TH 9815 PA
1" VIDICON

- MAGNETIC FOCUS AND DEFLECTION
- HIGH RESOLUTION (1000 TV LINES)
- HIGH SENSITIVITY
- LOW LAG
- RADIOLOGICAL T.V.

TH 9815PA is a photoconductive pick-up tube specially intended for televising picture obtained from X-rays image intensifier tubes. This tube incorporates in its structure the latest isolated post-acceleration electrode with separate mesh connection. Due to this feature TH 9815PA tube provides higher resolution, higher output signal capability and better resolution and signal uniformity than previous Vidicon tubes.

The spectral response of the photoconductive layer allows for good matching with P20 (yellow-green) and P11 (blue) output screen of X-ray image intensifiers.

Selected photoconductive targets secure good uniformity of signal on the entire square scanned area suitable for circular pictures delivered by image intensifier tubes.

When used with a P20 output screen image intensifier, having a conversion factor of 100 cd/m^2/mR/s (30 ft.L/mR/s), excellent quality picture of still and moving bodies can be obtained at dose rate lower than 150 micro-Roëntgen/second, with a coupled optical system at unity aperture. Sensitivity is equivalent to a photographic film having an ASA exposure index of 2400 (35/10 DIN 42 Sch).

Lag characteristics allow for reduction of quantum noise of X-ray photons when incident dose rate is reduced at image intensifier input without impairing details and low contrast perception in case of moving bodies.

Tube sensitivity can be controlled by target voltage which also causes some variation of dark current within a narrow range. Maximum sensitivity at output signal of 50 nA and optimum gamma characteristic is obtained by increasing dark current to a maximum value of 100 nA. Gamma characteristic is close to 0.9 for illumination lower than 0.2 lux (20 mfc) on the target and decreases to 0.6 for illumination reaching 20 lux (2 fc) on the target. This performance allows for over exposure of the target without impairing final quality of the picture by limiting the range of the output signal avoiding spurious signals.

TH 9815PA can be operated over a wide range of electrode voltage selection although recommended adjustment requires a g4 voltage to g3 voltage ratio of 1.4 - 1.5. Under these conditions TH 9815PA can provide an optimum resolution and an uniform signal output over the entire scanned area with a beam landing considerably improved minimizing "porthole" effect and geometrical distortion.

The limiting resolution of TH 9815PA is about 1000 T.V. lines at center of picture and 600 T.V. lines at corner. This high resolution is obtained with 900 V on electrode g4 and 600 V on g3. When the TH 9815PA is operated at a lower g4 voltage of 500 V and g3 voltage of 350 V, its limiting resolution will be 900 T.V. lines at center and 500 T.V. lines at corner. Operating g4 voltage at 1.5 times g3 voltage requires 20 % deflection current increase over current necessary for g3 - g4 connected mode. Focusing field is not noticeably changed with such an operation.

Full advantage of resolution and signal uniformity is achieved when deflecting and focusing components are properly designed and when the tube is correctly located inside. The thickness of the photoconductive layer is made very uniform and allows for constant output signal and constant dark current. When landing error due to imperfect scanning system is present, the voltage gradient across the photoconductive layer is not uniform and a signal variation (shading) is introduced which can be compensated by proper adjustment of the cathode, g1 and g2 voltages.

Due to good design, high reliability is obtained all along tube life. Requirement alignment field is reduced to a minimum by precise electron gun mounting. An extremely flat faceplate avoids all optical distortions and allows for the use of any good quality lens. Particle barriers adjacent to the field mesh allows these tubes to operate in any position.

One watt power heater makes these Vidicons particularly suitable for transistorized equipment. The reduced heat dissipation improves the quality of the picture by lowering faceplate temperature.

GENERAL CHARACTERISTICS

Electrical

Heater	for unipotential cathode indirectly heated	
Heater :		
– Voltage	6.3 ± 10 %	V
– Current at 6.3 V	0. 15	
Minimum preheating time	60	s
Output capacitances :		
– Target to all other electrodes	4. 5	pF
Spectral response	see curve	
Focusing method	magnetic	
Deflection method	magnetic	

Mechanical

Base (Ditetrar, 8 pins)	UTE 9 C 15 (JEDEC N° E8 - 11)	
Socket note 1	METOX N° 30.250	
Deflecting yoke - Focusing coil Assembly note 2	GERHARD type BV 200 - 1K1 or equivalent	
Alignment coil note 2	GERHARD type BV 80/3 or equivalent	
Dimensions	see drawing	
Photoconductive layer :		
– normal dimensions of image on target	12.7 mm x 9,5	mm
– maximum useful diagonal diameter (4 x 3 aspect ratio)	17	mm
– orientation of quality rectangle : horizontal scan parallel to the plane passing through the tube axis and short index pin note 3		
Maximum temperature of faceplate	70	°C
Mounting position	any	
Net weight, approximate	60	g

OPERATING CONDITIONS

Scanned area 12.7 mm x 9.5 mm

Maximum ratings

Electrode g4 voltage (post acceleration electrode)	1000	V
Electrode g3 voltage (wall electrode)	1000	V
Electrode g2 voltage (accelerator)	350	V
Electrode g1 voltage (electrode for picture cut-off)		
– negative bias value	150	V
– positive bias value	0	V
Peak heater - cathode voltage :		
– heater negative with respect to cathode	125	V
– heater positive with respect to cathode	10	V
Target voltage	125	V
Dark current	0. 20	μA
Peak target current (note 4)	0. 40	μA
Faceplate :		
– Illumination	10000	lux
	or 1000	fc
– Temperature	70	°C

Typical operation

Scanned area 12.7 mm x 9.5 mm
Faceplate temperature 25 °C (note 5)

Electrode voltage modes :	low	Intermediate	High	
Electrode g4 voltage	300	500	900	V
Electrode g3 voltage	200	350	600	V
Electrode g2 voltage	300	300	300	V
Electrode g1 (note 6)	–45 to –110	–45 to –110	–45 to –110	V
Average "gamma" for a target illumination between 1 and 100 lux (note 7)	0. 65	0. 65	0. 65	
Minimum blanking peak to peak voltage :				
– applied to electrode g1	–75	–75	–75	V
– applied to cathode	+20	+20	+20	V
Limiting resolution at center of picture (note 8)	800	900	1000	TV lines
Limiting resolution at corner of picture	400	500	600	TV lines
M.T.F. response at 400 T.V. lines at center of picture (5 MHz - 625 CCIR standard) (note 9)	30	40	50	%
Field strength at center of focusing coil	30 ± 2	40 ± 2	50 ± 2	Gauss
Peak deflecting coil current :				
– horizontal	130	170	200	mA
– vertical	15	20	24	mA
Field strength of alignment coil	0 to 4	0 to 4	0 to 4	Gauss

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1 - AVERAGE SENSITIVITY OPERATION

(faceplate illumination 10 lux or 1 fc)

Dark current i_o	20	nA
Target voltage for i_o = 20 nA (note 10)	20 to 50	V
Faceplate illumination (2854 °K (note 11)	10	lux
	or 1	fc
Signal current	250	nA
Corresponding sensitivity	200	µA/lm
Target illumination for 100 nA signal current	1.5	lux
	or 150	mfc
Lag : (note 12)		
– maximum	20	%
– average	12	%

2 - HIGH SENSITIVITY OPERATION

(faceplate illumination 1 lux or 100 mfc)

Dark current i_o	50	nA
Target voltage for i_o = 50 nA (note 10)	20 to 60	V
Faceplate illumination (2854 °K) (note 11)	1	lux
	or 100	mfc
Signal current	110	nA
Corresponding sensitivity	900	µA/lm
Target illumination for 100 nA signal current	0.2 to 0.3	lux
	or 20 to 30	mfc
Lag : (note 12)		
– maximum	20	%
– average	15	%

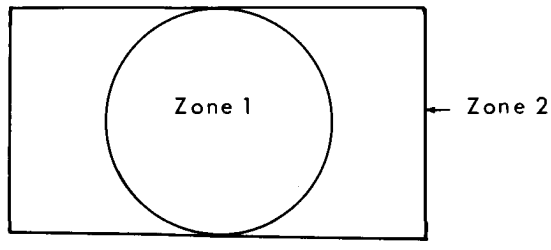
3 - VERY HIGH SENSITIVITY OPERATION

(faceplate illumination 0.5 lux or 50 mfc)

Dark current i_o	100	nA
Target voltage for i_o = 100 nA (note 10)	30 to 70	V
Faceplate illumination (2854 °K) (note 11)	0.5	lux
	or 50	mfc
Signal current	100	nA
Corresponding sensitivity	1500	µA/lm
Target illumination for 50 nA signal current	0.1	lux
	or 10	mfc
Lag : (note 12)		
– maximum	20	%
– average	17	%

4 - SPURIOUS SIGNAL TEST

The test is performed using a uniform grey test pattern that is separated into two zones as shown in drawing :



The tube is operated under the "Typical Operation" conditions with a dark current of 50 nanoamperes and the lens adjusted to provide a signal current of 50 nanoamperes.

Spurious signals are classified by their size which is measured by percent of raster height.

Will actually be considered as a defect, a spot blemish (black or white spot) having a contrast ratio greater than 25 %. (note 13)

Allowable spot size for each zone is shown in table :

Ratio D/H* (percent raster height)	Number allowed	
	Zone 1	Zone 2
D/H > 0.6 %	0	0
0.4 ⩽ D/H ⩽ 0.6 %	1	1
0.25 ⩽ D/H < 0.4 %	2	2
0.15 ⩽ D/H < 0.25 %	2	4
Total spots	6	

0.15 % and under : do not count spots of this size unless concentration causes a smudge appearance.

* *D : average diameter of spot*
H : raster height

Smudges, streaks, mottled or grainy background having a contrast ratio greater than 10 % constitute a reject.

NOTES

1 - METOX - 86, rue de Villiers de l'isle Adam - PARIS 20ème - Telephone : 636 - 31 - 10.

2 - GERHARD KG - REICHELSHEIM / ODW Germany

3 - It is necessary to assure correct positioning of the tube inside the coils. An immediate test consists in observing the fine mesh grid, the wires of which should be inclined 45° with respect to scanning. Then again the front end of the deflecting yoke should be positioned at 20 mm from the tube faceplate.

4 - Target current is defined as total current in load resistance connected to target electrode : signal current plus dark current, dark current being the current left when illumination is subtracted.
Video amplifiers must be designed properly to handle peak target current of 0.4 μA to avoid amplifier overload and picture distortion.

5 - All these characteristics are provided for a temperature of faceplate of 25 °C, the temperature range recommended is within 20 to 30 °C. The rise of faceplate temperature is a function of ambient temperature, thermic dissipation of ambient devices and of the tube itself. Consequently, 10 °C of faceplate temperature rise implies a dark current multiplied by a factor of 2.

6 - Without blanking pulses applied on electrode g1.

7 - Average "gamma" should be defined as the slope of the rectilinear part of transfer characteristics in log coordinates.

8 - Practically, limiting resolution corresponds to the resolution measured with twin bar test card with a modulation ratio of about 7 %.

9 - For 625 lines C.C.I.R. standard, line duration being 52 μs (line suppression period not included), 400TV lines correspond to 5 MHz.

10 - Indicated range of each type of service serves only to illustrate the operating target voltage range normally encountered. The target voltage for each Vidicon must be adjusted to that value which gives the designed operating dark current.

11 - All the above mentioned illumination assume 2854 °K incandescent tungsten source.

12 - Lag is defined as the ratio of residual signal current measured 60 milliseconds after light excitation being removed to the initial signal current ; this value assumes 50 field/second scanning rate.

13 - Contrast is defined as : $100 \times \dfrac{\text{increment in video current due to the blemish}}{\text{normal signal current}}$

Figure 1

TYPICAL SPECTRAL SENSITIVITY CHARACTERISTICS

For equal values of signal current at all wavelengths (0.02 µA signal current and 0.02 µA dark current for scanned area of 12.7 x 9.5 mm)

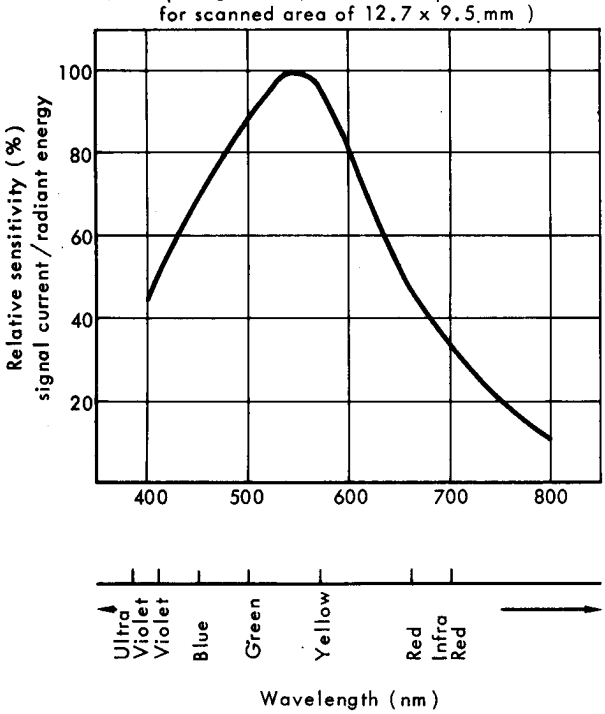
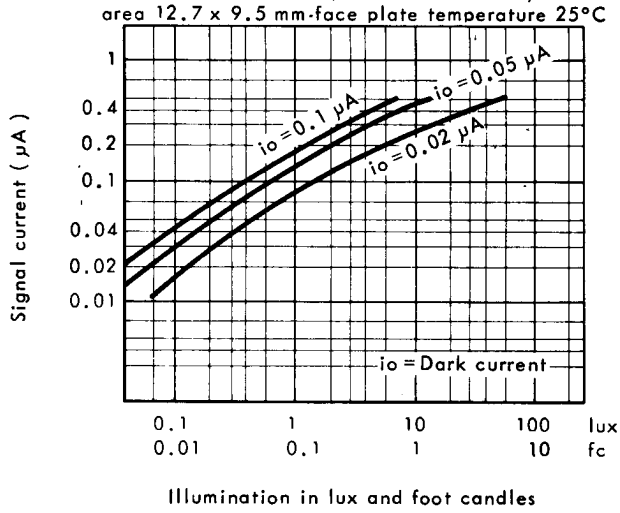


Figure 2

LIGHT TRANSFER CHARACTERISTICS

Illumination uniform over photoconductive layer scanned area 12.7 x 9.5 mm-face plate temperature 25°C



Illumination in lux and foot candles

Figure 3

MODULATION TRANSFER FUNCTION

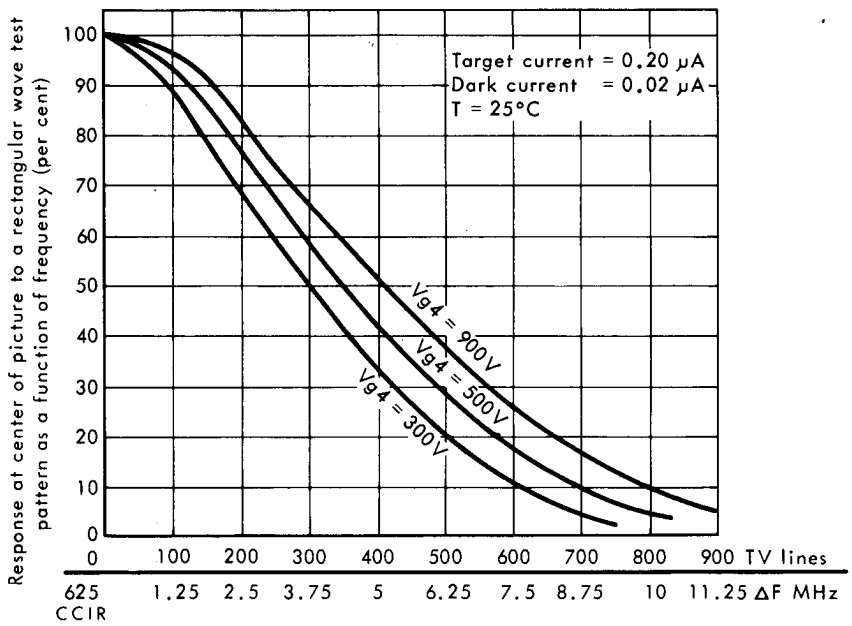


Figure 4

RANGE OF DARK CURRENT
Scanned area of photoconductive layer 12.7 mm x 9.5 mm

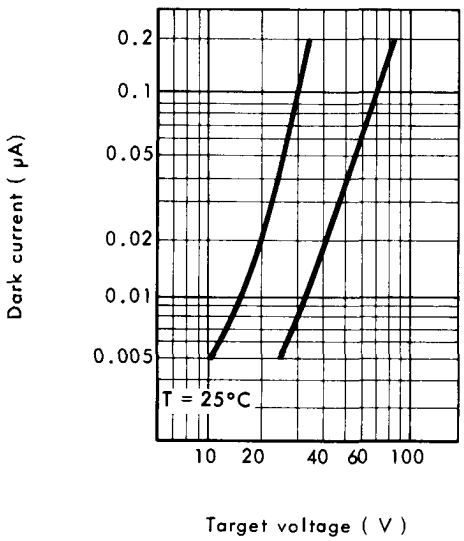


Figure 5

TYPICAL PERSISTENCE CHARACTERISTICS
Initial highlight signal current of 0.2 μA scanned area of photoconductive layer 12.7x9.5 mm

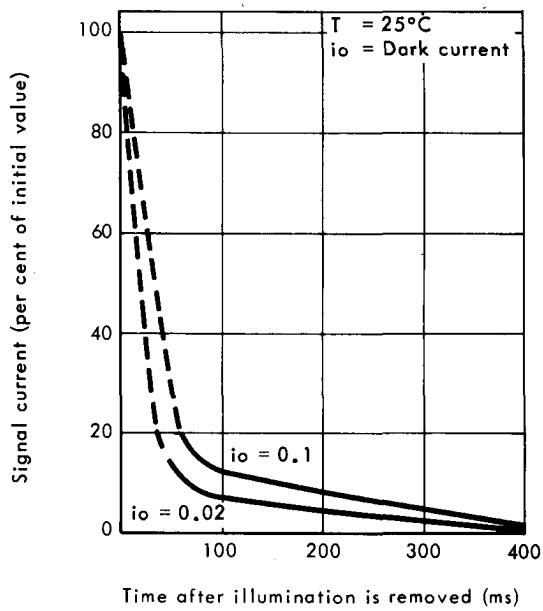
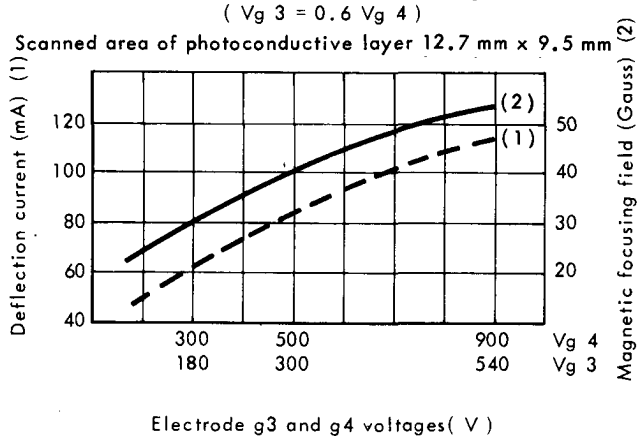


Figure 6

(1) Deflection current as a function of electrode g3 and g4 voltages(Vg 3 = 0.6 Vg 4)

(2) Magnetic field at center of focusing coil (Vg 3 = 0.6 Vg 4)

Scanned area of photoconductive layer 12.7 mm x 9.5 mm



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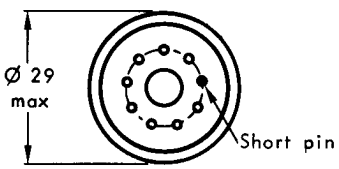
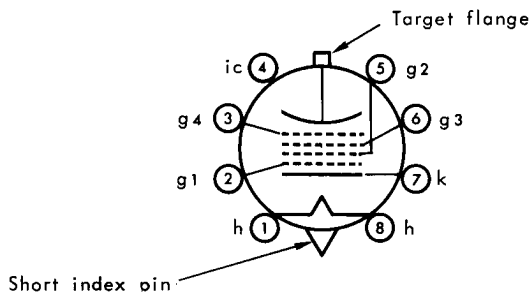
OUTLINE DRAWING

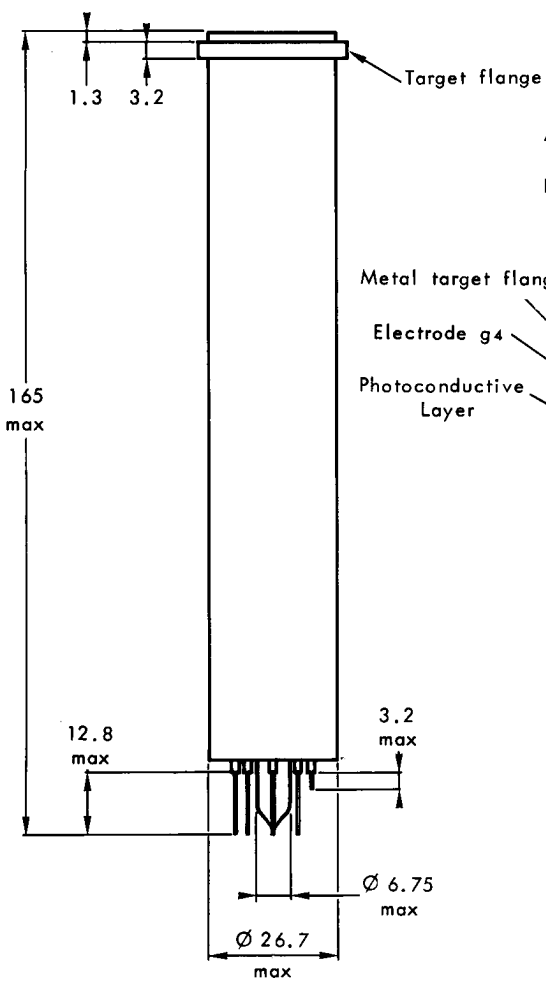
UTE 9C15 base
(JEDEC E8-11)

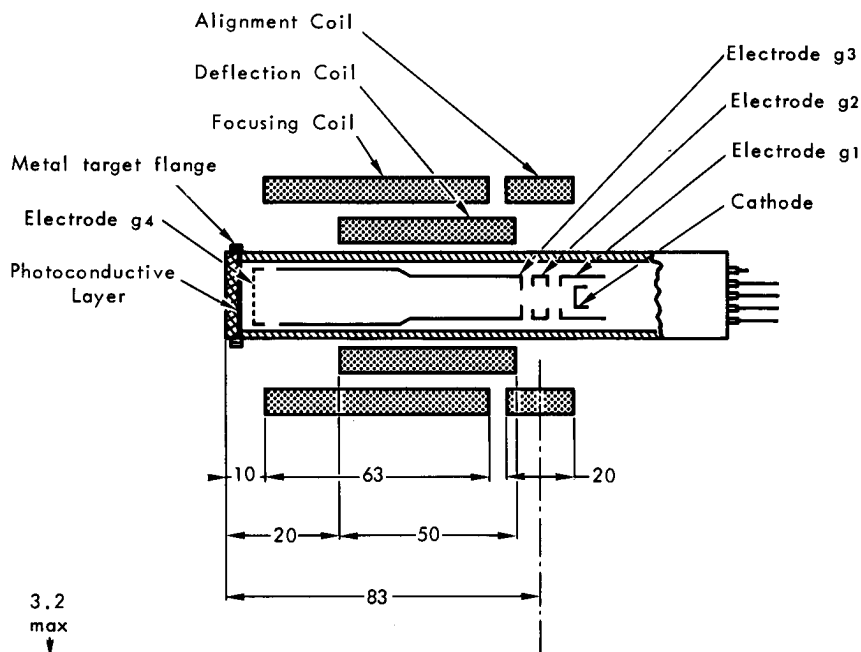


BASING DIAGRAM



1 - Heater	5 - Electrode g2
2 - Electrode g1	6 - Electrode g3
3 - Electrode g4	7 - Cathode
4 - Internal connection	8 - Heater





Optimum locating of the tube inside the deflecting - focusing - alignment components

Dimensions in mm.