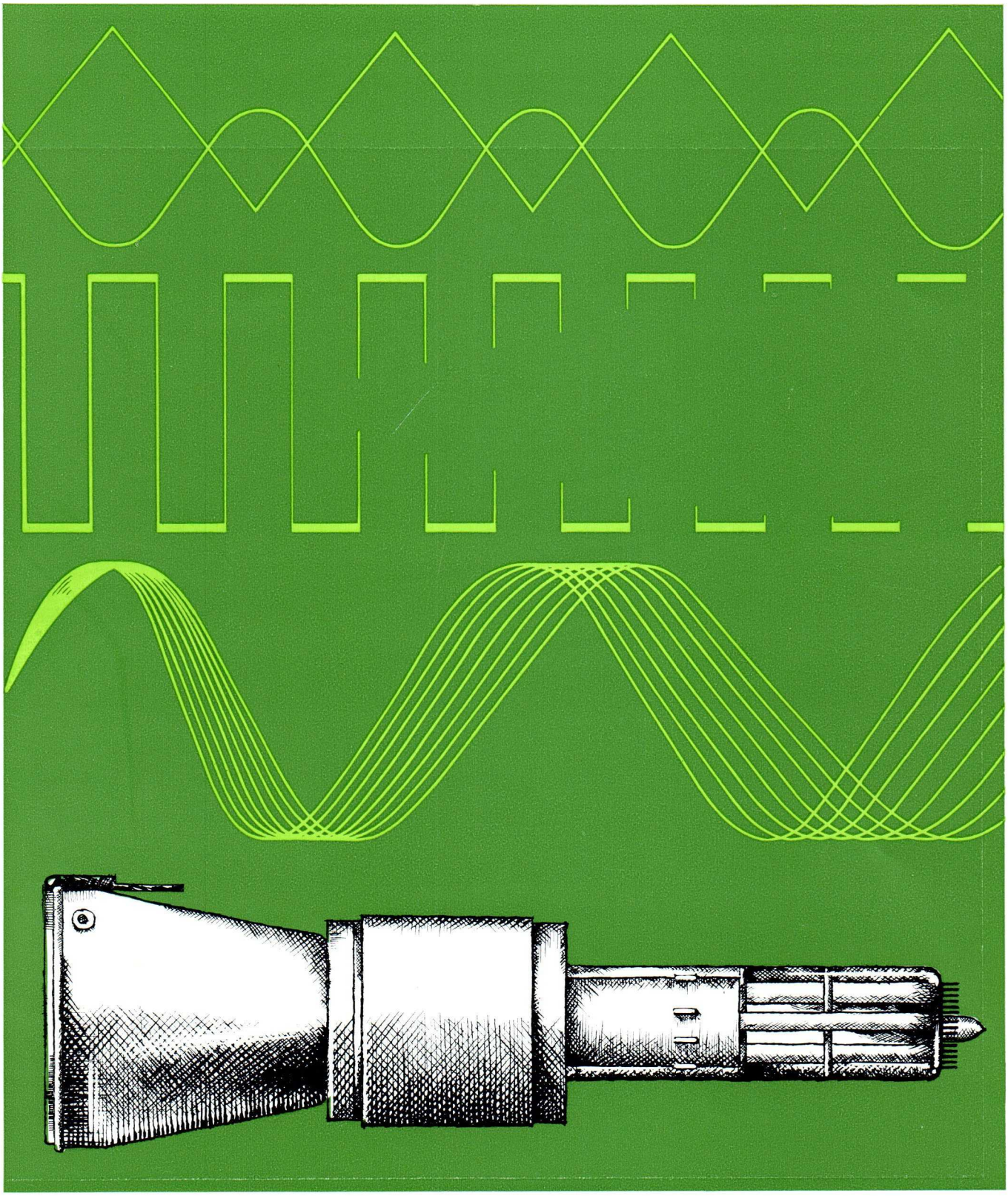
PHILIPS

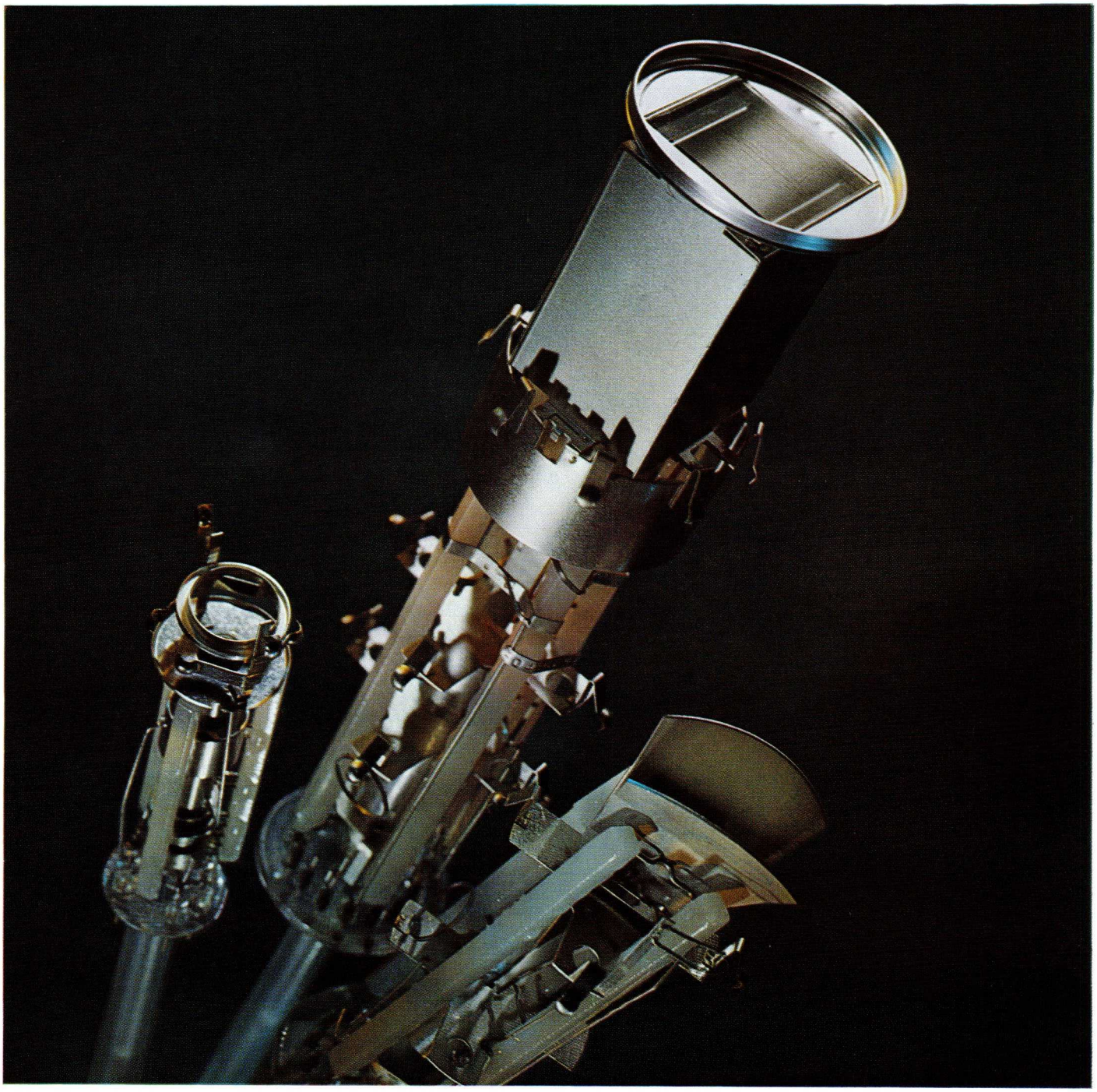
Product survey

Electronic components and materials

Cathode ray tubes

for instruments, monitors, data display, etc.





PROGRESS REPORT

And progress it is with a new storage tube, the whole p.d.a. range now with mesh screens, and a completely professionalized monitor tube range! However, the most noteworthy element is still that of continuity. Sudden switches in range benefit neither manufacturer nor customer. Controlled progress is essential to commercial success and commercial success is what we enjoy. Our policy of supplying robust tubes at attractive prices and with a guaranteed performance is endorsed by customer response.
Technological progress you will find in these pages, but the most worthwhile advances are often the hidden ones. Foreseeing the trend to rectangular bulbs, we sank a lot of money into glass reseach — its something we've lived and worked with for over eighty years. Having introduced rectangular bulbs into the medium priced range, we are now prepared to announce them in the most price sensitive range of mono-accelerators!

Note: This Survey gives brief data on our preferred ranges of tubes — those intended for new designs. A full list of all available tubes is given on the inside back cover.

Mono-accelerator tubes
This highly successful range remains unchanged from last year. As already mentioned, we expect that in the course of 1973, at least the D13-480 will appear in a modern, space-saving rectangular dress.

Post deflection accelerator tubes
The new split-beam E14-100GH comes with a long list of advantages over double gun tubes. Another newcomer is an 18 cm (7½″) rectangular tube for large screen displays. All preferred tubes in this range are now fitted with mesh screen.

Storage tubes
A half-tone storage tube that is so designed that it can offer oscilloscope manufacturers a simple means of extending their ranges — with a storage oscilloscope using the same amplifiers as the D14-120 and D14-160 series.

High frequency tubes
Here the changes are small but significant. The D13-450 now appears as the D13-451/45, it is 6 mm shorter and has a new internal graticule with dotted 10% and 90% lines.

Monitor tubes
This range has been completely updated and fully professionalized. All tubes are available with or without integral protection and with either the standard white phosphor or one of the professional phosphors (GH, GR, or GM) to special order.
Flying spot scanner tubes and projection tubes remain unchanged.

MONO-ACCELERATOR INSTRUMENT TUBES

These tubes are intended for the large proportion of applications that make no very great demands as regard bandwidth; their needs are often met by a non p.d.a. tube that has the concomitant advantages of reliability, excellent geometry, and a well defined trace. This type of tube is being increasingly used for digital register display in calculators and business machines.
Beam blanking by means of a special electrode has always meant a reduction of useful beam current and, if image distortion (caused by spot shift) were to be avoided, has placed severe demands on the flatness of the unblanking pulse. Now, thanks to our introduction of inexpensive beam-blanking circuits a special electrode is no longer necessary.*
In this range the D7-190, D10-160, and D13-480 * are outstanding. They are up-to-date flat-faced tubes based on the same gun, which means that components are fabricated in large series, keeping costs to a minimum while maintaining exceptional tolerance standards.
Particular advantages of this series are:
— Rugged construction
— Compactness
— High current efficiency
— High control sensitivity

* Application Information on this subject is available from your tube supplier.

DG7-31, DG7-32

7 cm (3″) monitor tubes;

low accelerator voltage.

The DG7-31 has asymmetrical x deflection. and symmetrical y deflection.
The DG7-32 has symmetrical x and y deflection.

Contrast is improved by a conductive layer between screen and phosphor; connecting this layer to the accelerator electrode prevents electrostatic image distortion.

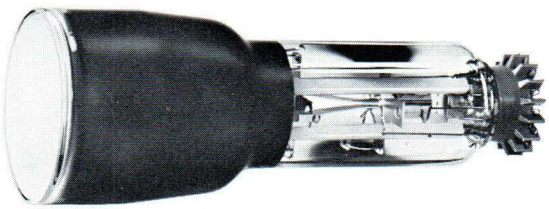
TYPICAL OPERATING CONDITIONS

Accelerator voltage		500 V		
Deflection factors	vertical	21 V/cm		
	horizontal	37 V/cm	Heater	6.3 V, 300 mA
Useful scan in both directions		min. 65 mm	Overall length	max. 172 mm
Line width		0.4 mm	Base	duodecal 12 p.

D7-190 . .

7 cm (3″) flat faced tube for inexpensive oscilloscopes and monitors;

symmetrical x and y deflection.



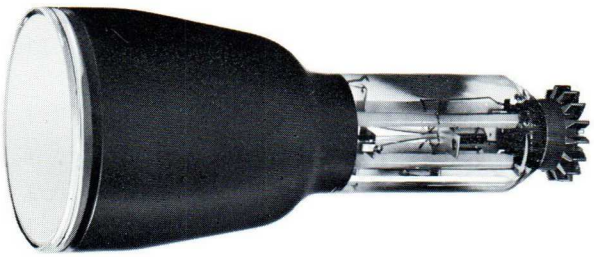
TYPICAL OPERATING CONDITIONS

Accelerator voltage		1000 V		
Deflection factors	vertical	11.5 V/cm		
	horizontal	29 V/cm	Heater	6.3 V, 300 mA
Useful scan	vertical	min. 50 mm	Overall length	max. 225 mm
	horizontal	min. 60 mm	Base	14 p. all glass
Line width		0.28 mm	Available phosphors	GH, GM

D10-160 . . , D10-161 . .

10 cm (4″) flat faced tube for inexpensive oscilloscopes and read-out devices;

symmetrical x and y deflection.



TYPICAL OPERATING CONDITIONS

Accelerator voltage			1500 V
Deflection factors	vertical		13.7 V/cm
	horizontal		32 V/cm
Useful scan	vertical	min.	60 mm
	horizontal	min.	80 mm
Line width			0.27 mm

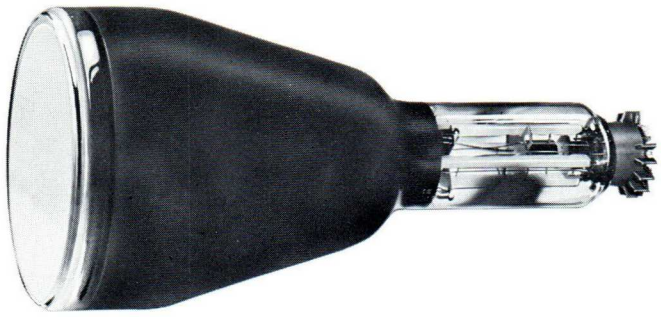
Heater: D10-160	6.3 V, 300 mA
D10-161	6.3 V, 95 mA
Overall length	max. 260 mm
Base	14 p. all glass
Available phosphors	GH, GM

D13-480 . . , D13-481 . . ,

13 cm (5″) flat faced tube for inexpensive oscilloscopes and read-out devices;

symmetrical x and y deflection.

A rectangular version of this tube will be released shortly.



TYPICAL OPERATING CONDITIONS

Accelerator voltage			2000 V
Deflection factors	vertical		14.4 V/cm
	horizontal		31.3 V/cm
Useful scan	vertical	min.	80 mm
	horizontal	min.	100 mm
Line width			0.3 mm

Heater: D13-480	6,3 V, 300 mA
D13-481	6,3 V, 95 mA
Overall length	max. 310 mm
Base	14 p. all glass
Available phosphors	GH, GM

POST-DEFLECTION ACCELERATOR TUBES

All preferred tubes in this range are now equipped with a mesh between deflection system and p.d.a. electrode. Advantages are:
— The ratio between p.d.a. and accelerator voltages can be higher.
— The bulb can be perfectly rectangular, which saves space.
— A mesh p.d.a. improves deflection sensitivity and increases useful scan.

The basic types are the D14-120 . . . and D14-121 . . . , the last-named having side connections for the deflection plates which reduces plate capacitance. The D14-160 . . . is derived from these two — it is slightly longer but has a more sharply defined trace in the screen centre.
The D10-170 . . . and D18-120 have the same gun as the D14-120 but in 10 cm circular and 18 cm rectangular bulbs. The latter is especially suitable for curve tracers, multi-trace oscilloscopes, etc.

The E14-100 . . . is a rectangular split-beam tube that is recommended as successor to our double gun tubes (E10-12, E10-130). Beam splitting has the advantage that a mesh is economic from the viewpoint of CRT design. Apart from the advantages mentioned above:
— The horizontal traces are perfectly parallel and have the same sensitivity because they have a common deflection system.
— Vertical overlap is 100%, as is the horizontal overlap.
— because the beams arrive at almost 90° to the screen, image distortion is minimal.
— With only one gun the tube is slim, which saves space.
One apparent disadvantage of split-beam tubes is the shift that occurs when intensity or focus are adjusted. We have developed a circuit that completely eliminates this shift and has the further advantage that focussing is automatic.

D14-120 . . , D-14-121 . .

14 cm (5½" diagonal) flat faced rectangular tube;

post-deflection acceleration electrode with mesh, metal-backed screen, symmetrical x and y deflection.

The D14-121 . . has side connections to the deflection plates and is intended for transistor oscilloscopes up to 50 MHz.

TYPICAL OPERATING CONDITIONS

Accelerator voltage			1500 V
Post-accelerator voltage			10000 V
Deflection factors	vertical		4.2 V/cm
	horizontal		15.5 V/cm
Useful scan	vertical	min.	80 mm
	horizontal	min.	100 mm
Line width			0.4 mm

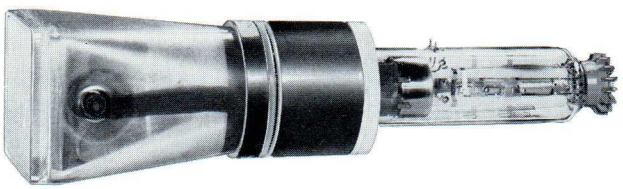
Heater	6.3 V, 300 mA
Overall length	max. 385 mm
Base	14 p. all glass
Available phosphors	GH, GM

D14-160 . . /09

14 cm (5½" diagonal) flat faced rectangular tube;

post-deflection acceleration electrode with mesh, metal-backed screen, symmetrical x and y deflection. edge-lit internal graticule

The D14-160 . . is similar to the D14-120 . . except that it is developed for better centre line-width and is fitted with a set of coils for image rotation and orthogonality correction. Suitable for oscilloscopes up to 80 MHz.



TYPICAL OPERATING CONDITIONS

Accelerator voltage			1500 V
Post-accelerator voltage			10000 V
Deflection factors	vertical		4.1 V/cm
	horizontal		15.2 V/cm
Useful scan	vertical	min.	80 mm
	horizontal	min.	100 mm
Line width			0.3 mm

Heater	6.3 V, 300 mA
Overall length	max. 417.5 mm
Base	14 p. all glass
Available phosphors	GH, GM

D10-170GH

10 cm (4″) flat faced tube;

post-deflection acceleration electrode with mesh, symmetrical x and y deflection.

TYPICAL OPERATING CONDITIONS

Accelerator voltage		1000 V
Post-accelerator voltage		6000 V
Deflection factors	vertical	3.5 V/cm
	horizontal	13 V/cm
Useful scan	vertical	min. 60 mm
	horizontal	min. 80 mm
Line width		0.42 mm

Heater	6.3 V, 300 mA
Overall length	max. 335 mm
Base	14 p. all glass
Available phosphor	GH

D18-120 . .

18 cm (7″ diagonal) flat faced rectangular tube;

post deflection acceleration electrode with mesh, metal backed screen, symmetrical x and y deflection.

TYPICAL OPERATING CONDITIONS

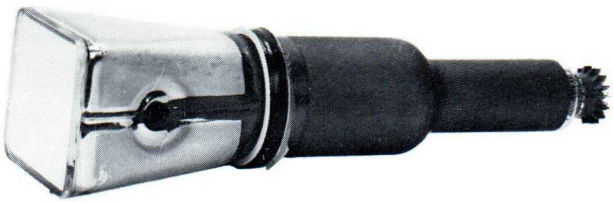
Accelerator voltage		2000 V
Post-accelerator voltage		10000 V
Deflection factors	vertical	4.5 V/cm
	horizontal	15.5 V/cm
Useful scan	vertical	min. 100 mm
	horizontal	min. 120 mm
Line width		0.35 mm

Heater	6.3 V, 300 mA
Overall length	max. 454 mm
Base	14 p. all glass
Available phosphors	GH, GM

E14-100GH

14 cm (5½″ diagonal) flat faced rectangular split beam tube;

post deflection acceleration electrode with mesh, metal backed screen, symmetrical x and y deflection.



TYPICAL OPERATING CONDITIONS

Accelerator voltage		1500 V
Post-accelerator voltage		10000 V
Deflection factors	vertical	9 V/cm
	horizontal	13.5 V/cm
Useful scan	vertical (each system)	min. 80 mm
	horizontal	min. 100 mm
Line width		0.35 mm
Overlap of two systems		100 %

Heater	6.3 V, 300 mA
Overall length	max. 425 mm
Base	14 p. all glass
Available phosphors	GH

STORAGE TUBE

The L14-110 . . . / . . . is a direct viewing transmission storage tube with variable persistence. It is a 14 cm diagonal tube with electrostatic deflection and focussing, and internal graticule. It is designed to have the same vertical sensivity, and better horizontal sensitivity, than the D14-120 and D14-160 series which means that oscilloscope manufacturers can supply a storage oscilloscope without having to design new vertical and horizontal amplifiers.
Persistence of the display is variable because it depends on the erase pulses fed to the storage mesh and not on the characteristics of the phosphor on the viewing screen. The tube is supplied as standard with the medium persistence GH phosphor which offers a high contrast, non-tiring green display. The tube is also supplied complete with correction coils for trace shift and alignment.

L14-110GH/55

14 cm (5½") diagonal flat-faced rectangular direct viewing, variable persistence, storage tube.

edge lit internal graticule

writing speed [1]	**>**	**100 div/ms**
storage time [2]	**>**	**1.5 min**

[1] defined as the maximum speed at which a trace is just visible against a 'just black' background. If some background is tolerated the writing speed can be raised to approx. 1 cm/μs

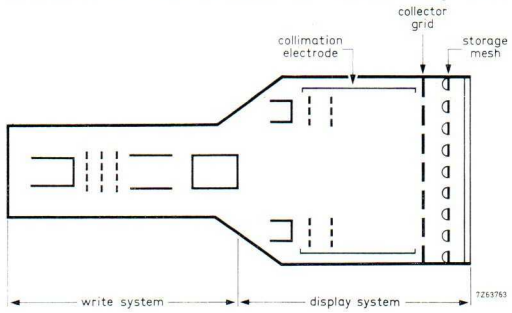
[2] defined as the time taken for the background to rise from zero brightness to 10 % of saturated brightness. At reduced intensity the storage time can be longer.

TYPICAL OPERATING CONDITIONS

Accelerator voltage		1500 V
Final accelerator voltage		8500 V
Deflection factors:	vertical	9.5 V/cm
	horizontal	4.1 V/cm
Useful scan:	vertical	min. 90 mm
	horizontal	min. 72 mm
Line width		0.3 mm

Heaters: write section	6.3 V, 300 mA
viewing section (2 x)	6.3 V, 300 mA
Overall length	max. 445 mm
Base	14 p. all glass
Phosphor	GH

The L14-110-GH storage tube has three electron guns: a write gun and two 'flood' guns. An image is written onto a storage medium by the write gun, and is reproduced on the phosphor screen by the flood guns.

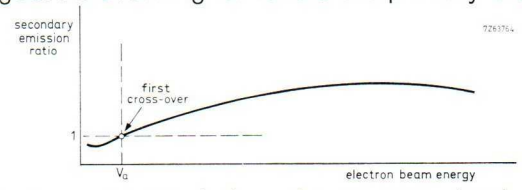


The write system

The write system is effectively the same as in a conventional tube — such as the D14-160GH/09. Instead of writing direct onto the phosphor screen, however, it writes onto a storage surface. The storage surface is a dielectric layer deposited on a conductive support mesh. High energy electrons from the write beam penetrate the storage surface and cause the emission of secondary electrons which are collected by a second mesh, the collector grid.

For a given surface material, the number of secondary electrons emitted depends on the energy of the primary electrons. As shown in Fig. 2, below a certain value the secondary emission ratio δ is less than 1, which means that less electrons are leaving the surface than arriving, and the surface becomes negatively charged. Increasing the energy of the primary electrons increases δ and a point is reached where $\delta = 1$: this is known as the first cross-over point.

Increasing the write beam energy still further raises δ above unity and more electrons leave the surface than arrive, the surface becomes, therefore, positively charged. At even higher levels the primary electrons

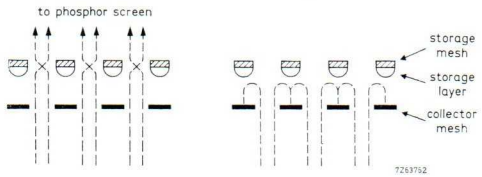


begin to penetrate below the escape depth of the material, and the secondary emission decreases until δ again $= 1$. This is the second cross-over point.

From the above descriptions it can be seen how the high energy electrons of the write system can write an image of differing positive charges on the dielectric (storage) surface.

The display system

The flood guns provide a low energy flood of electrons that evenly illuminate the storage surface and travel normal to it (collimation). Where the region about a mesh opening is charged to a certain positive level, all the flood electrons in the neighbourhood pass through the opening to the high acceleration field between the storage mesh and the phosphor display screen. Where the storage surface is charged to a certain negative level, the electrons are repelled and are collected by the collector grid sited on the gun side of the storage mesh. At intermediate charge levels, a proportionate amount of electrons are passed through the mesh and are displayed as a lower brightness image on the phosphor screen. As tonal gradations are possible this type of tube is commonly called a half-tone storage tube. It can be seen that, with respect to the flood beam, the storage mesh behaves much like the control grid in a triode.



Erasure

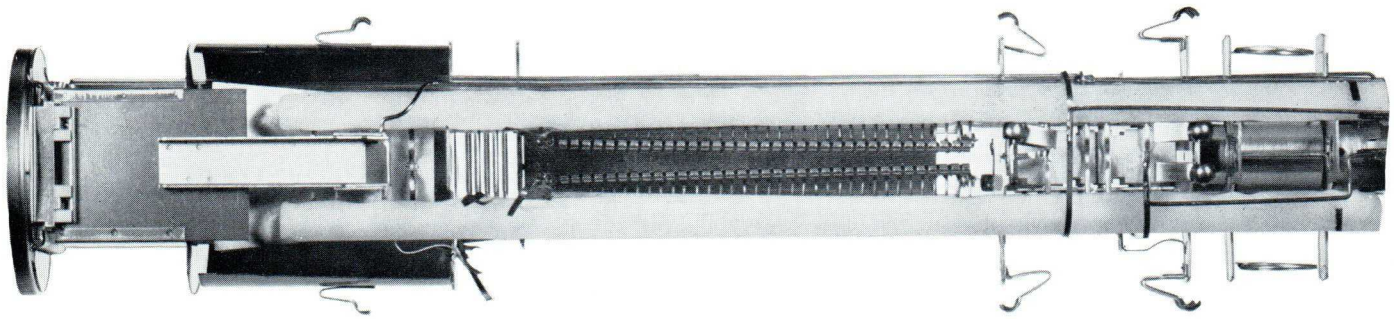
The image on the storage surface can be erased by making the backing mesh positive with respect to the flood cathodes. Because of its capacitive coupling to the backing mesh, the storage surface also goes positive and attracts flood electrons that cancel the positive charges. When the backing electrode is restored to 0 V, the storage surface again follows and is ready to be rewritten.

Erasure can be made static or dynamic. In the static mode a single pulse of appropriate width and magnitude erases the image. In the dynamic mode a train of short pulses discharges the storage surface in discrete steps. By varying the width or frequency of the pulses, the persistence of the image can be varied from several seconds to several minutes.

HIGH FREQUENCY INSTRUMENT TUBES

The moment someone announces a really advanced oscilloscope - someone else demands one twice as fast - with twice the screen area, a brighter trace - and goodness knows what else. It's a hard struggle to keep up, particularly for the tube maker! For one thing tube deflection systems must be able to handle very high frequencies and must, in any case, be exceptionally sensitive. Beam densities, too, must be adapted to give a clear trace at high writing speeds. For us it means producing tubes that give the oscilloscope makers a bit of leeway.
Our latest all-purpose high-frequency tube*, the D13-500, is more than a step ahead of current demand. It has a vertical deflection system good for 800 MHz (sensitivity - 2 V/cm, a 6 cm x 10 cm display, and brightness to match. The delay line deflection system is separated from the p.d.a. system by a mesh; vertical sensitivity and scan are doubled by an electrostatic quadrupole lens. The aluminized face is flat, rectangular with a 13 cm diagonal, and incorporates an internal graticule for parallax-free measurement. Neck mounted coils allow trace alignment, vertical shift, and orthogonality correction.
The D13-451 is also a rectangular faced tube*, but intended for transistorized oscilloscopes with a bandwidth of 100 MHz to 250 MHz. The internal graticule can be illuminated by a special light conductor: Alignment, shift, and orthogonality correction are catered for by neck mounted coils.

* Application information on this subject is available from your tube supplier.



Gun of the D13-500 . ./01 showing the delay-line vertical deflection system.

D13-451GH/45

13 cm (5″ diagonal) rectangular flat faced tube;

post-deflection acceleration electrode with mesh,
metal-backed screen,
sectioned y-plates,
edge-lit internal graticule,
symmetrical x and y deflection.

The tube is suitable for transistorized oscilloscopes with a bandwidth from 100 to 250 MHz; it is provided with coils for orthogonality correction, shift of scanned area and picture rotation.

TYPICAL OPERATING CONDITIONS

Accelerator voltage			1500 V
Post-accelerator voltage			15000 V
Deflection factors	vertical		3 V/cm
	horizontal		9.9 V/cm
Useful scan	vertical	min.	60 mm
	horizontal	min.	100 mm
Line width			0.40 mm

Heater	6.3 V, 300 mA
Overall length	max. 449 mm
Base	14 p. all glass

D13-500 . . /01

13 cm (5″ diagonal) rectangular flat faced tube;

post-deflection acceleration electrode with mesh,
metal-backed screen,
vertical deflection by a symmetrical helix system,
vertical scan magnification by an electrostatic quadrupole lens,
symmetrical x deflection,
edge-lit internal graticule.

An all-purpose oscilloscope tube with high sensitivity and large useful scan, capable of displaying signals up to 800 MHz; it has coils for alignment, vertical shift and orthogonality correction.

TYPICAL OPERATION CONDITIONS

Accelerator voltage			2500 V
Post-accelerator voltage			15000 V
Deflection factors	vertical		1.7 V/cm
	horizontal		13.5 V/cm
Useful scan	vertical	min.	60 mm
	horizontal	min.	100 mm
Line width			0.35 mm

Heater	6.3 V, 300 mA
Overall length	max. 492 mm
Base	14 p. all glass
Available phosphors	BE, GH

MONITOR TUBES

Tubes for data display, closed circuit television, large screen oscilloscopes, television camera viewfinders, and television monitors must meet similar standards - high resolution, high quality, stable and predictable characteristics, and not least important, assured long term availability. It is really only in screen phosphors that the requirements differ. In television, of course, white is mostly used, but in the other applications there is a preference for other phosphors.

Experience, confirmed by ergonomic analysis, shows that green is the least tiring colour for operators and observers, and therefore promotes error free reading. A flicker-free picture, too, is less tiring, so a slower decay is to be preferred. Another point in favour of green is that it gives a pleasing and professional appearance to the final product. For these reasons we recommend the GH and GR phosphors for data display. They are both green, but the GR has the longer persistence and is thus more suitable for slower repetition rates. For medical system monitors and other lower speed application where a longer decay is needed we recommend the GR or GM phosphors. The GM is the slower to decay and has a purplish blue flash and yellowish green persistence.

Our range includes tubes from 17 cm to 38 cm, with deflection angles from 70° to 110°; particular attention being drawn to the M17-140W, the M17-141W, and the M24-100W. The first two are rectangular flat-faced tubes intended primarily as camera viewfinders but, because of their excellent resolution, recommended for use anywhere where the display of fine detail is important. The last named, the M24-100W has been developed with the small data display market particularly in mind. Although white is the standard phosphor for tubes in this range, we shall be happy to supply tubes with any of the above mentioned phosphors against special order.

M17-140W, M17-141W

Rectangular picture tubes for use as television camera view finder, and high resolution display;

17 cm (7") diagonal,
70° deflection angle,
flat faced,
metal-backed screen,
very high resolution,
bonded face plate
metal mounting band } **M17-141W only**

TYPICAL OPERATING CONDITIONS

	M17-140W	M17-141W
Final accelerator voltage	14	16 kV
First accelerator voltage	400	600 V
Grid No. 1 voltage	-30 to -62	-40 to -90 V
Resolution at screen centre	min. 650	700 lines

Heater	6.3 V, 300 mA
Overall length M17-140W	max. 234 mm
M17-141W	max. 240 mm
Neck diameter	28 mm
Base	B8H

M24-100W, M24-101W

Rectangular picture tube for use as precision monitor and data display tube;

24 cm (9½") diagonal,
90° deflection angle,
high resolution,
integral protection, for U.L. approval (M24-101W).

TYPICAL OPERATING CONDITIONS

Final accelerator voltage	16 kV	Heater	6.3 V, 300 mA
First accelerator voltage	600 V	Overall length	max. 260 mm
Grid No. 1 voltage	−32 to −85 V	Neck diameter	28 mm
Resolution at screen centre	900 lines	Base	B8H

M31-130W, M31-131W

Rectangular picture tube for use as monitor and data display tube;

31 cm (12") screen diagonaal,
90° deflection angle,
metal backed screen,
high resolution,
integral protection, for U.L. approval (M31-131W).

TYPICAL OPERATING CONDITIONS

Final accelerator voltage	16 kV	Heater	6.3 V, 300 mA
First accelerator voltage	600 V	Overall length	max. 310 mm
Grid No. 1 voltage	−32 to −85 V	Neck diameter	28 mm
Resolution at screen centre	min. 900 lines	Base	B8H

M38-120W, M38-121W

Rectangular picture tube for use as precision monitor and data display tube;

38 cm (15") screen diagonal,
110° deflection angle,
metal-backed screen,
integral protection, U.L. approved (M38-121W).
also available with WA phosphor (white D 6500).

TYPICAL OPERATING CONDITIONS

Final accelerator voltage	16 kV	Heater	6.3 V, 300 mA
First accelerator voltage	400 V	Overall length	max. 279.5 mm
Grid No. 1 voltage	−40 to −85 V	Neck diameter	28 mm
Resolution at screen centre	min. 650 lines	Base	B8H

FLYING SPOT SCANNER TUBES

Q13-110GU Q13-110BA

13 cm (5″) flying spot scanner tubes;

useful screen diameter min. 108 mm,
high resolution,
40° deflection angle,
magnetic deflection,
magnetic focusing,
metal-backed screen.
Q13-110BA with purplish blue phosphor of very short persistence.
Q13-110GU with white phosphor of very persistence.

TYPICAL OPERATING CONDITIONS

Accelerator voltage	25 kV	Heater	6.3 V, 300 mA
Grid No. 1 voltage	−50 to −100 V	Overall length	max. 347 mm
Resolution at screen centre	1000 lines	Base	duodecal 7 p.

PROJECTION TUBES

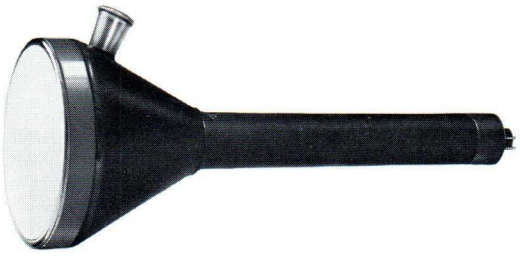
MW13-38, MG13-38
MY13-38
MU13-38

13 cm (5″) projection tubes;

useful screen area 92 x 69 mm,
47° deflection angle,
high brightness,
magnetic deflection,
magnetic focusing.

MW13-38 for large screen projection of black and white television pictures.

MG 13-38, MY 13 38, MU 13-38 for large screen projection of colour television pictures.



TYPICAL OPERATING CONDITIONS

Accelerator voltage	50 kV	Heater	6.3 V, 300 mA
Grid No. 1 voltage	−100 to −170 V	Overall length	max. 374 mm
		Base	duodecal 7 p.

SCREEN PHOSPHORS AND EQUIVALENTS

Designation			Colour		Persistence	Typical use
Pro-Electron		Jedec	Fluores-cence	Phosphor-escence		
new	old					
BE	B	P11	blue	blue	medium short	oscillography and photography
GH	H	P31	green	green	medium short	general purpose oscillography
GJ	G	P1	yellowish-green	yellowish-green	medium	general purpose oscillography
GM	P	P7	purplish-blue	yellowish-green	long	low-speed oscillography
GP	N	P2	bluish-green	green	medium short	medium-speed oscillography, photography
GR	—	P39	green	green	long	monitoring and display devices
GU	—	—	white	white	very short	colour flying spot scanners
BA	C	—	purplish-blue	— —	very short	flying spot scanners
W	W	P4	white	— —	medium short	television and monitoring devices
WA	—	—	white	— —	medium short	studio monitors (white point matched to colour tv white point)

COMPLETE TYPE RANGE AND STATUS CODE

Type No.	Phosphors	Status
D.3-91	H	C
D.7-5	G, P	C
D.7-6	G, P	C
D.7-11	H, P	M
D.7-31	G	D
D.7-32	G	D
D.7-78	B, H, N, P	M
D7-190 . .	GH, GM	D
D.10-6	B, G, P	O
D10-11 . .	GH, GM, GP	O
D10-12 . .	GH, GM, GP	O
D.10-78	B, H, N, P	O
D10-160 . .	GH, GM	D
D10-161 . .	GH, GM	D
D10-170 . .	GH	C
D10-200 . ./07	GH	O
D13-16 . .	GH, GM, GP	O
D13-16 . ./01	GH	O
D13-21 . .	GH, GM, GP	O
D13-26 . .	GH, GM, GP	O
D13-26 . ./01	GH, GM	O
D13-27 . .	GH, GM	M
D13-450 . ./01	GH	O
D13-451 . ./45	GH	C
D13-480 . .	GH, GM	D
D13-481 . .	GH, GM	D

Type No.	Phosphors	Status
D13-500 . ./01	GH	D
D14-120 . .	GH, GM	D
D14-121	GH, GM	D
D14-160 . ./09	GH, GM	D
D18-120 . .	GH, GM	C
E10-12 . .	GH, GM, GP	M
E10-130 . .	GH, GM, GP	M
E14-100 . .	GH	D
L14-110 . ./55	GH	D
M.13-38	G, U, Y, W	C
M17-140 .	W	D
M17-141 .	W	D
M21-11 .	W	O
M21-12 .	W	O
M24-100 .	W	D
M24-101 . .	W	D
M28-12 .	W	O
M31-120 . .	W	O
M31-130 . .	W	D
M31-131 . .	W	D
M36-11 .	W	O
M36-16 .	W	O
M33-120 . .	W	D
M38-121 . .	W	D
Q13-110 . .	BA, GU	C

D: design type.
Recommended for design and availabe in full production quantities.

C: current type.
Available for equipment production and for replacement.
Not recommended for design.

M: maintenance type.
Available for maintenance only.

O: obsolescent type.
Available until stocks are exhausted.

Other phosphors are available to special order.

Argentina: FAPESA I.y.C., Av. Crovara 2550, Tel. 652-7438/7478, BUENOS AIRES. **Australia:** Philips Industries Ltd., Elcoma Division, 67-71 Mars Road, Tel. 42 1261, LANE COVE, 2066, N.S.W. **Austria:** Österreichische Philips Bauelemente Industrie G.m.b.H., Zieglergasse 6, Tel. 93 26 22, A1072 VIENNA. **Belgium:** M.B.L.E., 80, rue des Deux Gares, Tel. 23 00 00, 1070 BRUSSELS. **Brazil:** IBRAPE S.A., Av. Paulista 2073-S/Loja, Tel. 278-1111, SAO PAULO, SP. **Canada:** Philips Electron Devices, 116 Vanderhoof Ave., Tel. 425-5161, TORONTO 17, Ontario. **Chile:** Philips Chilena S.A., Av. Santa Maria 0760, Tel. 39-40 01, SANTIAGO. **Colombia:** SADAPE S.A., Calle 19, No. 5-51, Tel. 422-175, BOGOTA D.E. 1. **Denmark:** Miniwatt A/S, Emdrupvej 115A, Tel. (01) 69 16 22, DK-2400 KØBENHAVN NV. **Finland:** Oy Philips Ab, Elcoma Division, Kaivokatu 8, Tel. 1 72 71, SF-00100 HELSINKI 10. **France:** R.T.C. La Radiotechnique-Compelec, 130 Avenue Ledru Rollin, Tel. 357-69-30, PARIS 11. **Germany:** Valvo G.m.b.H., Valvo Haus, Burchardstrasse 19, Tel. (0411) 3296-1, 2 HAMBURG 1. **Greece:** Philips S.A. Hellénique, Elcoma Division, 52, Av. Syngrou, Tel. 915 311, ATHENS. **Hong Kong:** Philips Hong Kong Ltd., Components Dept. (Kowloon Branch), Din Wai Industrial Building, 11th Floor, 49 Yuen Road, Kwun Tong, Tel. K-42 82 05-8, HONG KONG. **India:** INBELEC Div. of Philips India Ltd., Band Box House, 254-D, Dr. Annie Besant Road, Tel. 457 311 to 15, Prabhadevi, BOMBAY-25-DD. **Indonesia:** P.T. Philips-Ralin Electronics, Elcoma Division, Djalan Gadjah Mada 18, Tel. 44 163, DJAKARTA. **Ireland:** Philips Electrical (Ireland) Ltd., Newstead, Clonskeagh, Tel. 69 33 55, DUBLIN 14. **Italy:** Philips S.p.A., Sezione Elcoma, Piazza IV Novembre 3, Tel. 69 94, MILANO. **Japan:** NIHON PHILIPS, 32nd Fl. World Trade Center Bldg., 5, 3-chome, Shiba Hamamatsu-cho, Minato-ku, Tel. (435) 5204-5, TOKYO. **Mexico:** Electrónica S.A. de C.V., Varsovia No. 36, Tel. 5-33-11-80, MEXICO 6, D.F. **Netherlands:** Philips Nederland B.V., Afd. Elonco, Boschdijk 525, Tel. (040) 79 33 33, EINDHOVEN. **New Zealand:** EDAC Ltd., 70-72 Kingsford Smith Street, Tel. 873 159, WELLINGTON. **Norway:** Electronica A.S., Middelthunsgate 27, Tel. 46 39 70, OSLO 3. **Peru:** CADESA, Jr. Ilo, No. 216, Appartado 10132, Tel. 27 73 17, LIMA. **Philippines:** EDAC, Philips Industrial Dev. Inc., 2246 Pasong Tamo Street, Tel. 88 94 53 (to 56), MAKATI-RIZAL. **Portugal:** Philips Portuguesa S.A.R.L., Av. Eng. Duharte Pacheco 6, Tel. 68 31 21, LISBOA 1. **Singapore:** Philips Singapore Private Ltd., 8th Floor, International Building, 360 Orchard Road, Tel. 37 22 11 (10 lines), SINGAPORE-9. **South Africa:** EDAC (Pty.) Ltd., South Park Lane, New Doornfontein, Tel. 24/6701-2, JOHANNESBURG. **Spain:** COPRESA S.A., Balmes 22, Tel. 232 66 80, BARCELONA 7. **Sweden:** ELCOMA A.B., Lidingövägen 50, Tel. 08/67 97 80, 10250 STOCKHOLM 27. **Switzerland:** Philips A.G., Edenstrasse 20, Tel. 01/44 22 11, CH-8027 ZUERICH. **Taiwan:** Philips Taiwan Ltd., San Min Building, 3rd Fl., 57-1, Chung Shan N. Road, Section 2, P.O. Box 22978, Tel. 553101-5, TAIPEI. **Turkey:** Türk Philips Ticaret A.S., EMET Department, Gümüssuyu Cad. 78-80, Tel. 45.32.50, Beyoglü, ISTANBUL. **United Kingdom:** Mullard Ltd., Mullard House, Torrington Place, Tel. 01-580 6633, LONDON WC1E 7HD. **United States:** North American Philips Electronic Component Corp., 230, Duffy Avenue, Tel. (516) 931-6200, HICKSVILLE, N.Y. 11802. **Uruguay:** Luzilectron S.A., Rondeau 1567, piso 5, Tel. 9 43 21, MONTEVIDEO. **Venezuela:** C.A. Philips Venezolana, Elcoma Department, Av. Principal de los Ruices, Edif. Centro Colgate, Apartado 1167, Tel. 36.05.11, CARACAS.

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Cathode Ray Tubes. Product Survey 1973

Het Storage principe.

De L14-110-GH storage buis heeft 3 elektronenkanonnen: een 'schrijf' kanon en twee 'lees' kanonnen. Een verschijnsel wordt door het 'schrijf' kanon op het storage medium geschreven en gereproduceerd op het fosfor scherm door de 'lees' kanonnen.

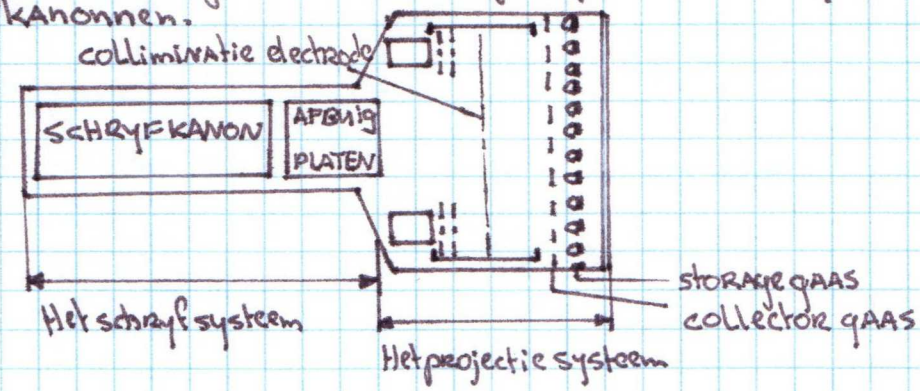

fig.1

Het schrijf systeem

Het schrijf systeem is gelijk aan dat van een conversiebuis – bv. de D14-160GH/xx. Inplaats van dat men direkt op het fosfor schrijft, wordt er geschreven op het storage gaas. Het storage gaas is een diëlektrische laag aangebracht op een draadhuisster. High energy elektronen van het schrijfkanon dringen het storage gaas binnen en veroorzaken een secundaire emissie van elektronen die worden opgevangen door het collectorgaas.

Voor een gegeven materiaal hangt de mate van de sec. emissie elektronen af van het energie niveau van de primaire electronen. Zoals fig.2 aantoont is beneden een bepaalde waarde de secundaire emissie quotiënt δ kleiner dan 1, wat betekent dat er minder elektronen het oppervlak dan dat er opvallen, zodat het oppervlak een neg. potentiaal krijgt. Neemt het energie niveau van de primaire elektronen toe, neemt ook de δ toe en dan wordt een punt bereikt waar $\delta = 1$, dit punt wordt genoemd het eerste cross-over punt. Stijgt het energie niveau van de primaire elektronen nog meer zo wordt δ hoger en verlaten meer elektronen het oppervlak dan dat er intreden. Hierdoor krijgt het oppervlak een pos. potentiaal. Op zelfs hogere energie-niveau's van de elektronen van het schrijfkanon, dringen zij dieper dan de ontshappingsdiepte in het materiaal in, met als gevolg dat de secundaire emissie quotiënt zakt tot $\delta = 1$. Dit is het tweede cross-over punt.

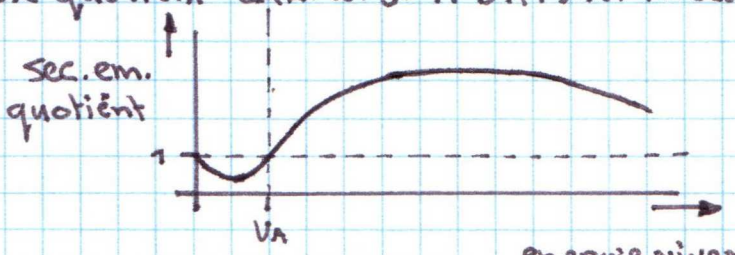

fig.2

Vanuit de boven staande beschrijving is het makkelijk concluderen dat de high-energy elektronen van het schrijfkanon een verschijnsel kunnen schrijven van verschillende pos. ladingen in de diëlektrische (storage) laag.

Het projectie systeem.

De leeskanonnen geven een low-energy elektronen stroom af, die het storage oppervlak illumineren en er normaal naar toe gaan (collimineren). Daar waar het storage gaas een pos. lading bezit zullen alle elelctronen in de omgeving hierdoor passeren naar het tussen het storage gaas en het fosforscherm gelegen high accelleration veld. (fig. 3A). Daar waar het storage gaas een neg. lading bezit worden alle electronen tegengehouden en vallen terug op het collector gaas dat is gesitueerd op de kanonzyde van het storage gaas (fig 3b). Op tussen liggende lading niveaus, dringt een gedeelte van de elektronen door het gaas en worden op het fosforscherm weergegeven met een lagere helderheid. De ze buis wordt een half-tone storage buis genoemd indien tonale variaties mogelyk zyn. Het blykt dat het storage-gaas ~~in~~ t.o.v. de lees kathode qua werking veel weg heeft van de control-grid in een triode.

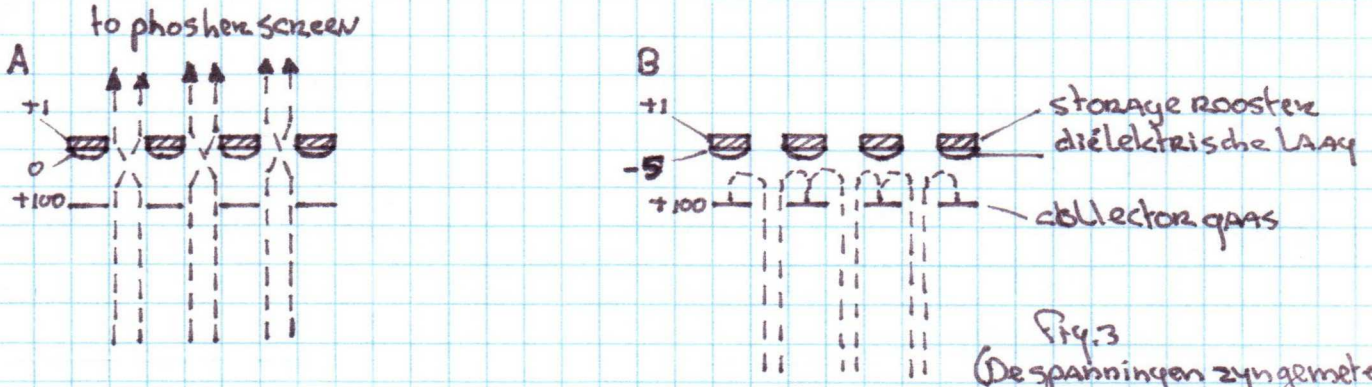

Fig. 3
(De spanningen zyn gemeten t.o.v. de leeskanonnen)

Wissen

Het verschynsel op het storage gaas kan worden ge wist door het achterliggende rooster pos. temaken t.o.v. de Lees kanonnen. Doordat het storage-gaas en het achterliggende gaas aan elkaar capacitief gekoppeld zyn wordt dit ook pos. en het storage gaas trekt dan elechtronen van het leeskanon die dan de pos. lading te niet doen. Als het rooster nu terugvalt naar 0v, volgt het storage gaas weer en is het klaar om op nieuw beschreven te worden. Het missen kan statisch dan wel dynamisch gebeuren. In het geval van statisch wissen wist een enkele puls het verschynsel. In het geval van dynamisch wissen ontlaadt een serie korte pulsen het storage gaas in verschillende stappen. Door variatie in grootte of frequentie van de pulsen kan de lengte van de wistyd variëren van enkele seconden tot enkele minuten.

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