

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *ET Enterprises / EMI 9817QA* at our website: ***Click HERE***

50 mm (2 in) diameter fast linear focused tubes with S11, bialkali, or S20 photocathodes

- Semi-transparent curved photocathode surface on end window which is flat externally
- Linear focused dynode structure with caesiated Be O surfaces for high gain and good stability
- Spectral responses S-11, S-13, Bialkali or S-20
- 10, 12 or 14 dynode stages
- Flexibility of envelope configuration, i.e. B19A(uncapped) or B20–102 (overcapped) base; borosilicate (Pyrex) or quartz (Spectrosil) end window material

The 2 in. diameter tubes 9810–9818 are designed for applications requiring very fast response times such as the detection and measurement of short lived nuclear events and pulsed light sources.

This new series has been introduced to replace the 9594 range. Apart from being more comprehensive, it incorporates design modifications to give improved reliability and performance. The external dimensions and pin connections are unchanged to preserve interchangeability.



MECHANICAL CHARACTERISTICS

Maximum envelope diameter	**All types 53 mm (2.09 in)**
Nominal cathode diameter	**All types 46 mm (1.81 in)**
Window material (see drawings for shapes)	**'B' and 'KB' types borosilicate (Pyrex): 'QB' and 'QKB' types quartz (Spectrosil)**
Dynodes	**Caesiated Be O surface, linear focused**
Base	**'B' and 'QB' types B19A (socket supplied) 'KB' and 'QKB' types Jedec B20–102 (socket extra)**

PRELIMINARY SELECTION GUIDE

Basic Type*	Spectral Response	Number of Dynodes	Old Type	Remarks
9810B	**S-11**	**14**	**9594UB**	**General purpose high gain parent type**
9811B	**S-11**	**12**	**—**	**Medium gain version of 9810B**
9812B	**S-11**	**10**	**9595UB**	**Lower gain version of 9810B for higher light levels**
9813B	**Bialkali**	**14**	**—**	**High gain, low dark current, high "blue" response**
9814B	**Bialkali**	**12**	**—**	**Medium gain version of 9813B**
9815B	**Bialkali**	**10**	**—**	**Lower gain version of 9813B for higher light levels**
9816B	**S-20**	**14**	**9597UB**	**High gain, spectral response extends to IR**
9817B	**S-20**	**12**	**—**	**Medium gain version of 9816B**
9818B	**S-20**	**10**	**9596UB**	**Lower gain version of 9816B, for higher light levels**

*Versions with quartz end window and/or overcapped are available in which case Q and/or K respectively are added to the type number, e.g. 9813QKB.

Notes

1 a) Each tube is individually calibrated and supplied with a test ticket giving the cathode sensitivity in μA/lm; cathode sensitivity measurements with filters appropriate to type of photocathode; the overall voltages for 50A/lm (10-stage tubes only), 200 A/lm (12-stage tubes only), 5000 A/lm (14-stage tubes only), and the relevant dark current (at 20°C).
A Corning glass filter (CS-5-58 ground to half stock thickness) is used to give a measure of the "blue" sensitivity; a Corning glass filter (CS-2-62), which passes all radiation longer than approximately 600nm, to indicate "red" sensitivity, and a Wratten 87 filter, which passes all radiation longer than approximately 800nm, to indicate sensitivity in the near infra-red region.

b) Test data is obtained with K to d1 held at 300 volts and the non-linear test dynode chain.

c) F (focus) should be connected to d1 for normal operation.

d) Generally, tubes should be operated at or near their rated overall sensitivity. Care should be taken not to exceed the maximum rated sensitivity or voltage.

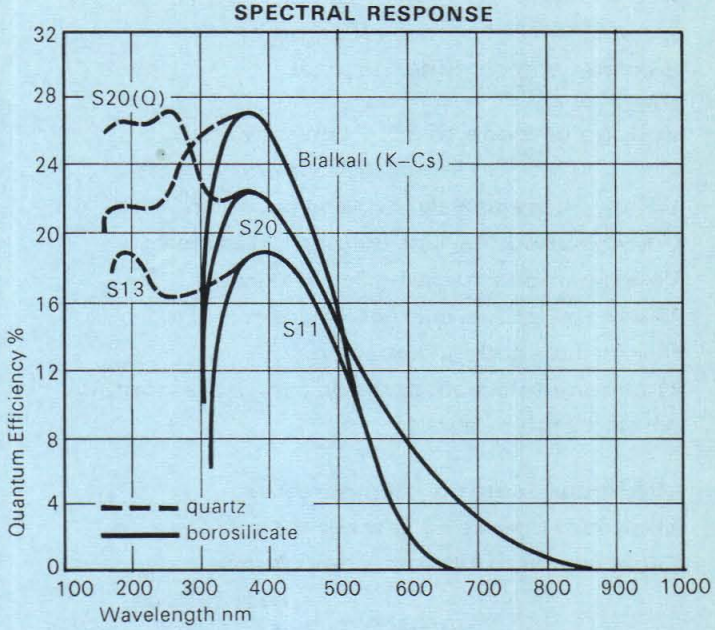
2 For optimum stability under d.c. conditions, the mean anode current should not exceed 10μA.

3 The glass envelope is coated with a screen which is connected to the cathode pin and over-wound with 3M's electrical tape, to ensure optimum dark current performance. Special care should be taken if the tube is operated with the cathode at high negative potential.

4 Overall sensitivity is greatly affected by variations in overall voltage, particularly in the case of tubes with a large number of dynodes.

5 In order to obtain a high value of peak output current, it is necessary to provide high voltages between the last dynode stages. The EMI test dynode chain is recommended for optimum results.

SPECTRAL RESPONSE

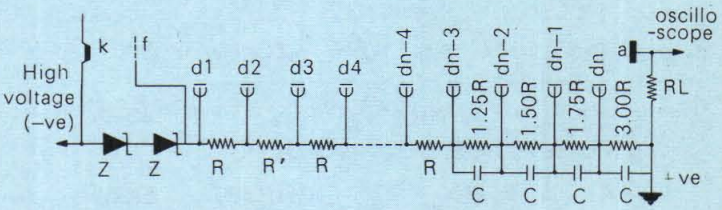


Tube type No.*	Cathode Sensitivity μA/lm		Overall Sensitivity 5000A/lm				Overall Sensitivity 10,000A/lm	
			V Overall		Dark Current nA		V Overall	Dark Current nA
	Min.	Typ.	Typ.	Max.	Typ.	Max.	Typ.	Typ.
9810B†	50	75	2250	2700	100	1000	2380	200
9810B‡			1980	—			2080	
9813B†	§	§	2350	2700	10	100	2480	20
9813B‡			2050	—			2160	
9816B†	100	170	2150	2700	50	1000	2270	100
9816B‡			1900	—			2000	
			Overall Sensitivity 200A/lm				Overall Sensitivity 2000A/lm	
9811B†	50	75	2050	2500	15	100	2600	150
9811B‡			1750	—			2220	
9814B†	§	§	2150	2500	2	8	2750	20
9814B‡			1850	—			2350	
9817B†	100	170	1950	2500	10	100	2470	100
9817B‡			1650	—			2070	
			Overall Sensitivity 50A/lm				Overall Sensitivity 500A/lm	
9812B†	50	75	1850	2300	2	50	2500	20
9812B‡			1560	—			2100	
9815B†	§	§	1950	2300	1	5	2620	10
9815B‡			1640	—			2200	
9818B†	100	170	1750	2300	2	50	2350	20
9818B‡			1470	—			1970	

* Tube characteristics apply equally to overcapped and quartz versions.
† Non-linear dynode chain.
‡ Linear dynode chain.
§ Types 9813, 9814 9815 have a minimum Corning blue cathode sensitivity of 7.0 and typical of 10.0.

DYNODE CHAIN DESIGN

The EMI (Non-linear) test dynode chain is shown below:



R' = 1.4R for normal operation but may be varied between R and 1.4R without significant change in performance

RL = 50 Ω — n = number of dynodes

Z = IS4150A (150V) — c = 1000pF

The value of R should be chosen to provide a series current, in the divider chain, of at least 10 times the mean expected anode current. To maintain linearity when high current anode pulses are being drawn, the voltages supplying the final dynodes should be increased, and if resistors are being used they should be decoupled by suitably large value capacitors. The photomultiplier output socket will also affect operation under pulsed conditions.

General notes on design aspects are given in the Introduction of the EMI photomultiplier catalogue P001/fP70, available on request.

RATINGS

PARAMETER	TUBE TYPE (All versions)		
	9810	9811	9812
	9813	9814	9815
	9816	9817	9818
Overall sensitivity: Rated	5,000 A/lm	200 A/lm	50 A/lm
Maximum	10,000 A/lm	2,000 A/lm	500 A/lm
Anode pulse rise time: Typical	2.4	2.0	1.6
(n. sec) Maximum	3.0	2.5	2.2
Anode Pulse f.w.h.m.: Typical	3.6	2.8	2.5
(n. sec) Maximum	4.4	4.0	3.5
Electron transit time: Typical (n. sec)	45	39	32
Voltage cathode to d1: Recommended	300	300	300
Maximum	500	500	500
Voltage between dynodes: Maximum	550	550	550
Voltage anode to last dynode: Maximum	550	550	550
Voltage anode to cathode: Maximum	3000	2800	2500
Maximum anode current (mean):	0.2mA	0.2mA	0.1mA
Maximum anode dissipation:	0.1W	0.1W	0.05W
Maximum tolerable cathode current (assuming	S-11 types	0.3 μA	
whole cathode used)	S-20 types	5 μA	
	Bialkali types	0.3 μA	
Maximum operating temperature:	60°C	60°C	60°C
Minimum operating temperature:	—80°C*	—80°C*	—80°C*
Capacitance to all electrodes: Anode	B types 5pf	KB types 7pf	
Last dynode	B types 7pf	KB types 9pf	
Energy resolution using Na I (Tl) crystal measured on type 9813	f.w.h.m. typically 7.5% for ^{137}Cs		
	P/V typically 6.0:1 for ^{60}Co		

* —20°C for 9813, 9814 and 9815

DARK CURRENT SHOT NOISE EQUIVALENT INPUT*

Type	9810	9811	9812	9813	9814	9815	9816	9817	9818
Lumens	2.9×10^{-13}	5.7×10^{-13}	4.1×10^{-13}	9.5×10^{-14}	2.1×10^{-13}	3.0×10^{-13}	1.4×10^{-13}	3.1×10^{-13}	2.7×10^{-13}
Watts	3.6×10^{-16}	6.9×10^{-16}	5.0×10^{-16}	8.1×10^{-17}	1.9×10^{-16}	2.5×10^{-16}	3.4×10^{-16}	7.7×10^{-16}	2.0×10^{-15}

*Calculated from typical performance data using Q.E. at λ peak and assuming △f of 1Hz and enhancement factor of unity.

TUBE REPLACEMENT GUIDE

RCA	EMI*	PHILIPS	EMI†
4459	9817KB	56AVP	9810KB
6810	9810KB	56TUVP	9816QKB
6810A	9810KB	56DVP	9813KB
7264	9810KB	56DUVP	9813QKB
7265	9816KB	PHILIPS	EMI*
7326	9818KB	XP1000	9812KB
7746	9812KB	XP1001	9812KB
7850	9811KB	XP1002	9818KB
8575	9814QB	XP1003	9818QKB

*nearest equivalent given – see data for differences
†direct plug-in replacement (focus voltage will need adjustment)

NOTES ON TIME CHARACTERISTICS

The anode pulse rise time is the time taken for the output pulse to rise from 10% to 90% of the peak when the photocathode of the tube is illuminated by a flash of light of very short duration.

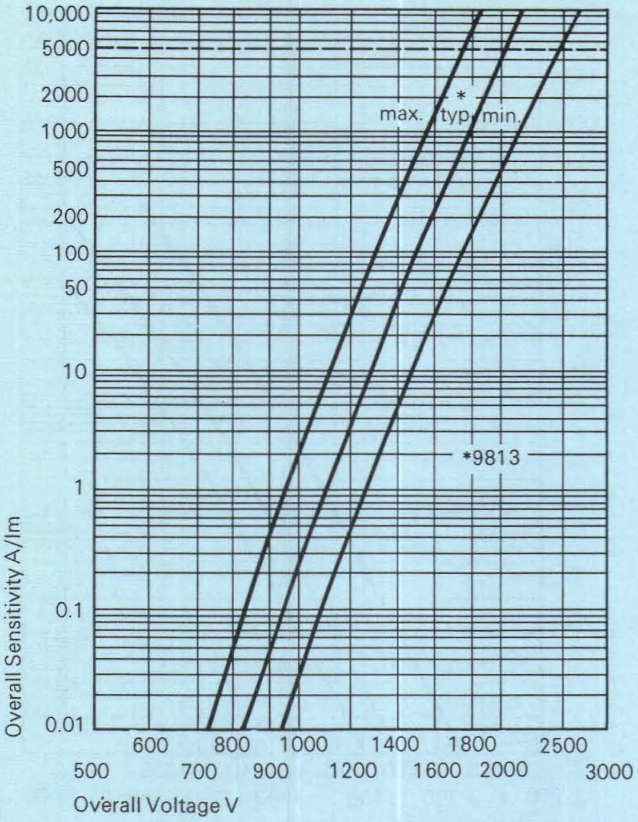
The anode pulse f.w.h.m. is the full width of the output pulse measured at half maximum amplitude.

The electron transit time is the time difference between the arrival of a flash of light at the photocathode and the instant when the output pulse is a maximum.

In each case the whole photocathode is illuminated by a point source situated about 50 mm above its centre. Measurements referred to in the "electrical ratings" were made at the maximum rated voltage for 10 and 12 stage tubes and the standard rated voltage for 14 stage tubes.

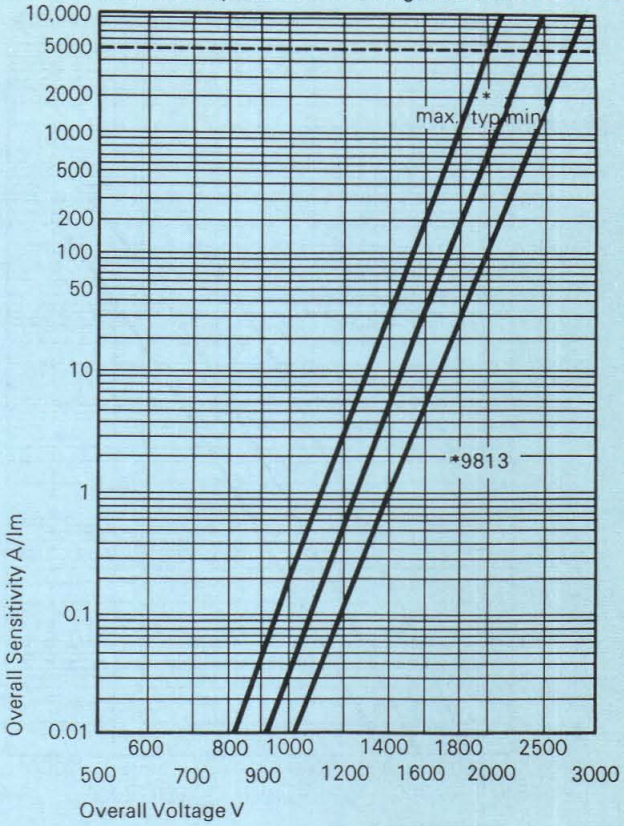
OVERALL SENSITIVITY vs OVERALL VOLTAGE

Linear dynode chain 14 stage tubes 9810 9813 9816



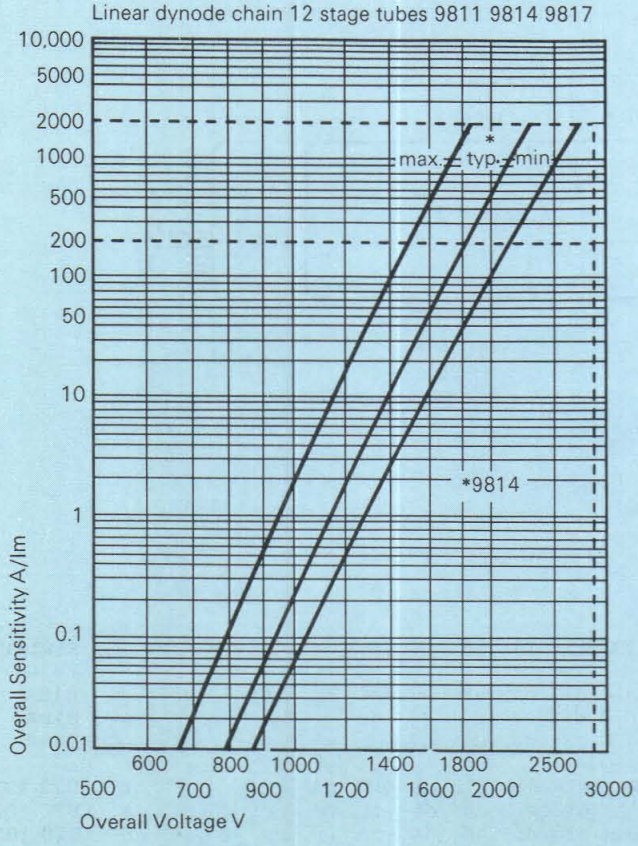
OVERALL SENSITIVITY vs OVERALL VOLTAGE

Non-linear dynode chain 14-stage tubes 9810 9813 9816



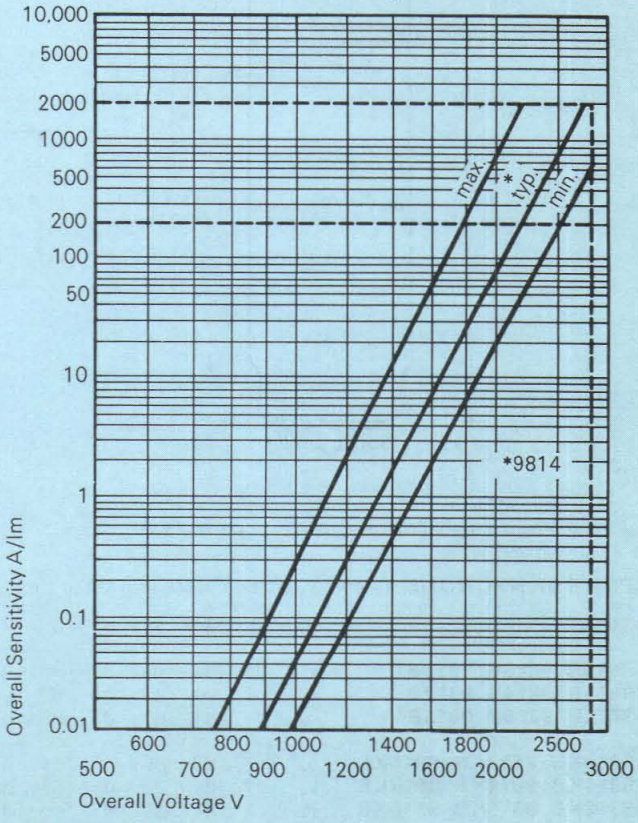
OVERALL SENSITIVITY vs OVERALL VOLTAGE

Linear dynode chain 12 stage tubes 9811 9814 9817



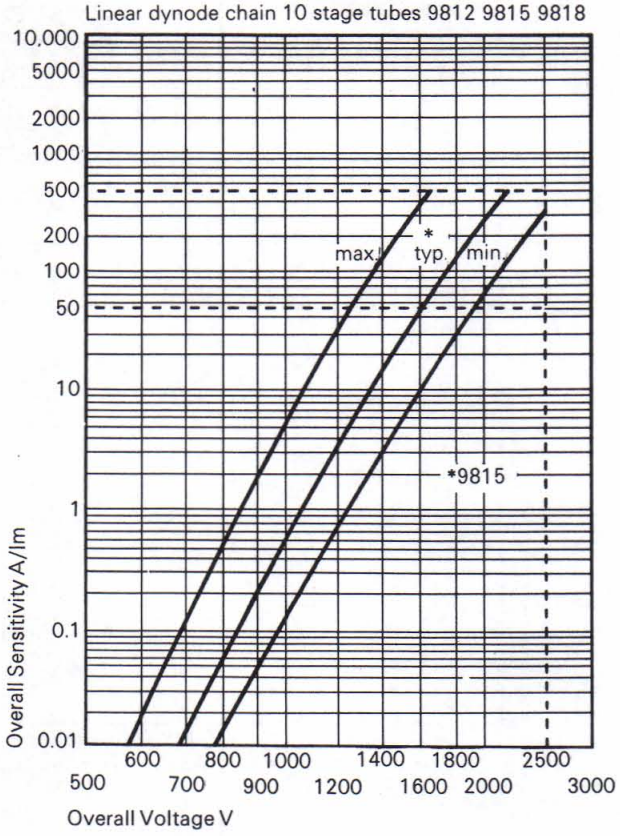
OVERALL SENSITIVITY vs OVERALL VOLTAGE

Non-linear dynode chain 12 stage tubes 9811 9814 9817



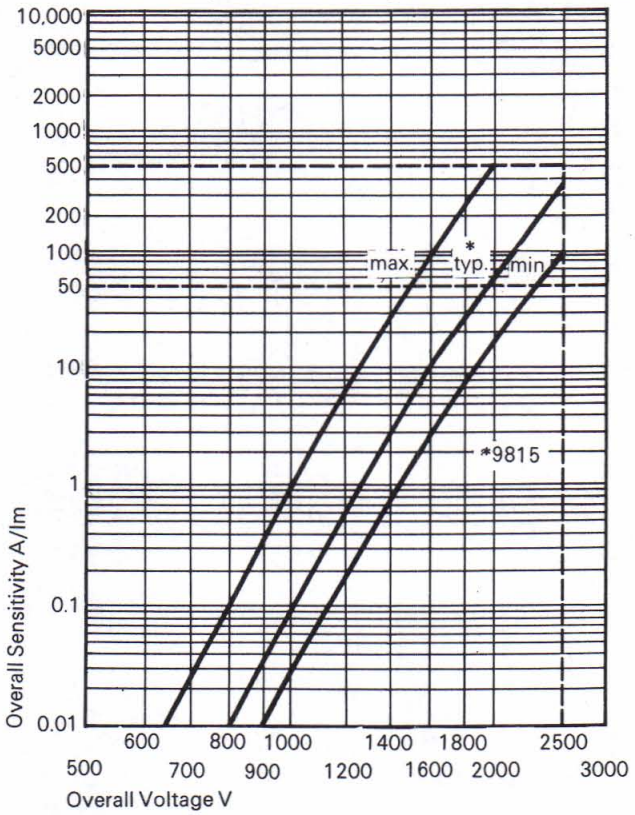
OVERALL SENSITIVITY vs OVERALL VOLTAGE

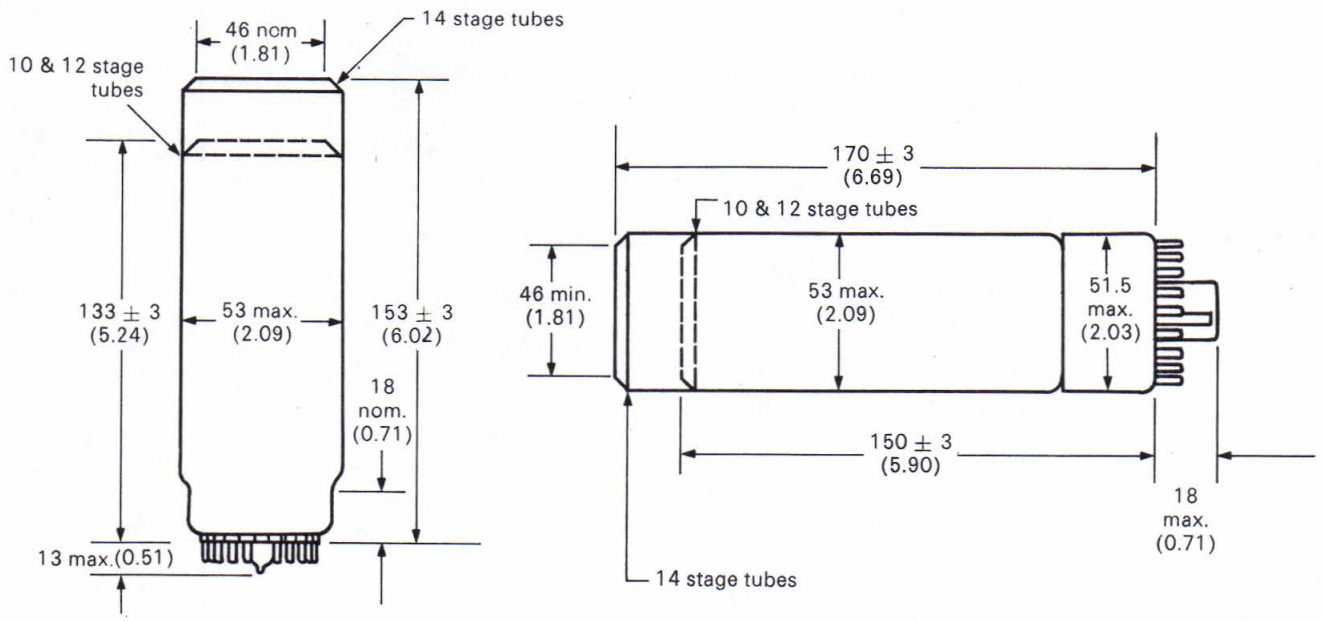
Linear dynode chain 10 stage tubes 9812 9815 9818



OVERALL SENSITIVITY vs OVERALL VOLTAGE

Non-linear dynode chain 10 stage tubes 9812 9815 9818





All dimensions in millimetres (inches in parenthesis).

PIN CONNECTIONS (viewed from below starting left of short pin or key)

Type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	SOCKET
9810B 9813B 9816B	ic	d1	d3	d5	d7	d9	d11	d13	A	d14	d12	d10	d8	d6	d4	d2	ic	F	K	—	**B19A**
9811B 9814B 9817B	ic	d1	d1	d3	d5	d7	d9	d11	A	d12	d10	d8	d6	d4	d2	ic	ic	F	K	—	**B19A**
9812B 9815B 9818B	ic	d1	d1	d1	d3	d5	d7	d9	A	d10	d8	d6	d4	d2	ic	ic	ic	F	K	—	**B19A**
9810KB 9813KB 9816KB	ic	d1	d3	d5	d7	d9	d11	d13	ic	A	d14	d12	d10	d8	d6	d4	d2	ic	F	K	**B20-102**
9811KB 9814KB 9817KB	ic	d1	d1	d3	d5	d7	d9	d11	ic	A	d12	d10	d8	d6	d4	d2	ic	ic	F	K	**B20-102**
9812KB 9815KB 9818KB	ic	d1	d1	d1	d3	d5	d7	d9	ic	A	d10	d8	d6	d4	d2	ic	ic	ic	F	K	**B20-102**

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP