BARRIER GRID STORAGE TUBE TYPE WL-7566
(RADECHON)

Rugged Construction    High Resolution    2.6" Useful Diameter Target
Shielded Target Assembly    Coaxial Connection for Signal Output

The WL-7566 is a 3" electrical write, electrical read, barrier-grid type storage tube. It is designed for service in digital or analog computer systems and pulse height analyzers.

The WL-7566 uses a single gun with electrostatic focus and deflection. The electron-optical design of this gun makes unnecessary any astigmatic correction in order to achieve a fine electron beam of high current density at all deflections. A high degree of mechanical strength is imparted to the 4-bead gun structure by making the collector terminal an integral part of the gun. The collector terminal is a thick Kovar ring sealed into the envelope of the tube and electrically connected to the collector wall coating and external conductive coating. Permanent axial alignment of the gun is thus ensured by mechanically securing both ends of the gun.

The mesh-target storage assembly of the WL-7566 is extremely rugged. The barrier-grid is a fine, woven stainless-steel mesh, treated to control secondary emission ratio to unity, stretched drum tight on a ring which is welded to the outer Kovar cylinder. The mica target is between, and in continuous contact with the barrier grid and back plate. The back plate is retained firmly against the target and a single heavy lead is brought out through a glass bead seal in the center of the Kovar end cup and terminated in the center conductor of a hermetically sealed BNC connector. Since the entire target assembly is surrounded by a Kovar cylinder, a high degree of shielding is obtained reducing the generation of spurious signals due to external fields.

The WL-7566 is designed to operate in existing systems. The use of a coaxial connector provides a quick and positive means of electrical connection with a shielded output. The increased resolution capability, uniformity of output and rugged construction results in an all round improvement in system performance.
ELECTRICAL:

Cathode ........................................... Coated Unipotential
Heater:
Voltage ........................................... 6.3 Volts
Current ........................................... 0.6 Amperes

Interelectrode Capacities:
Cathode to all Other Electrodes ............... 15 μF
Grid 1 to all Other Electrodes ................. 10 μF
Grids 2 & 4 to all Other Electrodes .......... 10 μF
DJ1 to all Other Electrodes .................. 8 μF
DJ2 to all Other Electrodes .................. 8 μF
DJ3 to all Other Electrodes .................. 7.5 μF
DJ4 to all Other Electrodes .................. 7.5 μF
DJ1 to DJ2 ....................................... 1.5 μF
DJ3 to DJ4 ....................................... 2 μF
Barrier Grid to Backplate ..................... 1600 ± 20% μF
Collector to Backplate ......................... 0.2 μF
Barrier Grid to Collector ..................... 18 μF
Collector to All Other Electrodes .......... 22 μF

Interelectrode Insulation:
Cathode to all Other Electrodes .......... 500 min. Megahms
Heater to Cathode .............................. 50 min. Megahms
Any one Deflection Plate to all Other Deflection Plates ........... 500 min. Megahms
Backplate to Barrier Grid .................... 100 min. Megahms
Grid 3 to all Other Electrodes .......... 500 min. Megahms
Grid 1 to All Other Electrodes .......... 500 min. Megahms
Focusing Method ................................ Electrostatic
Deflecting Method ................................ Electrostatic
Deflection Sensitivity:
DJ1 and DJ2 ................................... 110 ± 7% Volts/Inch/KV
DJ3 and DJ4 ................................... 125 ± 7% Volts/Inch/KV
Spot Position® ............................... 0.065" Inch

MECHANICAL:

Mounting Position ............................. Any
Maximum Diameter ................................ 3-1/8"
Maximum Overall Length ......................... 11-7/8"
Maximum Usable Target Diameter ............. 2.6"
Base ........................................... Small Shell 14 Pin Base (JEDEC B14-45)
Signal Connector ............................. Hermetically Sealed BNC Panel Jack
JAN No. UG-657/U
Net Weight (approx.) ......................... 1 Pound
Shipping Weight (approx.) .................. 4 Pounds

MAXIMUM RATINGS:

Absolute Maximum Values
Cathode to Barrier Grid Voltage .............. -3300 max. Volts
Grid 1 to Barrier Grid Voltage .............. -3000 max. Volts
Grid 1 to Cathode Voltage ........................ +3 max. Volts
Grid 3 to Grids 2 & 4 Voltage .............. -3000 max. Volts
Back Plate to Barrier Grid Voltage ........... +200 max. Volts
Heater-Cathode Voltage ..................... ±100 max. Volts

TYPICAL OPERATING CONDITIONS:

(With Barrier Grid Grounded)
Cathode Voltage ................................ -1100 Volts
Grid 1 Cutoff Voltage .......................... -1140 Volts
Grids 2 & 4 Voltage ........................... +150 Volts
Grid 3 Voltage ................................ -770 ± 5% Volts
Collector Voltage ................................. +150 Volts
Back Plate Voltage: ..........................
Reading Conditions .......................... 0 Volts
Writing Conditions ........................... +40 Volts

MERIT FACTOR:

Read Around Ratio using 70% of usable target diameter .... 800 3000

PRINCIPLES OF OPERATION

When an electron beam bombards an insulator, secondary electrons are emitted in proportion to the secondary emission ratio of the target material at the operating voltage. For the WL-7566 target, this ratio follows the general pattern in curve CE-A1509.

VARIATION OF SIGNAL OUTPUT WITH HEATER CURRENT

SECONDARY EMISSION CHARACTERISTIC

WESTINGHOUSE ELECTRIC CORPORATION, ELECTRONIC TUBE DIVISION, ELMIRA, NEW YORK
If a grounded grid is placed touching the target, and a positive potential applied to the backplate, a retarding electric field is formed which acts like a barrier to prevent the secondary electrons from escaping from the small areas formed by the spaces of the grid. If the back plate is returned to the potential of the barrier grid during scan, secondary electrons will be released. These secondary electrons are attracted to the collector maintained at a positive potential.

In the writing operation of the WL-7566 the backplate is pulsed 20 to 50 volts positive with respect to the barrier grid. A similar positive potential is initially induced on the target surface. The modulated electron beam is scanned across the target. The barrier grid prevents the escape or redistribution of secondary electrons and the information is stored on the target in the form of a pattern of negatively charged areas. This operation is illustrated in CE-A1418.

This current, or the displacement current flowing in the backplate, constitutes the output signal. This reading process discharges the target toward an equilibrium potential which is close to that of the barrier grid. A negligible disturbance signal is produced when the scanning beam strikes the mesh which is treated in such a manner that the secondary emission ratio is approximately unity. This close control of the secondary emission ratio of the barrier grid results in a very favorable signal to noise ratio.

**PERFORMANCE**

The WL-7566 is primarily designed for use in digital computers. In this application, a significant performance indicator is the Readaround Ratio capability. The Readaround Ratio Test is performed in the following manner:

**Raster:** A pattern of 4096 dots is made by arranging 16 square blocks of 16 × 16 each in the form shown in CE-A1508. An identical pattern interlaced results in a 8192 dot raster.
Writing: Writing is achieved by switching the backplate to either +15 volts to write a “1” or -15 volts to write a “0”. In each case the beam duration is sufficient to bring the spot to equilibrium. The Radechon grid drive is adjusted to provide a “1” read signal of a predetermined size at the output of the gain stabilized read amplifier; this is arranged to correspond to a beam current of approximately 1 μA.

Reading: The output from the read amplifier drives a discriminator having a triggering threshold of one quarter of the nominal “1” signal amplitude. Any signal triggering the discriminator is interpreted as a “1”, all others as “0” ’s. The test is performed with an ultor voltage of 1100 volts and a well focused spot.

The Readaround Ratio Test: An interlaced pattern of 8192 “0” ’s or “1” ’s is stored on the target. The regeneration cycle is set at 1 microsecond “read”, 3 microsecond “rewrite” and 6 microsecond “deflect”. Next, an equally spaced pattern of one-eighth of the total dot pattern (1024) is written to the opposite polarity of the previously written pattern. In turn, each of the 1024 locations is addressed N consecutive times. (An address is a read followed by a rewrite). The addressing of a spot in this manner, degrades the charge stored at adjacent spots. When the degradation of charge at any spot is such that its “readout” signal crosses the discriminator threshold, a “readaround failure” is said to have occurred. This procedure is then repeated for a pattern of dots written to the oppo-
site polarity. The entire pattern is examined in this way such that every nearest neighbor of every spot is consulted N consecutive times, and the smallest value N for which a readaround failure occurs is called the readaround ratio of the tube.

Results: When the WL-7566 is tested this way, the readaround ratio is approximately 3000 with a minimum of 800. This test, however, only uses approximately 70% of the usable target area. If the full usable target diameter is used, a much higher readaround ratio will be obtained. For high resolution applications, up to 40,000 dots can be stored with corresponding lower readaround ratios.

Information may be written and stored for many hours, if desired, before being read out. The uniformity of output is such that for a constant signal applied the ratio of the maximum to minimum signal obtained from the target does not exceed 2 to 1 with a cathode voltage of -1100 volts. The signal output actually is much more uniform than this ratio indicates. The wide latitude given includes highly localized disturbances on the target surface.

For further information on the use of Radechons in a digital storage application see:

Greenwood and Stachler
Bell System Technical Journal
September 1958 Page 1195
and
C.F. Ault
Bell System Technical Journal
March 1959 Page 445

Target Life: Under conditions of intensive bombardment of one spot, the signal output will fall, approaching a final value of 70% of its original value.

When a 50% duty cycle is used, this decrease in signal will not occur within the first four hours.

The normal operating conditions of digital computers are such that noticeable signal decrease is unlikely to occur for at least 1000 hours.

Resolution: The WL-7566 may also be used in applications employing a conventional raster. The tube characteristic of value in this application is its resolution. The resolution of the WL-7566 may be expressed in lines per target diameter when the target is scanned with a conventional raster. The difference in resolution with four values of beam current is shown in GC-A1514.
Socket Connections
(Bottom View)

Pin No. Element
1 Heater
2 Cathode
3 Grid 1
4 Internal Connection (Do Not Use)
5 Grid 3
6 No Connection
7 Deflecting Electrode 4
8 Deflecting Electrode 3
9 Grids 2 & 4
10 Deflecting Electrode 2
11 Deflecting Electrode 1
12 No Connection
13 Internal Connection (Do Not Use)
14 Heater

Bulb Terminals

Neck Flange: External Conductive Coating (C), Internal Shield, Collector (CL)

Coaxial Connector
Center Electrode: Back Plate
Outside Electrode: Barrier Grid, End Cylinder