



MODEL CEM-4010 CHANNELTRON[®] ELECTRON MULTIPLIER

DESCRIPTION:

The curved Channeltron Electron Multiplier (CEM) is the most recent of the windowless multipliers developed at the Bendix Research Laboratories Division. It was designed specifically for rocket-probe investigations of the auroral plasma, but is also well suited for satellite experiments and other applications where small size, light weight, low power consumption, and an exposed cathode are important considerations.

As opposed to the conventional discrete dynode electron multipliers, the Bendix CEM* is an electrostatic device which employs a continuous dynode surface -- only two electrical connections are required to establish the necessary voltage distribution for electron multiplication. Because of the stability of the dynode surface on exposure to normal atmospheric conditions and its complete lack of photosensitivity to visible and near ultraviolet radiation, CEM's have found wide application as windowless solar blind detectors for the ultraviolet and soft X-ray region of the spectrum and for energetic charged particles. Principles of operation of Bendix CEM's are described in the literature.**

Forming the CEM into a circular arc makes stable electron gains of greater than 10^8 realizable. The output pulse height distribution is approximately Gaussian with a FWHM of 50 percent at an electron gain of 10^8 , and dark count rate is normally less than five per minute. This combination of high gain, narrow pulse height distribution, and low dark count rate makes the curved CEM ideal for photon and particle counting applications where simplicity of electronic circuitry is required.

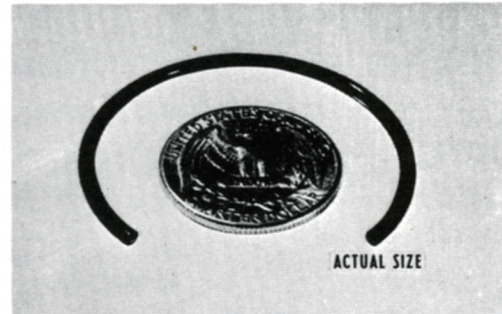
*PATENT NO. 3128408

**WILEY, W. C. AND HENDEE, C. F., IRE TRANS. NUCLEAR SCI., NS-9, APRIL 1962

GOODRICH, G. W. AND WILEY, W. C., REV. SCI. INST., 33, 761, 1962

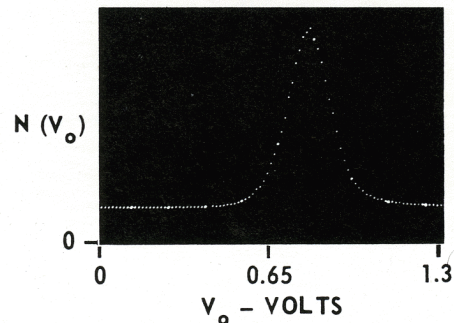
EVANS, D. S., REV. SCI. INST., 36, 375, MARCH 1965

CHANNELTRON IS A REGISTERED TRADEMARK OF THE BENDIX CORPORATION



DETECTS

- XUV AND X-RAY PHOTONS
- β PARTICLES
- LOW ENERGY ELECTRONS
- LOW ENERGY PROTONS
- POSITIVE IONS
- NEGATIVE IONS



TYPICAL PULSE HEIGHT DISTRIBUTION

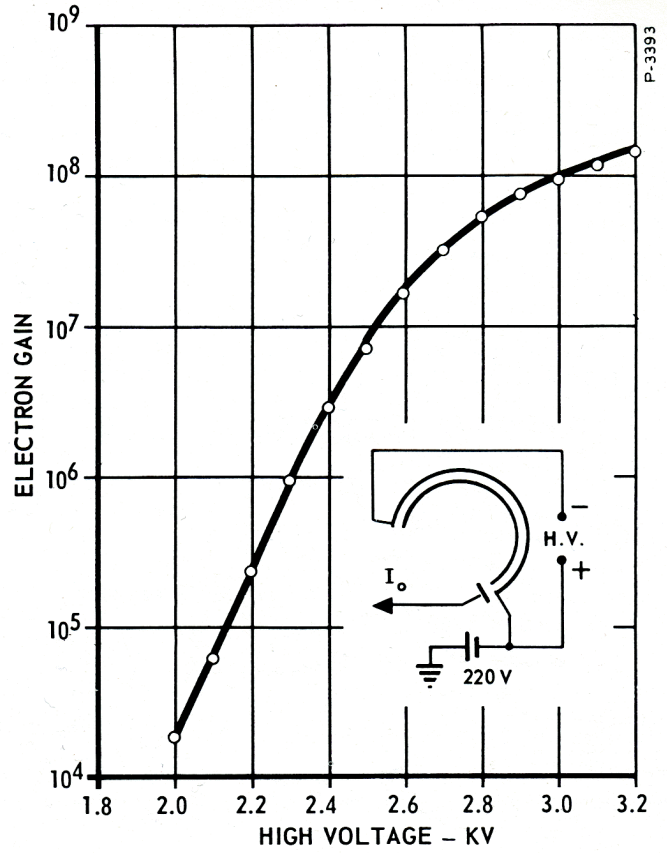
Other configurations of the CEM (helix, spiral, cone, etc.) can be made to suit special applications.

Miniaturized high voltage power supplies, capable of extreme environmental operation, are available from the Bendix Electro-Optics Division.

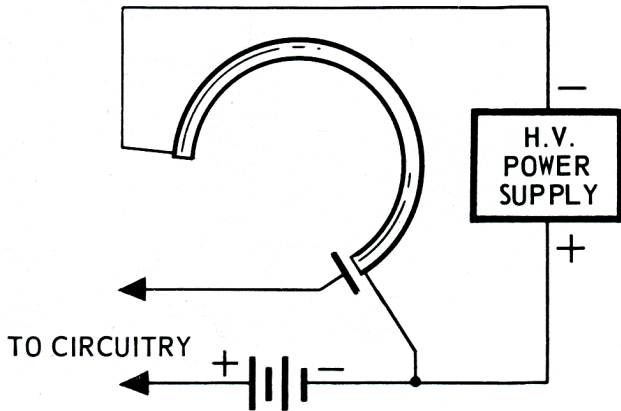
SPECIFICATIONS

SPECTRAL RESPONSE	1500°A TO BELOW 2°A
DARK PULSE COUNT RATE	FIVE COUNTS PER MINUTE OR LESS
TYPICAL ELECTRON GAIN	SEE GAIN CURVE
FULL WIDTH HALF MAXIMUM (FWHM) AT GAIN OF 1×10^8	50% OR LESS
MAXIMUM D-C ANODE CURRENT FOR LINEAR ANALOG RESPONSE	10% OF BIAS * CURRENT
MAXIMUM OPERATING HIGH VOLTAGE	4 KV
DYNODE SURFACE RESISTANCE	$1 \times 10^9 \Omega$ (NOMINAL)
INNER DIAMETER	0.040" (1 mm)
OUTER DIAMETER	0.080" (NOMINAL)
LENGTH OF ARC	4.00"
RADIUS OF CURVATURE	0.85"
SUBTENDED ARC	270°
WEIGHT	1/42 OZ.
ELECTRICAL CONNECTIONS	SUPPLIED BY USER
ANODE	SUPPLIED BY USER

MEASURED GAIN CURVE



TYPICAL ELECTRICAL CONNECTIONS

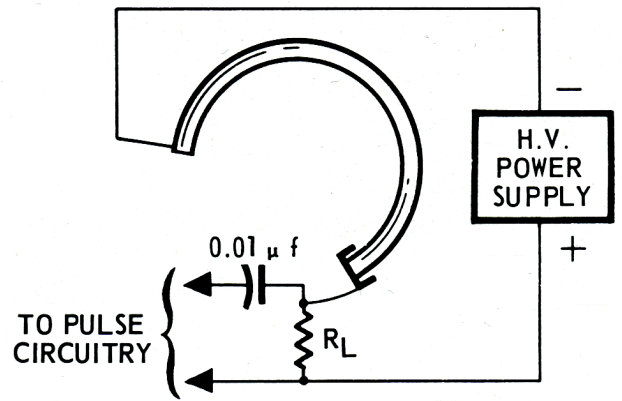


SEPARATE COLLECTOR

NOTE:

- (1) POINT OF GROUNDING OPTIONAL
- (2) COLLECTOR SPACING NOMINALLY ONE MILLIMETER
- (3) COLLECTOR VOLTAGE TYPICALLY 200-300 VOLTS

*BIAS CURRENT IS EQUAL TO THE OPERATING VOLTAGE DIVIDED BY THE DYNODE SURFACE RESISTANCE



CAP COLLECTOR

NOTE:

- (1) POINT OF GROUNDING OPTIONAL
- (2) COLLECTOR CAN BE METAL FOIL BONDED TO CEM WITH CONDUCTIVE ADHESIVE
- (3) R_L TYPICALLY 100 K Ω

FOR FURTHER INFORMATION CONTACT:

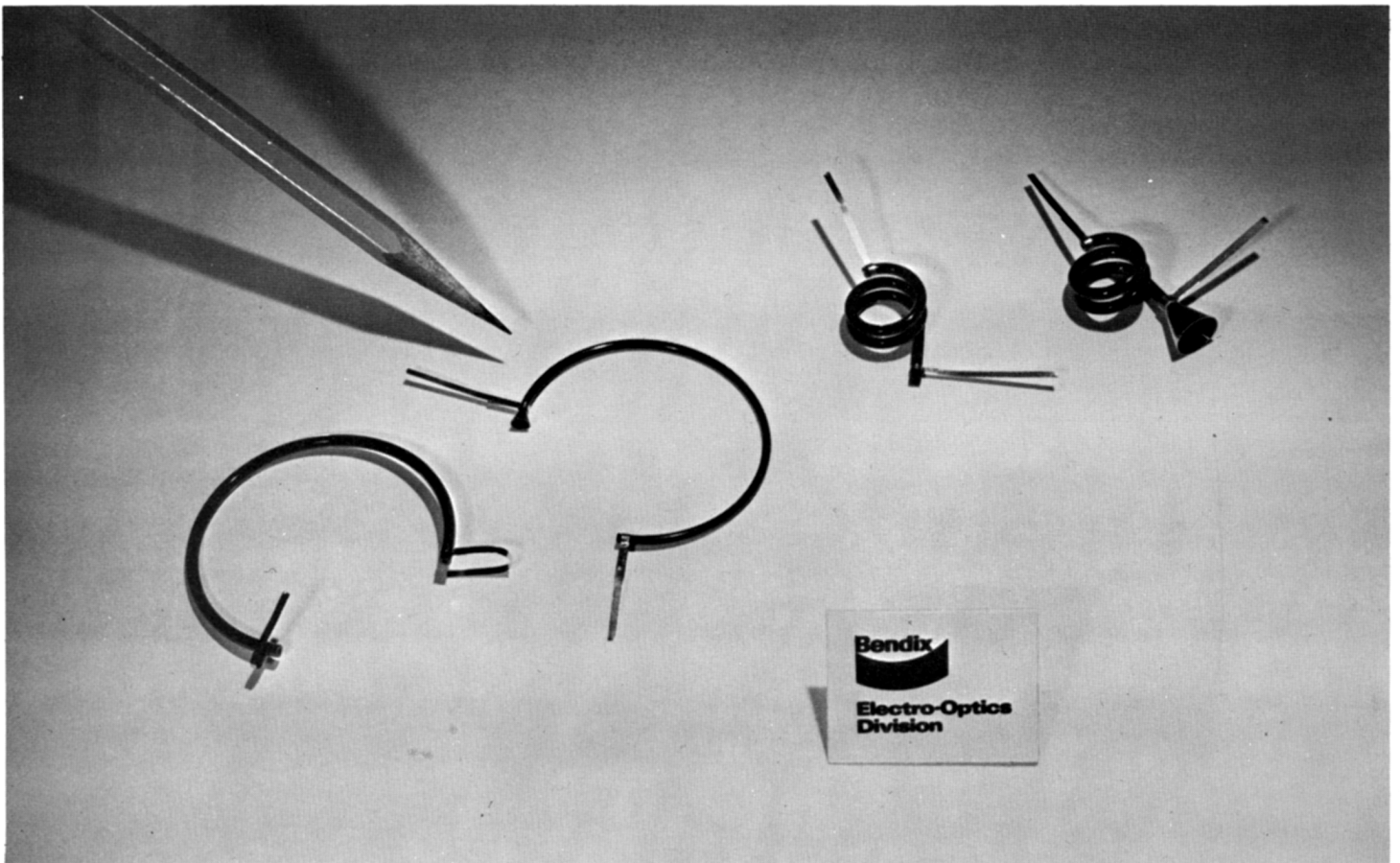
MARKETING DEPARTMENT
 THE BENDIX CORPORATION
 ELECTRO-OPTICS DIVISION
 1975 GREEN ROAD
 ANN ARBOR, MICHIGAN 48107
 TELEPHONE (313) 663-3311

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CHANNELTRON[®] ELECTRON MULTIPLIERS



MODELS: CEM-4010, CEM-4013, CEM-4020, CEM-4028

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SPECIFICATIONS

CHANNELTRON[®] ELECTRON MULTIPLIERS

CHARACTERISTIC	MODEL			
	4010	4013	4020	4028
MECHANICAL:				
SHAPE	CIRCULAR	CIRCULAR	HELIX	HELIX
SUBTENDED ARC	270°	270°	840°	840°
CONE DIAMETER*	None	3mm	None	8mm
CONE ANGLE	—	45°	—	45°
CHANNEL I. D.	0.040"	0.040"	0.040"	0.040"
CHANNEL O. D.	0.080"	0.080"	0.080"	0.080"
RADIUS OF CURVATURE	0.85"	0.85"	0.24"	0.24"
ELECTRICAL:				
SPECTRAL RESPONSE	1500 Å to below 2 Å			
MINIMUM GAIN	5 x 10 ⁷ with 3000 vdc applied			
OUTPUT PULSE HEIGHT				
DISTRIBUTION	Full width half maximum 50 %			
OUTPUT CURRENT PULSE				
WIDTH	20 nanoseconds (nominal) at 5 x 10 ⁷ gain			
BACKGROUND COUNT RATE** (avg) at 3000 vdc	< 0.5/sec	< 1.5/sec	< 0.5/sec	< 4.0/sec
DYNODE SURFACE RESISTANCE	1 x 10 ⁹ Ω	1 x 10 ⁹ Ω	1 x 10 ⁹ Ω	1 x 10 ⁹ Ω
MAX. OPERATING PRESSURE	1 x 10 ⁻⁴ Torr	1 x 10 ⁻⁴ Torr	1 x 10 ⁻⁴ Torr	1 x 10 ⁻⁴ Torr
MAX. OPERATING VOLTAGE	4 kv	4 kv	4 kv	4 kv
MAX. DC ANODE CURRENT FOR LINEAR ANALOG RESPONSE	10% OF BIAS CURRENT SEE NOTE 2	10% OF BIAS CURRENT SEE NOTE 2	10% OF BIAS CURRENT SEE NOTE 2	10% OF BIAS CURRENT SEE NOTE 2

NOTE: 1. ALL SPECIFICATIONS ARE NOMINAL UNLESS OTHERWISE NOTED.

2. BIAS CURRENT IS EQUAL TO THE OPERATING VOLTAGE DIVIDED BY THE DYNODE SURFACE RESISTANCE.

* MODEL CEM-4010 WITH 10MM CONE AVAILABLE AS CEM-4019. MODEL CEM 4020 WITH 10MM AXIAL CONE AVAILABLE AS CEM 4039

** <4.0/SEC FOR MODELS CEM-4019 & CEM-4039

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