technical data

GEC 7828 SCAN CONVERSION TUBE

The GEC 7828 is a charge storage tube capable of simultaneous reading and writing with variable dynamic decay time. It is designed for use in high resolution systems where conversion from one scanning system or frequency to another is desired, as in slow scan narrow band TV transmission and P. P. I. radar to TV conversion. The tube is designed so that read and write signals are easily separated with simple cancellation circuits without the necessity for RF separation methods.

The tube incorporates the patented GEC particle shield and precision molded hard glass envelope which permits operation and handling in any position, and extremely accurate alignment of electron guns.

DATA

GENERAL:

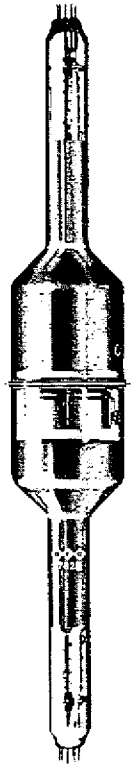
Operating Position	Any
Focusing Method	Magnetic/Electrostatic
Deflection	Magnetic
Deflection Angle	20°
Useful Target Diameter	2 in.
Bases	8 Pin JEDEC E8-11

ELECTRICAL CHARACTERISTICS:

Heater (both guns)	
Voltage (AC or DC)	6.3 V ± 10%
Current	.60 Amps

ABSOLUTE MAXIMUM RATINGS:

Writing Side (referred to cathode)	
Ultor Voltage (G3 and G5)	10 KV
Focus Voltage (G4)	3 KV
Grid No. 2	500 V
Grid No. 1	
Positive	0 V
Negative	-150 V



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ABSOLUTE MAXIMUM RATINGS, Continued:

Reading Side (referred to cathode)

G3 and G5	2.5 KV
Focus Voltage (G4)	750 V
Grid No. 2	500 V
Grid No. 1	
Positive	0 V
Negative	-150 V
Target Voltage to G3 and G5	50 V
Collector Voltage to Target	50 V
Field Correction Electrode to Target	65 V

TYPICAL OPERATION:

Writing Side (referred to ground)

Ultor (G3 and G5)	0 V
Focus Voltage (G4)	-5 KV to -6 KV
Grid No. 2	-7700 V
Grid No. 1 (to cathode)	-30 to -70 V
Cathode	-8 KV

Reading Side (referred to ground)

G3 and G5	0
Focus Voltage (G4)	-750 to -850 V
Grid No. 2	-900 V
Grid No. 1 (to cathode)	-30 to -70 V
Field Correction Electrode Voltage	0 to 65 V
Collector Voltage	0 to 50 V
Target Voltage	0 V
Cathode	-1.2 KV
Typical Average Signal Current (from collector)	0.15 uA
Typical Average Signal Current (from target)	0.01 uA

THEORY OF OPERATION

The GEC 7828 scan conversion tube is comprised of three basic sections: a writing section, a reading section, and a target section as shown in Figure 1.

WRITING SECTION:

The writing section contains an electron gun consisting of a cathode, a control grid (G1), an accelerating electrode (G2), a focusing grid (G4), and an accelerating electrode (G3), connected to an ultor (G5), which is evaporated on the inside surface of the bulb. (See Fig. 1)

The writing section generates a high velocity electron beam which is deflected magnetically and focused by an external focus coil in conjunction with G4. The tube may be focused electrostatically and provision for dynamic focusing is provided.

READING SECTION:

The electron gun of the reading section generates an electron beam of medium velocity that may be focused electrostatically or with an external focus coil for higher resolution capabilities. G3 is connected to an ultor (G5) inside the tube envelope. The beam is deflected by external electromagnetic deflection.

TARGET SECTION:

The target section is composed of a fine mesh screen on which an extremely thin aluminum backplate has been applied. A high resistivity dielectric material that will serve as a storage medium is applied to the reading gun side of the target. The other elements in the target section of the tube are the collector and the field correction electrode.

OPERATION:

The dielectric material deposited on the reading gun side of the target will, under operating conditions, provide a secondary emission ratio of greater than unity. As the unmodulated reading gun beam scans the target, secondary electrons are emitted causing the dielectric surface to become positively charged until it reaches an equilibrium potential of approximately collector voltage. Since the target backplate is operated negatively with respect to the collector, a charged capacitance is formed with the high resistivity material as the dielectric. This charging of the target to an equilibrium potential with the unmodulated reading beam is the basic erasing process and prepares, or primes, the target for writing.

The high velocity writing gun beam, modulated by the video signal, passes through the thin metallic backplate causing conduction to the front or reading gun surface of the target material. The front surface positive charge is reduced toward the negative potential of the backplate by an amount proportional to the instantaneous intensity of the writing beam. The capacitor formed by the dielectric material and the backplate assumes a varying charge over its front surface in the configuration of the input video signal applied to the writing beam control grid. If the reading gun is cut off, the capacitance will retain this charge pattern.

As the reading gun beam again scans the target, the quantity of secondary electrons reaching the collector varies as a function of the dielectric charge pattern. More secondary electrons are collected when scanning those areas nearest backplate potential and this collected secondary emission constitutes the output signal current.

As stated above, the reading process erases the signal by equalizing the charge pattern across the dielectric material. Since the target capacitance is relatively high, a great number of reading gun scans is necessary to completely neutralize the charge pattern created by the writing beam. This characteristic contributes to the storage property of the tube. The number of scans of the reading beam or the time required to return the target to equilibrium voltage after the writing beam is

OPERATION, Continued:

cut off is a function of initial charge, backplate potential, reading beam current and scanning frequency. The curve of Figure 2 illustrates a typical storage characteristic obtainable with the GEC 7828 under one set of conditions of reading beam current and operating potentials.

The field correction electrode in the target section compensates for a variation in target equilibrium voltage as a result of beam landing characteristics. It is operated slightly positive with respect to the target and reduces effective shading of the signal.

OPERATING CONSIDERATIONS

RESOLUTION:

The resolution of the tube is dependent on proper focus coil orientation, shielding and operating voltages on both sections of the tube, and is capable, under these conditions, of resolving with 50% detail contrast, 150 concentric range rings of 100% modulated write information. The write tube section shall be adjusted so that the 150 range rings occupy the full diameter of the target area. To utilize this capability the associated video amplifiers and monitoring system should be designed for 1000 TV line resolution.

CROSSTALK:

The amplitude of writing beam crosstalk appearing in the read signal output is of such an amplitude as to be cancelled, if desired, by simple reverse phase mixing. RF carrier modulated techniques are not necessary for cancellation.

ERASURE:

Since the reading function is an erasing process, no special erasing procedures are required. However, if in certain applications it is desirable to erase more rapidly than normal reading permits, the erasing process may be accelerated by operating the collector at a negative value with respect to target, the target backplate potential positive or a combination of the two, with maximum reading beam current. For sequential or sectionalized erase, automatic circuits may be utilized to control the element voltage charges and the time of application of these potentials.

SWEEP FAILURE:

It is necessary in circuit design to supply a method of automatic sweep failure protection for both sections of the tube. The circuit should be designed to cut off the beam in the event of loss of either vertical or horizontal deflection voltages.

CIRCUITS:

The video amplifiers associated with the reading section output signal must be designed to meet certain requirements in order to utilize the full capabilities of the tube. The input stage of the amplifier should be designed for low noise and high

CIRCUITS, Continued:

gain. The input stage should be followed by sufficient stages to achieve the over-all desired gain with aperture distortion correction and high peaking circuits. A typical input amplifier circuit is shown in Figure 3.

It is important that the entire tube be protected from the effects of external electromagnetic and electrostatic fields. The output lead of the reading section should be kept as short as possible and should present minimum shunt capacity.

DEFLECTION:

The deflection circuits and components for use with the 7828 will be governed by the designers requirements, the type of writing scan and the frequencies employed. It is suggested that deflection yokes be specified for a deflection angle of two times the angle of the 7828 deflection to minimize beam distortion. Electromagnetic centering should be provided and when using writing gun rotational radar scanning, the tube should be supplied with a correction waveform to compensate for the change in effective radial scan velocity. A simplified schematic of a reading section transistorized horizontal deflection amplifier is shown in Figure 4.

POWER SUPPLIES:

The power supplies associated with the use of the 7828 should be designed for good regulation. This is especially true of those controlling beam and focus current. The focus voltage power supply must be designed with minimum ripple component to assure the maximum resolution capabilities of the tube.

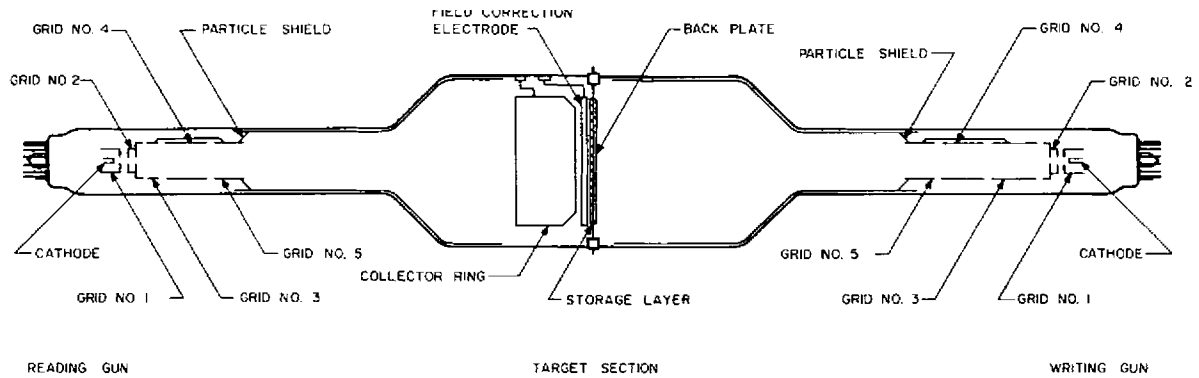


FIG. 1

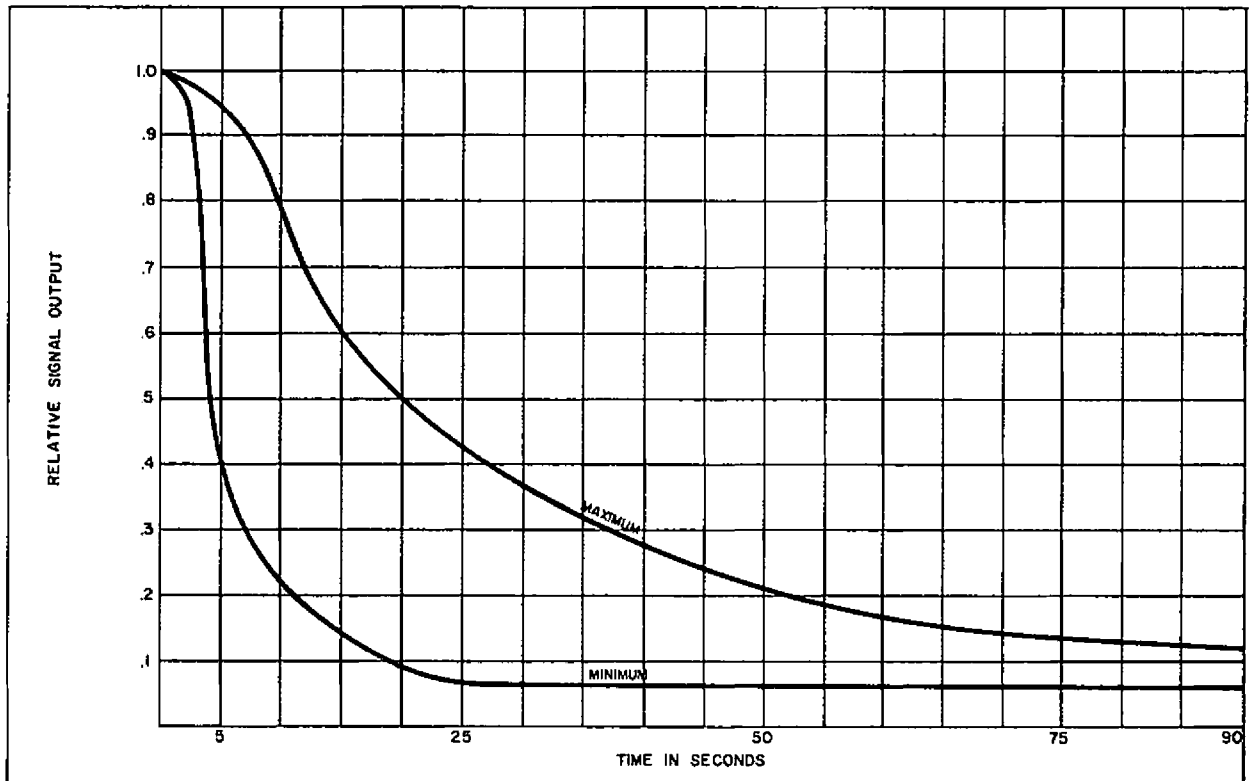


FIG. 2 TYPICAL STORAGE CHARACTERISTIC

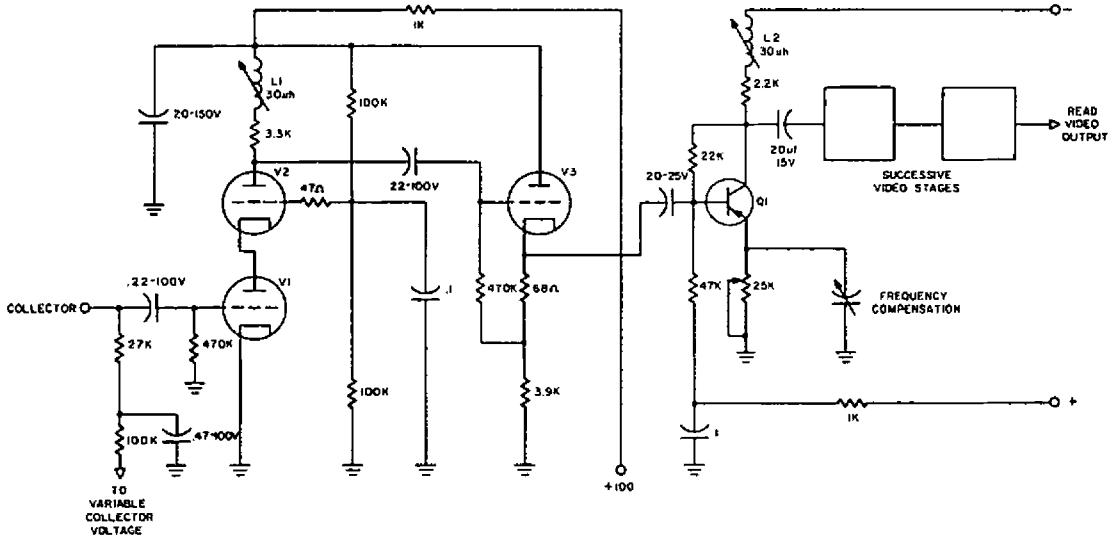


FIG. 3 SIMPLIFIED SCHEMATIC READ VIDEO PRE-AMPLIFIER

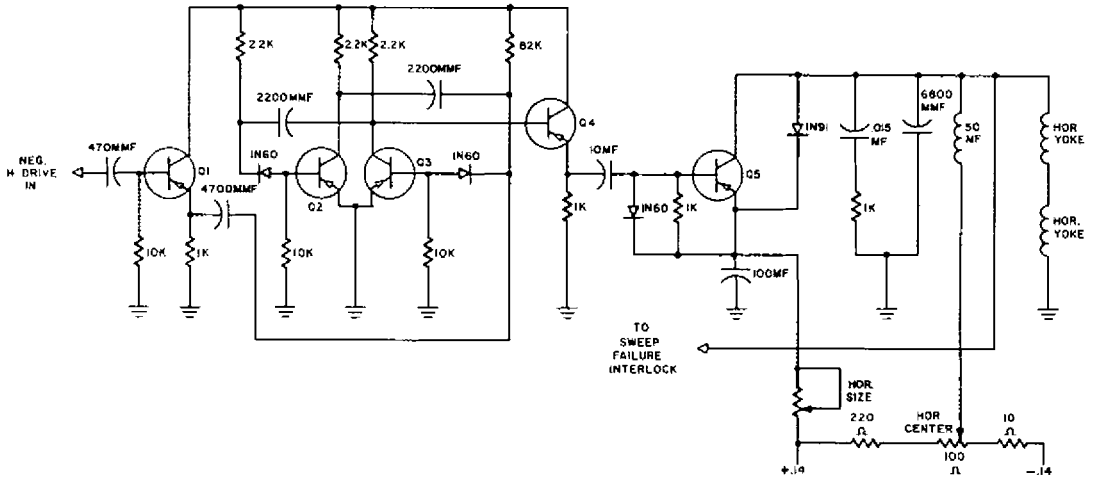
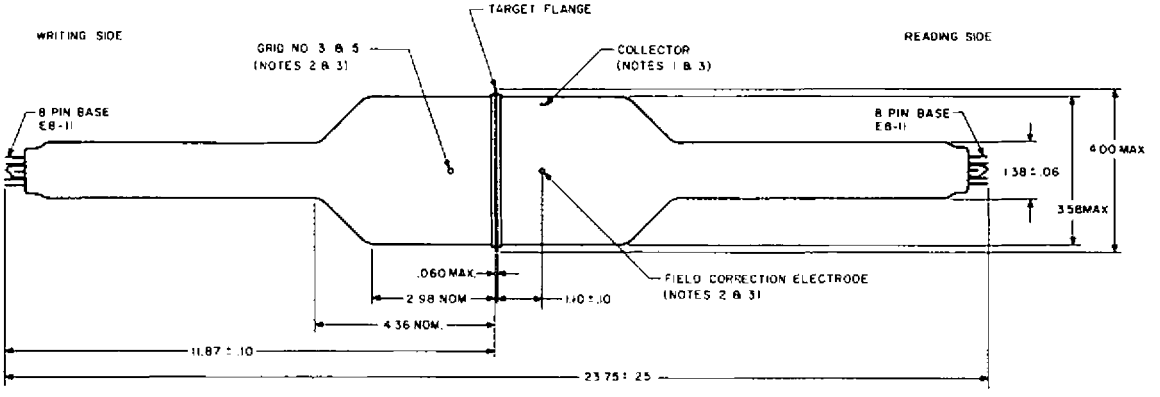


FIG. 4 TYPICAL READING SECTION HORIZONTAL DEFLECTION AMPLIFIER

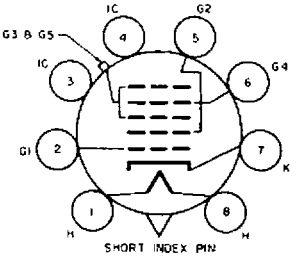


NOTES:

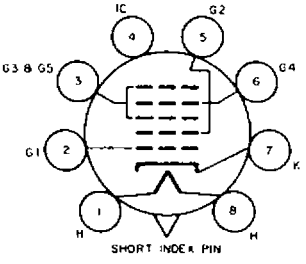
1. COLLECTOR RING BUTTON IS LOCATED 120° CLOCKWISE FROM FIELD CORRECTION ELECTRODE BUTTON WHEN VIEWED FROM READING GUN END
2. GRID NO 5 AND FIELD CORRECTION ELECTRODE BUTTONS ARE IN LINE WITH SHORT INDEX PINS
3. CONNECTOR CINCH JONES TYPE 3A1 OR EQUIVALENT.

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. 4
PIN 7 CATHODE
PIN 8 HEATER
SHORT INDEX PIN INTERNAL CONNECTION--DO NOT USE

WRITING GUN



READING GUN



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

FIG. 5