous scan. Which scanning mode to select will depend on the intended application.

Unity gamma is highly desirable from a circuitry standpoint, and from an optical point of view a wide dynamic range is required. The photoconductor is optimized to provide these mutually conflicting requirements. The Mariner mission, for instance, calls for a spectral response that is almost flat over the visible region; the photoconductor of the 1343-010 substantially meets this requirement. In slow scan applications, the photoconductor dark current should be as low as possible; the 1343-010 has a very low dark current of the order of 0.2 na, even at the 24-second frame time of the Mariner camera. The low dark current permits a stable camera set-up by use of the black level reference deposited inside the tube.

One of the features of the fully electrostatic vidicon is the Deflectron deflection system which provides a common center of deflection, thereby minimizing vidicon electron-optical aberrations. Since distortions can occur elsewhere in the television system, it was considered desirable to use fiducial marks in the plane of the photoconductor for determination of the precise relationship of objects being viewed.

ELECTRONIC TUBE DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS

GENERAL:

Operating Position	Any
Focusing Method	Electrostatic
Deflection Method	Electrostatic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.

ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ± 10%
Current (at 6.3 V)	150 ma ± 10%
Spectral Response	Visible; 4000 to 7000 Angstroms
Direct Interelectrode Capacities	
Signal Electrode to all others	4 pf
D 1 to D 2 (Horizontal Plates)	6 pf
D 3 to D 4 (Vertical Plates)	6 pf

ABSOLUTE MAXIMUM RATINGS:

Grid No. 1 Voltage		
Negative Bias		300 V
Positive Bias		0 V
Heater to Cathode Peak Voltage		
Heater Negative with Respect to Cathode		125 V
Heater Positive with Respect to Cathode		10 V
Grid No. 2 Voltage		750 V
Grid No. 3 Voltage		1000 V
Grid No. 4 Voltage		1000 V
Grid No. 5 Voltage		1000 V
Faceplate		
Illumination		1000 ft-c
Operating and Storage Temperature		-54 to + 71°C
Signal Electrode Current		.60 uA
Shock		50g for 5 milliseconds; 30g for 11 milliseconds
Vibration:	Sinusoidal	0.7 inches da from 5 to 28 cps 20 g from 28 to 500 cps
	Gaussian Noise	5 g from 20 to 2000 cps for 5 mins.
Microphonics		Shock Impulse of 5 g for 5 ms. Observed microphonics less than noise
Acceleration		30 g @ 800 g/sec.
Ambient Accoustical Noise		150 db overall sound pressure level

TYPICAL OPERATION:

	Low Voltage	High Voltage
Minimum Peak-to-Peak Blanking Voltage		
When applied to Grid No. 1	30 V	
When applied to Cathode	10 V	
Deflection Voltages (Peak-to-Peak)		
Horizontal (D1 to D2)	60 V	90 V
Vertical (D3 to D4)	50 V	75 V
All Plates DC Voltage	160 to 240 V	250 to 350 V
Grid No. 1 Voltage (For picture cutoff with no blanking voltage on Grid No. 1	-30 to -70 V	-45 to -100 V
Grids No. 2 and 4 Voltage	200 V	300 V
Grid No. 3 Focus Electrode Voltage	0 to 50 V	30 to 70 V
Grid No. 5 Voltage	300 V	500 V
Signal Electrode Voltage	10 to 25 V	
Average Gamma of Transfer Characteristic	Unity	
Faceplate Temperature	30° to 35°C	

PRINCIPLES OF OPERATION OF TD 1343-010

INTRODUCTION

It is assumed that the principles of operation of standard fully magnetic vidicons are well understood. Fully electrostatic vidicons employ an electrostatic focusing field and a Deflectron deflection system. Slow scan vidicons employ a special photoconductor. In the following paragraphs, these and other differences between the standard magnetic tube and the 1343-010 will be discussed.

ELECTRON-OPTICAL

FOCUS. Electrostatic focus is accomplished in a saddle field lens arrangement composed of grids 2, 3 and 4, with grid 3 as the variable focusing electrode.

DEFLECTION. Electrostatic deflection in the 1343-010 is accomplished through the use of a specially designed deflection electrode configuration called the Deflectron. A photograph of the Deflectron is shown in Figure 1. The conventional crossed pair of deflection plates causes the electron beam to be deflected sequentially; that is, in passing between the first set of plates it is deflected in one plane and then when reaching the second set of plates it is deflected in the other plane. The Deflectron causes the beam to be deflected both horizontally and vertically simultaneously as in magnetic deflection. This common center of deflection reduces defocusing caused by dissimilar horizontal and vertical scanning angles, the undesirable effects of fringe fields such as astigmatism, coma and keystoning and other abberations found in conventional deflection plate scanning. In a GEC Deflectron, quadrature is as good as that obtained in the best magnetic deflection yokes. The Deflectron gives considerable freedom in selection of scanning formats, for instance, horizontal and vertical deflection may be interchanged or rotated as desired.

Physically the Deflectron is a cone of insulating material, the inside of which contains the printed deflection electrode pattern. The pattern of the Deflectron is illustrated laid out on a flat plane in Figure 2. If the pattern is rolled to connect Side A to Side B, four individual electrical paths can be traced.

FIELD CORRECTION. A special mesh electrode, grid 5, is incorporated in the 1343-010 to assure flat field output and to compensate for beam landing error and optical lens distortion. The potential of this mesh can be varied independently of the other electrodes.

SLOW SCAN PHOTOCONDUCTOR

CHARGE STORAGE. The light input signal is stored in a photoconductive layer whose dark resistance is very high. This high dark resistance results in a low front-to-back leakage current which permits storage of information for long frame or delay times. The high dark resistance also results in a low lateral leakage which permits the storage of high resolution information. It is to be noted that the ability of this layer to store information does not depend on photoconductive lag. In fact, the information is erased quickly when scanned.

The information to be stored in the photoconductive layer may be received either at a low light level with a long exposure time, or at a high light level with a short exposure time. The tube will saturate at a given foot-candle-second exposure level. For Mariner III and IV missions, the exposure time normally is 200 milliseconds, but an alternate exposure time of 18 milliseconds is available.

SLOW SCAN. "Slow Scan" is generally defined as any rate slower than standard TV rate, that is, slower than 30 frames per second. At these longer frame times, the charge leakage of standard photoconductors is excessive and slow scan photoconductors are required. Either continuous scanning or single frame scanning may be employed, depending on the application.

SCANNING SYSTEM. The Mariner scanning system, for instance, produces one picture every 48 seconds. Twenty-four seconds are used for active frame scan during which time the signal is read out and stored on tape. The remaining 24 seconds are used to prepare the photoconductor for a new picture and to expose the new picture. The exposure time is either 200 msec. or 18 msec. depending on the available light level.

There are 200 horizontal scan lines, one line occurring each 120 msec. The active line time is 14.4 msec. during which time the cathode is modulated by a 100 Kcps square wave. The remainder of the 120 msec. is used to erase residual information.

SIGNAL OUTPUT CURRENT. The signal derived from the photoconductor used in the 1343-010 is a function of photoconductor illumination, target voltage, area scanned and rate of scan. In the unattended Mariner application only the illumination is a variable, and with the unity gamma provided, the output current is directly proportional to the level of illumination.

DARK CURRENT. This type of slow scan photoconductor has a typical dark current of 0.2 na at standard TV rates, with the normal 1/2 x 3/8 in. raster. Dark current varies with frame time, and beam travel rate so that for the Mariner application, the dark current is of the order of 0.2 na.

RESIDUAL SIGNAL AND ERASURE. Although the signal can be stored in some GEC photoconductors for as long as fifteen minutes with little degradation, the 1343-010 was optimized for a 24-second frame rate. The residual signal after the first scan is small and the signal is erased quite readily when the surface is subsequently scanned by the electron beam. In the Mariner application, complete erasure was effected by rescanning each line several times immediately after each line readout.

SPECTRAL RESPONSE. Slow scan photoconductors have generally the same spectral response as S-18. The Mariner mission calls for a spectral response that is almost flat over the visible region. The 1343-010 has a relative response above 75% over the entire range from 4000 to 6000 angstroms, decreasing to 0% at approximately 7000 angstroms.

LIGHT TRANSFER CHARACTERISTIC. The light transfer characteristic is best expressed by the gamma, or linear slope of the log-log plot of output signal as a function of faceplate illumination. The average gamma is near unity within the dynamic range of the tube. (The dynamic range is the range of values of illumination between zero signal and photoconductor saturation.) For Mariner, a gamma of unity was highly desirable from photogrammetrical and circuitry standpoints. Since a wide range of illumination levels was anticipated on Mars, a photoconductor with a wide dynamic range was required. The 1343-010 is optmized to provide these mutually conflicting requirements.

BLACK LEVEL REFERENCE

In slow scan applications, it is very important to have a stable camera set-up. A very dependable method for obtaining stable operation is to provide a reference black area within the vidicon, which accurately tracks the vidicon dark current, to which the video level is clamped. The black level reference used in the 1343-010 is shown in Figure 3.

FIDUCIAL MARKS

Electronic distortions resulting in inaccurate spatial measurements can occur at many points in the television system. For the Mariner mission, fiducial marks (these marks are often referred to as a reticle or reseau pattern) are deposited in the plane of the phtoconductor for determination of the precise relationship of objects being viewed. The fiducial marks used in the 1343-010 are shown in Figure 3.

RESOLUTION

A fully electrostatic vidicon is capable of a limiting resolution in excess of 600 TV lines in the center. Slow scan photoconductors are inherently capable of much higher resolution. The 1343-010 thus easily exceeds the resolution requirements of the Mariner application which is limited by the scanning format and bandpass of the system.

SCANNING MODES

This type of vidicon is readily adaptable to various unconventional scanning modes such as spiral scan or radial scan. Digital scanning can also be employed. The aspect ratio of rectangular scanned areas may be varied as desired. In the standard orientation for linear scanning, horizontal scan lines are essentially parallel to a plane passing through base pins Nos. 2 and 9, but other orientations may be used if desired.

In the Mariner application, the design parameters of the optical system prescribed the use of a relatively small scanning area of .22 x .26, and an active area of .22 x .22 inches.

ENVIRONMENTAL

The absolute maximum ratings shown on page 2 list the normal environmental levels which the super-ruggedized tube design used for the Mariner application will withstand. The camera containing the 1343-010 was subjected to three orthogonal vibration tests of 10-minute duration each, with Gaussian noise to 14g rms added with sinusoidal vibration to 9g rms. An additional low frequency sinusoidal three-axis shake of several seconds duration with levels up to 30g rms was performed.

FIG. 1

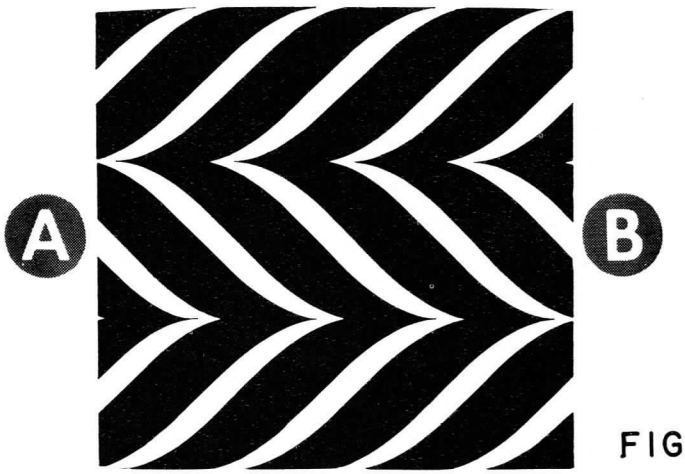


FIG. 2

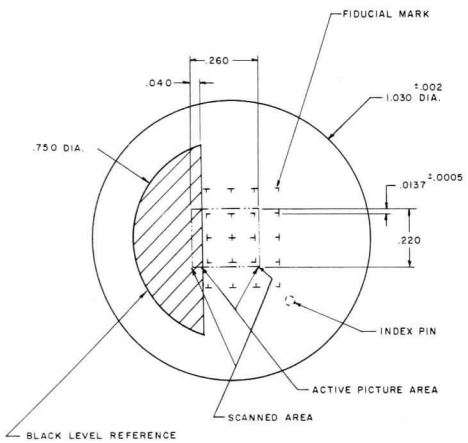


FIG. 3 VIEW OF FACEPLATE SHOWING BLACK LEVEL REFERENCE AND FIDUCIAL MARKS

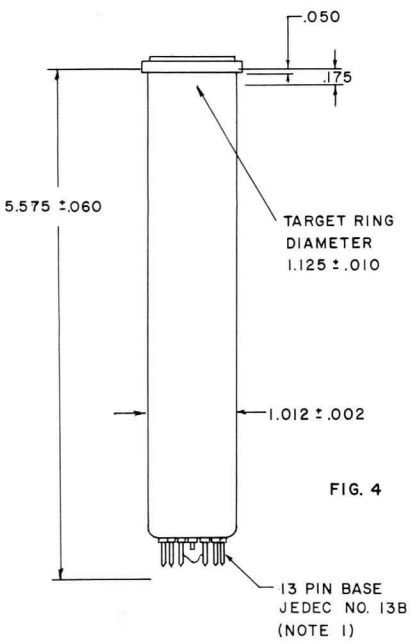
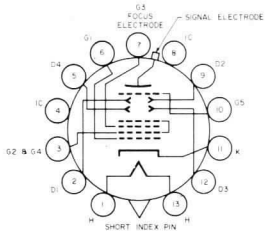


FIG. 4



PIN 1	HEATER
PIN 2	D1 HORIZONTAL DEFLECTION PLATE
PIN 3	GRID NO 2 & 4
PIN 4	INTERNAL CONNECTION--DO NOT USE
PIN 5	D4 VERTICAL DEFLECTION PLATE
PIN 6	GRID NO 1
PIN 7	G3 FOCUS ELECTRODE
PIN 8	INTERNAL CONNECTION--DO NOT USE
PIN 9	D2 HORIZONTAL DEFLECTION PLATE
PIN 10	GRID NO 5
PIN 11	CATHODE
PIN 12	D3 VERTICAL DEFLECTION PLATE
PIN 13	HEATER
SHORT INDEX PIN	INTERNAL CONNECTION--DO NOT USE
FLANGE	SIGNAL ELECTRODE

FIG. 5 BOTTOM VIEW

NOTES

1. Base-pin positions fit 0.25 inch thick, 15-hole flat plate gage with holes located as follows: 14 holes, 0.0470 (±0.0005) inch diameter, equally spaced, 0.2510 (±0.0005) inch apart on a circle, 0.6560 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) inch diameter, concentric with 14-hole circle.
2. All dimensions are shown in inches.
3. Faceplate thickness 0.094 + 0.004 - 0.008.
4. The socket for this tube can be obtained from GEC.

GEC 6014 VIDEO SIGNAL GENERATOR

Tentative Data

GENERAL DESCRIPTION:

The Model 6014 Slow Scan Video Signal Generator is designed to generate the standard Indian Head Resolution Chart video signal including 500 line resolution wedges and five gray scales. The system, with the exception of the monoscope tube, is completely transistorized. Rectilinear sweep generators in the unit provide a wide range of slow speed sweep frequencies. Additionally, provision is made to drive the DC coupled sweep amplifiers from an external source making it possible to use less conventional scanning formats. Sweep, blanking and, of course, video outputs are all provided by the Model 6014. A total of six modes of operation are provided by the equipment:

Internal Sweep, Internal Sync.
The frequency and timing of the sweeps is completely under internal control. The phase of the line generator is reset at the beginning of each new frame. Sweep, sync and blanking outputs are provided for external use.

Internal Sweep, External Sync.
The operation is the same as above except the phase and frequency of the sweeps may be controlled by input pulses.

One Shot, Direct Initiate
In this mode the sweep rates are controlled internally; however, only one frame will be scanned when the panel mounted push button is actuated. Provisions are made for external line synchronization.

One Shot, External Initiate.
This mode is the same as above except individual frames may be initiated by an external negative pulse.

External Sweep.
As implied, the DC coupled line and frame sweep amplifiers may be driven from an external signal.

Test.
This position disconnects the frame generator while permitting the line generator to continue running. By operating the frame center control any portion of the signal pattern may be selected for focusing and brightness adjustment.

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CONTROL ELECTRONICS:

Line Generator.

This circuit contains the necessary elements to form a variable frequency sawtooth voltage waveform and a linear power amplifier with which to drive the deflection yoke. Negative current feedback around the amplifier causes the current through the yoke to follow the input voltage sawtooth.

Frame Generator.

The frame generator circuit is similar to the line generator with the exception of the sweep timing components.

Blanking Generator.

The blanking generator circuit contains line and frame monostable multivibrators and blanking amplifiers, along with line and frame sweep hold off circuits. The frame hold off is used in conjunction with the one shot mode of operation, the line hold off is used to reset the line sweep generator at the beginning of each frame. A blanking output is provided in addition to blanking for the video amplifier.

Video Amplifier.

The video amplifier circuit provides the gain necessary to boost the output of the monoscope tube up to 0. 5 volts. The response of this circuit extends from DC to beyond 100 KC. Difference amplifiers together with a large amount of negative feedback around the entire loop provides good DC stability.

POWER SUPPLY:

Low Voltage Power Supply.

A low voltage power supply section provides plus and minus 14 volts DC regulated for the operation of the Model 6014 transistor circuits. In addition minus 14 volts is provided for the high voltage supply.

High Voltage Supply.

The high voltage supply is housed in a separate enclosed container. Here a power oscillator acting through a step up transformer and full wave rectifier provide a negative 1200 volts DC for the monoscope tube cathode. A bleeder string and zener diode circuit supply control and focusing grid potentials, a separate winding on the high voltage transformer, and a half wave rectifier supply plus 250 volts DC for the collector grid.

PERFORMANCE:

Input Power:	105 - 125 VAC, 55 - 65 cps, 1 amp
Deflection Generators	
Line	
Frequency: (Two Ranges)	5 to 500 cps
Input Sensitivity:	2 volts P-P
Input Sync:	5 volts negative
Output Sync:	5 volts negative
Frame	
Frequency: (Two Ranges)	0. 01 to 1. 0 cps
Input Sensitivity:	2 volts P-P
Input Sync:	5 volts negative
Output Sync:	5 volts negative
External Initiate:	10 volts negative pulse
Blanking Generator	+ 10 Volts - normal
Output	- 10 Volts - Blanking
Video Amplifier	
Frequency Response:	DC to 100 KC
Output:	0. 5 volts (white - positive)
Resolution	500 lines
Number of Gray Scales	Five

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GEC technical data

MODEL 6021 UNIVERSAL TRANSISTORIZED SCAN CONVERTER

GENERAL DESCRIPTION:

The GEC 6021 Scan Converter provides a direct method of converting video signals from one scanning format into another; typically, Radar PPI to TV, Slow Scan TV to Standard TV, TV to TV, etc. This capability results from use of a special GEC Scan Conversion Tube which incorporates separate reading and writing guns and whose target provides information storage capability. This is accomplished in one basic unit by using plug-in functional modules selected to provide the required conversion. The following standard signal processing modules are available and can be used on either input or output sections of the Converter:

... TV Control
... PPI Control
... Slow Scan Control

Special scan formats can be provided to customer requirements. High and Low Voltage Power Supplies, required by all configurations, are made in similar modular form. This modular construction produces a versatile and easily maintained system.

The GEC manufactured Scan Conversion Tube provides variable storage of the input signal with simultaneous reading and writing.

The GEC 6021 is rack mounted, requiring less than 37 inches of panel space. Transistorized plug-in printed circuit modules simplify maintenance and reduce power requirements to a minimum.

ELECTRONIC EQUIPMENT DIVISION
GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS

BULLETIN NO. GEC 602 — 1-62

THEORY OF OPERATION:

As stated in the general description, a Universal Scan Converter is an electronic device which may be utilized in converting video information from one scan format to another. For example, PPI type scanned video signals fed into the unit may be simultaneously read out as a video signal in standard TV raster format. The GEC 6021 is Universal in that it is equipped to take plug-in modules controlling each of the major functions required. As a result, scanning can be readily changed to any format by plugging in the required control module.

Basically, a Scan Converter performs four functions--it writes information into the storage tube, stores the information, reads information from the storage tube, and supplies the necessary supporting power.

The Scan Converter is made possible by a special tube. This tube has two independent electron guns with a common target which is made up of an Ebic (electron bombardment induced conductivity) material. An electron beam writing on one side of the target changes the conductivity of the material according to the beam intensity. A second beam, the reading beam, recharges the surface of the target, producing the output video signal. The target area has the ability to store the written-in information for a number of reading scans, thus making possible storage of input video for periods up to 60 seconds with constant reading of the output side at normal TV rates.

In the GEC 6021 Scan Converter, a separate module is provided for each of the following:

Input or Writing Module
Output or Reading Module
High Voltage Power Supply Module
Low Voltage Power Supply Module

Each of these portions will be discussed in more detail, however, it should be pointed out that any one of the scan modules (PPI, TV or Slow Scan TV) may be used for either reading or writing.

MODULE FEATURES:

TV Control Module - Type 001:

This module provides sweep and blanking circuits necessary to drive the GEC 7828 Scan Converter Tube at standard commercial television rates 30 frame/sec and 15, 750 line/sec. The scanning rates may be synchronized from an external

Sync Generator or from an optional self-contained generator.

An ~~Optical~~ OPTIONAL Pointer Generator is also available that allows a reference marker to be injected into the TV signal. Marker location can be controlled remotely.

PPI Control Module - Type 002:

This module contains circuits necessary to operate the Scan Conversion Tube with PPI (Rho-theta) scanning format. It features an all electronic sweep system that accepts antenna direction information in the form of a 3-wire synchro signal. The input scanning beam is rotated electronically without the use of moving elements within the system. This circuit functions over a wide range of antenna speeds and pulse repetition frequencies. The antenna may be sector scanned or rotated continuously.

Ranges of 25, 50 and 150 nautical miles are provided in the standard unit. A Range Mark Generator produces range rings at 5-mile intervals with 25 mile rings intensified.

Slow Scan Control Module - Type 003:

The Slow Scan Control Module contains sweep and blanking circuits that will scan the Conversion Tube in a rectilinear manner over a 100:1 frequency range within the region of 0.01 to 500 cps. The line and frame scanning frequencies are continuously and independently variable. The unit has four modes of operation: 1. Internal Sweep, Internal Sync, 2. Internal Sweep, External Sync, 3. One Shot or Single Frame, 4. External Sweep. Appropriate input and output signal connections are provided.

The one shot mode of operation allows sweeping of individual frames that may be initiated by an external pulse or by a push button located on the control panel.

High Voltage Power Supply - Type 004:

This module provides all voltages necessary for operation of the Scan Conversion Tube. In addition, it contains controls for the tube focus and intensity. Interlock is provided in such a manner that failure of sweep currents in the deflection yoke will cause power to be removed.

Low Voltage Power Supply - Type 005:

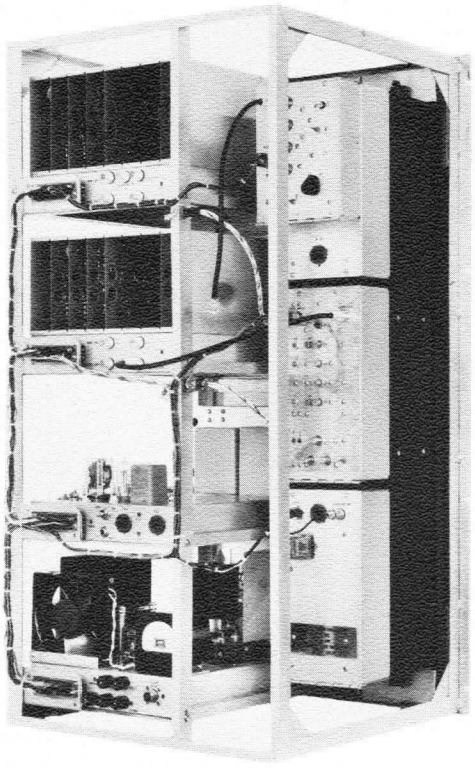
This unit supplies the remaining power to the conversion system in addition to providing control of the video storage, shading and erase.

Electronic voltage regulation throughout this unit provides excellent stability for

the entire system. Here again interlocks are used to shut down the entire system in case of failure of one of the major supplies.

An elapsed time meter is provided in this supply.

CONTROLS



TV Control Module - Type 001:

Video Gain - Potentiometer
Line Size - Potentiometer
Line Center - Potentiometer
Frame Size - Potentiometer
Frame Center - Potentiometer

PPI Control Module - Type 002:

Video Gain - Potentiometer
Sweep Size - Potentiometer
Vertical Center - Potentiometer
Horizontal Center - Potentiometer
Range Mark - Off/on - Switch
Range Mark Intensity - Potentiometer
Range - Rotary switch selects range marks for 25, 50 or 150 mile range

Slow Scan Control Module - Type 003:

Mode Switch - Rotary switch selects operating mode
- Internal Sweep, Internal Sync
- Internal Sweep, External Sync
- One Shot
- External Sweep
- Test

One Shot Initiate - Push Button
Video Gain - Potentiometer
Frequency Multiplier - Locking push button for X10 and X1
Line Size - Potentiometer
Line Center - Potentiometer
Line Frequency - Potentiometer
Frame Size - Potentiometer
Frame Center - Potentiometer
Frame Frequency - Potentiometer

High Voltage Power Supply Module - Type 004:

High Voltage - Lamp indicates high voltage on
Input Intensity - Potentiometer adjusts storage tube parameters
Input Focus - Potentiometer adjusts storage tube parameters
Output Intensity - Potentiometer adjusts storage tube parameters
Output Focus - Potentiometer adjusts storage tube parameters

Low Voltage Power Supply Module - Type 005:

Off/on - Main Power switch
Power - Lamp indicates power on
Video Shade - Potentiometer adjusts shading or storage tube
Video Storage - Potentiometer adjusts storage time of storage tube
Video Erase - Switch manually initiates erase function

SPECIAL FEATURES:

Sweep Internally or Externally Triggered

Single Frame Mode may be triggered manually or by external pulse. Sweep amplifiers may be driven from external source. Video modulated to enable DC coupling to scan converter tube. High voltage power supply interlocked with line and frame amplifiers. Scan Converter Tube thoroughly shielded. Elapsed time meter. Printed circuit plug-in modular construction simplifies maintenance. Feedback control on critical power supplies.

OPTIONAL CIRCUITS:

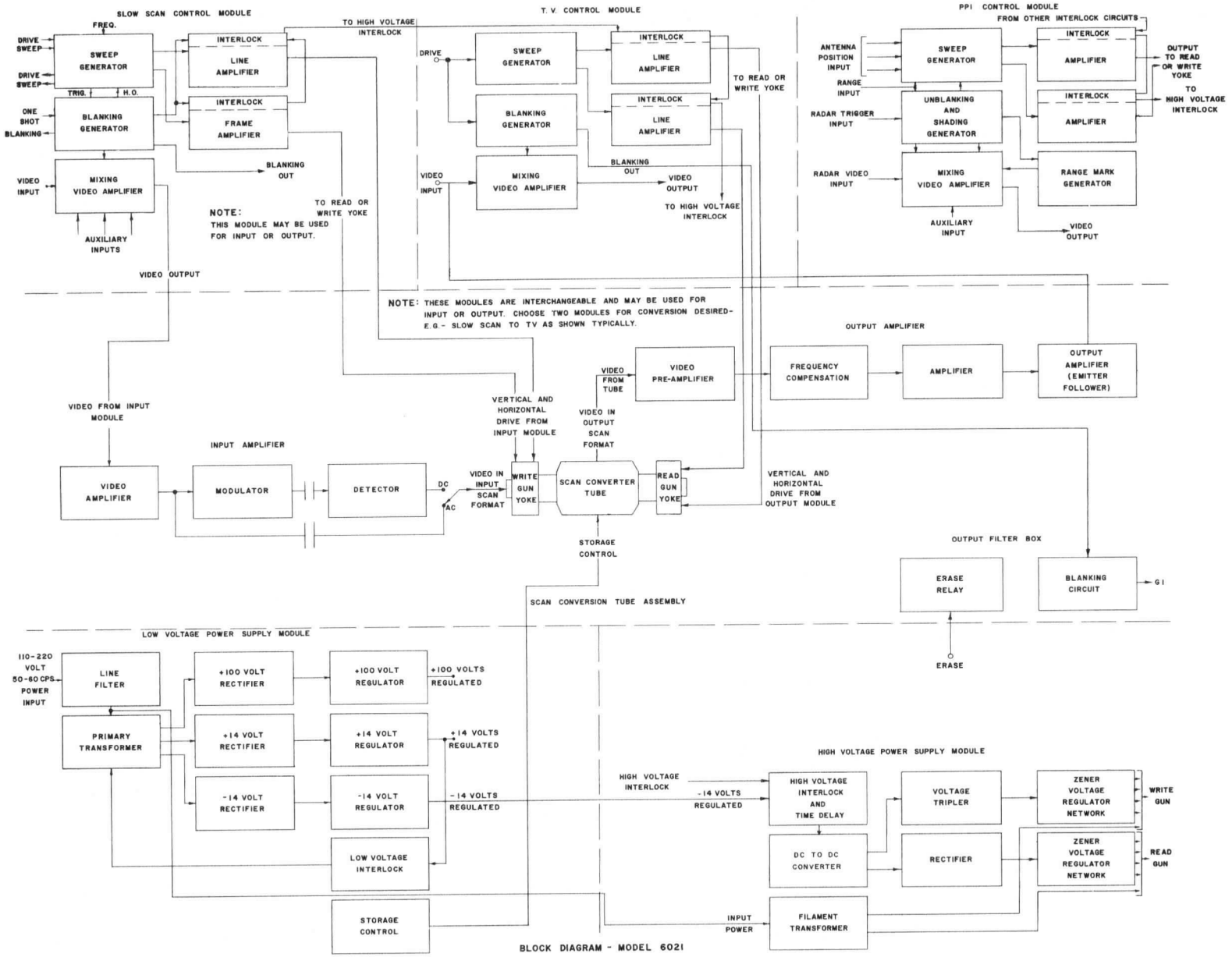
The following special circuits are available for use in the GEC 6021 Scan Converter.

Pointer Generator - The Pointer Generator is an electronic remotely controlled circuit which enables an observer to inject a reference mark into the converted TV picture. This pointer can be moved about in the picture and can be turned off or on from a remote location.

Sync Generator - The Sync Generator is a transistorized countdown circuit which provides 15, 750 and 60 cps sync pulses with interlace. Output sync pulses are available for driving external equipment.

SYSTEM SPECIFICATION

System	
Input Power	105-125 vac, 55-65 cps, 1.5amp
Image Storage	Controllable to 60 seconds
Image Resolution	800 lines
Number of Gray Scales	8
TV Control - Type 001:	
Video	
Sensitivity	1.0 volt (white positive)
Response	10 cps to 10MC ± 3 db
Impedance	75 ohms
Sweep Frequency	
Line	15,750 cps
Frame	30 cps
Sync Amplitude	4 volts negative
PPI Control - Type 002:	
Video	
Sensitivity	1.0 volt (white positive)
Response	10 cps to 10 MC ± 3 db
Impedance	75 ohms
Pulse Repetition Rate	100 to 1200 cps
Standard Display Ranges	25, 50 and 150 nautical miles
Radar Trigger Input	4 volts positive
Synchro Input	
Signal Type	3-wire
Carrier Frequency	60 to 400 cps
Sensitivity	26 vac wire to wire
Impedance	5,000 ohms
Antenna Speed	0 to 28 RPM
Slow Scan Control - Type 003:	
Video	
Sensitivity	1.0 volt (white positive)
Response	D. C. to 1MC ± 3 db
Impedance	1,000 ohms
Sweep Generators	
Line Frequency	5 to 500 cps
Frame Frequency	.01 to 1 cps
Input Sensitivity	2 volts peak to peak
Input Sync	4 volts negative
Output Sync	4 volts negative
External Initiate Pulse	4 volts negative



BLOCK DIAGRAM - MODEL 6021

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GENERAL ELECTRODYNAMICS CORPORATION, GARLAND, TEXAS

LITHO IN U.S.A.

PRELIMINARY BROCHURE
GEC 6025 TRANSISTORIZED VIDEO SIGNAL GENERATOR

GENERAL DESCRIPTION:

The GEC 6025 Universal Scan Video Signal Generator provides video signals by scanning actual pictures in any desired scan format. The plug-in control module need only be changed to select scan mode. The video is provided from a vidicon reading magazine loaded 35 MM slides.

This unit is of relay rack panel construction and can be provided in a table top cabinet or in panel mounting form. In this form it is 19" wide, 12-1/4" high and 18" deep. A table top cabinet can be provided as an option.

The unit contains a vidicon and lens system, light source, magazine and slide feed, and a removable vidicon control module. The control module contains the necessary sweep generator and camera control circuits in plug-in printed circuit board form. Interchangeable video control units can be supplied for various functions in addition to the standard slow scan unit - e. g. radar PPI type sweep, standard TV raster, or special to customer requirements. The attached specification sheet covers the slow scan module.

VIDICON CONTROL MODULE

This is a plug-in unit housing the control circuits in printed circuit board form. All processing circuits necessary for the control of the vidicon are contained herein. This unit provides continuously variable control of the scanning frequencies over the range specified. The control module features four modes of operation:

Internal Sweep, Internal Sync.
The frequency and timing of the sweeps are completely under internal control. The phase of the line generator is reset at the beginning of each new frame. Sweep, sync and blanking outputs are provided for external use.

Internal Sweep, External Sync.
The operation is the same as above except the phase and frequency of the sweeps may be controlled by external sync pulses.

One Shot Initiate.
In this mode the sweep rates are controlled internally, however, only one frame will be scanned when the panel mounted push button is actuated or an external pulse applied. Provisions are made for external line synchronization.

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External Sweep.
As implied, the DC coupled line and frame sweep amplifiers may be driven from an external signal.

The following circuits are contained in the control module:

Sweep Generators provide continuously variable frequency saw tooth voltage waveform at a low impedence for driving the line and frame sweep amplifiers and for external use. Provisions are included for sync input and output.

Sweep Amplifiers supply the power gain necessary to drive the magnetic deflection yoke. These amplifiers are DC coupled in order to maintain good linearity at the slow sweep speeds. Negative current feedback around the amplifier is utilized to cause the current through the yoke to follow the input voltage. Temperature stabilization is incorporated.

The Blanking Generator contains line and frame multivibrators, blanking amplifier and sweep hold-off circuits. An external blanking output is provided in addition to the blanking required for the video amplifier.

The Video Amplifier provides gain necessary to boost the output of the video preamp to a 1 volt level. A carrier system is utilized to obtain DC response while retaining good stability at the high gain needed.

CONTROLS:

On/off - Power switch
Power - Lamp indicates power on
Lamp Off/on - Slide illumination switch
Lamp Indicator - Lamp indicates slide illumination on
Beam - Potentiometer controls vidicon parameter
Target - Potentiometer controls vidicon parameter
Focus - Potentiometer controls vidicon parameter
Frame Size - Potentiometer controls vidicon sweep
Frame Center - Potentiometer controls vidicon sweep
Frame Frequency - Potentiometer controls vidicon sweep
Line Size - Potentiometer controls vidicon sweep
Line Center - Potentiometer controls vidicon sweep
Line Frequency - Potentiometer controls vidicon sweep
Frequency Multiplier - Locking push button switch selects X1 or X10 range
Video Gain - Potentiometer
Mode Switch - Rotary switch selects operating mode
- Internal Sweep, Internal Sync
- Internal Sweep, External Sync
- One Shot
- External Sweep
- Test

One Shot Initiate - Push button manually initiates sweep when mode switch is set to "one shot" position.

Model 6025 Vidicon Type Video Signal Generator

Specifications with Slow Scan TV Control Module:

Input Voltage	105-125 VAC/60 cps
Deflection Generators	
Line	
Frequency (Two Ranges)	10 to 1000 cps
Input Sweep Sensitivity	2 volts P-P
Sweep Voltage Output	2 volts P-P
Input Sync	5 volts negative
Output Sync	5 volts negative
Frame	
Frequency (Two Ranges)	.02 to 2 cps
Input Sweep Sensitivity	2 volts P-P
Sweep Voltage Output	2 volts P-P
Input Sync	5 volts negative
Output Sync	5 volts negative
Blanking Generator	
Output	± 10 volts (blanking negative)
Video	
Frequency Response	DC to 220 KC
Output Amplitude	1.0 volt nominal (white positive)
Resolution	600 lines/inch
Number of Gray Scales	Eight
Sensitivity	0.5 ft.-candles faceplate illumination

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