



**THOMSON-CSF**

DIVISION TUBES ELECTRONIQUES

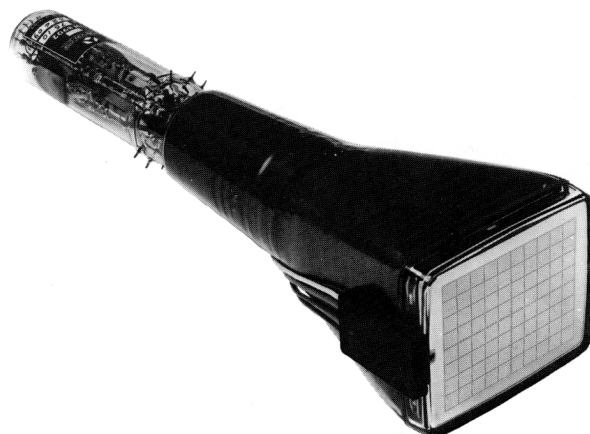
# TH 8902 DIRECT VIEW STORAGE TUBE FOR STORAGE OSCILLOSCOPE

- VARIABLE PERSISTENCE
- HIGH WRITING SPEED
- 8 x 10 DIVISIONS ILLUMINABLE GRATICULE
- FLAT RECTANGULAR FACEPLATE
- 100 MHz BANDWIDTH
- BURN RESISTANT

The TH 8902 is a direct view storage tube having a rectangular faceplate, especially designed for high frequency (100 MHz bandwidth) storage oscilloscope applications.

The flat screen (P31 phosphor) includes a 8 x 10 divisions internal illuminable graticule. The two flood guns symmetrically located with respect to the tube axis enable to obtain bright display of information over the entire useful area. The writing gun features high resolution and high deflection sensitivity.

The TH 8902 is suitable for storage oscilloscope application being able to display stored information with or without persistence and non-stored information.



## TYPICAL PERFORMANCE

Writing speed* (Note 14)	100	cm/ $\mu$ s
Linewidth at center	0.4	mm
Viewing time* (see page 4)		variable
Luminance*	400	cd.m <sup>-2</sup>

\* These values being closely correlated can be adjusted within a wide range depending on specific applications.

## GENERAL CHARACTERISTICS

### Electrical

#### — FLOOD GUNS

Number	2
Heater voltage (D.C.)	6.3 V
Heater current	2 x 0.3 A

#### — WRITING GUN

Heater voltage	6.3 V
Heater current	0.6 A
Focusing method	electrostatic
Deflection method	electrostatic



**– INTERELECTRODE CAPACITANCE**

g1 to all other electrodes, . . . . .	max.	15	pF
k to all other electrodes . . . . .	max.	6	pF
x <sub>1</sub> to all other electrodes (except x <sub>2</sub> ) . . . . .	max.	8	pF
y <sub>1</sub> to all other electrodes (except y <sub>2</sub> ) . . . . .	max.	5	pF
x <sub>1</sub> to x <sub>2</sub> . . . . .	max.	4	pF
y <sub>1</sub> to y <sub>2</sub> . . . . .	max.	3	pF

**Optical**

Phosphor :

- type . . . . . P31 aluminized
- fluorescence and phosphorescence . . . . . blue - green

Faceplate . . . . . flat

**Mechanical**

Faceplate dimensions . . . . .	100 mm x 120 mm
Graticule dimensions . . . . .	72 mm x 90 mm
Overall length . . . . .	450 mm
Neck diameter . . . . .	50 mm
Base . . . . .	UTE 14 C 25 (IEC 67-1-46 a)
Neck pins . . . . .	see drawing
Encapsulated leads . . . . .	see drawing
Net weight, approx. . . . .	1.4 kg

**OPERATING CONDITIONS**

**Maximum values** (absolute ratings)

Unless otherwise stated, voltages are given with respect to ground potential.

**– FLOOD GUNS**

Heater h' voltage (D.C.) . . . . .	5.7 to 6.9	V
Cathode k <sub>1</sub> ' and k <sub>2</sub> ' voltages . . . . .	max. 50	V
Peak heater to cathode voltage :		
- heater negative with respect to cathode . . . . .	max. 150	V
- heater positive with respect to cathode . . . . .	max. 150	V
Grid g <sub>1</sub> ' voltage (control grid) . . . . .	- 200	V
Grid g <sub>2</sub> ' voltage (accelerating electrode) . . . . .	- 50 to + 50	V
Grid g <sub>3</sub> ' voltage (collimating electrode) . . . . .	max. 100	V

**– STORAGE UNIT AND VIEWING SCREEN**

Grid g <sub>5</sub> ' voltage (collecting electrode) . . . . .	max. 150	V
Grid g <sub>6</sub> ' voltage (backing electrode) . . . . .	- 150 to + 1600	V
Viewing screen g <sub>7</sub> ' voltage . . . . .	max. 8	kV

**– WRITING GUN**

Heater h voltage . . . . .	5.7 to 6.9	V
Cathode voltage . . . . .	max. - 3.6	kV
Peak heater to cathode voltage :		
- heater negative with respect to cathode . . . . .	max. 150	V
- heater positive with respect to cathode . . . . .	max. 150	V
Grid g <sub>1</sub> voltage** (control grid) . . . . .	- 300	V
Grid g <sub>2</sub> voltage (accelerating voltage) . . . . .	max. 50	V
Grid g <sub>3</sub> voltage (focusing electrode) . . . . .	max. - 3	kV
Grid g <sub>4</sub> voltage (astigmatism) . . . . .	max. 100	V
Grid g <sub>5</sub> voltage (geometry) . . . . .	max. 100	V

\*\* With respect to writing gun cathode.

**Typical operation**

Unless otherwise stated, voltages are given with respect to ground potential.

– FLOOD GUNS

Heater h' voltage (D.C.)	6.3 ± 10 %	V
Cathode k <sub>1</sub> ' voltage (Note 1)	0 to +3	V
Cathode k <sub>2</sub> ' voltage (Note 1)	0 to +3	V
Grid g <sub>1</sub> ' voltage (control grid)	0	V
Grid g <sub>2</sub> ' voltage (accelerating electrode) (Note 2)	see table below	
Grid g <sub>3</sub> ' voltage (collimating electrode) (Note 2)	30 to 70	V

– STORAGE UNIT AND VIEWING SCREEN

Grid g <sub>5</sub> ' voltage (collecting electrode)	see table below
Grid g <sub>6</sub> ' voltage (backing electrode) (Notes 4 and 7)	see table below
Viewing screen g <sub>7</sub> ' voltage (Note 8)	see table below

Modes	g <sub>2</sub> '	g <sub>5</sub> '	g <sub>6</sub> '	g <sub>7</sub> '
Non-storage	– 6 V	0 V	– 30 V	7 kV
Variable persistence	20 to 40 V	100 V	Note 5	7 kV
Normal storage	20 to 40 V	100 V	1 to 3 V	7 kV
Long storage	Note 3	100 V	1 to 3 V	7 kV
Long-term retention	– 6 V	0 V	– 30 V	0 kV
Erase	20 to 40 V	100	Note 6	7 kV

– WRITING GUN

Heater h voltage	6.3 ± 10 %	V
Cathode k voltage (Note 14)	– 1700	V
Grid g <sub>1</sub> voltage (for cut-off) (w.r.t. V <sub>k</sub> )	– 100 to – 40	V
Grid g <sub>2</sub> voltage (acceleration)	40	V
Grid g <sub>3</sub> voltage (focus)	–1400 to –1000	V
Grid g <sub>4</sub> voltage (astigmatism)	10 to 70	V
Grid g <sub>5</sub> voltage (geometry) (w.r.t. x plates mean potential)	– 30 to +30	V
x plates mean potential	20 to 60	V
y plates mean potential	40	V

– MAXIMUM ELECTRODE CURRENTS

Flood guns :		
- heater current (D.C.) at V <sub>h</sub> ' = 6.3 V	0.66	A
- cathode k <sub>1</sub> ' current	1.5	mA
- cathode k <sub>2</sub> ' current	1.5	mA
- grid g <sub>2</sub> ' current	1	mA
- grid g <sub>3</sub> ' current	2	mA
Storage unit and viewing screen :		
- grid g <sub>5</sub> ' current	0.5	mA
- grid g <sub>6</sub> ' current	0.5	mA
- grid g <sub>7</sub> ' current	0.2	mA
Writing gun :		
- heater current at V <sub>h</sub> = 6.3 V	0.66	mA
- cathode current	3.5	mA
- grid g <sub>2</sub> current	3	mA

**REMARKS :**

- 1 - A high permeability shield (mumetal) is necessary to protect the tube against external electrostatic and magnetic fields.
- 2 - For the writing gun, a heater transformer with insulated secondary coil must be used (4 kV insulation minimum).

**PERFORMANCE**

**I - Non-store mode**

Resolution (Note 9) .....	0.4 mm
Spot position (Note 10) .....	9 mm
Deflection sensitivity :	
- x plates deflection factor (Note 14) .....	10 V ± 10 % per division
- y plates deflection factor (Note 14) .....	4.7 V ± 10 % per division
- deflection factor uniformity .....	see Note 11
Trace alignment .....	see Note 12
Pattern distortion .....	see Note 13

**II - Store mode**

– MAXIMUM LUMINANCE

The luminance for a saturated written trace is over 400 cd.m<sup>-2</sup>.

– WRITING SPEED (Note 14)

100 cm/μs speed (the background is not dark but the contrast is sufficient to make the trace visible).

– VIEWING TIME

The viewing time mentioned in the following table is given as a function :

- 1 - of the writing speed (0.1 div/μs - 5 div/μs - 100 div/μs)
- 2 - of the duty rate of the flood gun ; when the duty rate decreases, the viewing time increases with resulting in loss of luminance.

Example of duty rate of flood guns	1			1/3			1/10		
	0.1	5	100	0.1	5	100	0.1	4	100
Writing speed (div/μs)	0.1	5	100	0.1	5	100	0.1	4	100
Typical viewing time*	1 mn	20 s	10 s	3 mn	1 mn	30 s	10 mn	3 mn	100 s

\* Time beyond which the written trace cannot be discerned on the background.

– VARIABLE PERSISTENCE

Depending on the rate and duration of pulses applied to the backing electrode g6', required visual output decay can be adjusted from 0.2 s to the values indicated in the table above.

– LONG TERM

When the flood beams are cut off and the screen voltage at 0 V potential, the written information is not degraded by ion charging and can be stored for up to many days.

## N O T E S

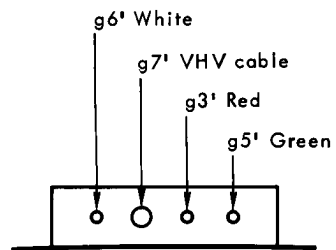
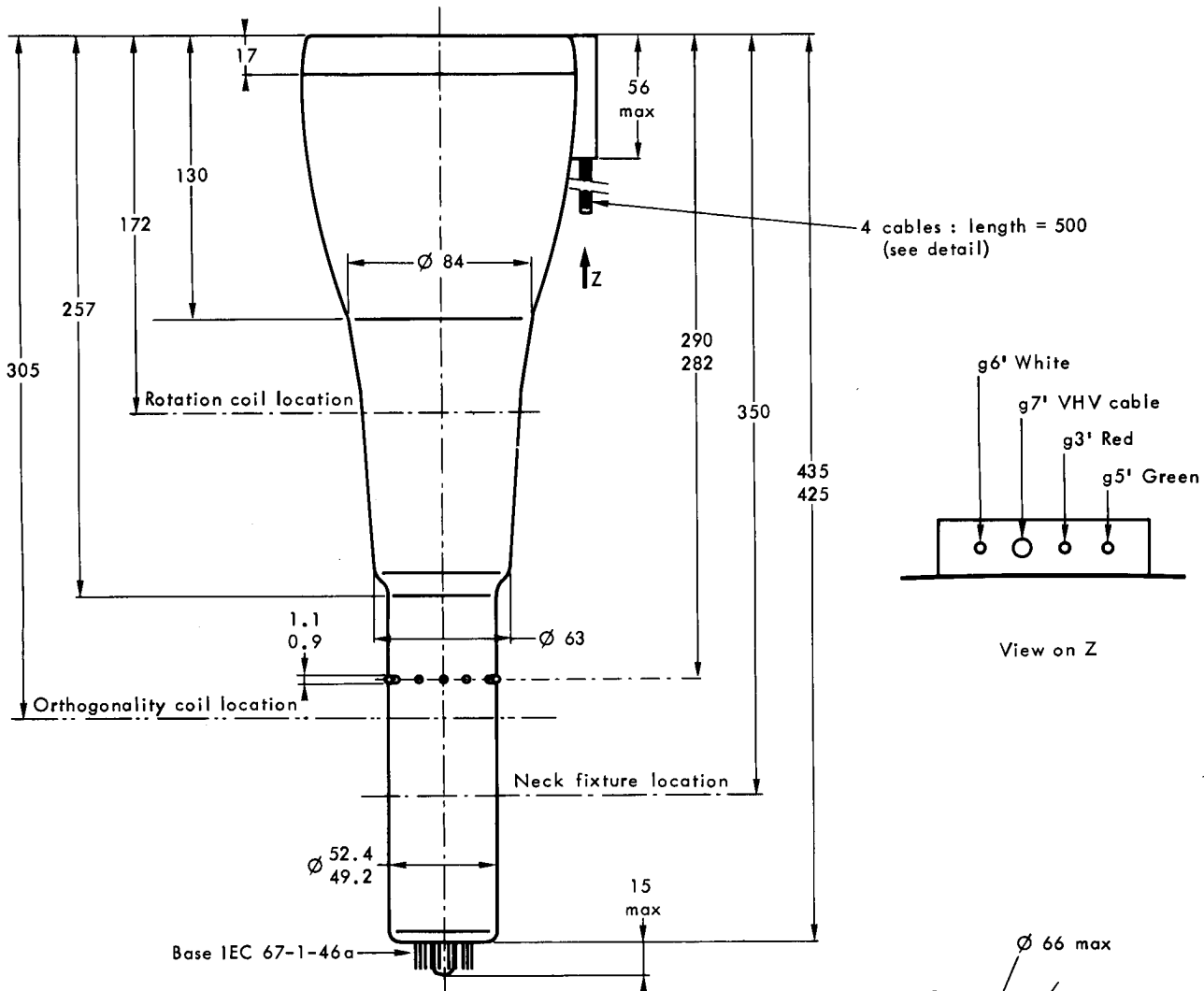
- 1 - The two flood gun cathodes are to be separately adjusted in order to obtain the best uniformity.
- 2 - The g2' and g3' voltages are to be adjusted in order to obtain the best uniformity.
- 3 - In the long-storage mode, g2' voltage is set at -6 V, then a positive pulse train of 26 to 46 V amplitude is applied.
- 4 - In store mode, the g6' voltage must never exceed 8 V. The impedance of the g6' circuit must be as low as possible and not exceed 1000  $\Omega$ .
- 5 - In variable persistence mode, a positive pulse train of 4 V amplitude is applied to grid g6'.
- 6 - In erase mode, the grid g6' potential must be raised from store-mode potential (i.e. 1 to 3 V) to +1500 V for about 1 second and then be returned to its store-mode potential. A positive pulse of 12 V amplitude maximum is then applied for 500 milliseconds.
- 7 - In changing the operating from the "non-store" to the "store" mode, the g6' voltage must be raised from -30 V to the proper positive voltage (1 to 3 V) in 2 seconds. This will prevent the storage surface to be damaged.
- 8 - To avoid permanent damage to the tube, insert a 30 M $\Omega$  minimum resistance in series in the supply circuit of g7' screen.
- 9 - Measurement is made by the shrinking raster method with a beam current of 5  $\mu$ A. The linewidth is 0.4 mm max. at center and does not exceed 0.8 mm on any point of the useful screen area.
- 10 - Distance of the focused and undeflected spot from geometric center of the screen.
- 11 - Measurement is made according to "I.E.C." specifications.
- 12 - Angle between x and y traces is adjusted by means of the orthogonality coil. Angle between x trace and the horizontal axis of graticule is adjusted by using the rotation coil.
- 13 - Vertical and horizontal traces must fall within the boundaries of the two following squares centered on the screen :
  - outer square : 8 x 8 divisions central square on the graticule (72 mm x 72 mm) ;
  - inner square : 70 mm x 70 mm (sides parallel to outer square).
 Because of the width of the trace, only one edge of the trace is to be taken into account.
- 14 - The limiting writing speed measured in normal ambient lighting conditions is 100 cm/ $\mu$ s. It is defined as the limiting discernibility of the trace on a slightly luminous background. The writing speed can reach 200 or 300 cm/ $\mu$ s in particular viewing conditions : optimum adjustment of the storage mesh potential, low ambient light level.  
 In addition, this limiting writing speed can be further multiplied by a factor of 2 or 3 by doubling the acceleration voltage of the writing gun ( $V_k = -3400$  V). In this case :
  - $S_x = 20 \text{ V} \pm 10 \% \text{ per division}$
  - $S_y = 9.4 \text{ V} \pm 10 \% \text{ per division}$



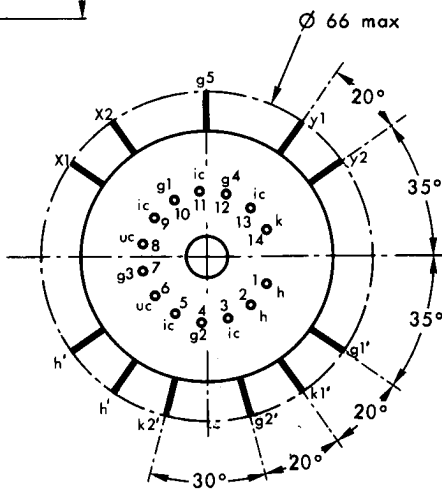
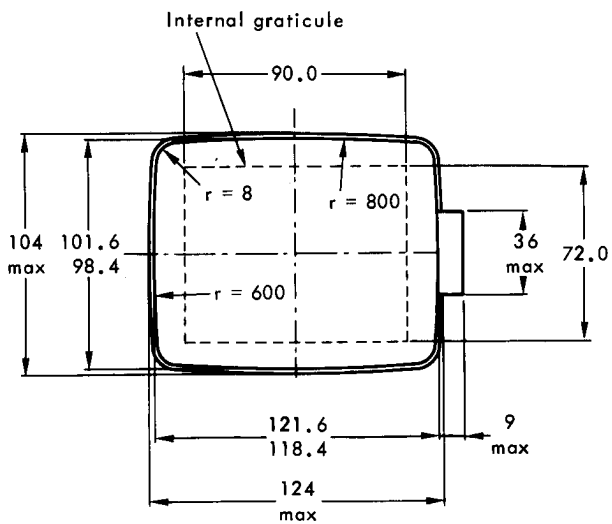
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### OUTLINE DRAWING

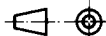


View on Z



BOTTOM VIEW

Dimensions in mm.



Note 1 - Nominal untoleranced dimensions given for general information.