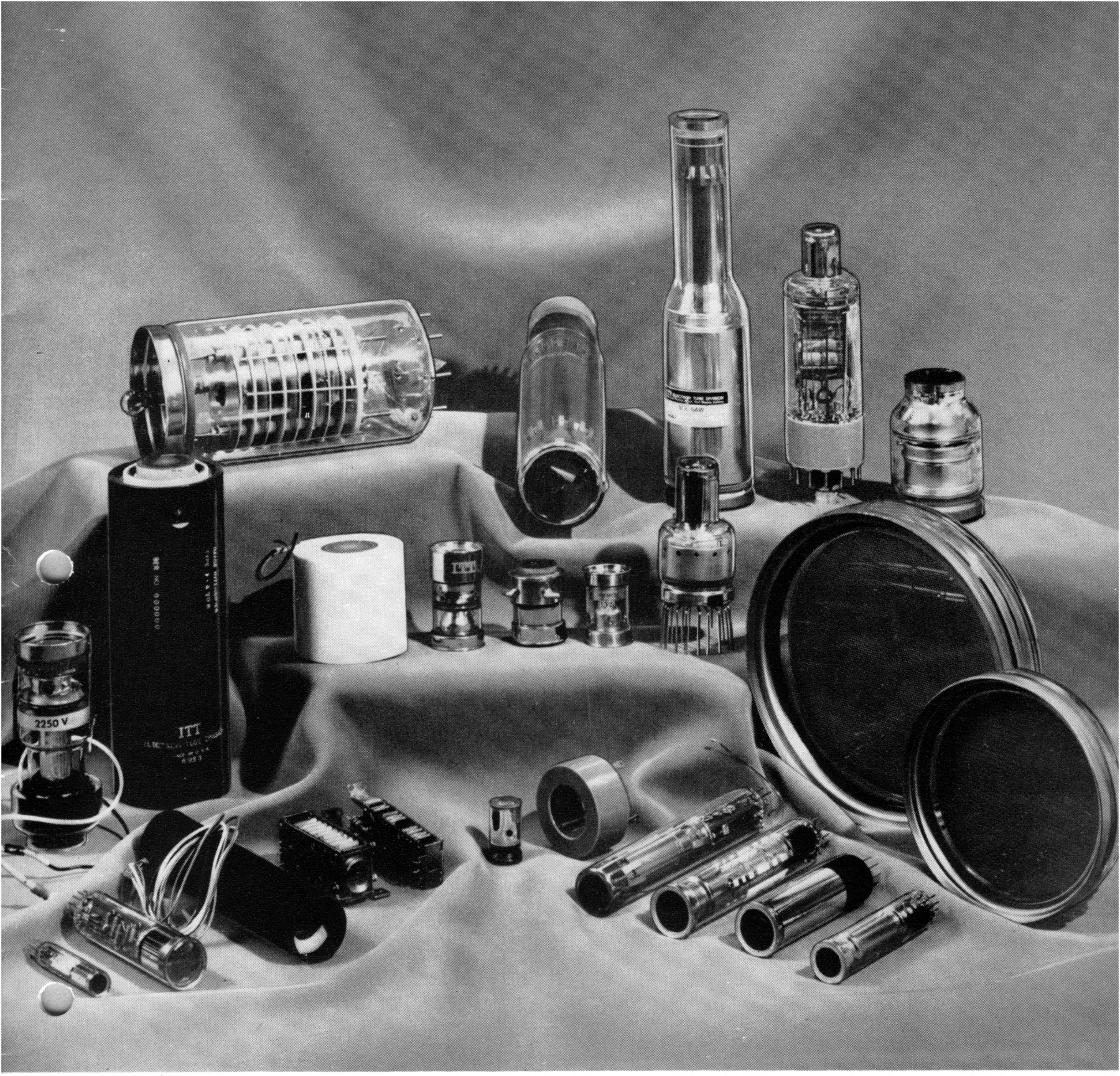

Electro-Optic Devices - Data Summary

1974/75

ITT

6340/2006E

Electro-Optic Devices

ITT is engaged in the manufacture and supply of components world wide. ITT components are sourced in more than 50 factories in Europe, as well as from plants in the Americas, Africa and the Far East. The sources of the components described in this publication are indicated by international code letters.

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Contents

Laser Diodes

Applications Guide

Single and double heterostructure lasers provide approximately the same mean output power so the type to be selected for a given application depends on the peak power, pulse length and pulse repetition frequency required.

Diodes Lasers

Guide des applications

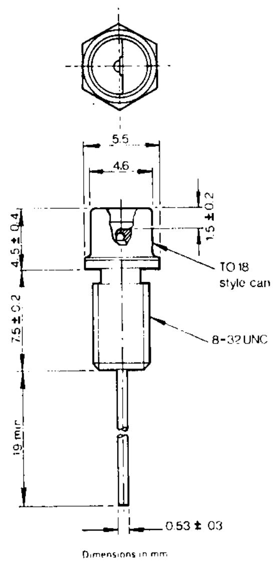
Les lasers à hétérostructure simple et double fournissent approximativement la même puissance de sortie moyenne, de sorte que le type à choisir pour une application donnée dépend de la puissance de crête, de la longueur d'onde et de la fréquence de répétition des impulsions requises.

Laserdioden

Anleitung zur Auswahl

Laser mit einfacher und doppelter Heterostruktur liefern etwa die gleiche mittlere Ausgangsleistung. Die Auswahl des für eine bestimmte Anwendung geeigneten Typs hängt daher nur von den erforderlichen Werten für Spitzenleistung, Impulsdauer und Pulsfolgefrequenz ab.

Application	Peak power range watt	Pulse repetition frequency range	Pulse length range	Hetero-structure type	Advantages
Voice communications	5	5–20 kHz	200 ns	single	High peak power.
Voice communications	0,1	5–20 kHz	5 µs	double	Low drive current.
Data transmission	0,1	>1 MHz	50 ns	double	Compatible with fibre-optic guide.
Intruder alarm	0,1	0,1 kHz	1 µs	double	Long range, long life.
Short range illuminator	10	10 kHz	100 ns	single	Short pulse length.
	0,1	100 kHz	1 µs	double	Compatible with photocathodes.
Target designator	10	10 kHz	200 ns	single	High power.
Target designator	0,1	100 kHz	1 µs	double	Compatible with photocathodes.
Ranging	10	10 kHz	>100 ns	single	Short pulse length.



Type	Description	P_O* peak (W)	Pulse* width (ns)	Duty* (D) (%)	I_F* peak (A)	λ (nm)	Heat sink polarity
LAH190A	Single heterostructure	10	200	0,2	40	905	−ve
LBA185A	Double heterostructure	0,15	5 000	5	1,5	850	+ve

** Maximum current and peak power output are inter-related with pulse width, duty factor and heat sink temperature. Data quoted are mutually compatible and for 25°C operation. Specifications can be agreed to match applications requirements.*

Fig. 1 Typical Inter-Related Conditions

Typical Output as a function of Duty Factor (Type LAH190A)

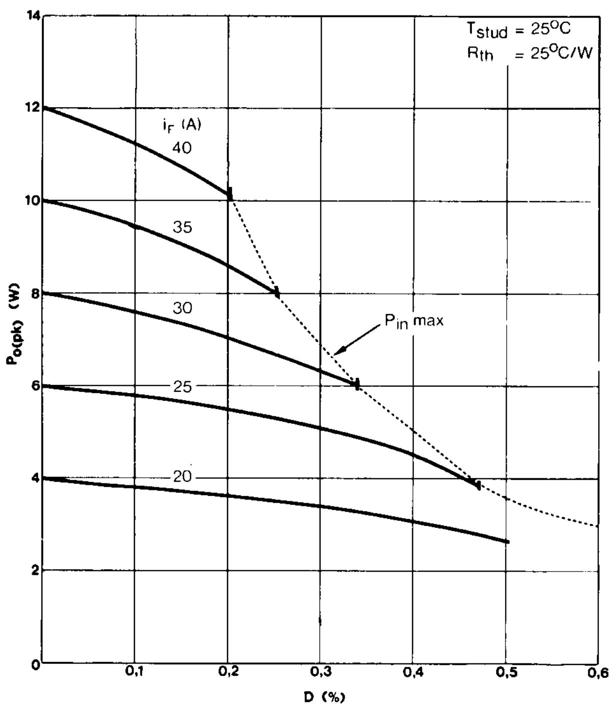
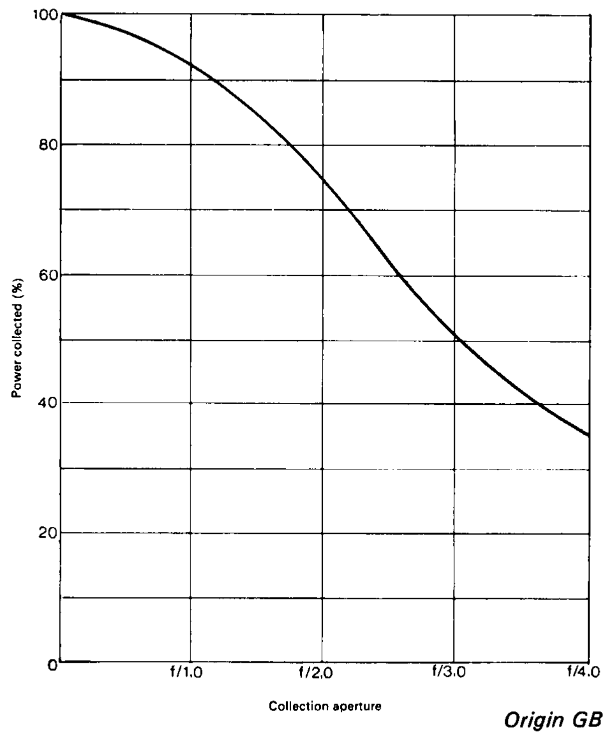


Fig. 2 Peak Power versus collection aperture



Origin GB

Xenon Lamps

The lamps listed below are short-arc devices intended for use in high efficiency projection systems and searchlights. Quartz envelopes are used and the spectral characteristics are suitable for solar simulation.

The continuous running voltage is relatively low but a starter circuit is required to provide high voltage to initiate the arc.

Lamps au xénon

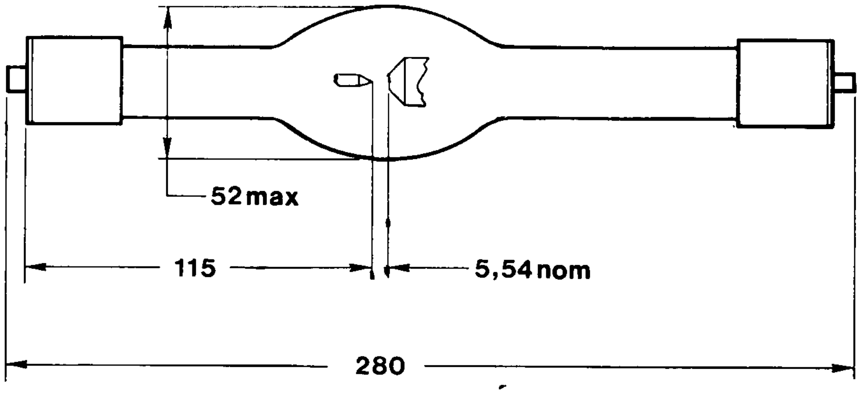
Les lampes dont la liste est donnée ci-dessous, sont des dispositifs à arc court conçus pour être utilisés dans des systèmes de projection et des projecteurs de rendement élevé. Des enveloppes en quartz sont utilisées et les caractéristiques spectrales conviennent pour la simulation de la lumière solaire.

La tension en service continu est relativement faible, mais un circuit d'amorçage est requis pour fournir la tension élevée nécessaire à l'amorçage de l'arc.

Xenonlampen

Bei den in der folgenden Liste aufgeführten Lampen handelt es sich um Kurzbogenlampen, die zum Einsatz in Hochleistungs-Projektionssystemen und Suchscheinwerfern bestimmt sind. Ihre Außenwand ist aus Quarz, und sie verfügen über eine zur Sonnensimulation geeignete Spektralverteilung.

Die Dauerbrennspannung ist relativ niedrig, doch wird eine Startvorrichtung benötigt, welche die erforderliche hohe Zündspannung liefert.



Example: F956 Dimensions in mm

Type	Cooling	Input power (kW)	Operating (V)	ignition (kV)	Luminous flux (lm)	O/length (mm)
F950	W	20	41–45	45	800k	610
F952	W	20	40–46	45	800k	480
F963	A	4	30–34	20–30	180k	370
F968	A	2,5	29–31	20–30	100k	425
F951	A	2,2	20–24	20–30	80k	335
F961	A	2,0	26–29	30–40	70k	280
F969	A	1,6	24–26	20–30	60k	365
F956	A	1,6	21–27	30–40	64k	280
F953	A	1,0	21–24	30–40	32k	240
F970	A	0,9	19–21	20–30	30k	325
F971	A	0,45	17–19	20–30	13k	260

Origin USA

Fig. 3 Typical absolute spectral response characteristics of Photoemissive devices

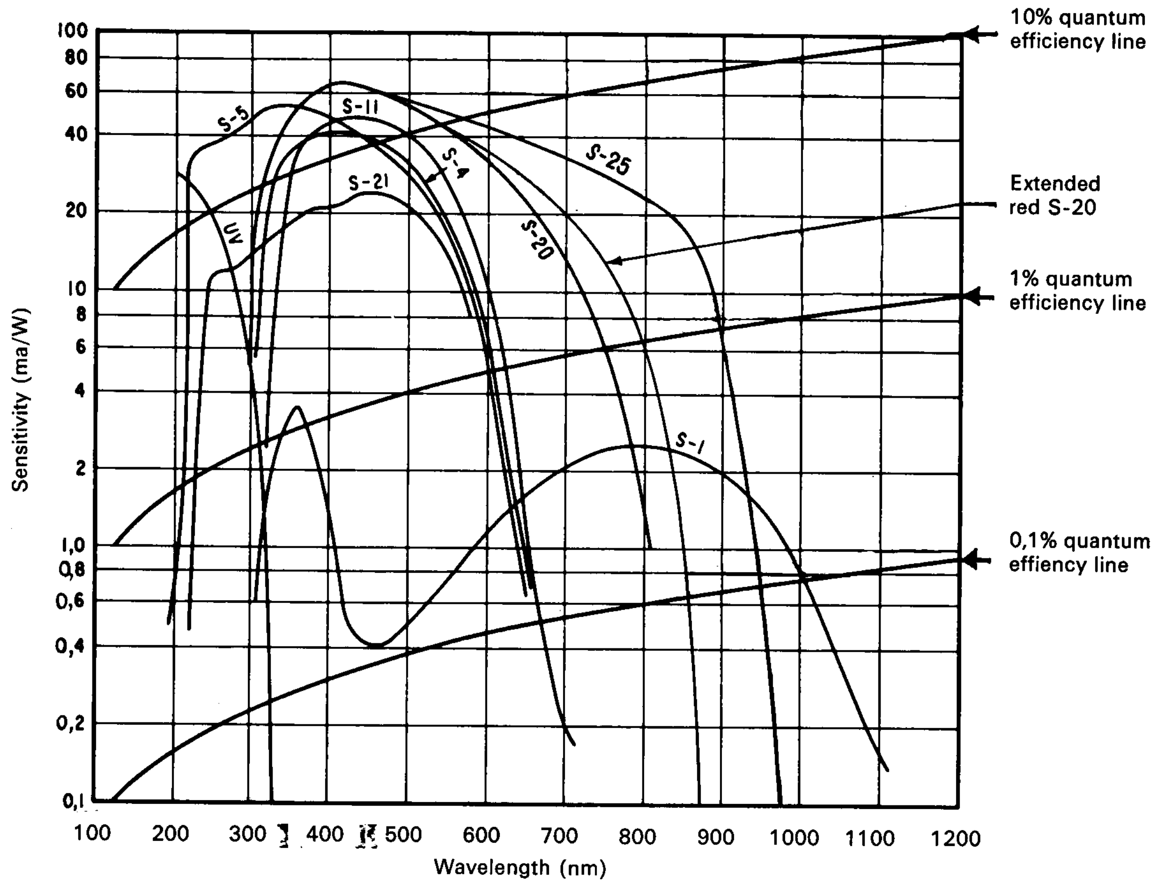


Fig. 4 Typical absolute spectral response characteristics of Aluminized Phosphor Screens

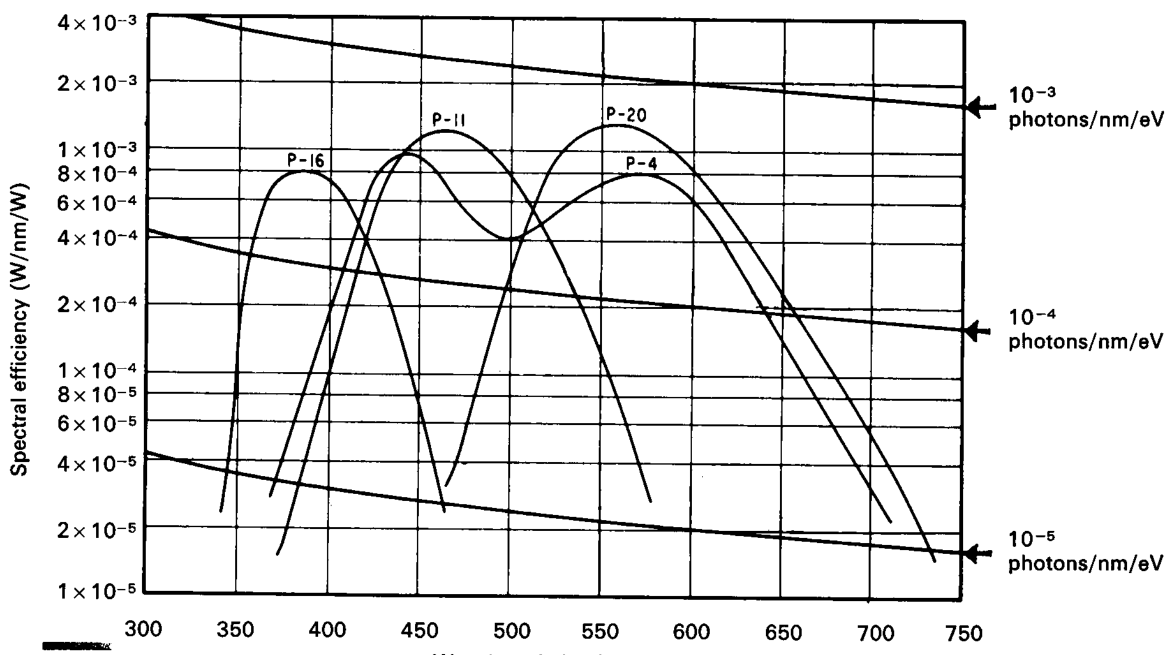


Image Intensifier Tubes

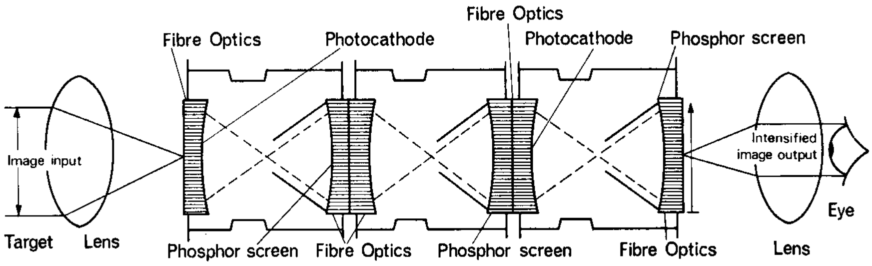
For image pick-up applications under low or high ambient light conditions.

Tubes intensificateurs d'image

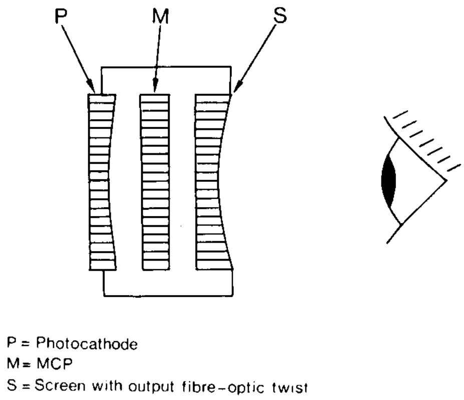
Pour les applications d'analyse d'images dans des conditions de lumière ambiante intense ou faible.

Bildverstärkerröhren

Zur Verstärkung und Betrachtung von Bildern bei schwachem oder starkem Umgebungslicht.



3-Stage Intensifier



Micro-Channel Plate Intensifier

Image Intensifiers

Type	Features	Spectral* response/ Phosphor	Sensitivity (µA/lm)	Useful diameter (mm)	Optical length (mm)	Luminous gain (min.)	Resolution (lp/mm)	Distortion (% at mm rad.)	E.B.I.§ max. (lux)	Input‖ typical (V)	Grounded end	Origin
PF253KC (F4721)	3 stage†	S20/P20	175	23	181	35 000	25 to 28	18 at 10	2×10^{-7}	6,75	Input	GB
PF403KC (F4725)	3 stage†	S20/P20	175	38	280	35 000	25 to 28	18 at 16	2×10^{-7}	6,75	Input	GB
F4747	Single stage microchannel plate‡	S20/P20	175 to 400	18	25	5 000 to 15 000 adjustable	25 to 28	—	2×10^{-11}	2,5	—	USA

** S20 extended red ranging up to S25. Other alternatives e.g. S1 can also be made available.*

† Single or twin units can also be supplied: also 1, 2 and 3 stage units with output faceplate grounded. Please see also table of USA types opposite.

‡ Complete with output optical inverter to restore upright image. Bifocal and tri-focal versions are also available.

§ Integral power supply input. Automatic Brightness Control facility is provided as standard with the 3 types shown. (The facility is lost if F4747 is used in the gated mode).

‖ Equivalent Background Input.

Typical Characteristics – 3-stage Intensifiers

Fig. 5 Typical Output versus Input Light Intensity

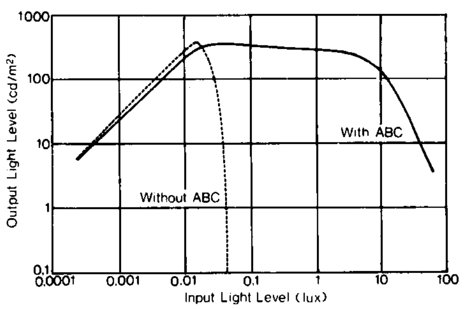


Fig. 6 Typical Modulation Transfer Function (MTF)

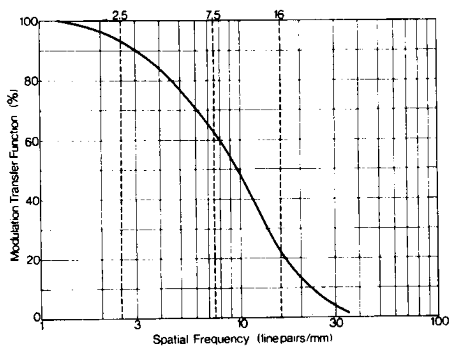


Fig. 7 Typical Magnification and Distortion

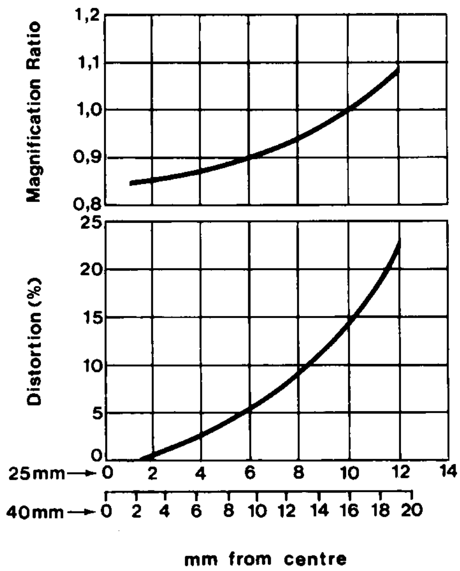


Image Intensifiers

Type	Diameter (mm)	No. of stages	Input (V)	Earth point	Features
F4051	40	1	17 k		
F4088	144	2	15 k	mid	
F4089	40	1	20 k	output	
F4091	40	2	20 k	mid	
F4092	90	1	20 k	output	
F4093	90	2	20 k	mid	
F4094	144	1	15 k	output	
F4703	25	2	2,8 k	output	
F4705	25	3	2,8 k	output	
F4706	25	3	2,8 k	input	
F4708	40	1	2,7	output	
F4711	40	3	2,8 k	input	
F4714	25	1	2,7	output	
F4715	25	3	6,75	output	
F4717	40	2	2,8 k	output	
F4719	25	1	13 k	output	
F4720	25	3	6,75	input	
F4721	25	3	6,75	input	ABC*
F4722	25	1	2,7	output	
F4724	40	3	6,75	input	
F4725	40	3	6,75	input	ABC
F4730	25	2	6,75	output	
F4742	40	3	6,75	output	ABC
F4751	40	2	6,75	output	ABC
F4753	40	3	2,8 k	output	

* *Automatic brightness control*

Origin USA

Vacuum Photodiode Tubes

Applications

Laser detection
Scintillation detection
High speed switching
Solar radiation monitoring
Interference detection

Primarily because of the plane parallel geometry or biplanar configuration of the anode and cathode, high linear output currents can be generated.

Other features of the 'biplanar' photodiodes include sub-nanosecond response times, low dark currents, stability, high voltage operation, and wide dynamic range.

Tubes photodiodes à vide

Applications

Détection laser
Détection de scintillations
Commutation à grande vitesse
Contrôle du rayonnement solaire
Détection d'interférences

Particulièrement à cause de la géométrie plan parallèle ou de la configuration biplanaire de l'anode et de la cathode, des courants de sortie linéaires d'intensité élevée peuvent être obtenus.

Les autres caractéristiques des photodiodes «biplanar» sont des temps de reponse inférieurs à la nanoseconde, des courants d'obscurité faibles, des tensions de fonctionnement élevées et une gamme dynamique étendue.

Hochvakuum-Photozellen

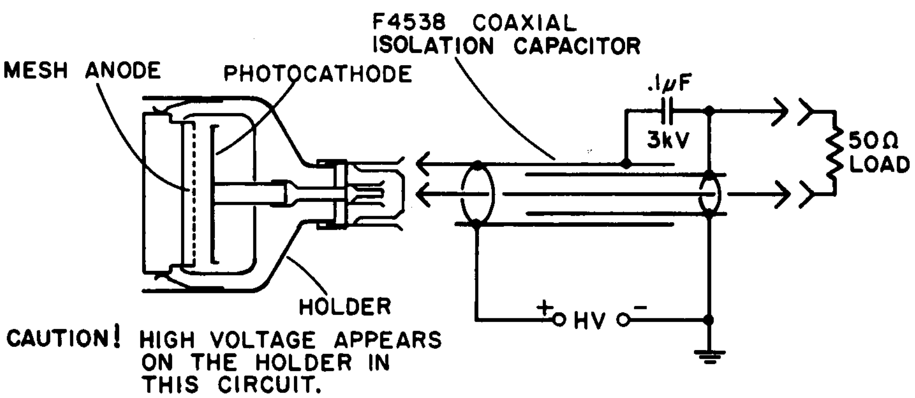
Anwendungen

Laserlichtempfang
Nachweis von Szintillationslicht
Schnelle Schaltvorgänge
Überwachung der Sonnenstrahlung
Nachweis von Interferenzen

Vor allem dank der planparallelen Geometrie bzw. der biplanaren Anordnung von Anode und Kathode können starke lineare Ausgangsströme erzielt werden.

Andere Vorzüge der „biplanaren" Photozellen sind Ansprechzeiten von Bruchteilen einer Nanosekunde, niedrige Dunkelströme, Stabilität, hohe Betriebsspannung und große Dynamik des Arbeitsbereichs.

Type	Spectral response (see Fig. 3)	Tube diameter nom. (mm)	Useful cathode diameter (mm)	Typical performance characteristics (for specified voltage at 25°C)						Tube holder
				Operating voltage d.c. or pk. a.c. (kV)	Typical luminous sensitivity (µA/lm)	Max. anode dark current (µA)	$i_{a\,pk}$ max. linear signal output current (A)	$I_{a\,av.}$ max. (d) (µA)	$t_{anode\ rise}$ (s)	
FW114	S4	57	44,5	2,5	30	0,005	5	75	5×10^{-10}	F4502
FW114A	S20 (a)	57	44,5	2,5	80	0,005	5	45	5×10^{-10}	F4502
FW127	S4	127	107,9	2,5	30	0,01	30	500	5×10^{-10}	
FW128	S4	32	21,3	1	30	0,005	0,5	18	7×10^{-10}	F4503
FW140	UV (b)	19	11,4	0,15	(c)	0,00001	—		—	
FW157	UV (b)	19	11,4	0,15	(c)	0,00001	—	1	—	
FW162	S4	19	11,4	1	25	0,0001	0,1	5	—	
F4000 (S1)	S1	57	44,5	2,5	12	0,05	5	75	5×10^{-10}	F4502
F4000 (S5)	S5	57	44,5	2,5	30	0,005	5	75	5×10^{-10}	F4502
F4000 (S20UVG)	S20 (e)	57	44,5	2,5	80	0,005	5	45	5×10^{-10}	F4502
F4007 (S4)	S4	178	152,4	2,5	30	0,005	60	900	5×10^{-10}	
F4014 (S1)	S1	19	10,2	1	10	0,05	0,1	0,35	1×10^{-10}	
F4014 (S4)	S4	19	10,2	1	20	0,0001	0,1	0,35	1×10^{-10}	
F4018 (S1)	S1	32	21,3	1	10	0,05	0,5	18	5×10^{-10}	F4503
F4018 (S5)	S5	32	21,3	1	30	0,005	0,5	18	5×10^{-10}	F4503
F4018 (S20)	S20 (a)	32	21,3	1	80	0,005	0,5	10	5×10^{-10}	F4503
F4018 (S20UVG)	S20 (e)	32	21,3	1	80	0,005	0,5	10	5×10^{-10}	F4503
F4018 (C_sT_eUVG)	UV (b)	32	21,3	1	(c)	0,005	0,5	3,5	5×10^{-10}	F4503
F4040 (S20)	S20	46	27,9	0,1	80	0,002	—	—	—	
F4115	UV (b)	32,5	19	1	—	0,005	0,5	30	—	



Notes

(a) The S-20 designation is for a multi-alkali photosurface on a translucent glass substrate. The FW114A photocathode is formed on an opaque metal substrate, therefore there may be a departure from the typical S-20 spectral response curve.

(b) No "S" designation has been assigned to these types of photocathodes – insensitive to visible and infrared radiation.

(c) Quantum efficiency at 2 735 angstroms is 10% typical.

(d) Output current averaged over 1 second time interval and uniformly distributed over photocathode. The permissible output current will be reduced according to the 3/2 power law for lower operating voltages.

(e) Ultraviolet grade glass entrance window for extended response to the ultraviolet region.

Origin USA

Photo-Multiplier Tubes

Applications

Stellar observations
Star tracking
Laser detection
Vibration analysis
Scintillation counting

Tubes photo-multiplicateurs

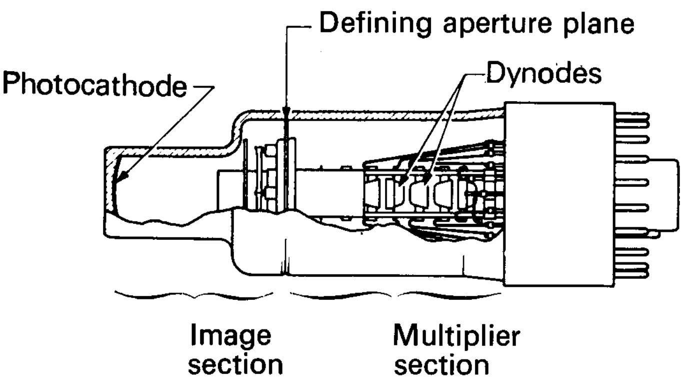
Applications

Observations stellaires
Examen de la trajectoire d'étoiles
Détection laser
Analyse de vibrations
Comptage de scintillations

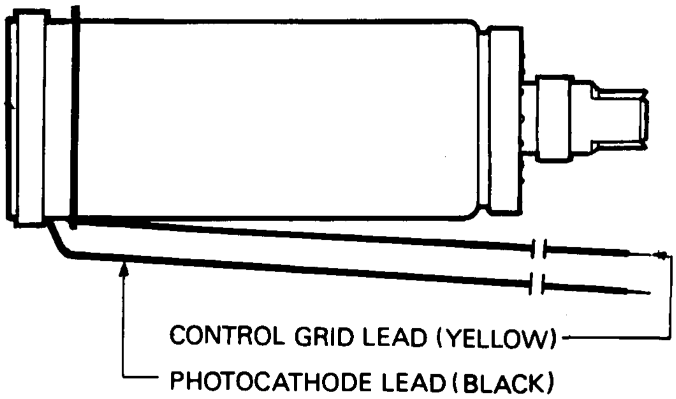
Photovervielfacher

Anwendungen

Beobachtung von Sternen
Bahnverfolgung bei Sternen
Empfang von Laserlicht
Schwingungsanalyse
Zählung von Szintillationsblitzen



Deflectable Type



Fast Type – Coaxial Output

Photo-Multipliers

Type	Standard I.E.P.D.*	Special features†	Spectral response‡	Typical V_{a-k} (kV)	I_a max. av. (mA)	pk (mA)	Rise time (s)	Luminous sensitivity cathode (µA/lm)	anode (A/lm)	Luminous equivalent of Noise input (max.) (lm)	I_a dark (max.) (lm)
FW118	100R	19 mm	S1	1,8	0,1	0,5	16×10^{-9}	20	200	10^{-10}	5×10^{-8}
FW129	100R	low noise	S11	1,8	0,1	0,5	16×10^{-9}	65	650	10^{-12}	2×10^{-9}
FW130	100R	deflectable	S20	1,8	0,1	0,5	16×10^{-9}	150	800	5×10^{-13}	$1,8\times10^{-11}$
FW136	100R	19 mm ruggedised	S11	1,8	0,1	0,5	16×10^{-9}	65	650	10^{-12}	2×10^{-9}
FW142	100R	low noise	S1	1,8	0,1	0,5	16×10^{-9}	20	200	10^{-10}	5×10^{-8}
FW143	100R	deflectable	S20	1,8	0,1	0,5	16×10^{-9}	150	800	5×10^{-13}	$1,8\times10^{-11}$
F4004	(S1 100R)	19 mm short	S1	1,8	0,1	0,5	16×10^{-9}	20	200	10^{-10}	5×10^{-8}
F4004	(S11 100R)	ruggedised low	S11	1,8	0,1	0,5	16×10^{-9}	40	200	10^{-12}	10^{-11}
F4004	(S20 100R)	noise, deflectable	S20	1,8	0,1	0,5	16×10^{-9}	100	200	10^{-12}	10^{-11}
F4013		19 mm broad band	S20+UV	1,8	0,1	0,5	16×10^{-9}	100	200	$3,5\times10^{-13}$	5×10^{-11}
	Similar to FW130 but with choice of input window material: sapphire, quartz, L_i F or 9741 glass.										
F4027	(S1 100R)	19 mm grid-control	S1	1,8	0,3	0,5	16×10^{-9}	20	50	10^{-10}	5×10^{-8}
F4027	(S11 100R)	low noise	S11	1,8	0,3	0,5	16×10^{-9}	40	200	10^{-12}	10^{-11}
F4027	(S20 100R)	deflectable	S20	1,8	0,3	0,5	16×10^{-9}	100	200	10^{-12}	10^{-11}
F4034	(S1 100R)	19 mm low noise	S1	5	2	1 000	8×10^{-10}	20	2	—	—
F4034	(S11 100R)	deflectable fast	S11	5	2	1 000	8×10^{-10}	50	5	—	—
F4034	(S20 100R)	response 50 Ω coax output	S20	5	2	1 000	8×10^{-10}	150	15	—	—
F4084		38 mm grid-controlled Fast – 50 Ω output	S20	5	2	200	15×10^{-10}	175	1,5 (approx.)	—	—
F4085	100R	19 mm deflectable Custom designed electron optics	S20	1,7	0,3	0,5		120	120	10^{-12}	5×10^{-11}
F4099	500R	19 mm low noise ruggedised	S20	1,7	3µ	5µ		200	2	2×10^{-11}	5×10^{-10} (typical)
F4102		38 mm ultra-fast 50 Ω coax output	S20	5	2	200	5×10^{-10}	175	1,8 (approx.)	—	—

** '100R' denotes 0,1 inch Instantaneous Effective Photocathode Diameter which corresponds to 0,07 inch diameter aperture in electron image focal plane: the demagnification of the imaging section is typically 0,7. Other I.E.P.D.'s can be supplied as "specials".*

† Dimension refers to useful photocathode diameter.

‡ See Figure 3.

Origin USA

Image Dissector Tubes
(Camera Tubes)

Applications

Slow-scan T.V. systems

Slide projector readers

Industrial process control

Electronic star trackers

Electronic scanning spectrometers

Image dissector tubes surpass all other camera tubes in resolution capability. This range of magnetically focused and deflected camera tubes provides a wide spectral response range from the ultraviolet to the near infrared.

In addition to the inherent high resolution capabilities, the tubes have other features such as non-storage, reliability, variable raster size, fast turn-on, no thermionic cathode, wide dynamic range and simple operation.

Tubes dissecteurs d'image
(Tubes de prise de vues)

Applications

Systèmes TV à balayage lent

Lecteurs de projecteurs de diapositives

Contrôle de processus industriels

Dispositifs électroniques de localisation des étoiles

Spectromètre à balayage électronique

Due point de vue résolution, les tubes dissecteurs d'image sont supérieurs à tous les autres tubes de prise de vues. Cette gamme de tubes de prise de vues focalisés et déviés magnétiquement fournit une large gamme de réponses spectrales, qui s'étend de l'ultraviolet au proche infrarouge.

Outre la résolution élevée inhérente, les tubes ont d'autres avantages, tels que non mémorisation, fiabilité, dimensions de trame variables, réponse rapide, absence de cathode thermionique, gamme dynamique étendue, et jonctionnement simple.

Bildzerlegungsröhren
(Fernseh-Aufnahmeröhren)

Anwendungen

Fernsehsysteme mit langsamer Abtastung

Abtastung von Diapositiven

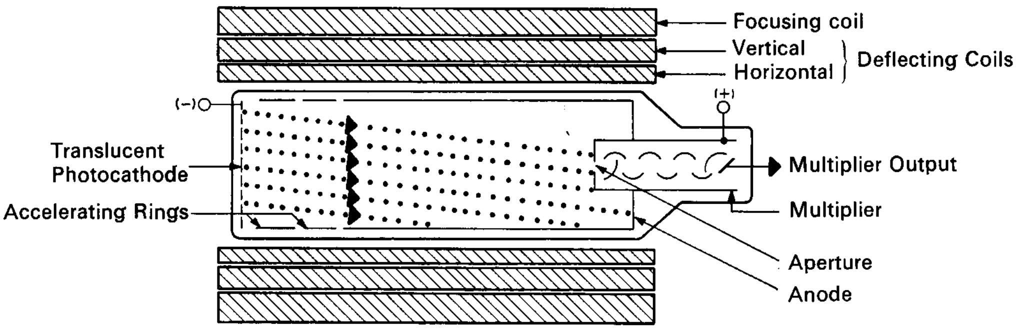
Prozeßsteuerung in der Industrie

Elektronische Verfolgung von Sternbahnen

Spektrometer mit elektronischer Abtastung

Bildzerlegungsröhren übertreffen alle anderen Aufnahmeröhren an Auflösungsvermögen. Die vorliegende Reihe von Aufnahmeröhren mit magnetischer Fokussierung und Ablenkung überdeckt einen weiten Spektralbereich vom Ultraviolett bis zum nahen Infrarot.

Neben dem für sie charakteristischen hohen Auflösungsvermögen zeichnen sich diese Röhren durch weitere Vorzüge aus, darunter das Fehlen von Speichereffekten, Zuverlässigkeit, veränderliche Rastergröße, kurze Anschaltzeit, Fehlen einer Glühkathode, große Signaldynamik und Einfachheit des Betriebs



Type			Spectral response (see Fig. 3)	Useful cathode diameter (mm)	Operating voltage (kV)	I_a average (μA)	Typical performance characteristics: Typical photo-cathode luminous sensitivity (μA/lm)	Current amplification
FW125			S11	76	3,2	10	50	5×10⁵
FW146			S1	76	3,2	10	20	5×10⁵
F4011	(S11)		S11	28	2	10	50	10^6
F4011	(S20)		S20	28	2	10	120	10^6
F4012	(S11)		S11	18	1,6	10	50	10^6
F4012	(S20)		S20	18	1,6	10	120	10^6
F4052	(S1)	(a)	S1	43	1,4	300	20	5×10^5
F4052	(S11)	(a)	S11	43	1,4	300	40	5×10^5
F4052	(S20)	(a)	S20	43	1,4	300	150	5×10^5
F4054		(b)	UV	18	1,86	10	—	10^5
F4077		(a)	S20	43	3	—	150	10^5
F4087		(a)	S20	43	3	—	150	10^5

(a) Developmental tube type: Values are estimated.

(b) This developmental image dissector of the Vidissector design is available with various types of solar blind photocathodes.

Origin USA

Fig. 8 Typical Vidissector Centre Resolution

Types F4011, F4012 and F4052

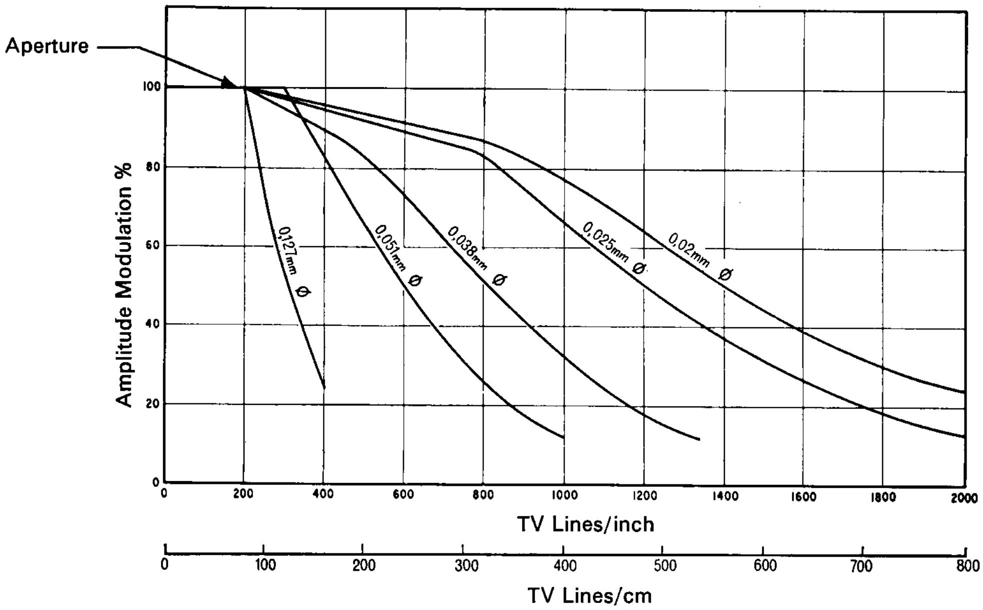


Fig. 9 Typical Image Dissector Characteristics

$$S/N = 3{,}6 \times 10^{-10} \sqrt{\frac{J_k\, a\, \Delta t(\sigma - 1)}{2m\, e\, \sigma}}$$

J_k = sL (μA/cm²)

s = Photocathode sensitivity (μA/lumen)

L = Photocathode illumination (lumen/cm²)

a = Defining aperture area (mil²)

(1 mil = $\frac{1}{1\,000}$ inch = 0,0254 mm)

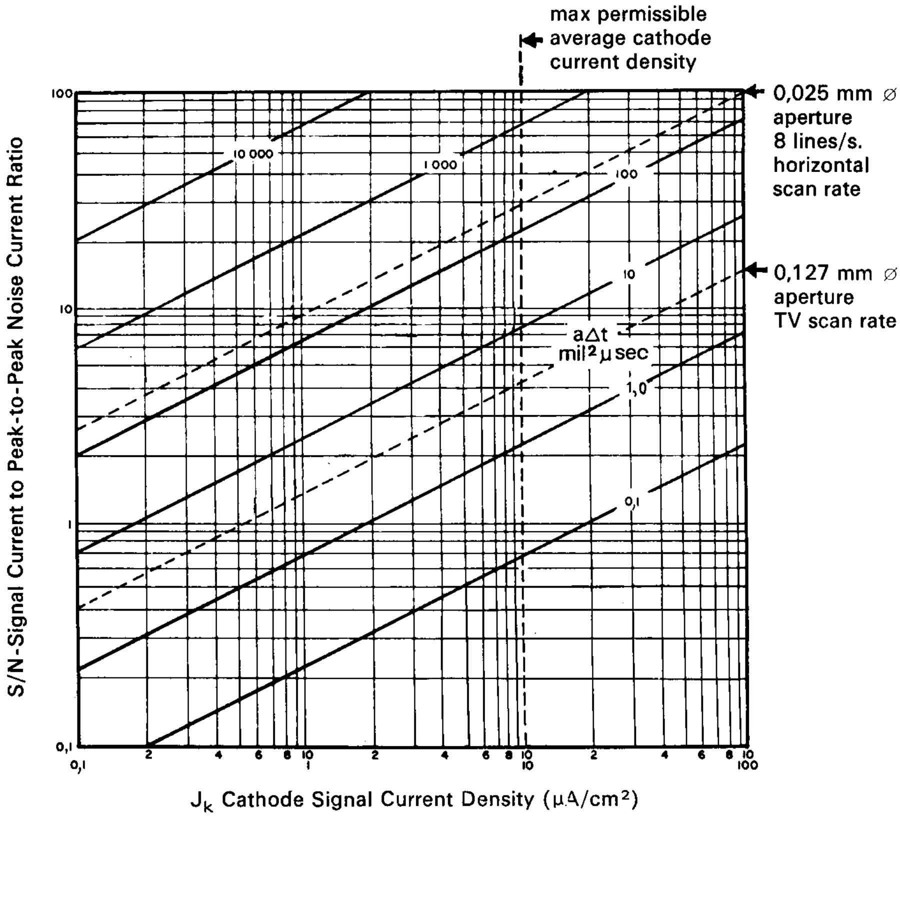
Δt = Aperture dwell time (μ sec) $\approx \frac{1}{2\Delta f}$

m = Linear magnification, cathode-to-defining aperture

σ = Multiplier gain per stage

e = Electronic charge = $1{,}6 \times 10^{-19}$ coulombs

Δf = Bandwidth (MHz)



Accessories for Sensor Tubes

Part number	Description	Associated tubes
FW315	Deflection yoke, Trancor-T core	Deflectable multiplier phototubes
F4501	Deflection yoke, air-core	Deflectable multiplier phototubes
F4501A	Deflection yoke, air-core	Deflectable multiplier phototubes
F4502	Phototube holder	2¼ inch (57 mm) diameter biplanar photodiodes
F4503	Phototube holder	1¼ inch (32 mm) diameter biplanar photodiodes
F4504 (a)	Deflection yoke	Vidissector F4011
F4505 (b)	Deflection yoke	Vidissector F4011
F4506	Focus coil	Vidissector F4011
F4507	Focus coil	Vidissector F4011
F4508 (c)	Deflection yoke	Vidissector F4011
F4509 (d)	Deflection yoke	Vidissector F4012
F4510	Focus coil	Vidissector F4012
F4511	Deflection and focus coil assembly	Image dissectors FW125, FW146
F4512	Deflection yoke, ferrite core	Deflectable multiplier phototubes
F4513 (e)	Deflection yoke	Vidissector F4011
F4514	Deflection yoke, ferrite core	Deflectable multiplier phototubes
F4515	Photomultiplier socket and potential divider	FW118, FW129, FW130, FW136, FW142, FW143, F4004, F4013, F4027
F4518	Deflection yoke, air core	Deflectable multiplier phototubes
F4518A	Deflection yoke, air core	Deflectable multiplier phototubes
F4523	Photomultiplier shield	FW118, FW129, FW130, FW136, FW142, FW143, F4013, F4027, F4034
F4530	Coaxial isolation capacitor type C male connector	F4034, F4084, F4102
F4531	Vidissector deflection assembly	F4052
F4532	Vidissector deflection assembly	F4012
F4533	Vidissector deflection assembly	F4011
F4538	Coaxial isolation capacitor type GR874B connector	F4502, F4503 holders
F4541	Coaxial isolation capacitor type GR874B connector	F4034, F4084, F4102
F4578	Coaxial isolation capacitor type GR874B connector	Photodiodes
F5005	Vidissector camera unit	Vidissector F4011
IL1-2.5	2,5 kV power supply	Biplanar photodiodes FW114, FW114A, F4000
IL2-1800	Variable h.v. power supply (1 to 3 kV)	Multiplier photodiodes
IL3-1800	Variable h.v. power supply (1 to 3 kV)	Multiplier phototubes
IL4-1800	Plug-in h.v. power supply (1,8 kV)	Multiplier phototubes FW118, FW129, FW130
IL5-30	20-tap h.v. power supply (1,8 to 30 kV)	General phototube use
IL1-12	Miniature h.v. power supply (12 kV)	General phototube use
IL2-16	Miniature h.v. power supply (16 kV)	General phototube use

Origin USA

Laser Detection

FW114A: A $2\frac{1}{4}''$ diameter biplanar vacuum photodiode with an opaque S-20 type photocathode. Linear output currents exceeding 5 amperes can be delivered to a terminated coaxial cable with a rise time of less than 5×10^{-10} seconds.

F4000(S1): Mechanically similar to type FW114A, but with an S-1 spectral response.

F4014(S1): A $\frac{3}{4}''$ diameter biplanar vacuum photodiode with an opaque S-1 type photocathode. Linear output currents exceeding 0·1 amperes can be delivered to a terminated coaxial cable with a rise time of less than 1×10^{-10} seconds.

FW118: A 16-stage multiplier phototube having an end-window photocathode with an S-1 spectral response. It has a limited area photocathode which reduces the equivalent noise input. An external magnetic deflection coil can be used to deflect the electron image in the plane of the defining aperture.

FW130: Mechanically similar to the FW118, but it has an S-20 spectral response.

F4027(S20): Similar in design to type FW118, FW129, FW130, but with an additional control grid in close proximity to the photocathode surface to electrically permit external control of emitted photoelectrons. By applying a small voltage potential to the control grid, such functions as electron energy selection, fast gating and heterodyne detection can be performed.

F4034(S20): A 10-stage, ultra-fast, medium gain multiplier phototube having an end-window photocathode with an S-20 spectral response. It has a limited area photocathode which reduces the equivalent noise input. It has a coaxial 50 ohm impedance anode output geometry and high voltage operation design to permit the delivery of high linear output currents with a rise time of less than one nanosecond.

Electronic Star Tracking

FW142: A ruggedised variant of type FW118. Refer to Laser Detection section.

FW143: A ruggedised variant of type FW130. Refer to Laser Detection section.

F4004(S1): A short ruggedised 15-stage multiplier phototube having an end-window type photocathode with an S-1 spectral response. It has a limited area photocathode and deflection capabilities similar to the FW118.

F4004(S20): Mechanically similar to the F4004(S1), but with an S-20 spectral response.

Quantum Counting

The following multiplier phototubes have the ability to count single photoelectrons with minimum interference from dark noise.

FW118: Refer to Laser Detection section for general features.

FW129: Similar to types FW118 and FW130, but it has an S-11 spectral response.

FW130: Refer to Laser Detection section for general features.

Scintillation Detection

FW114: A $2\frac{1}{4}''$ diameter biplanar vacuum photodiode with an S-4 spectral response. The faceplate is designed for efficient optical coupling to an appropriate scintillator. Has fast rise and fall time characteristics and is capable of generating 5 amperes peak linear current output.

FW127: A 5″ diameter biplanar vacuum photodiode with an S-4 spectral response. The faceplate is designed for efficient optical coupling to an appropriate scintillator. It has fast rise and fall time characteristics and is capable of generating 30 amperes peak linear current output.

FW128: A $1\frac{1}{2}''$ diameter biplanar vacuum photodiode with an S-4 spectral response. The faceplate is designed for efficient optical coupling to an appropriate scintillator. It has fast rise and fall time characteristics and is capable of generating 0,5 amperes peak linear current output.

Scanning Photometry

The following magnetically focused and deflected image dissector camera tubes have such properties as non-storage high resolution, wide dynamic range, simple operation, and long life.

FW125: A $4\frac{1}{2}''$ diameter tube having an S-11 spectral response. Employs 10 accelerating rings in the image section and an 11-stage electron multiplier.

FW146: Mechanically similar to the FW125, but with an S-1 spectral response.

F4011 Series: A family of $1\frac{1}{2}''$ diameter tubes having photo-cathodes with S-1, S-11, or S-20 spectral response. Tubes are of the Vidissector design, have a 10-stage electron multiplier, and internal voltage divider resistors are provided for part of the dynode chain.

F4012 Series: A family of 1″ diameter tubes having photocathodes with S-1, S-11, or S-20 spectral response. Tubes are of the Vidissector design, having a 12-stage electron multiplier, and internal voltage divider resistors are provided for part of the dynode chain.

F4052 Series: A family of $2\frac{1}{4}''$ diameter tubes having photocathodes with S-1, S-11, or S-20 spectral response. Tubes are of the Vidissector design and have a 10-stage electron multiplier.

F4054 Series: A family of 1″ diameter tubes having sensitivity in the ultraviolet spectral region below 3500 angstroms. Mechanically, the F4054 "Solar Blind" Uvissector is identical to the F4012 types except for the UV grade input window.

Ultraviolet Radiation Detection

F4000(S5): A $2\frac{1}{4}''$ diameter biplanar vacuum photodiode mechanically similar to the FW114, but with an S-5 spectral response.

F4013 Series: A family of 16-stage, end-window, multiplier phototubes with an S-20 spectral response extended into the ultraviolet portion of the spectrum. Mechanically similar to the FW130 multiplier phototube, but with an ultraviolet transmitting entrance window.

FW140: A miniaturised vacuum photodiode with sensitivity confined to the ultraviolet portion of the spectrum. It has good linearity and low dark current. It has a CsTe photocathode and a sapphire end-on entrance window.

FW157: Similar to the FW140, but with a fused-silica faceplate.

Particle Detection*

FW141: A 16-stage, windowless, electron multiplier designed to withstand repeated exposure to the atmosphere. A voltage divider network is an integral part of the unit to supply intermediate operating potentials. The unit is suitable for detecting ultraviolet radiation when dynode #1 is used as a cathode.

F4020: A ruggedised, 16-stage, windowless electron multiplier with the same general features as the FW141.

F4021: A ruggedised, 15-stage, windowless electron multiplier having a conical input cathode and 14 toroidal quarter-section dynodes. A voltage divider network is an integral part of the unit to supply intermediate operating potentials. Has an energy selection feature and it can be operated either with current measuring or pulse counting circuits.

F4036: Similar in design to the FW141, but with a much lower anode dark current value.

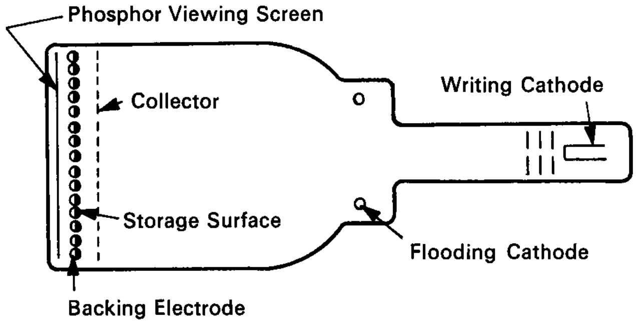
F4074: A 16-stage, windowless electron multiplier designed to withstand repeated exposure to the atmosphere. A voltage divider network is an integral part of the unit to supply intermediate operating potentials. Suitable for commercial applications requiring a low anode dark current characteristic.

** The tubes quoted for this application are NOT otherwise mentioned in this data summary, but data are available on request.*

Direct View Storage Tubes (iatrons)

Applications

Aircraft radar displays
Automatic weapons systems display
Narrow bandwidth picture transmission
Ground air traffic control radar display



These devices produce a visual display of controllable duration.

The tube has two electron guns, a phosphor viewing screen and two fine mesh metal screens. One of the electron guns is termed the writing gun, the other the flooding gun.

The web of one screen is coated on the gun side with a thin dielectric material to form a surface on which the electron beam stores information; the other screen serves as an electron collector.

The writing gun emits a pencil-like electron beam which is intensity modulated by the information to be stored. The information is in the form of an electrical input signal.

The storage surface is scanned by this high resolution beam and actually strikes this surface.

A positive charge image, corresponding in value to the input signal pattern, is imposed on the storage surface until it decays or is erased. The storage screen forms an array of elemental electron guns with each mesh hole acting as a control element of a miniature electron gun. After the desired information has been stored on the storage mesh, the entire surface is flooded by an electron beam from the flooding gun.

The value of positive charge deposited at each mesh aperture controls the amount of flood beam current that can pass through the mesh aperture to the phosphor viewing screen. The current that passes through the mesh strikes the phosphor viewing screen where a light output is observed in proportion to the bombarding current density and the energy with which the electrons strike the phosphor: that is, the tube reproduces a grey scale in the stored image. After the stored information has been observed or recorded, it is erased from the storage surface, which is then prepared for storing a new image.

Type	Usable display surface min. (mm)	Focus/ Deflection (Note 1)	Luminance (Note 2) (cd/m²)	Writing speed (Note 3) (m/s)	Shades of grey min. (Note 4)	Erase time (Note 5) (ms)	Storage time (s)	Resolution (Note 6) (lines/mm)	View screen voltage (kV)	Write-gun cathode voltage (V)
7174	76ϕ	EM/EM	4 380	635	6	20	20	2	15	−450
FW241	102ϕ	ES/ES	584	2 540	6	10	30	2	9	−1 500
F3006	102ϕ	ES/EM	876	2 540	7	8	20	3	8	−2 000
F3007	102ϕ	ES/EM	876	2 540	7	8	20	3	8	−2 000
F3013	102ϕ	ES/EM	438	1 925	7	10	20	3	10	−2 500
F3046	108×82ϕ	ES/ES	190	2 540	7	25	180	1,9	11	−1 000
F3015	102ϕ	ES/ES	438	12 700	7	5	30	4	8	−2 000
F3019	102ϕ	ES/EM	584	3 810	9	1,5	15	5	10	−2 000
F3019–2	102ϕ	ES/EM	2 190	3 810	8	1	10	5	10	−2 500
F3024	102ϕ	ES/EM	730	7 620	8	1	15	5	12	−2 500
F3033	102ϕ	ES/EM	584	7 620	9	0,6	15	5	10	−2 000
F3039	102ϕ	ES/EM	458	2 540	9	2	30	5	10	− 1700
F3045	102ϕ	ES/EM	146	2 540	7	5	300	3	10	−1 500
7423	102ϕ	ES/ES	1 168	508	6	12	30	2	9	−750
F3016	145ϕ	ES/ES	292	76,2	7	50	30	3	9	−750
F3020A	145ϕ	ES/EM	584	7 620	9	1,2	60	4	12	−2 500
FW245	145ϕ	EM/EM	219	6,35	8	200	240	3	10	−700
F3501	145ϕ	ES/ES	292	12,7	7	75	30	4	9	−750
F3023	216ϕ	ES/EM	234	2 540	7	4	20	4	12	−2 500
F3041	216ϕ	ES/EM	175	3 810	8	2	30	4	12	−2 500
F3062	100ϕ	ES/EM	415	2 540	5	10	90	3	8	−2 500
F3063	100ϕ	ES/EM	415	2 540	5	10	90	3	8	−2 500
F3064	100ϕ	ES/EM	415	2 540	5	10	90	3	8	−2 500
F3068	144ϕ	ES/ES	450	25,4	7	80	30	1,9	10	−750

Origin USA

Note 1
EM=electromagnetic
ES=electrostatic

Direct View Storage Tubes (continued)

Note 2

Saturation luminance is measured after removing erase pulses from the backing electrode and allowing the tube to write to maximum luminance. Saturation luminances range from 140 to 2 540 cd/m² for most direct view applications. Typical airborne cockpit displays range from 292 to 584 cd/m² at the tube faceplate.

Note 3

Writing speed is measured at 50% saturated luminance with no line overlapping. Writing speeds can be provided for any application up to 25 400 m/s or more. Note that as writing speed increases, viewing time decreases.

Note 4

Shades of grey are the number of clearly evident half-tone or luminance level obtained by applying a suitable staircase video waveform to the writing gun control grid (black and white levels included).

Note 5

Erase time is equal to the maximum period required for a single pulse of optimum amplitude to erase stored information from 100% to 10% of saturated luminance.

Note 6

Resolution is measured by the shrinking raster method, at a raster brightness of 50% saturated luminance.

These components are available from:

ITT Components Group Europe

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