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TELETYPE CG 2790

RAULAND 8098 SIGNAL STORAGE TUBE

The Rauland 8098 is a charge storage tube utilizing electronic input and electronic output for use in data processing systems where signal information must be continuously transformed from one scanning method to another. The output signal may be used to provide bright displays under high ambient light conditions. The 8098 may be used in systems requiring storage of half-tone or binary information, or to provide conversion of the stored data to another time base or co-ordinate system, or both.

The 8098 is capable of variable storage of information ranging from the order of seconds to minutes depending upon the signal-noise ratio required and the choice of tube operating voltages. In a Radar PPI to TV scan-conversion system, the 8098 is capable of resolving 150 concentric range rings with a contrast ratio of 50% or greater. In a 525 line TV to TV system, for example, for band saving application, the resolution is in excess of 350 TV lines as determined with the standard "Indian Head" test pattern.

Principles of Operation

The 8098 utilizes two electron guns and a storage surface of the EBIC type with its associated signal electrodes. The reading gun supplies a medium velocity electron beam for target priming and generates the output signal at the target through secondary emission. Beam focusing is accomplished by an electrostatic lens of the unipotential type and deflection by electrostatic plates. The writing gun supplies a high velocity beam which removes the priming charge on the target in a pattern determined by the input signal. Focus is electrostatic, while deflection is accomplished by external magnetic coils.

The storage target is composed of a thin film of semi-conductor material with very high resistivity supported by a fine metal mesh and backed with a very thin layer of metal. The target is positioned in the tube with the storage surface facing the reading gun and the metal backing layer facing the writing gun. The collector or output signal electrode and a corrector electrode are on the reading gun side of the target. The corrector electrode is used to modify field conditions at the storage surface to assure uniform background shading.

In operation, the first function to take place is the priming of the target. This is done by scanning the target surface with the medium velocity reading beam which drives secondary electrons from the storage layer. Since the storage surface emits a greater number of secondary electrons than primaries arriving, the surface charges toward the positive potential of the collector electrode. The storage surface will charge to an equilibrium potential slightly above the collector potential, at which time the ratio of secondary to primary electrons will be unity.

The storage layer now has a potential across it approximately equal to the potential difference between the collector electrode and the target backplate which is held at a lower potential. Thus the thin film constitutes a capacitor which is charged uniformly over its entire surface. When the target is scanned by the writing beam, the high velocity electrons penetrate the backplate and the storage layer to greatly reduce the resistivity of the layer. Thus the layer is discharged in a pattern determined by the position of the beam and the beam current. The storage characteristic of the EBIC target is a function of writing beam current and accelerating voltage, scanning speed, and current density. Pulse width, repetition rate and duty cycle are factors when using the tube with pulse signal systems.

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The output signal is generated at the target by the reading beam as it tends to re-charge the areas written upon. These areas will emit a greater number of secondary than primary electrons arriving. The secondary electrons will be accelerated to the collector electrode and constitute the output signal current. The decay characteristic of the storage surface will depend upon the rate of repriming of the discharged areas and the potential of the collector electrode. Higher collector potentials give longer storage times. High reading beam currents will give large signal currents with shorter storage times. High scanning speeds of the reading beam will give lower output currents with longer storage. Long storage will generally be limited by the minimum value of reading beam current and the other parameters affecting output signal currents in relation to the noise of the associated amplifiers.

Signal Storage Type Cathode Ray Tube ELECTRICAL DATA

Writing Gun

Maximum Anode Voltage[1]	10,000 Volts
Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Maximum Potential Between Heater and Cathode	150 Volts
Focusing Method	Electrostatic
Focus Voltage[1]	Approx. 25% E_{anode}
Deflecting Method	Magnetic
Deflecting Angle	Approx. 40°
Control Grid Bias (for beam current Cut-off)[1]	—30 to —60 Volts
Control Grid Voltage Max. Limits	—100 to 0 Volts

Reading Gun

Maximum Anode Voltage[2]	1500 Volts
Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Maximum Potential Between Heater and Cathode	150 Volts
Max. G^3 Voltage[2]	500 Volts
Focusing Method	Electrostatic
Focus Voltage[2]	Approx. 28% E_{anode}
Control Grid Bias (for beam current Cut-off)[2]	—40 to —80 Volts
Control Grid Voltage Max. Limits	—100 to 0 Volts
Deflection Method	Electrostatic
Deflection Sensitivity	D_1D_2 310 V/KV/Diam D_3D_4 270 V/KV/Diam

Storage Electrode

Target Voltage[3]	0-40 Volts
Corrector Voltage	See Note 3
Collector Voltage	See Note 3

TYPICAL OPERATING DATA

Writing Gun

Anode Voltage[1]	8 KV
Focus Voltage[1]	2 KV
Control Grid Bias[1]	Beyond Cut-Off
Signal Input	Approx. 10 to 20V

Reading Gun

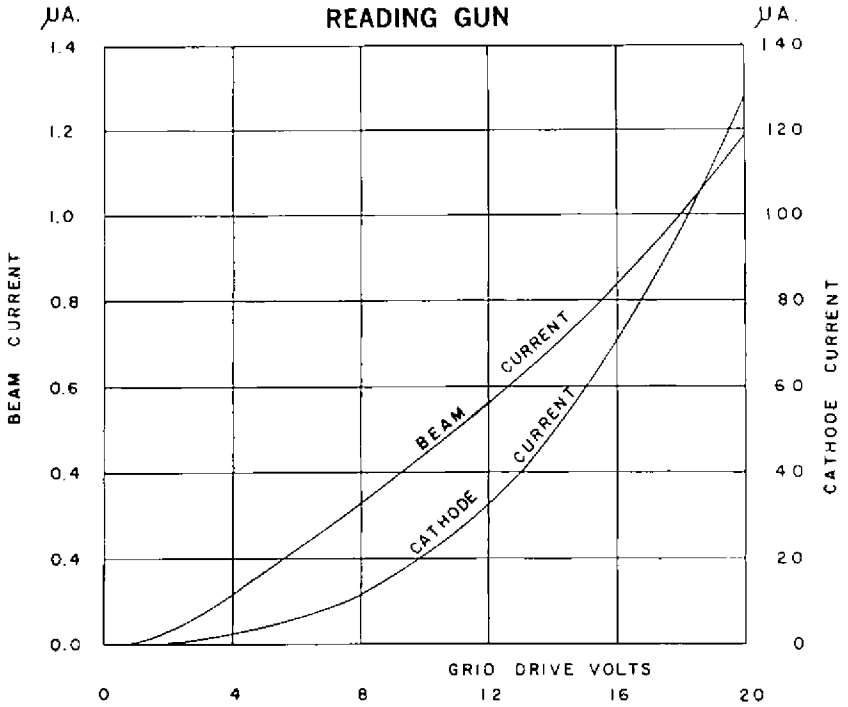
Anode Voltage[2]	1.25 KV
Focus Voltage[2]	340 V
G_2 Voltage[2]	300 V
Control Grid Bias	Note 4

Storage Control Parameters

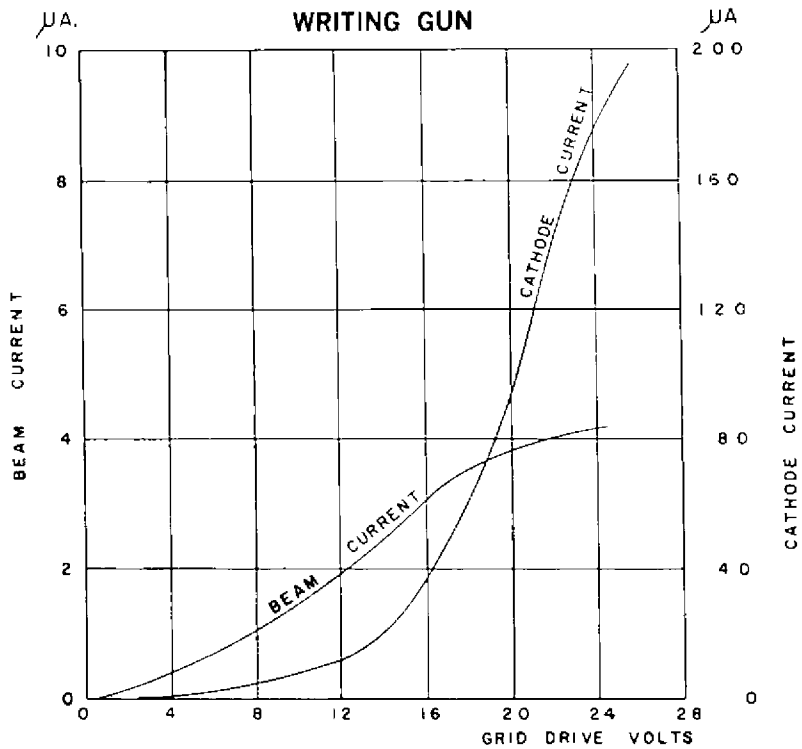
Target Backplate[3]	0 V
Corrector[3]	0 to 25 V
Collector[3]	0 to 25 V

NOTES

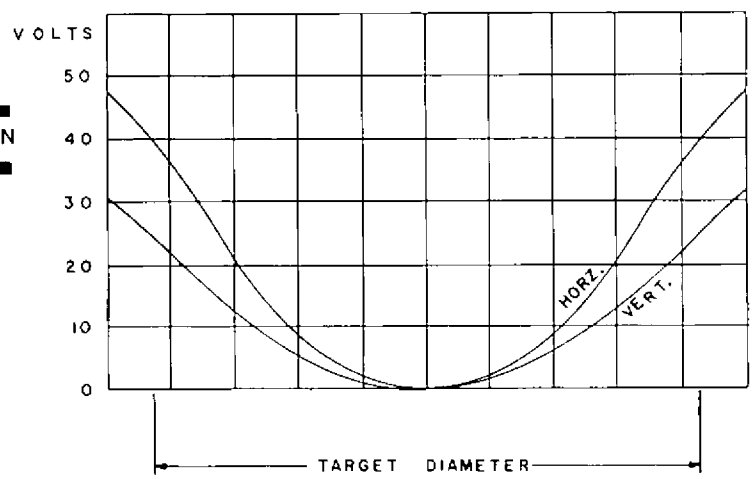
1. The tube is normally operated with the anode at ground and with the cathode negative, and all values indicated by Note 1 are with respect to the cathode at a potential of minus 10,000 volts.
2. All values indicated by Note 2 are with respect to the cathode at a potential of minus 1500 volts.
3. Storage electrode voltages referenced to ground.
   These voltages partially control the length of storage and brightness of display. They may be varied at the discretion of the operator.
   Corrector voltage should be referenced to collector voltage to avoid upsetting of target shading when changing storage time by varying collector voltage. It is permissible to run the target backplate at a negative potential and vary this voltage for storage control and still maintain good background shading over the usual range of storage time adjustments.
4. Reading control grid bias will depend on storage required and signal output desired.



GUN CHARACTERISTICS



DYNAMIC FOCUS DATA- READING GUN



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OPERATING CONSIDERATIONS

Writing Gun

The input signal may be applied to either Grid No. 1 or the cathode of the writing gun. Positive polarity for grid drive and negative for cathode drive. In applications where the scanning speed varies across the target, an appropriate unblanking pulse shape will be required to assure uniform writing levels. Higher drive amplitudes are required for regions of higher scan speeds. The tube is generally operated with the cathode at high negative potential to permit the target and signal electrode to be operated near ground potential. The high voltage supply for the writing gun must be well filtered since much less ripple can be tolerated than in ordinary display tubes. In certain slow writing scan applications the video drive may be of very low amplitude, the order of 1 volt or less.

Output Signal

The output signal current in most applications will be generally 0.1 to 1 ua. depending on the storage time desired. The output amplifier must of necessity have low noise and high gain. Where high amplitude writing video signals are required, cross talk between the writing beam and the output signal will necessitate cancellation by using a sample of the writing beam current at the backplate, inverting its phase and mixing this with the output signal, or use of RF separation techniques.

The tube should be shielded from stray magnetic fields, especially from AC fields since such fields will have a detrimental effect on the resolution achieved in the output signal. The region of the target assembly should also be shielded from the magnetic field of the write scanning coils. Proper design of the magnetic shields will provide the required electrostatic shielding in the signal output electrode region of the tube.

An improved signal shading across the target may be achieved by using the corrector as well as the collector electrode as a signal electrode. This will require AC coupling between the two electrodes and sufficient DC decoupling to permit control of background shading. A considerable signal is available at the corrector electrode since it is operated at a potential just above that of the collector. The signal shading as read by the corrector generally gives a higher amplitude at the edges than the center, while the signal shading at the collector is such that the signal falls off at the edges due to a better collection of secondaries by the corrector in this region.

Erasure: For a total erase cycle of 10 seconds the following procedure is recommended:

Adjust reading gun bias to 0 volts during entire erase cycle of 10 seconds and simultaneously:

a. Set target backplate at 0 volts and collector and corrector at 100 volts for the first 5 seconds.

b. Set target backplate at 100 volts and collector and corrector at 0 volts for the next 4 seconds.

c. Return target backplate, collector and corrector to conditions used for signal storage for the 10th second.

The total erase time may be shorter than 10 seconds. Then the time for (a) and (b) should be shortened in proportion.

STORAGE CHARACTERISTICS...

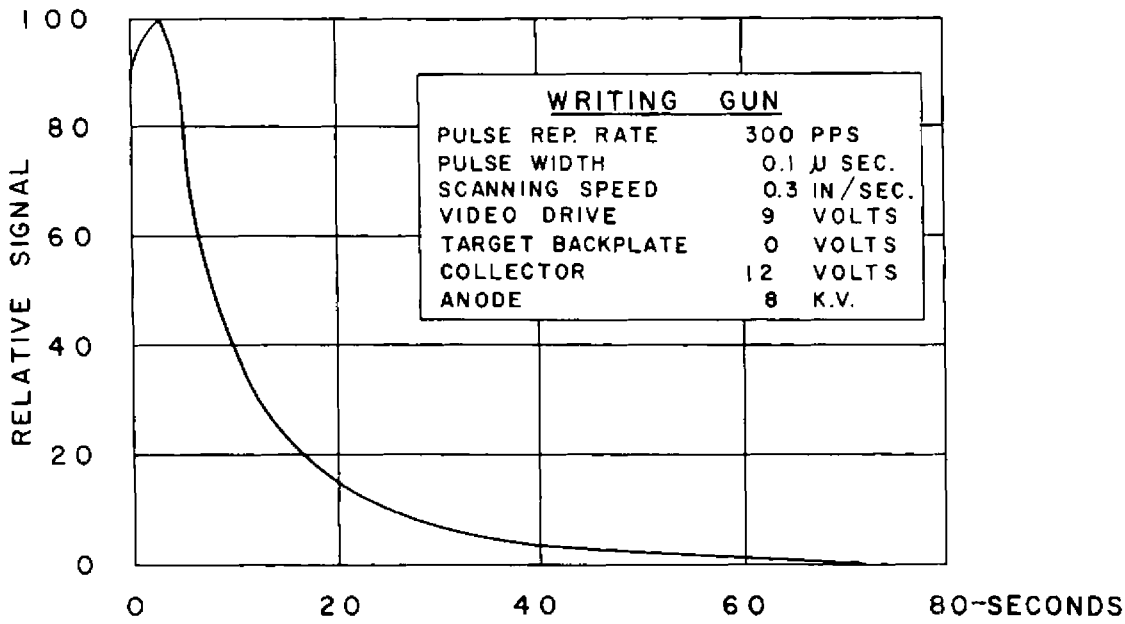

FIGURE 1 Long storage

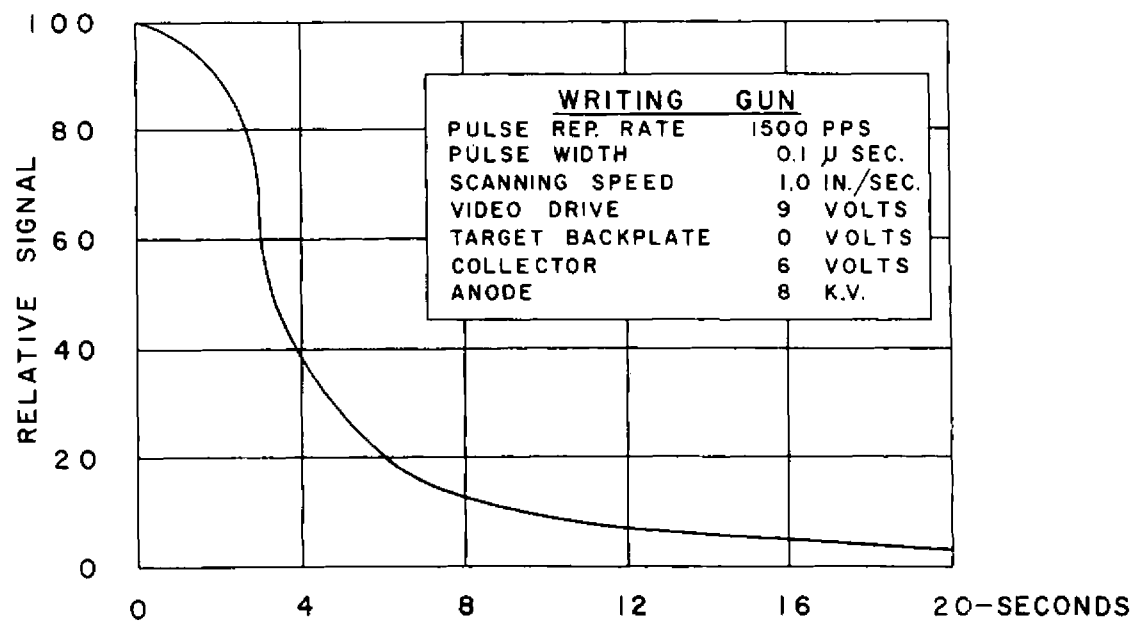

FIGURE 2 Short storage

INQUIRIES ARE INVITED FOR DEVIATIONS FROM THE ABOVE CHARACTERISTICS.

RAULAND 8098 SIGNAL STORAGE TUBE

PIN CONNECTIONS
(READING SIDE)

1. VERT. DEFLECTION
2. VERT. DEFLECTION
3. GRID NO. 2
4. N.C.
5. GRID NO. 1
6. N.C.
7. CATHODE
8. HEATER
9. HEATER
10. FOCUS
11. N.C.
12. HORZ. DEFLECTION
13. HORZ. DEFLECTION
14. ANODE

PIN CONNECTIONS
(WRITING SIDE)

1. HEATER
2. GRID NO. 1
6 FOCUS
10. N.C.
11. CATHODE
12. HEATER