TH 9815
1" VIDICON FOR RADIOLOGICAL TV

- Magnetic focus and deflection
- High sensitivity, well matched to the P20 phosphor used in X-ray image-intensifier tubes
- High resolution : over 1000 TV lines
- Low lag

The TH 9815 is a 1"-diameter magnetically focused and deflected vidicon, especially designed for televising images obtained from X-ray image-intensifier tubes. It incorporates a separate post-acceleration electrode, which provides higher and more uniform resolution and more uniform signal output than vidicons without this feature.

The spectral response of the photoconductive layer is well matched to the P20 (yellow-green) screen phosphor used in X-ray image-intensifier tubes.

The selected photoconductive target provides good signal uniformity over the entire scanned area ; this feature makes the tube suitable for the pickup of circular pictures displayed on an image-intensifier screen. In the case of a P20 screen having a conversion index of 100 cd/m²/mR/s (or 30 fL/mR/s), excellent quality pictures of still or moving bodies can be obtained at dose rates of less than 150 microroëntgen/s with an optical system at unity aperture.

The lag characteristics enable reducing the quantum noise of X-ray photons when the incident dose rate is reduced, without impairing detail and low-contrast perception, in the case of moving pictures.

The limiting resolution of the TH 9815 is over 1000 TV lines at the center and 600 TV lines at the corners of the picture.

Full advantage of the TH 9815's resolution and signal uniformity is taken when the deflection and focus coils are properly designed and the tube correctly located inside them. The alignment requirement is minimized by precise-electron gun mounting. An extremely flat faceplate prevents any optical distortion and permits the use of any good quality lens.

GENERAL CHARACTERISTICS

Electrical

Cathode	Unipotential, oxide-coated, indirectly heated
Heater :	
— voltage	6.3 V
— current at 6.3 V	0.15 A ± 10 %
Minimum preheating time	60 s
Output capacitance :	
— target to all other electrodes	4.5 pF
Spectral response	See the curve of Figure 1
Focusing method	Magnetic
Deflection method	Magnetic

Mechanical

Maximum overall length	165 mm
Maximum outer diameter	29 mm
Maximum bulb diameter	26.7 mm
Base	JEDEC E8-11
Socket (Note 1)	METOX No. 30520
Deflection/focusing-coils assembly (Note 2)	GERHARD BV 200 - 1 K1 or equivalent
Alignment coil (Note 2)	GERHARD BV 80/3 or equivalent
Deflection/focusing/alignment-coils assembly (Note 3)	THOMSON-CSF TH 7200 or equivalent
Photoconductive layer :	
— normal dimensions of image on target	12.7 mm x 9.5 mm
— maximum useful diagonal diameter (4 x 3 format)	17 mm
— useful diameter in radiological applications	15 mm
— orientation of quality image	Horizontal scan parallel to the plane passing through the tube axis and the short index pin
Maximum faceplate temperature	70 °C
Dimensions	See the Outline Drawing
Net weight, approx.	60 g
Operating position	Any

OPERATING CONDITIONS

Maximum Ratings (absolute values)

Scanned area : 12.7 mm x 9.5 mm
or 15 mm x 20 mm

	Min.	Max.	Units
Electrode g4 voltage (post-acceleration)	–	1000	V
Electrode g3 voltage (wall)	–	1000	V
Electrode g2 voltage (accelerator)	–	350	V
Electrode g1 voltage (picture cutoff)	−150	0	V
Peak heater-to-cathode voltage	−125	10	V
Target voltage (Note 4, Figure 4)	–	125	V
Dark current (Note 4, Figure 4)	–	0.20	µA
Peak target current (Note 4)	–	0.40	µA
Faceplate :			
– illumination	–	10000	lux
– temperature	–	70	°C

Typical Operation

Faceplate temperature : 25 °C (Note 5)
Scanning standard : 25 images/s – 625 interlaced lines
Scanned area : 12.7 mm x 9.5 mm or 15 mm x 20 mm

Electrode voltage modes	Average	High	Units
Electrode g4 voltage (Note 6)	400 to 450	800 to 850	V
Electrode g3 voltage (Note 6)	300	600	V
Electrode g2 voltage	300	300	V
Electrode g1 voltage (for picture cutoff) (Note 7)	−45 to −110	−45 to −110	V
Minimum blanking peak-to-peak voltage :			
– applied to g1 electrode	−75	−75	V
– applied to cathode	+20	+20	V

Currents in coils (GERHARD BV 200 - 1 k 1 or equivalent)

Scanned area	12.7 mm x 9.5 mm		20 mm x 15 mm		
Electrode voltage mode	Average	High	Average	High	Units
Focus-coil current	67 ± 2	98 ± 3	67 ± 2	98 ± 3	mA
Alignment-coil current (each pair)	0 to 36	0 to 36	0 to 36	0 to 36	mA
Peak current in horizontal deflection coil	170 ± 15	220 ± 20	270 ± 25	350 ± 30	mA
Peak current in vertical deflection coil	20 ± 2	26 ± 2	30 ± 2	40 ± 4	mA

Electrooptical Performances

Faceplate temperature : 25 °C
Scanning standard : 25 images/s – 625 interlaced lines
Scanned area : 12.7 mm x 9.5 mm

Dark current	20	nA
Target voltage (for i_o = 20 nA)	20 to 60	V
Sensitivity to light source at 2854 °K		
Faceplate illumination	1	lux
Sensitivity	420	µA/lm
Signal current	50	nA
Sensitivity to P20 phosphor (Note 8 - Figure 2)		
Illumination from 2854 °K light source incident on MTO filters (Note 9 - Figure 3)	1	lux
Sensitivity	210	µA/lm
Signal current	25	nA

Electrode voltage modes	Average	High	
Average gamma for target illumination between 1 and 100 lux (Note 10)	0.65	0.65	
Limiting resolution : (Note 11 - Figure 5)			
– center	900	1000	TV lines
– corners	500	600	TV lines
Modulation transfer function for 400 TV lines at center of picture (Note 12 - Figure 5)	50	60	%
Lag at the 3rd frame, average (Note 13 - Figure 6)	15	15	%

BLEMISH SPECIFICATIONS

The spurious-signal tests are made under the following conditions :

- The dark current and signal current are adjusted for the 12.7 mm x 9.5 mm scanning format at 20 nA and 50 nA respectively.
- The scanned area is the 20 mm x 15 mm format.
- The tests are performed by using a uniformly diffused white test pattern, which is separated into two zones by two circles of 12 mm and 15 mm diameter :
  Zone 1 : inside the 12-mm diameter circle,
  Zone 2 : annular zone between the circles of 12-mm and 15-mm diameter.
- The gain of the video amplifier and the monitor are adjusted for the best image quality obtainable.
  The control monitor in adjusted as follows :
  • for the pedestal level (black), the screen luminance is set at cutoff,
  • for the highlight level (white), the gain of the monitor is adjusted for the best quality image depending on image content and ambient light.
- The defects are evaluated by the ratio in % of the average diameter d of the spot to the raster height h of the image.
- The contrast C is defined as the percentage of the increment in video signal (due to the blemish) to the normal signal current.

Spots (black and white)

Only those spots having a contrast C ⩾ 25 % will be considered as defects.

Dimensions of defects d/h in %	Number allowed	
	Zone 1	Zone 2
d/h >0.8	0	0
0.8 ⩾ d/h >0.6	0	1
0.6 ⩾ d/h >0.4	1	2
0.4 ⩾ d/h ⩾ 0.2	2	4
Total of spots	6 max.	

Spots of relative dimensions d/h < 0.2 % are not counted unless their concentration causes a smudged appearance.

Do not take into account spots having a contrast C < 25 %.

Other Defects

Smudges, streaks, mottled or grainy background are not considered as defects if their contrast is C ⩽ 10 %.

NOTES

1 – METOX : 86 rue de Villiers de l'Isle Adam, 75020 PARIS – Tél. : 636-31-10.

2 – GERHARD KG : Reichelsheim/ODW, W. Germany.

3 – THOMSON-CSF - DTE : 38 rue Vauthier, 92100 Boulogne-Billancourt - FRANCE – Tél. : 604-81-75.

4 – The target current is the total current drawn in the load resistance that is connected to the target : signal current + dark current ; the dark current is the component existing when the illlumination is removed. Figure 4 illustrates the operating target voltage range normally encountered. The target voltage for each vidicon must be adjusted to that value which gives the desired operating dark current.
The video amplifier must be designed to handle a target current of 1 μA in order to avoid amplifier overloads or image distortions.

5 – All characteristics are given for a faceplate temperature of 25 °C, the recommended temperature range being 20 °C to 30 °C.
The rise of the faceplate temperature is determined by the ambient temperature, the thermal dissipation of the surrounding components and of the tube itself. A faceplate temperature rise of 10 °C will result in the dark current being multiplied by a factor of 2.

6 – In any case, the grid g4 voltage should be lower than the grid g3 voltage. The voltage ratio Vg4/Vg3 must be adjusted, depending on the coils used, to a value of 1.5 to 1.3.

7 – Without blanking pulses applied to grid g1.

8 – The MTO filter assembly must be interposed between the light source and the tube faceplate.

9 – The MTO filter assembly, whose characteristics are given in Figure 3, is composed of DA 545 C + DH 543 C' filters.

10 – Average gamma is defined as the slope of the rectilinear part of the light-transfer characteristics, in logarithmic coordinates.

11 – In practice, the limiting resolution corresponds to the resolution measured with a twin- bar test card, at 5 % amplitude response.

12 – In the 625 line CCIR standard, 400 TV lines correspond to 5 MHz bandwidth.

13 – The lag is defined as the percentage of the residual signal (measured at the 3rd frame after the illumination is removed) to the initial signal. This value assumes a 50 frames/second scanning rate.

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)

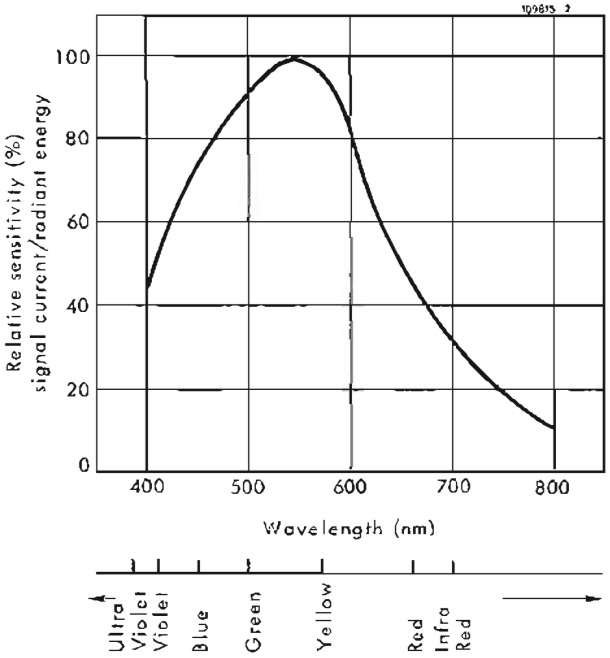


Figure 1 - Typical spectral sensitivity characteristics

Illumination uniform over photoconductive layer, scanned area 12.7 x 9.5 mm, faceplate temperature 25°C

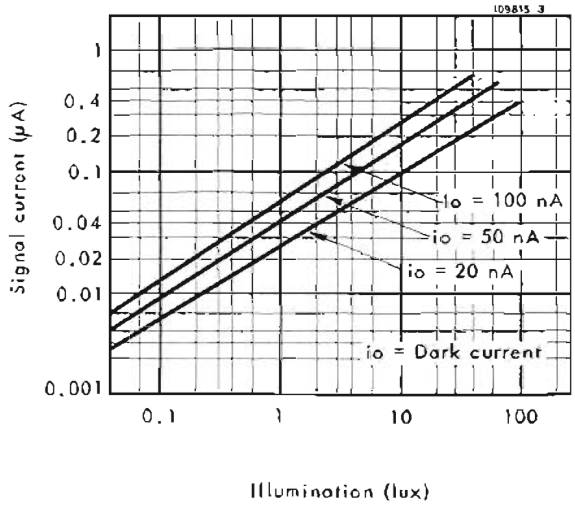


Figure 2 - Light transfer characteristics
Sensitivity to P20

MTO filter assembly characteristics
λ_o : 545 nm
τ_m : 58 %
$\Delta\lambda$: 112 nm
$r.t$: 873 x 10^{-6} W/lm (2854 °K)

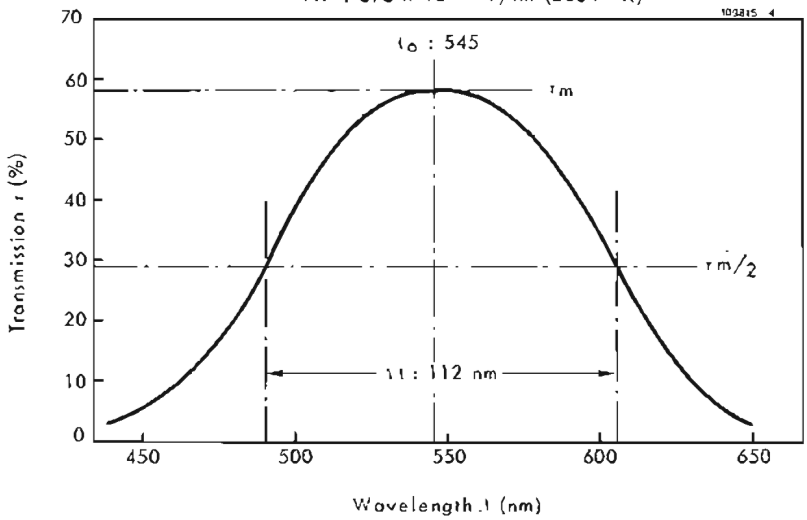


Figure 3 - Typical transmission of MTO filter assembly
(DA 545C + DH 543C')

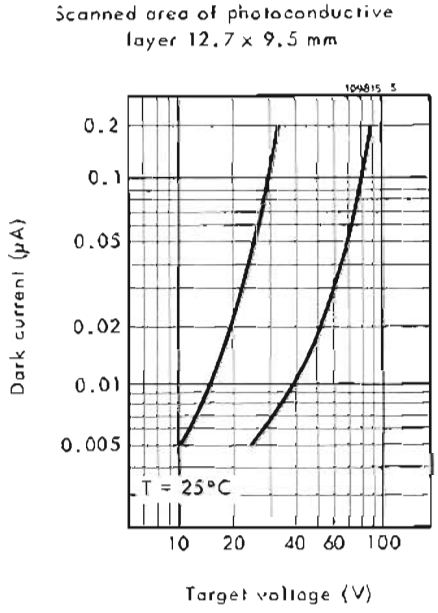


Figure 4 - Range of dark current

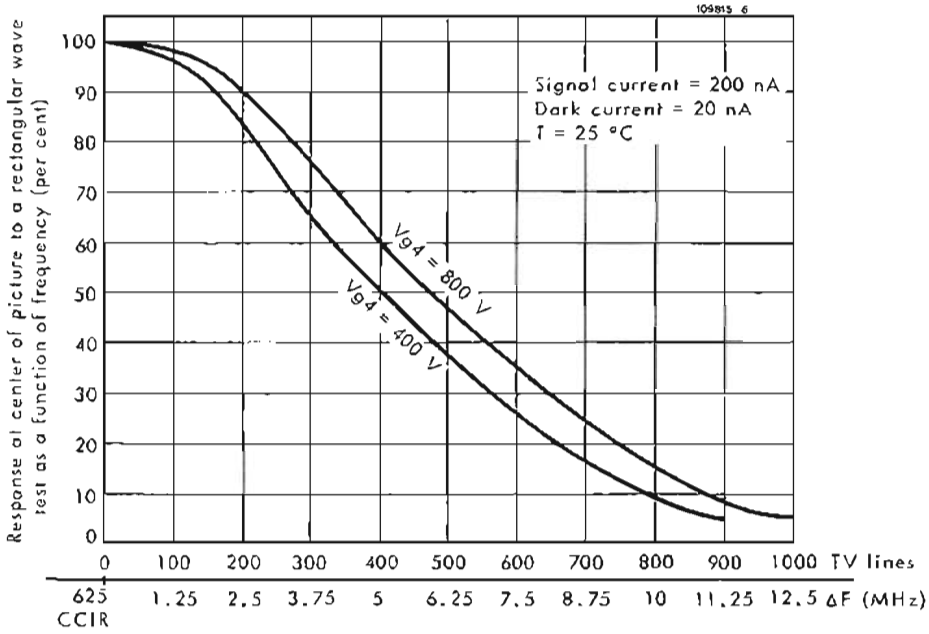


Figure 5 - Modulation Transfer Function

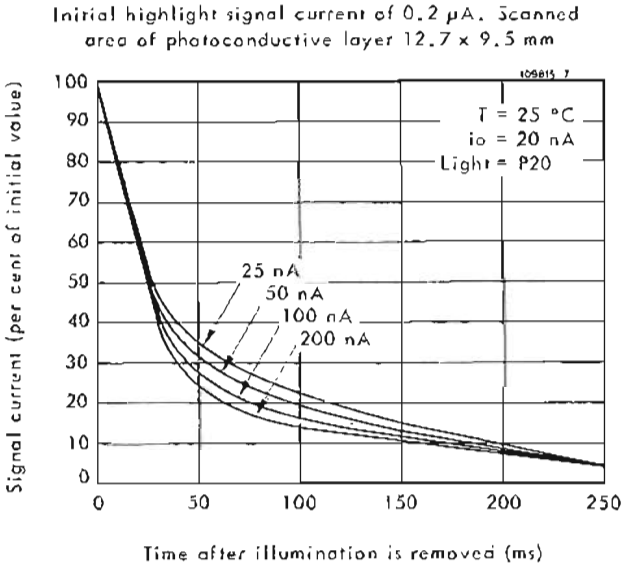


Figure 6a - Typical persistence characteristics

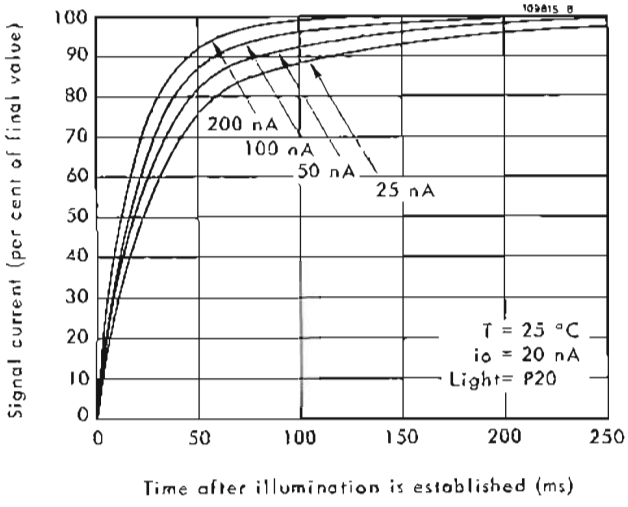
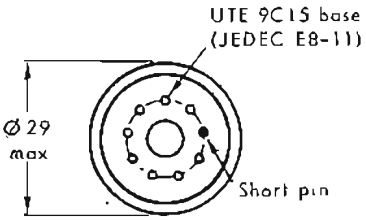
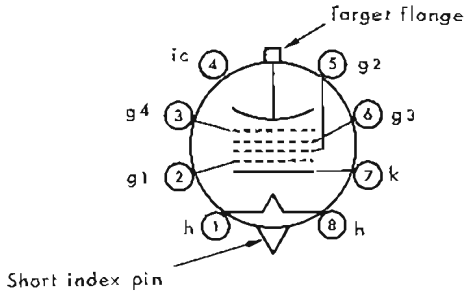


Figure 6b - Signal current rise time

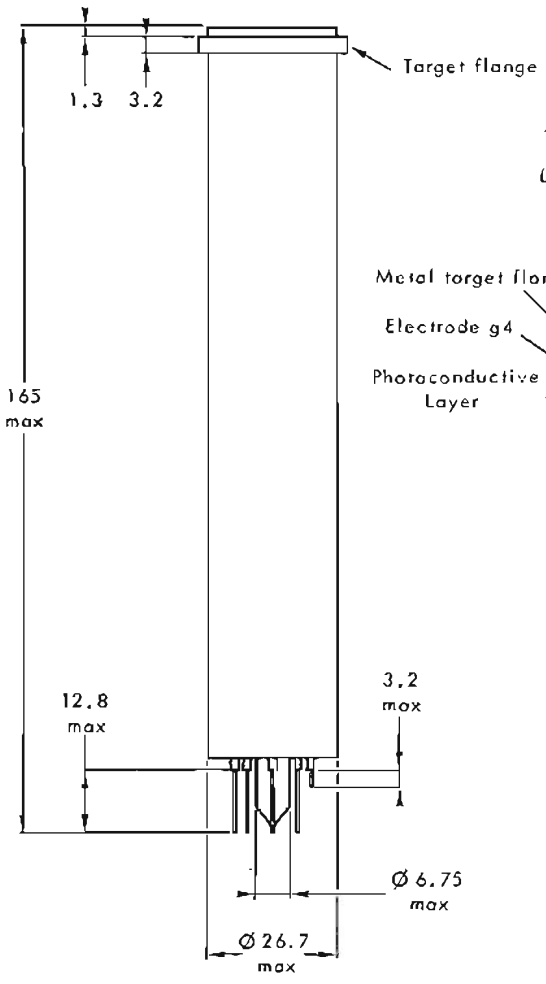
OUTLINE DRAWING

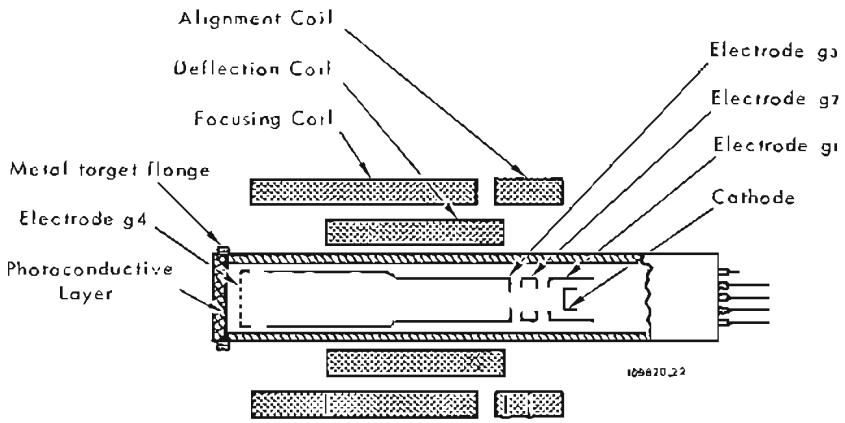


BASING DIAGRAM
Bottom view



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





Dimensions in mm